APPENDIX A

Criteria & Implementation Procedures for Valley & Stream Corridor Regeneration and Remedial Works Projects

b) Flood protection will be implemented on a priority basis related to public safety and property damage, within the limitations of funding approvals, access and property requirements. Priorities shall generally be based on the technical criteria described above.

c) Where flood control remedial works are proposed on private lands, title to the land or an easement, where applicable, will be required.

d) Flood control remedial works will be analyzed on the basis of financial and environmental cost/benefit and acquisition will be considered as a viable alternative to remedial works, where the proposed works exceed the value of the property or will not be compatible with this Program.

6.2 EROSION CONTROL AND SLOPE STABILITY REMEDIAL WORKS

The Authority currently maintains information on active erosion/slope stability sites on those watercourses draining generally in excess of 1,300 hectares.

The implementation of this program component relies on the continued monitoring and updating of the data base in order to keep abreast of changing site conditions. Because erosion and slope instability is dynamic, priorities can change from year to year and sometimes even after a single storm. The process of reviewing and updating priorities must be continued not only to make the system equitable but also to adjust annual funding requirements.

In evaluating and assigning priorities for erosion control/slope remediation works, two major factors are considered: risk to structure(s) and cause of erosion/slope instability hazard. The potential risk to existing structures is deemed the most important factor and accordingly is given more weight than the physical and geological condition associated with the cause or erosion. Valley wall conditions considered include; the height, slope angle, vegetative cover, ground water characteristics and the soil type and composition. River or river action, as a factor, considers the present river alignment as well as the potential cutting action.

In all cases, the design of erosion control works will provide protection compatible with the Authority's Designed Criteria and where appropriate, will improve or enhance the aquatic and terrestrial habitats through natural channel designs. In the case of in-stream work, the natural pool/riffle systems will either be maintained or created. The deep channels which often occur on the outside bend will be simulated and by creative positioning of the stone protection, shading and opportunities for riparian plantings will be provided. Riparian and slope plantings will generally consist of native plant material.

The principal funding sources for the remedial works will be grants from the Province of Ontario and levies from the designated benefiting regional municipality. The Regional Municipality may, however, choose to pass on their share to the local municipality and the Authority will provide the necessary information should this occur. As a result, an erosion inventory and priority list has been developed and will be maintained for each of the regional municipalities.

Design Criteria

Design criteria of the Authority governing erosion control remedial works are as follows:

a) Remedial works will be carried out on those watercourses which generally drain in excess of 1,300 hectares.

b) For the purposes of erosion protection works, design blocks shall be established and works undertaken on a design block basis. Design blocks shall be of a size to be technically, economically feasible and environmentally responsible.

c) Erosion protection for public safety will be installed on a technical priority basis related to the safety of property and structures within the limitations of funding, approvals, construction access and property acquisitions. Priorities shall be based on technical criteria including, but not necessarily limited to the following:

- distance from top of bank to structure;
- rate of slope retreat;
- extent of ground water seepage;
- height and steepness of slope;
- evidence of previous movement;
- condition of toe or slope;
- existing habitat resources.

d) Priorities for protection will be reviewed and approved by the Authority on an annual basis.

e) Where erosion protection works are proposed on private land, the Authority shall require title to the land or an easement where applicable and/or require a suitable financial contribution from the benefiting owner(s).

f) Erosion protection works will be analyzed on the basis of financial and environmental cost/benefit, and acquisition will be considered as a viable alternative to remedial works, where the proposed works exceed the value of the property or are not compatible with this Program.

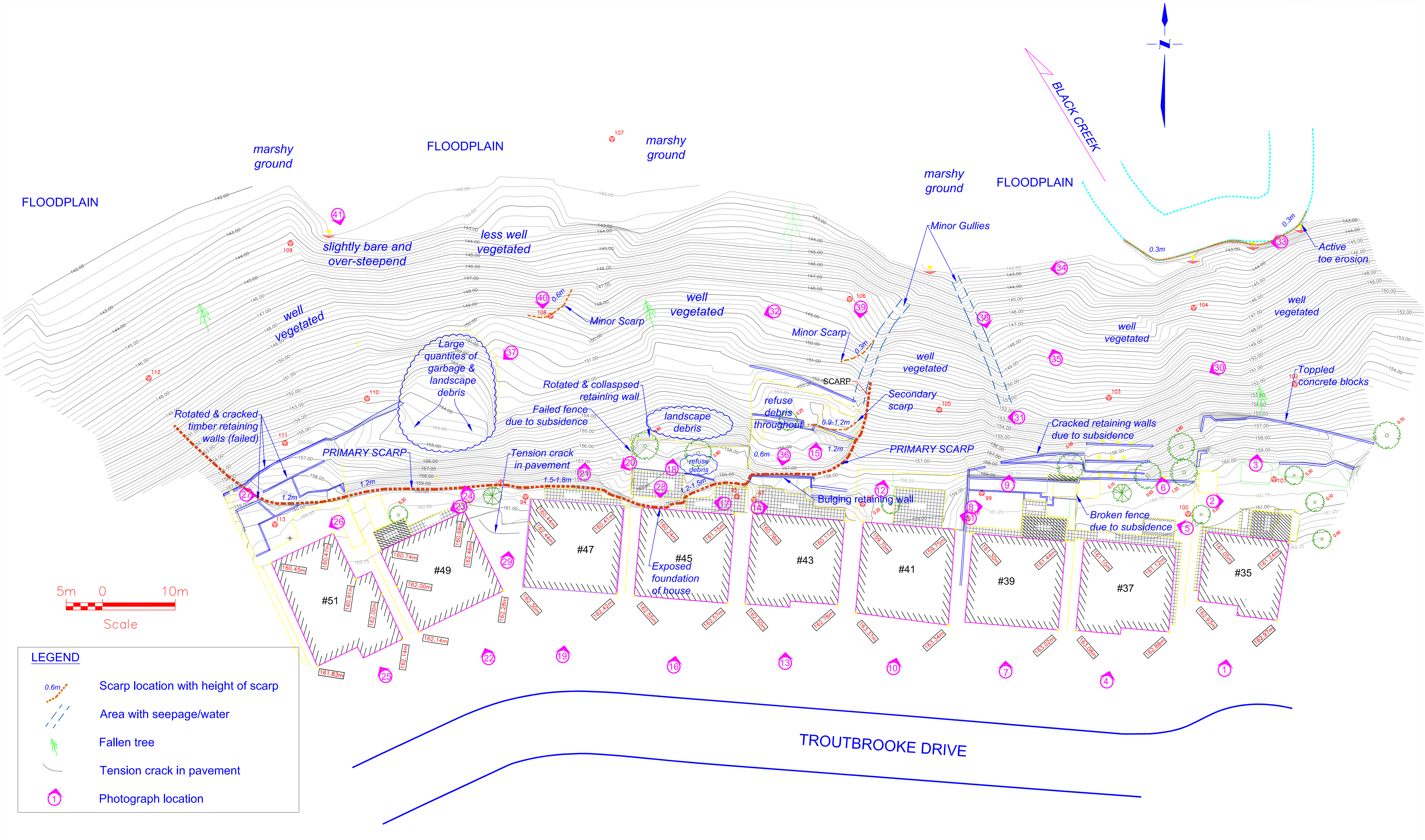
g) Design criteria for erosion protection works on the designated watercourses are dependent upon the nature of each specific problem. Generally, two types of problems exist. The first and less common type, involves bank or valley wall instability in which slumping or major rotational failure is involved due to inherent soil conditions or overloading of the slope. The more common type of problem involves the river in coincidence with the valley wall. Wherever possible, erosion control work shall be designed to:

- accommodate the 100 year flood for the "coincident case";
- accommodate the low flow channel in all other cases as a minimum;
- permit channel overtopping with minimal danger to the remedial work;
- decrease the velocity of the stream by flattening the hydraulic gradient and minimizing the flow energy by incorporating meanders and natural channel design;
- enhance aquatic habitat by incorporating natural channel design such as pools and riffles features, deep channels and overhangs on outside bends;
- enhance terrestrial habitat through the planting of riparian vegetation (10 m from river edge) and through the introduction of native plants and trees on the valley slopes and other floodplain lands;
- minimize potential aggravation of upstream or downstream flooding and/or erosion.

h) In the design of all protection works, the Authority shall be cognizant of the natural features and resources and will, where appropriate, enhance the aquatic and terrestrial habitats.

APPENDIX B

Existing Conditions



PHOTOGRAPH LOCATION AND PHYSICAL FEATURES PLAN

TERRAPROBE

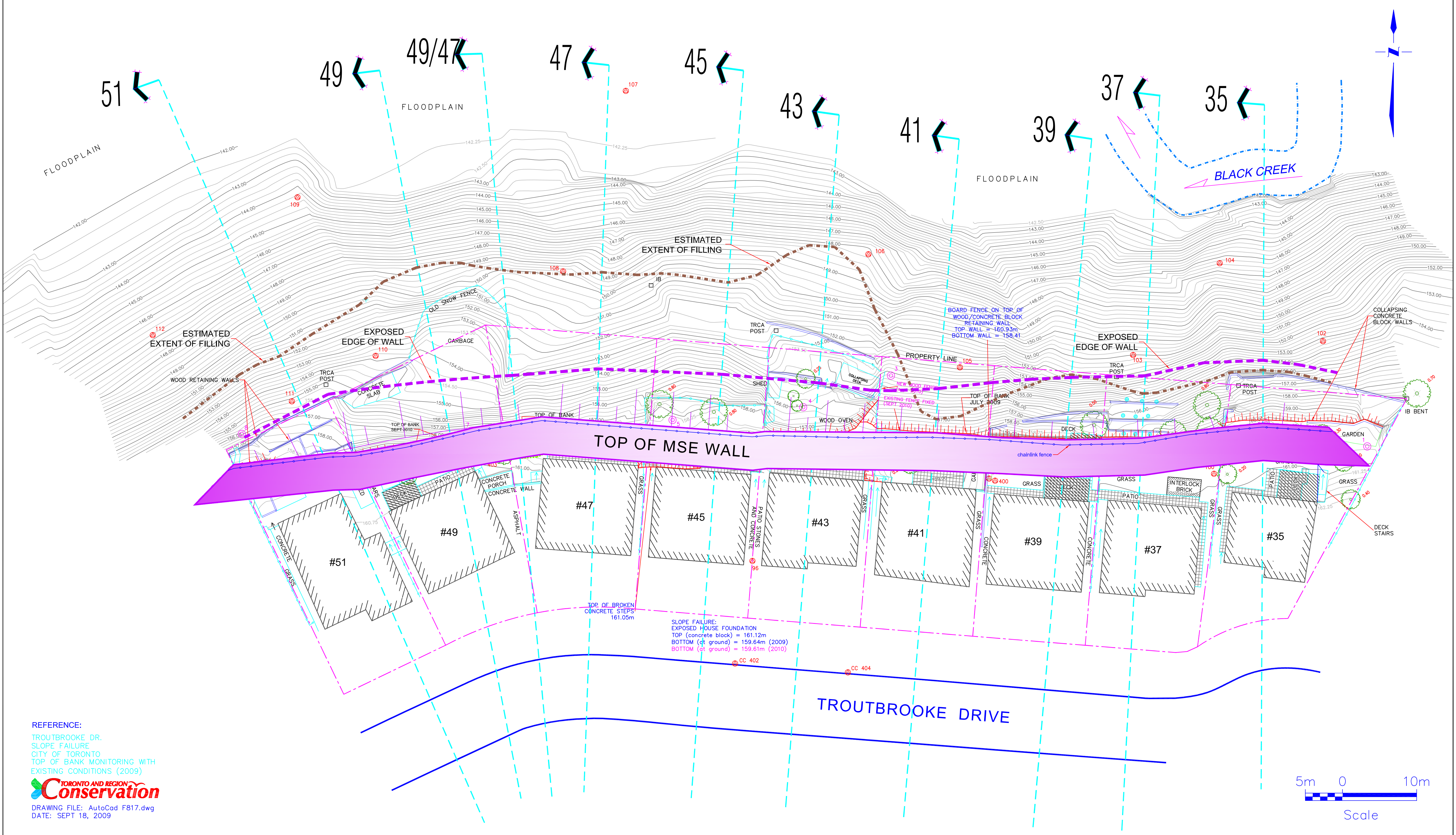
File No. 1-09-4125

FIGURE 4

\\TERRADOCS\FileServer\Terraprobe Limited\All Projects\2009 Files\1-09-4100-4199\1-09-4125\A. Dwgs, Logs\1-09-4125 FIG 4 only.dwg, SANDY

APPENDIX C

Design Drawings of the Preferred Alternative



REFERENCE:

TROUTBROOKE DR.
SLOPE FAILURE
CITY OF TORONTO
TOP OF BANK MONITORING WITH
EXISTING CONDITIONS (2009)

TORONTO AND REGION Conservation

DRAWING FILE: AutoCad F817.dwg
DATE: SEPT 18, 2009

OPTION 3 - PLAN - REPLACE WITH MSE WALL (1H:1V)

TERRAPROBE

File No. 1-10-5216

FIGURE 8

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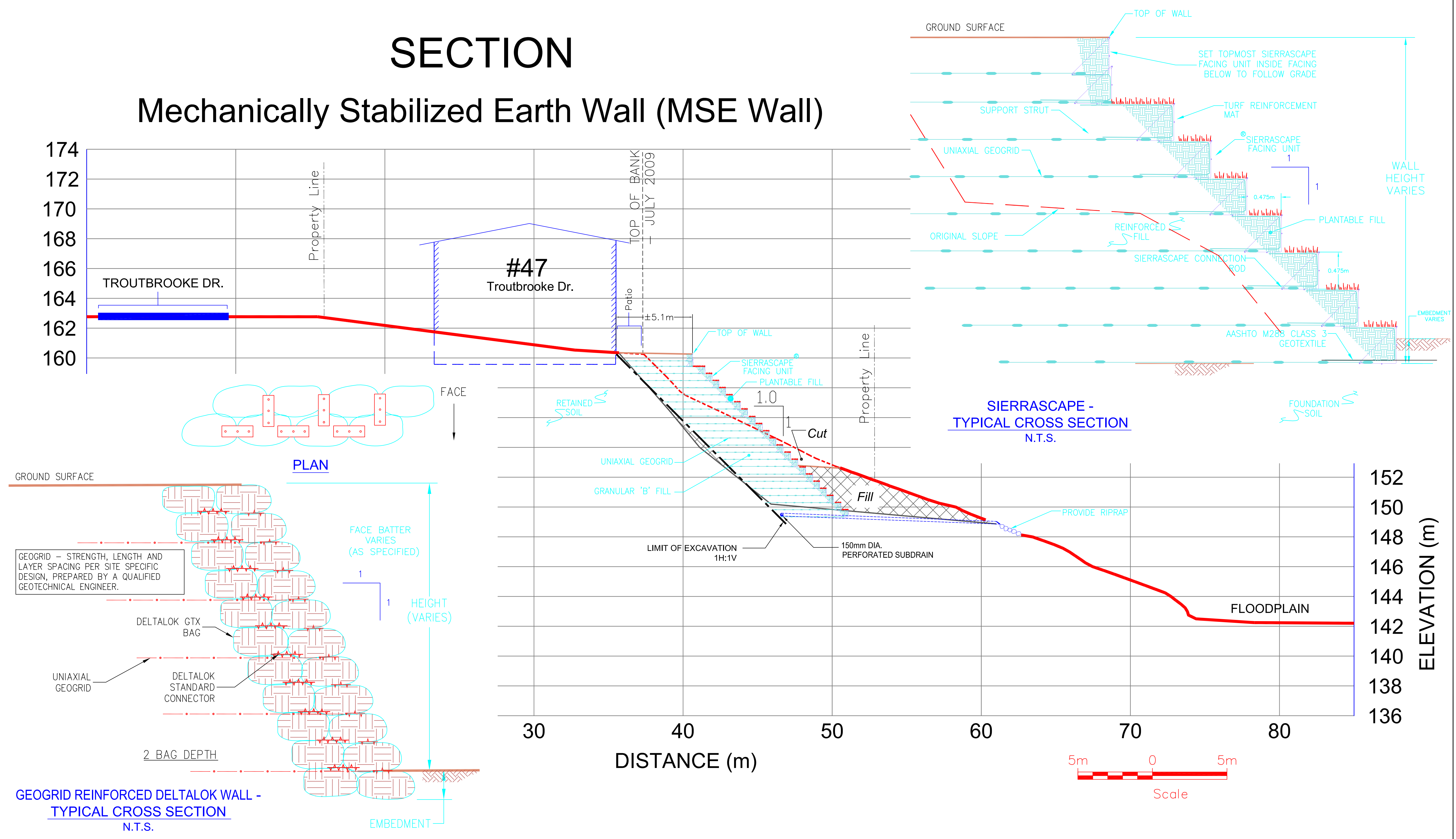
SECTION

Mechanically Stabilized Earth Wall (MSE Wall)



PLAN

SIERRASCAPE - TYPICAL CROSS SECTION
N.T.S.

GEOGRID REINFORCED DELTALOK WALL - TYPICAL CROSS SECTION
N.T.S.

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SIERRASCAPE OR DELTALOK WALL - OPTION 3

TERRAPROBE

File No. 1-10-5216

FIGURE 9

APPENDIX D

PUBLIC CONSULTATION

Notice of Intent

Community Liaison Committee (CLC) Meeting Documentation

CLC Meeting # 1 November 24th, 2010
(Agenda, Presentation, Minutes, Workbooks)

CLC Meeting # 2 February 16, 2011
(Agenda, Presentation, Minutes, Workbooks)

CLC Meeting # 3 April 6, 2011
(Agenda, Presentation, Minutes, Workbooks)

Meeting with Property Owners or Representatives Documentation

Individual Meetings with Each Affected Property Owner or Representative March 2011
(Minutes)

Notice of Filing

Remembering our country's fallen soldiers

A Remembrance Day service will be held at 3 p.m. Sunday at Little Avenue Memorial Park, 2 Little Ave.

The service will include prayers, song and recognition of Canadians serving in Afghanistan.

ON DISPLAY

SHOW AND SALE: Alan Yao stops to examine a display of works by the Willowdale Group of Artists in the North York Civic Centre on Tuesday. The annual show is on display until Nov. 12. 9 a.m. to 6 p.m. daily. Admission is free and the building is wheelchair accessible. For more information, visit www.willowdaleartists.com

Photo/MARY GAUDET

Early closures for Spadina subway line users until Nov. 27

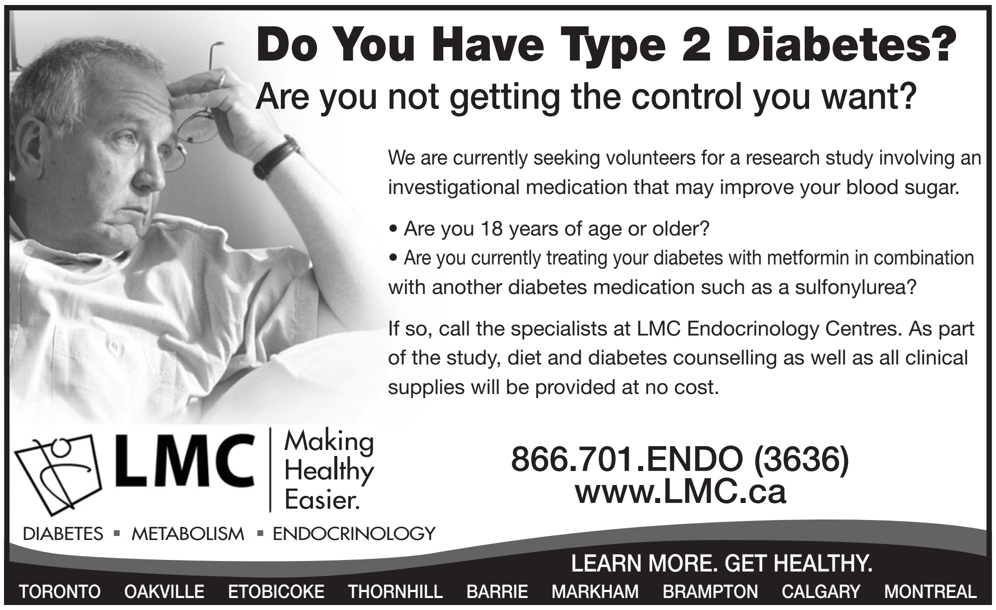
Late-night riders on the Yonge-University-Spadina subway line may face a long-than-usual commute until Saturday, Nov. 27.

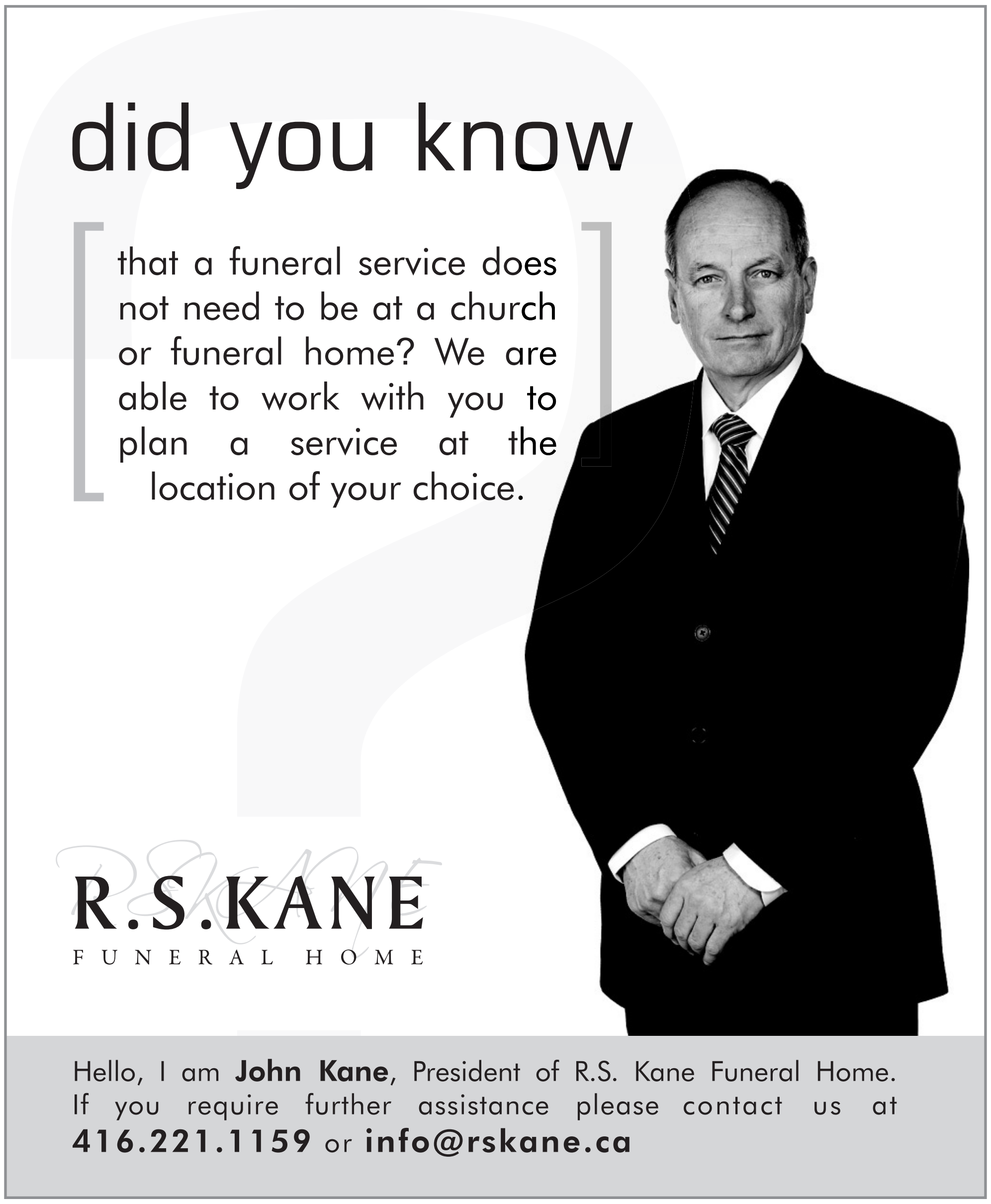
The line will close each night at 11:59 p.m. for scheduled track maintenance.

Until Saturday, Nov. 13, the subway line will close early from Lawrence West Station to Downsview Station.

The line will close from St. Clair West Station to Downsview Station from Sunday, Nov. 14 through Nov. 27.

Shuttle buses will be deployed for subway passengers looking to travel between those stops, with an accessible shuttle bus operating between Eglinton West Station and Downsview.





— NOTICE OF INTENT —

TORONTO AND REGION CONSERVATION AUTHORITY TROUTBROOKE DRIVE SLOPE STABILIZAZTION PROJECT CLASS ENVIRONMENTAL ASSESSMENT

Toronto and Region Conservation Authority (TRCA) has commenced a study regarding the development of alternatives to remediate slope erosion located on Black Creek adjacent Troutbrooke Drive in the City of Toronto. The project is being considered in order to provide protection for nine residential properties which currently are at risk.

TRCA invites you to participate in this study, which is subject to the *Class Environmental Assessment for Remedial Flood and Erosion Control Projects* approved for this type of undertaking. Your input will be incorporated in the planning and design process for this project.

If you wish to be involved in this study, or to receive further information, please contact:

Laura Stephenson
Manager, Project Management Office
Toronto and Region Conservation Authority
5 Shoreham Drive
Downsview, Ontario, M3N 1S4
Tel: (416) 661-6600, ext 5296
Fax: (416) 667-6278
Email: lstephenson@trca.on.ca

Subject to comments received as a result of this study and the receipt of necessary approvals and funding, TRCA intends to proceed with the construction of this project.

TORONTO AND REGION Conservation
for The Living City
Member of Conservation Ontario

Notice issued November 5, 2010

Beausoleil First Nation
Office of Council
One O-Gema Street
Christian Island, ON
L0K 1C0
705-247-2051 Fax: 705-247-2239

Chief Roland Monague, Chief Councillor Karry Sandy-McKenzie, Councillor Alfred Dan Monague,
Councillor C. Susan Copegog, Councillor Hector Copegog, Councillor B. Jeffrey Monague

RECEIVED
NOV 2 6 2010
PLANNING & DEVELOPMENT
T.R.C.A.

November 19, 2010

Toronto and Region Conservation
5 Shoreham Drive
Downsview, ON
M3N 1S4

RE: Toronto and Region Conservation Authority Troutbrooke Drive Slope Stabilization Project Class Environmental Assessment

To: Whom it may concern;

As a member of the Williams Treaties First Nations, Beausoleil First Nation acknowledges receipt of your which was received on November 10, 2010.

A copy of your letter has been forwarded to Karry Sandy-McKenzie, Barrister & Solicitor, Coordinator for Williams Treaties First Nations for further review and response directly to you. Mrs. Sandy-McKenzie's address is 8 Creswick Court, Barrie, ON L4M 2J7, or by e-mail at k.a.sandy-mckenzie@rogers.com.

We appreciate your taking the time to share this important information with us.

Sincerely,

Chief Roland Monague
Beausoleil First Nation

c.c: Beausoleil First Nation Council
Karry Sandy-McKenzie, Coordinator Williams Treaties First Nations

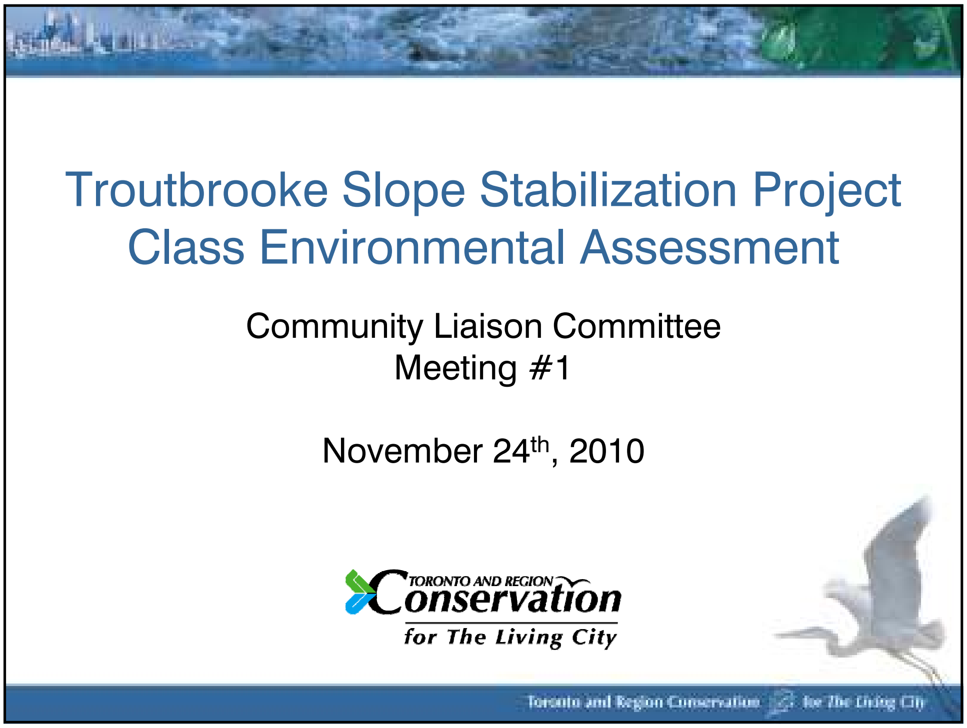
TORONTO AND REGION
Conservation
for The Living City

TROUTBROOKE SLOPE STABILIZATION PROJECT
COMMUNITY LIAISON COMMITTEE (CLC) MEETING #1

Wednesday November 24, 2010
Beverley Heights Middle School
26 Troutbrooke Drive, Toronto
6:30 p.m. – 8:30 p.m.

AGENDA

6:30 – 6:45	Attendance sign in, welcome and opening remarks
6:45 – 7:30	Presentation by TRCA • Project Site • Background Information • Project Purpose • The Class EA process Presentation by Terraprobe Limited • Review of geotechnical investigation and slope stability analysis • Overview of conceptual options for slope remediation
7:30 – 8:30	Discussion Period Next Steps Meeting adjournment



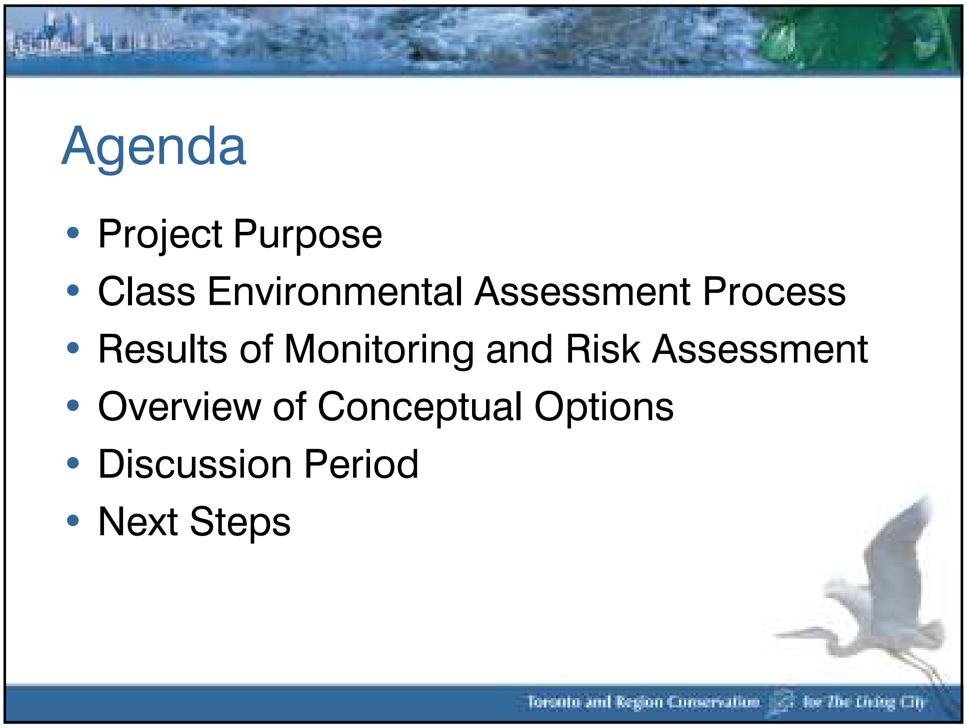
Troutbrooke Slope Stabilization Project Class Environmental Assessment

Community Liaison Committee
Meeting #1

November 24th, 2010

TORONTO AND REGION Conservation
for The Living City

Toronto and Region Conservation for The Living City



Agenda

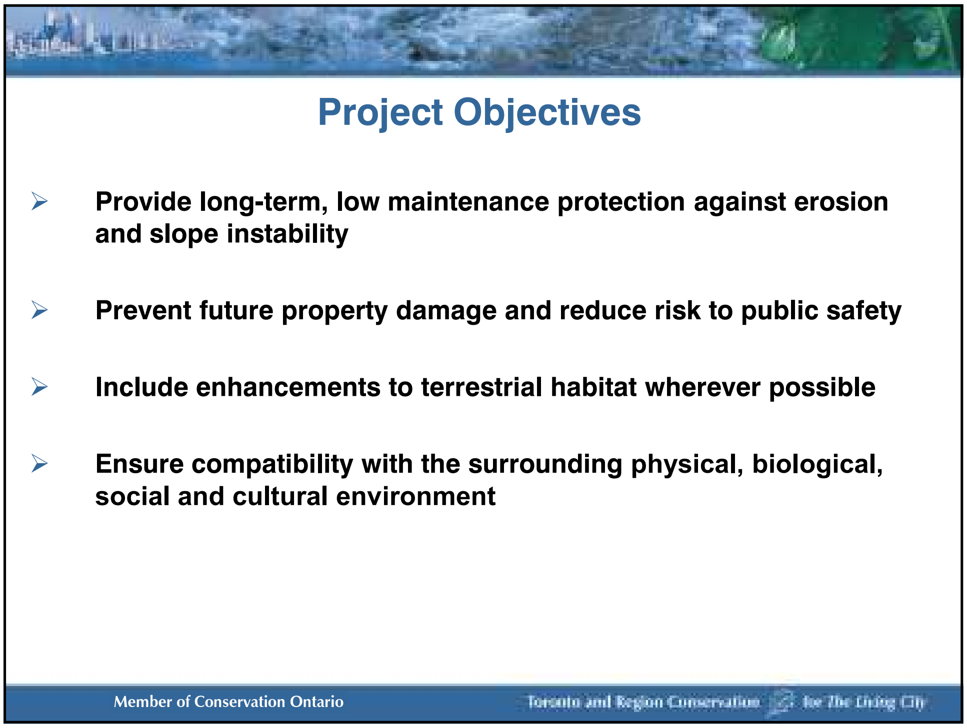
- Project Purpose
- Class Environmental Assessment Process
- Results of Monitoring and Risk Assessment
- Overview of Conceptual Options
- Discussion Period
- Next Steps

Toronto and Region Conservation for The Living City

TRCA Erosion Control Monitoring and Maintenance Program

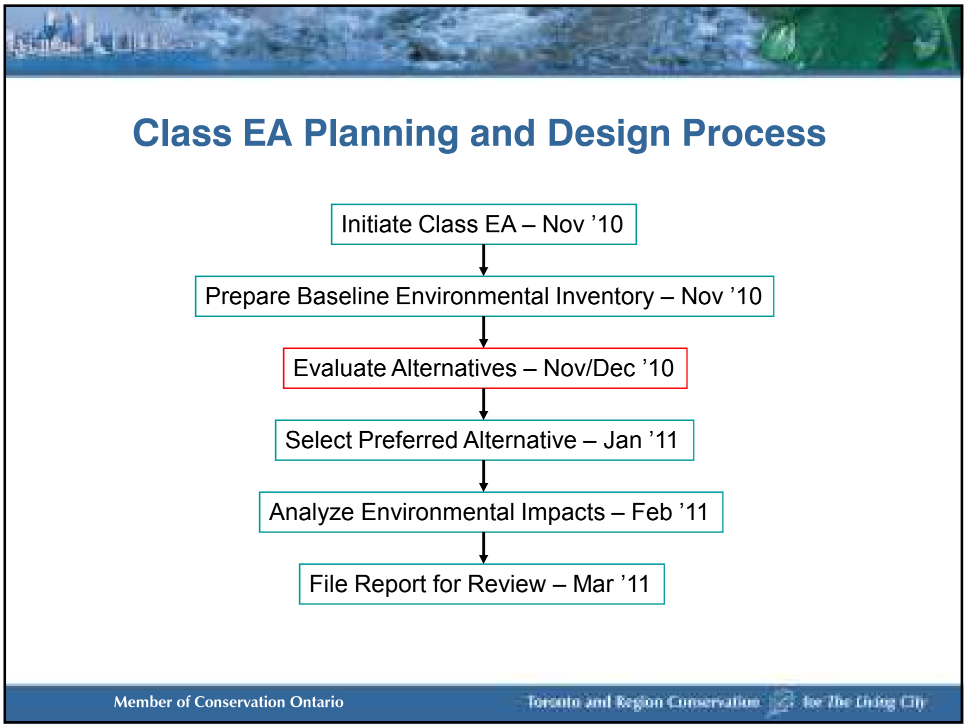
- **Program purpose is to protect public infrastructure, parklands, recreational trails, and residential dwellings threatened by erosion and slope instability issues arising typically from historic planning and development decisions.**

Project Location



Project Objectives

- Provide long-term, low maintenance protection against erosion and slope instability
- Prevent future property damage and reduce risk to public safety
- Include enhancements to terrestrial habitat wherever possible
- Ensure compatibility with the surrounding physical, biological, social and cultural environment



Class EA Planning and Design Process

Initiate Class EA – Nov ’10

Prepare Baseline Environmental Inventory – Nov ’10

Evaluate Alternatives – Nov/Dec ’10

Select Preferred Alternative – Jan ’11

Analyze Environmental Impacts – Feb ’11

File Report for Review – Mar ’11

Role of CLC

- To assist TRCA in obtaining public input on the project
- To identify items of concern related to the design of the project
- To assist in resolving issues of concern

Geotechnical and Slope Stability Assessment

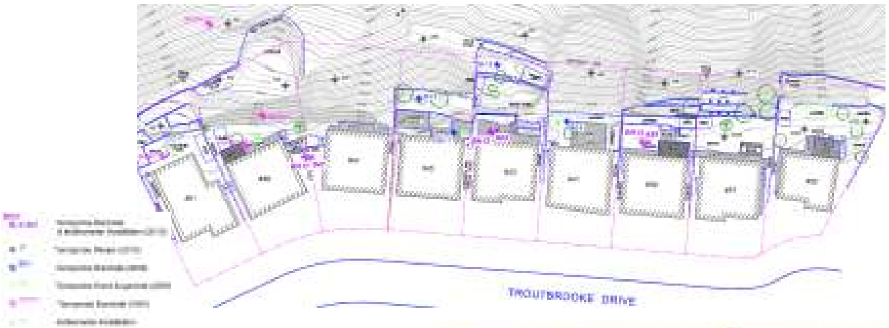
- Geotechnical Investigation in 1991 following spring slope movement
  - Movement had taken place through previously placed earth fill & retaining walls
  - Dwellings did not appear to be affected
  - Significant risk of additional movement within slope fill near slope crest
  - Installed inclinometer casings at #51 and 49 – no significant movement found

Geotechnical and Slope Stability Assessment

- Geotechnical Investigation in 2009 following spring slope movement
  - Movement through earth fill from #51 to 43, exposed foundation wall at #45
  - Boreholes drilled, hand auger samples, inclinometers installed behind #45 & 41
  - Study concluded:
    - Slope conditions adequately safe and stable against deep seated slides
    - Significant risk of additional slides in upper fills & retaining structures near slope crest & dwellings
    - Ongoing monitoring recommended
    - Further investigation recommended to allow for final design
    - Preliminary recommendations for remediation

Geotechnical and Slope Stability Assessment

- Current Study: initiated late September 2010
- Three additional boreholes (I1 to I3) and inclinometers on table land between #49/47, behind 43 and 39. Now inclinometers at #51 to #39.
- Thirteen additional fill thickness boreholes (H1 to H13)



Geotechnical and Slope Stability Assessment

- Site Stratigraphy:
  - Earth fill and rubble extends to depths of 1.1 to 7.6 m near the dwellings and reduces to no fill part way down the slope
  - Underlying native soils consist of competent very stiff or dense glacial till deposits, overlying hard clay and silt
  - All investigations (1991, 2009, 2010) found that the native soils were consistent
  - About 8,000 m^3 of fill across site
- Ground water
  - Consistently found in piezometers at ~ Elev. 155 m (about 4 to 5 m below grade), within the glacial till deposit

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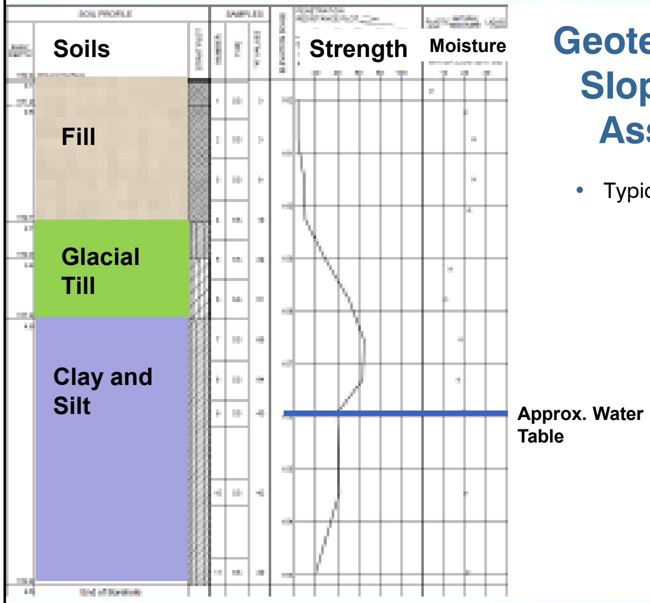
Geotechnical and Slope Stability Assessment

- Typical Borehole Log



Review of Rock Fill Dam

- Rock fill dam located 130 m west of #51, within Black Creek flood plain
- During flood events, water contacts slope toe
- 100 year storm water elevation ~ 145 m, about 2 m above toe (11 m below slope crest)
- Concern about “tea bag effect” or capillarity due to suction
- Capillarity / suction can only occur in unsaturated soils
- Clay and silt layer have moisture contents of 20 to 26%, and is therefore already in saturated condition
- Even if not saturated, overlying glacial till is too coarse to be subject to capillarity
- If capillarity had led to slope instability, it would have been near toe of slope, not in the upper, oversteepened earth fill well above the native soils

Review of Options

- “Do Nothing”
- Remove existing fill and replace with an engineered slope
- Remove existing fill and replace with an engineered mechanically stabilized earth wall
- Greenspace acquisition

Option 1: "Do Nothing"

- Upper, over-steepened earth fill slope will eventually self-flatten to a stable inclination of about 2 H : 1 V
- Provide fencing, frost protection to foundations, ongoing monitoring

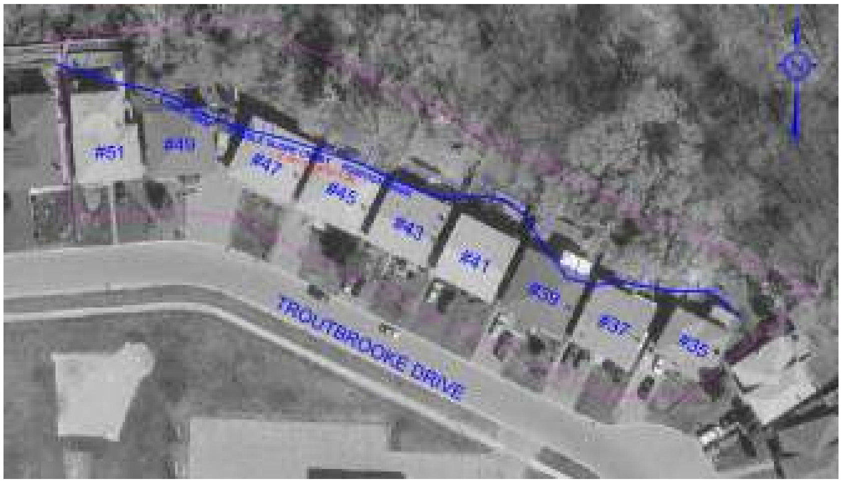
Advantages

- Low cost
- Low construction disturbance
- Low valley land impact

Disadvantages

- Very low level of stabilization to slopes
- High tableland loss
- High potential impact to dwellings
- Unknown timeframe

Option 1: "Do Nothing"

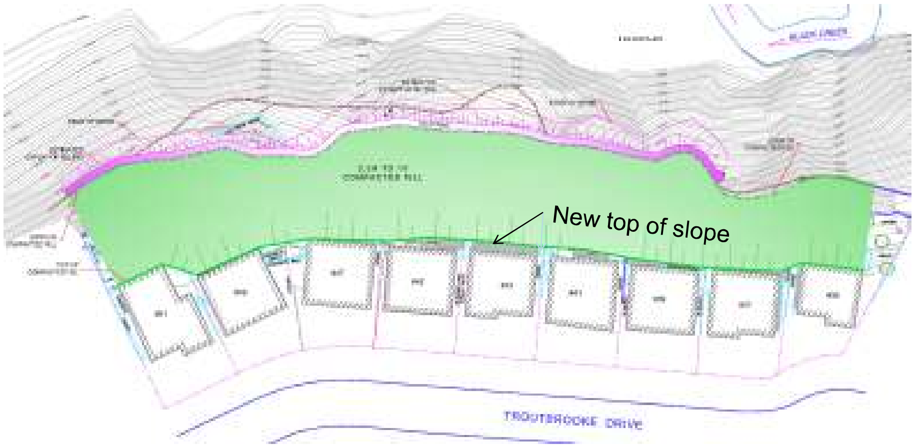


Option 2: Remove Fill and Replace with an Engineered Slope

- Remove existing fill and replace with one of three options:
  - Sort existing fill and re-compact at 2.5 H : 1 V (~ 22 deg.)
  - Replace with imported granular fill at 2.0 H : 1 V (~ 27 deg.)
  - Replace with geogrid reinforced granular fill at 1.5 H : 1 V (~ 34 deg.)
- Re-vegetate final slope configuration

Advantages	**Disadvantages**
Medium level of slope stabilization	High construction disturbance
Low impact to dwellings	Some tableland loss
Known time frame	Little to no tableland in back yards

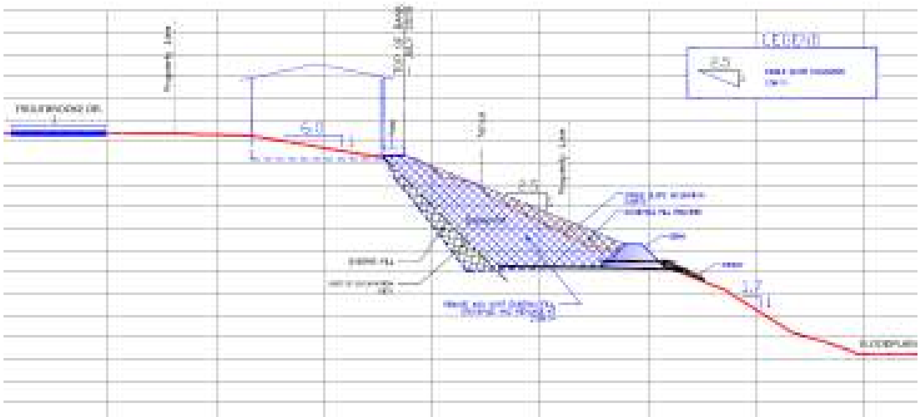
Option 2: Remove Fill and Replace with an Engineered Slope



New top of slope

Option 2a: Remove Fill and Replace with an Engineered Slope

Sort existing fill and re-compact at 2.5 H : 1 V



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Option 2b: Remove Fill and Replace with an Engineered Slope

Remove existing fill and import granular fill at 2.0 H : 1 V

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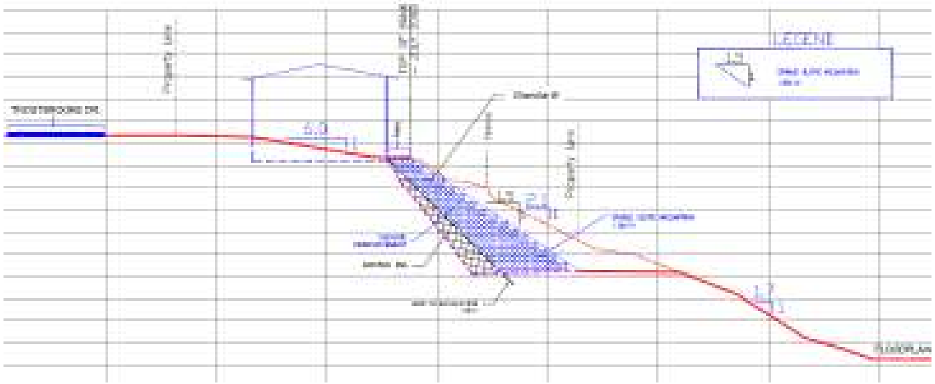
Option 2c: Remove Fill and Replace with an Engineered Slope

Remove existing fill and replace with geogrid reinforced granular fill at 1.5 H : 1 V

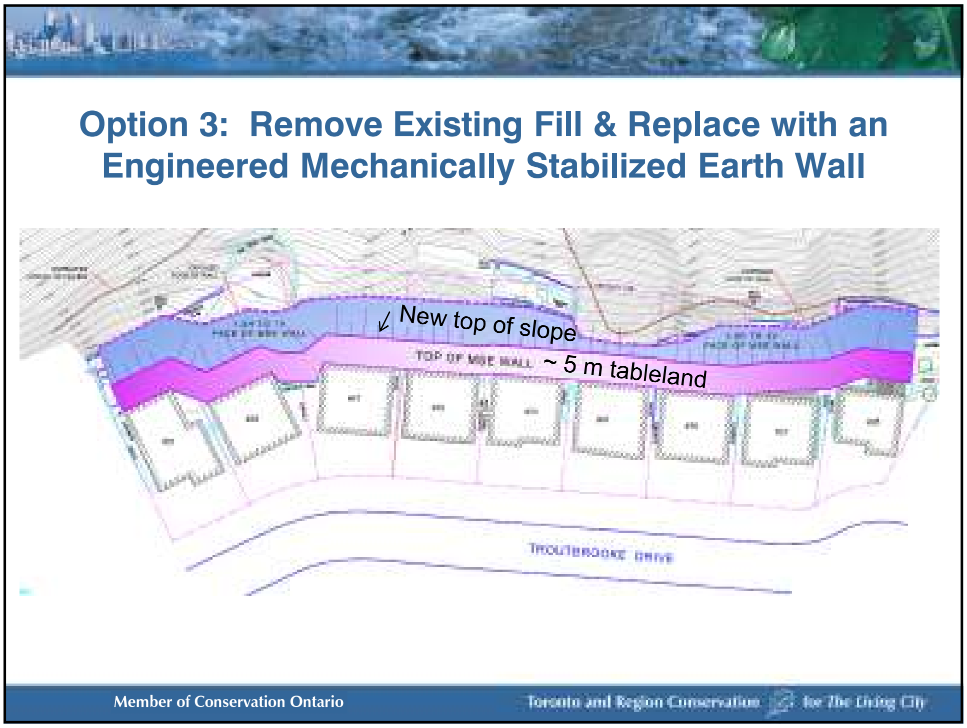


Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

- Remove existing fill and replace with a mechanically stabilized earth wall with a face angle of 1 H : 1 V (~ 45 deg.)
  - Geogrid reinforcement in structure
  - ‘Soft’ vegetated face
  - Backfilled with imported granular fill

Advantages
- Highest level of stabilization
- Low impact to dwellings
- Creation of tableland at each dwelling
- Known time frame

Disadvantages
- High construction disturbance
- Highest cost



Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

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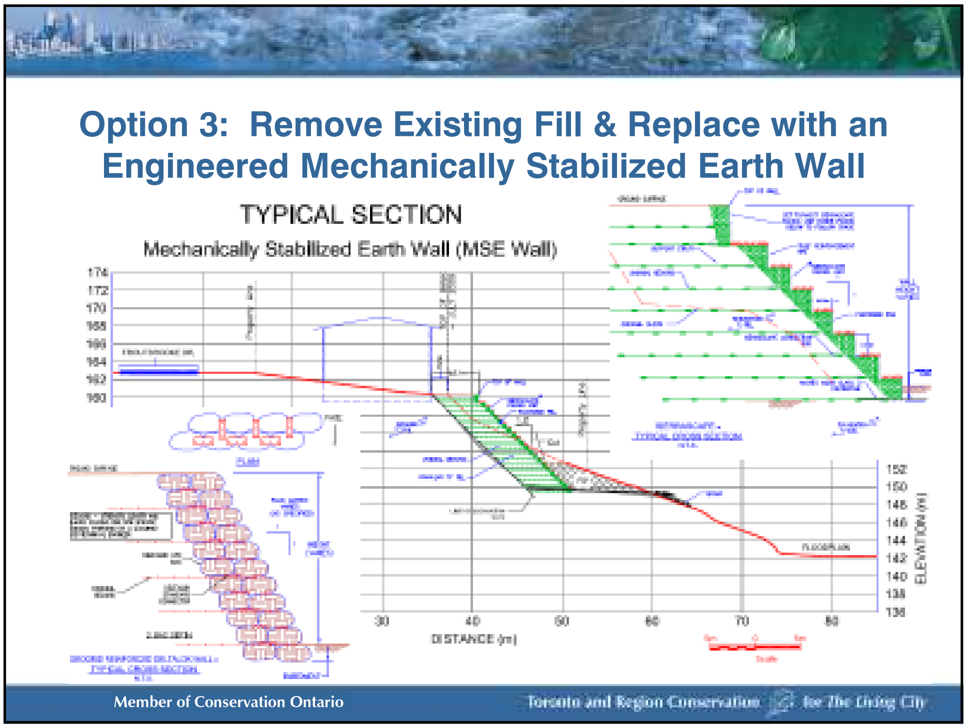

Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

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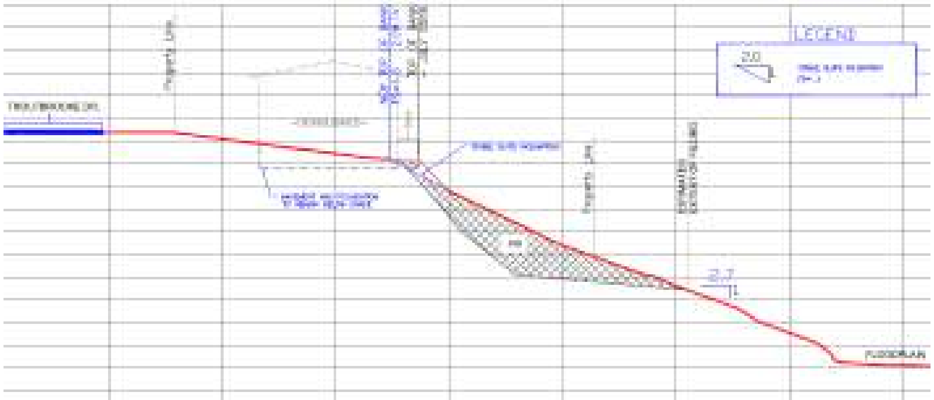
Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

Option 4: Greenspace Acquisition



Next Steps

- CLC members to complete feedback forms and return to TRCA by Friday December 3, 2010
- TRCA to work with Terraprobe to modify/add/omit alternative options based on input received
- Next CLC meeting tentatively scheduled for mid-January 2010 to discuss evaluation of alternatives and to select the preferred option
- Final CLC meeting will be held in March to discuss the project plan

TORONTO AND REGION
Conservation
for The Living City

Troutbrooke Slope Stabilization Project

CLC Meeting #1

Wednesday, November 24, 2010

Attendees:

Nick Saccone, Director Restoration Services
Laura Stephenson, Manger Project Management Office
Mark Preston, Senior Construction Supervisor
Lindsay Prihoda, Project Coordinator
Thomas Sciscione, Environmental Technician
Mike Fenning, Manager, Acquisitions and Sales
Craig Mitchell, Flood Infrastructure Coordinator
Jason Crowder, Terraprobe Inc.
Alida Troini, Councillor Augimeri's EA
Gaspar Horvath, Black Creek Project
Maria Lucente, Representative for Resident
Filomena Lucente, Resident
Patricia Meza, Resident
Juan Segura, Resident
Abdul Gulban, Resident
Silvia Volpini, Representative for Resident
David Le Quang, Resident
Maria Busca, Resident
Vince Tropiano, Representative for Resident
Alda Busca, Resident
P Busca, Resident

MINUTES

- Introductions - TRCA staff, Terraprobe Inc. (Consultant), Attendees.

- LS begins the presentation with summarizing the following: TRCA's Erosion Control Monitoring and Maintenance Program, the purpose of the Troutbrooke Slope Stabilization Project, the Class Environmental (Class EA) process, and the role of the Community Liaison Committee (CLC).

- LS informs the attendees that assuming funds and approvals are acquired, construction will occur in early summer (June).

- LS introduces JC, a Professional Engineer with Terraprobe Inc, the consulting firm that has completed the geotechnical investigation in support of the project.

- Terraprobe (JC) continues the presentation with a review of all the investigations completed at the site (1991, 1995, 2009, and 2010).

- JC summarizes the results and recommendation of the Geotechnical and Slope Stability Assessment completed in 2010:
    - Black Creek Retardation Dam is not the cause of the failure.
    - The failure occurred in the upper fill slope due to the significant weather conditions in the spring/winter of 2009, and due to the loose and unengineered fill placement.
    - Slope is safe from deep seated failures, however there is significant risk of additional slides in upper fills and retaining structures near slope crest and dwellings.

- JC continues to summarize the additional geotechnical works completed in September and October 2010:
    - There are inclinometers at the rear of each property in the project area.
    - Un-engineered earth fill and rubble extends to depths of 1.1 to 7.6 m near the dwellings;
    - There is an estimated of 8,000 m^3 of fill material along the slope.

- JC reviews the Black Creek Retardation Dam in relation to the “Tea Bag Effect”
    - The professional term for “Tea Bag Effect” is capillarity.
    - The soil material at the base of the valley wall is a clay and silt material, and is constantly saturated, therefore capillarity is not possible.
    - If capillarity had caused the slope instability, the failure would have occurred along the base of the slope.

- Attendee inquires what type of soil is at base of slope
    - JC responds the material at the base of the slope is clay and silt material.

- JC reviews Option 1: “Do Nothing”
    - The top of slope will move towards the residential structures, however the timeline is unknown.
    - Recommendations to provide fencing, frost protection for the foundation of the residential structures and continue ongoing monitoring of slope.

- JC reviews Option 2: Remove Fill and Replace with an Engineered Slope
    - Three methods of removing fill material including: sort existing fill and re-compact, replace with imported fill material or replace with a geogrid reinforced granular fill.
    - Existing fill material would be removed and replaced.
    - The final slope configuration would be re-vegetated.

- Attendee inquires on the amount of tableland that would be produced with the implementation of Option 2.
    - JC shows the attendees a cross section for a better view of the proposed tableland.
    - JC notes there would be minimal tableland.

- JC reviews Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall.
    - Existing fill material would be replaced with mechanically stabilized earth wall, with a vegetated face.

- Attendee inquires if the amount of tableland would be uniform throughout the project site (i.e.) across the affected properties.
    - JC shows the attendees the top of slope and the amount of tableland proposed with this option.

- LS reviews the Option 4, Green Acquisition.

- Attendee comments that the feedback of the property owners will depend highly on cost of the alternatives and the property owners required contribution (i.e) more property loss will result in the decrease value of the properties.

.

- LS explains the Landowner Contribution Policy:

    - TRCA is dependent on capital funding from the City of Toronto to implement such projects.
    - TRCA applies for capital funding on a yearly basis.
    - TRCA anticipates the capital funding will be able to fund the majority of this project.
    - The Landowner Contribution Policy requires that benefiting landowners contribute either financially, or through the transfer of lands, to the cost of the project.
    - Typically the preferred option selected by private landowners involves transfer of title to the involved lands to TRCA as the owner contribution in lieu of a cash contribution.

- Attendee inquires if the Government of Ontario is involved with the funding of projects.
    - LS notes that in the past the province has provided funding, however currently there is minimal funding.

- Attendee requests clarification related to Landowner Contributions.
    - MF explains that either the property owner would transfer a portion of their land to TRCA or provide cash contribution.
    - LS adds that TRCA has an approved funding formula to determine the cash amount (see meeting handout for details).

- Attendee inquires about the total cost of the project
    - LS noted that least expensive of the options is estimated at approximately 1 million dollars and that staff are currently working on preparing more detailed estimates for each of the proposed options for discussion at the next CLC meeting.

- Attendee comments that the majority of the affected property owners will request the largest amount of tableland possible.

- Attendees inquire if the current fill material can be kept with an addition of a retaining structure
    - JC notes the fill material is not stable, there will be further movement and the fill material is not recommended to remain on-site.

- Attendee inquires if there are any property owners interested in the Greenspace Acquisition, more specifically if TRCA is willing to purchase would the affected property owners be interested.
    - Several attendees raise their hands.

- Attendees inquire if Option 3 (retaining structure) could be constructed along the existing property line.
    - JC informs the attendees it is technically feasible.
    - LS noted that the cost of filling to the property line would have to be evaluated.
    - NS informs the attendees that this would be inconsistent with TRCA's mandate.

- Attendee inquires about the influence "rocks" downstream from site.
    - JC reiterates the Black Creek Retardation Dam is not the cause of the slope failure.

- Attendee comments that should Option 3 proceed their yard would be reduced in size

  - JC indicates that the current fill is not stable and has the potential to fail in the future.

- Attendee inquires about the high levels of E coli found in Black Creek
  - LS confirms that water quality data indicates elevated E coli levels, however at this time TRCA is uncertain of the source.
  - CM informs the attendees there could be several reasons the E coli count is high (i.e.) animal feces, infrastructure, etc…
  - GH informs TRCA staff and attendees that the City of Toronto has identified works to remediate all infrastructure issues.

- Attendee comments that the Black Creek Retardation Dam was constructed in the late 1960's, after the development of the affected properties.
  - CM informs the attendees that the dam was built in 1960 prior to the development of affected properties.
  - Attendee inquires for additional information on the dam.
  - **Action Item #1** – See attached aerial photography from 1961 of project area and an excerpt from the *Plan for Flood Control and Water Conservation, Metropolitan Toronto and Region Conservation Authority, September 2, 1959*. Further information about the dam will be documented in the Environmental Assessment Report.

- LS explains the Next Steps.
  - Attendees are to complete the workbook to provide feedback on the alternatives and return to TRCA by Friday December 3, 2010.
  - TRCA to work with Terraprobe to modifty/add/omit alternative options based on feedback received and prepare cost estimates.
  - If attendees have any questions or concerns please contact either Laura Stephenson, Project Manager at lstephenson@trca.on.ca or Lindsay Prihoda, Project Coordinator at lprihoda@trca.on.ca.
  - Next CLC Meeting tentatively scheduled for mid-January 2011 to discuss evaluation of alternatives and to select the preferred option.
  - Final CLC meeting will be held in March to discuss project plan.

- Attendee inquires if the existing trees along the valley wall will be preserved during construction, as many property owners would like to preserve as many as possible.
  - LS informs that tree removals along the valley wall will be required to access the project site, however effort will be taken to preserve as many trees as possible and to restore the site conditions following construction.

- Attendee inquires if JC would explain the "Tea Bag Effect" or Capillarity in more detail.
  - JC illustrates by drawing an example on the whiteboard.

- Attendee comments that there is stagnant water at the base of the slope, which causes many insects to be present in this area, and there is a concern for West Nile.
  - **Action Item #2** – TRCA staff have made an inquiry about available monitoring information.

- CM recommends that JC explain the perched water table vs. the water table in relation to the project site.
  - JC proceeds by illustrating the effects of the perched water table within the project site on the whiteboard.

    - Groundwater discharge along the upper slope face triggers movement of the fill material and structures, particularly after major storm or freeze/thaw events;
    - Overland surface flow directed over the slope face also contributes to instability of the slope.
    - He notes the perched water table along the with the significant weather conditions of winter 2009 and unegineered fill contributed the failure.

- Attendee inquires about cylinders that are cemented and not upright tilting at the rear of the property.
    - JC notes the cylinders were likely installed to assist with stabilizing the slope, and the tilting of these cylinders indicates the movement of the slope.

- Attendees thank the TRCA for completing the geotechnical and slope stability assessment and for their on-going efforts to assist the affected property owners.

- LS introduces GS from the Black Creek Project
    - The Black Creek Project is a community volunteer group that was formed in 1982.
    - This community group organizes clean ups, tree plantings, and coordinates nature walks in the parks along Black Creek.

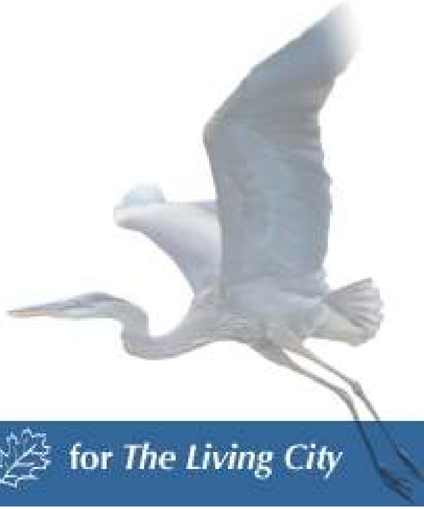
Meeting adjourned at 8:30 pm.

Troutbrooke Slope Stabilization Project

Class Environmental Assessment

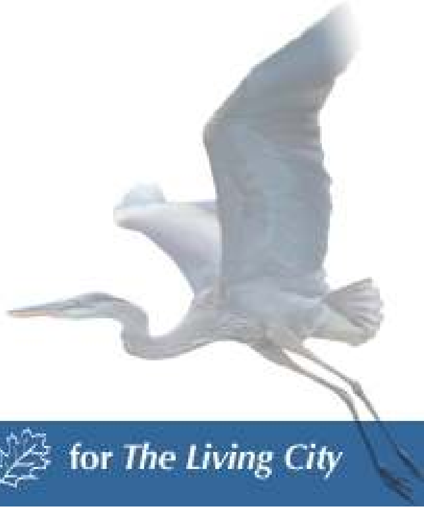
Community Liaison Committee (CLC) Meeting #1
Wednesday, November 24th, 2010

Participant Workbook



Key Questions

- Feedback on Alternatives
- Feedback on Landowner Contribution
- Other Questions and Comments



Project Purpose

- Provide long-term, low maintenance protection against erosion and slope instability
- Prevent future property damage and reduce risk to public safety
- Include enhancements to terrestrial habitat wherever possible
- Ensure compatibility with the surrounding physical, biological, social and cultural environment

Comments:

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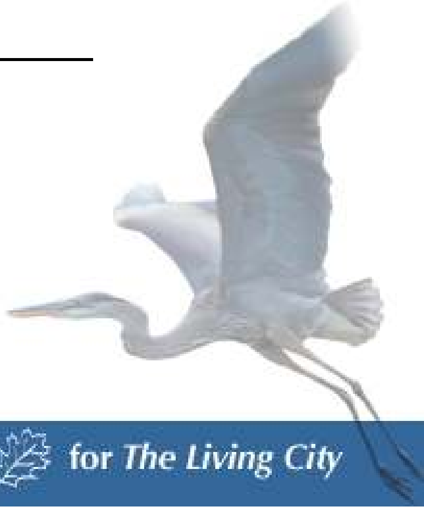

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Evaluation Targets

Natural Environment

- Ensure no negative impact to aquatic habitat
- Prevent or minimize negative water quality impacts
- Preserve or enhance existing native vegetation
- Consider potential impact on nesting birds

Socio-Economic Environment

- Ensure no negative impact to existing infrastructure
- Prevent future property damage
- Prevent or minimize loss of public and private land
- Reduce risk to public safety
- Consider compatibility with existing land use

Technical Environment

- Eliminate or reduce slope hazard
- Protect against future erosion and slope instability
- Consider impact of construction (noise, dust, vibration)
- Consider site access requirements

Cultural Environment

- Consider impact on cultural resources and parkland

Cost

- Consider implementation costs
- Consider future maintenance requirements and cost
- Consider impact on other projects

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Results of Evaluation

Do you agree with the evaluation of the preliminary alternatives? Are there any other impacts we should consider in the evaluation?

Comments:

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 1: “Do Nothing”

Feedback on Option 1

Do you have any comments on the alternative as presented?

Comments:

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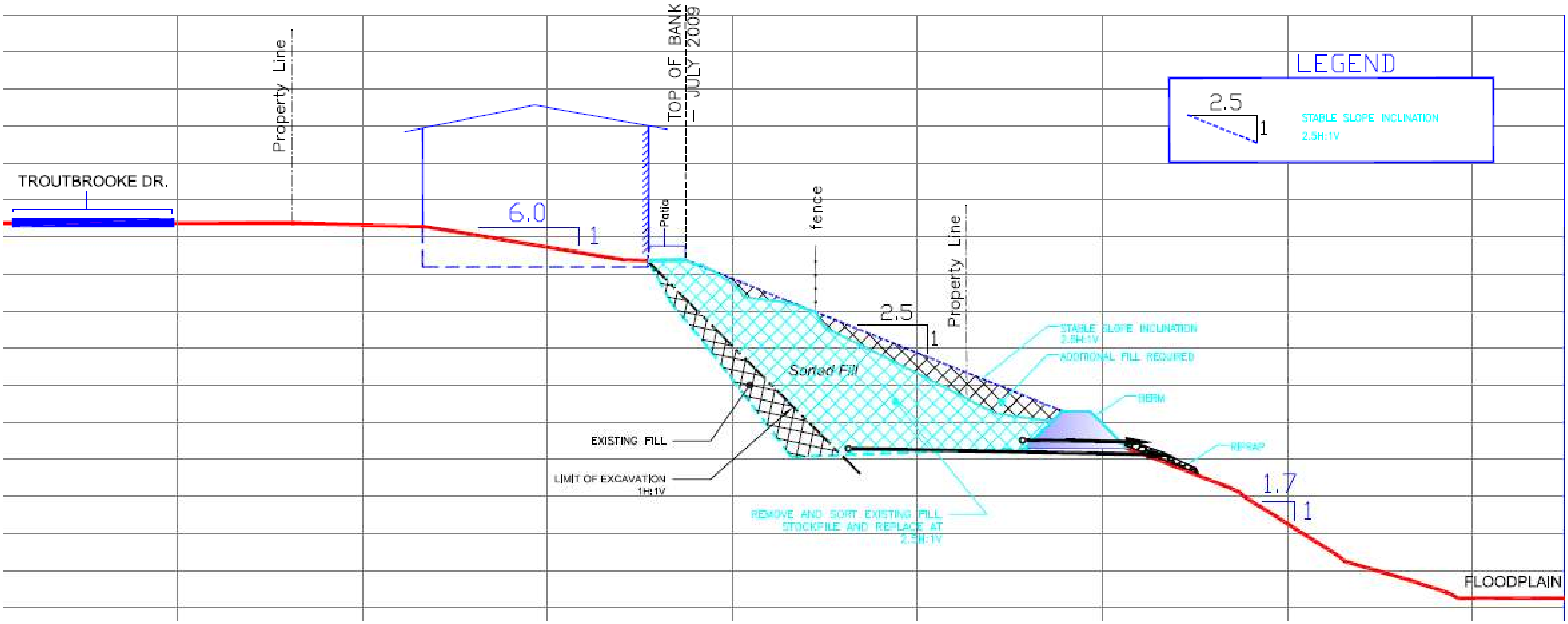
Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 2: Remove Fill and Replace with an Engineered Slope (with Deck)

Option 2a: Remove Fill and Replace with an Engineered Slope

Sort existing fill and re-compact at 2.5 H : 1 V



Feedback on Option 2a

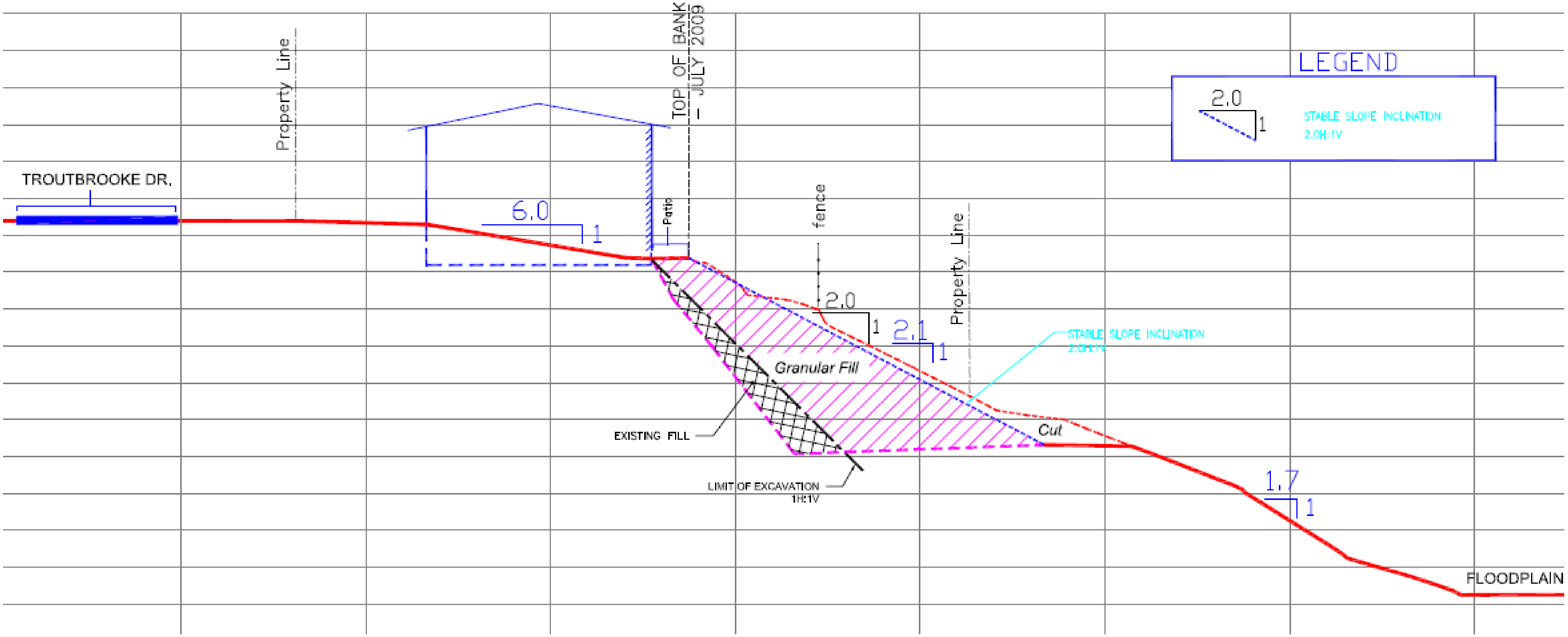
Do you have any comments on the alternative as presented?

Comments:

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 2b: Remove Fill and Replace with an Engineered Slope

Remove existing fill and import granular fill at 2.0 H : 1 V



Feedback on Option 2b

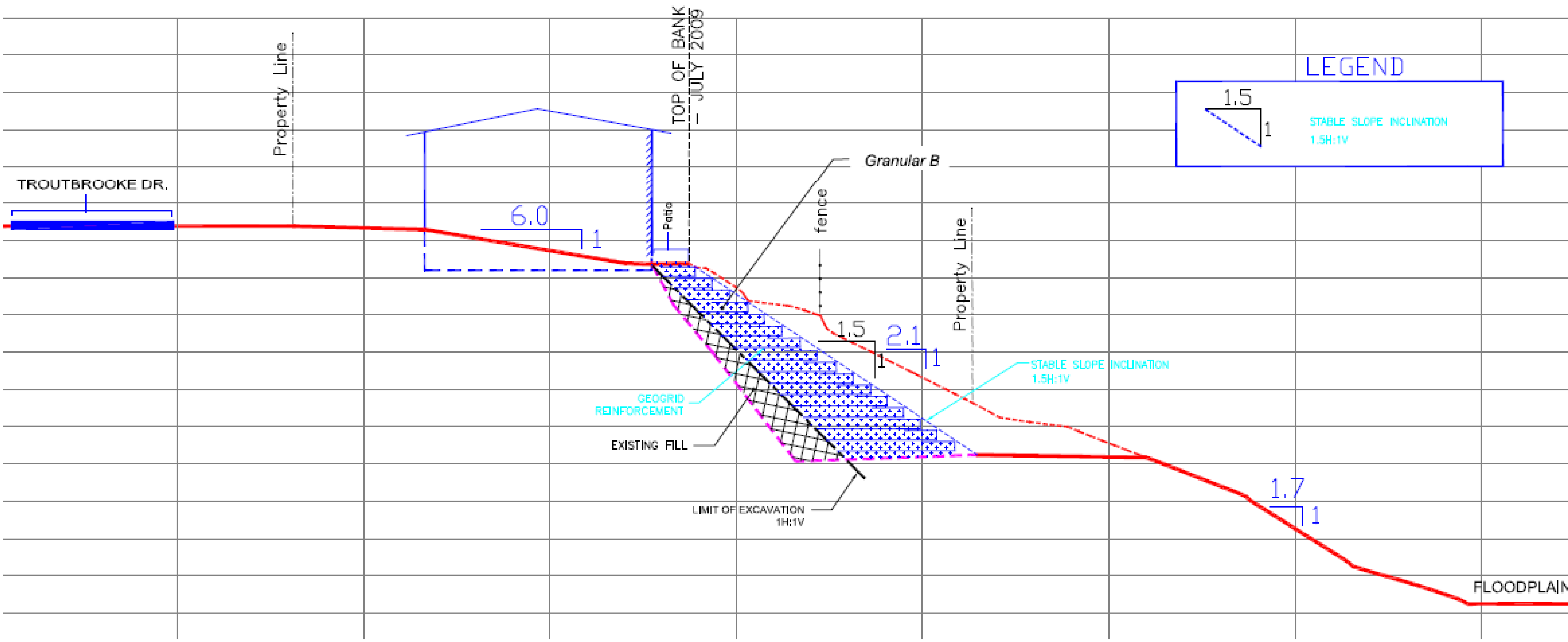
Do you have any comments on the alternative as presented?

Comments:

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 2c: Remove Fill and Replace with an Engineered Slope

Remove existing fill and replace with geogrid reinforced granular fill at 1.5 H : 1 V



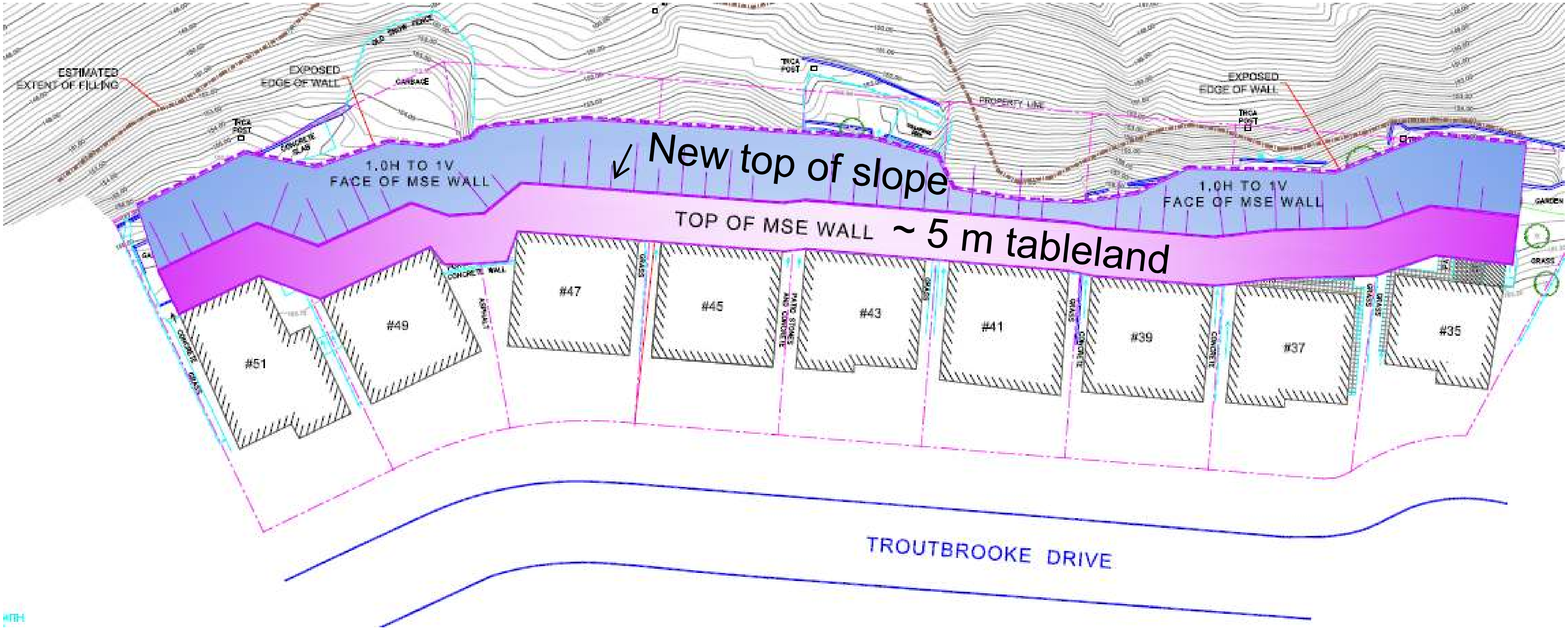
Feedback on Option 2c

Do you have any comments on the alternative as presented?

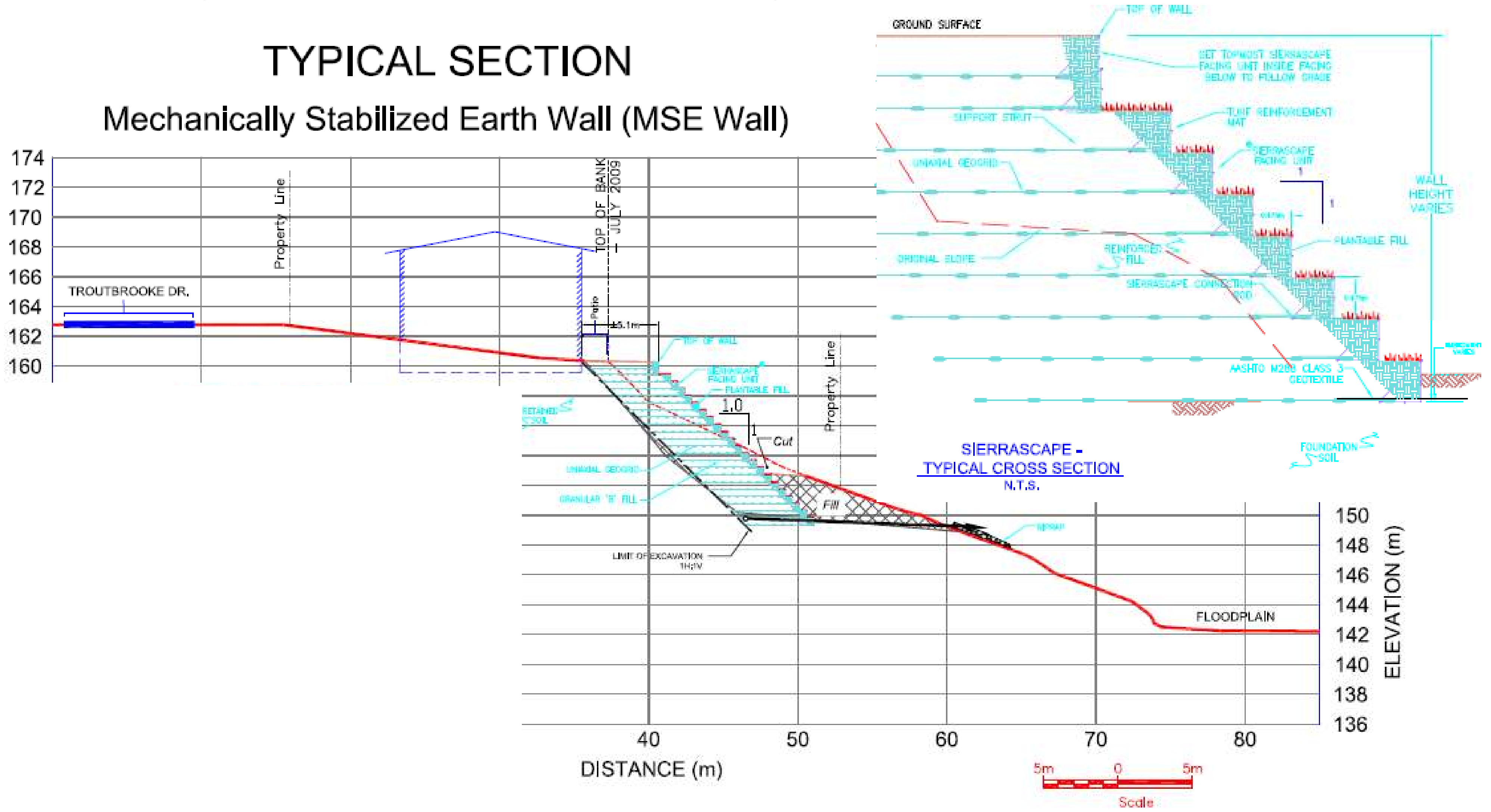
Comments:

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall



Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall



TYPICAL SECTION

Mechanically Stabilized Earth Wall (MSE Wall)

SIERRASCAPE - TYPICAL CROSS SECTION

N.T.S.

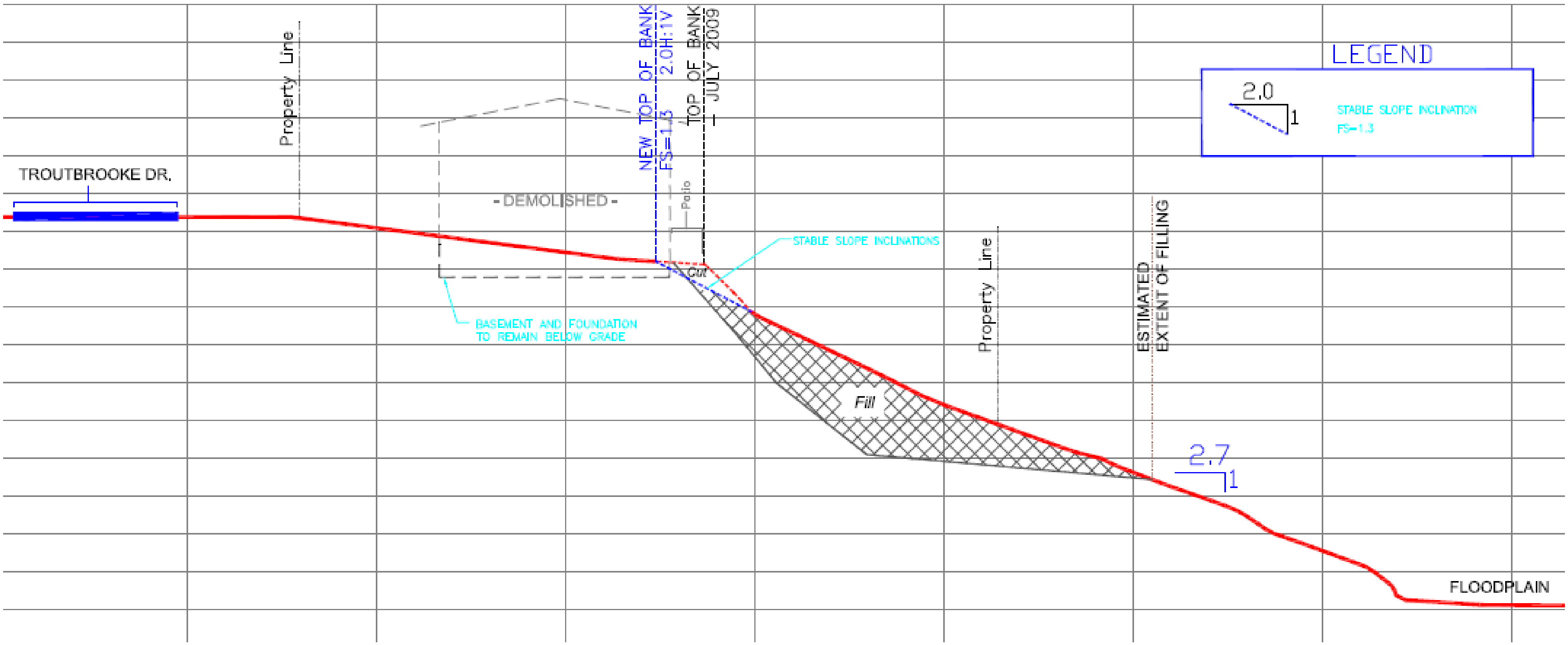
Feedback on Option 3

Do you have any comments on the alternative as presented?

Comments:

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 4: Greenspace Acquisition



Feedback on Option 4

Do you have any comments on the alternative as presented?

Comments:

Other Questions or Comments

Do you have any other questions of comments on the project?

Comments:

Name (optional) and Address

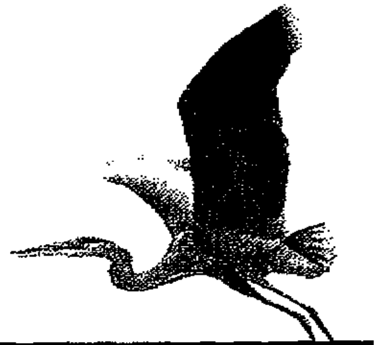
Please return the completed workbook by Friday December 3, 2010 to Lindsay Prihoda, Project Coordinator;
by facsimile (416) 392 - 9726; by e-mail lprihoda@trca.on.ca; by mail: TRCA 5 Shoreham Drive, Downsview, ON M3N 1S4

Troutbrooke Slope Stabilization Project

Class Environmental Assessment

Community Liaison Committee (CLC) Meeting #1
Wednesday, November 24th, 2010

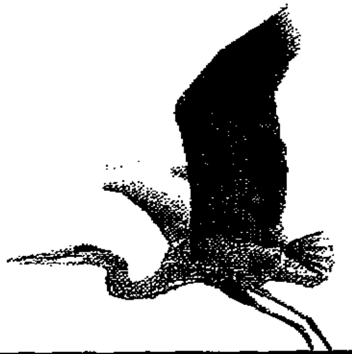
Participant Workbook

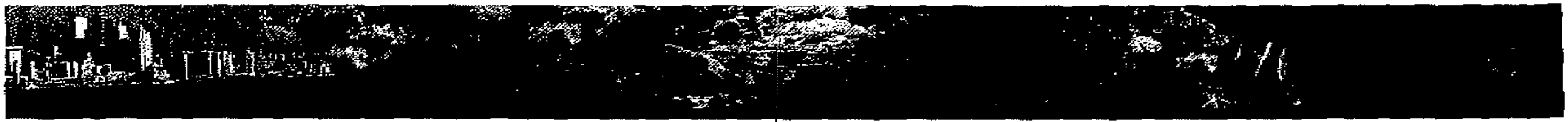


Key Questions

- ➢Project Purpose
- ➢Evaluation Targets
- ➢Feedback on Alternatives
- ➢Other Questions and Comments

Troutbrooke Slope Stabilization Project
Class Environmental Assessment



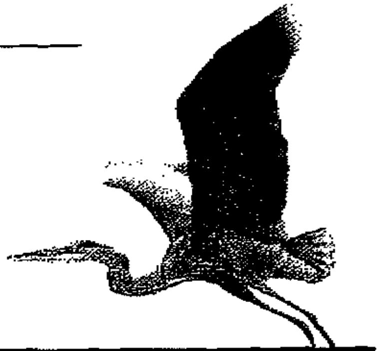


Project Purpose

- Provide long-term, low maintenance protection against erosion and slope instability
- Prevent future property damage and reduce risk to public safety
- Include enhancements to terrestrial habitat wherever possible
- Ensure compatibility with the surrounding physical, biological, social and cultural environment

Comments:

I would like to see the pre-erosion backyard re-established, which means horizontal to almost property line before slope starts.



Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Evaluation Targets

Natural Environment

- Ensure no negative impact to aquatic habitat
- Prevent or minimize negative water quality impacts
- Preserve or enhance existing native vegetation
- Consider potential impact on nesting birds

Socio-Economic Environment

- Ensure no negative impact to existing infrastructure
- Prevent future property damage
- Prevent or minimize loss of public and private land
- Reduce risk to public safety
- Consider compatibility with existing land use

Technical Environment

- Eliminate or reduce slope hazard
- Protect against future erosion and slope instability
- Consider impact of construction (noise, dust, vibration)
- Consider site access requirements

Cultural Environment

- Consider impact on cultural resources and parkland

Cost

- Consider implementation costs
- Consider future maintenance requirements and cost
- Consider impact on other projects

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Evaluation Targets

Do you agree with the targets presented? Are there any others we should consider in the evaluation of the alternatives?

Comments:

Consider restoring to pre-erosion condition of backyard.

Option 1: "Do Nothing"

Feedback on Option 1

Do you have any comments on the alternative as presented?

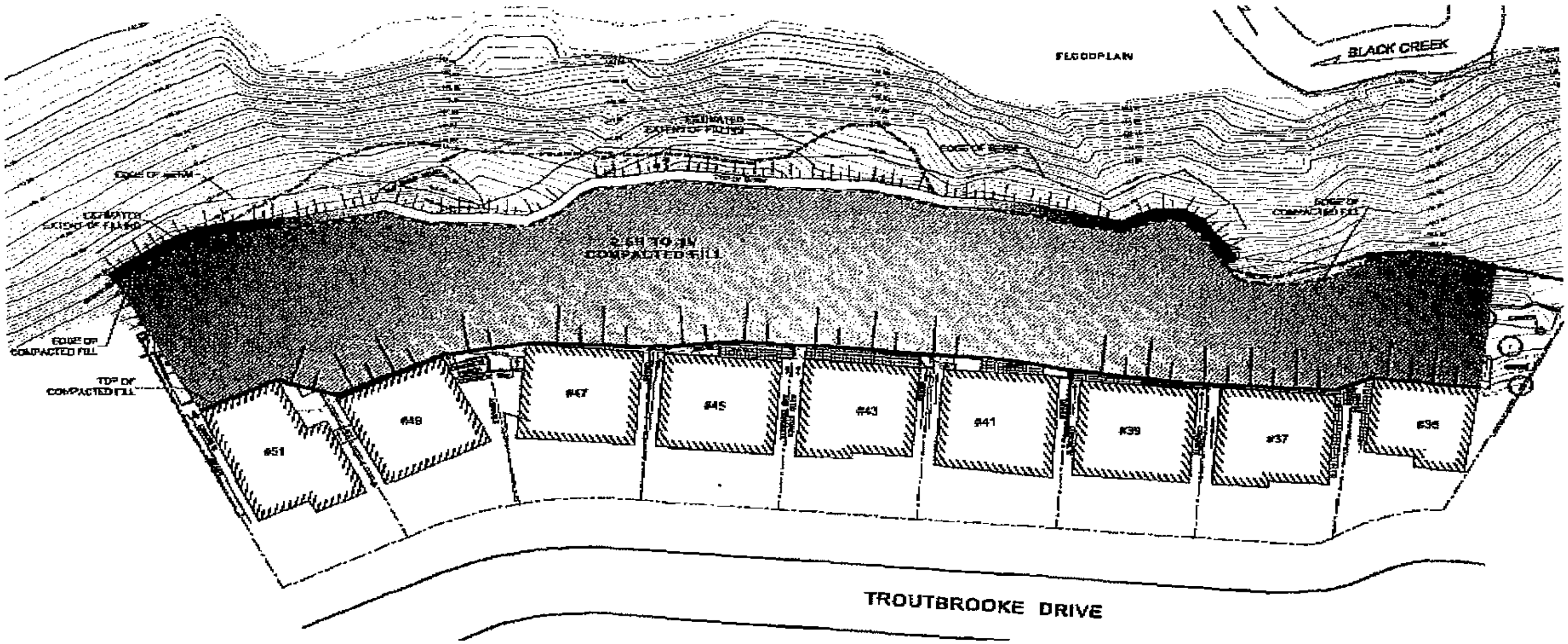
Comments:

Option 1 is definitely not acceptable for #47.

According to TRCA letter of Nov 4, 2010, Re: Troutbrooke Drive Geotechnical and Slope Stability Assessment, on page 2, the last item listed in "additional measures" is "all access to behind 47 Troutbrooke should be restricted".

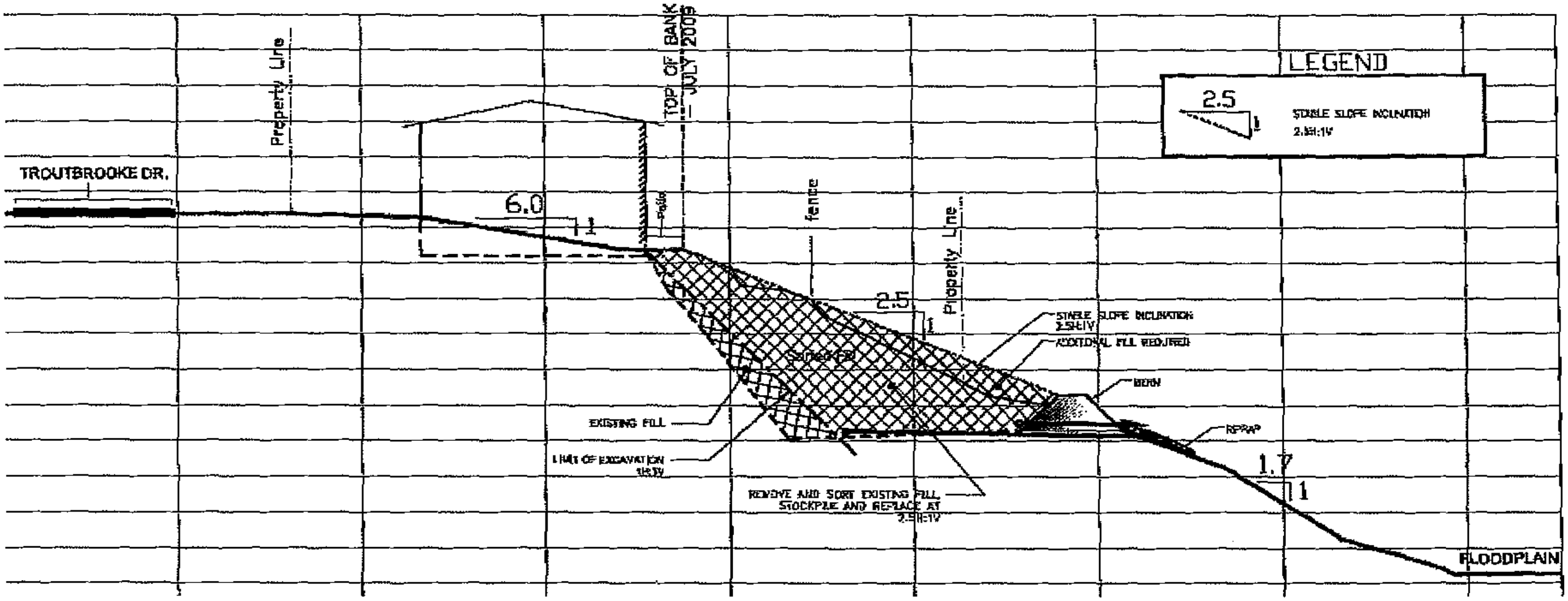
Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 2: Remove Fill and Replace with an Engineered Slope



Option 2a: Remove Fill and Replace with an Engineered Slope

Sort existing fill and re-compact at 2.5 H : 1 V



Feedback on Option 2a

Do you have any comments on the alternative as presented?

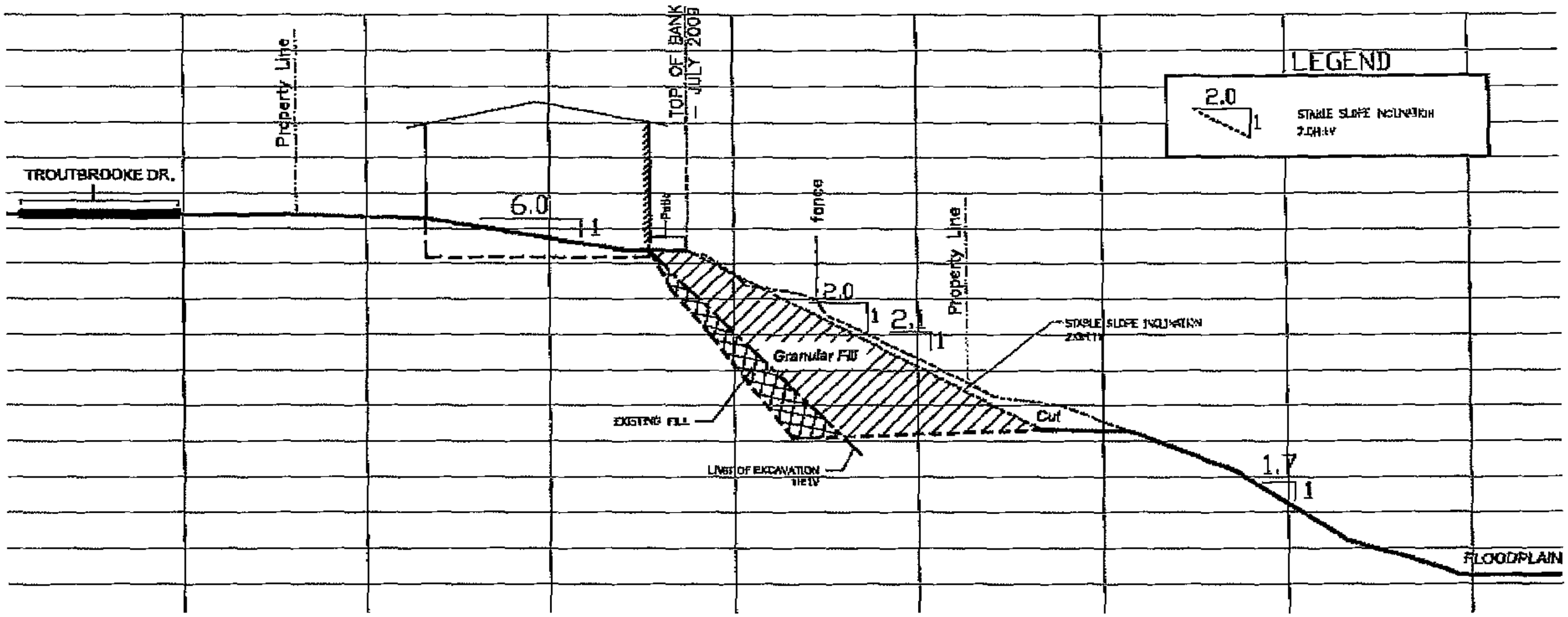
Comments:

N/A

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 2b: Remove Fill and Replace with an Engineered Slope

Remove existing fill and import granular fill at 2.0 H : 1 V



Feedback on Option 2b

Do you have any comments on the alternative as presented?

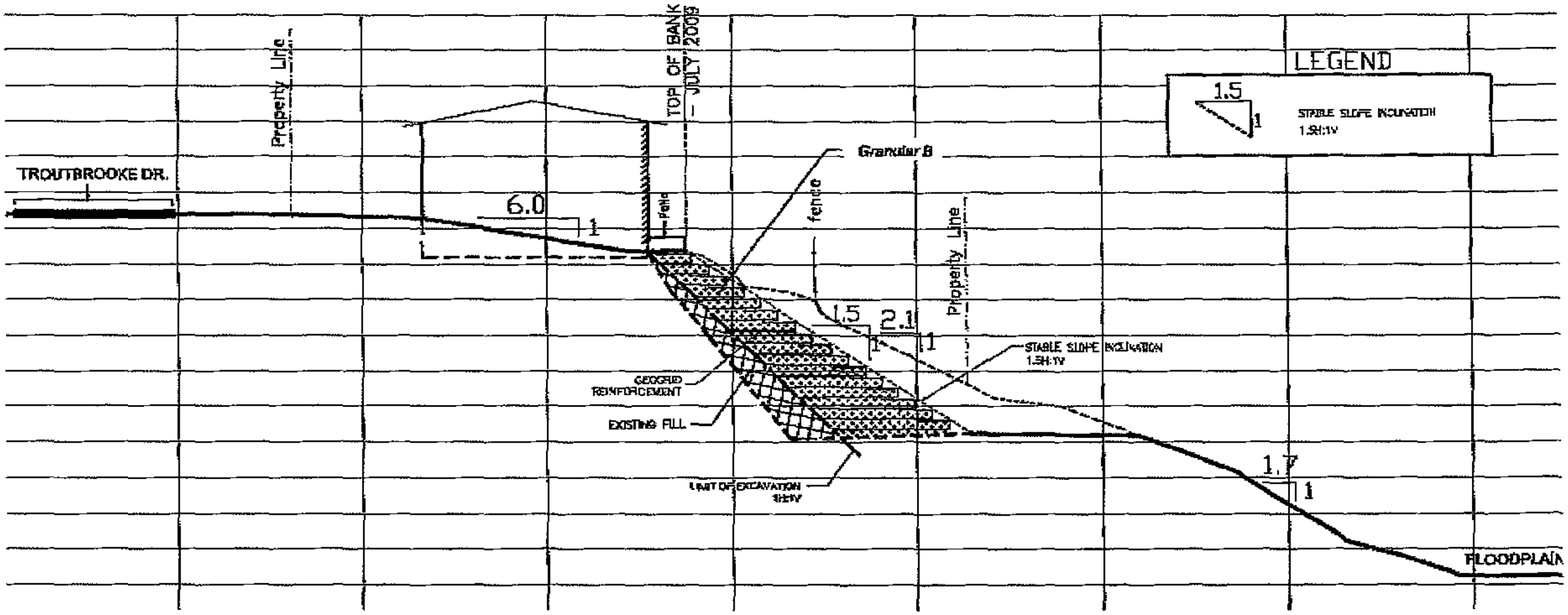
Comments:

N/A

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 2c: Remove Fill and Replace with an Engineered Slope

Remove existing fill and replace with geogrid reinforced granular fill at 1.5 H : 1 V



Feedback on Option 2c

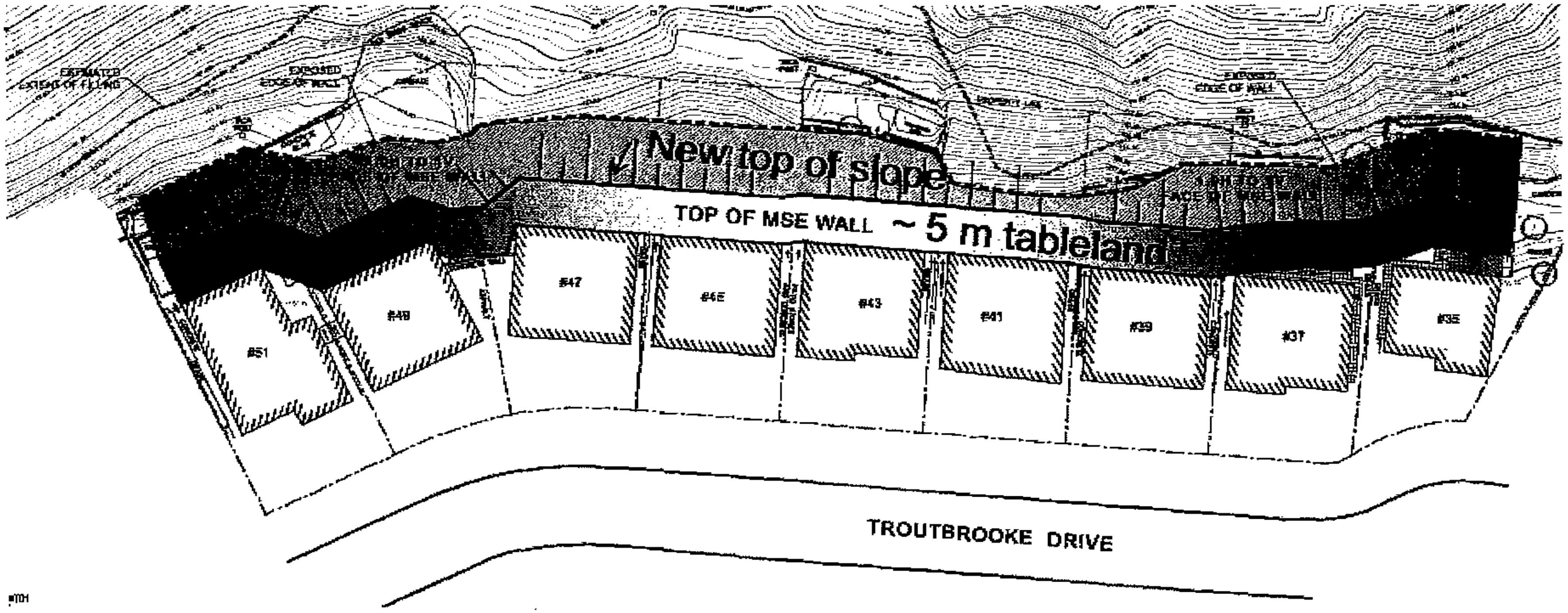
Do you have any comments on the alternative as presented?

Comments:

N/A

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall



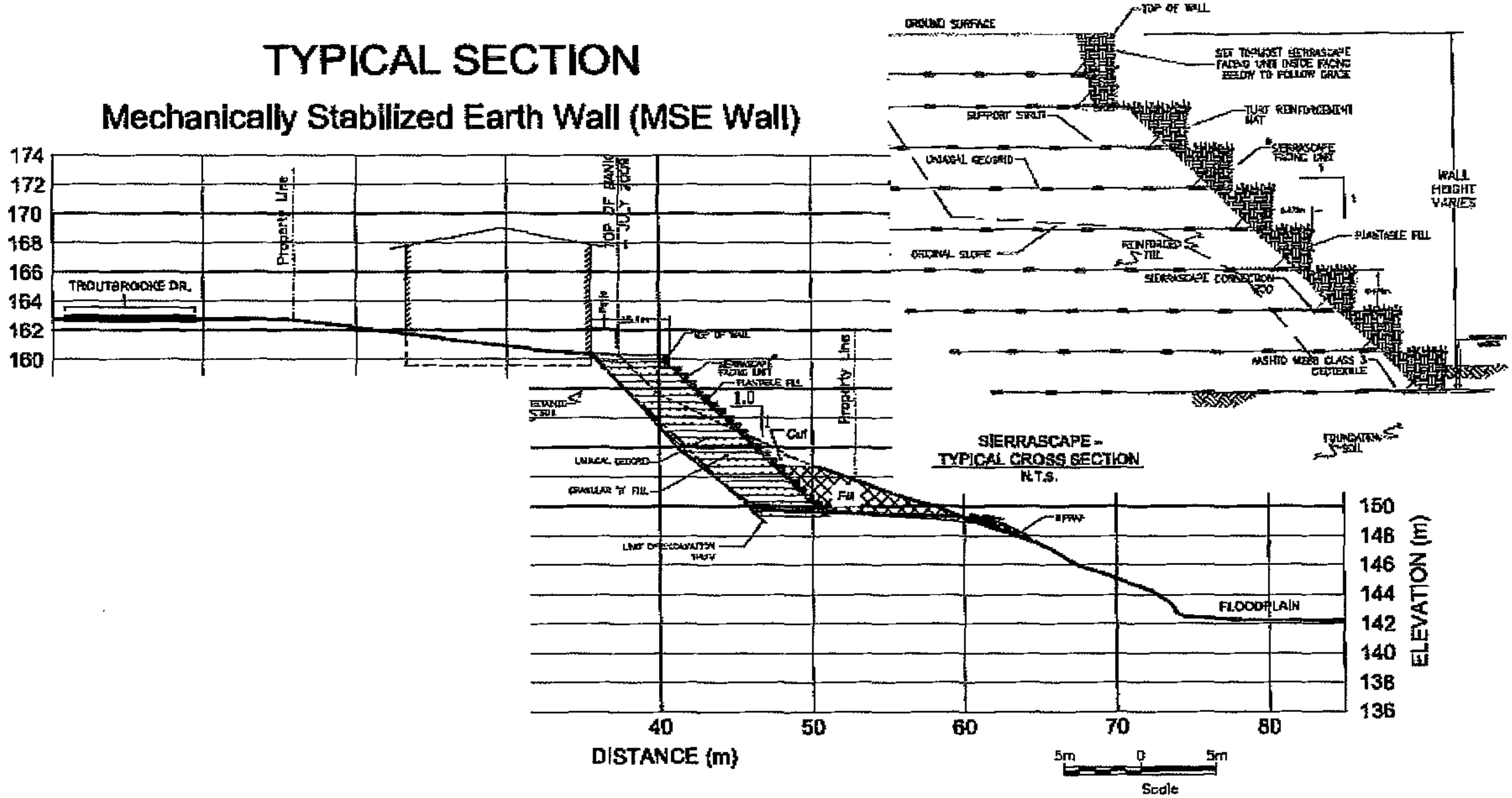
New top of slope

~ 5 m tableland

Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

TYPICAL SECTION

Mechanically Stabilized Earth Wall (MSE Wall)



Feedback on Option 3

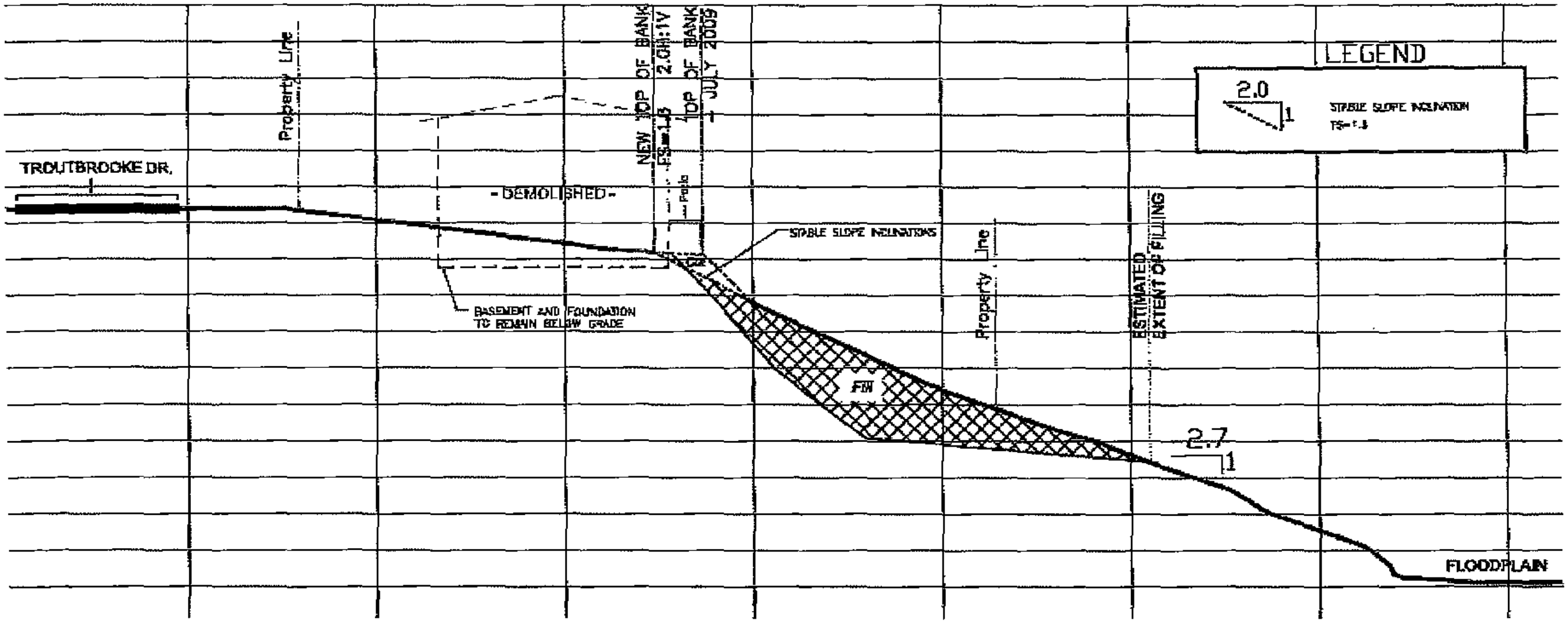
Do you have any comments on the alternative as presented?

Comments:

This option is acceptable, however, if you could add an additional 10 feet to the patio, to make it 25 feet, that would be even better.

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 4: Greenspace Acquisition



Feedback on Option 4

Do you have any comments on the alternative as presented?

Comments:

This option is also acceptable depending on the "time-frame" of acquisition.

My two questions are:
① When would it take place?
② Purchase price?

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Other Questions or Comments

Do you have any other questions of comments on the project?

Comments:

Name (optional) and Address

Silvia Volpini (rep. for Carmela Volpini)
47 Troutbrooke Drive

Please return the completed workbook by Friday December 3, 2010 to Lindsay Prihoda, Project Coordinator; by facsimile (416) 392 - 9726; by e-mail lprihoda@trca.on.ca; by mail: TRCA 5 Shoreham Drive, Downsview, ON M3N 1S4

[redacted]
02/16/2011 12:40 AM

To lprihoda@trca.on.ca
cc [redacted]
bcc
Subject Troutbrooke Slope Stabilization Project

Lindsay Prihoda, Project Coordinator

I find the process of reading the handouts and completing the workbook
very stressful indeed and so I have been avoiding it.

The diagrams in handouts are illegible, even with a magnifying glass.
The terminology so new to me that I am overwhelmed.
Totally overwhelmed and totally frustrated.
So I stop.

I do not understand why everything is 'shrunk' so,
even the article on 'Black Creek Remedial Measures'
has been reduced to 3/4 of the photocopy paper, why?,
with faded print and graphs illegible.
All useless to me for I cannot read them.

Participant Workbook

- Ensure no negative impact to aquatic habitat

How is this target relevant?
The only aquatic habitat I know of in the flood plain are aquatic insects.

- Ensure no negative impact to existing infrastructure

What does this mean? What, which infrastructure?

- Consider impact on cultural resources and parkland

??? Cultural?

Evaluation Targets

Do you agree with the targets presented?
Are there any others we should consider in the evaluation of alternatives.
The 17 targets are, to me, general and at a very 'vanilla' high level
that they can apply to any and all TRCA project,
something for every project management consideration.

I cannot offer input for I do not know their intent, focus, parameters or purpose.
I would need more dialogue to understand this section.

Option 1: 'Do Nothing"
Feedback on Option 1
Do you have any comments on the alternatives as presented?

No.

Option 2: Remove Fill and Replace with an Engineered Slope

Diagrams are illegible to me

What are the distance in feet between Troutbrooke Drive and floodplain? and the bottom of the section coloured blue and red ?

Option 2a: Remove Fill and Replace with an Engineered Slope
Sort existing fill and re-compact at 2.5H:1V
Feedback on Option 2a
Do you have any comments on the alternatives as presented?
What does 'Sort existing fill and re-compact' mean? How is this executed?
What is what looks like an upside down coffee cup with an arrow through it at the base?
What are the distances here, how far, how deep?
Will the 'Sort existing fill and re-compact' support, allow for tree growth?

Option 2b: Remove Fill and Replace with an Engineered Slope
Remove existing fill and import granular fill at 2.0H:1V
Feedback on Option 2b
Do you have any comments on the alternatives as presented?
How will the existing fill be removed?
What is the proposed granular fill?
What 'is' the red dotted line from the top of bank to the word 'cut'
What does 'cut' mean?
What are the distances here, how far, how deep?
Will the granular fill support, allow for tree growth?

Option 2c: Remove Fill and Replace with an Engineered Slope
Remove existing fill and replace with geogrid reinforced granular fill at 1.5H:1V
Feedback on Option 2b
Do you have any comments on the alternatives as presented?
How will the existing fill be removed?
What is the proposed reinforced granular fill?
What 'is' the red dotted line from the top of bank to the solid line.
What are the distances here, how far, how deep?
Will the geogrid reinforced granular fill support, allow for tree growth?

Option 3 Remove Fill and Replace with an Engineered Mechanically Stabilized Earth Wall
Remove existing fill and replace with geogrid reinforced granular fill at 1.5H:1V
This diagram is particularly difficult to read, for me.
Feedback on Option 3
Do you have any comments on the alternatives as presented?
Can the 'steps' be used as stairs?
Can the stairs be as 2a; i.e., 2.5H : 1V ?

Other Questions or Comments
Do you have any comments on the alternatives as presented?

Our lot is irregular in size.
I estimate the size of backyard from the north wall as 52 feet [15.8 meters];
east [with # 47] and west [with # 51] sides as 55 feet 16.8 meters]
and lot line with TRCA as 77 feet [23.5 meters]

On the north west side of our home we have a balcony.
It is 9 feet [2.7 meters] by 16 feet [4.9 meters].

One end of the balcony steel beams are anchored
between the basement ceiling and the first floor flooring
whlie the other ends are supported by steel poles

anchored in the soil at a distance of about
9 feet [2.7 meters] from the back house wall.

At present by the lot line with # 51, [the west side of the balcony,
there is 24 feet [7.3 meters] of land and
by tour basement door, the east side of the balcony,
there is 17 feet [5.2 meters] of land.

**Each of 2a, 2b, 2c, and 3 have soil removal right up to the house wall.
The removal of existing soil will disturb the balcony support,
the unsupported beams will fall gouging, tearing holes in the wall of my home**.

Cannot the existing land in our backyard, the north west side,
be left undisturbed as it has been since 1964
and the Engineering start at the existing slope crest?

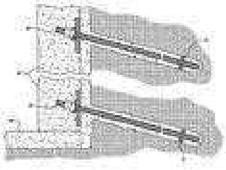
Options 2 and 3,
all projects have our backyards with a little land
and the rest, the majority of the backyard, as slope.

Cannot the backyard be terraced instead of sloped?
Perhaps using 'soil nailing' where possible.

Kindly provide legible diagrams.

Yours,
Alda Busca
49 Troutbrooke Drive

Images for **soil nailing**



Soil nailing is a technique in which **soil slopes**, excavations or **retaining walls** are reinforced by the insertion of relatively slender elements - normally steel reinforcing bars. The bars are usually installed into a pre-drilled hole and then grouted into place or drilled and grouted simultaneously. They are usually installed untensioned at a slight downward inclination. A rigid or flexible facing (often pneumatically applied concrete otherwise known as shotcrete) or isolated soil nail heads may be used at the surface. Since its first application using modern techniques in Versailles, France in 1972,] soil nailing is now a well-established technique around the world. One of the first national guideline publications for soil nailing was produced in Japan in 1987; the USA has produced national guideline publications through the Federal Highway Administration on this subject in 1996 and in 2003

Erosion control

^ "Construction d'un mur de soutènement entre Versailles-Chantiers et Versailles-Matelots", S. Rabejac and P. Toudic, Revue générale des chemins de fer, 93ème annee, pp 232-237
^ FHWA Publication No. "FHWA-SA-96-069", Manual for Design and Construction Monitoring of Soil Nail Walls
^ FHWA Publication No. "FHWA-IF-03-017", Geotechnical Engineering Circular No. 7- Soil Nail Walls
--

Rembco - Soil Nailing
Soil nailing is an **economical technique for stabilizing slopes and for constructing retaining walls from the top down.** This ground reinforcement process **...**
www.rembco.com/soil_nailing.html - Cached - Similar

Soil Nailing Earth Shoring System
Soil nailing is an in-situ earth reinforcement method which enables **... Soil nailing** has been used for excavation shoring and slope stabilization in France **...**
www.isherwood.to/downloads/papers/soi... - Cached - Similar

Soil Nailing
When space is limited, **soil nailing** construction **may be best bet for building a retaining wall.**
www.basementquestions.com/soilnailing... - Cached - Similar

Soil Nail Walls
Soil nail walls are retaining walls which are built from the top downwards in cut situations where the soil has enough apparent cohesion that it can stand **...**
structsource.com/retainingwall/types/... - Cached - Similar

DSI Canada > Products > DYWIDAG **Soil Nails** > History and General Notes
Soil nails are used for stabilizing slopes and excavations. **They find an efficient application in granular soils.**
www.dsicanada.ca/products/geotechnics... - Cached - Similar


609

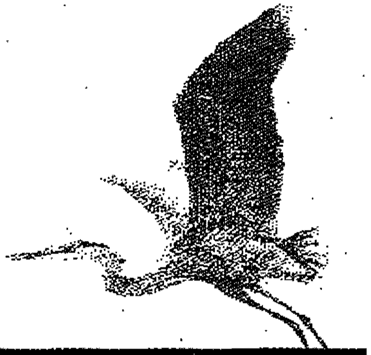
from: 51 TROUTBROOKE DR.

Troutbrooke Slope Stabilization Project

Class Environmental Assessment

Community Liaison Committee (CLC) Meeting #1
Wednesday, November 24th, 2010

Participant Workbook



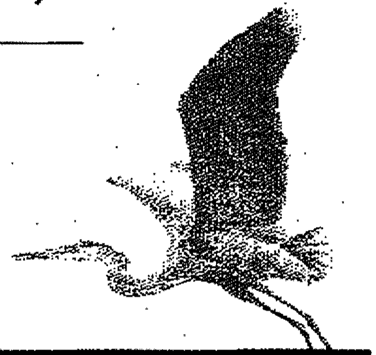
Toronto and Region Conservation for *The Living City*

Project Purpose

- Provide long-term, low maintenance protection against erosion and slope instability
- Prevent future property damage and reduce risk to public safety
- Include enhancements to terrestrial habitat wherever possible
- Ensure compatibility with the surrounding physical, biological, social and cultural environment

Comments:

- AGREED WITH ALL OF THE ABOVE
- TO RETAIN FULL VALUE OF PROPERTY



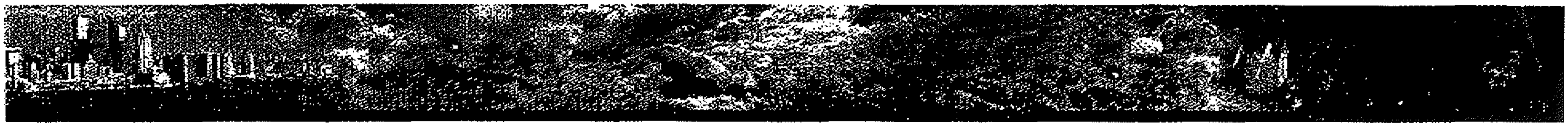
Evaluation Targets

Do you agree with the targets presented? Are there any others we should consider in the evaluation of the alternatives?

Comments:

- AGREE WITH ALL TARGETS.
- PROJECT COSTS / IMPLEMENTATION COSTS ARE IRRELAVENT TO PROPERTY OWNERS - We want our land back (what we originally purchased)

Troutbrooke Slope Stabilization Project
Class Environmental Assessment



Feedback on Option 1

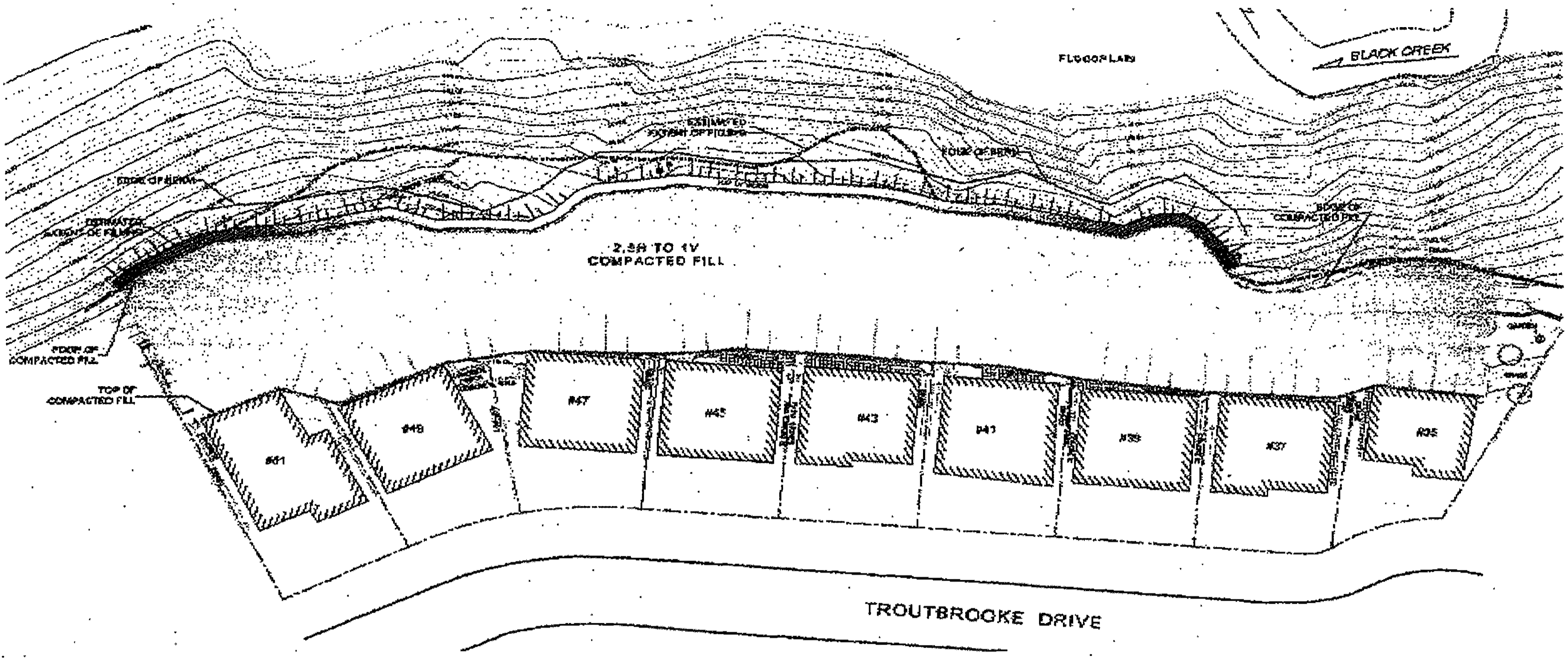
Do you have any comments on the alternative as presented?

Comments:

Not an OPTION

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Option 2: Remove Fill and Replace with an Engineered Slope



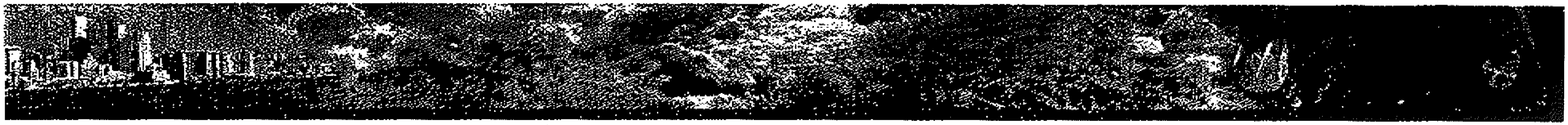
Feedback on Option 2a

Do you have any comments on the alternative as presented?

Comments:

- NOT AN OPTION
- No USABLE Land for the homeowner
- loss of value to property
- as property owner we are entitled to full use of our land as was originally purchased.

Troutbrooke Slope Stabilization Project
Class Environmental Assessment



Feedback on Option 2b

Do you have any comments on the alternative as presented?

Comments:

- refer to comments outlined in 2a

Troutbrooke Slope Stabilization Project
Class Environmental Assessment

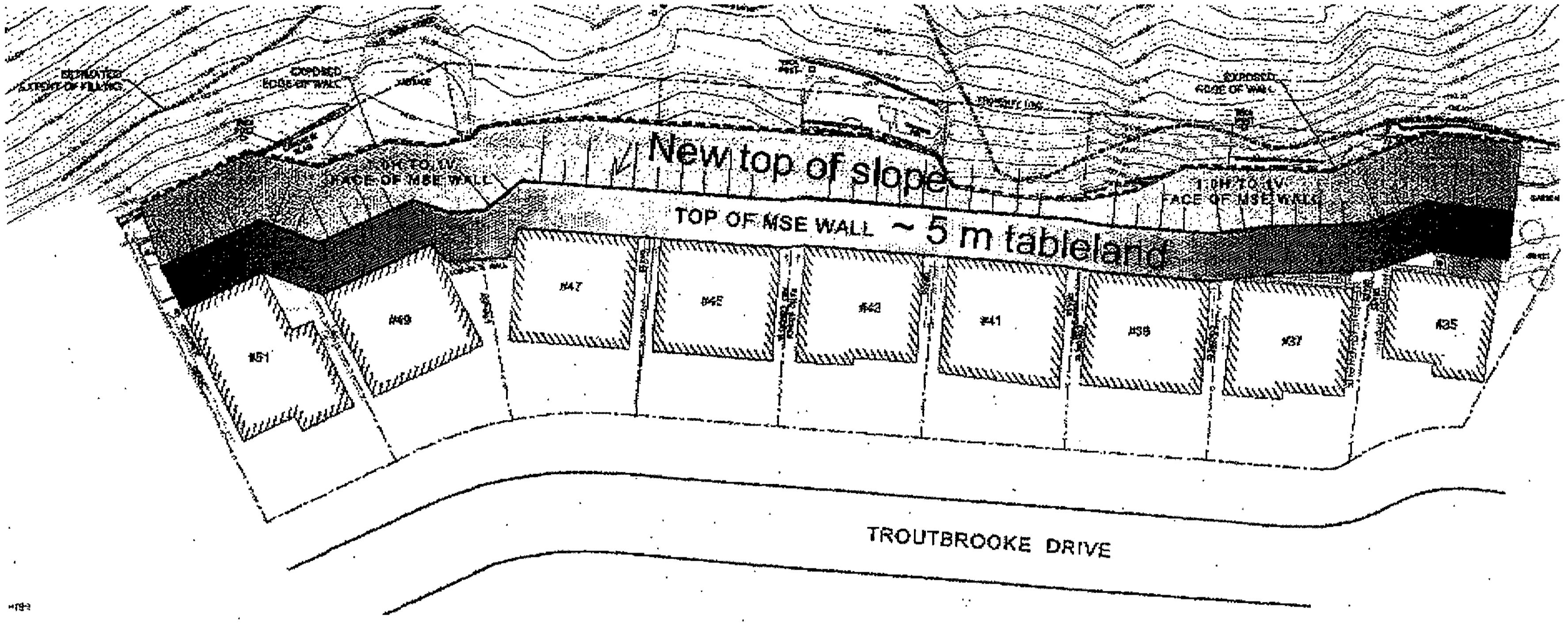
Feedback on Option 2c

Do you have any comments on the alternative as presented?

Comments:

– Refer to comments outlined in 2a

Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall



Feedback on Option 3

Do you have any comments on the alternative as presented?

Comments:

- once again this only presents a partial remedy to correct the problem.
- the homeowner will still lose value and full use of the property
- we would consider a wall at the end of the property line and have the slope begin from there

Other Questions or Comments

Do you have any other questions of comments on the project?

Comments:

Our main objective is twofold: firstly to restore the property to its original state at time of purchase ie (full use of property) or purchase the property outright at market value as if the property is in full use.

Name (optional) and Address

[redacted]

Please return the completed workbook by Friday December 3, 2010 to Lindsay Prihoda, Project Coordinator;
by facsimile (416) 392 - 9726; by e-mail lprihoda@trca.on.ca; by mail: TRCA 5 Shoreham Drive, Downsview, ON M3N 1S4

TORONTO AND REGION
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TROUTBROOKE SLOPE STABILIZATION PROJECT
COMMUNITY LIAISON COMMITTEE (CLC) MEETING #2

Wednesday February 16, 2011
Beverley Heights Middle School
26 Troutbrooke Drive, Toronto
6:30 p.m. – 8:30 p.m.

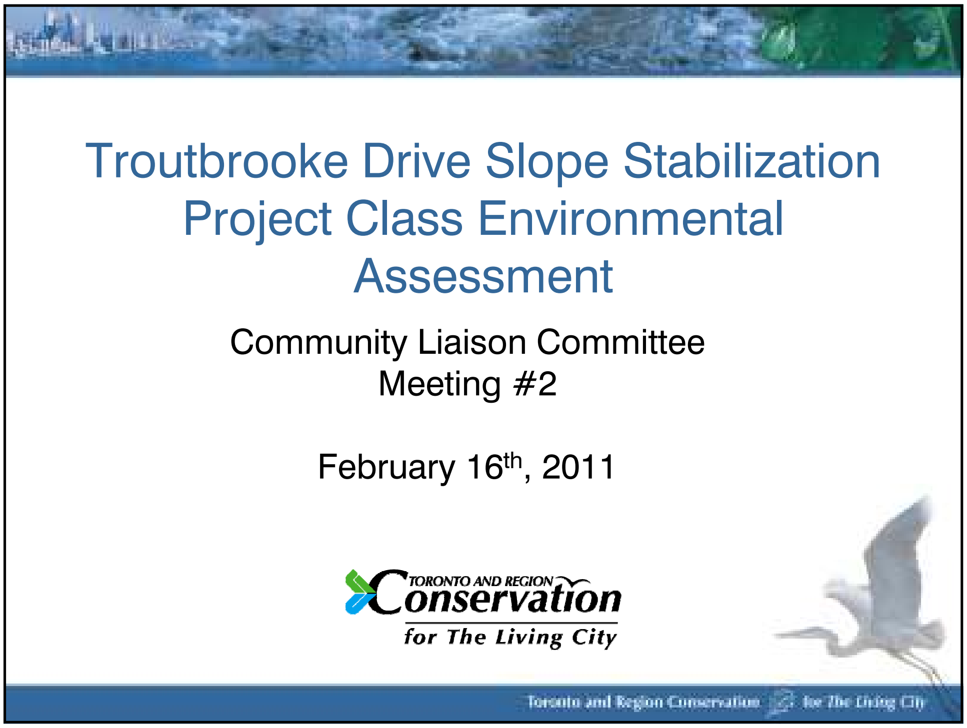
AGENDA

6:30 – 6:45 Attendance sign in, welcome and opening remarks

6:45 – 7:30 Presentation by TRCA

- Overview of CLC Meeting #1
- Evaluation Criteria
- Results of Evaluation
- Modification of Remedial Options
- Costs of Remedial Options
- Landowner Contribution

7:30 – 8:30 Discussion Period
Next Steps
Meeting adjournment



Troutbrooke Drive Slope Stabilization Project Class Environmental Assessment

Community Liaison Committee
Meeting #2

February 16th, 2011

TORONTO AND REGION Conservation
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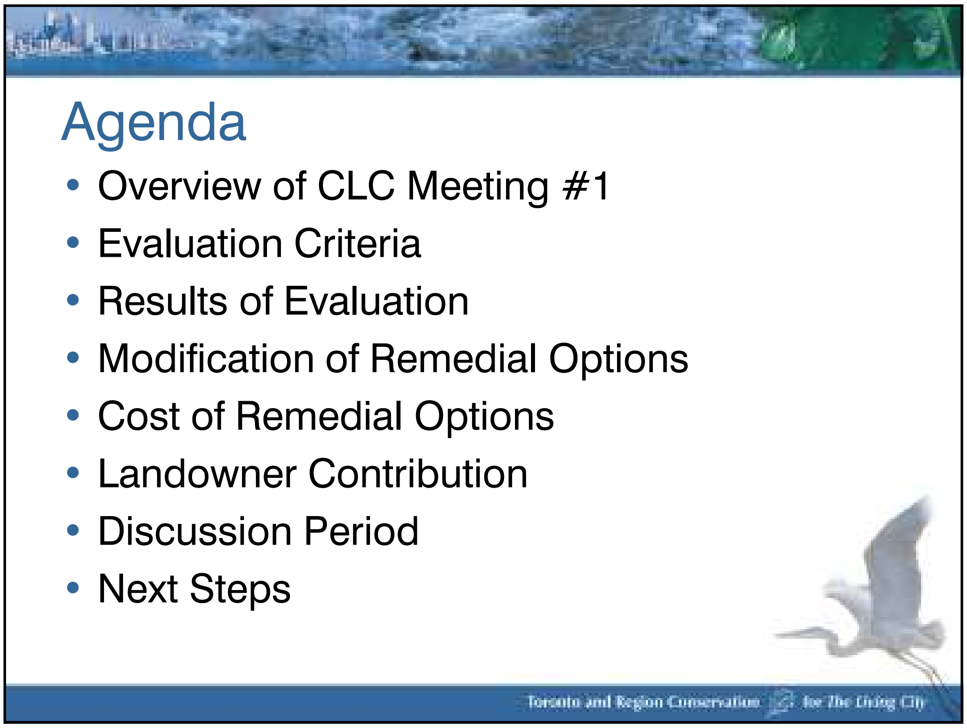
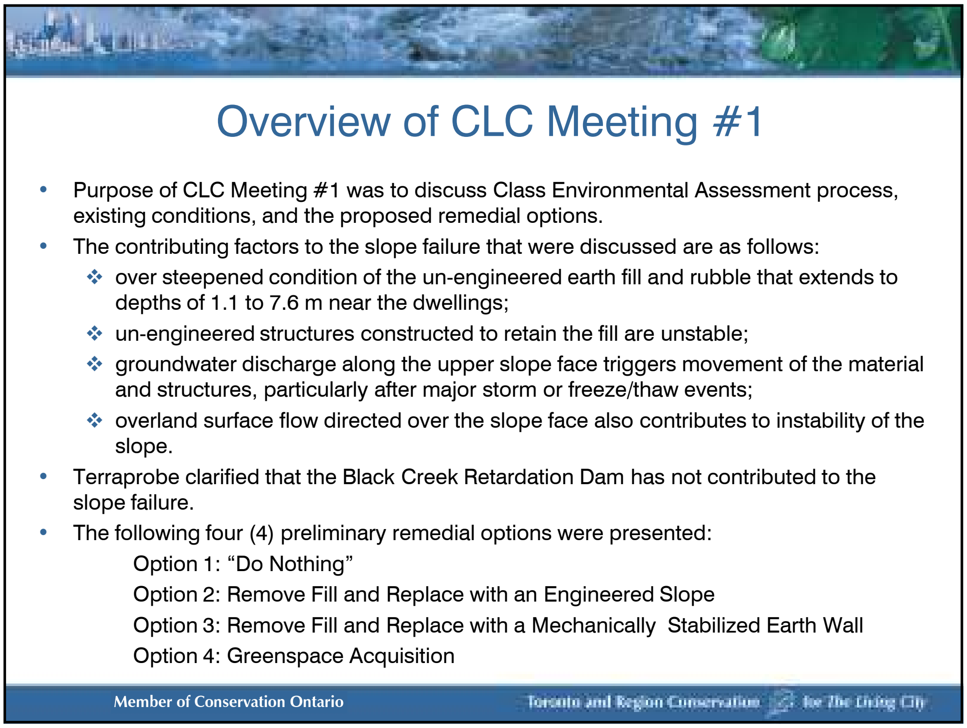


Agenda

- Overview of CLC Meeting #1
- Evaluation Criteria
- Results of Evaluation
- Modification of Remedial Options
- Cost of Remedial Options
- Landowner Contribution
- Discussion Period
- Next Steps



Overview of CLC Meeting #1

- Purpose of CLC Meeting #1 was to discuss Class Environmental Assessment process, existing conditions, and the proposed remedial options.
- The contributing factors to the slope failure that were discussed are as follows:
  - over steepened condition of the un-engineered earth fill and rubble that extends to depths of 1.1 to 7.6 m near the dwellings;
  - un-engineered structures constructed to retain the fill are unstable;
  - groundwater discharge along the upper slope face triggers movement of the material and structures, particularly after major storm or freeze/thaw events;
  - overland surface flow directed over the slope face also contributes to instability of the slope.
- Terraprobe clarified that the Black Creek Retardation Dam has not contributed to the slope failure.
- The following four (4) preliminary remedial options were presented:

  Option 1: “Do Nothing”
  Option 2: Remove Fill and Replace with an Engineered Slope
  Option 3: Remove Fill and Replace with a Mechanically Stabilized Earth Wall
  Option 4: Greenspace Acquisition

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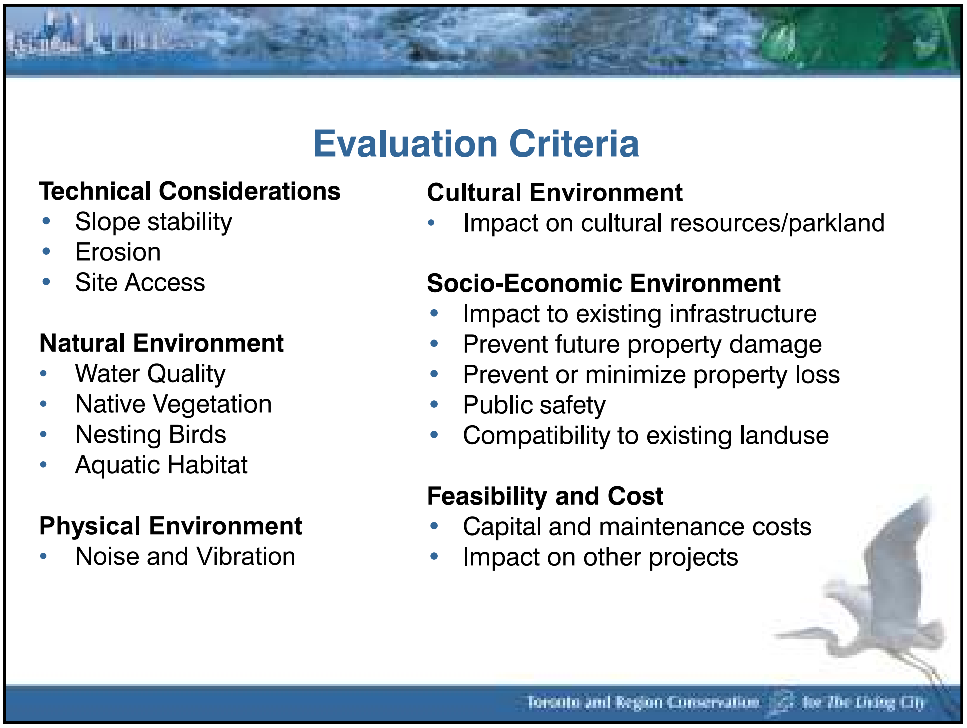

Evaluation Criteria

Technical Considerations
- Slope stability
- Erosion
- Site Access

Natural Environment
- Water Quality
- Native Vegetation
- Nesting Birds
- Aquatic Habitat

Physical Environment
- Noise and Vibration

Cultural Environment
- Impact on cultural resources/parkland

Socio-Economic Environment
- Impact to existing infrastructure
- Prevent future property damage
- Prevent or minimize property loss
- Public safety
- Compatibility to existing landuse

Feasibility and Cost
- Capital and maintenance costs
- Impact on other projects

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Technical Considerations

- Eliminate or reduce slope hazard
- Protect against future erosion and slope instability
- Consider site access requirements

Natural Environment

- Ensure no negative impact to Black Creek
- Prevent or minimize negative water quality impacts
- Preserve or enhance existing native vegetation
- Consider potential impact on nesting birds

Physical Environment

- Consider impact of construction on noise, dust, vibration

Cultural Environment

- Consider impact on Downsview Dells Park

Socio-Economic Environment

- Ensure no negative impact to existing infrastructure
- Prevent future property damage
- Prevent or minimize property loss of public and private land
- Reduce risk to public safety
- Consider compatibility with existing land use

Feasibility and Cost

- Consider implementation costs
- Consider future maintenance costs
- Consider impact on other projects

Results of Evaluation

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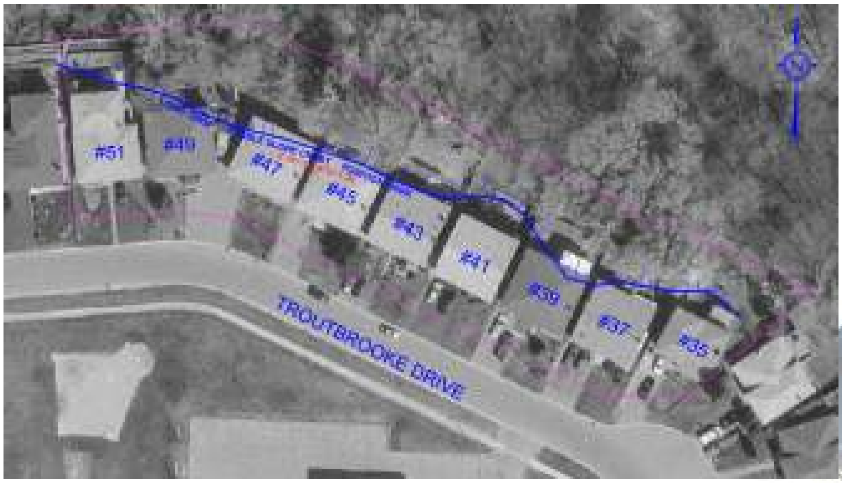
Option 1: "Do Nothing"



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Option 1: “Do Nothing”

Physical Environment
- No construction related impacts

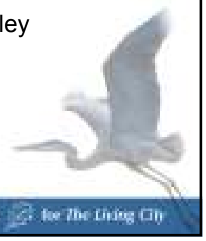
Cultural Environment
- Little impact on adjacent parkland

Feasibility and Cost
- No construction related costs
- Ongoing cost to landowners

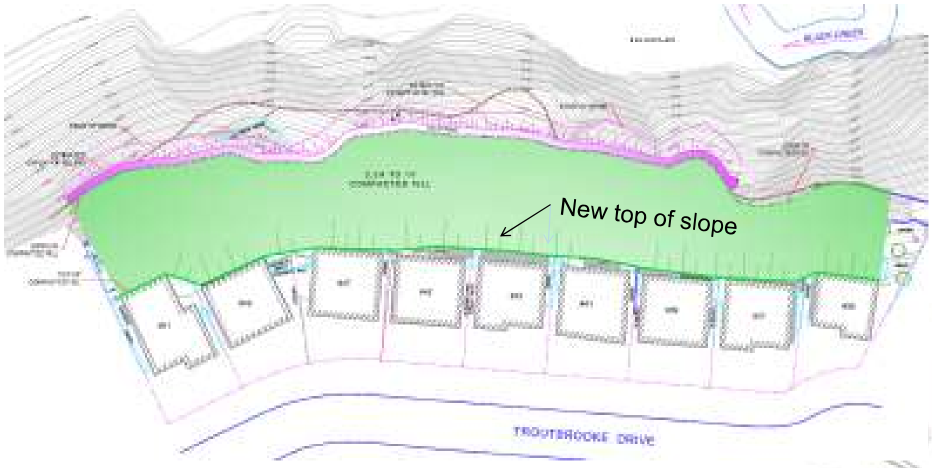
Socio-Economic Environment
- High likelihood of future property damage and loss of tableland
- Ongoing concern for public safety
- Impact ability of landowners to use rear yard

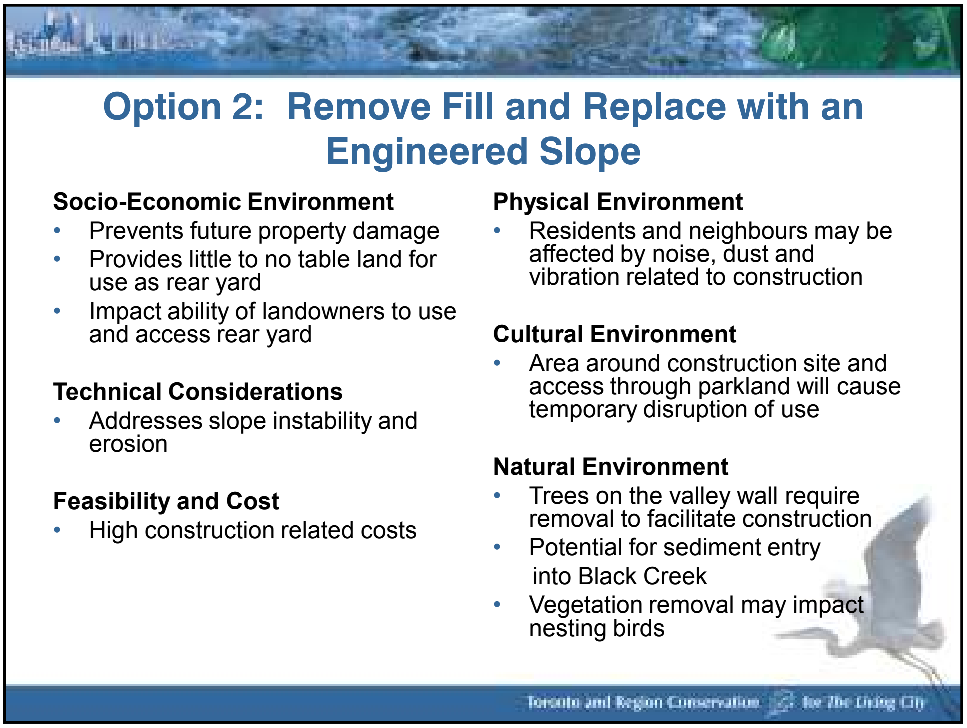
Technical Considerations
- Does not address slope instability and erosion

Natural Environment
- Some trees on the valley wall will be lost to erosion



Option 2: Remove Fill and Replace with an Engineered Slope





Option 2: Remove Fill and Replace with an Engineered Slope

Socio-Economic Environment
- Prevents future property damage
- Provides little to no table land for use as rear yard
- Impact ability of landowners to use and access rear yard

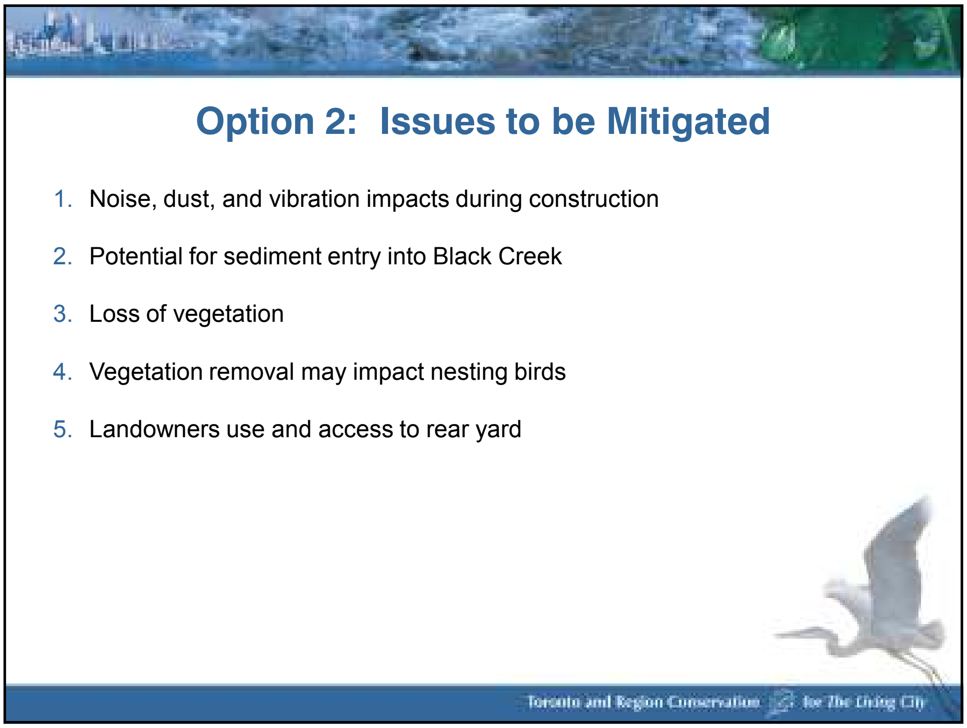
Technical Considerations
- Addresses slope instability and erosion

Feasibility and Cost
- High construction related costs

Physical Environment
- Residents and neighbours may be affected by noise, dust and vibration related to construction

Cultural Environment
- Area around construction site and access through parkland will cause temporary disruption of use

Natural Environment
- Trees on the valley wall require removal to facilitate construction
- Potential for sediment entry into Black Creek
- Vegetation removal may impact nesting birds



Option 2: Issues to be Mitigated

1. Noise, dust, and vibration impacts during construction
2. Potential for sediment entry into Black Creek
3. Loss of vegetation
4. Vegetation removal may impact nesting birds
5. Landowners use and access to rear yard

Option 2: Mitigation Strategies

1. Noise, dust, and vibration impacts during construction
- Conduct pre-construction inspection of homes
- Use best management practices to suppress dust
- Operate site in compliance with noise by-law

2. Potential for sediment entry into Black Creek
- Ensure appropriate sediment and erosion control measures are in place

3. Loss of vegetation
- Replace loss vegetation within Downsview Dells Park

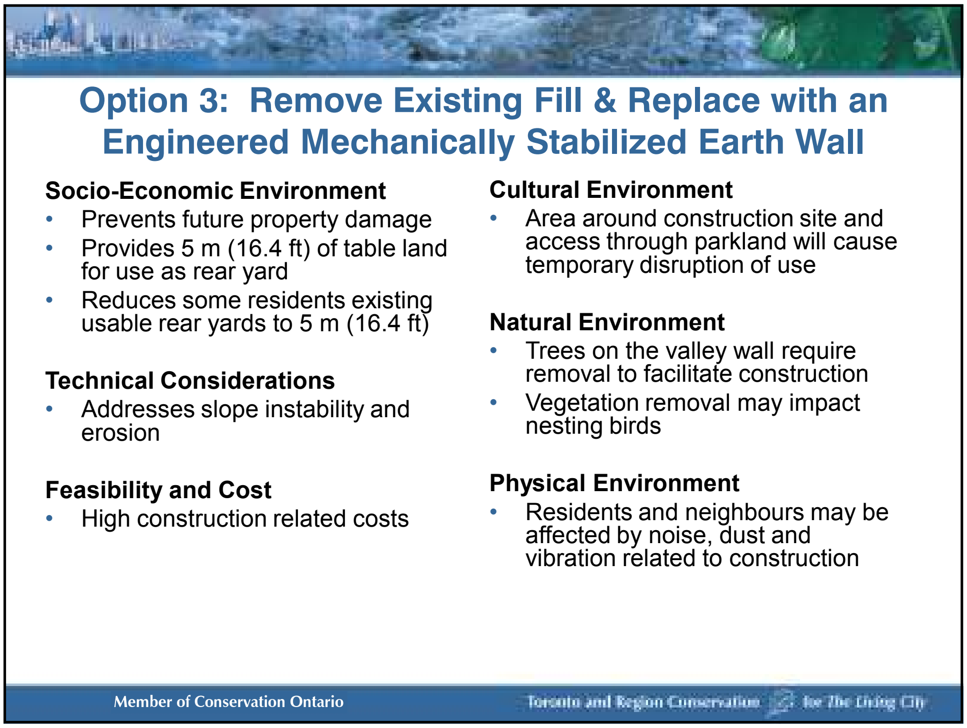
4. Vegetation removal may impact nesting birds
- Ensure no vegetation removal during May 1 to July 23 to avoid nesting period

5. Landowners use and access to rear yard
- Adjust design to provide landowner with safe access and use of rear yard

Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

↙ New top of slope

~ 5 m tableland



Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

Socio-Economic Environment

- Prevents future property damage
- Provides 5 m (16.4 ft) of table land for use as rear yard
- Reduces some residents existing usable rear yards to 5 m (16.4 ft)

Technical Considerations

- Addresses slope instability and erosion

Feasibility and Cost

- High construction related costs

Cultural Environment

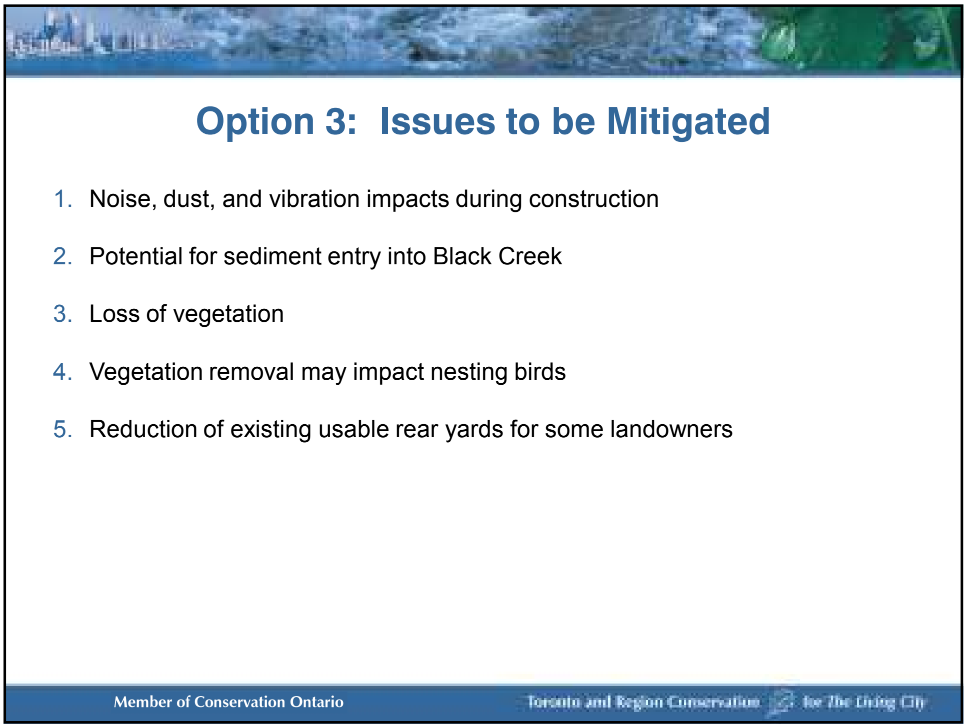
- Area around construction site and access through parkland will cause temporary disruption of use

Natural Environment

- Trees on the valley wall require removal to facilitate construction
- Vegetation removal may impact nesting birds

Physical Environment

- Residents and neighbours may be affected by noise, dust and vibration related to construction



Option 3: Issues to be Mitigated

1. Noise, dust, and vibration impacts during construction
2. Potential for sediment entry into Black Creek
3. Loss of vegetation
4. Vegetation removal may impact nesting birds
5. Reduction of existing usable rear yards for some landowners

Option 3: Mitigation Strategies

1. Noise, dust, and vibration impacts during construction
- Conduct pre-construction inspection of homes
- Use best management practices to suppress dust
- Operate site in compliance with noise by-law

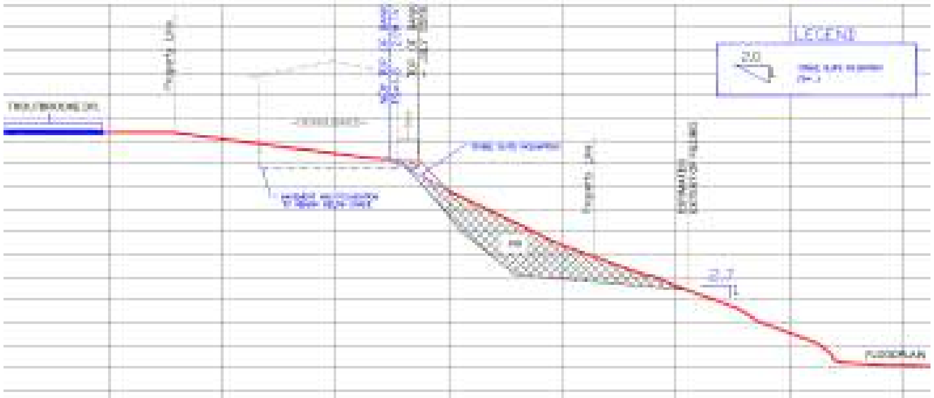
2. Potential for sediment entry into Black Creek
- Ensure appropriate sediment and erosion control measures are in place

3. Loss of vegetation
- Replace loss vegetation within Downsview Dells Park

4. Vegetation removal may impact nesting birds
- Ensure no vegetation removal during May 1 to July 23 to avoid nesting period

5. Landowners use and access to rear yard
- Design to limit impact on existing available rear yard space

Option 4: Greenspace Acquisition



Option 4: Greenspace Acquisition

Socio-Economic Environment
- Requires residents to relocate

Technical Considerations
- Addresses slope instability and erosion

Feasibility and Cost
- Very high costs

Cultural Environment
- Area around construction site will cause temporary disruption of use
- Parkland will be increased

Natural Environment
- Natural vegetation can be expanded

Physical Environment
- Neighbours may be affected by noise, dust and vibration related to demolition

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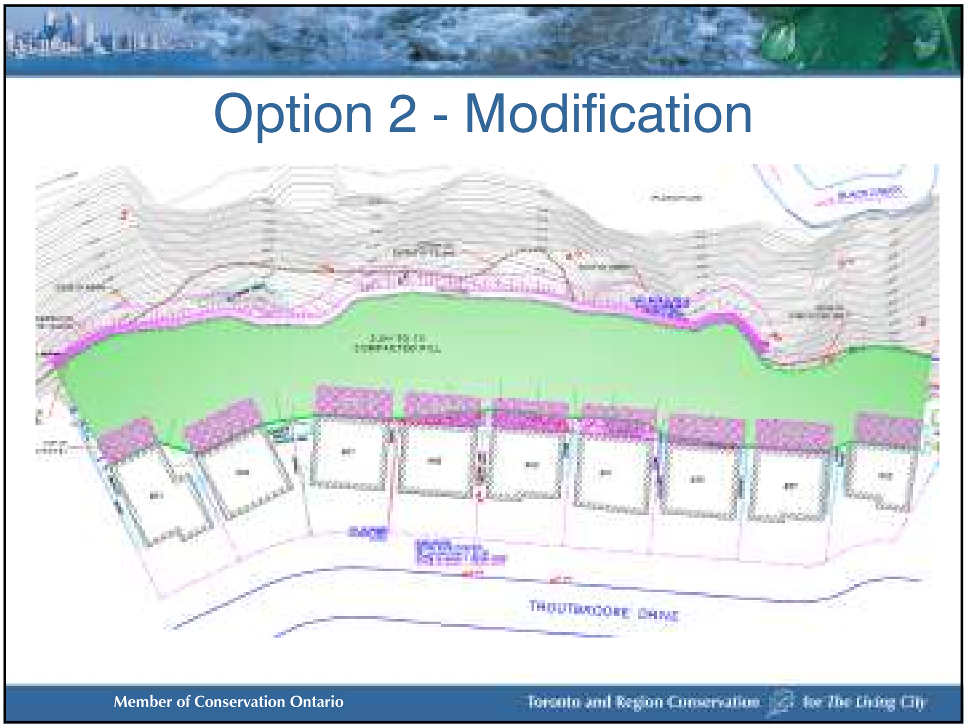
Modification of Remedial Options



Option 2 - Modification

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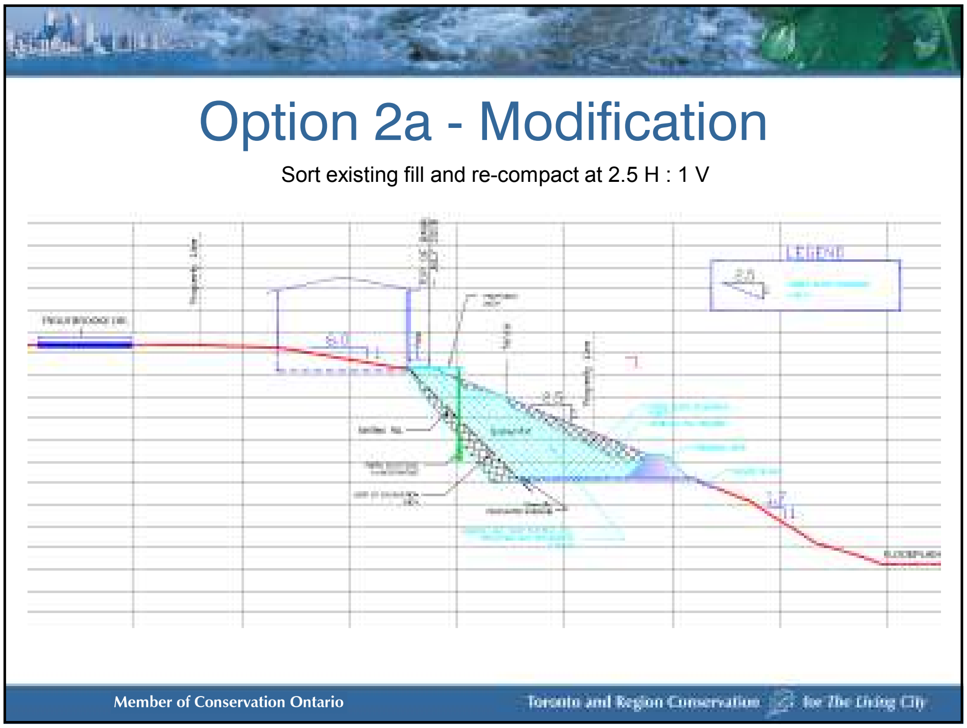

Option 2a - Modification

Sort existing fill and re-compact at 2.5 H : 1 V

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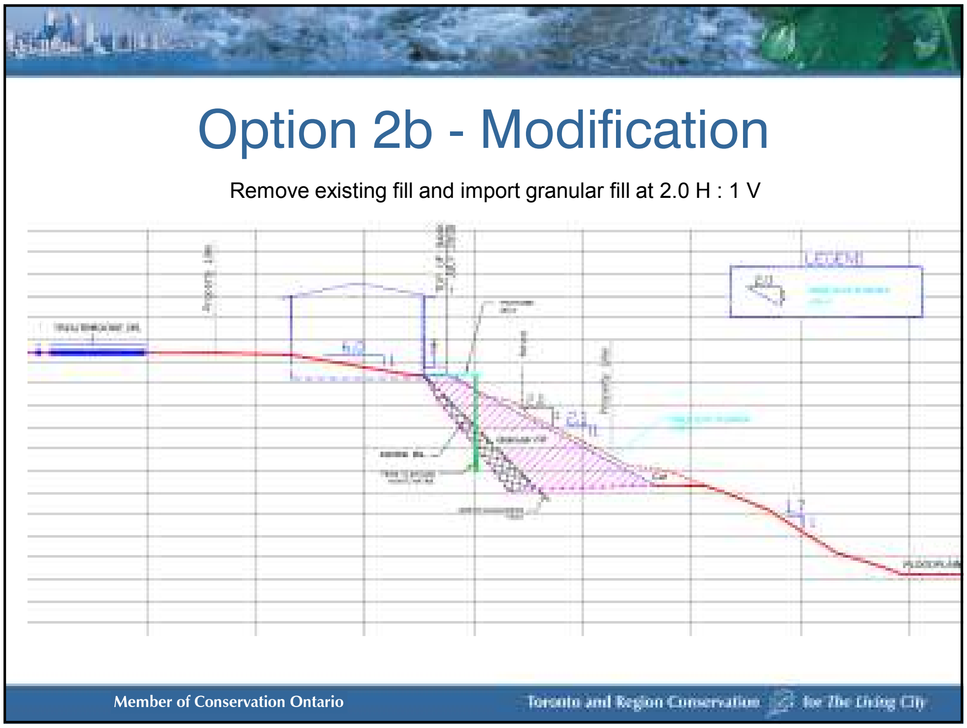

Option 2b - Modification

Remove existing fill and import granular fill at 2.0 H : 1 V

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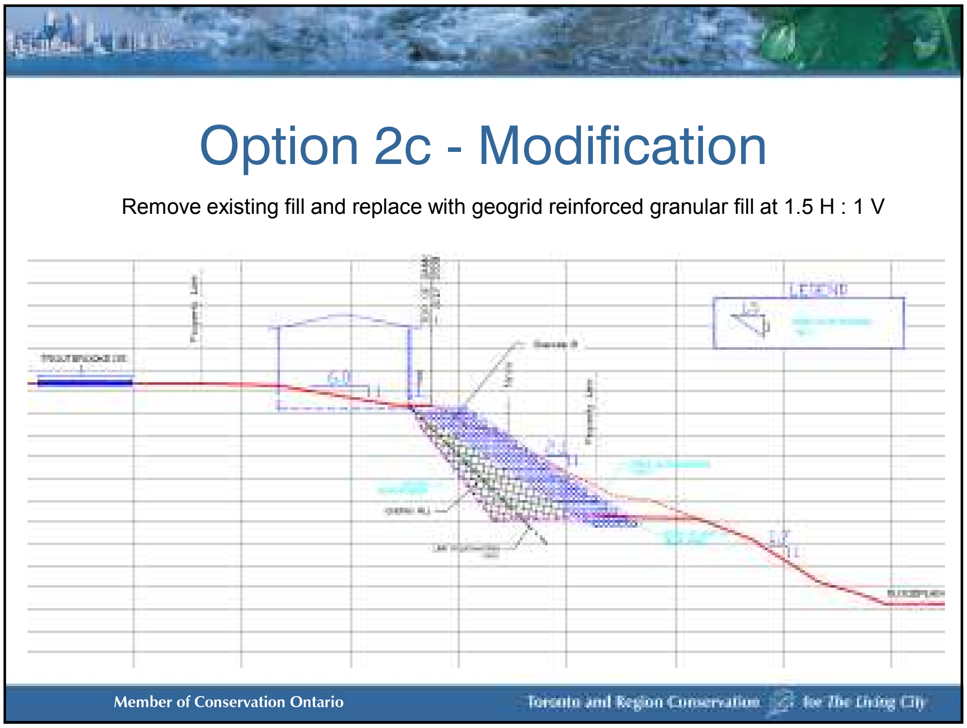

Option 2c - Modification

Remove existing fill and replace with geogrid reinforced granular fill at 1.5 H : 1 V

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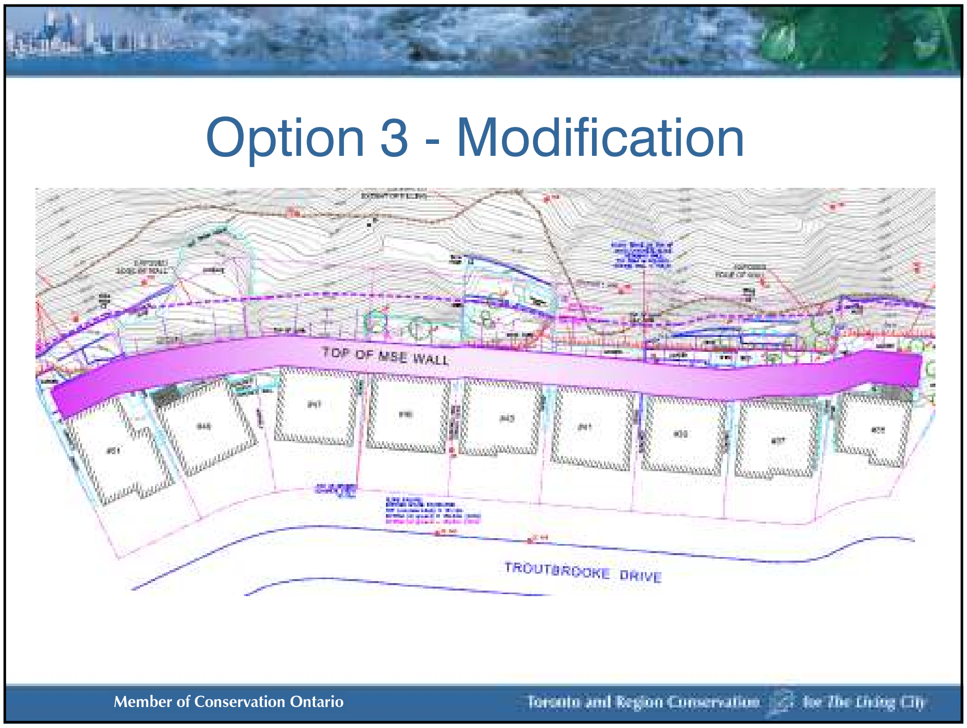

Option 3 - Modification

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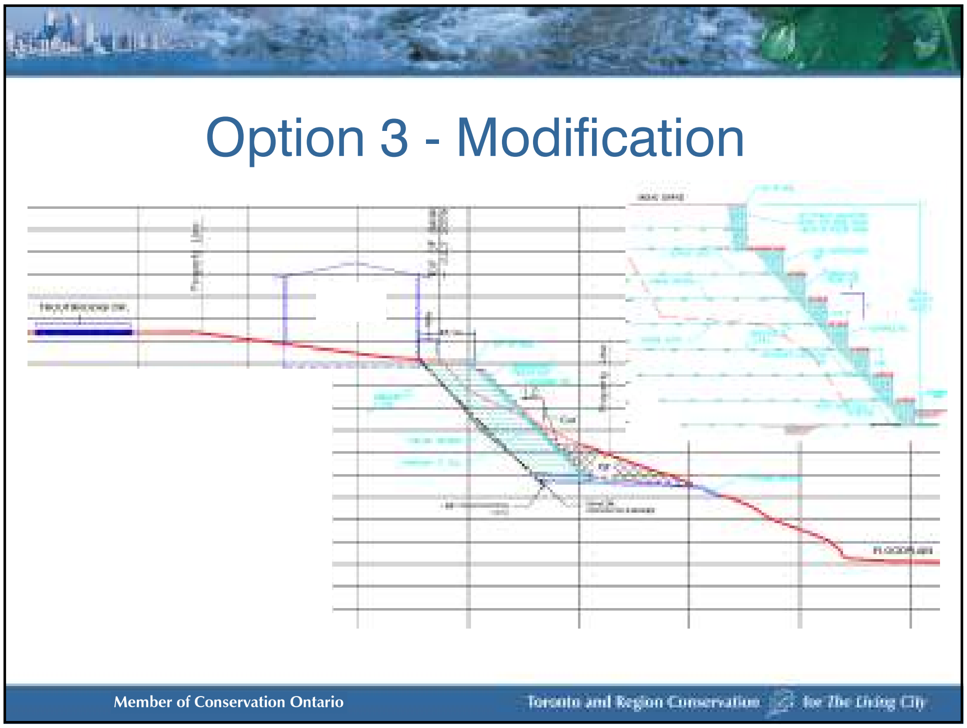

Option 3 - Modification

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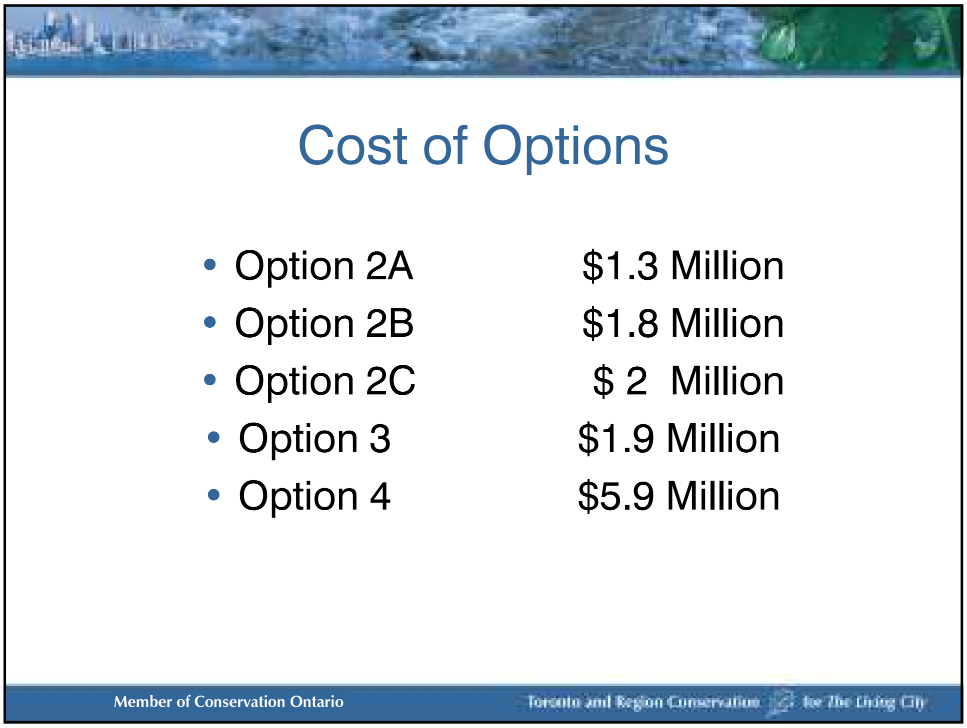
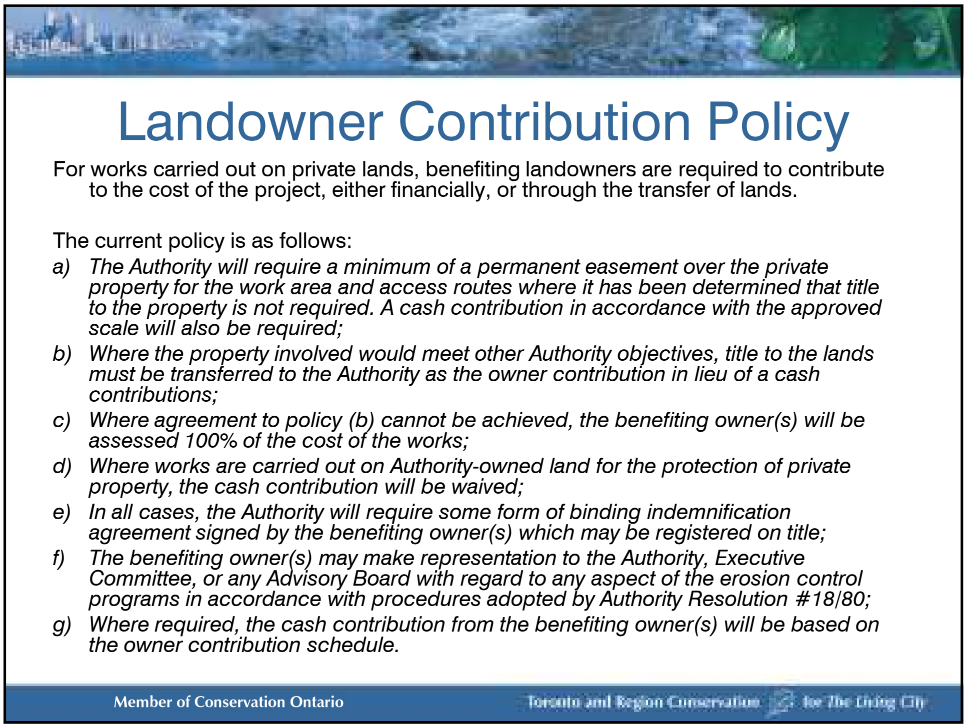


Cost of Options

Option 2A	$1.3 Million
Option 2B	$1.8 Million
Option 2C	$ 2 Million
Option 3	$1.9 Million
Option 4	$5.9 Million



Landowner Contribution Policy

For works carried out on private lands, benefiting landowners are required to contribute to the cost of the project, either financially, or through the transfer of lands.

The current policy is as follows:

a) *The Authority will require a minimum of a permanent easement over the private property for the work area and access routes where it has been determined that title to the property is not required. A cash contribution in accordance with the approved scale will also be required;*

b) *Where the property involved would meet other Authority objectives, title to the lands must be transferred to the Authority as the owner contribution in lieu of a cash contributions;*

c) *Where agreement to policy (b) cannot be achieved, the benefiting owner(s) will be assessed 100% of the cost of the works;*

d) *Where works are carried out on Authority-owned land for the protection of private property, the cash contribution will be waived;*

e) *In all cases, the Authority will require some form of binding indemnification agreement signed by the benefiting owner(s) which may be registered on title;*

f) *The benefiting owner(s) may make representation to the Authority, Executive Committee, or any Advisory Board with regard to any aspect of the erosion control programs in accordance with procedures adopted by Authority Resolution #18/80;*

g) *Where required, the cash contribution from the benefiting owner(s) will be based on the owner contribution schedule.*

Owner Contribution Options

Option 1

Title to lands transferred to Authority in lieu of cash contribution

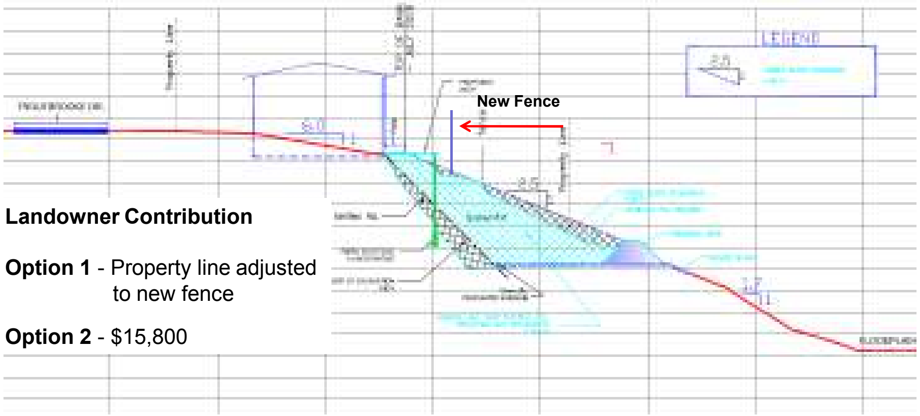
Option 2

Works on property valued at $100,000 and over require landowner contribution of

$11,500 + 10% of (Cost- $100,000)

Landowner Contribution

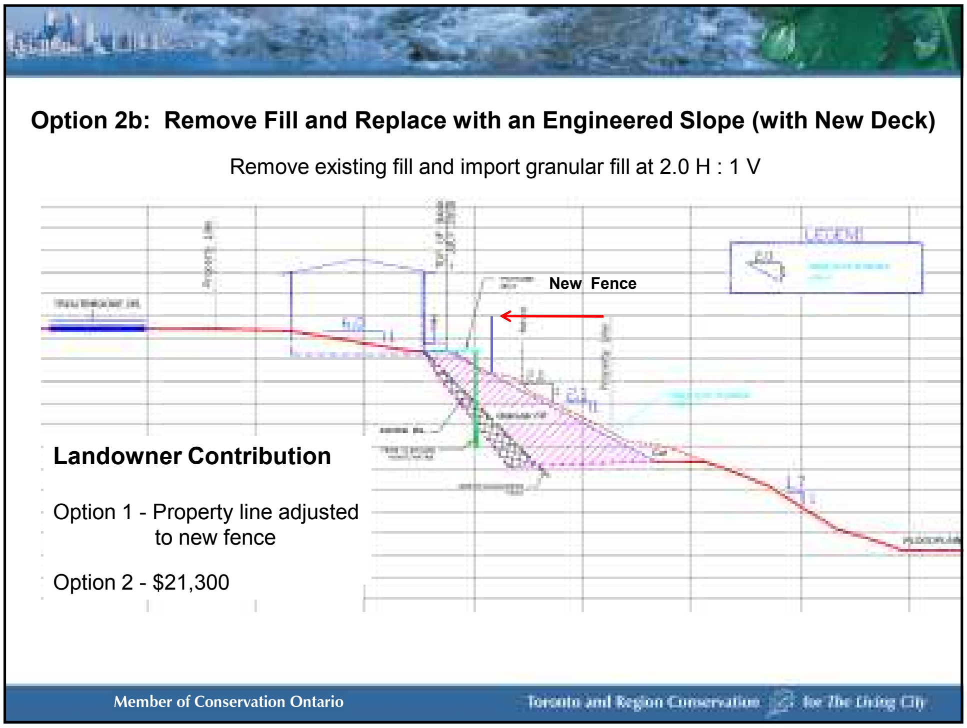
Option 2a: Remove Fill and Replace with an Engineered Slope (with New Deck)



Landowner Contribution

Option 1 - Property line adjusted to new fence

Option 2 - $15,800



Option 2b: Remove Fill and Replace with an Engineered Slope (with New Deck)

Remove existing fill and import granular fill at 2.0 H : 1 V

Landowner Contribution

Option 1 - Property line adjusted to new fence

Option 2 - $21,300

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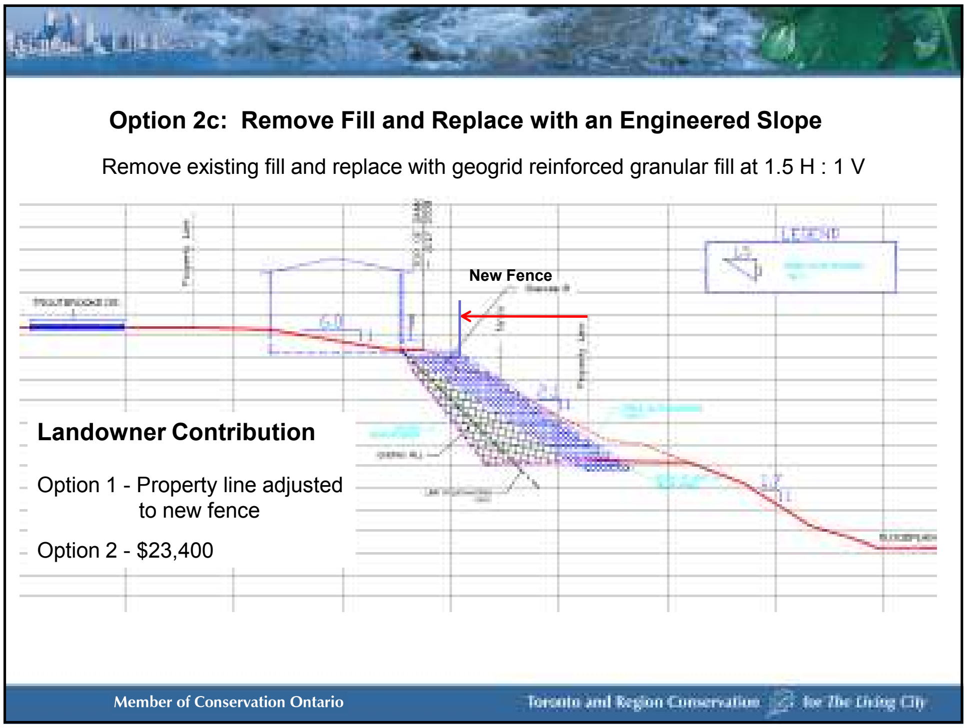

Option 2c: Remove Fill and Replace with an Engineered Slope

Remove existing fill and replace with geogrid reinforced granular fill at 1.5 H : 1 V

Landowner Contribution

Option 1 - Property line adjusted to new fence

Option 2 - $23,400

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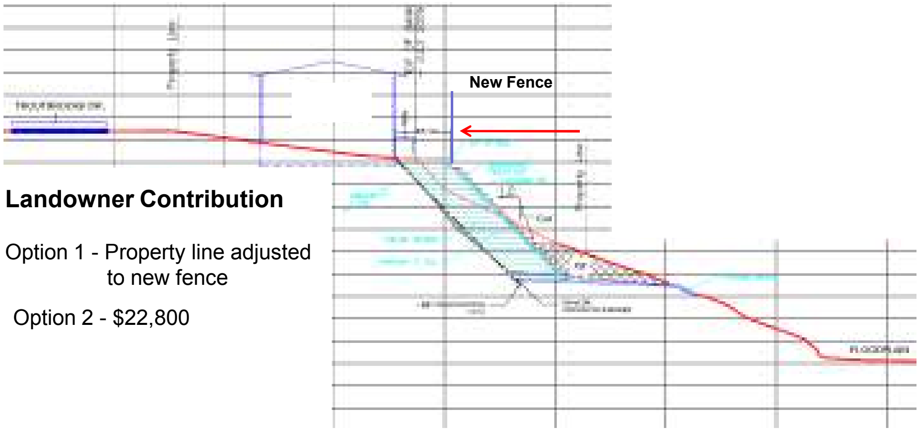
Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall



Landowner Contribution

Option 1 - Property line adjusted to new fence

Option 2 - $22,800

Next Steps

- Appointment (approximately 30 mins) with TRCA to discuss options. TRCA staff available to meet at the following times:
  - Tuesday February 22, 2011 – 3:30 to 5:00 pm
  - Wednesday February 23, 2011 – 3:30 to 5:00 pm
  - Monday February 28, 2011 – 3:00 to 5:00 pm
  - Wednesday March 2, 2011 – 3:00 to 5:00pm

  Schedule appointment with Lindsay Prihoda at the end of this meeting
- CLC members to complete feedback forms and return to TRCA by Wednesday March 2, 2011
- TRCA to work with Terraprobe to select a preferred remedial option based on input received
- Next CLC meeting tentatively scheduled in March 2011 to discuss the selection of the preferred remedial option and the Project Plan

TORONTO AND REGION Conservation
for The Living City

Troutbrooke Slope Stabilization Project

CLC Meeting #2

Wednesday, February 16, 2011

Attendees:

Laura Stephenson, Manger Project Management Office
Mark Preston, Senior Construction Supervisor
Lindsay Prihoda, Project Coordinator
Thomas Sciscione, Environmental Technician
Mike Fenning, Manager, Acquisitions and Sales
Craig Mitchell, Flood Infrastructure Coordinator
Jason Crowder, Terraprobe Inc.
Alida Troini, Councillor Augimeri's Constituency Assistant
David Le Quang, Resident
Abdul Gulban, Resident
Patricia Meza, Resident
Juan Segura, Resident
Silvia Volpini, Representative for Resident
Rocco DeSantis, Representative of Resident
Maria Busca, Resident
Vince Tropiano, Representative for Resident
Tony Tropiano, Representative of Resident
Alda Busca, Resident
Pierangelo Busca, Resident

MINUTES

- Introductions - TRCA staff, Terraprobe Inc. (Consultant), Attendees.

- LS begins the meeting with inquiring if there are any questions or omissions to the meeting minutes from the Community Liaison Committee meeting #1 held on Wednesday November 24, 2010.
    - There were no questions or omissions to the meeting minutes.
    - LS notes that all comments received from the residents and meeting minutes will be incorporated into the Project Plan document to be submitted to the Ministry of the Environment (MOE) for project approvals.

- LS begins the presentation with summarizing the Evaluation Criteria and Results of Evaluation for each of the remedial options.

- LS informs the attendees of the potential impacts on the technical considerations, socio-economic, physical, cultural and natural environments for each remedial option. Furthermore, LS comments on the cost/feasibility of all options.

- LS welcomes JC, a Professional Engineer with Terraprobe Inc. to continue the presentation with a review of the modifications of the remedial options to incorporate the feedback from CLC meeting #1.

- JC notes the following modifications to the remedial options:
    - Option 2a and 2b a deck has been added to ensure the property owners have usable outdoor space in the rear yards. The details of the deck (i.e., size) would be determined in the detail design process.
    - Option 2c and 3 will ensure each property will have 5 metres (m) or to the position of the 2009 slope crest, which ever creates more tableland.

- Attendee requests JC clarify the quantity of tableland each property owner will receive, if there is presently 10 m (20 ft) of tableland then the project design will attempt to recreate a comparable amount of usable tableland tableland.
    - JC confirms the attendees comment is true and that the goal of the design is to ensure that no property owner will lose tableland.

- Attendee inquires if the face of the slope will be vegetated.
    - JC notes that the face of the slope could be re-vegetated.
    - Attendee inquires further on the type of vegetation.
    - JC notes that the type of vegetation would be determined during the detailed design process.

- Attendee inquires if Option 3 (MSE Wall) could be built to a 2 H: 1V slope vs the proposed 1 H: 1V slope.
    - JC informs the members that Option 3 is not required to be on a 2:1 slope and would require additional fill material to develop on a slope.

- Attendee inquires why the slope crest will be remediated to the 2009 slope crest and not to an earlier position with additional tableland.
    - LS informs the members that this project was established in 2009, and in accordance with the TRCA Erosion Control Monitoring and Maintenance program the slope crest is required to be remediated to the current position. Furthermore, TRCA's funding is limited.
    - MF adds that TRCA's mandate states erosion sites should only be restored to the position that will ensure the safety of the public.

- Attendee inquires about the difference between Option 2c (Geogrid) and Option 3 (MSE Wall)
    - LS informs the members that both options are very similar.
    - JC confirms there are no technical differences between these options, but that MSE Wall allows a steeper slope face, which prevents further encroachment of the structure into the ravine.

- Attendee inquires about the potential impact of the remedial works on existing second storey decks.
    - JC informs the members that all second storey decks would be assessed and likely require removal prior to construction and replacement post construction.

- Attendee inquires about the standard of 5 m of tableland.
    - LS informs the committee that an estimate was completed on the rear yards within the area and the average size was 5 m of tableland.

- Attendee inquires about the deck size proposed in Option 2a and 2b.
    - JC confirms that the deck can be built to any size. The size would be determined during the detailed design process. They are shown in the design as extending the width of the homes.

- Attendee inquires about the angle of the slope for each option.
    - JC summarizes each of the angels, and informs the committee that a fence will be installed at the slope crest for safety.

- LS continues the presentation and summarizes the cost of each option and the available landowner contribution options.

- LS informs the committee of the following two options for landowner contribution.
  Option 1: Property line would be adjusted to the new top-of-bank.
  Option 2: Cash contribution based on value of work and approved funding formula.

- Attendee inquires if the easement required as part of Option 2 of the landowner contribution is permanent.
    - MF and LS confirm the easement is permanent and would be registered on the title for the property. Therefore, any future potential purchasers of the property will be aware of the easement on the property.

- Attendee inquires if the land was transferred to the TRCA would it be maintained.
    - MF confirms that TRCA would be responsible to maintain the slope.

- Attendee inquires on the type of fence that will be installed at the crest of the slope.
    - LS informs the committee that the fence is typically a black chain link fence.
    - Attendee inquires further if the fence is an eye sore.
    - LS notes the fence is black and not overly visible.

- Attendee inquires about what will happen if the land once it is transferred to TRCA.
    - LS informs the committee that the land will be incorporated into the existing TRCA conservation lands in the area and associated Black Creek greenspace.

- Attendee inquires about the next steps if any property owners disagree with all the proposed remedial options.
    - LS informs the committee that there will be meetings with each of the property owners to discuss the project further, and it can be discussed during this time.

- Attendee inquires about the cost for each remedial option if the property owner does not want to transfer the lands to TRCA.
    - LS informs the committee that there are estimates on the handouts of the presentation, and the costs range from $15,800 to $23,400 depending on the selected remedial option. LS further notes these are just estimates, the costs will vary for each option and property based on the final detailed design.
    - Attendee inquires further if a property owner contributed cash, whether an easement would be required, and further whether property owners would be able to modify the property.
    - LS confirms that an easement will be required and the property owners will not be able to modify the property. A TRCA permit will be required prior to any type of work.
    - MF adds that a TRCA permit is required for ravine lots with or without the remedial works and easement.

- LS explains the Next Steps.

  - Individual appointments (approximately 30 mins) are available with TRCA to discuss options and address outstanding issues at the following times:

    Tuesday February 22, 2011 – 3:30 to 5:00 pm
    Wednesday February 23, 2011 – 3:30 to 5:00 pm
    Monday February 28, 2011 – 3:00 to 5:00 pm
    Wednesday March 2, 2011 – 3:00 to 5:00pm

    Schedule appointment with Lindsay Prihoda at the end of this meeting
  - Attendees are to complete the workbook to provide feedback on the modifications and return to TRCA by Wednesday March 2, 2011.
  - TRCA to work with Terraprobe to select a preferred remedial option based on input received.
  - Next CLC meeting tentatively scheduled in March 2011 (pending outcome of further meetings) to discuss the selection of the preferred remedial option and the Project Plan.

- Attendee inquires if the remedial work was completed would a permit be required in the future if a deck was built.
  - LS informs the committee that permits would be required.
  - MF reiterates that permits are currently required with or without remedial works.

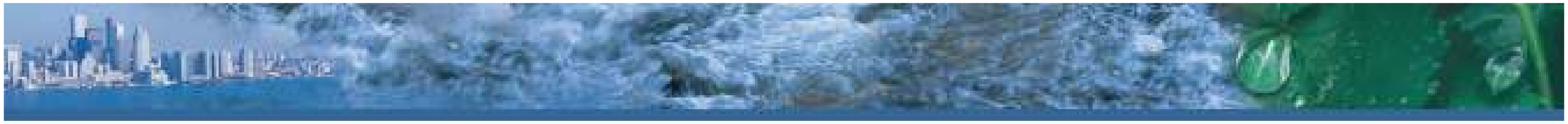
- Attendee inquires if Option 2a or 2b was selected as the preferred option and a deck structure was built would TRCA warranty the deck.
  - MP informs the committee that the deck structure would be built by a contractor. Therefore, the deck would most likely have a general 2-3 warranty with the contractor. There would be no warranty from TRCA.

- Attendee comments that Option 2a and 2b with the deck option are not preferred, as a property owner the re-development of tableland with Option 2c and 3 would be preferred.

- Attendee inquires for clarification on the position of the slope crest after the remedial works.
  - LS informs the committee that the position of the slope crest would be remediated to the position in 2009 with Option 2c and 3 or 5 m (which ever is greater). Therefore, the properties presently with more than 5 m of tableland will be remediated to achieve a comparable amount of tableland in 2009.

- Attendee inquires if a property owner would transfer the land required for the remedial works will property taxes remain the same.
  - LS recommends that if a property owner were to transfer the land to TRCA that they have their property re-evaluated to adjust the property taxes.

Meeting adjourned at 8:00 pm.

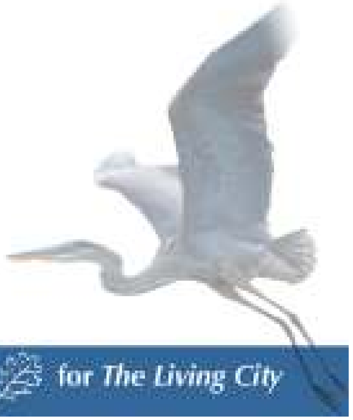


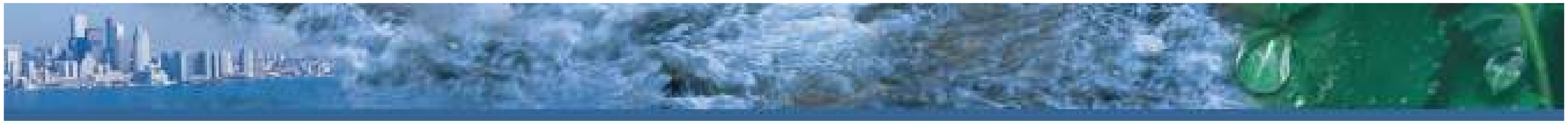
Troutbrooke Slope Stabilization Project

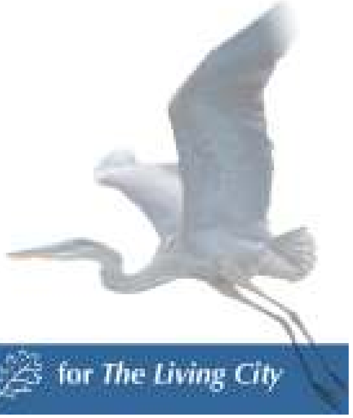
Class Environmental Assessment

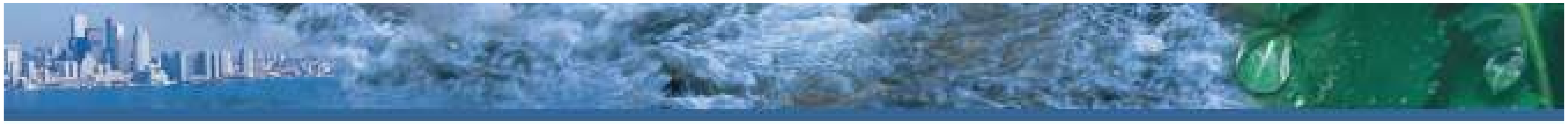
Community Liaison Committee (CLC) Meeting #2
Wednesday, February 16th, 2011

Participant Workbook



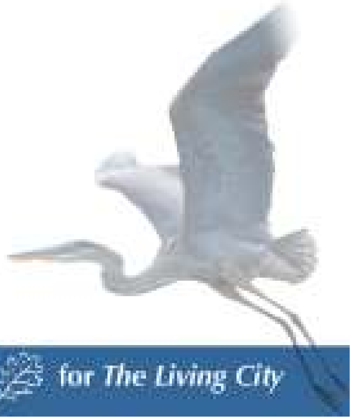


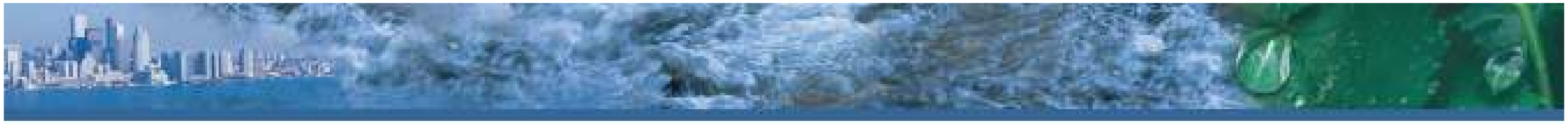




Key Questions

- Feedback on Evaluation of Remedial Options
- Feedback on Modifications of Remedial Options
- Other Questions and Comments





Option 1: “Do Nothing”

Physical Environment

- No construction related impacts

Cultural Environment

- Little impact on adjacent parkland

Feasibility and Cost

- No construction related costs
- Ongoing cost to landowners

Socio-Economic Environment

- High likelihood of future property damage and loss of tableland
- Ongoing concern for public safety
- Impact ability of landowners to use rear yard

Technical Considerations

- Does not address slope instability and erosion

Natural Environment

- Some trees on the valley wall will be lost to erosion

Feedback on Evaluation of Option 1

Do you have any comments on the evaluation as presented?

Comments:

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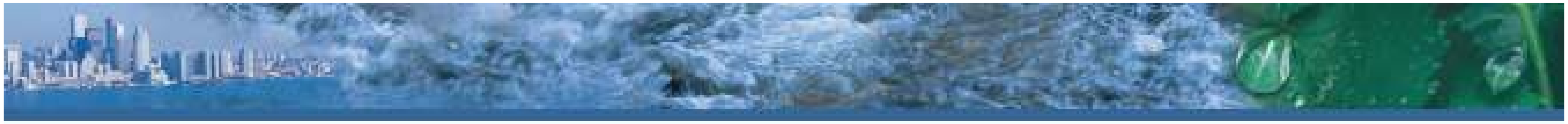


Option 2: Remove Fill and Replace with an Engineered Slope

Socio-Economic Environment

- Prevents future property damage
- Provides little to no table land for use as rear yard
- Impact ability of landowners to use and access rear yard

Technical Considerations

- Addresses slope instability and erosion

Feasibility and Cost

- High construction related costs

Physical Environment

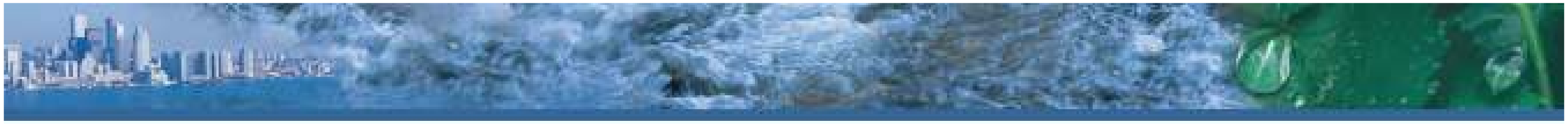
- Residents and neighbours may be affected by noise, dust and vibration related to construction

Cultural Environment

- Area around construction site and access through parkland will cause temporary disruption of use

Natural Environment

- Trees on the valley wall require removal to facilitate construction
- Potential for sediment entry into Black Creek
- Vegetation removal may impact nesting birds



Option 2: Mitigation Strategies

1. Noise, dust, and vibration impacts during construction

- Conduct pre-construction inspection of homes
- Use best management practices to suppress dust
- Operate site in compliance with noise by-law

2. Potential for sediment entry into Black Creek

- Ensure appropriate sediment and erosion control measures are in place

3. Loss of vegetation

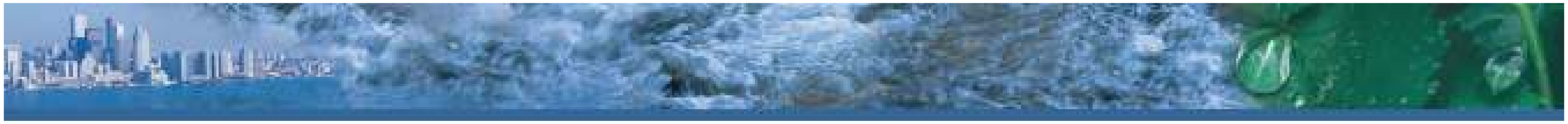
- Replace loss vegetation within Downsview Dells Park

4. Vegetation removal may impact nesting birds

- Ensure no vegetation removal during May 1 to July 23 to avoid nesting period

5. Landowners use and access to rear yard

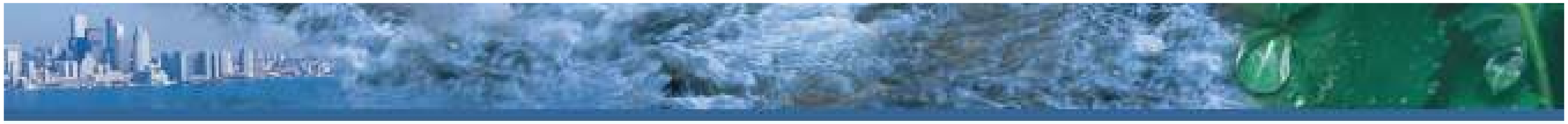
- Adjust design to provide landowner with safe access and use of rear yard



Feedback on Evaluation of Option 2

Do you have any comments on the evaluation as presented?

Comments:



Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

Socio-Economic Environment

- Prevents future property damage
- Provides 5 m (16.4 ft) of table land for use as rear yard
- Reduces some residents existing usable rear yards to 5 m (16.4 ft)

Technical Considerations

- Addresses slope instability and erosion

Feasibility and Cost

- High construction related costs

Cultural Environment

- Area around construction site and access through parkland will cause temporary disruption of use

Natural Environment

- Trees on the valley wall require removal to facilitate construction
- Vegetation removal may impact nesting birds

Physical Environment

- Residents and neighbours may be affected by noise, dust and vibration related to construction

Option 3: Mitigation Strategies

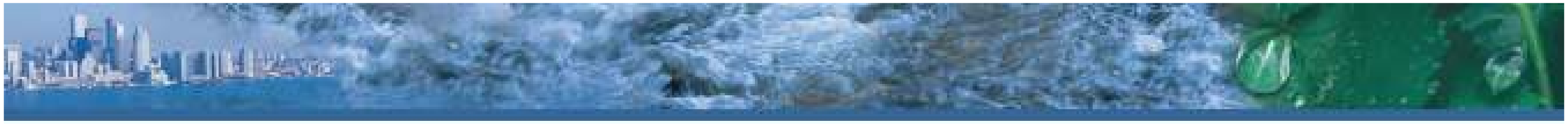
1. Noise, dust, and vibration impacts during construction
- Conduct pre-construction inspection of homes
- Use best management practices to suppress dust
- Operate site in compliance with noise by-law

2. Potential for sediment entry into Black Creek
- Ensure appropriate sediment and erosion control measures are in place

3. Loss of vegetation
- Replace loss vegetation within Downsview Dells Park

4. Vegetation removal may impact nesting birds
- Ensure no vegetation removal during May 1 to July 23 to avoid nesting period

5. Landowners use and access to rear yard
- Design to limit impact on existing available rear yard space



Feedback on Evaluation of Option 3

Do you have any comments on the evaluation as presented?

Comments:

Option 4: Greenspace Acquisition

Socio-Economic Environment

- Requires residents to relocate

Technical Considerations

- Addresses slope instability and erosion

Feasibility and Cost

- Very high costs

Cultural Environment

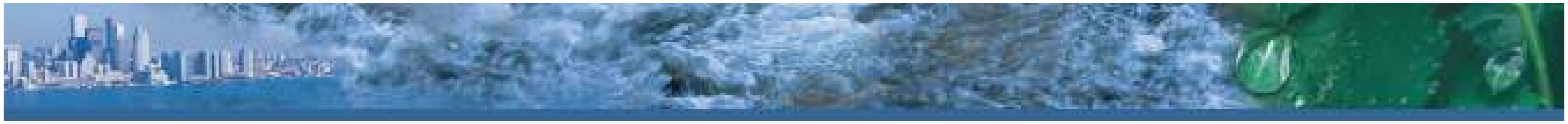
- Area around construction site will cause temporary disruption of use
- Parkland will be increased

Natural Environment

- Natural vegetation can be expanded

Physical Environment

- Neighbours may be affected by noise, dust and vibration related to demolition



Feedback on Evaluation of Option 4

Do you have any comments on the evaluation as presented?

Comments:

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Is this your preferred Option
Yes ☐ No ☐
Comments:

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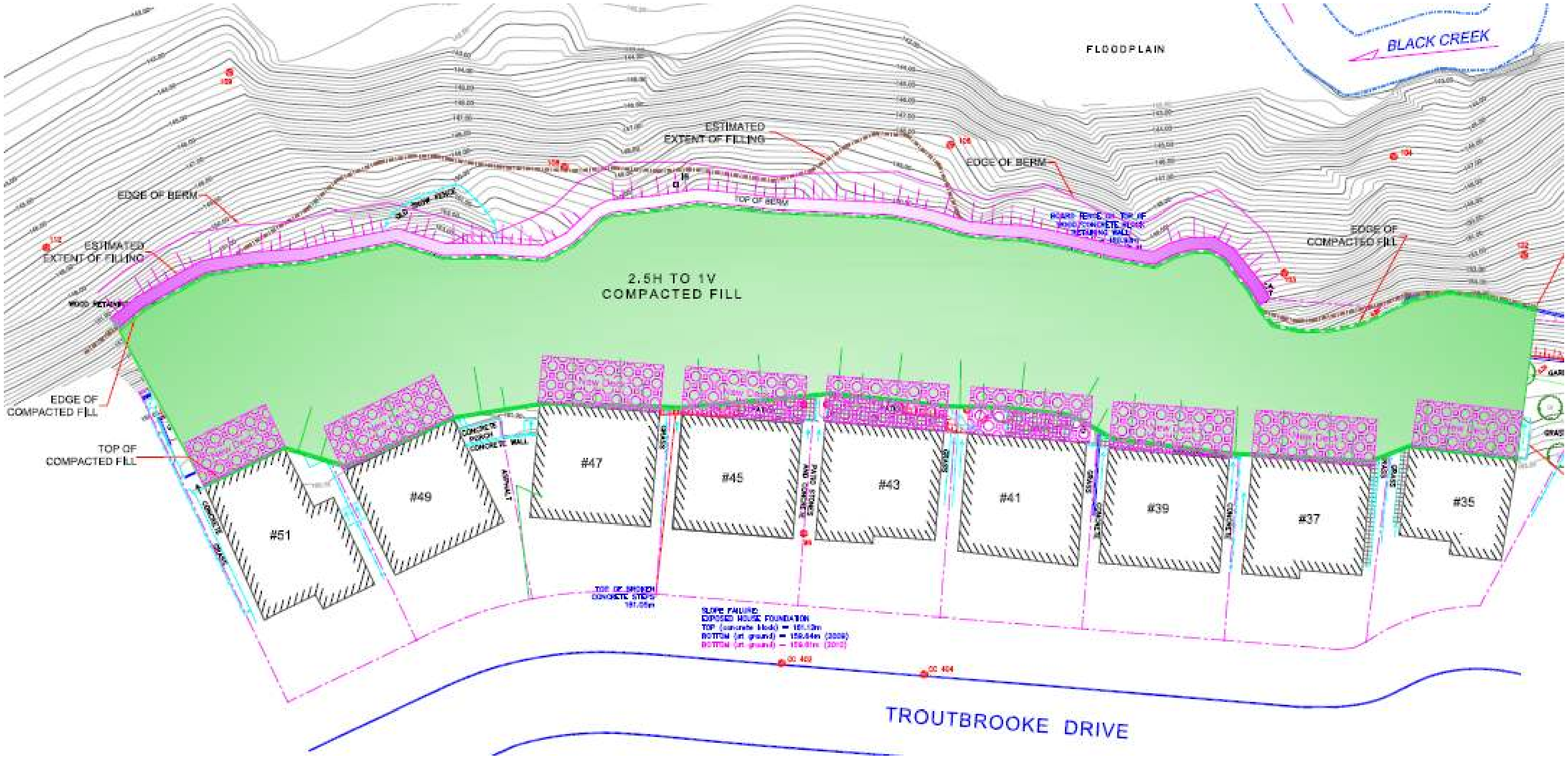
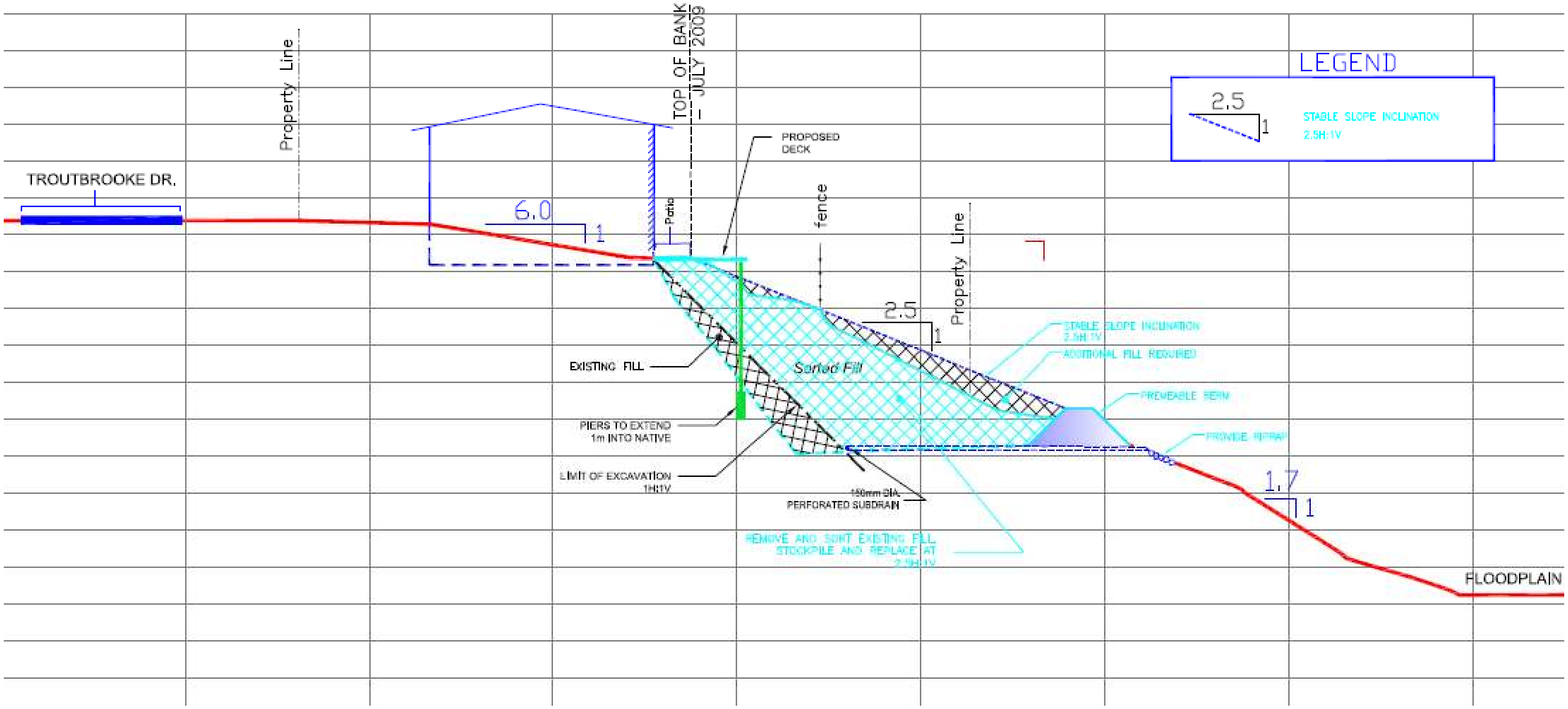
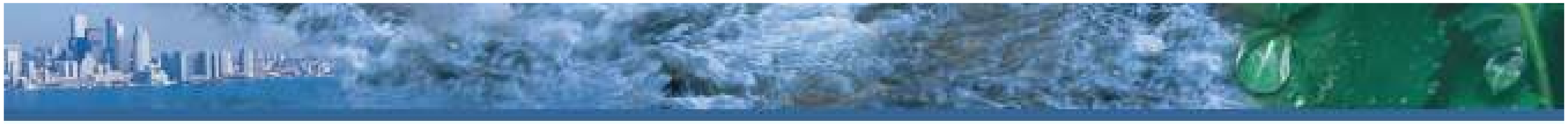
Modified Option 2: Remove Fill and Replace with an Engineered Slope



Modified Option 2a: Remove Fill and Replace with an Engineered Slope (with New Deck)

Sort existing fill and re-compact at 2.5 H : 1 V





Feedback on Option 2a

Do you have any comments on the modification as presented?

Comments:

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Is this your preferred Remedial Option

Yes ☐ No ☐

Comments:

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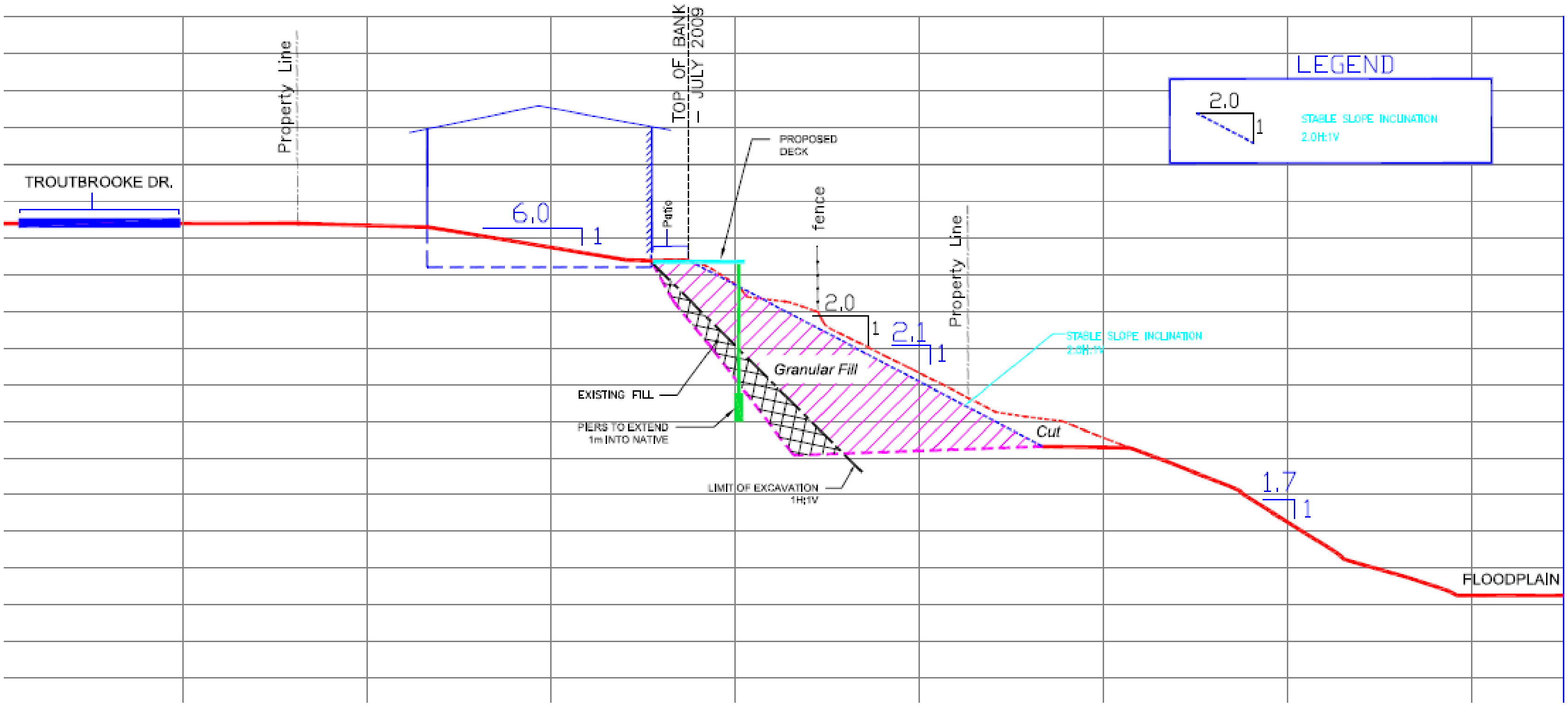
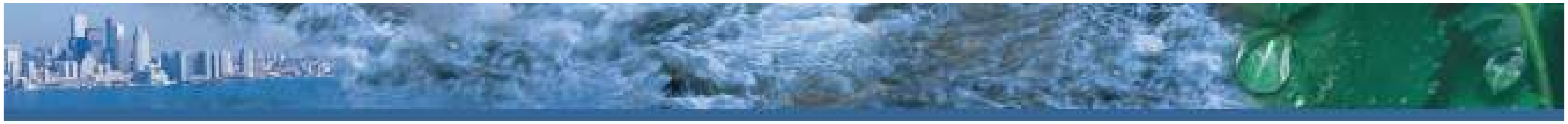
Troutbrooke Slope Stabilization Project
Class Environmental Assessment

Modified Option 2b: Remove Fill and Replace with an Engineered Slope (with New Deck)

Remove existing fill and import granular fill at 2.0 H : 1 V





Feedback on Option 2b

Do you have any comments on the modification as presented?

Comments:

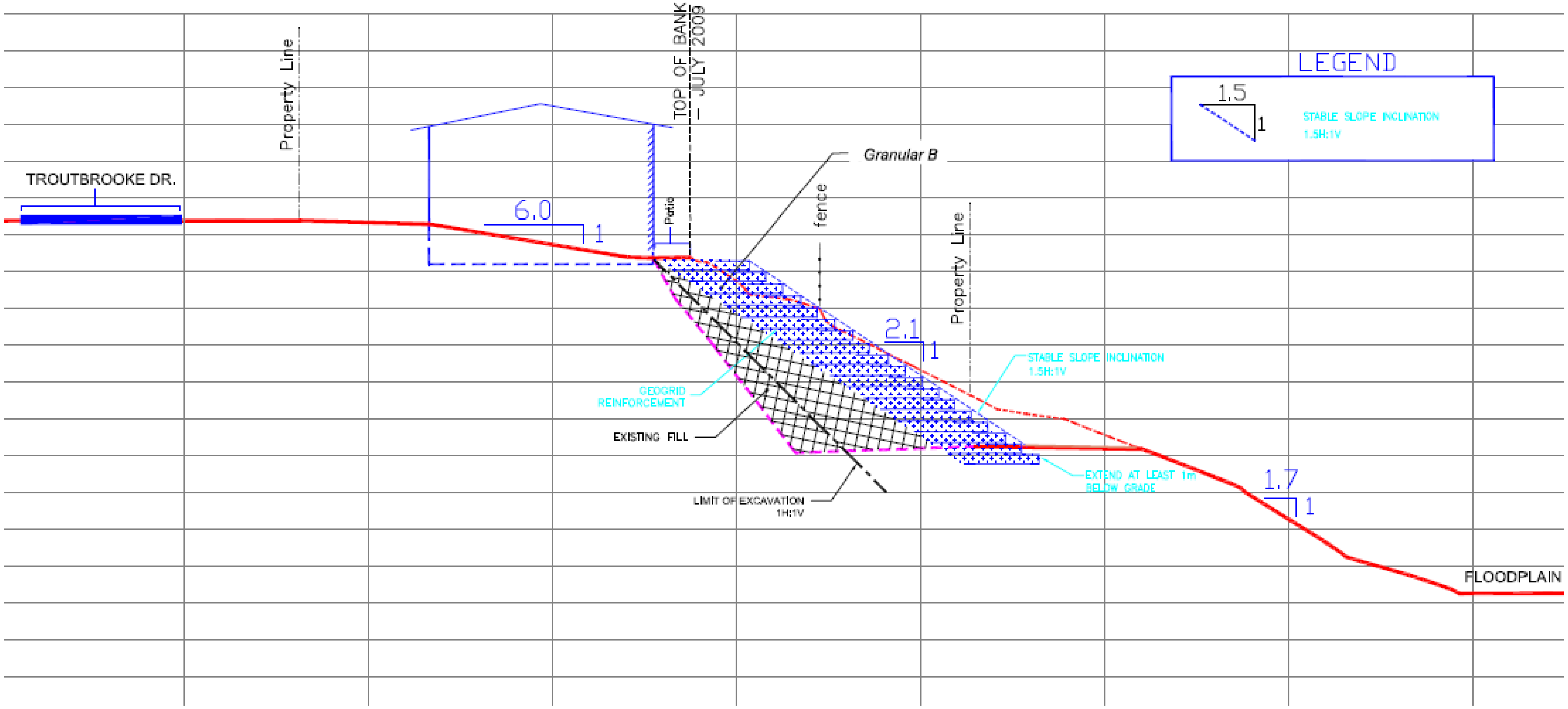
Is this your preferred Remedial Option

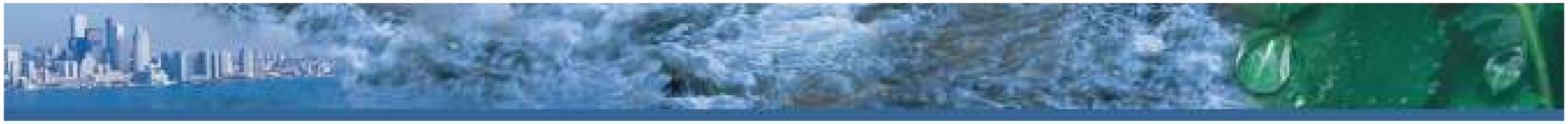
Yes ☐ No ☐

Comments:

Modified Option 2c: Remove Fill and Replace with an Engineered Slope

Remove existing fill and replace with geogrid reinforced granular fill at 1.5 H : 1 V





Feedback on Option 2c

Do you have any comments on the modification as presented?

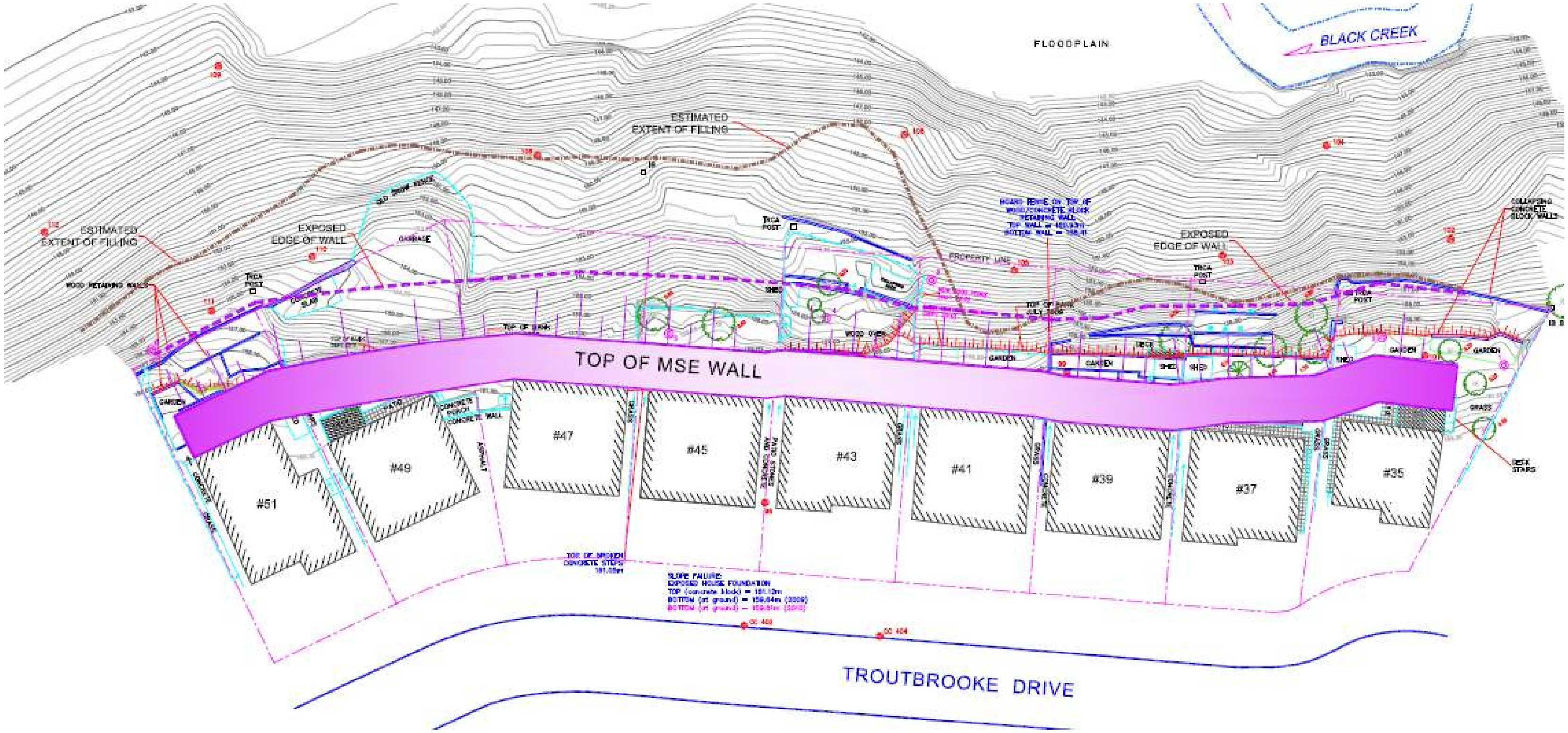
Comments:

Is this your preferred Remedial Option

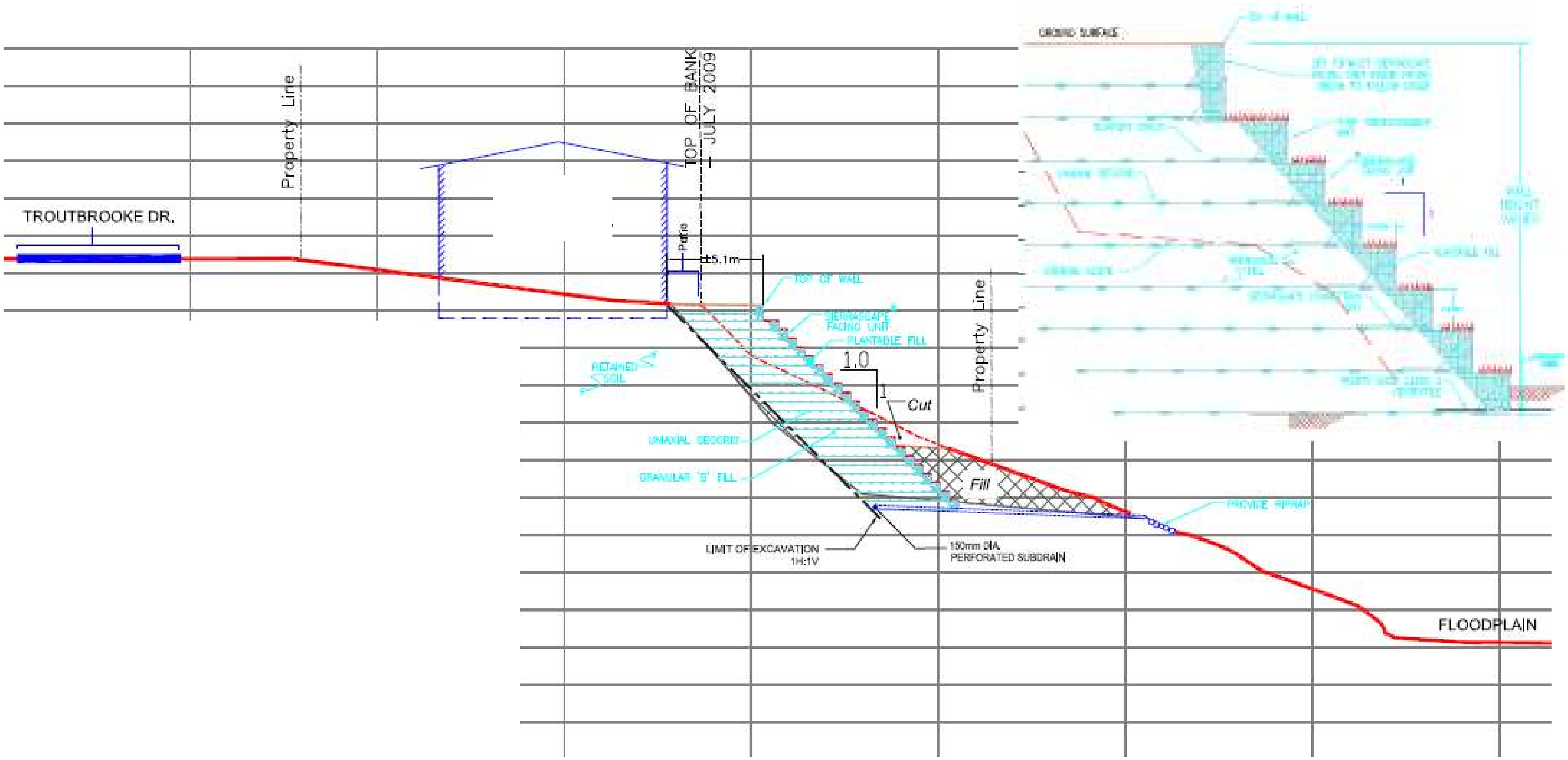
Yes ☐ No ☐

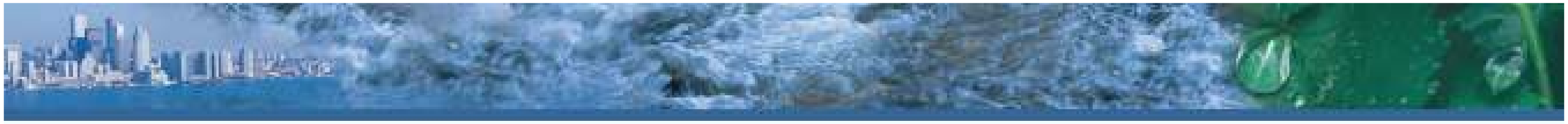
Comments:

Modified Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall



Modified Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall





Feedback on Option 3

Do you have any comments on the modification as presented?

Comments:

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Is this your preferred Remedial Option

Yes ☐ No ☐

Comments:

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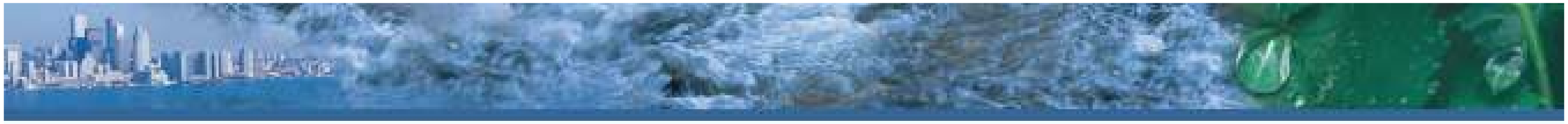
Troutbrooke Slope Stabilization Project
Class Environmental Assessment



Other Questions or Comments

Do you have any other questions of comments on the project?

Comments:

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Name (optional) and Address

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Please return the completed workbook by Wednesday March 3, 2011 to Lindsay Prihoda, Project Coordinator;
by facsimile (416) 667 - 6277; by e-mail lprihoda@trca.on.ca; by mail: TRCA 5 Shoreham Drive, Downsview, ON M3N 1S4

TORONTO AND REGION Conservation
for The Living City

TROUTBROOKE SLOPE STABILIZATION PROJECT
COMMUNITY LIAISON COMMITTEE (CLC) MEETING #3

Wednesday April 6, 2011
Beverley Heights Middle School
26 Troutbrooke Drive, Toronto
6:30 p.m. – 8:30 p.m.

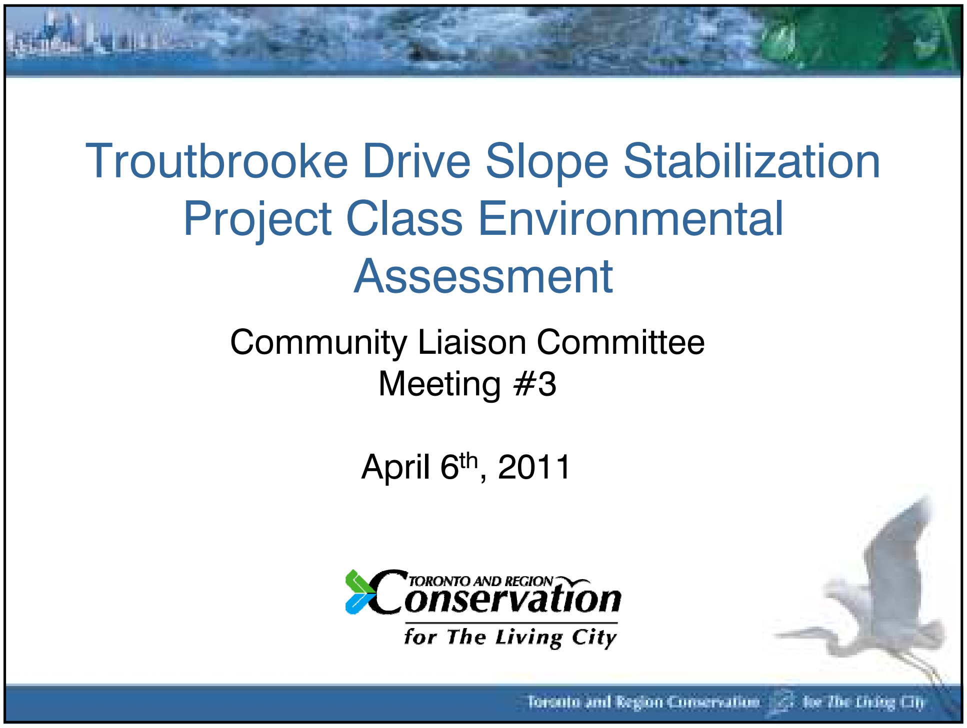
AGENDA

6:30 – 6:45 Attendance sign in, welcome and opening remarks

6:45 – 7:30 Presentation by TRCA and Terraprobe

- Overview of CLC#2 and Meetings with Residents
- Preferred Alternative
- Details of Construction
- Project Plan

7:30 – 8:30 Discussion Period
Next Steps
Meeting Adjournment



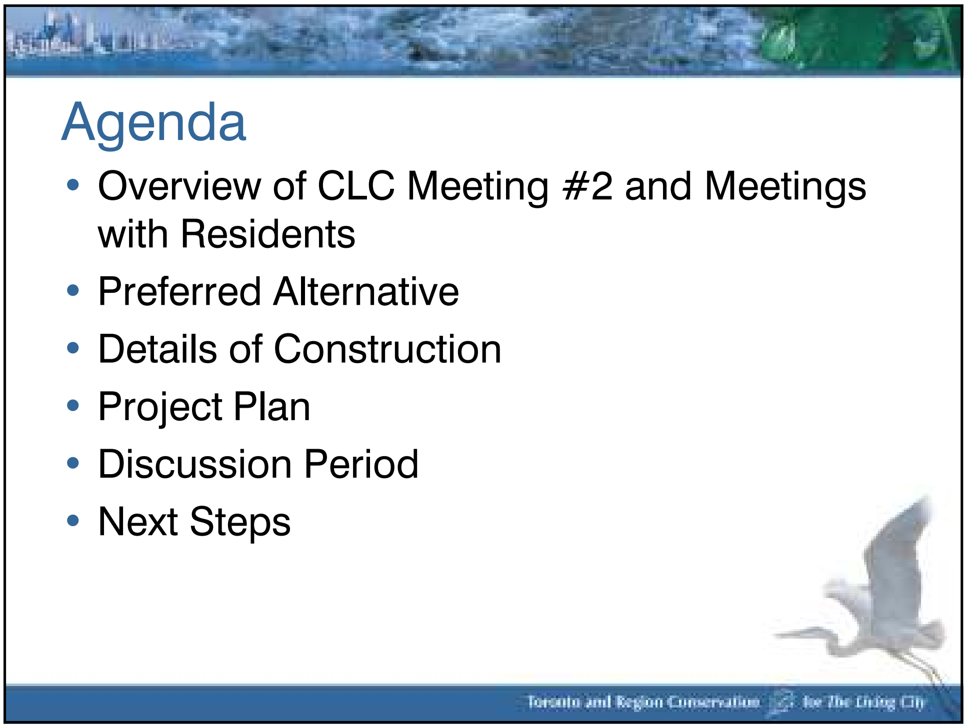
Troutbrooke Drive Slope Stabilization Project Class Environmental Assessment

Community Liaison Committee
Meeting #3

April 6th, 2011

Toronto and Region Conservation for The Living City

Toronto and Region Conservation for The Living City



Agenda

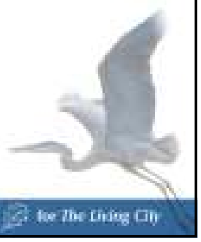
- Overview of CLC Meeting #2 and Meetings with Residents
- Preferred Alternative
- Details of Construction
- Project Plan
- Discussion Period
- Next Steps

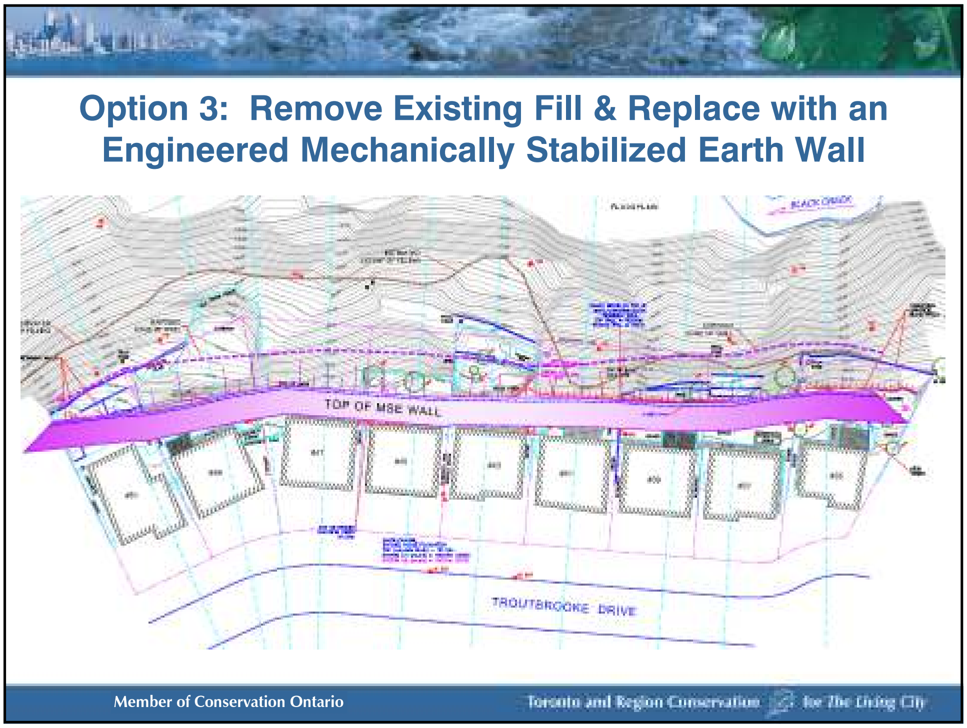
Toronto and Region Conservation for The Living City

Overview of CLC Meeting #2 and Meetings with Residents

- During CLC Meeting #2, TRCA presented modifications and costs of each preliminary remedial option. Furthermore, the attendees were provided information regarding the available landowner contribution options.
- Following the CLC meeting, TRCA staff had the opportunity to meet individually with most of the affected property owners or representatives to further discuss the presented options and to work towards determining the preferred alternative and resolving any remaining questions or concerns regarding the project.
- Based on these discussions, TRCA has determined the preferred remedial option.

Preferred Alternative

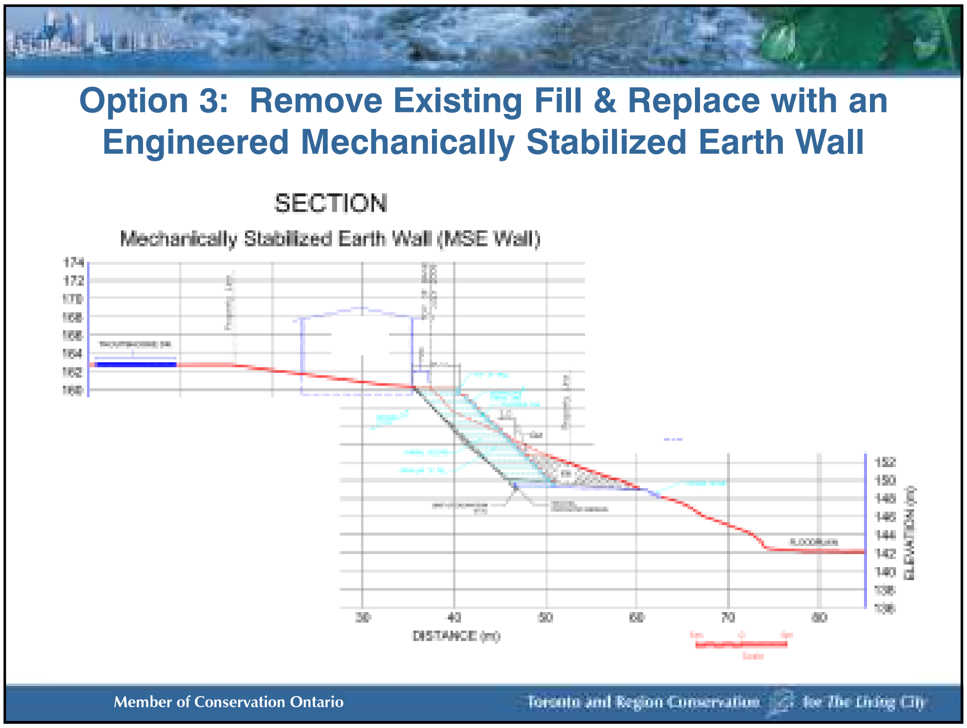




Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

Member of Conservation Ontario

Toronto and Region Conservation for The Living City



Option 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall

SECTION

Mechanically Stabilized Earth Wall (MSE Wall)

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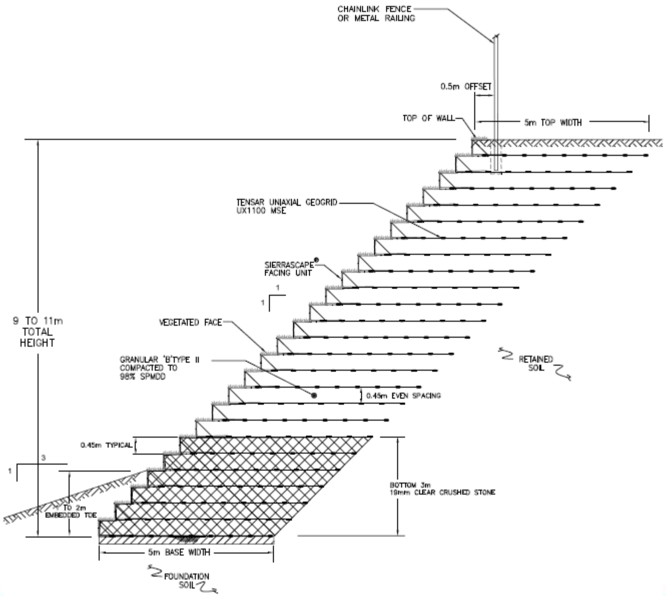
Toronto and Region Conservation for The Living City



Details of Construction

Pre-Construction – Owner Responsibility

- Existing down spouts draining into rear yard or ground must be re-routed to the front of the property.
- Discuss with neighbouring interest in installing privacy fencing between properties, as TRCA will install only footings for privacy fencing between neighbouring properties during construction of remedial works.
- Remove all structures (i.e., Shed) and/or objects (i.e, patio furniture, patio stones, etc.) prior to construction.
- Set-up appointment with TRCA to discuss detailed design and pre-construction assessment of property (may include structural assessment of second storey decks).

Pre-Construction – TRCA Responsibility

- Ensure Terraprobe continues the monthly monitoring with conducting slope inclinometer casing and standpipe piezometer measurements to report any further movement of slope.
- Acquire all required permits for the stabilization works.
- Retain a structural engineering firm to complete an inspection of any structures (i.e., residences, decks, etc.) prior to construction and monitor these structures throughout construction to ensure there is no significant impact with the implementation of the stabilization works.
- Install survey pins at the north west and north east corner of the dwellings to monitor throughout construction.
- Conduct meetings with each of the property owners to address any concerns, discuss detailed design and complete a pre-construction assessment of the property.

Post-Construction – Owner Responsibility

- Installation of privacy fencing, if desired.
- Ensure no above ground pools, nor hot tubs, nor storage of any materials in excess of 4 kPa on the top of the wall.
- Acquire TRCA permits for any alterations to the rear yard including the construction, reconstruction, erection or placing of a building or structure of any kind, site grading, and/or the temporary or permanent placing, dumping or removal of any material, originating on the site or elsewhere.
- Report any changes in site conditions to TRCA.
- Refrain from making any alterations to the slope.
- Maintain fencing in good working order.
- Ensure drainage is directed to the front of the property.

Post-Construction – TRCA Responsibility

- Restoration of the site
    - Planting of the slope face.
    - Installation of sod in the rear yards.
- Monitor the vegetation and replace as required.
- Ensure a visual inspection of the stabilization works is completed after each major storm event for the period of 1 year.
- Ensure surveys are conducted annually until a period of 5 years has passed, after which time inspection will be adjusted to an appropriate frequency depending on structure condition.

Deltalok

SierraScape – Example 1

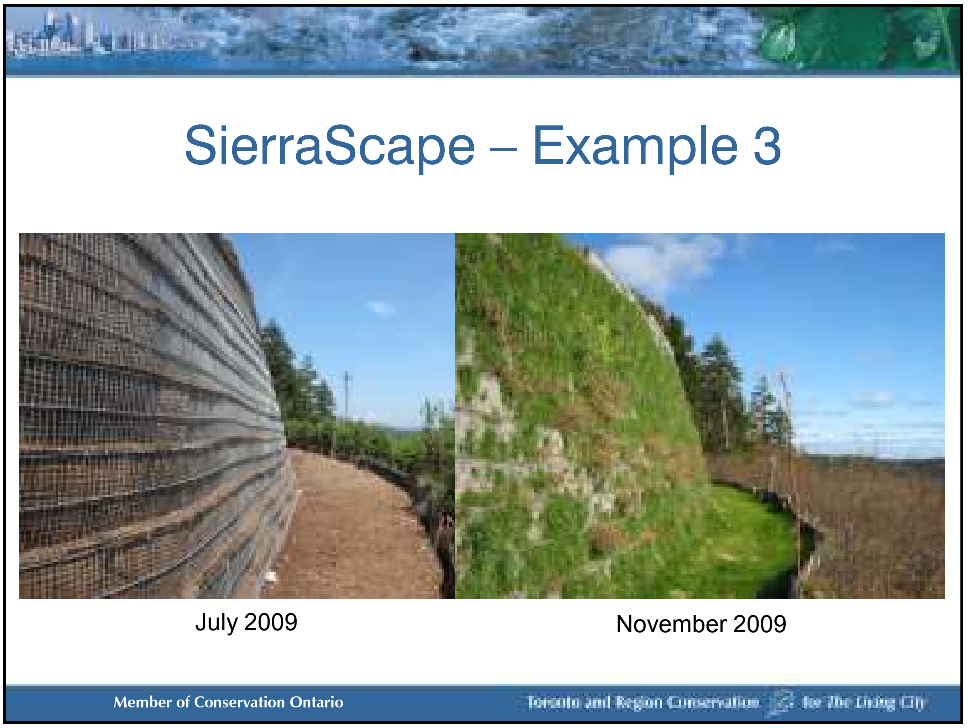
July 2009

November 2009

SierraScape – Example 2

July 2009

November 2009



SierraScape – Example 3

July 2009

November 2009

Plantings

Honeysuckle

Upland Pussy Willow

Grey Dogwood

Red Osier Dogwood

Member of Conservation Ontario

Toronto and Region Conservation for The Living City

Plantings

Sandbar Willow

Staghorn Sumac

Shining Willow

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Toronto and Region Conservation for The Living City

Project Plan

- Following tonight's meeting, the Project Team will review and consider all public comments and finalize the Project Plan.
- The Project Plan will include public comments received throughout the EA process and describe the decision-making process.
- The Project Plan will be filed with the Municipal Clerk, Ministry of the Environment (MOE), and placed on the public record for a 30 day review period, where the public and review agencies can provide comments.
- At the time of filing the Project Plan, a Notice of Filing will be advertised in the North York Mirror and through direct mail to those on the project mailing list.
- Part II Order: A person may request that the MOE make an order for the project to comply with Part II of the Environmental Assessment Act, which addresses individual environmental assessments. If no request is received project will proceed to detailed design and approval stage.

Next Steps

- CLC members to complete review and provide comments on Project Plan by Wednesday April 13, 2011
- TRCA to file Project Plan with Ministry of the Environment for a 30-day review period on Friday April 15, 2011.
- TRCA and Terraprobe to complete Detailed Design.
- Appointment (approximately 30 mins) with TRCA to discuss detailed design and property agreements. TRCA staff available to meet at the following times:

    Tuesday May 24, 2011 – 3:00 to 5:00 pm
    Wednesday May 25, 2011 – 3:00 to 5:00 pm
    Thursday May 26, 2011 – 3:00 to 5:00 pm

Schedule appointment with Lindsay Prihoda at the end of this meeting

TORONTO AND REGION Conservation
for The Living City

Troutbrooke Slope Stabilization Project

CLC Meeting #3

Wednesday, April 6, 2011

Attendees:

Laura Stephenson, Manger Project Management Office
Mark Preston, Senior Construction Supervisor
Lindsay Prihoda, Project Coordinator
Thomas Sciscione, Environmental Technician
Mike Fenning, Manager, Acquisitions and Sales
Jason Crowder, Terraprobe Inc.
Gaspar Horvath, Black Creek Project
David Le Quang, Resident
Abdul Gulban, Resident
Alda Busca, Resident
Pierangelo Busca, Resident
Patricia Meza, Resident
Juan Segura, Resident
Silvia Volpini, Representative for Resident
Nick Monestero, Representative for Resident
Maria Busca, Resident
Vince Tropiano, Representative for Resident
Tony Tropiano, Representative for Resident
Jerry Tropiano, Representative for Resident
Maria Lucente, Representative for Resident
Filomena Lucente, Resident

MINUTES

- LS begins the presentation with an overview of the Community Liaison Committee (CLC) meeting #2 held on Wednesday February 16, 2011, and the individual meetings with the residents.
    - LS notes that Toronto and Region Conservation Authority (TRCA) has not met with all of the property owners, and TRCA is hoping to hold meetings to de-brief these property owners.
    - LS explains that the meeting is intended to be the last meeting of the CLC before TRCA files the Class EA for the 30 day public review period and that TRCA will meet with homeowners individually from this point on.

- LS welcomes JC, a Professional Engineer with Terraprobe Inc. to present the Preferred Alternative.
    - JC presents the Preferred Alternative which is a refined version of Option 3: Remove Existing Fill and Replace with a Mechanically Stabilized Earth (MSE) wall.
    - JC notes the nine (9) properties would be remediated to provide a minimum of five (5) metres (m) of useable tableland from the rear wall of the residential structure to the fence.
    - A fence is required along the edge of the slope to ensure safety and compliance with the Ontario Building Code.
    - The fence will be installed 0.5 m from the crest of the slope to ensure the geogrid and facing of the MSE wall is not compromised.

- Attendee inquires if there is an existing MSE wall that the property owners would be able to visit and observe.
    - JC notes there are several MSE walls within the Greater Toronto area, however permission must be granted in order for him to share this information.
    - **ACTION ITEM #1 – Terraprobe to confirm if supplier will provide an example of a MSE wall for property owners to observe.**

- Attendee inquires about the use of the word “minimum”.
    - JC explains that it is a word commonly used in engineering to explain standards of slope stabilization.
    - JC explains that the design meets or exceeds the minimum design factor of safety standards, as is common practise, and as set out in the Canadian Foundation Engineering Manual and Canadian Highway Bridge Design Code
    - JC adds that Terraprobe has run many engineering models on this proposed design to ensure the most accurate specifications to minimize the potential of any failures for a 100 year design life.

- JC continues the presentation with a detailed explanation of the construction of the proposed MSE wall:
    - Constructed with a SierraScape face (galvanized baskets) with Tensar uniaxial geogrid as the tensile reinforcement.
    - Layers of geogrid will be spaced every 0.45 m, which is dictated by SierraScape system.
    - The reinforced soil shall be 19 mm clear crushed stone in the lower 3 m of the wall. Above that, the reinforced soil will consist of Granular ‘B’ type II.
    - A fence will be set back 0.5 m from the crest of the slope.
    - Design does not allow for any loads on the top of the wall in excess of 4kPa (i.e., no pools, hot tubs or storage of heavy material).

- Attendee inquires if there will be a minimum of 5 m of tableland between the rear wall of the residential structure to the fence or the slope crest.
    - JC reiterates that there will be a minimum of 5 m of tableland from the rear wall of the residential structure to the fence. Some properties may have more than 5 m depending on the position of the crest in 2009.

- Attendee inquires if sheds will be allowed in the rear yards once the remedial works are complete.
    - JC confirms that garden sheds will be allowed in the rear yards, however the material stored in the shed cannot be over 4 kPa (e.g. bags of concrete).

- Attendee inquires for clarification on 4 kPa and whether further information can be provided that outlines loading restrictions.
    - JC notes that pedestrian traffic is equivalent to between 1.6 to 4.0 kPa. A 1 m high flower bed would be equivalent to about 19 kPa and hence is not allowed. JC noted that patio stones are allowed as long as they are set into / flush with the ground surface.
    - **ACTION ITEM #2 – Terraprobe to provide some further guidelines and information on loading restrictions.**

- Attendee requests JC clarify the quantity of tableland each property owner will receive, for example if there is presently 10 m (20 ft) of tableland then will the project design attempt to recreate a comparable amount of usable tableland.

    - JC confirms the attendees comment is true and that the goal of the design is to ensure that no property owner will lose tableland.

- Attendee inquires if the fence will allow access to the slope.
    - JC notes that the face of the slope will not be accessible, as it is a safety issue for any individual to descend this structure. Furthermore, there would be potential to compromise the structure if the slope was accessible.
    - Attendee notes that they were under the impression the slope would be accessible.
    - LS replies that TRCA has discussed this option with the engineers and it was determined it is not advisable.

- Attendee inquires if any of the preliminary options would have allowed the property owners to access their property at the base of the slope.
    - LS informs the members that none of the preliminary options were designed to provide access to the base of the slope from the top.
    - JC adds the base of the slope would only be accessible from the parkette at Jane and Troutbrooke via construction access road.

- Attendee inquires why the slope crest will be remediated to provide additional tableland.
    - LS comments that the intent of TRCA's program is to mitigate risk and through the Class EA process we have recognized the homeowners' interest in maintaining usable yard space.
    - Furthermore program funding is limited and staff is attempting to provide a solution that is in line with the approved 2011 budget.

- Attendee comments that with the limited tableland, and resizing of the property that the properties will not be purchased.

- LS informs the members that if the project planning is prolonged into next year (2012) there is no guarantee the funding will still be available from the City of Toronto. TRCA recognizes the concerns of the affected residents; however the proposed remedial works must be in keeping with TRCA's policy to eliminate the risk to the public.

- Attendee notes that as property owners, the properties were purchased, taxes were paid, building permits were retained. Everything that was required was completed. The attendee further notes there should be compensation for the loss of tableland.

- LS informs the members that through the Class Environmental Assessment (EA) process TRCA has proposed preliminary options that reclaims some of the lost land, however further expansion of the works would result in encroachment into the Black Creek floodplain, and additional impacts to the environment.
    - LS adds that from an engineering and safety view point the remedial options presented are feasible options, with the tableland reclaimed to either 5 m or the position of the 2009 slope crest.

- Attendee notes that they would like to voice their opinion to Councillor Augimeri.

- Attendee inquires on the next steps, if the property owners would like further tableland reclaimed, as they do not agree with the 5 m or the position of the 2009 slope crest.
    - LS informs the members that through the Class EA process TRCA has offered several options to protect the properties from further risk. Therefore, if the

property owners are not in agreeance the project has the potential to be cancelled, and the funding to be retracted by the City of Toronto.

- Attendee comments that their property was appraised because they are not interested in the transfer of land or a cash contribution to TRCA to complete the remedial works.

- Attendee notes that there was no preliminary option to reclaim all of the lost land (i.e. to the property lines).
    - LS reiterates that it is not an option to remediate the slope to the property lines as TRCA's mandate is to remediate the slope to eliminate the potential risk to life. Further reclaiming of land would have significant environmental impacts to the Black Creek ravine.

- LS continues the presentation on the details of construction.
    - TRCA is working towards having all approvals in place to proceed with construction planning as of June 1.
    - TRCA anticipates the commencement of construction in mid-August 2011 to November 2011.

- LS explains the proposed construction access road.
    - There are two methods of construction that are being explored.
        1. Excavation behind all properties and install MSE wall, east to west.
        2. Excavation of two (2) properties, install wall and then proceed to next two (2) properties, install wall, etc…

- LS explains the responsibilities of the property owners pre-construction:
    - Existing down spouts must be redirected to drain into the front of the property.
    - Discuss with neighbouring property owners installation of privacy fencing between properties, as TRCA will install footings during construction.
    - Must remove all structures (i.e., shed) and/or objects (i.e., patio furniture, patio stones, etc.) they would like retained prior to construction.

- Attendee inquires if all sheds need to be removed, even if in an area that is not to be disturbed.
    - LS informs that the shed will most likely need to be removed, however this will be determined in the pre-construction assessment that TRCA will complete. All property owners will be informed during the pre-construction assessment on the structures/objects that will be required to be removed.
    - Attendee further inquires if TRCA will remove and replace the shed.
    - LS informs the attendees that it will be the responsibility of the property owners to remove and replace the structures/objects in the rear yards, not including the rear fence and second storey deck structures.

- Attendee inquires what will happen if winter arrives early in October.
    - LS notes that restoration would occur in the spring instead of November.
    - JC adds that with the types of soil (i.e., granular) and reinforced grid the cold weather or freezing would not cause an issue for construction.

- Attendee notes the concern of the construction access road through the park during the fall and spring.
    - LS informs the attendees that there will be protective measures (i.e., sediment fencing, mats, etc.) to protect the park and creek during construction.

- Attendee inquires if there will be a fence at the base of the slope.
    - LS notes there will only be a fence at the top of the slope, set back 0.5 m from the crest of the slope.

- Attendee inquires if there will be pins installed along the property boundaries.
    - LS notes that a legal survey must be completed as part of the property agreements, and the surveyors will install markers at this time.

- LS explains TRCA's responsibilities pre-construction:
    - Acquire all required permits for the stabilization works.
    - Retain a structural engineering firm to complete an inspection of any structures (i.e., residences, decks, etc.) prior to construction and monitor these structures throughout construction to ensure there is no significant impact with the implementation of the stabilization works.
    - Install survey pins at the north west and north east corner of the dwellings to monitor throughout construction.
    - Conduct meetings with each of the property owners to address any concerns, discuss detailed design and complete a pre-construction assessment of the property.

- LS explains property owner's responsibilities post-construction:
    - Installation of privacy fencing, if desired.
    - Ensure no above ground pools, nor hot tubs, nor storage of any materials in excess of 4 kPa on the top of the wall.
    - Acquire TRCA permits for any alterations to the rear yard including the construction, reconstruction, erection or placing of a building or structure of any kind, site grading, and/or the temporary or permanent placing, dumping or removal of any material, originating on the site or elsewhere.
    - Report any changes in site conditions to TRCA.
    - Refrain from making any alterations to the slope.
    - Maintain fencing in good working order.
    - Ensure drainage is directed to the front of the property.

- Attendee inquires if the down spouts must remain in the front of the properties.
    - JC informs the members that the down spouts must remain directed to the front of the property.

- Attendee seeks confirmation regarding what portion of the properties is to be disturbed.
    - JC notes the properties will be disturbed from the rear wall of the residential structure to the existing crest of slope. No property between residential structures will be disturbed.
    - JC adds that safety fencing will be installed between the residences and the construction zone. This fencing must be maintained throughout the construction period to ensure the safety of the owners.

- LS explains TRCA's responsibilities post-construction:
    - Restoration of the site including: Planting of the slope face and installation of sod in the rear yards.
    - Monitor the vegetation and replace as required.
    - Ensure a visual inspection of the stabilization works is completed after each major storm event for the period of 1 year.

    - Ensure surveys are conducted annually until a period of 5 years has passed, after which time inspection will be adjusted to an appropriate frequency depending on structure condition.

- LS shows photos of SierraScape/Deltalok and examples of native plant to be used as part of the restoration plan.

- LS explains the Project Plan and filing of the document.
    - The Project Plan will be filed with the Municipal Clerk, Ministry of the Environment (MOE), and placed on the public record for a 30 day review period, where the public and review agencies can provide comments.
    - At the time of filing the Project Plan, a Notice of Filing will be advertised in the North York Mirror and through direct mail to those on the project mailing list.
    - Part II Order: A person may request that the MOE make an order for the project to comply with Part II of the Environmental Assessment Act, which addresses individual environmental assessments. If no request is received project will proceed to detailed design and approval stage.

- LS informs the members that the detailed design and draft property agreements will be discussed in individual meetings at the end of May. Property owners are required to sign-up for an appointment with Lindsay Prihoda, Project Coordinator.

- Attendee inquires on the details of the easement.
    - LS and MF confirmed that the details of the easement will be in the property agreement, which will be provided at the end of May prior to the individual meetings.

- Attendee inquires if the MSE wall can be constructed at a 70 degree angle.
    - JC notes that there are a lot of engineering options, however the more the MSE wall is modified the costs will be more expensive, as the quantity of fill material and type of material required will be modified. More importantly, the wall would be farther into the floodplain, and increase the environmental impacts.

- Attendees inquire about the elevation between 39, 41 and 43 Troutbrooke Drive.
    - JC notes that the existing retaining wall is cracked, and will be replaced during construction. Details of the remediation method will be determined in the detail design process.

- Attendees inquire about the height of the retaining wall.
    - JC informs the members that the height of the wall will vary across the site, from 5 to 11 m.

- Attendee inquires if there was a flood event would the water compromise the MSE wall.
    - JC informs that the MSE wall is engineered and will not be compromised.

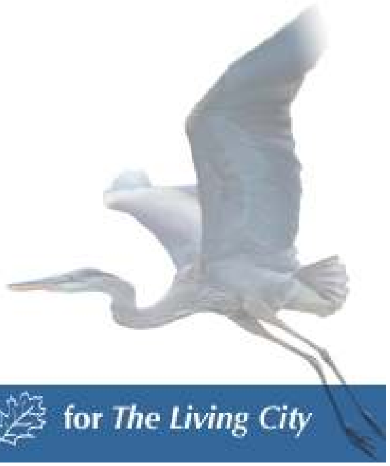
Meeting adjourned at 8:00 pm.

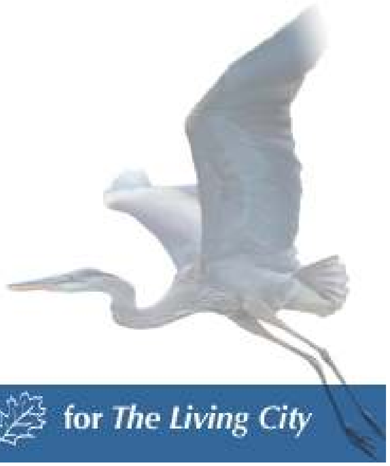
Troutbrooke Slope Stabilization Project

Class Environmental Assessment

Community Liaison Committee (CLC) Meeting #3
Wednesday, April 6th, 2011

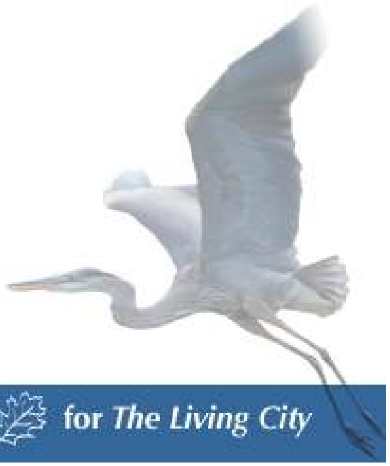
Participant Workbook





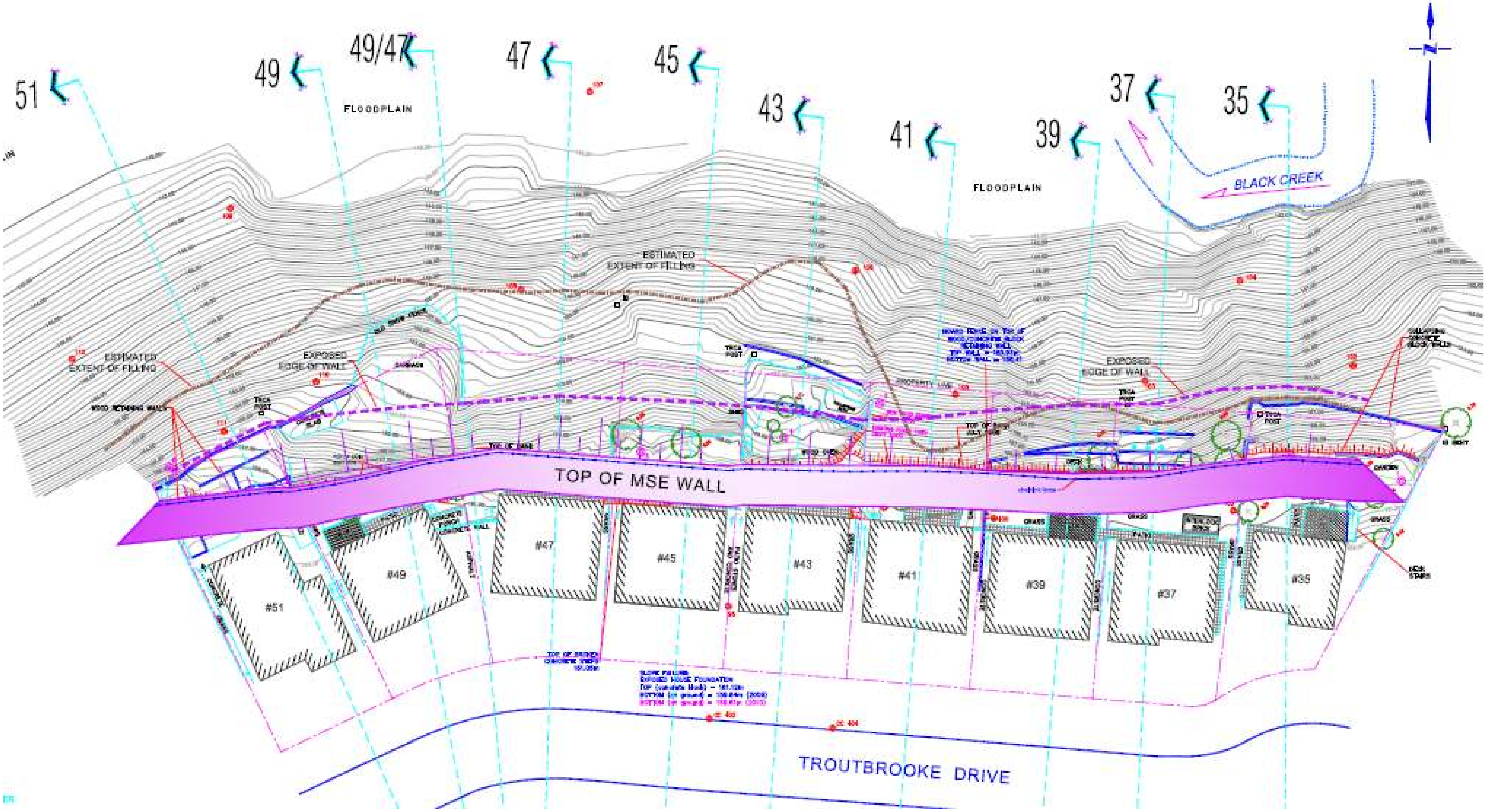
Key Questions

- Feedback on the Preferred Alternative
- Feedback on the Project
- Feedback on the Class Environmental Environmental Process
- Other Questions and Comments



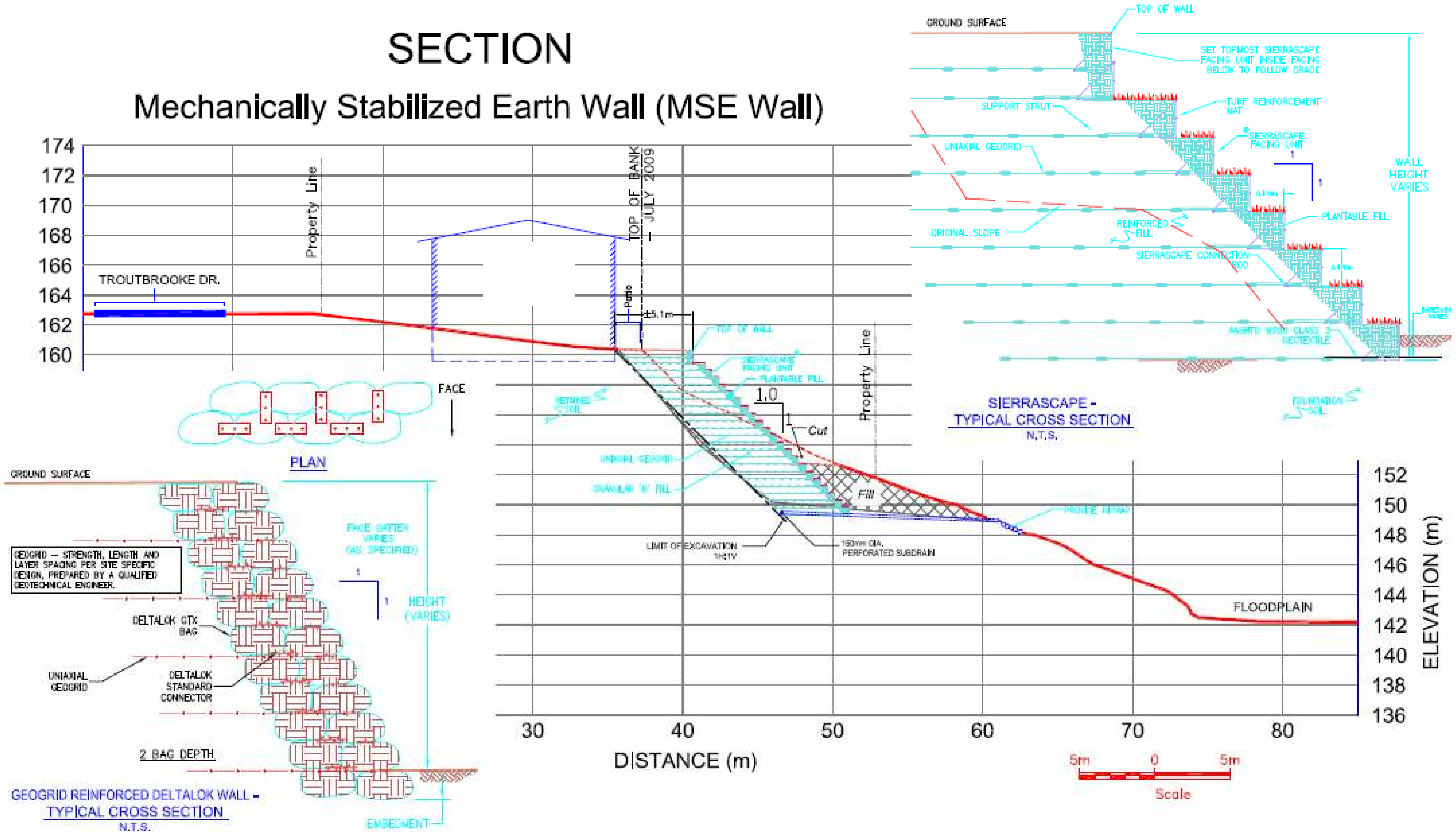
Preferred Alternative

Concept 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall



Preferred Alternative

Concept 3: Remove Existing Fill & Replace with an Engineered Mechanically Stabilized Earth Wall



Feedback on the Preferred Alternative

Do you have any comments on the Preferred Alternative as presented?

Comments:

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Feedback on Troutbrooke Slope Stabilization Project

Do you have any questions or comments on the project?

Comments:

Feedback on Class Environmental Assessment Process

	Least Satisfied			Most Satisfied	
Initiation of Class EA Process	1	2	3	4	5
Examination of Environmental Planning and Design Principles	1	2	3	4	5
Preparation of Baseline Inventory	1	2	3	4	5
Evaluation of Alternatives for Carrying Out Remedial Work	1	2	3	4	5
Selection of Preferred Alternative	1	2	3	4	5
Detailed Environmental Analysis of Preferred Alternative	1	2	3	4	5
Report Preparation (Project Plan)	1	2	3	4	5
Notification	1	2	3	4	5
Level of CLC Participation	1	2	3	4	5
Conservation Authority's Ability to Understand Concerns	1	2	3	4	5
Conservation Authority's Accommodation of Concerns	1	2	3	4	5
Provision of Sufficient Education Opportunities to Increase Your Level of Understanding Project Results	1	2	3	4	5

Name (optional) and Address

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Please return the completed workbook by Wednesday April 13, 2011 to Lindsay Prihoda, Project Coordinator;
by facsimile (416) 667 - 6277; by e-mail lprihoda@trca.on.ca; by mail: TRCA 5 Shoreham Drive, Downsview, ON M3N 1S4

Troutbrooke Slope Stabilization Project

Meeting with 37 Troutbrooke

Wednesday, February 23, 2011
4:00 pm

Attendees:

Laura Stephenson, Manger Project Management Office
Mike Fenning, Manager Acquisitions and Sales
Lindsay Prihoda, Project Coordinator
Juan Segura, Property Owner

MINUTES

- Introductions - TRCA staff and Property Owner.

- LS informs the Owner that this meeting is to review the cross sections of the property, 37 Troubrooke Drive, in relation to each of the proposed remedial options.

- LS inquires about the year the current owner purchased the property.
    - Owner informs TRCA that the property was purchased approximately three (3) years ago.

- Owner informs TRCA that the only concern is the removal of trees along the slope.
    - LS informs the Owner that the selection of the preferred option will consider the potential impacts to the vegetation on the slope, as TRCA prefers to limit the impact to the vegetation.

- LS reviews and summarizes each of the remedial options and any potential impact to 37 Troutbrooke.
    - LS informs the Owner that Option 2c will not be able to remediate to the position of the slope crest in 2009. There will be loss of tableland if this is selected as the preferred option.

- Owner inquires about the face of the slope.
    - LS informs the Owner that the face of the slope will be vegetated, and a TRCA forester will review the project site and determine the ideal vegetation to be planted.
    - LS adds that the vegetation will most likely be a shrub type vegetation.

- LS informs the Owner that Option 3 would achieve the position of the slope crest in 2009, reduce the quantity of fill material and allow the slope to be vegetated.
    - Owner inquires on the approximate height of the vegetation.

  - LS informs the Owner that the TRCA forester will determine the type of shrub material, however some of the vegetation will most likely be approximately 3 – 4 feet in height.
  - Owner comments that larger trees have large roots which may potentially assist with the stability of the slope.

- Owner informs TRCA that their preferred option is Option 3 with the lands to be transferred to TRCA and the property line shifted to the new position of the slope crest (i.e., new fence line).

- LS inquires if the Owner has any additional questions.
  - Owner inquires if a cedar tree along the existing fence line in the rear yard could be transplanted to the front yard.
  - LS informs the Owner that TRCA will observe the location of the cedar tree and determine if it can be transplanted to the front yard. However, TRCA can not guarantee the survival of the tree after the transplant.
  - **Action Item#1: LS to determine if the cedar tree can be able to be transplanted.**

- LS explains the Next Steps.
  - TRCA will meet with all of the nine (9) affected properties owners to discuss the remedial options further.
  - TRCA will determine if the cedar tree can be successfully transplanted to the front yard.
  - TRCA will provide all information above to the Owner prior to the next CLC meeting scheduled for April 2011.

Meeting adjourned at 4:10 pm.

TORONTO AND REGION
Conservation
for The Living City

Troutbrooke Slope Stabilization Project

Meeting with 39 Troutbrooke

Wednesday, March 2, 2011
3:30 pm

Attendees:

Laura Stephenson, Manger Project Management Office
Mike Fenning, Manager Acquisitions and Sales
Lindsay Prihoda, Project Coordinator

Maria Busca, Property Owner
Adriano Busca, Property Owner

MINUTES

- Introductions - TRCA staff and Property Owner.

- LS informs the Representatives that this meeting is to review the cross sections of the property as they relate to 39 Troubrooke Drive, for each of the proposed remedial options.

- Owner illustrates a cross section of his property and informs TRCA staff that he expects the tableland that is currently present, which is approximately 8 metres (m).
    - LS reiterates that attempts have been made to offer a solution that will allow the tableland to be remediated to the position of the 2009 slope crest.

- Owner comments that they will remove the shed in the rear yard prior to construction and will reconstruct after all the remedial work is complete.

- LS inquires when the house was purchased.
    - Owner informs TRCA staff that he built the residential structure in 1964.

- LS inquires if the Owner understands TRCA's Landowner Contribution.
    - Owner asks for LS to summarize options.
    - LS summarizes TRCA's Landowner Contribution options.
    - Owner notes he is unsure which option they would select. They would like to see the work complete before deciding on an option.
    - The Owner's discuss the options and determine in the meeting that there would be no point in keeping the land. Therefore, the Owners would like to transfer the lands to TRCA.

- LS notes that TRCA will complete a legal land survey of each property, and then a property agreement will be drafted for property owner's to review with a lawyer.

- LS notes that TRCA requires all property agreements to be signed in order to proceed with construction. Construction is anticipated to commence in September 2011.

- LS informs the Owners that a pre and post construction survey of the property and residential structure will be completed to ensure there are no impacts from the remedial works.

- LS explains the Next Steps.
    - TRCA will meet with all of the nine (9) affected properties owners to discuss the remedial options further.
    - TRCA will commence the detailed design process of the selected remedial option.
    - The next CLC meeting is schedule for April 2011.

- LS informs the Owners that it at this time we are unsure if the second storey deck structure will need to be removed. If it is required to be removed TRCA will remove and replace as part of the project.
    - Owner notes that he doesn't think the deck will need to be removed; however it may require additional support during construction.
    - LS informs the Owners that it will be determined in the detailed design process.
    - **Action Item #1: LS to consult Terraprobe to determine which decks will be required to be removed and replaced during construction.**

- Owner inquires about the restoration of the tableland.
    - LS informs the Owner that topsoil and sod will be laid along the tableland as part of the restoration of the site.

- LS comments that once TRCA has met with all property owners a preferred alternative will be selected.

- Owner inquires about the retaining wall between his property (39 Troutbrooke) and the neighbor (41 Troutbrooke). Owner adds that his residence was built, and then the builders of 41 Troutbrooke excavated for an additional storey. Therefore, there is an approximate 8 ft difference in height between the properties.
    - LS informs the Owner that this retaining wall will most likely be replaced, and the remedial works specifically between these two (2) properties will be determined in the detailed design process.

- LS explains the construction access route to the Owner.

- TRCA thanks the Owner for attending the meeting and discussing the remedial options further.

Meeting adjourned at 3:54 pm.

TORONTO AND REGION Conservation
for The Living City

Troutbrooke Slope Stabilization Project

Meeting with 43 Troutbrooke

Monday, February 28, 2011
3:00 pm

Attendees:

Laura Stephenson, Manger Project Management Office
Mike Fenning, Manager Acquisitions and Sales
Lindsay Prihoda, Project Coordinator

Abdul Gulban, Property Owner

MINUTES

- Introductions - TRCA staff and Property Owner.
- LS informs the Representatives that this meeting is to review the cross sections of the property, 43 Troubrooke Drive, in relation to each of the proposed remedial options.
- LS inquires about the year the current owner purchased the property.
  - Owner informs TRCA that the property was purchased approximately 17 years ago.
- Owner and LS discuss the photos provided during this meeting and work completed along the slope in attempt to stabilize. More specifically, the details of the slope failure that occurred in 2009.
- LS inquires if there was a deck structure in the rear yard.
  - Owner informs the TRCA that there was a deck structure; however after the slope failure in 2009 the deck was removed.
- LS summarizes Option 2a and Option 2b.
  - LS adds that the modification to these options was a deck structure to provide the property owners with useable outdoor space in the rear yard.
  - Owner notes that their preference is for the tableland to be remediated, not a slope and deck structure.
  - LS confirms remediation of the tableland would be achieved by Option 2c or Option 3.
- Owner inquires about the different elevations between the neighbouring properties.
  - LS informs the Owner that these details will be determined in the detailed design process, and there will most likely be a slope between the neighbouring properties.

- LS confirms that the Owner understands the landowner contribution and the two (2) options presented at CLC meeting #2.
    - Owner notes that they will transfer the land to TRCA, as the household has limited income and does not have the finances to complete a cash contribution.

- Owner informs TRCA the that the property is approximately 17 ft by 45 ft.

- Owner informs TRCA that a retaining wall structure was constructed in an attempt to create useable space and flower garden. However, the retaining walls were unsuccessful.

- Owner notes that there are a lot of materials in the rear yard that they would like to keep and re-use potentially in the front yard.
    - LS informs the Owner that TRCA will complete a pre-construction assessment of the property and the Owner will be required to remove any material from the backyard prior to contruction to ensure the construction workers do not dispose during the remedial works.

- Owner inquires about the fencing between the neighbouring properties
    - LS informs the Owner that all fencing between the affected properties will be required to be removed and the Owner will be responsible for replacing privacy fencing. It was suggested that the Owner discuss interest in rebuilding the privacy fences with neighbours. TRCA will install fence along the crest of the slope and will not be responsible for installing fencing between each of the properties.
    - **Action Item #1: LS to consult Terraprobe, regarding the fencing between the properties and if TRCA will need to install the posts during construction.**

- Owner inquires about the surface of the rear yard once the remedial works is complete.
    - LS informs the Owner that TRCA will lay sod in each of the rear yards.
    - Owner inquires if patio stones or concrete is an option.
    - LS informs the Owner that these options will have to be discussed and approved by Terraprobe to determine if there will be any impacts to the slope. However, TRCA will only lay sod, if patio stones or concrete are determined to be viable it will be the responsibility of the property owner to complete.

- Owner confirms that if the tableland were to be remediated there would be a slope.

- LS informs the Owner that if Option 2c or Option 3 are the preferred option there would be a very steep slope.

- Owner inquires if the slope would be able to be terraced.
    - LS informs the Owner that there are limited funds to complete the remedial work, as such for Option 2c and Option 3 the slope will be very steep and built without terraces.

- Owner comments that they would like the work to be completed as soon as possible, as their rear yard has been unusable for the last three years.

- LS explains the Construction Access Route to the Owner.

- LS explains the Next Steps.
    - TRCA will meet with all of the nine (9) affected properties owners to discuss the remedial options further.
    - TRCA will commence the detailed design process of the selected remedial option.
    - The next CLC meeting is schedule for April 2011.

- TRCA thanks the Owner for attending the meeting and discussing the remedial options further.

Meeting adjourned at 3:43 pm.

TORONTO AND REGION Conservation for The Living City

Troutbrooke Slope Stabilization Project

Meeting with 45 Troutbrooke

Friday, March 4, 2011
4:30 pm

Attendees:

Laura Stephenson, Manger Project Management Office Lindsay Prihoda, Project Coordinator	David Quang Le, Property Owner

MINUTES

- Introductions - TRCA staff and Property Owner.
- LS informs the Owner that this meeting is to review the cross sections of the property, 45 Troubrooke Drive, in relation to each of the proposed remedial options.
- LS inquires if the Owner has noticed any additional erosion at the property.
- Owner notes that he has not noticed any erosion since the slope failure in 2009.
- LS summarizes each of the remedial options.
    - Owner comments that his preferred alternative is Option 3.
- Owner requests the fence to be installed approximately 2 metres (2) from the crest along the slope, as he is not interested in a fence at the crest of the slope.
    - LS informs the Owner that this request will need to be reviewed by Terraprobe, as the retaining wall cannot be compromised. Furthermore, LS informs the Owner that it is a safety issue if a fence is not installed at the crest of the slope, as the slope will be steep.
    - **Action Item #1: LS to determine the potential for the property line and fence adjustment.**
- Owner inquires which option was selected by the other affected property owners
    - LS informs the Owner that all property owners TRCA has met with to date have selected Option 3 as the Preferred Alternative, and TRCA is agreeable with the implementation of this option.
- Owner reiterates that he does not want the fence installed at the crest of the slope.

- LS confirms that the Representative understands the landowner contribution and the two (2) options presented at CLC meeting #2.
    - Representative notes that he will transfer the land to TRCA.

- Owner inquires about construction.
    - LS informs the Owner that construction is anticipated to commence in September 2011.
    - Owner inquires why construction will not commence earlier.
    - LS informs the Owner that TRCA requires approvals and all property agreements to be signed by the owners before construction can be implemented.
    - LS ensures the Owner that if all required documents are received prior to September than construction will commence earlier.

- Owner comments that he hopes all property owners are agreeable to ensure the project proceeds.

- LS explains the Construction Access Route to the Owner.

- Owner inquires about the face of the slope.
    - LS informs the Owner that the face will be vegetated with shrubs. There will be no trees on the slope as it will compromise the retaining wall structure.
    - Owner confirms that he is agreeable to no trees on the slope.
    - **Action Item #2: LS to consult TRCA specialists to determine the type of vegetation to be planted on the face of the slope.**

- LS explains the Next Steps.
    - TRCA will meet with all of the nine (9) affected properties owners to discuss the remedial options further.
    - TRCA will commence the detailed design process of the selected remedial option.
    - The next CLC meeting is schedule for April 2011.

- TRCA thanks the Representative for attending the meeting and discussing the remedial options further.

Meeting adjourned at 4:46 pm.

TORONTO AND REGION Conservation for The Living City

Troutbrooke Slope Stabilization Project

Meeting with 47 Troutbrooke

Wednesday, March 2, 2011
4:55 pm

Attendees:

Laura Stephenson, Manger Project Management Office
Mike Fenning, Manager Acquisitions and Sales
Lindsay Prihoda, Project Coordinator
Silvia Ceccorulli, Representative of Property Owner
Alda Busca, Property Owner of 49 Troutbrooke

MINUTES

- Introductions - TRCA staff and Representative of Property Owner.
- LS informs the Representative that this meeting is to review the cross sections of the property, 47 Troubrooke Drive, in relation to each of the proposed remedial options.
- Representative comments that she is unsure about the differences of the options, and trusts her neighbours and their selection.
- LS summarizes Option 2a and Option 2b.
    - LS adds that the modification to these options was a deck structure to provide the property owners with useable outdoor space in the rear yard.
    - Representative notes that their preference is for the tableland to be remediated, not a slope and deck structure.
    - LS confirms the remediation of the tableland would be achieved by Option 2c or Option 3.
- Representative comments that as long as it is an improvement to the current state of the rear yard she will be content with any option.
- Representative inquires if Option 2c or 3 were implemented the rear yard would be remediated with 5 metres (m) of tableland.
    - LS confirms that these Options would allow the rear yard to be remediated with 5 m.
- Representative inquires on the size of the deck and the number of steel posts for the deck structure.
    - LS informs the Representative that the details of the deck will not be confirmed until the detailed design process.

- Representative inquires which Option TRCA would prefer to implement.
    - LS informs the Representative that the Property Owners to date have all selected Option 3 as the Preferred Alternative, and TRCA is agreeance with the implementation of this option.

- AB inquires about the difference between Option 2c and Option 3.
    - LS informs AB that Option 2c uses more of the floodplain and certain properties on the east portion of the project site will not be able to be remediated to the position of the 2009 slope crest. However Option 3 limits the impact to the floodplain and all properties can be remediated to 5 m or the position of the 2009 slope crest.

- LS confirms that the Representative understands the landowner contribution and the two (2) options presented at CLC meeting #2.
    - Representative inquires on the difference in value of the property if the lands were transferred.
    - MF informs Representative that typically the remediation of the land will increase the value of the property, however the difference in the transfer of lands to TRCA or the cash contribution typically have little impact to the value of the property as this portion of the property transferred is often unusable.
    - Representative inquires if the re-evaluation of the property will significantly impact property taxes.
    - MF note that it will more than likely result in a small modification.
    - Representative notes that they will transfer the land to TRCA, as the land is unusable and is not worth the cash contribution.

- Representative inquires if any other property owners are interested in the sale of their property.
- LS informs the Representative that there is limited interest in TRCA purchasing property.

- AB inquires about Option 4.
    - MF notes that TRCA currently does not have the funds required to purchase each of the affected properties, demolish residential structures and stabilize the slope.
    - MF adds that if there were a few affected properties interested in the sale of their property, TRCA would evaluate the situation and potentially purchase/complete work and re-sell property.

- Representative inquires if the cash contribution for the Landowner Contribution could be paid as a payment plan.
    - MF informs the residents that TRCA typically does not complete payment plans, however TRCA will look into the possibility.
    - MF adds that there will most likely be interest.
    - **Action Item #1: MF to determine if cash contribution can be paid in a payment plan.**

- LS informs the Representative that all structures or belongings must be removed from the rear yard prior to construction or else it will be disposed of during construction.

- Representative notes she is unsure what is in the rear yard, however she will check prior to construction.

- LS explains the Next Steps.
    - TRCA will meet with all of the nine (9) affected properties owners to discuss the remedial options further.
    - TRCA will commence the detailed design process of the selected remedial option.
    - The next CLC meeting is schedule for April 2011.

- TRCA thanks the Representative for attending the meeting and discussing the remedial options further.

Meeting adjourned at 5:23 pm.

TORONTO AND REGION Conservation
for The Living City

Troutbrooke Slope Stabilization Project

Meeting with 49 Troutbrooke

Wednesday, March 2, 2011
4:00 pm

Attendees:

Laura Stephenson, Manger Project Management Office	Alda Busca, Property Owner
Mike Fenning, Manager Acquisitions and Sales	Pierangelo Busca, Property Owner
Lindsay Prihoda, Project Coordinator	

MINUTES

- Introductions - TRCA staff and Property Owner.

- LS informs the Representatives that this meeting is to review the cross sections of the property, 49 Troubrooke Drive, in relation to each of the proposed remedial options.

- LS summarizes Option 2a and Option 2b.
  - LS adds that the modification to these options was a deck structure to provide the property owners with useable outdoor space in the rear yard.
  - Owner notes that their preference is for the tableland to be remediated, not a slope and deck structure.
  - LS confirms the remediation of the tableland would be achieved by Option 2c or Option 3.

- Owner comments that they would like no fill material removed.
  - LS informs the Owners in each of the proposed remedial options a portion of the existing fill material is required to be removed to ensure the stability of the slope and the safety of the residents.

- Owner inquires if any structures in the rear yard are required to be removed to allow for construction.
  - LS informs the Owner that all structures and items that they wish to retain (including shed and patio stones) are required to be removed prior to construction, or else it will be disposed of during construction.
  - LS adds that a pre and post construction assessment will be completed on the property, at this time the Owner can inquire further on the items required to be removed for construction.

- Owner inquires if a fence will be installed at the crest of the slope.
    - LS informs the Owner that due to the safety risk a fence is required to be installed at the crest.
    - Owner notes that they are not interested in a chain-link fence.
    - MF inquires if the Owner has any alternative fence options in mind.
    - Owner notes there are no fencing options in mind but a landscaped fencing option would be the most ideal.

- LS confirms that the Owner understands the landowner contribution and the two (2) options presented at CLC meeting #2.
    - Owner notes that they are not interested in transferring the land to TRCA, they will provide a cash contribution.

- Owner inquires if a stairwell would be permitted on the slope, as there is a portion of land at the base of the slope that they would like to create a private garden.
    - LS comments that the property is a ravine lot and in a regulated area, therefore permits would need to be acquired from TRCA and the City of Toronto.

    - Modification of the slope may also affect stability which would need to be reviewed by Terraprobe.

    - **Action Item #1: LP to confirm whether modification to the slope would be permissible.**

- Owner inquires about the different elevations between the neighbouring properties.
    - LS informs the Owner that these details will be determined in the detailed design process, and there will most likely be a slope between neighbouring properties where there is a grade change.
    - Owner comments that there is a weak point in the slope between their property (49 Troutbrooke) and the neighboring property (47 Troutbrooke).
    - Owner recalls as a boy playing on the slope there was a small drainage pipe protruding out the slope between 49 and 47 Troutbrooke about half way down.
    - **Action Item #2: LP to acquire infrastructure mapping of the Project area.**

- Owner comments that the garbage on the slope does not belong to them.

- Owner inquires if blocks can be inserted on the retaining structure to create a stairwell to access the base of the slope.
    - LS informs the Owner that Terraprobe must review and provide comments, as TRCA does not want the structure being compromised once it has been constructed.

- Owner inquires if TRCA can recommend any cheap seedlings to use on the their property.
    - LS informs the Owner that staff will inquire with the TRCA specialists.
    - **Action Item #3: LS to provide the Owner with recommendations on seedlings.**

- Owners inquire if all existing vegetation along the slope will be removed during construction.
    - LS informs the Owner that currently the preferred alternative is Option 3, which limits the impact of the construction to the slope. However, trees will be required to be removed from the slope to facilitate access and construction. The site restoration will ensure the slope is re-vegetated, although the plantings will be most likely be limited to shrub type vegetation to ensure the integrity of the structure is not compromised.
    - LS adds that City of Toronto, Urban Forestry will comment on removal of trees.

- LS explains the construction access route to the Owners.

- Owners inquire if the road will be transformed into a permanent trail for recreational use to the park.
    - LS informs the Owners that at this time there are no plans to transform this access route into a formal pedestrian trail, however it may be considered.

- LS explains the Next Steps.
    - TRCA will meet with all of the nine (9) affected properties owners to discuss the remedial options further.
    - TRCA will commence the detailed design process of the selected remedial option.
    - The next CLC meeting is schedule for April 2011.

- TRCA thanks the Owner for attending the meeting and discussing the remedial options further.

Meeting adjourned at 4:26 pm.

TORONTO AND REGION Conservation for The Living City

Troutbrooke Slope Stabilization Project

Meeting with 51 Troutbrooke

Tuesday, February 22, 2011
4:00 pm

Attendees:

Laura Stephenson, Manger Project Management Office	Vince Tropiano, Representative for Resident
Mike Fenning, Manager Acquisitions and Sales	Tony Tropiano, Representative for Resident
Lindsay Prihoda, Project Coordinator	

MINUTES

- Introductions - TRCA staff and Representatives of Resident. Representatives are two (2) of the property owners sons.

- LS informs the Representatives that this meeting is to review the cross sections of the property, 51 Troubrooke Drive, in relation to each of the proposed remedial options.

- LS inquires about the year the current owner purchased the property.
    - Representative informs TRCA that the property was purchased by their parents in 1975.

- Representative of property owner inquires about regulation during the development of the residential structure.
    - LS and MF informs the representative that there were no TRCA or the City of Toronto (North York) regulations at the time of development. Ravine lots started to be regulated in the mid 1980s.
    - LS adds that the City of Toronto and TRCA developed the Erosion Control and Monitoring Program to assist private landowners with erosion issues. This program allows funds to remediate erosion on private lands.

- Representative inquires about compensation for the loss of land from either the TRCA or the City of Toronto.
    - MF informs the representative that the property owners can contact the city, or councilors office to discuss the issue further. However, TRCA is unable to provide any compensation for the loss of land.

- Representative comments that there should be a note on the title for the properties in relation to the risk of property loss.

- LS informs the representatives that the onus is on potential home buyers to seek professional opinion on associated risk of purchasing a home (e.g., a home inspector or engineer) in a vulnerable area, in this instance a home close to top-of-bank.

- Representative requests information on Option 4.
    - MF informs the representative that TRCA can explore the potential purchase of the property.
    - Representative comments that they would like TRCA to explore this Option further, with consideration that the rear yard is fully useable.
    - MF comments that the property will be appraised with the current conditions.
    - **Action Item#1: MF to explore the opportunity to purchase property (i.e., property appraisal).**

- Representative inquires about the remediation of the rear yard to the property line.
    - LS informs the Representatives that TRCA is unable to fill into the valley, as it is against TRCA's mandate.
    - MF adds that TRCA is unable to complete works that TRCA would not typically provide permits to the general public to complete.

- LS and the Representatives discuss the position of the slope crest in 1990.

- Representatives comment that their parents had full use of the rear yard, from the residential structure to the property line.

- Representatives reiterate that the property owners are interested in TRCA potentially purchasing the property.

- Representatives add that there is concern that the tableland will not be remediated with 5 metres (m) of property, especially if the property has to be aligned with the neighbouring properties.
    - LS informs the Representatives that TRCA will have Terraprobe review the properties immediately adjacent to the property and estimate the amount of property to allow the new position of the slope crest to tie into neighbouring properties.
    - **Action Item #2: LS to follow-up with Terraprobe to determine the extent of tableland required to connect with neighbouring properties.**

- LS informs the Representatives that TRCA is currently leaning towards Option 3 as the preferred option, but are concerned with the amount of usable property and expressed their father's interest reclaiming the lost yard space..

- LS explains the Next Steps.
    - TRCA will meet with all of the nine (9) affected properties owners to discuss the remedial options further.
    - TRCA will determine if there is an opportunity to purchase the property.
    - TRCA will review the property and position of the new proposed crest position in relation to the neighbouring properties.
    - TRCA will followup the Representatives prior to the next CLC meeting scheduled for April 2011.

Meeting adjourned at 4:25 pm.

NOTICE OF FILING

TROUTBROOKE SLOPE STABILIAZATION PROJECT

Toronto and Region Conservation Authority (TRCA) has now completed the Project Plan regarding the Troutbrooke Slope Stabilization Project, located from Nos. 35 to 51 Troutbrooke Drive, in the City of Toronto. The Project Plan has been prepared in accordance with the *Class Environmental Assessment for Remedial Flood and Erosion Control Projects*, approved for projects of this type.

As described in the Project Plan, the preferred solution determined through the Class EA process is to remove the existing fill and replace with an engineered mechanically stabilized earth (MSE) wall, also known as a retaining wall, which will protect the nine (9) affected residential properties.

Interested persons are invited to review this document available on TRCA's website:
http://www.trca.on.ca/troutbrooke

Copies are also available for review at the following locations:

TRCA – Head Office
5 Shoreham Drive
Mon to Fri
8:00 am to 4:00 pm

Jane/Sheppard Library
1906 Sheppard Avenue West
Tues/Thurs 12:30 pm to 8:30 pm
Wed/Fri 10:00 am to 6:00 pm
Sat 9:00 am to 5:00 pm

Written comments must be received by **May 14, 2011**:

Laura Stephenson, Manager
Toronto and Region Conservation Authority
5 Shoreham Drive
Downsview, Ontario
M3N 1S4
Phone: (416) 661-6600 ext 5296
Fax: (416) 667-6277
Email: lstephenson@trca.on.ca

Subject to comments received as a result of this study and the receipt of necessary approvals and funding, TRCA intends to proceed with the construction of this project. If any individual feels that serious environmental concerns remain unresolved after consulting with TRCA staff, it is their right to request that the project be subject to a Part II order by the Minister of the Environment. Part II Order requests must be received by the Minister, with a copy to TRCA, at the following address by **May 14, 2011**:

Minister of the Environment
The Honourable John Wilkinson
77 Wellesley Street West
11th Floor, Ferguson Block
Toronto Ontario
M7A 2T5

TORONTO AND REGION Conservation
for The Living City
Member of Conservation Ontario

Notice issued April 15, 2011

APPENDIX E

Terraprobe Inc., *Geotechnical and Slope Stability Assessment, # 35 to 51 Troutbrooke Drive, Toronto, Ontario*. October 2010.

Terraprobe Inc., Troutbrooke *Stabilization Project, # 35 to 51 Troutbrooke Drive, Toronto, Ontario*. April 2011.

Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

GEOTECHNICAL AND SLOPE STABILITY ASSESSMENT 35 TO 51 TROUTBROOKE DRIVE TORONTO, ONTARIO

Prepared for:

Toronto and Region Conservation Authority
1 Eastville Ave.
Toronto, Ontario
M1M 2N5

Attn: Moranne McDonnell

File No. 1-09-4125
October 6, 2010

Distribution:

5 Copies	-	Toronto and Region Conservation Authority
1 Copy	-	Terraprobe Inc., Brampton

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APPENDICES

1. INTRODUCTION

Terraprobe Inc. was retained by the Toronto and Region Conservation Authority (TRCA) to conduct a geotechnical and slope stability assessment, regarding a slope failure which is believed to have occurred in March 2009. An initial inspection noted a significant failure scarp and tension crack along the slope crest extending from behind the dwelling at 51 Troutbrooke Drive to behind the dwelling at 43 Troutbrooke Drive. The failure scarp had exposed the foundation wall of 45 Troutbrooke Drive.

This report encompasses the geotechnical investigation of the subject site to determine the prevailing subsurface soil and shallow ground water conditions, and a detailed visual slope inspection to review the existing slope conditions. The scope of work also included detailed slope stability analysis. Based on these studies, this report provides geotechnical engineering recommendations pertaining to the site, stability setbacks, erosion risks for the slope, as well as preliminary recommendation options for remediation of the slope.

2. SITE DESCRIPTION AND BACKGROUND

The site is generally located east of Jane Street and north of Wilson Avenue, along the southern bank of the Black Creek. The section of the site for this project was immediately north of Troutbrooke Drive, which for the purposes of this report will be identified as running east-west. The section of the slope examined for this study is bounded by Troutbrooke Drive to the south, Black Creek at the base of the ravine to the north, and by #51 Troutbrooke Drive to the west and #35 Troutbrooke Drive to the east. The subject nine (9) properties back directly onto the crest of the slope of the ravine. A site location plan is provided as **Figure 1**. Air photographs taken in 2009 and 2001 are provided as **Figures 2A and 2B**. Existing two-storey dwellings are located adjacent to the slope crest at 51 through 35 Troutbrooke Drive (9 dwellings). The properties are all about 12 to 15 m wide (east to west). The creek valley slope is about 18 m high and the slope crest is located from 2 to 10 m behind the existing dwellings. It is understood from existing mapping that the private properties all extend part way down the slope, some 12 to 18 m beyond / behind the dwellings. There are numerous make-shift retaining walls along and below the slope crest.

2.1 Previous Studies

It is understood that the residential development at this portion of Troutbrooke Drive was completed some time after 1962. Records indicate that there was a slope failure behind #71 to 63 Troutbrooke Drive in 1966. It is understood that there has been a history of instability ever since the residential development was constructed.

Terraprobe was retained by the MRTCA in 1991 to conduct a geotechnical investigation of a slope failure along the crest behind the dwellings at #51 and #49 Troutbrooke Drive (Terraprobe file no. 91161, dated

October 21, 1991). The failure occurred on April 25, 1991. The investigation found that the slope failure had taken place through earth fill which had been previously (1962 to 1991) dumped over the natural slope face. Numerous make-shift retaining walls (timber and sheet metal) had been erected to contain the fill materials. Slope stability analysis concluded that the failure was triggered by a combination of wet weather, unstable fill and unstable retaining walls. The analyses indicated that the dwellings had not been affected by the failure and that the houses seemed safe from further instability, although it was reported that there was a significant risk of additional slope slides within the slope fill near the crest. The report recommended some stabilization measures. Slope inclinometer casing was installed in boreholes on the slope crest behind 51 and 49 Troutbrooke Drive to facilitate monitoring of possible ground movements.

In this same report, Terraprobe examined a series of historical air photographs for this area. The 1962 air photo indicated some filling on the slope crest prior to the construction of the dwellings; but the slope had a generally a well-treed face down to the flood plain. In 1968, the photograph indicated that the houses were constructed and occupied, with the presence of retaining walls and filling along the slope crest. The air photos also indicated that the position of the original slope crest, prior to 1962, was estimated to be about 10 to 15 m south of its position in 1991. Therefore, it is believed that some filling was carried out over the slope crest and face to create a flat and level area for the dwellings and the rear yards. It is understood that the residents have continued filling their property beyond the slope crest to maintain a flat and level rear yard area, resulting in a steepened inclination within the upper slope fill, while the lower natural slope has a much flatter inclination.

Terraprobe wrote a follow-up report (Terraprobe File No. 91161, dated April 21, 1992), after it was reported that the homeowner of the dwelling at 51 Troutbrooke Drive had noticed cracking in the interior walls. The inclinometer casings were monitored and the house was inspected by Terraprobe. The report indicated that the timber retaining wall seemed to have moved about 10 to 30 mm away from the house since it was measured in July 1991; that the inclinometer monitoring indicated that there had been no significant movement of the ground adjacent to the houses over the previous 10 months; and that the minor cracking on the interior of the house was not caused by recent ground movements around the house.

In 1995, Terraprobe wrote another follow up report (Terraprobe File No. 91161, dated January 31, 1995), after it was reported that the homeowner of the dwelling at 51 Troutbrooke Drive had noticed additional cracking in the interior walls. The report indicated that the ground surface in the rear yard appeared to be about 30 to 40 mm lower than previously measured; that the inclinometer monitoring showed no significant movement over the previous 46 months; and that isolated minor hairline cracking of the interior drywall of the house at 51 Troutbrooke Drive was not caused by recent ground movements around the house.

2.2 Spring 2009 Slope Failure

In April 2009, the TRCA was contacted regarding a slope failure that occurred behind 51 to 43 Troutbrooke Drive (five dwellings), about 80 m in length. It is understood that the failure occurred in March or early April 2009, but the exact date of failure was not disclosed to TRCA nor to Terraprobe. The extent of the failure scarp is shown on **Figure 4** - Photograph Location and Physical Features Plan. The scarp varies in height from about 0.3 to 2 m.

Terraprobe reviewed Environment Canada weather data for the months of January to April 2009. The average, monthly, and daily climatic data is included in the appendix. The data indicate almost double the average snowfall in January 2009, followed by more than double the average rainfall in February 2009 (with one day of near record rainfall). There was also more than double the average rainfall in April 2009. Large melting and rainfall events like these, coupled with freezing temperatures in between the events which would deter infiltration and promote runoff, are likely significant enough to have build up of ground water within the earth fill at this site.

3. PROCEDURE

The field investigation of the site consisted of slope mapping and borehole drilling, as well as the installation of standpipe piezometers and slope inclinometer casing. The borehole drilling portion of the investigation was conducted on July 20, 22, 24, and 27, 2009, and consisted of drilling and sampling four (4) exploratory boreholes as follows:

- Boreholes 1 and 2 were advanced on the property at 45 Troutbrooke Drive on the tableland and below the failure scarp, about 2 m and 7 m north of the dwelling, to depths of 12.7 and 8.1 m below existing grade, respectively;
- Borehole 3 was advanced on the property at 43 Troutbrooke Drive well below the failure scarp, about 14 m north of the dwelling, to a depth of 5.8 m below existing grade; and
- Borehole 4 was advanced on the property at 41 Troutbrooke Drive beyond the extent of the failure scarp on the tableland, about 4 m north of the dwelling, to a depth of 8.0 m below existing grade.

The boreholes were established and staked out in the field by Terraprobe at approximate locations shown on the Borehole Location Plan in **Figure 3**. The ground surface elevations at the borehole locations, as noted on each borehole log, and all stated elevations in this report, were surveyed by the TRCA. The TRCA also performed a full topographic survey of the site.

It should be noted that the subsurface conditions encountered are confirmed at the borehole locations only, and may vary at other locations, particularly with respect to the thickness and condition of fill. All elevations are referred to Geodetic datum.

The drilling work was carried out by a drilling contractor and was observed and recorded by a full time member of Terraprobe's field engineering staff. The supervising technician logged the borings and examined the samples as they were obtained. The boreholes were advanced by a compact continuous flight power auger drill rig. The results of the boreholes are recorded in detail on the accompanying borehole logs.

Representative disturbed samples of the strata penetrated were obtained from the boreholes using a split-barrel sampler advanced by a 63.5 kg hammer dropping approximately 760 mm. The results of these Penetration Tests are reported as "N" values on the borehole logs at respective sampling and testing depths.

Samples obtained from the boreholes were inspected in the field immediately upon retrieval for type, texture, colour and odour. The samples obtained were then sealed in clean plastic containers and transferred to the Terraprobe laboratory where the samples were examined by a geotechnical engineer to verify the accuracy of the initial soil descriptions and to select appropriate samples for laboratory testing. Laboratory testing consisted of water content determination on all samples, while a sieve and hydrometer analysis was conducted on selected native soil samples (Borehole 1 - Sample 4, Borehole 3 - Sample 8, Borehole 4 - Sample 5). The measured natural water content for individual samples are plotted on the corresponding borehole logs at respective sampling depths, and the results of the sieve and hydrometer analysis are appended.

Water levels were monitored in the open boreholes upon completion of drilling. Standpipe type piezometers consisting of PVC tubing were installed in Boreholes 1 and 4 to facilitate shallow ground water monitoring. The PVC tubing was saw slotted near its base and fitted with a bentonite clay seal as shown on the accompanying borehole logs. The water level in the standpipes in Boreholes 1 and 4 were measured on August 4, 19, and October 21, 2009, and August 4 and September 8, 2010. The results of ground water monitoring are summarized in a subsequent section of this report. Slope inclinometer casing was installed next to Boreholes 1 and 4, to facilitate the monitoring of slope movement.

Terraprobe also advanced fourteen hand auger holes in the filled slope and lower natural slope face at the locations shown on Figure 3. The auger boreholes were advanced only to assess the depths of earth fill.

A visual inspection of the table land and slope area was conducted on October 26,2009. General information pertaining to the existing slope features such as slope profile, slope drainage, water course features, vegetation cover, structures in the vicinity of the slope, erosion features and slope slide features, was obtained during this inspection. Photographs were taken during the inspection and are provided in the appendix. A photograph location and physical features plan is provided as **Figure 4**.

4. SUBSURFACE CONDITIONS

The results of the individual boreholes are summarized below and recorded on the accompanying Borehole Logs. This summary is intended to correlate this data to assist in the interpretation of the subsurface conditions at the site.

It should be noted that the soil conditions are confirmed at the borehole locations only and may vary between and beyond the boreholes. The stratigraphic boundaries as shown on the logs represent an inferred transition between the various strata, rather than a precise plane of geologic change.

4.1 Fill

The boreholes and auger hole information indicate that earth fill extends to depths of 1.1 to 7. 6 m near the dwellings, reducing to no fill part way down the slope. The fill was variable in composition, consisting of sand, to silty clay. Some zones within the fill contained cinders and ash, rock fragments, topsoil, and other organics; and occasional rubble. The fill was typically moist and brown to dark brown and occasionally black. Standard Penetration Test results (‘N’ Values) obtained in the fill varied considerably, from 1 to 29 blows per 300 mm of penetration, suggesting a very loose / soft to very stiff consistency.

4.2 Native Soils

Beneath the fill, the native stratigraphy at the site consists of silty clay to clayey silt glacial till, overlying a deposit of silt and sand glacial till, overlying a lacustrine deposit of clay and silt.

The upper, cohesive glacial till was encountered in Boreholes 1 and 4 at depths of 2.3 and 1.1 m below grade (Elev. 158.5 and 157.5 m), respectively. The till has a matrix that varies from silty clay to clayey silt, and contains embedded sand and gravel. The cohesive till is brown and moist. Standard Penetration Test results (‘N’ Values) obtained in the cohesive till varied from 20 to 23 blows per 300 mm of penetration, suggesting a very stiff consistency. The undrained shear strength of the cohesive till, as assessed by pocket penetrometer, varied from 150 to greater than 225 kPa.

A cohesionless silt and sand glacial till was encountered in Boreholes 1 and 4 beneath the cohesive glacial till at depths of 4.9 and 2.3 m below grade (Elev. 155.9 and 156.3 m), respectively. The silt and sand till contains some clay and embedded gravel, and is brown and moist. Standard Penetration Test results (‘N’ Values) obtained in the cohesionless silt and sand till varied from 16 to 31 blows per 300 mm of penetration, suggesting a compact to dense relative density.

A deposit of clay and silt was encountered beneath the silt and sand till in Boreholes 1 and 4 at depths of 7.63 and 4.5 m below grade (Elev. 153.2 and 154.1 m), respectively. The clay and silt was encountered beneath the earth fill in Boreholes 2 and 3 at depths of 7.6 and 5.0 m below grade (Elev. 150.1 and 148.7 m), respectively. The clay and silt contains some fine silt seams, and is grey and moist. Standard Penetration Test results (‘N’ Values) obtained in the clay and silt varied from 16 to 92 blows per 300 mm of penetration, suggesting a very stiff to hard consistency. The undrained shear strength of the clay and silt, as assessed by pocket penetrometer, varied from 150 to greater than 225 kPa.

The above noted stratigraphy from this study is very similar to that completed by Terraprobe in 1991 behind 51 and 49 Troutbrooke Drive. These boreholes fill extending to 2. 9 to 3.7 m immediately behind the dwellings, and to depths of 4 to 4.5 m at the slope crest, reducing to no fill part way down the slope. While these boreholes did not encounter the upper cohesive till, they did encounter a cohesionless silty sand till resting on silty clay, which is very similar as that reported in this study. One of the boreholes was advanced on the slope face to considerable depth, and hence penetrated through the silty clay and encountered a lower deposit of very dense sand (N values of 80 and 115 blows per 300 mm of penetration). The borehole logs from this previous study are included in the appendix, the locations of which are shown on **Figure 3**.

4.3 Ground Water

The site is next to Black Creek, with the toe of the slope located at the flood plain level of the creek. There is a rock fill dam downstream of the site. Groundwater observations were made in each of the boreholes as they were drilled. The depth of ground water seepage was observed in open boreholes upon completion of drilling. The water levels were also measured on August 4, 13, 19, and October 21, 2009 in the standpipe piezometer installed in Boreholes 1 and 4. The water level measurements obtained from the open boreholes and the standpipe piezometer are summarized below:

Borehole No.	Depth of Boring, m	Depth to Cave, m	Unstabilized Water Level at the Time of Drilling, m	Water Level in Standpipe, Depth (Elev.), m - date
1	12.7	11.0	6.1 (Elev. 154.7 m)	5.5 (155.3) - Aug. 04, 2009 5.5 (155.3) - Aug. 13, 2009 5.5 (155.3) - Aug. 19, 2009 5.5 (155.3) - Oct. 21, 2009
4	8.0	Open	3.0 (Elev. 155.6 m)	3.7 (154.9) - Aug. 04, 2009 3.7 (154.9) - Aug. 13, 2009 3.7 (154.9) - Aug. 19, 2009 3.7 (154.9) - Oct. 21, 2009

It should be noted that the ground water levels noted above may fluctuate seasonally depending on the amount of precipitation and surface runoff.

The level of Black Creek and the flood plain at the toe of the slope is at about Elevation 142 ± metres.

5. DISCUSSION AND RECOMMENDATIONS

The following discussion and recommendations are based on the factual data obtained from this investigation, and are intended for use of the owner and the design engineer. Contractors bidding or providing services on this project should review the factual data and determine their own conclusions regarding construction methods and scheduling.

This report is provided on the basis of these terms of reference and on the assumption that the design features relevant to the geotechnical analyses will be in accordance with applicable codes, standards and guidelines of practice. If there are any changes to the site development features, or if there is any additional information relevant to the interpretations made of the subsurface information with respect to the geotechnical analyses or other recommendations, then Terraprobe should be retained to review the implications of these changes with respect to the contents of this report.

5.1 Slope Inspection and Mapping

A visual inspection of the slope area was conducted on October 26, 2009. General information pertaining to the existing slope features such as slope profile, slope drainage, water course features, vegetation cover, structures in the vicinity of the slope, erosion features and slope slide features, was obtained during this inspection. A brief summary of the results of the visual inspection is presented below. Photographs taken during the inspection are appended. The locations of the features discussed below are shown in the Photograph and Features Plan in **Figure 4**.

The visual inspection covered the slope within the limits of the tableland of 35 to 51 Troutbrooke Drive to the slope toe directly north of these properties. Photographs 1 to 27 show the houses along the site, the tablelands and the slope faces directly adjacent to the houses. The overall slope height ranges from approximately 18 to 19 m. The slope inclination varies widely across the site and this range may have been caused by the recent slumping failure. Where scarps are present, the slope inclination is as steep as near vertical. There are also instances where the slope is sub-horizontal, particularly in the central portions of the slope sections. The western portion of thse site has a slope inclination ranging from 1.8 H : 1 V to 2.6 H : 1 V. The central portion of the site has a slope inclination ranging from 1.8 H : 1 V to 2.3 H : 1 V. The eastern portion of the site has a slope inclination ranging from 1.0 H : 1 V to 2.3 H : 1 V. In general, the slope inclination is steepest in the upper fill area, flattens considerably in the mid-slope section, and flattens even more close to the toe of the slope.

The tableland consists of two-storey medium-sized residential houses with landscaped lawns. The main floor of the dwellings is on grade in the front, with walk-out basements in the rear near the slope crest. The backyards of each house are all landscaped, but some of the landscaping and tableland has been lost due to the recent slope failure, and presumably past failures. In general, the tableland is flat in the front yard south of the dwellings and slopes gently toward the back yards, northward toward the slope crest. The landscaped yards consist of grass, small bushes, saplings, mature trees and man-made structures including fences, decks, patiostones, sheds, and other such features commonly found in such residential environments. There are also many make-shift low retaining walls present across most of the properties. The retaining walls consist of railroad ties, sheeting, timber, concrete blocks, etc. Many of the make-shift retaining walls have experienced structural problems, by a variety of means, including bulging, cracking and rotating.

There is a 1.2m to 2.0m primary scarp that is directly north of #43 to #51 Troutbrooke Drive. This scarp and associated slumping failure has destroyed some landscaping, has damaged retaining walls, and has exposed approximately 1.2 m of the foundation wall of 45 Troutbrooke Drive (Photograph 28). The primary scarp is bare and oversteepened. There are also secondary scarps north of the primary scarp near the slope crest that range from 0.3m to 1.0m in height. There is a tension crack in the pavement that was observed between #47 and #49 Troutbrooke Drive (Photograph 29). Along the tableland and slope crest there are multiple instances of landscaping debris and refuse, indicating considerable fill dumping in the rear yards, over the slope crest and upper slope face. The filling has created additional flat and level rear yard areas.

Below the upper filled areas, the slope face is generally well vegetated (Photograph 30). There are some less vegetated areas that exist due to the mature trees blocking much sunlight from reaching the ground. There are also some bare and oversteepened areas present due to both landscaping debris and minor scarps (Photograph 41). There are bent trees throughout the site (Photograph 32). The saplings are primarily straight with some slight bending while the more mature trees have a much more pronounced bending to them indicating the presence of both long-term creep and slope failures in the past (Photograph 31). Throughout the site, but primarily along the western portion of the slope, there is much garbage and landscaping debris. Directly behind #49 Troutbrooke Drive there is a high concentration of this garbage and debris (Photograph 37). There exist two very minor gullies with minimal erosion that extend down the entirety of the slope face (Photograph 38). The fences, retaining walls and structures associated with the residential houses also extend onto the upper portions of the slope, some of which are failing or compromised (Photograph 36). Across the slope face, isolated minor scarps were observed ranging from 0.3 m to 0.6 m (Photograph 39 to 40).

The slope toe is primarily adjacent to swampy and marshy ground, and due to this, there is no evidence of active toe erosion (Photograph 34 to 35). On the eastern portion of the slope, the slope toe is adjacent to a meander of Black Creek. The creek at the time of inspection at this eastern site location was approximately 5 m wide, about 0.5 m deep, and flowing very slowly at an estimated 0.05 to 0.2 m/s. This area is experiencing some active toe erosion and the toe has approximately 0.3m of exposed soil and roots (Photograph 33). The soil on the slope toe adjacent to the river appears to be silty clay, which is firm, dark brown and wet. Along the lower portion of the slope face and the slope toe, the slope is still well vegetated, and there is slightly less landscape debris and garbage present than the slope face.

5.2 Slope Stability Analysis

A detailed engineering analysis of slope stability was carried out for the selected slope cross-sections utilizing the commercially available slope stability program SLIDE (version 5.043), developed by Rocscience Inc. The slope stability analyses were based on an effective stress limit equilibrium analysis for long term slope stability using Morgenstern-Price, Spencer, Bishop and Janbu methods. These methods of analysis allow the calculation of Factors of Safety for hypothetical or assumed failure surfaces through the slope. The analysis method is used to assess potential for movements of large masses of soil over a specific failure surface which is often curved or circular.

For a specific failure surface, the Factor of Safety is defined as the ratio of the available soil strength resisting movement, divided by the gravitational forces tending to cause movement. The Factor of Safety of 1.0 represents a "limiting equilibrium" condition where the slope is at a point of pending failure since the soil resistance is equal to forces tending to cause movement. The analysis involves dividing the sliding mass into many thin slices and calculating the forces on each slice. The normal and shear forces acting on the sides and base of each slice are calculated. It is an iterative process that converges on a solution. It is usual to require a Factor of Safety greater than one (1) to ensure stability of the slope.

The analysis was carried out by preparing a model of the slope geometry and subsurface conditions and analyzing numerous different failure surfaces through the slope in search of the minimum or critical Factor of Safety for specific conditions. The pertinent data obtained from topographic mapping, slope profiles, slope mapping, and the borehole information, were input for the slope stability analysis. Many calculations were carried out to examine the Factors of Safety for varying depths for potential failure surfaces.

5.2.1 Existing Slope Conditions (September 2009)

The locations of the cross sections of the slope analysed (Sections 35 through 51) are indicated on Figure 3, and are shown in Figures 5A to 5E. A typical analysis for this project is provided in the Appendix, and presents many of the potential failure surfaces analyzed. Based on the borehole results the following average soil properties were utilized for the soil strata in the slope stability analysis:

Stratum	Unit Weight (kN/cu.m)	Cohesion (kPa)	Angle of internal friction
Fill	18	0	31°
Silty Clay Till	20	12	30°
Sand and Silt Till	19	0	34°
Clay and Silt	20	25	30°
Sand (1991 BH)	20	0	36°

The above soil strength parameters are based on effective stress analysis for long-term slope stability. Ground water levels in the model are based on the levels recorded in the piezometers in August 2009. The water level of Black Creek is shown in each individual section and is extrapolated back into the slope.

The analysis was conducted for existing slope conditions for Sections 35, 37, 39, 41, 43, 45a, 45b, 47, 49, and 51. The slope stability analysis results are presented in the appendix, and are summarized below for deep-seated failure surfaces extending through the entire slope and through the native soil.

Section (House No.)	**Slope Inclination**	**Approx. Slope Height (m)**	**Minimum Factor of Safety for Potential Slope Slides**
			Overall Slope Existing Conditions
35	1.3 H : 1 V (upper) 2.0 H : 1 V (lower)	19	1.3
37	1.3 H : 1 V (upper) 2.1 H : 1 V (lower)	19	1.3
39	1.2 H : 1 V (upper) 2.0 H : 1 V (lower)	19	1.4
41	1.6 H : 1 V (upper) 1.8 H : 1 V (lower)	18	1.5

Section (House No.)	**Slope Inclination**	**Approx. Slope Height (m)**	**Minimum Factor of Safety for Potential Slope Slides**
			Overall Slope Existing Conditions
43	1.7 H : 1 V (upper) 2.5 H : 1 V (lower)	18	1.8
45a	1.6 H : 1 V (upper) 1.7 H : 1 V (lower)	19	1.6
45b	1.6 H : 1 V (upper) 2.0 H : 1 V (lower)	18	1.6
47	1.0 H : 1 V (upper) 2.6 H : 1 V (lower)	18	1.6
49	1.0 H : 1 V (upper) 1.7 H : 1 V (lower)	18	1.5
51	1.8 H : 1 V (upper) 2.1 H : 1 V (lower)	19	1.6

The typical Factor of Safety used for engineering design of slopes for stability, ranges from about 1.3 to 1.5 for developments situated close to the slope crest. The most common design guidelines are based on a 1.5 minimum Factor of Safety. TRCA guidelines are based on a minimum factor of safety of 1.5. For residential developments, the MNR Policy Guidelines allow a minimum Factor of Safety of 1.3 to 1.5 for slope stability, as follows:

TYPE	**LAND-USES**	**DESIGN MINIMUM FACTOR OF SAFETY**
A	PASSIVE: no buildings near slope; farm field, bush, forest, timberland, woods, wasteland, badlands, tundra	1.1
B	LIGHT: no habitable structures near slope; recreational parks, golf courses, buried small utilities, tile beds, barns, garages, swimming pools, sheds, satellite dishes, dog houses	1.2 to 1.3
C	ACTIVE: habitable or occupied structures near slopes; residential, commercial, and industrial buildings, retaining walls, storage/warehousing of non-hazardous substances	1.3 to 1.5
D	INFRASTRUCTURE and PUBLIC USE: public use structures and buildings (i.e. hospitals, schools, stadiums), cemeteries, bridges, high voltage power transmission lines, towers, storage/warehousing of hazardous materials, waste management areas	1.4 to 1.5

The analysis results indicate that the existing slope configuration is stable when considering overall slope deep seated failures.

Analyses were conducted on two of the sections for shallow failures in the upper, oversteepened fill, and with temporary high ground water table conditions. The two sections, 37 and 45 Troutbrooke represent sections where there has yet to have a failure, and where a failure has occurred, respectively. In the case of 45 Troutbrooke, the slope section was slightly modified to represent an inferred slope profile prior to failure. In both cases, the factor of safety for shallow slides within the fill is at or less than 1.0. The upper slope within the fill is therefore considered prone to shallow failure surfaces. Furthermore, the retaining structures are non-engineered structures built in a make-shift, uncontrolled fashion; and are considered to be unreliable for stability purposes. It is recommended that these unstable, oversteepened, areas with poor and un-engineered retaining structures be either flattened to a more stable inclination or be replaced with a reinforced soil structure for stability purposes.

Analyses were also conducted for the same sections, but with a focus on shallow failures within the fill zones. The analyses were checked against the measure ground water table conditions and with an elevated water table condition. The analyses were conducted for a hypothetical slope profile with a flatter inclination and similar sub-surface conditions, to result in a minimum factor of safety of 1.5. This factor of safety conforms to the minimum safety factor requirement and is considered adequate and acceptable. The analysis suggests that the long term stable slope inclination for the upper, oversteepened fill portions of the slope can be taken as about 2.5 H : 1 V, or flatter as indicated in the table below.

Section	**Approx. Slope Height (m)**	**Stable Inclination for Factor of Safety of 1.5**		**Stable Inclination for Factor of Safety of 1.3**	
		Normal Water Table Circular Failure	**Normal Water Table Non- Circular Failure**	**Elevated Water Table Circular Failure**	**Elevated Water Table Non-Circular Failure**
Maximum Fill Slope (Sec. 45a)	8	2.2 H : 1 V	2.3 H : 1 V	2.6 H : 1 V	2.6 H : 1 V

The application of the toe erosion allowance (see discussion below) in addition to the stability setback component is known as the Long Term Stable Slope Crest (LTSSC). The LTSSC, based on the above noted fill slope inclination, is shown in plan on Figure 6 and is interpolated between the locations of the cross sections. The LTSSC varies from about 4 to 11 m from the existing top of bank, and is based on the analysis above, and assuming that toe erosion is arrested.

5.2.2 Toe Erosion Allowance

In addition to a stability set-back, a toe erosion allowance is also recommended in areas of potential future erosion where the watercourse position is within 15 m of the slope toe. Black Creek is located at the slope toe at 35 and 37 Troutbrooke Drive. West of 37 Troutbrooke Drive, there is a significant flood plain that varies from 19 to more than 40 m from the slope toe. Based on the visual observation, the creek bank at creek water level in the study area generally comprises very stiff clay and silt.

With lack of long term monitoring data to extrapolate over 100 years, a guideline table is recommended for estimating the erosion allowance is presented as follows:

Guideline Table

MINIMUM TOE EROSION ALLOWANCE - River within 15 m of Slope Toe *				
Type of Material Native Soil Structure	Evidence of Active Erosion** or Bankfull Flow Velocity > Competent Flow Velocity***	No evidence of Active Erosion** or Flow Velocity << Competent Flow Velocity***		
		Bankfull Width		
		< 5 m	5 - 30 m	> 30 m
1. Hard Rock (granite)	0 - 2 m	0 m	0 m	1 m
2. Soft Rock (shale, limestone) Cobbles, Boulders	2 - 5 m	0 m	1 m	2 m
3. Stiff/Hard Cohesive Soil (clays, clayey silt) Coarse Granular (gravels) Tills	5 - 8 m	1 m	2 m	4 m
4. Soft/Firm Cohesive Soil Fine Granular (sand, silt) Fill	8 - 15 m	1 - 2 m	5 m	7 m

* If a valley floor is > 15m width, still may require study or inclusion of a toe erosion allowance.

** Active Erosion is defined as: bank material is bare and exposed directly to stream flow under normal or flood flow conditions and, where undercutting, over steepening, slumping of a bank or high down stream sediment loading is occurring. An area may be exposed to river flow but may not display "active erosion" (i.e. is not bare or undercut) either as a result of well rooted vegetation or as a result of shifting of the channel or because flows are relatively low velocity. The toe erosion allowances presented in the right half of Table 2 are suggested for sites with this condition.

*** Competent Flow velocity; the flow velocity that the bed material in the stream can support without resulting in erosion or scour. Consideration must also be given to potential future meandering of the watercourse channel.

Source: Ontario Ministry of Natural Resources (2002), "Technical Guide River & Stream Systems: Erosion Hazard Limit, pp38

West of 37 Troutbrooke Drive, the flood plain is greater than 15 m wide. At 37 and 35 Troutbrooke Drive, the slope toe is exposed to creek flow, and according there is some evidence of active erosion (bare areas, exposed roots, undercutting), as observed in the visual site inspection. Accordingly, based on the type of soil (type 3 in the table) and some evidence of active erosion, it is recommended that there be a 5 m toe erosion setback.

5.2.3 Potential Effect of Dam on Slope Stability

About 130 metres west of 51 Troutbrooke Drive, outside of the study area, there is an existing rock fill dam within the Black Creek flood plain. It is understood that at certain times during the year, the rock fill dam causes Black Creek to back up somewhat, causing the flood plain to be full of water that contacts the toe of the slope in the study area (35 to 51 Troutbrooke Drive). It is also understood that some of the residents in the study area are concerned that this flooding action is causing the water to be ‘sucked’ up into the slope through capillary action, also referred to by these residents as the ‘tea bag effect’. Capillarity is the rise of water through soil due to surface tension in an unsaturated soil. Silt soils can be subject to capillary rise (where unsaturated), but typically sands and gravels are not subject to such effects.

Based on the results of the borings and visual observation, the creek bank and the toe of the slope are comprised of very stiff clay with some silt seams. The borehole logs indicate that this layer has a moisture content of 20 to 26% by weight, and is hence saturated. This is consistent with the standpipe piezometer readings which indicate that the ground water table, within the slope, lies above the clay and silt layer. Therefore, the clay and silt layer can be considered to be in a saturated condition and not subject to capillary rise, or the ‘tea bag effect’. Furthermore, even if the clay and silt layer was subject to capillary rise, the overlying sand and silt glacial till is a sand and is not subject to capillary rise.

If capillary rise had actually led to slope instability, it would have been in failures near the toe of the slope, where the capillary rise had taken place. The failure actually occurred in the upper, oversteepened earth fill slope above the native soils in the back yards of the dwellings. Therefore, there is no effect on the upper-slope instability due to the rock fill dam, or high water levels in the creek due to the rock fill dam.

5.3 Monitoring Results

Slope inclinometer casing was installed in boreholes drilled immediately adjacent to Boreholes 1 and 4 at 45 and 41 Troutbrooke Drive, respectively. The casing was installed to permit monitoring of possible ground movements (depth, magnitude and rates of movements within the ground) close to the dwellings. Terraprobe’s previous investigation in 1991 also installed slope inclinometer casing behind the dwellings of 51 and 49 Troutbrooke Drive.

Monitoring of the four slope inclinometer casings (1991 and 2009 installations) was carried out in August, October, and December 2009; and February April, August, and September 2010. The results of the monitoring are shown on the plots provided in the appendix. The plots show that there has been no significant movement (less than 5 mm) of the ground adjacent to the houses since the monitoring began - both in the 2009 installations and in the 1991 installations.

Terraprobe also briefly examined the exterior of the dwellings and found no significant cracks on the walls. There was some cracking, however, of the surface asphalt pathway between 47 and 49 Troutbrooke Drive, indicating some minor settlement of the underlying fill, due to the nearby slope failure. The concrete block retaining structure at 39 Troutbrooke Drive has a vertical crack, indicating some rotational movement of the retaining structure. The fence along the slope crest at 41 Troutbrooke Drive is rotating downslope, indicating some creep of the slope in this area.

5.4 Stabilization Alternatives

Based on the above analyses and monitoring results, it is Terraprobe's opinion that the slope is not prone to deep seated failures, and that there is no influence from the Black Creek or the rock fill dam on slope stability. The historical filling at the site near the slope crest and over the slope crest, as well as the construction of make-shift retaining structures, has resulted in unstable slope conditions near the slope crest. It is presumed that the rear yards were filled to obtain flat amenity areas (gardens, patios, etc.) behind the dwellings. There is a significant risk of additional slope slides within the slope fill, near the crest.

Since the slope is not at risk to deep seated failures, assuming that the existing dwellings are founded on competent native soils, and given that the slope inclinometer casings do not show any significant movement, it is reasonable to assume that the existing dwellings are not threatened by potential slope failures. Therefore, there are two potential courses of action (with different consequences) to consider with the current slope failure: 1) do nothing; and 2) undertake major slope restoration and stabilization works.

5.4.1 'Do Nothing'

If nothing is done, there is significant risk of additional slope slides near the slope crest and near the dwellings in the near future. The amount of level, flat rear yard will be decreased even further. Some small structures (sheds, exterior slabs, small retaining structures, gardens, landscaping, etc.) will be at risk due to slope movements. The oversteepened fill will eventually 'self-stabilize' by gradually flattening to an inclination less than the design long term stable slope inclination. With the do nothing option, ongoing monitoring of the slope crest position, slope inclinometer casings, and building condition is recommended. Fences should be erected to prevent persons from getting too close to the oversteepened slope crest and scarp areas.

5.4.2 Major Earth Works

Major restoration consists of physical changes to the slope geometry. Such efforts would only be required in the vicinity of 37 to 51 Troutbrooke Drive. There are only two alternatives within this option:

a) remove some of the existing fill and re-grade the filled upper slope to a flatter average inclination (2 H : 1 V or flatter) and improve the drainage of the existing fill materials; this alternative would significantly reduce the amount of flat level rear yard area; or

b) construct a reinforced soil slope along the rear property lines to safely contain or replace the fill materials to create flat level tableland behind each dwelling.

For either of the above options, existing sheds, retaining walls, slabs, and all deleterious fill materials would need to be removed and disposed. It is estimated that the quantity of fill to be removed is on the order of 9000 m^3. Should any improved drainage systems be incorporated into the final design, the drainage must be outletted to the flood plain below and must not be allowed to flow along the slope face. Whether re-grading or using a reinforced soil slope, it is recommended that a vegetated face be used to provide protection against surface run-off erosion. Slope surfaces should be protected using erosion control mats that encourage vegetation growth.

5.5 Construction Access

Access to the rear yard areas between the houses is not possible due to space limitations. Terraprobe investigated potential access routes for typical construction equipment required for the remediation recommended above. **Figure 7** presents two possible access routes.

The first access route would start from the northeast corner of Troutbrooke Drive and Jane Street, where there is a parking lot and parkette that could be used as a staging area. There is an existing access road runs from the parkette, eastward and ends at the existing rock fill dam. From there, an access road would need to be constructed in the flood plain of Black Creek over to the construction area starting at 51 Troutbrooke Drive. Such an access road could be constructed by end-dumping and spreading of granular materials.

The second access route would begin on the north side of the ravine off of Giltspur Drive, at Magellan Drive. At this point along Giltspur Drive, there is a vacant lot that could be used for access. Getting down the slope will require some modification of the existing slope geometry to accommodate typical construction equipment, as the slope is too steep and too well vegetated. An access road down the slope would have to be graded flatter than the existing slope and may need to cut into the vacant lot or traverse at an oblique angle to the slope. This access route would then need to traverse over the existing rock fill dam. The rock fill is too coarse at this time for construction equipment, so a granular layer would have to be end-dumped and spread to facilitate a road across the dam. Once across the dam, this route would then follow the same access road route through the flood plain of Black Creek.

Given these two options, it is recommended that the least intrusive, and likely the least expensive route would be the route from the parkette at the northeast corner of Jane Street and Troutbrooke Drive.

5.6 Recommended Further Investigation and Monitoring

Regardless to the approach regarding site remediation / stabilization, the following investigations are recommended.

Ongoing monthly monitoring of the slope inclinometer casing and ground water levels in the piezometers is strongly recommended to monitor any potential slope movements. Please be advised that it is highly recommended that Terraprobe carry out this monitoring, as slope inclinometer readings are individually calibrated and switching measurement devices will result in loss of baseline readings. Hence potential movements can only be done relative to the first reading on a different instrument. Consideration may be given to installing more inclinometers, one behind each dwelling, for ongoing monitoring purposes.

It is strongly recommended that the existing footing condition of the dwellings be assessed to ensure that they are founded on competent native soils, such that in the event of further slope failures, the safety of the dwellings can be ensured.

Ongoing slope crest monitoring by surveyors is recommended monthly, or more frequently if any changes in the slope condition are noticed by the residents. Monitoring of the slope crest position should be made from the corners and the middle of each house (37 to 51 Troutbrooke Drive) to the slope crest / retaining wall, in order to monitor changes in and movement of the slope crest position.

It is recommended that all down-spouts be routed toward the street. Many of the down-spouts of the dwellings are draining underground, presumably, but not necessarily, into the storm sewer. Some are routed onto the ground in front and some are in back of the dwellings. All overland drainage must be routed toward the street or conveyed directly to the bottom of the slope; not to the slope crest or face.

It is recommended that a more formal inspection of the houses be undertaken in a format similar to that of a pre-construction condition survey. This would take the form of a photographic and visual survey of the back half of the outside walls of the dwellings. Should there be any cracks in the walls, crack monitors should be installed to monitor the magnitude and rate of aperture opening.

Prior to the finalization of the remediation plan, it is recommended that there be at least one borehole advanced per property included in the remediation. This additional information would serve to define, not estimate, the extent of filling that has occurred at the site. The site access should also be further assessed to ensure viability of the two proposed routes.

Additional consideration could be given to performing some soil chemical testing for the purposes of offsite disposal of the existing fill materials. Testing would include metals and inorganics; PAHs and petroleum hydrocarbons including BTEX. Chemical testing could be performed in test pits prior to excavation, or during the removal process by testing stockpiles of excavated fill.

6. SUMMARY

The exiting rear yard areas behind 35 to 51 Troutbrooke Drive have been filled up to 7 m depth below existing grade, over a considerable distance beyond the existing dwellings and slope crest. The filling took place during the original land development in 1962, and considerably by the residents over the years to date. The natural slope crest was located close behind the dwellings, and filling has been conducted to obtain flat amenity areas behind the dwellings. The fill consists of predominantly loose / firm sands / clayey silt with some rubble and debris. The filling and construction of make-shift retaining structures has resulted in unstable slope conditions within the fill near the slope crest. There is no influence on slope stability from the Black Creek or the rock fill dam.

A slide occurred in 1991 behind the dwellings at 49 and 51 Troutbrooke Drive. A larger slide occurred behind the dwellings at 41 to 51 Troutbrooke Drive in late March or early April, 2009. The scarp from the latest failure has exposed a section of the foundation wall of the dwelling at 45 Troutbrooke Drive. The house did not show signs of trauma at the time of investigation.

The existing slope conditions are considered adequately safe and stable against deep seated slides. There is, however, significant risk of additional slope slides within the upper fills and retaining structures near the slope crest and dwellings, in the near future. If the dwellings are founded on undisturbed native soils, which are very competent at the site, then the dwellings are not at risk. Slope inclinometer casing monitoring indicates that the ground close to the dwellings is not moving significantly.

Stabilization of the existing upper slope conditions near the slope crest can be accomplished by removing some of the fill near the slope crest and re-grading the rear yards to a more stable, flatter inclination with improved drainage. Alternatively, stabilization can be accomplished by constructing a reinforced soil slope structure along the rear of the dwellings, thereby creating a safe, flat and level back yard. Access for the stabilization works is best achieved from the parkette at the northeast corner of Jane Street and Troutbrooke Drive, as there is already an access road form the parkette to the existing rock fill dam. From there, a temporary access road could be made in the flood plain of Black Creek.

Recommendations for further investigations and monitoring include: monthly monitoring of slope inclinometer casings and piezometers, installation of new slope inclinometer casings behind each dwelling, inspection of existing footing conditions to ensure the dwellings are founded on competent native soils, monthly slope crest position monitoring by a surveyor, re-routing of all surface runoff (including down-spouts) toward the front of the houses, periodic inspection of the houses for cracks and monitoring of cracks if found, drilling more boreholes prior to final design in order to better assess the extent of filling, and consideration of soil chemical testing for the purposes of offsite disposal.

In general, site development and construction activities should be conducted in a manner which do not result in surface erosion of the slope. In particular, site grading and drainage should be designed to prevent direct concentrated or channelized surface runoff from flowing directly over the slope. Water drainage from down-spouts, sumps, road drainage, and the like should not be permitted to flow over the slope, but a minor sheet flow may be acceptable. A healthy vegetative cover should be created and maintained on the slope. It is recommended that the final site plans be reviewed by Terraprobe to ensure that they are consistent with the recommendations provided in the report.

7. CLOSURE

This report was prepared for the express use of the Toronto and Region Conservation Authority, and their retained design consultants. It is not for use by others. This report is copyright of Terraprobe Inc., and no part of this report may be reproduced by any means, in any form, without the prior written permission of Terraprobe Inc.. Toronto and Region Conservation Authority and their retained design consultants are authorized users.

It is recognized that the City of Toronto in its capacity as the planning and building authority under Provincial statues will make use of and rely upon this report, cognizant of the limitations thereof, both expressed and implied.

We trust the foregoing information is sufficient for your present requirements. If you have any questions, or if we can be of further assistance, please do not hesitate to contact us.

Yours truly,

Terraprobe Inc.

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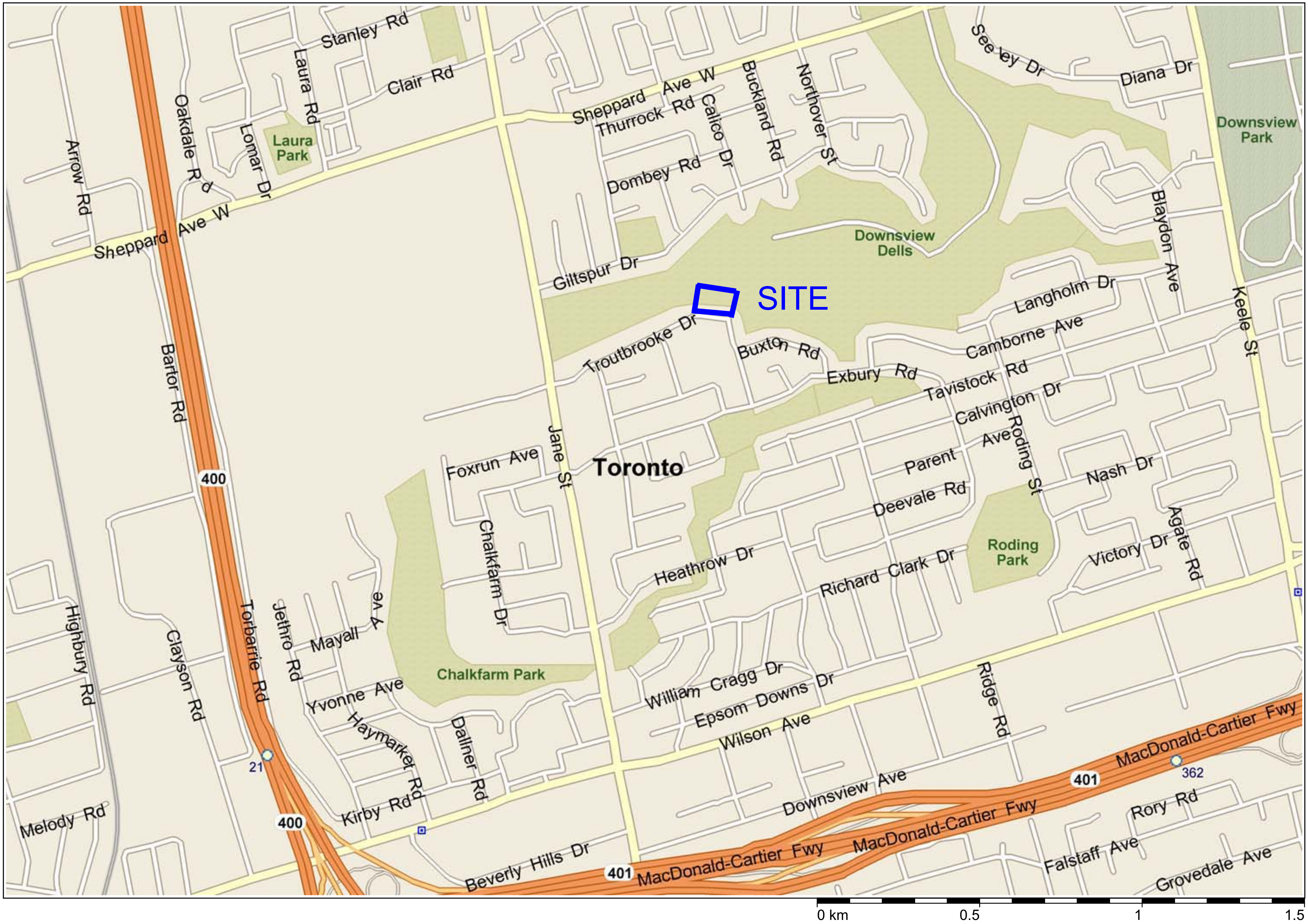
FIGURES

TERRAPROBE INC.

TROUTBROOKE DRIVE , TORONTO



SITE LOCATION PLAN

TERRAPROBE

File No. 1-09-4125

FIGURE 1

N.T.S.

AIR PHOTOGRAPH (2009)

TERRAPROBE

File No. 1-09-4125

FIGURE 2A

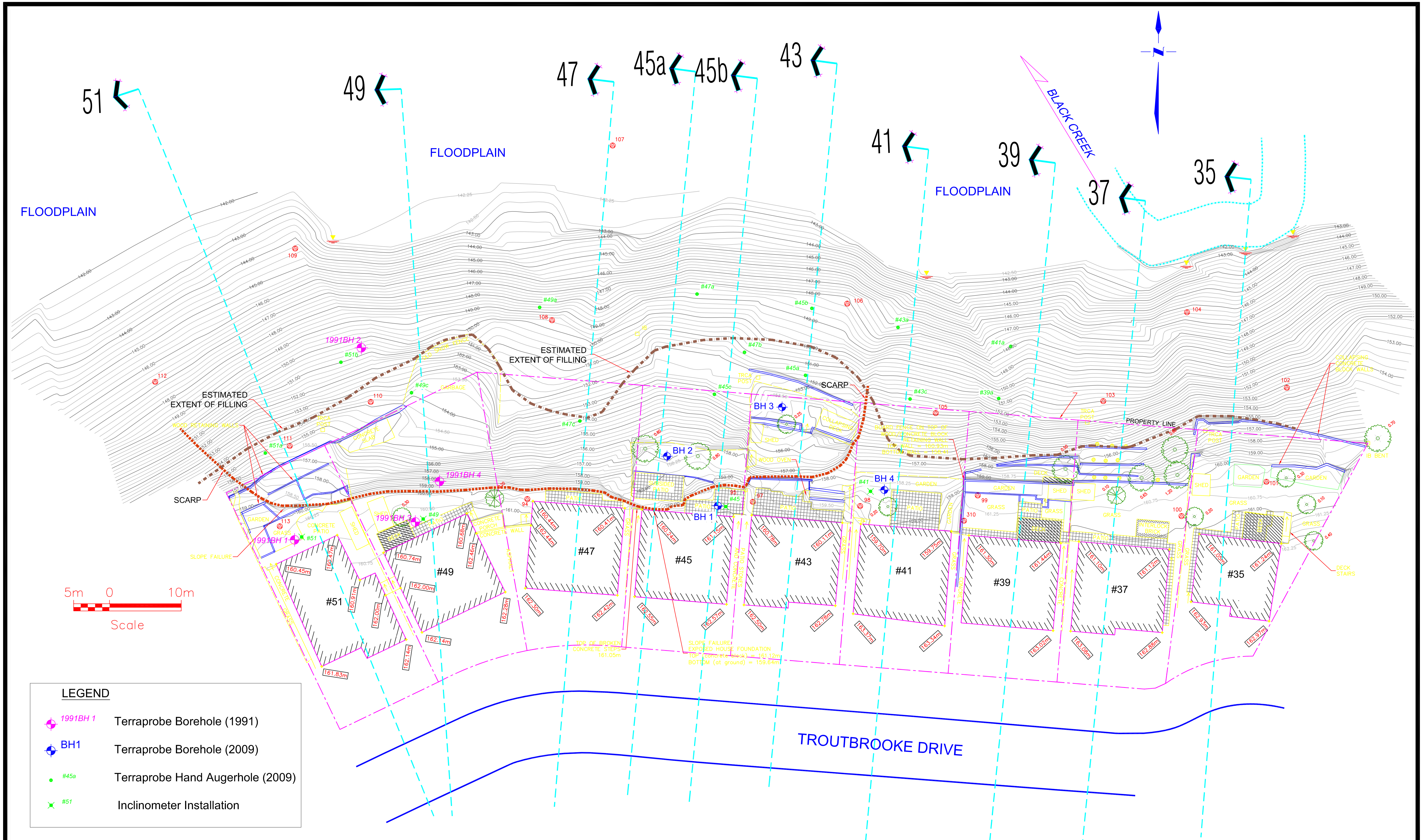
N.T.S.

SITE PLAN

TERRAPROBE

File No. 1-09-4125

FIGURE 2B



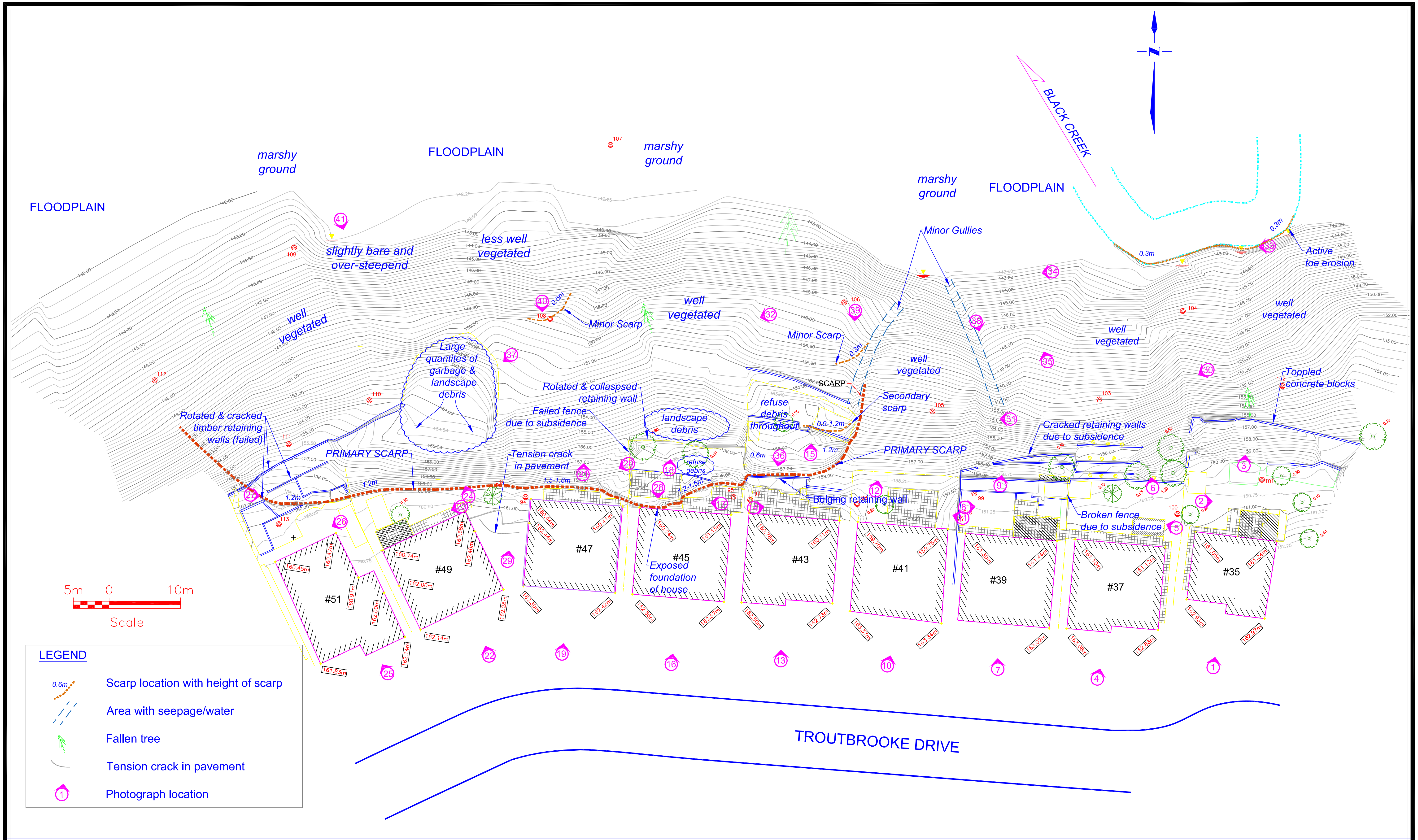
BOREHOLE LOCATION PLAN

TERRAPROBE

File No. 1-09-4125

FIGURE 3

\\Terradocs\FileServer\Terraprobe Limited\All Projects\2009 Files\1-09-4100-4199\1-09-4125\A. Dwgs, Logs\1-09-4125 Troutbrooke Dr BH SEC.dwg, KAMAL



LEGEND

0.6m	Scarp location with height of scarp
/ /	Area with seepage/water
↑	Fallen tree
⌒	Tension crack in pavement
①	Photograph location

PHOTOGRAPH LOCATION AND PHYSICAL FEATURES PLAN

TERRAPROBE

File No. 1-09-4125

FIGURE 4

\\TERRADOCS\FileServer\Terraprobe Limited\All Projects\2009 Files\1-09-4100-4199\1-09-4125\A. Dwgs, Logs\1-09-4125 FIG 4 only.dwg, SANDY

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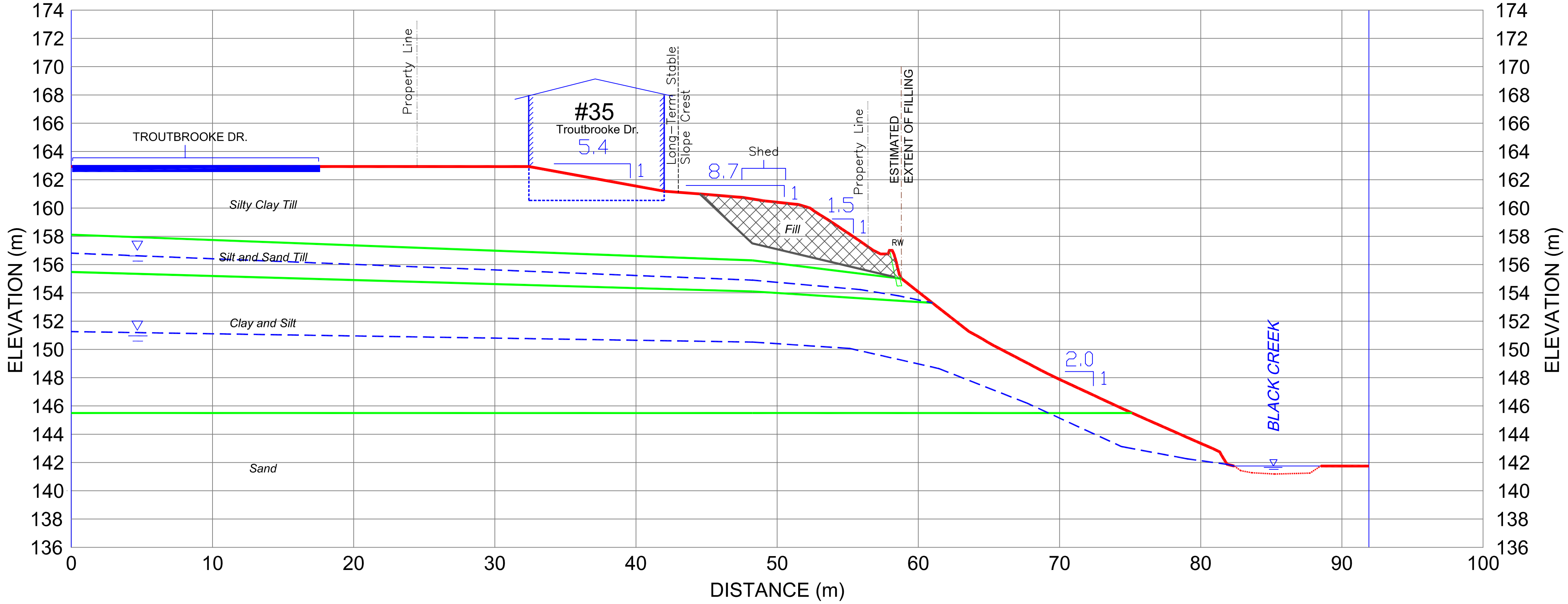
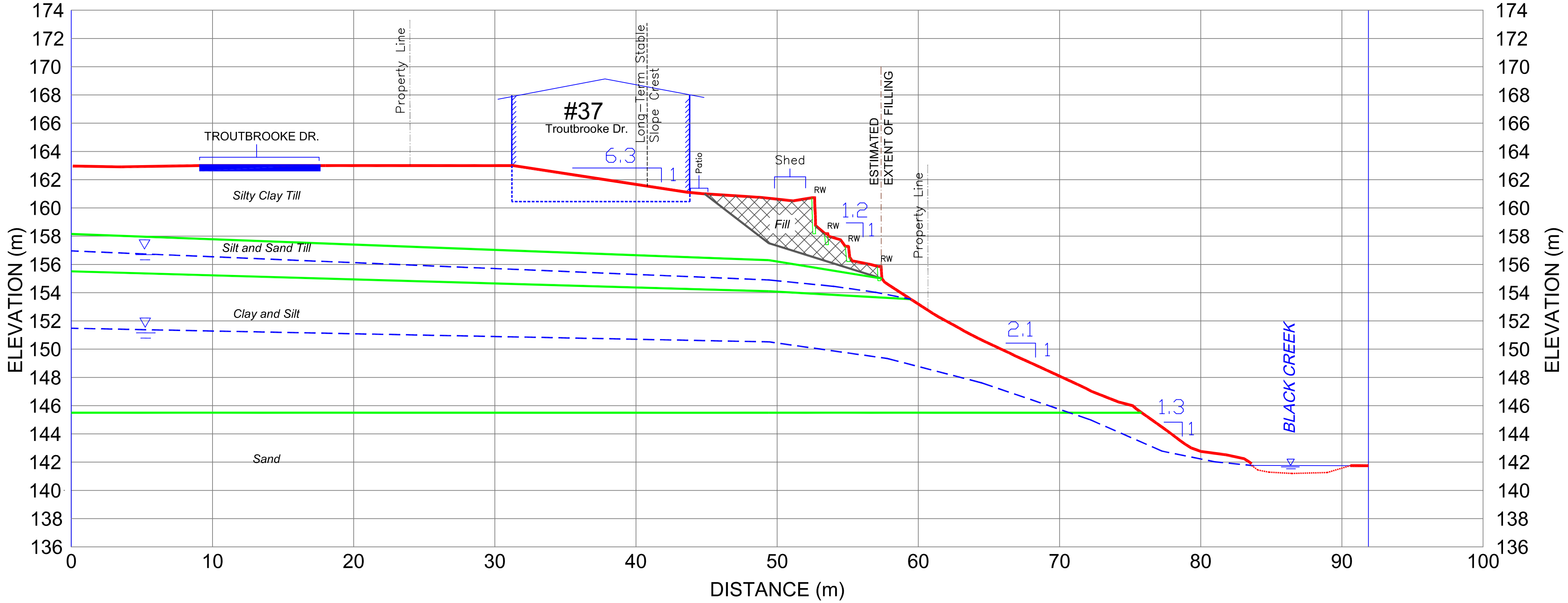
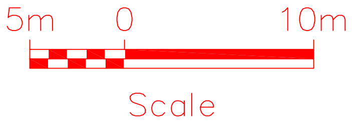


37





SLOPE CROSS SECTION

TERRAPROBE

File No. 1-09-4125

FIGURE 5A

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2009 Files\1-09-4100-4199\1-09-4125\A. Dwgs, Logs\1-09-4125 Troutbrooke Dr BH SEC.dwg, KAMAL

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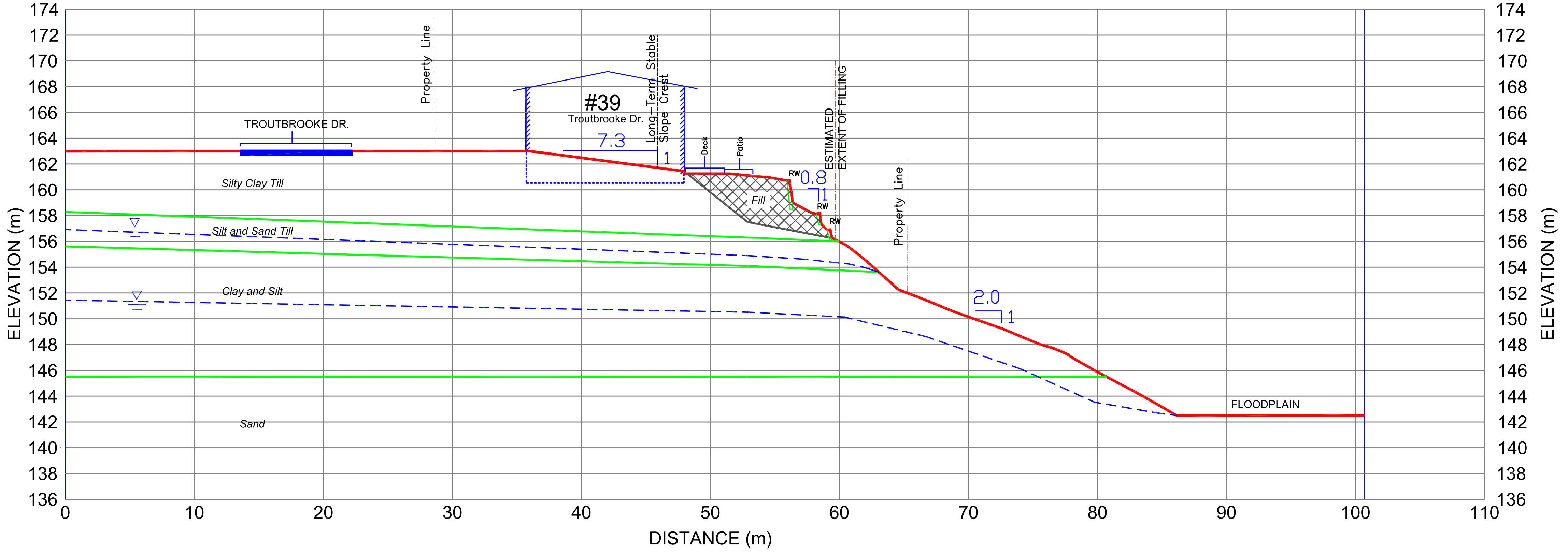
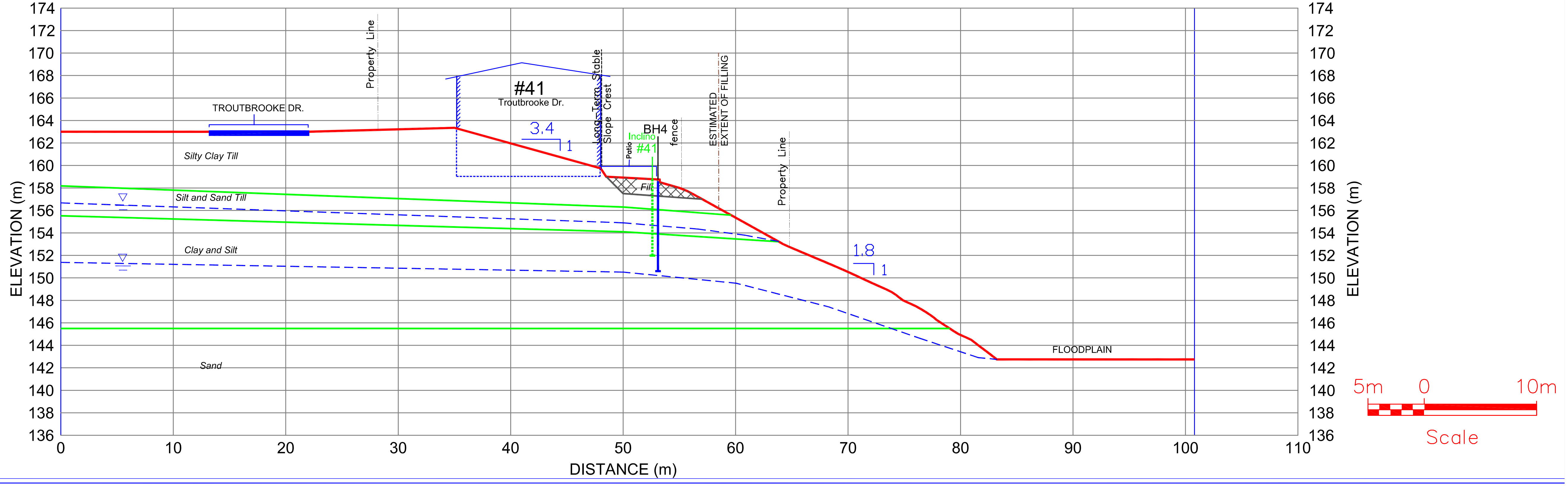


41



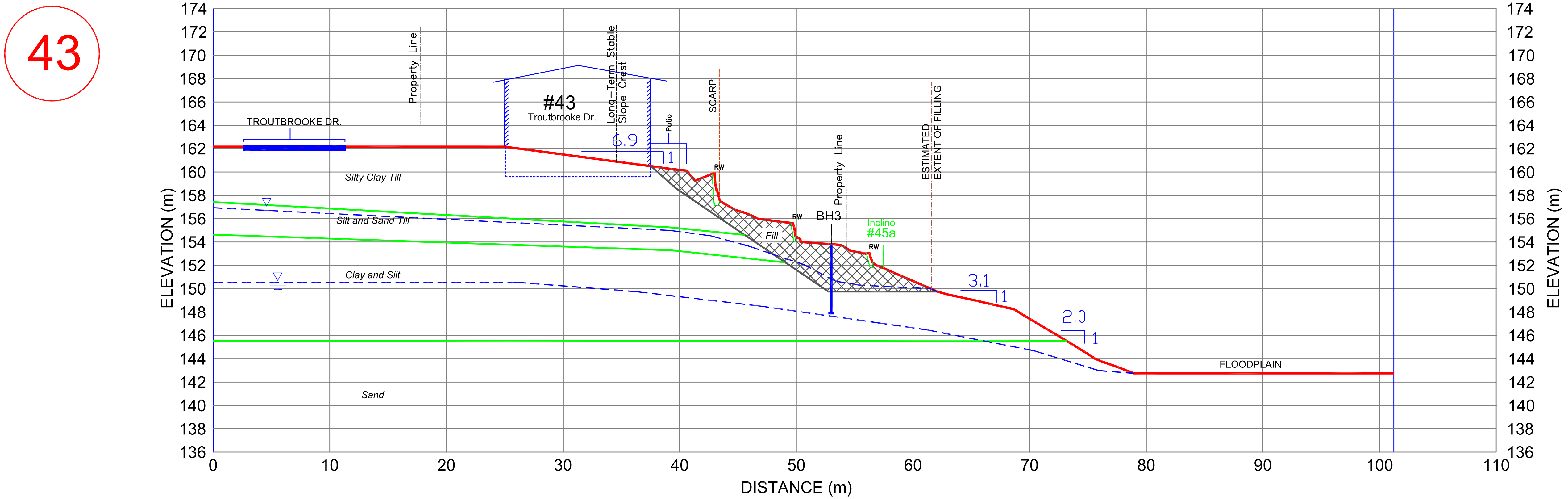
SLOPE CROSS SECTION

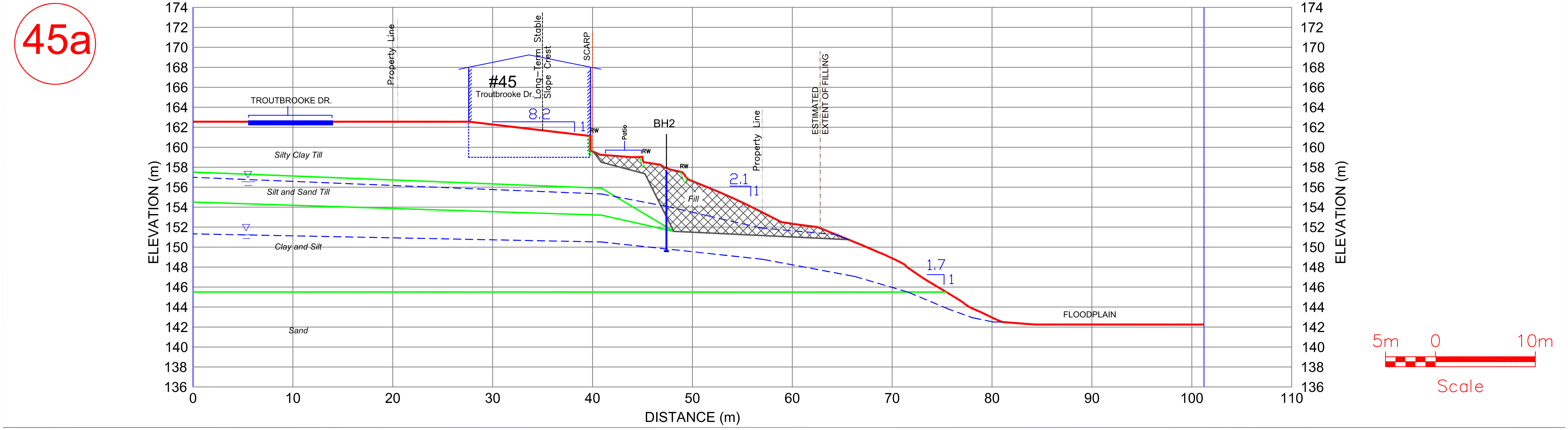
TERRAPROBE

File No. 1-09-4125

FIGURE 5B

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2009 Files\1-09-4100-4199\1-09-4125\A. Dwgs, Logs\1-09-4125 Troutbrooke Dr BH SEC.dwg, KAMAL





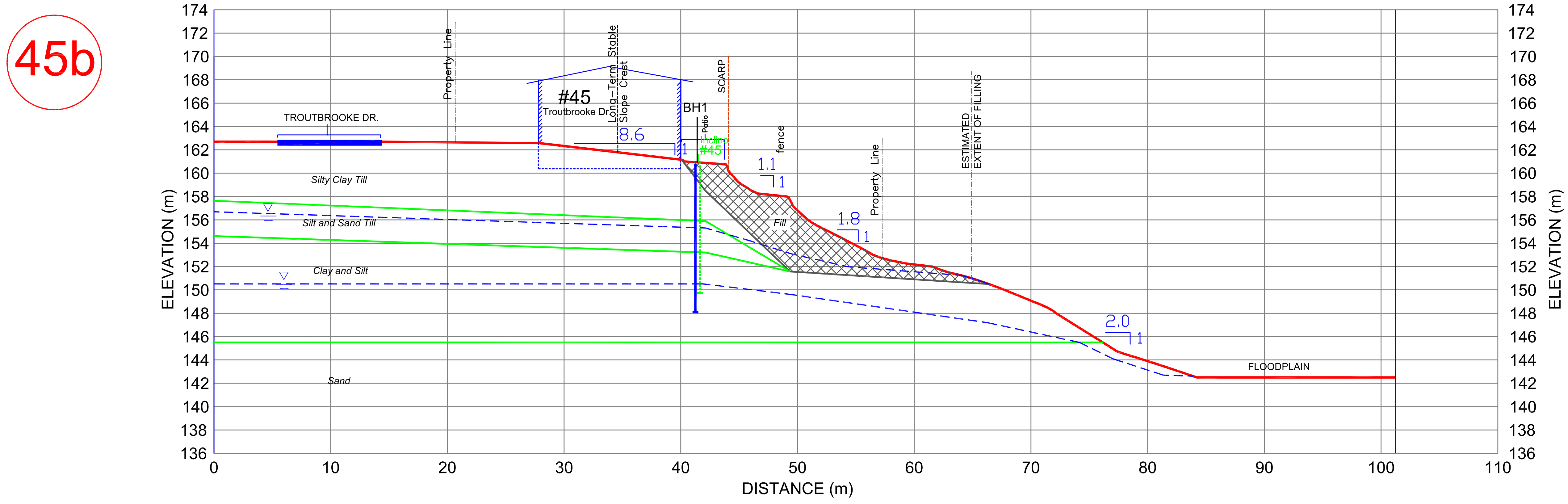
SLOPE CROSS SECTION

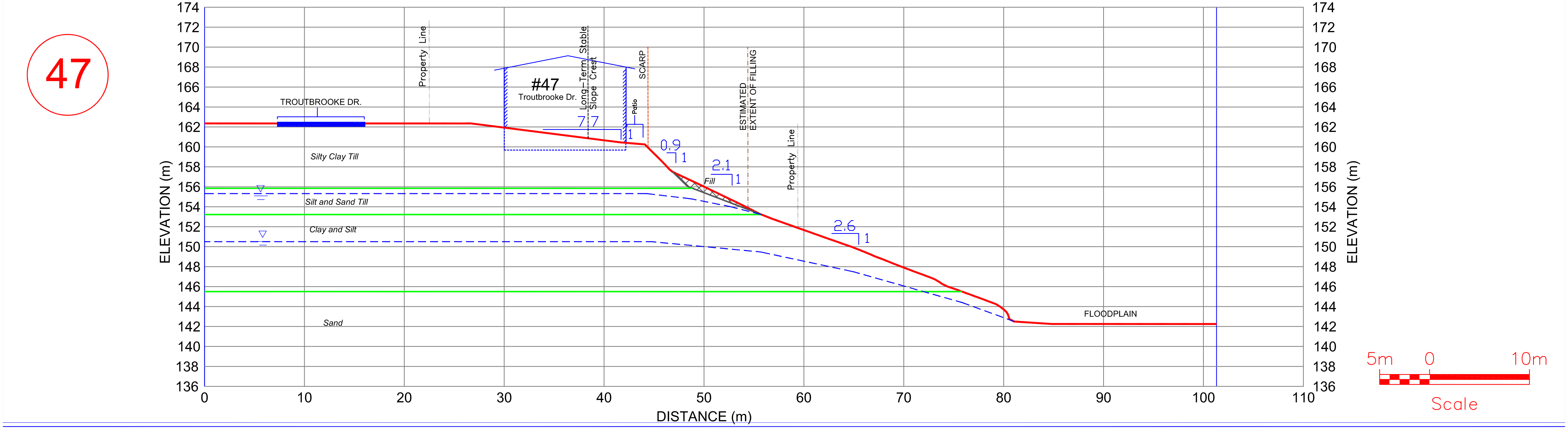
TERRAPROBE

File No. 1-09-4125

FIGURE 5C

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2009 Files\1-09-4100-4199\1-09-4125\A. Dwgs, Logs\1-09-4125 Troutbrooke Dr BH SEC.dwg, KAMAL





SLOPE CROSS SECTION

TERRAPROBE

File No. 1-09-4125

FIGURE 5D

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2009 Files\1-09-4100-4199\1-09-4125\A. Dwgs, Logs\1-09-4125 Troutbrooke Dr BH SEC.dwg, KAMAL

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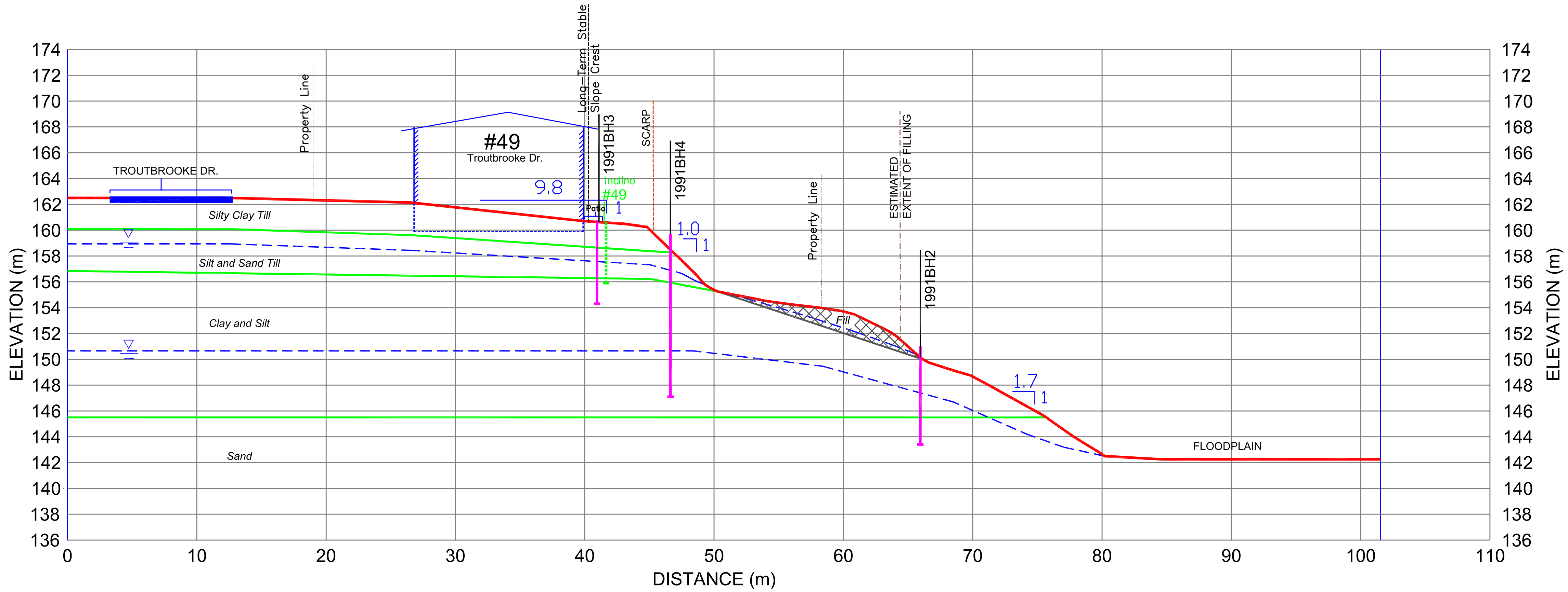
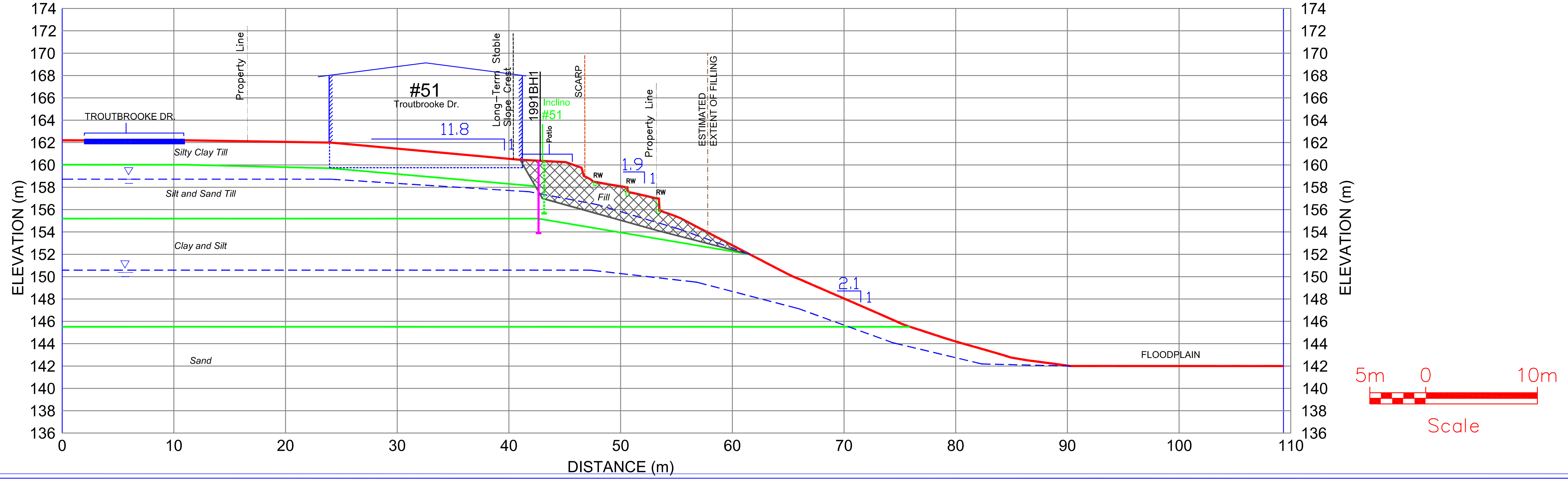


51



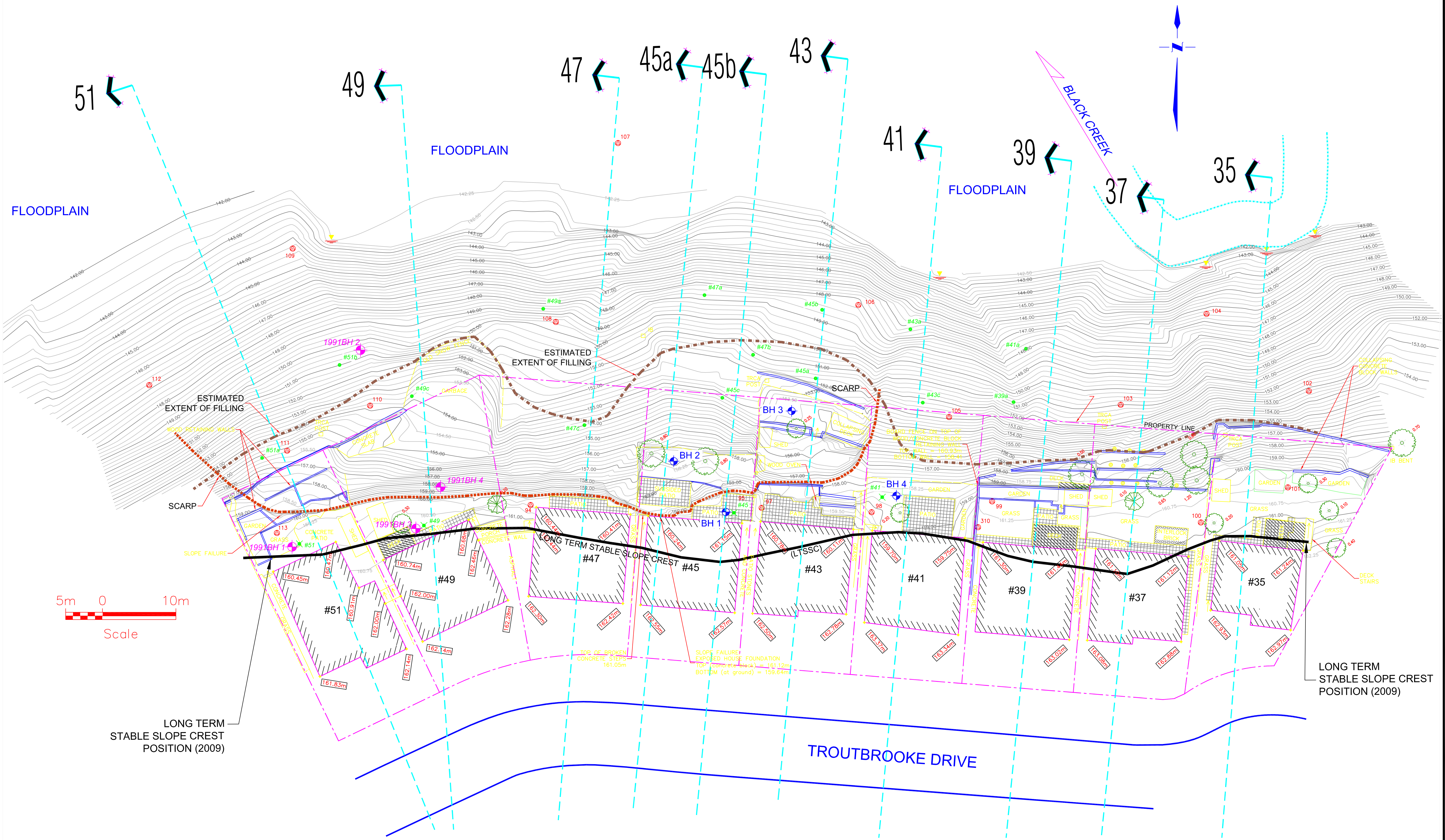
SLOPE CROSS SECTION

TERRAPROBE

File No. 1-09-4125

FIGURE 5E

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2009 Files\1-09-4100-4199\1-09-4125\A. Dwgs, Logs\1-09-4125 Troutbrooke Dr BH SEC.dwg, KAMAL



LONG TERM STABLE SLOPE CREST PLAN

TERRAPROBE

File No. 1-09-4125

FIGURE 6

N.T.S.

POTENTIAL ACCESS ROUTES

TERRAPROBE

File No. 1-09-4125

FIGURE 7

\\Terradocs\FileServer\Terraprobe Limited\All Projects\2009 Files\1-09-4100-4199\1-09-4125\A. Dwgs, Logs\1-09-4125 FIG 7-----.dwg, KAMAL

APPENDICES

TERRAPROBE INC.

Environmental Canada Climate Data - Averages, Monthly 2009, & Daily January to April 2009

TERRAPROBE INC.

Environment Canada Environnement Canada Canada

Home » Climate Normals & Averages 1971-2000 » Station Results

Notices:

Recent modifications have been made to how the 1971-2000 Normals codes are displayed on Climate Data Online. Please click here for further details.

As of November 19 2009, changes have been made to how Wind Chill and Humidex values are calculated. Please click here for further details. A detailed outline of these calculations can be found in the Glossary.

The Notice Inventory contains a record of all past and current Notices.

Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a code for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

TORONTO LESTER B. PEARSON INT'L A *
ONTARIO

Latitude: 43° 40.800' N **Longitude**: 79° 37.800' W **Elevation**: 173.40 m

Climate ID: 6158733 **WMO ID**: 71624 **TC ID**: YYZ

*** This station meets WMO standards for temperature and precipitation.**

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul
Daily Average (°C)	-6.3	-5.4	-0.4	6.3	12.9	17.8	20.8
Standard Deviation	3	2.7	2.3	1.7	2	1.5	1.3
Daily Maximum (°C)	-2.1	-1.1	4.1	11.5	18.8	23.7	26.8
Daily Minimum (°C)	-10.5	-9.7	-5	1	6.9	11.9	14.8
Extreme Maximum (°C)	16.7	14.9	25.6	31.1	34.4	36.7	37.6
Date (yyyy/dd)	1950/25	1984/23	1945/28+	1990/25	1962/16+	1952/25	1988/07
Extreme Minimum (°C)	**-31.3**	-31.1	-28.9	-17.2	-5.6	0.6	3.9
Date (yyyy/dd)	**1981/04**	1943/15	1950/04	1972/07	1966/07	1949/08+	1968/30
Precipitation:							
Rainfall (mm)	24.9	22.3	36.7	62.4	72.4	74.2	74.4
Snowfall (cm)	31.1	22.1	19.2	5.7	0.1	0	0
Precipitation (mm)	52.2	42.6	57.1	68.4	72.5	74.2	74.4
Average Snow Depth (cm)	7	6	3	0	0	0	0
Median Snow Depth (cm)	6	6	2	0	0	0	0
Snow Depth at Month-end (cm)	7	5	0	0	0	0	0
Extreme Daily Rainfall (mm)	58.7	31.8	41.7	55.8	92.7	53.8	118.5
Date (yyyy/dd)	1946/09	1975/24	1942/16	1992/11	1944/31	2000/13	1980/28
Extreme Daily Snowfall (cm)	36.8	**39.9**	32.3	26.7	2.3	0	0
Date (yyyy/dd)	1966/23	**1965/25**	1964/10	1939/10	1976/07	1938/01+	1938/01+
Extreme Daily Precipitation (mm)	58.7	55.9	41.7	55.8	92.7	53.8	118.5
Date (yyyy/dd)	1946/09	1965/25	1942/16	1992/11	1944/31	2000/13	1980/28
Extreme Snow Depth (cm)	**67**	43	28	13	0	0	0
Date (yyyy/dd)	**1999/15+**	1982/06+	1968/13+	1975/04+	1955/01+	1955/01+	1955/01+
Days with Maximum Temperature:							
<= 0 °C	18.7	15.7	7.9	0.6	0	0	0
> 0 °C	12.3	12.6	23.1	29.4	31	30	31
> 10 °C	0.57	0.53	5.1	16.9	29.7	30	31
> 20 °C	0	0	0.6	2.5	11.8	23.6	30.1
> 30 °C	0	0	0	0.13	0.43	2.3	5.7
> 35 °C	0	0	0	0	0	0.1	0.37
Days with Minimum Temperature:							
> 0 °C	1.8	1.9	5.7	16.8	29.6	30	31

<= 2 °C	30.5	27.9	28.4	18.5	4.5	0.13	0
<= 0 °C	29.2	26.3	25.3	13.2	1.4	0	0
< -2 °C	26.9	23.5	20.4	7.1	0.2	0	0
< -10 °C	16	14	5.8	0.17	0	0	0
< -20 °C	2.8	1.6	0.23	0	0	0	0
< - 30 °C	0.1	0	0	0	0	0	0
Days with Rainfall:							
>= 0.2 mm	5.1	4.6	8	10.7	11.9	11	10.1
>= 5 mm	1.5	1.5	2.2	4.1	4.6	5.2	3.9
>= 10 mm	0.77	0.7	1.3	2.2	2.4	2.6	2.4
>= 25 mm	0.1	0.1	0.13	0.23	0.27	0.43	0.77
Days With Snowfall:							
>= 0.2 cm	12.6	9.4	7.1	2.6	0.07	0	0
>= 5 cm	2	1.4	1.3	0.33	0	0	0
>= 10 cm	0.47	0.27	0.33	0.1	0	0	0
>= 25 cm	0	0	0	0	0	0	0
Days with Precipitation:							
>= 0.2 mm	14.9	11.6	13.1	12.1	11.9	11	10.1
>= 5 mm	3.5	2.7	3.5	4.5	4.6	5.2	3.9
>= 10 mm	1.2	0.97	1.8	2.4	2.4	2.6	2.4
>= 25 mm	0.13	0.17	0.23	0.27	0.27	0.43	0.77
Days with Snow Depth:							
>= 1 cm	22	20.3	11.8	1.6	0	0	0
>= 5 cm	15.7	13.5	7.3	0.7	0	0	0
>= 10	8.3	7.3	4.3	0.43	0	0	0
>= 20	2.1	1.6	0.47	0	0	0	0
Wind:							
Speed (km/h)	17.8	16.5	17.1	17.1	14.1	12.9	12.3
Most Frequent Direction	SW	N	NW	NW	NW	NW	NW
Maximum Hourly Speed	77	77	**97**	81	71	63	61
Date (yyyy/dd)	1959/22	1958/17	**1959/15**	1979/06	1964/09	1980/20	1964/13+
Direction of Maximum Hourly Speed	SW	W	SW	W	SW	NW	W
Maximum Gust Speed	115	105	124	111	109	107	**135**
Date (yyyy/dd)	1978/26	1956/25	1964/05	1979/06	1983/02	1990/03	**1956/01**
Direction of Maximum Gust	E	W	SW	W	SW	W	NW
Days with Winds >= 52 km/h	3.4	2.2	3.4	3.2	1.5	0.7	0.6
Days with Winds >= 63 km/h	1.1	0.8	1	1	0.5	0.2	0.2
Degree Days:							
Above 24 °C	0	0	0	0	0.2	2.2	9.5
Above 18 °C	0	0	0	1.1	12	44.2	96.7
Above 15 °C	0	0	0.3	3.7	32.1	99.8	181.4
Above 10 °C	0	0	3.1	18.9	108.4	235.3	335.8
Above 5 °C	1	1.1	16.6	76.4	244	384.8	490.8
Above 0 °C	13	15.6	63.7	194	398.2	534.8	645.8
Below 0 °C	207.9	168.9	77.3	6.2	0	0	0
Below 5 °C	350.9	295.8	185.1	38.6	0.8	0	0
Below 10 °C	505	436	326.6	131.2	20.2	0.5	0
Below 15 °C	659.9	577.3	478.9	265.9	98.9	15	0.6
Below 18 °C	752.9	662.1	571.6	353.3	171.8	49.4	8.9
Humidex:							
Extreme Humidex	14	14.8	29.2	37.9	41.8	45	**50.3**
Date (yyyy/dd)	1995/14	1984/23	1998/30	1990/25	1962/15	1957/17	**1995/14**
Days with Humidex >= 30	0	0	0	0.3	3.1	8.6	16
Days with Humidex >= 35	0	0	0	0	0.3	2.7	6.5
Days with Humidex >= 40	0	0	0	0	0	0.4	1.5
Wind Chill:							
Extreme Wind Chill	**-44.7**	-38.9	-32.6	-25.4	-9.5	-2.6	2.5
Date (yyyy/dd)	**1981/04**	1967/06	1967/18	1972/07	1963/01	1964/05+	1968/30
Days with Wind Chill < -20	10.7	9	2.7	0.1	0	0	0
Days with Wind Chill < -30	2.3	1	0.1	0	0	0	0
Days with Wind Chill < -40	0.1	0	0	0	0	0	0

Humidity:							
Average Vapour Pressure (kPa)	0.4	0.4	0.5	0.7	1	1.4	1.7
Average Relative Humidity - 0600LST (%)	81.7	81.3	81.2	78.8	80	82.6	84.5
Average Relative Humidity - 1500LST (%)	74.3	70.8	65.4	56.5	53.9	55.1	53.1
Pressure:							
Average Station Pressure (kPa)	99.5	99.6	99.5	99.4	99.4	99.3	99.4
Average Sea Level Pressure (kPa)	101.7	101.8	101.6	101.5	101.5	101.4	101.5
Visibility (hours with):							
< 1 km	9.3	14.9	12.3	4.3	4.9	5.5	2.3
1 to 9 km	150	138.6	124	82.5	95.9	105.9	105.9
> 9 km	584.7	525.2	607.7	633.2	643.2	608.5	635.8
Cloud Amount (hours with):							
0 to 2 tenths	137.1	142	197.4	188.2	208.1	197.3	228.6
3 to 7 tenths	103.8	106	117	126.8	151.7	189.4	222.3
8 to 10 tenths	503.1	430.6	429.6	405	384.2	333.3	293.2

Date Modified: 2009-04-30

NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

TORONTO LESTER B. PEARSON INT'L A *
ONTARIO

Latitude: 43° 40.800' N Longitude: 79° 37.800' W Elevation: 173.40 m

Climate ID: 6158733 WMO ID: 71624 TC ID: YYZ

Temperature:	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	19.9	15.3	8.9	3.2	-2.9	7.5	A
Standard Deviation	1.3	1.2	1.6	1.5	2.7	0.9	A
Daily Maximum (°C)	25.6	21	13.9	7	0.9	12.5	A
Daily Minimum (°C)	14	9.6	3.9	-0.7	-6.7	2.5	A
Extreme Maximum (°C)	**38.3**	36.7	30.6	25	20		
Date (yyyy/dd)	**1948/25**	1953/02	1951/05	1950/01+	1982/03		
Extreme Minimum (°C)	1.1	-3.9	-8.3	-18.3	-31.1		
Date (yyyy/dd)	1965/30	1965/27	1969/23	1949/26	1942/20		
Precipitation:							
Rainfall (mm)	79.6	77.5	63.4	62	34.7	684.6	A
Snowfall (cm)	0	0	0.5	7.6	29.2	115.4	A
Precipitation (mm)	79.6	77.5	64.1	69.3	60.9	792.7	A
Average Snow Depth (cm)	0	0	0	0	3	2	A
Median Snow Depth (cm)	0	0	0	0	2	1	A
Snow Depth at Month-end (cm)	0	0	0	1	4	1	A
Extreme Daily Rainfall (mm)	80.8	108	**121.4**	86.1	40.9		
Date (yyyy/dd)	1970/30	1948/18	**1954/15**	1962/10	1962/06		
Extreme Daily Snowfall (cm)	0	0	7.4	33.5	28.2		
Date (yyyy/dd)	1938/01+	1938/01+	1962/25	1940/30	1944/11		
Extreme Daily Precipitation (mm)	80.8	108	**121.4**	86.1	40.9		
Date (yyyy/dd)	1970/30	1948/18	**1954/15**	1962/10	1962/06		
Extreme Snow Depth (cm)	0	0	13	16	33		
Date (yyyy/dd)	1955/01+	1955/01+	1969/22	1991/29	1977/09		
Days with Maximum Temperature:							
<= 0 °C	0	0	0	2.1	12.2	57.2	A
> 0 °C	31	30	31	27.9	18.8	308	A
> 10 °C	31	29.9	23.3	7.9	1.7	207.5	A
> 20 °C	28.8	16.7	3.5	0.27	0	118	A
> 30 °C	3.2	0.8	0	0	0	12.6	A
> 35 °C	0.07	0	0	0	0	0.54	A
Days with Minimum Temperature:							
> 0 °C	31	29.6	25.4	12.3	4.1	219.1	A
<= 2 °C	0.03	1.3	11.7	22.8	29.8	175.6	A
<= 0 °C	0	0.43	5.6	17.7	26.9	146.2	A
< -2 °C	0	0.03	2.2	11.3	22.7	114.3	A
< -10 °C	0	0	0	0.57	8.9	45.4	A
< -20 °C	0	0	0	0	0.63	5.2	A
< - 30 °C	0	0	0	0	0	0.1	A
Days with Rainfall:							
>= 0.2 mm	10.8	10.7	11.5	10.6	6.7	111.8	A
>= 5 mm	4.3	4.3	4	3.8	2.6	42.1	A
>= 10 mm	2.4	2.5	2.1	2	1	22.4	A
>= 25 mm	0.83	0.6	0.27	0.4	0.17	4.3	A
Days With Snowfall:							
>= 0.2 cm	0	0	0.4	4	10.3	46.5	A
>= 5 cm	0	0	0	0.37	1.8	7.2	A
>= 10 cm	0	0	0	0.2	0.67	2	A
>= 25 cm	0	0	0	0	0	0	A
Days with Precipitation:							
>= 0.2 mm	10.8	10.7	11.5	13.2	14.6	145.5	A
>= 5 mm	4.3	4.3	4	4.3	4.3	49.2	A
>= 10 mm	2.4	2.5	2.1	2.2	1.7	24.8	A
>= 25 mm	0.83	0.6	0.27	0.4	0.23	4.6	A
Days with Snow Depth:							
>= 1 cm	0	0	0.03	2.8	15.8	74.3	A
>= 5 cm	0	0	0	0.93	8.2	46.3	A
>= 10	0	0	0	0.3	3.3	24	A
>= 20	0	0	0	0	0.83	5	A
Wind:							
Speed (km/h)	11.2	12.2	13.3	15.6	16	14.7	A
Most Frequent Direction	NW	NW	NW	SW	SW	NW	A

Maximum Hourly Speed	71	77	92	80	70		
Date (yyyy/dd)	1958/31	1954/22	1954/16	1955/16+	1980/03+		
Direction of Maximum Hourly Speed	W	S	SW	SW	SW	W	
Maximum Gust Speed	93	92	104	122	109		
Date (yyyy/dd)	1961/11	1961/26	1989/14	1955/17	1996/01		
Direction of Maximum Gust	SW	SW	NW	SW	S	NW	
Days with Winds >= 52 km/h	0.7	0.7	1.8	2.4	3.1	23.8	A
Days with Winds >= 63 km/h	0.2	0.3	0.4	0.9	0.6	7.2	A
Degree Days:							
Above 24 °C	4.5	1	0	0	0	17.4	A
Above 18 °C	75	22.1	1	0	0	252	A
Above 15 °C	153.1	56.9	5.3	0.1	0	532.7	A
Above 10 °C	305.3	165.2	39.6	4.8	0.2	1216.7	A
Above 5 °C	460.3	309.6	132.3	32.1	4.6	2153.6	A
Above 0 °C	615.3	459.6	276.8	112.9	29.6	3359.1	A
Below 0 °C	0	0	0.4	18.3	119	598	A
Below 5 °C	0	0	11	87.6	249	1218.8	A
Below 10 °C	0	5.6	73.3	210.3	399.6	2108.3	A
Below 15 °C	2.8	47.3	194	355.6	554.4	3250.6	A
Below 18 °C	17.8	102.5	282.6	445.5	647.4	4065.7	A
Humidex:							
Extreme Humidex	45.6	48	35.4	28.6	23.9		
Date (yyyy/dd)	1955/21	1953/01	1971/02	1961/03	1982/03		
Days with Humidex >= 30	14.2	5.4	0.1	0	0	47.6	A
Days with Humidex >= 35	4.6	1.2	0	0	0	15.4	A
Days with Humidex >= 40	0.8	0.1	0	0	0	2.9	A
Wind Chill:							
Extreme Wind Chill	-0.9	-8	-13.5	-25.4	-38.5		
Date (yyyy/dd)	1965/30	1965/27	1969/23	1958/30	1980/25		
Days with Wind Chill < -20	0	0	0	0.1	4.9	27.6	A
Days with Wind Chill < -30	0	0	0	0	0.3	3.6	A
Days with Wind Chill < -40	0	0	0	0	0	0.1	A
Humidity:							
Average Vapour Pressure (kPa)	1.7	1.4	0.9	0.7	0.5	0.9	A
Average Relative Humidity - 0600LST (%)	88.6	89.5	87.1	84.7	83.7	83.6	A
Average Relative Humidity - 1500LST (%)	56.2	59.4	62.8	71.2	75.5	62.8	A
Pressure:							
Average Station Pressure (kPa)	99.6	99.6	99.7	99.6	99.6	99.5	A
Average Sea Level Pressure (kPa)	101.7	101.7	101.8	101.7	101.8	101.6	A
Visibility (hours with):							
< 1 km	2.6	7	10	10.4	18.3	101.7	B
1 to 9 km	122.4	126.1	113.6	135.4	151.4	1451.7	B
> 9 km	619	586.9	620.5	574.3	574.3	7213.3	B
Cloud Amount (hours with):							
0 to 2 tenths	226.8	218	198.2	114.9	122.7	2179.2	B
3 to 7 tenths	206.7	167.6	146.9	107.4	102.3	1747.9	B
8 to 10 tenths	310.5	334.4	399	497.8	519	4839.7	B

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Monthly Data Report for 2009

Notes on Data Quality.

TORONTO LESTER B. PEARSON INT'L A
ONTARIO

Latitude: 43° 40.800' N **Longitude**: 79° 37.800' W **Elevation**: 173.40 m

Climate ID: 6158733 **WMO ID**: 71624 **TC ID**: YYZ

Monthly Data Report for 2009

Month	Mean Max Temp °C 📈	Mean Temp °C 📈	Mean Min Temp °C 📈	Extr Max Temp °C 📈	Extr Min Temp °C 📈	Total Rain mm 📈	Total Snow cm 📈	Total Precip mm 📈	Snow Grnd Last Day cm 📈	Dir of Max Gust 10's Deg	Spd of Max Gust km/h 📈
Jan	-4.5	-8.8	-13.0	3.6	-22.1	1.0	46.0	44.4	32	31*	65*
Feb	0.9	-3.7	-8.2	9.4	-22.2	48.0	24.4	73.6	T	29	85
Mar	5.8	0.8	-4.2	18.9	-15.7	68.0	0.6	68.8	0	33	82
Apr	13.0	7.8	2.6	27.9	-3.9S	129.6	3.8	133.6	0	26	115
May	18.9	13.1	7.2	29.1	0.3	60.8	0.0	60.8	0	26	82
Jun	22.3	17.5	12.7	31.4	6.8	70.2	0.0	70.2	0	36	61
Jul	24.2	19.2	14.2	28.3	9.4	84.8	0.0	84.8	0	27	70
Aug	25.5	20.6	15.7	31.4	10.5	144.0	0.0	144.0	0	6*	115*
Sep	21.9	16.9	11.8	27.8	4.8	40.2	0.0	40.2	0	24*	67*
Oct	12.7	8.7	4.7	17.6	-1.2	71.0	0.0	71.0	0	24*	80*
Nov											
Dec											
Sum						**M**	**M**	**M**			
Avg	**M**	**M**	**M**								
Xtrm				**M**	**M**					**M**	**M**

Legend

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Daily Data Report for January 2009

Notes on Data Quality.

TORONTO LESTER B. PEARSON INT'L A
ONTARIO

Latitude: 43° 40.800' N **Longitude**: 79° 37.800' W **Elevation**: 173.40 m

Climate ID: 6158733 **WMO ID**: 71624 **TC ID**: YYZ

Daily Data Report for January 2009

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01	-3.8	-15.6	-9.7	27.7	0.0	0.0	0.0	0.0	2		<31
02	0.7	-4.7	-2.0	20.0	0.0	0.0	1.2	0.6	2	28	48
03	-1.9	-11.8	-6.9	24.9	0.0	0.0	0.0	0.0	2	28	35
04	-0.7	-12.2	-6.5	24.5	0.0	T	0.0	T	2		<31
05	0.6	-7.7	-3.6	21.6	0.0	T	0.0	T	1	27	44
06	-0.6	-10.0	-5.3	23.3	0.0	T	3.6	3.4	1	11	33
07	0.7	-2.8	-1.1	19.1	0.0	1.0	9.0	10.0	5	25	46
08	-2.8	-12.0	-7.4	25.4	0.0	0.0	0.2	0.2	11	30	48
09	-6.0	-12.2	-9.1	27.1	0.0	0.0	T	T	11		<31
10	-6.8	-14.9	-10.9	28.9	0.0	0.0	3.8	3.4	11	1	39
11	-6.3	-12.8	-9.6	27.6	0.0	0.0	0.2	0.2	14	36	33
12	-3.5	-10.6	-7.1	25.1	0.0	0.0	0.0	0.0	14	27	35
13	1.1	-16.9	-7.9	25.9	0.0	0.0	4.0	4.6	15	31	65
14	-13.1	-22.1	-17.6	35.6	0.0	0.0	0.8	0.8	18		<31
15	-10.8	-19.3	-15.1	33.1	0.0	0.0	0.6	0.6	18	26	33
16	-12.7	-18.0	-15.4	33.4	0.0	0.0	0.0	0.0	18	26	50
17	-6.9	-20.0	-13.5	31.5	0.0	0.0	4.8	4.0	18	14	37
18	-3.0	-8.6	-5.8	23.8	0.0	0.0	2.8	2.8	21	14	33
19	-5.6	-11.6	-8.6	26.6	0.0	0.0	0.8	0.8	24		<31

20	-10.2	-17.5	-13.9	31.9	0.0	0.0	T	T	24	36	44
21	-5.5	-19.0	-12.3	30.3	0.0	0.0	T	T	24	27	41
22	-1.9	-6.0	-4.0	22.0	0.0	0.0	T	T	24		<31
23	3.6	-6.8	-1.6	19.6	0.0	0.0	T	T	24	30	63
24	-6.7	-19.2	-13.0	31.0	0.0	0.0	0.0	0.0	21	31	46
25	-8.9	-15.6	-12.3	30.3	0.0	0.0	0.0	0.0	21	25	37
26	-8.8	-16.9	-12.9	30.9	0.0	0.0	0.0	0.0	21	26	33
27	-4.0	-13.8	-8.9	26.9	0.0	0.0	T	T	21	11	33
28	-3.4	-8.2	-5.8	23.8	0.0	0.0	13.4	12.6	23	M	M
29	-3.1	-10.2	-6.7	24.7	0.0	0.0	0.4	0.4	32	22	35
30	-3.2	-10.8	-7.0	25.0	0.0	0.0	T	T	32	27	48
31	-4.7	-16.7	-10.7	28.7	0.0	0.0	0.4	T	32	23	37
Sum				**830.2**	**0.0**	**1.0**	**46.0**	**44.4**			
Avg	**-4.5**	**-13.0**	**-8.8**								
Xtrm	**3.6**	**-22.1**								**31***	**65***

Legend
[empty] = No data available
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Daily Data Report for February 2009

Notes on Data Quality.

TORONTO LESTER B. PEARSON INT'L A
ONTARIO

Latitude: 43° 40.800' N **Longitude**: 79° 37.800' W **Elevation**: 173.40 m

Climate ID: 6158733 **WMO ID**: 71624 **TC ID**: YYZ

Daily Data Report for February 2009

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01	4.4	-4.8	-0.2	18.2	0.0	0.0	0.0	0.0	32	26	52
02	2.0	-7.9	-3.0	21.0	0.0	0.0	0.0	0.0	28		<31
03	-3.8	-10.5	-7.2	25.2	0.0	0.0	7.4	6.2	27	8	37
04	-10.2	-18.0	-14.1	32.1	0.0	0.0	1.6	1.0	35	35	35
05	-9.0	-22.2	-15.6	33.6	0.0	0.0	T	T	35		<31
06	-2.0	-11.8	-6.9	24.9	0.0	0.0	0.0	0.0	35		<31
07	7.9	-8.3	-0.2	18.2	0.0	0.0	0.0	0.0	32	24	70
08	4.0	-4.8	-0.4	18.4	0.0	0.0	0.0	0.0	9	30	57
09	3.2	-6.2	-1.5	19.5	0.0	0.0	0.0	0.0	6		<31
10	9.3	-0.1	4.6	13.4	0.0	T	0.0	T	3	22	35
11	8.9	6.5	7.7	10.3	0.0	25.8	0.0	25.8	1		<31
12	7.8	-2.1	2.9	15.1	0.0	11.8	T	11.8	T	29	85
13	-0.9	-7.4	-4.2	22.2	0.0	0.0	0.0	0.0	T	35	32
14	-1.8	-8.2	-5.0	23.0	0.0	0.0	0.0	0.0	T		<31
15	1.3	-8.9	-3.8	21.8	0.0	0.0	0.0	0.0	T		<31
16	0.7	-7.5	-3.4	21.4	0.0	0.0	0.0	0.0	T		<31
17	2.2	-6.8	-2.3	20.3	0.0	0.0	0.0	0.0	T	22	32
18	1.0	-0.8	0.1	17.9	0.0	0.0	8.2	12.4	T		<31
19	1.3	-7.9	-3.3	21.3	0.0	0.0	0.4	0.4	3	27	59

20	-2.6	-8.8	-5.7	23.7	0.0	0.0	T	T	3	29	70
21	-0.5	-11.2	-5.9	23.9	0.0	0.0	4.6	3.6	2	12	37
22	-2.0	-8.3	-5.2	23.2	0.0	0.0	T	T	5	25	54
23	-6.0	-11.4	-8.7	26.7	0.0	0.0	0.0	0.0	4	34	59
24	-3.2	-15.1	-9.2	27.2	0.0	0.0	0.0	0.0	4		<31
25	2.8	-6.9	-2.1	20.1	0.0	0.8	2.2	2.8	3		<31
26	6.5	-0.5	3.0	15.0	0.0	3.8	0.0	3.8	1		<31
27	9.4	-12.0	-1.3	19.3	0.0	5.8	T	5.8	T	35	59
28	-6.5	-16.4	-11.5	29.5	0.0	0.0	0.0	0.0	T	36	35
Sum				**606.4**	**0.0**	**48.0**	**24.4**	**73.6**			
Avg	**0.9**	**-8.2**	**-3.7**								
Xtrm	**9.4**	**-22.2**								**29**	**85**

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Daily Data Report for March 2009

Notes on Data Quality.

TORONTO LESTER B. PEARSON INT'L A
ONTARIO

Latitude: 43° 40.800' N **Longitude**: 79° 37.800' W **Elevation**: 173.40 m

Climate ID: 6158733 **WMO ID**: 71624 **TC ID**: YYZ

Daily Data Report for March 2009

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01	-4.2	-12.5	-8.4	26.4	0.0	0.0	0.0	0.0	T	34	52
02	-9.5	-15.4	-12.5	30.5	0.0	0.0	0.0	0.0	T	35	52
03	-3.9	-15.7	-9.8	27.8	0.0	0.0	0.0	0.0	T		<31
04	1.6	-12.5	-5.5	23.5	0.0	0.0	0.0	0.0	T		<31
05	5.6	-7.1	-0.8	18.8	0.0	T	0.0	T	T		<31
06	18.9	1.3	10.1	7.9	0.0	0.0	0.0	0.0	T	24	61
07	4.6	-2.0	1.3	16.7	0.0	19.8	0.0	19.8	T		<31
08	5.5	1.1	3.3	14.7	0.0	9.8	T	9.8	0	9	59
09	4.4	-0.5	2.0	16.0	0.0	1.4	0.6	2.2	T	33	48
10	3.7	0.2	2.0	16.0	0.0	6.4	0.0	6.4	0	11	32
11	9.5	-5.2	2.2	15.8	0.0	5.4	T	5.4	0	33	82
12	-2.1	-9.5	-5.8	23.8	0.0	0.0	T	T	0	31	41
13	-0.7	-10.3	-5.5	23.5	0.0	0.0	0.0	0.0	0		<31
14	6.9	-6.1	0.4	17.6	0.0	0.0	0.0	0.0	0		<31
15	9.6	-3.8	2.9	15.1	0.0	0.0	0.0	0.0	0		<31
16	10.0	-2.4	3.8	14.2	0.0	0.0	0.0	0.0	0		<31
17	11.8	-1.8	5.0	13.0	0.0	0.0	0.0	0.0	0		<31
18	15.0	2.5	8.8	9.2	0.0	T	0.0	T	0	28	76
19	4.3	-3.6	0.4	17.6	0.0	0.0	0.0	0.0	0	33	41

20	2.8	-6.4	-1.8	19.8	0.0	0.0	0.0	0.0	0		<31
21	5.9	-5.7	0.1	17.9	0.0	0.0	0.0	0.0	0		<31
22	5.8	-4.3	0.8	17.2	0.0	0.0	0.0	0.0	0	1	41
23	2.6	-6.4	-1.9	19.9	0.0	0.0	0.0	0.0	0	2	32
24	4.0	-2.9	0.6	17.4	0.0	0.0	0.0	0.0	0	11	44
25	8.6	1.9	5.3	12.7	0.0	2.6	0.0	2.6	0	10	33
26	10.4	2.0	6.2	11.8	0.0	T	0.0	T	0	30	35
27	12.3	-3.0	4.7	13.3	0.0	0.0	0.0	0.0	0		<31
28	13.2	0.3	6.8	11.2	0.0	0.0	0.0	0.0	0	9	50
29	10.8	2.6	6.7	11.3	0.0	22.6	0.0	22.6	0	23	61
30	5.6	-2.7	1.5	16.5	0.0	0.0	0.0	0.0	0	30	54
31	5.6	-3.1	1.3	16.7	0.0	T	0.0	T	0	9	44
Sum				**533.8**	**0.0**	**68.0**	**0.6**	**68.8**			
Avg	**5.8**	**-4.2**	**0.8**								
Xtrm	**18.9**	**-15.7**								**33**	**82**

Legend

[empty] = No data available

M = Missing

E = Estimated

A = Accumulated

C = Precipitation occurred, amount uncertain

L = Precipitation may or may not have occurred

F = Accumulated and estimated

N = Temperature missing but known to be > 0

Y = Temperature missing but known to be < 0

S = More than one occurrence

T = Trace

* = The value displayed is based on incomplete data

† = Data for this day has undergone only preliminary quality checking

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Daily Data Report for April 2009

Notes on Data Quality.

TORONTO LESTER B. PEARSON INT'L A
ONTARIO

Latitude: 43° 40.800' N **Longitude**: 79° 37.800' W **Elevation**: 173.40 m

Climate ID: 6158733 **WMO ID**: 71624 **TC ID**: YYZ

Daily Data Report for April 2009

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01	14.0	2.5	8.3	9.7	0.0	1.8	0.0	1.8	0	24	70
02	15.1	1.3	8.2	9.8	0.0	0.2	0.0	0.2	0	10	48
03	10.0	3.1	6.6	11.4	0.0	40.2	0.0	40.2	0	29	74
04	5.6	2.5	4.1	13.9	0.0	T	0.0	T	0	30	80
05	12.1	0.3	6.2	11.8	0.0	0.2	0.0	0.2	0	34	37
06	4.8	-3.3	0.8	17.2	0.0	13.8	3.8	17.8	T	33	65
07	-0.1	-3.9	-2.0	20.0	0.0	0.0	T	T	1	30	56
08	8.3	-1.7	3.3	14.7	0.0	0.0	T	T	T	27	63
09	11.7	-1.7	5.0	13.0	0.0	0.0	0.0	0.0	0	30	52
10	10.7	-0.6	5.1	12.9	0.0	0.0	0.0	0.0	0	2	33
11	8.9	-0.8	4.1	13.9	0.0	0.0	0.0	0.0	0	33	56
12	6.7	-2.5	2.1	15.9	0.0	0.0	0.0	0.0	0	35	46
13	6.8	-3.9	1.5	16.5	0.0	0.0	0.0	0.0	0		<31
14	11.8	3.9	7.9	10.1	0.0	0.0	0.0	0.0	0	8	57
15	14.5	3.6	9.1	8.9	0.0	0.0	0.0	0.0	0	7	33
16	14.5	2.5	8.5	9.5	0.0	0.0	0.0	0.0	0		<31
17	20.9	3.9	12.4	5.6	0.0	0.0	0.0	0.0	0	31	41
18	21.2	8.0	14.6	3.4	0.0	0.0	0.0	0.0	0		<31
19	12.4	5.2	8.8	9.2	0.0	T	0.0	T	0	9	59

20	9.3	4.3	6.8	11.2	0.0	25.8	0.0	25.8	0	9	57
21	12.0	3.9	8.0	10.0	0.0	1.0	0.0	1.0	0	17	39
22	8.0	3.5	5.8	12.2	0.0	T	0.0	T	0	30	48
23	12.0	3.6	7.8	10.2	0.0	T	0.0	T	0	34	56
24	19.8	4.8	12.3	5.7	0.0	0.0	0.0	0.0	0	13	32
25	27.9	10.5	19.2	0.0	1.2	9.8	0.0	9.8	0	26	115
26	16.2	8.1	12.2	5.8	0.0	3.0	0.0	3.0	0	36	33
27	27.5	7.0	17.3	0.7	0.0	0.0	0.0	0.0	0	23	69
28	17.3	4.4	10.9	7.1	0.0	10.4	0.0	10.4	0	35	59
29	12.5	3.6	8.1	9.9	0.0	0.0	0.0	0.0	0	13	37
30	17.5	7.3	12.4	5.6	0.0	23.4	0.0	23.4	0	22	48
Sum				**305.8**	**1.2**	**129.6**	**3.8**	**133.6**			
Avg	**13.0**	**2.6**	**7.8**								
Xtrm	**27.9**	**-3.9S**								**26**	**115**

Legend
[empty] = No data available
M = Missing
E = Estimated
A = Accumulated
C = Precipitation occurred, amount uncertain
L = Precipitation may or may not have occurred
F = Accumulated and estimated
N = Temperature missing but known to be > 0
Y = Temperature missing but known to be < 0
S = More than one occurrence
T = Trace
* = The value displayed is based on incomplete data
† = Data for this day has undergone only preliminary quality checking

Date Modified: 2008-10-09

Photographs
2009

TERRAPROBE INC.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.1

Front yard of 35 Troutbrooke Dr., looking north.

PHOTOGRAPH No.2

Tableland and slope crest of 35 Troutbrooke Dr., looking east.

PHOTOGRAPH No.3

Slope face directly north of 35 Troutbrooke Dr., well vegetated, looking north.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.4

Front yard of 37 Troutbrooke Dr., looking north.

PHOTOGRAPH No.5

Tableland and slope crest of 37 Troutbrooke Dr., failed fence in background, looking west.

PHOTOGRAPH No.6

Slope face directly north of 37 Troutbrooke Dr., landscape debris present, looking north.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.7

Front yard of 39 Troutbrooke Dr., looking north.

PHOTOGRAPH No.8

Tableland and slope crest of 39 Troutbrooke Dr., failed fence in background, looking east.

PHOTOGRAPH No.9

Slope face directly north of 39 Troutbrooke Dr., well vegetated, looking north.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.10

Front yard of 41 Troutbrooke Dr., looking north.

PHOTOGRAPH No.11

Tableland and slope crest of 41 Troutbrooke Dr., looking west.

PHOTOGRAPH No.12

Slope face directly north of 41 Troutbrooke Dr., well vegetated, looking north.

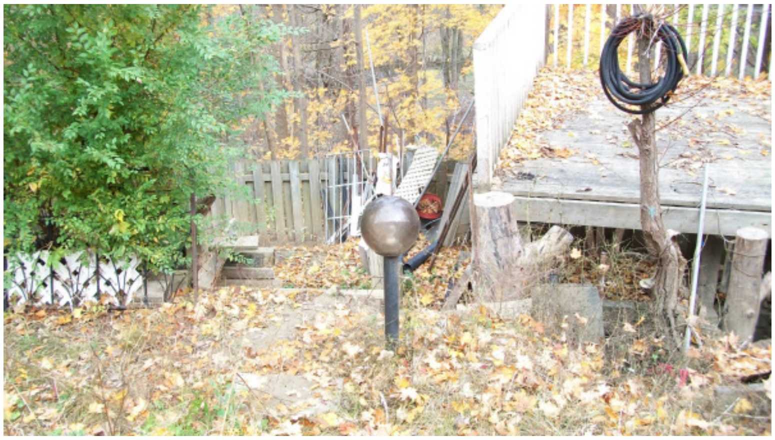
TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.13

Front yard of 43 Troutbrooke Dr., looking north.

PHOTOGRAPH No.14

Tableland and slope crest of 43 Troutbrooke Dr., destruction of tableland due to slumping, looking east.



PHOTOGRAPH No.15

Slope face directly north of 43 Troutbrooke Dr., unusable deck and secondary scarp, looking north.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.16

Front yard of 45 Troutbrooke Dr., looking north.

PHOTOGRAPH No.17

Tableland and slope crest of 45 Troutbrooke Dr., destruction of tableland due to slumping and exposed foundation wall, looking west.

PHOTOGRAPH No.18

Slope face directly north of 45 Troutbrooke Dr., failed retaining wall, looking north.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.19

Front yard of 47 Troutbrooke Dr., looking north.

PHOTOGRAPH No.20

Tableland and slope crest of 47 Troutbrooke Dr., primary scarp associated with slumping, looking west.

PHOTOGRAPH No.21

Slope face directly north of 47 Troutbrooke Dr., well vegetated, some debris, looking north.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.22

Front yard of 49 Troutbrooke Dr., looking north.

PHOTOGRAPH No.23

Tableland and slope crest of 49 Troutbrooke Dr., looking west.

PHOTOGRAPH No.24

Slope face directly north of 49 Troutbrooke Dr., well vegetated, scarp crest, looking north.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.25

Front yard of 51 Troutbrooke Dr., looking north.

PHOTOGRAPH No.26

Tableland and slope crest of 51 Troutbrooke Dr., looking west.

PHOTOGRAPH No.27

Scarp north of 51 Troutbrooke Dr., looking east.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.28

Exposed foundation present directly north of 45 Troutbrooke Dr., looking south.

PHOTOGRAPH No.29

Tension cracking in pavement in between 49 and 51 Troutbrooke Dr., looking northwest.

PHOTOGRAPH No.30

Well vegetated slope face, looking west.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.31

Well vegetated slope face with bent mature trees and relatively straight saplings, looking west.

PHOTOGRAPH No.32

Well vegetated slope face with bent trees, looking west.

PHOTOGRAPH No.33

Slope toe adjacent to river, toe erosion causing 0.3m scarp and exposed roots, looking west.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.34

Slope toe adjacent to marshy area, looking west.

PHOTOGRAPH No.35

Marshy area adjacent to slope toe, looking northwest.

PHOTOGRAPH No.36

Failing retaining wall north of
43 Troutbrooke Dr., looking south.

TROUTBROOKE DRIVE, TORONTO

PHOTOGRAPH No.37

Extensive garbage and landscaping debris, looking southwest.

PHOTOGRAPH No.38

Minor gully on slope face,
minimal erosion, looking southeast.

PHOTOGRAPH No.39

Minor (0.3m) scarp associated
with eastern portion of site, looking south.

PHOTOGRAPH No.40

Minor (0.6m) scarp associated with western portion of site, looking south.

PHOTOGRAPH No.41

Bare and over steepened areas present, associated with both mature trees and landscaping debris/garbage, looking south.

Terraprobe Borehole Logs and Geotechnical Laboratory Tests (2009)

TERRAPROBE INC.

ABBREVIATIONS, TERMINOLOGY, GENERAL INFORMATION

BOREHOLE LOGS

SAMPLING METHOD

SS	split spoon
ST	Shelby tube
AS	auger sample
WS	wash sample
RC	rock core
WH	weight of hammer
PH	pressure, hydraulic

PENETRATION RESISTANCE

Standard Penetration Test (SPT) resistance ('N' values) is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.).

Dynamic Cone Test (DCT) resistance is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a conical steel point of 50 mm (2 in.) diameter and with 60° sides on 'A' size drill rods for a distance of 0.3 m (12 in.).

SOIL DESCRIPTION - COHESIONLESS SOILS

Relative Density	'N' value
very loose	< 4
loose	4 - 10
compact	10 - 30
dense	30 - 50
very dense	> 50

SOIL DESCRIPTION - COHESIVE SOILS

Consistency	Undrained Shear Strength, kPa	'N' value
very soft	< 12	< 2
soft	12 - 25	2 - 4
firm	25 - 50	4 - 8
stiff	50 - 100	8 - 15
very stiff	100 - 200	15 - 30
hard	> 200	> 30

SOIL COMPOSITION

	% by weight
'trace' (e.g. trace silt)	< 10
'some' (e.g. some gravel)	10 - 20
adjective (e.g. sandy)	20 - 35
'and' (e.g. sand and gravel)	35 - 50

TESTS, SYMBOLS

MH	mechanical sieve and hydrometer analysis
w, w_c	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity index
k	coefficient of permeability
γ	soil unit weight, bulk
ϕ'	angle of internal friction
c'	cohesion shear strength
C_c	compression index

GENERAL INFORMATION, LIMITATIONS

The conclusions and recommendations provided in this report are based on the factual information obtained from the boreholes and/or test pits. Subsurface conditions between the test holes may vary.

The engineering interpretation and report recommendations are given only for the specific project detailed within, and only for the original client. Any third party decision, reliance, or use of this report is the sole and exclusive responsibility of such third party. The number and siting of boreholes and/or test pits may not be sufficient to determine all factors required for different purposes.

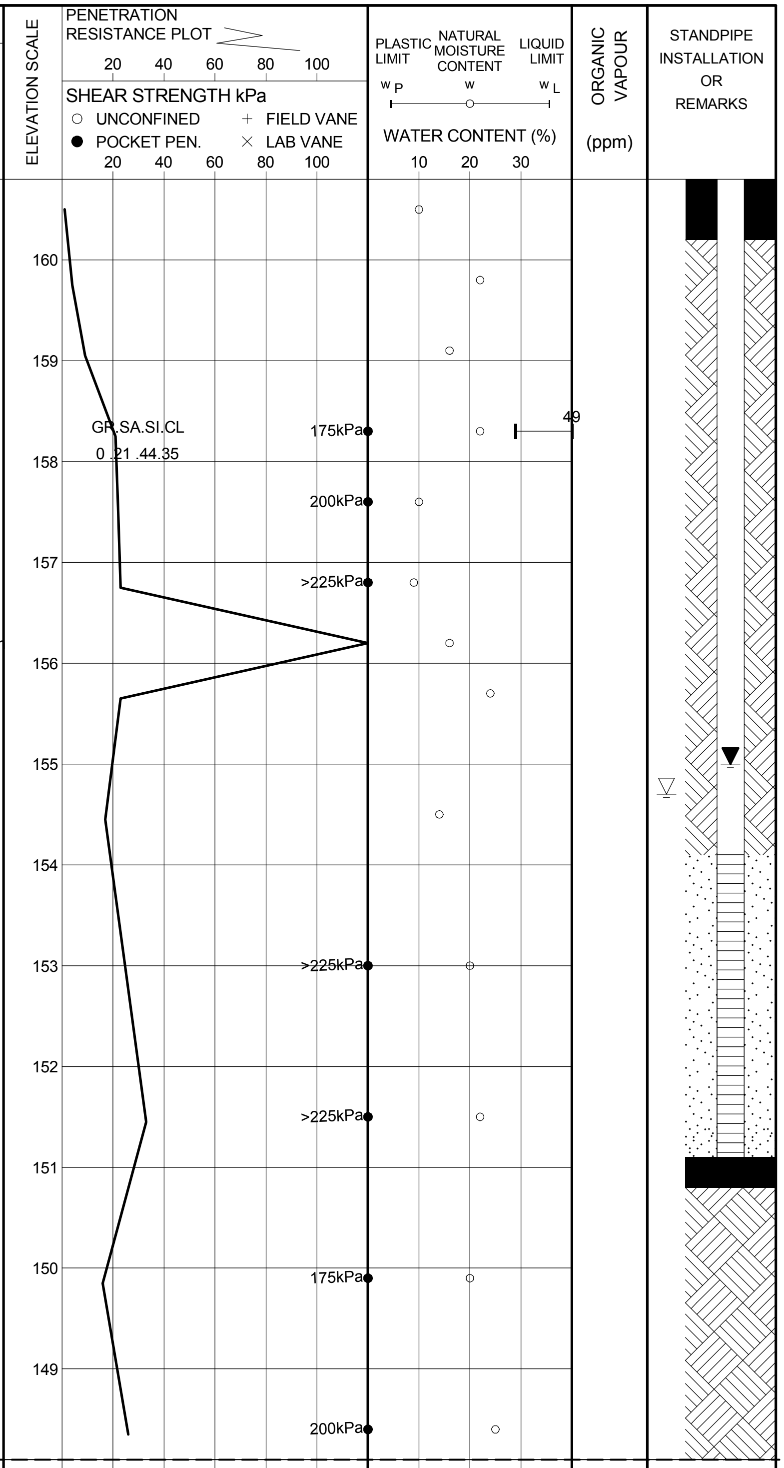
It is recommended Terraprobe be retained to review the project final design and to provide construction inspection and testing.

Terraprobe

LOG OF BOREHOLE 1

PROJECT: Slope Stability and Erosion Risk Assessment
DATE: July 20, 2009
LOCATION: 45 Troutbrooke Drive, Toronto, Ontario
EQUIPMENT: Beaver - Manual SPT
CLIENT: Toronto Region Conservation Authority
ELEVATION DATUM: Geodetic
FILE: 1-09-4125

SOIL PROFILE		SAMPLES		
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
160.8	Ground Surface			
0.0	FILL - Sand, some silt, trace gravel, very loose, brown, moist	1	SS	1
160.0 0.8	FILL - Silty Clay, some sand, trace gravel, firm to stiff, brown, moist	2	SS	4
		3	SS	9
158.5 2.3	sand seams and partings ---- SILTY CLAY embedded sand and gravel, very stiff to hard, brown, moist (GLACIAL TILL)	4	SS	21
		5	SS	22
		6	SS	23
		7	SS	50/8cm
155.9	---- boulder obstruction			
4.9	SILT AND SAND some clay, embedded gravel, compact, brown, moist (GLACIAL TILL)	8	SS	23
		9	SS	17
153.2 7.6	CLAY AND SILT occasional fine silt seams, very stiff to hard, grey, moist	10	SS	25
		11	SS	33
		12	SS	16
		13	SS	26
148.1 12.7	End of Borehole			



End of Borehole

Water Level Readings:

Date	Depth(m)	Elevation(m)
Aug.04.09	5.5	155.3
Aug.19.09	5.5	155.3
Oct.21.09	5.5	155.3
Aug.04.10	5.4	155.4
Sep.08.10	5.8	155.0

NOTES:
Borehole was caving at 11.0m and water level at 6.1m upon completion of drilling.

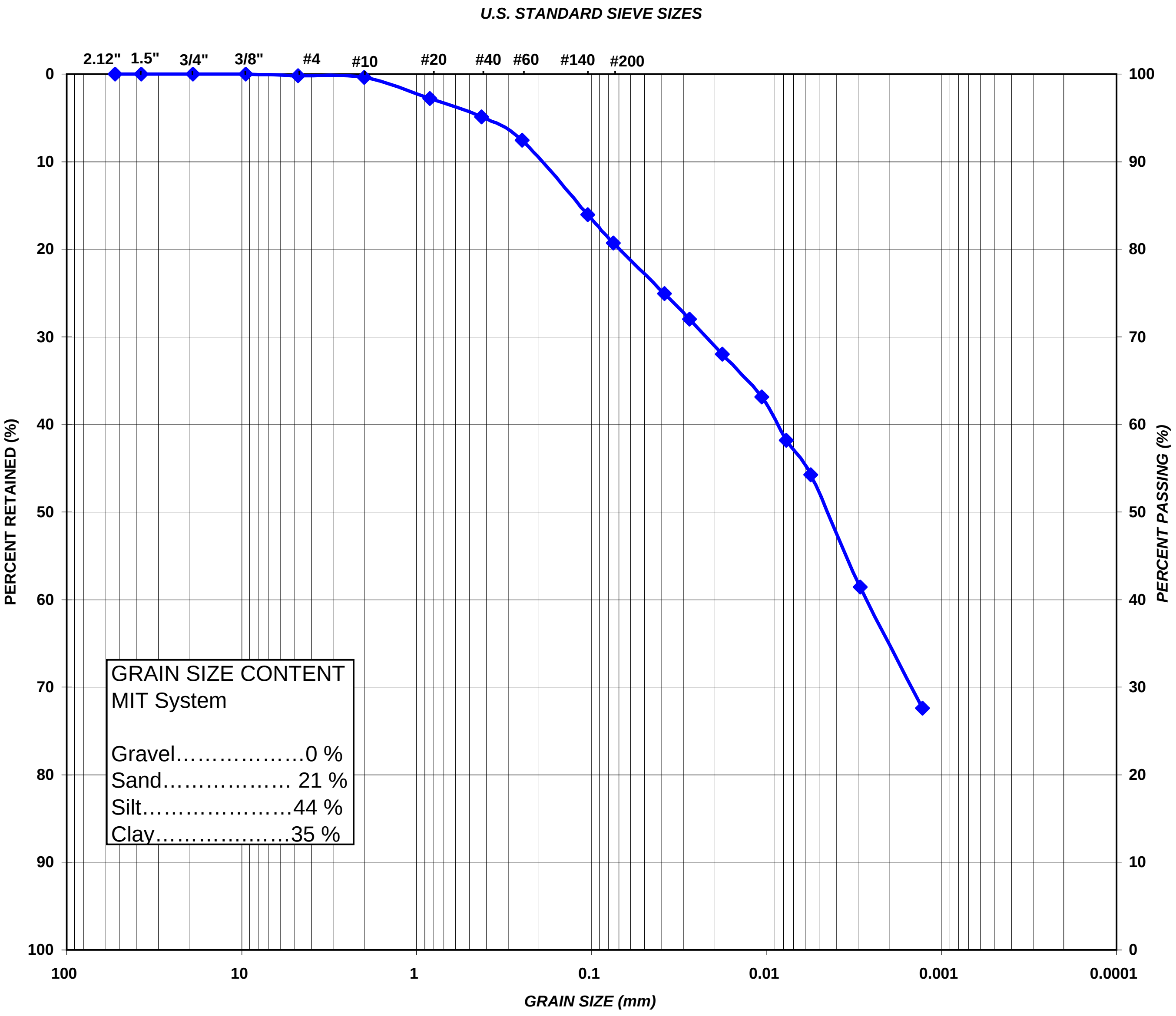
Terraprobe

SIEVE AND HYDROMETER ANALYSIS
TEST REPORT

PROJECT: **35 - 51 Troutbrooke Drive**
LOCATION: **Toronto, Ontario**
CLIENT: **TRCA**
BOREHOLE NUMBER: **1**
SAMPLE NUMBER: **4**
SAMPLE DEPTH: **2.3 - 2.7 m**
SAMPLE DESCRIPTION: **SILTY CLAY, sandy (Glacial Till)**

FILE NO.: **1-09-4125**
LAB NO.: **1177C**
SAMPLE DATE: **July 24, 2009**
SAMPLED BY: **P.K.**

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

Terraprobe

LOG OF BOREHOLE 2

PROJECT: Slope Stability and Erosion Risk Assessment

LOCATION: 45 Troutbrooke Drive, Toronto, Ontario

CLIENT: Toronto Region Conservation Authority

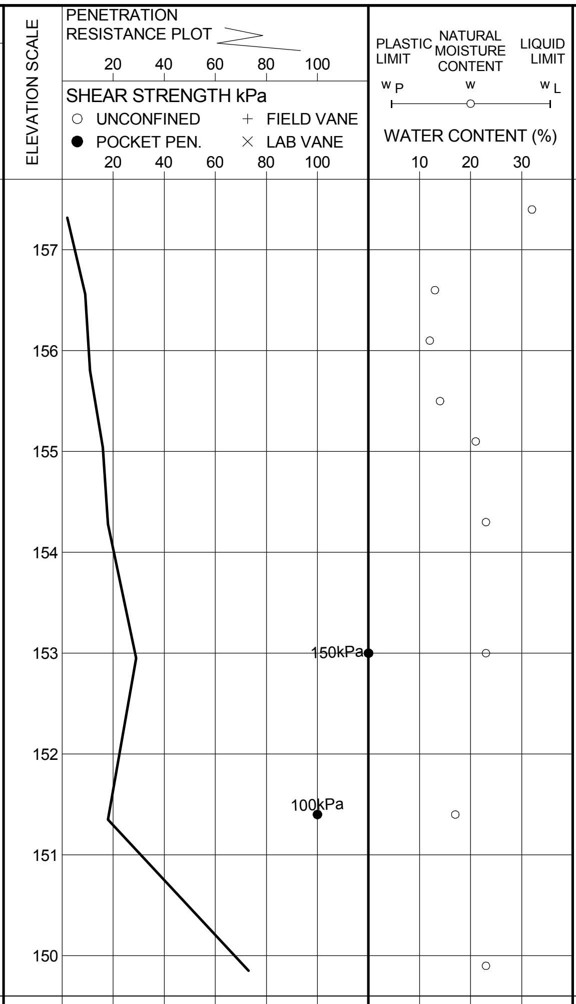
DATE: July 27, 2009

EQUIPMENT: Beaver - Manual SPT

ELEVATION DATUM: Geodetic

FILE: 1-09-4125

SOIL PROFILE			SAMPLES		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
157.7	Ground Surface				
0.0 157.4	280mm TOPSOIL				
0.3	very soft		1	SS	2
	---- topsoil / organic inclusions, concrete rubble, trace shingle debris ----		2	SS	9
	FILL - Clayey Silt, some sand, trace gravel, stiff to very stiff, brown, moist		3	SS	11
			4	SS	16
	---- some topsoil inclusions, trace cinders		5	SS	18
			6	SS	29
	---- trace organics and ash, trace rock fragments		7	SS	18
150.1 7.6	CLAY AND SILT very stiff to hard, grey, moist		8	SS	73
149.6 8.1	End of Borehole				



ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Borehole was caving at 5.8m and dry upon completion of drilling.

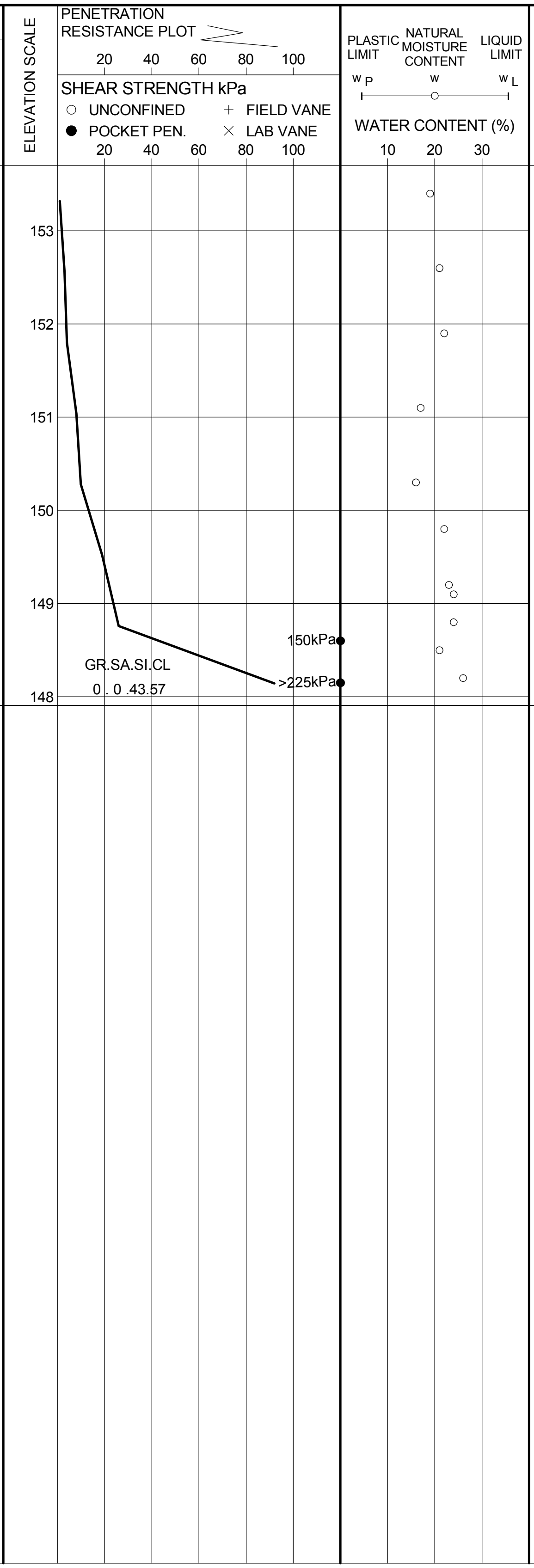
Sheet 1 of 1

Terraprobe

LOG OF BOREHOLE 3

PROJECT: Slope Stability and Erosion Risk Assessment
DATE: July 22, 2009
LOCATION: 43 Troutbrooke Drive, Toronto, Ontario
EQUIPMENT: Beaver - Manual SPT
CLIENT: Toronto Region Conservation Authority
ELEVATION DATUM: Geodetic
FILE: 1-09-4125

SOIL PROFILE		SAMPLES		
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
153.7	Ground Surface			
0.0	very soft ----	1	SS	1
	FILL - Clayey Silt some sand, trace gravel, trace topsoil / organic inclusions, soft to firm, brown, moist	2	SS	3
		3	SS	4
		4	SS	8
	---- stiff to very stiff	5	SS	10
		6	SS	19
148.7	---- trace cinders	7	SS	26
5.0	CLAY AND SILT very stiff to hard, grey, moist	8	SS	92
147.9 5.8	End of Borehole Auger Refusal at 5.8m			



ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Borehole was caving at 2.1m and dry upon completion of drilling.

Sheet 1 of 1

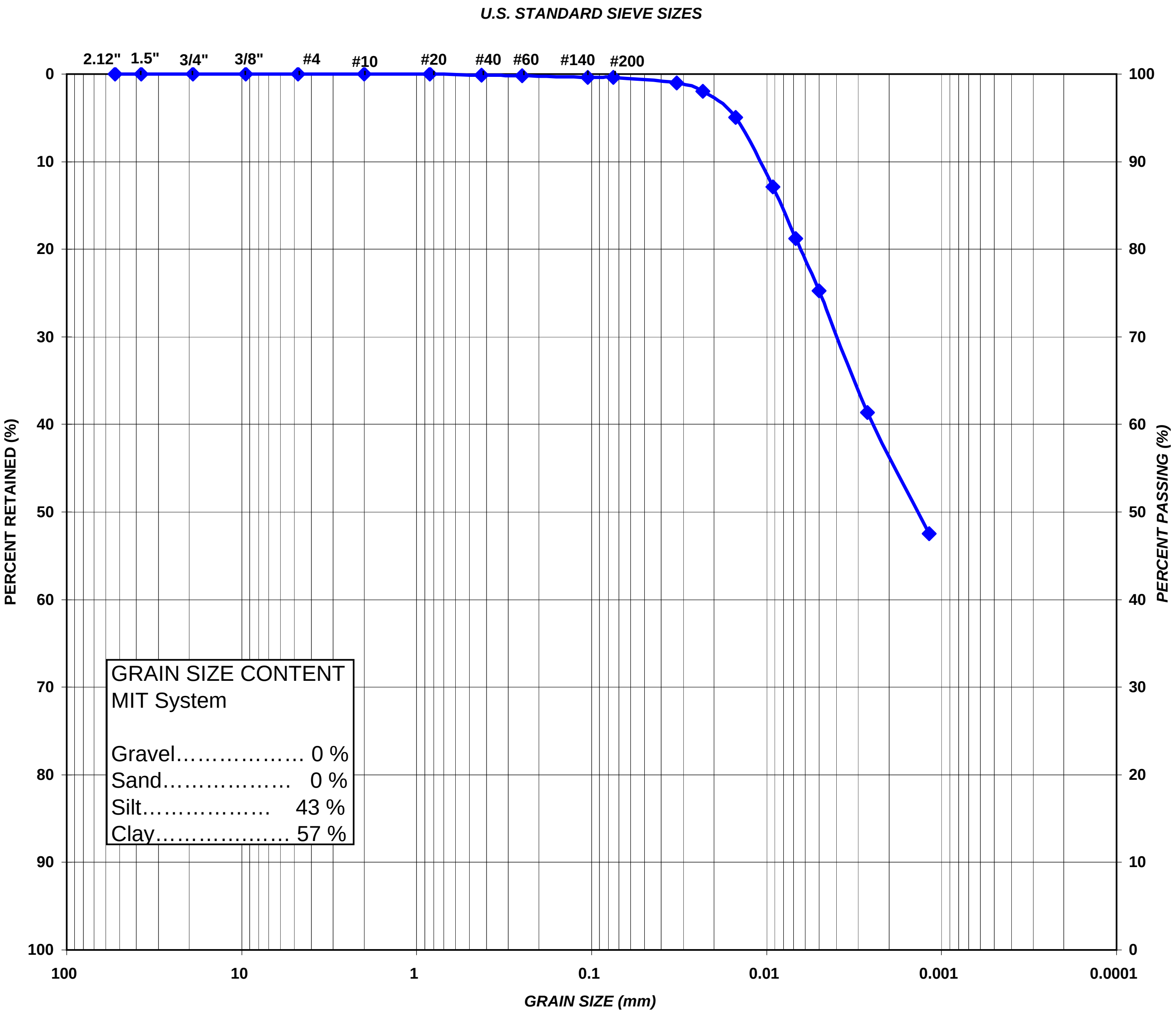
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **35 - 51 Troutbrooke Drive**
LOCATION: **Toronto, Ontario**
CLIENT: **TRCA**
BOREHOLE NUMBER: **3**
SAMPLE NUMBER: **8**
SAMPLE DEPTH: **5.3 - 6.1 m**
SAMPLE DESCRIPTION: **CLAY AND SILT**

FILE NO.: **1-09-4125**
LAB NO.: **1177A**
SAMPLE DATE: **July 24, 2009**
SAMPLED BY: **P.K.**

GRAIN SIZE DISTRIBUTION



GRAIN SIZE CONTENT
MIT System

Gravel……………… 0 %
Sand……………… 0 %
Silt……………… 43 %
Clay……………… 57 %

		COARSE	MEDIUM	FINE		
MIT SYSTEM	GRAVEL	SAND			SILT	CLAY

	COARSE	FINE	COARSE	MEDIUM	FINE	
UNIFIED SYSTEM	GRAVEL		SAND			SILT AND CLAY

Terraprobe

LOG OF BOREHOLE 4

PROJECT: Slope Stability and Erosion Risk Assessment

LOCATION: 41 Troutbrooke Drive, Toronto, Ontario

CLIENT: Toronto Region Conservation Authority

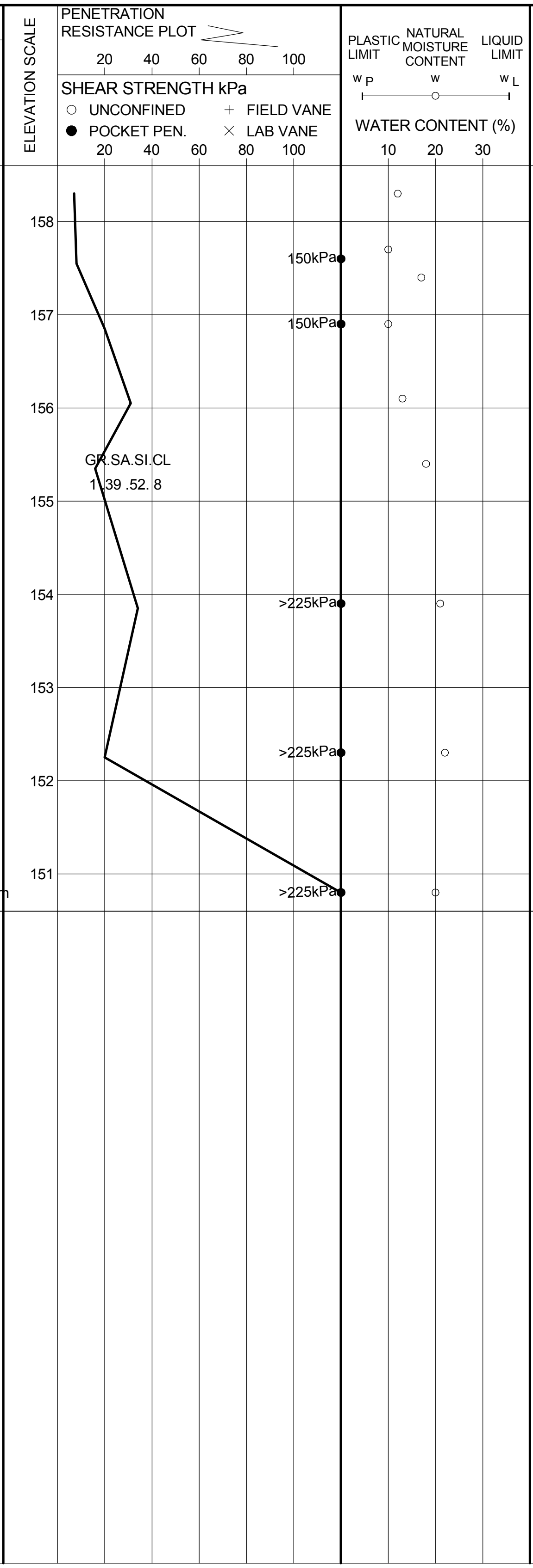
DATE: July 24, 2009

EQUIPMENT: Beaver - Manual SPT

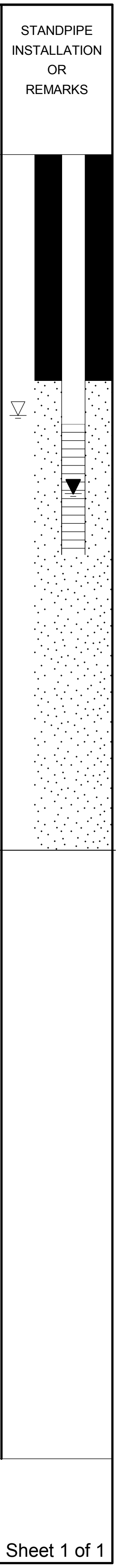
ELEVATION DATUM: Geodetic

FILE: 1-09-4125

SOIL PROFILE		SAMPLES		
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
158.6	Ground Surface			
158.5 0.0	150mm TOPSOIL			
0.2	FILL - Clayey Silt, some sand, trace gravel, firm, brown, moist	1	SS	7
157.5 1.1	CLAYEY SILT embedded sand and gravel, very stiff, brown, moist (GLACIAL TILL)	2	SS	8
		3	SS	20
156.3 2.3	SILT AND SAND trace clay, embedded gravel, compact to dense, brown, moist (GLACIAL TILL)	4	SS	31
		5	SS	16
154.1 4.5	brown ---- CLAY AND SILT trace sand, occasional fine silt seams, very stiff to hard, grey, moist	6	SS	34
		7	SS	20
		8	SS	50/23cm
150.6 8.0	End of Borehole			



ORGANIC VAPOUR (ppm)



Water Level Readings:

Date	Depth(m)	Elevation(m)
Aug.04.09	3.7	154.9
Aug.19.09	3.7	154.9
Oct.21.09	3.7	154.9
Aug.04.10	5.4	155.4
Sep.08.10	3.9	154.7

NOTES:

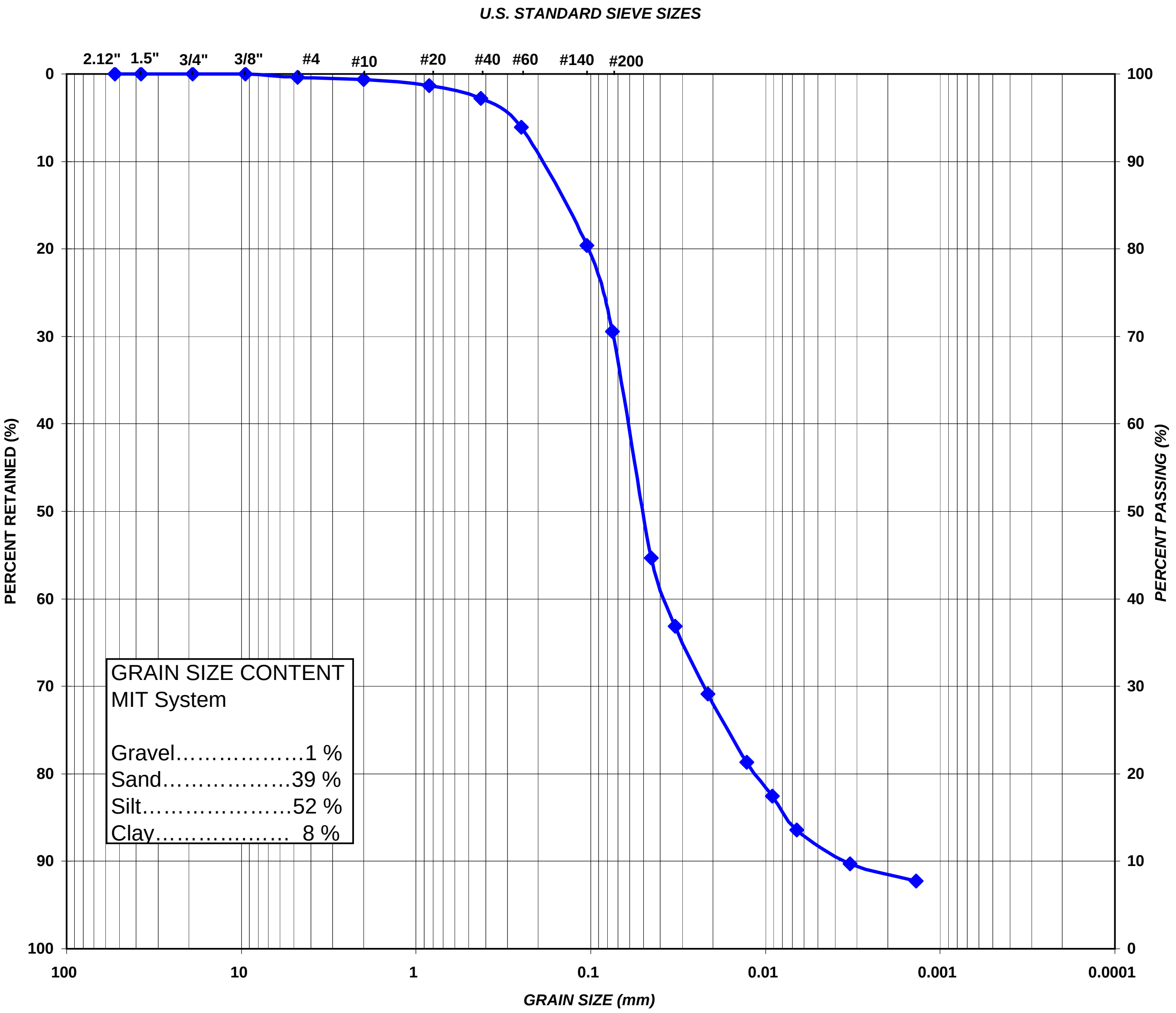
Borehole was open and water level at 3.0m upon completion of drilling.

Terraprobe

SIEVE AND HYDROMETER ANALYSIS
TEST REPORT

PROJECT:	**35 - 51 Troutbrooke Drive**	FILE NO.:	**1-09-4125**
LOCATION:	**Toronto, Ontario**	LAB NO.:	**1177B**
CLIENT:	**TRCA**	SAMPLE DATE:	**July 24, 2009**
BOREHOLE NUMBER:	**4**	SAMPLED BY:	**P.K.**
SAMPLE NUMBER:	**5**		
SAMPLE DEPTH:	**3 - 3.5 m**		
SAMPLE DESCRIPTION:	**SILT AND SAND, trace clay, trace gravel (Glacial Till)**		

GRAIN SIZE DISTRIBUTION



GRAIN SIZE CONTENT
MIT System

Gravel……………….1 %
Sand……………….39 %
Silt…………………52 %
Clay………………. 8 %

		COARSE	MEDIUM	FINE		
MIT SYSTEM	GRAVEL	SAND			SILT	CLAY

	COARSE	FINE	COARSE	MEDIUM	FINE	
UNIFIED SYSTEM	GRAVEL		SAND			SILT AND CLAY

Terraprobe Borehole Logs
(1991)

TERRAPROBE INC.

Terraprobe

LOG OF BOREHOLE 1

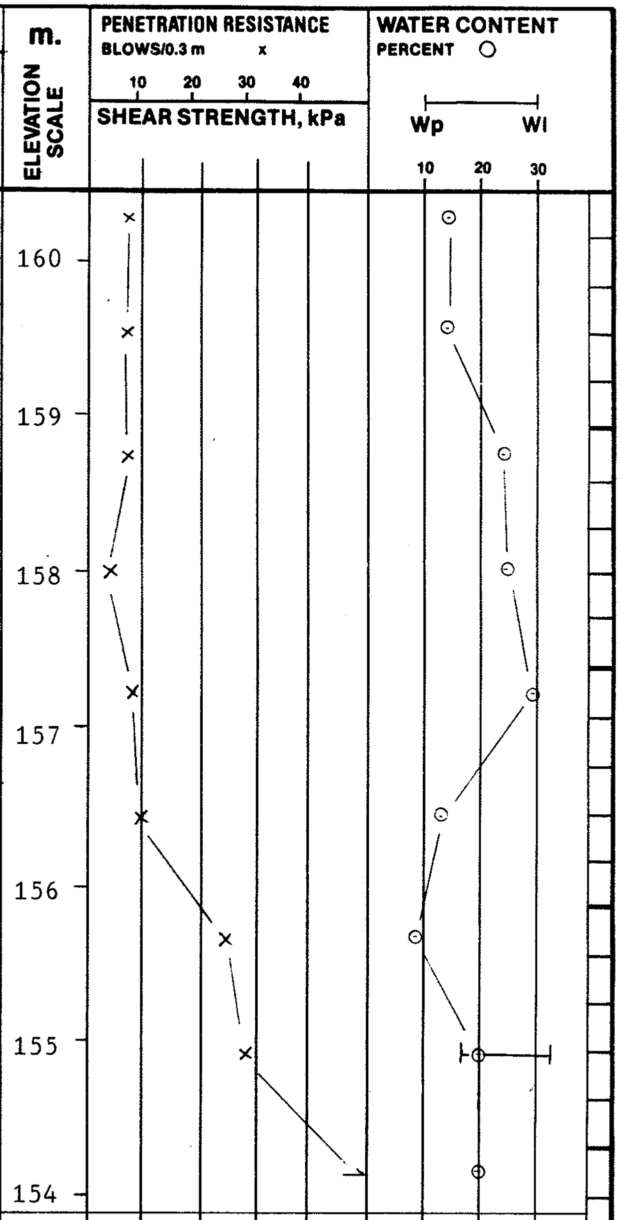
PROJECT: 49/51 Troutbrooke Dr.
LOCATION: North York
CLIENT: M.T.R.C.A.
DATE: July 15, 1991
EQUIPMENT: D-25 Auger
ELEVATION DATUM: Geodetic
FILE: 91161

STRATIGRAPHY

ELEV. DEPTH m.	DESCRIPTION
	Behind No. 51
160.4	**Ground Surface**
0.0	22 cm Topsoil Loose/ Firm Brown Moist **FILL** Clayey silt, some sand and gravel, trace organics Grey
156.7	
3.7	Compact Brown Moist **SILTY SAND TILL** some gravel, clay
155.2	
5.2	Hard Brown Moist **SILTY CLAY,** occasional silt seams
153.9	
6.5	End of Borehole

SAMPLES

NUMBER	TYPE	'N' VALUES
1	SS	8
2	SS	7
3	SS	7
4	SS	4
5	SS	9
6	SS	10
7	SS	24
8	SS	28
9	SS	65



NOTES:

1) Borehole dry on completion of drilling.

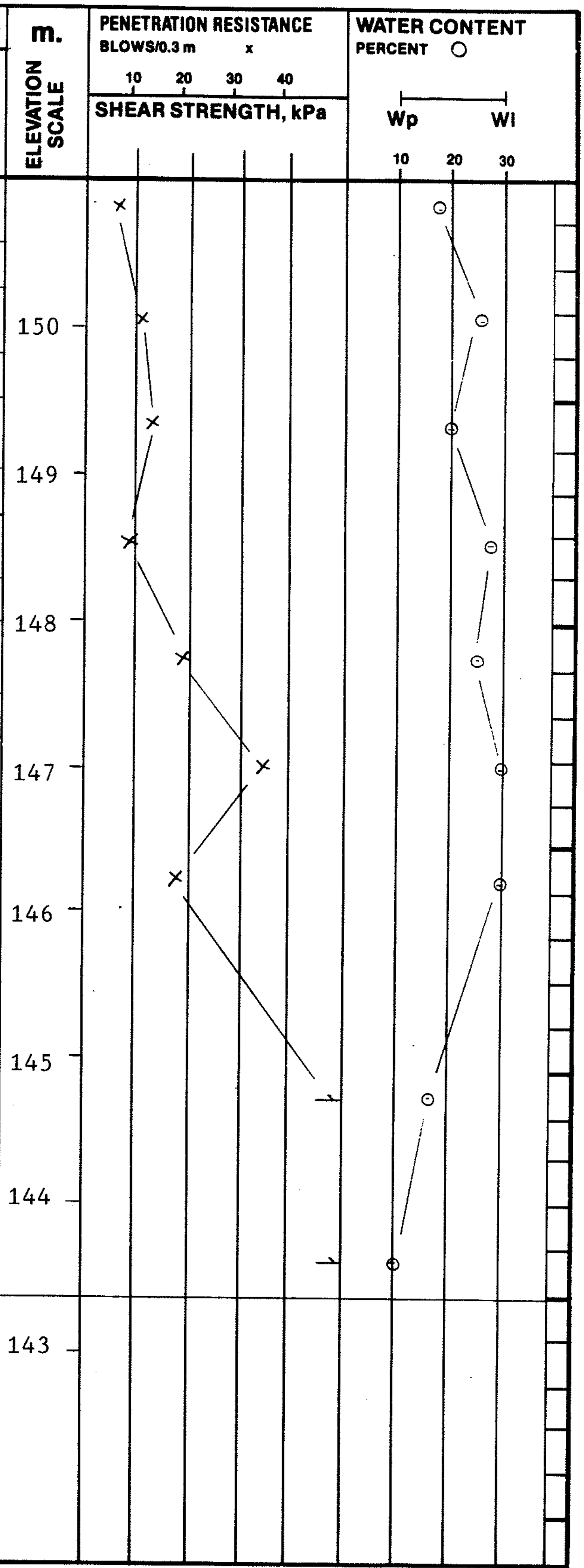
FORM TO-SL-101

Terraprobe

LOG OF BOREHOLE 2

PROJECT: 49/51 Troutbrooke Dr.
LOCATION: North York
CLIENT: M.T.R.C.A.
DATE: July 15, 1991
EQUIPMENT: TRIPOD, Nash Boring
ELEVATION DATUM: Geodetic
FILE: 91161

STRATIGRAPHY		SAMPLES		
ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
	On Lower Natural Slope			
151.0	**Ground Surface**			
0.0	Stiff to Very Stiff Brown Moist **SILTY CLAY,** occasional silt seams	1	SS	8
		2	SS	11
		3	SS	13
		4	SS	9
		5	SS	19
	fine sand seams	6	SS	34
		7	SS	18
145.4 ~~155.4~~ 5.6	Very Dense Brown Moist **SAND,** medium, some gravel, trace silt	8	SS	80
143.4		9	SS	115
7.6	End of Borehole			



NOTES:
1) Borehole dry on completion of drilling.

FORM TO-SL-101

Terraprobe

LOG OF BOREHOLE 3

PROJECT: 49/51 Troutbrooke Drive
LOCATION: North York
CLIENT: M.T.R.C.A.

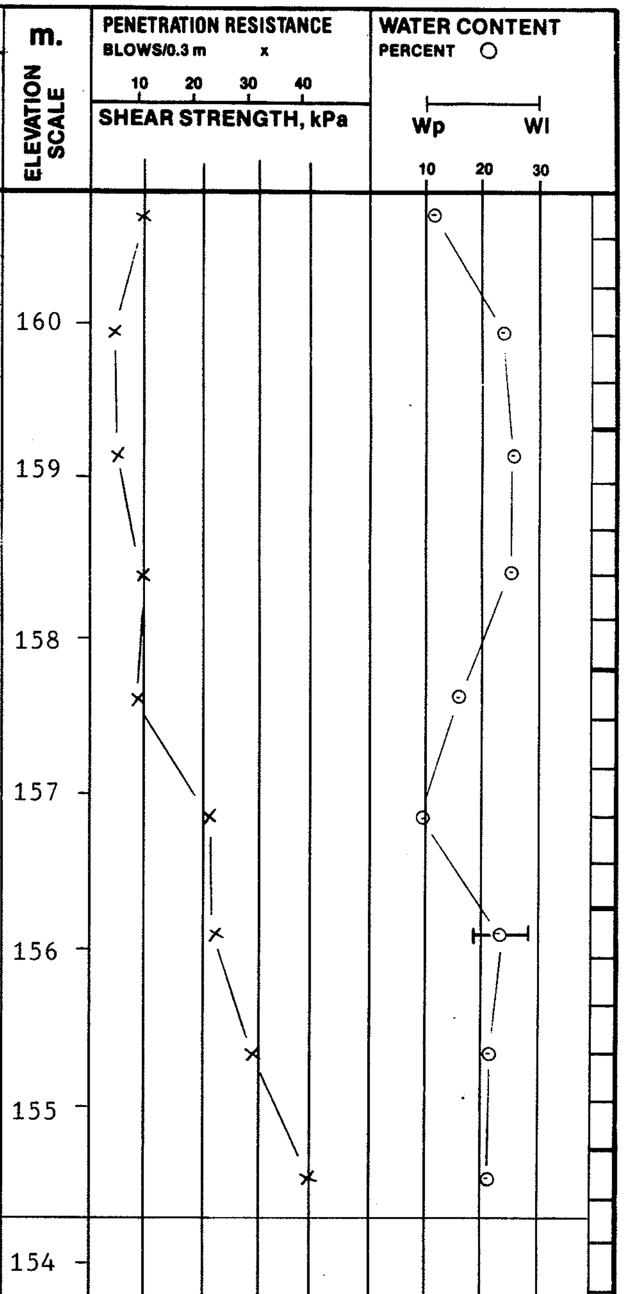
DATE: July 16, 1991
EQUIPMENT: D-25 Auger
ELEVATION DATUM: Geodetic
FILE: 91161

STRATIGRAPHY

ELEV. DEPTH m.	DESCRIPTION
160.8	Behind No. 49 **Ground Surface**
0.0 157.9	5 cm Topsoil Loose/ Brown/Grey Moist **FILL** Clayey silt, some sand and gravel, trace organics
2.9 156.4	Compact Brown Moist **SILTY SAND TILL** some gravel, clay
4.4 154.3	Very Stiff to Hard Brown Moist **SILTY CLAY** occasional seams of sand, silt
6.5	End of Borehole

SAMPLES

NUMBER	TYPE	'N' VALUES
1	SS	10
2	SS	4
3	SS	5
4	SS	10
5	SS	9
6	SS	21
7	SS	22
8	SS	29
9	SS	40



NOTES:

1) Borehole dry on completion of drilling.

FORM TO-SL-101

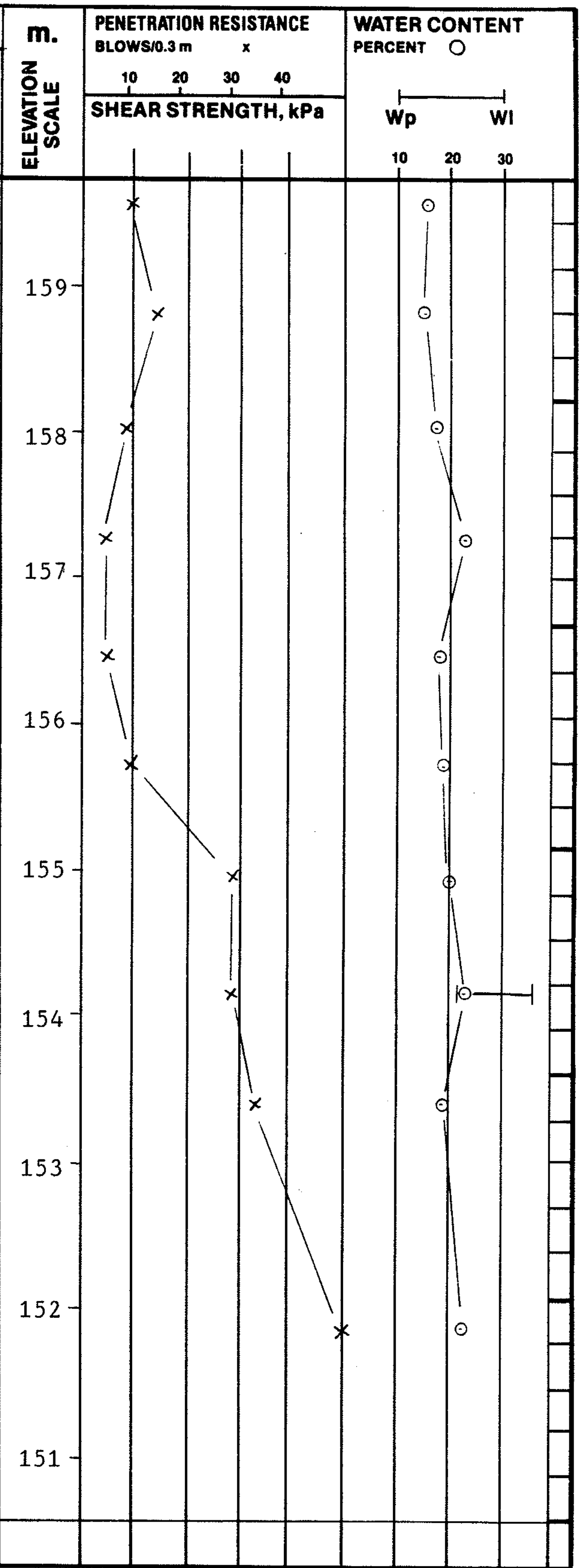
Terraprobe

LOG OF BOREHOLE 4

PROJECT: 49/51 Troutbrooke Drive
LOCATION: North York
CLIENT: M.T.R.C.A.

DATE: July 16, 1991
EQUIPMENT: D-25 Auger
ELEVATION DATUM: Geodetic
FILE: 91161

STRATIGRAPHY		SAMPLES		
ELEV. DEPTH m.	DESCRIPTION	NUMBER	TYPE	'N' VALUES
159.7	Through Failure Behind No. 49 **Ground Surface**			
0.0	Loose/Firm Brown Moist **FILL** Clayey silt, some sand and gravel, trace organics	1	SS	10
		2	SS	14
		3	SS	9
		4	SS	5
	Grey	5	SS	5
156.0 3.7	Compact Brown Moist **SILTY SAND TILL** some gravel, trace clay	6	SS	10
155.3 4.4	Very Stiff to Hard **SILTY CLAY** occasional silt seams	7	SS	29
		8	SS	29
		9	SS	33
	wet thin sand seams, 4 cm layers	10	SS	50
150.6 9.1	Continued...			



NOTES:

FORM TO-SL-101

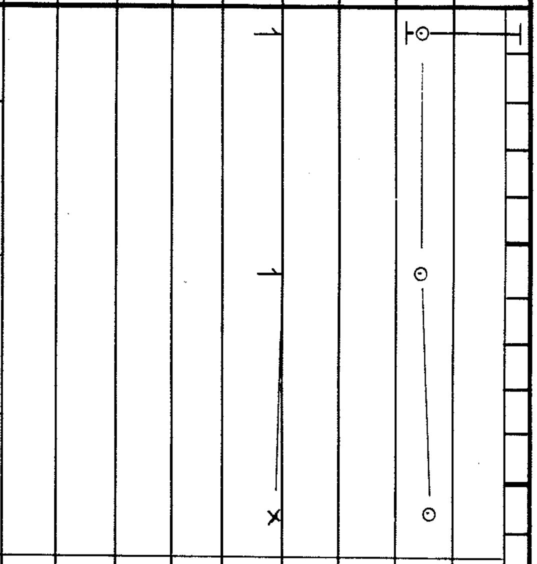
Terraprobe

LOG OF BOREHOLE 4 CON'T

PROJECT: 49/51 Troutbrooke Drive
LOCATION: North York
CLIENT: M.T.R.C.A.

DATE: July 16, 1991
EQUIPMENT: D-25 Auger
ELEVATION DATUM: Geodetic
FILE: 91161

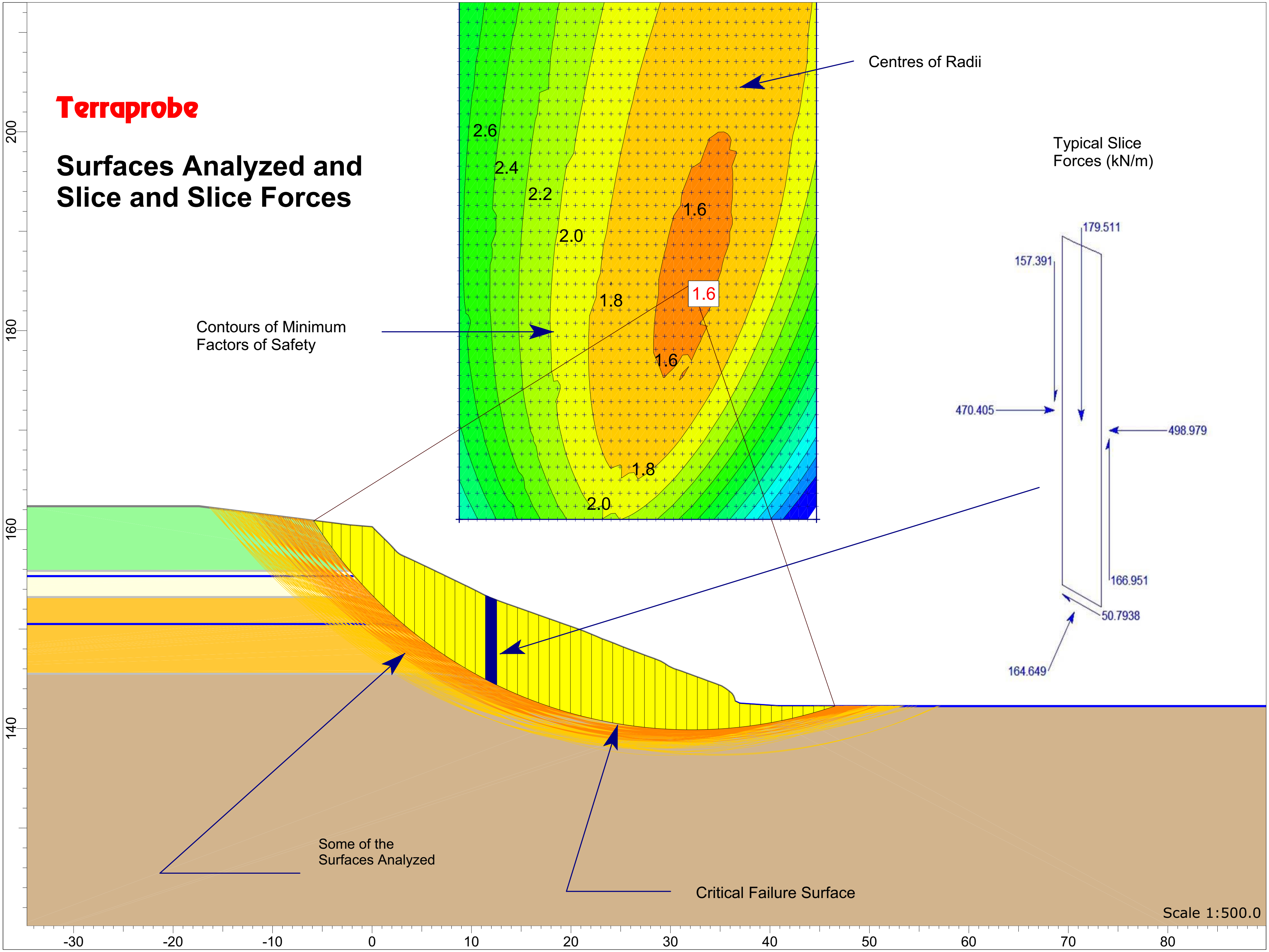
STRATIGRAPHY				SAMPLES			m.	PENETRATION RESISTANCE BLOWS/0.3 m x 10 20 30 40 SHEAR STRENGTH, kPa	WATER CONTENT PERCENT ○ Wp Wl 10 20 30
ELEV. DEPTH m.	DESCRIPTION	STRAT. PLOT	GROUND WATER	NUMBER	TYPE	'N' VALUES	ELEVATION SCALE		
150.6	Continued								
9.1	Hard SILTY CLAY with sand seams and 5 cm thick layers Moist Brown Grey			11	SS	84	150		
				12	SS	54	149		
147.1				13	SS	49	148		
12.6	End of Borehole						147		

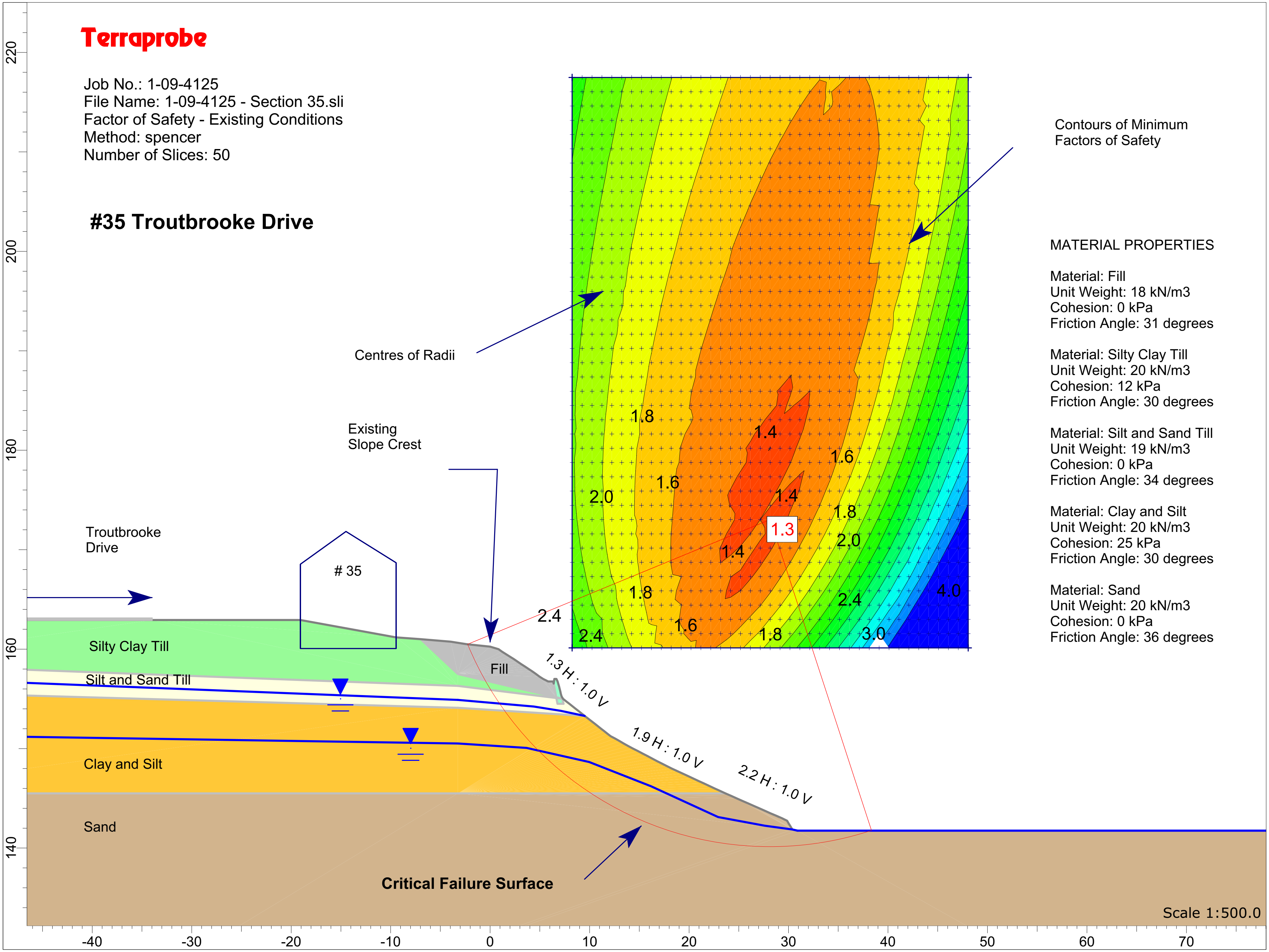


NOTES:

Slope Stability Analysis - Results, Typical Analysis, and Slice and Slice Forces

TERRAPROBE INC.


Terraprobe
Surfaces Analyzed and Slice and Slice Forces
Centres of Radii
2.6
2.4
2.2
2.0
1.8
1.6
1.6
1.6
1.8
2.0
Contours of Minimum Factors of Safety
Typical Slice Forces (kN/m)
179.511
157.391
470.405
498.979
166.951
50.7938
164.649
Some of the Surfaces Analyzed
Critical Failure Surface
Scale 1:500.0
200
180
160
140
-30
-20
-10
0
10
20
30
40
50
60
70
80



Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 35.sli
Factor of Safety - Existing Conditions
Method: spencer
Number of Slices: 50

#35 Troutbrooke Drive

MATERIAL PROPERTIES

Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

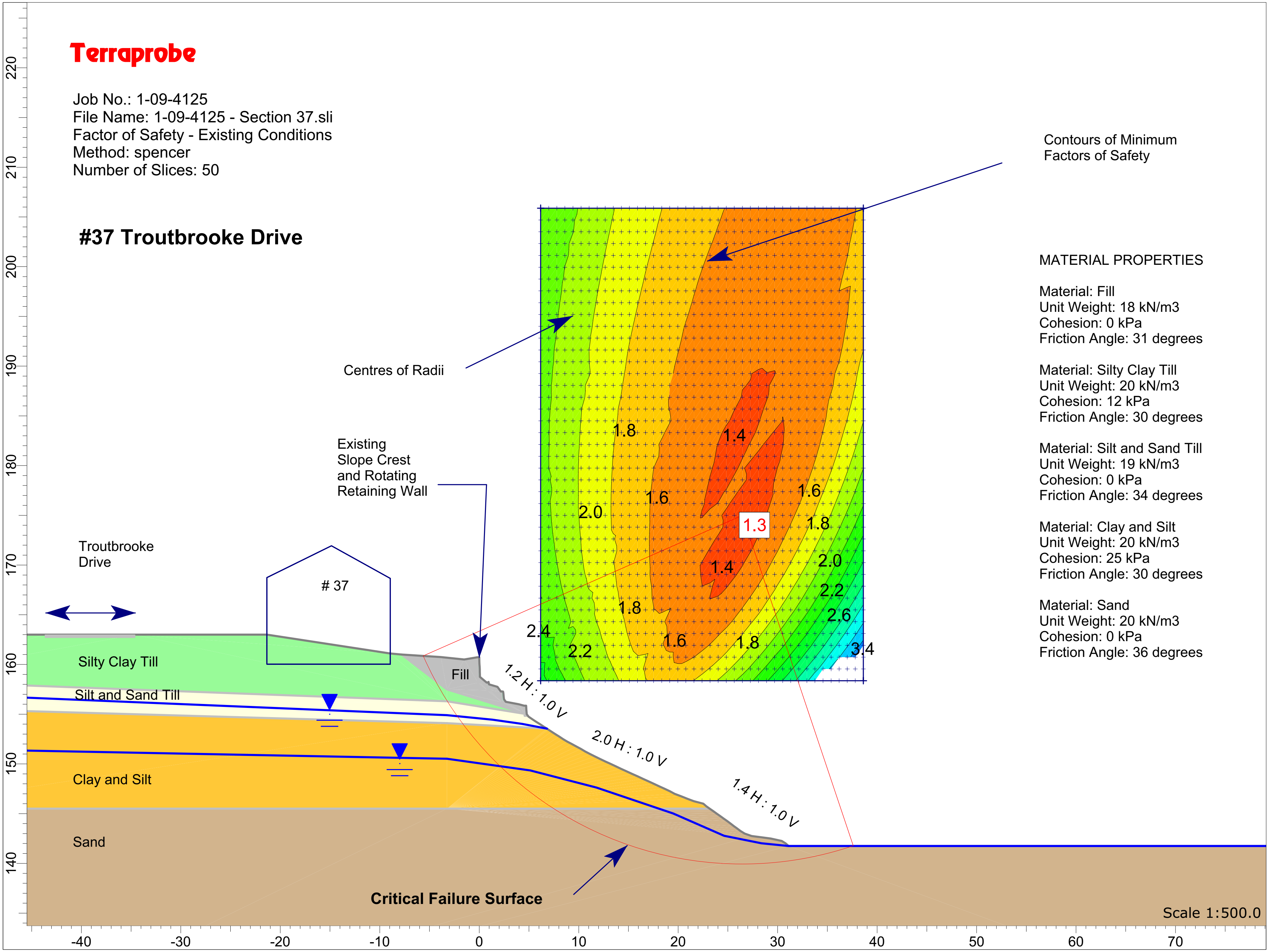
Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees

Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 37.sli
Factor of Safety - Existing Conditions
Method: spencer
Number of Slices: 50

#37 Troutbrooke Drive



MATERIAL PROPERTIES

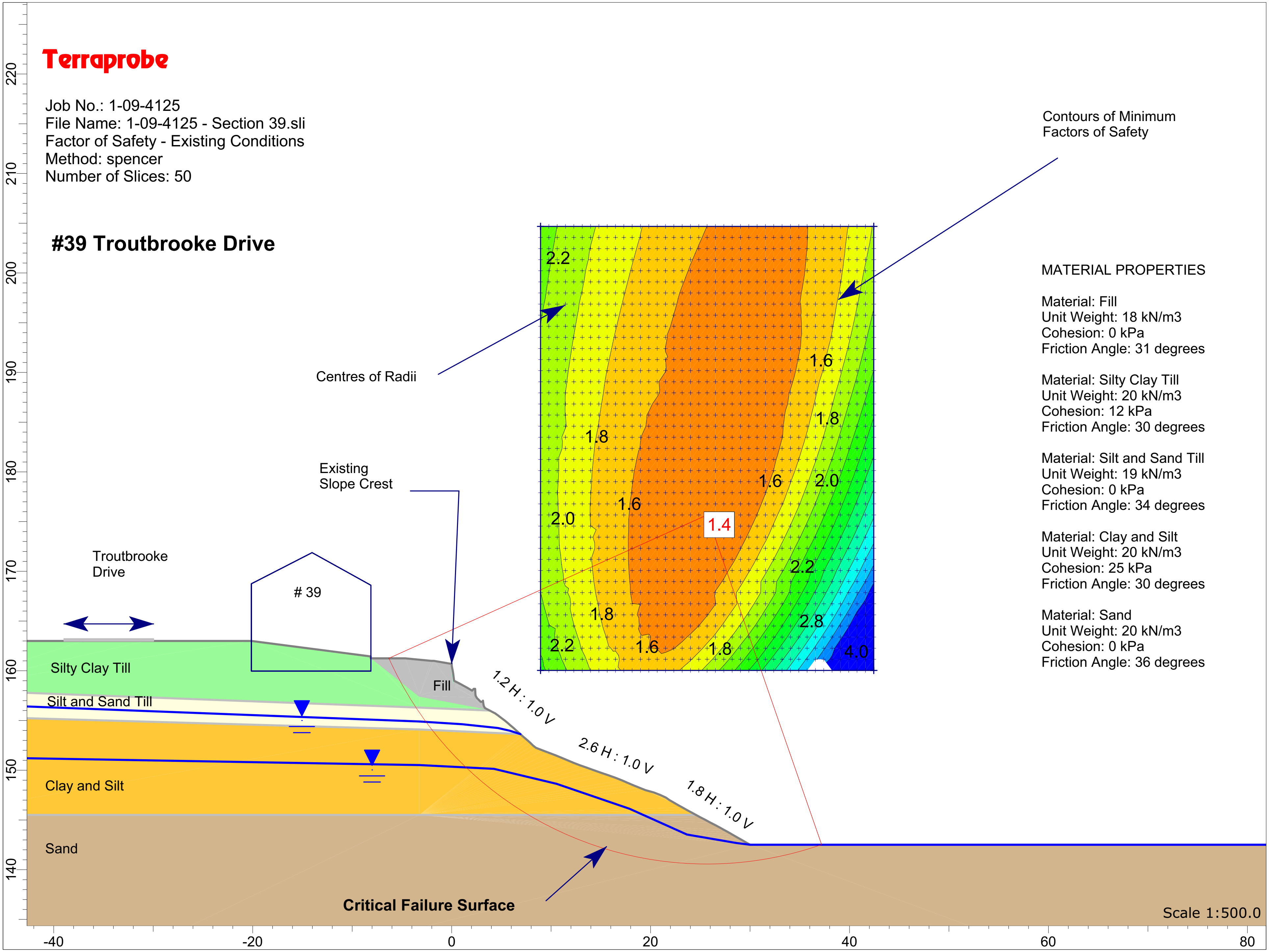
Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees



Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 39.sli
Factor of Safety - Existing Conditions
Method: spencer
Number of Slices: 50

#39 Troutbrooke Drive

MATERIAL PROPERTIES

Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

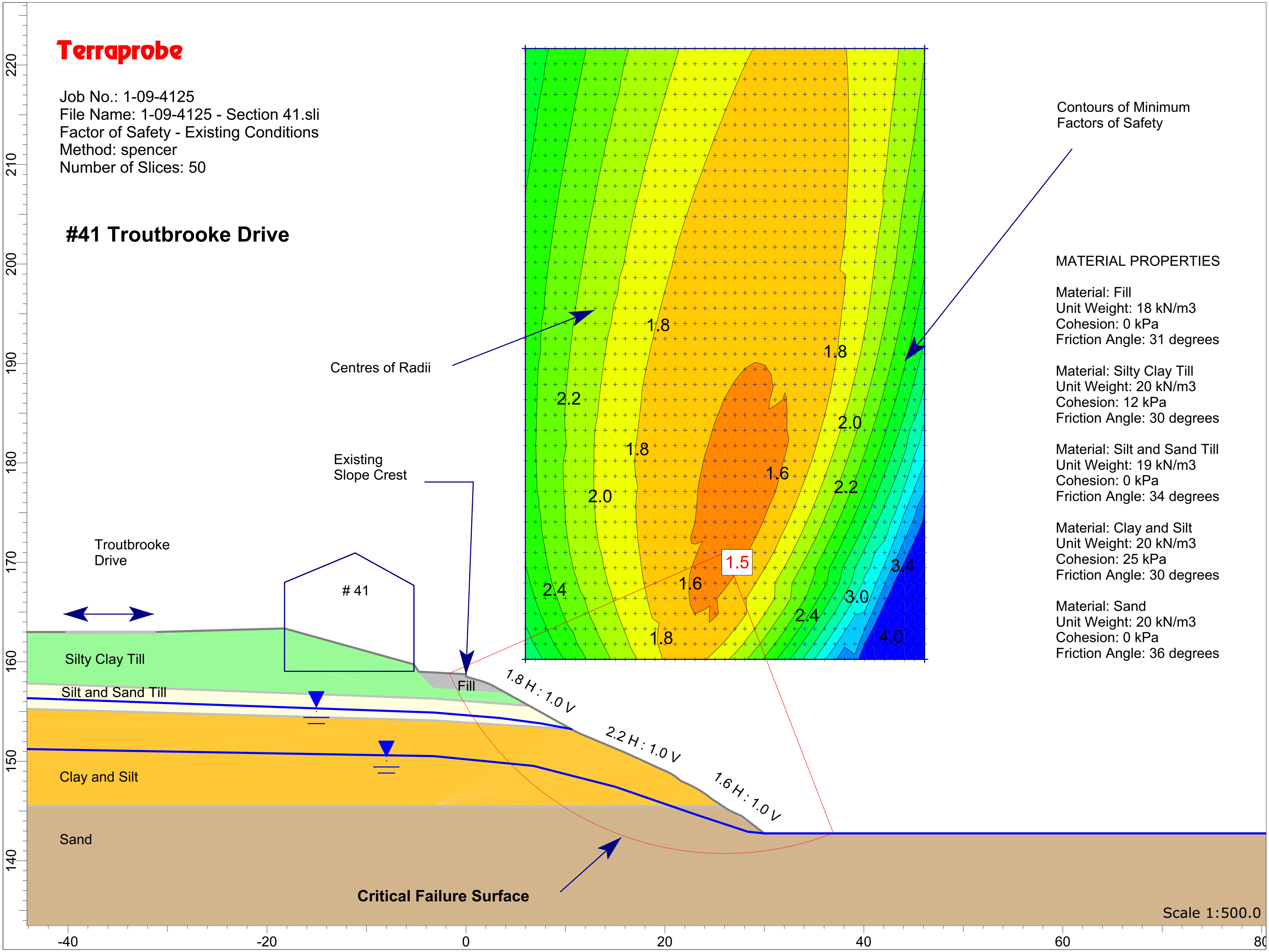
Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees

Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 41.sli
Factor of Safety - Existing Conditions
Method: spencer
Number of Slices: 50

#41 Troutbrooke Drive



MATERIAL PROPERTIES

Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

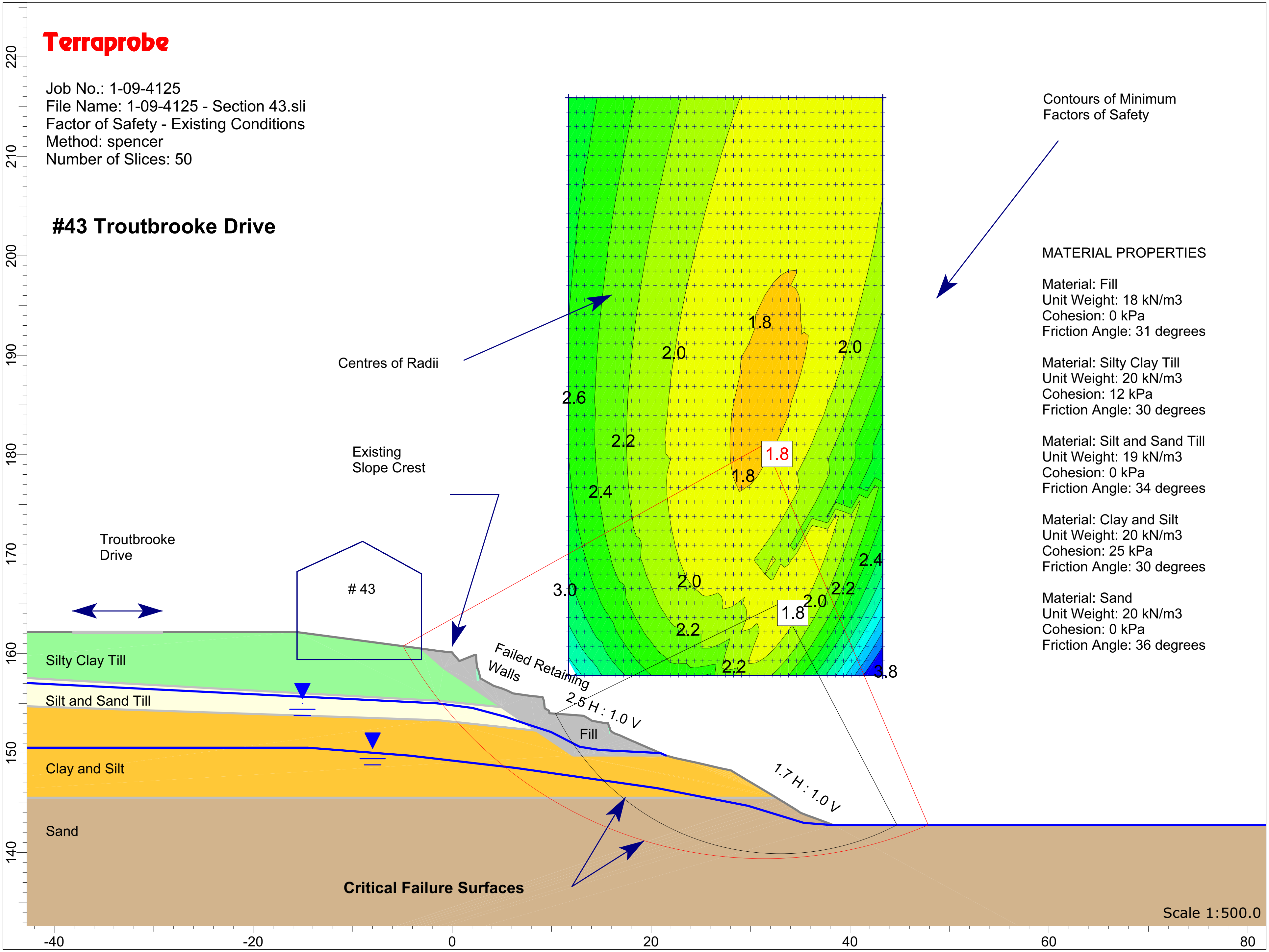
Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees

Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 43.sli
Factor of Safety - Existing Conditions
Method: spencer
Number of Slices: 50

#43 Troutbrooke Drive



MATERIAL PROPERTIES

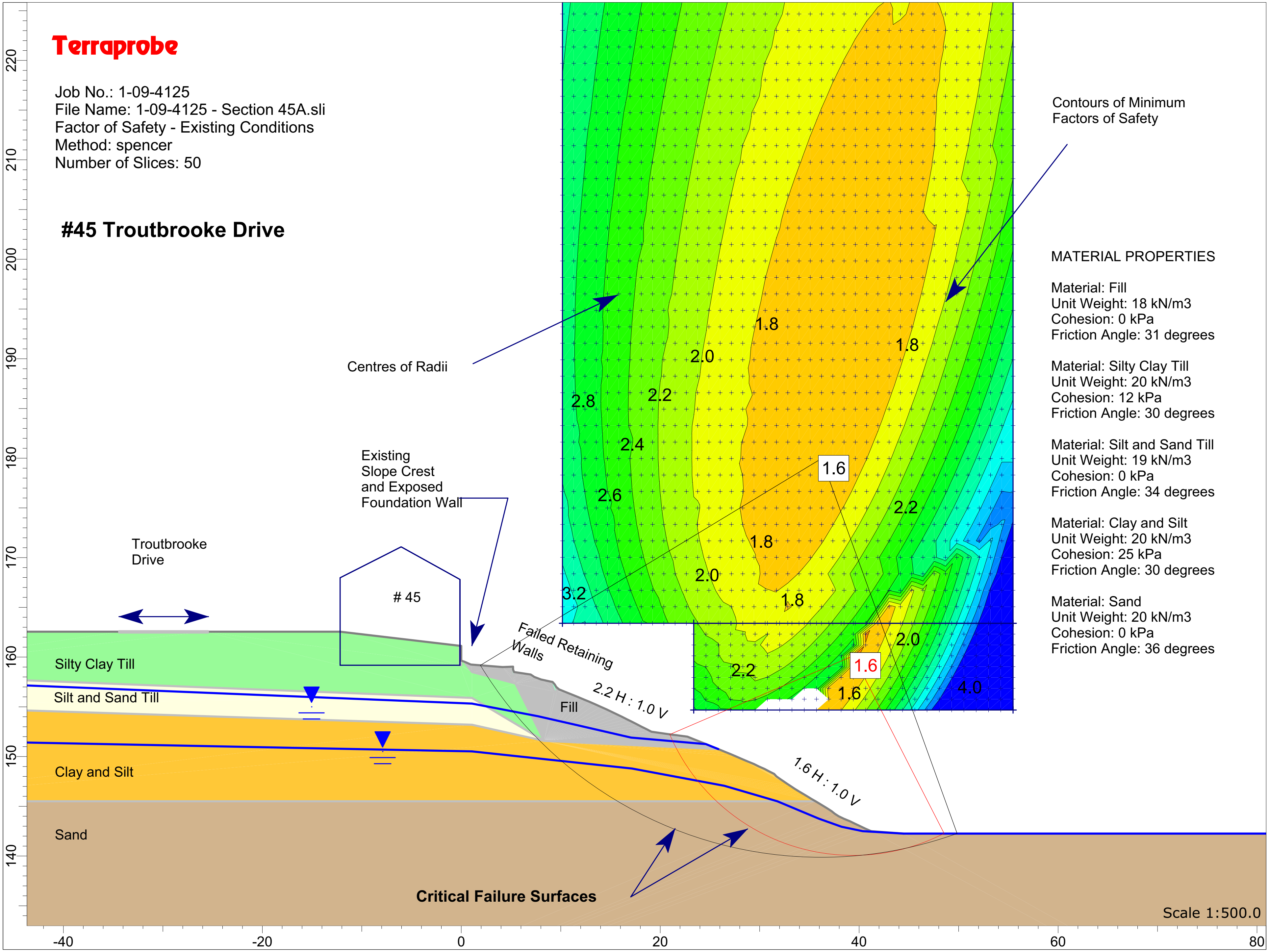
Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees



Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 45A.sli
Factor of Safety - Existing Conditions
Method: spencer
Number of Slices: 50

#45 Troutbrooke Drive

MATERIAL PROPERTIES

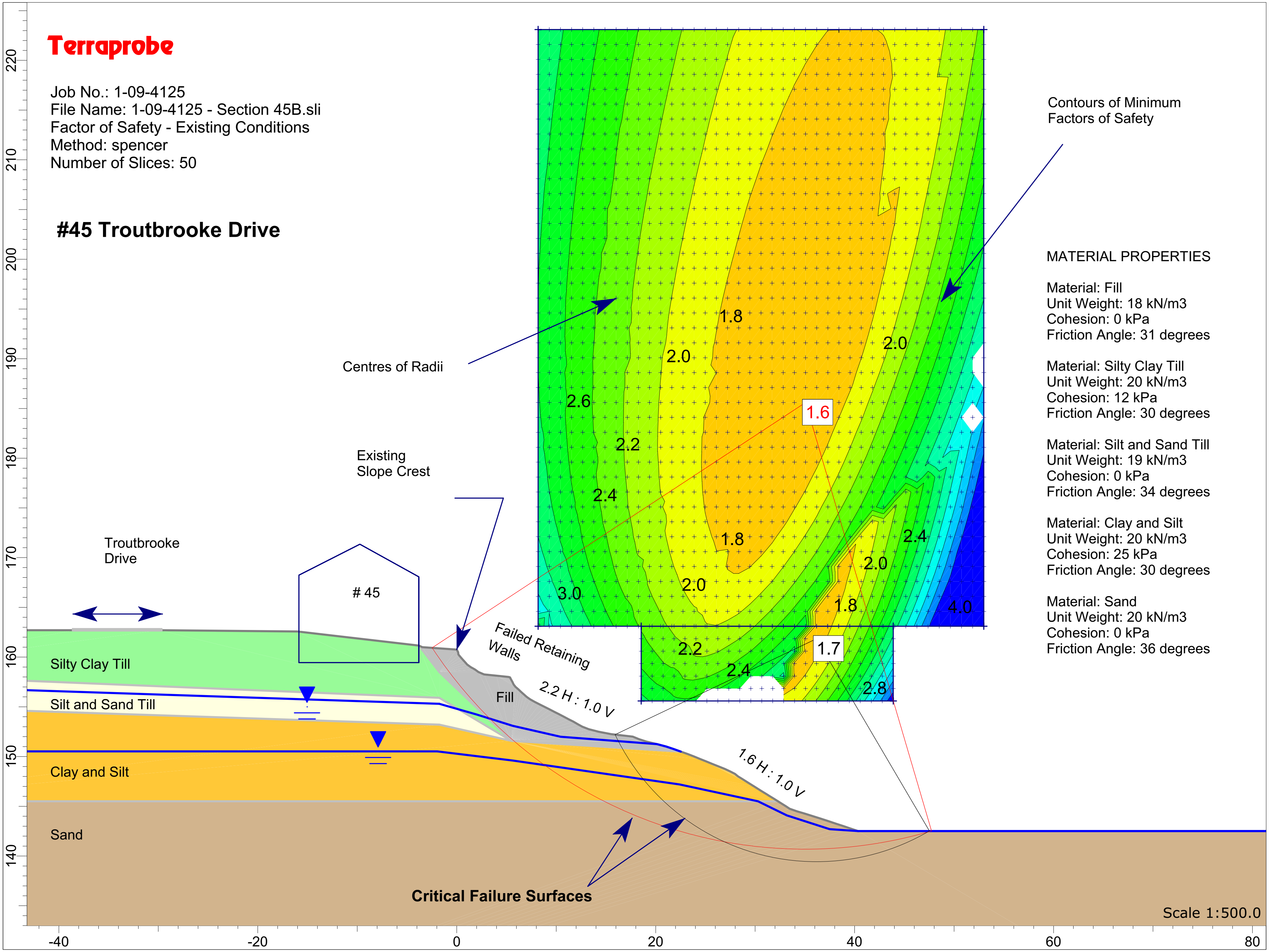
Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees



Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 45B.sli
Factor of Safety - Existing Conditions
Method: spencer
Number of Slices: 50

#45 Troutbrooke Drive

MATERIAL PROPERTIES

Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

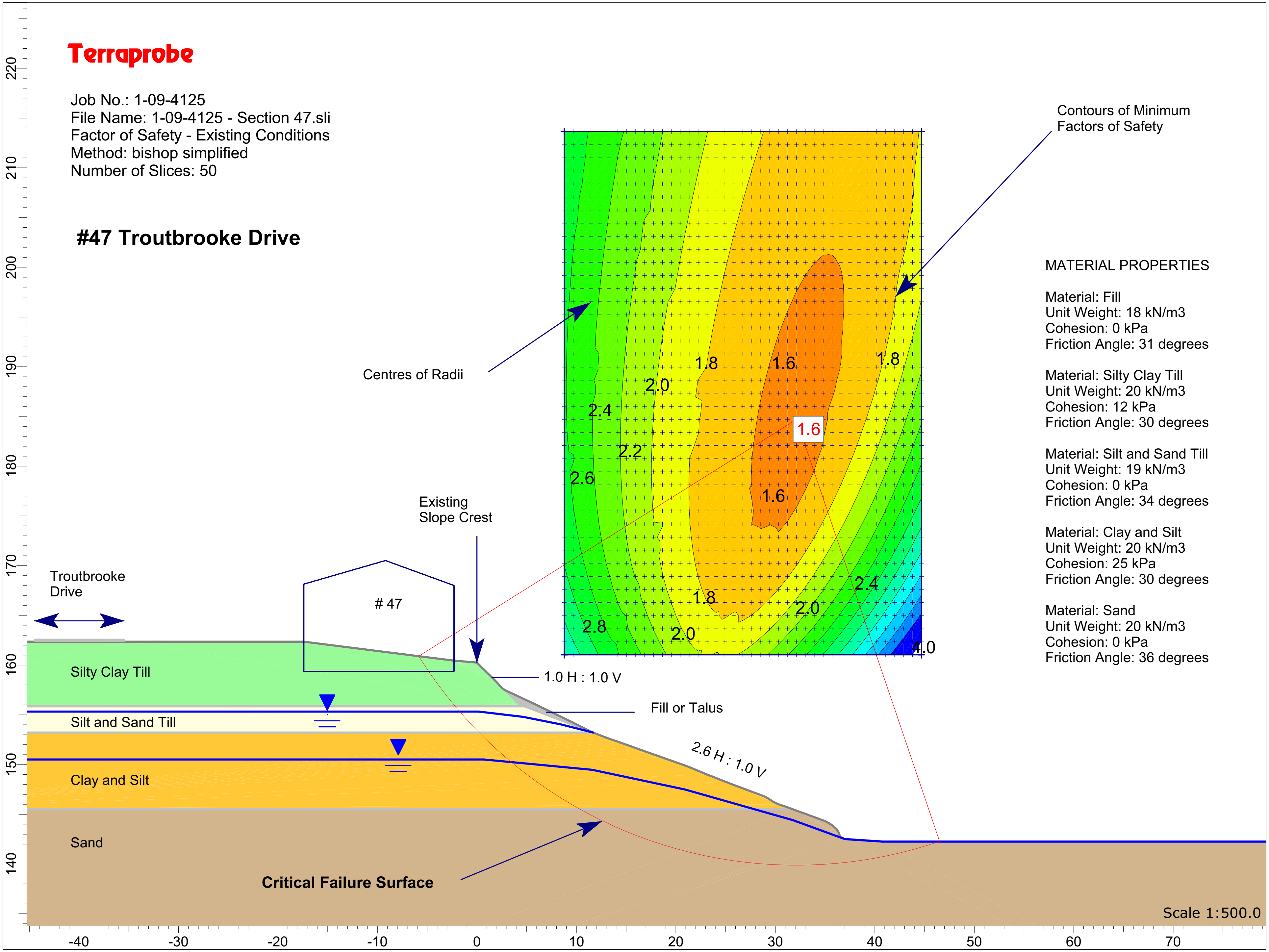
Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees

Scale 1:500.0

Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 47.sli
Factor of Safety - Existing Conditions
Method: bishop simplified
Number of Slices: 50

#47 Troutbrooke Drive



MATERIAL PROPERTIES

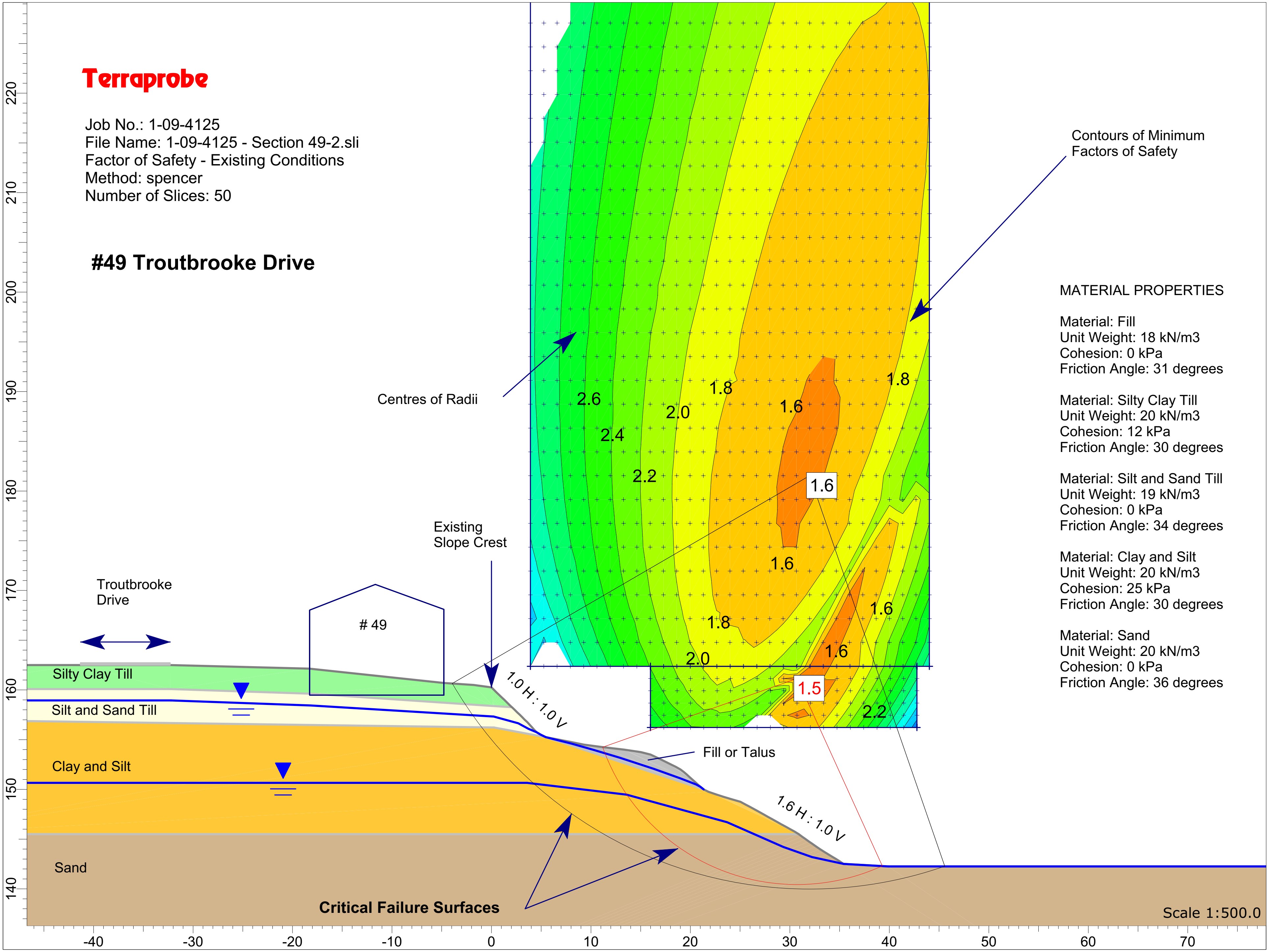
Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees



Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 49-2.sli
Factor of Safety - Existing Conditions
Method: spencer
Number of Slices: 50

#49 Troutbrooke Drive

MATERIAL PROPERTIES

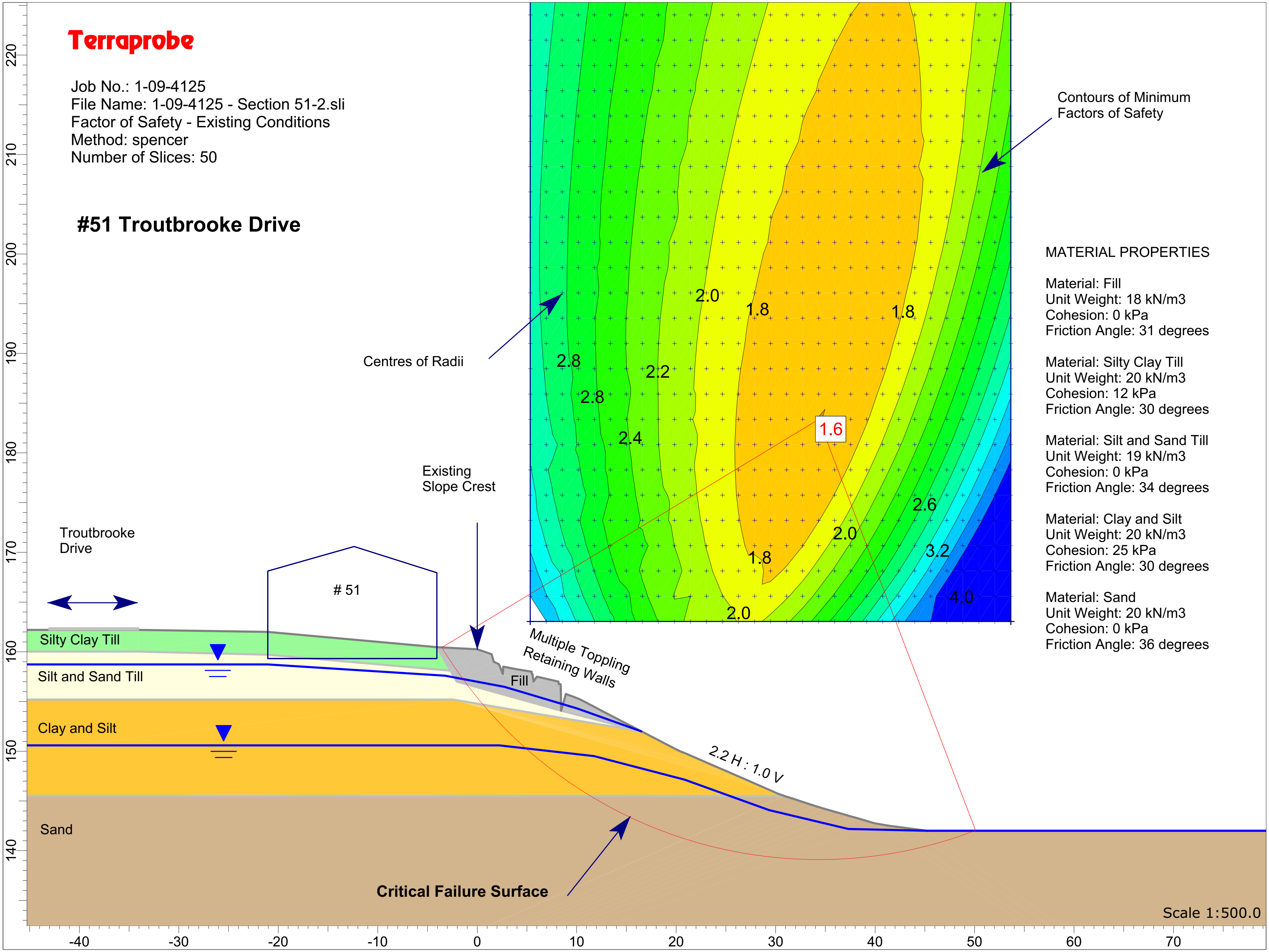
Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees



Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 51-2.sli
Factor of Safety - Existing Conditions
Method: spencer
Number of Slices: 50

#51 Troutbrooke Drive

MATERIAL PROPERTIES

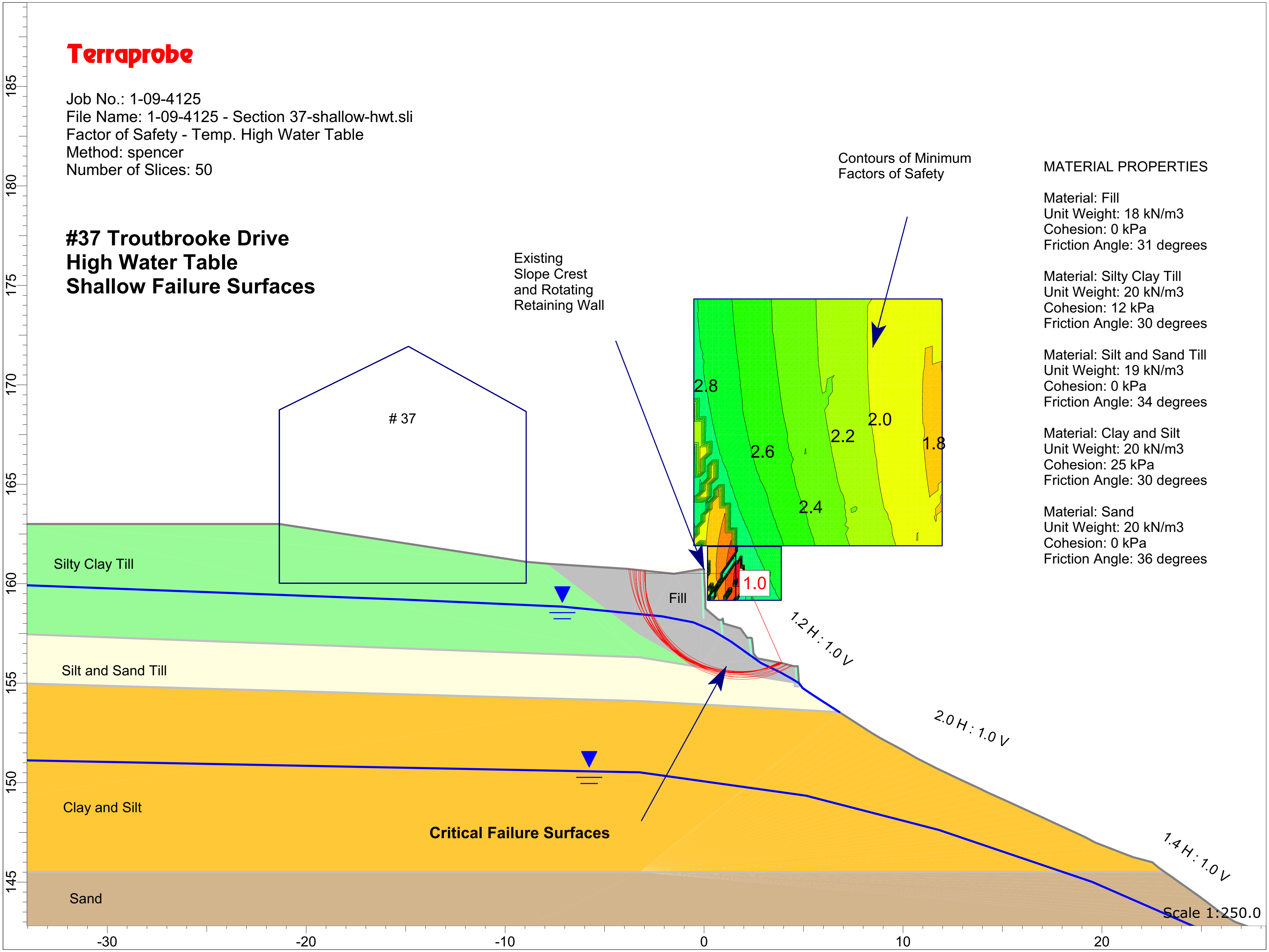
Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees



Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 37-shallow-hwt.sli
Factor of Safety - Temp. High Water Table
Method: spencer
Number of Slices: 50

#37 Troutbrooke Drive
High Water Table
Shallow Failure Surfaces

MATERIAL PROPERTIES

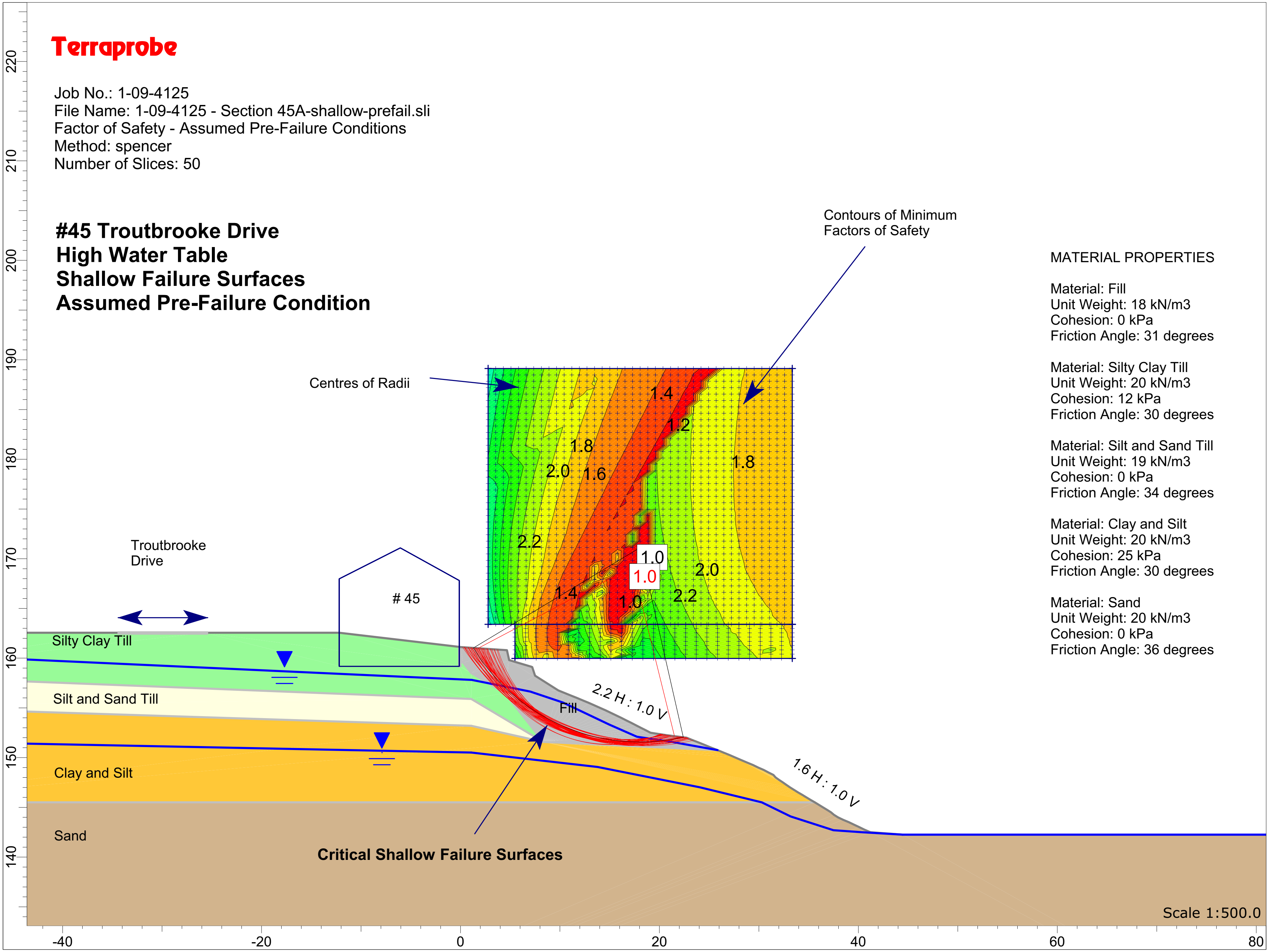
Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees



Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 45A-shallow-prefail.sli
Factor of Safety - Assumed Pre-Failure Conditions
Method: spencer
Number of Slices: 50

#45 Troutbrooke Drive
High Water Table
Shallow Failure Surfaces
Assumed Pre-Failure Condition

MATERIAL PROPERTIES

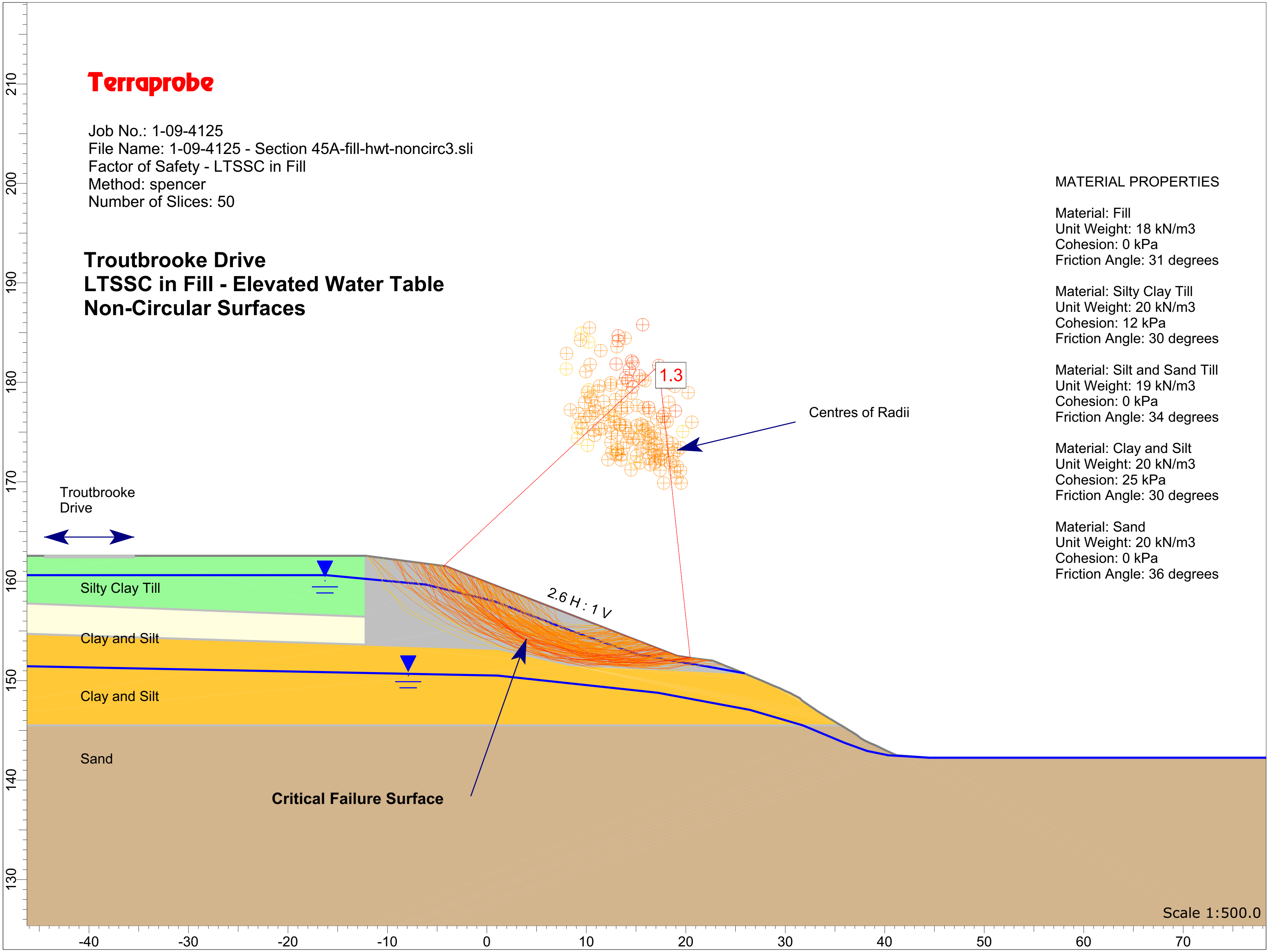
Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees



Terraprobe

Job No.: 1-09-4125
File Name: 1-09-4125 - Section 45A-fill-hwt-noncirc3.sli
Factor of Safety - LTSSC in Fill
Method: spencer
Number of Slices: 50

Troutbrooke Drive
LTSSC in Fill - Elevated Water Table
Non-Circular Surfaces

MATERIAL PROPERTIES

Material: Fill
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
Friction Angle: 31 degrees

Material: Silty Clay Till
Unit Weight: 20 kN/m3
Cohesion: 12 kPa
Friction Angle: 30 degrees

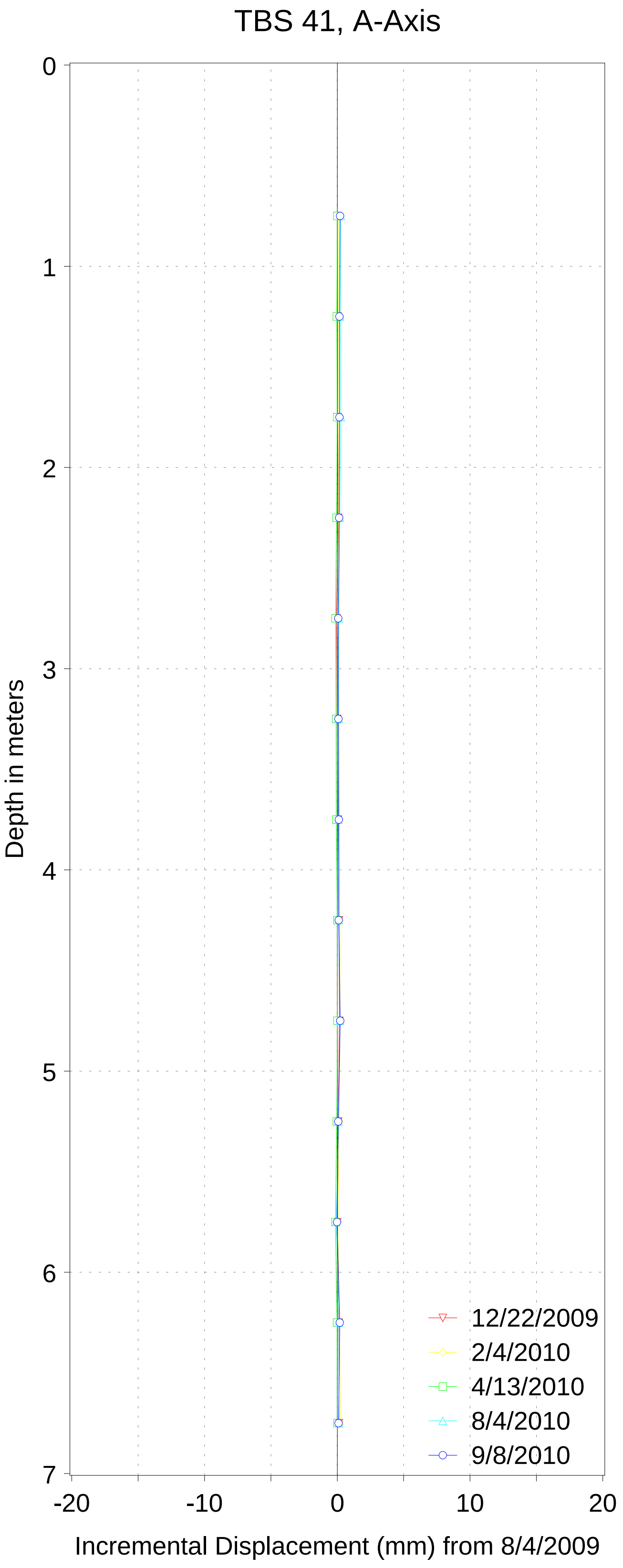
Material: Silt and Sand Till
Unit Weight: 19 kN/m3
Cohesion: 0 kPa
Friction Angle: 34 degrees

Material: Clay and Silt
Unit Weight: 20 kN/m3
Cohesion: 25 kPa
Friction Angle: 30 degrees

Material: Sand
Unit Weight: 20 kN/m3
Cohesion: 0 kPa
Friction Angle: 36 degrees

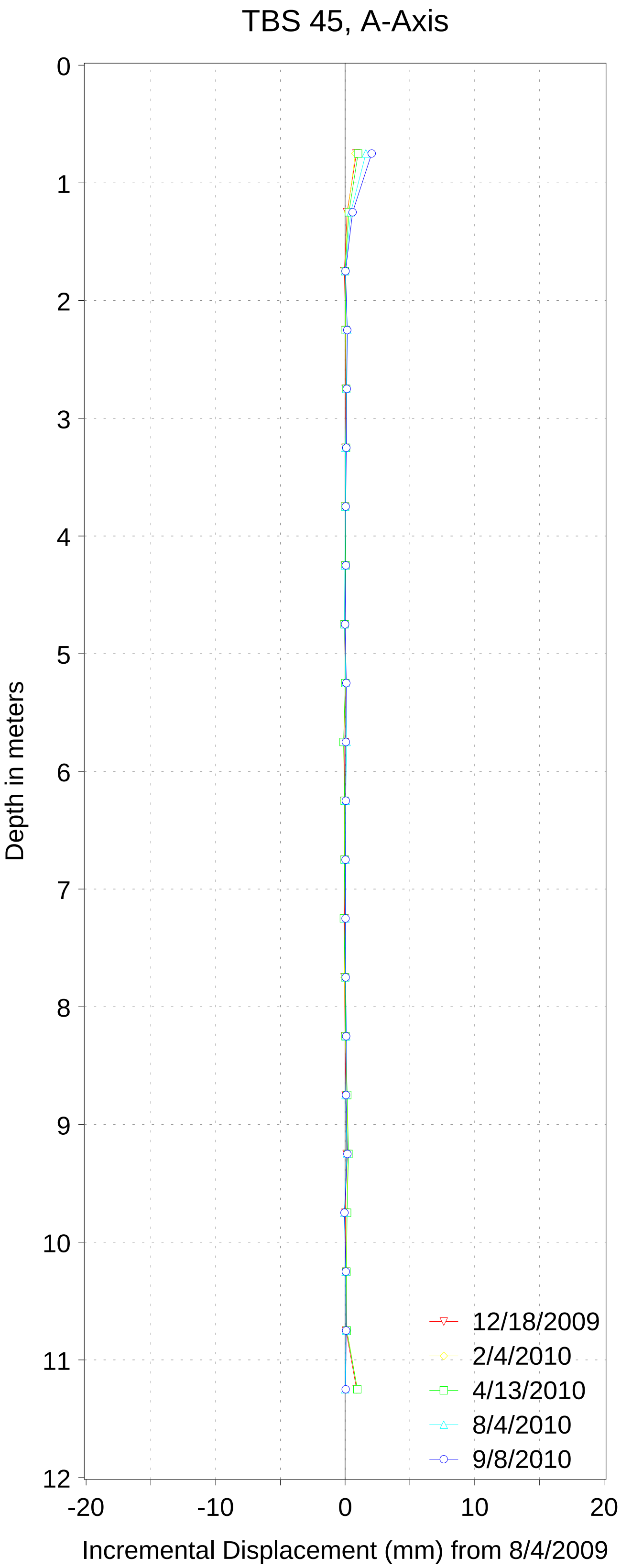
Slope Inclinometer Monitoring Results

TERRAPROBE INC.



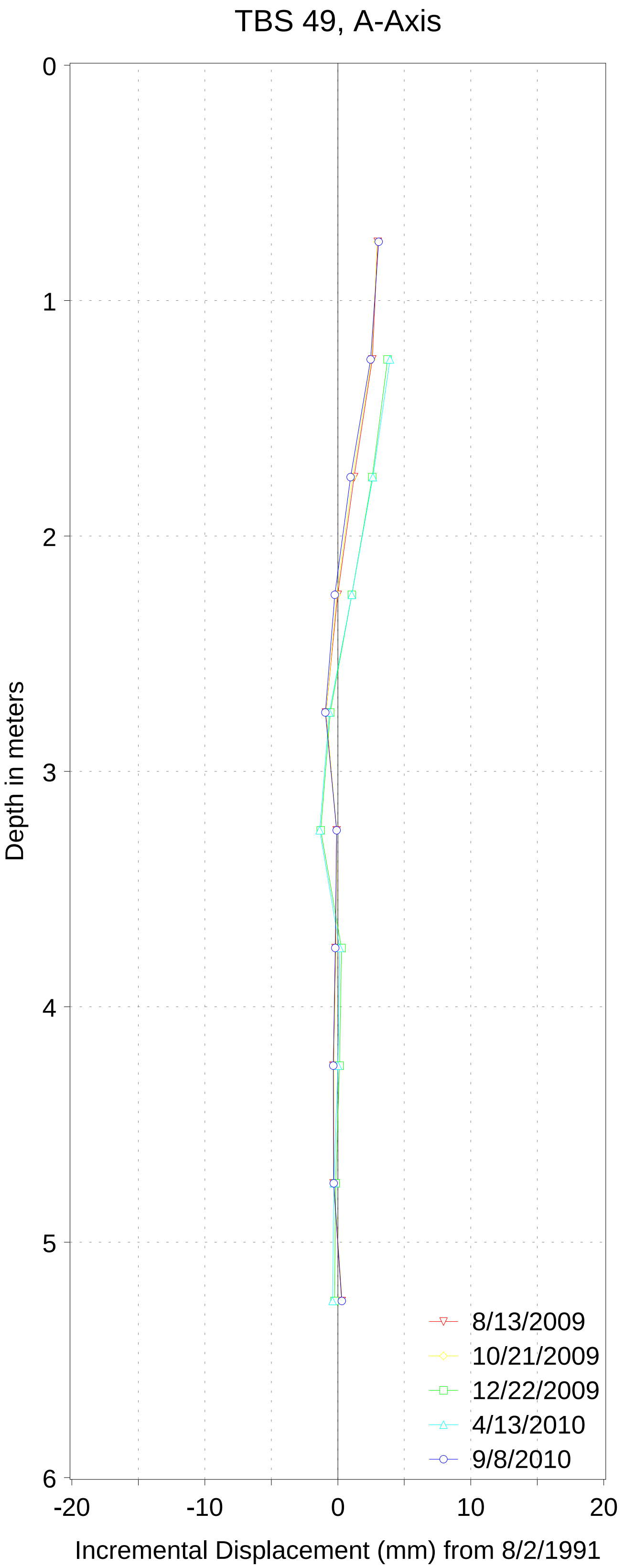
Terraprobe

File No. 1-09-4125
Troutbrooke Drive



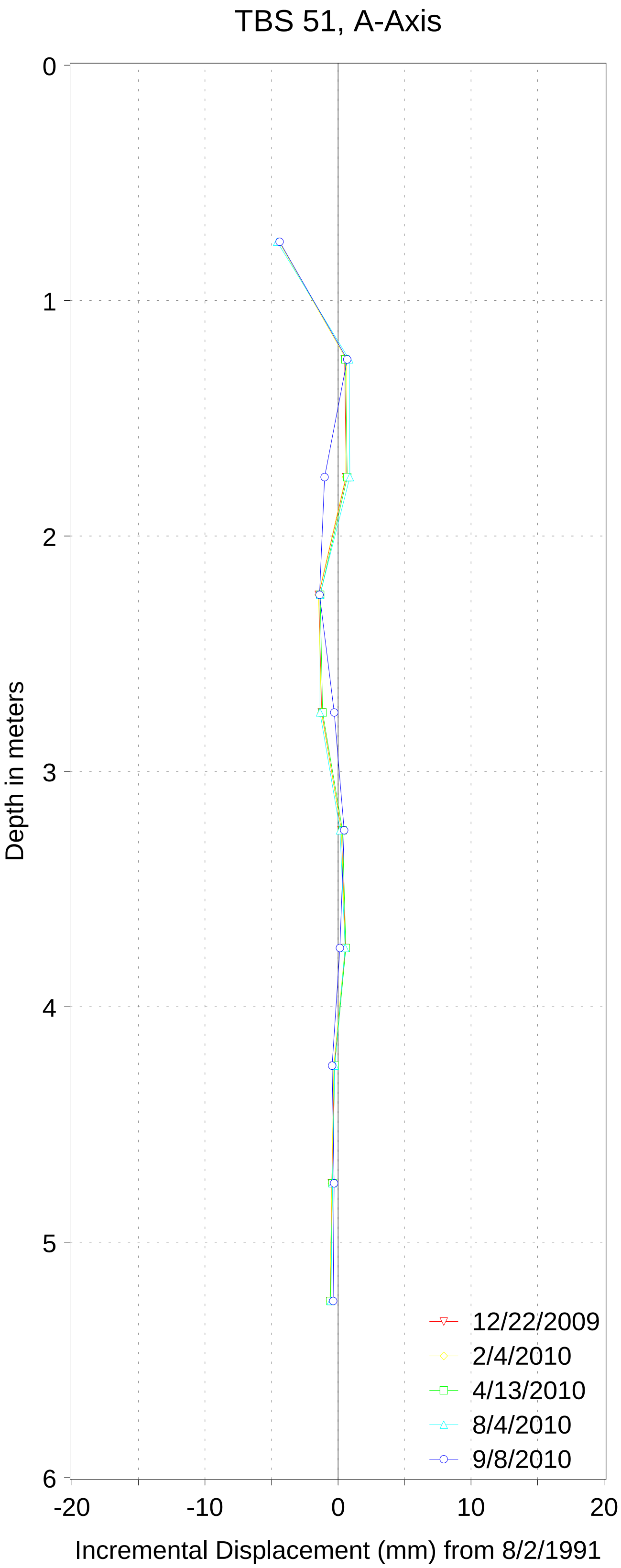
Terraprobe

File No. .1-09-4125
Troutbrooke Drive



Terraprobe

File No. 1-09-4125
Troutbrook Drive



Terraprobe

File No. 1-09-4125
Troutbrooke Drive

Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

REPORT NO. 2
TROUTBROOKE STABILIZATION PROJECT
35 TO 51 TROUTBROOKE DRIVE
TORONTO, ONTARIO

Prepared for: Toronto and Region Conservation Authority
5 Shoreham Drive
Toronto (Downsview), Ontario
M3N 1S4

Attention: Laura Stephenson

File No. 1-10-5216
April 1, 2011

Distribution:

5 Copies	-	Toronto and Region Conservation Authority
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TABLE OF CONTENTS

ATTACHMENTS

1. INTRODUCTION

Terraprobe Inc. was retained by Toronto and Region Conservation Authority (TRCA) to carry out the final design of the remedial erosion control and slope stabilization works for 35 to 51 Troutbrooke Drive in Toronto, Ontario. Terraprobe recently completed a slope stability assessment for the site (Terraprobe No. 1-09-4125, dated October 6,2010).

The purpose of this study was to initially develop three alternative options (including 'do nothing'), and then based on feedback from the Community Liaison Committee, municipal bodies and the TRCA, develop a final design. This Report No. 2 provides an update to Report No. 1 and includes a review of the existing project information, provides a summary of the results of additional field works and findings, and presents the revisions to the four preliminary alternatives for remedial measures.

2. SITE & PROJECT DESCRIPTION

2.1 General

The site is generally located east of Jane Street and north of Wilson Avenue, along the southern bank of the Black Creek. The section of the site for this project was immediately north of Troutbrooke Drive, which for the purposes of this report will be identified as running east-west. The section of the slope examined for this study is bounded by Troutbrooke Drive to the south, Black Creek at the base of the ravine to the north, and by #51 Troutbrooke Drive to the west and #35 Troutbrooke Drive to the east. The subject nine (9) properties back directly onto the crest of the slope of the ravine. A site location plan is provided as **Figure 1**. Air photographs taken in 2009 and 2001 are provided as **Figures 2A and 2B**. Existing two-storey dwellings are located adjacent to the slope crest at 51 through 35 Troutbrooke Drive (9 dwellings). The properties are all about 12 to 15 m wide (east to west). The creek valley slope is about 18 m high and the slope crest is located from 2 to 10 m behind the existing dwellings. It is understood from existing mapping that the private properties all extend part way down the slope, some 12 to 18 m beyond / behind the dwellings. There are numerous make-shift retaining walls along and below the slope crest.

Terraprobe recently completed a slope stability assessment for the site (Terraprobe No. 1-09-4125, dated October 6,2010). Based on the Terraprobe report, a Class Environmental Assessment was initiated to address the final remedial design work for erosion control and slope stabilization.

2.2 Previous Studies

It is understood that the residential development at this portion of Troutbrooke Drive was completed some time after 1962. Records indicate that there was a slope failure behind #71 to 63 Troutbrooke Drive in 1966. It is understood that there has been a history of instability ever since the residential development was constructed.

2.2.1 Studies from 1991 to 1995

Terraprobe was retained by the MRTCA in 1991 to conduct a geotechnical investigation of a slope failure along the crest behind the dwellings at #51 and #49 Troutbrooke Drive (Terraprobe file no. 91161, dated October 21, 1991). The failure occurred on April 25, 1991. The investigation found that the slope failure had taken place through earth fill which had been previously (1962 to 1991) dumped over the natural slope face. Numerous make-shift retaining walls (timber and sheet metal) had been erected to contain the fill materials. Slope stability analysis concluded that the failure was triggered by a combination of wet weather, unstable fill and unstable retaining walls. The analyses indicated that the dwellings had not been affected by the failure and that the houses seemed safe from further instability, although it was reported that there was a significant risk of additional slope slides within the slope fill near the crest. The report recommended some stabilization measures. Slope inclinometer casing was installed in boreholes on the slope crest behind 51 and 49 Troutbrooke Drive to facilitate monitoring of possible ground movements. These inclinometer casings are still in existence and are being monitored by Terraprobe.

Terraprobe examined a series of historical air photographs for this area. The 1962 air photo indicated some filling on the slope crest prior to the construction of the dwellings. In 1968, the photograph indicated that the houses were constructed and occupied, with the presence of retaining walls and filling along the slope crest. The air photos also indicated that the position of the original slope crest, prior to 1962, was estimated to be about 10 to 15 m south of its position in 1991. Therefore, it is believed that some filling was carried out over the slope crest and face to create a flat and level area for the dwellings and the rear yards. It is understood that the residents have continued filling their property beyond the slope crest to maintain a flat and level rear yard area, resulting in a steepened inclination within the upper slope fill, while the lower natural slope has a much flatter inclination.

Terraprobe wrote a follow-up report (Terraprobe File No. 91161, dated April 21, 1992), after it was reported that the homeowner of the dwelling at 51 Troutbrooke Drive had noticed cracking in the interior walls. The inclinometer casings were monitored and the house was inspected by Terraprobe. The report indicated that the timber retaining wall seemed to have moved about 10 to 30 mm away from the house since it was measured in July 1991; that the inclinometer monitoring indicated that there had been no significant movement of the ground adjacent to the houses over the previous 10 months; and that the minor cracking on the interior of the house was not caused by recent ground movements around the house.

In 1995, Terraprobe wrote another follow up report (Terraprobe File No. 91161, dated January 31, 1995), after it was reported that the homeowner of the dwelling at 51 Troutbrooke Drive had noticed additional cracking in the interior walls. The report indicated that the ground surface in the rear yard appeared to be about 30 to 40 mm lower than previously measured; that the inclinometer monitoring showed no significant movement over the previous 46 months; and that isolated minor hairline cracking of the interior drywall of the house at 51 Troutbrooke Drive was not caused by recent ground movements around the house.

2.2.2 Studies from 2009 to 2010

Terraprobe was retained in 2009 (Terraprobe No. 1-09-4125, dated October 6, 2010) to investigate a slope failure that occurred behind 51 to 43 Troutbrooke Drive (five dwellings), about 80 m in length. The scarp varied in height from about 0.3 to 2 m. The scarp from the 2009 failure exposed a section of the foundation wall of the dwelling at 45 Troutbrooke Drive. The house did not show signs of trauma at the time of investigation. At the time, it was understood that the failure occurred in March or early April 2009, but the exact date of failure was not disclosed to TRCA nor to Terraprobe. The field investigation of the site consisted of slope mapping and the drilling of four boreholes, as well as the installation of standpipe piezometers and slope inclinometer casing. The boreholes were drilled behind #41, 43, and 45 Troutbrooke Drive. Several hand auger probes were advanced to generally determine the extent of filling. The boreholes and auger hole information indicated that earth fill and rubble extends to depths of 1.1 to 7. 6 m near the dwellings, reducing to no fill part way down the slope. The study found underlying native soils consisting of very stiff or dense glacial till deposits overlying a very stiff to hard deposit of clay and silt, which was consistent with the findings of the 1991 geotechnical investigation.

The study concluded that the existing slope conditions are considered adequately safe and stable against deep seated slides, but indicated however, that there is significant risk of additional slope slides within the upper fills and retaining structures near the slope crest and dwellings, in the near future. If the dwellings are founded on undisturbed native soils, which are very competent at the site, then the dwellings are not at risk. Slope inclinometer casing monitoring indicated that the ground close to the dwellings was not moving significantly. Ongoing monthly monitoring, which began in September 2010 also found that the ground close to the dwellings was not moving significantly.

The 2009 study recommended that stabilization of the existing upper slope conditions near the slope crest could be accomplished by removing some of the fill near the slope crest and re-grading the rear yards to a more stable, flatter inclination with improved drainage. Alternatively, stabilization can be accomplished by constructing a reinforced soil slope structure along the rear of the dwellings, thereby creating a safe, flat and level back yard. Other recommendations included:

- ongoing monthly monitoring of the slope inclinometer casing and ground water levels in the piezometers,
- installing more inclinometers (one behind each dwelling, for ongoing monitoring purposes),
- ongoing slope crest monitoring made from the corners and the middle of each house (37 to 51 Troutbrooke Drive) to the slope crest / retaining wall, in order to monitor changes in and movement of the slope crest position,
- that all down-spouts be routed toward the street, and that all overland drainage must be routed toward the street or conveyed directly to the bottom of the slope; not to the slope crest or face,
- a photographic and visual survey of the back half of the outside walls of the dwellings (should there be any cracks in the walls, crack monitors should be installed to monitor the magnitude and rate of aperture opening),
- that there be at least one borehole advanced per property included in the remediation works, to define, not estimate, the extent of filling that has occurred at the site, and
- consideration could be given to performing some soil chemical testing for the purposes of offsite disposal of the existing fill materials (it is understood that this has been completed by TRCA).

Terraprobe is also undertaking monthly monitoring of the slope, houses, and inclinometer casings, as per the above recommendation (Terraprobe Job No. 1-10-5192). The visits to the time of writing of this report, occurred on September 8, October 12, November 9, December 7, 2010, and January 12, 2011. As of the these visits, the reports concluded that the houses do not appear to be at any more risk since the original failure in 2009. The reports noted that here had been some further slumping and erosion of the soil near the failure scarp. The northeast corner of the foundation wall of #47 Troutbrooke Drive is now exposed, and there is some further loss of the slope crest between #45 and 47, as well as between #47 and 49. No further distress to the dwellings was observed.

3. FIELD INVESTIGATION

3.1 Subsurface Conditions

The field investigation for the previous Terraprobe study was conducted in 2009, and consisted of drilling and sampling four boreholes extended to depths of 5.8 to 12.7 metres below the existing ground surface, behind #41, 43, and 45 Troutbrooke Drive. The general stratigraphy across consists of earth fill and rubble that extends to depths of 1.1 to 7. 6 m near the dwellings, reducing to no fill part way down the slope. The underlying native soils consists of very stiff or dense glacial till deposits overlying a very stiff to hard deposit of clay and silt.

In 2010, three additional boreholes (Boreholes I1, I2, and I3) were advanced on the table land between 49/47, behind 43 and 39 Troutbrooke Drive, respectively. The purpose of these boreholes was to determine the thickness of earth fill, confirm the elevations of the very stiff / dense native soils, and to install inclinometer casings. Thirteen boreholes (Boreholes H1 to H13) were also advanced on the slope face to accurately determine the thickness and extent of fill or talus (accumulated slumped soil). The locations of these boreholes are shown on **Figure 3**. The detailed borehole logs are provided in Appendix A.

Boreholes I1 to I3 found 2.7, 2.1, and 3.0 metres of fill below grade, respectively. The earth fill is comprised predominantly of silty clay with trace gravel. In Boreholes I1 and I2, the fill had organic staining and inclusions just above the native soil / fill interface. The earth fill was underlain by deposits of clayey silt to silt and sand glacial till. The glacial till is compact to dense or stiff to very stiff. A deposit of clay and silt was encountered at depths of 4.6, 5.0, and 5.2 metres below grade (Elev. 157.8, 155.4, 156.1 m), in BH I1 to I3, respectively. The clay and silt contains occasional fine silt seams and is very stiff to hard, light brown to grey, and moist. This layer extended beyond the vertical extent of investigation in all three boreholes.

The thirteen slope face boreholes (Boreholes H1 to H13) were advanced using a Pionjar, equipped with a split-barrel (split-spoon) sampler. Continuous samples were obtained to penetrate through the fill, and into native soils. The results of these boreholes are presented in tabular form in Appendix A. Some of the boreholes found up to 3.8 metres of fill below grade, and some of the boreholes further down the slope encountered no earth fill. The native soils found were consistent with those found in the 1991, 2009, and 2010 borehole investigations. Cross sections indicating existing conditions, including fill depths and extent, with interpreted subsurface conditions, are provided in **Figures 4A to 4E**. Based on these interpreted sections, the site has about 8000 m^3 of fill.

3.2 Slope Conditions

The slope at this site was inspected in Terraprobe's original report in 2009. The slope was re-inspected in 2010 for this design project, as well as for the ongoing monthly monitoring that Terraprobe is also undertaking. A tension crack on the asphalt between #47 and 49 appears to have increased in length and has subsided in spots about 50 mm (based on photographic comparison only). The foundation wall at the north east corner of #47 is now exposed. There has been some subsidence of the ground behind this same dwelling, but it is difficult to determine from photographic evidence when this subsidence occurred. Between #45 and 47 there has been undermining of the asphalt / concrete walkway due to erosion and runoff. Some tilting of the ground surface toward the slope crest was noted at #39. The collapsing deck at #45 has been removed. The inclinometer casing at #45 is elevated above the original casing, and observations note that this is likely due to the patio settling, rather than slope movement.

4. ALTERNATIVES ASSESSMENT

Based on Terraprobe's original findings, it was our opinion that the dwellings at 35 to 51 Troutbrooke Drive were not considered to be in immediate danger from a deep-seated slope failure. However, it was noted that throughout the site, there is anticipated further slumping of the upper un-engineered fill which may cause loss of existing table land and damage to the existing un-engineered retaining wall and other structures.

In order to establish and maintain stable slope conditions across the site, the first approach considered was: **Option 1**: "Do Nothing" immediately but monitor the site, and minor temporary maintenance. Three further options were considered:

- **Option 2**: Remove fill and replace with compacted fill slope, using one of three approaches:
    A) remove fill and sort existing fill, stockpile and replace at 2.5 H : 1 V,
    B) remove fill and replace with granular fill at 2 H : 1 V, or
    C) remove fill and replace with Granular 'B' with geogrid reinforcement at 1.5 H : 1 V, or

- **Option 3**: Remove fill and replace with an engineered structure with an approximate 45 degree face using one of two face treatments:
    a) SierraScape facing, mechanically stabilized earth wall
    b) Deltalok facing, mechanically stabilized earth wall

- **Option 4**: Greenspace Acquisition - Purchase and demolish homes, and regrade existing fill to a stable inclination of between 2.6 H - 2.0 H : 1 V

4.1 Option 1: Do Nothing

With the “Do Nothing” option, where the slope is over-steepened, it will eventually stabilize to a stable inclination. The final configuration will not necessarily be at the inclination as defined by FS = 1.5, but by an inclination defined by a lower FS, most likely around 2 H : 1 V, to 2.5 H : 1 V. With this option, a chain-link fence should be installed wherever the scarp is over 1.2 m in height, to stop people and animals from falling over the slope crest. It is also recommended that any exposed foundation walls (such as #45 and 47 Troutbrooke Drive) be provided with frost protection over the winter months (e.g. straw bales covered by a weighed-down tarp to prevent runoff or infiltration into the bales). With this option, the loss of tableland is anticipated but the amount of loss can only be estimated, and will occur at an unknown timeframe. However, there are no construction impacts to the slope or to vegetation. A plan of this option is provided as **Figure 5.** An evaluation of this concept is provided below.

Potential Impact	**Do Nothing**
Cost	V. Low
Level of Stabilization to Existing Slopes	V. Low
Amount of Tableland Loss	V. High
Loss of Habitat / Vegetation on slope	V. Low
Production of New Habitat	N / A
Access Requirements on Private Property	Low
Construction Equipment on Private Property	N / A
Disruption During Construction	N / A
Impact to Existing Dwelling	High
Valley Land Impact	Low

If the “Do Nothing” option is chosen, it is strongly recommended that an ongoing monitoring program be implemented, which includes inclinometer and piezometer readings, as well as visual inspections of the dwellings and slope crest and upper slope areas. Initially the monitoring should be conducted monthly, and could decrease eventually to a frequency of twice per year should no further significant movements occur. It is also recommended that the existing north wall foundations of the dwellings be physically examined for founding elevation and founding bearing strata, to confirm that the foundation are made on native competent soils.

4.2 Option 2: Remove Fill and Replace with Compacted Fill Slope

The 2009 Terraprobe study concluded that the existing slope conditions are considered adequately safe and stable against deep seated slides, but indicated however, that there is significant risk of additional slope slides within the upper fills and retaining structures near the slope crest and dwellings, in the near future. If the dwellings are founded on undisturbed native soils, which are very competent at the site, then the dwellings are not at risk. Similar to Option 2, this option proposes to create stable slopes at the site, but keeping the dwellings in place. In order to achieve stable slopes in the rear yards of the dwellings, it is recommended to remove the existing, un-engineered fill (at a cut line of about 1 H : 1 V from the edge of the existing dwellings) and replace it with compacted and good quality fill, at stable inclinations. There are three potential options for removing fill and replacing with compacted fill:

- **Option 2A -** Remove existing fill, sort through the existing fill into stockpiles of reusable and not-reusable fill, then compact the reusable fill along with new fill at 2.5 H : 1 V;
- **Option 2B -** Remove the existing fill, dispose of the excavated fill, replace with compacted Granular "B" fill at an inclination of 2.0 H : 1 V; or
- **Option 2C -** Remove the existing fill, dispose of the excavated fill, replace with compacted Granular "B" fill that is reinforced with a wrapped face geogrid (reinforced soil slope - "RSS") with a face inclination of 1.5 H : 1 V.

A typical plan and profile of this option is provided as **Figures 6 & 7A to 7C**. An evaluation of this concept is provided below.

Potential Impact	**OPTION 2A Remove, Sort, Stockpile & Re-Use Fill 2.5 H : 1 V**	**OPTION 2B Remove & Replace with Granular B 2.0 H : 1 V**	**OPTION 2C Remove & Replace with RSS 1.5 H : 1 V**
Cost	High	Medium	Medium
Level of Stabilization to Existing Slopes	Medium	Medium	Medium
Amount of Tableland Loss	V. Low	V. Low	V. Low
Loss of Habitat / Vegetation on slope	Low	Low	Low
Production of New Habitat	N / A	N / A	N / A
Access Requirements on Private Property	Medium	Medium	Medium
Construction Equipment on Private Property	High	High	High
Disruption During Construction	High	High	High

Potential Impact	**OPTION 2A Remove, Sort, Stockpile & Re-Use Fill 2.5 H : 1 V**	**OPTION 2B Remove & Replace with Granular B 2.0 H : 1 V**	**OPTION 2C Remove & Replace with RSS 1.5 H : 1 V**
Impact to Existing Dwelling	Low	Low	Low
Valley Land Impact	Medium	Medium	Medium

If the 2.5 H : 1 V slope is chosen, a toe berm will need to be constructed on the slope to contain the re-compacted fill. The berm will be only 1 to 2 metres in height and will run across the majority of the site (from 51 to 39 Troutbrooke Drive). The berm must be made with free draining materials, such as concrete rubble, clear stone, etc.

A perforated seepage collector pipe must be placed at the lowest elevation of the newly compacted fill slope at the interface between the native slope and the compacted fill slope. Closed pipes will conduct the collected ground water out to the slope face. Rip rap aprons must be provided at the outlets of the pipes to reduce surficial erosion of the slope below the outlets.

Surface water control is important to prevent / minimize erosion on the newly compacted slope. The compacted and graded slopes must be re-vegetated, by increased planting and or seeding of all graded slopes. If required, this option could include the placement of a perforated cellular confinement system to hold topsoil and vegetation (for the non-geogrid options). Other options could include live staking, bio-facines, and other bio-engineered methods. With this option, once slope fill compaction, grading and re-vegetation is completed, there is little long term loss of tableland anticipated.

Options 2A and 2B will leave little to no usable tableland north of the dwellings over the majority of the site. After consultation with TRCA, it was decided to add a wooden deck behind the dwellings for these two options, where there will be less than 5 m of tableland. The wooden decks will be made the full width of the dwellings, extending 5 m to the north of the dwellings, and will be supported on piles extended to bear within native soils. Each deck will therefore have slightly different costs based on the thickness of fill behind each of the dwellings. To accommodate the construction of the slope and deck, upper decks at #39 and #49 will have to be removed and then subsequently replaced. The approximate cost of each deck will be determined by TRCA.

Option 2C, reinforced soil slope, has been reconfigured since Report No.1 to ensure that a minimum 5 metre tableland has been created behind each dwelling. Where the tableland is more than 5 metres, as of the identified Top of Bank 2009, that position has been maintained.

The following table indicates the amount of existing fill that will be removed, and amount of fill to be imported and placed.

Approximate Fill Volumes (m^3)	**OPTION 2A Remove, Sort, Stockpile & Re-Use Fill 2.5 H : 1 V**	**OPTION 2B Remove & Replace with Granular B 2.0 H : 1 V**	**OPTION 2C Remove & Replace with RSS 1.5 H : 1 V**
Existing Fill to be Removed	7,500	7,500	5,000
New Fill to be Placed	8,000	5,500	7,500
Toe Berm to be Placed	1,500	0	0

4.3 Option 3: Remove Fill and Replace with a Mechanically Stabilized Earth (MSE) Wall

Similar to Option 3, this option will provide a steeper slope that is constructed as a retaining wall with a face angle of 1 H : 1 V, thereby saving on imported fill volumes. This option also keeps existing dwellings in place but also provides some table land behind the dwellings, of approximately 5 or more metres, depending on final design. In order to accomplish this objective, it is recommended to remove the existing, un-engineered fill from the backs of the dwellings at a 1 H : 1 V inclination (so not to undermine existing footings), and replace it with a compacted geogrid mechanically reinforced wall that has a sloped face of 1 H : 1 V. This option provides the highest level of stabilization. The MSE wall would be constructed over the entire site, but would be of varying height, from about 7 to 11 metres. The facing of the MSE wall could be comprised of SierraScape or Envirolok system. Both of these systems are constructed with a ‘soft’ vegetated face, which is consistent with, or may actually improve, the valley land habitat. SierraScape is a wire form basket with seeded topsoil in behind the face with fasteners for geogrid connection. Envirolok is a system of geotextile bags that are filled with seeded soil with fasteners for geogrid connection. A typical plan and profile of this option is provided as **Figures 8 and 9**. An evaluation of this concept is provided below.

Potential Impact	**Remove & Replace with MSE Wall - SierraScape System 1 H : 1 V**	**Remove & Replace with MSE Wall - Envirolok System 1 H : 1 V**
Cost	High	High
Level of Stabilization to Existing Slopes	High	High
Amount of Tableland Loss	V. Low (creates tableland)	V. Low (creates tableland)
Loss of Habitat / Vegetation on slope	Low	Low
Production of New Habitat	N / A	N / A
Access Requirements on Private Property	Medium	Medium
Construction Equipment on Private Property	High	High
Disruption During Construction	High	High
Impact to Existing Dwelling	Low	Low
Valley Land Impact	Medium	Medium

The major advantages of this option is that the slope will be stabilized using a mechanically stabilized earth wall, with a vegetated face. As well, due to the nature of such structures with geogrid reinforcement, there will be some tableland created (or re-created) behind the dwellings. The approximate face area of the geogrid reinforced MSE wall is 1,500 m^2. The following table indicates the amount of existing fill that will be removed, and amount of fill to be imported and placed.

Approximate Fill Volumes (m^3)	**Remove & Replace with MSE Wall - SierraScape System 1 H : 1 V**	**Remove & Replace with MSE Wall - Envirolok System 1 H : 1 V**
Existing Fill to be Removed	7,000	7,000
New Fill to be Placed	7,500	7,500

A perforated seepage collector pipe must be placed at the lowest elevation of the wall at the interface between the MSE wall structure and the native soil. Closed pipes will conduct the collected ground water out to the slope face. Rip rap aprons must be provided at the outlets of the pipes to reduce surficial erosion of the slope below the outlets. Surface water control is important to prevent / minimize erosion in the vicinity of the RSS structure and to limit infiltration of water into the reinforced soil zone. A minimum 300 mm thick low-permeability soil cap must be placed on the MSE wall to minimize infiltration of precipitation and runoff into the reinforced soil zone.

4.4 Option 4: Greenspace Acquisition

The 2009 Terraprobe study concluded that the existing slope conditions are considered adequately safe and stable against deep seated slides, but indicated however, that there is significant risk of additional slope slides within the upper fills and retaining structures near the slope crest and dwellings, in the near future. If the dwellings are founded on undisturbed native soils, which are very competent at the site, then the dwellings are not at risk, but there is anticipated loss of backyards right back to the north face of the dwellings. This reduces the use of the property and creates a hazard directly out the back door of the dwellings.

This option therefore removes the risk by removing the dwellings and regrading the slope to a more stable inclination. The 2009 Terraprobe study indicated that the stable inclination of the existing fill is 2.6 H : 1 V, corresponding to a factor of safety of 1.5. A regrading inclination was also determined using a factor of safety of 1.3, which is considered as a generally acceptable engineering factor of safety for slopes to establish a more stable inclination. Slope stability modelling determined that the regrading the slope to a more stable inclination of 2.0 H : 1 V achieved a factor of safety of at least 1.3. Depending on the choice of reasonable factor of safety for a re-graded slope at this site, areas of existing fill that are steeper than 2.6 H to 2.0 H : 1 V should be re-graded. Other areas that are 2.6 H to 2.0 H : 1 V or flatter should be intensely re-vegetated. With this option, little long term loss of tableland is anticipated. A typical plan and profile of this option is provided as **Figures 10 and 11**. An evaluation of this concept is provided below.

Potential Impact	**Demolish Dwelling and Re-grade to 2.6 H : 1 V (F.S. = 1.5)**	**Demolish Dwelling and Re-grade to 2.0 H : 1 V (F.S. = 1.3)**
Cost	Medium	Medium
Level of Stabilization to Existing Slopes	Medium	Medium
Amount of Tableland Loss	V. High	V. High
Loss of Habitat / Vegetation on slope	Low	Low
Production of New Habitat	N / A	N / A
Access Requirements on Private Property	High	High
Construction Equipment on Private Property	High	High
Disruption During Construction	High	High
Impact to Existing Dwelling	High	High
Valley Land Impact	Very Low	Very Low

The benefit to this option is that there will be no risk ever to existing structures, since all will be removed. Furthermore, there will be only some removal of fill, as most will be reused in regrading efforts. Re-graded slopes must be re-vegetated, by increased planting and or seeding of all graded slopes. If required, this option could include the placement of a perforated cellular confinement system to hold topsoil and vegetation. Other options could include live staking, bio-facines, and other bio-engineered methods. Prior to re-vegetation or other bio-engineered methods, all debris from slope face needs to be removed. With this option, once slope regrading and re-vegetation is completed, there is little long term loss of tableland anticipated. This option will also provide for new parkland along the Black Creek River valley.

4.5 Preliminary Cost Estimates

The following cost estimates will be confirmed during Steering Committee Meeting No. 4, using the volumes calculated at this preliminary design stage from a cross-sectional area taken at each property. The unit costs were estimated and provided to Terraprobe from the TRCA. The summary below does not include construction access costs, nor the costs to construct the wooden decks in options 2A and 2B. The cost for Option 4 include acquisition, demolition, clearing, re-grading, legal, restoration, etc.

OPTION	COST ESTIMATE ($million)
1. Do Nothing	$ 0.01
2A. Remove Fill, Sort, Stockpile & Re-Use Fill, Re-Grade at 2.5 H : 1 V	$ 1.14
2B. Remove Fill & Replace with Granular B, Re-Grade at 2.0 H : 1 V	$ 1.64
2C. Remove Fill & Replace with Reinforced Soil Slope at 1.5 H : 1 V	$ 1.82
3. Remove Fill and Replace with a Mechanically Stabilized Earth (MSE) Wall	$ 1.77
4. Greenspace Acquisition	$ 5.49

5. PREFERRED ALTERNATIVE

Based on the feedback from the community liaison committee, and all the stakeholders, it is understood that option 3 has been chosen as the preferred alternative.

At this time, this option has not been fully developed. However, the preliminary design will include removal of some of the existing fill, and replacement with a Mechanically Stabilized Earth (MSE) wall with a face angle of about 1 H to 1 V. This flexible structure will be constructed using a SierraScape face (galvanized baskets) with Tensar uniaxial geogrid as the tensile reinforcement. The layers of geogrid will be spaced every

0.45 metres (height), which is dictated by the SierraScape basket system. Preliminary calculations indicate that the minimum geogrid length is 5 m. The geogrid will likely consist of Tensar UX1100 MSE. The reinforced soil shall be 19 mm clear crushed stone in the lower 3 m of the wall. Above that, the reinforced soil will consist of Granular 'B' type II compacted to not less than 98% Standard Proctor Maximum Dry Density (SPMDD). A fence or metal railing must be provided at the top of the wall as per the Ontario Building Code. The fence or metal railing should be set back a minimum of 0.5 m from the face. The design does not allow for any loads on the top of the wall in excess of 4 kPa. Therefore, there should be no above ground pools, nor hot tubs, nor any storage of any materials in excess of 4 kPa.

5. CONSTRUCTION ACCESS

The Terraprobe 2009 report, indicated that access to the rear yard areas between the houses is not possible due to space limitations. Several potential access routes were investigated for typical construction equipment required for the remediation options recommended above. Based on this investigation, and in discussion with TRCA, it was agreed that the access route would start from the northeast corner of Troutbrooke Drive and Jane Street, where there is a parking lot and parkette that could be used as a staging and / or stockpiling area. There is an existing access road runs from the parkette, eastward and ends at the existing rock fill dam. From there, an access road would need to be constructed in the flood plain of Black Creek or on the toe of the slope, over to the construction area starting at 51 Troutbrooke Drive. Such an access road could be constructed by end-dumping and spreading of granular materials. This option for access is relatively low-impact since there is an existing access road that runs the majority of the distance from Jane Street & Troutbrooke Drive, to the site. If the access road from the rock dam is constructed in the flood plain of Black Creek, a geotextile would be required to separate the granular materials from the flood plain grade.

6. MONITORING

Prior to any construction works, pre-construction condition surveys should be conducted of any structures (houses, decks, etc.) that are close to the proposed works. The purpose of a pre-construction survey is to protect the proponent against unreasonable claims of damage due to construction works. Similarly, post-construction condition surveys should also be undertaken.

Each of the dwellings from 35 to 51 Troutbrooke Drive should have survey pins installed to the north west and north east corners. The purpose of the survey pins is to monitor if there is any change in position of the back wall of the dwellings.

7. SUMMARY

The existing rear yards at 35 to 51 Troutbrooke drive have been filled with up to 8 metres, below grade, of un-engineered fill over a considerable distance beyond the existing dwellings and slope crest. The filling took place during the original land development in 1962 and considerably by the residents since then, to date. There are also many un-engineered, make-shift retaining structures constructed on the slope in the rear yards of the dwellings, many of which show signs of previous or current distress. Site inspections indicate that several slides within the fill materials have taken place historically, and most recently in 2009, at which time, a portion of the foundation wall of 45 Troutbrooke Drive was exposed. There has been some subsequent erosion and minor slumping of the scarp from the 2009 slide. Ongoing monitoring of slope inclinometer casing, and visual inspection of the tableland and rear of the dwellings indicates that the dwellings do not show signs of trauma. It can therefore be reasonably assumed that he dwellings are founded on the very competent undisturbed native soils at the site.

This Report 2 of the Class EA for the project, summarized the results of further investigation and installation of three additional inclinometer casings (at 43, 47, and 49 Troutbrooke Drive). A series of slope face boreholes were also advanced to better delineate the extent and depth of fill on the slope. The factual information from these boreholes, and the boreholes advanced for the installation of the inclinometer casing, were used along with updated topographic information to develop cross-sections for each property on the site.

The results of these studies, along with consultation with the TRCA, has led to the development of four distinct alternatives for remedial erosion control and slope stabilization works. The four options are:

- Do nothing
- Remove existing fill, and replace with a compacted fill slope (2.5 H : 1 V to 1.5 H : 1 V) that is re-vegetated, leaving the dwellings in place
- Remove existing fill and construct a Mechanically Stabilized Earth (MSE) Wall, using a geogrid reinforced structure with a vegetated face angle of about 1 H : 1 V
- Greenspace Acquisition - Purchase and demolish the dwellings, and re-grade (and re-vegetate) the existing fill slope to a stable inclination of between 2.6 H : 1 V and 2.0 H : 1 V, depending on the required factor of safety

Option 3 has been chosen as the preferred alternative to apply across the entire site. In general the MSE wall will consist of a Sierrascape facing with Tensar geogrid 5 m in length, every 0.45 m in elevation. The backfill will consist of clear stone in the lower 3 m, and Granular ‘B’ Type II above. There should be no above

Site construction activities should be conducted in a manner that does not result in surface erosion on the slope. In particular, earth filling and grading should be designed to prevent direct concentrated or channelized surface runoff from flowing directly over the slope. Water drainage from pools, down-spouts, sumps, etc. should not be permitted to flow over the slope. Minor sheet flow is acceptable. Areas disturbed by construction should be restored with suitable native vegetation.

We trust the foregoing information is sufficient for your present requirements. If you have any questions, or if we can be of further assistance, please do not hesitate to contact us.

Yours truly,

Terraprobe Inc.

Jason Crowder, Ph.D., P.Eng.
Associate

Michael Tanos, P. Eng.
Principal

APPENDIX A

TERRAPROBE INC.

Terraprobe

LOG OF BOREHOLE I1

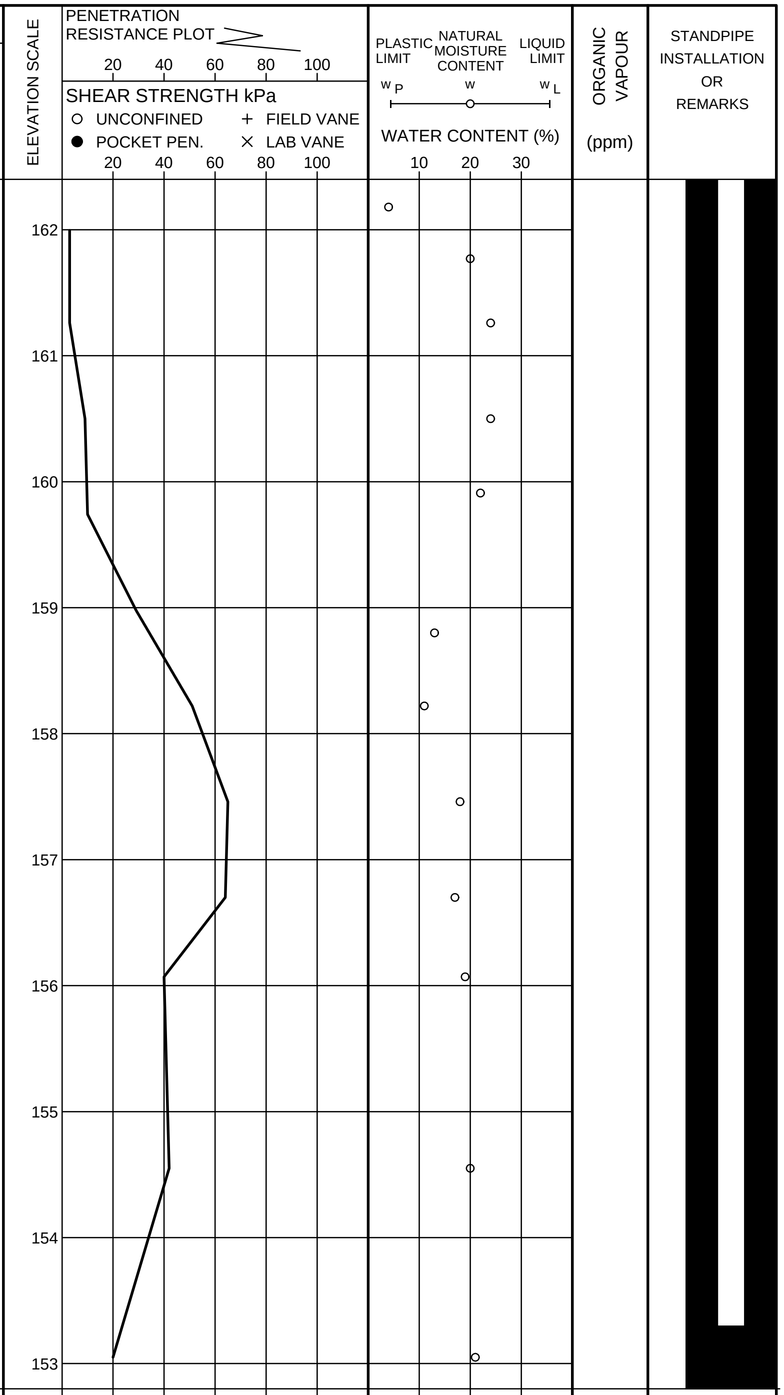
PROJECT: 35-51 Troutbrooke Drive Detailed Design
COORDINATES: N:4843401 E:620356
DATE: October 6, 2010
LOCATION: Toronto, Ontario
EQUIPMENT: Ram Sounder/Power Auger
CLIENT: Toronto Region Conservation Authority
ELEVATION DATUM: Geodetic
FILE: 1-10-5216

SOIL PROFILE

ELEV DEPTH	DESCRIPTION
162.4	Ground Surface
0.1	50mm ASPHALT
161.9 0.5	FILL: Gravelly Sand, some silt, very loose, tan, damp
	FILL: Silty Clay, trace sand, trace gravel, soft, light brown, moist --- stiff, brown ---organic silt inclusions, brown / grey / black
159.7 2.7	SILTY CLAY, embedded sand and gravel, stiff to very stiff, brown, moist (GLACIAL TILL)
159.0 3.4	SILT AND SAND, some clay, embedded gravel, compact to very dense, brown, moist (GLACIAL TILL)
157.8 4.6	CLAY AND SILT occasional fine silt seams, hard, light brown, moist --- very stiff, grey
152.8 9.6	End of Borehole

SAMPLES

NUMBER	TYPE	"N" VALUES
1	SS	3
2	SS	3
3	SS	9
4	SS	10
5	SS	29
6	SS	51
7	SS	65
8	SS	64
9	SS	40
10	SS	42
11	SS	20



NOTES:
Borehole was open and dry upon completion of drilling. Inclinometer casing installed and grouted to 9.1m depth.

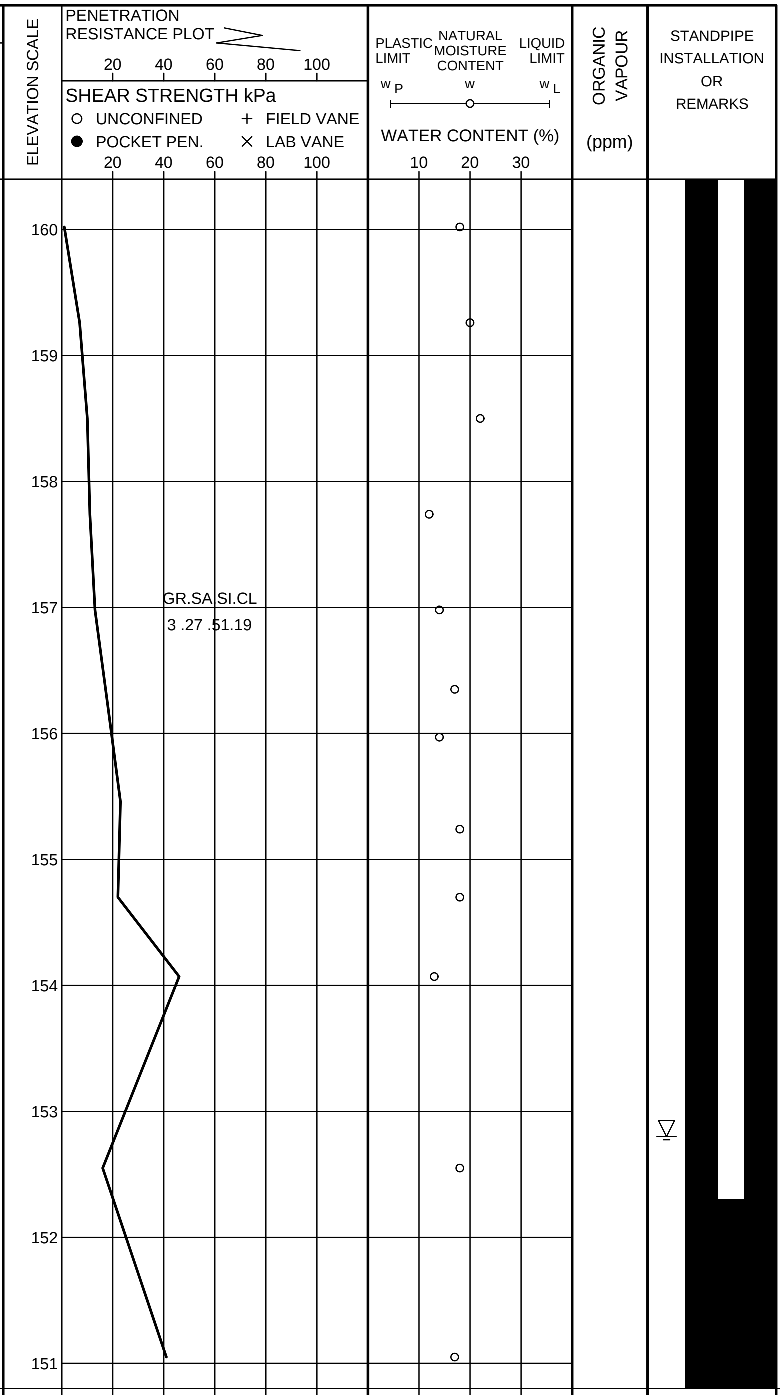
Terraprobe

LOG OF BOREHOLE I2

PROJECT: 35-51 Troutbrooke Drive Detailed Design
COORDINATES: N:4843411 E:620389
DATE: October 7, 2010
LOCATION: Toronto, Ontario
EQUIPMENT: Ram Sounder/Power Auger
CLIENT: Toronto Region Conservation Authority
ELEVATION DATUM: Geodetic
FILE: 1-10-5216

ELEV DEPTH	SOIL PROFILE DESCRIPTION
160.4	Ground Surface
0.0	trace plastic debris, very soft --- FILL - Silty Clay, some sand, trace gravel, firm, brown, moist ---organic staining, stiff, black
158.3 2.1	SANDY SILT some clay, trace gravel, compact, brown, moist (GLACIAL TILL)
156.1 4.3	SILT some sand, trace clay, compact, light brown, moist
155.4 5.0	CLAY AND SILT occasional fine silt seams, very stiff to hard, grey, moist
150.8 9.6	End of Borehole

SAMPLES NUMBER	TYPE	"N" VALUES
1	SS	1
2	SS	7
3	SS	10
4	SS	11
5	SS	13
6	SS	18
7	SS	23
8	SS	22
9	SS	46
10	SS	16
11	SS	41



NOTES:
Borehole was caving at 8.2m with an unstablilized water level at 7.6m upon completion of drilling. Inclinometer casing installed and grouted to 8.2m depth.

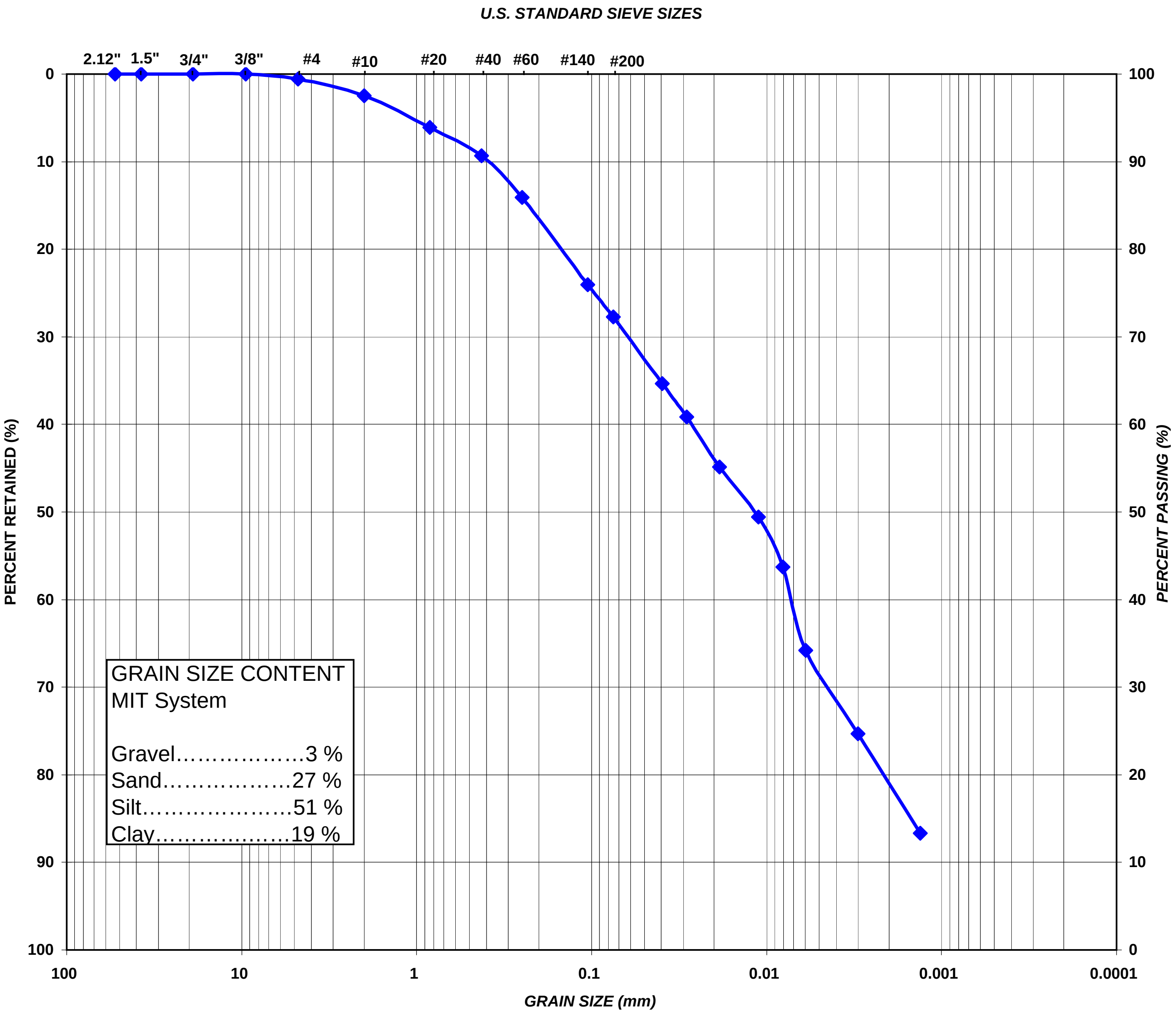
Terraprobe

SIEVE AND HYDROMETER ANALYSIS
TEST REPORT

PROJECT: **Troutbrooke Detailed Design**
LOCATION: **Toronto, Ontario**
CLIENT: **TRCA**
BOREHOLE NUMBER: **I2**
SAMPLE NUMBER: **5**
SAMPLE DEPTH: **3.0 - 3.8 m**
SAMPLE DESCRIPTION: **SANDY SILT, some clay, trace gravel**

FILE NO.: **1-10-5216**
LAB NO.: **1216A**
SAMPLE DATE: **October 7, 2010**
SAMPLED BY: **P.K.**

GRAIN SIZE DISTRIBUTION



GRAIN SIZE CONTENT
MIT System

Gravel………………3 %
Sand………………27 %
Silt…………………51 %
Clay………………19 %

<table>
<tr><td rowspan="2">MIT SYSTEM</td><td rowspan="2">GRAVEL</td><td>COARSE</td><td>MEDIUM</td><td>FINE</td><td rowspan="2">SILT</td><td rowspan="2">CLAY</td></tr>
<tr><td colspan="3">SAND</td></tr>
</table>

<table>
<tr><td rowspan="2">UNIFIED SYSTEM</td><td>COARSE</td><td>FINE</td><td>COARSE</td><td>MEDIUM</td><td>FINE</td><td rowspan="2">SILT AND CLAY</td></tr>
<tr><td colspan="2">GRAVEL</td><td colspan="3">SAND</td></tr>
</table>

Terraprobe

LOG OF BOREHOLE I3

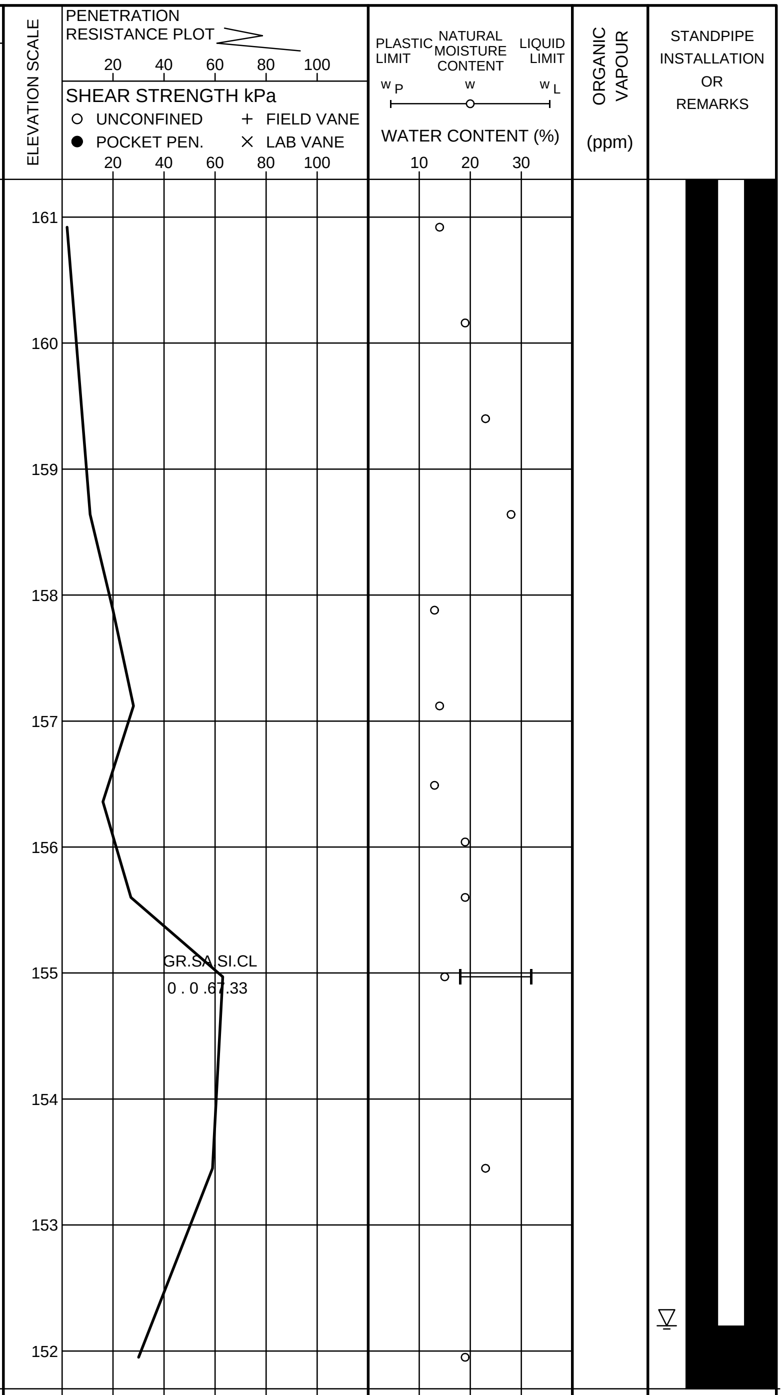
PROJECT: 35-51 Troutbrooke Drive Detailed Design
COORDINATES: N:4843424 E:620419
DATE: October 8, 2010
LOCATION: Toronto, Ontario
EQUIPMENT: Ram Sounder/Power Auger
CLIENT: Toronto Region Conservation Authority
ELEVATION DATUM: Geodetic
FILE: 1-10-5216

SOIL PROFILE

ELEV DEPTH	DESCRIPTION
161.3	Ground Surface
161.1 0.2	150mm TOPSOIL
	sandy, soft --- FILL - Silty Clay, some sand, trace gravel, firm to stiff, greyish brown, moist
158.3 3.0	SILT AND SAND, some clay, embedded gravel, compact, brown, wet (GLACIAL TILL)
157.5 3.8	SAND AND SILT trace clay, compact, brown, moist
156.7 4.6	SILT AND SAND, some clay, embedded gravel, compact, brown, wet (GLACIAL TILL)
156.1 5.2	CLAYEY SILT occasional fine sand seams, very stiff to hard, light brown, moist --- grey
151.7 9.6	End of Borehole

SAMPLES

NUMBER	TYPE	"N" VALUES
1	SS	2
2	SS	5
3	SS	8
4	SS	11
5	SS	20
6	SS	28
7	SS	16
8	SS	27
9	SS	63
10	SS	59
11	SS	30



NOTES:
Borehole was open with an unstablizied water level at 9.1 upon completion of drilling. Inclinometer casing installed and grouted to 9.1m depth.

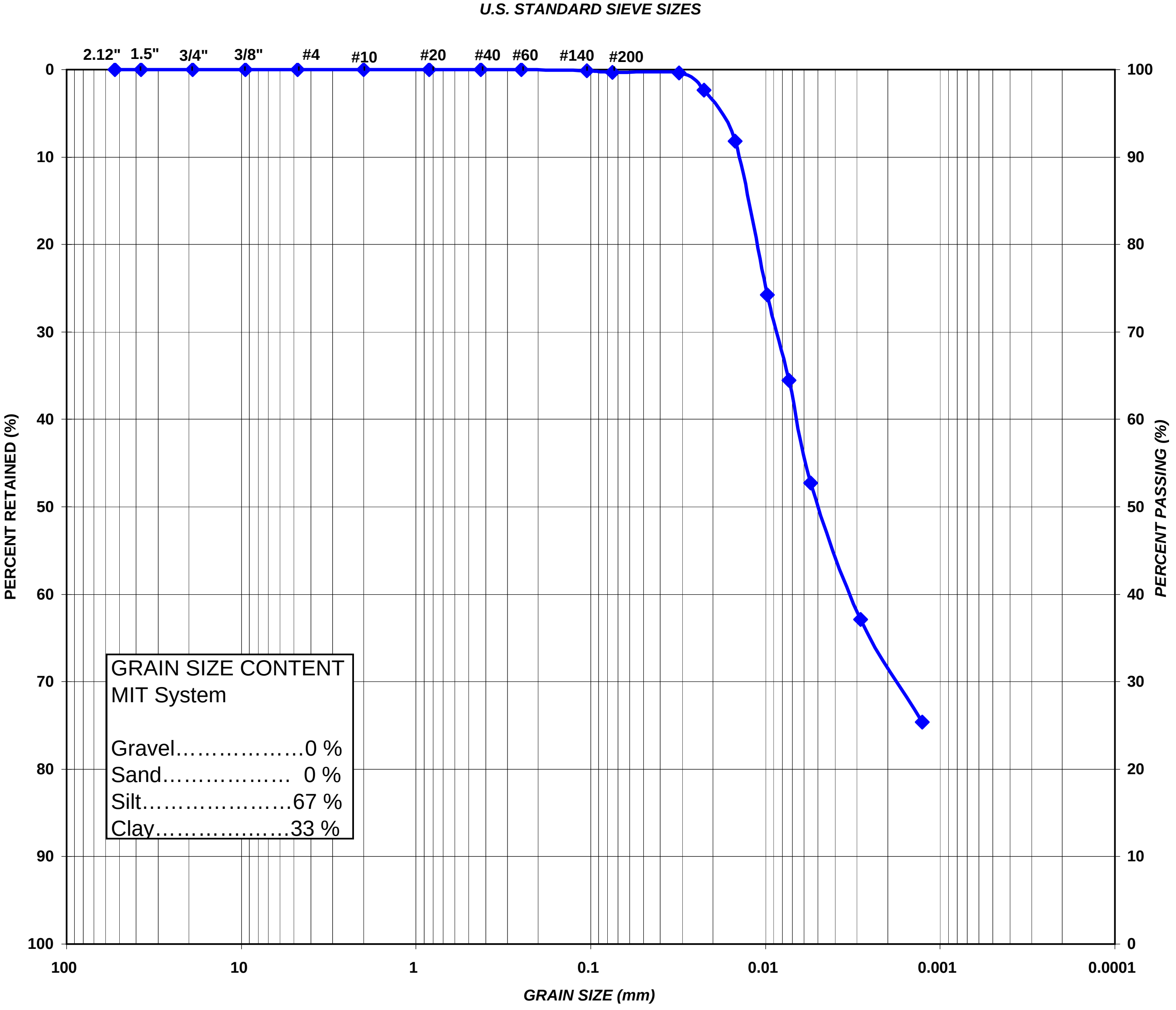
Terraprobe

SIEVE AND HYDROMETER ANALYSIS
TEST REPORT

PROJECT: **Troutbrooke Detailed Design**
LOCATION: **Toronto, Ontario**
CLIENT: **TRCA**
BOREHOLE NUMBER: **I3**
SAMPLE NUMBER: **9**
SAMPLE DEPTH: **6.1 - 6.6 m**
SAMPLE DESCRIPTION: **CLAYEY SILT**

FILE NO.: **1-10-5216**
LAB NO.: **1216B**
SAMPLE DATE: **October 8, 2010**
SAMPLED BY: **P.K.**

GRAIN SIZE DISTRIBUTION



GRAIN SIZE CONTENT
MIT System

Gravel……………….0 %
Sand……………… 0 %
Silt…………………67 %
Clay……………….33 %

MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

Terraprobe Pionjar Boreholes (2010) - "H" Boreholes

BH H1

0 - 760	Tps
760 - 4.26	Fill, Br Si(y) Cl, Some Sa, Tr Gr, Tr Org, Moist
4.26 - 5.33	Br Si(y) Cl, Some Sa, Tr Gr, Moist, Till

BH H2

0 - 80	Tps
80 - 3.05	Fill, Br Si(y) Cl, Some Sa, Tr Gr, Tr Org, Moist
3.05 - 3.81	Br Si(y) Cl, Some Sa, Tr Gr, Moist

BH H3

0 - 150	Tps
150 - 760	Fill, Br Si(y) Cl, Some Sa, Some Org, Tr Gr, Moist
760 - 1.52	Br Si(y) Cl, Some Sa, Tr Gr, Moist, Weath, Till
1.52 - 2.29	Dk Br Si(y) Sa, Tr Gr, Damp

BH H4

0 - 80	Tps
80 - 2.29	Fill, Br Cl(y), Sa(y) Si, Tr Gr, Moist
2.29 - 3.81	Br Si And Sa, Some Cl, Tr Gr, Moist, Till

BH H5

0 - 80	Tps
80 - 3.81	Fill, Br Si(y) Cl, Some Sa, Moist
3.81 - 4.57	Br Si(y) Cl, Some Sa, Tr Gr, Moist, Till

BH H6

0 - 230	Tps
230 - 1.83	Fill, Br Si(y) Cl, Some Sa, Tr Gr, Tr Org, Moist
1.83 - 3.05	Br Si(y) Cl, Some Sa, Tr Gr, Moist, Weath, Till

BH H7

0 - 150	Tps
150 - 1.83	Fill, Br Si(y) Cl, Some Sa, Tr Gr, Tr Org, Moist, Till
1.83 - 2.29	Dk Gry, Si, Some Cl, Tr Sa, Tr Org, Moist

BH H8

0 - 200	Tps
200 - 760	Br Si And Sa, Some Cl, Tr Org, Moist, Till
760 - 2.29	Br Cl and Si, Moist

BH H9

0 - 50	Tps
50 - 1.52	Fill, Br Si(y) Cl, Some Sa, Tr Gr, Moist
1.52 - 2.29	Br Si And Sa, Some Cl, Moist, Till
2.29 - 3.81	Lt Br Cl And Si, Moist

BH H10

0 - 150	Tps
150 - 610	Fill, Br Si(y) Cl, Some Sa, Tr Gr, Tr Org, Moist
610 - 2.29	Br Si(y) Cl, Some Sa, Tr Gr, Moist, Weath, Till
2.29 - 3.81	Lt Br Si And Sa, Some Cl, Tr Gr, Moist, Till

...

BH H11

0 - 50	Tps
50 - 760	Br Si And Sa, Some Cl, Tr Gr, Tr Org, Moist, Weath, Till
760 - 2.29	Br Cl and Si, Moist

BH H12

0 - 130	Tps
130 - 2.29	Fill, Br Si(y) Cl, Some Sa, Tr Gr, Tr Org, Moist
2.29 - 4.27	Br Si(y) Cl, Some Sa, Tr Gr, Moist, Weath, Till
4.27 - 5.33	Br Cl And Si, Moist

BH H13

0 - 130	Tps
130 - 1.98	Fill, Br Si(y) Cl, Some Sa, Tr Gr, Tr Org, Moist
1.98 - 3.05	Br Si(y) Cl, Some Sa, Tr Gr, Moist, Weath, Till
3.05 - 3.81	Br Cl And Si, Moist

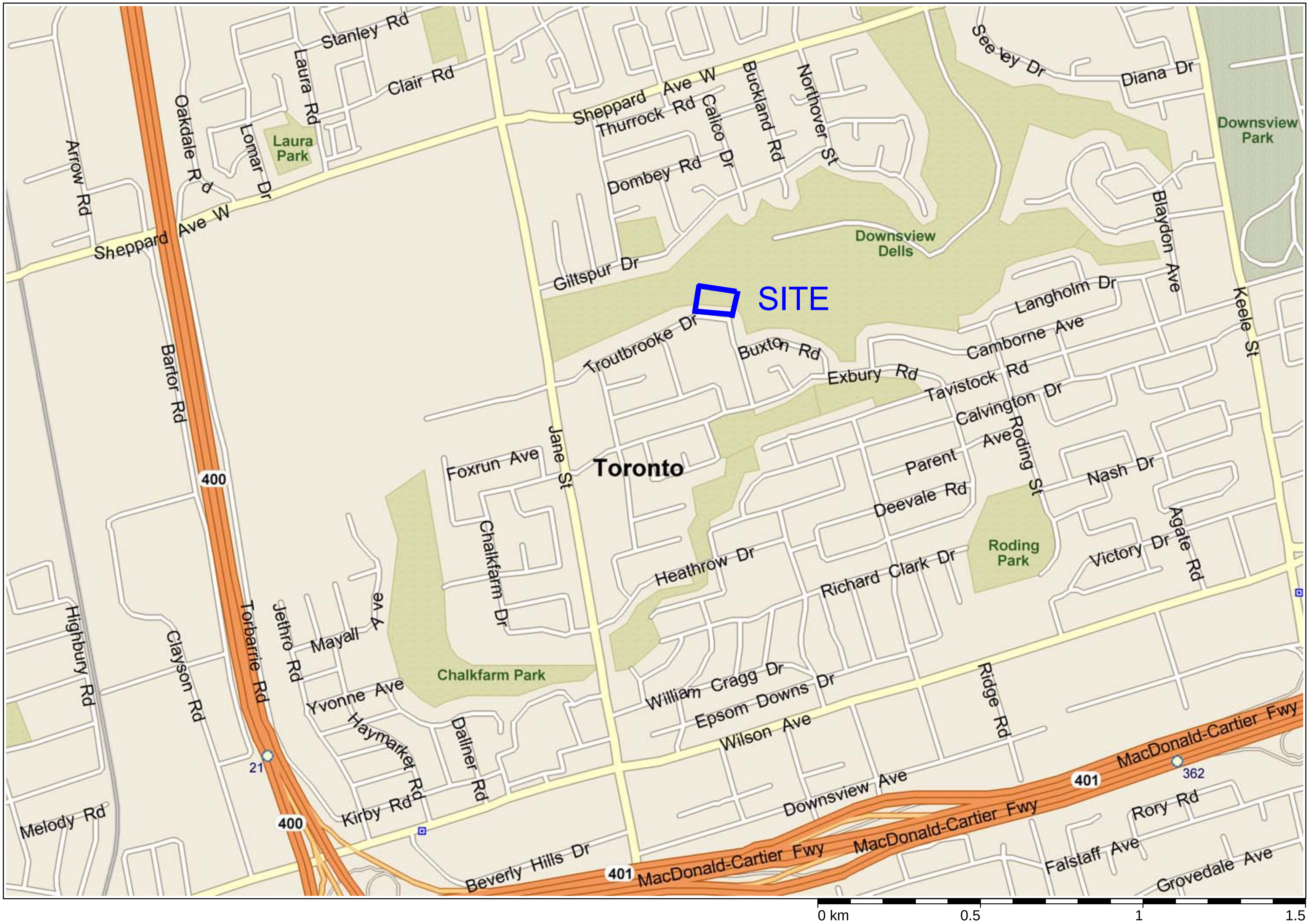
LEGEND

And	And
Br	Brown
Cl(y)	Clay(ey)
Damp	Damp
Dk	Dark
Fill	Fill
Gry	Grey
Gr(y)	Gravel
Lt	Light
Org	Organics
Moist	Moist
Sa(y)	Sand(y)
Si(y)	Silty(y)
Some	Some
Till	Glacial Till
Tps	Topsoil
Tr	Trace
Weath	Weathered

FIGURES

TERRAPROBE INC.

TROUTBROOKE DRIVE , TORONTO



SITE LOCATION PLAN

TERRAPROBE

File No. 1-10-5216

FIGURE 1

N.T.S.

AIR PHOTOGRAPH (2009)

TERRAPROBE

File No. 1-10-5216

FIGURE 2A

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 FIG2A AIRPHOTOS.dwg, JOHN

N.T.S.

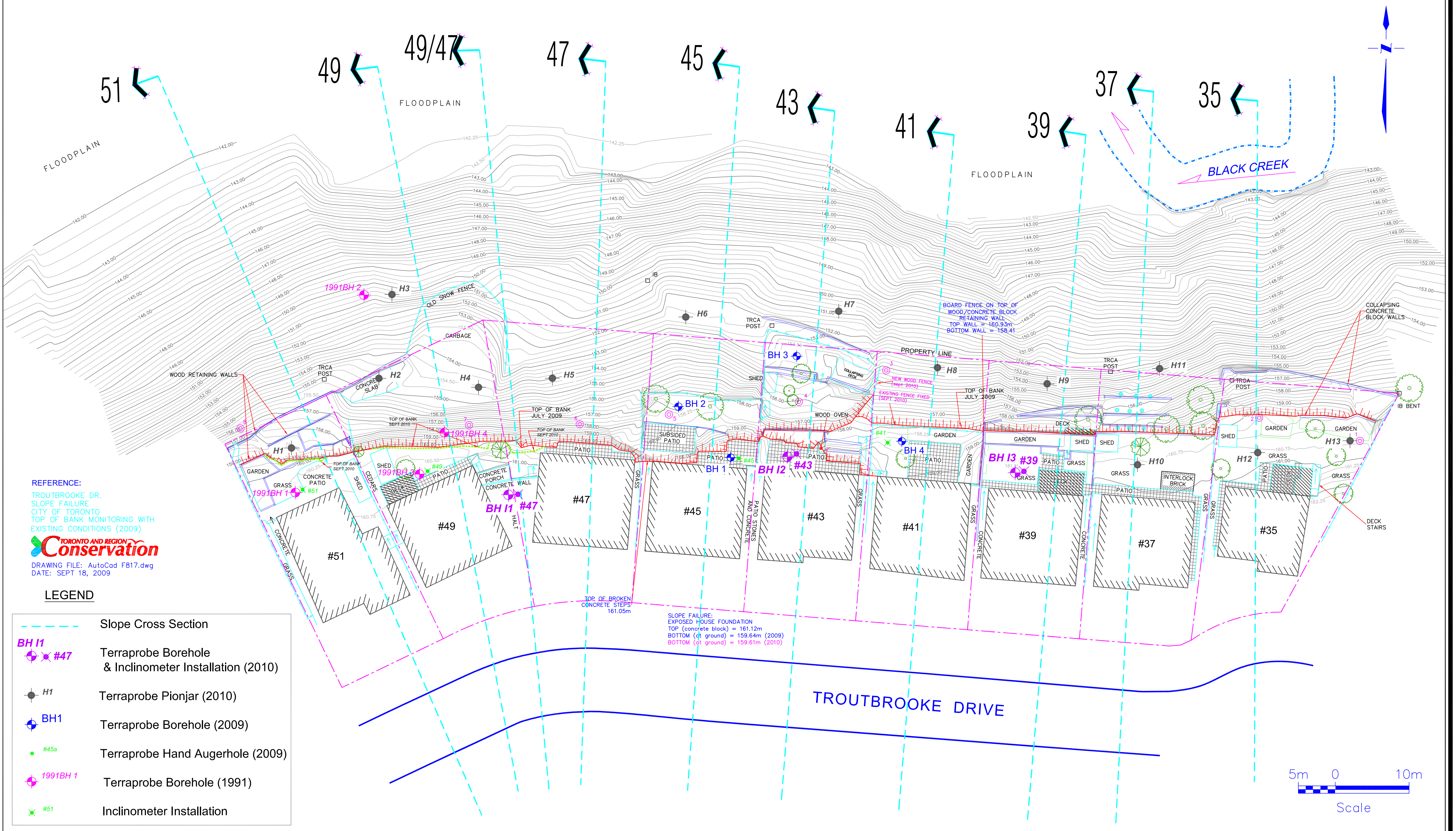
SITE PLAN

TERRAPROBE

File No. 1-10-5216

FIGURE 2B

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 FIG2B.dwg, JOHN



REFERENCE:

TROUTBROOKE DR.
SLOPE FAILURE
CITY OF TORONTO
TOP OF BANK MONITORING WITH
EXISTING CONDITIONS (2009)

TORONTO AND REGION Conservation

DRAWING FILE: AutoCad F817.dwg
DATE: SEPT 18, 2009

LEGEND

— — — — —	Slope Cross Section
BH I1 ⊕ ✕ #47	Terraprobe Borehole & Inclinometer Installation (2010)
⊕ H1	Terraprobe Pionjar (2010)
⊕ BH1	Terraprobe Borehole (2009)
● #45a	Terraprobe Hand Augerhole (2009)
⊕ 1991BH 1	Terraprobe Borehole (1991)
✕ #51	Inclinometer Installation

BOREHOLE LOCATION PLAN

TERRAPROBE

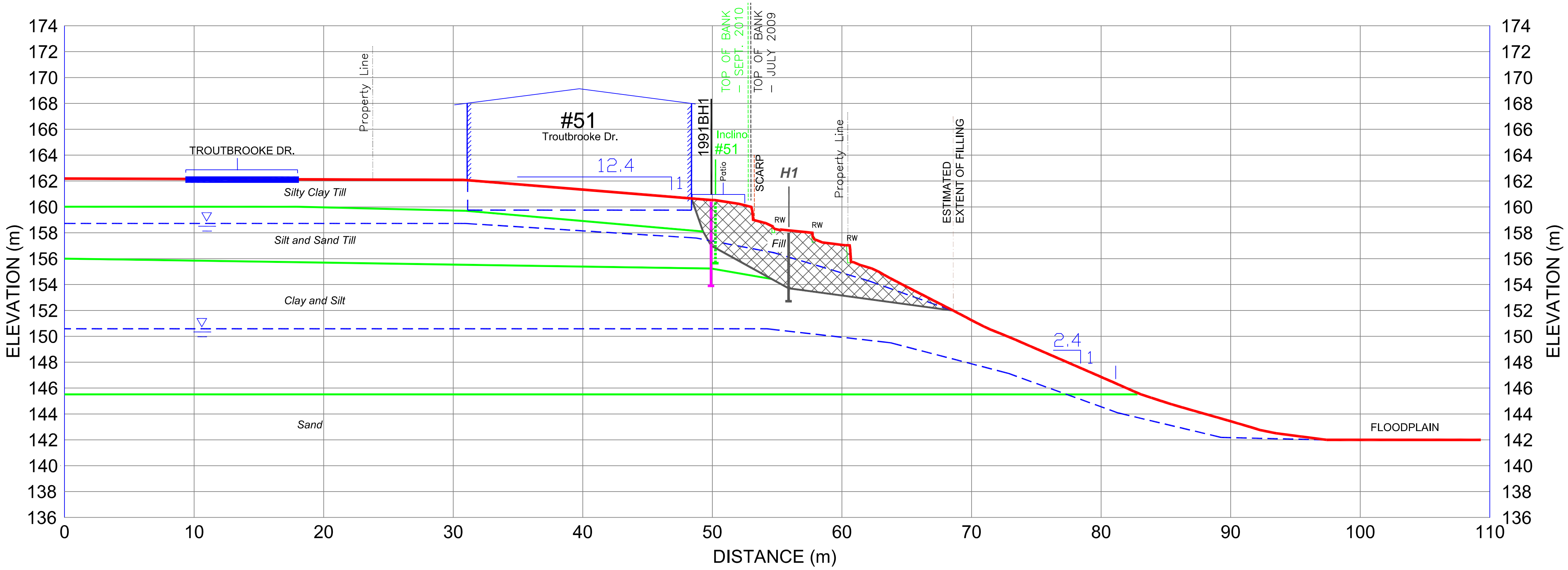
File No. 1-10-5216

FIGURE 3

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN

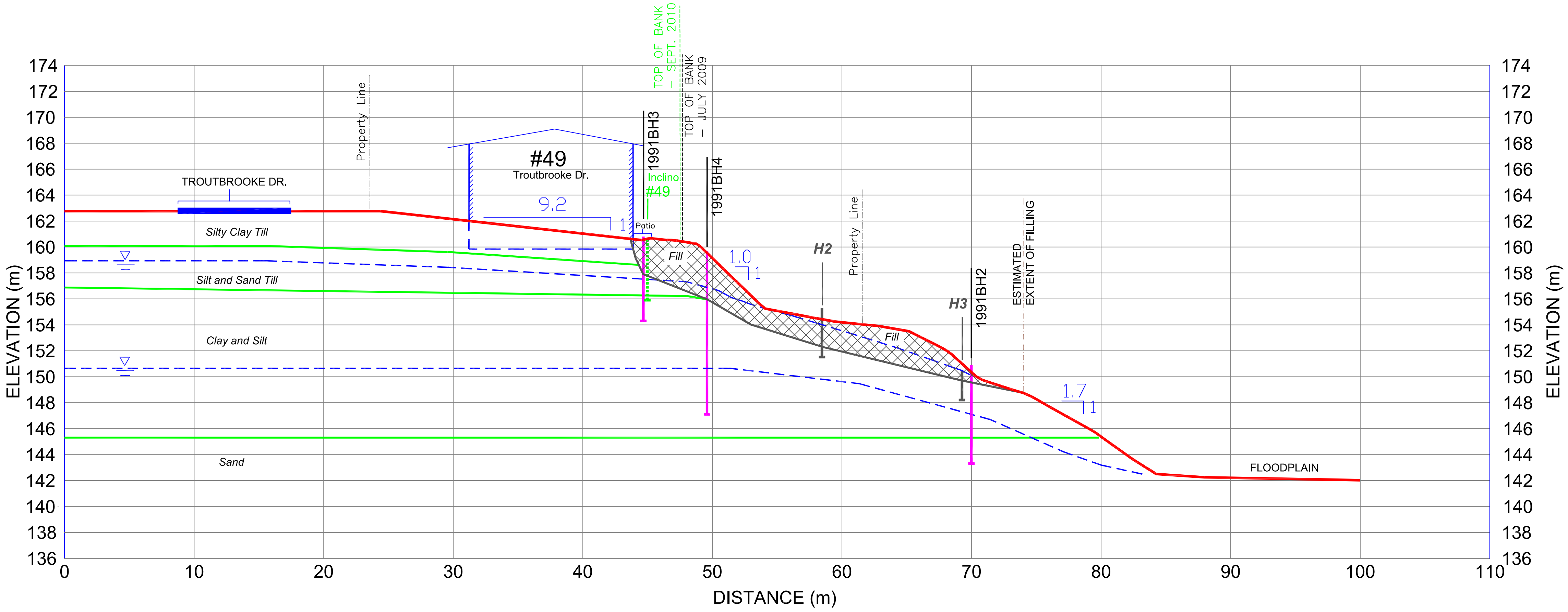
SECTION

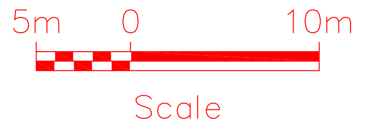
51



SECTION

49





EXISTING CONDITIONS SECTIONS

TERRAPROBE

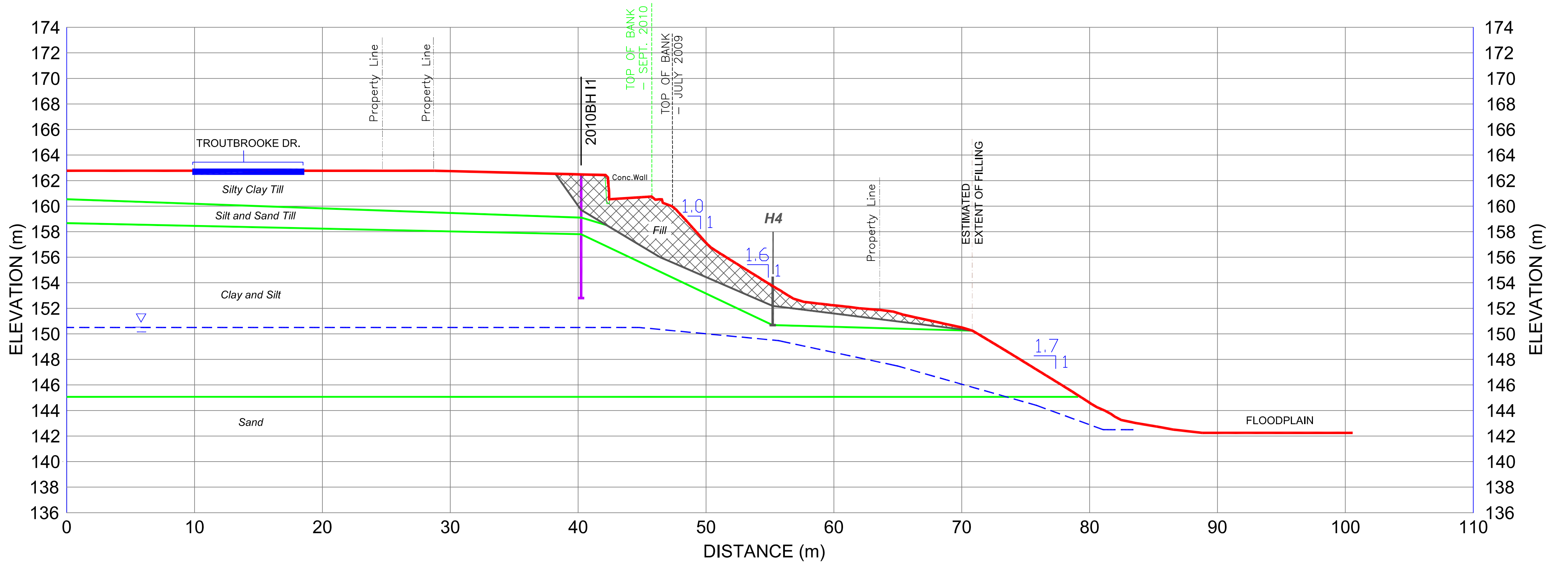
File No. 1-10-5216

FIGURE 4A

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN

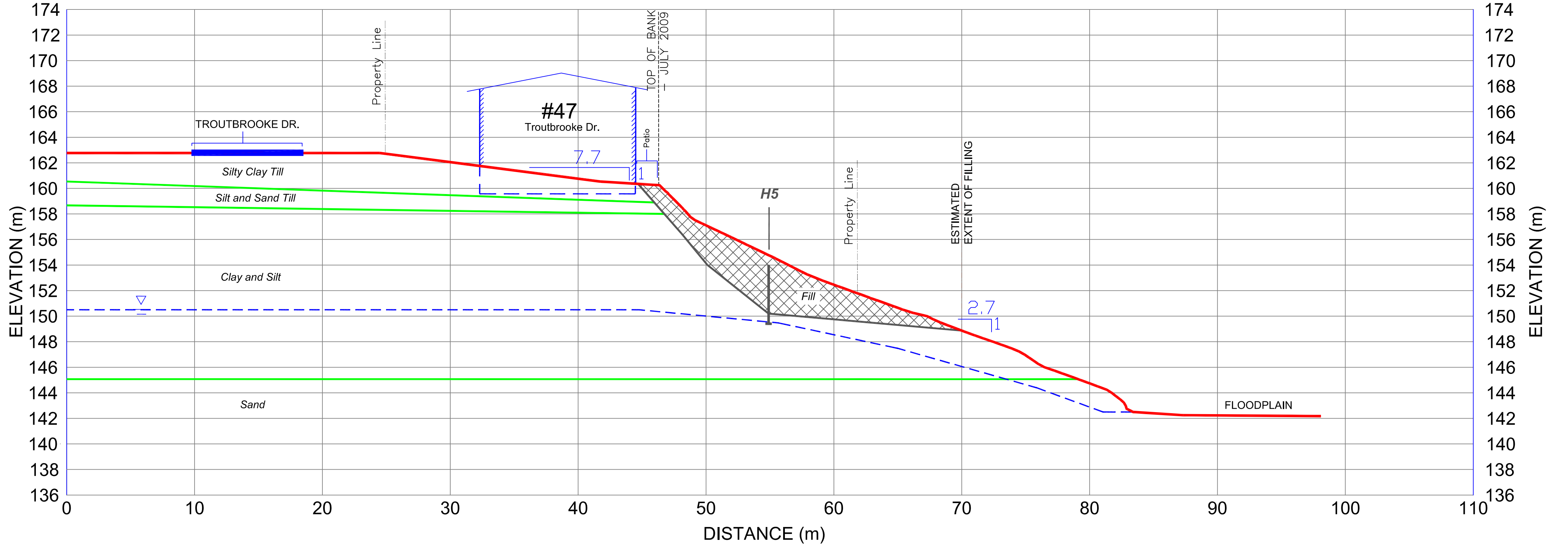
SECTION

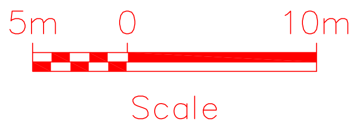
49/47



SECTION

47





EXISTING CONDITIONS SECTIONS

TERRAPROBE

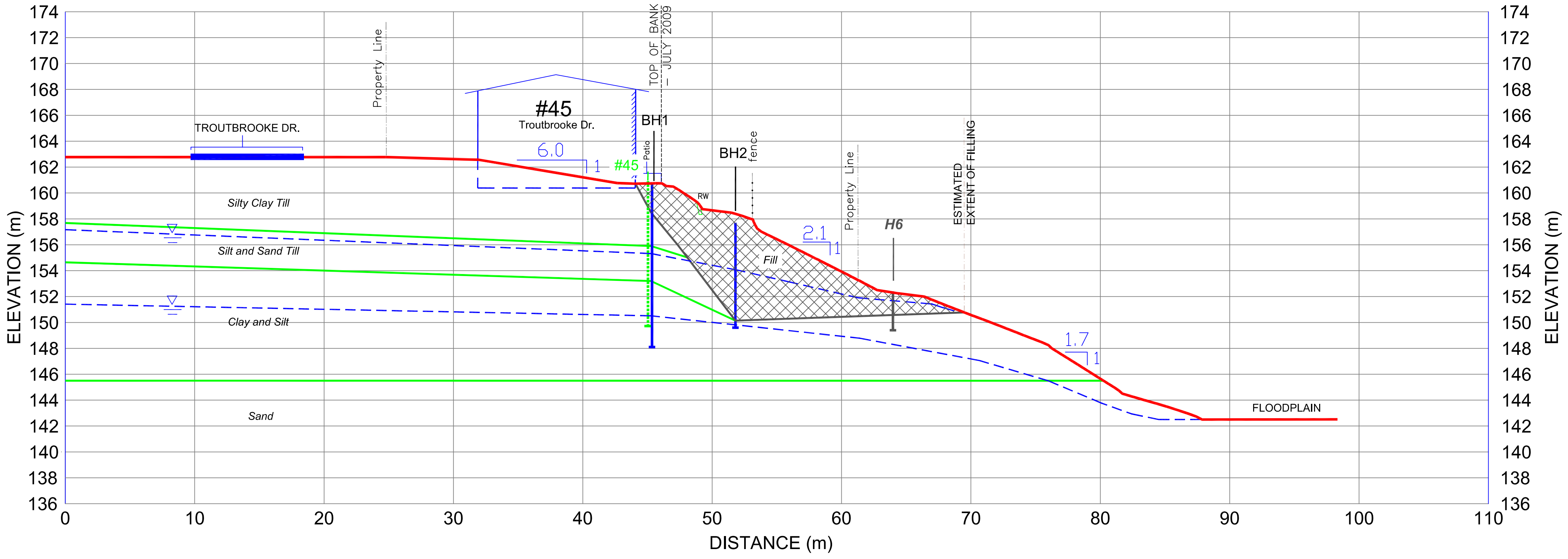
File No. 1-10-5216

FIGURE 4B

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN

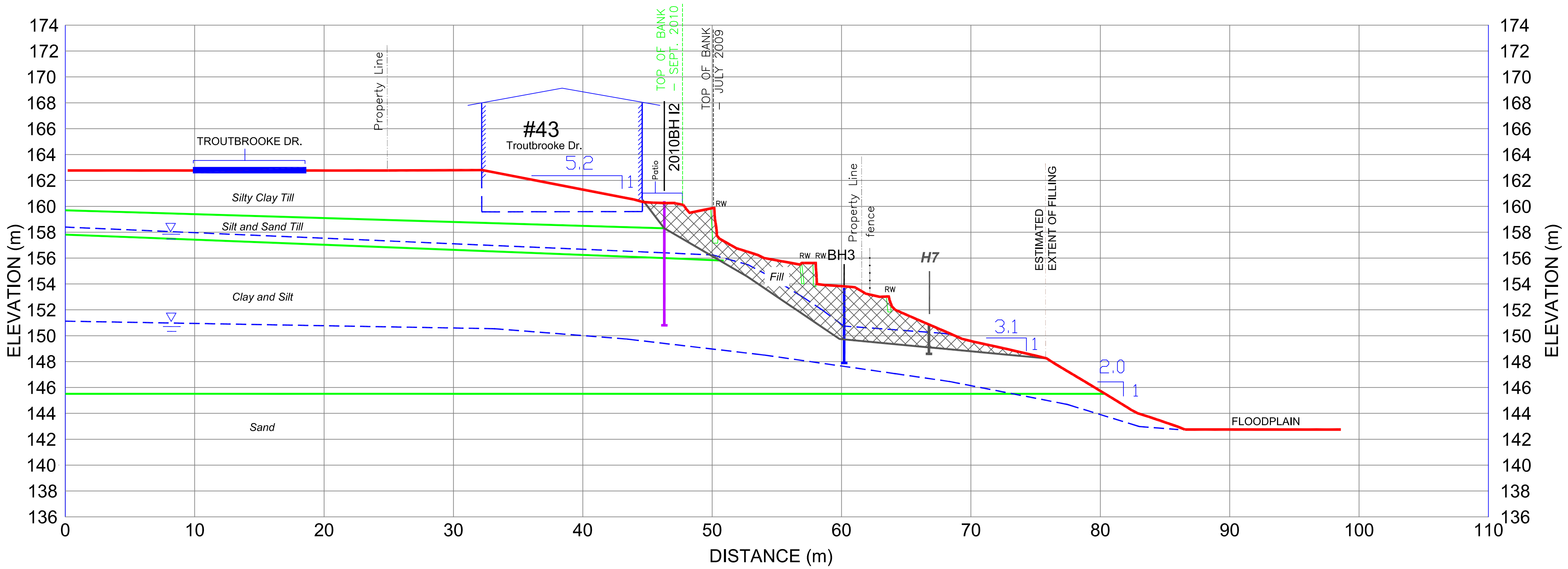
SECTION

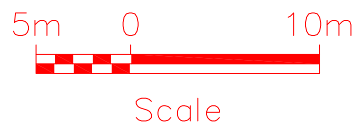
45



SECTION

43





EXISTING CONDITIONS SECTIONS

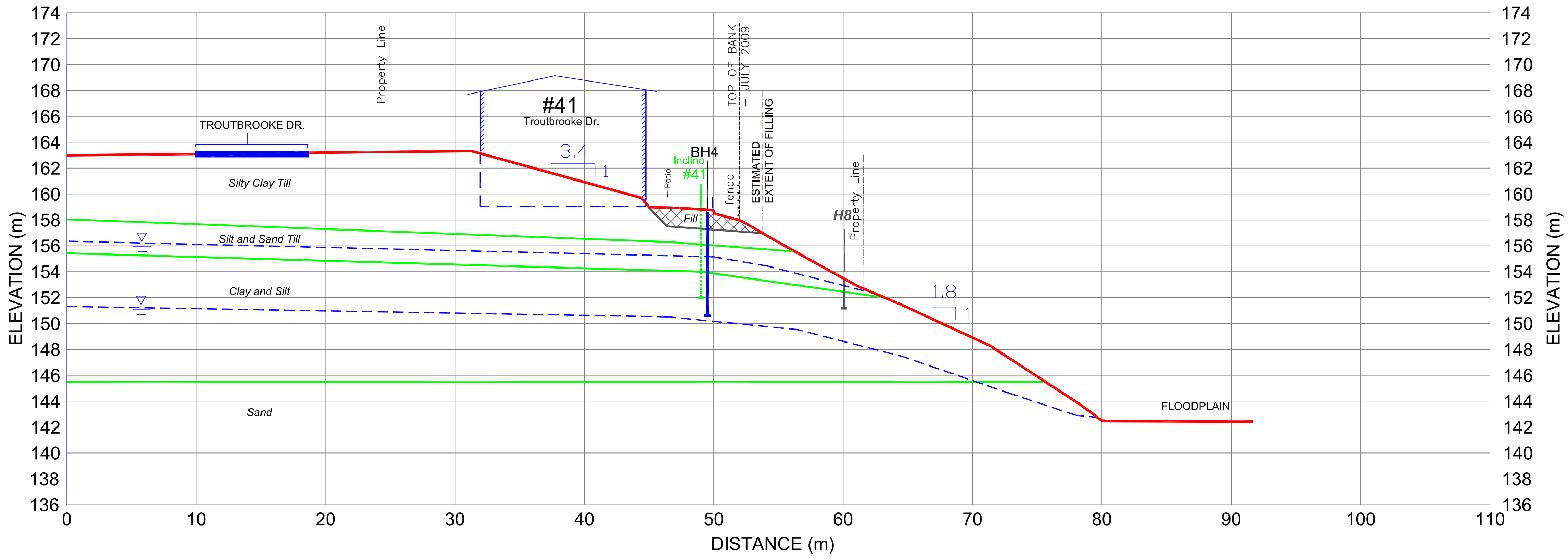
TERRAPROBE

File No. 1-10-5216

FIGURE 4C

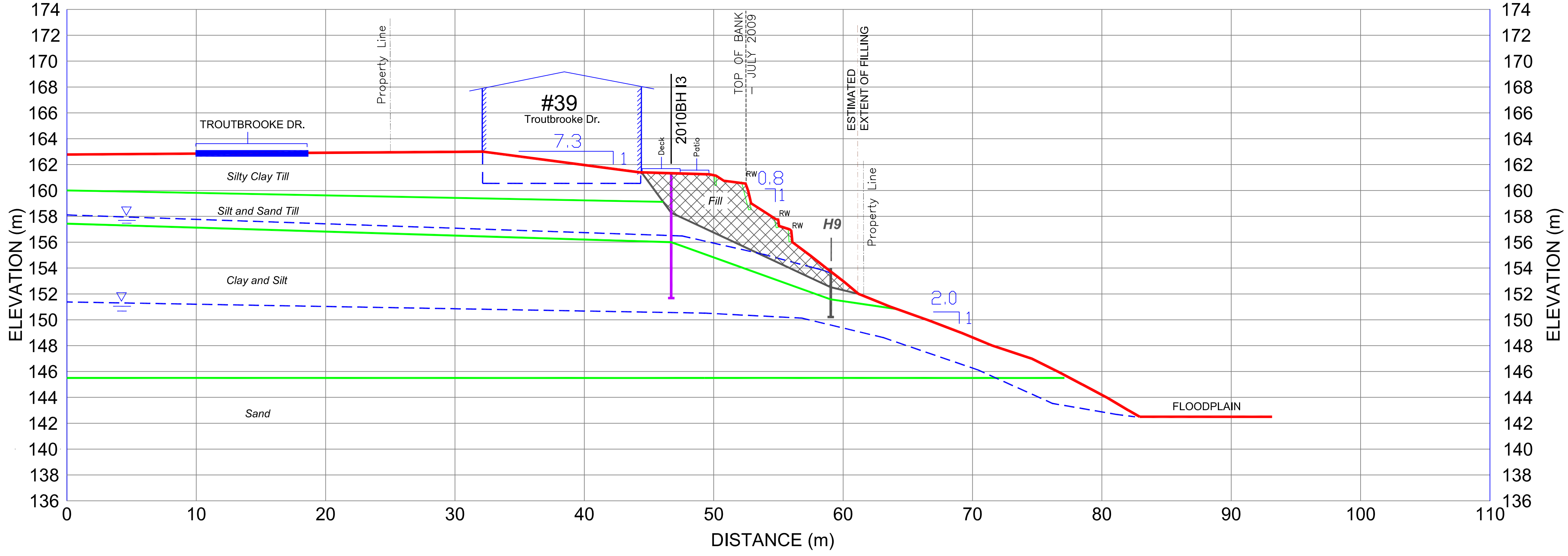
SECTION

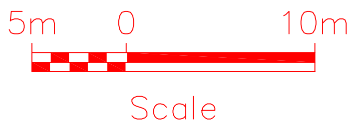
41



SECTION

39





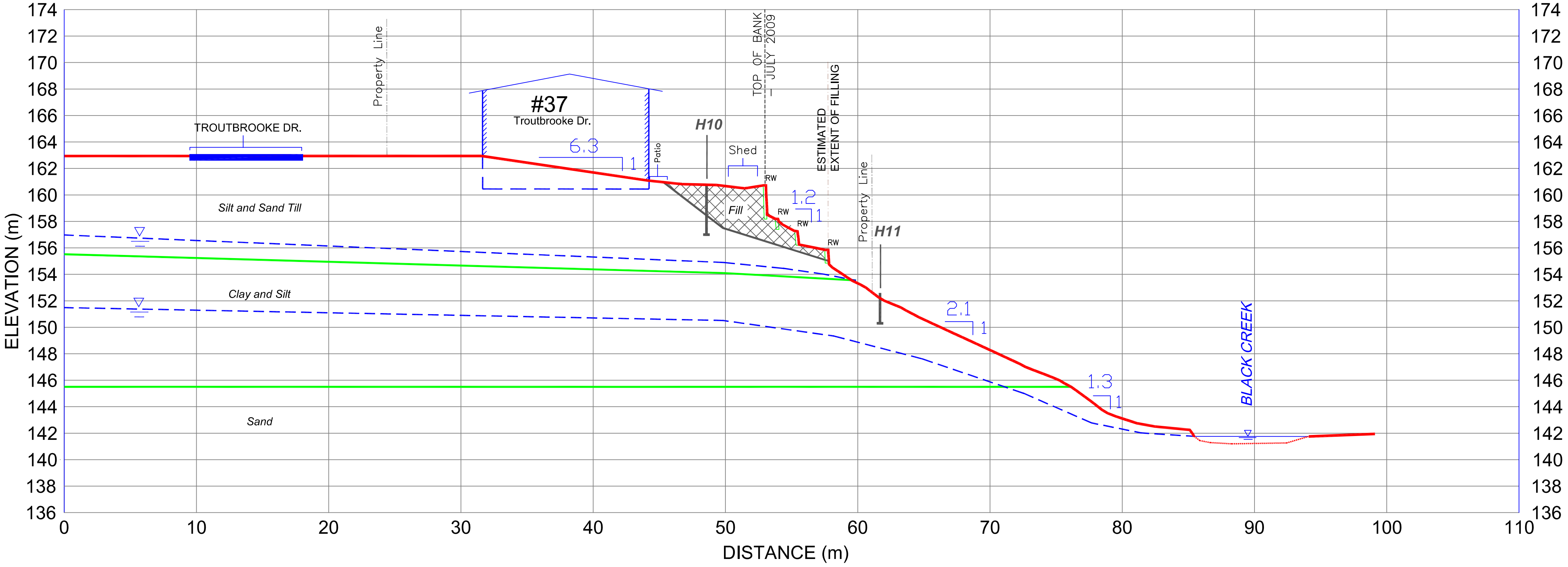
EXISTING CONDITIONS SECTIONS

TERRAPROBE

File No. 1-09-5216

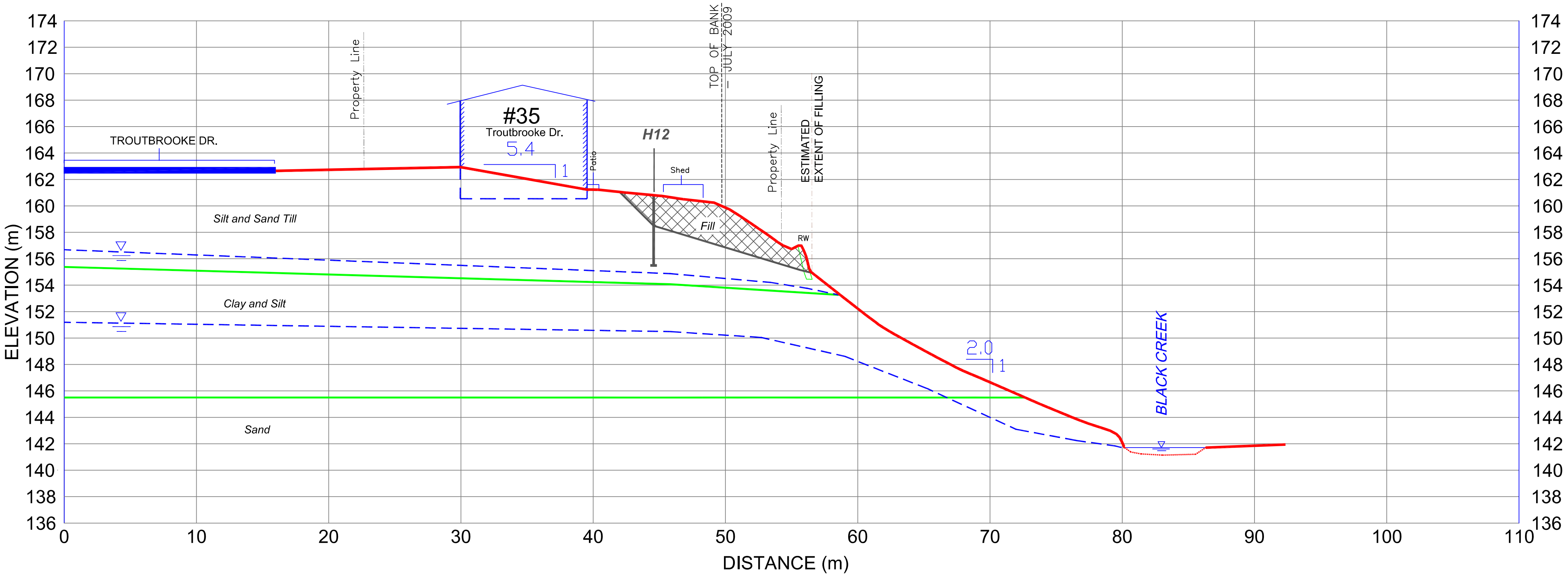
FIGURE 4D

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN



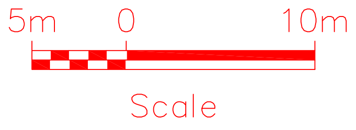
SECTION

37



SECTION

35



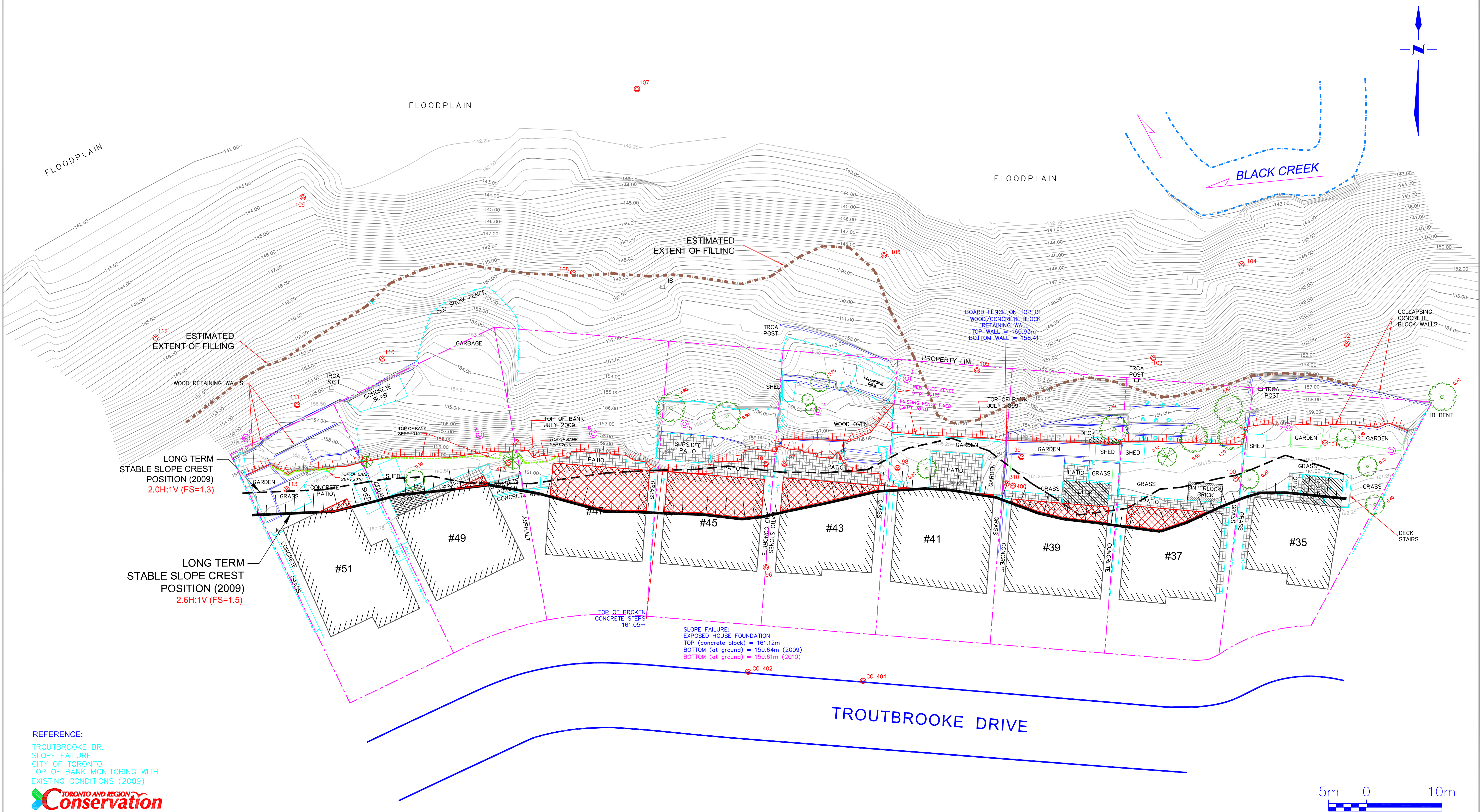
EXISTING CONDITIONS SECTIONS

TERRAPROBE

File No. 1-10-5216

FIGURE 4E

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN



REFERENCE:

TROUTBROOKE DR.
SLOPE FAILURE
CITY OF TORONTO
TOP OF BANK MONITORING WITH
EXISTING CONDITIONS (2009)

TORONTO AND REGION Conservation

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DATE: SEPT 18, 2009

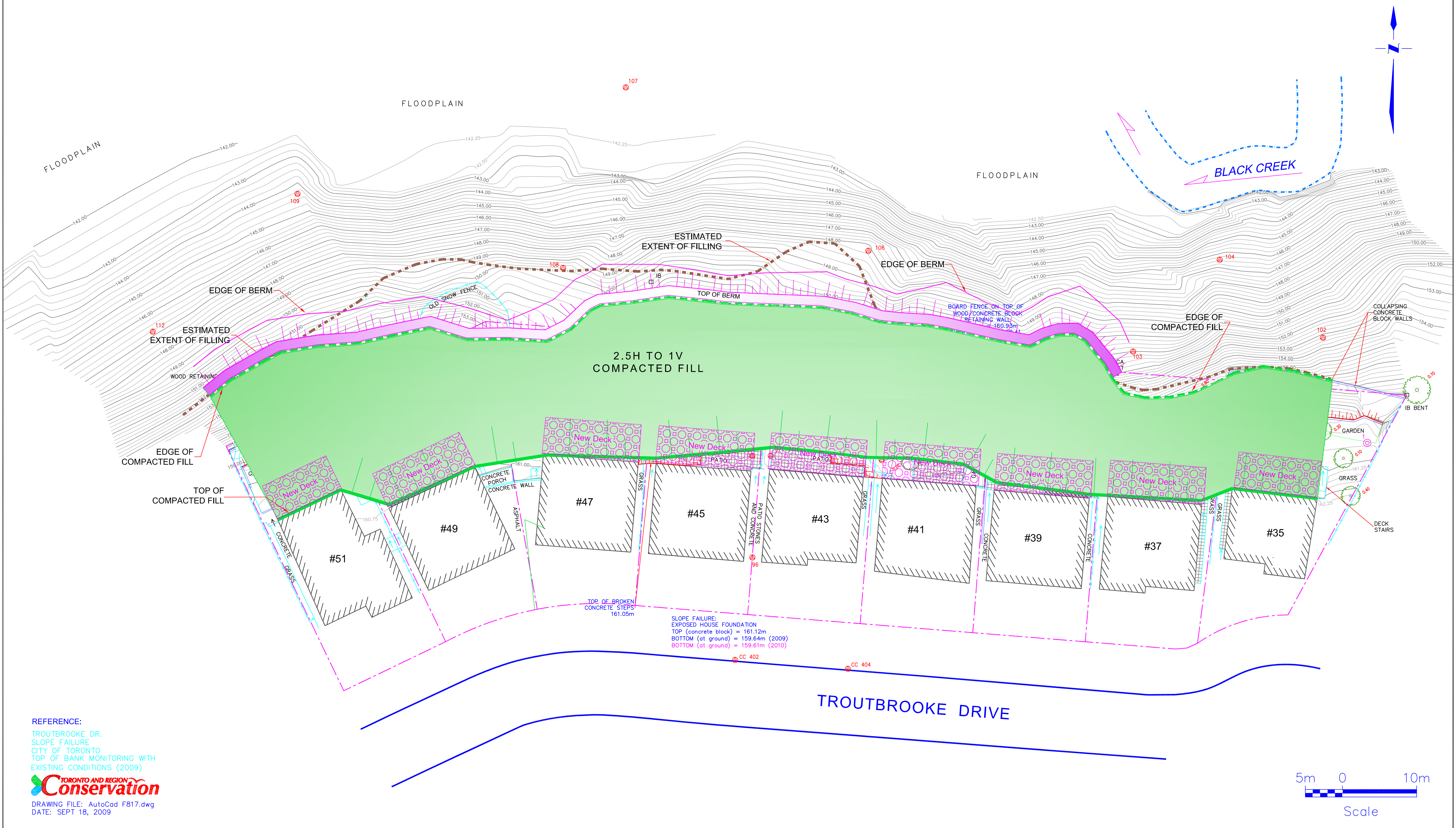
OPTION 1 - "DO NOTHING" PLAN

TERRAPROBE

File No. 1-10-5216

FIGURE 5

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN



REFERENCE:

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SLOPE FAILURE
CITY OF TORONTO
TOP OF BANK MONITORING WITH
EXISTING CONDITIONS (2009)

TORONTO AND REGION Conservation

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DATE: SEPT 18, 2009

OPTION 2A - PLAN - REMOVE FILL & SORT, STOCKPILE, RE-USE FILL AT 2.5H:1V

TERRAPROBE

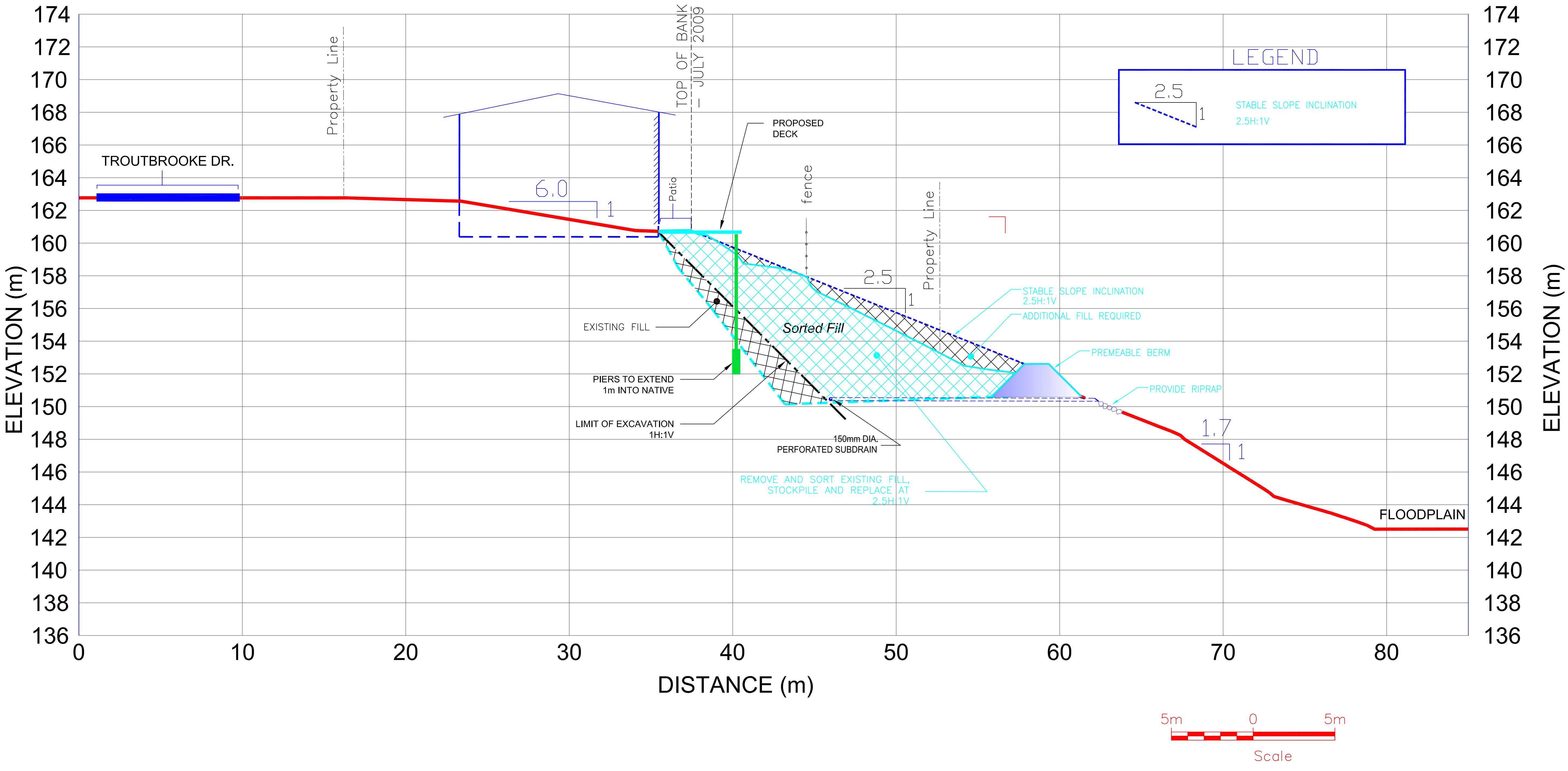
File No. 1-10-5216

FIGURE 6

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN

SECTION

Replace Existing Fill - Sort and Replace at 2.5H:1V



OPTION 2A - TYPICAL CROSS SECTION - REPLACE EXISTING FILL

TERRAPROBE

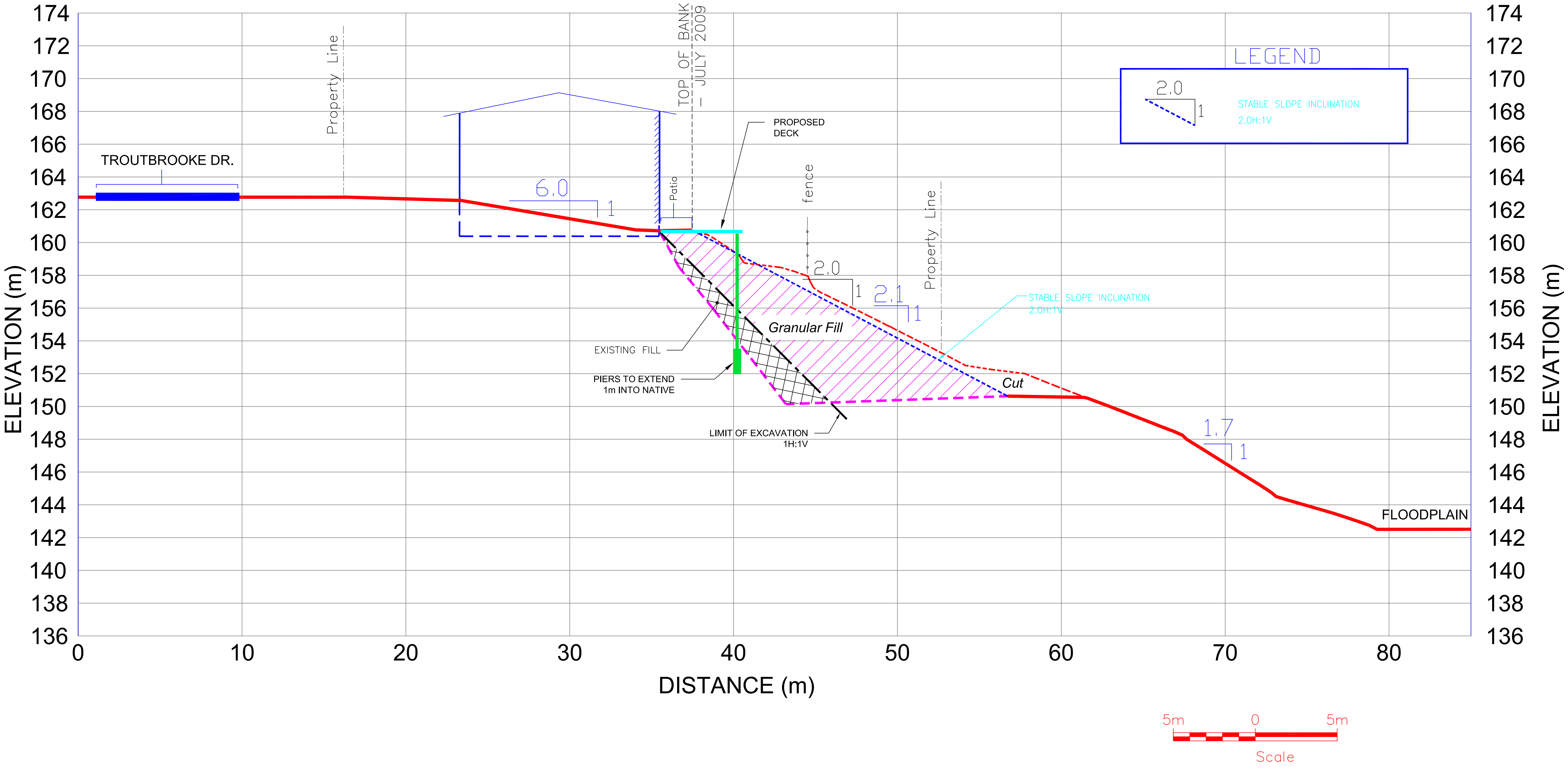
File No. 1-10-5216

FIGURE 7A

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN

SECTION

Replace Existing Fill - Replace with Granular 'B' at 2.0H:1V



OPTION 2B - TYPICAL CROSS SECTION - REPLACE WITH GRANULAR FILL

TERRAPROBE

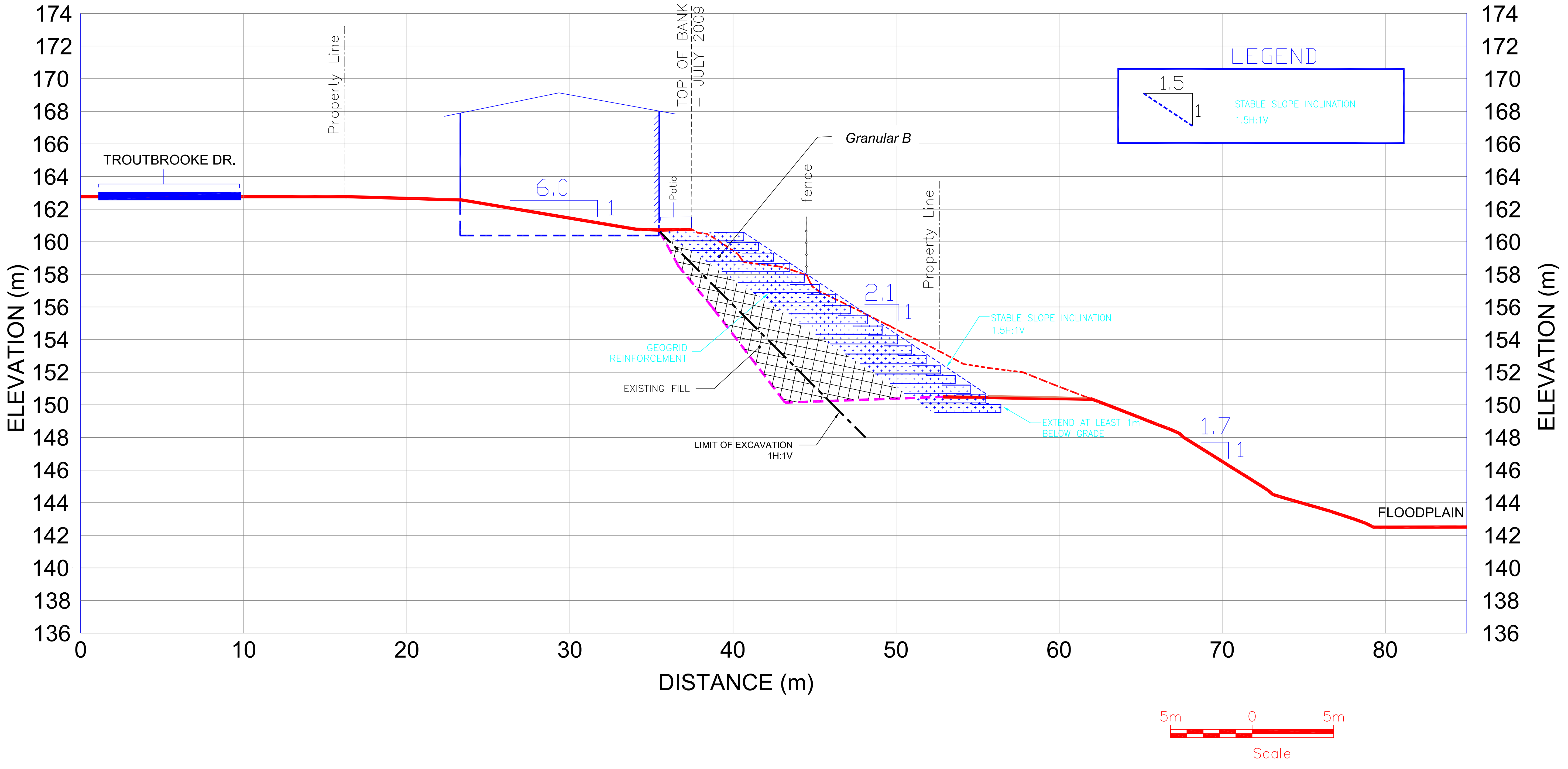
File No. 1-10-5216

FIGURE 7B

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN

SECTION

Replace Existing Fill - Replace with Geogrid Reinforced Granular 'B' at 1.5H:1V



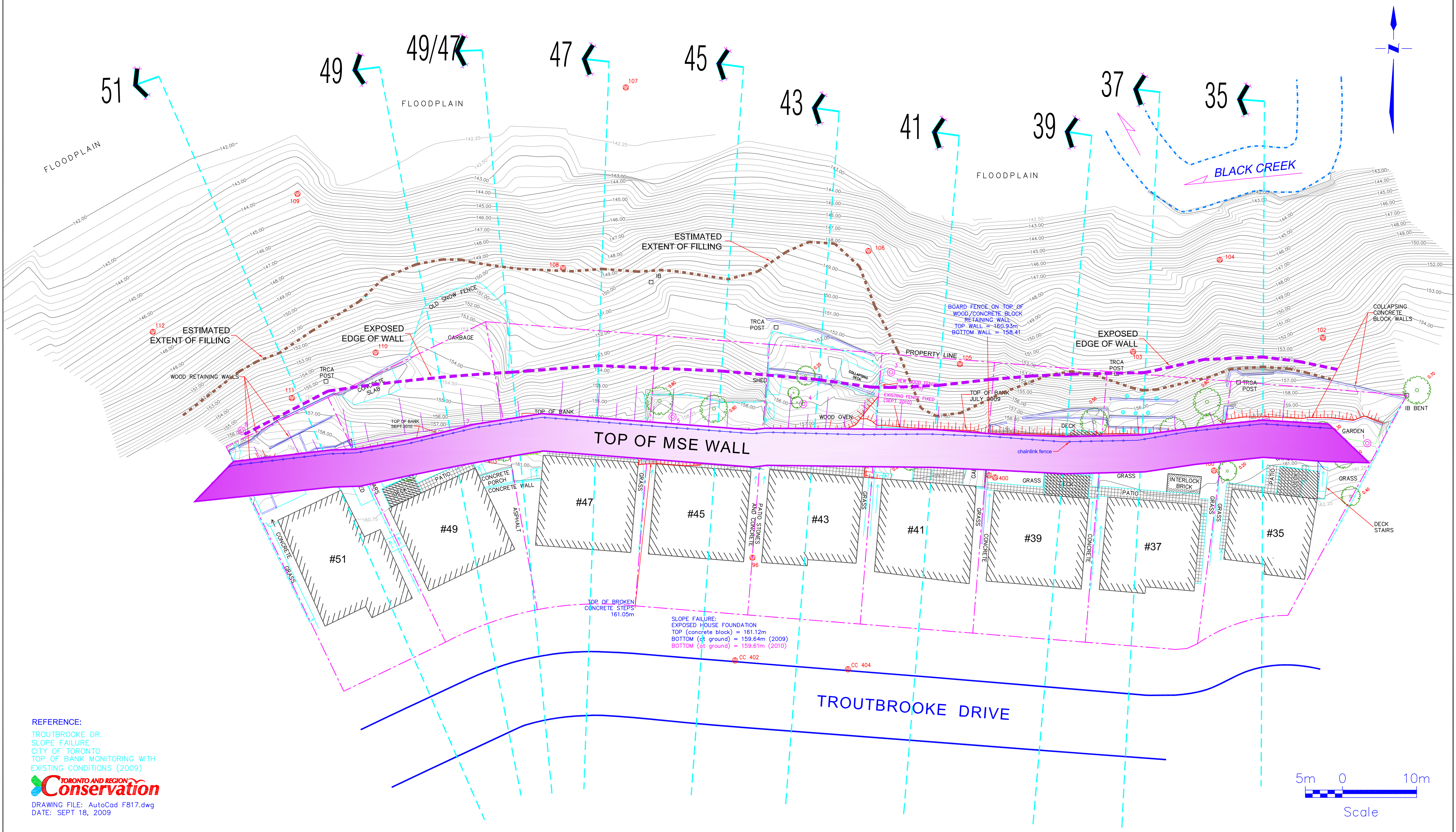
OPTION 2C - TYPICAL CROSS SECTION - REPLACE WITH GRANULAR B & GEOGRID REINFORCEMENT

TERRAPROBE

File No. 1-10-5216

FIGURE 7C

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN



REFERENCE:

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TOP OF BANK MONITORING WITH
EXISTING CONDITIONS (2009)

TORONTO AND REGION Conservation

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DATE: SEPT 18, 2009

OPTION 3 - PLAN - REPLACE WITH MSE WALL (1H:1V)

TERRAPROBE

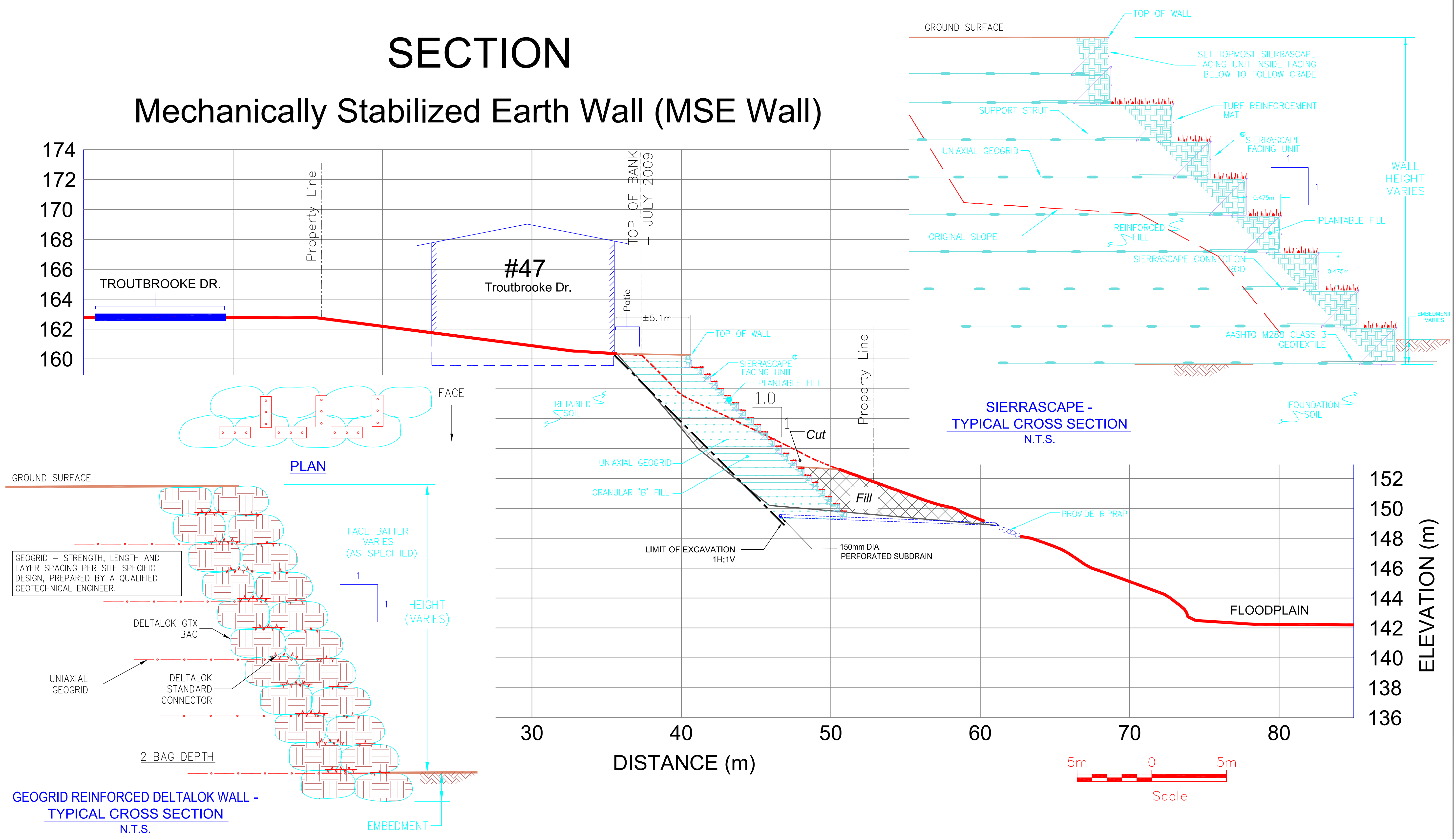
File No. 1-10-5216

FIGURE 8

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN

SECTION

Mechanically Stabilized Earth Wall (MSE Wall)



PLAN

SIERRASCAPE - TYPICAL CROSS SECTION
N.T.S.

GEOGRID REINFORCED DELTALOK WALL - TYPICAL CROSS SECTION
N.T.S.

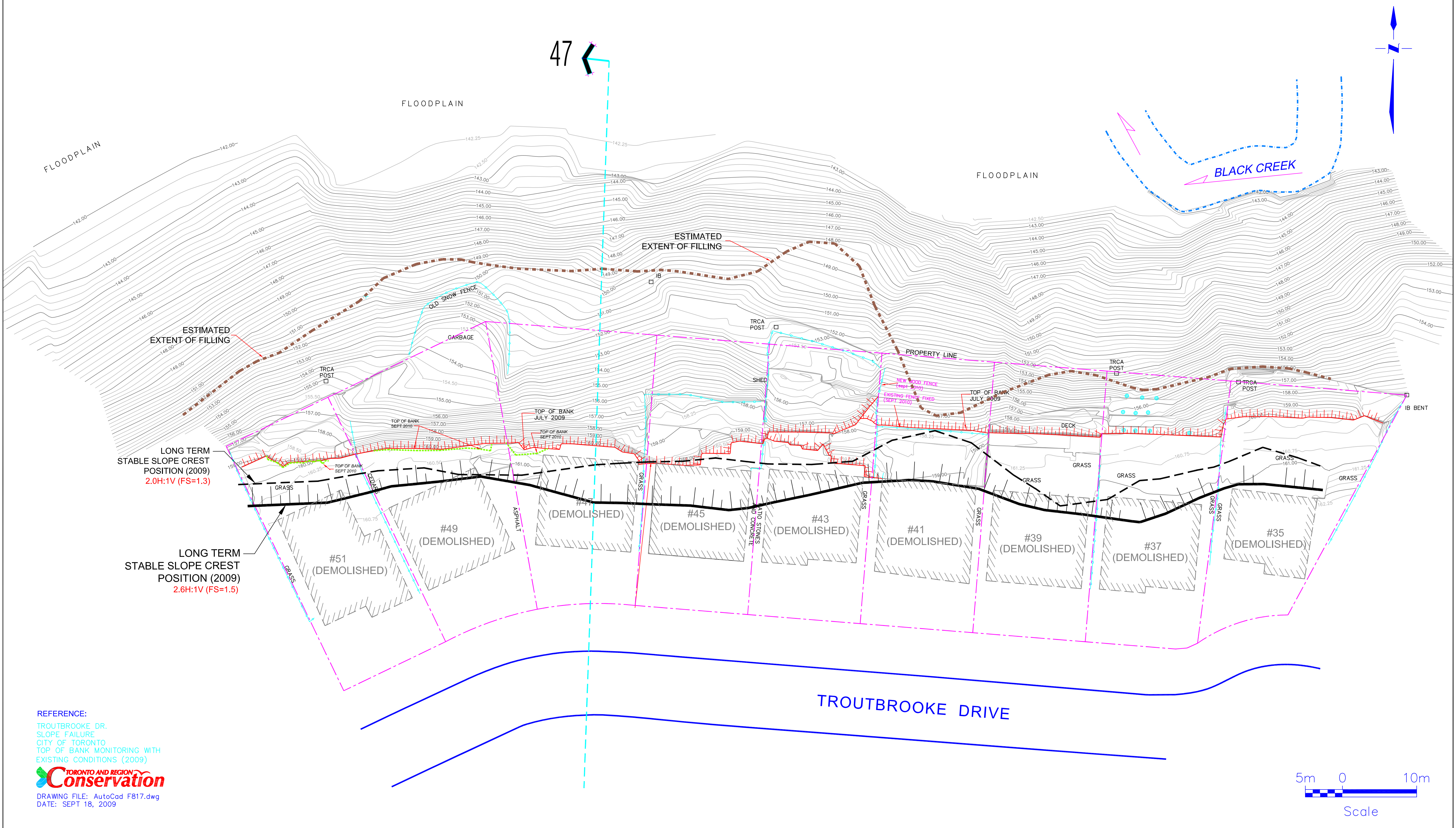
SIERRASCAPE OR DELTALOK WALL - OPTION 3

TERRAPROBE

File No. 1-10-5216

FIGURE 9

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN



REFERENCE:

TROUTBROOKE DR.
SLOPE FAILURE
CITY OF TORONTO
TOP OF BANK MONITORING WITH
EXISTING CONDITIONS (2009)

TORONTO AND REGION Conservation

DRAWING FILE: AutoCad F817.dwg
DATE: SEPT 18, 2009

OPTION 4 - GREENSPACE ACQUISITON

TERRAPROBE

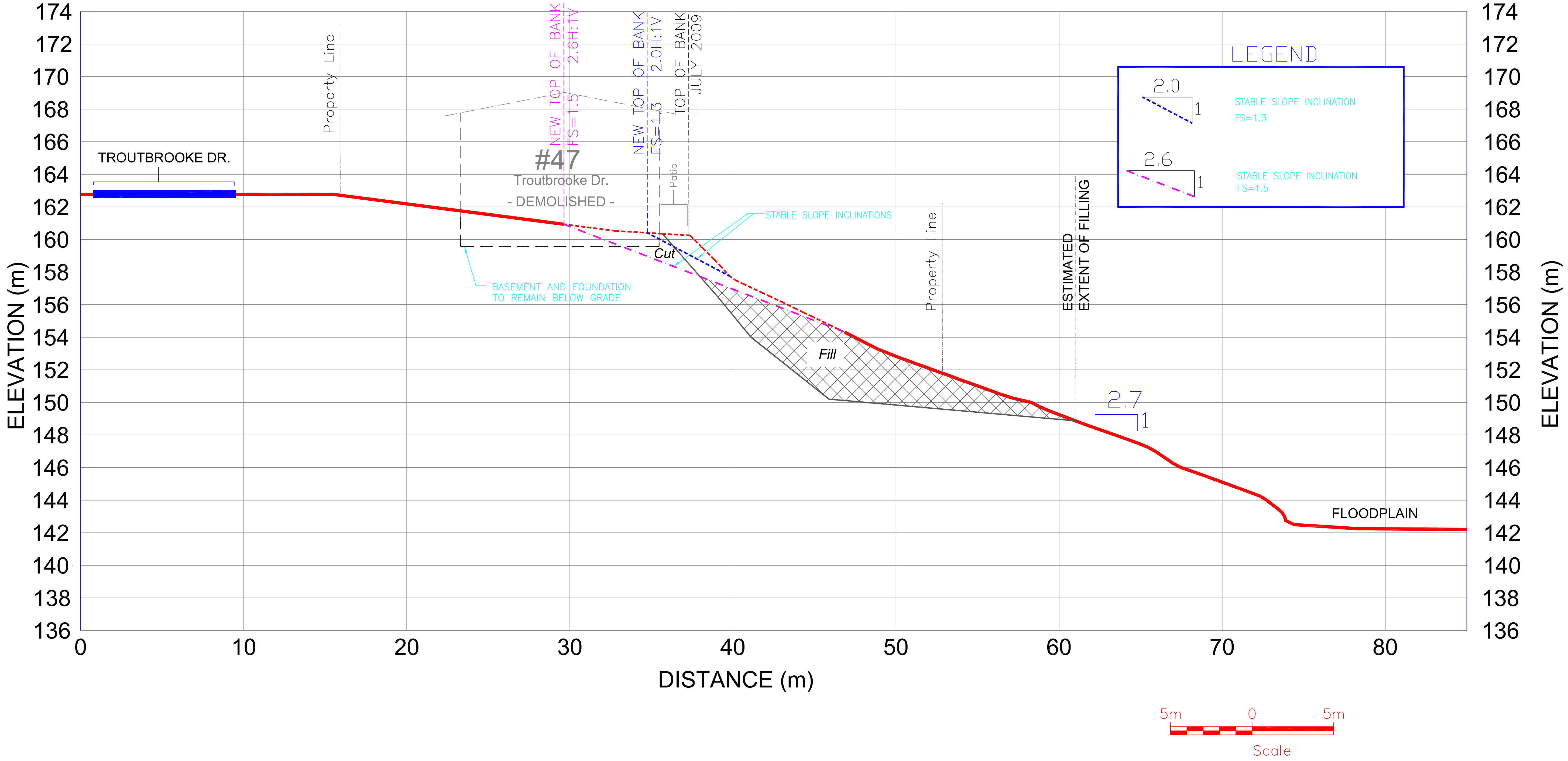
File No. 1-10-5216

FIGURE 10

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN

SECTION

Greenspace Aquisition, Regrade Slope



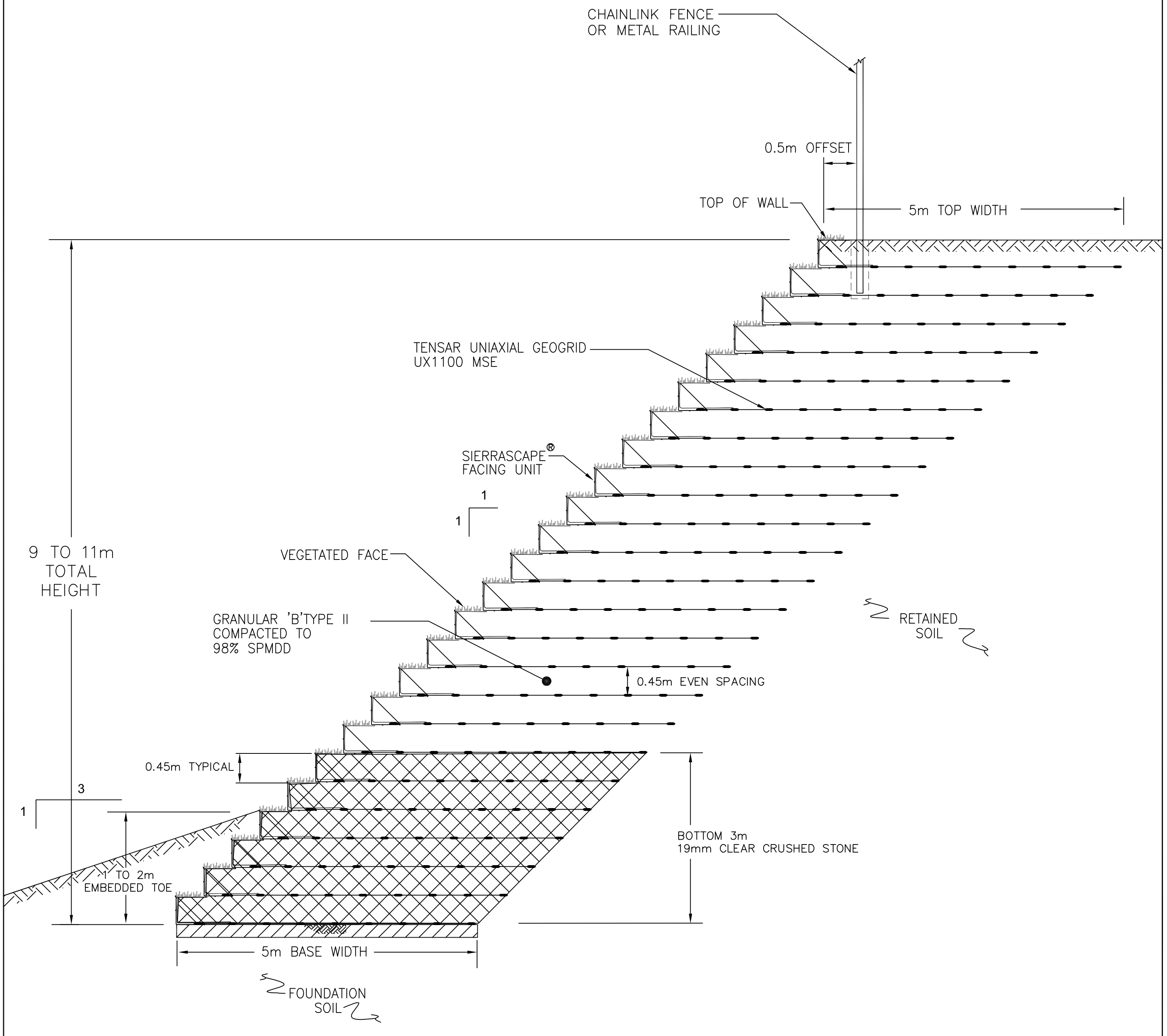
OPTION 4 - TYPICAL CROSS SECTION - GREENSPACE AQUISITION

TERRAPROBE

File No. 1-10-5216

FIGURE 11

\\Terradocs\fileserver\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 TROUTBROOKE DETAILED DESIGN rev 1.DWG, JOHN



TROUTBROOKE DRIVE
TYPICAL CROSS CROSS-SECTION
VERTICAL
N.T.S.

PREFERED ALTERNATIVE CONCEPTUAL SKETCH

TERRAPROBE

File No. 1-09-4072

FIGURE 12

\\Terradocs\FileServer\Terraprobe Limited\All Projects\2010 Files\1-10-5200 to 5299\1-10-5216\A. Dwgs, Logs\AutoCAD\1-10-5216 fig 12 SIERRASCAPE.dwg, JOHN