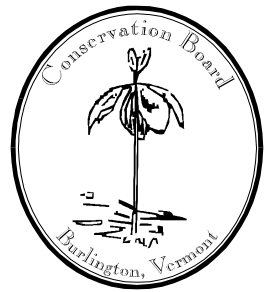


Burlington Conservation Board

645 Pine Street
Burlington, VT 05401
<http://www.burlingtonvt.gov/dpi>
Telephone: (802) 865-7188

*Miles Waite, Chair
Zoe Richards
Matt Moore
Don Meals
Ryan Crehan
Hannah Brislin
Rebecca Roman
Jules Lees
Tori Hellwig*



Conservation Board Meeting Public Notice

April 5, 2021 at 5:30 PM

Remote Meeting

Zoom: <https://us02web.zoom.us/j/87619425654?pwd=QW9PU0wyWERrZ0FoRkE1VkJwV0Vidz09>

Webinar ID: 876 1942 5654

Password: 628734

Telephone: +1 301 715 8592 or +1 312 626 6799 or +1 929 205 6099 or +1 253 215 8782 or
+1 346 248 7799 or +1 669 900 6833

Agenda

- I. Minutes (5:30)** – Accept minutes from March 1, 2021 meeting
- II. Board Comment (5:35)**
- III. Public Comment (5:40)**
- IV. Open Space Subcommittee (5:45)**
 - 1. Open Space Addendum / Discussion with Resilience Planning & Design
- V. Project Review (6:30)**
 - 1. **21-0729CA: 44-50 Lakeside Ave. (Ward 5S, E-LM) Lakeside Ovens, LLC**
Install a 30' diameter yurt at northern end of property and relocate previously permitted deck to southwest corner of building 32.
- VI. Update & Discussion (6:45)**
 - 1. Slope stability report
 - 2. Intervale deer management
- VII. Adjournment (7:30)**

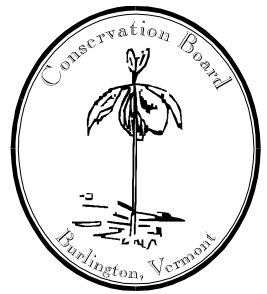
Note that agenda times are approximate only.

The City of Burlington will not tolerate unlawful harassment or discrimination on the basis of political or religious affiliation, race, color, national origin, place of birth, ancestry, age, sex, sexual orientation, gender identity, marital status, veteran status, disability, HIV positive status or genetic information. The City is also committed to providing proper access to services, facilities, and employment opportunities. For accessibility information or alternative formats, please contact Human Resources Department at (802) 540-2505.

Burlington Conservation Board

645 Pine Street
Burlington, VT 05401
<http://www.burlingtonvt.gov/DPI/CB>
Telephone: (802) 865-7189

*Miles Waite, Chair
Zoe Richards
Don Meals
Matt Moore
Ryan Crehan
Hannah Brislin
Rebecca Roman
Tori Hellwig
Jules Lees*



Conservation Board Meeting Minutes

Monday, March 1, 2021 – 5:30 pm
Remote Meeting

Attendance

- **Board Members:** Zoe Richards (ZR), Miles Waite (MW), Rebecca Roman (RR), Don Meals (DM), Hannah Brislin (HB), Jules Lees (JL), Ryan Crehan (RC)
- **Absent:** Tori Hellwig (TH), Matt Moore (MM)
- **Public:** Steve Whitman (Open Space Addendum) Rowan Ciganoni, Patrick Dunseith (Intervale Deer Management)
- **Staff:** Scott Gustin (Permitting & Inspections), Dan Cahill (Parks & Recreation)

MW, Chair, called the meeting to order at 5:37 p.m.

Minutes

A MOTION was made by ZR and SECONDED by HB:

Approve the meeting minutes of February 1, 2021 as written.

Vote: 5-0-1, motion carried. (No RC yet)

Board Comment

SG noted that the lakeshore amendment cleared public hearing by the Planning Commission recently. It's scheduled for a March 9 first read by the City Council. After that, it will likely move on to the Council's ordinance committee.

SG mentioned that he and Meagan Tuttle are working with the UVM NR 206 class to work on a shoreline management manual for Burlington. That should be complete later this coming spring.

RC appeared at 5:40

MW noted the possibility for naturalizing part of the Urban Reserve's sheet pile shoreline. Basically, the northern half could possibly be removed. The southern half is needed for deep water boat access. **We should consider this as a future agenda item for discussion.**

RC said that it's a project that he's pursuing through his work with US F&W. MW suggested sharing with the NR 206 class. RC said 1997 urban reserve plan contemplates similar action.

SG asked about soil contamination concerns for migration into the lake if the sheet piling is removed. MW said that assessment of soils nearby indicate that contaminant migration into the lake is unlikely.

Public Comment

None.

Open Space Subcommittee

The programs and services of the Dept. of Permitting & Inspections are accessible to people with disabilities. For accessibility information call 865-7188.

1. Open Space Addendum / Discussion with Resilience Planning & Design

Steve Whitman appeared on behalf of this item.

Steve Whitman overviewed the addendum meetings with various boards and commissions thus far. They will be useful in framing the Open Space summit meeting later this month on March 29. It is scheduled for 7:00 PM and will be a virtual summit. We've worked on flyers and other informational material. The summit structure will include a welcome (by BCB member), overview, interactive poll about nature-based solutions, and overview of the topic that's similar to those provided to BCB thus far. The summit will help us solicit ideas and input and what should be pursued moving forward.

HB asked if we have ideas of who to invite and how to advertise the summit event. Mr. Whitman said that we are relying on relational organizing / word of mouth. HB said that relational organizing is one of the best forms of outreach. She asked if there will be folks to host the breakout rooms for the discussion groups during the summit.

ZR thanked HB for helping them cast a wider net for participation in the summit.

Dan Cahill noted that the "Media Factory" will help facilitate event.

HB suggested building the meeting breakout rooms the day before. Ask people to use their real names. HB suggested that people pre-register.

RR suggested having someone familiar with NBS in each break-out room.

Update & Discussion

1. Slope stability (existing standards)

MW reviewed the staff memo as to existing zoning standards related to steep slopes. He recommends that a section of the CDO address slope stability and the potential for slope failure and the need for geotechnical analysis.

SG noted that that the CDO could establish thresholds to require a geotechnical analysis pre-development that finds development could occur without inducing slope failure. We could use the existing thresholds of 30% and/or 15% as the threshold. Avoid establishing technical criteria in the CDO.

DM asked if slope failure is the only focus here. MW said that the focus really is on determining whether a proposed development could be done without slope failure.

ZR asked if a geotechnical analysis would include the necessary information, i.e. like knowing there's fill over buried cars. MW felt that, yes, a geotechnical analysis would determine whether fill soils are encountered.

RC said he's unsure how to rectify the disparity wherein expensive development might succeed whereas lower budget development may not. Also, what about provision to require retention of vegetation on the slope?

JL, is it possible to account for proximity to steep slopes, like along Colchester Ave? MW said that there may be a possibility for a setback. SG suggested that something like development within a certain distance of a steep slope needs a geo tech analysis.

MW said he'd work with SG to put together an initial draft.

2.311 North Avenue draft management plan & consideration of future trail network

Dan Cahill provided background and history of the city's acquisition of the land. This plan is intended to serve as a template for future land management plans for Burlington. He also noted the draft plan drawings for the path link to the waterfront bike path. He is looking for comment from Board members as to the draft plan and the project plans.

HB asked about the naming portion of the draft plan. Mr. Cahill said that the park name has been decided but not yet unveiled. HB mentioned a recent standard passed by the State of Vermont that requires the Abenaki names of state parks on park signs.

ZR said that VHCB was very pleased with the management plan.

MW, does it make sense to hold onto the draft plan until the park name is announced? Mr. Cahill said that he's looking to allow for as much community engagement in the management plan as possible through the spring.

RC, how does the management plan interface with the draft path plans? Mr. Cahill responded that the timeline for the two initially lined up; however, it's looking more likely that the plan will be wrapped up this year, and the path will be constructed next year. We want to have a public process that will be open and informative. Construction of the path will bring about changes to that landscape.

RR pointed out that the path must be ADA accessible, and that affected design.

Mr. Cahill overviewed the proposed path layout and the preservation of mature oak trees along it. Some mature cottonwoods will be removed. There will be opportunity for some interesting revegetation along the path.

MW, is there concern about people taking short cuts along the existing ravine to get to Texaco Beach? Mr. Cahill pointed out a pedestrian staircase close to the beach.

Mr. Cahill pointed out the slope grading options paralleling the proposed path. MW said he's ok with a more aggressive 3:1 slope. The existing slope is similar. RC asked if the area would be largely undisturbed with the steeper slope. Mr. Cahill said that he had a similar thought. With the amount of machinery that will be involved with the project, nothing will be left undisturbed.

MW asked about the green lines on the plan. Mr. Cahill said that it denotes some form of stormwater apparatus.

ZR asked about the path from the stone cottage. Will it stay mostly the same? Mr. Cahill said it will be changed. The trail will go around an expanded community garden.

RC, big thumbs up on opening up the cemetery for access. It's like an arboretum.

3. Intervale Deer Management

MW said there's more work to be done before the Board can be more fully involved in this item. The Board should decide whether to participate in this item and, if so, in what form?

JL noted the Ethan Allen Homestead is right next to the Intervale and their Abenaki component. Maybe open up a hunting opportunity for indigenous people first.

ZR said that deer impacts are obvious in the Intervale. The city encourages farming, but farmers in the Intervale cannot obtain a depredation permit to deal with deer. There are many ways to address the issue and many different groups with different interests. What work needs to be done

and who's going to do it? If the hunt is only on the Intervale lands, will that just push deer elsewhere? ZR mentioned a "community deer manager" guide put together by TNC.

DM said he thinks the Board does have a role. There's a big need for public education to define the problem. There is a major opportunity for backlash, too. The Board could sponsor a seminar or something similar to define and explain the problem.

MW, a next step could be talking about the community based deer management concept. This boils down to relaxing a city ordinance in a certain area for a period of time in season.

HB, the community discussion needs to be done wisely – after a couple of months of planning and outlining.

Rowan Ciganoni said he was just listening in.

Patrick Dunseith said that he'll continue to show up and continue to advocate moving forward with this issue. He thinks folks are ready to engage with a really nuanced concept like this. We're dealing with complex issues, including climate change. This matter ties in with so many other issues that are important to the community.

RC, with a topic like this, we know the BCB supports pursuing it. Someone needs to take the lead in order to make this happen. He encouraged Patrick, possibly in partnership with VT F&W, to come up with a plan for outreach and how we can get to the end result. Mr. Dunseith said that he most needs a venue for the conversations. He and the other parties are ready to have the discussion.

MW agreed that the Board can't be the driver but we can be a partner. Mr. Cahill said that the city could possibly have a role, with other support, in pulling together some sort of project to address the matter.

MW asked if the Intervale Center has approached the press as to advertising the deer problem.

Mr. Dunseith said that he sees value in pushing a process for community engagement, but he cannot create that process on his own. We have a lot of folks who are ready to talk about the matter. MW said that the WVPD needs to be involved in this as well.

RR said that she hears that the BCB do not have the time or resources to drive this item. It would be very helpful if Mr. Dunseith could put together a timeline for outreach and ways BCB can help, we could then provide more assistance in terms of facilitating and hosting a public forum.

ZR, there is a profound question as to whether this is the Intervale Center's job. She suggested looking at TNC's community deer management document as a first step.

A MOTION was made by RR and SECONDED by HB:

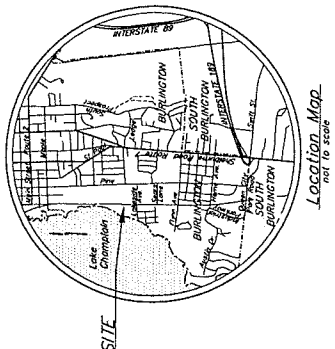
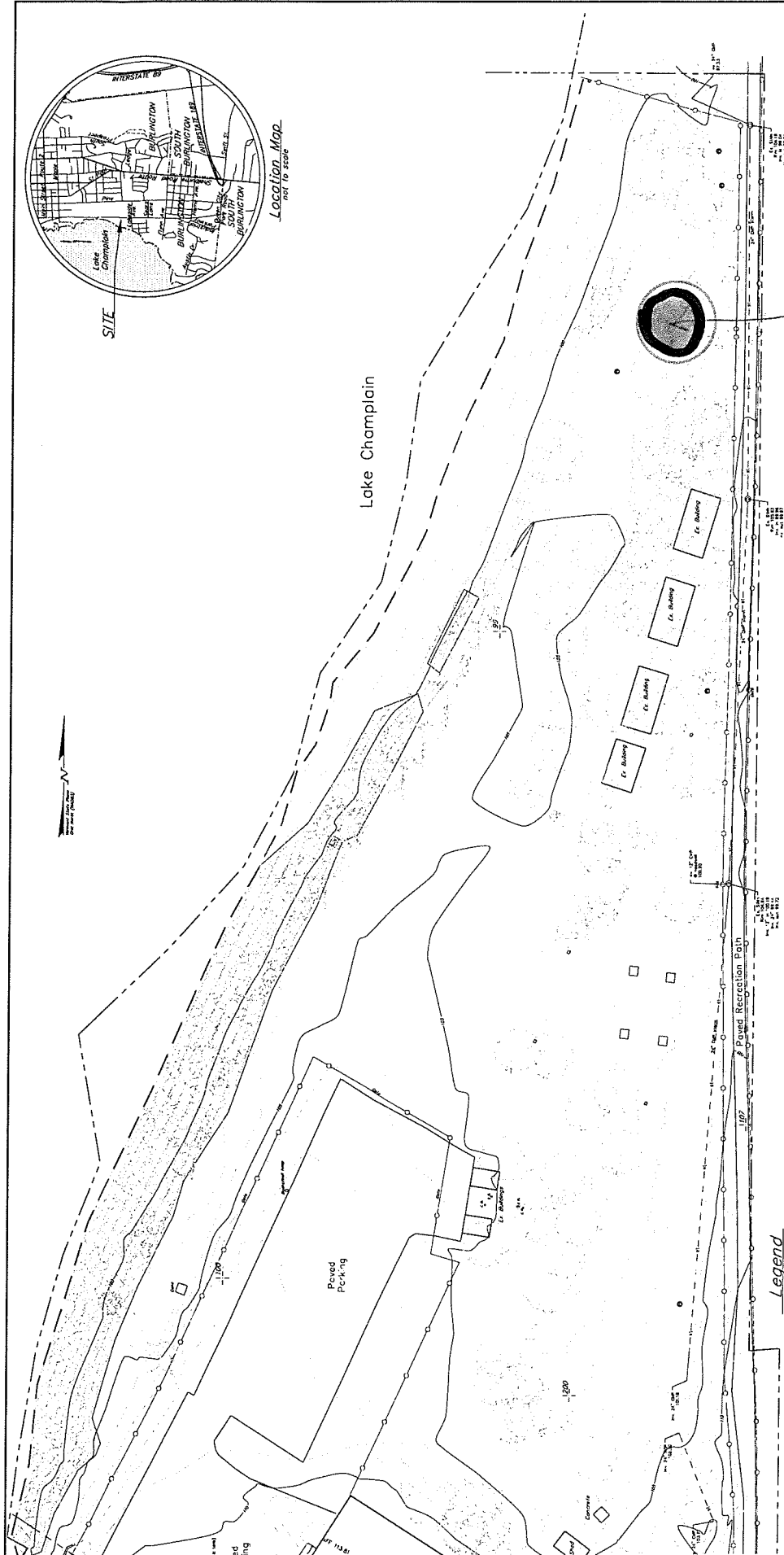
Review the TNC community deer management document.

Vote: 7-0-0

Mr. Cahill, when we review the document, it's not just about hunting. It's more holistic than that.

Adjournment

The meeting adjourned at 7:43 PM.



- Notes:**
- This plan is not a boundary survey. The property lines shown are based on boundary surveys prepared by Civil Engineering Associates, Inc. (CEA) in 1998 and 2001. The survey was performed by CEA and is not warranted to be exact or verified. The survey was performed by CEA and is not warranted to be exact or verified. The survey was performed by CEA and is not warranted to be exact or verified.
 - The underground utilities shown on this plan are based on the 1998 and 2001 surveys. The survey was performed by CEA and is not warranted to be exact or verified. The survey was performed by CEA and is not warranted to be exact or verified. The survey was performed by CEA and is not warranted to be exact or verified.
 - Elevations are based on the NAVD 88 (Geoid 121) vertical datum.
 - Project Horizontal Coordinates derived from GPS observation using reference from NAD83 (2011) 2012.00 epoch.

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MAR 05 2021

Legend

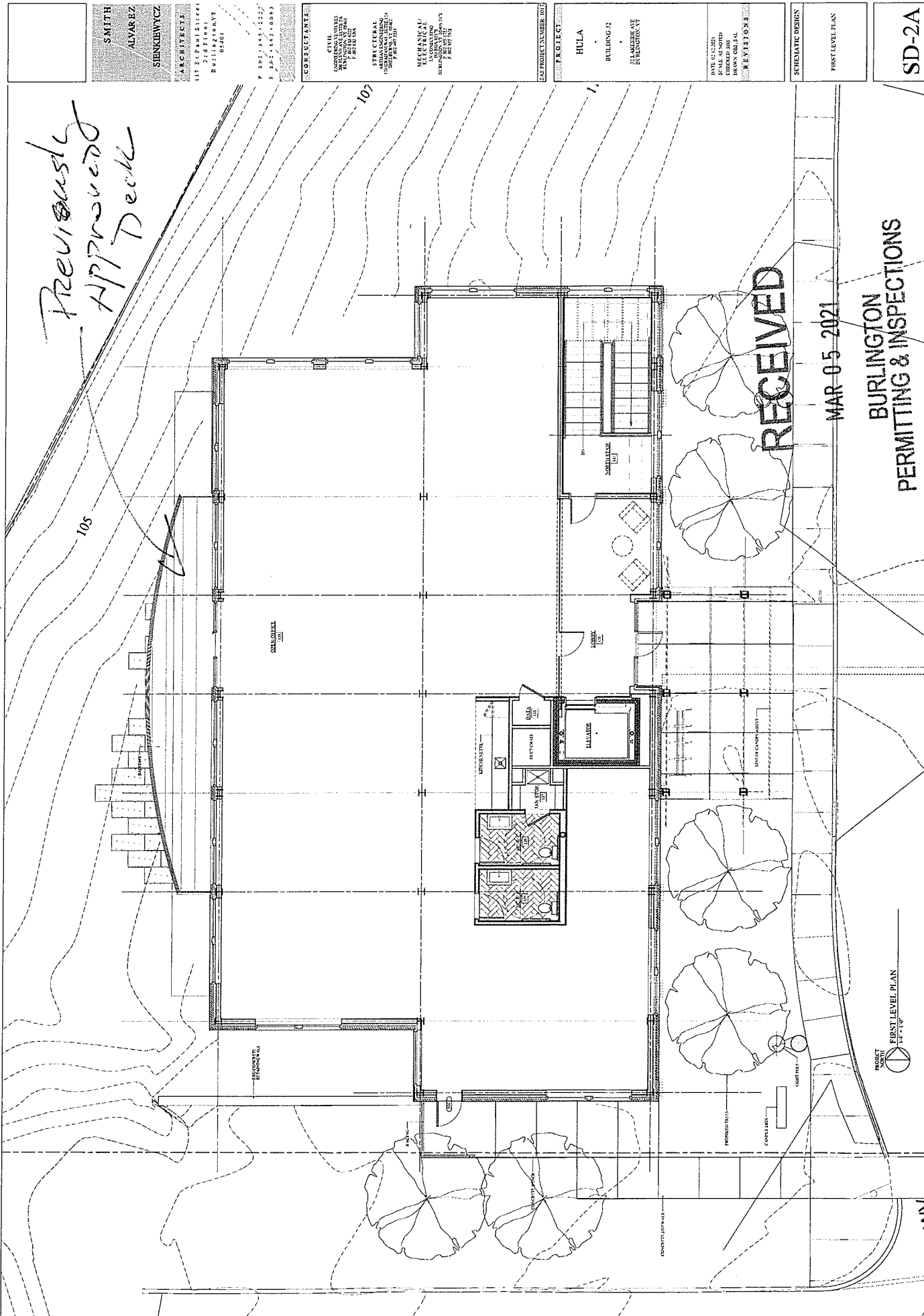
- Survey Control Point
- Existing Spot
- Existing monitor well
- Existing Outcrops Tree
- Existing Ephemeral Tree
- Existing Spot Grade Elevation
- Existing Contour
- Existing Gas Line/Noise
- Existing Sewer Line/Manhole
- Existing Storm Line/Manhole/Booth
- Existing Overhead Electric Line/Power Pole
- Existing Overhead Utility
- Existing Underground Electric & Telephone Line
- Existing Gageout
- Existing Tree Line

- Survey Control Point
- Existing Spot
- Existing monitor well
- Existing Outcrops Tree
- Existing Ephemeral Tree
- Existing Spot Grade Elevation
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- Existing Overhead Electric Line/Power Pole
- Existing Overhead Utility
- Existing Underground Electric & Telephone Line
- Existing Gageout
- Existing Tree Line

Drawn	Checked	Date
Design		
Drawn		
Checked		
Scale	1" = 30'	
Date	April 11, 2018	
Project	Blodgett Campus	
Client	Blodgett Campus	
Address	164 Main Street, Colchester, Vermont 05445	
Sheet	X-3	

Building 32 - Elevated Deck

Previously
Approved
Deck



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MAR 05 2021
BURLINGTON
PERMITTING & INSPECTIONS

PROJECT
FIRST LEVEL PLAN
1/4" = 1'-0"

SMITH
ALVAREZ
SIENKOWICZ
ARCHITECTS
117 STATE STREET
BURLINGTON, VT 05401
P 802.443.2222
F 802.443.0093

CONSULTANTS
CIVIL
WILLIAMSON & ASSOCIATES
P 802.443.2222
F 802.443.0093
STRUCTURAL
WILLIAMSON & ASSOCIATES
P 802.443.2222
F 802.443.0093
MECHANICAL/ELECTRICAL
WILLIAMSON & ASSOCIATES
P 802.443.2222
F 802.443.0093

PROJECT NUMBER 1017
PROJECT
HULA
BUILDING 32
BLANKENBACH
BURLINGTON, VT

DATE 02.12.2021
DESIGNED BY
CHECKED JH
DRAWN GBL
REVISIONS

SCHEMATIC DESIGN
FIRST LEVEL PLAN

SD-2A

Proposed
Relocated
Deck

BICYCLE PARKING REQUIREMENTS:

DISTRICT ZONING TABLE 22-1

LONG TERM SPACES
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PLANTING SCHEDULE	
KEY	COMMON NAME
A	KEYSTONE THORNLESS HONEYSUCKLE
B	ARBOREAL VIVIPAROUS

[illegible][illegible]

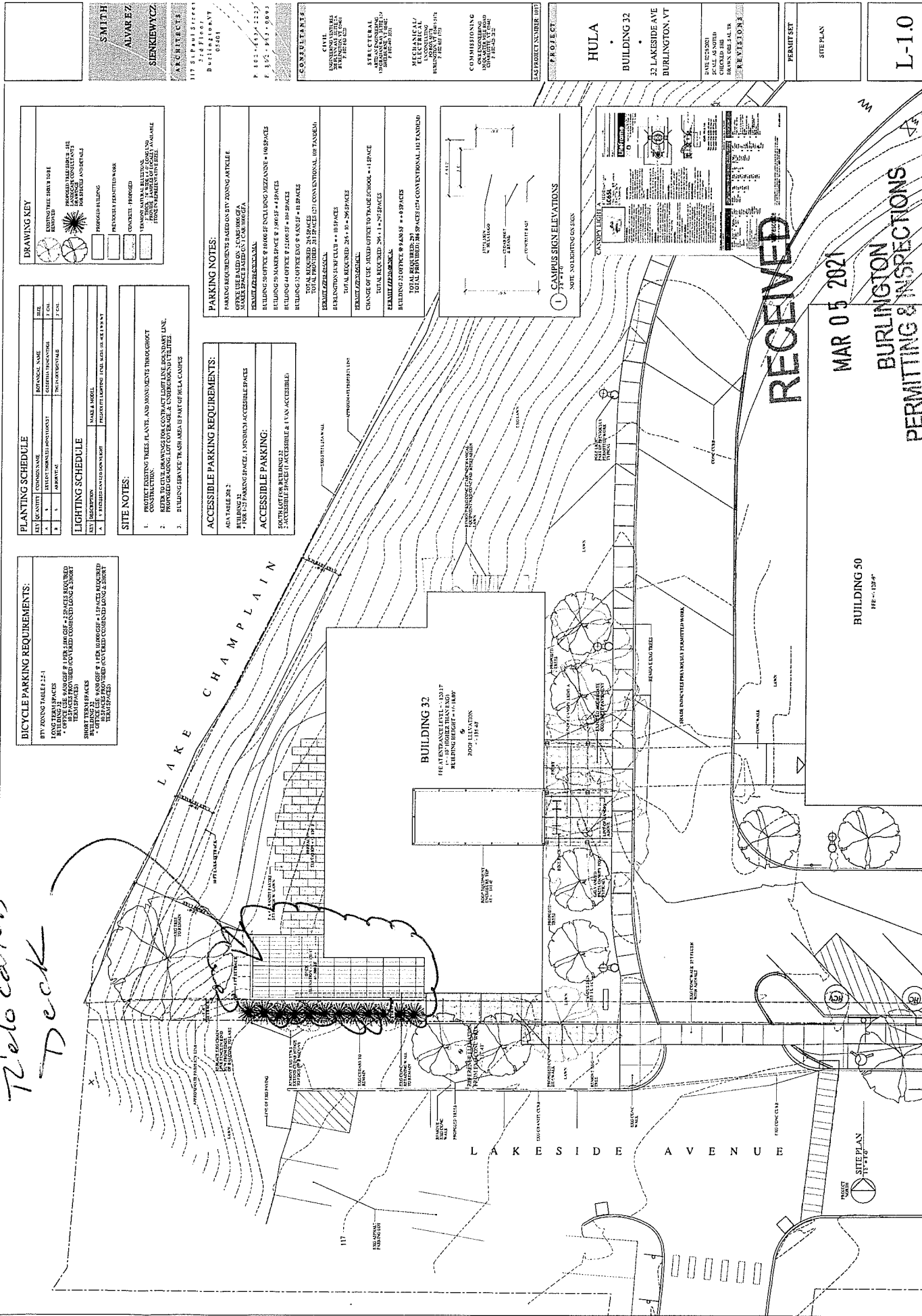
SITE NOTES:	1. PROTECT EXISTING TREES, PLANTS, AND MONUMENTS THROUGHOUT CONSTRUCTION.
	2. REFER TO CIVIL DRAWINGS FOR CONTRACT LIMIT LINE, BOUNDARY LINE, PROPOSED ROADING, LOT COVERAGE, & UNDERGROUND UTILITIES.
	3. BUILDING SERVICE TRASH AREA IS PART OF MULA CANINE

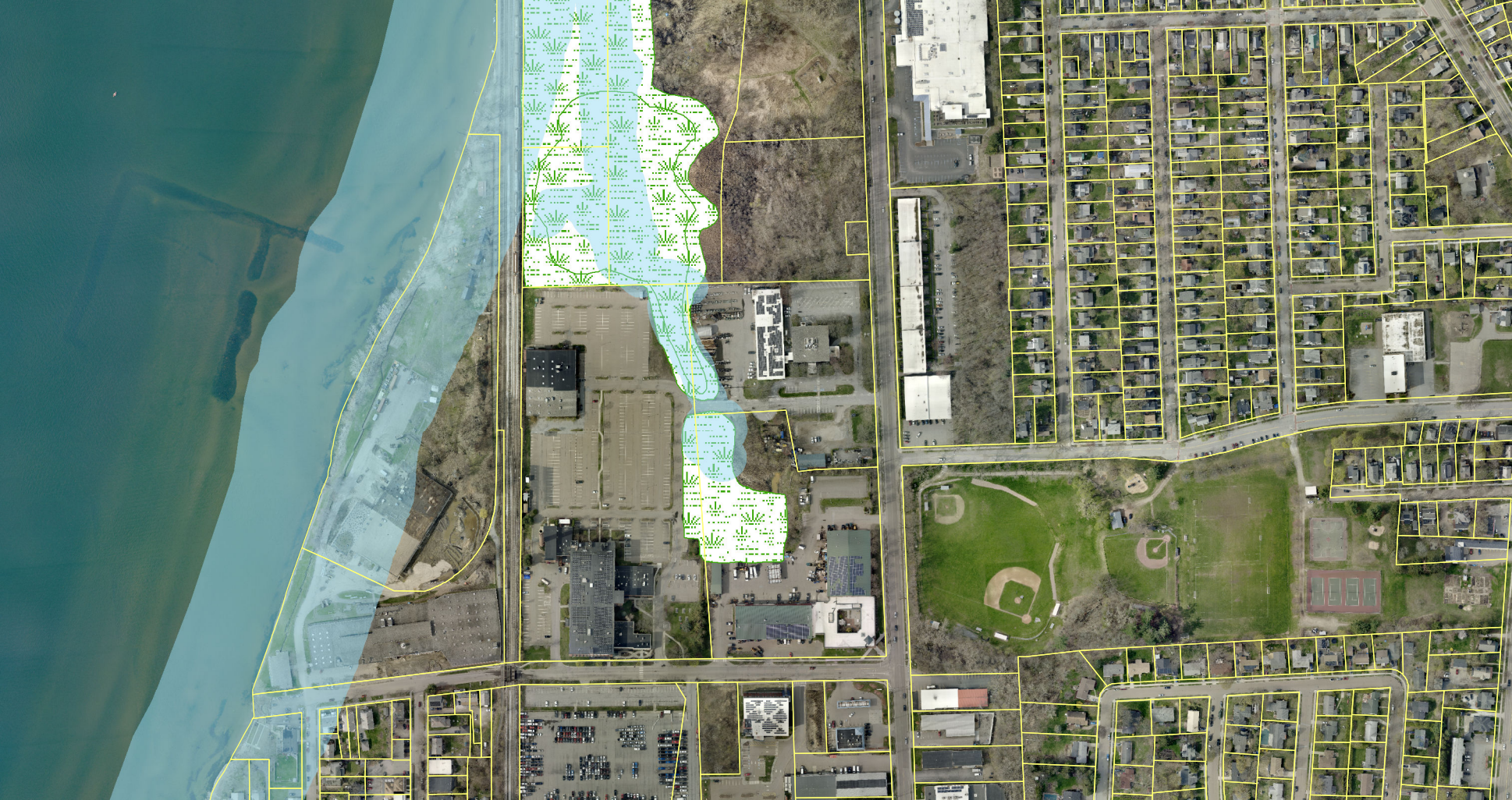
ACCESSIBLE PARKING REQUIREMENTS: ADA TABLE 302.2 BUILDING 32 * 4 FOR 752 PARKING SPACES, 1 MINIMUM ACCESSIBLE SPACES	ACCESSIBLE PARKING: BUILDING 32 2 ACCESSIBLE SPACES (1 VAN ACCESSIBLE)
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[illegible][illegible][illegible]

15 2021

INSPECTIONS









FY20 Slope Inspections – Executive Summary

Slope inspections were conducted for the City of Burlington as the first of an inspection program being established to inspect, monitor, and identify prioritized projects as a pro-active maintenance plan to address slope stability issues within the City.

Hoyle, Tanner & Associates teamed up with Terracon to perform inspections of four City-identified slope locations including: Northshore Natural Area, Manhattan Drive at Route 127 Beltline, Manhattan Drive at North Champlain Street, and Riverside Avenue. Visual inspections were completed in the Fall of 2019 and Summer of 2020.

Each inspection was documented in the following format:

- A. Inspection Summary including Condition, Future Inspection Frequency, and Recommendations.
- B. Terracon Site Assessment Report with photos.
- C. Hoyle, Tanner Inspection Forms - Drainage, Guardrail/Fence, and Roadway features.
- D. Photolog with site photos and feature GPS coordinates of key features (hyperlinked to photos in a separate folder).

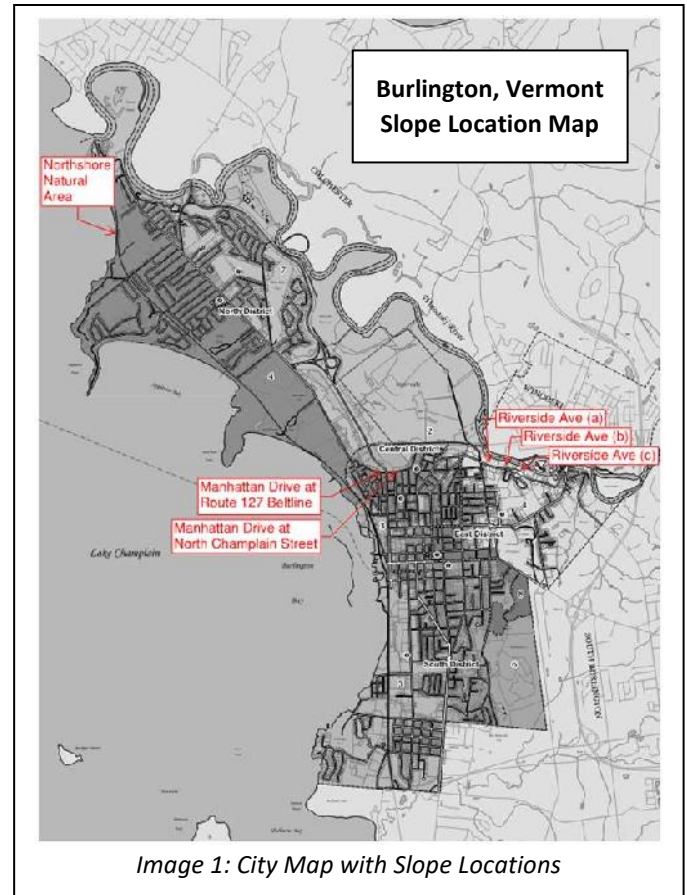


Image 1: City Map with Slope Locations

This FY20 Executive Summary includes the attached individual Inspection Summaries from each location. Full reports and photos can be accessed through the *hyperlinks* in the table below.

Slope	Condition	Next Inspection	Notes
Northshore Natural Area	Stable	2024	Monitor Slope and Retaining Wall. Miscellaneous SW Department Coordination/Maintenance.
Manhattan Drive at Route 127 Beltline	Stable	2023	Inspect adjacent slope to West. Miscellaneous SW Department Coordination/Maintenance
Manhattan Drive at North Champlain Street	Urgent Repair Needed (Reduced to "Stable" See Notes)	2024	City SW department took video of questionable pipe and found in-tact in 2020. Verify erosion issue has been corrected/infilled with stone fill.
Riverside Ave (a)	Urgent Repair Needed Needs Further Assessment	2021	Evidence of active slope movement. See attached Summary/Recommendations.
Riverside Ave (b)	Urgent Repair Needed Needs Further Assessment	2021	Evidence of active slope movement. See attached Summary/Recommendations.
Riverside Ave (c)	Needs Further Assessment	2021	Evidence of active slope movement. See attached Summary/Recommendations.

FY20 Burlington Slope Inspections

Location: Northshore Natural Area Slope 2
(Burlington Bike Path at Starr Farm)

Inspector	Date of Inspection
Terracon	11/11/2019
Hoyle, Tanner	11/26/2019

INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- Stable

Future Inspection Frequency:

- 5 years
- Next Inspection Fall 2024

Recommendations:

- Future Inspections - Monitor armored slope stability and ongoing creep of flank slopes. The retaining wall shall also be monitored, measuring the identified crack over time (reference historical photos and photo log for crack measurements).
- Coordinate with the City stormwater department for camera inspection of the stormwater pipe and structures along bikepath. Provide results for future inspection review.
- General maintenance need for stormwater structures (clean of leaves from inlet) - identified at time of November site visit.
- Consider installing stone armoring at drainage channel on slope – Reference D4 on photo log
- City staff should take annual measurements of top of sheet-pile wall points – Reference Hoyle, Tanner Photographs and Photo Log with 2019 measured distances.



2019 Burlington Slope Inspections
Location: Manhattan Drive @ Route 127 Beltline

Inspector	Date of Inspection
Terracon	October 2020
Hoyle, Tanner	11/27/2019

INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- Stable

Future Inspection Frequency:

- 3 years
- Next Inspection Fall 2023

Recommendations:

- Future Inspections – Monitor vegetated slope stability and erosion around drainage pipes and swale. It is recommended that a future inspection be completed where project limits are extended further west to capture more slope features.
- Coordinate with the City stormwater department for inspections of drainage structures.
- General maintenance need for stormwater structures (clean of leaves from inlet) – identified at time of November 2019 site visit.



FY20 Burlington Slope Inspections

Location: Manhattan Drive at North
Champlain Street

Inspector	Date of Inspection
Terracon	11/11/2019
Hoyle, Tanner	11/26/2019

INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- **URGENT REPAIR NEEDED** – Stormwater Pipe (see below)

Future Inspection Frequency:

- 1 years (Stormwater Sinkhole)
- Next Inspection Fall 2020
- Frequency to be reassessed after Urgent Repair (Reference Terracon Report)

Recommendations:

- Future Inspections - Monitor armored slope stability and flank slopes.
- **URGENT REPAIR** - Immediate action is recommended to coordinate with the City Stormwater Department to perform a camera inspection of the pipe and catch basin tied to the identified sinkhole. (Reference Photo P4). Guardrail post issue associated. Fix Pipe and Slope Impacts/Sinkhole.
- General maintenance need for stormwater structures (clean of leaves from inlets) was identified at time of November site visit.
- Fence being pulled down by overgrown vegetation. Not of concern for slope stability, but maintenance recommended to salvage fence (Reference Photo P7).



FY20 Burlington Slope Inspections

Location: Riverside Ave – Slope 4a
505 & 471 Riverside Avenue

Inspector	Date of Inspection
Terracon	August 2020
Hoyle, Tanner	December 3, 2019

INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- **URGENT REPAIR NEEDED** – 505 Riverside Avenue
- **Needs Further Assessment** – (471 Riverside Avenue and Michael's Auto Sales Property) See Recommendations below
- Evidence of active slope movement

Future Inspection Frequency:

- Immediate attention (505 Riverside Ave) – See Recommendations below
- 1 year for 471 Riverside Avenue and Michael's Auto Sales (Visual Monitoring – top of slope)
- Next Inspection August/September 2021
- Frequency of future inspection to be reassessed after recommended field investigation and establishment of instrumentation monitoring program, and Storm Pipe Outlet Repair

Recommendations:

- **URGENT REPAIR** (505 Riverside Avenue): Active slope movement and surface erosion issues in close proximity to the building structure. Recommend implementing a field investigation program, including review of existing information (historic boring logs and aerial photography), and advancement of test borings, to evaluate subsurface conditions and provide data for global stability analyses to assess suitable repair options; install geotechnical instrumentation (inclinometers, strain gauges, and/or survey benchmarks) to monitor slope movement/behavior (see Exhibit 2 for recommended boring/instrumentation locations); evaluate remedial options for slope stability; Direct roof drainage further down slope away from building foundation at 505 Riverside Avenue; armor the exposed soil surfaces behind building with crushed stone and geotextile fabric to limit ongoing surface erosion of soil;
- Future Inspections (471 Riverside Avenue and Michael's Auto Sales) - Monitor surface erosion, pipe outlets, scarp development and top of bank proximity to buildings and lots;
- **Needs Further Assessment** – (471 Riverside Avenue and Michael's Auto Sales): drill test borings at locations shown on Exhibit 2 to identify thickness of fill, in-situ soil densities and soil types, and groundwater levels; complete borings with casings for installation of inclinometers;
- **Needs Further Assessment** – Significant erosion at pipe outlet (reference Drainage Issue D2). Recommend City address by stabilizing apron and channel with rock slope armoring. Verify with Stormwater Department pipe flows and size armoring accordingly.



General Site Location
Lat: 44.488880 Long: -73.200524
Google Maps Image source

FY20 Burlington Slope Inspections

Location: Riverside Ave – Slope 4b
411, 389, and 356 Riverside Avenue

Inspector	Date of Inspection
Terracon	August 2020
Hoyle, Tanner	December 3, 2019

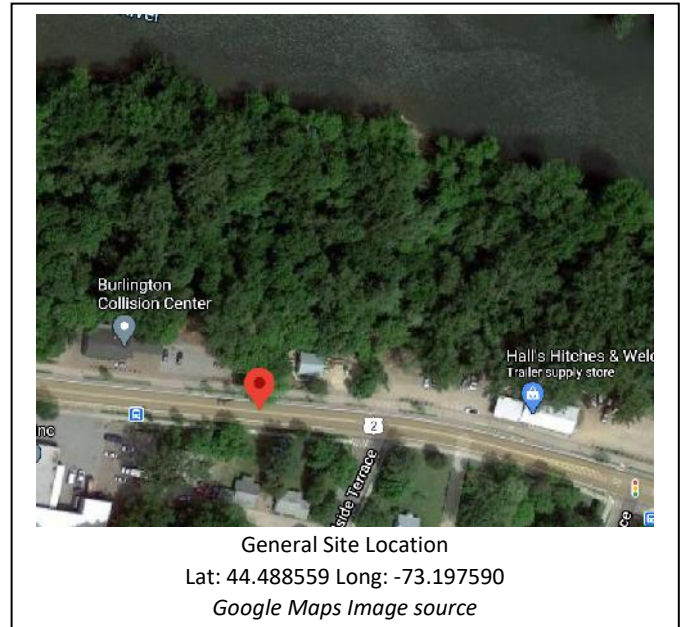
INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- **URGENT REPAIR NEEDED** (389 Riverside Avenue) – See Recommendations below
- **Needs Further Assessment (411 and 356 Riverside Avenue)** – See Recommendations below
- Evidence of active slope movement

Future Inspection Frequency:

- Immediate attention (389 Riverside Ave)
- 1 year for 411 and 365 Riverside Avenue (Annual Visual Monitoring)
- Next Inspection August/September 2021
- Inspection frequencies to be reassessed after recommended field investigation and establishment of instrumentation monitoring program.



Recommendations:

- **URGENT REPAIR** – 389 Riverside Avenue: Active slope movement and surface erosion issues in close proximity to the building structure. Recommend implementing a field investigation program, including review of existing information (historic borings logs and aerial photography), and advancement of test borings, to evaluate subsurface conditions and provide data for global stability analyses to assess suitable repair options; install geotechnical instrumentation (inclinometers, strain gauges, and/or survey benchmarks) to monitor slope behavior; evaluate remedial options for slope stability;
- **Needs Further Assessment** – 411 and 365 Riverside Avenues: drill geotechnical borings at the top of the slope at these locations to evaluate thickness of fill materials, in-situ soil densities and soil types and groundwater level; complete borings with casings for installation of inclinometers (see Exhibit 2 for recommended locations); the inclinometers will provide a means for the City and land owners to monitor slope movement and behavior over time.
- Restrict dumping of bark mulch, soil and vegetative debris along slope at eastern portion of 411 Riverside Avenue;
- Future Inspections – Monitor surface erosion, expansion of crown cracking at 411 Riverside Avenue, scarp development between 389 and 356 Riverside Avenue, pipe outlets, and top of bank proximity to buildings and lots; drill test boring and install inclinometer for long term monitoring of exposed scarp between 389 and 365 Riverside Avenue (see Exhibit 2).

FY20 Burlington Slope Inspections

Location: Riverside Ave – Slope 4c
317 Riverside Avenue

Inspector	Date of Inspection
Terracon	August 2020
Hoyle, Tanner	December 3, 2019

INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- **Needs Further Assessment** – See Recommendations below
- Evidence of active slope movement

Future Inspection Frequency:

- 1 year (Visual Monitoring)
- Next Inspection August/September 2021
- Frequency of inspection to be reassessed after establishment of instrumentation monitoring program (see Recommendations below).

Recommendations:

- **Needs Further Assessment** – It is recommended that further geotechnical evaluation be conducted to identify subsurface conditions that may be affecting the stability of the slope. This assessment includes review of existing data (boring logs and aerial photography), advancement of test borings and installation of inclinometers in casings set in the borings; the borings will provide data on thickness and density of fill material, in-situ soil density and soil type, and groundwater levels. The geotechnical data can be used to perform global slope stability analyses to assess suitable repair options. The inclinometers will provide the City and private property owners an ongoing means to evaluate slope movements and stability. Recommended test boring/inclinometer locations are shown on Exhibit 2.
- Future Inspections – Monitor surface erosion, pipe outlets, top of bank proximity to buildings and lots, and instrumentation monitoring (reference bullet above)



General Site Location

Lat: 44.488154 Long: -73.195364

Google Maps Image source

FY20 Burlington Slope Inspections

Location: Northshore Natural Area Slope 2
(Burlington Bike Path at Starr Farm)

Inspector	Date of Inspection
Terracon	11/11/2019
Hoyle, Tanner	11/26/2019

INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- Stable

Future Inspection Frequency:

- 5 years
- Next Inspection Fall 2024

Recommendations:

- Future Inspections - Monitor armored slope stability and ongoing creep of flank slopes. The retaining wall shall also be monitored, measuring the identified crack over time (reference historical photos and photo log for crack measurements).
- Coordinate with the City stormwater department for camera inspection of the stormwater pipe and structures along bikepath. Provide results for future inspection review.
- General maintenance need for stormwater structures (clean of leaves from inlet) - identified at time of November site visit.
- Consider installing stone armoring at drainage channel on slope – Reference D4 on photo log
- City staff should take annual measurements of top of sheet-pile wall points – Reference Hoyle, Tanner Photographs and Photo Log with 2019 measured distances.



**CITY OF BURLINGTON, VERMONT
SLOPE STABILITY INSPECTION**

Date of Inspection: 11/11/2019

Site Inspector

Name:	David C. Del Marco, P.G.	E-mail:	David.Delmarco@Terracon.com
Title:	Senior Project Manager	Phone:	603.206.1191
Office/Facility Location:	Manchester, NH	Mobile:	781.844.6001

Owner Information

Owner:	City of Burlington, VT	Owner Contact:	Phillip Peterson
	645 Pine Street	Phone:	(802) 865-5832
	Burlington, VT 054001	E-mail:	ppeterson@burlingtonvt.gov

Site Location Information

Site GIS Location ID:		Site Coordinates	44.51721
		Latitude:	
Site Name:	Bike Path Near Starr Farm	Longitude:	-73.268942

Assessment Findings

NOTE: It is important to investigate the areas adjacent to the site when possible as indicators of ground movement may not be directly above the pipeline. Photographs, including panoramic view of entire ground movement (landslide, subsidence, mining, etc.), overview of site and vicinity, and any relevant site features such as curved tree trunks, leaning fence posts, loose rock etc... Overview photographs of the site should still be taken even if there are no evidence of ground movement found. Site photographs should be included as attachments to the site assessment from.

☒ No evidence of ground movement observed (within limits of remediated slope)

Ground Movement Type (if evidence of ground movement observed)

☐ Landslide ☐ Subsidence / Sinkhole ☒ Other (erosion, etc.), describe:

Remediated slope appears stable and well armored with cobble and boulder-sized stone rip-rap; large stone blocks are placed at the base of the slope; historical rotational slide observed on slope immediately north of remediated slope with smooth, rounded, well-vegetated scarp head; this flanking slope is outside the scope of our inspection.

Consequence of Failure:

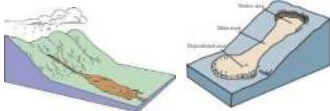
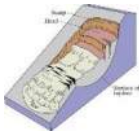
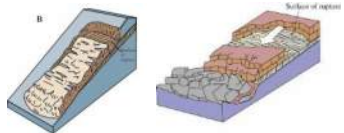
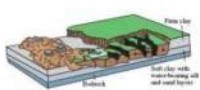
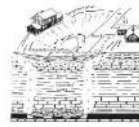
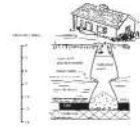
Down-slope failure will deposit soil and cobbles/boulders on beach face; future slides and slumping can impact bike path at top of the slope; flanking failures will deposit sand, trees and vegetation on beach face. Flanking slope failure may also impact the bike path at the top of the slope.

Recommended Future Inspection Frequency:

5 years based on observations of stability for the remediated slope; we also recommend periodic measuring (at least annually) of the distance between the existing sheet-pile joints to monitor potential movement across joints (see appended photographs by Hoyle, Tanner and Associates, Inc.)

Terracon Consultants, Inc. Offices Nationwide
[800] 593 7777 terracon.com

Burlington, VT Slope Stability Inspection

Geohazard Type (Which best fits the observed conditions? If complex slide, it may be appropriate to select more than one type)			
Landslide Types			
☐ Fall Mass detaches from a steep slope or cliff. Free-fall, bouncing, or rolling		☐ Topple Forward rotation or tilting of a column of rock or soil	
☐ Flow Fluid-like movement of a mass; slowly or swiftly. Flows of mud and debris may resemble moving wet concrete		☐ Avalanche Extremely rapid flow- or sheet-like movement of a large, crumbling mass down a steep mountainside or over a cliff.	
☐ Rotational Bowl-shaped failure. Movement at top (scarp) is downward and may tilt into the slope. Bottom is marked by bulging mass (toe bulge).		☐ Translational Movement occurring along a relatively planar surface; commonly parallel to the slope	
☐ Spread Lateral movement causing the ground to pull apart; or in formation of parallel fractures. May occur on gentle slopes.		☒ Creep Similar to spread, but commonly imperceptibly slow movement; results hummocky (undulating) ground surface	
Subsidence / Sinkhole			
☐ Ground Subsidence Downward ground movement (sag) or settlement of an area		☐ Sinkhole Localized downward ground movement forming a closed depression with or w/out open drain hole or throat.	

Site Setting and Surrounding Area
☒ Open-Slope ☐ Side-Slope ☐ Gully/Ravine ☐ Waterway ☐ Residential ☐ Agricultural ☐ Mine/Quarry ☐ Wooded ☐ Natural ☐ Cut ☒ Fill ☐ Embankment ☒ Recently graded (Cut/Fill)

Notes: Remediated slope is well armored with stable cobble and boulder-sized stone rip-rap; large stone blocks have been placed at base of remediated slope; flank slopes are well vegetated; north flank shows some historical rotational sliding; south flanking slope shows wave-cut scarps at base of slope (see photographs); flanking slopes adjacent to the remediated slope are outside the scope of the inspection.

Material Type and Consistency
☐ Bedrock ☒ Gravel, cobbles, and boulders ☒ Sand ☐ Silt and Clay ☐ Colluvial (mixed coarse- and fine-grain material) ☐ Shallow soil over rock ☐ Liquid ☐ Solid-Wet ☐ Solid-Dry ☐ Rubble ☐ Organics; describe:

Notes: Remediated slope has been armored with stable cobble and boulder-size rip-rap; flank slopes are comprised of alluvial sand and are vegetated with pine, birch and oak trees

Condition of Trees, Fences, Posts, etc.
☐ Standing upright ☐ Leaning uphill ☒ Leaning downhill ☐ Leaning all directions ☐ Fallen ☐ None

Notes: Remediated slope does not contain vegetation (armored with stable stone rip-rap); trees on flanking slopes have slight to moderate lean down-slope, indicative of ongoing creep.



Site Assessment Form – Burlington, VT Slope Stability Inspection

Surface-Water Features

☐ Stream ☐ Pond/Lake ☒ Springs/Seepage ☐ Marshes ☐ Closed depressions ☐ Culverts ☐ Ditches ☐ Water-breaker
☐ Free-water on slope ☐ Saturated soils ☐ None

Notes: seepage observed at base of stone-covered remediated slope (see photographs); slope is on the shore of Lake Champlain; flanking natural slopes show wave cut scarps at base; strip of beach is most likely a wave-cut platform with materials derived from erosion of natural slopes

Relative Activity

☐ Sharp un-vegetated features ☐ Partially vegetated features ☐ Smooth vegetated features ☐ Un-drained depressions
☐ Drained depressions ☐ Ponds/Sags/Marshes ☐ Undulating (hummocky) topography ☐ Un-vegetated cracks ☐ Vegetated cracks

Notes: No transverse cracks, slumps or signs of movement in remediated slope, or on the bike path and thin grass strip at the top of the remediated and natural flanking slopes; wave cut scarps observed at base of flanking slopes; north flanking slope shows small historical rotational slide with well defined, smooth, rounded and well-vegetated scarp head; flanking slopes are outside the scope of the inspection.

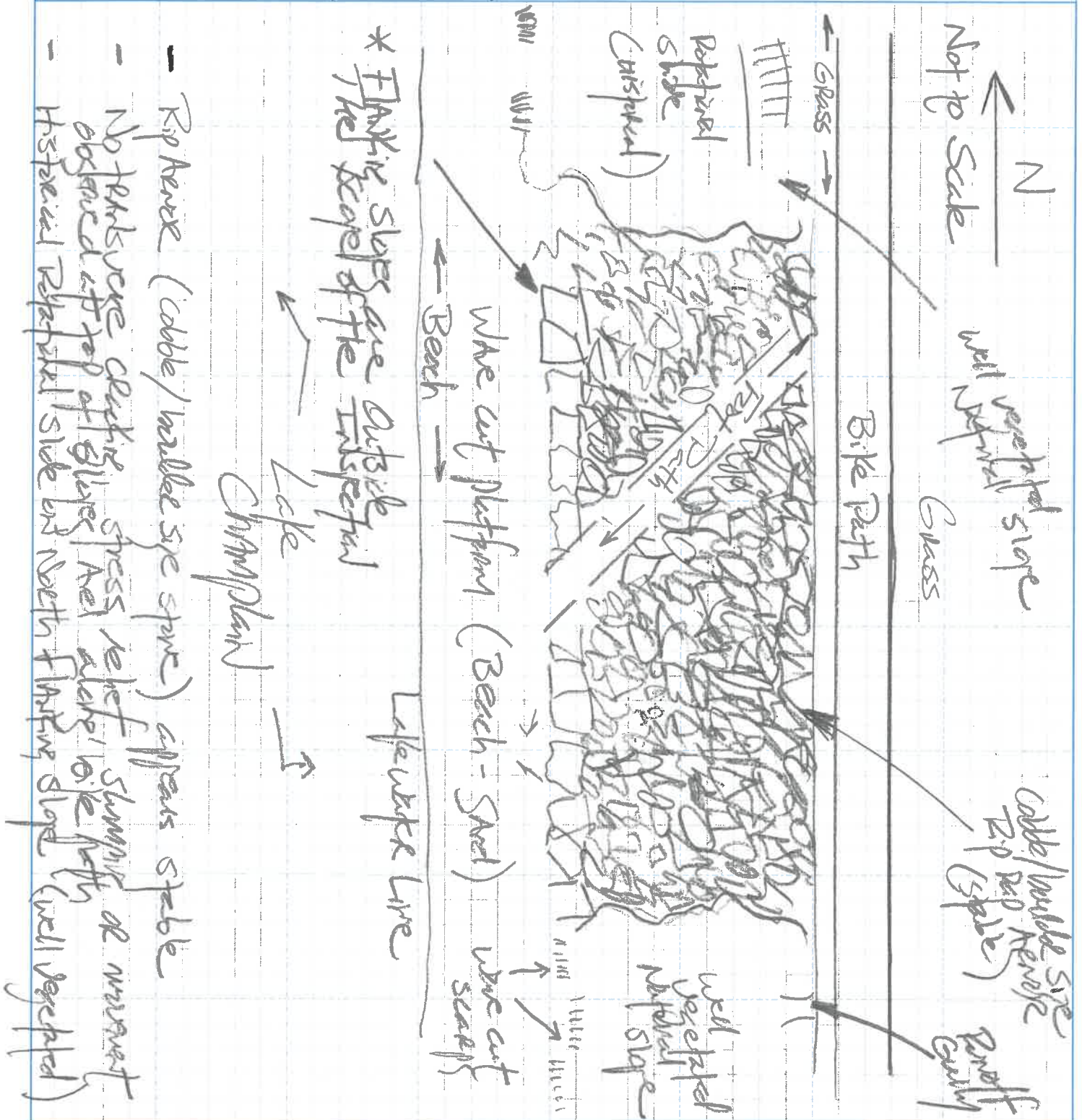
Landslide Dimensions

Scarp Height	N/A	Scarp width	N/A
Width of source area	N/A	Depth of Source area	N/A
Width of deposit	N/A	Depth of deposit	N/A
Length (distance) from top to bottom	N/A	Height (elevation) from top to bottom	N/A
Overall Width	N/A	Other Notes:	

Subsidence / Sinkhole Dimensions

Length:	N/A	Width:	N/A	Depth:	N/A
Hole / Throat (Y/N):	N/A	Diameter:	N/A	Depth:	N/A
Description:	N/A				

Sketch – Plan and Profile (Cross-section)





Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

SITE PHOTOGRAPHS

Slope Location: Bike Path Near Starr Farm Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 1 – Northern Portion of Remediated Slope



Photograph 1: View to north of northern section of remediated slope showing boulder and cobble rip-rap armor and large basal blocks; natural vegetated slope located to north of remediated area, and bike path at top of slope

Slope Location: Bike Path Near Starr Farm

Date: 11/11/2019

City: Burlington

State: Vermont

Description : Photograph 2 – Central Portion of Remediated Slope



Photograph 2: View to east of central portion of remediated slope showing cobble and boulder rip-rap armor and large basal blocks; bike path is located beyond fence; slope appears stable

Slope Location: Bike Path Near Starr Farm

Date: 11/11/2019

City: Burlington

State: Vermont

Description : Photograph 3 – Southern Portion of Remediated Slope



Photograph 3: View to south of southern portion of remediated slope; natural vegetated slope at southern flank located in background

Slope Location: Bike Path Near Starr Farm Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 4 – Vegetated Natural Slope on South Flank of Remediated Slope



Photograph 4: View to south of vegetated natural slope on south flank of remediated slope

Slope Location: Bike Path Near Starr Farm

Date: 11/11/2019

City: Burlington

State: Vermont

Description : Photograph 5 – Base of Natural Slope on Southern Flank of Remediated Slope



Photograph 5: View to north; base of natural slope on southern flank of remediated slope; remediated slope is shown in the background; note lean of birch trees down-slope indicative of slope creep

Slope Location: Bike Path Near Starr Farm

Date: 11/11/2019

City: Burlington

State: Vermont

Description : Photograph 6 – Wave-Cut Scarp at Base of Natural Slope on Southern Flank



Photograph 6: View to northeast of wave-cut scarp at base of natural slope located on the southern flank of the remediated slope

Slope Location: Bike Path Near Starr Farm

Date: 11/11/2019

City: Burlington

State: Vermont

Description : Photograph 7 – Erosion Caused by Surface Run-off (Incipient Gullying)



Photograph 7: View to southeast; incipient gullying at top of natural slope caused by surface water run-off

Slope Location: Bike Path Near Starr Farm

Date: 11/11/2019

City: Burlington State: Vermont

Description : Photograph 8 – Seepage at Base of Remediated Slope



Photograph 8: View to east; seepage at base of rip-rap and basal blocks of remediated slope

Slope Location: Bike Path Near Starr Farm Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 9 – Bike Path at Top of Remediated Slope



Photograph 9: View to north of bike path at the top of remediated slope; no stress-relief cracking or incipient slumping observed

Slope Location: Bike Path Near Starr Farm Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 10 – Landslide Scarp on Natural Slope North of Remediated Slope



Photograph 10: View to north showing rotational landslide scarp (indicated by arrows) and scarp head in foreground; natural slope on northern flank of remediated slope; indicates historical event(s)

Slope Location: Bike Path Near Starr Farm Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 11 – Top of Natural Slope North of Remediated Slope

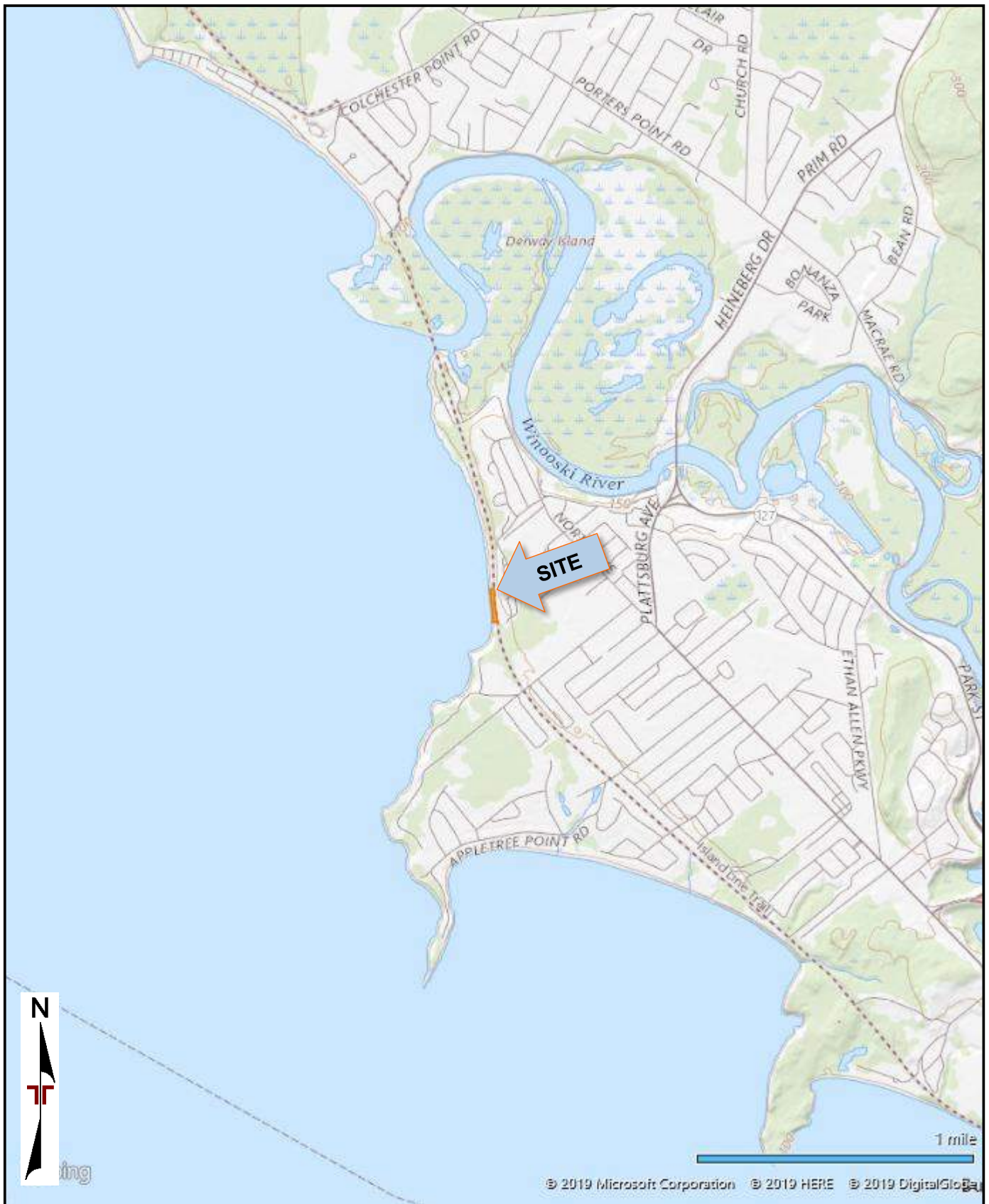


Photograph 11: View to north; top of natural slope north of remediated slope; possible beginning of minor ground disturbance in vegetated area directly adjacent to bike path?



Site Assessment Form ATTACHMENTS
Burlington, VT Slope Stability Inspection

SITE MAPS



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY

Project Manager:	ASP
Drawn by:	MAG
Checked by:	DCD
Approved by:	CWT
Project No.	J1195064
Scale:	As Shown
File Name:	
Date:	12/3/2019

Terracon
77 Sundial Ave, Ste 401W
Manchester, NH 03103-7236

SITE LOCATION
Burlington Slope Inspections Bike Path at Starr Farm Burlington, VT

Exhibit
A-1



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Project Manager: ASP	Project No. J1195064	 77 Sundial Ave, Ste 401W Manchester, NH 03103-7236	EXPLORATION PLAN Burlington Slope Inspections Bike Path at Starr Farm Burlington, VT	Exhibit
Drawn by: MAG	Scale: AS SHOWN			A-2
Checked by: DCD	File Name:			
Approved by: CWT	Date: 12/3/2019			

Burlington Bike Path at Star Farm

DRAINAGE

Feature	Structure	Size	Type/Material	Condition	Comments	Recommendation
D1	MH ☐ CB/DI ☐ Outlet ☐ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☐ Swale ☐ _____ ☒ <i>Erosion</i>	1' wide	No stone	Good	Surface water drainage concentrates at the limits of the retaining wall.	Monitor for erosion.
D2	MH ☐ CB/DI ☒ Outlet ☐ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☐ Swale ☐ _____ ☐	4' dia.	Type D	Good	Covered in leaves, runs parallel to bike path.	Clear of leaves.
D3	MH ☐ CB/DI ☒ Outlet ☐ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☐ Swale ☐ _____ ☐	4' dia.	Type D	Good	Covered in leaves, runs parallel to bike path.	Clear of leaves.

D4	MH ☐ CB/DI ☐ Outlet ☐ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☐ Swale ☒ _____ ☐	3' wide	No stone	Fair	Drainage channel down slope, perpendicular to bike path.	Monitor for erosion.
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Burlington Bike Path at Star Farm

GUARDRAIL/FENCE

Feature	Height (in)	Face of Rail/Fence to Shoulder Break (ft-in)	Leaning?	Condition	Comments	Recommendation
G1	-	-	Yes ☐ Slope instability ☐ Plow damage ☐ No ☐	-	-	-

No guardrail/fence issues were identified during the 2019 inspection.

RETAINING WALL

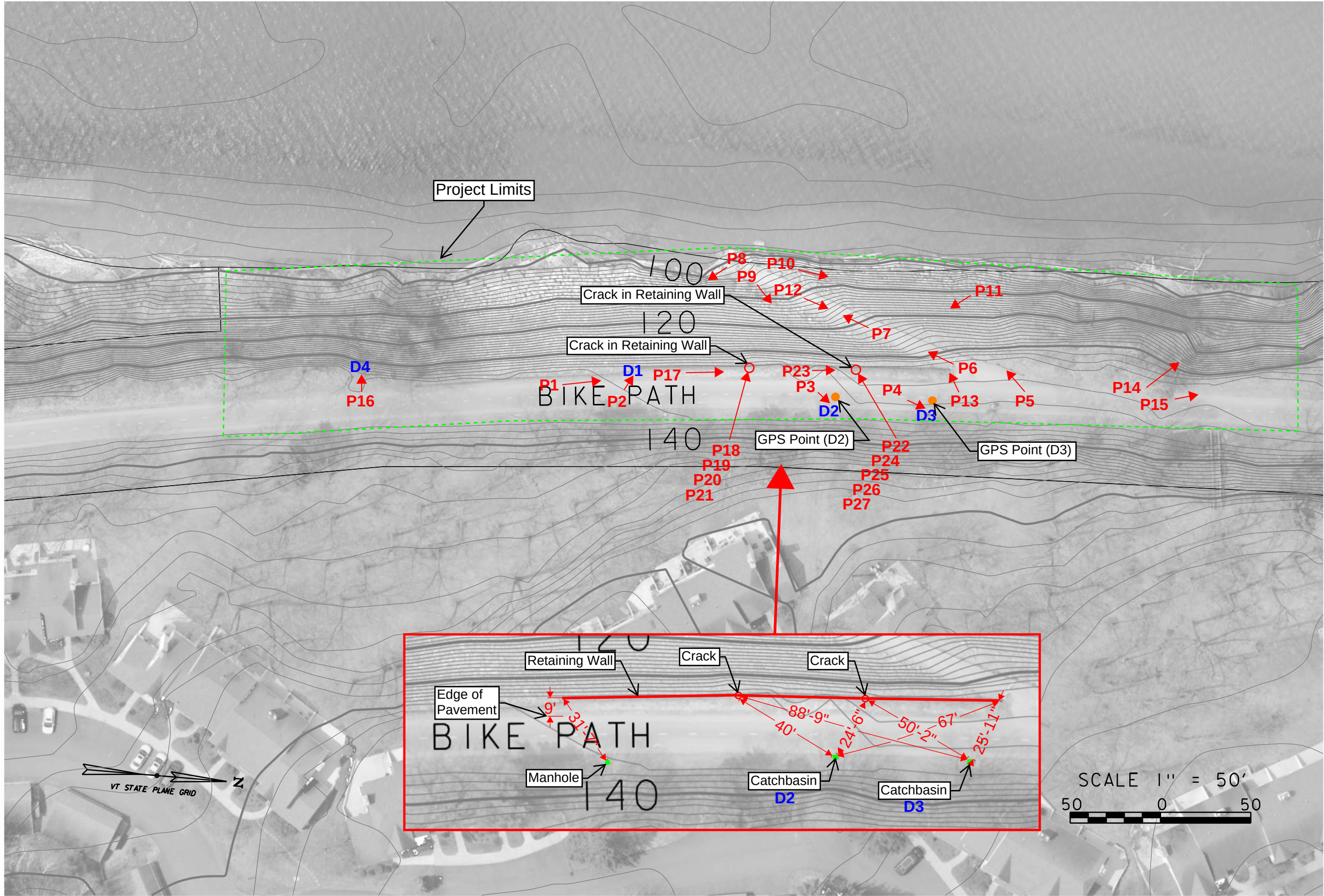
Feature	Height (in)	Face of Rail/Fence to Shoulder Break (ft-in)	Leaning?	Condition	Comments	Recommendation
RW1	-	-	Yes ☒ Slope instability ☐ Plow damage ☐ No ☐	Fair	Wall previously shifted which led to slope repair, possibly tied to the large RCP stormwater line that runs N-S under the bike path. Wall appears stable in current condition. Tie-offs points taken to monitor the wall for potential shift.	Monitor wall and slope. Coordinate with City stormwater department for camera inspection of the stormwater pipe and structures.

Burlington Bike Path at Star Farm

ROADWAY

Feature	Pavement Defect	Length (ft-in)	Width (ft-in)	Condition	Comments	Recommendation
R1	Pothole ☐ Edge Crack ☐ Settlement ☐ Shoulder Berm ☐ Longitudinal Crack ☐ _____ ☐	-	-	-	-	-

No roadway (bike path) shoulder/pavement issues were identified in the 2019 inspection.



FILENAME	DESIGNER	This document is prepared as an instrument of service and shall remain the property of Hoyle, Tanner, & Associates, Inc. It may not be used, reproduced, disseminated or modified in any form, including electronically, for any other purpose than this project, without the written permission of Hoyle, Tanner, & Associates, Inc.		
909051_02bdr	NLC	NLC	NLC	NLC
MODEL NAME	DRAWN			
PLAN01	NLC			
SCALE	CHECKED			
AS SHOWN	JAO			
DATE	DATE			
11/07/2019	11/07/2019			

Hoyle, Tanner & Associates, Inc.
125 College Street, 4th Floor, Burlington, VT 05401
Tel (802) 860-1331
www.hoyletanner.com

BURLINGTON, VERMONT
BURLINGTON SLOPE STABILITY INSPECTION
Slope 1

2019 Burlington Slope Inspections
Location: Manhattan Drive @ Route 127 Beltline

Inspector	Date of Inspection
Terracon	October 2020
Hoyle, Tanner	11/27/2019

INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- Stable

Future Inspection Frequency:

- 3 years
- Next Inspection Fall 2023

Recommendations:

- Future Inspections – Monitor vegetated slope stability and erosion around drainage pipes and swale. It is recommended that a future inspection be completed where project limits are extended further west to capture more slope features.
- Coordinate with the City stormwater department for inspections of drainage structures.
- General maintenance need for stormwater structures (clean of leaves from inlet) – identified at time of November 2019 site visit.





Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

**CITY OF BURLINGTON, VERMONT
SLOPE STABILITY INSPECTION**

Date of Inspection: October 2020

Site Inspector

Name:	David C. Del Marco, P.G.	E-mail:	David.Delmarco@Terracon.com
Title:	Senior Project Manager	Phone:	603.206.1191
Office/Facility Location:	Manchester, NH	Mobile:	781.844.6001

Owner Information

Owner:	City of Burlington, VT	Owner Contact:	Phillip Peterson
	645 Pine Street	Phone:	(802) 865-5832
	Burlington, VT 054001	E-mail:	ppeterson@burlingtonvt.gov

Site Location Information

Site GIS Location ID:	Manhattan Dr. and Rt. 127	Site Coordinates Latitude:	44.4880
Site Name:	Manhattan/Beltline	Longitude:	-73.2210

Assessment Findings

No evidence of large-scale failure masses observed. No distinct surface cracking, ground disturbance or subsidence observed at the top of the slope along Manhattan Drive. Exposed soil surfaces on majority of the slope subject to continual erosion from sheet wash generated during heavy precipitation events. Beginning of formation of gullies and preferential surface flow pathways observed at central and western portions of slope. Undercutting of toe at western portion of slope by unlined stormwater-discharge channel will continue to cut back toe of slope during heavy flow events. Continued undercutting will result in localized failures at toe. Small-scale localized slides observed at top of western portion of slope.

Ground Movement Type (if evidence of ground movement observed)

☐ Landslide ☐ Subsidence / Sinkhole ☒ Other (erosion, etc.), describe:

Surface soil erosion on majority of slope was observed; beginning of formation of gullies and preferential surface flow pathways observed at central and western portions of slope. Undercutting of toe at western portion of slope by unlined stormwater-discharge channel has cut back toe of slope and resulted in localized soil slides. Two small-scale localized slides observed at top of western portion of slope.

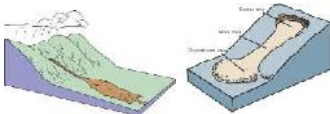
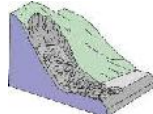
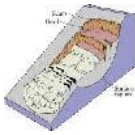
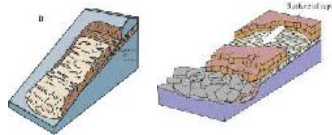
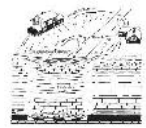
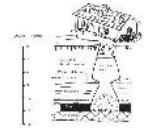
Consequence of Failure:

Limited failures at the top of the slope will eventually cut back to Manhattan Drive over the long term. Failures downslope may disrupt existing lined and unlined stormwater drainage channels.

Recommended Future Inspection Frequency:

3 years; spot inspections of the central and western portions of the slope, especially of the toe adjacent to the unlined drainage channel, may be warranted after heavy and/or longer-term precipitation events.

Burlington, VT Slope Stability Inspection

Geohazard Type (Which best fits the observed conditions? If complex slide, it may be appropriate to select more than one type)			
Landslide Types			
☐ Fall Mass detaches from a steep slope or cliff. Free-fall, bouncing, or rolling		☐ Topple Forward rotation or tilting of a column of rock or soil	
☐ Flow Fluid-like movement of a mass; slowly or swiftly. Flows of mud and debris may resemble moving wet concrete		☐ Avalanche Extremely rapid flow- or sheet-like movement of a large, crumbling mass down a steep mountainside or over a cliff.	
☐ Rotational Bowl-shaped failure. Movement at top (scarp) is downward and may tilt into the slope. Bottom is marked by bulging mass (toe bulge).		☒ Translational Movement occurring along a relatively planar surface; commonly parallel to the slope	
☐ Spread Lateral movement causing the ground to pull apart; or in formation of parallel fractures. May occur on gentle slopes.		☒ Creep Similar to spread, but commonly imperceptibly slow movement; results hummocky (undulating) ground surface	
Subsidence / Sinkhole			
☐ Ground Subsidence Downward ground movement (sag) or settlement of an area		☐ Sinkhole Localized downward ground movement forming a closed depression with or w/out open drain hole or throat.	

Site Setting and Surrounding Area

☐ Open-Slope ☐ Side-Slope ☐ Gully/Ravine ☐ Waterway ☐ Residential ☐ Agricultural ☐ Mine/Quarry ☐ Wooded
☒ Natural ☐ Cut ☐ Fill ☐ Embankment ☐ Recently graded (Cut/Fill)

Notes: Existing slope is a combination of open, exposed soil surfaces and densely vegetated surfaces. Channel located at and near the toe of the slope receives stormwater discharge from a series of culvert pipes. The eastern part of the channel is lined with stone rip-rap but is overgrown. The central and western parts of the channel are unlined with open portions and overgrown portions. Channel flow has cut into the toe of the western portion of the slope.

Material Type and Consistency

☐ Bedrock ☐ Gravel, cobbles, and boulders ☒ Sand ☒ Silt and Clay ☐ Colluvial (mixed coarse- and fine-grain material) ☐ Shallow soil over rock ☐ Liquid ☐ Solid-Wet ☐ Solid-Dry ☐ Rubble ☐ Organics; describe: _____

Notes: From samples examined in the field, slope soils are glacial/alluvial silty sand;

Condition of Trees, Fences, Posts, etc.

☒ Standing upright ☐ Leaning uphill ☒ Leaning downhill ☐ Leaning all directions ☒ Fallen ☐ None



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Burlington, VT Slope Stability Inspection

Notes: Trees are primarily upright; limited areas of downslope lean especially in those areas subject to steady erosion and small limited failures.

Surface-Water Features

☐ Stream ☐ Pond/Lake ☐ Springs/Seepage ☐ Marshes ☐ Closed depressions ☐ Culverts ☐ Ditches ☐ Water-breaker
☐ Free-water on slope ☐ Saturated soils ☐ None

Notes: Channel that receives stormwater discharge from a series of culverts occurs at and near the base of the slope. The eastern part of the channel is lined with stone rip-rap and the central and western portions are unlined. Heavy erosion has incised a well-defined channel at the western base of the slope. Discharge from the channel appears to be directed to an area of wetlands northwest of the slope.

No natural seepage on the slope or at the base of the slope was observed.

Relative Activity

☐ Sharp un-vegetated features ☒ Partially vegetated features ☒ Smooth vegetated features ☐ Un-drained depressions ☐ Drained depressions ☐ Ponds/Sags/Marshes ☐ Undulating (hummocky) topography ☐ Un-vegetated cracks
☐ Vegetated cracks

Notes: No open or well-defined surface cracks, or distinct, widespread soil slumping observed at top of slope along Manhattan Drive; two small localized failures were observed at the top of the western portion of the slope. Preferential discharge of surface water from Manhattan Drive not captured by catch-basins has enabled the beginning of gully formation. Exposed soil surfaces on the slope will continue to erode as a result of precipitation events; erosion of the unlined channel at the base of the western portion of the slope will continue to cut back the toe of the slope and will generate local failures.

Landslide Dimensions

Scarp Height	N/A	Scarp width	N/A
Width of source area	N/A	Depth of Source area	N/A
Width of deposit	N/A	Depth of deposit	N/A
Length (distance) from top to bottom	N/A	Height (elevation) from top to bottom	N/A
Overall Width	N/A	Other Notes:	

Subsidence / Sinkhole Dimensions

Length:	N/A	Width:	N/A	Depth:	N/A
Hole / Throat (Y/N):	N/A	Diameter:	N/A	Depth:	N/A
Description:	N/A				



Site Assessment Form ATTACHMENTS
Burlington, VT Slope Stability Inspection

SITE PHOTOGRAPHS

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 1: Stormwater Discharge Pipe and Stone-Lined Channel (Culvert 1)



Photograph 1: View to southeast, toward intersection of Manhattan Drive and Route 127 showing stormwater discharge point (designated herein as Culvert 1) and stone-lined drainage channel.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 2: Stone-Lined Stormwater Discharge Channel at Base of Slope



Photograph 2: View to northwest of stone-lined stormwater discharge channel at base of slope and downstream from Culvert 1; drainage designed to discharge to wetlands at top right of photograph; note density of vegetative overgrowth within channel (compare with Photographs 3 and 4).

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 3: Culverts 1 and 2 Discharge Channel in November 2019



Photograph 3: View to southeast taken in November 2019 by Hoyle, Tanner & Associates of well-lined discharge channel from Culvert 1.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 4: Culverts 1 and 2 Discharge Channel in November 2019



Photograph 4: View to west south-west taken in November 2019 during Hoyle, Tanner & Associates inspection showing well-defined Culvert 1 discharge channel at base of slope.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 5: Manhattan Drive Discharge Pipe and Culvert



Photograph 5: View to south towards Manhattan Drive of stormwater discharge pipe and top of culvert (designated herein as Culvert 2); note soil erosion around exposed pipe.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 6: View of Slope West of Discharge Culvert 2



Photograph 6: View to south-southeast toward Manhattan Drive of portion of slope to the west of Culvert 2 discharge pipe (right-center of photograph).

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 7: View of Slope West of Culvert 2



Photograph 7: View to southwest toward Manhattan Drive showing slope west of Culvert 2; stone-lined discharge channel from Culvert 1 at toe of slope in foreground; note lack of distinct lean of trees mid-slope.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 8: Surface Erosion and Beginning of Gully Formation



Photograph 8: View to south towards Manhattan Drive, west of Culvert 2, showing surface soil erosion from sheet wash generated during heavy precipitation events; surface expression of gully formation beginning to appear; note lean of trees at top of slope.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 9: View of Slope West of Photo 8 Showing Surface Soil Erosion



Photograph 9: View southwest from toe of slope, west of Photograph 8, showing surface soil erosion from sheet wash generated during heavy precipitation events; surface expression of gully formation beginning to appear; note lean of trees at top of slope (top center and top left).

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 10: View of Slope West of Culvert 2



Photograph 10: View to southeast from toe of slope showing surface soil erosion from sheet wash during precipitation events; surface expression of gully formation beginning to appear;

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 11: Toe of Slope Looking East to Culvert 2



Photograph 11: View to east showing toe of slope west of Culvert 2 and east of Culvert 3; unlined discharge channel from Culverts 1 and 2 at left-center of photograph.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 12: Toe of Slope Looking East to Culvert 2 - November 2019



Photograph 12: View to east taken by Hoyle, Tanner & Associates in November 2019 showing toe of slope west of Culvert 2 and east of Culvert 3; unlined discharge channel from Culverts 1 and 2 in foreground; note intensity of erosion from surface flow cutting back towards toe of the slope.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 13: Stormwater Discharge Pipe from Manhattan Drive to Culvert 3



Photograph 13: View to southwest of exposed discharge pipe from Manhattan Drive to Culvert 3.

CITY OF BURLINGTON, VERMONT
SLOPE STABILITY INSPECTION

Date of Inspection: August 2020

Site Inspector

Name:	David C. Del Marco, P.G.	E-mail:	David.Delmarco@Terracon.com
Title:	Senior Project Manager	Phone:	603.206.1191
Office/Facility Location:	Manchester, NH	Mobile:	781.844.6001

Owner Information

Owner:	City of Burlington, VT	Owner Contact:	Phillip Peterson
	645 Pine Street	Phone:	(802) 865-5832
	Burlington, VT 054001	E-mail:	ppeterson@burlingtonvt.gov

Site Location Information

Site GIS Location ID:	411 Riverside Avenue	Site Coordinates	44.4883
		Latitude:	
Site Name:	Burlington Collision	Longitude:	-73.1988

Assessment Findings

Ground Movement Type (if evidence of ground movement observed)

☒ Landslide ☐ Subsidence / Sinkhole ☒ Other (erosion, etc.), describe:

Evidence of historic landslide observed east of Burlington Collision building. Base of recent slump/slide mass stabilized by placement of large logs. Crown cracks indicative of future failure event(s) observed in existing slope at top of historic slide/slump mass. Incipient slumping characterized by slightly disturbed ground observed at the top of the slope immediately behind the building. Majority of historic slump/slide mass near base of slope is unvegetated and exposed soil surfaces will continue to erode during precipitation events. The slope east of and behind the building is subject to localized failure events that will incrementally cut back the slope. Presence of crown cracks east of building subject to failure following freeze-thaw cycles.

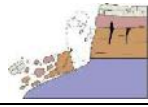
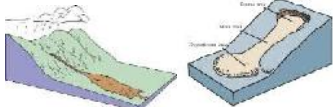
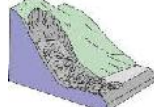
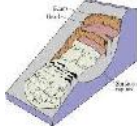
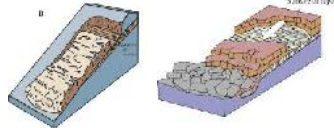
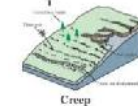
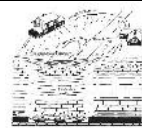
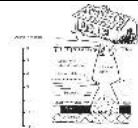
Consequence of Failure:

Failures at the top of the slope will continue to cut back the slope and could eventually compromise the structural integrity of the Burlington Collision building. There are limited effects down-slope from localized failures (i.e. continued deposition of limited soil masses).

Recommended Future Inspection Frequency:

Annual inspection at top of slope for increase in ongoing slumping and cracking; 5 years for the central and basal portions of the slope where effects of failure are less severe. Area subject to crown cracking may warrant higher frequency inspection, especially following major precipitation and freeze-thaw events.

Burlington, VT Slope Stability Inspection

Geohazard Type (Which best fits the observed conditions? If complex slide, it may be appropriate to select more than one type)			
Landslide Types			
☐ Fall Mass detaches from a steep slope or cliff. Free-fall, bouncing, or rolling		☐ Topple Forward rotation or tilting of a column of rock or soil	
☐ Flow Fluid-like movement of a mass; slowly or swiftly. Flows of mud and debris may resemble moving wet concrete		☐ Avalanche Extremely rapid flow- or sheet-like movement of a large, crumbling mass down a steep mountainside or over a cliff.	
☒ Rotational Bowl-shaped failure. Movement at top (scarp) is downward and may tilt into the slope. Bottom is marked by bulging mass (toe bulge).		☒ Translational Movement occurring along a relatively planar surface; commonly parallel to the slope	
☐ Spread Lateral movement causing the ground to pull apart; or in formation of parallel fractures. May occur on gentle slopes.		☒ Creep Similar to spread, but commonly imperceptibly slow movement; results hummocky (undulating) ground surface	
Subsidence / Sinkhole			
☐ Ground Subsidence Downward ground movement (sag) or settlement of an area		☐ Sinkhole Localized downward ground movement forming a closed depression with or w/out open drain hole or throat.	

Site Setting and Surrounding Area

☒ Open-Slope
 ☐ Side-Slope
 ☐ Gully/Ravine
 ☐ Waterway
 ☐ Residential
 ☐ Agricultural
 ☐ Mine/Quarry
 ☐ Wooded
☒ Natural
☐ Cut
☐ Fill
☐ Embankment
☐ Recently graded (Cut/Fill)

Notes: Top of slope behind the building exhibits incipient slumping. Top of slope east of Burlington Collision building exhibits crown cracks. Base of recent failure mass stabilized by large logs. Historic slump/slope mass near base of slope primarily unvegetated and exposed. Downslope areas contain scattered automotive debris and refuse.

Material Type and Consistency

☐ Bedrock
☐ Gravel, cobbles, and boulders
☒ Sand
☒ Silt and Clay
☐ Colluvial (mixed coarse- and fine-grain material)
☐ Shallow soil over rock
☐ Liquid
☐ Solid-Wet
☐ Solid-Dry
☐ Rubble
☐ Organics; describe:

Notes: From samples examined in the field, slope soils are glacial/alluvial silty sand; fill material; refuse (brick, rock, refuse and vegetative debris) exposed on portion of the slope bordering 317 Riverside Avenue

Condition of Trees, Fences, Posts, etc.

☒ Standing upright
☒ Leaning uphill
☒ Leaning downhill
☐ Leaning all directions
☐ Fallen
☐ None

Notes: Tree at upper portion and top of slope lean primarily downslope; trees in historic slump/slide mass near base of slope lean primarily upslope or are straight.



Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

Surface-Water Features

☐ Stream ☐ Pond/Lake ☐ Springs/Seepage ☐ Marshes ☐ Closed depressions ☐ Culverts ☐ Ditches ☐ Water-breaker
☐ Free-water on slope ☐ Saturated soils ☐ None

Notes: No seepage from the exposed slope or debris mass was observed.

Relative Activity

☒ Sharp un-vegetated features ☒ Partially vegetated features ☒ Smooth vegetated features ☐ Un-drained depressions
☐ Drained depressions ☐ Ponds/Sags/Marshes ☒ Undulating (hummocky) topography ☒ Un-vegetated cracks
☐ Vegetated cracks

Notes: Presence of crown cracks at top of slope indicate recent movement. Incipient soil slumping observed at the top of the slope behind the Burlington Collision building. The slope in these areas will continue to experience small-scale, localized sliding and/or slumping.

Landslide Dimensions

Scarp Height	N/A	Scarp width	N/A
Width of source area	N/A	Depth of Source area	N/A
Width of deposit	N/A	Depth of deposit	N/A
Length (distance) from top to bottom	N/A	Height (elevation) from top to bottom	N/A
Overall Width	N/A	Other Notes:	

Subsidence / Sinkhole Dimensions

Length:	N/A	Width:	N/A	Depth:	N/A
Hole / Throat (Y/N):	N/A	Diameter:	N/A	Depth:	N/A
Description:	N/A				



Site Assessment Form ATTACHMENTS
Burlington, VT Slope Stability Inspection

SITE PHOTOGRAPHS



PROJECT NO. 909051.02		SHEET NO.	
5		SHEET 5 OF 6	
BURLINGTON SLOPE STABILITY INSPECTION			
BURLINGTON, VERMONT			
Slope 4b			
Hoyle, Tanner & Associates, Inc. 125 College Street, 4th Floor, Burlington, VT 05401 Tel (802) 860-1331 www.hoyletanner.com			
FILENAME 909051_02bdr	DESIGNER NLC	DRAWN NLC	CHECKED JAO
MODEL NAME PLAN04b	SCALE AS SHOWN	DATE 11/07/2019	
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Slope Location: 411 Riverside Avenue – Burlington Collision Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 1: Top of Slope Behind Burlington Collision Building



Photograph 1: View to east behind Burlington Collision showing incipient slumping (center and center foreground) of photograph) at top of slope; note leaning trees top left

Slope Location: 411 Riverside Avenue – Burlington Collision Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 2: Top of Slope Behind Burlington Collision



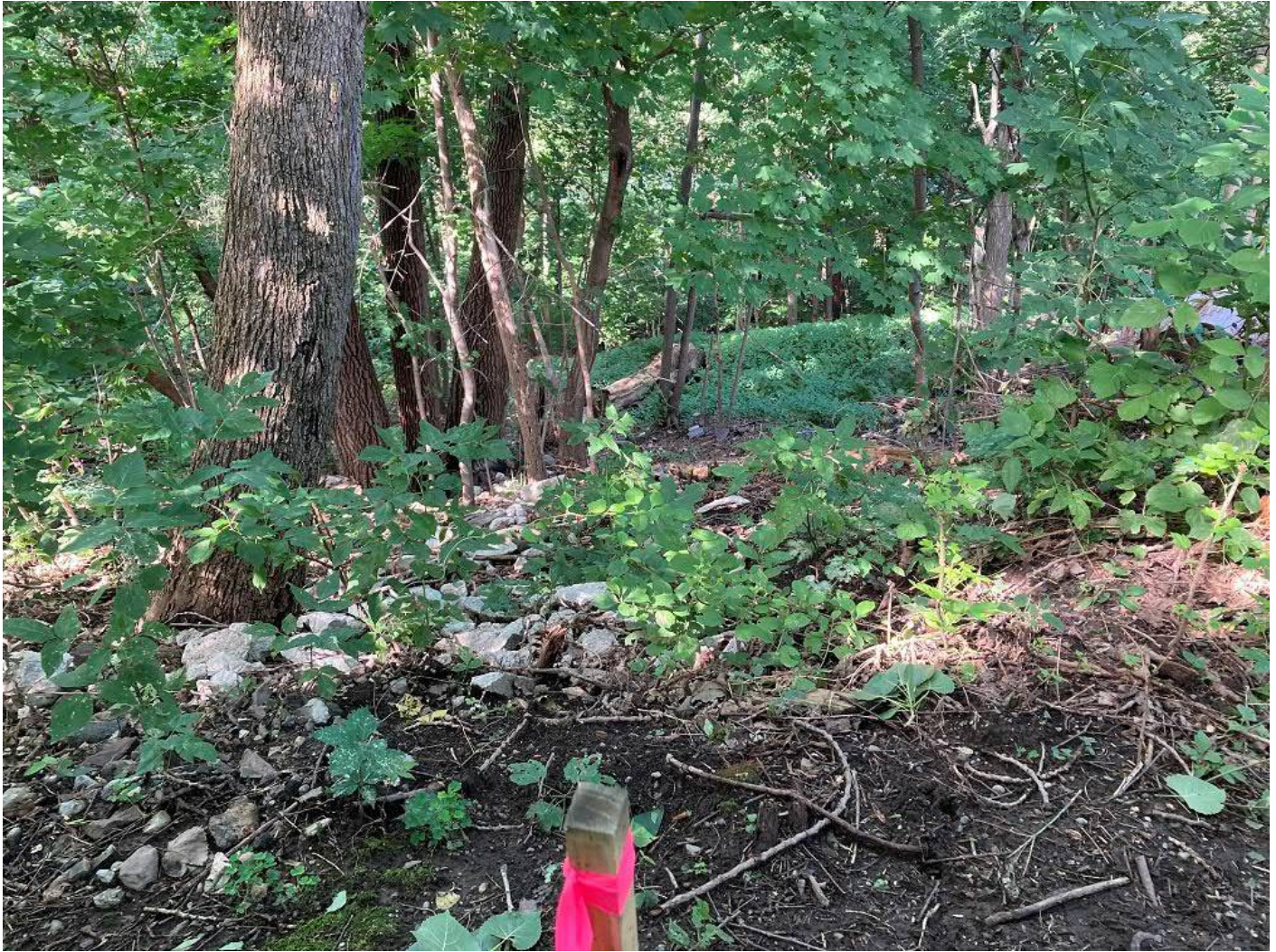
Photograph 2: Additional view of incipient slumping behind Burlington Collision Building

Slope Location: 411 Riverside Avenue – Burlington Collision Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 3: Top of Slope Behind Burlington Collision



Photograph 3: View to west behind Burlington Collision showing incipient slumping at center of photograph; note leaning trees top right; soil scarp obscured by vegetation at center-right of photograph.

Slope Location: 411 Riverside Avenue – Burlington Collision Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 4: View Downslope from Behind Burlington Collision Building



Photograph 4: View to north from behind Burlington Collision building showing overgrown downslope historical slump/slide debris center right

Slope Location: 411 Riverside Avenue – Burlington Collision Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 5: Crown Cracking at Top of Slope East of Burlington Collision Building



Photograph 5: View to west northwest, east of Burlington Collision building, showing crown cracks and beginning of future slump/slide, at top of former failed slope

Slope Location: 411 Riverside Avenue – Burlington Collisions Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 6: Crown Cracks Top of Slope Burlington Collision



Photograph 6: View to northeast, additional view of crown cracks at top of slope, east of Burlington Collision building

Slope Location: 411 Riverside Avenue – Burlington Collision Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 7: Downslope from Crown Cracks, Burlington Collision



Photograph 7: View to north downslope from crown cracks at top of slope east of Burlington Collision building; logs appear to be placed to stabilize slide; overgrown historic slump/slide debris apparent beyond logs;

Slope Location: 411 Riverside Avenue – Burlington Collision Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 8: Soil Scarps in Former Slide/Slump Debris Downslope from Burlington Collision



Photograph 8: View to south-southwest towards Burlington Collision showing exposed, unvegetated, historic slump/slide debris; exposed soil mass subject to continual erosion during precipitation.

Slope Location: 411 Riverside Avenue – Burlington Collision Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 9: Scarps Downslope from Burlington Collision



Photograph 9: View to southwest of soil scarps in historic slide debris downslope from Burlington Collision

Slope Location: 411 Riverside Drive – Burlington Collision Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 10: Downslope from Burlington Collision



Photograph 10: View to south of historic debris slump downslope from Burlington Collision; location of crown cracks at top of slope east of building at upper left; note leaning trees at center of photo and exposed soil surface subject to continual erosion during precipitation events

**CITY OF BURLINGTON, VERMONT
SLOPE STABILITY INSPECTION**

Date of Inspection: August 2020

Site Inspector

Name:	David C. Del Marco, P.G.	E-mail:	David.Delmarco@Terracon.com
Title:	Senior Project Manager	Phone:	603.206.1191
Office/Facility Location:	Manchester, NH	Mobile:	781.844.6001

Owner Information

Owner:	City of Burlington, VT	Owner Contact:	Phillip Peterson
	645 Pine Street	Phone:	(802) 865-5832
	Burlington, VT 054001	E-mail:	ppeterson@burlingtonvt.gov

Site Location Information

Site GIS Location ID:	389 Riverside Avenue	Site Coordinates	44.4883
		Latitude:	
Site Name:	Private Residence	Longitude:	-73.1979

Assessment Findings

Ground Movement Type (if evidence of ground movement observed)

☒ Landslide ☐ Subsidence / Sinkhole ☒ Other (erosion, etc.), describe:

Evidence of historic landslide observed between private residence at 389 Riverside Avenue and Hall's Hitches and Welding at 365 Riverside Avenue. Historic landslide and soil slumping observed immediately east of private residence and behind residence to north. Top of slope east of private residence has undergone remediation. Exposed former slump/slide mass downslope will continue to erode during precipitation and stormwater discharge. Majority of historic slide/slump mass downslope between the two properties is vegetated. Top of slope at 389 Riverside Avenue may be subject to localized failure events that will incrementally cut back the slope. Incipient slumping was observed at the top of the slope west of the residence.

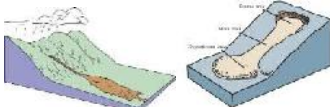
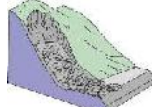
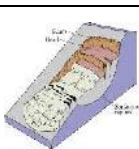
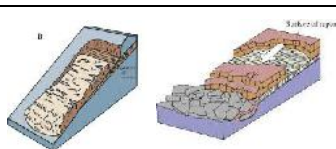
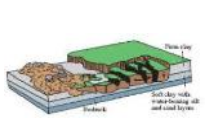
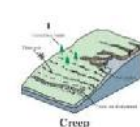
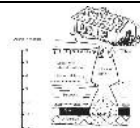
Consequence of Failure:

Localized failures at the top of the slope will continue to cut back the slope towards the private residence and Riverside Avenue. Cut back of the slope behind the private residence may compromise the structural integrity of the residence. There are limited effects down-slope from localized failures (i.e. continued deposition of limited soil masses).

Recommended Future Inspection Frequency:

Annual inspection at top of slope for presence of incipient or ongoing slumping and cracking; 5 years for the central and basal portions of the slope where effects of failure are less severe.

Burlington, VT Slope Stability Inspection

Geohazard Type (Which best fits the observed conditions? If complex slide, it may be appropriate to select more than one type)			
Landslide Types			
☐ Fall Mass detaches from a steep slope or cliff. Free-fall, bouncing, or rolling		☐ Topple Forward rotation or tilting of a column of rock or soil	
☐ Flow Fluid-like movement of a mass; slowly or swiftly. Flows of mud and debris may resemble moving wet concrete		☐ Avalanche Extremely rapid flow- or sheet-like movement of a large, crumbling mass down a steep mountainside or over a cliff.	
☒ Rotational Bowl-shaped failure. Movement at top (scarp) is downward and may tilt into the slope. Bottom is marked by bulging mass (toe bulge).		☒ Translational Movement occurring along a relatively planar surface; commonly parallel to the slope	
☐ Spread Lateral movement causing the ground to pull apart; or in formation of parallel fractures. May occur on gentle slopes.		☒ Creep Similar to spread, but commonly imperceptibly slow movement; results hummocky (undulating) ground surface	
Subsidence / Sinkhole			
☐ Ground Subsidence Downward ground movement (sag) or settlement of an area		☐ Sinkhole Localized downward ground movement forming a closed depression with or w/out open drain hole or throat.	

Site Setting and Surrounding Area

☒ Open-Slope
 ☐ Side-Slope
 ☐ Gully/Ravine
 ☐ Waterway
 ☐ Residential
 ☐ Agricultural
 ☐ Mine/Quarry
 ☐ Wooded
☒ Natural
☐ Cut
☐ Fill
☐ Embankment
☐ Recently graded (Cut/Fill)

Notes: Top of slope east of the private residence has been armored with rip-rap to mitigate local failure in this area; remaining portions of the slope are subject to localized failure. Exposed soil surfaces downslope will continue to erode during precipitation events and ongoing discharge of stormwater.

Material Type and Consistency

☐ Bedrock
☐ Gravel, cobbles, and boulders
☒ Sand
☒ Silt and Clay
☐ Colluvial (mixed coarse- and fine-grain material)
☐ Shallow soil over rock
☐ Liquid
☐ Solid-Wet
☐ Solid-Dry
☐ Rubble
☐ Organics; describe:

Notes: From samples examined in the field, slope soils are glacial/alluvial silty sand; fill material; refuse (brick, rock, refuse and vegetative debris) exposed on portion of the slope bordering 317 Riverside Avenue

Condition of Trees, Fences, Posts, etc.

☒ Standing upright
☒ Leaning uphill
☒ Leaning downhill
☐ Leaning all directions
☐ Fallen
☐ None

Notes: Distinct upslope lean of trees on historic slump mass downslope from residence; trees on mass at base of slope are upright.



Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

Surface-Water Features

☐ Stream ☐ Pond/Lake ☐ Springs/Seepage ☐ Marshes ☐ Closed depressions ☐ Culverts ☐ Ditches ☐ Water-breaker
☐ Free-water on slope ☐ Saturated soils ☐ None

Notes: No seepage from the exposed slope or debris mass was observed. Stormwater discharge hoses from house discharge water downslope.

Relative Activity

☒ Sharp un-vegetated features ☒ Partially vegetated features ☒ Smooth vegetated features ☐ Un-drained depressions ☐ Drained depressions ☐ Ponds/Sags/Marshes ☒ Undulating (hummocky) topography ☐ Un-vegetated cracks ☐ Vegetated cracks

Notes: No transverse cracks or distinct, widespread soil slumping observed at top of slope; exposed failure scarps are present at the top of the slope immediately east of the residence. Historic failure scarps east of the residence have been armored with rip-rap to mitigate future localized failure. Incipient surface slumping indicated by slightly disturbed ground and failed fencing observed at the top of the slope west of the residence. The slope in this area will continue to experience small-scale, localized sliding and/or slumping.

Landslide Dimensions

Scarp Height	<u>N/A</u>	Scarp width	<u>N/A</u>
Width of source area	<u>N/A</u>	Depth of Source area	<u>N/A</u>
Width of deposit	<u>N/A</u>	Depth of deposit	<u>N/A</u>
Length (distance) from top to bottom	<u>N/A</u>	Height (elevation) from top to bottom	<u>N/A</u>
Overall Width	<u>N/A</u>	Other Notes:	<u></u>

Subsidence / Sinkhole Dimensions

Length:	<u>N/A</u>	Width:	<u>N/A</u>	Depth:	<u>N/A</u>
Hole / Throat (Y/N):	<u>N/A</u>	Diameter:	<u>N/A</u>	Depth:	<u>N/A</u>
Description:	<u>N/A</u>				



Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

SITE PHOTOGRAPHS

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 11: Incipient Slumping Top of Slope West of House



Photograph 11: View to northeast, west of residence, showing incipient slumping at top of slope, left-center of photograph; note disturbed fencing where soil scarp is beginning to form.

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 12: View Behind Residence



Photograph 12: View to west of the top of the slope behind the residence showing covered scarp and slump mass downslope from scarp

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 13: View Downslope Behind Residence



Photograph 13: View to southwest behind residence showing covered scarp at top of slope and head scarp of historic soil slump downslope; note lean of trees upslope at center and left-center of photograph

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 14: View Downslope from Behind Residence



Photograph 14: View to north northwest from behind residence showing head scarps from historic slumps and exposed soil surfaces subject to continued erosion during precipitation events; note discharge hose at bottom right and refuse debris in center; note lean of trees upslope in center of photograph

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 15: Discharge Pipe at Top of Slope



Photograph 15: View to southeast, east of residence, showing discharge pipe; ongoing discharge flow will contribute to surface erosion and creation of flow gully in unvegetated portions downslope

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 16: Remediation at Top of Slope East of Residence



Photograph 16: View to west toward residence showing remediation at top of slope (placement of fabric and rip-rap); no distinct surface cracking or slumping in grassy area south of rip-rap

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 17: Remediation at Top of Slope



Photograph 17: View to west northwest, additional view of rip-rap armor at top of slope east of residence

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 18: View Downslope from Remediated Area



Photograph 18: View to north showing historic slide debris downslope from remediated area east of residence (see Photographs 15 and 16); note vegetative cover on historic slide debris

Slope Location: 389 Riverside Avenue – Private Residence Date: 12/2019
City: Burlington State: Vermont
Description : Photograph 19: View of Slide Mass in December 2019



Photograph 19: View to north between 389 and 365 Riverside Avenue showing slide debris in December 2019 during inspection by Hoyle Tanner Associates; Photo 17 above shows same view taken in August 2020.

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 20: Soil Slide East of Residence



Photograph 20: View to east of soil slide east of residence, looking towards property at 365 Riverside Avenue; note leaning tree top center (see inspection report for 365 Riverside Avenue for additional photographs); exposed surfaces subject to localized failure and erosion during precipitation events

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 21: Downslope from Residence at 389 Riverside Avenue



Photograph 21: View to south of exposed historic soil slump debris downslope from residence at 389 Riverside Avenue; exposed soil subject to continual erosion during precipitation events; note gully formation from surface runoff at center and right of photograph

Slope Location: 389 Riverside Avenue – Private Residence Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 22: Soil Slide Between 389 and 365 Riverside Avenue



Photograph 22: View to southeast of exposed scarp and slide/slump debris (center of photograph) downslope from area between 389 (private residence) and 365 Riverside Avenue (Hall's Hitches and Welding)

**CITY OF BURLINGTON, VERMONT
SLOPE STABILITY INSPECTION**

Date of Inspection: August 2020

Site Inspector

Name:	David C. Del Marco, P.G.	E-mail:	David.Delmarco@Terracon.com
Title:	Senior Project Manager	Phone:	603.206.1191
Office/Facility Location:	Manchester, NH	Mobile:	781.844.6001

Owner Information

Owner:	City of Burlington, VT	Owner Contact:	Phillip Peterson
	645 Pine Street	Phone:	(802) 865-5832
	Burlington, VT 054001	E-mail:	ppeterson@burlingtonvt.gov

Site Location Information

Site GIS Location ID:		Site Coordinates	44.4881
		Latitude:	
Site Name:	365 Riverside Avenue	Longitude:	-73.1968

Assessment Findings

Ground Movement Type (if evidence of ground movement observed)

☒ Landslide ☐ Subsidence / Sinkhole ☒ Other (erosion, etc.), describe:

Evidence of historic landslide observed between 365 Riverside Avenue and private residence at 389 Riverside Avenue. Exposed soil surfaces on downslope areas will continue to erode during precipitation events; majority of historic slide/slump mass downslope between the two properties is vegetated. Top of slope may be subject to limited, small-scale, localized failure events. The area behind the building at 365 Riverside Avenue could not be observed due to the presence of debris and dense vegetation.

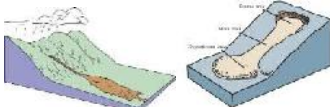
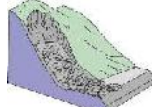
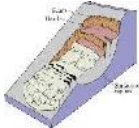
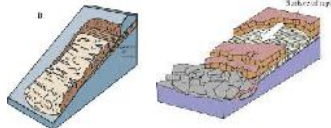
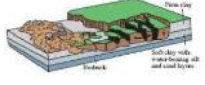
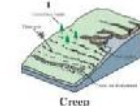
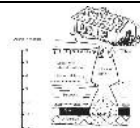
Consequence of Failure:

Limited failures at the top of the slope will continue to cut back the slope towards Riverside Avenue. Cut back of the slope behind the building at 365 Riverside Avenue may affect the structural integrity of the building, but that portion of the slope is densely vegetated. There are limited effects down-slope from localized failures (i.e. continued deposition of limited soil masses).

Recommended Future Inspection Frequency:

Annual inspection at top of slope for presence of incipient or ongoing slumping and cracking; 5 years for the central and basal portions of the slope where effects of failure are less severe.

Burlington, VT Slope Stability Inspection

Geohazard Type (Which best fits the observed conditions? If complex slide, it may be appropriate to select more than one type)			
Landslide Types			
☐ Fall Mass detaches from a steep slope or cliff. Free-fall, bouncing, or rolling		☐ Topple Forward rotation or tilting of a column of rock or soil	
☐ Flow Fluid-like movement of a mass; slowly or swiftly. Flows of mud and debris may resemble moving wet concrete		☐ Avalanche Extremely rapid flow- or sheet-like movement of a large, crumbling mass down a steep mountainside or over a cliff.	
☒ Rotational Bowl-shaped failure. Movement at top (scarp) is downward and may tilt into the slope. Bottom is marked by bulging mass (toe bulge).		☒ Translational Movement occurring along a relatively planar surface; commonly parallel to the slope	
☐ Spread Lateral movement causing the ground to pull apart; or in formation of parallel fractures. May occur on gentle slopes.		☒ Creep Similar to spread, but commonly imperceptibly slow movement; results hummocky (undulating) ground surface	
Subsidence / Sinkhole			
☐ Ground Subsidence Downward ground movement (sag) or settlement of an area		☐ Sinkhole Localized downward ground movement forming a closed depression with or w/out open drain hole or throat.	

Site Setting and Surrounding Area

☒ Open-Slope
 ☐ Side-Slope
 ☐ Gully/Ravine
 ☐ Waterway
 ☐ Residential
 ☐ Agricultural
 ☐ Mine/Quarry
 ☐ Wooded
☒ Natural
☐ Cut
☒ Fill
☐ Embankment
☐ Recently graded (Cut/Fill)

Notes: Existing slope behind and to the east of the building is densely vegetated; open, exposed, failed slope occurs between 365 and 389 Riverside Avenue; downslope slide debris in this area is vegetated and contains some vegetative refuse, concrete and rock fragments.

Material Type and Consistency

☐ Bedrock
☐ Gravel, cobbles, and boulders
☒ Sand
☒ Silt and Clay
☐ Colluvial (mixed coarse- and fine-grain material)
☐ Shallow soil over rock
☐ Liquid
☐ Solid-Wet
☐ Solid-Dry
☐ Rubble
☐ Organics; describe:

Notes: From samples examined in the field, slope soils are glacial/alluvial silty sand; fill material (brick, rock, refuse and vegetative debris) exposed on portion of the slope bordering 317 Riverside Avenue

Condition of Trees, Fences, Posts, etc.

☒ Standing upright
☐ Leaning uphill
☒ Leaning downhill
☐ Leaning all directions
☐ Fallen
☐ None

Notes: Distinct downslope lean of trees at top of slope between 365 and 389 Riverside Avenue



Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

Surface-Water Features

☐ Stream ☐ Pond/Lake ☐ Springs/Seepage ☐ Marshes ☐ Closed depressions ☐ Culverts ☐ Ditches ☐ Water-breaker
☐ Free-water on slope ☐ Saturated soils ☐ None

Notes: No seepage from the exposed slope or debris mass was observed. .

Relative Activity

☐ Sharp un-vegetated features ☒ Partially vegetated features ☒ Smooth vegetated features ☐ Un-drained depressions
☐ Drained depressions ☐ Ponds/Sags/Marshes ☒ Undulating (hummocky) topography ☐ Un-vegetated cracks
☐ Vegetated cracks

Notes: No transverse cracks or distinct, widespread soil slumping observed at top of slope; exposed failure scarps are present in the slope between 365 and 389 Riverside Avenue. The slope in this area will continue to experience small-scale, localized sliding. Exposed soil surfaces on slope at eastern boundary of the property will continue to erode during precipitation events.

Landslide Dimensions

Scarp Height	<u>N/A</u>	Scarp width	<u>N/A</u>
Width of source area	<u>N/A</u>	Depth of Source area	<u>N/A</u>
Width of deposit	<u>N/A</u>	Depth of deposit	<u>N/A</u>
Length (distance) from top to bottom	<u>N/A</u>	Height (elevation) from top to bottom	<u>N/A</u>
Overall Width	<u>N/A</u>	Other Notes:	<u></u>

Subsidence / Sinkhole Dimensions

Length:	<u>N/A</u>	Width:	<u>N/A</u>	Depth:	<u>N/A</u>
Hole / Throat (Y/N):	<u>N/A</u>	Diameter:	<u>N/A</u>	Depth:	<u>N/A</u>
Description:	<u>N/A</u>				



Site Assessment Form ATTACHMENTS
Burlington, VT Slope Stability Inspection

SITE PHOTOGRAPHS

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 23: Top of Slope Between Hall's Hitches and Welding at 365
Riverside and Private Residence at 389 Riverside



Photograph 23: View to west of top of slope between 365 Riverside Avenue (Hall's Hitches) and 389 Riverside Avenue (private residence – top center) showing stable platform at top of slope to left; incipient slumping possible at bottom-right and center-right of photograph; failed slope to right of stakes and flagging; exposed soil scarp obscured by vegetation at center-right of photograph.

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 24: View Towards Hall's Hitches and Welding Building



Photograph 24: View to east towards Hall's Hitches and Welding showing stable platform to right of flagging (i.e. no evidence of surface slumping or cracking) and top of failed slope at extreme left; note lean of trees top left; note monitoring well center right

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 25: View of Failure Scarp Between 365 and 389 Riverside Avenue



Photograph 25: View to west toward residence at 389 Riverside Avenue showing failure scarp at top of slope and overgrown slide/slump debris to center-right

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 26: View of Slide/Slump Debris Downslope from Failure Scarp



Photograph 26: View to north of overgrown historical slide/slump debris from top of failure scarp between 365 and 389 Riverside Avenue

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 27: Top of Slope West of Hall's Hitches Building



Photograph 27: View to east towards Hall's Hitches building, east of failed slope, showing stable surface platform (i.e. no distinct slumping or crown cracking); possible beginning traces of surface slumping top center of photograph; soil scarp obscured and covered by vegetation at left of photograph

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 28: Top of Slope East of Hall's Hitches Building



Photograph 28: View to northeast of top of slope at eastern portion of Hall's Hitches and Welding property showing stable platform at top of slope; note dense vegetation at top of slope which extends downslope

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 29: Eastern Portion of Slope at 365 Riverside Avenue – Hall's Hitches



Photograph 29: View to southwest of eroded slope at eastern boundary between 365 Riverside Avenue and 317 Riverside Avenue (Bluebird BBQ); brick fragments within mass indicate historic filling; note gully formation at left and lean of trees at extreme left and top right; exposed soil subject to continual erosion and gully formation during precipitation events (photo taken from 317 Riverside Avenue property).

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 30: Eroded Scarp at East Property Boundary 365 Riverside Avenue



Photograph 30: Additional view to west of eroded slope between 365 and 317 Riverside Avenue; note brick fragments and density of vegetation to west; (photograph taken from 317 Riverside Avenue property – Bluebird BBQ west parking area)

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 12/2019
City: Burlington State: Vermont
Description : Photograph 31: Boundary Between 365 and 317 Riverside Ave December 2019



Photograph 31: View to northwest, downslope, taken by Hoyle Tanner Associates during the December 2019 inspection showing the boundary between 365 and 317 Riverside Avenue (Bluebird BBQ); note gully formation from surface runoff at center of photograph and possible crown cracking at bottom right; western parking area for Bluebird BBQ at top right

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 32: Density of Vegetation Downslope from 365 Riverside Avenue



Photograph 32: View to south looking upslope to 365 Riverside Avenue, Hall's Hitches and Welding, showing density of vegetation on historic slide/slump debris; soil scarp in historic debris mass present at center and center-left of photograph

Slope Location: 365 Riverside Avenue – Hall's Hitches and Welding Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 33: Density of Vegetation Downslope from 365 Riverside Avenue



Photograph 33: View to south southeast showing density of vegetation overgrown on historic slump/slide mass downslope from 365 Riverside Avenue, Hall's Hitches and Welding

Riverside Avenue Corridor – Slope Section 4b

DRAINAGE

Feature	Structure	Size	Type/Material	Condition	Comments	Recommendation
D4	MH ☐ CB/DI ☐ Outlet ☒ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☒ Swale ☐ _____ ☐	18" dia.	CMP	Good	Pipe exposed, laid on top of slope approximately 50' in length. Pipe appears in good condition with a slightly elevated outlet acceptable for plunge with a stable rock armor apron.	No action. Monitor Rock Apron Outlet in future inspections

Riverside Avenue Corridor – Slope Section 4b

GUARDRAIL/FENCE

Feature	Height (in)	Face of Rail/Fence to Shoulder Break (ft-in)	Leaning?	Condition	Comments	Recommendation
G1	-	-	Yes ☐ Slope instability ☐ No ☐ Plow damage ☐	-	-	-

No City-owned guardrail/fence issues were identified in the 2019 inspection as top of slope is further back from Roadway ROW.

Private fences and barriers near top of slope are leaning. Reference Terracon Inspection Reports.

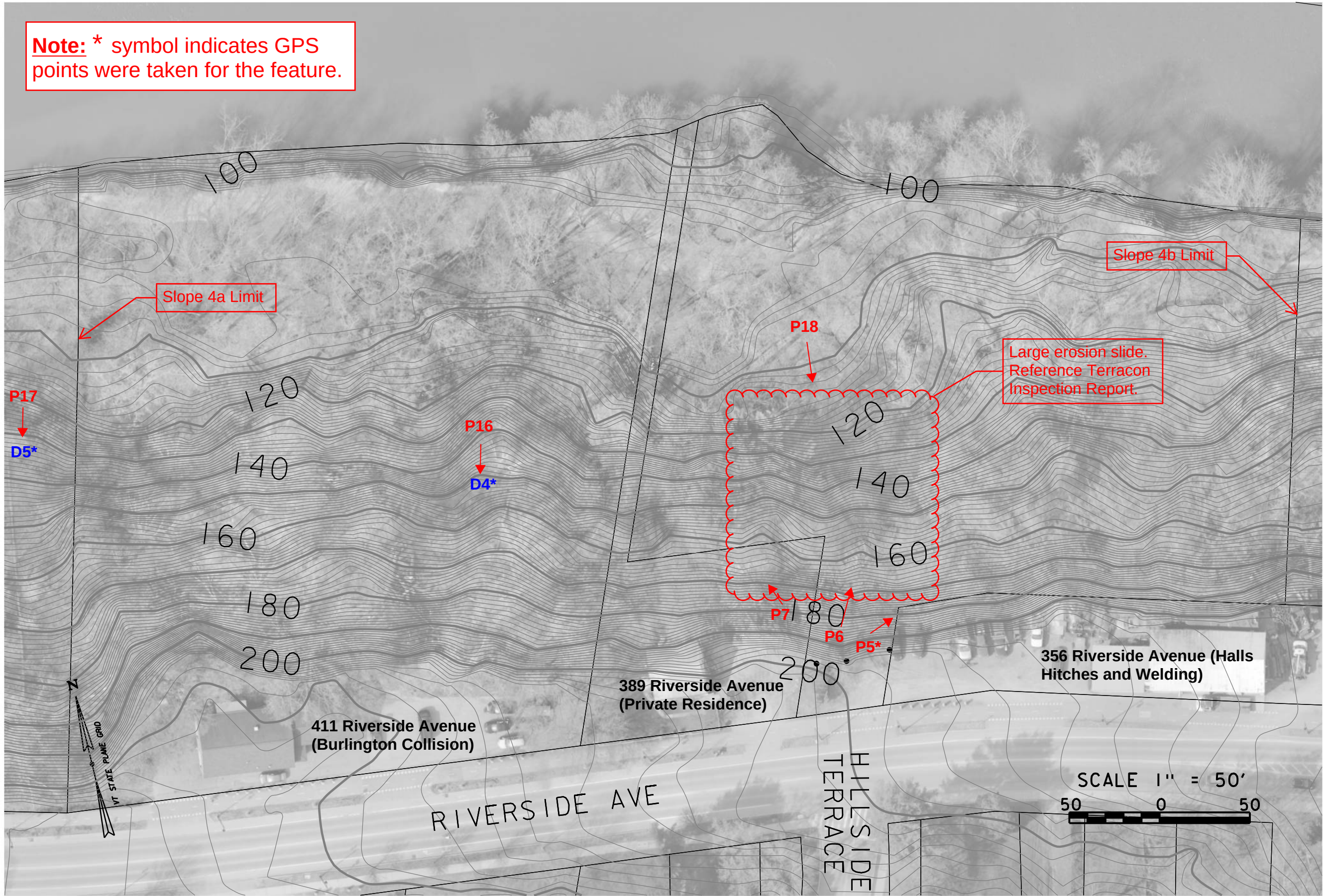
Riverside Avenue Corridor – Slope Section 4b

ROADWAY

Feature	Pavement Defect	Length (ft-in)	Width (ft-in)	Condition	Comments	Recommendation
R1	Pothole ☐ Edge Crack ☐ Settlement ☐ Shoulder Berm ☐ Longitudinal Crack ☐ <u>Erosion Slide</u> ☐					

No City-owned roadway issues were identified in the 2019 inspection.

Note: * symbol indicates GPS points were taken for the feature.



PROJECT NO. 909051.02		SHEET NO. 5		SHEET 5 OF 6	
BURLINGTON SLOPE STABILITY INSPECTION					
BURLINGTON, VERMONT					
Slope 4b					
Hoyle, Tanner & Associates, Inc.					
125 College Street, 4th Floor, Burlington, VT 05401 Tel (802) 860-1331 www.hoyletanner.com					
FILENAME 909051_02bdr	DESIGNER NLC	MODEL NAME PLAN04b	CHECKED JAO	DATE 11/07/2019	This document is prepared as an instrument of service and shall remain the property of Hoyle, Tanner, Inc. It may not be used, reproduced, disseminated or otherwise made available in any form, including electronically, for any other purpose than this project, without the written permission of Hoyle, Tanner, Inc.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 14: Soil Erosion and Gully Formation at Pipe to Culvert 3



Photograph 14: View to south towards Manhattan Drive showing exposed discharge pipe to Culvert 3, and soil erosion and gully formation at top and mid-slope.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 15: Culvert 3 and Unlined Discharge Channel from Culverts 1 and 2



Photograph 15: View to west of unlined discharge channel from Culverts 1 and 2; Culvert 3 at center-left of photograph.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 16: Unlined Culverts 1 and 2 Discharge Channel East of Culvert 3



Photograph 16: View to east of unlined discharge channel at toe of slope; note density of overgrowth as compared to Photograph 17.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 17: November 2019 - Unlined Discharge Channel East of Culvert 3



Photograph 17: View to east of unlined discharge channel at toe of slope; note lack of overgrowth and sediment infilling channel (compare to Photograph 16).

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 18: View of Slope West of Culvert 3 Pipe



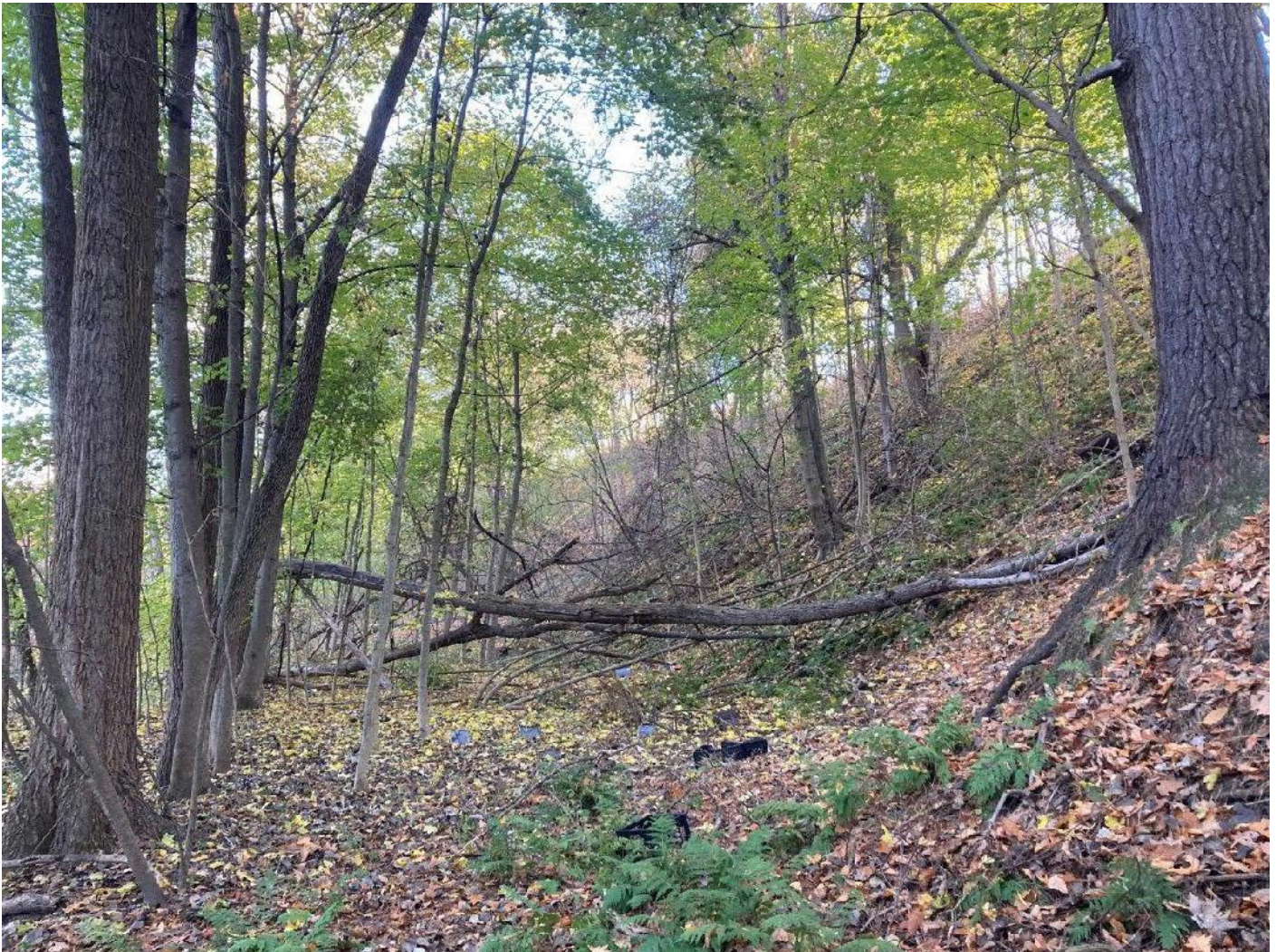
Photograph 18: View to southwest of slope west of Culvert 3 pipe showing exposed soil surface exposed to erosion during precipitation events; exposed surfaces will continue to erode; note no distinct lean of trees at mid and top of slope.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 19: Another View of Slope from Position of Photograph 18



Photograph 19: View to south-southwest from toe of slope, from position of Photograph 18, providing another view of the slope.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 20: Toe of Slope West of Culvert 3



Photograph 20: View to east of toe of slope west of Culvert 3; culvert pipe can be seen at left-center of photograph; discharge channel from Culvert 1 extreme left of photograph, obscured by trees.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 21: Erosion Channel at Base of Slope West of Culvert 3



Photograph 21: View to west of erosion channel at the toe of the slope west of Culvert 3; failed lower portion of slope at left-center of photograph a result of erosion undercutting into the toe of the slope.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 22: Large Erosional Gully East of Photograph 21



Photograph 22: View to east from position of Photograph 21 showing large erosional gully north of toe of Manhattan Drive slope.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 23: Discharge Pipe to Culvert 4



Photograph 23: View to southwest from toe of slope showing discharge pipe from Manhattan Drive at top-center (designated herein as Culvert 4) and failure/erosional surface in foreground at toe of slope; failure a result of historical heavy surface flow cutting into toe of slope;

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 24: Failure Surface Near Base of Slope West of Culvert 4 Pipe



Photograph 24: View to south from near toe of slope to Manhattan Drive showing failure surface at base of slope; failure most likely a result of erosion into base of slope during historical flow in erosion channel at toe of slope (see Photograph 25).

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 25: Erosion Channel and Failure Surface West of Culvert 4 Pipe



Photograph 25: View to east showing erosion channel and failed lower portion of slope west of Culvert 4 pipe.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 26: Western End of Channel at Toe of Slope



Photograph 26: View west-northwest showing discharge channel at base of slope; channel is directed towards wetlands at right-center of photograph; future high-flow events will continue to erode into toe of slope as shown in foreground.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 27: Western End of Slope



Photograph 27: View to southwest upslope to Manhattan Drive at Convent Square; note the amount of debris on slope.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 28: Top of Slope – Manhattan Drive from Convent Square



Photograph 28: View to east along Manhattan Drive from Convent Square at top of slope; no distinct ground disturbance observed; stressed asphalt cracking may be a result of slope creep?

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 29: Minor Failure at Top of Slope



Photograph 29: View to north from top of slope on Manhattan Drive showing minor surface failure; note lean of trees at center of photo and exposed soil at bottom right.

Slope Location: Manhattan Drive and Route 127 (Beltline) Date: Oct. 2020
City: Burlington State: Vermont
Description : Photograph 30: Top of Slope on Manhattan Drive

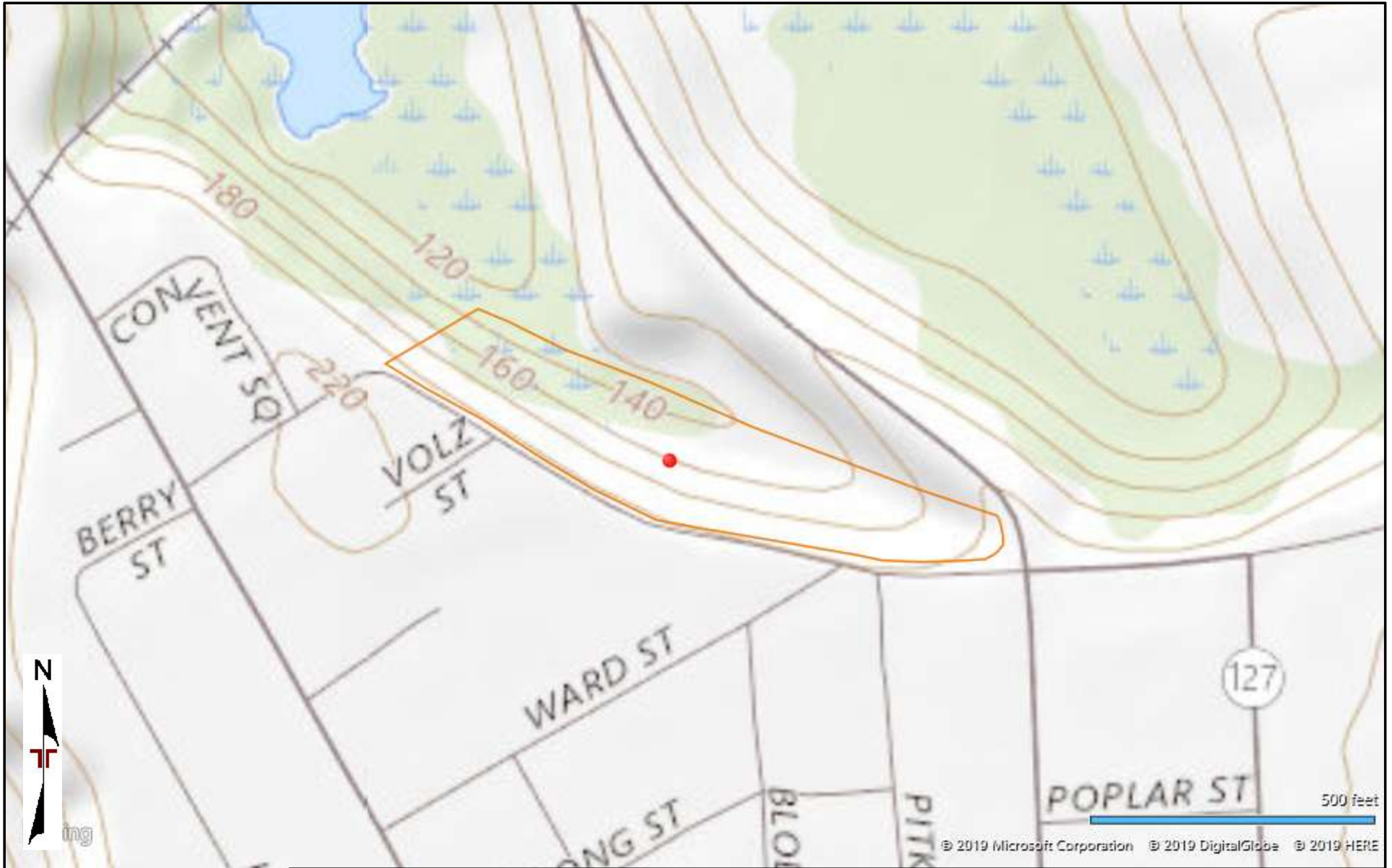


Photograph 30: View to east along Manhattan Drive at the top of the slope; no distinct scarps or disturbed ground observed; note stressed pavement cracking.



Site Assessment Form ATTACHMENTS
Burlington, VT Slope Stability Inspection

EXHIBITS



TOPOGRAPHIC MAP IMAGE COURTESY OF
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DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION
PURPOSES

Project Manager:
ASP

Drawn by:
MAG

Checked by:
DCD

Approved by:
CWT

Project No.
J1195064

Scale:
As Shown

File Name:

Date:
11/18/2019

Terracon

77 Sundial Ave, Ste 401W
Manchester, NH 03103-7236

SITE LOCATION

Burlington Slope Inspections
Manhattan at 127 Beltline
Burlington, VT

Exhibit

A-1

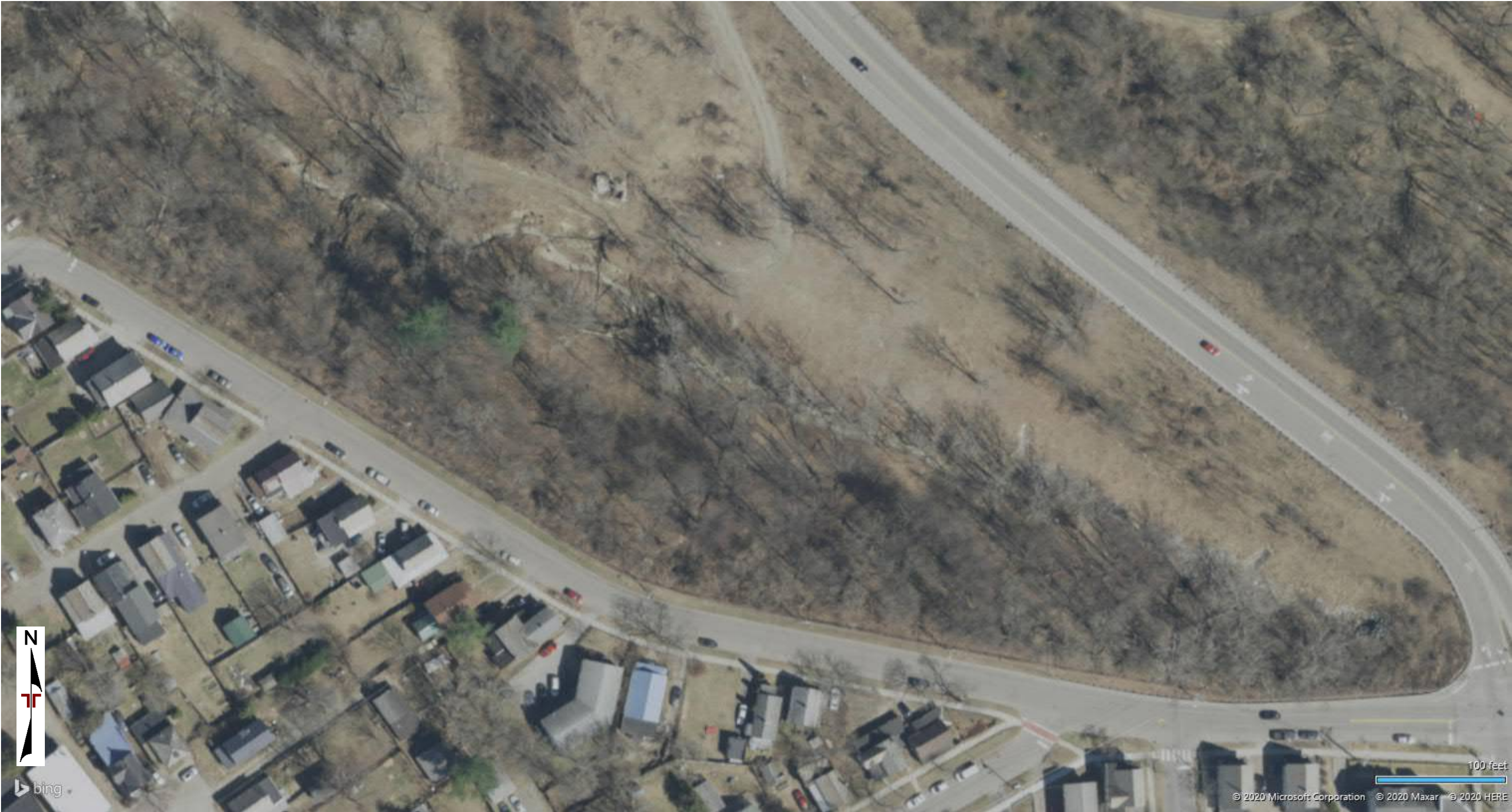


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Project Manager: DCD	Project No. J1195064
Drawn by: MAG	Scale: N.T.S.
Checked by: DCD	File Name: N/A
Approved by: CWT	Date: Nov. 2020

Terracon
Consulting Engineers & Scientists

77 Sundial Avenue Suite 401W
PH. (603) 647-9700

Manchester, NH 03103
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Area Plan – Manhattan Drive
Manhattan Drive Slope Inspections Burlington, Vermont

EXHIBIT
2

Manhattan Drive @ Route 127 Beltline

DRAINAGE

Feature	Structure	Size	Type/Material	Condition	Comments	Recommendation
D1	MH ☒ CB/DI ☐ Outlet ☐ Headwall ☐ End Section ☐ Stone ☐ Swale ☐ _____ ☐	4' dia.	N/A	Poor, needs attention.	Pipe outlet into unused/unburied structure, no grate or other pipes connecting. Exposed 18" plastic pipe outlet.	Coordinate with stormwater department. At minimum, install cover on structure and determine if exposed pipe is due to erosion. Recommended to install check dams or other velocity reducers and scour protection measures.
D2	MH ☐ CB/DI ☐ Outlet ☐ Headwall ☐ End Section ☐ Stone ☐ Swale ☒ _____ ☐	5'-20' width	Lined with stone southern half, no lining further north.	Fair	Moderate erosion, 1-2' deep, worse where no stone. Swale not currently impacting toe of slope.	Monitor swale erosion for future possible impacts to toe of slope.
D3	MH ☐ CB/DI ☐ Outlet ☒ Headwall ☐ End Section ☐ Stone ☒ Swale ☐ _____ ☐	12" dia.	CMP	Poor, needs attention.	Half buried, on north side of swale, not impacting identified slope.	Clear outlet.

D4	MH ☐ CB/DI ☐ Outlet ☒ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☐ Swale ☐ _____ ☐	24" dia.	Pipe outlets into large concrete structure.	Fair	Erosion around exposed pipe. Possible Causes: - Pipe failure - Overtopping at roadway catch basin (no curb, runoff down slope), reference D8	Monitor erosion causing exposed pipe. Recommend stormwater program inspect condition of CMP pipe.
D5	MH ☐ CB/DI ☐ Outlet ☒ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☐ Swale ☐ _____ ☐	12" dia.	CMP	Good	N/A	No action.
D6	MH ☐ CB/DI ☐ Outlet ☒ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☒ Swale ☐ _____ ☐	18" dia.	CMP	Good	Elevated outlet.	No action.
D7	MH ☐ CB/DI ☐ Outlet ☒ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☒ Swale ☐ _____ ☐	18" dia.	CMP	Good	Elevated outlet.	No action.

D8	MH ☐ CB/DI ☒ Outlet ☐ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☐ Swale ☐ _____ ☐	4' dia.	Type D	Fair	Structure in pavement patch, covered in leaves, erosion down bank behind structure.	Investigate structure connection to bank erosion and monitor.
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GUARDRAIL/FENCE

Feature	Height (in)	Face of Rail/Fence to Shoulder Break (ft-in)	Leaning?	Condition	Comments	Recommendation
G1	-	-	Yes ☐ Slope instability ☐ Plow damage ☐ No ☐	-	-	-

Guardrail and Fence are present at the top of slope over the length of this slope location. No visible defects associated with the slope were identified at the time of this inspection.

Manhattan Drive @ Route 127 Beltline

ROADWAY

Feature	Pavement Defect	Length (ft-in)	Width (ft-in)	Condition	Comments	Recommendation
R1	Pothole ☐ Edge Crack ☐ Settlement ☐ Shoulder Berm ☐ Longitudinal Crack ☐ <u>Pavement Patch</u> ☒	8'	5'	Good	Pavement patch around D8 associated with catch basin install/repair.	No action.

No other roadway shoulder/pavement issues were identified during the 2019 inspection.

Slope Location: Manhattan Drive at North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 6 – Natural Slope on Eastern Flank of Remediated Slope



Photograph 6: View to south of natural vegetated slope on western flank of remediated slope; photo shows density of vegetation and leaf mat

Slope Location: Manhattan Drive at North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 7 – Natural Slope on Western Flank of Remediated Slope



Photograph 7: View to southwest of natural vegetated slope on western flank of remediated slope; stormwater drainage outlet is shown left foreground

Slope Location: Manhattan Drive at North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 8 – Natural Slope on Western Flank of Remediated Slope



Photograph 8: View to southwest of natural vegetated slope on western flank of remediated slope; culvert outlet is shown left foreground

Slope Location: Manhattan Drive at North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 9 – Top of Remediated Slope



Photograph 9: View to west along Manhattan Drive showing the top of the remediated slope and absence of transverse cracks and slumps indicative of movement

Slope Location: Manhattan Drive at North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 10 – Top of Natural Slope West Flank of Remediated Slope



Photograph 10: View to west along Manhattan Drive showing the top of the natural slope on western flank of remediated slope; no transverse stress cracking in pavement and guard rail shows no sign of movement; fence section may have been damaged during remediation of slope

Slope Location: Manhattan Drive and North Champlain Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 11 – Rip-Rap Armor on Remediated Slope



Photograph 11: View to north showing stability, nature and size of rip-rap armor on remediated slope

Slope Location: Bike Path Near Starr Farm Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 12 – Top of Remediated Slope



Photograph 12: View to east along Manhattan Drive showing top of remediated slope; pavement and grassy areas show no signs of distress or transverse cracking indicative of movement; guard rail appears stable and shows no sign of movement

Slope Location: Manhattan Drive and North Champlain Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 13 – Top of Natural Slope on East Flank of Remediated Slope



Photograph 13: View to southwest of top of natural slope on eastern flank of remediated slope; no distinct signs of stress or indications of slumping or movement are evident

Slope Location: Manhattan Drive and North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 14 – Top of Natural Slope on Eastern Flank of Remediated Slope

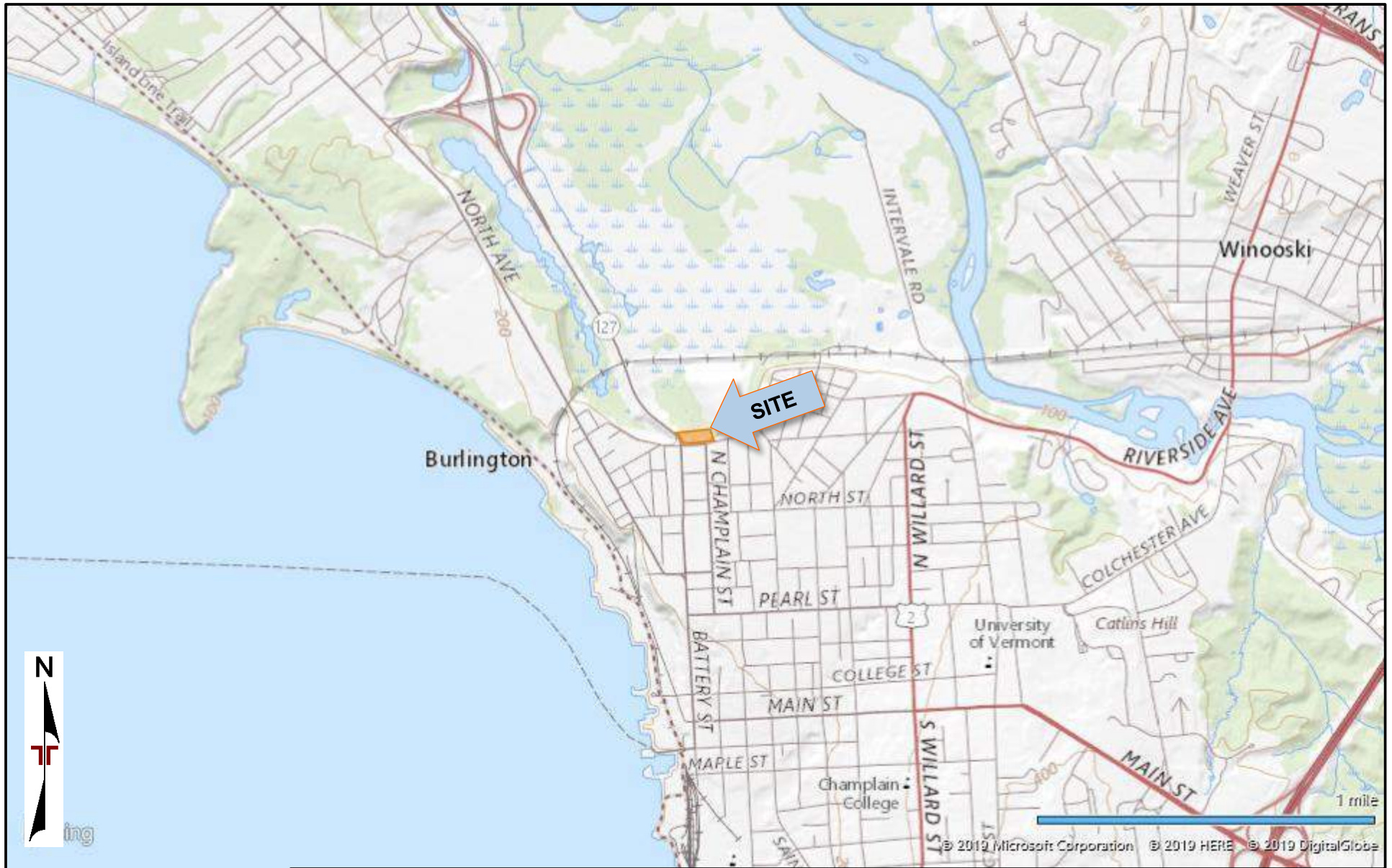


Photograph 14: View to east showing top of natural slope on eastern flank of remediated slope; no distinct signs of stress cracking, slumping or movement evident



Site Assessment Form ATTACHMENTS
Burlington, VT Slope Stability Inspection

SITE MAPS



TOPOGRAPHIC MAP IMAGE COURTESY OF
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DIAGRAM IS FOR GENERAL LOCATION ONLY,
AND IS NOT INTENDED FOR CONSTRUCTION
PURPOSES

Project Manager: ASP
Drawn by: MAG
Checked by: DCD
Approved by: CWT

Project No. J1195064
Scale: As Shown
File Name:
Date: 12/3/2019

Terracon

77 Sundial Ave, Ste 401W
Manchester, NH 03103-7236

SITE LOCATION

Burlington Slope Inspections
Manhattan at North Champlain
Burlington, VT

Exhibit

A-1



AERIAL PHOTOGRAPHY PROVIDED BY
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Project Manager: ASP
Drawn by: MAG
Checked by: DCD
Approved by: CWT

Project No. J1195064
Scale: AS SHOWN
File Name:
Date: 12/3/2019

Terracon
77 Sundial Ave, Ste 401W
Manchester, NH 03103-7236

EXPLORATION PLAN

Burlington Slope Inspections
Manhattan at North Champlain
Burlington, VT

Exhibit

A-2

Manhattan Drive @ North Champlain Street

DRAINAGE

Feature	Structure	Size	Type/Material	Condition	Comments	Recommendation
D1	MH ☐ CB/DI ☒ Outlet ☐ Headwall ☐ End Section ☐ Stone ☐ Swale ☐ ☐	4' dia.	Round	Good	Rim elevation above ground.	No action.
D2	MH ☐ CB/DI ☒ Outlet ☐ Headwall ☐ End Section ☐ Stone ☐ Swale ☐ Curb inlet ☒	4' dia.	Type E	Good	Covered in leaves.	Clear of leaves and debris.
D3	MH ☐ CB/DI ☒ Outlet ☐ Headwall ☐ End Section ☐ Stone ☐ Swale ☐ Curb inlet ☒	4' dia.	Type E	Poor, needs attention.	Covered in leaves, deep structure, heavily eroded hole behind structure. Appears to be eroded from underneath.	Investigate erosion hole behind structure, possible pipe failure.



Site Assessment Form ATTACHMENTS
Burlington, VT Slope Stability Inspection

SITE PHOTOGRAPHS

Slope Location: Manhattan Drive at North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 1 – Remediated Slope



Photograph 1: View to south showing remediated section of slope with boulder rip-rap; stormwater drainage outlet shown in foreground; natural vegetated slopes occur on flanks of remediated slope

Slope Location: Manhattan Drive at North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 2 – Remediated Slope with Natural Slopes on Flanks



Photograph 2: View to southeast of remediated slope and natural vegetated slopes on eastern and western flanks

Slope Location: Manhattan Drive at North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 3 – Remediated Slope with Natural Slope on Eastern Flank



Photograph 3: View to southeast of remediated slope and natural vegetated slopes on eastern flank; stormwater drainage outlet in foreground

Slope Location: Manhattan Drive at North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 4 – Eastern Flank of Remediated Slope



Photograph 4: View to south-southeast of natural vegetated slope on eastern flank of remediated slope

Slope Location: Manhattan Drive at North Champlain Street Date: 11/11/2019
City: Burlington State: Vermont
Description : Photograph 5 – Vegetated Natural Slope on Eastern Flank of Remediated Slope



Photograph 5: View to south of densely vegetated natural slope on eastern flank of remediated slope

D4	MH ☐ CB/DI ☐ Outlet ☒ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☐ Swale ☐ _____ ☐	24" dia.	Plastic	Good	Outlet into large concrete structure.	No action.
D5	MH ☐ CB/DI ☐ Outlet ☒ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☒ Swale ☐ _____ ☐	36" dia.	CMP	Good	N/A	Associated with D3. Recommend SW pipe camera inspection from both sides of this pipe.

Manhattan Drive @ North Champlain Street

GUARDRAIL/FENCE

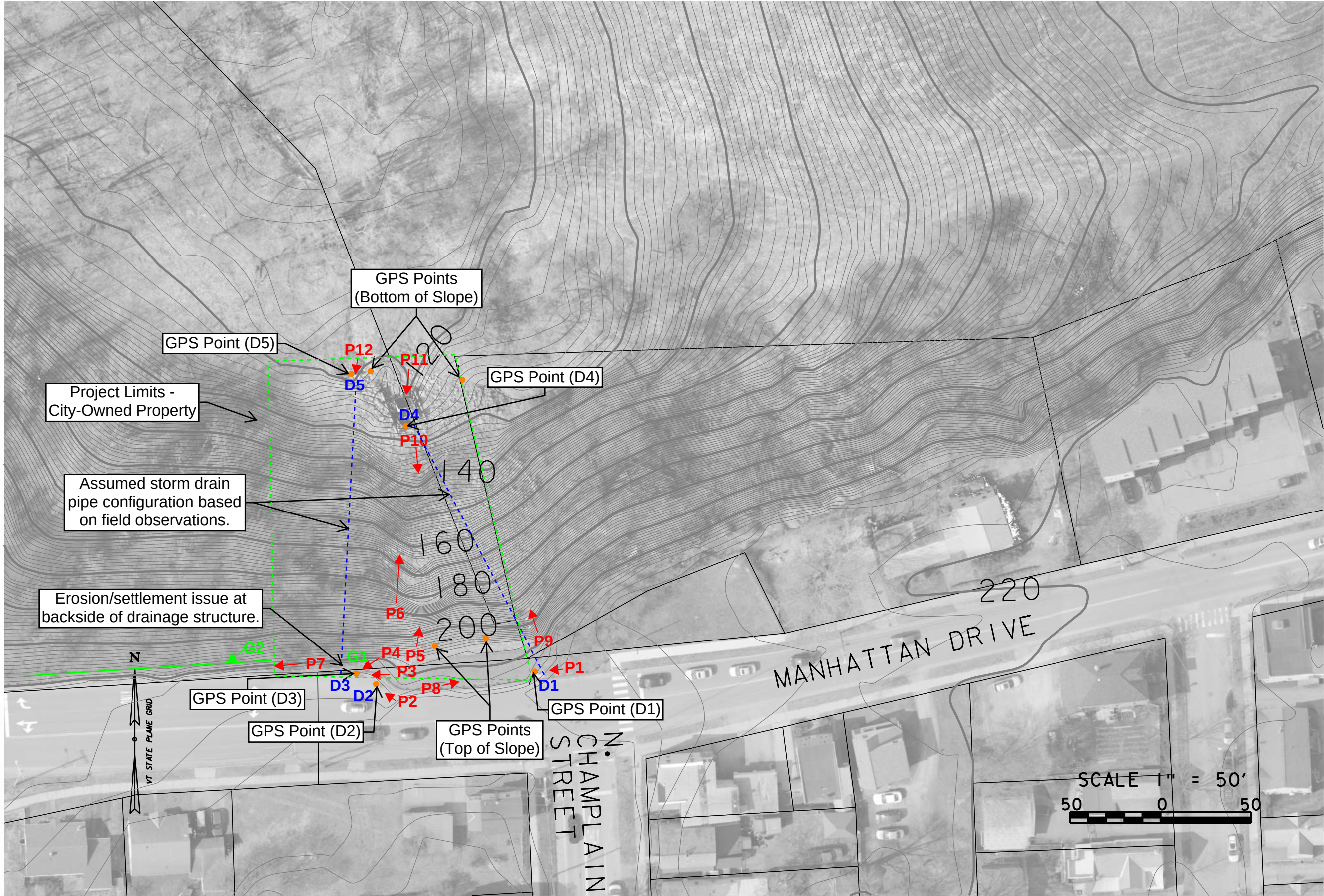
Feature	Height (in)	Face of Rail/Fence to Shoulder Break (ft-in)	Leaning?	Condition	Comments	Recommendation
G1	N/A	N/A	Yes ☐ Slope instability ☐ No ☒ Plow damage ☐	Poor, needs attention.	Concentrated erosion hole behind guardrail exposing most of one guardrail post, associated with D3.	Address erosion hole to stabilize exposed guardrail post.
G2	N/A	N/A	Yes ☐ Slope instability ☐ No ☒ Plow damage ☐	Fair	Fence being pulled down by overgrown vegetation, slope appears to be stable.	Remove overgrown vegetation from fence.

Manhattan Drive @ North Champlain Street

ROADWAY

Feature	Pavement Defect	Length (ft-in)	Width (ft-in)	Condition	Comments	Recommendation
R1	Pothole ☐ Edge Crack ☐ Settlement ☐ Shoulder Berm ☐ Longitudinal Crack ☐ _____ ☐	-	-	-	-	-

No roadway shoulder/pavement issues were identified in the 2019 inspection.



FY20 Burlington Slope Inspections

Location: Riverside Ave – Slope 4a
505 & 471 Riverside Avenue

Inspector	Date of Inspection
Terracon	August 2020
Hoyle, Tanner	December 3, 2019

INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- **URGENT REPAIR NEEDED** – 505 Riverside Avenue
- **Needs Further Assessment** – (471 Riverside Avenue and Michael's Auto Sales Property) See Recommendations below
- Evidence of active slope movement

Future Inspection Frequency:

- Immediate attention (505 Riverside Ave) – See Recommendations below
- 1 year for 471 Riverside Avenue and Michael's Auto Sales (Visual Monitoring – top of slope)
- Next Inspection August/September 2021
- Frequency of future inspection to be reassessed after recommended field investigation and establishment of instrumentation monitoring program, and Storm Pipe Outlet Repair

Recommendations:

- **URGENT REPAIR** (505 Riverside Avenue): Active slope movement and surface erosion issues in close proximity to the building structure. Recommend implementing a field investigation program, including review of existing information (historic boring logs and aerial photography), and advancement of test borings, to evaluate subsurface conditions and provide data for global stability analyses to assess suitable repair options; install geotechnical instrumentation (inclinometers, strain gauges, and/or survey benchmarks) to monitor slope movement/behavior (see Exhibit 2 for recommended boring/instrumentation locations); evaluate remedial options for slope stability; Direct roof drainage further down slope away from building foundation at 505 Riverside Avenue; armor the exposed soil surfaces behind building with crushed stone and geotextile fabric to limit ongoing surface erosion of soil;
- Future Inspections (471 Riverside Avenue and Michael's Auto Sales) - Monitor surface erosion, pipe outlets, scarp development and top of bank proximity to buildings and lots;
- **Needs Further Assessment** – (471 Riverside Avenue and Michael's Auto Sales): drill test borings at locations shown on Exhibit 2 to identify thickness of fill, in-situ soil densities and soil types, and groundwater levels; complete borings with casings for installation of inclinometers;
- **Needs Further Assessment** – Significant erosion at pipe outlet (reference Drainage Issue D2). Recommend City address by stabilizing apron and channel with rock slope armoring. Verify with Stormwater Department pipe flows and size armoring accordingly.



General Site Location
Lat: 44.488880 Long: -73.200524
Google Maps Image source



Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

**CITY OF BURLINGTON, VERMONT
SLOPE STABILITY INSPECTION**

Date of Inspection: August 2020

Site Inspector

Name:	David C. Del Marco, P.G.	E-mail:	David.Delmarco@Terracon.com
Title:	Senior Project Manager	Phone:	603.206.1191
Office/Facility Location:	Manchester, NH	Mobile:	781.844.6001

Owner Information

Owner:	City of Burlington, VT	Owner Contact:	Phillip Peterson
	645 Pine Street	Phone:	(802) 865-5832
	Burlington, VT 054001	E-mail:	ppeterson@burlingtonvt.gov

Site Location Information

Site GIS Location ID:	505 Riverside Avenue	Site Coordinates Latitude:	44.4890
Site Name:	Kismayo Kitchen	Longitude:	-73.2020

Assessment Findings

Ground Movement Type (if evidence of ground movement observed)

☒ Landslide ☐ Subsidence / Sinkhole ☒ Other (erosion, etc.), describe:

Evidence of historic landsliding and distinct failure scarps were observed along most of the top of the slope that borders the 505 Riverside Avenue property. Surface expression of slumping and formation of a soil scarp was identified at the top of the slope west of the site building. Fencing at the top of the slope in this area has failed. Erosion of exposed soil immediately behind the building due to sheet flow and discharge of stormwater during precipitation events is ongoing. Localized failures are expected along the top of the slope and continued surface erosion of exposed soil surfaces is expected during precipitation events. Stormwater discharge downslope has created a significant gully that will continue to expand as the side walls slough following undercutting by discharged surface flow. Exposed soil surfaces downslope on historic slump/slide debris will continue to erode.

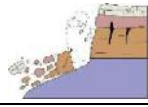
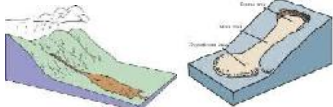
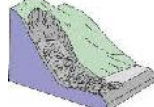
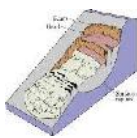
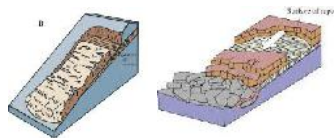
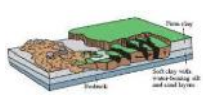
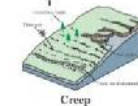
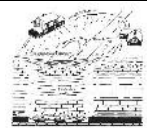
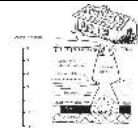
Consequence of Failure:

Failures at the top of the slope will continue to cut back the slope to the south and could eventually compromise the structural integrity of the existing Kismayo Kitchen building. Discharge of stormwater immediately behind the building is contributing to significant surface erosion and gully formation. There are limited effects down-slope from localized failures (i.e. continued deposition of limited soil masses and ongoing erosion of soil from exposed soil surfaces).

Recommended Future Inspection Frequency:

Annual inspection at top of slope to evaluate increase in ongoing slumping and scarp development; periodic inspections of the ongoing erosion behind the building and formation of slump scarp west of the building may warrant more periodic inspections, especially following significant precipitation events. 5 years for the central and basal portions of the slope where effects of failure are less severe.

Burlington, VT Slope Stability Inspection

Geohazard Type (Which best fits the observed conditions? If complex slide, it may be appropriate to select more than one type)			
Landslide Types			
☐ Fall Mass detaches from a steep slope or cliff. Free-fall, bouncing, or rolling		☐ Topple Forward rotation or tilting of a column of rock or soil	
☐ Flow Fluid-like movement of a mass; slowly or swiftly. Flows of mud and debris may resemble moving wet concrete		☐ Avalanche Extremely rapid flow- or sheet-like movement of a large, crumbling mass down a steep mountainside or over a cliff.	
☒ Rotational Bowl-shaped failure. Movement at top (scarp) is downward and may tilt into the slope. Bottom is marked by bulging mass (toe bulge).		☒ Translational Movement occurring along a relatively planar surface; commonly parallel to the slope	
☐ Spread Lateral movement causing the ground to pull apart; or in formation of parallel fractures. May occur on gentle slopes.		☒ Creep Similar to spread, but commonly imperceptibly slow movement; results hummocky (undulating) ground surface	
Subsidence / Sinkhole			
☐ Ground Subsidence Downward ground movement (sag) or settlement of an area		☐ Sinkhole Localized downward ground movement forming a closed depression with or w/out open drain hole or throat.	

Site Setting and Surrounding Area

- ☒ Open-Slope
 ☒ Side-Slope
 ☒ Gully/Ravine
 ☐ Waterway
 ☐ Residential
 ☐ Agricultural
 ☐ Mine/Quarry
 ☐ Wooded
 ☒ Natural
 ☐ Cut
 ☐ Fill
 ☐ Embankment
 ☐ Recently graded (Cut/Fill)

Notes: The top of slope to the west of the site building exhibits distinct scarp formation and surface expression of soil slumping; exposed soil surfaces immediately behind the building are subject to ongoing erosion and gully formation during precipitation events; exposed soil scarps along the top of the slope will continue to erode during precipitation events and may eventually be subject to localized failure. Historic slope-failure soil masses exist downslope. The exposed soil surfaces will continue to erode during precipitation events.

Material Type and Consistency

- ☐ Bedrock
 ☐ Gravel, cobbles, and boulders
 ☒ Sand
 ☒ Silt and Clay
 ☐ Colluvial (mixed coarse- and fine-grain material)
 ☐ Shallow soil over rock
 ☐ Liquid
 ☐ Solid-Wet
 ☐ Solid-Dry
 ☐ Rubble
 ☐ Organics; describe:

Notes: From samples examined in the field, slope soils are glacial/alluvial silty sand; some refuse (concrete fragments, scrap steel, and general debris) exposed in gully downslope

Condition of Trees, Fences, Posts, etc.

- ☒ Standing upright
 ☒ Leaning uphill
 ☒ Leaning downhill
 ☐ Leaning all directions
 ☐ Fallen
 ☐ None

Notes: Trees on upper portion and top of slope lean up and downslope; trees in historic slump/slide mass near base of slope are primarily straight.



Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

Surface-Water Features

☐ Stream ☐ Pond/Lake ☐ Springs/Seepage ☐ Marshes ☐ Closed depressions ☐ Culverts ☐ Ditches ☐ Water-breaker
☐ Free-water on slope ☐ Saturated soils ☐ None

Notes: No seepage from the exposed slope or debris mass downslope was observed. No ongoing flow from discharge pipe downslope into gully was observed.

Relative Activity

☒ Sharp un-vegetated features ☒ Partially vegetated features ☒ Smooth vegetated features ☐ Un-drained depressions ☐ Drained depressions ☐ Ponds/Sags/Marshes ☒ Undulating (hummocky) topography ☒ Un-vegetated cracks ☐ Vegetated cracks

Notes: Presence of slumping and scarp formation west of the site building indicate recent movement. Exposed scarps along the top of the slope and soil slump/slide mass downslope indicate historic failure events. The top of the slope at 505 Riverside Avenue will continue to experience localized sliding and/or slumping in the future. Ongoing erosion and gully formation immediately behind the building and downslope will continue during precipitation events.

Landslide Dimensions

Scarp Height	N/A	Scarp width	N/A
Width of source area	N/A	Depth of Source area	N/A
Width of deposit	N/A	Depth of deposit	N/A
Length (distance) from top to bottom	N/A	Height (elevation) from top to bottom	N/A
Overall Width	N/A	Other Notes:	

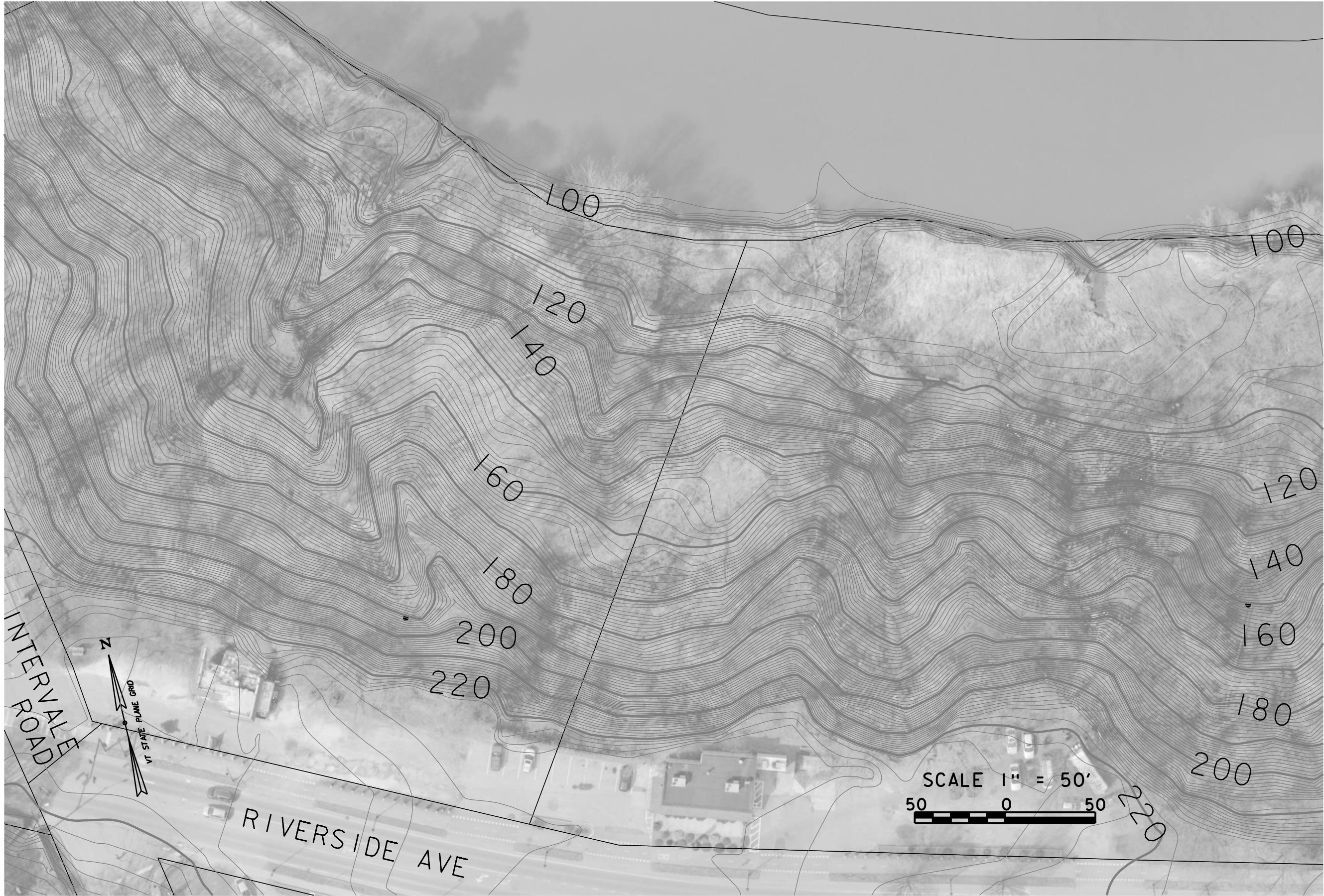
Subsidence / Sinkhole Dimensions

Length:	N/A	Width:	N/A	Depth:	N/A
Hole / Throat (Y/N):	N/A	Diameter:	N/A	Depth:	N/A
Description:	N/A				



Site Assessment Form ATTACHMENTS
Burlington, VT Slope Stability Inspection

SITE PHOTOGRAPHS



PROJECT NO. 909051.02		SHEET NO. 4		SHEET 4 OF 6	
BURLINGTON SLOPE STABILITY INSPECTION					
BURLINGTON, VERMONT					
Slope 4a					
Hoyle, Tanner & Associates, Inc. 125 College Street, 4th Floor, Burlington, VT 05401 Tel (802) 860-1331 www.hoyletanner.com					
FILENAME 909051_02bdr	DESIGNER NLC	MODEL NAME PLAN04a	DRAWN NLC	CHECKED JAO	DATE 11/07/2019
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Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 1: Formation of Scarp West Side Kismayo Kitchen Building



Photograph 1: View to east of scarp formation at top of slope west of Kismayo Kitchen building; note failure of wooden fence

Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 2: Incipient Slumping West Side of Kismayo Kitchen Building



Photograph 2: View to west of Kismayo Kitchen building showing beginning of scarp formation at top of slope and irregular ground indicative of incipient slumping; note direction of lean of trees at upper left

Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 3: View Behind Kismayo Kitchen Building



Photograph 3: View behind Kismayo Kitchen building showing erosion gully from surface runoff; soil will continue to erode during precipitation events; note location of downspout; note lean of tree left center of photograph; soil scarp at left obscured by vegetation.

Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 4: East Side Kismayo Kitchen Building



Photograph 4: View to west-northwest of east side of Kismayo Kitchen building, showing slightly irregular ground surface that appears stable; note monitoring well top left; soil scarp at center and center right obscured by vegetation.

Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 5: Erosional Gully Downslope (i.e. North) from 505 Riverside Ave.



Photograph 5: View to south southwest, downslope from and north of 505 Riverside Avenue, showing erosional gully formed by runoff and/or discharge from top of slope; unvegetated slopes subject to continued erosion during precipitation events; note stairs to right leading from Intervale Road to River Walk trail

Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 6: Face of Soil Scarp Behind and East of 505 Riverside Avenue



Photograph 6: View to southwest of exposed face of historical failure scarp; Kismayo Kitchen building can be seen at top right; note density of summer vegetation; exposed soil will continue to erode during precipitation events and top of slope will be subject to future localized failures; not discharge pipe at lower left of photograph.

Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 7: Stormwater Discharge Pipe East of 505 Riverside Avenue



Photograph 7: View to southeast of stormwater discharge pipe (center of photograph) and gully formation from discharge; note debris in gully and exposed soil scarp at top of slope (top right of photograph) east of Kismayo Kitchen building

Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 8: View Downslope of Gully Formation from Stormwater Discharge



Photograph 8: View to north northwest of large gully formed in historic downslope slump mass by stormwater discharge; sides of gully will continue to collapse and expand with ongoing stormwater discharge; note density of summer vegetation.

Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 12/2019
City: Burlington State: Vermont
Description : Photograph 9: Discharge Pipe and Downslope Gully Formation, December 2019 Inspection by Hoyle Tanner Associates



Photograph 9: View to north of gully shown in Photographs 7 and 8, taken in December 2019 during slope inspection conducted by Hoyle Tanner Associates; note significant difference in density of winter vs. summer vegetation; exposed side slopes will continue to erode during discharge events as base of slope erodes and collapses.

Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 10: View Upslope to East Side of 505 Riverside Avenue



Photograph 10: View to south upslope showing probable historic slump/slide mass generated during historic failure events; note no distinct leaning of trees

Slope Location: 505 Riverside Avenue – Kismayo Kitchen Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 11: Downslope Between 471 and 505 Riverside Avenue



Photograph 11: View to east-southeast of historic soil slump/slide mass downslope from area between 471 Riverside Avenue (GBG Indian Kitchen) and 505 Riverside Avenue (Kismayo Kitchen); areas of exposed soil will continue to erode during precipitation events

CITY OF BURLINGTON, VERMONT
SLOPE STABILITY INSPECTION

Date of Inspection: August 2020

Site Inspector

Name:	David C. Del Marco, P.G.	E-mail:	David.Delmarco@Terracon.com
Title:	Senior Project Manager	Phone:	603.206.1191
Office/Facility Location:	Manchester, NH	Mobile:	781.844.6001

Owner Information

Owner:	City of Burlington, VT	Owner Contact:	Phillip Peterson
	645 Pine Street	Phone:	(802) 865-5832
	Burlington, VT 054001	E-mail:	ppeterson@burlingtonvt.gov

Site Location Information

Site GIS Location ID:	471 Riverside Avenue	Site Coordinates Latitude:	44.4888
Site Name:	GBG Indian Kitchen	Longitude:	-73.2010

Assessment Findings

Ground Movement Type (if evidence of ground movement observed)

☒ Landslide ☐ Subsidence / Sinkhole ☒ Other (erosion, etc.), describe:

Evidence of historic landsliding and distinct failure scarps were observed along most of the top of the slope that borders the 471 Riverside Avenue property. Surface expression of slumping identified in the asphalt-surfaced parking area west of the restaurant building. Upper portion of slope is well vegetated, but exposed failure scarps exist. Incipient ground slumping and developed failure scarp occur behind the restaurant building near the edge of the slope. Historic slump/slide soil mass exists downslope near the River Walk Trail. This mass is not as well vegetated as the upper portions of the slope, and exposed surfaces will continue to erode during precipitation events. The top of the slope along the northern property boundary will continue to experience localized sliding and failures in the future.

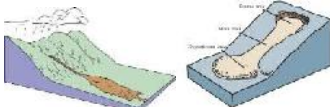
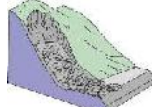
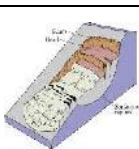
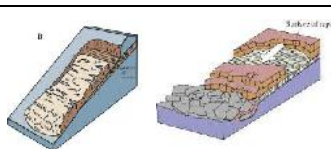
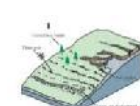
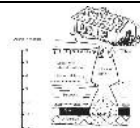
Consequence of Failure:

Failures at the top of the slope will continue to cut back the slope to the south and could eventually compromise the structural integrity of the GBG Indian Kitchen building in the future. There are limited effects down-slope from localized failures (i.e. continued deposition of limited soil masses and ongoing erosion of soil from exposed soil surfaces).

Recommended Future Inspection Frequency:

Annual inspection at top of slope to evaluate increase in ongoing slumping and scarp development; 5 years for the central and basal portions of the slope where effects of failure are less severe.

Burlington, VT Slope Stability Inspection

Geohazard Type (Which best fits the observed conditions? If complex slide, it may be appropriate to select more than one type)			
Landslide Types			
☐ Fall Mass detaches from a steep slope or cliff. Free-fall, bouncing, or rolling		☐ Topple Forward rotation or tilting of a column of rock or soil	
☐ Flow Fluid-like movement of a mass; slowly or swiftly. Flows of mud and debris may resemble moving wet concrete		☐ Avalanche Extremely rapid flow- or sheet-like movement of a large, crumbling mass down a steep mountainside or over a cliff.	
☒ Rotational Bowl-shaped failure. Movement at top (scarp) is downward and may tilt into the slope. Bottom is marked by bulging mass (toe bulge).		☒ Translational Movement occurring along a relatively planar surface; commonly parallel to the slope	
☐ Spread Lateral movement causing the ground to pull apart; or in formation of parallel fractures. May occur on gentle slopes.		☒ Creep Similar to spread, but commonly imperceptibly slow movement; results hummocky (undulating) ground surface	
Subsidence / Sinkhole			
☐ Ground Subsidence Downward ground movement (sag) or settlement of an area		☐ Sinkhole Localized downward ground movement forming a closed depression with or w/out open drain hole or throat.	

Site Setting and Surrounding Area

☒ Open-Slope
 ☐ Side-Slope
 ☐ Gully/Ravine
 ☐ Waterway
 ☐ Residential
 ☐ Agricultural
 ☐ Mine/Quarry
 ☐ Wooded
☒ Natural
☐ Cut
☐ Fill
☐ Embankment
☐ Recently graded (Cut/Fill)

Notes: The top of slope behind the building exhibits incipient slumping. Exposed failure scarps have developed along most of the top of the slope bordering the property to the north. Distinct surface expression of soil slumping was observed in the parking area west of the restaurant building and adjacent to the top of the slope. Historic failure soil masses exist downslope. The masses are well vegetated on the upper portions and exhibit exposed soil surfaces on the lower portions near the River Walk Trail

Material Type and Consistency

☐ Bedrock
☐ Gravel, cobbles, and boulders
☒ Sand
☒ Silt and Clay
☐ Colluvial (mixed coarse- and fine-grain material)
☐ Shallow soil over rock
☐ Liquid
☐ Solid-Wet
☐ Solid-Dry
☐ Rubble
☐ Organics; describe:

Notes: From samples examined in the field, slope soils are glacial/alluvial silty sand; some refuse (concrete fragments, scrap steel, and general debris) exposed on upper portion of slope

Condition of Trees, Fences, Posts, etc.

☒ Standing upright
☒ Leaning uphill
☒ Leaning downhill
☐ Leaning all directions
☐ Fallen
☐ None

Notes: Trees on upper portion and top of slope lean up and downslope; trees in historic slump/slide mass near base of slope are primarily straight.



Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

Surface-Water Features

☐ Stream ☐ Pond/Lake ☐ Springs/Seepage ☐ Marshes ☐ Closed depressions ☐ Culverts ☐ Ditches ☐ Water-breaker
☐ Free-water on slope ☐ Saturated soils ☐ None

Notes: No seepage from the exposed slope or debris mass downslope was observed.

Relative Activity

☒ Sharp un-vegetated features ☒ Partially vegetated features ☒ Smooth vegetated features ☐ Un-drained depressions
☐ Drained depressions ☐ Ponds/Sags/Marshes ☒ Undulating (hummocky) topography ☒ Un-vegetated cracks
☐ Vegetated cracks

Notes: Presence of crown cracks at top of slope indicate recent movement. Incipient soil slumping observed at the top of the slope behind the Burlington Collision building. The slope in these areas will continue to experience small-scale, localized sliding and/or slumping.

Landslide Dimensions

Scarp Height	N/A	Scarp width	N/A
Width of source area	N/A	Depth of Source area	N/A
Width of deposit	N/A	Depth of deposit	N/A
Length (distance) from top to bottom	N/A	Height (elevation) from top to bottom	N/A
Overall Width	N/A	Other Notes:	

Subsidence / Sinkhole Dimensions

Length:	N/A	Width:	N/A	Depth:	N/A
Hole / Throat (Y/N):	N/A	Diameter:	N/A	Depth:	N/A
Description:	N/A				



Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

SITE PHOTOGRAPHS

Slope Location: 471 Riverside Avenue – GBG Indian Kitchen Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 12: View Behind GBG Indian Kitchen



Photograph 12: View to west behind GBG Indian Kitchen showing slight irregular surface and incipient slumping at center of photograph obscured by vegetation; exposed soil scarp to right of photograph is also obscured by dense vegetation (see Photograph 15).

Slope Location: 471 Riverside Avenue – GBG Indian Kitchen Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 13: Surface Expression of Incipient Soil Slumping



Photograph 13: View to west toward Kismayo Kitchen (505 Riverside Avenue) from GBG Indian Kitchen showing stressed pavement and surface depressions as an indicator of incipient soil slumping; exposed soil scarp is present beyond trees to right-center.

Slope Location: 471 Riverside Avenue – GBG Indian Kitchen Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 14: View Towards GBG Indian Kitchen Showing Incipient Slumping



Photograph 14: View to east towards GBG Indian Kitchen showing localized incipient earth slumping in parking area at center of photograph; note area of recent ponded water; exposed historical failure scarp is present beyond trees to left.

Slope Location: 471 Riverside Avenue – GBG Indian Kitchen Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 15: Soil Scarp North of GBG Parking Lot



Photograph 15: View to southeast of exposed soil scarp adjacent to northern boundary of western parking lot for GBG Indian Kitchen; note density of vegetation

Slope Location: 471 Riverside Avenue – GBG Indian Kitchen Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 16: Soil Scarp in Slope North of GBG Indian Kitchen Parking Lot



Photograph 16: View to southwest showing exposed soil scarp in slope north of GBG Indian Kitchen parking lot; Kismayo Kitchen (505 Riverside Avenue) at top right; note density of vegetation and mature trees at top of scarp leaning downslope.

Slope Location: 471 Riverside Avenue – West of GBG Indian Kitchen Date: 12/12/2019
City: Burlington State: Vermont
Description : Photograph 17: December 2019 HTA Inspection GBG Indian Kitchen



Photograph 17: View to southwest showing GBG Indian Kitchen (top right), and failure scarp top left; photograph taken in December 2019 during inspection by Hoyle-Tanner Associates; note change in density of vegetation; exposed slope subject to surface erosion during precipitation events

Slope Location: 471 Riverside Avenue – GBG Indian Kitchen Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 18: Exposed Slope Behind GBG Indian Kitchen, Near River Walk



Photograph 18: View to west downslope from GBG Indian Kitchen (just south of River Walk Trail) showing soil slump debris from inferred historic failure event; exposed soil surfaces subject to continual surface erosion from precipitation events;

**CITY OF BURLINGTON, VERMONT
SLOPE STABILITY INSPECTION**

Date of Inspection: August 2020

Site Inspector

Name:	David C. Del Marco, P.G.	E-mail:	David.Delmarco@Terracon.com
Title:	Senior Project Manager	Phone:	603.206.1191
Office/Facility Location:	Manchester, NH	Mobile:	781.844.6001

Owner Information

Owner:	City of Burlington, VT	Owner Contact:	Phillip Peterson
	645 Pine Street	Phone:	(802) 865-5832
	Burlington, VT 054001	E-mail:	ppeterson@burlingtonvt.gov

Site Location Information

Site GIS Location ID:	Riverside Avenue	Site Coordinates	44.4886
		Latitude:	
Site Name:	Michael's Auto Sales	Longitude:	-73.2002

Assessment Findings

Ground Movement Type (if evidence of ground movement observed)

☒ Landslide ☐ Subsidence / Sinkhole ☒ Other (erosion, etc.), describe:

Evidence of historic localized landsliding observed along the eastern and central portions of the property. Mild, incipient slumping and initial formation of soil scarp observed at central and eastern portions of the property. Trees in the eastern portion have distinct upslope lean. Landowner has taken remedial actions along the eastern boundary including placement of filter fabric stabilized with stakes and a layer of fine pea stone. Historic slump/slide soil debris identified downslope. No large-scale discontinuities, disturbed ground, or surface cracking observed on the level platform back from the top of the slope. Property owner periodically monitors conditions at the top of the slope.

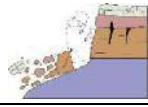
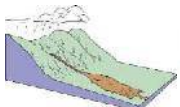
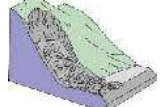
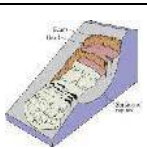
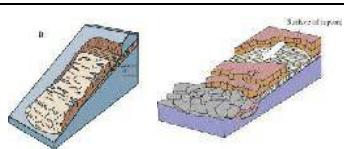
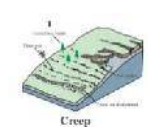
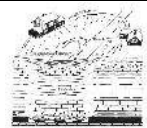
Consequence of Failure:

Localized failures at the top of the slope will continue to cut back the slope but no permanent structures are located on the level ground back from the top of the slope. There are limited effects down-slope from localized failures (i.e. continued deposition of limited soil masses).

Recommended Future Inspection Frequency:

Annual inspection at top of slope to monitor slump and scarp formation; 5 years for the central and basal portions of the slope where effects of failure are less severe.

Burlington, VT Slope Stability Inspection

Geohazard Type (Which best fits the observed conditions? If complex slide, it may be appropriate to select more than one type)			
Landslide Types			
☐ Fall Mass detaches from a steep slope or cliff. Free-fall, bouncing, or rolling		☐ Topple Forward rotation or tilting of a column of rock or soil	
☐ Flow Fluid-like movement of a mass; slowly or swiftly. Flows of mud and debris may resemble moving wet concrete		☐ Avalanche Extremely rapid flow- or sheet-like movement of a large, crumbling mass down a steep mountainside or over a cliff.	
☒ Rotational Bowl-shaped failure. Movement at top (scarp) is downward and may tilt into the slope. Bottom is marked by bulging mass (toe bulge).		☒ Translational Movement occurring along a relatively planar surface; commonly parallel to the slope	
☐ Spread Lateral movement causing the ground to pull apart; or in formation of parallel fractures. May occur on gentle slopes.		☒ Creep Similar to spread, but commonly imperceptibly slow movement; results hummocky (undulating) ground surface	
Subsidence / Sinkhole			
☐ Ground Subsidence Downward ground movement (sag) or settlement of an area		☐ Sinkhole Localized downward ground movement forming a closed depression with or w/out open drain hole or throat.	

Site Setting and Surrounding Area

☒ Open-Slope
 ☐ Side-Slope
 ☐ Gully/Ravine
 ☐ Waterway
 ☐ Residential
 ☐ Agricultural
 ☐ Mine/Quarry
 ☐ Wooded
☒ Natural
☐ Cut
☐ Fill
☐ Embankment
☐ Recently graded (Cut/Fill)

Notes: Top of slope at eastern property boundary exhibits mild, incipient slumping and scarp formation. This area has been remediated by the landowner through the laying of filter fabric stabilized with stakes and a layer of fine pea stone. Areas immediately downslope in this area are densely vegetated. Historic slump/slide mass near River Walk Trail exhibits exposed surfaces and formation of gullies subject to ongoing erosion during precipitation events. Incipient slumping and possible mild scarp formation are present at the central portion of the property.

Material Type and Consistency

☐ Bedrock
☐ Gravel, cobbles, and boulders
☒ Sand
☒ Silt and Clay
☐ Colluvial (mixed coarse- and fine-grain material)
☐ Shallow soil over rock
☐ Liquid
☐ Solid-Wet
☐ Solid-Dry
☐ Rubble
☐ Organics; describe:

Condition of Trees, Fences, Posts, etc.

☒ Standing upright
☒ Leaning uphill
☒ Leaning downhill
☐ Leaning all directions
☐ Fallen
☐ None

Notes: Trees at top of slope at eastern portion of property lean upslope; trees in historic slump/slide mass at base are primarily straight



Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

Surface-Water Features

☐ Stream ☐ Pond/Lake ☐ Springs/Seepage ☐ Marshes ☐ Closed depressions ☐ Culverts ☐ Ditches ☐ Water-breaker
☐ Free-water on slope ☐ Saturated soils ☐ None

Notes: No seepage from the exposed slope or debris mass was observed.

Relative Activity

☒ Sharp un-vegetated features ☒ Partially vegetated features ☒ Smooth vegetated features ☐ Un-drained depressions
☐ Drained depressions ☐ Ponds/Sags/Marshes ☒ Undulating (hummocky) topography ☒ Un-vegetated cracks
☐ Vegetated cracks

Notes: Mild incipient soil slumping accompanied by minor scarp formation observed at the top of the slope at the eastern and central portions of the property; the slope in these areas will continue to experience sporadic, small-scale, localized sliding and/or slumping events. Historic, unvegetated, downslope slump/slide soil masses will continue to erode during precipitation events.

Landslide Dimensions

Scarp Height	<u>N/A</u>	Scarp width	<u>N/A</u>
Width of source area	<u>N/A</u>	Depth of Source area	<u>N/A</u>
Width of deposit	<u>N/A</u>	Depth of deposit	<u>N/A</u>
Length (distance) from top to bottom	<u>N/A</u>	Height (elevation) from top to bottom	<u>N/A</u>
Overall Width	<u>N/A</u>	Other Notes:	<u></u>

Subsidence / Sinkhole Dimensions

Length:	<u>N/A</u>	Width:	<u>N/A</u>	Depth:	<u>N/A</u>
Hole / Throat (Y/N):	<u>N/A</u>	Diameter:	<u>N/A</u>	Depth:	<u>N/A</u>
Description:	<u>N/A</u>				



Site Assessment Form ATTACHMENTS
Burlington, VT Slope Stability Inspection

SITE PHOTOGRAPHS

Slope Location: Riverside Avenue – Michael's Auto Sales Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 19: Eastern Portion of Michael's Auto Sales Property



Photograph 19: View to west from eastern portion of Michael's Auto Sales property to GBG Indian Kitchen, showing beginning of scarp formation in center foreground; note trees leaning upslope

FY20 Burlington Slope Inspections

Location: Riverside Ave – Slope 4c
317 Riverside Avenue

Inspector	Date of Inspection
Terracon	August 2020
Hoyle, Tanner	December 3, 2019

INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- **Needs Further Assessment** – See Recommendations below
- Evidence of active slope movement

Future Inspection Frequency:

- 1 year (Visual Monitoring)
- Next Inspection August/September 2021
- Frequency of inspection to be reassessed after establishment of instrumentation monitoring program (see Recommendations below).

Recommendations:

- **Needs Further Assessment** – It is recommended that further geotechnical evaluation be conducted to identify subsurface conditions that may be affecting the stability of the slope. This assessment includes review of existing data (boring logs and aerial photography), advancement of test borings and installation of inclinometers in casings set in the borings; the borings will provide data on thickness and density of fill material, in-situ soil density and soil type, and groundwater levels. The geotechnical data can be used to perform global slope stability analyses to assess suitable repair options. The inclinometers will provide the City and private property owners an ongoing means to evaluate slope movements and stability. Recommended test boring/inclinometer locations are shown on Exhibit 2.
- Future Inspections – Monitor surface erosion, pipe outlets, top of bank proximity to buildings and lots, and instrumentation monitoring (reference bullet above)



General Site Location
Lat: 44.488154 Long: -73.195364
Google Maps Image source

CITY OF BURLINGTON, VERMONT
SLOPE STABILITY INSPECTION

Date of Inspection: August 2020

Site Inspector

Name:	David C. Del Marco, P.G.	E-mail:	David.Delmarco@Terracon.com
Title:	Senior Project Manager	Phone:	603.206.1191
Office/Facility Location:	Manchester, NH	Mobile:	781.844.6001

Owner Information

Owner:	City of Burlington, VT	Owner Contact:	Phillip Peterson
	645 Pine Street	Phone:	(802) 865-5832
	Burlington, VT 054001	E-mail:	ppeterson@burlingtonvt.gov

Site Location Information

Site GIS Location ID:	317 Riverside Avenue	Site Coordinates	44.4879
		Latitude:	
Site Name:	Bluebird BBQ	Longitude:	-73.1593

Assessment Findings

- ☒ No evidence of recent ground movement observed; no distinct surface expression of incipient slumping or formation of cracks observed at top of slope; however, top of slope may be subject to future, small-scale failure events and ongoing surface erosion. Historic slide/slump masses downslope will be subject to continual erosion.

Ground Movement Type (if evidence of ground movement observed)

- ☐ Landslide ☐ Subsidence / Sinkhole ☒ Other (erosion, etc.), describe:

Exposed soil surfaces on downslope areas of the property will continue to erode during precipitation events and discharge of stormwater through the outlet hose; historic slide/slump mass downslope at the eastern end of the property is densely vegetated. Top of slope may be subject to limited, small-scale failure events.

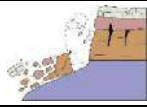
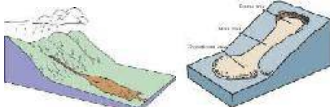
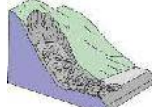
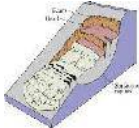
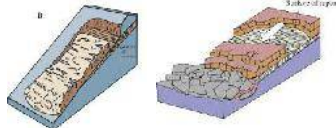
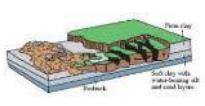
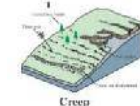
Consequence of Failure:

Limited failures at the top of the slope can eventually affect the structural integrity of the existing Bluebird BBQ building and parking areas. There are limited effects down-slope from localized failures (i.e. continued deposition of limited soil masses).

Recommended Future Inspection Frequency:

Annual inspection at top of slope for presence of incipient or ongoing slumping and cracking; 5 years for the central and basal portions of the slope where effects of failure are less severe.

Burlington, VT Slope Stability Inspection

Geohazard Type (Which best fits the observed conditions? If complex slide, it may be appropriate to select more than one type)			
Landslide Types			
☐ Fall Mass detaches from a steep slope or cliff. Free-fall, bouncing, or rolling		☐ Topple Forward rotation or tilting of a column of rock or soil	
☐ Flow Fluid-like movement of a mass; slowly or swiftly. Flows of mud and debris may resemble moving wet concrete		☐ Avalanche Extremely rapid flow- or sheet-like movement of a large, crumbling mass down a steep mountainside or over a cliff.	
☒ Rotational Bowl-shaped failure. Movement at top (scarp) is downward and may tilt into the slope. Bottom is marked by bulging mass (toe bulge).		☒ Translational Movement occurring along a relatively planar surface; commonly parallel to the slope	
☐ Spread Lateral movement causing the ground to pull apart; or in formation of parallel fractures. May occur on gentle slopes.		☒ Creep Similar to spread, but commonly imperceptibly slow movement; results hummocky (undulating) ground surface	
Subsidence / Sinkhole			
☐ Ground Subsidence Downward ground movement (sag) or settlement of an area		☐ Sinkhole Localized downward ground movement forming a closed depression with or w/out open drain hole or throat.	

Site Setting and Surrounding Area

☐ Open-Slope ☐ Side-Slope ☐ Gully/Ravine ☐ Waterway ☐ Residential ☐ Agricultural ☐ Mine/Quarry ☐ Wooded
☒ Natural ☐ Cut ☐ Fill ☐ Embankment ☐ Recently graded (Cut/Fill)

Notes: Existing slope is a combination of open, exposed soil surfaces and densely vegetated surfaces. A historic failure scarp exists at the top of the slope at the central and eastern margins of the property. Downslope consists of historic exposed and overgrown former soil slump/slide masses.

Material Type and Consistency

☐ Bedrock ☐ Gravel, cobbles, and boulders ☒ Sand ☒ Silt and Clay ☐ Colluvial (mixed coarse- and fine-grain material) ☐ Shallow soil over rock ☐ Liquid ☐ Solid-Wet ☐ Solid-Dry ☐ Rubble ☐ Organics; describe:

Notes: From samples examined in the field, slope soils are glacial/alluvial silty sand;

Condition of Trees, Fences, Posts, etc.

☐ Standing upright ☐ Leaning uphill ☐ Leaning downhill ☒ Leaning all directions ☐ Fallen ☐ None

Notes:



Site Assessment Form ATTACHMENTS

Burlington, VT Slope Stability Inspection

Surface-Water Features

☐ Stream ☐ Pond/Lake ☐ Springs/Seepage ☐ Marshes ☐ Closed depressions ☐ Culverts ☐ Ditches ☐ Water-breaker
☐ Free-water on slope ☐ Saturated soils ☐ None

Notes: Discharge of stormwater downslope occurs through a 4-inch diameter plastic pipe; saturated soils occur at and downgradient from the discharge point. No natural seepage was observed.

Relative Activity

☐ Sharp un-vegetated features ☒ Partially vegetated features ☒ Smooth vegetated features ☐ Un-drained depressions
☐ Drained depressions ☐ Ponds/Sags/Marshes ☒ Undulating (hummocky) topography ☐ Un-vegetated cracks
☐ Vegetated cracks

Notes: No transverse cracks or distinct, widespread soil slumping observed at top of slope; exposed soil surfaces downslope will continue to erode as a result of precipitation events and stormwater discharge; the slope will continue to experience small-scale, localized sliding.

Landslide Dimensions

Scarp Height	N/A	Scarp width	N/A
Width of source area	N/A	Depth of Source area	N/A
Width of deposit	N/A	Depth of deposit	N/A
Length (distance) from top to bottom	N/A	Height (elevation) from top to bottom	N/A
Overall Width	N/A	Other Notes:	

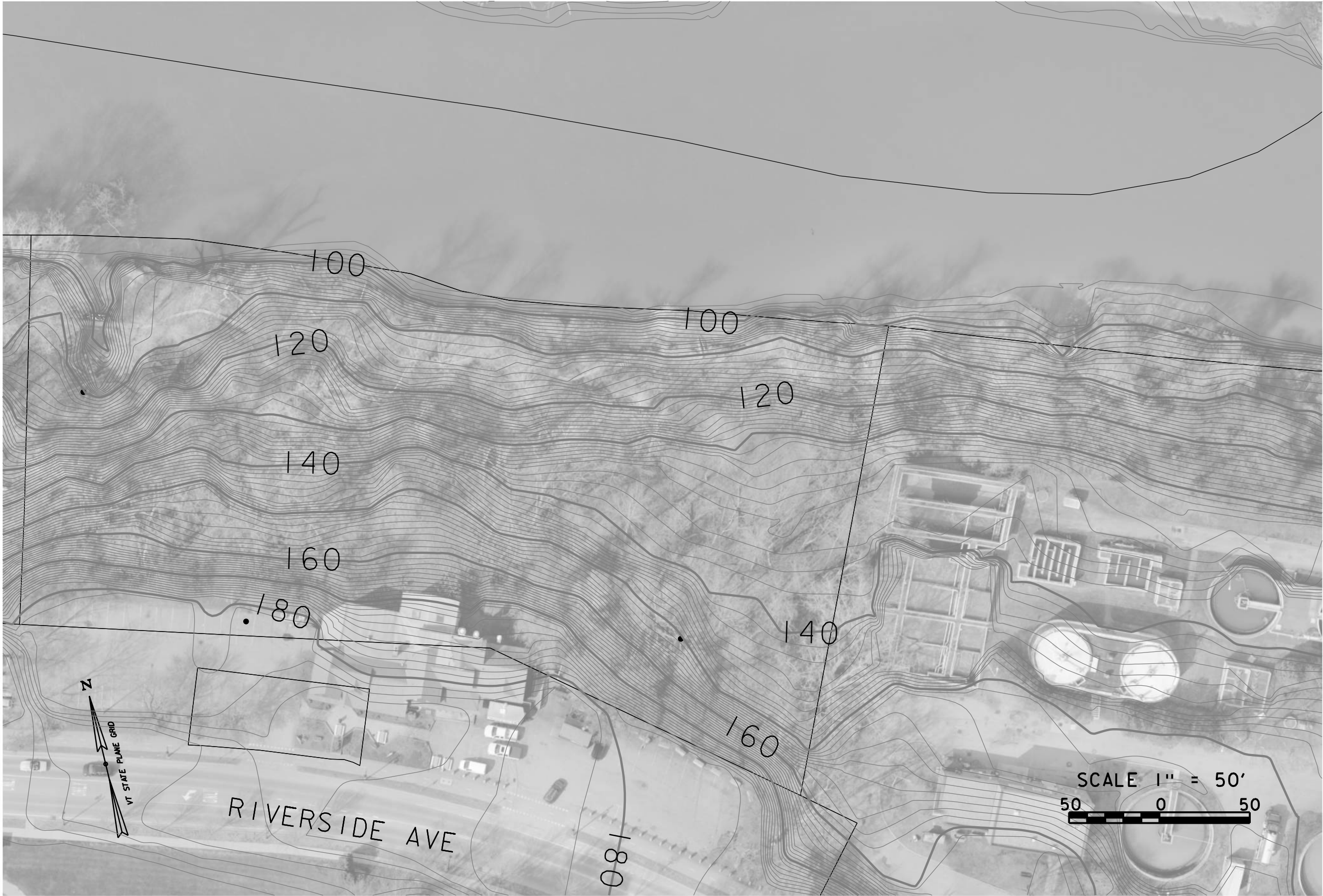
Subsidence / Sinkhole Dimensions

Length:	N/A	Width:	N/A	Depth:	N/A
Hole / Throat (Y/N):	N/A	Diameter:	N/A	Depth:	N/A
Description:	N/A				



Site Assessment Form ATTACHMENTS
Burlington, VT Slope Stability Inspection

SITE PHOTOGRAPHS



PROJECT NO. 909051.02		SHEET NO. 6		SHEET 6 OF 6	
BURLINGTON SLOPE STABILITY INSPECTION					
Slope 4c					
BURLINGTON, VERMONT					
Hoyle, Tanner & Associates, Inc. 125 College Street, 4th Floor, Burlington, VT 05401 Tel (802) 860-1331 www.hoyletanner.com					
FILENAME 909051_02bdr	DESIGNER NLC	MODEL NAME PLAN04c	DRAWN NLC	CHECKED JAO	DATE 11/07/2019
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Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 1: Top of Slope West of Bluebird BBQ Building, 317 Riverside Ave



Photograph 1: View to east, toward Bluebird BBQ building from boundary between 317 and 365 Riverside Avenue properties, showing top of slope and absence of distinct surface expression of slump formation or crown cracking; stressed pavement cracks are a possible indicator of ongoing creep; note catch basin at right center of photograph; washout and gully formation from excess surface flow can be seen at bottom left of photograph

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 2: Stress Cracks in Pavement – West Parking Lot, Bluebird BBQ



Photograph 2: View to east towards Bluebird BBQ building showing stress-release cracking in pavement at top of slope in west parking; cracking in pavement is a possible indicator of ongoing creep; gully washout from surface flow can be seen at bottom left of photograph

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 3: Gully Formation West Parking Lot of Bluebird BBQ



Photograph 3: View to north showing close-up of gully formation (Photo 2) from excess surface runoff at top of slope

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 12/2019
City: Burlington State: Vermont
Description : Photograph 4: Gully Formation at Top of Slope – December 2019



Photograph 4: View to northwest taken by Hoyle Tanner Associates during December 2019 inspection showing gully formation and surface cracking at top of slope at west parking lot of Bluebird BBQ

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 5: View Downslope from Western Parking Area at Bluebird BBQ



Photograph 5: View downslope from western parking lot of Bluebird BBQ

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 6: Top of Slope Behind Bluebird BBQ Building



Photograph 6: View to west behind Bluebird BBQ building; note curvature at top of slope but no distinct slump or crack formation at surface; soil scarp obscured by vegetation at right of photograph

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 7: Top of Slope Behind Bluebird BBQ Building



Photograph 7: View to east behind Bluebird BBQ building showing well vegetated stable platform with no evidence of surface cracking or slumping; however, note failed fence at top center of photograph

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 8: Drainage Discharge Hose from Bluebird BBQ Building



Photograph 8: View to north downslope showing stormwater discharge hose from Bluebird BBQ building; discharge of water downslope has caused surface soil erosion (see Photo 14)

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 9: Top of Slope at East Parking Area Bluebird BBQ



Photograph 9: View to east of top of slope adjacent to the eastern parking lot of Bluebird BBQ showing rounded surface expression of slope resulting from sheet flow during precipitation events; no surface expression of slumping or cracking apparent, but ongoing surface erosion will continue to cut back slope (see Photo 10 for view in opposite direction)

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 10: Top of Slope at Eastern Parking Area Bluebird BBQ



Photograph 10: View to west toward Bluebird BBQ building showing top of slope at eastern parking lot; asphalt parking most likely sloped to induce surface flow away from slope; note lean of blocks at top center, a possible expression of incipient surface slumping and slope cutback

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 11: Downslope from Just West of Bluebird BBQ Building



Photograph 11: View to southwest of top of slope just to the west of the Bluebird BBQ building showing soil surface exposed to continual erosion during precipitation events; soil scarp present at top left of photograph

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 12: Exposed Slope Behind Bluebird BBQ Building



Photograph 12: View to southeast of exposed slope behind Bluebird BBQ building; exposed surface soil subject to continual erosion during precipitation events; note discharge hose left foreground; ongoing discharge downslope facilitates continual erosion of exposed surface soil

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 13: View Upslope Behind Bluebird BBQ



Photograph 13: View to south upslope to Bluebird BBQ showing historic slump/slide mass and effects of surface erosion;

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 14: View Downslope of Surface Water Discharge Hose



Photograph 14: View to north downslope from near position of Photograph 13 showing surface erosion effects from upslope surface water discharge

Slope Location: 317 Riverside Avenue – Bluebird BBQ Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 15: Base of Slope Behind Bluebird BBQ from River Walk Trail



Photograph 15: View to south-southeast from River Walk Trail, looking up to eastern side of Bluebird BBQ property, showing dense vegetative growth on historic slide/slump mass

Riverside Avenue Corridor – Slope Section 4c

DRAINAGE

Feature	Structure	Size	Type/Material	Condition	Comments	Recommendation
D6	MH ☐ CB/DI ☐ Outlet ☒ Headwall ☐ End Section ☐ Stone ☒ Swale ☐ _____ ☐	48" dia.	CMP	Fair	Bottom of pipe is rusted.	Monitor for future pipe corrosion and consider replacement or culvert lining.
D7	MH ☐ CB/DI ☐ Outlet ☒ Headwall ☐ End Section ☐ Stone ☐ Swale ☐ _____ ☐	10" dia.	CMP	Good	Pipe exposed, laid on top of slope approximately 30' in length. Slightly elevated outlet.	No action. Monitor Outlet Apron in future inspections

Riverside Avenue Corridor – Slope Section 4c

GUARDRAIL/FENCE

Feature	Height (in)	Face of Rail/Fence to Shoulder Break (ft-in)	Leaning?	Condition	Comments	Recommendation
G1	-	-	Yes ☐ Slope instability ☐ No ☐ Plow damage ☐	-	-	-

No City-owned guardrail/fence issues were identified in the 2019 inspection as top of slope is further back from Roadway ROW.

Private fences and barriers near top of slope are leaning. Reference Terracon Inspection Reports.

Riverside Avenue Corridor – Slope Section 4c

ROADWAY

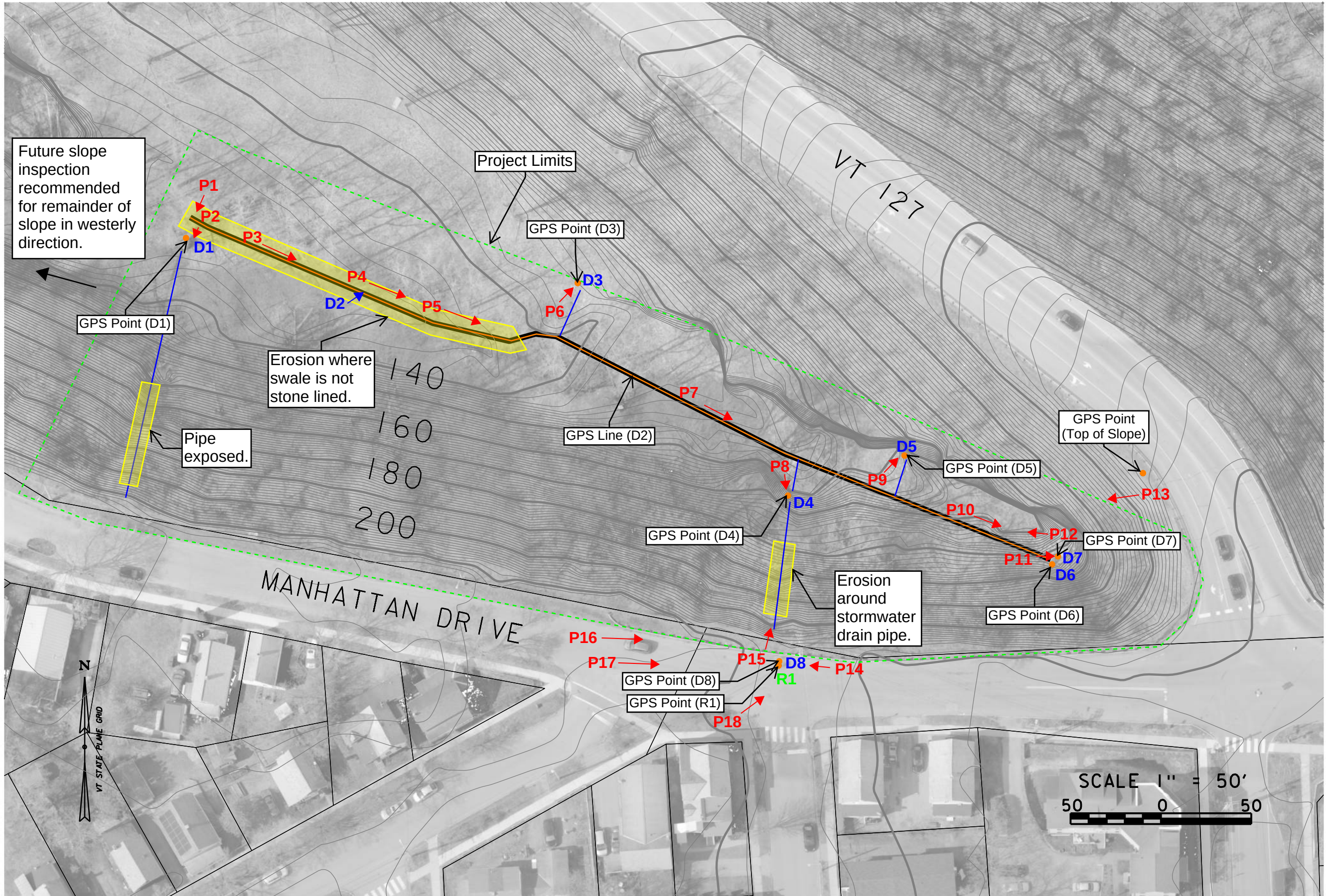
Feature	Pavement Defect	Length (ft-in)	Width (ft-in)	Condition	Comments	Recommendation
R1	Pothole ☐ Edge Crack ☐ Settlement ☐ Shoulder Berm ☐ Longitudinal Crack ☐ <u>Erosion Slide</u> ☒	10'	5'	Poor	Small erosion slide off edge of pavement of Bluebird parking lot. Appears to have been recently filled with soil.	Monitor and coordinate with property owner. Reference Terracon Report

No City-owned roadway issues were identified in the 2019 inspection.

Note: * symbol indicates GPS points were taken for the feature.



PROJECT NO. 909051.02		SHEET NO. 6		SHEET 6 OF 6	
BURLINGTON SLOPE STABILITY INSPECTION					
BURLINGTON, VERMONT					
Slope 4c					
Hoyle, Tanner & Associates, Inc.					
125 College Street, 4th Floor, Burlington, VT 05401 Tel (802) 860-1331 www.hoyletanner.com					
FILENAME 909051_02bdr	DESIGNER NLC	MODEL NAME PLAN04c	CHECKED AS SHOWN	DATE 11/07/2019	This document is prepared as an instrument of service and shall remain the property of Hoyle, Tanner. It may not be used, reproduced, disseminated or otherwise made available for any other purpose than this project, without the written permission of Hoyle, Tanner.



FY20 Burlington Slope Inspections

Location: Manhattan Drive at North
Champlain Street

Inspector	Date of Inspection
Terracon	11/11/2019
Hoyle, Tanner	11/26/2019

INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- **URGENT REPAIR NEEDED** – Stormwater Pipe (see below)

Future Inspection Frequency:

- 1 years (Stormwater Sinkhole)
- Next Inspection Fall 2020
- Frequency to be reassessed after Urgent Repair (Reference Terracon Report)

Recommendations:

- Future Inspections - Monitor armored slope stability and flank slopes.
- **URGENT REPAIR** - Immediate action is recommended to coordinate with the City Stormwater Department to perform a camera inspection of the pipe and catch basin tied to the identified sinkhole. (Reference Photo P4). Guardrail post issue associated. Fix Pipe and Slope Impacts/Sinkhole.
- General maintenance need for stormwater structures (clean of leaves from inlets) was identified at time of November site visit.
- Fence being pulled down by overgrown vegetation. Not of concern for slope stability, but maintenance recommended to salvage fence (Reference Photo P7).



**CITY OF BURLINGTON, VERMONT
SLOPE STABILITY INSPECTION**

Date of Inspection: 11/11/2019

Site Inspector

Name: David C. Del Marco, PG
Title: Senior Project Manager
Office/Facility Location: Manchester, NH

Email: David.Delmarco@Terracon.com
Phone: 603.206.1191
Mobile: 781.844.6001

Owner Information

Owner: City of Burlington, VT
645 Pine Street
Burlington, VT 054001

Owner Contact: Phillip Peterson
Phone: (802) 865-5832
E-mail: ppeterson@burlingtonvt.gov

Site Location Information

Site GIS Location ID:
Site Name: Manhattan Drive at
North Champlain Street

Site Coordinates
Latitude: 44.48730
Longitude: -73.218261

Assessment Findings

NOTE: It is important to investigate the areas adjacent to the site when possible as indicators of ground movement may not be directly above the pipeline. Photographs, including panoramic view of entire ground movement (landslide, subsidence, mining, etc.), overview of site and vicinity, and any relevant site features such as curved tree trunks, leaning fence posts, loose rock etc... Overview photographs of the site should still be taken even if there are no evidence of ground movement found. Site photographs should be included as attachments to the site assessment form.

☒ **No evidence of ground movement observed (within limits of remediated slope)**

Sinkhole (approximately 4 x 6 x 3 ft) observed adjacent to drainage structure located at top of slope on Manhattan Drive; see appended photographs by Hoyle, Tanner, and Associates, Inc.

Ground Movement Type (if evidence of ground movement observed)

☐ Landslide ☐ Subsidence / Sinkhole ☐ Other (erosion, etc.), describe:

Slope has been remediated with stable, boulder-sized stone rip-rap; no evidence of movement or instability observed; flank slopes are well vegetated and appear stable

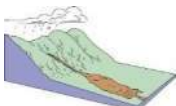
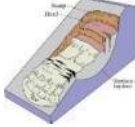
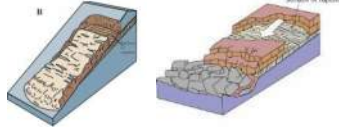
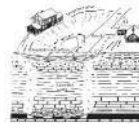
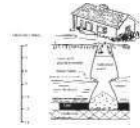
Consequence of Failure:

Possible disruption of drainage downslope and damage to outfall drainage pipe; impact to Manhattan Drive and associated utilities and catch-basins at the top of the slope

Recommended Future Inspection Frequency:

5 years for the remediated portion of the slope based on observations of stability; more frequent observations (not greater than 1 year) of sinkhole opened adjacent to drainage structure on Manhattan Drive (at the top of the slope) to monitor for potential expansion and instability (see appended photographs by Hoyle, Tanner, and Associates, Inc.)

Burlington, VT Slope Stability Inspection

Geohazard Type (Which best fits the observed conditions? If complex slide, it may be appropriate to select more than one type)			
Landslide Types			
☐ Fall Mass detaches from a steep slope or cliff. Free-fall, bouncing, or rolling		☐ Topple Forward rotation or tilting of a column of rock or soil	
☐ Flow Fluid-like movement of a mass; slowly or swiftly. Flows of mud and debris may resemble moving wet concrete		☐ Avalanche Extremely rapid flow- or sheet-like movement of a large, crumbling mass down a steep mountainside or over a cliff.	
☐ Rotational Bowl-shaped failure. Movement at top (scarp) is downward and may tilt into the slope. Bottom is marked by bulging mass (toe bulge).		☐ Translational Movement occurring along a relatively planar surface; commonly parallel to the slope	
☐ Spread Lateral movement causing the ground to pull apart; or in formation of parallel fractures. May occur on gentle slopes.		☐ Creep Similar to spread, but commonly imperceptibly slow movement; results hummocky (undulating) ground surface	
Subsidence / Sinkhole			
☐ Ground Subsidence Downward ground movement (sag) or settlement of an area		☐ Sinkhole Localized downward ground movement forming a closed depression with or w/out open drain hole or throat.	

Site Setting and Surrounding Area

☒ Open-Slope
 ☐ Side-Slope
 ☐ Gully/Ravine
 ☐ Waterway
 ☐ Residential
 ☐ Agricultural
 ☐ Mine/Quarry
 ☐ Wooded
 ☐ Natural
 ☐ Cut
 ☒ Fill
 ☐ Embankment
 ☐ Recently graded (Cut/Fill)

Notes: Slope has been armored with boulder-sized stone rip-rap; flanking slopes are well vegetated natural slopes; flanking slopes are outside the scope of this inspection.

Material Type and Consistency

☐ Bedrock
 ☒ Gravel, cobbles, and boulders
 ☐ Sand
 ☐ Silt and Clay
 ☐ Colluvial (mixed coarse- and fine-grain material)
 ☐ Shallow soil over rock
 ☐ Liquid
 ☐ Solid-Wet
 ☐ Solid-Dry
 ☐ Rubble
 ☐ Organics; describe: _____

Notes: Remediated slope stabilized with boulder-sized stone rip-rap; natural flanking slopes are comprised of alluvial sand; surfaces of natural slopes are vegetated

Condition of Trees, Fences, Posts, etc.

☐ Standing upright
 ☐ Leaning uphill
 ☐ Leaning downhill
 ☒ Leaning all directions
 ☒ Fallen
 ☐ None

Notes: Trees exhibit no perceptible direction of lean; fallen trees appear to be a results of storm forces; observations made from public properties and flanking slopes were outside the scope of this inspection.



Site Assessment Form – Burlington, VT Slope Stability Inspection

Surface-Water Features

☐ Stream ☐ Pond/Lake ☐ Springs/Seepage ☐ Marshes ☐ Closed depressions ☒ Culverts ☐ Ditches ☐ Water-breaker
☐ Free-water on slope ☐ Saturated soils ☐ None

Notes: No seepage observed on slope surfaces; existing stormwater discharge culvert located at the base of the re-mediated slope; discharge has formed a channel at the base of the slope; flow is to the north, away from the slope

Relative Activity

☐ Sharp un-vegetated features ☐ Partially vegetated features ☐ Smooth vegetated features ☐ Un-drained depressions
☐ Drained depressions ☐ Ponds/Sags/Marshes ☐ Undulating (hummocky) topography ☐ Un-vegetated cracks
☐ Vegetated cracks

Notes: No evidence of movement or instability observed on remediated or natural flanking slopes; at the top of the slopes no stress relief, transverse cracking or signs of ground movement are evident; pavement on Manhattan Drive is in excellent condition with no distinct cracks and guard rails are stable; fence damage appears due to construction; flanking slopes were outside the scope of the inspection.

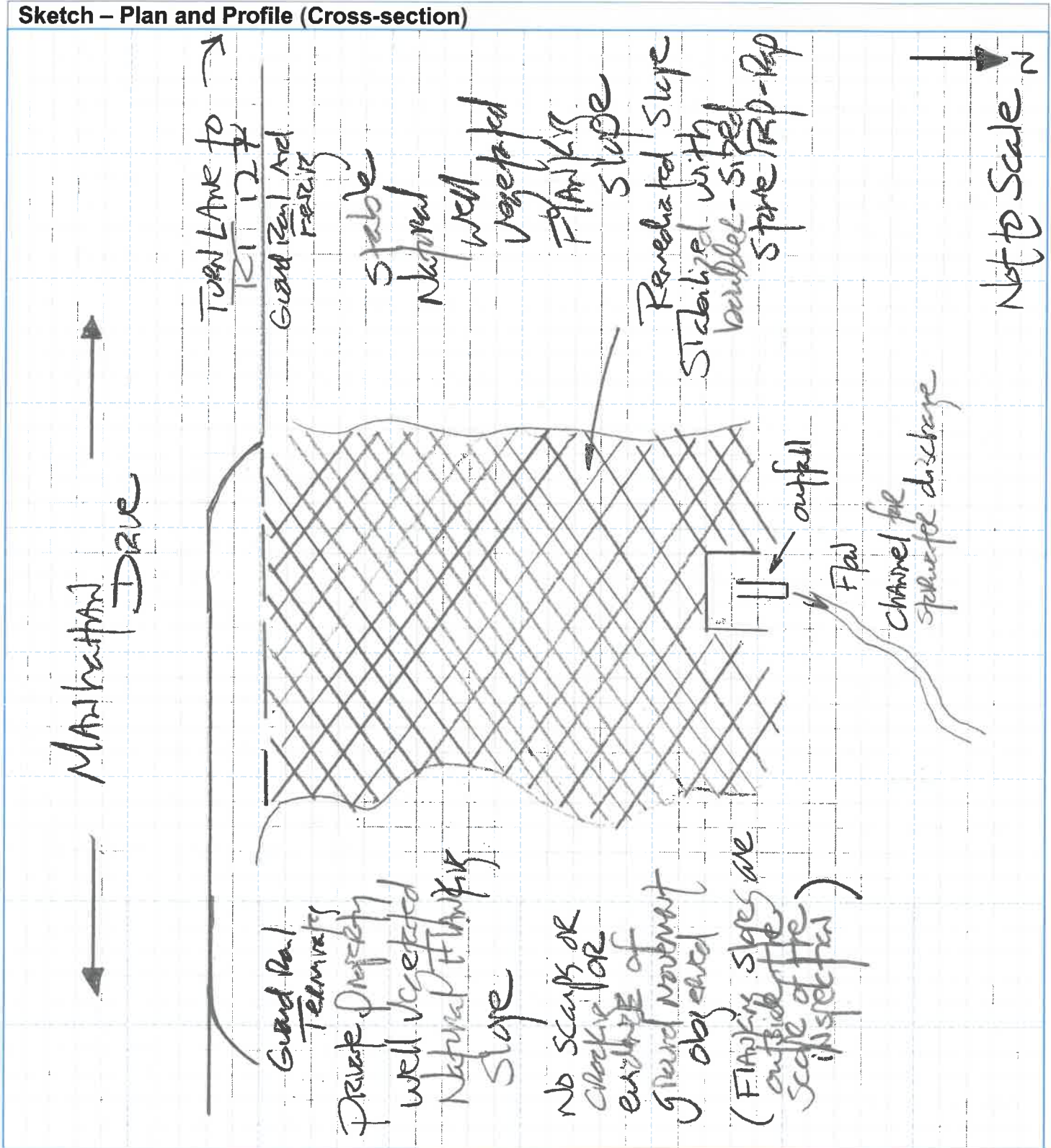
Landslide Dimensions

Scarp Height	N/A	Scarp width	N/A
Width of source area	N/A	Depth of Source area	N/A
Width of deposit	N/A	Depth of deposit	N/A
Length (distance) from top to bottom	N/A	Height (elevation) from top to bottom	N/A
Overall Width	N/A	Other Notes:	N/A

Subsidence / Sinkhole Dimensions

Length:	N/A	Width:	N/A	Depth:	N/A
Hole / Throat (Y/N):	N/A	Diameter:	N/A	Depth:	N/A
Description:	N/A				

Sketch – Plan and Profile (Cross-section)



Slope Location: Riverside Avenue – Michael's Auto Sales Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 20: Eastern Portion of Michael's Auto Sales Property



Photograph 20: View to southeast from eastern portion of Michael's Auto Sales property showing beginning of scarp formation at stakes; historic failure scarp obscured by vegetation at left of photograph.

Slope Location: Riverside Avenue – Michael's Auto Sales Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 21: Slope Remediation by Owner of Michael's Auto Sales



Photograph 21: View to northwest from eastern portion of Michael's Auto Sales property showing remediation implemented by landowner, including placing of geotextile fabric and pea-stone ballast; soil scarp occurs beyond and obscured by vegetation to right.

Slope Location: Riverside Avenue – Michael's Auto Sales Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 22: Central Portion of Michael's Auto Sales Property



Photograph 22: View to west from central portion of Michael's Auto Sales showing beginning traces of scarp development at center of photograph (may be initial formation of gully from surface flow)

Slope Location: Riverside Avenue – Michael's Auto Sales Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 23: Area at Top of Slope Exposed to Surface Erosion



Photograph 23: View to east showing eastern portion of Michael's Auto Sales property; poorly vegetated area subject to continual surface erosion at the top of the slope and downslope; soil scarp from historic failures obscured by vegetation at left of photograph.

Slope Location: Riverside Avenue – Michael's Auto Sales Date: 8/5/2020
City: Burlington State: Vermont
Description : Photograph 24: Dense Vegetation Downslope from Michael's Auto Sales



Photograph 24: View to north from top of slope at Michael's Auto Sales giving an indication of the density of summer vegetation in this area

Slope Location: Riverside Avenue – Michael's Auto Sales Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 25 – Downslope from Michael's Auto Sales, Near River Walk Trail



Photograph 25: View to west downslope from Michael's Auto Sales, (near River Walk Trail) showing poorly vegetated, exposed, former slump/slide debris; poorly vegetated soil surfaces subject to continual surface erosion from precipitation events;

Slope Location: Riverside Avenue – Michael's Auto Sales Date: 8/13/2020
City: Burlington State: Vermont
Description : Photograph 26: Former Debris Slide/Slump Downslope from Michael's Auto



Photograph 26: View to southeast downslope from Michael's Auto Sales; gullies evident top right and top left provide conduit for surface flow; poorly vegetated slope continues to erode during precipitation events

Riverside Avenue Corridor – Slope Section 4a

DRAINAGE

Feature	Structure	Size	Type/Material	Condition	Comments	Recommendation
D1	MH ☐ CB/DI ☐ Outlet ☒ Headwall ☐ End Section ☐ Stone ☐ Swale ☐ _____ ☐	15" dia.	CMP	Pipe – Good Outfall - Poor	Large erosion swale/slide at outlet and down bank, end of pipe exposed.	Repair Outfall – Stone Fill Armor/stabilization. Large area project with challenging access.
D2	MH ☐ CB/DI ☐ Outlet ☒ Headwall ☐ End Section ☐ Stone ☒ Swale ☐ _____ ☐	15" dia.	CMP	Good	Pipe exposed, laid on top of slope approximately 75' in length. Pipe appears in good condition with a slightly elevated outlet acceptable for plunge with a stable rock armor apron.	No action. Monitor Rock Apron Outlet in future inspections
D3	MH ☐ CB/DI ☐ Outlet ☐ Headwall ☐ End Section ☐ Stone ☐ Swale ☒ _____ ☐	5' width	Stone lined	Fair	Moderate erosion, ~1' deep.	Monitor erosion.

D4	Reference Slope Section 4b					
D5	MH ☐ CB/DI ☐ Outlet ☒ <i>Headwall</i> ☐ <i>End Section</i> ☐ <i>Stone</i> ☐ Swale ☐ _____ ☐	15" dia.	CMP	Good	Pipe half full of ice.	Monitor for ice blockage.

Riverside Avenue Corridor – Slope Section 4a

GUARDRAIL/FENCE

Feature	Height (in)	Face of Rail/Fence to Shoulder Break (ft-in)	Leaning?	Condition	Comments	Recommendation
G1	-	-	Yes ☐ Slope instability ☐ No ☐ Plow damage ☐	-	-	-

No City-owned guardrail/fence issues were identified in the 2019 inspection as top of slope is further back from Roadway ROW.

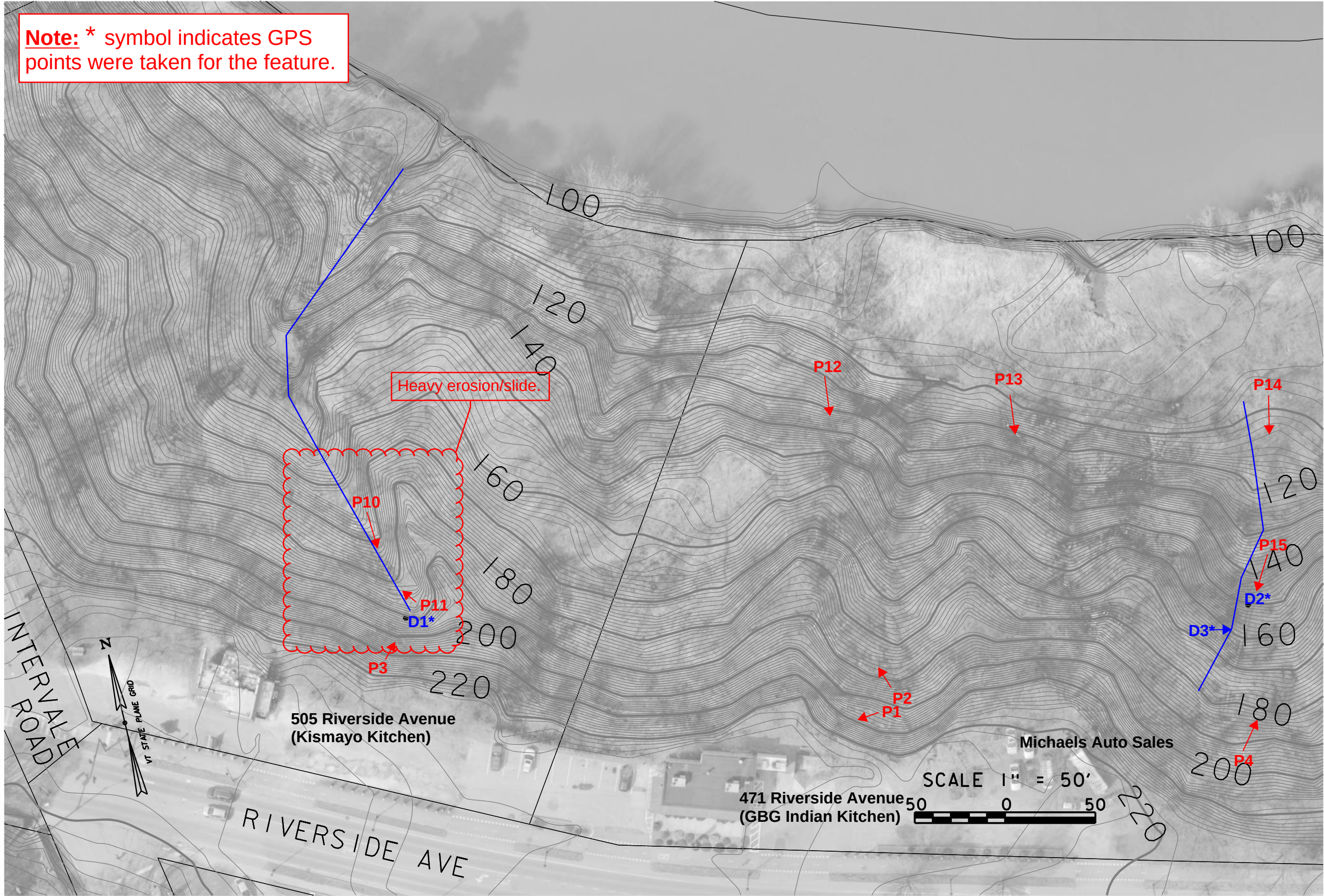
Private fences and barriers near top of slope are leaning. Reference Terracon Inspection Reports.

Riverside Avenue Corridor – Slope Section 4a

ROADWAY

Feature	Pavement Defect	Length (ft-in)	Width (ft-in)	Condition	Comments	Recommendation
R1	Pothole ☐ Edge Crack ☐ Settlement ☐ Shoulder Berm ☐ Longitudinal Crack ☐ <u>Erosion Slide</u> ☐					

No City-owned roadway issues were identified in the 2019 inspection.



PROJECT NO. 909051.02		SHEET NO. 4		SHEET 4 OF 6	
BURLINGTON SLOPE STABILITY INSPECTION					
BURLINGTON, VERMONT					
Slope 4a					
Hoyle, Tanner & Associates, Inc.					
125 College Street, 4th Floor, Burlington, VT 05401 Tel (802) 860-1331 www.hoyletanner.com					
FILENAME 909051_02bdr	DESIGNER NLC	MODEL NAME PLAN04a	CHECKED JAO	DATE 11/07/2019	This document is prepared as an instrument of service and shall remain the property of Hoyle, Tanner, Inc. It may not be used, reproduced, disseminated or otherwise made available in any form, including electronically, for any other purpose than this project, without the written permission of Hoyle, Tanner, Inc.

FY20 Burlington Slope Inspections

Location: Riverside Ave – Slope 4b
411, 389, and 356 Riverside Avenue

Inspector	Date of Inspection
Terracon	August 2020
Hoyle, Tanner	December 3, 2019

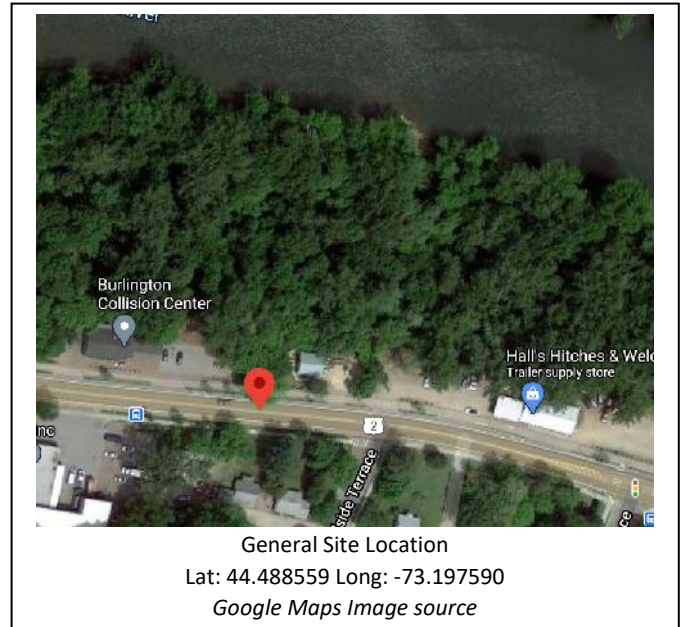
INSPECTION SUMMARY

Condition: *(Stable, Needs Further Assessment, or Urgent Repair Needed)*

- **URGENT REPAIR NEEDED** (389 Riverside Avenue) – See Recommendations below
- **Needs Further Assessment (411 and 356 Riverside Avenue)** – See Recommendations below
- Evidence of active slope movement

Future Inspection Frequency:

- Immediate attention (389 Riverside Ave)
- 1 year for 411 and 365 Riverside Avenue (Annual Visual Monitoring)
- Next Inspection August/September 2021
- Inspection frequencies to be reassessed after recommended field investigation and establishment of instrumentation monitoring program.



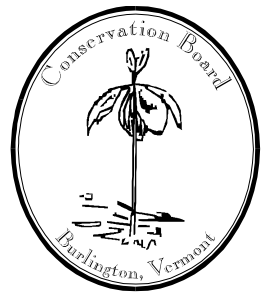
Recommendations:

- **URGENT REPAIR** – 389 Riverside Avenue: Active slope movement and surface erosion issues in close proximity to the building structure. Recommend implementing a field investigation program, including review of existing information (historic borings logs and aerial photography), and advancement of test borings, to evaluate subsurface conditions and provide data for global stability analyses to assess suitable repair options; install geotechnical instrumentation (inclinometers, strain gauges, and/or survey benchmarks) to monitor slope behavior; evaluate remedial options for slope stability;
- **Needs Further Assessment** – 411 and 365 Riverside Avenues: drill geotechnical borings at the top of the slope at these locations to evaluate thickness of fill materials, in-situ soil densities and soil types and groundwater level; complete borings with casings for installation of inclinometers (see Exhibit 2 for recommended locations); the inclinometers will provide a means for the City and land owners to monitor slope movement and behavior over time.
- Restrict dumping of bark mulch, soil and vegetative debris along slope at eastern portion of 411 Riverside Avenue;
- Future Inspections – Monitor surface erosion, expansion of crown cracking at 411 Riverside Avenue, scarp development between 389 and 356 Riverside Avenue, pipe outlets, and top of bank proximity to buildings and lots; drill test boring and install inclinometer for long term monitoring of exposed scarp between 389 and 365 Riverside Avenue (see Exhibit 2).

Burlington Conservation Board

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*Miles Waite, Chair
Zoe Richards
Don Meals
Matt Moore
Ryan Crehan
Hannah Brislin
Rebecca Roman
Tori Hellwig
Jules Lees*



Conservation Board Meeting Minutes

Monday, April 5, 2021 – 5:30 pm
Remote Meeting

Attendance

- **Board Members:** Zoe Richards (ZR), Miles Waite (MW), Rebecca Roman (RR), Hannah Brislin (HB), Jules Lees (JL), Ryan Crehan (RC), Tori Hellwig (TH)
- **Absent:** Matt Moore (MM), Don Meals (DM)
- **Public:** John Caulo (44 Lakeside Ave), Patrick Dunseith (Intervale Deer Management)
- **Staff:** Scott Gustin (Permitting & Inspections), Norm Baldwin, Susan Molzon, and Philip Peterson (DPW)

MW, Chair, called the meeting to order at 5:33 p.m.

Minutes

A MOTION was made by ZR and SECONDED by RR:

Approve the meeting minutes of March 1, 2021 as written.

Vote: 5-0-1, motion carried. (No HB yet)

Board Comment

TH mentioned a re-wilding opportunity in the city coming up this spring. Look for info from Dan Cahill. RR asked if it's through Parks & Rec. TH said yes.

ZR noted a city nature celebration coming up at the end of April. The City Nature Challenge is going on, and Burlington and Winooski are involved. Who can see the most species within a week using I-Naturalist? It's a global event.

RC mentioned the urban reserve sheet piling renaturalization project. He's met with David White and Cindy Wight, both are supportive. He'll follow up with an engineer to assess erosion potential if this is done. MW asked how it would be funded. RC said it would be through the Fish & Wildlife Service. MW mentioned nearby soil contamination, like at the Astroline site. Further north, there is less impact from the petroleum tanks.

HB appeared 5:45 PM.

Public Comment

None.

Open Space Subcommittee

ZR said there were about 75 attendees at last week's summit. Somewhere around 160 signed up beforehand. She thanked HB for pre-meeting advice on conducting the meeting. Lots of public input was provided. The meeting provided project background, potential target areas, and open Q&A. She

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mentioned the Q&A material from the public around the five main topic areas. There was lots of interest in metrics around carbon sequestration and in additional data. Questions were raised about how we can get to our target of 50% tree canopy. Lots of questions and comments around incentives relative to tree planting and stormwater management.

RR said it was a good introduction for the community as to reshaping our mindsets for working with nature rather than having control over it. Equitable mindsets. She reiterated the requests for data around carbon sequestration. RR also mentioned the quality of life aspects of trees within our community. ZR noted health benefits of community natural areas too.

SG noted next steps for May (addendum outline) and June (draft addendum) and ongoing opportunities for public input and engagement through the spring.

ZR, what role does all of this have within the city's land use regulations (i.e. like tree clearing offsets)?

ZR also mentioned the mayor's willingness to sign on to the community and urban forest initiative as requested.

Update & Discussion

1. Slope stability report

Philip Peterson, Norm Baldwin, and Susan Molzon appeared for this item.

Norm Baldwin provided project background. The city has tried to identify and map areas of slope stability concern. That's what this study is aimed at. Some of the areas are located on private property and limit the city's ability to address problems that may occur. This Hoyle Tanner study establishes clear baseline conditions. This is the first comprehensive documentation of what's going on with slopes in the city.

Philip Peterson provided the Board with a presentation about the project. This project began in 2019 with Terracon and Hoyle Tanner. This project analyzed slopes at Northshore, Manhattan Drive, and Riverside Avenue. Existing conditions were examined, but no design work was done as to remedying identified unstable areas.

Mr. Peterson said that the slope at Northshore is stable but will be monitored annually. Manhattan Drive at Rt. 127 and at Champlain is also stable. It, too, will be monitored in the years ahead. Stormwater is involved with assessment and maintenance of the outfall.

Mr. Peterson said that the study looked at Riverside Avenue in 3 different locations. They all involve private property. We are limited as city staff as to what we can do on private property. Near Intervale Road, the slope is in urgent need of repair, but more information is needed. What data is available already and what might need to be done for further analysis like test pits and soil borings? At 386 Riverside Ave, the slope is also in need of urgent repair. More assessment and stability analysis is needed.

Norm Baldwin noted that the 3 properties have had problems at least since the October 2019 storm event and associated slope failure. That slope failure was somewhat superficial. There's concern that the banks will continue to be top loaded. They are under a zoning order to remediate the problem and are involved with an ongoing effort to address it. A city property is in the mix here. MW asked which one is the city parcel. Mr. Baldwin said it's the one behind the hitch business.

Mr. Peterson went on and noted that the property owners have allowed the assessment and have been involved in the ongoing effort. MW, don't most of the properties extend to the river? Mr. Baldwin replied that they do, except for where the city property is located.

Mr. Peterson said the last section along Riverside is further east and was found to be relatively stable. Further analysis and ongoing monitoring is needed. He said that the report has been shared with all of the property owners. The stormwater team is looking to improve and stabilize the stormwater outfall in this area. Mr. Peterson said that the full report is available online.

Mr. Baldwin talked about next steps. His authority as City Engineer is limited with respect to slope failures. He's working with the city attorney's office to expand his authority. His authority is articulated in the city charter. We need to think about requirements for slope assessment during permit application review. The city has a number of outfalls along slopes. They can cause scouring erosion and are in need of repair. The work will take time. Without question, a lot of these projects are located in difficult sites and are costly to fix. We need to continue to inspect these sites to catch changes or deterioration early on. This will be an ongoing effort.

MW said he's familiar with 505 Riverside Ave. Does this report take into consideration the analysis that has been done of this site already? Mr. Baldwin said that the work probably post-dates this report. We can go back to 505 and see how it fits into this report. MW asked, do you think that one way to address this is to remove the buildings along the north side of Riverside Ave and renaturalize the bank? Mr. Baldwin said that they have reached out to CCRPC to inquire about hazard mitigation grants. It's possible but not imminent due to the 2-year grant cycle.

RC, much of the soil from the slope failure is on city property now. Has the city done anything to address the slope failure? Mr. Baldwin, the property owners have been charged with developing a remedy. We also had to determine where the city property is in relation.

ZR, it sounds like there is urgent need here. Are the structures in danger? Who's liable if damage or injury occurs? Mr. Baldwin said that the three owners are involved. There are various factors of safety that could be achieved. The city is identifying the concern and making property owners aware and working with them. If people insist on development, we need to require professional geotechnical analysis. ZR, maybe the bar is too high for these property owners to fix it.

Mr. Baldwin said that the report has identified natural and artificial conditions. None of the areas are expected to fail in the next day or two. We are in early stages of design to fix the outfall.

RR, can you expand on requested authorities? Mr. Peterson said we have authority to issue dangerous building orders. The problem is that slopes are not included. We are working with the city attorney's office to have that legal authority. Mr. Baldwin said that slope stability problems tend to be hidden until it becomes obvious. We need to have the authority to conduct the analysis to determine the conditions. We also need to consider the limits to what government can compel someone to address.

RR, are there financial resources available? Mr. Baldwin mentioned the hazard mitigation grant program.

ZR, this area along Riverside Ave has had slides over the years. How confident are we that it won't happen again if we get heavy rains? How do we get in a position that we can do something about this before the next failure occurs? Mr. Baldwin said that we're exploring what the city needs to do as well as what the property owners need to do.

MW, we had an applicant less than a year ago that was considering development along Riverside Ave. We wanted to see that geotechnical analysis is done. He also mentioned the presentation by Paul Bierman. Maybe we can identify an overlay zone for increased geotechnical analysis for evaluation under zoning but also DPW. Mr. Baldwin said that he did evaluate that proposal and required determination of the property lines and a geotechnical and structural engineering analysis. He concurred with establishing standards for applicants.

ZR asked if CEDO has been consulted and could help with coordinating this effort. Mr. Baldwin said he'd reach out to inquire with them. ZR said they may be a good resource for identifying funding resources.

MW noted other nearby properties along Riverside Ave with site contamination issues. Maybe there's a way to coordinate with DEC as to soil borings on these properties – both for contamination and for slope assessment.

Project Review

1. 20-0729CA; 44 Lakeside Ave (ELM, 5S) Lakeside Ovens, LLC

Install a 30'diameter yurt at northern end of property. Relocate previously approved elevated deck @ west end of building #32 to SW corner of building.

John Caulo attended on behalf of the application.

Mr. Caulo said that one more structure – a yurt – is proposed. It will have no foundation, like the others. There is also a bath house building that's not depicted on this site plan (it was previously approved). The yurt is anticipated to be a contemplative space intended to compliment the yoga use in the area. The proposed location is within the lakeshore buffer.

ZR asked about the location of the bath house and the history of the 4 outbuildings and pavilion. SG noted the after-the-fact permit review for the 4 sheds. The proposed pavilion was also included but not yet built. The bath house was permitted separately and is outside of the lakeshore setback. ZR said she has some concerns with the incremental development along the shore.

RC said that during the review of the site redevelopment, there was applicant push back to any degree of shoreline renaturalization. Is any sort of mitigation being offered for continued encroachment into the lakeshore buffer? Mr. Caulo said that the property owner is a very responsible steward of the property. The proposed use is seasonal and very low impact. The primary purpose of this property is to serve as a job hub for the creative economy. A primary attraction of this property is its location – its connection to the waterfront and the historic use of the shoreline by employees. The prospect of conducting yoga classes has resonated with people working at the property. The yurt will be a wooden structure that does not anchor into the ground. He mentioned the site clean-up that has been done at the property as part of the redevelopment. There is no specific mitigation proposed for the yurt.

RR, there's no perception of mal-intention, but placement of a structure within the buffer does have adverse impact. Why can it not be located outside of the buffer? Why does it need to be where proposed? Mr. Caulo said that the northerly end of the site is narrow and fully within the lakeshore buffer. The water-oriented activities are located in this area, and the yurt will be part of that. SG noted that the aerial photo on display pre-dates the redevelopment of the property and does not depict present on-the-ground conditions.

ZR said that a sixth building is requested in this sensitive lakeshore area. The bathroom facility was approved because it was not located within the buffer. Mr. Caulo said that there was historically a bathroom facility here and had a failing onsite septic system. The present facility connects to the city sewer system. All of these outbuildings lack foundations and could be removed within a day if need be. The applicant has tried to have a light footprint.

MW said that the lakeshore buffer does not prevent development. It carries requirements for permit review. Some would like to see the shoreline naturalized, while others would like to provide lakeshore access. MW said the yurt doesn't seem like a big ask.

Mr. Caulo talked about the adjusted deck at building 32 Lakeside. The project has been scaled down to retain the existing building scale and footprint. No 3rd story is proposed now. The previously permitted deck will be adjusted to the southwest corner. The relocated deck is 31' from the lakeshore, more than twice the distance of the prior deck. An existing stand of cedars will remain. SG clarified the review is triggered by relocating the deck over green space, whereas the prior location was over impervious surface. Mr. Caulo stated that the deck will be elevated.

RC asked about the prior location. Mr. Caulo said that the pavers will remain, just without a deck. MW asked if the lakeshore green space will be mowed lawn. Mr. Caulo said that, through Act 250, some area along the sheet piling will be allowed to be more natural. The landscaping plan calls it out.

ZR said she sees no problem with the shift in the deck, but is more concerned with the yurt.

A MOTION was made by RR and SECONDED by JL:

Approve the deck relocation.

Vote: 7-0-0

MW said he feels the yurt is a lot like a tent. He doesn't see it being a big deal as to inhibiting wildlife.

HB said it's pretty common to keep camp sites away from the water's edge. ZR reiterated that the original four buildings were built before they were permitted. They were approved rather than forced to be removed. The area has gone from no buildings to 6 in a couple of years. RR said that there's a difference between a temporary structure and a permanent one that could be moved easily. It's about the structure and the related human impacts.

JL said we need to consider whose use of the lake is a stake here. Humans versus wildlife. We need to consider cumulative impacts on lake health.

MW suggested that a better plan along with a site visit may be worthwhile. Mr. Caulo is willing to do this.

RC said that one of the other outbuildings could be removed and replaced with the yurt.

MW asked about process. SG said the applicant could keep the two items together or split the application into two separate applications. The deck could be approved and the yurt review would continue in May.

Update & Discussion (cont.)

2. Intervale Deer Management

MW noted that there will be a follow up meeting with stakeholders about this item to get more into the weeds of process and next steps.

JL, is there a way to prioritize Abenaki access? Maybe talking with Chief Don Stevens would be worthwhile. SG said that it could be done. It really comes down to how the Intervale Center and other partners (if any) want to manage an archery hunt.

Patrick Dunseith said that the community deer advisor is very helpful and provides an adaptable framework for communities to build upon. He said that with the guidelines provided, the Conservation Board providing a venue for this discussion is very attainable. The eventual ask of the City Council would ideally come with the support of the Conservation Board.

RR, what do you see as the role of the Intervale Center? Mr. Dunseith, we have a strong interest in managing a deer hunt on the Intervale Center landscape. We don't have the capacity to affect city ordinance. We would be interested in a broader discussion of how hunting integrates into the community. The simplest ask pertains to the city's archery discharge ordinance.

ZR said that the ask to the City Council should be based in a holistic approach to deer management, rather than simply pushing deer to the next property. Is encouraging to see that other communities have struggled with this matter and have found a way forward.

Mr. Dunseith said that this effort can integrate well with nature based climate solutions. If the Conservation Board can agree to host a community discussion or survey as to deer hunting in the Intervale, we could achieve something in 2021. He suggested looking at deer management in Cayuga Heights in the community deer advisor. This could be another component of the NBS community outreach process.

SG recapped next to meet with stakeholders, figure out what's been done already, what needs to be done and who should be involved.

TH said she supports this effort.

Adjournment

The meeting adjourned at 7:51 PM.