ROADS SUB-COMMITTEE ELECTRONIC MEETING AGENDA
WEDNESDAY, AUGUST 19, 2020 - 1:30 P.M.

(For information on how to join the meeting, please go to the Roads Sub-Committee Meetings page on the Township Website to find the link, Meeting ID and Password)

1. Call to Order

2. Additions/Deletions/Approval of Agenda

Be it resolved that the agenda be approved as _____. Carried.

3. Declaration of Pecuniary Interest or Conflict of Interest

4. Approval of Draft Minutes - July 8th, 2020

Be it resolved that the minutes of the Roads Sub-Committee meeting held on July 8th, 2020 be approved as Circulated. Carried.

5. Business Arising from Minutes

6. Correspondence Items

7. General Business
    1. Update from Public Works Superintendent
    2. 2nd Line SW Update
    3. NWN Scientific - 2nd Line SW Road Impact Memo
    4. Dufferin County Road 21 Traffic Volume
    5. Structure 2013 & 11 Update
    6. Church Street Resurfacing
    7. 2021 Road Projects
    8. Other/Additions
    9. Unfinished Business
        1. Speed Bump in Horning's Mills Main Street
        2. Sidewalks in Corbetton

8. Delegations

9. Recommendations to Council

10. Public Question Period

11. Confirmation Motion

Be it resolved that all actions of the Members and Officers of the Roads Sub-Committee with respect to every matter addressed and/or adopted by the Board on the above date be hereby adopted, ratified and confirmed; and each motion, resolution and other actions taken by the Board Members and Officers at the meeting held on the above date are hereby adopted, ratified and confirmed. Carried.

12. Adjournment and Date of Next Meeting

Be it resolved that we adjourn this Roads Sub-Committee meeting to meet again on _____ at _____ or at the call of the Chair. Carried

Denise Holmes

From: Kaitlin Chessell
Sent: Monday, August 10, 2020 9:13 AM
To: Denise Holmes
Cc: Donna Funston; Wendy Atkinson
Subject: FW: 03-2020, Township of Melancthon, 2nd Line - Baseline Schedule
Attachments: SureTrak_ 03-2020 TOWNSHIP OF MELANCTHON.pdf; ATT00001.htm

FYI

Kaitlin Chessell | Administration and Finance Assistant | Township of Melancthon |
kchessell@melancthontownship.ca | PH: 519-925-5525 ext 104 | FX: 519-925-1110 | www.melancthontownship.ca |

Please note: Effective 10:00 a.m. on March 17, 2020, the Township of Melancthon Municipal Office will be closed to the Public until further notice. Some of our services are available online (tax payments, planning applications, fire permits) or Staff will be available by phone at 519-925-5525 to assist.

From: Roads <roads@melancthontownship.ca>
Sent: Monday, August 10, 2020 7:25 AM
To: Kaitlin Chessell <kchessell@melancthontownship.ca>
Subject: Fwd: 03-2020, Township of Melancthon, 2nd Line - Baseline Schedule

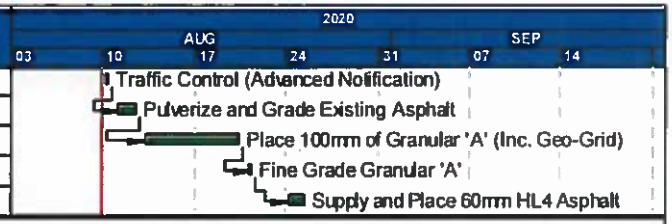
Sent from my iPhone

Begin forwarded message:

> **From:** Jeffrey Ferreira <jferreira@grahambros.com>
> **Date:** August 6, 2020 at 4:08:02 PM EDT
> **To:** roads@melancthontownship.ca
> **Cc:** Kyle Pollitt <kpollitt@grahambros.com>, Mark Thompson <mthompson@grahambros.com>
> **Subject: 03-2020, Township of Melancthon, 2nd Line - Baseline Schedule**
>
> Hi,
>
> Please see attached baseline schedule.
>
> Regards,
>
> **Jeffrey Ferreira, BAT | Project Manager**

Graham Bros. Construction Limited
297 Rutherford Rd. S | Brampton ON L6W 3J8
Cell: 647.836.0959 |Tel: 905.453.1200 x234
grahambros.com

Act ID	Description	Orig Dur	Rem Dur	Early Start	Early Finish	Total Float	%	Resource
1000	Traffic Control (Advanced Notification)	1d	1d	10AUG20	10AUG20	3d	0	
1005	Pulverize and Grade Existing Asphalt	2d	2d	11AUG20	12AUG20	3d	0	
1010	Place 100mm of Granular 'A' (Inc. Geo-Grid)	6d	6d	13AUG20	20AUG20	3d	0	
1020	Fine Grade Granular 'A'	1d	1d	21AUG20	21AUG20	3d	0	
1030	Supply and Place 60mm HL4 Asphalt	2d	2d	24AUG20	25AUG20	3d	0	



Start date	10AUG20
Finish date	25AUG20
Data date	10AUG20
Run date	06AUG20
Page number	1A

Graham Bros. Construction Limited
Project 03-2020

- Early bar
- Progress bar
- Critical bar
- Summary bar
- Start milestone point
- Finish milestone point

Denise Holmes

From: Denise Holmes
Sent: Thursday, August 13, 2020 1:59 PM
To: Denise Holmes
Subject: FW: 117287 2nd Line SW , Melancthon
Attachments: 5. 200318_Review_Road_Impact_050618.pdf

From: Humphrey, Jeremy <Jeremy.Humphrey@wsp.com>
Sent: Tuesday, August 4, 2020 9:28 AM
To: Chris Jones <Chris_MPlanningServices@rogers.com>
Cc: Denise Holmes <dholmes@melancthontownship.ca>
Subject: RE: 117287 2nd Line SW , Melancthon

Hi Chris,

That is correct.

Comment #5 – from my reading – is about the cost sharing responsibility for maintenance of the road. The geotechnical submission contains cost estimates for road rehabilitation along the portion of 2nd Line SW that the client will be using. I have attached the RJ Burnside comment memo for reference.

The information provided that addresses the other comments will allow for a discussion between the Township and the Client about this responsibility. Once Burnside and the Roads Sub-Committee have had an opportunity to review and discuss the submission materials, we would be in a position to initiate that dialogue.

Thank you for your time,

Jeremy Humphrey
Project Planner
Planning, Landscape Architecture and Urban Design

T+ 1 647-730-7116

119 Spadina Avenue, Suite 500
Toronto, Ontario
M5V 2L1 Canada

wsp.com

From: Chris Jones <Chris_MPlanningServices@rogers.com>
Sent: August 3, 2020 5:26 PM
To: Humphrey, Jeremy <Jeremy.Humphrey@wsp.com>
Cc: Denise Holmes <dholmes@melancthontownship.ca>
Subject: Re: 117287 2nd Line SW , Melancthon

Hi Jeremy - just so I am clear:

1. WSP submission dated July 21 addresses Burnside comments 1, 2 and 6 of March 18?

2. WSP submission dated July 28 addresses Burnside comments 3 and 4 of March 18?

What about Comment #5 of the Burnside March 18 memo?

Thanks,

Chris

On Jul 29, 2020, at 5:09 PM, Humphrey, Jeremy <Jeremy.Humphrey@wsp.com> wrote:

Good afternoon Chris,

Please find attached the final comment responses addressing the balance of the RJ Burnside comments from Roads Impact memo.

Thank you for your time,

Jeremy Humphrey
Project Planner
Planning, Landscape Architecture and Urban Design

<image001.png>

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M5V 2L1 Canada

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From: Humphrey, Jeremy
Sent: July 22, 2020 12:09 AM
To: Chris Jones <Chris_MPlanningServices@rogers.com>
Cc: Denise Holmes <dholmes@melancthontownship.ca>; John-Baptiste, Chad <Chad.John-Baptiste@wsp.com>
Subject: RE: 117287 2nd Line SW , Melancthon

Good evening Chris,

Please find the geotechnical investigation addressing comments #1, #2, and #6 of the RJ Burnside comment letter.

The remaining comments are addressed in a separate memo that will be provided under a separate cover in the coming days.

I also have a response from the client about the hoop house operations:

- 5 hoop houses (in the same size and configuration as the current 'cluster') will be built for every 50 acres under cultivation.

- The location of each cluster of 5 hoop houses to be determined as each 50 acre parcel is defined/licensed.
- The hoop houses will remain seasonal and will be used in the Spring season for hardening plants.
- Each hoop house is approximately 2,000 sq ft

Given the above points, perhaps we can arrange a meeting between you, Chad, and myself to figure out how the SPA agreement can best deal with these structures.

Thank you for your time,

Jeremy Humphrey
Project Planner
Planning, Landscape Architecture and Urban Design

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Toronto, Ontario
M5V 2L1 Canada

wsp.com

R.J. Burnside & Associates Limited 15 Townline Orangeville ON L9W 3R4 CANADA
telephone (519) 941-5331 fax (519) 941-8120 web www.rjburnside.com

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

Technical Memorandum

Date: March 18, 2020 **Project No.:** 300050618.0000

Project Name: 117287 2nd Line SW (NWN Cannabis) - Road Impact

Client Name: Township of Melancthon

Submitted To: Township of Melancthon

Submitted By: Henry Centen, P. Eng.

Reviewed By: Gord Feniak, P. Eng.; Arunas Kalinauskas, B.Sc.

This memorandum provides Burnside's peer review comments on the following document:

- 117287 2nd Line SW – Roads Impact Memo, Addendum; dated March 13, 2020; prepared by WSP

The Roads Impact Memo (RIM) responds to Clause 34 of the Development Agreement, which states the following:

- *Clause 34) The OWNER agrees to prepare a traffic assessment memo to review potential traffic demands during construction and operation of the facility and consider the impacts of such demands in the context of the maintenance of 2nd Line SW. The memo will also consider By-law 27-2012 and the cost of current maintenance obligations to 2nd Line SW and will provide recommendations to address or minimize future costs to the Township to maintain 2nd Line SW. Recommendations may include but are not limited to a preferred or alternate haul route, road repairs or upgrades. The OWNER agrees to provide said memo on or before March 2, 2020 and to amend this Agreement on or before April 16, 2020 to incorporate the recommendations of the memo. The Township reserves the right to have the memo peer reviewed by a qualified professional at the OWNER's expense.*

The RIM provides the following main conclusions/recommendations (paraphrased by Burnside):

- Construction traffic will have due regard to By-law 49-2015 (half load requirements in the Spring) and exemption allowed by Section 2.2 of By-law 27-2012 (i.e., truck route restrictions, allowing heavy trucks where no other reasonable access is available).
- The proposed haul route is along part of 2nd Line SW (approximately 2.8 km in length).

- It is noted that the Township's Road Management Plan (RMP) proposes the following maintenance on this road: preventative and routine maintenance ($63,213 in 2020) and resurfacing ($382,855 in 2026).
- The machine building and 30% of the internal roads/parking lot are scheduled for completion by summer 2020, generating 67 concrete trucks and 154 gravel trucks.
- The nursery building is scheduled for construction in 2021, generating 122 concrete trucks and 112 gravel trucks.
- The freezer building is scheduled for construction in the fall of 2021 and early winter 2022, generating 127 concrete trucks and 111 gravel trucks.
- The extraction/processing building and the remaining 70% of the internal roads/parking lot are scheduled for construction in 2022, generating 54 concrete trucks and 279 gravel trucks.
- Each gravel truck has a weight of 22 tonnes, and each concrete truck has a load of 9 cu m.
- Until the end of 2022, there will be weekly transport of frozen crops, via 13,000 lb, 26-foot long trucks.

Burnside Comments

1. The RIM quantifies the traffic demands for the construction period but provides no analysis of the impacts of such traffic, particularly with respect to loading impacts on the haul road. Equivalent single axle loads (ESALs) should be used to establish the damage relationship for comparing the effects of vehicles carrying different loads.

2. The RIM identifies the road maintenance plans for the haul road; however this maintenance plan assumes normal operations for a road that has heavy truck prohibitions (i.e., assuming that the original road was designed and constructed to meet such normal operating conditions). The verification of the road's design (load carrying capability) should be confirmed via borehole investigation by a geotechnical consultant.

3. The Township's RMP estimates Annual Average Daily Traffic (AADT) of 812 vehicles per day (vpd) on the haul road, with about 22 of these being trucks (i.e., 2.7%). This low truck percentage is indicative of the heavy truck prohibition on this road (i.e., allowing for exceptions such as milk trucks, waste vehicles, maintenance vehicles, etc.). Further quantification comparisons should be provided on the forecasted construction and operation traffic volumes to the existing truck volumes on this road, and the impact on the anticipated life cycles costs for this road.

4. Additional operational information should be provided for the proposed facility to confirm the number of trucks anticipated, both under the initial operations (i.e., until the end of 2022) and under ultimate normal operations.

5. Granting an exception for this type of use under By-law 27-2012 (truck route restriction by-law) is based on there being no other reasonable access available. While the proposed haul route appears to represent the only available access, the quantification

and responsibility of road maintenance and improvement costs should be further reviewed.

6. An analysis should be provided to confirm whether the planned maintenance and resurfacing work is sufficient to accommodate the increased truck volumes and loading, or whether the timing or extent of such work should be modified. If it is anticipated that the road base and road subgrade will be significantly impacted by the additional truck traffic, then consideration should be given to providing a more extensive rehabilitation treatment, with corresponding cost increases (i.e., unit costs for rehabilitation were estimated to be over twice the cost of resurfacing), to restore the road to its desirable condition and life cycle.

In summary, the RIM does not fully address the requirements of Clause 34 of the Development Agreement and we recommend that it be resubmitted to address the items noted in this peer review.

R.J. Burnside & Associates Limited

Henry Centen, P. Eng.
Senior Transportation Engineer

HBC:ba

PAVEMENT INVESTIGATION AND ASSESSMENT – 2ND LINE SW ROAD IMPACT STUDY – PROPOSED DEVELOPMENT AT 117287 2ND LINE SW

NWN INC.

PAVEMENT INVESTIGATION AND ASSESSMENT REPORT

PROJECT NO. 19M-00524-00
DATE: JULY 2020

WSP CANADA INC.
2 INTERNATIONAL BLVD, SUITE 201
TORONTO, ON, CANADA M9W1A2

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F +1 416-798-0518
WSP.COM

July 21, 2020

Mr. Gord Fox
NWN Inc.
1680 Tech Avenue
Mississauga, ON L4W 5S9

Dear Mr. Fox,

We are pleased to submit our Pavement Investigation and Assessment Report for the Road Impact Study of 2nd Line SW for the proposed Cannabis Facility (agricultural development) at 117287 2nd Line SW in Melancthon, ON.

The report is based on information obtained from a borehole investigation and laboratory testing regimen conducted in June of 2020.

We trust that this report meets your present requirements. Please contact us if you have any questions.

Yours sincerely,

Lewis Wong, P.Eng
Pavement Engineer

WSP ref.: 19M-00524-00

QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks				
Date	July 17, 2020			
Prepared by	Mat Nayagam			
Signature				
Checked by	Lewis Wong			
Signature				
Authorised by	Aswan Assadi			
Signature				
Project number	19M-00524-00			
Report number				
File reference				

SIGNATURES

PREPARED BY

Mat Nayagam, P.Eng.
Geotechnical Engineer

REVIEWED BY

Lewis Wong, P.Eng.
Pavement Engineer

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TABLES

FIGURES

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APPENDICES

1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by NWN Inc. to complete a Pavement Investigation and Assessment for 2nd Line SW in Melancthon, ON to support the Road Impact Memo (RIM) submitted by WSP in March 2020, for the proposed Cannabis Facility (agricultural development) at 117287 2nd Line SW. The road impact study was completed by WSP to determine the construction activities and operational impacts on Township roads resulting from the Cannabis Facility (Clause No. 34).

The following comments identified by the Township of Melancthon's peer-reviewer (R.J. Burnside and Associates Ltd.) will be addressed in this report:

- Comment #1: Equivalent single axle loads (ESALs) should be used to establish the damage relationship for comparing effects of vehicles carrying different loads;
- Comment #2: The verification of the road's design (load carrying capability) should be confirmed via borehole investigation by a geotechnical consultant; and
- Comment #6: An analysis should be provided to confirm whether the planned maintenance and resurfacing work is sufficient to accommodate the increased truck volumes and loading, or whether the timing or extent of such work should be modified. It is anticipated that the road base and road subgrade will be significantly impacted by additional truck traffic, then considerations should be given to provide a more extensive rehabilitation treatment, with corresponding cost increases (i.e. unit costs for rehabilitation were estimated to be over twice the cost of resurfacing), to restore the road to its desirable condition and life cycle.

This Pavement Investigation and Assessment Report will provide findings from the visual road condition survey, existing pavement structures, ESAL quantification for estimated future truck traffic during construction and operation of the proposed Cannabis Facility, AASHTO 1993 Pavement Design Analysis, and Life Cycle cost analysis for a period of 30 years.

1.1 SITE DESCRIPTION

The site is the existing 2nd Line SW in Melancthon, Ontario. The study limits were from the proposed facility (117287 2nd Line SW) to the intersection of 2nd Line with County Road 17, for a project length of approximately 2.8 km.

2nd Line SW is a two-lane, two-direction roadway and can be classified as a Rural Local Road with a posted speed limit of 80kh/hr and understood to have heavy truck loading restrictions. Within the study limits the existing road is a flexible pavement with a rural cross-section (i.e. surface water drains towards ditches on either side of road crown). There are two (2) distinct pavement surfaces observed within the study limits, and the pavement joint is located approximately 5 m west of the driveway for 117185 2nd Line SW. The pavement on the western section (approximately 1 km length) of the study limit appears to be rehabilitated more recently than the eastern section (approximately 1.8 km length), and generally appears to be in a better condition.

Site photographs are presented in **Appendix A.**

2 PHYSIOGRAPHY

The site is situated in the Till Plains (Drumlinized). The surface of the Till Plains is made up of clay to silt-textured till (derived from glaciolacustrine deposits or shale). The regional topography is undulating and gradual sloping southwards towards Lake Ontario.

3 INVESTIGATION PROCEDURES

3.1 PERMITS AND UTILITY LOCATES

The borehole locations were predetermined and established in the field by WSP personnel. The borehole locations were selected to avoid conflicts with existing above ground and underground utilities, including wind farm conduits, hydro, gas and telecommunications using Ontario One-call.

Approval was obtained from the Township of Melancthon to carry out the fieldwork. Traffic control was provided during the investigation and was implemented in accordance with Book 7 of the Ontario Traffic Manual (January 2014).

3.2 FIELD INVESTIGATION

3.2.1 PAVEMENT CONDITION SURVEY

A visual condition survey was performed in June 2020. The detailed visual condition survey was carried out to classify the extent and severity of observed distresses, and to identify any particularly poor performing areas. Visual condition ratings were performed based on the Ontario Ministry of Transportation's (MTO) SP-024 guidelines. Site photographs with typical observed distresses are presented in **Appendix A.**

Based on surface conditions, there are two (2) distinct pavement sections within the study limits and the observed distresses in each section are described as follows:

WEST SECTION (NEWER)

- Frequent slight ravelling and coarse aggregate loss;
- Intermittent slight flushing; and
- Intermittent slight segregation.

This pavement section extends from the west project limit (proposed facility) to the pavement transition joint located approximately 5 m west of the driveway for 117185 2nd Line SW. The pavement in this section appears have been rehabilitated more recently and is observed to generally be in good condition. The extent of rehabilitation work is unknown.

EAST SECTION (OLDER)

- Extensive slight to moderate transverse cracking;
- Frequent slight to moderate centreline joint and longitudinal cracking;
- Frequent slight to moderate wheel-path rutting;
- Frequent slight to moderate random cracking;
- Frequent moderate to severe ravelling and coarse aggregate loss;
- Intermittent slight to severe alligator cracking (primarily within wheel-path rutting locations);
- Intermittent slight flushing;

- Few slight pavement edge cracking; and
- Few slight to moderate potholing.

This pavement section extends from the pavement transition joint located approximately 5 m to the west of the driveway for 117185 2nd Line SW, extending easterly to the road's intersection with County Road 17. This pavement section is generally in fair condition with localized areas in poor condition.

3.2.2 BOREHOLE PROGRAM

The borehole investigation was conducted on June 12, 2020. A total of twelve (12) boreholes were advanced through the existing surface within the study limit. The boreholes were drilled to depths ranging between 1.5 to 2.1 metres below ground surface. The boreholes were advanced at the locations shown on Figure 1 and 2, provided in the Figures section of this report. The borehole program is summarized in Table 3-1.

Table 3-1 Borehole Program

BH No.	Borehole Easting, Northing (m) (UTM NAD 83, Zone 17)	Direction	Explored Depth (m)	Drilling Methodology/Remarks
West Section (Newer)				
BH1	555240, 4884175	WBL	1.5	Solid Stem Auger
BH2	555430, 4884017	EBL	2.1	Solid Stem Auger/SPT
BH3	555626, 4883867	WBL	1.5	Solid Stem Auger
BH4	555817, 4883706	EBL	1.5	Solid Stem Auger
BH5	556015, 4883555	WBL	1.5	Solid Stem Auger
East Section (Older)				
BH6	556199, 4883398	EBL	1.5	Solid Stem Auger
BH7	556382, 4883254	WBL	2.1	Solid Stem Auger/SPT
BH8	556599, 4883066	EBL	1.5	Solid Stem Auger
BH9	556806, 4882906	WBL	1.5	Solid Stem Auger
BH10	556996, 4882738	EBL	1.5	Solid Stem Auger
BH11	557215, 4882571	WBL	2.1	Solid Stem Auger/SPT
BH12	557393, 4882419	EBL	1.5	Solid Stem Auger

The boreholes were advanced using a truck-mounted drilling machine equipped with solid stem augers or manual split-spoon penetration testing. Samples were retrieved from the augers of the encountered granular fill and subgrade materials, and at select locations, samples were taken with a 50 mm Outer Diameter (O.D.), split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (ASTM D 1586) method. This sampling method recovers samples from the soil strata, and the number of blows required to drive the samples 300 mm depth into the undisturbed soil (SPT 'N'-values) gives an indication of the compactness condition or consistency of the sampled soil material based on the cohesionless or the cohesive nature of the material, respectively.

Geotech Support Services Inc. performed the drilling, and a qualified WSP geotechnical engineering technician logged and retrieved samples from the borehole. Soil samples were recovered and retained in labeled air-tight containers for

subsequent review by the project engineer and laboratory testing, as required. Asphalt and granular fill material thicknesses were recorded at each borehole location.

The depth to groundwater and/or borehole "cave-in" was measured upon completion of drilling. The borehole was backfilled immediately after completion and reinstated with asphalt.

The borehole log detailing the individual soil profiles are provided in **Appendix B.**

3.3 LABORATORY TESTING PROGRAM

3.3.1 GEOTECHNICAL TESTING

Select soil samples were submitted to WSP's certified soils laboratory for geotechnical testing in accordance with Table 3-2. Geotechnical laboratory test results are presented on the borehole logs in **Appendix B.** A copy of the geotechnical laboratory test results is provided in **Appendix C.**

Table 3-2 Geotechnical Laboratory Testing Summary

Geotechnical Test	Procedure/Methodology	Number of Tests
Moisture Content	LS-701	Twenty-two (22)
Sieve Analysis	LS-602	Eight (8)
Sieve and Hydrometer Analysis	LS-702	Four (4)

4 SUBSURFACE CONDITIONS

4.1 GENERAL

The subsurface conditions encountered at the borehole locations are described in the following sections. The soil descriptions are based on visual and tactile observations and complemented by the results of field and laboratory testing results.

It should be noted that the subsurface conditions and the pavement structure layer thicknesses encountered might vary around and beyond the borehole location.

An overview of subsurface conditions is described below. All depths quoted are below the existing ground surface.

The laboratory result can be found in **Appendix C.**

4.2 SUBSURFACE CONDITIONS

4.2.1 PAVEMENT STRUCTURE THICKNESS

The existing pavement structure encountered was measured and recorded from the advanced boreholes. Based on the visual condition survey and subsurface findings, the road is divided into two (2) sections. The Asphalt and Granular Fill Thicknesses were measured and are presented in the following Tables 4-1 and 4-2:

Table 4-1: Pavement Structure Thickness- Section 1- West Section (Newer)

Borehole ID	Asphalt Thickness (mm)	Granular Fill Thickness (mm)	Total Pavement Structure Thickness (mm)
BH1	120	590	710
BH2	160	610	770
BH3	160	650	810
BH4	140	700	840
BH5	160	270*	430
Minimum	120	590	390
Maximum	160	700	860
Average	150	640	790

*BH5 granular fill thickness has been considered an outlier and as the borehole is located approximately 50 m west of the pavement transition joint.

Table 4-2: Pavement Structure Thickness- Section 2- East Section (Older)

Borehole ID	Asphalt Thickness (mm)	Granular Fill Thickness (mm)	Total Pavement Structure Thickness (mm)
BH6	100	370	470
BH7	100	350	450
BH8	90	340	430
BH9	100	310	410
BH10	90	720	810
BH11	90	670	760
BH12	100	680	780
Minimum	90	310	400
Maximum	100	720	810
Average	95	490	585

4.2.2 GRANULAR FILL MATERIALS

Eight (8) sieve analyses were performed on the granular fill materials sampled from the boreholes, with the results presented in the following Table 4-3:

Table 4-3: Grain Size Distribution - Granular Fill

Borehole ID	Sample ID	% Gradation			Material Description	OPSS 1010 Gradation Acceptance	
		Gravel	Sand	Fines		Granular A	Granular B Type I
BH2	AS1	30	61	9	Gravelly Sand, trace fines	Not Accepted	Acceptable
BH2	AS2	42	37	21	Sandy gravel with fines	Not Accepted	Not Accepted

Borehole ID	Sample ID	% Gradation			Material Description	OPSS 1010 Gradation Acceptance	
		Gravel	Sand	Fines		Granular A	Granular B Type I
BH5	1	31	50	19	Gravelly sand, some fines	Not Accepted	Not Accepted
BH5	AS2	10	47	43	Sand and Fines, some gravel	Not Accepted	Not Accepted
BH8	AS1	37	50	13	Gravelly sand, some fines	Not Accepted	Not Accepted
BH8	AS2	10	33	47	Sand and Fines, some gravel	Not Accepted	Not Accepted
BH11	AS1	33	52	15	Gravelly sand, some fines	Not Accepted	Not Accepted
BH11	AS2	22	54	24	Sand with gravel and fines	Not Accepted	Not Accepted

The moisture content of the encountered granular fill materials ranged between 4 to 11 % with an average of 6%.

The results of the sieve analyses were compared against the gradation requirements in Ontario Provincial Standards and Specifications (OPSS) 1010 for Granular A and Granular B Type I. Generally, the tested samples were found to not meet the requirements of Granular A due to high percentage of finer materials and the samples were found to generally meet most of the requirements of Granular B Type I, but are however considered not acceptable due to excessive fine content.

4.2.3 SUBGRADE MATERIALS

4.2.3.1 SANDY SILT

A deposit of sandy silt was encountered underlying the pavement structure in all the boreholes. This sandy silt deposit was found with to some clay, trace gravel and brown to grey in colour.

Four (4) particle size analyses tests were performed on the encountered sandy silt deposit and the test results are summarized in Table 4-4 below:

Table 4-4: Particle Size Distribution and Atterberg Results - Subgrade Fill

Borehole ID	Sample ID	% Gradation				Soil Description
		Gravel	Sand	Silt	Clay	
BH2	AS3	4	38	44	14	Sandy Silt, some clay, trace gravel
BH5	AS3	1	34	50	15	Sandy Silt, some clay, trace gravel
BH8	AS3	6	39	43	12	Sandy Silt, some clay, trace gravel
BH11	AS3	3	31	42	24	Sandy Silt with clay, trace gravel

The moisture content of the encountered subgrade fill materials ranged between 11 to 18 % with an average of 12%. SPT N-Values from the subgrade were found to range from 4 to 8 blows per 300mm of penetration, corresponding to a firm consistency.

Based on the above particle size distribution, the soil is of low to moderate susceptibility to frost heaving (LSFH-MSFH).

4.3 GROUNDWATER AND CAVE-IN CONDITIONS

Groundwater was not encountered during the investigation and most the boreholes remained open and dry upon completion. Boreholes BH8, BH9, BH10 and BH11 caved between 1.1m to 1.4m below ground surface upon completion of the investigation.

4.4 FROST DEPTH

Following the Frost Penetration Depth of Southern Ontario presented in MTO Pavement Design and Rehabilitation Manual, Second Edition, (MTO, 2013), the Frost depth is 1.4 metres.

5 PAVEMENT DESIGN ANALYSES

5.1 GENERAL

Pavement design analyses was performed using the AASHTO 1993 Pavement Design Methodology and Ontario Ministry of Transportation (MTO) publication MI-183 'Adaption and Verification of AASHTO Pavement Design Guide for Ontario Conditions' and 'Procedures for Estimating Traffic Loads for Pavement Design, 1995'.

Based on the findings from our investigation and laboratory testing, the existing subgrade materials are comprised of sandy silt, found to be in a firm consistency and of low to moderate susceptibility to frost-heave.

AASHTO Design Outputs are presented in **Appendix D.**

5.2 EXISTING PAVEMENT STRUCTURE DESIGN INPUT

Based on the pavement investigation completed by WSP in June 2020, the following pavement structure layer thicknesses will be used for pavement design analysis:

Table 5-1: Selected Pavement Structure Layer Thicknesses - 2nd Line SW

West Section (Newer)		East Section (Older)	
Material Type	**Thickness (mm)**	**Material Type**	**Thickness (mm)**
Asphalt	150	Asphalt	95
Granular Fill	640	Granular Fill	490
Total Pavement Structure	**790**	**Total Pavement Structure**	**585**
Existing SN	**69**	**Existing SN**	**47**

The existing pavement structural number (SN) was calculated using the following layer coefficients:

	West Section (Newer)	East Section (Older)
Material Type	**Coefficient**	
Existing Asphalt	0.27	0.23
Existing Granular Fill	0.05	
Drainage (Granular Fill)	0.9	

5.3 TRAFFIC DATA

Traffic data was provided by WSP Transportation and the traffic inputs selected for the pavement design analysis are presented below in Table 5-2. It should be noted that a growth rate was not applied based on the letter issued by WSP to R.J. Burnside Associates Ltd. on June 30, 2020 titled *NWN Cannabis, 117287 2nd Line SW, Melancthon – Response to Peer Review Comments – Transportation.*

Table 5-2: Adopted Traffic Inputs

Base Year	Average Annual Daily Traffic (AADT)	% Growth	% Truck Vehicles
2020	810	Not Applied	3.5
2022	835	Not Applied	2.7

5.3.1 TRUCK FACTOR

It is understood that the subject road will be used as a haul road during the two (2) phases of construction for the facility and will be used by gravel and concrete trucks. Subsequently, during the operation of the facility, the road will be readily used by 26-foot box trucks.

During construction (2020 – 2022) it is assumed that the primary truck loading will be from 3-axial single unit trucks carrying aggregates (gravel) and twin-steer 4-axle single unit concrete truck. The following vehicles were selected as the maximum vehicle weights based on Ontario Ministry of Transportation's (MTO) Vehicle Weights and Dimension Limits in Ontario (2001):

Vehicle	Steering Axle (kg)	Rear Axle – Loaded (kg)
Standard 3-Axle Single Unit Aggregate Vehicle	9,000 (single)	17,900 (dual)
Twin Steer 4-Axle Unit Vehicle (Concrete Truck)	17,750 (dual)	19,100 (dual)

The Load Equivalency Factor (LEF) is used to determine the Equivalent Single Axle Load (ESAL). The LEF methodology was calculated using the formula's presented on Figure 3.2.1 of MTO's Pavement Design and Rehabilitation Manual (2013):

Standard 3-Axle Single Unit Aggregate Vehicle	Twin Steer 4-Axle Unit Vehicle (Concrete Truck)
Steering Axle LEF = $0.004836 \times Load^{2.9093} = 2.89$ Tandem Axle LEF = $0.001515 \times Load^{2.5403} = 2.31$ LEF Total = 5.2 ESALs	Tandem Axle LEF = $0.001515 \times Load^{2.5403} = 2.26$ Tandem Axle LEF = $0.001515 \times Load^{2.5403} = 2.72$ LEF Total = 5.0 ESALs

Where: Load = Loaded weight of vehicle in tons.

Considering that the percent distribution between aggregate and concrete trucks are roughly 50/50, the average LEF of 5.1 was selected as the design truck factor for years 2020-2022.

Beyond year 2022 (following construction), the following Table 5-3 shows the estimates used to calculate the truck factor taken from MTO's MI-183 (Table D-2 and D-4) for rural collector and local roads with the required adjustments to capture the nature of the traffic conditions present at this location (i.e. operational traffic), as reference above.

Table 5-3: Truck Factor

Truck Category	Average Truck Distribution (%)	Typical Truck Factor	Resultant Truck Factor Fraction
2 and 3-axle	80	0.5	0.4
4-axle	12	2.3	0.27
5-axle	6	1.6	0.1
6-axle	2	5.5	0.1
Total Truck Factor			**0.9**

5.4 EQUIVALENT SINGLE AXLE LOADS

The input parameters used to calculate Equivalent Singe Axle Loads (ESALS) and the resultant ESALs are presented in the table below.

Table 5-4: ESAL Design Inputs

Base Year	Design Period	AADT	% Growth	% Commercial	Truck Factor	DD	LD	Cumulative ESALS
2020	2 yrs	810	N/A	3.5	5.1	0.5	1.0	52,775
2022/2026	18 yrs	835	N/A	2.7	0.9	0.5	1.0	66,655
20-Design Life Cumulative ESALs								119,430

5.5 AASHTO DESIGN ANALYSIS – NEW FLEXIBLE PAVEMENT

An analysis was performed to determine the structural number (SN) required for a flexible pavement structure to provide 2-year design life during construction and then for a subsequent 18-year design life considering the truck traffic during facility operations. Design input parameters are shown in Table 5.5.

Table 5-5: Input Parameters for New Flexible Pavement Structure

Design Parameter	Value	Layer Material Type	Value
Mean Soil Resilient Modulus (MPa)	25	New Hot-Mix Asphalt Structural Coeff.	0.42
Reliability Level (%)	85	New Granular A Structural Coeff.	0.14
Overall Standard Deviation	0.44	New Granular B Type I Structural Coeff.	0.09
Initial Serviceability	4.2	Pulverized Base Coeff.	0.12
Terminal Serviceability	2.0	Existing Granular Fill Coeff.	0.05
Design Serviceability Loss	4.2-2.0=2.2	Drainage Coefficient – Base/Subbase	1.0

The results of the pavement design analysis indicate the target SN required to support the construction truck traffic over the period of 2020 to 2022 is 67 mm. The target SN required to support the existing predicted AADT and facility operation truck tracking over the period of 2022 to 2040 or 2026 to 2044 is 69 mm. The target SN over the total 20-year design period from 2020 to 2040 is 76 mm.

The minimum required pavement structure for a 20-year design period based on the AASTHO method and the above input parameters are presented in Table 5.6.

Table 5-6: Minimum Pavement Structure Layer Thicknesses - AASHTO 20 Year Design Life (Flexible)

Material Type	Thickness (mm)
Hot-Mix Asphalt	100
Granular Base - Granular A	150
Granular Subbase - Granular B Type I	150
Total Pavement Structure	**400**

It should be noted that the above pavement structures provide the **minimum** layer thickness to meet the target structural number and does not account for deep-strength asphalt typical of trucking routes and the frost-susceptibility of subgrade soils.

5.6 PAVEMENT REHABILITATION STRATEGY

5.6.1 R.J. BURNSIDE ROAD MANAGEMENT PLAN - PROPOSED REHABILITATION STRATEGY

It is our understanding from the Road Management Plan (RMP) prepared by R.J. Burnside Associates Ltd. in October 2019, and an email response to follow-up questions from July 2020, that the proposed pavement rehabilitation strategy for this section of 2nd Line SW, considering the higher AADT and truck traffic volumes, is to pulverize the existing asphalt and granular in accordance with OPSS 330, pad 100 mm of Granular A and pave two (2) lifts of asphalt (40 mm HL3 and 60mm HL4). The road rehabilitation under the RMP is scheduled for year 2026.

It is assumed that the pulverization depth accounts for 50/50 blend of existing asphalt with existing granular material. Also, it's assumed that the road profile can be adjusted appropriately to meet existing grade raise restrictions and approximately 50 mm thick of shouldering will be completed to reduce the overall grade raise and save costs. Utilizing the abovementioned rehabilitation strategy, the resultant structural number is as follows for the two (2) sections, providing greater than 20-years design life under the AASHTO methodology.

Table 5-7: Planned Rehabilitation of Pavement Structure Layer Thicknesses - 2nd Line SW

West Section (Newer)		East Section (Older)	
Material Type	**Thickness (mm)**	**Material Type**	**Thickness (mm)**
New Hot-Mix Asphalt	100	New Hot-Mix Asphalt	100
New Granular A	100	New Granular A	100
Pulverized Base	200	Pulverized Base	100
Existing Granular Fill (Remaining)	490	Existing Granular Fill (Remaining)	385
Total Pavement Structure	**890**	**Total Pavement Structure**	**685**
Rehabilitated SN	**100**	**Rehabilitated SN**	**84**
Design Life	**20+**	**Design Life**	**20+**

5.6.2 INTERIM PAVEMENT REHABILITATION STRATEGY

Based on the findings from our investigation, and considering the future traffic use of the road, an interim rehabilitation strategy consisting of resurfacing with two (2) lifts of asphalt for a total thickness of 100 mm of new hot-mix asphalt was

evaluated. The resultant structural number, and calculated AASHTO design life for 2020-2022 and 2022-2040 are presented below.

Table 5-8: Interim Rehabilitation of Pavement Structure Layer Thicknesses - 2nd Line SW

West Section (Newer)		East Section (Older)	
Material Type	**Thickness (mm)**	**Material Type**	**Thickness (mm)**
New Hot-Mix Asphalt	100	New Hot-Mix Asphalt	100
Existing Asphalt	60	Existing Asphalt	0
Existing Granular Fill	640	Existing Granular Fill	490
Total Pavement Structure	**800**	**Total Pavement Structure**	**590**
Rehabilitated SN	**87**	**Rehabilitated SN**	**64**
Design Life (yrs) (2020 - 2022 ESALS)	**20+**	**Design Life (yrs) (2020 - 2022 ESALS)**	**1.5**
Design Life (yrs) (2022+ ESALS)	**20+**	**Design Life (yrs) (2022+ ESALS)**	**10**

A minor grade raise is anticipated using the above strategy.

5.7 LIFECYCLE COST ANALYSIS

The lifecycle cost analysis model is the simplified LCCA method developed by the Ministry of Transportation. The model used representative cost-per-unit analysis to determine an estimated initial capital expenditure followed by rehabilitation and maintenance costs over a 30-year time horizon over the project limits; 2800 metres of two-lane pavement with total pavement width of 6.5 m for an approximate total area of 18,200 m^2. A discount rate of 5% was used and capital expenditures were adjusted using the present-worth method for proposed rehabilitation strategy.

The model used representative cost-per-unit analysis to determine an estimated initial capital expenditure followed by rehabilitation and maintenance costs over a 30-year time horizon.

Life-cycle analyses were performed to confirm whether the planned maintenance and resurfacing work is sufficient, or whether the timing or extent of such work should be modified. Three (3) scenarios were evaluated and are described as follows:

- Scenario #1: Major Rehabilitation of entire road section in 2020 by proposed pulverize and pave strategy;
- Scenario #2: Interim Rehabilitation of eastern section in 2020 by remove 100mm and pave 100 mm strategy (to improve road for construction traffic). Subsequently in 2022, rehabilitate entire road section by proposed pulverize and pave; or
- Scenario #3: Interim Rehabilitation of entire road section in 2020 as by remove 100mm and pave 100mm strategy (to improve road for construction traffic), and then maintain a resurfacing program of 100 mm for the road, in lieu of pulverize and pave strategy.

Summary of the life-cycle cost analysis is presented in Table 5.9 below.

Table 5-9: Life-Cycle Cost Analysis and Summary

Rank	Scenario	Design Life	Initial Estimated Construction Cost	Estimated 30 Year Lifecycle Cost	Cost Differential Between Scenarios
1	Scenario 1	20+ for full road section	$453,950	$656,460	-
2	Scenario 2	2 years for full road, after 2022 20+ years for western and 10 years for eastern section	$277,300	$831,350	+27%
3	Scenario 3	20+ for western section, 2 years for eastern section, after 2022 20+years for for western and 10 years for eastern	$440,475	$957,350	+46%

Based on a lifecycle cost analyses, Scenario#1 is the most cost-effective option over this time horizon, with Scenario 2 and 3 life-cycle costs calculated to be 27 and 46% greater, respectively.

Detailed LCCA costing and breakdown is available in **Appendix D** of this report.

6 DISCUSSIONS

6.1 GENERAL

Based on information on our current understanding of the project requirements, the following sections provide discussions on the road impact from the forecasted construction and operation truck traffics.

6.2 EXISTING PAVEMENT LOAD CAPACITY AND SERVICE LIFE

The required SN for the 2-year haul road operations was calculated to be 67 mm. The existing west section (newer) and east section (older) road sections, have an estimated existing structural number of 69 mm and 48 mm, respectively, which correspond to an AASHTO remaining service life of 6-years and 0-years, under the projected traffic conditions outlined above.

The existing western section is in good condition, and the existing asphalt and granular fill materials were determined to be structurally sufficient to carry the future estimated traffic volumes for 2-years of haul road operations, and overall design life of 6-years. This section of 2nd Line SW can be rehabilitated in 2026.

The existing eastern section is in fair condition with localized poor areas, and the existing asphalt and granular fill thicknesses were found to be thinner than the west section, and it was determined that the east section of the project road is insufficient to carry the projected traffic volumes including the anticipated construction traffic. Rehabilitation of this section will improve the structural capacity of the road and improve rideability/serviceability of the road during construction of the facility.

6.3 REHABILITATION COST

The life-cycle cost analyses revealed that the most cost-effective scenario is to perform a major rehabilitation consisting pulverization and paving of two (2) lifts of new asphalt. Due to the high design life for this rehabilitation strategy over the 30-year life-cycle period, major rehabilitation works are not anticipated. For this scenario, the initial cost is high but the estimated maintenance costs are relatively low over the 30-year period. Whereas for the other scenarios, the lower design

life for the initial rehabilitation would require multiple minor or major rehabilitation over the 30-year period. Despite having lower initial construction costs, the overall life-cycle costs can be significantly greater.

6.4 RECOMMENDATIONS

Based on the visual condition survey, subsurface findings, pavement design analyses, and life-cycle cost analyses, it is determined that interim pavement rehabilitation along 2nd Line SW is not required. The proposed pulverize and pave rehabilitation strategy should be moved up and ideally be completed after the construction of the facility (i.e. after year 2022). This strategy is considered suitable considering it will increase the granular fill thickness and provide for uniform pavement layers. Also, this strategy will strengthen the road pavement and it will be able to support future traffic loading from the operation of the Cannabis Facility.

From 2020 to 2022, this section of 2nd Line SW will experience construction traffic and the existing western section was found to be structurally adequate and the eastern section was found to be structurally deficient to carry the projected construction traffic loads. With an understanding that there will be a lower acceptability for rideability/serviceability during the construction period 2020-2022, the interim rehabilitation is a costly effort to address a short-term construction period. The eastern section is in fair visual condition and despite the high severity distressing it may experience from the construction traffic, it is more beneficial to carry out major rehabilitation work after the construction activities.

Considering the frequent truck traffic that will be experienced during the operation of the facility, it is recommended that the asphalt mixes are upgraded to HL1 for the surface course and Heavy Duty Binder Course (HDBC) for the binder course.

The recommended rehabilitation strategy for 2nd Line SW in 2022 (after construction) is as follows:

- Pulverize 300 mm depth in western section and 200 mm depth in eastern section, and blade-off 100 mm for use for 50 mm depth shouldering;
- Pad 100 mm thickness of Granular A (OPSS 1010) and compacted to 100% Standard Proctor Maximum Dry Density (SPMDD);
- Pave 60 mm HDBC Binder Course Hot-Mix Asphalt (OPSS 1150) and compacted to 92% of Maximum Dry Density (MRD);
- Place SS-1 Tack Coat;
- Pave 40 mm HL1 Surface Course Hot-Mix Asphalt (OPSS 11150) and compacted to 92% MRD.

The above pavement strategy will result in an approximate grade raise of 100 mm.

7 LIMITATIONS

The comments given in this report are intended for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., may be greater than has been carried out for current purposes. Contractors bidding on or undertaking the work shall, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

Information in this report shall not be used by third parties without WSP's permission. We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact us.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact us.

FIGURES

Legend

Approximate BH Location

Client:	NWN Inc.			Drawing No:	1
Drawn:	MA	Approved:	MN	Title:	BOREHOLE LOCATION PLAN -
Date:	1-Jul-20	Scale:	N.T.S	Project:	Pavement Investigation - 2nd Line SW Road Impact Study for Cannabis Facility, 117287 2nd Ln SW
Original Size:	Letter	Rev:	N/A		wsp

Legend

Approximate BH Location

Client:	NWN Inc.			Drawing No:	2
Drawn:	MA	Approved:	MN	Title:	BOREHOLE LOCATION PLAN -
Date:	1-Jul-20	Scale:	N.T.S	Project:	Pavement Investigation - 2nd Line SW Road Impact Study for Cannabis Facility, 117287 2nd Ln SW
Original Size:	Letter	Rev:	N/A		

APPENDIX

A SITE PHOTOGRAPHS

Site Photos – 2nd Line SW

Road Impact Study - Cannabis Facility, 117287 2nd Ln SW

Project #: 19M-00524-00

Photo 1: West limit, looking East. 2nd Line SW at proposed Cannabis Facility Entrance. Slight coarse aggregate loss, slight flushing and slight segregation.

Photo 2: Location of BH 2, looking East. Slight coarse aggregate loss, slight flushing and slight segregation.

Site Photos – 2nd Line SW

Road Impact Study - Cannabis Facility, 117287 2nd Ln SW

Project #: 19M-00524-00

Photo 3: Location of BH 4, looking West. Slight coarse aggregate loss, slight flushing and slight segregation.

Photo 4: Pavement transition west of 117185 2nd Line SW, looking North. Poor construction joint (rough transition), slight coarse aggregate loss, moderate distortions, and moderate transverse cracking (east side of pavement joint).

Site Photos – 2nd Line SW

Road Impact Study - Cannabis Facility, 117287 2nd Ln SW

Project #: 19M-00524-00

Photo 5: Location of BH 6, looking East. Moderate centerline joint cracking, slight to moderate transverse and longitudinal cracking, slight random cracking, slight wheel-path rutting and cracking, slight pavement edge cracking.

Photo 6: At water-course crossing (west of BH 7), looking North-East. Moderate centerline joint cracking, moderate transverse cracking, slight random cracking, and slight distortions.

Site Photos – 2nd Line SW

Road Impact Study - Cannabis Facility, 117287 2nd Ln SW

Project #: 19M-00524-00

Photo 7: Location of BH 7, looking East. Moderate wheel-path rutting and cracking, slight centerline joint cracking and slight flushing

Photo 8: Location of BH 10, looking East. Slight to moderate wheel-path rutting and cracking and slight coarse aggregate loss.

Site Photos – 2nd Line SW

Road Impact Study - Cannabis Facility, 117287 2nd Ln SW

Project #: 19M-00524-00

Photo 9: Location of BH 11, looking West. Moderate wheel-path rutting and cracking, slight coarse aggregate loss and slight pavement edge cracking.

Photo 10: Approximately 100m E from BH11, looking East. Moderate wheel-path rutting and cracking, moderate to severe alligator cracking, severe ravelling and coarse aggregate loss, and moderate potholing.

Photo 11: East of BH 12, looking West. Severe ravelling and coarse aggregate loss, severe segregation, and severe distortions/settlement of manual asphalt patches.

Photo 12: East Limit, looking North. 2nd Line SW meets County Road 17. Moderate construction joint cracking, slight to moderate distortions, slight to moderate ravelling and coarse aggregate loss, slight pavement edge cracking and slight flushing.

APPENDIX

B

BOREHOLE LOGS

wsp

LOG OF BOREHOLE BH1

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 1

BH LOCATION: Melancthon, ON N 555240 E 4884175

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) (20 40 60 80 100)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (w_P w w_L) WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m							GR SA SI CL
	Ground Surface											
0.0	**ASPHALT (120 mm)**											
0.1	**BASE (330mm):** Gravelly sand, brown, moist		1	AS					o			
0.5	**SUBBASE (260mm):** Sandy gravel, some silt, brown, moist		2	AS					o			
0.7	**SANDY SILT:** some clay, trace gravel, dark brown, moist		3	AS					o			
1.5	**END OF BOREHOLE** Notes: 1) Borehole was open and dry upon completion											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3 Numbers refer to Sensitivity; O ε=3% Strain at Failure

wsp

LOG OF BOREHOLE BH2

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 2

BH LOCATION: Melancthon, ON N 555430 E 4884017

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: 'N' BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa): o UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT (160 mm)**											
0.2	**BASE (220mm):** Gravelly sand, trace silt, dark brown, moist		1	AS					o			30 61 (9)
0.4	**SUBBASE (390mm):** Sandy gravel with silt, brown, moist		2	AS					o			42 37 (21)
0.8	**SANDY SILT:** some clay, trace gravel, dark brown, moist		3	AS					o			4 38 44 14
			4	SS	15				o			
2.1	**END OF BOREHOLE** Notes: 1) Borehole was open and dry upon completion											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3 ×3 Numbers refer to Sensitivity; o ε=3% Strain at Failure

wsp

LOG OF BOREHOLE BH3

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 3

BH LOCATION: Melancthon, ON N 555626 E 4883867

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) O UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) kPa	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m							GR SA SI CL
0.0	Ground Surface **ASPHALT (160 mm)**											
0.2	**BASE (220mm):** Gravelly sand, trace silt, dark brown, moist		1	AS					o			
0.4	**SUBBASE (430mm):** Sandy gravel, some silt, brown, moist		2	AS					o			
0.8	**SANDY SILT:** some gravel, trace clay, dark brown, moist		3	AS					o			
1.5	**END OF BOREHOLE** Notes: 1) Borehole was open and dry upon completion											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3$, $\times^3$ Numbers refer to Sensitivity; O $^{\varepsilon=3\%}$ Strain at Failure

wsp

LOG OF BOREHOLE BH4

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 4

BH LOCATION: Melancthon, ON N 555817 E 4883706

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) o UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE 20 40 60 80 100	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
Ground Surface											
0.0	**ASPHALT (140 mm)**										
0.1	**BASE (330mm):** Gravelly sand, dark brown, moist		1	AS					o		
0.5	**SUBBASE (370mm):** Sandy Gravel, lightbrown, moist		2	AS					o		
0.8	**SANDY SILT:** some clay, grey, moist		3	AS					o		
1.5	**END OF BOREHOLE** Notes: 1) Borehole was open and dry upon completion										

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3$, $\times^3$ Numbers refer to Sensitivity; $o^{\varepsilon=3\%}$ Strain at Failure

wsp

LOG OF BOREHOLE BH5

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 5

BH LOCATION: Melancthon, ON N 556015 E 4883555

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)				
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m							GR	SA	SI	CL
Ground Surface															
0.0	**ASPHALT (160 mm)**														
0.2	**BASE (270mm):** Gravelly sand, some silt, dark brown, moist		1	AS					○			31	50		(19)
0.4	**FILL:** Sand and silt, some gravel, light brown, moist		2	AS					○			10	47		(43)
0.7	**SANDY SILT:** some clay, trace gravel, dark brown, moist		3	AS					○			1	34	50	15
1.5	**END OF BOREHOLE** Notes: 1) Borehole was open and dry upon completion														

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES +3, ×3 Numbers refer to Sensitivity ○ ε=3% Strain at Failure

wsp

LOG OF BOREHOLE BH6

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 6

BH LOCATION: Melancthon, ON N 556199 E 4883398

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L / WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Ground Surface **ASPHALT (100 mm)**										
0.1	**BASE (370mm):** Gravelly sand, dark brown, moist		1	AS					○		
0.5	**FILL:** Sand and silt, some gravel, light brown, moist		2	AS					○		
0.8	**SANDY SILT:** some clay, trace gravel, dark brown, moist		3	AS					○		
1.5	**CLAYEY SILT:** with Sand, trace gravel, brown, wet		4	SS	7				○		
2.1	**END OF BOREHOLE** Notes: 1) Borehole was open and dry upon completion										

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3$, $\times^3$ Numbers refer to Sensitivity ○ $^{\varepsilon=3\%}$ Strain at Failure

wsp

LOG OF BOREHOLE BH7

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 7

BH LOCATION: Melancthon, ON N 556382 E 4883254

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) O UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m							GR SA SI CL
0.0	Ground Surface **ASPHALT (100 mm)**											
0.1	**BASE (350mm):** Gravelly sand, dark brown, moist		1	AS					o			
0.5	**SANDY SILT:** some clay, trace gravel, dark brown, moist		2	AS					o			
			3	AS					□			
1.5	**END OF BOREHOLE** Notes: 1) Borehole was open and dry upon completion											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$ $\times^3$ Numbers refer to Sensitivity; O $^{\varepsilon=3\%}$ Strain at Failure

wsp

LOG OF BOREHOLE BH8

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

PROJECT LOCATION: 2nd Ln SW, Melancthon

DATUM: Geodetic

BH LOCATION: Melancthon, ON N 556599 E 4883066

Method: Solid Stem Auger

Diameter: 152.4 mm

Date: Jun/12/2020 to Jun/12/2020

REF. NO.: 19M-00524-00

ENCL NO.: 8

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) (20 40 60 80 100) O UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV / DEPTH	DESCRIPTION Ground Surface	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m							GR SA SI CL
0.0	**ASPHALT (90 mm)**											
0.1	**BASE (340mm):** Gravelly sand, some fines, dark brown, moist		1	AS								37 50 (13)
0.4	**SANDY SILT:** some clay, trace gravel, dark brown, moist		2	AS								10 33 (47)
			3	AS								6 39 43 12
1.5	**END OF BOREHOLE** Notes: 1) Borehole was caved to 1.25m below ground surface and dry upon completion											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3$, $\times^3$ Numbers refer to Sensitivity; O $^{\varepsilon=3\%}$ Strain at Failure

WSP

LOG OF BOREHOLE BH9

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 9

BH LOCATION: Melancthon, ON N 556806 E 4882906

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) O UNCONFINED, + FIELD VANE & Sensitivity, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"							GR SA SI CL
	Ground Surface											
0.0	**ASPHALT (100 mm)**											
0.1	**BASE (310mm):** Gravelly sand, brown, moist		1	AS								
0.4	**SANDY SILT:** some clay, trace gravel, dark brown, moist		2	AS								
			3	AS								
1.5	**END OF BOREHOLE** Notes: 1) Borehole was caved to 1.15m below ground surface and dry upon completion											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3$ $\times^3$ Numbers refer to Sensitivity $O^{\varepsilon=3\%}$ Strain at Failure

wsp

LOG OF BOREHOLE BH10

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 10

BH LOCATION: Melancthon, ON N 556996 E 4882738

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) O UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m 'N'							GR SA SI CL
	Ground Surface											
0.0	**ASPHALT (90 mm)**											
0.1	**BASE (350mm):** Gravelly sand, brown, dry		1	AS								
0.4	**SUBBASE (370mm):** Sand with gravel and silt, brown, moist		2	AS								
0.8	**SANDY SILT:** some clay, trace gravel, dark brown, moist		3	AS								
1.5	**END OF BOREHOLE** Notes 1) Borehole was caved to 1.1m below ground surface and dry upon completion											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3$, $\times^3$ Numbers refer to Sensitivity; O $^{\varepsilon=3\%}$ Strain at Failure

wsp

LOG OF BOREHOLE BH11

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 11

BH LOCATION: Melancthon, ON N 557215 E 4882571

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) O UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m							GR SA SI CL
0.0	**ASPHALT (90 mm)**											
0.1	**BASE (360mm):** Gravelly sand, some silt, brown, moist		1	AS								33 52 (15)
0.5	**SUBBASE (310mm):** Sand with gravel and silt, brown, moist		2	AS					o			22 54 (24)
0.8	**SANDY SILT:** With clay, trace gravel, dark brown to brown, moist, stiff		3	AS					o			3 31 42 24
1			4	SS	10							
2.1	**END OF BOREHOLE** Notes: 1) Borehole was caved to 1.1m below ground surface and dry upon completion											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$ Numbers refer to Sensitivity; O $^{\varepsilon=3\%}$ Strain at Failure

wsp

LOG OF BOREHOLE BH12

PROJECT: Pavement Investigation for 2nd Line SW Road Impact Study

CLIENT: NWN Inc.

Method: Solid Stem Auger

PROJECT LOCATION: 2nd Ln SW, Melancthon

Diameter: 152.4 mm

REF. NO.: 19M-00524-00

DATUM: Geodetic

Date: Jun/12/2020 to Jun/12/2020

ENCL NO.: 12

BH LOCATION: Melancthon, ON N 557394 E 4882421

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS 0.3 m 'N'	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) O UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Ground Surface											
0.0	**ASPHALT (100 mm)**											
0.1	**BASE (350mm):** Gravelly sand, brown, moist		1	AS								
0.5	**SUBBASE (330mm):** Sand with gravel, trace silt, brown, moist		2	AS								
0.8	**SANDY SILT:** With clay, trace gravel, dark brown to brown, moist		3	AS								
1.5	**END OF BOREHOLE** Notes: 1) Borehole was open and dry upon completion											

GROUNDWATER ELEVATIONS

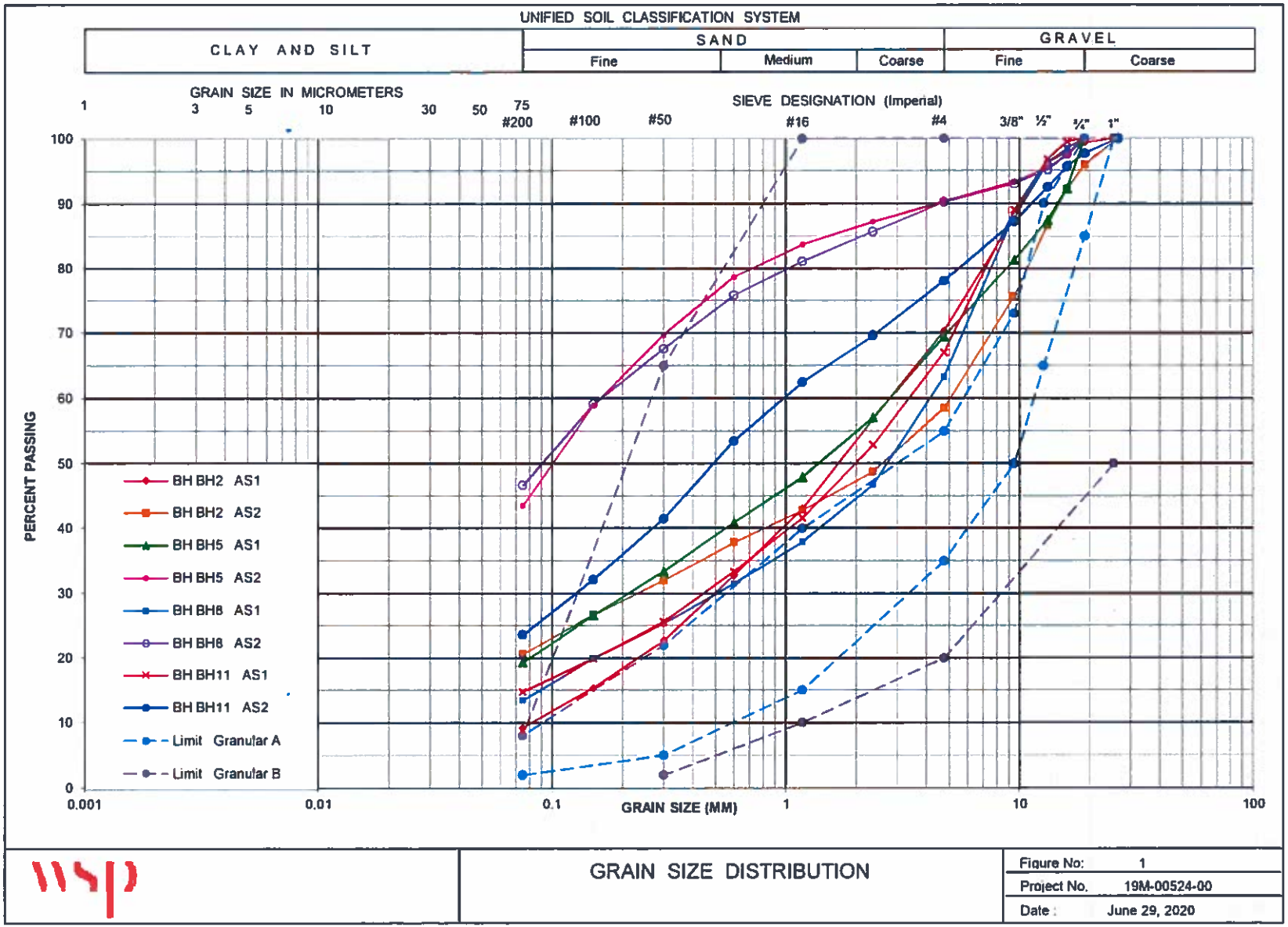
Measurement 1st 2nd 3rd 4th

GRAPH NOTES $+^3$, $\times^3$ Numbers refer to Sensitivity; $O^{\varepsilon=3\%}$ Strain at Failure

APPENDIX

C

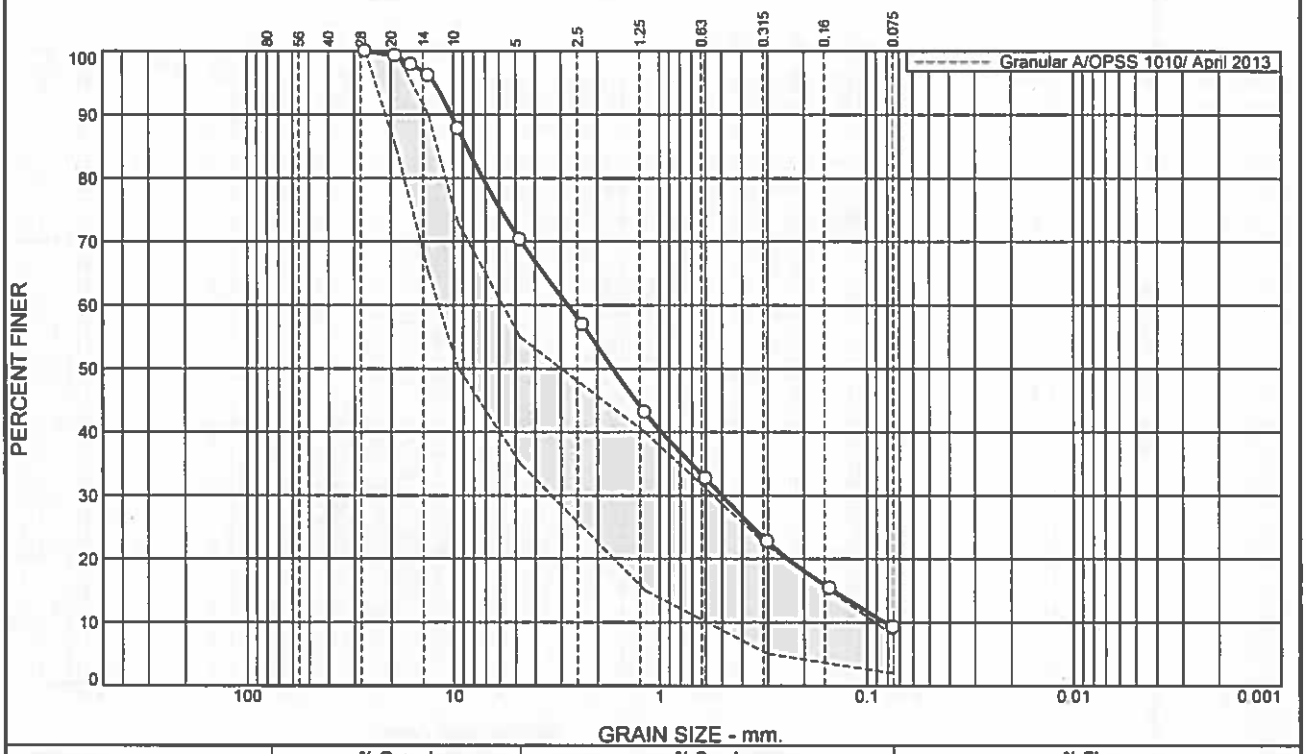
GEOTECHNICAL LABORATORY TEST RESULTS



GRAIN SIZE DISTRIBUTION

Figure No:	1
Project No.	19M-00524-00
Date :	June 29, 2020

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	1	29	16	26	19	9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
26.50	100	100	
19.00	99	85 - 100	
16.00	98		
13.20	96	65 - 90	X
9.50	88	50 - 73	X
4.75	70	35 - 55	X
2.36	57		
1.18	43	15 - 40	X
0.60	33		
0.300	23	5 - 22	X
0.150	15		
0.075	9.2	2.0 - 8.0	X

* Granular A/OPSS 1010/ April 2013

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.2370 D_{85}= 8.6447 D_{60}= 2.7736
D_{50}= 1.6812 D_{30}= 0.5015 D_{15}= 0.1447
D_{10}= 0.0822 C_u= 33.75 C_c= 1.10

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH2_AS1

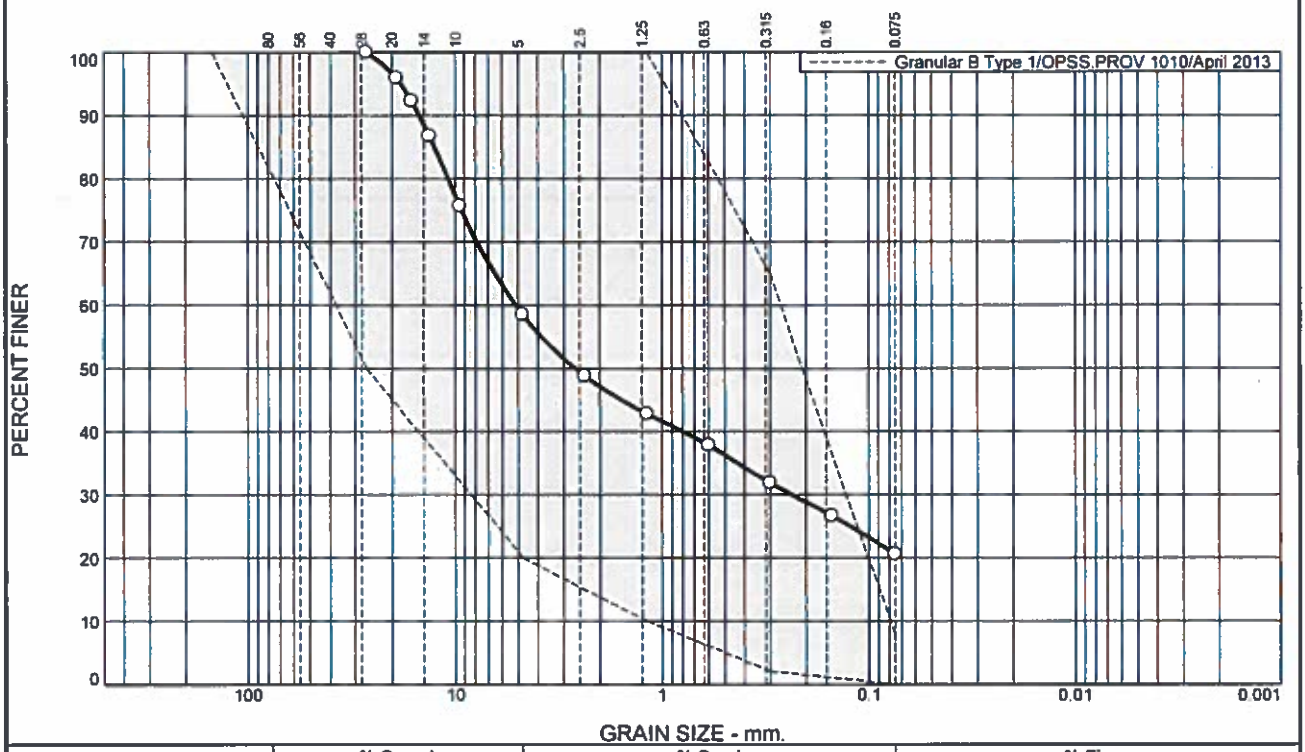
Date: June 21, 2020

WSP CCIL

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW
Project No: 19M-00524-00 **Figure** BH2_AS1

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	4	38	11	12	14	21	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
26.50	100	50 - 100	
19.00	96		
16.00	92		
13.20	87		
9.50	76		
4.75	58	20 - 100	
2.36	49		
1.18	43	10 - 100	
0.600	38		
0.300	32	2 - 65	
0.150	27		
0.075	21	0.0 - 8.0	X

* Granular B Type 1/OPSS.PROV 1010/April 2013

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 14.7100 D_{85}= 12.5225 D_{60}= 5.1473
D_{50}= 2.6400 D_{30}= 0.2348 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH2_AS2

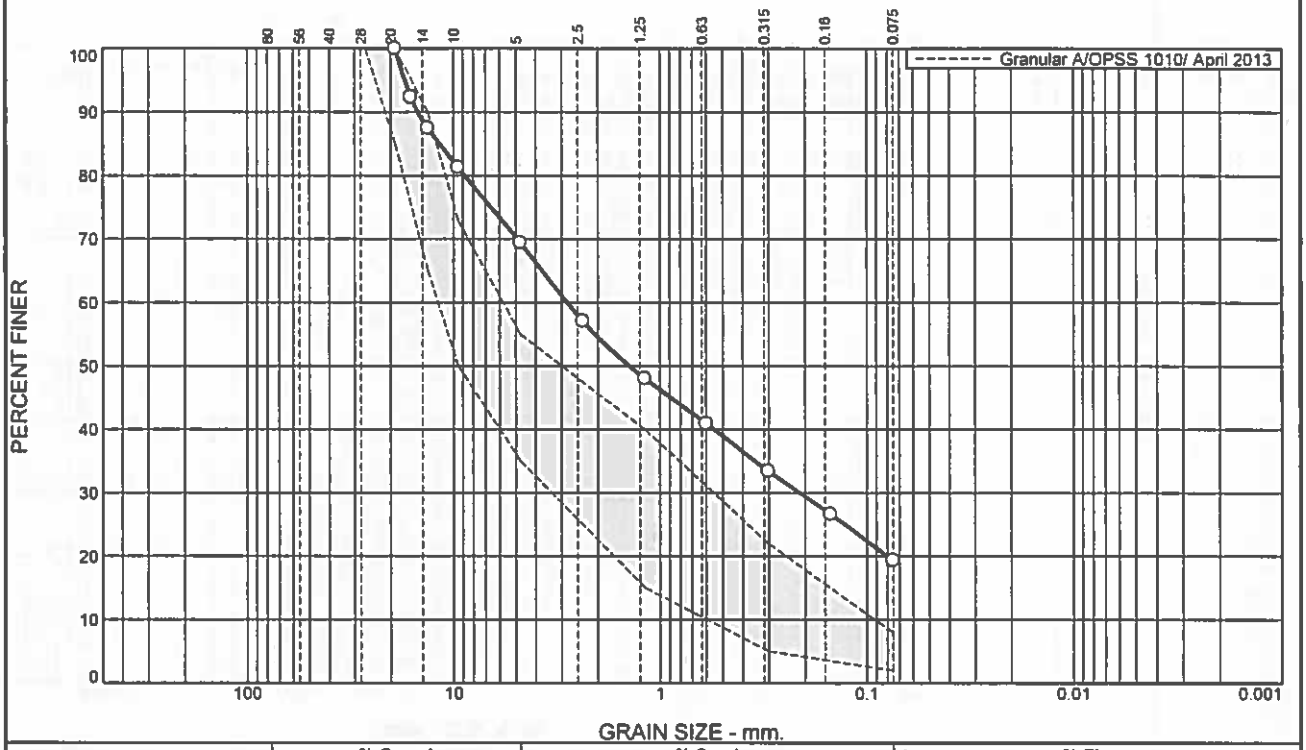
Date: June 21, 2020

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW

Project No: 19M-00524-00 **Figure** BH2 AS2

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	31	14	18	18	19	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19.00	100	85 - 100	
16.00	92		
13.20	87	65 - 90	
9.50	81	50 - 73	X
4.75	69	35 - 55	X
2.36	57		
1.18	48	15 - 40	X
0.60	41		
0.300	33	5 - 22	X
0.150	27		
0.075	19	2.0 - 8.0	X

* Granular A/OPSS 1010/ April 2013

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 14.8177 D_{85}= 11.6220 D_{60}= 2.8156
D_{50}= 1.4041 D_{30}= 0.2123 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

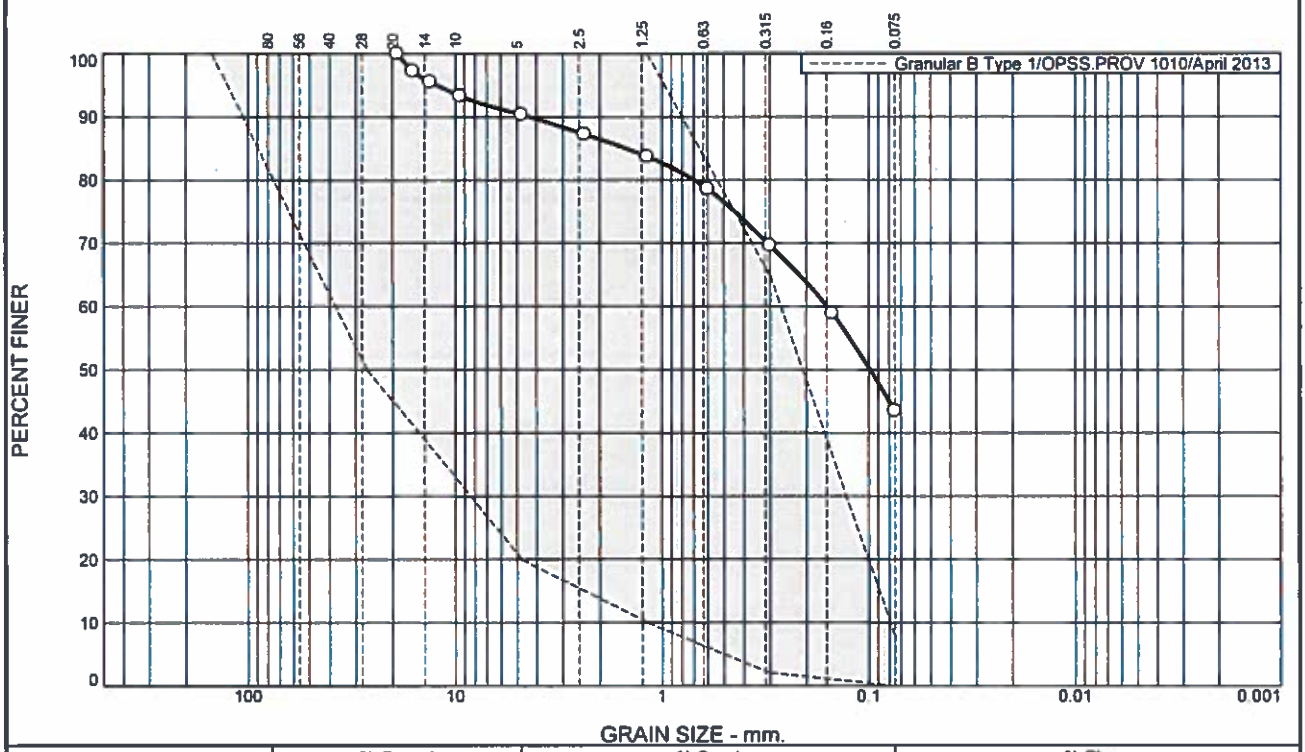
Source of Sample: Site Drilling
Sample Number: BH5_AS1

Date: June 21, 2020

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW
Project No: 19M-00524-00 **Figure** BH5_AS1

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	10	4	12	31	43	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19.00	100		
16.00	97		
13.20	96		
9.50	93		
4.75	90	20 - 100	
2.36	87		
1.18	84	10 - 100	
0.600	79		
0.300	70	2 - 65	X
0.150	59		
0.075	43	0.0 - 8.0	X

* Granular B Type 1/OPSS PROV 1010/April 2013

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.3613 D_{85}= 1.4969 D_{60}= 0.1592
D_{50}= 0.0987 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH5_AS2

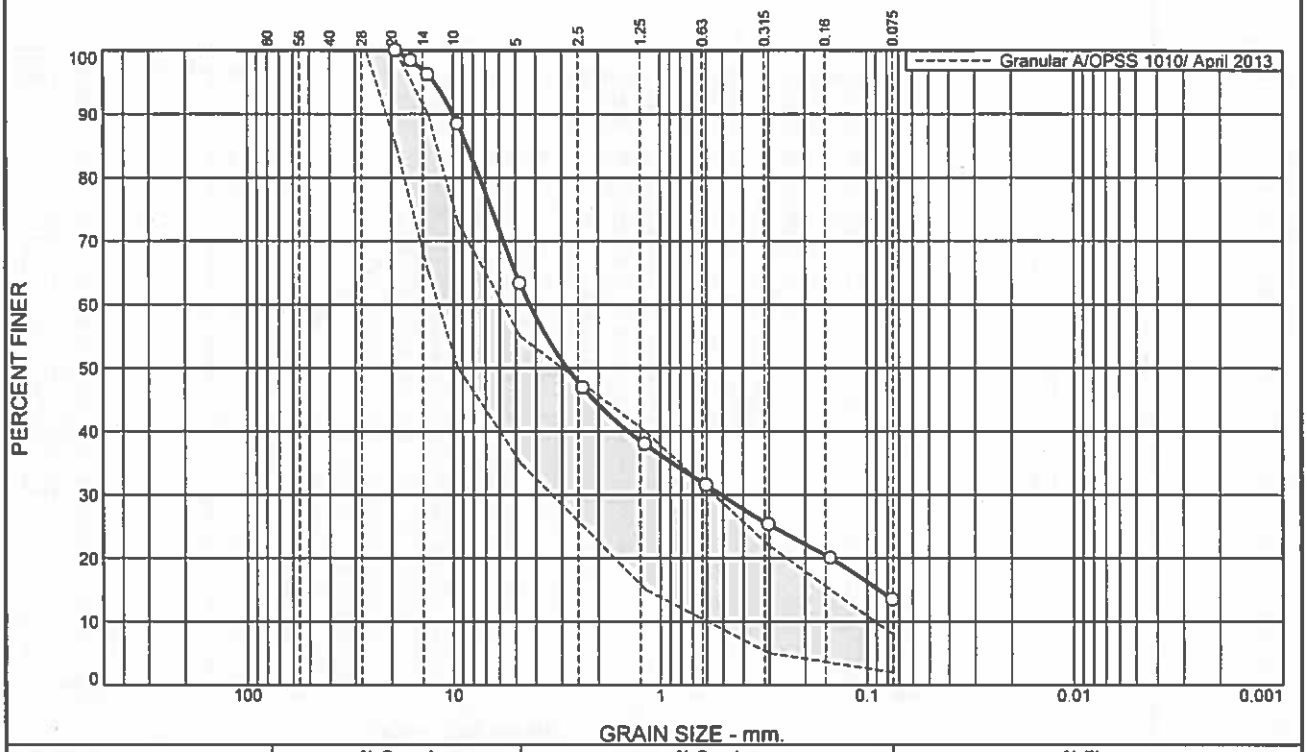
Date: June 21, 2020

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW

Project No: 19M-00524-00 **Figure** BH5_AS2

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	37	19	16	15	13	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19.00	100	85 - 100	
16.00	98		
13.20	96	65 - 90	X
9.50	88	50 - 73	X
4.75	63	35 - 55	X
2.36	47		
1.18	38	15 - 40	
0.60	31		
0.300	25	5 - 22	X
0.150	20		
0.075	13	2.0 - 8.0	X

* Granular A/OPSS 1010/ April 2013

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.0183 D_{85}= 8.5624 D_{60}= 4.2806
D_{50}= 2.8221 D_{30}= 0.5115 D_{15}= 0.0881
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH8_AS1

Date: June 21, 2020

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW

Project No: 19M-00524-00 **Figure** BH8_AS1

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	10	5	13	25	47	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19.00	100		
16.00	98		
13.20	95		
9.50	93		
4.75	90	20 - 100	
2.36	86		
1.18	81	10 - 100	
0.600	76		
0.300	68	2 - 65	X
0.150	59		
0.075	47	0.0 - 8.0	X

* Granular B Type 1/OPSS PROV 1010/April 2013

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 4.5579 D_{85}= 2.1391 D_{60}= 0.1592
D_{50}= 0.0887 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH8_AS2

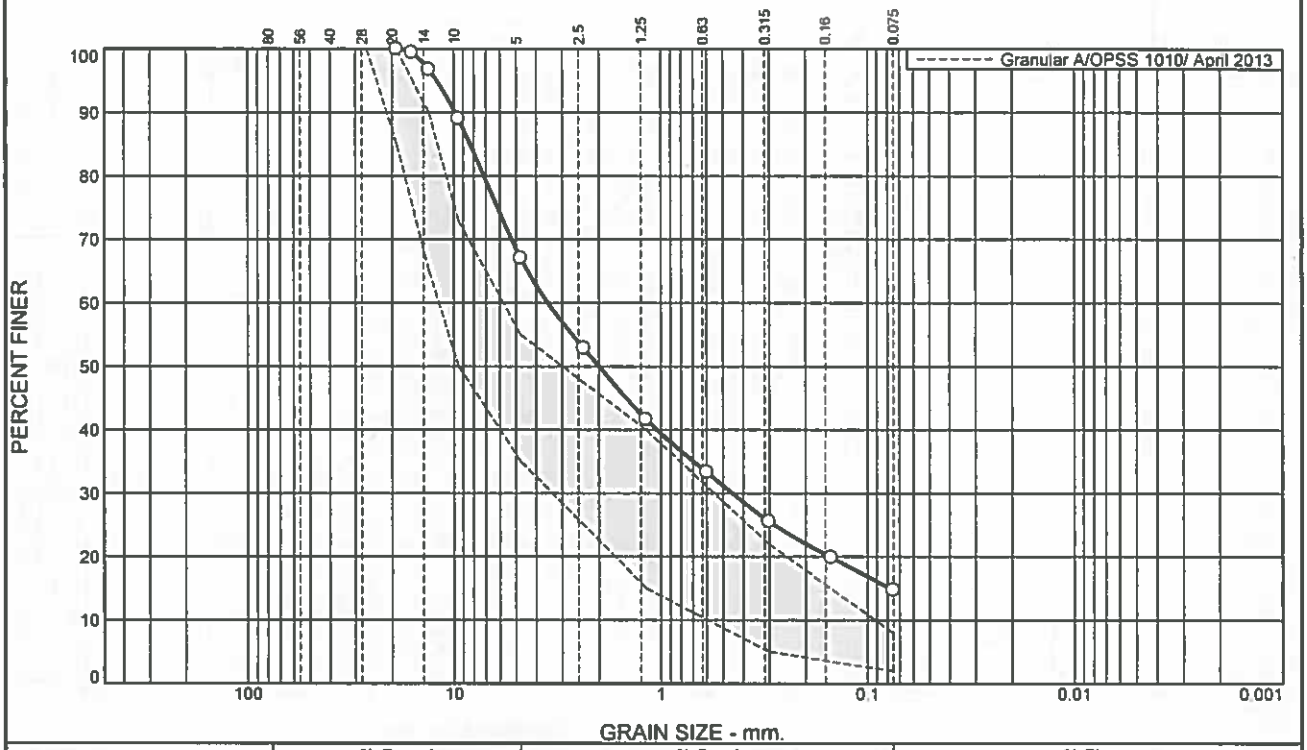
Date: June 21, 2020

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW

Project No: 19M-00524-00 **Figure** BH8_AS2

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	33	17	21	14	15	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
19.00	100	85 - 100	
16.00	99		
13.20	97	65 - 90	X
9.50	89	50 - 73	X
4.75	67	35 - 55	X
2.36	53		
1.18	42	15 - 40	X
0.60	33		
0.300	26	5 - 22	X
0.150	20		
0.075	15	2.0 - 8.0	X

* Granular A/OPSS 1010/ April 2013

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 9.8496 D_{85}= 8.3262 D_{60}= 3.5212
D_{50}= 1.9947 D_{30}= 0.4514 D_{15}= 0.0777
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH11_AS1

Date: June 21, 2020

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW

Project No: 19M-00524-00 **Figure** BH11 AS1

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	2	20	10	21	23	24	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
26.50	100	50 - 100	
19.00	98		
16.00	96		
13.20	92		
9.50	87		
4.75	78	20 - 100	
2.36	70		
1.18	62	10 - 100	
0.600	53		
0.300	41	2 - 65	
0.150	32		
0.075	24	0.0 - 8.0	X

* Granular B Type 1/OPSS PROV 1010/April 2013

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 11.3747 D_{85}= 8.1370 D_{60}= 0.9543
D_{50}= 0.4900 D_{30}= 0.1262 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH11_AS2

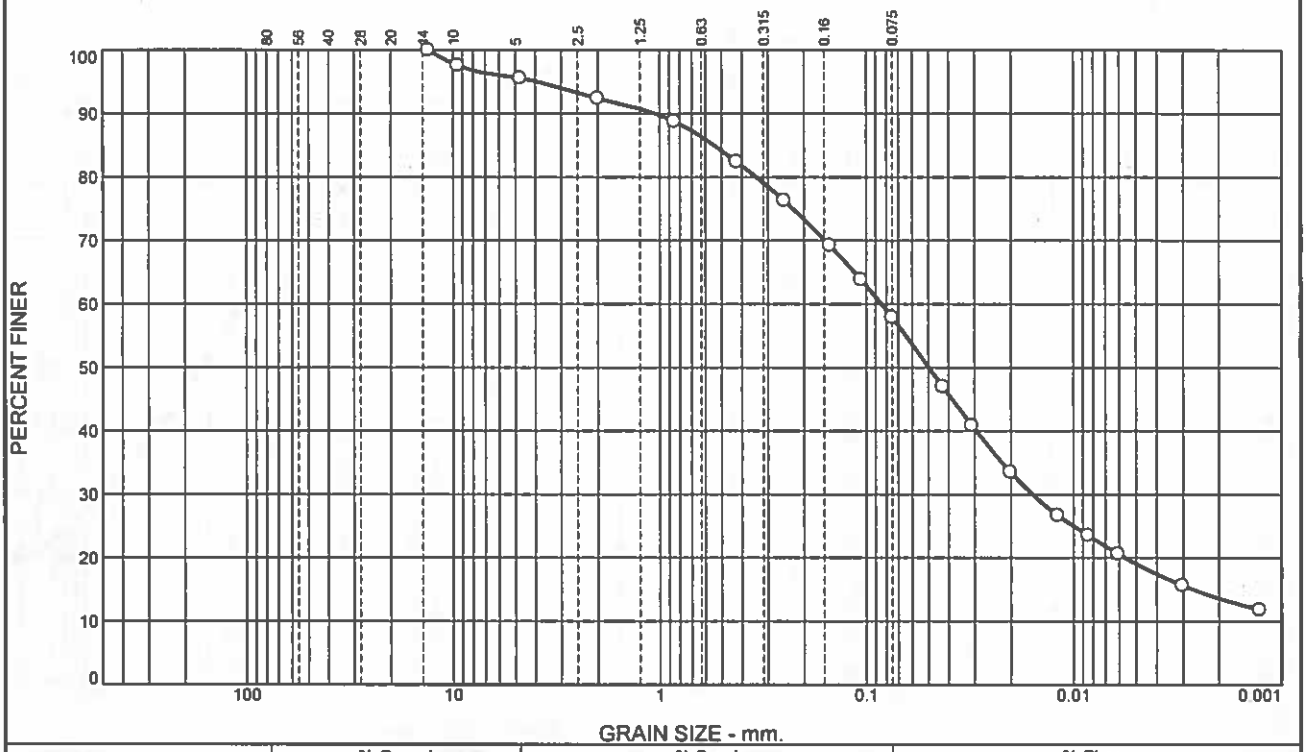
Date: June 21, 2020

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW

Project No: 19M-00524-00 **Figure** BH11_AS2

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	4	4	10	24	44	14

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
13.20	100		
9.50	98		
4.75	96		
2.00	92		
0.85	89		
0.425	82		
0.250	76		
0.150	69		
0.106	64		
0.075	58		
0.0427 mm.	47		
0.0309 mm.	41		
0.0201 mm.	34		
0.0119 mm.	27		
0.0085 mm.	24		
0.0061 mm.	21		
0.0030 mm.	16		
0.0013 mm.	12		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.0561 D_{85}= 0.5452 D_{60}= 0.0844
D_{50}= 0.0498 D_{30}= 0.0157 D_{15}= 0.0027
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH2_AS3

Date: June 20, 2020

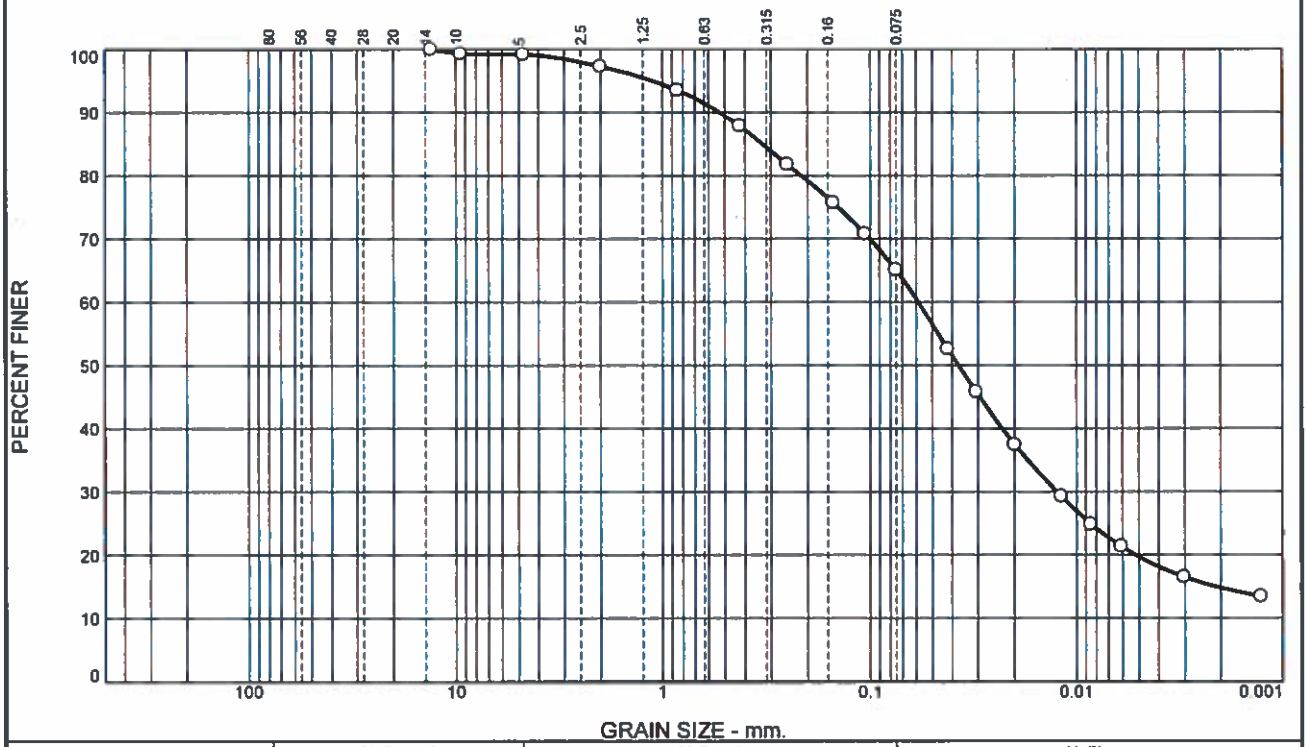
WSP CCIL

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW

Project No: 19M-00524-00 **Figure** BH2_AS3

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	2	9	23	50	15

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
13.20	100		
9.50	99		
4.75	99		
2.00	97		
0.85	93		
0.425	88		
0.250	82		
0.150	76		
0.106	71		
0.075	65		
0.0421 mm.	53		
0.0305 mm.	46		
0.0199 mm.	37		
0.0118 mm.	29		
0.0085 mm.	25		
0.0061 mm.	21		
0.0030 mm.	17		
0.0013 mm.	13		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5321 D_{85}= 0.3294 D_{60}= 0.0586
D_{50}= 0.0374 D_{30}= 0.0124 D_{15}= 0.0021
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH5_AS3

Date: June 20, 2020

WSP CCIL

Client: NWN Inc.
Project: Cannabis Facility, 17287 2nd Line SW

Project No: 19M-00524-00 **Figure** BH5_AS3

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	6	3	8	28	43	12

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
13.20	100		
9.50	96		
4.75	94		
2.00	91		
0.85	88		
0.425	83		
0.250	77		
0.150	69		
0.106	62		
0.075	55		
0.0431 mm.	44		
0.0313 mm.	37		
0.0203 mm.	30		
0.0120 mm.	24		
0.0086 mm.	21		
0.0061 mm.	19		
0.0030 mm.	14		
0.0013 mm.	11		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.3554 D_{85}= 0.5100 D_{60}= 0.0944
D_{50}= 0.0581 D_{30}= 0.0203 D_{15}= 0.0035
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH8_AS3

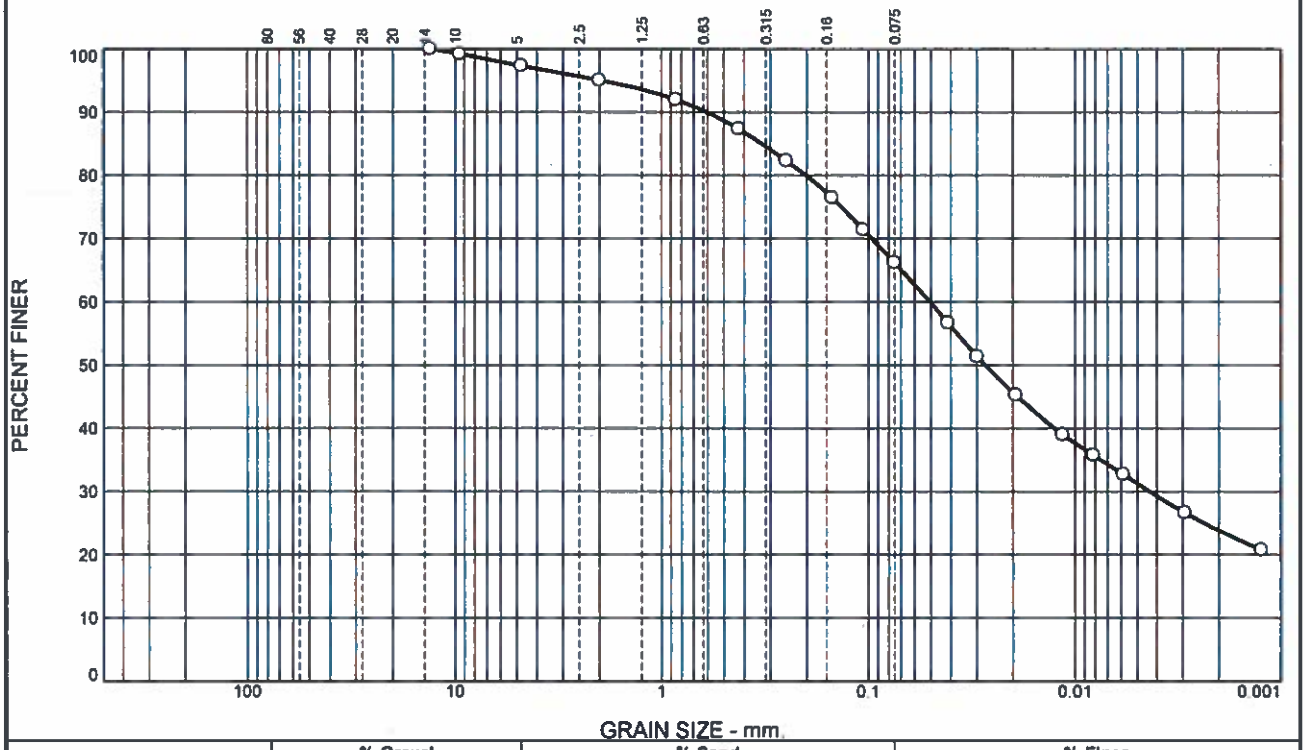
Date: June 20, 2020

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW

Project No: 19M-00524-00 **Figure** BH8_AS3

Tested By: Bruce Shan & LXQ

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	3	2	8	21	42	24

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
13.20	100		
9.50	99		
4.75	97		
2.00	95		
0.85	92		
0.425	87		
0.250	82		
0.150	76		
0.106	71		
0.075	66		
0.0413 mm.	57		
0.0298 mm.	51		
0.0193 mm.	45		
0.0114 mm.	39		
0.0082 mm.	36		
0.0058 mm.	33		
0.0029 mm.	27		
0.0012 mm.	21		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6078 D_{85}= 0.3283 D_{60}= 0.0506
D_{50}= 0.0273 D_{30}= 0.0043 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: Site Drilling
Sample Number: BH11_AS3

Date: June 20, 2020

WSP CCIL

Client: NWN Inc.
Project: Cannabis Facility, 117287 2nd Line SW

Project No: 19M-00524-00 **Figure** BH11_AS3

Tested By: Bruce Shan & LXQ

APPENDIX

D

AASHTO DESIGN OUTPUTS

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: 2nd Line SW - Road Impact Study
Route: 2nd Line SW - County Rd 17 to 2.8km northerly
Location: Melanchton, ON
Owner/Agency: Township of Melanchton/NWN Inc.
Design Engineer: M.Nayagam - AASHTO Minimum - 20yr Design Life

Flexible Pavement Design/Evaluation

Structural Number	75.76		**Subgrade Resilient Modulus**	25.00	**MPa**
Total Flexible ESALs	119,430		**Initial Serviceability**	4.20	
Reliability	85.00	**percent**	**Terminal Serviceability**	2.00	
Overall Standard Deviation	0.44				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.42	1.00	100.00	42.00
Granular Base	0.14	1.00	150.00	21.00
Granular Subbase	0.09	1.00	150.00	13.50
			Σ SN	76.50

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: 2nd Line SW - Road Impact Study
Route: 2nd Line SW - County Rd 17 to 2.8km northerly
Location: Melanchton, ON
Owner/Agency: Township of Melanchton/NWN Inc.
Design Engineer: East Section - Pulverize and Pave - 20+ Yr Life

Flexible Pavement Design/Evaluation

Structural Number	75.76		**Subgrade Resilient Modulus**	25.00	MPa
Total Flexible ESALs	119,430		**Initial Serviceability**	4.20	
Reliability	85.00	percent	**Terminal Serviceability**	2.00	
Overall Standard Deviation	0.44				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.42	1.00	100.00	42.00
Granular Base	0.14	1.00	100.00	14.00
Pulverized materials	0.12	0.90	100.00	10.80
Existing Granular Subbase	0.05	0.90	385.00	17.33
			Σ SN	84.13

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: 2nd Line SW - Road Impact Study
Route: 2nd Line SW - County Rd 17 to 2.8km northerly
Location: Melanchton, ON
Owner/Agency: Township of Melanchton/NWN Inc.
Design Engineer: East Section - Mill/Pave - 1.5 Yr Life (ESAL 2020-2022)

Flexible Pavement Design/Evaluation

Structural Number	66.83		**Subgrade Resilient Modulus**	25.00	**MPa**
Total Flexible ESALs	52,775		**Initial Serviceability**	4.20	
Reliability	85.00	**percent**	**Terminal Serviceability**	2.00	
Overall Standard Deviation	0.44				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.42	1.00	100.00	42.00
Existing Base/Subbase	0.05	0.90	485.00	21.83
			Σ SN	63.83

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: 2nd Line SW - Road Impact Study
Route: 2nd Line SW - County Rd 17 to 2.8km northerly
Location: Melanchton, ON
Owner/Agency: Township of Melanchton/NWN Inc.
Design Engineer: East Section - Mill/Pave - 10 Yr Life (ESAL 2022-2040)

Flexible Pavement Design/Evaluation

Structural Number	69.27		**Subgrade Resilient Modulus**	25.00	MPa
Total Flexible ESALs	66,655		**Initial Serviceability**	4.20	
Reliability	85.00	percent	**Terminal Serviceability**	2.00	
Overall Standard Deviation	0.44				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.42	1.00	100.00	42.00
Existing Base/Subbase	0.05	0.90	485.00	21.83
			Σ SN	63.83

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: 2nd Line SW - Road Impact Study
Route: 2nd Line SW - County Rd 17 to 2.8km northerly
Location: Melanchton, ON
Owner/Agency: Township of Melanchton/NWN Inc.
Design Engineer: West Section - Pulverize and Pave - 20+ Yr Life

Flexible Pavement Design/Evaluation

Structural Number	75.76		**Subgrade Resilient Modulus**	25.00	**MPa**
Total Flexible ESALs	119,430		**Initial Serviceability**	4.20	
Reliability	85.00	**percent**	**Terminal Serviceability**	2.00	
Overall Standard Deviation	0.44				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.42	1.00	100.00	42.00
Granular Base	0.14	1.00	100.00	14.00
Pulverized materials	0.12	0.90	200.00	21.60
Existing Granular Subbase	0.05	0.90	490.00	22.05
			Σ SN	99.65

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: 2nd Line SW - Road Impact Study
Route: 2nd Line SW - County Rd 17 to 2.8km northerly
Location: Melanchton, ON
Owner/Agency: TownShip of Melanchton/NWN Inc.
Design Engineer: West Section - Mill/Pave - 20+Yr Life
(ESAL 2020-2022)

Flexible Pavement Design/Evaluation

Structural Number	66.83		**Subgrade Resilient Modulus**	25.00	MPa
Total Flexible ESALs	52,775		**Initial Serviceability**	4.20	
Reliability	85.00	percent	**Terminal Serviceability**	2.00	
Overall Standard Deviation	0.44				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.42	1.00	100.00	42.00
Existing Asphalt Cement Concrete	0.27	1.00	60.00	16.20
Existing Base/Subbase	0.05	0.90	640.00	28.80
			Σ SN	87.00

WinPAS

Pavement Thickness Design According to

1993 AASHTO Guide for Design of Pavements Structures

American Concrete Pavement Association

Flexible Design Inputs

Project Name: 2nd Line SW - Road Impact Study
Route: 2nd Line SW - County Rd 17 to 2.8km northerly
Location: Melanchton, ON
Owner/Agency: Township of Melanchton/NWN Inc.
Design Engineer: West Section - Mill/Pave - 20+Yr Life
(ESAL 2022 - 2040)

Flexible Pavement Design/Evaluation

Structural Number	69.27		**Subgrade Resilient Modulus**	25.00	**MPa**
Total Flexible ESALs	66,655		**Initial Serviceability**	4.20	
Reliability	85.00	**percent**	**Terminal Serviceability**	2.00	
Overall Standard Deviation	0.44				

Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.42	1.00	100.00	42.00
Existing Asphalt Cement Concrete	0.27	1.00	60.00	16.20
Existing Base/Subbase	0.05	0.90	640.00	28.80
			Σ SN	87.00

APPENDIX

E

LIFE-CYCLE COST ANALYSIS

Scenario #1
Pulverize and Pave in 2020
20 Year Design Life
Initial Construction Costs

40	mm	HL3
60	mm	HL4
0	mm	Granular A Base Material
0	mm	Granular B Subbase Material
100	mm	Total Thickness

Task/ Item	Quantity	Pay Item Price $	Units	Total Cost
Removals/ Preparations				
Mill Existing Asphalt	0 m2	$4.00	m^2	$0
Pulverization	18,200 m3	$2.00	m^2	$36,400
Existing Granular Base/Subbase	- mm	$18.00	m^3	$0
New Construction - Shoulders - Pulverized Materials to be used for 50mm depth shoulders				
Granular B Subbase (B Type I)	0 mm	$14.00	t	$0
Granular A Base Material	0 mm	$17.00	t	$0
HL4	0 mm	$65.00	t	$0
HL3	0 mm	$90.00	t	$0
Tack Coat (per layer)	0 applications	$0.50	m^2	$0
New Construction - Pavement				
Granular B Subbase (B Type I)	0 mm	$14.00	t	$0
Granular A Base Material	100 mm	$17.00	t	$68,068
HL4	60 mm	$65.00	t	$174,611
HL3	40 mm	$90.00	t	$165,766
Tack Coat (per layer)	1 applications	$0.50	m^2	$9,100
	Total Initial Construction Cost			**$453,944**

Lyfe Cycle Cost Analysis for Scenario#1
Pulverize and Pave in 2020
20 Year Design Life
19M-00524-00- 2020 Road Impact Study 2nd Line SW
Cannabis Facility,117287 2nd Line SW, Melancthon, ON

Pulverize 300 mm, pad 100mm Granular A and pave 100 mm HMA
Estimated LCCA for 2-lane section

Scheduled Maint./Rehab. Year	Maintenance/ Rehabilitation Activity	Quantities/km		Pay Item Price ($)	Cost ($)	Present Worth ($)
1	*Initial Construction Cost*					*$453,944*
5	Rout and Seal Cracks[2]	700	m	$9.00	$6,300.00	$4,936
	Mill (50 mm) and 50-mm Patch[3]	910	m^2	$15.00	$13,650.00	$10,695
10	Rout and Seal Cracks[2]	700	m	$9.00	$6,300.00	$3,868
	Mill (50 mm) and 50-mm Patch[3]	910	m^2	$15.00	$13,650.00	$8,380
15	Rout and Seal Cracks[2]	700	m	$9.00	$6,300.00	$3,030
	Mill (50 mm) and 50-mm Patch[3]	910	m^2	$15.00	$13,650.00	$6,566
20	Mill 100mm	18,200	m^2	$4.00	$72,800.00	$27,438
	Pave 60mm HL4	2,686	t	$65.00	$174,610.80	$65,809
	Pave 40mm HL3	1,842	t	$90.00	$165,765.60	$62,475
	Application of Tack Coat 1 Layers	18,200	m^2	$0.50	$9,100.00	$3,430
25	Rout and Seal Cracks[2]	700	m	$9.00	$6,300.00	$1,860
	Mill (50 mm) and 50-mm Patch[3]	910	m^2	$15.00	$13,650.00	$4,031
30	Salvage Value	0	years	-$42,227.64	$0.00	$0
				Total Life Cycle Cost Analysis Worth		**$656,462**

Notes:
1. Discount rate of 5.0 % has been assumed.
2. Length of route and crack sealing based on an estimated 25% of the total length of the project road.
3. Area for mill and patch treatment based on an estimated 5% of the total area of the project road

Scenario #2
Rehab Eastern Section in 2020 and Pulverize/Pave in 2022
2 Year Design Life (Eastern Section)
Initial Construction Costs

40	mm	HL3
60	mm	HL4
0	mm	Granular A Base Material
0	mm	Granular B Subbase Material
100	mm	Total Thickness

Task/ Item	Quantity		Pay Item Price $	Units	Total Cost
Removals/ Preparations					
Mill Existing Asphalt	11,700	m2	$4.00	m^2	$46,800
Existing Granular Base/Subbase	-	mm	$18.00	m^3	$0
New Construction - Shoulders					
Granular B Subbase (B Type I)	0	mm	$14.00	t	$0
Granular A Base Material	0	mm	$17.00	t	$0
HL4	0	mm	$65.00	t	$0
HL3	0	mm	$90.00	t	$0
Tack Coat (per layer)	0	applications	$0.50	m^2	$0
New Construction - Pavement					
Granular B Subbase (B Type I)	0	mm	$14.00	t	$0
Granular A Base Material	0	mm	$17.00	t	$0
HL4	60	mm	$65.00	t	$112,250
HL3	40	mm	$90.00	t	$106,564
Tack Coat (per layer)	2	applications	$0.50	m^2	$11,700
			Total Initial Construction Cost		**$277,313**

Scenario #2
Rehab Eastern Section in 2020 and Pulverize/Pave in 2022
2 Year Design Life (Eastern Section)
19M-00524-00- 2020 Road Impact Study 2nd Line SW
Cannabis Facility,117287 2nd Line SW, Melancthon, ON

Remove/Mill 100 mm and Pave 100 mm HMA (Eastern Section) and Pulverize/Pave in 2026
Estimated LCCA for 2-lane section

Scheduled Maint./Rehab. Year	Maintenance/ Rehabilitation Activity	Quantities/km		Pay Item Price ($)	Cost ($)	Present Worth ($)
1	*Initial Construction Cost*					*$277,313*
2	Pulverize	18,200	m^2	$2.00	$36,400.00	$33,016
	Pad 100 mm Granular A	4,004	t	$17.00	$68,068.00	$61,740
	Pave 60mm HL4	2,686	t	$65.00	$174,610.80	$174,611
	Pave 40mm HL3	1,842	t	$90.00	$165,765.60	$165,766
	Application of Tack Coat 1 Layers	18,200	m^2	$0.50	$9,100.00	$8,254
10	Rout and Seal Cracks[2]	700	m	$9.00	$6,300.00	$3,868
	Mill (50 mm) and 50-mm Patch[3]	910	m^2	$15.00	$13,650.00	$8,380
15	Rout and Seal Cracks[2]	700	m	$9.00	$6,300.00	$3,030
	Mill (50 mm) and 50-mm Patch[3]	910	m^2	$15.00	$13,650.00	$6,566
20	Rout and Seal Cracks[2]	700	m	$9.00	$6,300.00	$2,374
	Mill (50 mm) and 50-mm Patch[3]	910	m^2	$15.00	$13,650.00	$5,145
25	Mill 100mm	18,200	m^2	$4.00	$72,800.00	$21,498
	Pave 60mm HL4	2,686	t	$65.00	$174,610.80	$51,563
	Pave 40mm HL3	1,842	t	$90.00	$165,765.60	$48,951
	Application of Tack Coat 1 Layers	18,200	m^2	$0.50	$9,100.00	$2,687
30	Salvage Value	4	years	-$46,919.60	-$187,678.40	-$43,425
				Total Life Cycle Cost Analysis Worth		**$831,337**

Notes:
1. Discount rate of 5.0 % has been assumed.
2. Length of route and crack sealing based on an estimated 25% of the total length of the project road.
3. Area for mill and patch treatment based on an estimated 5% of the total area of the project road.

Scenario #3
Mill 100mm and Pave 100mm in 2020 and Repeat in 2022 for Eastern Section
20 Years Design Life(Western Section) and 2 Year Design Life (Eastern Section)
Initial Construction Costs

40 mm	HL3	
60 mm	HL4	
0 mm	Granular A Base Material	
0 mm	Granular B Subbase Material	
100 mm	Total Thickness	

Task/ Item	Quantity	Pay Item Price $	Units	Total Cost
Removals/ Preparations				
Remove Existing Asphalt	18,200 m2	$4.00	m^2	$72,800
Existing Granular Base/Subbase	- mm	$18.00	m^3	$0
New Construction - Shoulders				
Granular B Subbase (B Type I)	0 mm	$14.00	t	$0
Granular A Base Material	0 mm	$17.00	t	$0
HL4	0 mm	$65.00	t	$0
HL3	0 mm	$90.00	t	$0
Tack Coat (per layer)	0 applications	$0.50	m^2	$0
New Construction - Pavement				
Granular B Subbase (B Type I)	0 mm	$14.00	t	$0
Granular A Base Material	0 mm	$17.00	t	$0
HL4	60 mm	$65.00	t	$174,611
HL3	40 mm	$90.00	t	$165,766
Tack Coat (per layer)	3 applications	$0.50	m^2	$27,300
	Total Initial Construction Cost			**$440,476**

Scenario #3
Mill 100mm and Pave 100mm in 2020 and Repeat in 2022 for Eastern Section
20 Years Design Life(Western Section) and 2 Year Design Life (Eastern Section)
19M-00524-00- 2020 Road Impact Study 2nd Line SW
Cannabis Facility,117287 2nd Line SW, Melancthon, ON

Remove/Mill 100 mm and Pave 100 mm HMA
Estimated LCCA for 2-lane section

Scheduled Maint./Rehab. Year	Maintenance/ Rehabilitation Activity	Quantities/km		Pay Item Price ($)	Cost ($)	Present Worth ($)
1	*Initial Construction Cost*					*$440,476*
2	Remove/Mill 100 mm - East Section ONLY	11,700	m^2	$4.00	$46,800.00	$42,449
	Pave 60mm HL4	1,727	t	$65.00	$112,249.80	$112,250
	Pave 40mm HL3	1,184	t	$90.00	$106,563.60	$96,656
	Application of Tack Coat 1 Layers	11,700	m^2	$0.50	$5,850.00	$5,306
8	Rout and Seal Cracks[2]	700	m	$9.00	$6,300.00	$4,264
	Mill (50 mm) and 50-mm Patch[3]	910	m^2	$15.00	$13,650.00	$9,239
12	Remove/Mill 100 mm - East Section ONLY	11,700	m^2	$4.00	$46,800.00	$26,060
	Pave 60mm HL4	1,727	t	$65.00	$112,249.80	$62,505
	Pave 40mm HL3	1,184	t	$90.00	$106,563.60	$59,339
	Application of Tack Coat 1 Layers	11,700	m^2	$0.50	$5,850.00	$3,257
18	Rout and Seal Cracks[2]	700	m	$9.00	$6,300.00	$2,618
	Mill (50 mm) and 50-mm Patch[3]	910	m^2	$15.00	$13,650.00	$5,672
22	Remove/Mill 100 mm - Entire Roadway	18,200	m^2	$4.00	$72,800.00	$24,887
	Pave 60mm HL4	2,686	t	$65.00	$174,610.80	$59,691
	Pave 40mm HL3	1,842	t	$90.00	$165,765.60	$56,667
	Application of Tack Coat 1 Layers	18,200	m^2	$0.50	$9,100.00	$3,111
28	Rout and Seal Cracks[2]	700	m	$9.00	$6,300.00	$1,607
	Mill (50 mm) and 50-mm Patch[3]	910	m^2	$15.00	$13,650.00	$3,482
30	Salvage Value	14	years	-$19,194.38	-$268,721.35	-$62,176
				Total Life Cycle Cost Analysis Worth		**$957,359**

Notes:
1. Discount rate of 5.0 % has been assumed.
2. Length of route and crack sealing based on an estimated 25% of the total length of the project road.
3. Area for mill and patch treatment based on an estimated 5% of the total area of the project road.

2020-07-28

Henry Centen, P.Eng.
R.J. Burnside & Associates Ltd.
15 Townline
Orangeville, ON
L9W 3R4

Subject: NWN Cannabis, 117287 2nd Line SW, Melancthon - Response to Peer Review Comments – Transportation
Client ref.: 300050618.0000

Dear Mr. Centen:

Please find below responses to comments three and four on page two of the Technical Memorandum by R.J. Burnside & Associates dated March 18, 2020. This memo was a peer review of the Roads Impact Memo Addendum by WSP dated March 13, 2020 in support of the application for a Machine Storage/Cannabis Facility at 117287 2nd Line SW in the Township of Melancthon.

Burnside Comment 3

"The Township's RMP estimates Annual Average Daily Traffic (AADT) of 812 vehicles per day (vpd) on the haul road, with about 22 of these being trucks (i.e., 2.7%). This low truck percentage is indicative of the heavy truck prohibition on this road (i.e., allowing for exceptions such as milk trucks, waste vehicles, maintenance vehicles, etc.). Further quantification comparisons should be provided on the forecasted construction and operation traffic volumes to the existing truck volumes on this road."

Burnside Comment 4

"Additional operational information should be provided for the proposed facility to confirm the number of trucks anticipated, both under the initial operations (i.e., until the end of 2022) and under ultimate normal operations."

WSP Transportation Response

The table below outlines the changes in truck percentages for each construction phase along 2nd Line SW. As a conservative estimate, existing weekly traffic volumes are based on the AADT volume assumed for all seven days of the week.

100 Commerce Valley Drive West
Thornhill, ON
Canada L3T 0A1

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F +1 905 882-0055
wsp.com

STAGE	EXPECTED START DATE	CONSTRUCTION PERIOD	ADDITIONAL WEEKLY SITE TRIPS	TOTAL WEEKLY VOLUME	CUMULATIVE AADT (VEH)	CUMULATIVE TRUCK AADT	TRUCK %
Existing Conditions	-	-	-	5,684	812	22	2.7%
Phase 1 Construction (Machine Storage)	August 2020	4 months (approx. 16 weeks)	6 trucks per week for 16 weeks = 96 trucks (192 two-way trips)	5,696	814	24	2.9%
Phase 1 Construction (Roads & Parking – 30%)	August 2020	4 months (approx. 16 weeks)	5 trucks per week for 16 weeks = 80 trucks (160 two-way trips)	5,706	815	25	3.1%
Phase 1 Operation	Winter 2020	-	1 truck per week - 26-foot box truck (2-way)	5,686	812	22	2.7%
			10 employee car trips/day (2-way) = 100 trips / week	5,786	827	22	2.7%
Phase 2 Construction (Nursery)	Fall 2021	9 months (approx. 36 weeks)	7 trucks per week for 36 weeks = 234 trucks (2-way)	5,800	829	24	2.9%
Phase 2 Construction (Roads & Parking – 70%)	Fall 2021	9 months (approx. 36 weeks)	7 trucks per week for 36 weeks = 241 trucks (2-way)	5,814	831	26	3.1%
Phase 2 Construction (Freezer)	Winter 2021	6 months (approx. 24 weeks)	10 trucks per week for 24 weeks = 238 trucks (2-way)	5,834	833	28	3.4%
Phase 2 Construction (Extraction & Processing)	Summer 2022	9 months	3 trucks per week for 36 weeks = 92 trucks (2-way)	5,840	834	29	3.5%
Full Operation	Fall 2022	-	2 trucks per week – 26-foot box truck (2-way)	5,688	813	22	2.7%

			20 employee car trips/day (2-way) = 200 trips / week	5,888	841	22	2.6%

Under existing conditions, the Annual Average Daily Traffic (AADT) along 2nd Line SW is 812 vehicles with 2.7% representing truck movements. A growth rate has not been applied to the AADT volumes.

During Phase 1 of construction, this percentage AADT for trucks increases by 0.4%.

The percentage of trucks along 2nd Line SW returns to existing conditions as phase 1 construction ends and Phase 1 operation begins. Phase 1 operation involves one truck trip per week plus 10 employee trips per day in private vehicles (or 100 two-way trips per week).

During Phase 2 of construction, the percentage of truck AADT increases to a cumulative maximum of 3.5% by Spring 2022. This maximum increase takes place at stage of constructing the Extraction & Processing building. Until this structure is completed in Fall/Winter 2022, the operational requirement will be to have frozen crops transported off-site.

As phase 2 construction ends, and as with the phase 1 operations, volumes along 2nd Line SW will more ore less return to existing conditions. Only 2 trucks per week will travel to the site as well as 20 employee cars per day (200 two-way trips per week). This is marginal increase to existing volumes.

Should you have any questions regarding the above response please do not hesitate to contact me.

Yours sincerely,

Irfan Akram
Senior Transportation Planner

cc Jeremy Humphrey, WSP

WSP ref.: 19M-00524-00

Denise Holmes

From: Gord Feniak <Gord.Feniak@rjburnside.com>
Sent: Wednesday, August 5, 2020 1:42 PM
To: Chris Jones
Cc: Denise Holmes; Roads
Subject: RE: NWN Residual Matters - Road Impact Assessment

Hi Chris- Sorry for the delay. I needed to have Henry Centen's review of the submission and he was away last week. I've reviewed it all with him today.
The WSP report was thorough and well written. The gist of it is that a portion of the road has a weak base and there is some surfacing that is near end of life. The NWN construction is going to cause damage, but when then get through the construction phase their normal operation will be within the range of normal usage. We agree with all of that.
There is a mistaken understanding of what the Township's road plan was. WSP took it to be a pulverization and rehab of the road while the actual intention was just a resurfacing. So... WSP recommends the rehabilitation take place, only sooner than intended. We agree that it will need rehab and it needs to be sooner, but there is also a bigger gap between the Township's plan and the recommendation.
All of this brings us to Comment 5 and an appropriate contribution from NWN to the Township. The next step therefore cannot be a Council agenda, as we don't have a recommendation.
The WSP report contained dollar estimates, as did the Burnside Asset Management Plan, but in each case they are for comparative purposes and based on various assumptions so you cannot mix and match to come up with an amount. Also, we have to acknowledge that the rehab road option will have a longer life than the resurfacing option. I think we need to crunch some numbers and then take them to Roads Committee in order to get instructions. Once the Township has a position on the required financial contribution we can put it back to NWN and if they agree it is then that we go to Council.
I hope that all makes sense. I tried to catch you on the phone and I will be tied up later today so I thought this was the best way to get back to you...gf

Gord Feniak
Executive Vice President, Public Sector
R.J. Burnside & Associates Limited | www.rjburnside.com
Office: +1 800-265-9662 Direct: +1 519-938-3076

From: Chris Jones <chris_mplanningservices@rogers.com>
Sent: Monday, August 03, 2020 5:27 PM
To: Gord Feniak <Gord.Feniak@rjburnside.com>
Cc: Denise Holmes <dholmes@melancthontownship.ca>
Subject: NWN Residual Matters - Road Impact Assessment

Hi Gord - WSP provided the attached supplement memo last week when I was off.

So I have attached your original comment letter dated March 18 as well as the following two WSP submissions intended to address these comments:

1. WSP letter dated July 28 addressing comments 3 and 4 ; and,

2. WSP Report dated July 21, 2020 addressing Burnside comments 1, 2 and 6.

I'm not sure where your comment #5 has been addressed but I have asked them to clarify.

Please provide your thought as soon as you are able.

Thanks

Chris.

Denise Holmes

From: Mike Hooper <mhooper@dufferincounty.ca>
Sent: Wednesday, August 12, 2020 12:34 PM
To: Denise Holmes
Cc: Scott Burns
Subject: Dufferin Road 21 Traffic Volumes

Hello Denise, hope you and your family are enjoying the summer despite COVID-19

I apologize, this one slipped through the cracks. As requested during the Roads Sub-Committee meeting back in July I have provided a very basic summary of traffic volumes on Dufferin Road 21 between 5th Line and the 4th Line NE. Our most recent traffic count at this location was captured in 2016. Based on the fluctuation in volumes observed between 2015-2016 I don't expect much has changed.

2015
Daily Volume:197
Percent Trucks / Agricultural Equipment: 9%

2016
Daily Volume:246
Percent Trucks / Agricultural Equipment: 7.8%

Please let us know if you require any additional information. We can also provide a more detailed summary of the traffic data if required.

Thanks

Mike Hooper, C.E.T. |Manager of Engineering|Public Works Department |County of Dufferin
Phone: 519-941-2816 Ext. 2604| mhooper@dufferincounty.ca | 55 Zina Street, Orangeville, ON L9W 1E5

Denise Holmes

From: Calum MacKenzie <Calum.MacKenzie@rjburnside.com>
Sent: Monday, August 10, 2020 5:09 PM
To: Denise Holmes; Roads
Cc: Chris Knechtel; Jeremy Cober
Subject: 050839 - Construction Summary - July 27-August 7
Attachments: 050839_Construction Summary_July 27-August 7.pdf

Good afternoon Denise and Craig,

Please find attached the construction summary for Structure 2013 from July 27 – August 7.

The Contractor is making good progress and finished pouring the concrete distribution slab this morning. Roadwork and steel beam guide rail layout are expected to be completed this week.

Please do not hesitate to contact me if you have any questions or concerns.

Thank you,

Calum

BURNSIDE
Calum MacKenzie
Engineer

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, Collingwood, Ontario L9Y 4J6
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www.rjburnside.com

COVID 19: We remain open for business

The health and safety of our employees and clients is of paramount importance. Most of our staff are working remotely and continue to serve clients using our well established collaborative technology platforms. For our full COVID 19 response please click here.

R.J. Burnside & Associates Limited 15 Townline Orangeville ON L9W 3R4 CANADA
telephone (519) 941-5331 fax (519) 941-8120 web www.rjburnside.com

BURNSIDE
[THE DIFFERENCE IS OUR PEOPLE]

Construction Summary – July 27 to August 7, 2020

Date Prepared: August 7, 2020 **Project No.:** 300050839.0000

Project Name: Structure 2013 Replacement

Location Township of Melancthon **Review Date.:** July 27 - August 7, 2020

Contractor: Reeves Construction Limited **Discipline:** Bridge

Photos Taken: Yes

1.0 Progress of Construction

1.1 July 27, 2020 - Mobilization

1.1.1 Contractor completed detour sign installation and road closure at structure 2013.

1.1.2 Contractor mobilizing equipment and machinery on site for proposed culvert replacement works.

1.2 July 30, 2020 – Structure Excavation and Elevation Check

1.2.1 Contractor installing of erosion and sediment control measures.

1.2.2 Contractor completed removal of existing structure.

1.2.3 Contractor completed temporary culvert bypass.

1.2.4 Burnside confirmed elevation of inlet apron wall.

1.3 August 5, 2020 – Culvert Bedding Elevation Check

1.3.1 Contractor completed placement and compaction of culvert bedding.

1.3.2 Contractor advised Burnside that Terraprobe has taken samples of bedding material and confirmed compaction.

1.3.3 Contractor completed placement of inlet and outlet precast apron walls.

1.4 August 6, 2020 – Precast Culvert Installation

1.4.1 Crane on site and set up for culvert placement at 9:00 A.M.

1.4.2 Precast units arrived on site at 9:45 A.M.

1.4.3 Contractor completed placement of 7 units by 11:45 A.M.

1.4.4 Contractor installing preformed flexible gasket, backer rod and silicone sealant between precast unit joints.

1.4.5 Contractor installing filter cloth over precast joints on culvert walls.

1.4.6 Contractor parging all lift anchor holes with grout.

1.5 August 7, 2020 – Distribution Slab Reinforcement Check

1.5.1 Contractor completed structure backfill.

1.5.2 Contractor advised Burnside that Terraprobe was on site testing compaction of backfill.

1.5.3 Contractor has completed installation of steel reinforcing in distribution slab.

1.5.4 Contractor placing smooth run river stone throughout culvert.

2.0 Remarks

2.1.1 Contractor scheduling concrete pour for distribution slab for Monday August 10, 2020

2.1.2 Contractor anticipates bypass culvert removal and road work will be performed the week of August 10th.

2.1.3 Contractor anticipates guide rail installation to occur the week of August 10th.

R.J. Burnside & Associates Limited

Prepared by:
Calum MacKenzie, P.Eng.
Site Inspector

Reviewed by:
Jeremy Cober, P.Eng.
Project Engineer

Distribution:

Denise Holmes	Township of Melancthon	Via: Email
Craig Micks	Township of Melancthon	Via: Email

Photo 1:

Road Closure

Photo 2:

Mobilization

Photo 3:

Inlet Apron Wall Placement

Photo 4:

Excavation Looking South

Photo 5:

Temporary Bypass Route and Cofferdam

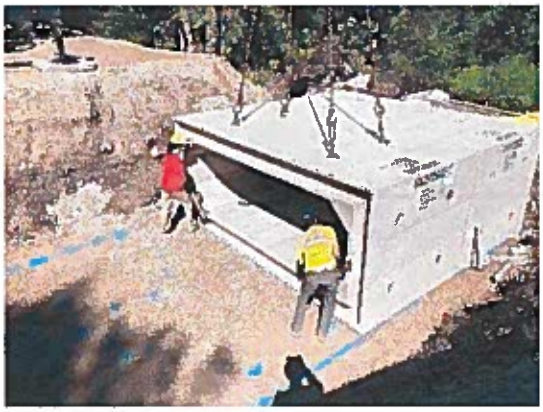
Photo 6:

Culvert Bedding

Photo 7:

Placing First Precast Unit (Outlet)

Photo 8:



Placing Second Precast Unit

Photo 9:

Placing Final Precast Unit (Inlet)

Photo 10:

Installing Backer Rod

Photo 11:

Distribution Slab Reinforcement

Photo 12:

Installing Smooth Run River Stone Throughout Culvert

Denise Holmes

From: Chris Knechtel <Chris.Knechtel@rjburnside.com>
Sent: Tuesday, July 14, 2020 8:54 AM
To: Kaitlin Chessell
Cc: Denise Holmes
Subject: RE: Structure 11

Morning Katlin,

Good to hear from you, hope you are keeping well and enjoying summer.

This was on my list to look into and was hoping to lump it into some other deck cores we have potentially for later this year in Dufferin County.

We will reach out to Bridge Check Canada to get a quotation for the core samples and testing (similar to what we had completed at Bridge 13) and will send the Township a separate email with the quotation for approval before proceeding.

It would be good to get the cores completed sooner than later, and if the results are favourable, we could discuss with the Township lumping Bridge 11 and 13 rehabilitation into one tender contract for 2021 or 2022, as we discussed the last time I was at the Roads Sub-Committee Meeting.

Thanks for following up on this, we will be in touch shortly.

Chris

Chris Knechtel, P.Eng.
Project Engineer
R.J. Burnside & Associates Limited | www.rjburnside.com
Office: +1 800-265-9662 Direct: +1 519-938-3012

From: Kaitlin Chessell <kchessell@melancthontownship.ca>
Sent: Monday, July 13, 2020 4:03 PM
To: Chris Knechtel <Chris.Knechtel@rjburnside.com>
Cc: Denise Holmes <dholmes@melancthontownship.ca>
Subject: Structure 11

Hi Chris,

At our Roads Sub-Committee Meeting last week Structure 11 was brought up as this was a bridge you thought we should be getting core samples done for at the meeting you last attended. I have in my notes you were going to draft something up to recommend we do this? Is this something we should still be looking at doing?

Thank you.

Kaitlin Chessell

Kaitlin Chessell | Administration and Finance Assistant | Township of Melancthon |
kchessell@melancthontownship.ca | PH: 519-925-5525 ext 104 | FX: 519-925-1110 | www.melancthontownship.ca |

delete it and advise me immediately. E-mail transmission cannot be guaranteed to be secure or error-free and the sender does not accept liability for errors or omissions.

Please note: Effective 10:00 a.m. on March 17, 2020, the Township of Melancthon Municipal Office will be closed to the Public until further notice. Some of our services are available online (tax payments, planning applications, fire permits) or Staff will be available by phone at 519-925-5525 to assist.