

PRELIMINARY DRAINAGE REPORT

**PUCE ROAD, MAJOR STREET & LILYDALE AVENUE
DRAINAGE IMPROVEMENTS**

MUNICIPALITY OF LAKESHORE

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Project No. D-18-015

August 19th, 2021

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PREAMBLE

Municipal Drains And The Drainage Act (Preliminary Report)

The "Drainage Act" is one of the oldest pieces of legislation in Ontario, originally passed in 1859. It provides a democratic procedure for the construction, improvement and maintenance of drainage works. A procedure whereby the Municipality may assist in providing a legal drainage outlet for surface and subsurface waters not attainable under common law. Accordingly, it provides assistance to facilitate the problems of obtaining a legal drainage outlet, engineering and cost distribution.

The Drainage Act administers a legal procedure by which an "area requiring drainage" may receive an outlet drain constructed to dispose of excess stormwater runoff to a sufficient outlet. This drainage infrastructure is otherwise known as a "Municipal Drain". Municipal Drains are identified by way of an Engineer's Report and adopted through Municipal By-law. The Drainage Engineer has the obligation to prepare an unbiased Engineer's Report based on information presented in written form, orally, and from visual inspection; in accordance with currently accepted design criteria. These reports form the legal basis for the construction and management of the Municipal Drain. As such, an Engineer's Report shall contain specific details such as plans, profiles, and specifications that define the location, size and depth of the drainage infrastructure, together with establishing how costs are shared amongst all stakeholders.

In some cases, a Preliminary Report is initiated to assist with focusing the proposed drainage works to the needs of the stakeholders. Through this process, the Engineer provides the stakeholders with potential options, with budgetary cost estimates, to assist in establishing an appropriate project direction. This preliminary report provides the stakeholder with the ability to participate in determining the initial direction of the project, prior to the Engineer expending significant time on moving forward with a detailed survey, design, and preparing the Final Engineer's Report. Based on the outcome of the Preliminary Report process, the project direction will be established for the Engineer on how to proceed.

Through the democratic procedure, the Final Engineer's Report is presented to all Stakeholders in front of Municipal Council (or a Drainage Board appointed by Council) for consideration. The Drainage Act provides an appeal process to address various aspects of Municipal Drains. These appeal bodies are the Court of Revision, the Ontario Drainage Tribunal and the Drainage Referee.

For additional information, Fact Sheets, and reference materials regarding the Drainage Act and Municipal Drains, please visit: <http://www.omafra.gov.on.ca/english/landuse/drainage.htm>

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PUCE ROAD, MAJOR STREET & LILYDALE AVENUE DRAINAGE IMPROVEMENTS

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August 19th, 2021

Mayor and Municipal Council
Corporation of the Municipality of Lakeshore
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Mayor Bain and Members of Council:

PROJECT: **PUCE ROAD, MAJOR STREET & LILYDALE AVENUE
DRAINAGE IMPROVEMENTS - PRELIMINARY REPORT
(Geographic Township of Maidstone)
Municipality of Lakeshore, County of Essex
Project No. D-18-015**

I. INTRODUCTION

In accordance with the instructions received by letter of March 8th, 2018 and May 18th, 2019, from the Municipality of Lakeshore Drainage Department, we have prepared the following report that provides for the preliminary outlet improvements to the various drainage systems along Puce Road, Major Street and Lilydale Avenue. These investigations were initiated by a resolution passed by Council for our firm to investigate the necessary improvements to the drainage systems associated with these municipal roadways, in accordance with the Drainage Act. The proposed improvements are intended to address the current deficiencies of the existing drainage systems, together with facilitating the future road reconstruction of these municipal roads. A plan showing the location and alignments of the existing Municipal Drains associated with these municipal roads, the potential options for improvement, together with identifying the lands and roads affected by these potential improvements, are included herein as part of this Preliminary Report.

The initial request to provide an Engineer's Report was initiated through submission by the Municipality of Lakeshore's Public Works Department for the improvements to the drainage systems along Puce Road to facilitate the proposed road reconstruction project. From this request and through the progression of this project, the scope of work also extended to include the drainage systems along Major Street and Lilydale Avenue. As a result of the overall progression of the project, the Municipality of Lakeshore has confirmed their instructions by email, dated December 2nd, 2019, to prepare a Preliminary Report to consider options for the drainage improvements along Puce Road, Major Street and Lilydale Avenue.

Our appointment and the works relative to the analysis and improvements to the drainage systems along Puce Road, Major Street and Lilydale Avenue, as proposed under this report, are in accordance with Section 78 of the "Drainage Act, R.S.O. 1990, Chapter D.17, as

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amended in 2020". We have performed all of the necessary analysis and preliminary investigations for the affected drainage systems, and we report the options currently being considered by way of a Preliminary Report through Section 10(1) of the "Drainage Act, R.S.O. 1990, Chapter D.17, as amended in 2020".

II. BACKGROUND AND WATERSHED CHARACTERISTICS

Following our appointment for the drainage works and pursuant to our extensive discussions with the Municipality of Lakeshore Drainage and Public Works Departments, we learned that the Municipality had intentions to reconstruct and otherwise improve Puce Road as a part of a capital road reconstruction project. These proposed improvements include widening portions of road cross-section and providing new curb and gutters, new sidewalks, potential watermain and/or sanitary sewer improvements, together with new street lights and isolated utility upgrades.

Puce Road extends northerly from County Road 22, where it crosses the VIA Rail tracks and terminates with a cul-de-sac adjacent to Lake St. Clair. The residential properties on the west side of Puce Road are further bounded by the east shore of the Puce River. On the east side of Puce Road, there are two (2) municipal roadways that intersect Puce Road. Major Street intersects Puce Road on the south of the VIA Rail tracks and Lilydale Avenue intersects Puce Road on the north side of the VIA Rail tracks. All lands affected by the drainage improvements are residential properties within Registered Plans 898, 1516 and 1517, East Puce River Concession and within the Geographic Township of Maidstone.

Based on our investigations, the reconstruction of Puce Road has direct implications to four (4) municipal drainage systems that have been created and maintained through the provisions of the Drainage Act. These municipal drainage systems include, Puce Lots Drain No. 1, Puce Lots Drain No. 2, Blanchard Drain and the Lilydale Drain, and their associated branches. Details and locations of these Municipal Drains are as follows:

Puce Lots Drain No. 1 - This municipal drainage system is located alongside the south right-of-way limit of the VIA Rail. This open-drain extends from the east limit of Puce Road, downstream in an easterly direction, to its outlet into the 4th Concession Drain.

Puce Lots Drain No. 2 and Branch - This municipal drainage system is located along both sides of Major Street. This covered drainage system extends from east to west where it currently crosses Puce Road, through private property, to its outlet into the Puce River.

Blanchard Drain - This municipal drainage system is located along both sides of Puce Road, between County Road 22 and Major Street. This covered drainage system extends from south to north and utilizes the Puce Lots Drain No. 2 as its drainage outlet.

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Lilydale Avenue Drain and North Branch - This municipal drainage system services the lands along Lilydale Avenue and the northern portion of Puce Road. The main drain is located along the north side of Lilydale Avenue. The North Branch is located along the east side of Puce Road. This covered drainage system has two (2) drainage outlets at each end of the system, with the watershed divide between M.N. 1076 and M.N. 1080 of Lilydale Avenue. The east portion extends from the watershed divide and extends easterly to its outlet into the 4th Concession Drain. The west portion extends westerly across Puce Road, through private property, to its outlet into the Puce River. The westerly portion also collects runoff along the northern section of Puce Road, north of the VIA Rail tracks through the Lilydale Avenue Drain North Branch.

In summary, the Puce Lots Drain No. 2 and the west portion of the Lilydale Avenue Drain carry runoff across Puce Road (from the east) to the Puce River at their respective locations. As a result, the watershed limits of these drains include portions of the residential lands alongside and including Major Street, the north side of County Road 22, the west half of Lilydale Avenue, and the north half of the VIA Rail corridor. Puce Lots Drain No. 1, located on the south side of the VIA Rail tracks, collects runoff from Puce Road, VIA Rail lands and adjacent residential properties to the south, and currently conveys these flows easterly to the 4th Concession Drain.

III. DRAINAGE HISTORY

Upon confirming the details of this project, we conducted a review of the Municipality of Lakeshore's drainage records for the drainage systems that will likely be affected by these drainage improvements. From our review of these drainage records, we found various Engineer's Reports prepared through the provisions of the Drainage Act related to these drainage systems. However, we have identified the following relevant Engineer's Reports as references for carrying out this project.

Puce Lots Drain No. 1

- a) **July 29th, 1949** Engineer's Report for the "Puce Lots Drains No. 1 and No. 2", prepared by C.B. Allison, O.L.S., was carried out under Maidstone By-Law No. 1737. This report provided for the initial construction of both Municipal Drains, as petitioned for, with a particular focus on addressing poor drainage conditions between the VIA Rail tracks and County Road 22. Under this report, new drainage systems were installed along the south side of the VIA Rail tracks and along Major Street to alleviate these drainage issues. Under this report, the Puce Lots Drain No. 1 conveyed flows to both the Puce River to the west and the 4th Concession Drain to the east.

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- b) **June 17th, 1988** Engineer's Report for the "Puce Lots Drain No. 1", prepared by N.J. Peralta, P.Eng., was carried out under Maidstone By-Law No. 3625-D-88. This report provided for the necessary improvements to this Municipal Drain, with a particular focus addressing the inadequate drainage conditions and flooding of the adjacent lands created by high lake levels within the Puce River. This report included the plugging of the westerly outlet across Puce Road, to the Puce River, and divert the entire open drain to the east into the 4th Concession Drain. With the 4th Concession Drain having a controlled outlet, utilizing flood gates and a pumped system, there will be added protection against high lake levels in Lake St. Clair.

Since the improvements conducted under this report, it is our understanding that no further improvements have been conducted on this drainage system through the provisions of the Drainage Act.

Puce Lots Drain No. 2 and Branch

- a) **July 29th, 1949** Engineer's Report for the "Puce Lots Drains No. 1 and No. 2", prepared by C.B. Allison, O.L.S., was carried out under Maidstone By-Law No. 1738. This report provided for the initial construction of both Municipal Drains, as petitioned for, with a particular focus on addressing poor drainage conditions between the VIA Rail tracks and County Road 22. Under this report, new drainage systems were installed along the south side of the VIA Rail tracks and along Major Street to alleviate these drainage issues. The Puce Lots Drain No. 2 was constructed as a covered drain along the south side of Major Street, with the Branch Drain along the north side of Major Street. The main drain continued across Puce Road and discharged directly into the Puce River, through private lands.
- b) **June 3rd, 1974** Engineer's Report for the "Puce Lots Drain No. 2", prepared by C.G.R. Armstrong, P.Eng., was carried out under Maidstone By-Law No. 2780. This reconsidered report provided for the replacement of the existing field tile drainage system with a corrugated steel pipe for the main and branch drains. This report also provided for the relocation of the outlet portion to be constructed within Lot 7, Block G of Registered Plan 1517 (and currently through 171 Puce Road), and parallel to the south property limit.

Since the improvements conducted under this report, it is our understanding that no further improvements have been conducted on this drainage system through the provisions of the Drainage Act.

Blanchard Drain

- a) **August 9th, 1984** Engineer's Report for the "Blanchard Drain", prepared by W.J. Settrington, P.Eng., was carried out under Maidstone By-Law No. 3332 and 3411D. This report provided for the initial construction of this Municipal Drain, as petitioned for,

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with a particular focus on addressing poor drainage conditions on both sides of Puce Road and within private property, located north of County Road 22. Under this report, new covered drainage systems were installed on both sides of Puce Road and utilized the Puce Lots Drain No. 2 as its primary outlet.

Since its original installation, it is our understanding that no further improvements have been conducted on this drainage system through the provisions of the Drainage Act.

Lilydale Avenue Drain and North Branch

- a) **August 22nd, 1969** Engineer's Report for the "Lilydale Avenue Drain", prepared by C.G.R. Armstrong, P.Eng., was carried out under Maidstone By-Law No. 2516 and 2628. This report provided for the initial construction of this Municipal Drain, as petitioned for, with a particular focus on addressing poor drainage conditions on the north side of Lilydale Avenue. Under this report, a new covered drainage system was installed and provided outlets into both the Puce River and the 4th Concession Drain.
- b) **July 22nd, 2002** Engineer's Report for the "Lilydale Avenue Drain and North Branch", prepared by N.J. Peralta, P.Eng., was carried out under Lakeshore By-Law No. 61-2002. This reconsidered report provided for the relocation of the Lilydale Avenue Drain outlet across Puce Road and further provided for the initial installation of the North Branch. These works were initiated to facilitate the development of new residential building lots along the east side of Puce Road, north of Lilydale Avenue.

4th Concession Drain and Pump Station Outlet

- a) **October 16th, 1986** Engineer's Report for the "4th Concession Drain Improvements and Pump Station Outlet Works", prepared by H.E. Regts, P.Eng., was carried out under Maidstone By-Law No. 3469-D and 3662-D-89. This report provided for the initial construction of flood protection gates and a pumping station, together with other improvements within the drainage system. The gate system and pumping station was designed for the benefit of the lands between the Canadian Pacific Railway to Lake St. Clair, with the intent to only pump the minor flows from the drainage basin.
- b) **April 30th, 1996** Engineer's Report for the "Maintenance Schedule of Assessment for the 4th Concession Drain Outlet Improvement Works and Pump Station", prepared by N.J. Peralta, P.Eng., was carried out under Maidstone By-Law No. 4427-D-96. This report provided for the reassessment of costs to this drainage system, so that costs for future maintenance work on this drain may be fairly assessed. No physical works were performed on this drain, as part of this report.

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The design parameters and the Schedule of Assessments included within these By-laws helped establish the extent of the affected drainage systems within this project site and further established the overall watershed limits affected by the associated drainage works. This information was in part utilized as the basis in our determination of the conceptual design and analysis performed under this project.

IV. PRELIMINARY INVESTIGATIONS AND INITIAL ON-SITE MEETING

Prior to our appointment to this project, the Municipality of Lakeshore had submitted a notice to the Essex Region Conservation Authority (E.R.C.A.) for comments and concerns related to the request for improvements to the various drainage systems affected by the proposed road reconstruction.

Following our appointment and in addition to the request for improvements to facilitate the proposed road reconstruction, the Municipality had received various complaints from affected landowners along Major Street regarding the poor performance and functionality of the Puce Lots Drain No. 2 and Branch.

Municipal staff had visited the site to perform a cursory review of the drainage system and found that due to higher than normal lake levels, the water levels within the system limited visibility. However, of the portions of the drain that were visible, they found that the existing corrugated steel pipe that formed part of the drainage system was corroded beyond repair. Based on its current condition and proximity to adjacent homes, the portion of the drainage system crossing Puce Road would require improvements to facilitate the road reconstruction of Puce Road, at a minimum, with efforts to provide the watershed with a suitable and sufficient mode of conveyance to its outlet into the Puce River. As such, the Municipality had requested that our office include the review of this drainage system and its outlet as part of our initial investigations.

After reviewing all of the drainage information provided by the Municipality of Lakeshore and gaining a better understanding of the request for improvements and the intended direction, we arranged for an On-Site Meeting with all affected landowners. This meeting was scheduled for August 15th, 2018 and was located at the intersection of Puce Road and Major Street. The following people were in attendance at the said meeting:

Barb Karn	landowner	- 1038 Major Street
Doug Perry	landowner	- 1023 Major Street
Don Campeau	landowner	- 1017 Major Street
Carole Amer	landowner	- 171 Puce Road
Gord Arsenault	landowner	- 1008 Major Street
Irene Brydges	landowner	- 179 Puce Road
Mike & Lynn Franzoso	landowners	- 1032 Major Street
Denis & Nancy Racine	landowners	- 1011 Major Street
Clare Morris	landowner	- 1008 County Road 22

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Cheryl Balint	landowner	- 168 Puce Road
Dave Goodfellow	landowner	- 164 Puce Road
Brian Laramie	landowner	- 1013 Major Street
Kevin Girard	landowner	- 188 Puce Road
Joel Chauvin	landowner	- 1027 Major Street
Sunghwee Mang	landowner	- 1012 County Road 22
Sal Pignanelli	landowner	- 1034 Major Street
Jen Shepherd	landowner	- 1030 Major Street
Mark Fishleigh	County of Essex	
Nelson Cavacas	Municipality of Lakeshore	
Jill Fiorito	Municipality of Lakeshore	
Brandon DiMenna	N.J. Peralta Engineering Ltd.	
AnneMarie Moniz	N.J. Peralta Engineering Ltd.	
Tony Peralta	N.J. Peralta Engineering Ltd.	

The following discussions took place at the On-Site Meeting:

1. Jill Fiorito introduced herself, Tony Peralta (Engineer appointed through the provisions of the Drainage Act) and the attending Municipal Staff. Specifically, Ms. Fiorito offered that the Municipality is looking to reconstruct and otherwise improve Puce Road as a part of a capital road reconstruction project.
2. Mr. Peralta elaborated on the request for improvements to the drainage systems affected by the road reconstruction works. He explained that through his discussions with Lakeshore Staff, the request for improvements was sought to review and analyze the functionality of the existing drainage systems along and crossing Puce Road. These investigations were to focus on addressing deficiencies and recommend the necessary improvements to bring the system to current drainage standards. These drainage improvements would be completed prior to and/or part of the road reconstruction works.
3. Mr. Peralta provided a brief history of each affected drainage system and outlined its status as Municipal Drain, through the provisions of the Drainage Act. The general condition and vintage of each of the systems were discussed, including the materials used at the time of their installation.
4. Mr. Peralta further explained that a Municipal Drain is a communally accepted drain and that all landowners within the watershed are considered stakeholders of the drain. Mr. Peralta further explained the purpose of this "On-Site Meeting" is to provide a general introduction to the project and to establish a general scope of work based on the submitted request and subsequent discussions of this meeting. Mr. Peralta provided the Ontario Ministry of Agriculture, Food and Rural Affairs (O.M.A.F.R.A.) Factsheets and encouraged landowners to review these documents and provide their input.

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5. Mr. Peralta advised that based on the vintage and materials used at the time of the initial installations it is very likely that the system has reached the end of its design life span (especially Puce Lots Drain No. 2 and possibly the Blanchard Drain). Therefore, it is very likely that these entire existing drainage systems will need replacement. Furthermore, based on a cursory review, it appears that these existing drainage systems do not meet current Municipal and Provincial drainage infrastructure standards. Furthermore, it appears that the current drainage outlets across Puce Road are located very close to existing homes, with limited access. As such, we intend to investigate alternative drain outlet locations for these systems. A topographic survey and field investigations will be required to evaluate the existing conditions, together with establishing any proposed improvements.
6. It was further explained that under the By-Laws in which these Municipal Drains were created, affected landowners who contribute and/or benefit from the associated drainage systems were assessed their share of the project costs. These landowners include the Municipality for their roads and VIA Rail for their railway. With some of the drainage systems having reached the end of their service life, the costs for their replacement may be levied to all affected owners based on their drainage contributions and the added benefits to the affected properties within the overall system. Furthermore, it should be noted that the landowners were advised that at this early stage of the project, the scope, analysis and design have yet to be considered. Therefore, the details and potential costs associated with the project have yet to be established.
7. Mr. Peralta made it clear that although the road reconstruction work will likely be undertaken at the same time as the drainage improvements, the affected landowners will only be responsible for their share of the drainage improvements costs. The costs for the road reconstruction works shall be borne 100% by the Municipality. Furthermore, Lakeshore had made it clear that a road reconstruction cannot proceed without improvements to the existing drainage systems. As such, the road reconstruction is contingent on the direction of the improvements to the associated drainage systems.
8. Mr. Peralta advised that this project is under the jurisdiction of the Department of Fisheries and Oceans (D.F.O.), the Essex Region Conservation Authority (E.R.C.A.), Ministry of Natural Resources and Forestry (M.N.R.F.) and the Ministry of Environment, Conservation and Parks (M.E.C.P.). The landowners were advised that the final design of the improvements may be governed by the regulatory requirements of these agencies.
9. Mr. Peralta reviewed the overall drainage report, future maintenance and potential appeal processes, together with general timelines with the landowners.

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10. Mr. Peralta opened up discussions with the landowners and requested that they provide their comments and concerns related to the associated drainage system improvements.
11. Some landowners identified that with the rising lake levels, water sits in the boulevard areas of Puce Road and Major Street for extended periods, especially following a rain event. There were also concerns with the rising lake levels and their influence on these overall drainage systems. Mr. Peralta explained that this is likely occurring to the low-lying properties relative to the current lake elevations. Therefore, to properly address the effects of rising lake levels, an appropriate flood protection gate and pump station may be required to address these issues. Mr. Peralta explained the necessary analysis and overall costs of pump stations could be costly. However, a gate and pump station would provide the most effective solution to rising lake levels. Mr. Peralta confirmed that the consideration of a Pump Station can be included as part of the overall analysis for this project.
12. Mr. Arsenault (1008 Major Street), provided some additional history in the area. He further expressed his concerns with water backing up through the Puce Lots Drain No. 1 onto his property. He advised that this water backs up onto his property when the 4th Concession Drain gates are closed and following a large storm event. Mr. Peralta elaborated on the function of the Puce Lots Drain No. 1 and that it is highly influenced by the 4th Concession Drain and Pump Station. Mr. Arsenault further questioned whether the Puce Lots Drain No. 2 system could be diverted to the 4th Concession Drain and Pump Station since it is a relatively small area of land being introduced to this system. Mr. Peralta advised that the consideration of diverting flows from one watershed to another can be complicated and the proper analysis of the receiving drainage system will need to be considered. Further investigations on the overall functionality and available capacity of the 4th Concession Drain and Pump Station must be evaluated in order to consider this option.
13. Several landowners questioned whether drainage assessments are part of their yearly taxes, paid to the Municipality. Mr. Fiorito explained that as a communal drainage system, drainage assessments are not covered on yearly taxes. Drainage assessments are specific to the drainage systems that each property contributes its runoff to, and costs are allocated only when works on the Municipal Drain are conducted.
14. Some landowners on the Puce Lots Drain No. 2 system questioned how the improvements to this drainage system would benefit them. Ms. Fiorito explained that the outlet portion of this drainage system crossing Puce Road, through private property to the west, and forms part of the Municipality's requests for improvement to facilitate the road reconstruction. However, in reviewing

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the status of the remainder of the system, it appears that this Municipal Drain has reached the end of its service life. Therefore, improvements to the entire system may be required due to its overall condition. By improving the entire system, it will allow runoff to be conveyed freely to the outlet and alleviate surface ponding and flooding through the system. Ms. Fiorito further explained that there will likely be cost savings with incorporating the replacement of the entire system as part of this project, rather than a standalone project in the future.

15. Further discussions ensued regarding how landowners are to pay for these drainage improvements. Ms. Fiorito explained that once the entire project is complete, the Municipality will issue invoices to all affected parties (based on the assessments within the By-Law). At that point, the landowners will have a choice to pay the invoice in full or have these costs debentured on their taxes over a set number of years.
16. Mr. Perry (1023 Major Street), advised that some of the residents on Major Street had already incurred costs to regrade their yards in efforts to alleviate ponding within their properties and wanted to understand why they would be responsible for additional costs to improve the drainage system. Mr. Peralta explained that the Municipal Drain improvements are intended to provide each affected property with a sufficient drainage outlet. It is the responsibility of each property owner to connect their private drainage systems to the communal drainage system.
17. Further discussion ensued regarding Puce Lots Drain No. 1 being overgrown with phragmites and the potential to perform drain maintenance. Ms. Fiorito advised that they could look into the potential maintenance of this drain.
18. Ms. Balint (168 Puce Road), inquired on how the final direction is established and whether options are provided to the landowners for consideration. She further questioned how assessments are derived to each affected landowner. Mr. Peralta identified that this meeting is intended to establish a scope of work for the project and the information gathered from this meeting will assist in establishing a final direction. If the landowners request that options be provided towards making an informed decision, a Preliminary Report could be prepared to provide conceptual design options with associated estimates and approximate distribution of costs. However, if the consensus is comfortable with proceeding with an established direction, we can proceed to a Final Report where the Engineer will determine the most appropriate solution taking into consideration the cost of the project relative to the benefit received. Based on the solution, the Engineer will establish the distribution of assessments.

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19. Mr. Arsenault (1008 Major Street), identified that the properties along County Road 22 utilize the Puce Lots Drain No. 2 as their drainage outlet. These properties drain overland through the rear of the homes on the south side of Major Street, into this system.
20. Based on the discussions and direction of this meeting, Mr. Peralta revisited the original request for improvement, initiated by the Municipality to address the improvements to the drainage systems across Puce Road to facilitate the road reconstruction. He further reiterated that based on the review of the Puce Lots Drain No. 2, the system appeared to have reached the end of its service life and needs replacement. At this point, there is an opportunity to extend the scope of work to include the replacement of the entire Puce Lots Drain No. 2 as part of this project. In an effort to establish the direction of this project, Mr. Peralta polled the landowners in attendance on whether the entire length of the Puce Lots Drain No. 2 should be included as part of the project scope, based on the information provided. By a show of hands, the landowners unanimously elected to proceed with the improvements to the entire Puce Lots Drain No. 2.
21. Ms. Amer (171 Puce Road), was unaware that the Puce Lots Drain No. 2 currently outlets through her property on the west side of Puce Road. We further discussed the details and approximate location based on the governing By-Law.

At the conclusion of the On-Site Meeting, we advised the landowners that we will be in close consultation with the Municipality of Lakeshore, the E.R.C.A., and other regulatory agencies towards the requested drainage improvements.

V. FURTHER INVESTIGATIONS AND FIELD SURVEY

Based on the information gathered at the Initial On-Site Meeting, we established that the initial scope of work shall consist of providing the necessary improvements to the drainage systems to facilitate the proposed road reconstruction along Puce Road. This scope shall also include the entire replacement of the Puce Lots Drain No. 2, along Major Street. Based on this direction, we arranged for our Survey Crew to attend the site and perform the necessary topographic survey, including taking necessary levels and details, along the entire length of the Puce Road and Major Street in order for us to complete our preliminary design calculations and estimates. Benchmarks were looped from previous work carried out on the associated drainage systems and tied into nearby Geodetic Benchmarks.

As part of our examinations, we evaluated the physical condition of the Blanchard Drain, the entire length of the Puce Lots Drain No. 2, together with the outlet portion of the Lilydale Avenue Drain and North Branch, along Puce Road. This included a historical review of

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the previous works completed on the drain relative to our findings during the field examinations and sewer inspections. With the lake levels relatively high within the associated drainage systems, finite invert elevations and details could not be easily acquired. A sewer inspection balloon was utilized to isolate portions of the drainage system from the effects of high lake levels. However, as part of our investigations related to the outlet of the Puce Lots Drain No. 2, the outlet pipe to the Puce River was not attainable. Furthermore, an underwater diver was retained to investigate the location of this outlet pipe. From these investigations, the outlet pipe was not visible or potentially concealed.

Of the information available through our investigations, we found that the existing condition of the Blanchard Drain and the Puce Lots Drain No. 2 were predominantly in poor condition and badly in need of upgrades, notwithstanding the need for drainage improvements to accommodate the proposed road reconstruction.

VI. ADDITION TO THE SCOPE OF WORK

While continuing with the scope of work as confirmed through the initial On-Site Meeting, the continual rise in lake levels had prompted landowners along Lilydale Avenue to come forth with concerns with the effectiveness of the Lilydale Avenue Drain. As part of the Municipality's review into the condition of this system, they found that this drainage system was in a similar condition as the Puce Lots Drain No. 2 and Blanchard Drain. In February of 2019, a formal request for improvement was submitted to the Municipality to address the replacement of the Lilydale Avenue Drain.

With the Lilydale Avenue Drain having direct implications to the proposed drainage improvements along Puce Road, the Municipality requested that the consideration of Lilydale Avenue Drain improvements shall form part of the scope of work for the entire project site. In doing so, they requested that we consider providing a holistic drainage solution for all affected drainage systems to address all drainage concerns brought forward to date and a potential solution to address the rising lake levels. As such, our office received a formal appointment by the Municipality of Lakeshore on May 28th, 2019 with the intent to include these works as part of the overall scope of work established for the Puce Road reconstruction drainage project. All of which could be presented to the affected landowners when scheduling a Subsequent On-Site Meeting to include the landowners along Lilydale Avenue and within the Lilydale Avenue Drain watershed.

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VII. CONSULTATION WITH VIA RAIL

In recognizing that any improvements to address the rising lake levels would include and/or incorporate the lands owned and operated by VIA Rail, we had reached out to their representatives to introduce them to the project. On July 5th, 2019, a meeting was scheduled with representatives of VIA Rail and Rail Term (Via Rail's Operations Consultants) to discuss and review the details of the project. The following people were in attendance at the said meeting:

Paul Charbachi	VIA Rail
Erik Gagnon	Rail Term
Kirk Raycraft	Rail Term
Ian Ruston	Rail Term
Emma Teskey	N.J. Peralta Engineering Ltd.
Brandon DiMenna	N.J. Peralta Engineering Ltd.
Tony Peralta	N.J. Peralta Engineering Ltd.

The following discussions took place during the Consultation Meeting:

1. Mr. Peralta provided introductions and provided an overview of the proposed road reconstruction project and the associated drainage improvements through the provisions of the Drainage Act.
2. Mr. Peralta further elaborated on the rising lake levels of Lake St. Clair and their effect on the low-lying lands within the project area.
3. VIA Rail / Rail Term identified that they recognize these effects and have received complaints from landowners along their railway ditches regarding stagnant water and the associated infestation of mosquitos.
4. Mr. Peralta presented plans illustrating the existing Municipal Drainage Systems in the project site, together with high-level conceptual plans towards amalgamating these drainage systems to a common outlet where a flood protection gate and pump station could be implemented. These plans include the potential for utilizing the railway ditches and/or potential crossing of the railway. Mr. Peralta further advised that as stakeholders within these Municipal Drains, VIA Rail should expect to see drainage assessments towards their contributions and benefit from the improved drainage system.
5. VIA Rail / Rail Term identified that they have no issues with the proposed drainage concepts and road reconstruction improvements, so long that the design of the infrastructure meets their design standards and regulations related to the VIA Rail tracks. They would request that this design information be provided to them in advance to ensure that they have an opportunity to review and provide comments before any construction was to commence.

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With VIA Rail's written confirmation towards their willingness to participate and facilitate the design along their railway, we felt comfortable with proceeding with the Subsequent On-Site Meeting with all affected landowners affected by the drainage works.

VIII. SUBSEQUENT ON-SITE MEETING

Based on the request for improvement on the Lilydale Avenue Drain, together with our consultation with the Town of Lakeshore and the VIA Rail regarding the need for added protection from rising lake levels, we felt that it is our obligation and duty to arrange a subsequent meeting with all of the affected parties within the project site. This meeting was scheduled to ensure that all stakeholders are aware of the existing site constraints and vulnerabilities that they previously may not have been aware of. The landowners invited to this meeting were those who utilize the Blanchard Drain, Puce Lots Drain No. 1 and No. 2, and Lilydale Avenue Drain and Branch. This meeting was scheduled for September 18th, 2019 and took place at the Municipality of Lakeshore's Atlas Tube Recreational Centre at 447 Renaud Line Road. The following people were in attendance at the said meeting:

Slawka Riley	landowner	- 1124 County Road 22
Al & Steve Micelli	landowners	- 1150 Shoreline Avenue
Gary Thibeault	landowner	- 1070 Lilydale Avenue
Pamela Shuren	landowner	- 1076 Lilydale Avenue
Chris Eagen	landowner	- 1108 Lilydale Avenue
Brigitte Potrin	landowner	- 1016 Major Street
MikeaLynn Franzoso	landowner	- 1032 Major Street
Gordon Arsenault	landowner	- 1008 Major Street
Lin Wilson	landowner	- 1042 Major Street
Fonda Asprakis	Landowner	- 175 Puce Road
Barb Karn	landowner	- 1038 Major Street
Dawn Kirchner	landowner	- 165 Puce Road
Dave Payette	landowner	- 1035 Major Street
Laurie Casagrande	landowner	- 1056 Lilydale Avenue
Andrew Makar	landowner	- 1052 Lilydale Avenue
Garnet Albert	landowner	- 1114 Lilydale Avenue
Mike Braun	landowner	- 1004 Lilydale Avenue
Vern Seaton	landowner	- 1024 Lilydale Avenue
Kathy McGowen	landowner	- 1064 Lilydale Avenue
Richard Blanchard	landowner	- 182 Puce Road
Janina Lesperance	landowner	- 1102 County Road 22
Denis & Nancy Racine	landowner	- 1011 Major Street
Pat Stevenson	landowner	- 1102 Lilydale Avenue
Thomas Mori	landowner	- 1036 Major Street
Francis Kennette	landowner	- 1030, 1032 & 1034 Lilydale Avenue
John Holsey	landowner	- 1068 Lilydale Avenue
Victor Bellavance	landowner	- 1140 County Road 22
Tom Bradd	landowner	- 1050 Lilydale Avenue
Mark Goulet	landowner	- 1042 Lilydale Avenue
Carole Amer	landowner	- 171 Puce Road

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Danny Marentette	landowner	- 171 Puce Road
Ron Strong	landowner	- 1150 County Road 22
Roger Freeman	landowner	- 1012 Lilydale Avenue
A.E. Roberts	landowner	- 1038 Lilydale Avenue
Kevin Girard	landowner	- 188 Puce Road
Bonnie Hogue	landowner	- 91 Puce Road
Saide Eid	landowner	- 1052 Lilydale Avenue
Tony Nehme	landowner	- 1020 Lilydale Avenue
Gerry Vanderheide	landowner	- 1026 Lilydale Avenue
Ross Ferrara	landowner	- 1048 Lilydale Avenue
Irene Hamilton	landowner	- 1066 Lilydale Avenue
Robert Weller	landowner	- 1128 Lilydale Avenue
Cynthia Casagrande	Essex Region Conservation Authority	
James Bryant	Essex Region Conservation Authority	
Mark Fishleigh	County of Essex	
Nelson Cavacas	Municipality of Lakeshore	
Jill Fiorito	Municipality of Lakeshore	
AnneMarie Moniz	N.J. Peralta Engineering Ltd.	
Tony Peralta	N.J. Peralta Engineering Ltd.	

The following discussions took place at the Subsequent On-Site Meeting:

1. Jill Fiorito introduced herself, Tony Peralta (Engineer appointed through the provisions of the Drainage Act) and the attending Municipal Staff. Ms. Fiorito elaborated on the purpose of the On-Site Meeting as it relates to this drainage project, specifically for the landowners along Puce Road, Major Street and Lilydale Avenue.
2. Mr. Peralta elaborated on the request for improvements brought forward by the Municipality and the landowners within each affected drainage system. He explained that through his discussions with Lakeshore Staff, the request for improvements was sought to review and analyze the functionality of the existing drainage systems crossing Puce Road and to address the deficiencies within the system. Mr. Peralta also identified that this is the second meeting for those landowners along Puce Road and Major Street. However, with the proposed expanded scope and the request for improvements to the Lilydale Drain, this would be the first meeting for those who live along Lilydale Avenue.
3. Mr. Peralta provided a PowerPoint presentation outlining each municipal drainage system affected by the project site. The presentation further outlined the existing functionality and the general watershed limits of the affected drainage systems. He further outlined that ultimately, the site contributes to two (2) separate and specific drainage outlets. The presentation also outlined the purpose of the meeting and the appointment through the provisions of the Drainage Act.

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4. Mr. Peralta further explained that a Municipal Drain is a communally accepted drain and that all landowners within the watershed are considered stakeholders of the drain. Mr. Peralta further explained the purpose of this "On-site Meeting" is to provide a general introduction to the project and to establish a general scope of work based on the submitted request and subsequent discussions of this meeting. Mr. Peralta provided the Ontario Ministry of Agriculture, Food and Rural Affairs (O.M.A.F.R.A.) Factsheets and encouraged landowners to review these documents and provide their input.
5. Mr. Peralta elaborated on the current condition, vintage, and functionality of each of the associated drainage systems. In addition to the functionality of each drainage system, Mr. Peralta identified the ongoing concerns related to the rising water levels of Lake St. Clair. Mr. Peralta also shared LiDAR mapping illustrating the existing lake elevation relative to the affected lands, together with its effect on various land and each drainage system. Ultimately, those lands that contribute to the Puce River watershed currently do not have any protection for rising lake water levels. Those lands that contribute to the 4th Concession Drain watershed do benefit from the existing flood protection gates and pump station associated with the system. However, due to the proximity to the outlet, the functionality of this system, and the associated land elevations, some properties within the Puce Lots Drain No. 1 experience extended periods of flooding within their lands.
6. Mr. Peralta presented two (2) potential scenarios for improvements. The first being to replace and/or enhance the existing systems without the benefit of protection from the rising lake water levels. The second scenario would be to replace and/or enhance the existing systems with the benefits of protection from rising lake water levels.
7. Mr. Peralta further explained that, as a communal drainage system, properties that contribute and/or benefit from the drainage system are typically assessed their fair share of the project costs. Based on the overall scope of work intended for the proposed improvements, assessments may be levied to all affected property owners who contribute and/or benefit from the improvements within the overall drainage system. In addition to the individual private property owners within the drainage system, the Municipality of Lakeshore (for their roads) and the VIA Rail (for their railway) would be considered landowners under this project and would be assessed their fair share of the project costs. The landowners were advised that, at this early stage of the project, the scope, analysis and design have yet to be considered. Therefore, the details and potential costs associated with the project have yet to be established.

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8. Mr. Peralta advised that this project is under the jurisdiction of the Department of Fisheries and Oceans (D.F.O.), the Essex Region Conservation Authority (E.R.C.A.), Ministry of Natural Resources and Forestry (M.N.R.F.) and the Ministry of Environment, Conservation and Parks (M.E.C.P.). The landowners were informed that we have already received preliminary comments from the E.R.C.A. as it pertains to this project. Primarily, the E.R.C.A. advised that the improvements shall not adversely affect the overall drainage system. The landowners were advised that in addition to the above, the final design of the improvements may be governed by further requirements of these agencies.
9. Based on the size and nature of this project, various options could be considered for the drainage improvements. Therefore, based on previous discussions with Municipal Staff, Mr. Peralta recommended that this project proceeds with a Preliminary Report to review potential improvement options that include budgetary cost estimates and general cost distribution to all affected parties. The Preliminary Report would be established to the overall direction for the final Engineer's Report through the provisions of the Drainage Act.
10. Mr. Peralta opened up discussions to the landowners and requested that they provide their comments and concerns as it relates to the proposed drainage improvements.
11. Mr. Gordon Arsenault (1008 Major Street), questioned whether the drainage system along Major Street (Puce Lots Drain No. 2) could be completely directed to the 4th Concession Drain and benefit from the flood protection gates and pump station. Mr. Peralta elaborated on the functionality of the 4th Concession Drain where the system is only intended to operate as a gravity drainage system with the flood protection gates open. During times when the lake levels are high, the flood protection gates are to be closed and the pumping station operates to pump a specific flow rate that is less than the regional standard. Based on preliminary discussions with the E.R.C.A., it is our understanding that although the additional area from Major Street would appear to be minor relative to the overall watershed, the deficiencies within the current system, together with any increase in flow contribution will require an extensive review and analysis of the system. Although the contributions would be small, the increase in runoff would likely require costly upgrades to bring the system to the current standard. Mr. Peralta further outlined that at the time when the Puce Lots No. 1 was improved in 1988, there was considerable opposition and concerns from landowners within the 4th Concession Drain for the minor increase in watershed contributions. If modifications to the 4th Concession Drain are requested and/or required, the landowners within this watershed will need to be notified and their comments and/or concerns will need to be considered. Based on the information provided, Mr. Peralta

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cautioned that the investigations required to divert the Puce Lots No. 2 watershed to the 4th Concession Drain could come with considerable cost implications due to the extensive study and likely improvements to the existing system.

12. Based on the considerable discussion in regards to diverting the Puce Lots Drain No. 2 watershed (Major Street) to the 4th Concession Drain, there were conflicting opinions on whether this option should be considered as part of the Preliminary Report options. As a result, it was suggested that a vote be conducted for those landowners on Major Street on whether this option should be considered. After polling the audience, there were thirteen (13) Major Street property owners present. Of those thirteen (13), only five (5) would like the Engineer to consider the necessary investigations for the 4th Concession Drain as a viable drainage outlet for Major Street. Based on the consensus, the Engineer will not include the additional investigations towards diverting Puce Lots Drain No. 2 to the 4th Concession Drain.
13. Property Owners along Major Street advised that the properties that front along County Road 22, contribute to the Puce Lots Drain No. 2 through the back yards of those along the south side of Major Street. Based on this information, the landowners asked whether a new drain can be installed between these properties to address these drainage issues. Mr. Peralta responded by clarifying his current appointment to provide improvements to the existing drainage systems through Section 78 of the Drainage Act. In order to construct a new drainage system, or extend the existing system upstream, between these properties, through the provisions of the Drainage Act, the area which requires drainage shall submit a formal petition to the Municipality for said improvements. The landowners were advised that petition forms can be made available through the Municipality of Lakeshore Drainage Division.
14. Mr. Larry Hogue (91 Puce Road), requested that we investigate the location of the Lilydale Avenue Drain outlet pipe into the Puce River, as he believes that it was not installed as outlined within the governing by-law.
15. Mr. Ross Ferrara (1048 Lilydale Avenue), expressed his desire to ensure that the drainage system and potential pump station are sized for the 1:100-year storm event. Mr. Peralta advised the typical level of service for Municipal Drain coincides with the provincial and regional minimum standards. A system designed above these standards may be cost-prohibitive.

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16. Ms. Barb Kern (1038 Major Street), advised that she is currently assessed to both the Puce Lots Drain No. 1 and the Puce Lots Drain No. 2 and would prefer that she only be assessed into one drainage system. Mr. Peralta confirmed that some lands along the north side of Major Street are assessed to both Municipal Drains due to the topography of these lands. Mr. Peralta advised that the drainage patterns can be reviewed as part of the investigations to see if there is a simple solution to this concern.
17. There were general discussions regarding specifics of the affected drainage systems (functionality, vintage, condition, watershed boundaries, etc.), general lake water levels, how the landowners connect to the new drainage system, and general timelines towards implementing a solution.
18. At the end of this meeting, Mr. Peralta questioned the audience as to whether this project should proceed towards preparing a Preliminary Report to provide various options for the necessary improvements to these drainage systems. By a show of hands, the audience unanimously voted to proceed with a Preliminary Report.

At the conclusion of the Subsequent On-Site Meeting, we advised the landowners that we will be in close consultation with the E.R.C.A., the Municipality of Lakeshore towards the requested improvements. A subsequent meeting with all affected landowners will likely be conducted once the Preliminary Report is completed.

IX. FURTHER INVESTIGATIONS AND PRELIMINARY ANALYSIS

Based on the scope of work established at the Subsequent On-Site Meeting, the request for drainage improvements along Puce Road, Major Street, and Lilydale Avenue Drain, together with the Municipality's desire to further review the influence of rising lake levels, our firm had sufficient guidance to proceed with the general analysis and investigations towards finding a holistic solution within the potential project site. Further to the discussions at the subsequent On-Site Meeting and the general direction to proceed with a Preliminary Report, the Municipality of Lakeshore provided instructions through email dated December 2nd, 2019, authorizing a Preliminary Report be prepared for the potential drainage improvements along Puce Road, Major Street and Lilydale Avenue. The following are details identified from our investigations:

Project Site Details

The overall project site is bounded by County Road 22 to the south, the Puce River to the west, the 4th Concession Drain to the east, and the properties along Lake St. Clair to the north. Both County Road 22 and the VIA Rail are significantly elevated relative to the lands within the project site. The properties within the project

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site are surrounded by bodies of water on three (3) of the four (4) sides. This project site is a rectangular-shaped watershed and encompasses approximately 45.600 hectares (112.70 acres). The drainage patterns for this project site primarily conveys surface and subsurface runoff to the Puce River and/or the 4th Concession Drain, as their drainage outlets.

Lake St. Clair Water Levels

Although the majority of these lands do not outlet directly to Lake St. Clair, the drainage systems and the lands within this project site are highly influenced by the lake's water levels. The Lake St. Clair water levels naturally vary and respond monthly, seasonally and annually to a variety of variables. Therefore, extremely difficult to predict on a yearly basis. Generally speaking, water levels are typically lower in the winter months and higher in the summer. These natural fluctuations are essential to the ecological environment, but high and low lake levels may impact local communities.

Relatively speaking, Lake St. Clair's historical monthly mean water level is at an elevation of 175.020 metres. The monthly mean lake levels have historically fluctuated between the all-time low elevation of 173.880 metres (set in 1936), to an all-time high of 176.040 metres (set in 2019). The Blanchard Drain, Puce Lots Drain No. 2 and Lilydale Avenue Drain were either newly installed or improved at times when lake levels were generally lower. The Puce Lots Drain No. 1 and the 4th Concession Drain were last improved during the late 1980s during high lake levels.

With the all-time high set in 2019, there are concerns that the lake level may continue to rise in the coming years, setting new highs. Based on the D.F.O. monthly bulletin of the Great Lakes water levels for July 2020, the monthly mean reached an elevation of 176.030 metres, nearly matching those in 2019. Lake St. Clair lake water level predictions, prepared by the Department of Fisheries and Oceans (D.F.O.) on June 1st, 2021, anticipate that the lake water elevations could reach an elevation of 175.680 metres by July of 2021. Which is approximately 0.360 metres (14.0") less than the all-time high set in 2019.

Project Site Characteristics

The residential properties within the project site have varying degrees of protection against high lake levels. In utilizing the latest Light Detection and Ranging (LiDAR) data, available through the Land Information Ontario (L.I.O.) and prepared by the Ministry of Natural Resources and Forestry (M.N.R.F.), we have gathered basic data on land elevations within the project site. As previously noted, the County Road 22 and the VIA Rail lands are significantly elevated relative to the adjacent residential lands at approximately 177.100 metres and 177.400 metres, respectively. The lands located immediately south of the VIA Rail, together with portions of Puce

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Road and Lilydale Avenue appears to be the lands with the lowest elevations within the project site, ranging between 175.700 metres and 177.000 metres. The level of protection along the shoreline of the Puce River and the Lake St. Clair range from having shore walls to having no protection at all. Based on a cursory review of the project site, some of these shore walls act as the initial barrier from encroaching lake levels. Where no shore wall exists, and if the existing shore walls are breached by exceeding lake water levels, the lands adjacent to the existing homes serve to represent the only barrier from protecting the existing homes from flooding.

As previously noted, the homes and the drainage system are currently protected by the existing barriers created by the shore walls and the lands around the existing homes. Using the latest LiDAR data, the following figure illustrates the existing areas within the project site that are susceptible to standing water and potential flooding:

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Elevation and Flood Analysis - Lilydale Avenue, Lakeshore
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Figure 1 - Areas within the project site influenced by Lake St. Clair's current and all-time high lake levels (up to 176.040 metres).

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As illustrated in Figure 1, the legend identifies a colour range representing the varying lake levels up to the highest recorded lake level elevation of 176.040 metres, set in 2019 (in Blue). All coloured areas within the site represent a range of lake levels above the existing land elevations. As a result, multiple areas within the project site are susceptible to lake water ponding in these areas as lake water backs up through the catch basins that form part of the existing drainage system. This was witnessed during ongoing site visits, where ponding water was present in these locations.

Lands Affected within the Puce River Watershed

The lands within the project site that convey their runoff westerly towards and along Puce Road, utilize the Puce River as their primary drainage outlet. The Puce River is a large natural watercourse that collects runoff from numerous drainage systems within the southwest quadrant of the Geographic Township of Maidstone. The drainage systems within the project site that currently utilize the Puce River as their drainage outlet include the Blanchard Drain, Puce Lots Drain No. 2 and the west half of Lilydale Avenue Drain. These drainage systems, and the lands in which contribute to these drainage systems, currently do not have any level of protection against rising lake levels. In reviewing the site parameters and general elevations of the associated lands, it is apparent that the affected lands that contribute to the Puce River would benefit from the implementation of flood protection gates and a pump station as protection against rising lake levels.

Lands Affected within the 4th Concession Watershed

The 4th Concession Drain is the primary outlet for a fairly large watershed. This system was upgraded in 1986 to include a flood protection gate and pump station to protect against rising lake levels at that time. Puce Lots Drain No. 1 and the east half of Lilydale Avenue utilize the 4th Concession Drain as their drainage outlet. Properties that discharge their runoff to the 4th Concession Drain benefit from the existing gate system that provides a level of protection from these rising lake levels. These protections are based on the proper functionality and upkeep of the gate system. Based on the details outlined within the 1986 4th Concession Drain Engineer's Report, the system is only intended to operate as a gravity drainage system with the flood protection gates open. During times when the lake levels are high, the flood protection gates are to be closed and the pumping station operates to pump the minor flows in the system. With some of the subject lands located at the very downstream portion of this watershed, the affected lands are susceptible to flooding during periods when storm events are in excess of the pump's discharge capacity. Under these circumstances, the 4th Concession Drain will back up into the Puce Lots Drain No. 1 and the Lilydale Avenue Drain. As a result, the affected lands within the project site that utilize the 4th Concession Drain would benefit from flood protection improvements and/or modifications to the Puce Lots Drain No. 1 and the east half of the Lilydale Drain.

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X. CONSULTATION WITH E.R.C.A.

To our knowledge, the Conservation Authorities Act was enacted in the mid-1940s to monitor and manage hydrological features through programs that balance human, environmental and economic needs. However, the Essex Region Conservation Authority (E.R.C.A.) did not form until the early 1970s. Therefore, the development of Puce Road, Major Street and Lilydale Avenue was created (the early 1900s) prior to any flood and erosion management and monitoring were regulated through the Conservation Authorities Act in the Essex County Region. As such, flood protection measures may not have been considered as part of these developments. Currently, the E.R.C.A. manages the risk associated with flooding and erosion as one of its primary roles through the Conservation Authorities Act. E.R.C.A. monitors weather information, river flows, lake levels, wind and ice conditions and other factors to predict when floods may occur, and how high the water or wave swells may rise. When flooding is possible, E.R.C.A. issues flood messages to municipal emergency management officials, the media, and the public. As a requirement under the provisions of the Drainage Act, consultation with the Local Conservation Authority is required and Conservation Authority may require a permit for the proposed works under Section 28 of the Conservation Authorities Act, as a regulatory body.

Through consultation with the E.R.C.A., we have received their comments and concerns regarding the replacement of the drainage system and potential road reconstruction details. We further requested comments related to establishing a minimum level of service related to flood protection. Ultimately, E.R.C.A. has identified that the project site is within the 1:100-year floodplain area associated with Lake St. Clair. With rising lake levels, the lands within the project area are susceptible to greater threats as a result of high water levels. They identified that prior to proceeding with a final design for any roadway and/or drainage improvements, they requested that the proposal be submitted to them for their comments.

XI. MINIMUM DESIGN REQUIREMENTS AND GENERAL GUIDELINES

Drainage systems were installed based on the requirements, guidelines, land use and the desired level of service required at the time of their installation. Based on a historical review of Municipal Drains in Essex County, drainage systems were typically designed to a level of service below (or sometimes equal to) the 2-year return period. With time and evolution, design standards change to meet current climate conditions, design requirements, improved materials, together with changes to the landscape within the watershed. As such, the replacement of existing drainage infrastructure may require improvements to meet current standards and guidelines.

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"A Guide for Engineers Working Under the Drainage Act in Ontario" - O.M.A.F.R.A. Publication 852 (2018), is the current reference documentation used by Engineer's carrying out work on Municipal Drains through provisions of the Drainage Act. Based on this document, the 2-year return period (50% chance of occurring each year) storm design is the recommended design standard applied to Municipal Drains within rural Ontario specific to open drain channels and low hazard agricultural access crossings. The exception is for residential, industrial and commercial properties where flooding could create significant damage to the surrounding properties. Therefore, a higher 5 to 10-year return period storm design could be utilized.

The Municipality of Lakeshore has created a Development Manual with the intent to streamline the process for "new" development works within their jurisdiction. This Development Manual is intended to work in conjunction with the requirements of Ontario Provincial Standard Specifications and Standard Drawings. This manual identifies that storm sewers in the Municipality shall be designed to a minimum 2-year return period based on the Rational Design Method. Although this document is helpful when establishing design requirements for drainage infrastructure, it does not specifically identify circumstances for addressing or retrofitting existing developments and drainage infrastructure.

The Windsor/Essex Region Stormwater Management Standards Manual (W.E.R.S.M.S.M.) outlines the general requirements for works proposed for "new" development within the Windsor/Essex Region. Based on the guidelines established within this document, the standard for a new municipal storm sewer (minor) system design is a 5-year return period (20% chance of occurring each year). As part of new development, the major drainage system (or floodproofing measures) shall consider a minimum design of a 100-year return period (1% chance of occurring each year) that also accounts for surface ponding and floodproofing elevations. This document also refers to the minimum design requirements when drainage systems have outfall conditions affected by lake levels. Although this document is helpful when establishing design requirements for drainage infrastructure, it does not specifically identify circumstances for addressing or retrofitting existing developments and drainage infrastructure.

Based on the information above, the details of this project and our firm's extensive experience dealing with Municipal Drains and municipal drainage infrastructure, the following is a summary of general guidelines and minimum standards intended to be used for the analysis and design of the improvements under this project:

Lake St. Clair Water Levels - The hydraulic analysis shall be performed based on an assumed minimum Lake St. Clair water level of elevation 175.810 metres, which is approximately equivalent to a 1:25-year water surface elevation (4% chance of occurring each year), with consideration of protection from the all-time high lake levels of 176.040 metres.

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Minor Storm Design Standard - The hydraulic analysis for the replacement of existing minor storm systems typically provides a level of service that ranges from a minimum of a 2 to 5-year return period. The level of service selected for this project could vary based on the overall configuration, storage capabilities and potential pumping capabilities.

Major Storm Design Standard - For new development, the hydraulic analysis for a major storm event is typically designed to a minimum of the 1:100-year return period (1% chance of occurring each year). However, with the project site already fully developed, the lands within the project area have existing site constraints and limitations. Therefore, there is no availability to meet current floodproofing provisions. These provisions would include raising property elevations, home openings and road elevations. With the flood protection measures design options included as part of this project, the flood protection measures could provide enhancements to provide a higher level of service than currently exists, to help protect against high lake level flooding of low-lying lands within the watershed.

XII. GENERAL FINDINGS

Based on our review of information currently available, discussions and review with Municipal Staff, the Essex Region Conservation Authority (E.R.C.A.), including information derived from the On-Site Meetings, we have proceeded to analyze the functionality of the existing conditions, together with proposed conditions to adequately address the necessary improvements to the affected drainage systems. The following are the results of the analysis conducted as part of this project and our findings are outlined in the following paragraphs.

Puce Lots Drain No. 1

The Puce Lots Drain No. 1 is an open drain that resides along the south side of the VIA Rail corridor. This drainage system has endured drainage issues for a number of years and more so during times when lake levels were high. In an effort to relieve some flooding concerns, this Municipal Drain was modified in 1988 to direct all runoff to the 4th Concession Drain with the intent to utilize the 4th Concession Drain flood gates and pump as added flood protection. The watershed contributing to this Municipal Drain include lands adjacent to the south side of the VIA Rail corridor, including the VIA Rail itself, and the lands along the east side of Puce Road between Major Street and the VIA Rail corridor. Per our observations and the discussions with affected landowners along the north side of Major Street, following large storm events the lands adjacent to the open drain endure prolonged ponding created by the accumulation of runoff that backs up into this drain from the 4th Concession Drain outlet.

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With lake levels on the rise, flooding concerns along the north side of Major Street became a prominent issue for these affected lands. As such, the Municipality felt it was prudent to take immediate action by installing a flap gate at the outlet end of the Puce Lots Drain No. 1 to address these immediate concerns.

During situations when the water levels in the Puce Lots Drain No. 1 are low, a gravity drainage system would accumulate enough water pressure to open a gate and sufficiently discharge runoff into the 4th Concession Drain. However, after a large storm event or during periods when high lake levels influence the confluence of the Puce Lots Drain No. 1 and the 4th Concession Drain, the force exerted by the higher water level shall keep the gate closed and restrict the gates from opening (hydrostatic pressure). Under these circumstances, a flap gate shall protect against stormwater from entering the drainage system. When the water level in the Puce Lots Drain No. 1 is equal to or greater than the levels in the 4th Concession Drain, the gate will open and allow the water level to equalize.

Puce Lots No. 2 Drain and Branch

The Puce Lots No. 2 Drain is a covered drainage system that was constructed on both sides of Major Street. The Main Drain has been constructed within the south right-of-way limit of Major Street, draining from east to west. The Main Drain continues across Puce Road and onto private property, where it outlets into the Puce River. The Branch Drain has been constructed within the north right-of-way limit and outlets into the Main Drain east of the intersection of Major Street and Puce Road. The watershed contributing to this drainage system include the lands that reside on both sides of Major Street, together with the lands that front onto County Road 22. This drainage system was installed in 1974, utilizing corrugated steel pipe materials. Based on our general review, we find that this drainage system is currently in poor physical condition and does not meet the minimum 2-year return period storm design requirements. Furthermore, the outlet portion of this Municipal Drain, west of Puce Road and within the private property of 171 Puce Road, is located in close proximity to the existing home. Upon conducting our field exploration, the outfall into the Puce River could not be located and was either buried in the river bed or potentially capped by the existing shorewall.

Blanchard Drain

As previously noted, the Blanchard Drain is a covered drainage system that was constructed on both sides of Puce Road, south of Major Street. This drainage system utilizes the Puce Lots Drain No. 2 as its direct drainage outlet. This drainage system was installed in 1984, utilizing corrugated plastic pipe materials. Based on our general review, we find that this drainage system currently does not meet the minimum 2-year return period storm design, nor does it comply with the current minimum Municipal Standards of the

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Development Manual. Furthermore, due to the proposed road reconstruction works planned for Puce Road, the alignment of the Blanchard Drain may require modifications to facilitate the proposed roadway.

Lilydale Avenue Drain and North Branch

The Lilydale Avenue Drain is a covered drainage system that was constructed along the north side of Lilydale Avenue. This Municipal Drain was constructed having two (2) drainage outlets to separate drainage systems. The west portion of the Lilydale Avenue Drain utilizes the Puce River as its drainage outlet. The east portion of the Lilydale Avenue Drain utilizes the 4th Concession Drain as its drainage outlet. Based on our review, it appears that the watershed limit between the east and west portions of the drainage system is located between M.N. 1076 and M.N. 1080 Lilydale Avenue. The drainage system was initially installed in 1967, utilizing corrugated steel pipe materials. Based on our general review, we find that this portion of the drainage system is currently in poor physical condition and does not meet the minimum 2-year return period storm design requirements. The westerly outlet portion across Puce Road, and through the private lands of 105 Puce Road, was improved in 2002 together with the creation of the North Branch. These improvements utilized PVC plastic pipe materials.

Lands Affected within the Puce River Watershed

As previously outlined, the majority of the lands located alongside Puce Road, Major Street and the west half of Lilydale Avenue utilize the Puce River as their primary drainage outlet. Based on the elevation of the existing outlet pipes, the general topography of the adjacent lands and the current high lake water levels, lake water can back up through the existing drainage systems and disperse onto the adjacent low-lying lands.

Further to our evaluation of the existing conditions, we find that during situations when the lake levels are low, a gravity drainage system would sufficiently discharge runoff to the Puce River. However, under high lake level situations, the drainage system will require the assistance of a gate to block the lake water from backing up into the low-lying areas within the system and pumping runoff to a sufficient outlet.

Lands Affected within the 4th Concession Drain Watershed

The lands alongside the south side of the VIA Rail corridor, together with the east half of Lilydale Avenue utilize the 4th Concession Drain as their primary drainage outlet. These lands are generally protected by the existing gate and pump station associated with this drainage system. However, the protection of these lands is subject to the available storage within the 4th Concession Drain and the carrying capacity of the pump station. As such, the lands within the project site are still vulnerable in circumstances when lake

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levels are high and the runoff within the 4th Concession Drain system is greater than the pump's discharge capacity.

XIII. RECOMMENDATIONS AND POTENTIAL OPTIONS

In order to address the deficiencies outlined above, two (2) separate and specific types of improvements are recommended. These improvements are related to the associated drainage systems to address the vulnerabilities of the existing and proposed conditions of the project site. These improvements are categorized as the following:

- PART 'A' - Flood Protection Capability Improvements
- PART 'B' - Free Outlet Conveyance Capability Improvements

In efforts to address the deficiencies for each component, we offer various options for improvements related to each affected drainage system. Both parts are recommended to address the deficiencies related to the performance of the system under the minimum design storm events and the effects of the Lake St. Clair water levels.

XIV. PART 'A' - FLOOD PROTECTION CAPABILITY IMPROVEMENTS

Further to our evaluation of the existing conditions, we find that during situations when the lake levels are low, gravity drainage systems discharge runoff to their associated outlets. However, under high lake level situations, the lands within the project site have varying degrees of flood protection capabilities.

The lands within the project site that ultimately utilize the 4th Concession Drain as their primary drainage outlet benefit from the flood protection gates and pump station that forms part of the system. However, based on its proximity to the lake and the current pump capabilities of the 4th Concession Drain, some improvements could be considered to further enhance the flood protection measure for the low-lying lands alongside the VIA Rail corridor. With the lands located south of the VIA Rail corridor at an elevation that is at or below the recorded high lake levels, these lands are susceptible to extending periods of ponding and/or flooding at times when the 4th Concession Drain is inundated with stormwater runoff from the upstream lands.

The land that utilizes the Puce River as its primary drainage outlet currently does not have any flood protection measures from the effect of rising lake levels. With the lands within the project site at an elevation that is at or below the recorded high lake levels, these lands are susceptible to extending periods of ponding and/or flooding. As such, the drainage system will require the assistance of a new gate to block the lake water from backing up into the low-lying areas within the system and a new pump station to pump the excess runoff to a sufficient outlet.

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i) PART 'A-1' - Puce Lots Drain No. 1 Flood Protection

The Puce Lots Drain No. 1 is an open drain configuration along the south side of the VIA Rail corridor. The open drain has sufficient capacity to convey stormwater runoff from the adjacent lands to the 4th Concession Drain. However, as previously identified, the primary deficiency related to the Puce Lots Drain No. 1 is associated with the effects of stormwater runoff from the 4th Concession Drain backing up into the Puce Lots Drain No. 1. The backup of stormwater runoff within the Puce Lots Drain No. 1 fills the open drain and spills onto the adjacent low-lying lands south of the open drain. Based on the discussion at the On-Site Meeting lands along the north side of Major Street are assessed to both the Puce Lots Drain No. 1 and Puce Lots Drain No. 2. These properties are also susceptible to the backup of stormwater runoff, due to its closer proximity to the Puce Lots Drain No. 1. To address this deficiency, we recommend the following design options:

OPTION 1: Redirect Flows to the Puce River Watershed

Currently, the entire length of the Puce Lots Drain No. 1 conveys stormwater runoff to the 4th Concession Drain with the intent to utilize its existing flood protection gates and pump to alleviate flooding in the area. However, the Puce Lots Drain No. 1 is located at the very downstream section of the large 4th Concession Drain watershed, where the pump station is only intended to pump minor flows. As a result, the lands adjacent to the Puce Lots Drain No. 1 are highly susceptible to flooding under circumstances when the flood gates and pump station are overwhelmed with stormwater runoff and/or high lake levels infiltrate the overall system.

This proposed drainage improvement would comprise of regrading the west portion of the Puce Lots Drain No. 1 to the west and towards the Puce River. The lands affected by the proposed diversion would be those who reside along the length of Major Street. These homes are in closer proximity to the open drain relative to the remainder of the watershed. Therefore, these lands are more susceptible to property damage caused by flooding. The watershed divide will be delineated by the installation of an earthen berm within the open drain east of M.N. 1044 Major Street. The homes alongside the east portion of the Puce Lots Drain No.1 are set further away from the open drain and are less susceptible to flooding. Therefore, these lands will remain within the 4th Concession Drain watershed with the same level of service that they previously endured.

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This proposed option will greatly reduce the risk of flooding to those land along the west portion of the Puce Lots Drain No. 1 created by the 4th Concession Drain. However, this drainage improvement would further benefit from a pumped system for the lands within the Puce River watershed, as recommended under Part 'A-2' of this report.

This option includes the following considerations:

1. Details and illustrations of this proposed option are included within **Sheet 2 of Appendix "A"**.
2. The earthen divide within the open drain, that separates the watersheds, shall include the installation of erosion protection measures to protect the drain banks caused by backwater conditions.
3. This option will result in the modification of the Puce Lots Drain No. 1 watershed limits, whereas the east portion shall remain part of the 4th Concession Drain, and the west portion will form part of the Puce River watershed.

OPTION 2: No Additional Flood Protection Improvements
(Status Quo)

This option will comprise of no physical improvements beyond what was previously completed to the drainage system. However, with no additional improvements to the drainage system, any ongoing drainage issues along the north side of Major Street, south side of the VIA Rail corridor, will continue to persist.

ii) PART 'A-2' - Puce River Watershed Pump Station

The existing drainage systems within the project site that contribute to the Puce River currently function as gravity outlets through the existing shore walls along the east bank of the Puce River. Based on the existing elevations of the outlet pipes and the general topography, together with the high lake water levels, lake water can back up through the existing drainage system and spill onto the lands and roads within and along Puce Road, Major Street and Lilydale Avenue.

The proposed drainage system is intended to safely collect storm runoff within the drain's watershed and convey these flows to a sufficient outlet. In order to do so, the prevention of backwater conditions created by high lake levels shall be addressed together with appropriately pumping the excess runoff into the Puce River.

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With the overall project scope including multiple Municipal Drainage systems, addressing the effects of high lake levels can be accomplished in a variety of ways. However, based on the information gleaned from the analysis and investigations, the following are the most feasible preliminary design options for the Puce River gate and pumping improvements:

OPTION 1: Separate Outlets and Pump Stations for the Systems on the North & South Sides of the VIA Rail Corridor

With the VIA Rail corridor creating a natural divide between the north and south portions of the project site, this option will comprise of directing all flows towards the VIA Rail corridor with two separate outlet systems on both sides of the corridor. In order to reduce the effects of high lake levels, a gate system shall be installed to assist with blocking lake water from infiltrating the low-lying lands, including the roadway and boulevards. Also, an appropriately sized pump station would be installed to dewater the drainage system during and after a storm event. In order to attenuate flows following a storm event, the storage of excess runoff will be required. This option would include the utilization of a portion of the VIA Rail ditch (to the north) and a portion of Puce Lots Drain No. 1, to store the excess stormwater runoff as the pump station discharges the accumulated volume of water.

These new pump station improvements would be sized to provide the minimum 1:2-year with the goal of achieving a 1:5-year return period storm event when the gates are closed (based on feasibility). The system shall also rely on sufficient open drain storage along the VIA Rail corridor to store runoff in excess of the pump's discharge capacity, potentially up to a 1:100-year storm event (depending on available storage).

OPTION 2: Consolidate All Puce River Drainage Systems with One Single Outlet and Pump Station

With the VIA Rail corridor creating a natural divide between the north and south portions of the project site, this option will comprise of directing all flows towards the VIA Rail corridor and consolidating all flows to a singular outlet system to the north side of the VIA Rail corridor. In order to reduce the effects of high lake levels, a gate system shall be installed to assist with blocking lake water from infiltrating the low-lying lands, including the roadway and boulevards. Also, an appropriately sized pump station would be installed to dewater the drainage system during and after a storm event. In order to attenuate flows following a storm event, the storage of excess runoff will be required. This option would include the utilization of the VIA Rail ditch (primarily to the north) to store the excess stormwater runoff as the pump station discharges the accumulated volume of water.

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These new pump station improvements would be sized to provide the minimum 1:2-year with the goal of achieving a 1:5-year return period storm event when the gates are closed (based on feasibility). The system shall also rely on sufficient open drain storage along the VIA Rail corridor to store runoff in excess of the pump's discharge capacity, potentially up to a 1:100-year storm event (depending on available storage). Options 1 and 2 include the following considerations:

1. This option may result in two (2) different scenarios based on the direction established for Puce Lots Drain No. 1 flood protection under Part 'A-1'. Details and illustrations of these proposed scenarios are included within **Sheet 3 and 4 of Appendix "A"**. Generally speaking, if the west portion of Puce Lots Drain No. 1 watershed shall remain within the 4th Concession Drain, the small area of affected lands on the north side of Major Street will not form part of the Puce River watershed and be excluded from these improvements.
2. The final location of the new pump station(s) and outlet alignment(s) will depend on the overall size and available space to install the new system(s).
3. Under these pump options, it is recommended that a minimum of two (2) pumps be utilized to meet the pump capacity and to provide redundancy in the event of a potential pump failure. Based on available space and functionality, the new pump station may be located below ground in a large chamber or within an above-ground pump house.
4. These options will require a review of the electrical service to the site and provide the availability to include a backup power supply for emergencies.
5. The ditches associated with the pump station(s) may still be susceptible to minor backwater effects during periods when the pumps are drawing down storm runoff in excess of the capacity of the pump. In addition to the associated storage ditches, the drainage systems along Puce Road, Major Street and Lilydale Avenue may experience some backwater within the associated drainage pipes during and after extreme storm events. As a result, private backflow prevention is recommended for each affected property to address these backwater effects from entering private drainage systems.

OPTION 3: No Flood Protection and Pump Improvements
(Status Quo)

This option will comprise of no physical flood protection improvements to the drainage system. However, with no gate and pumping improvements to these drainage systems, the ongoing drainage issues with prolonged ponding and flooding within the

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watershed will continue to persist during times of high lake levels.

XV. PART 'B' - FREE OUTLET CONVEYANCE CAPABILITY IMPROVEMENTS

As previously identified, each affected drainage system was installed at different periods and vary in the available capacity to convey runoff to a sufficient outlet. The majority of the deficient drainage systems were last improved between the years 1967 and 1984 and have reached (or exceeded) their design service lifespan. Based on their age, it is very likely that these systems do not meet current design and materials standards.

With the overall project scope including multiple Municipal Drainage systems, the recommendation for addressing the free outlet conveyance capability improvements shall be presented based on the associated roadway and receiving drainage outlets for each. Based on the information gathered from the analysis and investigations, we have established preliminary design options for each drainage system to address the free outlet conveyance capabilities of each. They are as follows:

i) PART 'B-1' - Major Street Drainage Improvements (Puce Lots No. 2 Drain And Branch)

The Puce Lots No. 2 Drain and Branch is a covered drainage system along both sides of Major Street. Based on its poor physical condition, the age of the existing system, together with the level of service that the system can convey drainage flows, we recommend that this drainage system be replaced in its entirety. Based on the watershed contributing to this system, the available drainage outlets and the alignment abilities, we recommend that the improvements to this drainage system be accomplished through the following options:

OPTION 1: Replacement with Outlet Towards Puce Road

This proposed drainage improvement would comprise of replacing the existing drainage system with all flows conveyed towards Puce Road. This would represent a similar configuration to that of the existing drainage system. The new drainage system will be installed to current design and material standards.

This option includes the following considerations:

1. Details and illustrations of this proposed option are included within **Sheet 5 of Appendix "A"**.
2. The final drainage alignment will depend on the overall size and available space to install the new system.

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3. This option shall include all of the necessary drainage components (catch basins, maintenance holes, private services, etc.) to facilitate the proper drainage of the roadway and adjacent lands.
4. The current drainage outlet for Major Street (across Puce Road) will need to be relocated as part of the Puce Road drainage improvements. The flows collected through the new Major Street drainage improvements shall be conveyed to the new outlet location as outlined in PART 'A-2'. As such, the Major Street drainage system outlined as part of this option will need to be extended to this new outlet along Puce Road. This extension will form part of the Puce Road drainage improvements (South of VIA Rail) identified in PART 'B-4' Option 1.
5. The level of service provided under this option will vary between a minimum of a 1:2-year to a 1:5-year return period. The final design level of service will take into consideration the storage and/or pump capabilities that form part of improvement PART 'A-2'.
6. The ditches associated with the pump station(s) may still be susceptible to minor backwater effects during periods when the pumps are drawing down storm runoff in excess of the capacity of the pump. In addition to the associated storage ditches, the drainage systems along Puce Road, Major Street and Lilydale Avenue may experience some backwater within the associated drainage pipes during and after extreme storm events. As a result, private backflow prevention is recommended for each affected property to address these backwater effects from entering private drainage systems.

OPTION 2: Replacement with New Outlet Towards Puce Lots Drain No. 1

This proposed drainage improvement would comprise of replacing the existing drainage system with all flows conveyed to a singular drainage outlet along the north side of Major Street and into the Puce Lots Drain No. 1. This configuration would collect runoff along Major Street and convey these flows through a new drainage outlet through private lands. This configuration would centrally locate the outlet pipe in an appropriate location. The outlet of this drainage system shall coincide with the new outlet options outlined within 'PART A-2'. The new drainage system will be installed to current design and material standards.

This option includes the following considerations:

1. Details and illustrations of this proposed option are included within **Sheet 5 of Appendix "A"**.

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2. The final drainage alignment will depend on the overall size and available space to install the new system.
3. This option shall include all of the necessary drainage components (catch basins, maintenance holes, private services, etc.) to facilitate the proper drainage of the roadway and adjacent lands.
4. The level of service provided under this option will vary between a minimum of 1:2-year to a 1:5-year return period. The final design level of service will take into consideration the storage and/or pump capabilities that form part of improvements in Part 'A-2'.
5. Currently, the access and maintenance corridors/easements are within the Major Street right-of-way. With a new drainage outlet through private property, allowances and compensation will be provided to those lands in which the new outlet pipe will reside. The new access and maintenance corridor/easement is intended to be free and clear of any future building, structure, fence, concrete, or any other obstruction that would prevent the future repair or maintenance of the new outlet pipe.
6. The ditches associated with the pump station(s) may still be susceptible to minor backwater effects during periods when the pumps are drawing down storm runoff in excess of the capacity of the pump. In addition to the associated storage ditches, the drainage systems along Puce Road, Major Street and Lilydale Avenue may experience some backwater within the associated drainage pipes during and after extreme storm events. As a result, private backflow prevention is recommended for each affected property to address these backwater effects from entering private drainage systems.

OPTION 3: No Replacement or Improvements (Status Quo)

This option will comprise of no physical improvements to the drainage system along the length of Major Street. However, with no improvements to the drainage system, the deficient drainage system will continue to deteriorate towards its failure. With all things considered, the Municipality will not be able to proceed with the future reconstruction of the roadway until the drainage deficiencies have been addressed.

This option includes the following considerations:

1. The current drainage outlet for Major Street (Puce Lots Drain No. 1) can not be improved in its current location and will need to be relocated as part of the Puce Road drainage improvements. Should Puce Road drainage improvements (South of VIA Rail) proceed without Major Street drainage improvements, the outlet portion of the Puce Lots Drain No.2

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will need to be relocated. As such the costs for this new outlet location along Puce Road shall be shared with all lands and roads that contribute to the improved outlet, including those along Major Street.

ii) PART 'B-2' - Lilydale Avenue Drain Improvements (East Portion)

Similar to Puce Lots Drain No.1, the east portion of the Lilydale Avenue Drain is susceptible to stormwater backing up into the systems during periods when the 4th Concession Drain flows are in excess of the pump's capacity. As such, the improvements to the east portion of the Lilydale Avenue Drain shall be accompanied with a flap gate to protect from stormwater runoff backing into this system.

The east portion of the Lilydale Avenue Drain currently conveys stormwater runoff towards the 4th Concession Drain. The lands affected by the east portion include the north half of the VIA Rail corridor, the entire width of Lilydale Avenue, and the properties along the north side of Lilydale Avenue from 1080 Lilydale Avenue, to 1146 Lilydale Avenue. Based on its poor physical condition, the age of the existing system, together with the level of service that the system can convey drainage flows, we recommend that this drainage system be replaced in its entirety. Currently, the VIA Rail drainage ditch along the north side of the railway has an irregular gradient that has not been maintained and endures issues with stagnant water. Improving and maintaining this ditch as part of the drainage improvements will reduce and/or eliminate the stagnant water concerns brought forward by the VIA Rail. Based on the watershed contributing to this system, the available drainage outlets and the alignment abilities, we recommend that the improvements to this drainage system be accomplished through the following options:

OPTION 1: Replacement with a Singular Drainage System

This proposed drainage improvement would comprise of replacing the existing drainage system with all flows conveyed towards the 4th Concession Drain in a linear fashion and parallel to the existing roadway. This would represent a similar configuration to that of the existing drainage system. The new drainage system will be installed to current design and material standards.

This option includes the following considerations:

1. Details and illustrations of this proposed option are included within **Sheet 6 of Appendix "A"**.
2. The final drainage alignment will depend on the overall size and available space to install the new system.

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3. This option shall include all of the necessary drainage components (catch basins, maintenance holes, private services, etc.) to facilitate the proper drainage of the roadway and adjacent lands.
4. The level of service provided under this option will vary between a minimum of a 1:2-year to a 1:5-year return period. The final design level of service will take into consideration the storage and/or pump capabilities of the 4th Concession Drain.
5. The ditches associated with the pump station(s) may still be susceptible to minor backwater effects during periods when the pumps are drawing down storm runoff in excess of the capacity of the pump. In addition to the associated storage ditches, the drainage systems along Puce Road, Major Street and Lilydale Avenue may experience some backwater within the associated drainage pipes during and after extreme storm events. As a result, private backflow prevention is recommended for each affected property to address these backwater effects from entering private drainage systems.
6. Currently, private gravel parking pads, landscaping, and gardens have been installed on the south side of Lilydale Avenue and on Municipal and VIA Rail Lands. Regardless of the drainage improvements selected, these areas shall be restored to a native grass boulevard area at a minimum. The Municipality of Lakeshore has plans to potentially extend the existing pedestrian pathway network from Shoreline Avenue.

OPTION 2: Replacement with Multiple Outlets to the VIA Rail Ditch

With the improvements to the VIA Rail ditch, this proposed drainage improvement would comprise of replacing the existing drainage system on the north side of Lilydale Avenue with all flows conveyed through multiple drainage outlets to the south side of Lilydale Avenue and into the improved VIA Rail ditch. This configuration would collect runoff alongside, and including Lilydale Avenue, together with conveying these flows through the improved VIA Rail ditch and outlet into the 4th Concession Drain. The new drainage system will be installed to current design and material standards.

This option includes the following considerations:

1. Details and illustrations of this proposed option are included within **Sheet 6 of Appendix "A"**.
2. The final drainage alignment will depend on the overall size and available space to install the new system.

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3. This option shall include all of the necessary drainage components (catch basins, maintenance holes, private services, etc.) to facilitate the proper drainage of the roadway and adjacent lands.
4. The level of service provided under this option will vary between a minimum of a 1:2-year to a 1:5-year return period. The final design level of service will take into consideration the storage and/or pump capabilities of the 4th Concession Drain.
5. The ditches associated with the pump station(s) may still be susceptible to minor backwater effects during periods when the pumps are drawing down storm runoff in excess of the capacity of the pump. In addition to the associated storage ditches, the drainage systems along Puce Road, Major Street and Lilydale Avenue may experience some backwater within the associated drainage pipes during and after extreme storm events. As a result, private backflow prevention is recommended for each affected property to address these backwater effects from entering private drainage systems.
6. Currently, the access and maintenance corridors/easements are within the Lilydale Avenue right-of-way. With the VIA Rail ditch being improved to form part of the drainage system, the working corridors will be re-established across Lilydale Avenue and alongside the improved VIA Rail ditch. A nominal allowance and/or compensation may be provided to the VIA Rail lands for the use of the lands in which the drainage ditch will be improved.
7. Currently, private gravel parking pads, landscaping, and gardens have been installed on the south side of Lilydale Avenue and on Municipal and VIA Rail Lands. Regardless of the drainage improvements selected, these areas shall be restored to a native grass boulevard area at a minimum. The Municipality of Lakeshore has plans to potentially extend the existing pedestrian pathway network from Shoreline Avenue.

OPTION 3: No Replacement or Improvements (Status Quo)

This option will comprise of no physical improvements to the drainage system. However, with no improvements to the drainage system, the deficient drainage system will continue to deteriorate towards its failure. The system will continue to utilize the current protection of the 4th Concession Drain flood protection gates and pump from rising lake levels. With a failing drainage system, the Municipality will not be able to proceed with any future reconstruction of the roadway until the drainage deficiencies have been addressed.

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iii) PART 'B-3' - Lilydale Avenue Drain Improvements (West Portion)

The west portion of the Lilydale Avenue Drain currently conveys stormwater runoff towards Puce Road. The lands affected by the west portion include the north half of the VIA Rail corridor, the entire width of Lilydale Avenue and the properties along the north side of Lilydale Avenue from M.N. 1004 Lilydale Avenue to M.N. 1076 Lilydale Avenue. Based on its poor physical condition, the age of the existing system, together with the level of service that the system can convey drainage flows, we recommend that this drainage system be replaced in its entirety. Currently, the VIA Rail drainage ditch along the north side of the railway has an irregular gradient that has not been maintained and endures issues with stagnant water. Improving and maintaining this ditch as part of the drainage improvements will reduce and/or eliminate the stagnant water concerns brought forward by the VIA Rail. Based on the watershed contributing to this system, the available drainage outlets and the alignment abilities, we recommend that the improvements to this drainage system be accomplished through the following options:

OPTION 1: Replacement with a Singular Drainage System

This proposed drainage improvement would comprise of replacing the existing drainage system with all flows conveyed towards Puce Road in a linear fashion and parallel to the existing roadway. This would represent a similar configuration to that of the existing drainage system. The new drainage system will be installed to current design and material standards.

This option includes the following considerations:

1. Details and illustrations of this proposed option are included within **Sheet 7 of Appendix "A"**.
2. The final drainage alignment will depend on the overall size and available space to install the new system.
3. This option shall include all of the necessary drainage components (catch basins, maintenance holes, private services, etc.) to facilitate the proper drainage of the roadway and adjacent lands.
4. The level of service provided under this option will vary between a minimum of a 1:2-year to a 1:5-year return period. The final design level of service will take into consideration the storage and/or pump capabilities that form part of improvement PART 'A-2'.
5. The ditches associated with the pump station(s) may still be susceptible to minor backwater effects during periods when the pumps are drawing down storm runoff in excess of the capacity of the pump. In addition to the associated storage

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ditches, the drainage systems along Puce Road, Major Street and Lilydale Avenue may experience some backwater within the associated drainage pipes during and after extreme storm events. As a result, private backflow prevention is recommended for each affected property to address these backwater effects from entering private drainage systems.

6. Currently, gravel parking pads, landscaping, and gardens have been installed on the south side of Lilydale Avenue and on Municipal and VIA Rail Lands. Regardless of the drainage improvements selected, these areas shall be restored to a native grass boulevard area. The Municipality of Lakeshore has plans to potentially extend the existing pedestrian pathway network from Shoreline Avenue.

OPTION 2: Replacement with Multiple Outlets to the VIA Rail Ditch

With the improvements to the VIA Rail ditch, this proposed drainage improvement would comprise of replacing the existing drainage system with all flows conveyed to multiple drainage outlets along the south side of Lilydale Avenue and into the VIA Rail ditch. This configuration would collect runoff along and including Lilydale Avenue and convey these flows through the improved VIA Rail ditch and outlet towards the Puce River. The new drainage system will be installed to current design and material standards.

This option includes the following considerations:

1. Details and illustrations of this proposed option are included within **Sheet 7 of Appendix "A"**.
2. The final drainage alignment will depend on the overall size and available space to install the new system.
3. This option shall include all of the necessary drainage components (catch basins, maintenance holes, private services, etc.) to facilitate the proper drainage of the roadway and adjacent lands.
4. The level of service provided under this option will vary between a minimum of a 1:2-year to a 1:5-year return period. The final design level of service will take into consideration the storage and/or pump capabilities that form part of improvement PART 'A-2'.
5. Currently, the access and maintenance corridors/easements are within the Lilydale Avenue right-of-way. With the VIA Rail ditch being improved to form part of the drainage system, the working corridors will be re-established across Lilydale Avenue and alongside the improved VIA Rail ditch. A nominal allowance and/or compensation may be provided to the VIA Rail

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lands for the use of the lands in which the drainage ditch will be improved.

6. Currently, gravel parking pads, landscaping, and gardens have been installed on the south side of Lilydale Avenue and on Municipal and VIA Rail Lands. Regardless of the drainage improvements selected, these areas shall be restored to a native grass boulevard area. The Municipality of Lakeshore has plans to potentially extend the existing pedestrian pathway network from Shoreline Avenue.

OPTION 3: No Replacement or Improvements (Status Quo)

This option will comprise of no physical improvements to the drainage system. However, with no improvements to the drainage system, the deficient drainage system will continue to deteriorate towards its failure. With all things considered, the Municipality will not be able to proceed with the future reconstruction of the roadway until the drainage deficiencies have been addressed.

This option includes the following considerations:

1. The current drainage outlet for Lilydale Avenue (West Portion) will need to be relocated as part of the Puce Road drainage improvements. Should Puce Road Drainage improvements (north of VIA Rail) proceed without Lilydale Avenue drainage improvements (West Portion) the outlet portion of the Lilydale Avenue Drain will need to be improved and/or relocated. As such, the costs for this new outlet location along Puce Road shall be shared with all lands and roads that contribute to the improved outlet, including those along Lilydale Avenue.

iv) PART 'B-4' - Puce Road Drainage Improvements (South of VIA Rail)

The Blanchard Drain resides within the Puce Road right-of-way limits, south of the VIA Rail corridor. This drain utilizes the outlet portions of the Puce Lots Drain No. 2 that currently crosses Puce Road and outlets to the Puce River through private property.

The Blanchard Drain currently serves the lands alongside both sides of Puce Road and currently does not meet current design standards. Based on its poor physical condition, the age of the existing system, together with the level of service that the system can convey drainage flows, we recommend that this drainage system be replaced in its entirety.

The Puce Lots Drain No. 2 outlet is located within private lands. Through the development of these lands, this outlet location is no longer accessible for improvements and/or replacement. This outlet location presents challenges that may

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lead to further issues and a significant increase in costs. Based on the watershed contributing to this system, the available drainage outlets and the alignment abilities, we recommend that the improvements to this drainage system be accomplished through the following options:

As noted in PART 'A-1', it is more functional to have the lands on the east side of Puce Road, between Major Street and the VIA Rail corridor, diverted to the Puce River watershed based on its proximity to the Puce River, together with the necessary road and drainage improvements. As such, these lands shall be included as part of this watershed.

OPTION 1: Replacement with a Singular Drainage Outlet at a New Location

This proposed drainage improvement would comprise of replacing and relocating the existing drainage system to a new outlet location towards the VIA Rail corridor. This drainage improvement shall serve to provide a new sufficient outlet for the lands along Major Street and Puce Road. The new drainage system will be installed to current design and material standards. The new outlet location would be situated along Puce Road and outlet to the Puce River through the VIA Rail corridor, as outlined in PART 'A-2'.

This option includes the following considerations:

1. Details and illustrations of this proposed option are included within **Sheet 8 of Appendix "A"**.
2. The final drainage alignment will depend on the overall size and available space to install the new system.
3. This option shall include all of the necessary drainage components (catch basins, maintenance holes, private services, etc.) to facilitate the proper drainage of the roadway and adjacent lands.
4. The level of service provided under this option will vary between a minimum of a 1:2-year to a 1:5-year return period. The final design level of service will take into consideration the storage and/or pump capabilities that form part of improvement PART 'A-2'.
5. The ditches associated with the pump station(s) may still be susceptible to minor backwater effects during periods when the pumps are drawing down storm runoff in excess of the capacity of the pump. In addition to the associated storage ditches, the drainage systems along Puce Road, Major Street and Lilydale Avenue may experience some backwater within the associated drainage pipes during and after extreme storm

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events. As a result, private backflow prevention is recommended for each affected property to address these backwater effects from entering private drainage systems.

OPTION 2: Direct All Flows to Major Street

In conjunction with PART 'B-1'-Option 2 (Major Street Drainage Improvements), this proposed drainage improvement would comprise of replacing the existing drainage system with all runoff along Puce Road conveyed through a new Major Street drainage outlet within private lands. This configuration would centrally locate the outlet pipe in an appropriate location and result in a smaller-sized drainage infrastructure. The outlet of this drainage system shall coincide with the new outlet options outlined within PART 'A-2'. The new drainage system will be installed to current design and material standards.

This option includes the following considerations:

1. Details and illustrations of this proposed option are included within **Sheet 8 of Appendix "A"**.
2. The final drainage alignment will depend on the overall size and available space to install the new system.
3. This option shall include all of the necessary drainage components (catch basins, maintenance holes, private services, etc.) to facilitate the proper drainage of the roadway and adjacent lands.
4. The level of service provided under this option will vary between a minimum of a 1:2-year to a 1:5-year return period. The final design level of service will take into consideration the storage and/or pump capabilities that form part of improvement PART 'A-2'.
5. The ditches associated with the pump station(s) may still be susceptible to minor backwater effects during periods when the pumps are drawing down storm runoff in excess of the capacity of the pump. In addition to the associated storage ditches, the drainage systems along Puce Road, Major Street and Lilydale Avenue may experience some backwater within the associated drainage pipes during and after extreme storm events. As a result, private backflow prevention is recommended for each affected property to address these backwater effects from entering private drainage systems.

OPTION 3: No Replacement or Improvements (Status Quo)

This option will comprise of no physical improvements to the drainage system. However, with no improvements to the drainage system, the deficient drainage system will continue to deteriorate towards its failure. With all things considered,

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the Municipality will not be able to proceed with the future reconstruction of the roadway until the drainage deficiencies have been addressed.

v) PART 'B-5' - Puce Road Drainage Improvements (North of VIA Rail)

The existing Municipal Drainage System that resides within the Puce Road right-of-way limits, north of the VIA Rail corridor include the North Branch of the Lilydale Avenue Drain. This drainage system utilizes the outlet portions of the Lilydale Avenue Drain that currently crosses Puce Road and outlet to the Puce River through private property.

The North Branch of the Lilydale Avenue Drain currently serves the lands alongside both sides of Puce Road north of the VIA Rail corridor. Based on the age and physical condition, the North Branch of the Lilydale Avenue Drain appears to be in fair condition. However, modifications may be required to divert flows to a new outlet for protection against high lake levels and to adequately collect and convey stormwater runoff to facilitate the proposed improvements to the roadway.

Based on the watershed contributing to this system, the available drainage outlets and the alignment abilities, we recommend that the improvements to this drainage system be accomplished through the following options:

OPTION 1: Direct Flows to a New Outlet with Minor Drainage Improvements along Puce Road

This proposed drainage improvement would comprise of making the necessary modifications to the drainage system to facilitate the proposed roadway improvements and to ensure proper drainage for the lands adjacent to the roadway. However, this system currently has no protection from the effects of rising lake levels. Therefore, it is recommended that the existing outlet portion shall be abandoned and a new drainage outlet location would be situated along the VIA Rail corridor, as outlined in PART 'A-2'

This option includes the following considerations:

1. Details and illustrations of this proposed option are included within **Sheet 9 of Appendix "A"**.
2. The final drainage alignment will depend on the overall size and available space to install the new system.
3. This option shall include all of the necessary drainage components (catch basins, maintenance holes, private services, etc.) to facilitate the proper drainage of the roadway and adjacent lands.

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4. The level of service provided under this option will vary between a minimum of a two (2) and five (5) year return period. The final design level of service will take into consideration the storage and/or pump capabilities that form part of improvement PART 'B'.
5. The ditches associated with the pump station(s) may still be susceptible to minor backwater effects during periods when the pumps are drawing down storm runoff in excess of the capacity of the pump. In addition to the associated storage ditches, the drainage systems along Puce Road, Major Street and Lilydale Avenue may experience some backwater within the associated drainage pipes during and after extreme storm events. As a result, private backflow prevention is recommended for each affected property to address these backwater effects from entering private drainage systems.

OPTION 2: No Replacement or Improvements (Status Quo)

This option will comprise of no physical improvements to the drainage system. However, with no improvements to the drainage system, and no protection from rising lake levels, the Municipality will not be able to proceed with the future reconstruction of the roadway.

XVI. ALLOWANCES AND COMPENSATION

With the exception of Part 'B-1'-Option 2, the lands required to construct the necessary improvements within the drainage system are primarily located within the right-of-way limit of the existing roadways and railway corridors. In the event that the proposed improvements require the use of private lands, these affected lands shall be compensated based on the current market value at the time of the final Engineer's Report. This compensation shall further establish the right to access the new drainage system for future maintenance and repair. In the event that the construction works shall result in indirect damages to residential property, these Landowners would be entitled to and should receive compensation for damages to such lands.

All allowances or compensation shall be provided for through Section 29 and 30 of the "Drainage Act, R.S.O. 1990, Chapter D.17, as amended 2020".

XVII. ESTIMATE OF COST

The following table outlines the estimated costs for each of the conceptual drainage improvement options, including construction incidental expenses and allowances, as outlined above.

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Affected System	Improvement Options	Construction & Allowances	Incidentals	Total Cost
Puce Lots Drain No. 1 - Flood Protection	PART 'A-1': Option 1	\$ 12,000.00	\$ 3,000.00	\$ 15,000.00
	PART 'A-1': Option 2	\$0.00	\$0.00	\$0.00
Puce River Drainage System - Flood Protection	PART 'A-2': Option 1	\$675,000.00	\$165,000.00	\$840,000.00
	PART 'A-2': Option 2	\$630,000.00	\$150,000.00	\$780,000.00
	PART 'A-2': Option 3	\$0.00	\$0.00	\$0.00
Major Street Drainage	PART 'B-1': Option 1	\$490,000.00	\$ 75,000.00	\$565,000.00
	PART 'B-1': Option 2	\$600,000.00	\$110,000.00	\$710,000.00
	PART 'B-1': Option 3	\$0.00	\$0.00	\$0.00
Lilydale Avenue (East)	PART 'B-2': Option 1	\$640,000.00	\$105,000.00	\$745,000.00
	PART 'B-2': Option 2	\$555,000.00	\$ 95,000.00	\$650,000.00
	PART 'B-2': Option 3	\$0.00	\$0.00	\$0.00
Lilydale Avenue (West)	PART 'B-3': Option 1	\$785,000.00	\$130,000.00	\$915,000.00
	PART 'B-3': Option 2	\$645,000.00	\$105,000.00	\$750,000.00
	PART 'B-3': Option 3	\$0.00	\$0.00	\$0.00
Puce Road Drainage (South)	PART 'B-4': Option 1	\$280,000.00	\$ 50,000.00	\$330,000.00
	PART 'B-4': Option 2	\$265,000.00	\$ 45,000.00	\$310,000.00
	PART 'B-4': Option 3	\$0.00	\$0.00	\$0.00
Puce Road Drainage (North)	PART 'B-5': Option 1	\$ 70,000.00	\$ 15,000.00	\$ 85,000.00
	PART 'B-5': Option 2	\$0.00	\$0.00	\$0.00

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As previously identified, the proposed improvements consist of two specific and distinct parts (PART 'A' and PART 'B'). Both of which are vital to the necessary improvements to address the deficiencies within the system. As such, one option from each "Part" shall be selected to form the overall improvements to the drainage system.

All of these budget estimates are based on the following:

- a) No H.S.T. has been included as the Municipality is currently able to recover most of the H.S.T. costs.
- b) The proposed drainage system layouts as illustrated in the attached plans, together with their associated estimated costs are conceptual. Refined design details and cost estimates will be included in the Final Engineer's Report.
- c) The estimated costs of the proposed Options anticipate that there will be no conflict with existing utilities. Should unforeseen conflicts arise during detailed design or construction, they could escalate final costs.
- d) The associated estimates are based on the cost of materials and servicing for the current year and may be subject to escalation should the project be delayed to some future date.

XVIII. ESTIMATED COST DISTRIBUTION

We have prepared preliminary cost distribution breakdowns for each of the above-noted options. These estimated cost distributions are being provided to better illustrate how the costs of each specific option may be allocated to the affected lands and roads within the Project Site.

PART 'A' - FLOOD PROTECTION CAPABILITY IMPROVEMENTS

The flood protection improvements within the project area are being proposed for the sole purpose of protecting the affected lands from high lake water elevation and to ensure that the affected drainage systems have a sufficient outlet under these conditions. As such, the options presented under PART 'A' shall be assessed to the land and roads that directly benefit from and/or contribute to these improvements.

i) PART 'A-1' - Puce Lots Drain No. 1 Flood Protection

The improvements proposed under this option are intended to provide added flood protection for the low-lying lands that existing adjacent to the Puce Lots Drain No. 1 from the effects of the 4th Concession Drain backing up during times when runoff is more than the pump's capacity.

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OPTION 1: Re-Direct Flows to the Puce River Watershed

The total estimated cost for this option is approximately **\$15,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands within Puce Lots Drain No.1 (along Major St.)	3.60	\$9,600.00	\$600.00	64.0%
VIA Rail	5.60	\$5,400.00	--	36.0%
TOTALS	9.20	\$15,000.00		100.0%

By redirecting the west portion of the Puce Lots Drain No. 1 towards the Puce River, the lands east of Major Street shall continue to utilize the 4th Concession Drain. However, the lands along Major Street shall be removed from the 4th Concession Drain watershed and benefit from the proposed outlet improvements that form part of PART 'A-2'. As such, the lands along Major Street will form part of the Puce Road Outlet improvements, and will no longer contribute to both watersheds.

ii) PART 'A-2' - Puce River Watershed Pump Station

These outlet and pump improvements are intended for all lands and roads which benefit from and/or contribute to the proposed Puce River watershed outlet and pump improvements, with runoff directed towards the Puce River.

OPTION 1: Separate Outlets and Pump Stations for the Systems on North & South Side of the VIA Rail Corridor

The total estimated cost for this option is approximately **\$840,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands within Puce Lots Drain No.1 (along Major St.)	3.60		*\$4,600.00 to \$5,000.00	6.6%
Lands along Major St.	6.17		\$5,000.00	11.4%

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Lands along County Road 22	4.58		\$1,700.00	8.4%
Lands along West Portion of Lilydale Ave.	10.20		\$5,000.00	18.7%
Lands along Puce Road (South)	1.90		\$5,000.00	3.5%
Lands along Puce Road (North)	1.70		\$5,000.00	3.1%
Subtotal for Lands	28.15	\$433,800.00		51.7%
VIA Rail	5.30	\$61,500.00	--	7.3%
Roads				
Major St.	1.40	\$ 57,400.00	--	6.8%
Lilydale Ave. (West)	3.10	\$181,800.00	--	21.6%
Puce Road (South)	1.00	\$ 58,600.00	--	7.0%
Puce Road (North)	1.00	\$ 46,900.00	--	5.6%
Subtotal for Roads	6.50	\$344,700.00		41.0%
TOTALS	39.95	\$840,000.00		100.0%

"* - Further to the details outlined within PART 'A-1', a portion of the land along the Puce Lots Drain No. 1 (along Major St.) has the option to remain part of the 4th Concession Drain or direct all of their runoff towards the Puce River. If the overall direction is to remain within the 4th Concession Drain through PART 'A-1', the estimated costs to the lands are reduced to reflect the area removed from the watershed.

These outlet and pump improvements are intended for all lands and roads which benefit from and/or contribute to the proposed outlet and pump improvements, with runoff directed towards the Puce River.

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OPTION 2: Consolidate All Puce River Drainage Systems with One Single Outlet and Pump Station

The total estimated cost for this option is approximately **\$780,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands within Puce Lots Drain No.1 (along Major St.)	3.60		*\$4,000.00 to \$4,600.00	6.5%
Lands along Major St.	6.17		\$4,600.00	11.2%
Lands along County Road 22	4.58		\$1,700.00	8.3%
Lands along West Portion of Lilydale Ave.	10.20		\$4,600.00	18.5%
Lands along Puce Road (South)	1.90		\$4,600.00	3.5%
Lands along Puce Road (North)	1.70		\$4,600.00	3.1%
Subtotal for Lands	28.15	\$398,500.00		51.1%
VIA Rail	5.30	\$64,800.00	--	8.3%
Roads				
Major St.	1.40	\$ 52,700.00	--	6.8%
Lilydale Ave. (West)	3.10	\$167,000.00	--	21.4%
Puce Road (South)	1.00	\$ 53,900.00	--	6.9%
Puce Road (North)	1.00	\$ 43,100.00	--	5.5%
Subtotal for Roads	6.50	\$316,700.00		40.6%
TOTALS	39.95	\$780,000.00		100.0%

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"*" - Further to the details outlined within PART 'A-1', a portion of the land along the Puce Lots Drain No. 1 (along Major St.) has the option to remain part of the 4th Concession Drain or direct all of their runoff towards the Puce River. If the overall direction is to remain within the 4th Concession Drain through PART 'A-1', the estimated costs to the lands are reduced to reflect the area removed from the watershed.

These outlet and pump improvements are intended for all lands and roads which benefit from and/or contribute to the proposed outlet and pump improvements, with runoff directed towards the Puce River.

PART 'B' - Free Outlet Conveyance Capability Improvements

The individual drainage system improvements within the project area are being proposed for the sole purpose of providing a means to convey runoff from the affected watershed to its outlet. As such, the options presented under PART 'B' shall be assessed to the land and roads that directly benefit from and/or contribute to the affected drainage system improvements.

iii) PART 'B-1' - Major Street Drainage Improvements (Puce Lots No. 2 Drain And Branch)

The majority of the lands and roads which reside along Major Street currently contribute to the Puce Lots Drain No. 2 and benefit from and/or contribute to the proposed improvements, with runoff directed towards the Puce River.

OPTION 1: Replacement With New Outlet Towards Puce Road

The total estimated cost for this option is approximately **\$565,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands along Major St.	6.17	\$292,800.00	\$11,300.00	51.8%
Lands along County Road 22	4.58	\$100,200.00	\$6,300.00	17.7%
Roads				
Major St.	1.40	\$172,000.00	--	30.5%
TOTALS	12.15	\$565,000.00		100.0%

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These drainage improvements directly affect all lands and roads that utilize this drainage system in which they benefit from and/or contribute to, with runoff directed towards the Puce River. With a new outlet required for the Puce Lots Drain No. 2, along Puce Road, the lands along Major Street shall also share in the costs outlined within PART 'B-4': Option 1.

OPTION 2: Replacement With New Outlet Towards Puce Lots Drain No. 1

The total estimated cost for this option is approximately **\$710,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands along Major St.	6.17	\$343,600.00	\$13,200.00	48.4%
Lands along County Road 22	4.58	\$107,800.00	\$6,800.00	15.2%
Lands along Puce Road (South)	1.90	\$29,200.00	\$1,900.00	4.1%
Roads				
Major St.	1.40	\$200,500.00	--	28.2%
Puce Road (South)	1.00	\$28,900.00	--	4.1%
TOTALS	15.05	\$710,000.00		100.0%

These drainage improvements directly affect all lands and roads that utilize this drainage system to which they benefit from and/or contribute to these improvements. With a new outlet directed to Puce Lots Drain No. 1, through Major Street, the lands along Puce Road shall also share in the costs outlined within Part "B-4": Option 2.

iv) PART 'B-2' - Lilydale Avenue Drain Improvements (East Portion)

The lands and roads which reside along the east end of Lilydale Avenue currently benefit from and/or contribute to the 4th Concession Drain and its pump station. As part of this project, these lands shall continue to utilize this drainage system as their primary outlet. The improvements to this portion of the Lilydale Avenue Drain are being proposed to provide sufficient conveyance to its outlet.

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OPTION 1: Replacement With a Singular Drainage System

The total estimated cost for this option is approximately **\$745,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands along East Portion of Lilydale Ave.	6.50	\$334,100.00	\$13,900.00	44.8%
VIA Rail	2.95	\$59,500.00	--	8.0%
Roads				
Lilydale Ave. (East)	2.50	\$351,400.00	--	47.2%
TOTALS	11.95	\$745,000.00		100.0%

OPTION 2: Replacement With Multiple Outlets to the VIA Rail Ditch

The total estimated cost for this option is approximately **\$650,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands along East Portion of Lilydale Ave.	6.50	\$293,100.00	\$12,200.00	45.1%
VIA Rail	2.95	\$48,500.00	--	7.5%
Roads				
Lilydale Ave. (East)	2.50	\$308,400.00	--	47.4%
TOTALS	11.95	\$650,000.00		100.0%

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In summary, both drainage improvements directly affect all lands and roads that utilize this drainage system to which they benefit from and/or contribute to these improvements, with runoff directed towards the 4th Concession Drain.

v) PART 'B-3' - Lilydale Avenue Drain Improvements (West Portion)

The lands and roads which reside along the west end of Lilydale Avenue currently convey runoff towards Puce Road and into the Puce River. As part of this project, these lands shall continue to utilize this drainage system as their primary outlet. The improvements to this portion of the Lilydale Avenue Drain are being proposed to provide sufficient conveyance to its outlet.

OPTION 1: Replacement With a Singular Drainage System

The total estimated cost for this option is approximately **\$915,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands along West Portion of Lilydale Ave.	10.20	\$467,200.00	\$14,200.00	51.1%
VIA Rail	3.50	\$59,400.00	--	6.5%
Roads				
Lilydale Ave. (West)	3.10	\$388,400.00	--	42.4%
TOTALS	16.80	\$915,000.00		100.0%

OPTION 2: Replacement With Multiple Outlets to the VIA Rail Ditch

The total estimated cost for this option is approximately **\$750,000.00** and the distribution of these costs is as follows:

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Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands along West Portion of Lilydale Ave.	10.20	\$386,000.00	\$11,700.00	51.5%
VIA Rail	3.50	\$43,000.00	--	5.7%
Roads				
Lilydale Ave. (West)	3.10	\$321,000.00	--	42.8%
TOTALS	16.80	\$750,000.00		100.0%

In summary, both these drainage improvements directly affect all lands and roads that utilize this drainage system to which they benefit from and/or contribute to these improvements, with runoff directed towards the Puce River.

vi) **PART 'B-4' - Puce Road Drainage Improvements (South of VIA Rail)**

The lands and roads along Puce Road which reside south of the VIA Rail corridor currently convey runoff into the Puce River. As part of this project, these lands shall continue to utilize the Puce River as their primary outlet. The improvements to this portion of the Puce Road are being proposed to provide sufficient conveyance to the new outlet location along Puce Road.

OPTION 1: Replace With New Drainage System to New Outlet

The total estimated cost for this option is approximately **\$330,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands along County Road 22 & Major St.	10.75	\$ 27,700.00	\$ 700.00	8.4%
Lands along Puce Road (South)	1.90	\$126,500.00	\$8,000.00	38.3%

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Puce Road, Major Street & Lilydale Avenue Drainage Improvements
 Geographic Township of Maidstone
 Municipality of Lakeshore - D-18-015

Roads				
Major St.	1.40	\$ 8,100.00	--	2.5%
Puce Road (South)	1.00	\$167,700.00	--	50.8%
TOTALS	15.05	\$330,000.00		100.0%

These drainage improvements directly affect all lands and roads that utilize this drainage system in which they benefit from and/or contribute to these improvements, with runoff directed towards the Puce River. With a new outlet required for the Puce Lots Drain No. 2, along Puce Road, the lands along Major Street contribute to the improvements as outlined within PART 'B-1': Option 1.

OPTION 2: Direct All Flows to Major Street

The total estimated cost for this option is approximately **\$310,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands along Puce Road (South)	1.90	\$135,700.00	\$8,500.00	43.8%
Roads				
Puce Road (South)	1.00	\$174,300.00	--	56.2%
TOTALS	2.90	\$310,000.00		100.0%

These drainage improvements directly affect all lands and roads that utilize this drainage system in which they benefit from and/or contribute to these improvements, with runoff directed towards the Puce River. With a new outlet directed to Puce Lots Drain No. 2, through Major Street, the lands along Puce Road contribute to these improvements as outlined within PART 'B-1' Option 2.

Preliminary Report

Puce Road, Major Street & Lilydale Avenue Drainage Improvements
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vii) PART 'B-5' - Puce Road Drainage Improvements (North of VIA Rail)

The lands and roads which reside north of the VIA Rail corridor currently convey runoff into the Puce River through the existing Lilydale Avenue Drain. As part of this project, these lands shall continue to utilize this drainage system as their primary outlet. However, these flows will need to be directed to a new outlet location. The improvements to this portion of the Puce Road are being proposed to provide sufficient conveyance to the new outlet location towards the VIA Rail Corridor.

OPTION 1: Direct Flows to New Outlet With Minor Drainage Improvements along Puce Road

The total estimated cost for this option is approximately **\$85,000.00** and the distribution of these costs is as follows:

Owners	Affected Area (Acres)	Total Estimated Cost	Approx. Cost Per Property	% of Cost
Lands				
Lands Along Puce Road (North)	1.70	\$34,900.00	\$3,200.00	41.1%
Roads				
Puce Road (North)	1.00	\$50,100.00	--	58.9%
TOTALS	2.70	\$85,000.00		100.0%

These drainage improvements directly affect all lands and roads that utilize this drainage system in which they benefit from and/or contribute to these improvements, with runoff directed towards the Puce River. With a new outlet required for the Lilydale Avenue Drain, towards the VIA Rail corridor, based on the direction outlined as part of PART 'B-3'.

Summary of Cost Distribution

The following table outlines a summary of potential assessments to individuals affected by this project. The breakdown is distributed based on the various groups of stakeholders within the project site.

Preliminary Report

Puce Road, Major Street & Lilydale Avenue Drainage Improvements
 Geographic Township of Maidstone
 Municipality of Lakeshore - D-18-015

	PART A	PART B	TOTALS (A + B)
Lands along Major Street	\$4,800 to \$5,400	\$11,700 to \$13,200	\$16,500 to \$18,600
Lands along County Road 22	\$1,700	\$6,300 to \$6,800	\$8,000 to \$8,500
Lands along the West Portion of Lilydale Ave.	\$4,600 to \$5,000	\$11,700 to \$14,200	\$16,300 to \$19,200
Lands along the East Portion of Lilydale Ave.	\$0.00	\$12,200 to \$13,900	\$12,200 to \$13,900
Lands along Puce Road (South)	\$4,300 to \$4,800	\$7,900 to \$10,300	\$12,200 to \$15,100
Lands along Puce Road (North)	\$4,300 to \$4,800	\$3,200	\$7,500 to \$8,000
VIA Rail	\$70,200 to \$71,400	\$116,900 to \$146,500	\$187,100 to \$217,900
Major Street			
	\$52,700 to \$57,400	\$172,000 to \$210,000	\$224,700 to \$267,400
Lilydale Avenue			
	\$167,000 to \$181,800	\$629,200 to \$739,800	\$796,200 to \$921,600
Puce Road			
	\$97,000 to \$105,500	\$217,800 to \$253,200	\$314,800 to \$358,700
Total for all Municipal Roads	\$316,700 to \$344,700	\$1,019,000 to \$1,203,000	\$1,335,700 to \$1,547,700

The preliminary assessment values are only estimates for the purpose of providing a general cost distribution for all affected lands, in an effort to make an informed decision. The final report that includes the selected Options will consist of a Construction Schedule of Assessment that will allocate a more detailed distribution of the cost estimate for the work based on the final details of the project. This final report will follow the prescribed Drainage Act process that includes the necessary public meetings for the Consideration of the Report and a Court of Revision to address specific questions and/or concerns regarding the technical merits and assessments.

Preliminary Report

Puce Road, Major Street & Lilydale Avenue Drainage Improvements
 Geographic Township of Maidstone
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XIX. DRAWINGS OF CONCEPTUAL OPTIONS

As part of this report, we have attached conceptual drawings for the various drainage improvement options for the project site, consisting of Sheets 1 through 9. These conceptual drawings illustrate each of the proposed options, together with the general map of the affected landowners, the approximate drain watershed, and additional details related to each improvement option. These drawings are included within **Appendix "A"**.

XX. CLOSING REMARKS

This Preliminary Report will be distributed to all of the affected Owners for their review. The Municipality of Lakeshore shall schedule a public meeting(s) for the consideration of this Preliminary Report, in front of the Municipality's Drainage Board. All Owners are encouraged to attend and/or provide a written response to the Municipal Clerk sufficiently in advance of the meeting to alert the Municipality of their specific concerns and/or preferred Options. The contents of this report will be presented in front of the Drainage Board in an effort to establish a clear direction based on the general consensus of the Options presented. Therefore, it is strongly recommended that all affected landowners participate in the upcoming meeting to provide their input and comments towards the overall direction of this project. The results of this meeting will essentially establish the scope of work and the overall direction of this project. It shall be noted that if you cannot (or choose not to) attend this meeting, the meeting will proceed in your absence.

Based on the outcome of this public meeting, the Drainage Board will provide instruction to the Engineer to proceed with the preparation of a Final Report based on the preferred Option as established through the input of the affected Owners.

All of which is respectfully submitted,

N. J. PERALTA ENGINEERING LTD.

 Antonio B. Peralta, P.Eng.

ABP/amm

N. J. PERALTA ENGINEERING LTD.

Consulting Engineers
 45 Division Street N.
 Kingsville, Ontario
 N9Y 1E1



APPENDIX “A”

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PLAN SHOWING THE

DRAINAGE IMPROVEMENTS FOR PUCE ROAD, MAJOR STREET, AND LILYDALE AVENUE

IN THE
MUNICIPALITY OF LAKESHORE (Geographic Township of Maidstone)
IN THE
COUNTY OF ESSEX ONTARIO

N. J. PERALTA ENGINEERING LTD.

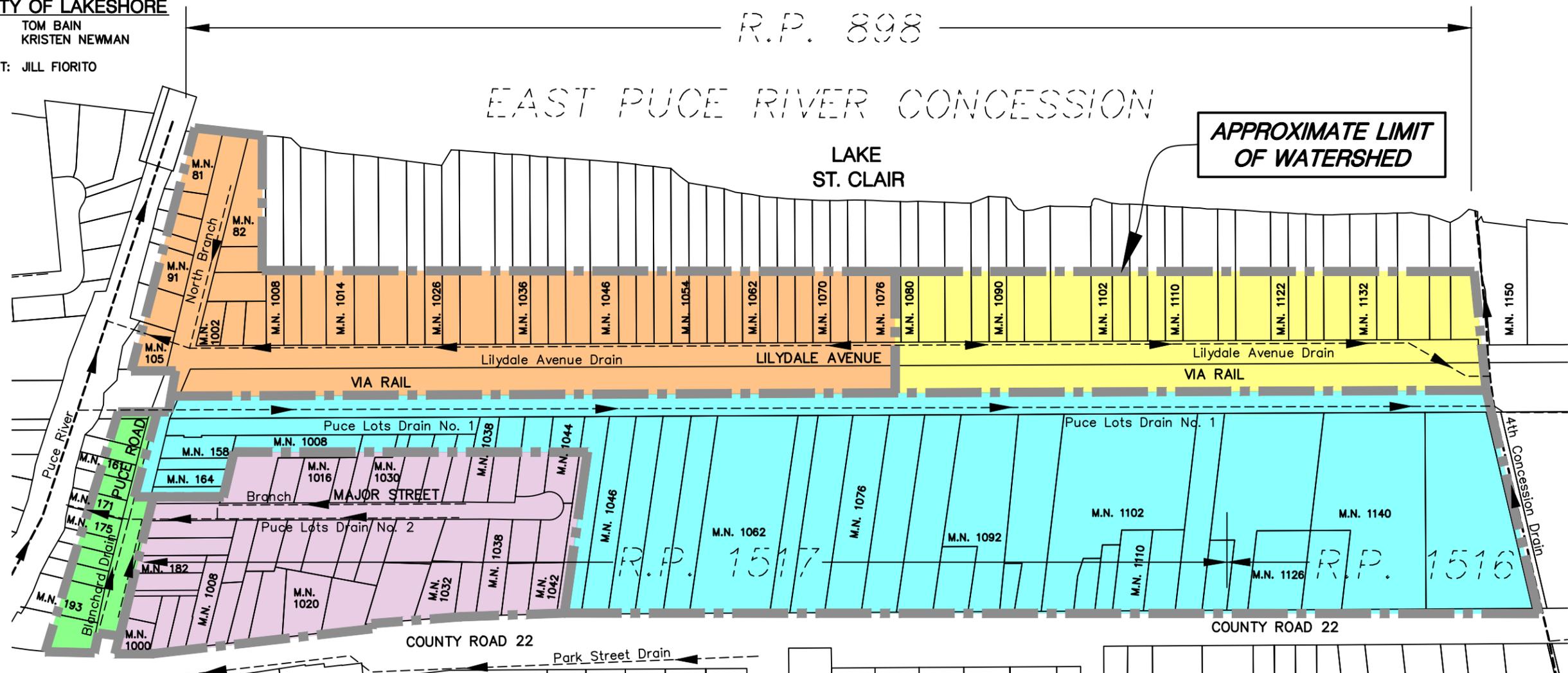
45 DIVISION STREET NORTH
KINGSVILLE, ONTARIO
N9Y 1E1

DATE: AUGUST 19th, 2021

MUNICIPALITY OF LAKESHORE

MAYOR: TOM BAIN
CLERK: KRISTEN NEWMAN
DRAINAGE SUPERINTENDANT: JILL FIORITO

EXISTING SUBCATCHMENT AREA	AREA (AC.)	% OF WATERSHED AREA
PUCE LOTS DRAIN No. 1	43.10	47.0%
PUCE LOTS DRAIN No. 2	13.77	15.0%
LILYDALE AVENUE DRAIN (EAST)	13.00	14.2%
LILYDALE AVENUE DRAIN (WEST) + NORTH BRANCH	19.19	20.9%
BLANCHARD DRAIN & PUCE ROAD	2.69	2.9%
TOTAL	91.75	100%



WATERSHED PLAN OF EXISTING CONDITIONS

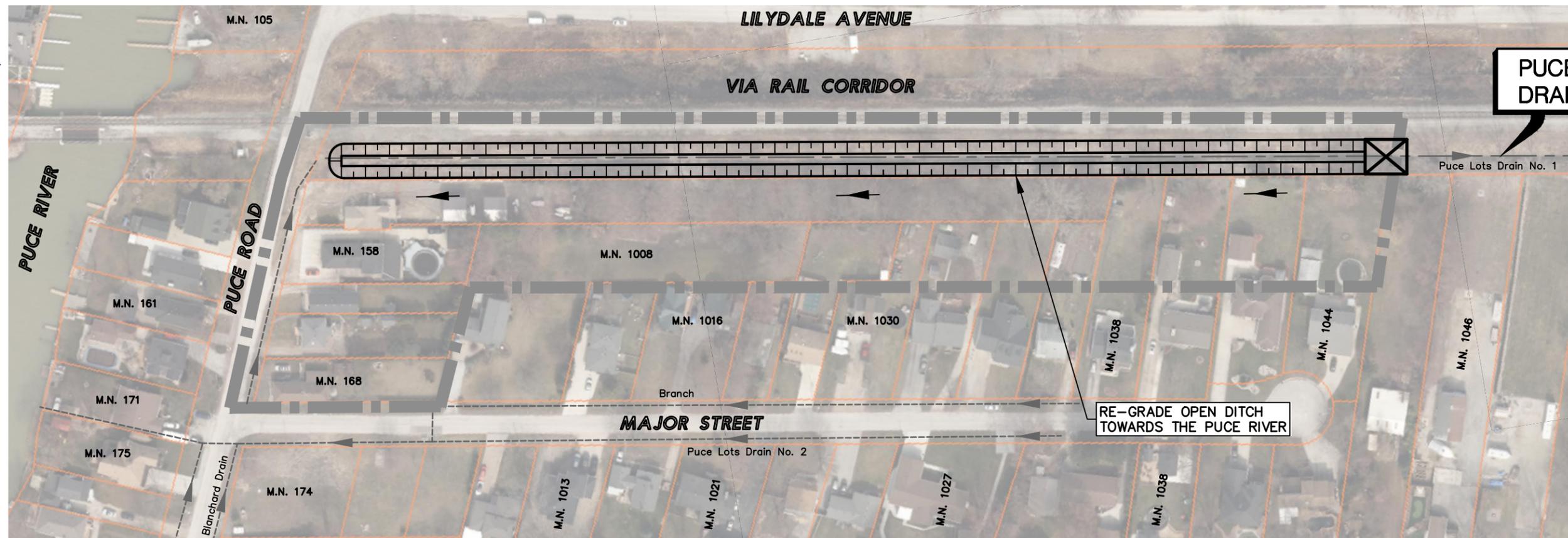
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PRELIMINARY REPORT

APPENDIX 'A'	
PROJECT No. D18-015	SHEET No.: 1 OF 9

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PART 'A-1' - PUCE LOTS DRAIN No. 1 FLOOD PROTECTION



OPTION 1: REDIRECT FLOWS TO THE PUCE RIVER WATERSHED

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GENERAL NOTES:

1. THE FINAL ALIGNMENTS WILL DEPEND ON THE OVERALL SIZE AND AVAILABLE SPACE.
2. OPTION 1 IS INTENDED TO BE INSTALLED IN CONJUNCTION WITH THE PUCE ROAD PUMPING OPTIONS IDENTIFIED IN PART 'A-2'.

	PROPOSED DRAIN DIVIDE
	PROPOSED OPEN DRAIN
	EXISTING COVERED DRAINAGE
	EXISTING OPEN DRAIN
	WATERSHED AFFECTED BY IMPROVEMENT

PRELIMINARY REPORT

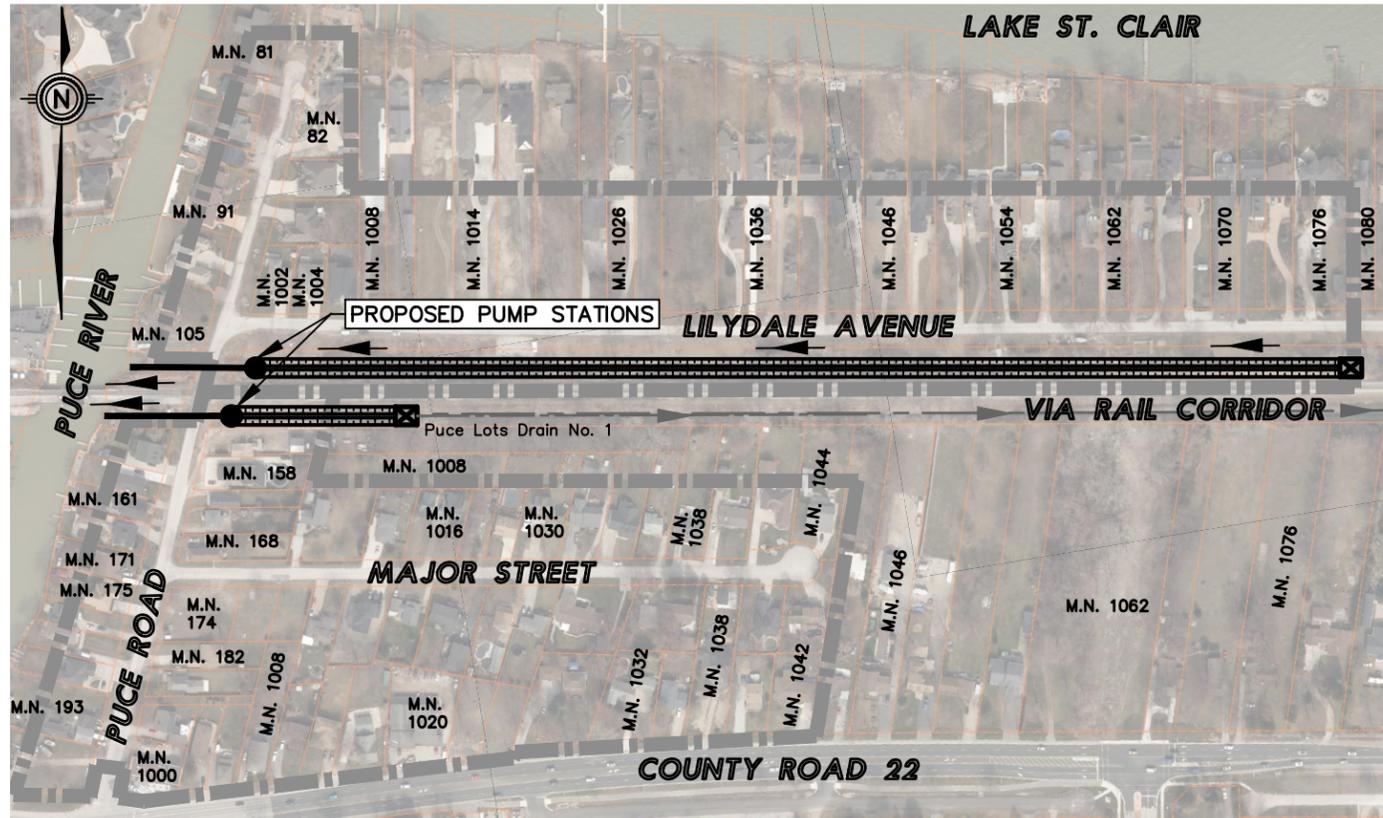
PART 'A-1'	
PROJECT No. D18-015	SHEET No.: 2 OF 9

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PART 'A-2' - PUCE RIVER WATERSHED PUMP STATION (SCENARIO 1 - EXCLUDE LANDS WITHIN PUCE LOTS DRAIN No. 1 - PER PART 'A-1' : OPTION 1)

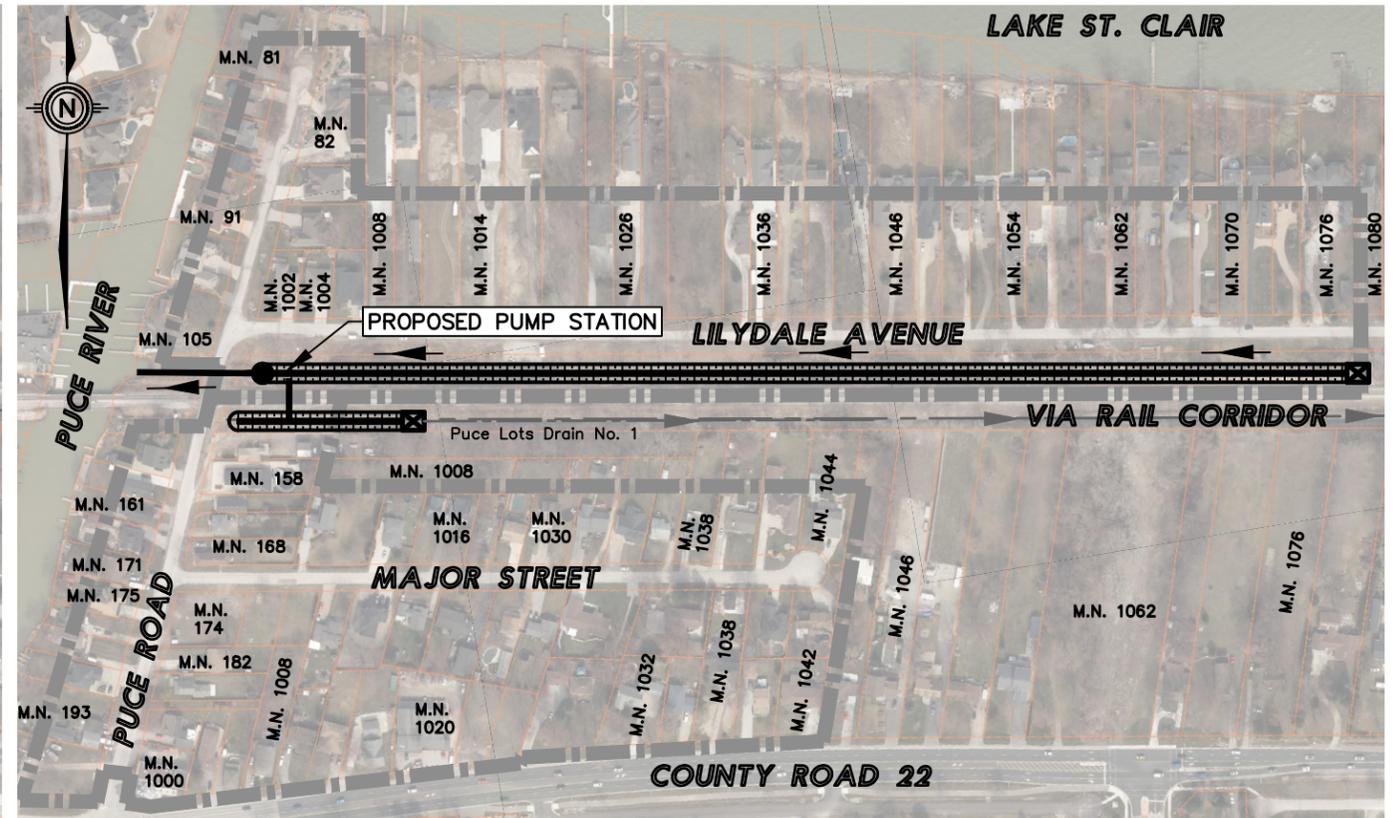


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OPTION 1 : SEPARATE PUMPS (NORTH AND SOUTH OF THE VIA RAIL)

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OPTION 2 : CONSOLIDATE ALL PUCE RIVER DRAINAGE SYSTEMS WITH SINGLE OUTLET

Scale = 1:4,000

GENERAL NOTES:

1. FINAL PUMP LOCATION AND OUTLET ALIGNMENT WILL DEPEND ON OVERALL SIZE AND AVAILABLE SPACE.
2. THE NEW PUMP STATION WILL INCLUDE A MINIMUM OF 2 PUMPS TO MEET THE MINIMUM PUMP CAPACITY AND PROVIDE REDUNDANCY IN THE SYSTEM TO ACCOMMODATE FOR A PUMP FAILURE.
3. EACH OPTION SHALL INCLUDE ALL ASSOCIATED PUMP AND DRAINAGE COMPONENTS WHERE THE PROPOSED PUMPS ARE INTENDED TO BE HOUSE IN AN UNDERGROUND CHAMBER. HOWEVER, BASED ON AVAILABLE SPACE AND FEASIBILITY, AN ABOVE GROUND PUMP HOUSE MAY BE REQUIRED.
4. BOTH SCENARIOS SHALL UTILIZE A PORTION OF THE EXISTING VIA RAIL DITCHES TO STORE THE ACCUMULATION OF EXCESS STORM WATER RUNOFF AS THE PUMPS DRAIN THE SYSTEM.
5. UNDER SCENARIO 1 OUTLINED BELOW, A SMALL PORTION OF THE PROPERTIES ALONG THE NORTH SIDE OF MAJOR STREET SHALL CONTINUE TO UTILIZE THE 4TH CONCESSION DRAIN AS THE PRIMARY DRAINAGE OUTLET AND BENEFIT FROM ITS EXISTING FLOOD PROTECTION GATE AND EXISTING PUMP STATION.

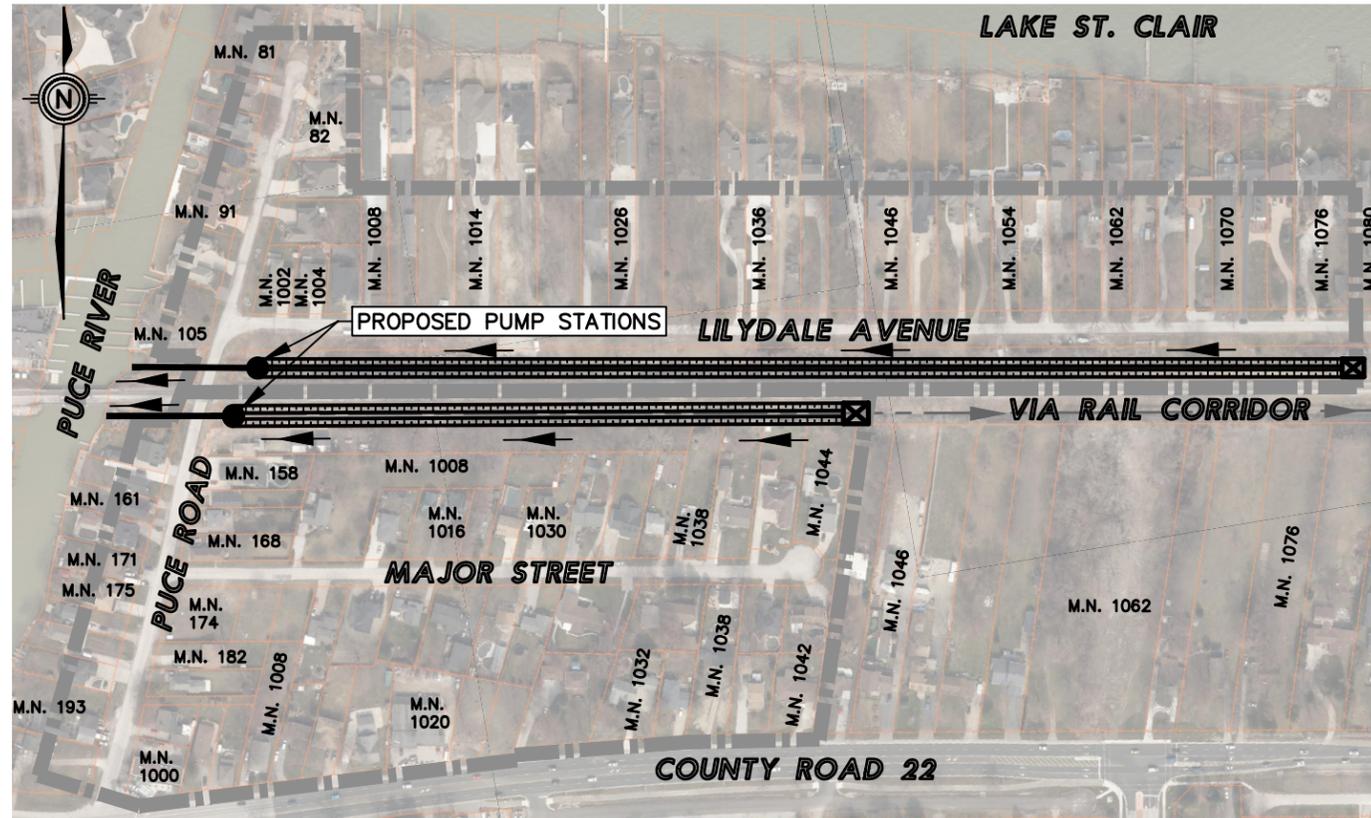
- PROPOSED DRAIN DIVIDE
- PROPOSED PUMP STATION & OUTLET
- PROPOSED OPEN DRAIN
- WATERSHED AFFECTED BY IMPROVEMENTS

PRELIMINARY REPORT

PART 'A-2'	
PROJECT No. D18-015	SHEET No.: 3 OF 9

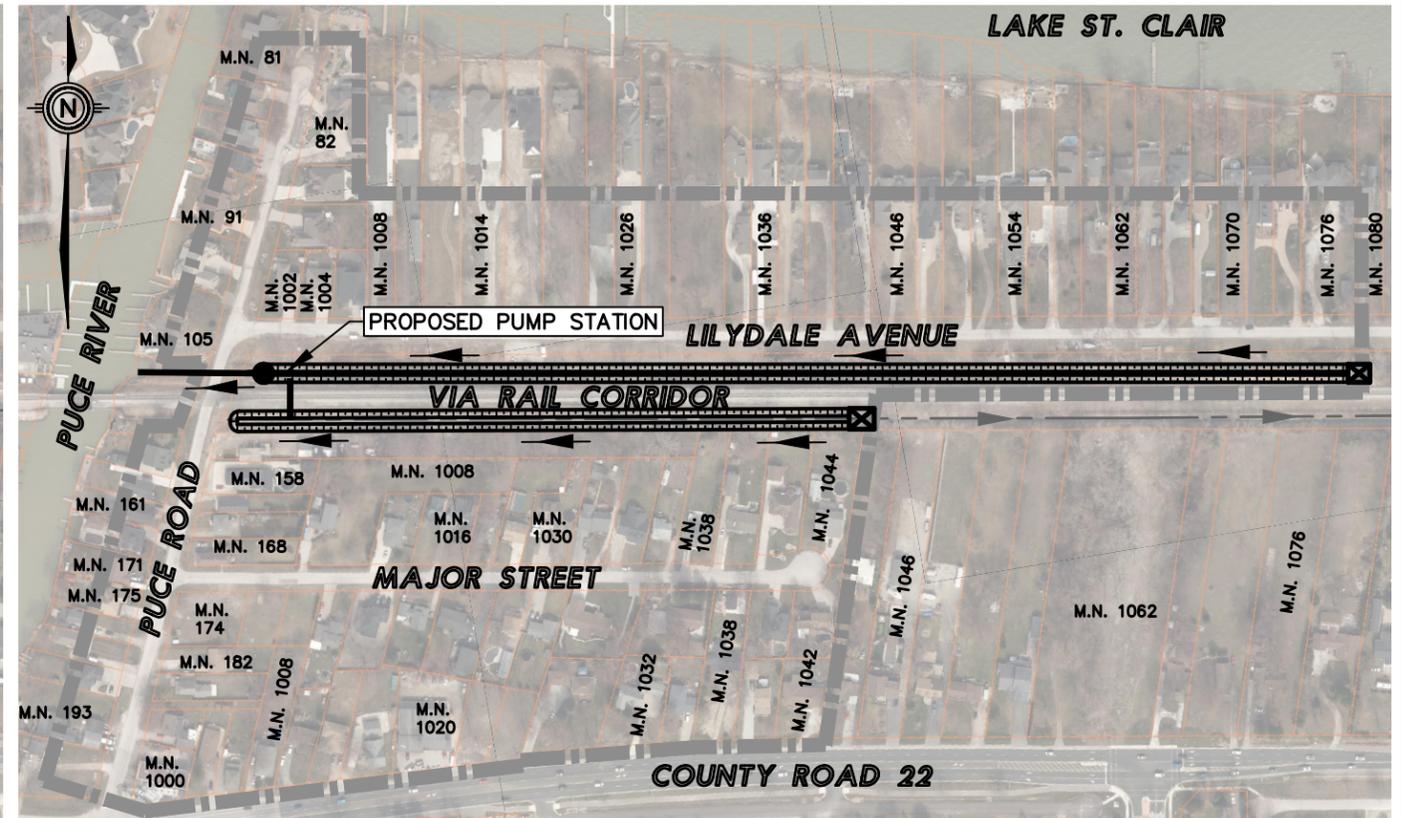
PART 'A-2' - PUCE RIVER WATERSHED PUMP STATION (SCENARIO 2 - INCLUDING A PORTION OF PUCE LOTS DRAIN No. 1 - PER PART 'A-1': OPTION 2)

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**OPTION 1 : SEPARATE OUTLETS AND PUMPS FOR SYSTEMS
ON THE NORTH AND SOUTH SIDE OF THE VIA RAIL**

Scale = 1:4,000



**OPTION 2 : CONSOLIDATE ALL PUCE RIVER DRAINAGE
SYSTEMS WITH SINGLE OUTLET AND PUMP STATION**

Scale = 1:4,000

GENERAL NOTES:

1. FINAL PUMP LOCATION AND OUTLET ALIGNMENT WILL DEPEND ON OVERALL SIZE AND AVAILABLE SPACE.
2. THE NEW PUMP STATION WILL INCLUDE A MINIMUM OF 2 PUMPS TO MEET THE MINIMUM PUMP CAPACITY AND PROVIDE REDUNDANCY IN THE SYSTEM TO ACCOMMODATE FOR A PUMP FAILURE.
3. EACH OPTION SHALL INCLUDE ALL ASSOCIATED PUMP AND DRAINAGE COMPONENTS WHERE THE PROPOSED PUMPS ARE INTENDED TO BE HOUSE IN AN UNDERGROUND CHAMBER. HOWEVER, BASED ON AVAILABLE SPACE AND FEASIBILITY, AN ABOVE GROUND PUMP HOUSE MAY BE REQUIRED.
4. WITH ALL LANDS DIVERTED TO THE PUCE RIVER, BOTH OPEN DRAINS ALONG THE VIA RAIL CORRIDOR SHALL BE UTILIZED TO STORE THE ACCUMULATION OF EXCESS STORM WATER RUNOFF AS THE PUMPS DRAIN THE SYSTEM.
5. UNDER SCENARIO 2 OUTLINED BELOW, THE PROPERTIES ALONG THE NORTH SIDE OF MAJOR STREET SHALL BE FULLY INCLUDED AS PART OF THE PUCE RIVER WATERSHED UNDER PART 'A-1':OPTION 2 AND UTILIZE THE PROPOSED PUCE RIVER PUMPING STATION AS PROTECTION AGAINST FLOODING.

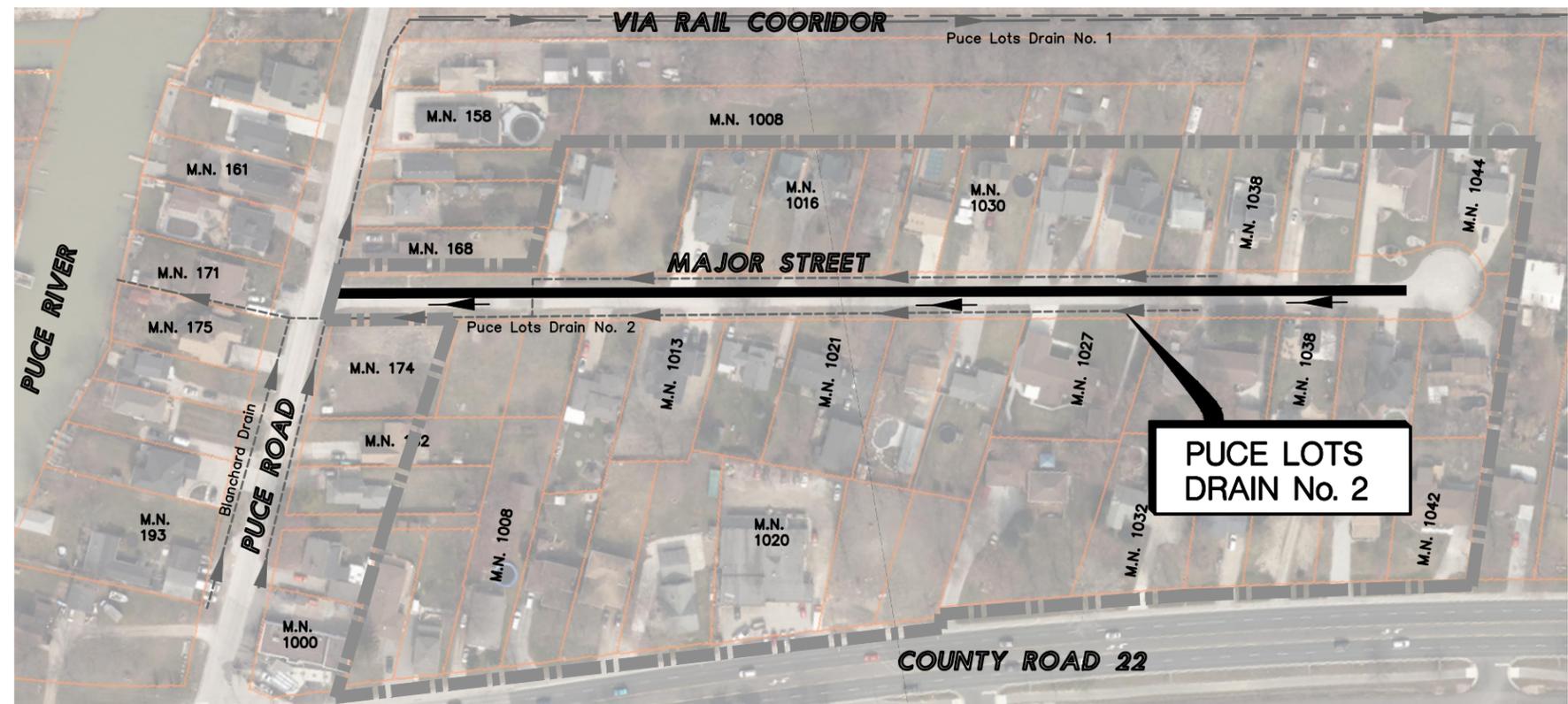
-  PROPOSED DRAIN DIVIDE
-  PROPOSED PUMP STATION & OUTLET
-  PROPOSED OPEN DRAIN
-  WATERSHED AFFECTED BY IMPROVEMENTS

PRELIMINARY REPORT

PART 'A-2'	
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PART 'B-1' - MAJOR STREET DRAINAGE IMPROVEMENTS



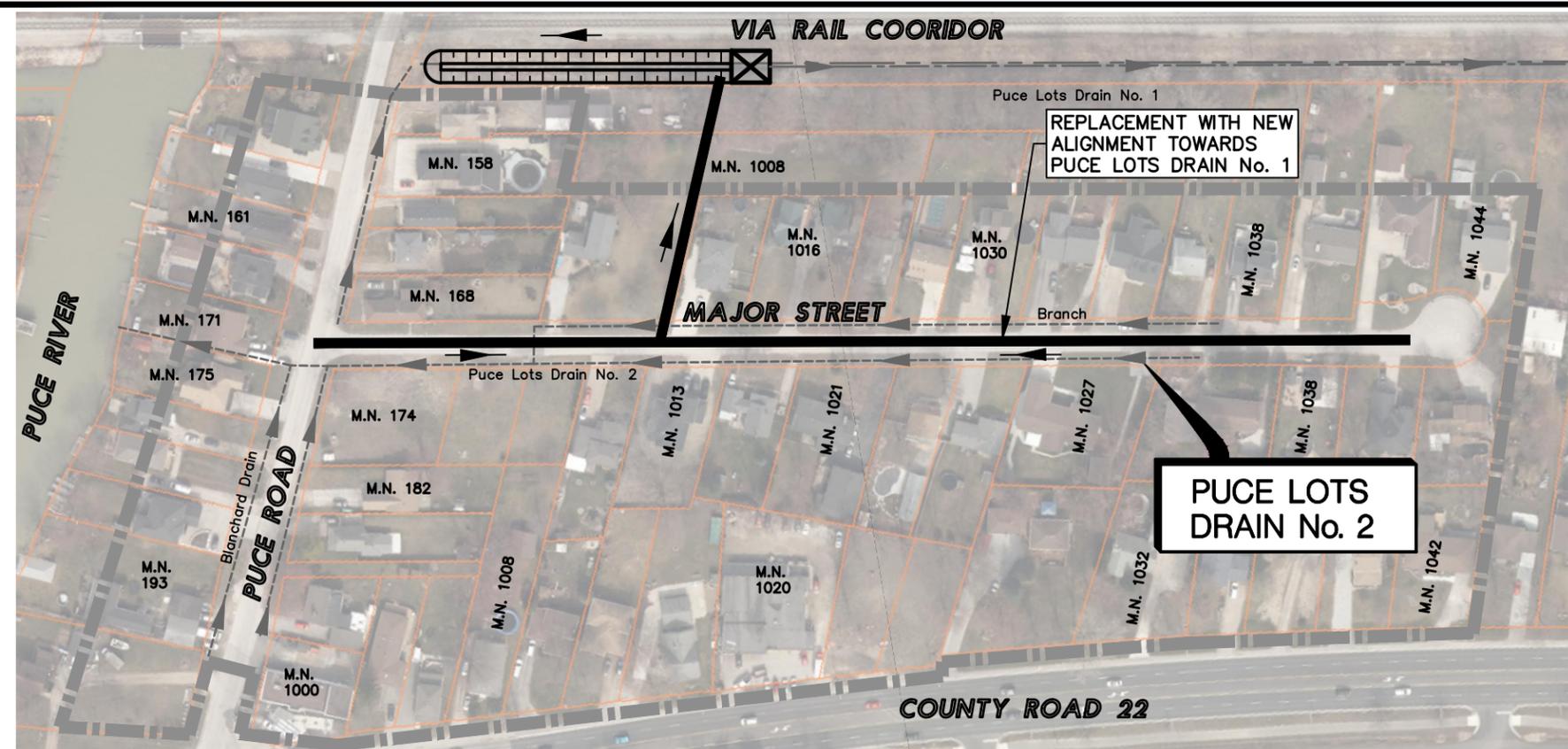
OPTION 1 : REPLACEMENT WITH AN OUTLET TOWARDS PUCE ROAD

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OPTION 1 NOTES:

1. THE EXISTING OUTLET ACROSS PUCE ROAD AND THROUGH PRIVATE LANDS IS NOT FEASIBLE TO MAINTAIN OR REPLACE. THEREFORE, A NEW OUTLET LOCATION IS RECOMMENDED AS OUTLINED UNDER PART 'A-2'.
2. OPTION 1 SHALL BE DIRECTED TO THE NEW DRAINAGE OUTLET ALONG PUCE ROAD.

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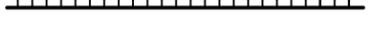


OPTION 2 : REPLACEMENT WITH NEW OUTLET TOWARDS PUCE LOTS DRAIN No. 1

Scale = 1:2,000

OPTION 2 NOTES:

1. OPTION 2 IS INTENDED TO BE COMPLETED IN CONJUNCTION WITH THE PUCE ROAD PUMPING OPTIONS IDENTIFIED IN PART 'A-1' OPTION 2.

-  PROPOSED BERM
-  PROPOSED COVERED DRAIN ALIGNMENT
-  PROPOSED OPEN DRAIN IMPROVEMENTS
-  EXISTING UNDERGROUND DRAINAGE
-  EXISTING OPEN DRAIN

GENERAL NOTES:

1. THE FINAL ALIGNMENTS WILL DEPEND ON THE OVERALL SIZE AND AVAILABLE SPACE.
2. EACH OPTION SHALL INCLUDE ALL ASSOCIATED DRAINAGE COMPONENTS (CATCH BASINS, MAINTENANCE HOLES, PRIVATE SERVICES, ETC.).
3. THE NEW DRAINAGE SYSTEM WILL REPLACE THE EXISTING DRAINAGE INFRASTRUCTURE.

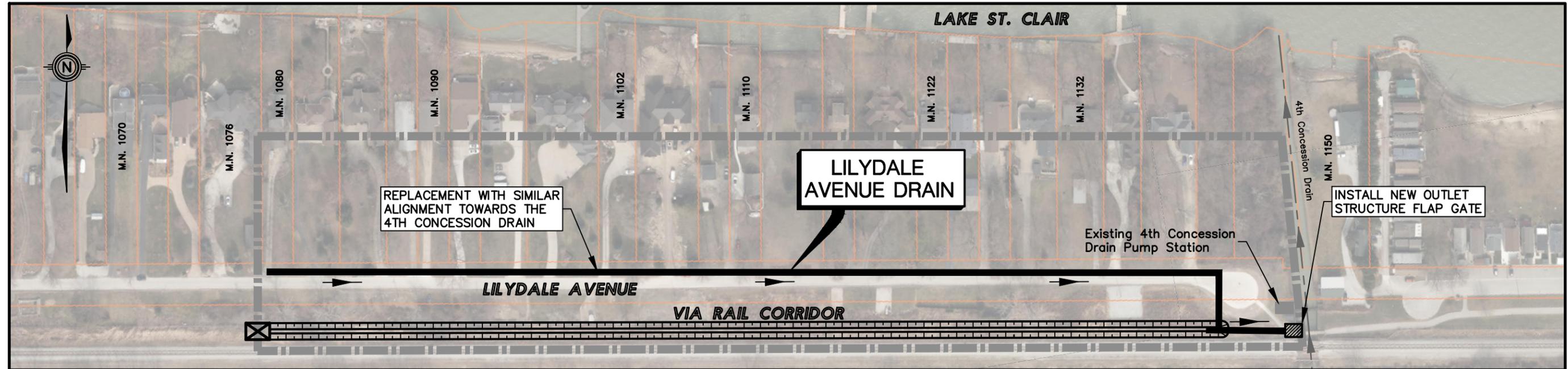
PRELIMINARY REPORT

PART 'B-1'

PROJECT No.
D18-015

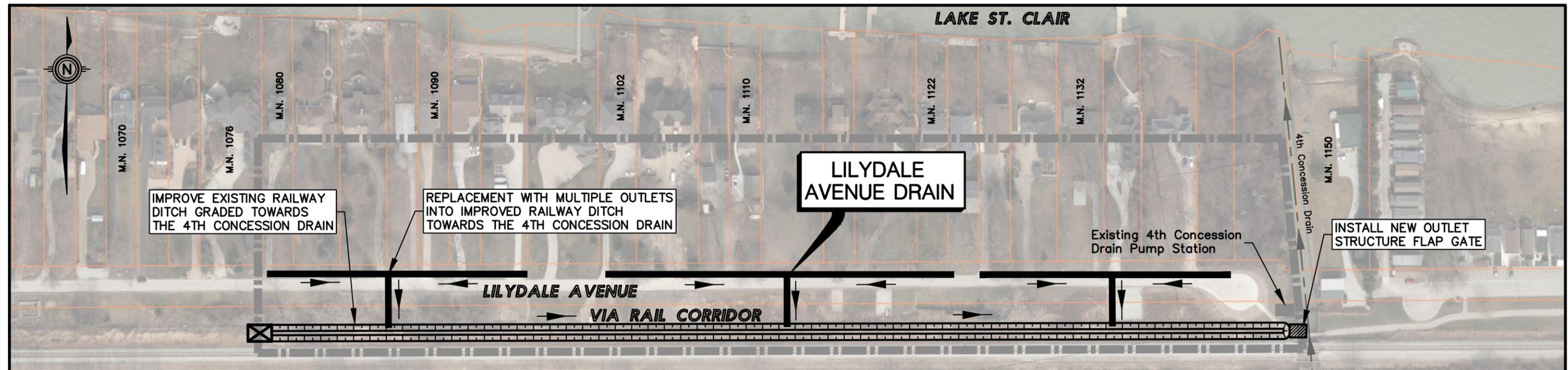
SHEET No.:
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PART 'B-2' - LILYDALE AVENUE DRAIN IMPROVEMENTS (EAST PORTION)



OPTION 1 : REPLACEMENT WITH A SINGULAR DRAINAGE SYSTEM

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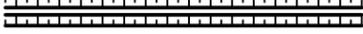


OPTION 2 : REPLACEMENT WITH MULTIPLE OUTLETS TO THE VIA RAIL DITCH

Scale = 1:2,000

GENERAL NOTES:

1. THE FINAL ALIGNMENTS WILL DEPEND ON THE OVERALL SIZE AND AVAILABLE SPACE.
2. EACH OPTION SHALL INCLUDE ALL ASSOCIATED DRAINAGE COMPONENTS (CATCH BASINS, MAINTENANCE HOLES, PRIVATE SERVICES, ETC.).
3. BOTH PROPOSED OPTIONS SHALL CONTINUE TO UTILIZE THE 4TH CONCESSION DRAIN AND BENEFIT FROM THE EXISTING FLOOD PROTECTION GATES AND PUMP STATION.
4. THE NEW DRAINAGE SYSTEM WILL REPLACE THE EXISTING DRAIN INFRASTRUCTURE.

-  PROPOSED DRAIN DIVIDE
-  PROPOSED OUTLET STRUCTURE AND FLAP GATE
-  EXISTING PUMP STATION
-  PROPOSED COVERED DRAIN ALIGNMENT
-  PROPOSED OPEN DRAIN IMPROVEMENTS
-  WATERSHED AFFECTED BY IMPROVEMENT

PRELIMINARY REPORT

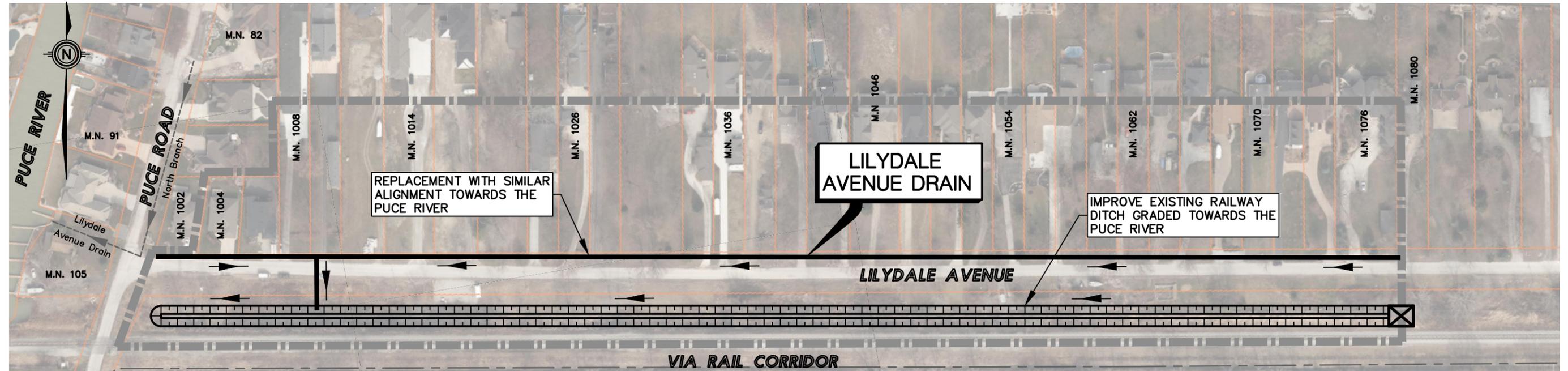
PART 'B-2'

PROJECT No.
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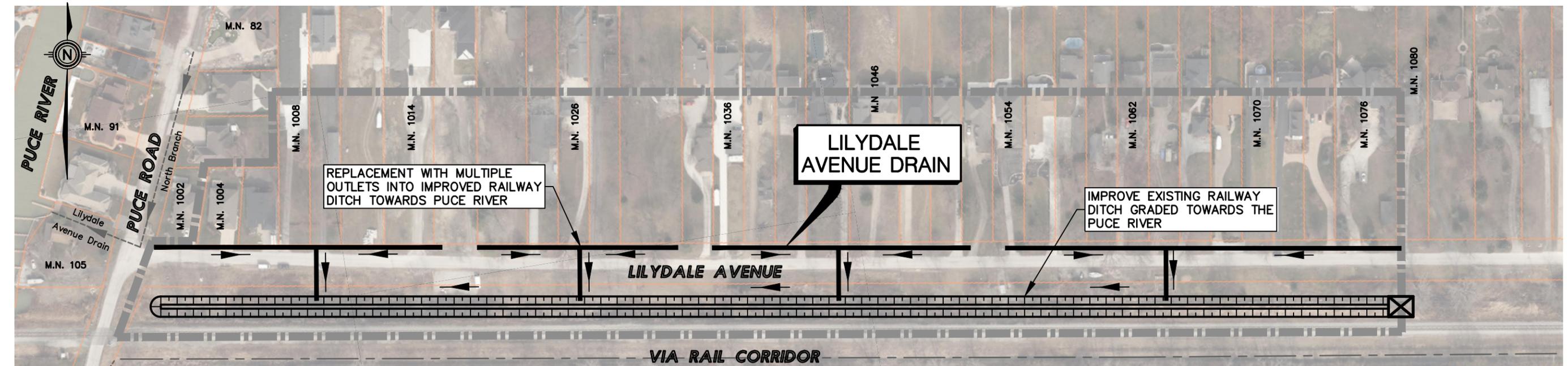
PART 'B-3' - LILYDALE AVENUE DRAIN IMPROVEMENTS (WEST PORTION)

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OPTION 1: REPLACEMENT WITH A SINGULAR DRAINAGE SYSTEM

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OPTION 2: REPLACEMENT WITH MULTIPLE OUTLETS TO THE VIA RAIL DITCH

Scale = 1:2,000

GENERAL NOTES:

1. THE FINAL ALIGNMENTS WILL DEPEND ON THE OVERALL SIZE AND AVAILABLE SPACE.
2. EACH OPTION SHALL INCLUDE ALL ASSOCIATED DRAINAGE COMPONENTS (CATCH BASINS, MAINTENANCE HOLES, PRIVATE SERVICES, ETC.).
3. THE EXISTING OUTLET ACROSS PUCE ROAD IS NOT IDEAL AND A NEW OUTLET LOCATION IS RECOMMENDED UNDER PART 'A-2'.

-  PROPOSED DRAIN DIVIDE
-  PROPOSED COVERED DRAIN ALIGNMENT
-  PROPOSED OPEN DRAIN IMPROVEMENTS
-  WATERSHED AFFECTED BY IMPROVEMENT
-  EXISTING UNDERGROUND DRAINAGE

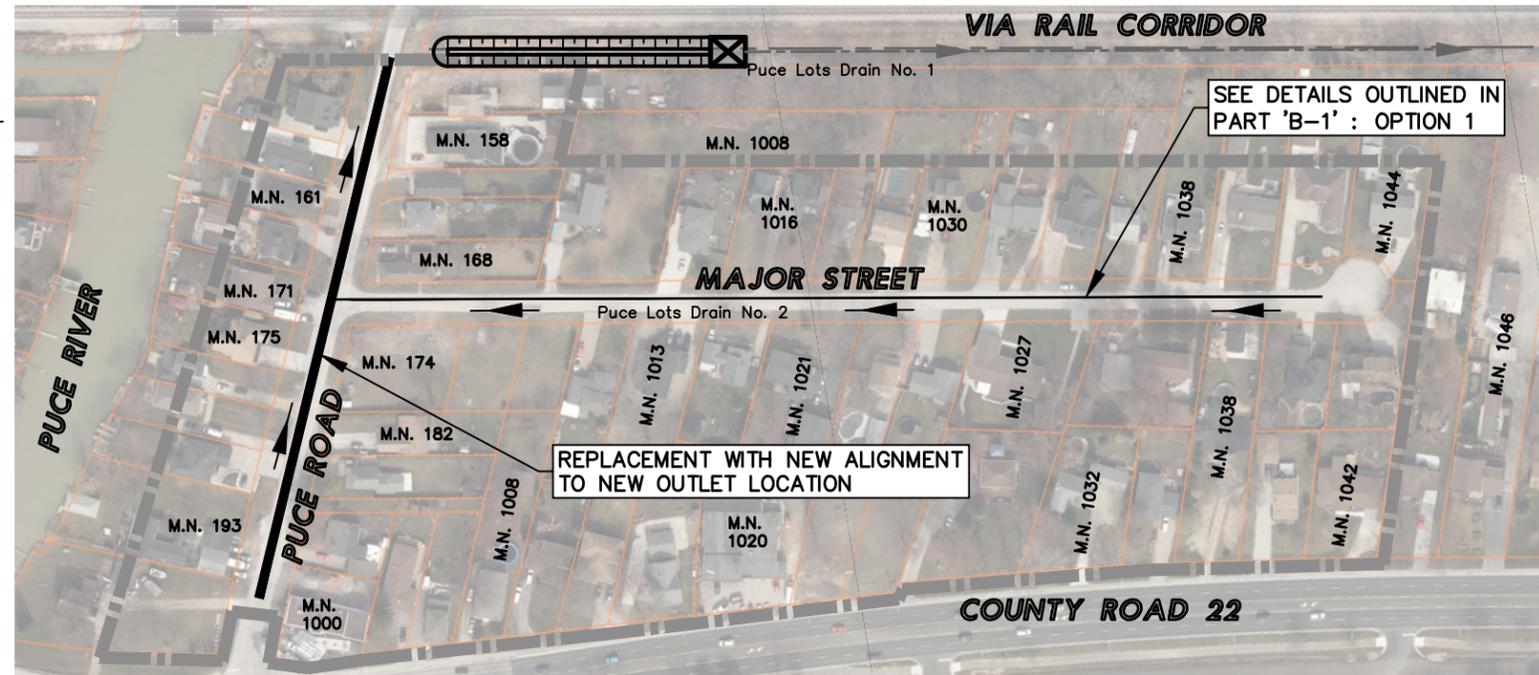
PRELIMINARY REPORT

PART 'B-3'

PROJECT No.
D18-015

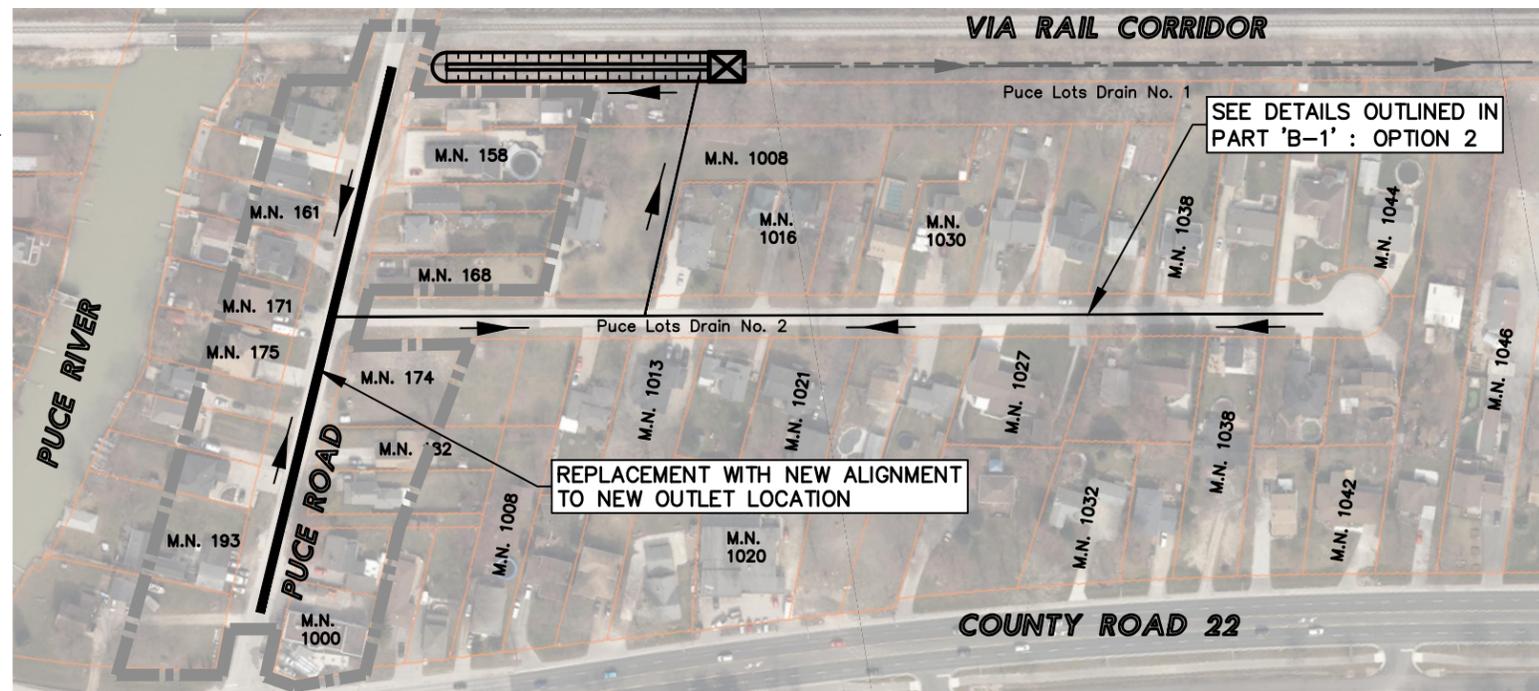
SHEET No.:
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PART 'B-4' - PUCE ROAD DRAINAGE IMPROVEMENTS (SOUTH OF VIA RAIL)



OPTION 1 : REPLACEMENT WITH SINGULAR DRAINAGE OUTLET AT A NEW LOCATION

Scale = 1:2,500



OPTION 2 : DIRECT ALL FLOWS TO MAJOR STREET

Scale = 1:2,500

GENERAL NOTES:

1. THE FINAL ALIGNMENTS WILL DEPEND ON THE OVERALL SIZE AND AVAILABLE SPACE.
2. EACH OPTION SHALL INCLUDE ALL ASSOCIATED DRAINAGE COMPONENTS (CATCH BASINS, MAINTENACE HOLES, PRIVATE SERVICES, ETC.).
3. OPTION 1 SHALL BE CONSIDERED IN CONJUNCTION WITH PART 'B-1': OPTION 1 (PUCE LOTS DRAIN No. 1 IMPROVEMENTS).
4. OPTION 2 SHALL BE CONSIDERED IN CONJUNCTION WITH PART 'A-1': OPTION 2 AND PART 'B-1': OPTION 2 (OUTLET PORTION OF PUCE LOTS DRAIN No. 1 TO PUCE RIVER).

- PROPOSED DRAIN DIVIDE
- PROPOSED COVERED DRAIN ALIGNMENT
- PROPOSED OPEN DRAIN IMPROVEMENTS
- WATERSHED AFFECTED BY IMPROVEMENT

PRELIMINARY REPORT

PART 'B-4'

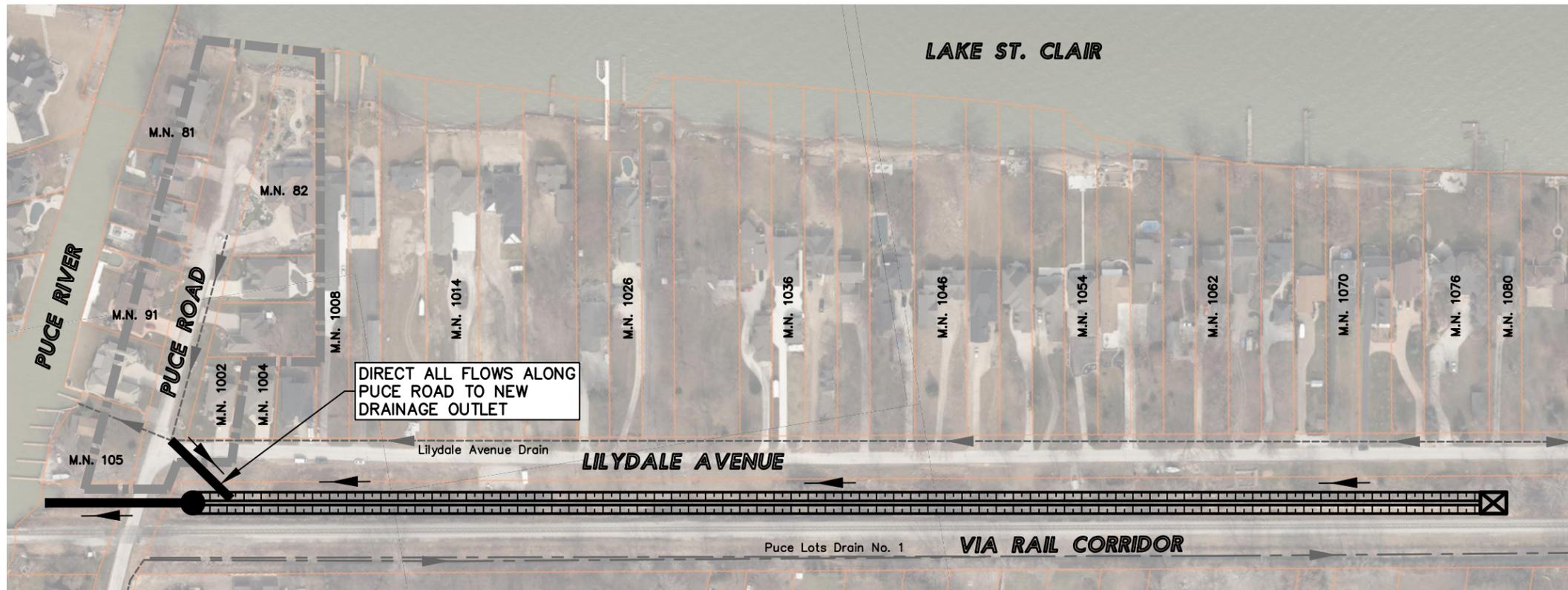
PROJECT No.
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PART 'B-5' - PUCE ROAD DRAINAGE IMPROVEMENTS (NORTH OF VIA RAIL)



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OPTION 1: DIRECT ALL FLOWS TO NEW OUTLET WITH MINOR DRAINAGE IMPROVEMENTS ALONG PUCE ROAD

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GENERAL NOTES:

1. THE FINAL ALIGNMENT OF THE IMPROVEMENT WILL DEPEND ON THE DIRECTION FOR PART 'B-3', TOGETHER WITH OVERALL SIZE AND AVAILABLE SPACE.
2. EACH OPTION SHALL INCLUDE ALL ASSOCIATED DRAINAGE COMPONENTS (CATCH BASINS, MAINTENANCE HOLES, PRIVATE SERVICES, ETC.).

-  PROPOSED DRAIN DIVIDE
-  PROPOSED COVERED DRAIN ALIGNMENT
-  EXISTING UNDERGROUND DRAINAGE
-  PROPOSED OPEN DRAIN IMPROVEMENTS
-  WATERSHED AFFECTED BY IMPROVEMENT
-  PROPOSED PUMP STATION & OUTLET

PRELIMINARY REPORT

PART 'B-5'	
PROJECT No. D18-015	SHEET No.: 9 OF 9