TECHNICAL MEMORANDUM

DATE September 4, 2024 **Project No.** CA0016184.7534

TO Tom Baumgarten, Senior Manager, Environmental Systems and Projects
Lafarge Canada Inc.

CC Kevin MacKenzie, Sean McFarland

FROM Craig De Vito **EMAIL craig.devito@wsp.com**

DEWATERING ESTIMATES FOR THE PROPOSED BELOW WATER EXTRACTION FROM LAFARGE WELLINGTON

1.0 INTRODUCTION AND BACKGROUND

Lafarge Canada Inc. (Lafarge) owns and operates the Wellington County Pit and Quarry (the Site), located on the south side of Highway 124, west of Guelph. Lafarge is evaluating the potential impacts of utilizing its existing license to quarry bedrock at the Site. To support this assessment, WSP INC. Canada (WSP) has been retained by Lafarge to conduct technical studies. These studies will investigate the potential for quarrying below the water table and will aid in the preparation of Permit to Take Water (PTTW) and Environmental Compliance Approval (ECA) applications.

Lafarge holds a license under the Aggregate Resources Act to extract sand, gravel, and bedrock at their Lafarge Guelph Pit and Quarry Site. To date, only sand and gravel have been extracted. Lafarge is now considering expanding their operations to include bedrock extraction which involves an updated 10-year excavation project targeting an area of 24 hectares, as illustrated in Figure 1. The proposed extraction depth will reach 285 meters above sea level, which is estimated to be above the Vinemount Member of the Eramosa Formation. This Vinemount Member generally serves as an aquitard, separating the Guelph Formation above from the Goat Island and Gasport Formations below. Since the targeted bedrock lies below the water table, quarry dewatering will be necessary. Lafarge is already authorized to pump water from the Speed River, a Source Pond, and a Holding Pond for operational needs such as aggregate washing and manufacturing, under an existing Permit to Take Water (PTTW) (Number 2718-7S3RM7) and Environmental Compliance Approval (Certificate of Approval Industrial Sewage Works Number 0290-6PHGPS).

2.0 DEWATERING ESTIMATES

A water balance assessment for the proposed quarry was conducted to estimate the volume of surface water requiring dewatering from the quarry and the following steps were undertaken:

Catchment Area Analysis: The catchment area draining to the sump encompasses approximately 70 hectares. This area includes various land uses within the Lafarge property boundary, such as open water,

vegetation/agricultural land, and bare pit/gravel land. Additionally, there are impervious surfaces in the catchment area that falls outside the property boundary.

Water Balance Calculations: To estimate the amount of water that needs to be dewatered from the quarry, water balance calculations were performed. These calculations included the following estimations:

- Mean Spring Surplus: Average surplus of surface water during the spring season (March – May).
- Mean Annual Surplus: Average annual surplus of surface water across the entire year.
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- Maximum 5-Year Return Spring Surplus: Maximum surplus expected during the spring season (March – May), based on a 5-year return period.
- 2-Year and 5-Year Return 24-Hour Precipitation Events: Estimated surplus resulting from 24-hour precipitation events with return periods of 2 and 5 years.

These estimates are essential for determining the volume of water that must be managed and dewatered from the quarry to ensure effective operation and mitigate potential impacts on the surrounding environment.
Table 1 details the necessary pumping rates for effectively dewatering the sump during various water surpluses and precipitation events in the catchment area.

Table 1: Quarry Water Pumping Rates

PTTW Pumping Rates	Total Volume (m3)	L/s	m3/day
Mean Spring Surplus	89,772	11.3	980
Mean Annual Surplus	238,279	7.56	650
5 Year Return Period Spring Surplus	121,210	15.3	1,320
2 Year Return Precip Event (pumped over 2 days)	33,023	191	16,510
5 Year Return Precip Event (pumped over 3 days)	43,260	167	14,420

For typical conditions, the mean spring surplus requires a pumping rate of 11.3 L/s, translating to 980 m^3/day, while the mean annual surplus demands a rate of 7.56 L/s or 650 m^3/day. Notably, the 5-year return period spring surplus, which involves managing a larger volume of water, requires a higher pumping rate of 15.3 L/s, equivalent to 1,320 m^3/day. These rates underscore the need for substantial and reliable pumping capacity to handle regular seasonal surpluses.

For more extreme weather events, the table indicates significantly higher pumping requirements. The 24-hour, 2-year return precipitation event, managed over two days, necessitates a pumping rate of 191 L/s (16,5100 m^3/day), while the 24-hour, 5-year return event, spread over three days, requires a rate of 167 L/s (14,420 m^3/day). These elevated rates highlight the critical need for robust and efficient pumping systems to address peak water volumes during intense precipitation events, ensuring the sump is adequately dewatered and preventing potential overflow or flooding. Consequently, the pump sizes for these event-based surface water contributions should be designed to handle up to 16,510 m^3/day plus groundwater inflows to manage these extreme scenarios effectively.

The groundwater assessment of the 10-Year Lafarge Wellington quarry footprint conducted by Matrix Solutions (Matrix 2024) demonstrated that the extraction rate of groundwater seepage from the quarry sump, remains nearly identical with (2,773 m^3/day) and without (2,756 m^3/day) the injection well located on Lafarge property at the southeast corner of the quarry footprint. In their simulation, the injection into the Upper Gasport Formation was shown to enhance head recovery primarily within the transmissive Gasport Formations located below the Vinemont Member. Consequently, the impact on head recovery above the Vinemont Member was minimal. This result underscores the efficient separation of the hydraulic head regimes above and below the Vinemont Member, as detailed in the Matrix Solutions groundwater report (2024).

3.0 CONCLUSIONS

The following conclusions can be made from the above dewatering estimates:

1) The typical quarry dewatering limit should consider both typical surface water surplus estimates and groundwater seepage (i.e., 1,320 m^3/day for surface water and 2,773 m^3/day for groundwater) for a total typical dewatering limit of approximately 4,100 m^3/day.

2) The PTTW should also have an allowance to dewater larger precipitation events. These dewatering events will require rates in the range of 19,300 m^3/day (i.e. 16,510 m^3/d for surface water and 2773 m^3/d for groundwater).

4.0 CLOSURE

We trust that this letter provides sufficient information for your current purposes. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact the undersigned.

WSP Canada Inc.

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Water Resources Engineer

Kevin MacKenzie, MSc, PEng
Principal, Senior Water Resources Engineer

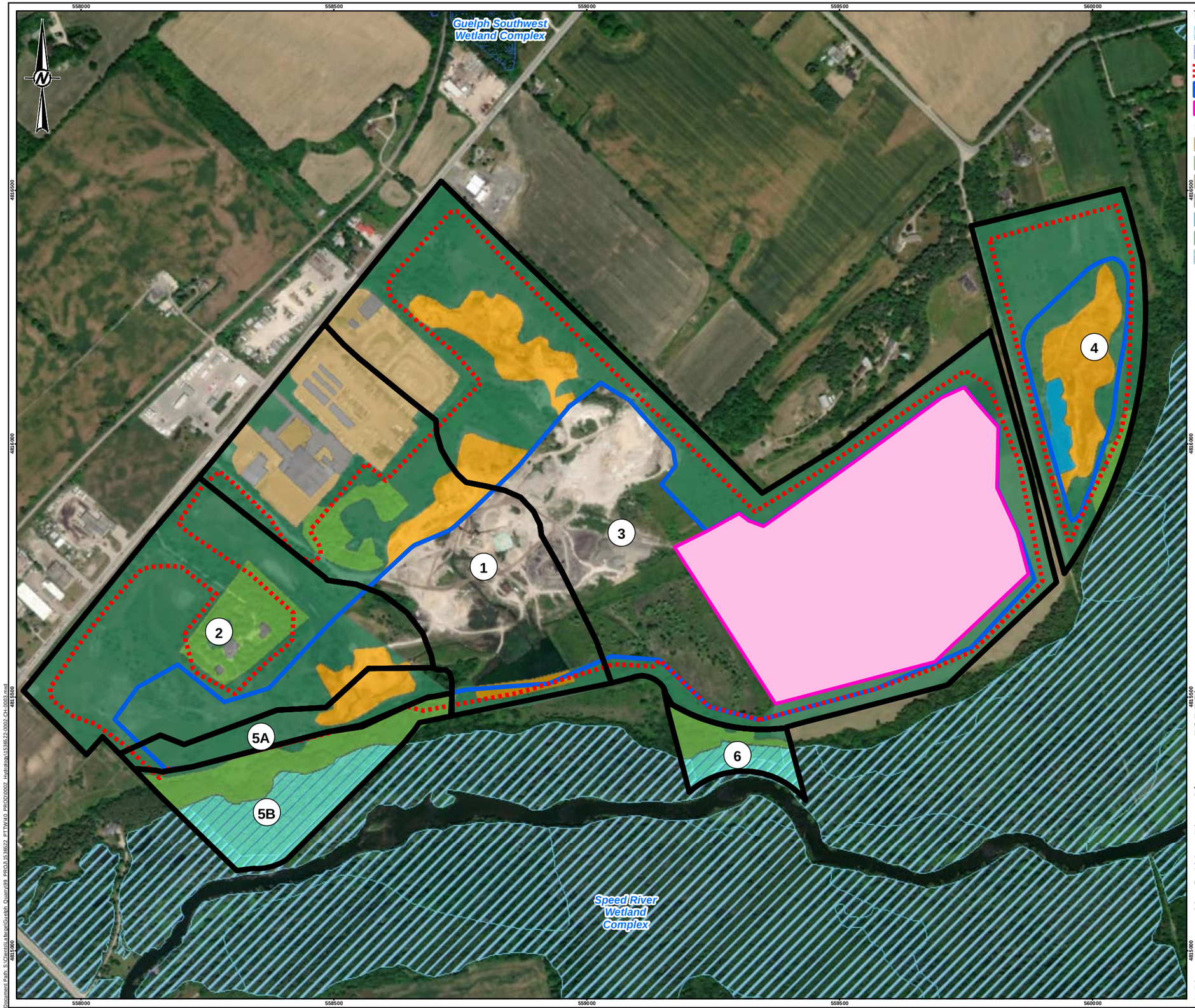
MM/CDV/KMM/mp

Attachment: Figure 1 – Operational Site Catchments

https://wsponlinecan.sharepoint.com/sites/ca-ca00161847534/shared documents/06. deliverables/surface water/01. dewater rates memo/draft/ca0016184-7534-ca-tm-rev0-lafarge wellington-04sept2024.docx

References

Matrix Solutions Inc. (Matrix), Groundwater Modelling of the 10-Year Lafarge Wellington Quarry Footprint, Version 2.0, Prepared for the City of Guelph, Guelph, Ontario, February 9, 2024.



LEGEND

- Provincially Significant Wetland
- Wetland
- Approximate Above Water Limit of Extraction
- Approximate Below Water Limit of Extraction
- Phase 1 Extraction Area

Land Cover

- Bare-Open Pit
- Forest
- Gravel
- Impervious
- Open Water
- Vegetated
- Wetland

0 250 500

1:7,500 METRES

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2015
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM
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PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17

CLIENT
LAFARGE GUELPH

PROJECT
PERMIT TO TAKE WATER
GUELPH QUARRY

TITLE
OPERATIONAL SITE CATCHMENTS

CONSULTANT

YYYY-MM-DD	2024-09-05
DESIGNED	KD
PREPARED	PR
REVIEWED	MLE/DH
APPROVED	CDV

PROJECT NO.	CONTROL	REV.	FIGURE
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