ONTARIO LAND TRIBUNAL

Appeals by ClubLink Corporation ULC of Zoning By-law Amendment and Plan of Subdivision Applications for 7000 Campeau Drive, Ottawa

OLT Case No. PL200195

WITNESS STATEMENT OF PAUL VILLARD (GEO MORPHIX LTD.)

November 12, 2021

Qualifications

1. I am the Director and Principal Geomorphologist with Geo Morphix Ltd. For over twenty-five years, I have been involved in research related to geomorphology in fluvial, coastal and estuarine systems. My research has covered a range of topics including fundamentals of sediment transport, bedform and channel evolution, turbulence and hydrodynamics, field measurement techniques, urban impacts on rivers, and the evolution and habitat benefit of restored river systems.

2. For the last twenty years, I have applied my knowledge of sediment transport, hydrodynamics and geomorphology to hundreds of projects throughout Ontario. I have also been involved in projects in Manitoba, California and the northeastern United States. These projects included sediment transport studies, geomorphic assessments, stream and shoreline restoration, erosion assessments for both stormwater management and dewatering projects, hazard assessments, and site remediation. I am a member in good standing of the Association of Professional Geoscientists of Ontario, and the Associations of Professional Engineers and Geoscientists of British Columbia, Alberta, and Manitoba. I have also been qualified as an expert witness in Fluvial Geomorphology and River/Shoreline Erosion by the Superior Court of Justice.

3. A copy of my *curriculum vitae* is attached to this Witness Statement, together with a signed Acknowledgement of Expert's Duty.

Retainer

4. GEO Morphix Ltd. was retained in 2020 by Minto Communities-Canada on behalf of ClubLink Corporation ULC to address fluvial geomorphological requirements to

support draft plan of subdivision and zoning by-law amendment applications for the proposed redevelopment of 7000 Campeau Drive, Ottawa. The work completed is summarized in the GEO Morphix Ltd. report titled *Kizell Drain Downstream of 7000 Campeau Drive Geomorphological and Erosion Threshold Assessment, Kanata, Ontario (July 7, 2020)*.

Summary of Evidence and Opinions

5. In my evidence, I will address the following issues, as discussed below.

City of Ottawa Issues

6. **Issue 2. Is the proposed plan of subdivision consistent with the Provincial Policy Statement, particularly policies 1.1.1 b), 1.1.3.4, 1.6.6.7, 2.2.1 i) and 2.2.2?**

PPS Policy 1.6.6.7: Planning for stormwater management shall:

c) minimize erosion and changes in water balance, and prepare for the impacts of a changing climate through the effective management of stormwater, including the use of green infrastructure;

7. *Response: GEO Morphix completed a detailed review of background information to gain context into the condition of Kizell Drain and a tributary of Watts Creek from an erosion perspective. This exercise was completed to inform and support storm water management strategies to ensure no exacerbated rates of erosion or sedimentation occur within the receiving watercourse. The work is summarized in the GEO Morphix July 7, 2020 Report.*

8. **Issue 4. Does the proposed plan of subdivision conform to the Official Plan of the City of Ottawa, particularly policies 2.2.2.22, 2.2.2.23, 2.3.3.1, 2.3.3.3, 2.4.5.4, 2.5.1.1, 3.6.1.5, 4.10.5, 4.11.5, 4.11.19 and 4.11.20, and is it compatible with adjacent plans of subdivision (s.51(24)(c))?**

City of Ottawa Official Plan Policy 2.3.3.1: Development will be in accordance with the system capacity for drainage and will implement stormwater management and where relevant, will conform to stormwater site management plans, the Infrastructure Master Plan and community design plans practices necessary to protect, improve or restore the quality and quantity of water in the receiving watercourse. [Amendment #76, OMB File #PL100206, August 18, 2011]

9. *Response: GEO Morphix confirmed the work performed by DSEL / JFSA to ensure there were no concerns from a geomorphological perspective. The updated existing conditions modelling and future stormwater management plan were optimized for a number of criteria including mitigating future potential erosion from the proposed redevelopment.*

10. **Issue 23. Is the proposed zoning consistent with the Provincial Policy Statement, particularly policies 1.1.1 b), 1.1.3.4, 1.6.6.7, 2.2.1 i) and 2.2.2?**

11. *Response: See response to Issue 2.*

12. **Issue 25. Does the proposed zoning conform to the Official Plan of the City of Ottawa, particularly policies 2.2.2.22, 2.2.2.23, 2.3.3.1, 2.3.3.3, 2.4.5.4, 2.5.1.1, 3.6.1.5, 4.10.5, 4.11.5, 4.11.19 and 4.11.20?**

13. *Response: See response to Issue 4.*

Kanata Greenspace Protection Coalition Issues

14. **Issue 31. Further to Section 51(24) Subsections (d) and (h), is it appropriate to consider the development of lands that will drain both overland and through piped infrastructure passing through a watershed with potential risk of flooding, erosion damage to tributaries and adverse impacts on natural wildlife given the unresolved pre-existing conditions as noted under Comments numbered 136, 140, 170, 171, 177, 178, 180, 181 and 191 in the City of Ottawa's letter dated December 19, 2019 in that watershed?**

15. City Comment 140. Please revise this report to describe the proposed strategies used to manage erosion at existing critical areas and the locations where an increase in erosion potential has been identified? Please refer to comments 178-180 below.

16. *Response: GEO Morphix completed an exercise to review downstream watercourses and define those most sensitive to erosion. Erosion thresholds were then defined and pre- to post-development hydrographs were prepared to ensure erosion potential was mitigated in the future condition.*

17. *To address increases in erosion from changes in local hydrology, appropriate stormwater management techniques were proposed. Specifically, JFSA (2021) incorporated low-impact development measures (LIDs), Oil Grit Separators (OGSs), and wet ponds to control stormwater on site. As a result of proposed erosion mitigation associated with the stormwater management plan, there is a limited change in the erosion regime between pre- and post-development scenarios, signifying that the redevelopment of 7000 Campeau Drive will not adversely impact the geomorphological condition of the Kizell Drain, and subsequently, downstream conditions within Watts Creek.*

18. City Comment 170. As per the Pre-Consultation minutes (dated March 19, 2019): the continuous SWM model should be considered for the entire length of Kizell/Watts creek. It appears that the continuous run evaluated only one location (0.5 cms) on the creek. Previous studies indicate that there is more than one location where erosion may be an issue. Please refer to comments made with respect to the Kizell Drain Erosion Assessment and ensure this memo is revised to report details for all critical areas.

19. *Response: I agree that in this case to adequately evaluate the potential for erosion within the receiving watercourse downstream of the proposed redevelopment, multiple sites must be assessed. In this instance, GEO Morphix Ltd. relied upon the insights provided by the work of JTB Environmental Systems Inc. (JTBES) (the City's consultant), Matrix Solutions Inc. (ClubLink's consultant) and our own rapid assessments of potentially impacted channels within Kizell Drain to determine which sites or site was the most sensitive to erosion. Since our assessment identified a different site than that proposed in the JTBES, 2020 memo, both were evaluated.*

20. *Specifically, Detailed Site KDG-3 and KDG-4 were determined to be the most sensitive to erosion by JTBES and GEO Morphix Ltd. The proposed redevelopment's storm water management strategy mitigates erosion at these locations. As such, conditions at the sensitive sites downstream are expected to be maintained in their current condition. This includes potentially sensitive sites within Watts Creek.*

21. *The rationale for the delineation of the study area is provided within Section 2 of the July 7, 2020 GEO Morphix Ltd. report, and the reasoning for the selection of the two sensitive sites is described on Page 9.*

22. City Comment 171. With respect to the erosion impacts evaluated for Kanata Golf and Country Club, it is not clear why any flow in excess of 0.5 m3/s at the critical location identified in the Kizell Drain Erosion Assessment (Matrix Solutions, August 2019), is considered acceptable as an erosion problem already exists. Please explain.

    As noted in the "Shirley's Brook & Watt's Creek Phase 2 Stormwater Management Study" (AECOM, 2015), hereafter referred to as the AECOM report, the existing rates and locations of erosion sedimentation and remobilization of existing silt deposits is already an issue. With respect to page 4, 1st paragraph, note that any proposed increase in flow volumes or peak flows shall include an appropriate mitigation strategy. Furthermore, the KNL development is not the baseline therefore comments in 2nd paragraph are not applicable. To say the increase is "minimal" and "negligible" means little when there is an existing problem. The report states that the increase is "manageable." Please revise this memo to describe the proposed strategies used to manage erosion at existing critical areas and the locations where an increase in erosion potential has been identified.

23. *Response: It is important that rates of existing erosion within the receiving watercourse are not exacerbated. However, given that the existing erosion conditions along Kizell Drain and Watts Creek are not a result of activities associated with the proponent, there should not be a requirement to mitigate existing erosion. The proponent is required to mitigate impacts from their proposed redevelopment only. To accomplish this, GEO Morphix has re-evaluated the erosion threshold and provided a more conservative value than what was originally documented under the Matrix (2019) assessment. This assessment is outlined in*

Section 6 of the GEO Morphix July 7, 2020 Report. JFSA has also modified the stormwater management plan to mitigate erosion exceedances with on-site controls as outlined in their June 2021 Report '7000 Campeau Drive Subdivision – Preliminary Stormwater Management Plan.

24. City Comment 177. Note that Section 5 states a concern with two culverts lacking smooth transition of flow. If these culverts are retrofit to address this concern, would there be increased flow downstream creating more erosion potential (especially at KDG-5)? Please explain.

25. *Response: In terms of erosion potential resulting from development, these culverts are an element of the existing condition. I am of the opinion that mitigating erosion potential as a result of this culvert alignment should not be the responsibility of the proponent, as it is not related to the development. However, assuming proper culvert sizing and design, I recommend that if any potential exacerbated local erosion were to occur it should be mitigated using local restoration. This activity would not require any modifications to the storm water management strategy for the proposed redevelopment.*

26. City Comment 178. The study ends at the confluence with Watts Creek. The expectation was that the investigation would include Watts Creek. The pre-consultation minutes state "there are concerns regarding erosion, sediment, and thermal impacts. There would be a requirement for continuous modelling from the beaver pond and downstream watercourse to the Ottawa river." Please ensure this is addressed within the next submission.

27. *Response: Please refer to my response to comment 170 and Section 2 of the July 7, 2020 GEO Morphix Ltd. Report.*

28. City Comment 180. In section 2: Background information: It is recommended that the author refer to "LINKING SEDIMENT ERODIBILITY AND CHANNEL STABILITY TO UTILIZATION OF AVAILABLE HABITATS BY FISH POPULATIONS IN WATTS CREEK" Prepared by : Colin D. Rennie, Ph.D., P.Eng. Prepared for: Binitha Chakraburtty Sr. Municipal Engineer, National Capital Commission, and "WATTS CREEK WATERCOURSE AND WATERSHED MANAGEMENT PLAN," Prepared for: National Capital Commission, Prepared by: Stantec Consulting Ltd. Please revise the report to make reference to these reports/studies and address the problematic areas identified within these studies.

29. *Response: Several works from Colin Rennie regarding the erosion threshold of Watts Creek were reviewed within Section 3 of the GEO Morphix Report. This includes 'Linking Sediment Erodibility and Channel Stability to Utilization of Available Habitats By Fish Populations In Watts Creek', and a paper titled 'Effect of Climate Change on Stream Erosion in a Small Watershed' by Brennan, Parsapour-Moghaddam, Rennie, and Seidou. A review of the Stantec Consulting Ltd. 'Watts Creek Watercourse and Watershed Management Plan (2011)' was also*

completed. This work is summarized within Section 3 of the GEO Morphix July 7, 2020 Report.

30. City Comment 191. The conclusion in the JTBES report was “Kizell Drain/Watts creek systems are currently responding to changing inflow and sediment regimes that have arisen from prior changes to land use activity.” “It can be concluded that additional development in these watersheds has the potential to exacerbate existing rates and locations of erosion sedimentation and remobilization of existing silt deposits. It will be the responsibility of the development proponent to mitigate the anticipated impacts through an appropriate stormwater management strategy.” There has been no strategy proposed; therefore, please provide a strategy to mitigate the impacts of an increase in runoff volume.

31. *Response: I agree that the existing erosion condition is a result of prior land use activity and that the proponent should only be required to address potential increases in erosion from changes to hydrology association with the proposed redevelopment. GEO Morphix has re-evaluated the previously defined erosion threshold from Matrix (2019), resulting in a more conservative erosion threshold value. The updated erosion threshold assessment is outlined in Section 6 the GEO Morphix July 7, 2020 Report. The updated erosion threshold assessment was used by JFSA to support development of a stormwater management plan that mitigates erosion exceedances through appropriate onsite stormwater management, resulting in a reduction in downstream erosion potential associated with the proposed redevelopment.*

32. **Issue 32. Is the proposed zoning amendment and plan of subdivision consistent with the PPS 2020 with particular reference to Section 1.1.1 b) and c); 1.1.3.4; 1.6.6.7; 2.2.1 a) and i); 2.2.2; and 3.2.2?**

33. *Response: See response to Issue #2*

34. **Issue 34. Is the proposed zoning amendment and plan of subdivision in general conformity with the Official Plan with particular reference to the following sections:**

    2.3.3 – Drainage and Stormwater Management Services

    Land-use change creates the need for drainage services to ensure safe, well-drained sites. The provision of storm sewers to efficiently convey frequent runoff is combined with overflow (or surface) routes that convey larger, less frequent flows that exceed storm sewer capacity. This “major/minor” system approach to drainage provides protection from flooding in new developments.

    Uncontrolled stormwater runoff can also impair aquatic habitat, increase erosion threats and limit the recreational potential of local rivers and streams. Increased flooding and erosion can also impact municipal drains when development occurs adjacent to them. Beyond protecting life, property and infrastructure from flooding,

stormwater management services are also required to mitigate the impacts of land-use change on receiving watercourses, including municipal drains.

The provision of appropriate drainage and stormwater management services requires coordination with land-use planning, and assessment of receiving watercourses (including municipal drains), environmental features and natural hazards, all of which is typically achieved through environmental management plans and subwatershed plans. Policies for these plans and stormwater site management plans are found elsewhere in this Plan.

35. *Response: GEO Morphix completed rapid geomorphological assessments for the four most sensitive sites located between the Beaver Pond and Kizell Drain (receiving watercourses) identified by JTBES. Rapid geomorphological assessments included characterization of stream form, process, and evolution, an assessment of the ecological function of the watercourse features, stream classification using a modified Downs (1995) and a modified Brierley and Fryirs (2005) River Styles Classification approach, instream estimates of bankfull channel dimensions, bed and bank material composition and structures, and identification of areas of significant erosion and areas of valley wall contact/valley wall systems.*

36. *To address concerns of the City and Conservation Authority, we completed a sensitivity analysis for the reaches downstream of the proposed redevelopment. The most sensitive reaches were identified and erosion thresholds for the associated reaches were defined based on detailed geomorphological assessments. The erosion thresholds were used to evaluate different strategies for mitigating erosion. Through our analysis, it was shown that JFSA's stormwater management approach, which includes retention on site, is appropriate for mitigating future erosion.*

<u>List of Documents to be Referred To</u>

- Stormwater Planning and Design Manual,
  Ministry of the Environment, March 2003. (formerly MOE)
  (SWMP Design Manual)

- Kanata North Community Design Plan, Master Servicing Study
  Novatech Engineering, June 28, 2016. *(KNCDP)*

- Geotechnical Investigation, Kanata Lakes Golf and Country Club, 7000 Campeau Drive, Ottawa, Ontario
  Paterson Group, May 2020 (Report: PG4135-2 Rev4) *(Paterson Geotechnical Report)*

- Kanata Golf & Country Club, 2019 Monitoring & Hydrologic Model Calibration Report
  J.F. Sabourin and Associates Inc., (Updated July 2020) (*JFSA Calibration)*

- 7000 Campeau Drive Subdivision – Preliminary Stormwater Management Plan J.F. Sabourin and Associates Inc., June 2021 (*JFSA SWM Plan)*

- Downstream of 7000 Campeau Drive – Hydrologic Assessment J.F. Sabourin and Associates Inc., June 2021 (*JFSA Hydrologic Assessment)*

- Kizell Drain Downstream of 7000 Campeau Drive – Geomorphological and Erosion Threshold Assessment, Kanata, Ontario GEO Morphix., July 2020 (*GEO Morphix Assessment)*

- Peer Review of Kizell Drain Erosion Assessment authored by Matrix Solutions – JTBES, May 25, 2020.

- Kizell Drain Erosion Assessment, Proposed Redevelopment of Kanata Golf and Country Club, 7000 Campeau Drive, Ottawa – Matrix Solutions Inc., August 2019.

- Linking Sediment Erodibility and Channel Stability to Utilization of Available Habitats by Fish Populations in Watts Creek – C.D. Rennie, 2016.

- Watts Creek Watercourse and Watershed Management Plan – Stantec Consulting Ltd. – January 20, 2011.

Paul Villard, P.Geo, CAN-CISEC, EP, CERP

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Dr. Paul Villard, Director, Principal Geomorphologist, P.Geo., CAN-CISEC, EP, CERP

Qualifications/Professional Affiliations

CERP 2019	Society for Ecological Restoration
EP 2019	ECO Canada
P.Geo. 2018	Engineers and Geoscientists British Columbia
P.Geo. 2015	Association of Professional Engineers and Geoscientists of Alberta
CAN-CISEC 2012	Certified Inspector of Sediment and Erosion Control Inc.
P.Geo. 2010	Engineers Geoscientists Manitoba
P.Geo. 2003	Professional Geoscientists Ontario
Ph.D. 1999	Geography, University of Auckland, New Zealand
M.Sc. 1996	Geography, University of Guelph
B.Sc. 1993	Geography, Honours (dist.), University of Guelph

Biography

For over twenty-five years Dr. Villard has been involved in research related to geomorphology in fluvial, coastal and estuarine systems. His research has covered a range of topics including fundamentals of sediment transport, bedform and channel evolution, turbulence and hydrodynamics, field measurement techniques, urban impacts on rivers, and the evolution and habitat benefit of restored river systems.

For the last fifteen years he has applied his knowledge of sediment transport, hydrodynamics and geomorphology to hundreds of projects throughout Ontario. He has also been involved in projects in Manitoba, California and the northeastern United States. Projects included sediment transport studies, geomorphic assessments, stream and shoreline restoration, erosion assessments for both stormwater management and dewatering projects, hazard assessments, and site remediation. He is a member in good standing of the Association of Professional Geoscientists of Ontario, and the Associations of Professional Engineers and Geoscientists of Alberta and Manitoba.

Specialties: Fluvial and coastal geomorphology, sediment transport assessment (measurement and modelling), landscape dynamics, watershed/shoreline assessment, process sedimentology, channel and shoreline restoration, and hazard analysis.

Research and Consulting Experience

GEO Morphix Ltd. • Milton, ON 2013 – Present
DIRECTOR, PRINCIPAL GEOMORPHOLOGIST

Dr. Villard leads a team of earth and environmental scientists that specialize in geomorphology, process sedimentology, and earth surface processes. We focus on river and shoreline restoration, erosion hazard delineation and mitigation, and projects that require an in-depth understanding of sediment transport.

Our team provides observation-rich answers based on a balanced application of quality science and years of experience to achieve practical, implementable and acceptable solutions for all stakeholders.

GHD Limited (Formerly The Sernas Group) • Mississauga, ON 2013
BUSINESS GROUP MANAGER, ENVIRONMENT, CANADA

Dr. Villard applied his considerable experience in marketing, management, and implementing geomorphological, sedimentological, and environmental-related projects in support of private development applications, public infrastructure projects and habitat restoration of public and private lands. Assignments included watercourse and shoreline restoration, identification and mitigation of natural hazards associated with rivers and coasts, support in master environmental servicing plans, sediment transport studies, impact mitigation, emergency site restoration, and peer-review. In his role as Business Group Manager (Environment) Canada, he delivered a wide range of client-focused consulting services.

Geomorphic Solutions, The Sernas Group • Mississauga, ON 2004 – 2013
GENERAL MANAGER, SENIOR GEOMORPHOLOGIST, PRINCIPAL

Dr. Villard applied his knowledge of sediment transport, hydrodynamics and geomorphology to numerous projects throughout Ontario and the northeastern United States. Projects included sub-watershed studies and secondary plans, natural channel and coastal designs, and stream rehabilitation and erosion threshold assessments for both stormwater management and dewatering projects, plus a wide range of hazard assessments. He has also worked on several site remediation and contaminant projects. He has been involved in various academic studies including several large international projects related to geomorphology and sediment transport in fluvial, estuarine and coastal environments. Dr. Villard continues to be actively involved in academic research, provides occasional lectures and delivers technical courses in geomorphology. His most recent academic work examines the evolution of river, delta and coastal barrier marsh morphology, and developing methods for measuring and modeling sediment transport in dynamic coastal and fluvial environments.

PARISH Geomorphic Ltd. • Georgetown, ON 2002 – 2004
SENIOR ASSOCIATE, SENIOR FLUVIAL GEOMORPHOLOGIST

Applied knowledge of physical geography and earth science to numerous projects including erosion assessments, natural channel designs, hazard assessments and the geomorphic components of sub-watershed studies. Responsibilities consisted of acquiring and managing projects; providing professional expertise, assessment, analyzing and modeling of natural systems; and providing science-based solutions to environmental issues.

University of British Columbia • Vancouver, BC 1999 – 2002
RESEARCH SCIENTIST (NSERC POST-DOCTORAL FELLOW)

Developed and conducted research projects to examine: 1) yearly and seasonal changes in channel, delta and bedform geometry in the estuarine reach of the Fraser River, B.C., 2) influence of dunes on sediment transport and hydrodynamics, and 3) utility of measuring bedload using bottom tracking from an acoustic Doppler profiler. Involved in studies to investigate the hydrodynamics of density currents and delta morphology in Lillooet Lake, B.C., and the morphology of avalanche impact features in Duffey Lake, B.C.

MND Consulting Associates • Guelph, ON 1995 – 1996
CONSULTANT

Work involved modeling levels of fugitive dust emissions from proposed gravel quarries.

University of Guelph • Guelph, ON 1992 – 1995
RESEARCH ASSISTANT

Worked on a range of geomorphic research projects including sediment transport processes in the Fraser River, monitoring subaqueous erosion of cohesive shorelines along the Great Lakes, subaqueous vegetation and surficial sediment survey of Rondeau Bay, gully erosion along Lake Huron, and mapping and classifying glacial landforms around the Norwood Esker in the Peterborough.

Academic Experience

University of Guelph, Department of Geography • Guelph, ON 2011 – 2020
LECTURER, ADJUNCT PROFESSOR

- GEOG3610 'Environmental Hydrology'; 75 undergraduate students.
- GEOG3000 'Fluvial Processes'; 40 undergraduate students.
- GEOG4150 'Catchment Processes'; 10 undergraduate students.
- Supervising three undergraduate projects.
- Co-supervising two master theses.

Ontario Good Roads Association • Mississauga, ON 2005 – 2020
INSTRUCTOR, COURSE DEVELOPER

Develop and teach continuing professional development courses on topics including applied geomorphology, channel restoration, stormwater management, environmental regulations, impact mitigation, and erosion and sediment control.

Reach Training Inc. • Mississauga, ON 2002 – 2004
INSTRUCTOR

Continuing professional development course on the theory and application of fluvial geomorphology and natural channel design to staff from conservation authorities, Department of Fisheries and Oceans and provincial ministries. Course involves both in-class and field components.

University of Victoria, Department of Geography • Victoria, BC 2002
SESSIONAL LECTURER

- GEOG476 'Geomorphology II: Physical Processes and Coastal Systems'; 25 undergraduate students.

University of Auckland, Department of Geography • Auckland, NZ 1997 – 1999

SESSIONAL LECTURER

- 430.774 'Geographic Information Systems and Modelling'; 10 graduate students (Semester II 1999).
- 20.091 'Wellesley Program'; general arts and science course introducing mature students to university studies, 30 students (1998).
- 424.713 'Geological Oceanography'; 12 graduate students (Semester I 1998).
- 430.746 'Coastal Dynamics'; 15 graduate students (Semester II 1998, Semester II 1997).
- 430.353 'Field Studies in Geography'; 50 undergraduate students (Semester II 1998, Semester I 1997, Semester II 1996).

Professional Service and Memberships

REVIEWER 2001 – 2012

- Water Resources Research
- Sedimentology
- Geomorphology
- Earth Surface Processes and Landforms
- Canadian Hydraulic Institute
- American Geophysical Union
- River, Coastal and Estuarine Morphodynamics

MEMBERSHIPS

- Canadian Association of Geographers, Canadian Geomorphic Research Group
- Canadian Water Resources Association
- International Erosion Control Association

Research and Consulting Related Activities

LARGE SCALE RESTORATION DESIGNS (PARTIAL LIST)

- Carruthers Creek, Barclay Fieldstone Estates – Town of Pickering, ON
- Centre Tributary of Sixteen Mile Creek (Reach B), Lions Sports Park – Milton, ON
- Etobicoke Creek West Branch, Natural Corridor – Mississauga, ON
- Grindstone Creek, Main Branch – Waterdown, ON
- Harmony Creek West and East Tributary – Taunton Planning Area – Oshawa, ON
- Harrison/Routh Drain – Niagara-on-the-Lake, ON
- Kerrison Drive Storm Sewer Outfall Channel – Ajax, ON
- Laurel; Creek, Realignment, Conceptual Design, Victoria Park – Kitchener/Waterloo, ON
- Lovers Creek, SmartCentres – Barrie, ON
- Pine Creek Storm Sewer Outfall Channel, San Francisco by the Bay – Pickering, ON
- Pottersburg Creek, Corridor Re-alignment Phase I and II – London, ON
- Reach A of Sixteen Mile Creek, Corridor Re-alignment, Octavian Meadows Estates - Milton, ON
- Second Creek, Terra Cotta Conservation Area – Halton Hills, ON
- Sixteen Mile Creek, Trafalgar Golf and Country Club – Milton, ON
- Spring Creek Tributary A, Rosedale Village – Brampton, ON
- Stoney Creek, Erosion Control – Hamilton, ON
- Tannery Creek (associated with removal of Dunin Pond) – Aurora, ON
- Tributaries of Miller Creek, Valley Restoration/Replacement, Picov Farm – Ajax, ON
- Tributary H2 of the West Humber River, Corridor Re-alignment – Brampton, ON

- Tributary of Appleby Creek, Corridor Re-alignment, Alton Community – Burlington, ON
- Tributary of Stouffville Creek – Stouffville, ON
- Tributary of the Credit River – South Slopes of Riverdale Farms – Inglewood, ON
- Tributary of Uxbridge Creek, Corridor Re-alignment/Naturalization – Uxbridge, ON
- Unnamed Tributary of Petticoat Creek – Pickering, ON
- Upper Mimico Creek, Natural Corridor – Brampton, ON

CHANNEL RESTORATION AND REHABILITATION (PARTIAL LIST)

- Jock River, Glenview Homes, Geomorphological Assessment and Channel Realignment Design – Ottawa, ON
- Jock River, Mattamy Homes, Geomorphological Assessment and Channel Realignment Design – Ottawa, ON
- Fraser Clarke Drain, Barrhaven Conservancy Development, Geomorphological Assessment and Channel Realignment Design – Ottawa, ON
- Clarke SWM Pond (Jock River) Outlet Channel Design – Ottawa, ON
- Madawaska River, Arnprior Fairground, Geomorphological Assessment and Outfall Design – Ottawa, ON
- SWM Pond Outfall Design, Creekside Subdivision – Ottawa, ON (Richmond)
- Faulkner Drain, Davidson Lands, Geomorphological Assessment and Design Support – Ottawa, ON (Stittsville)
- Jock River and O'Keefe Drain, Barrhaven Conservancy Development, Conceptual Floodplain Restoration and Channel Realignment – Ottawa, ON
- McKinnon Creek, Summerside West, Geomorphological Support for Culvert Replacement – Ottawa, ON
- McKinnon Creek, Mer Bleue Urban Expansion, Geomorphological Assessment and Detailed Design – Ottawa, ON
- Greenbank SWM Pond (Jock River) Outlet Channel Design, Mattamy Homes - Ottawa, ON
- Cardinal Creek Village SWM Pond (Ottawa River) Outlet and Spillway Design – Ottawa, ON (Cumberland)
- Fernbank SWM Pond Outlet Channel Design, Mattamy Homes – Ottawa, ON (Fernbank)
- Appleby and Shoreacres Creeks, Geomorphological Assessment and Corridor Restoration Design, Paradise Homes – Burlington, ON
- Bendale Branch of W. Highland Creek (Birkdale Ravine), Channel Corridor Restoration – Toronto, ON
- Black Creek at Courtice Road, Channel Stabilization – Courtice, ON
- Bruce Creek at Major Mackenzie Drive, Bank Stabilization – Markham, ON
- Burke Brook, Fish Habitat & Channel Restoration – Toronto, ON
- Byersville Creek, Fish Habitat and Channel Enhancement – Peterborough, ON
- Carlton Creek at Woodbine Avenue – Markham, ON
- Carruthers Creek at Achilles Road – Ajax, ON
- Carruthers Creek Dam Decommissioning, Deer Creek Golf & Country Club – Ajax, ON
- Credit River at Britannia Road and Eglinton Avenue, Bank Stabilization – Mississauga, ON
- East Duffins Creek at Taunton Road, Bank Stabilization – Pickering, ON
- East Morrison Creek, Bioswale and Pocket Wetland Design, Green Ginger Developments – Oakville, ON
- German Mills Creek, Channel Restoration – Richmond Hill, ON
- Harmony Creek at Coldstream Drive, Channel Stabilization – Oshawa, ON
- Harrison Creek, Geomorphological Assessment and Corridor Restoration Design, The Oskar Group – East Gwillimbury, ON
- Humber River – Channel Assessment and Remediation Recommendations CPR Site
- Kolb Drain Realignment/Erosion Control – Kitchener/Waterloo, ON

- Laurel Creek Realignment and Erosion Control – Westmount Road Extension – Waterloo, ON
- Little Creek, Bank Stabilization – Millbrook, ON
- Lynde Creek at Cedarbrook Trail, Erosion and Hazard Mitigation – Whitby, ON
- Lynde Creek at Columbus Road, Erosion and Hazard Mitigation – Whitby, ON
- Lynde Creek at Woodhaven Drive, Channel Restoration and Stabilization – Whitby, ON
- Miller Creek, Fish Passage Restoration – Ajax, ON
- Pine Creek, Bank Restoration – Pickering, ON
- Pringle Creek at Burns Street, Bank Stabilization – Whitby ON
- Pringle Creek at Watson Street, Bank Stabilization – Whitby, ON
- Rouge River, Channel Assessment and Remediation Recommendations CPR Site
- Rouge River at Elgin Mills Cemetery, Bank Restoration – Richmond Hill, ON
- W. Highland Creek at Markham Road, Fish Habitat & Channel Restoration – Toronto, ON
- Silver Creek, Channel and Corridor Restoration – Toronto, ON
- Tannery Creek, Geomorphological Assessment and Channel Restoration Design, The Kerbal Group – Aurora, ON
- Tributary of the Don River, Bioswale and Pocket Wetland Design, Teefy Developments – Vaughan, ON
- Tributary of Fletcher's Creek, Geomorphological Assessment and Corridor Restoration Design – Town of Caledon, ON
- Tributary of the Humber River, Headwater Bioswale and Pocket Wetland Design, Harbourview Developments – Caledon, ON
- Tributary of the Humber River, Geomorphological Assessment and Restoration Support, Dam Removal, BHVL William Hostrawser, TRCA – Brampton, ON
- Tributary of Munn's Creek, Geomorphological Assessment and Corridor Restoration Design, Mattamy – Oakville, ON
- Tributary of the Rouge River, Headwater Restoration Concepts, Clera Developments – Markham, ON
- Tributary of Sixteen Mile Creek, Geomorphological Assessment and Corridor Restoration Design, Milton Heights – Milton, ON
- Tributary of Sixteen Mile Creek, Geomorphological Assessment and Corridor Restoration Design – Milton, ON
- Tributary Sixteen Mile Creek, Geomorphological Assessment and Restoration Support, Britannia Road Expansion, Mattamy Homes/Town of Milton – Milton, ON
- W. Highland Creek at Scarborough Golf & Country Club, Bank Restoration – Toronto, ON

GEOMORPHOLOGICAL AND SEDIMENTOLOGICAL STUDIES (PARTIAL LIST)

- Mosquito Creek, Riverside South Master Drainage Plan, Geomorphological Assessment – Ottawa, ON
- Jock River, Environmental Impact Report (EIR), Barrhaven Conservancy East – Ottawa, ON
- McEwen Creek and Mather Award Ditch, Erosion Threshold Determination – Ottawa, ON
- Green's Creek (two tributaries), Orleans Village, Erosion Threshold Assessment – Ottawa, ON (Orleans)
- Lemieux Island Water Purification Plant Intake Improvements, Geomorphological Study – Ottawa, ON
- Mosquito Creek, Urbandale Corporation, Erosion Mitigation Assessment – Ottawa, ON
- Carp River, The Stirling Group, Geomorphological Study – Ottawa, ON
- Jock River, Mattamy Homes, Crossing Design and Scour Analysis – Ottawa, ON
- Carp River, Kanata Highlands Development, Geomorphological Support for Functional Servicing Design – Ottawa, ON

- Surf Zone Experiments at Cooks Beach and Tairua North, Coromandel - New Zealand
- Sediment Erosion and Geomorphic Assessment – The Coves - London, ON
- Credit River Harbour Sedimentation Study, City of Mississauga, Mississauga, ON
- EETP, Upper Horsehill Creek, Edmonton, AB
- Lower Grindstone Creek and Borer's Creek Preliminary Geomorphological Assessment, Conservation Halton, Hamilton, ON
- Lower Stoney Creek, Geomorphic Assessment, Fruitland Winona Secondary Plan – Hamilton, ON
- Little Credit and Centerville Creek, Geomorphic Assessment – Caledon, ON
- Gilbert Creek, Geomorphic Assessment, Paris - ON
- Tributary of Fairchild Creek, Geomorphological Assessment – St. George, ON
- Matheson and Coldwater Creeks, Geomorphological Assessment, Horseshoe Craighurst Corridor Master Plan – Craighurst, ON
- Sharon Creek, Geomorphological Assessment – East Gwillimbury, ON
- Tributaries of Purpleville Creek, Geomorphological Characterization – Vaughan, ON
- Bilberry Creek Subwatershed Geomorphic Assessment – Ottawa, ON
- Cardinal Creek Watershed, Geomorphic Assessment – Ottawa, ON
- Dingle Creek Erosion Assessment – Simcoe, ON
- East Mud Creek Subwatershed Study- London, ON
- Grand River Exceptional Waters Study – Development of Geomorphic Thresholds for Water Taking
- Lillooet Lake Delta, Density Current Study – Lillooet, B.C.
- Geomorphic and Sedimentological Assessment of the Lower Humber River Marshes - Toronto, ON
- Sediment Management Strategy for Oakville and Bronte Harbours, Town of Oakville, Oakville, ON
- Port Hope Sediment Management Study, Municipality of Port Hope - Port Hope, ON
- Rattray Marsh Sedimentological/Geomorphic/ Restoration Studies, Credit Valley Conservation - Mississauga, ON
- Sherwood Creek/Burke Brook Geomorphic Systems Master Plan – Toronto, ON
- Subwatershed 17/Shaw's Creek and Tributaries – Credit River Watershed, ON
- Sunday River Watershed Assessment and Preliminary Restoration Study
- TRCA Fluvial Geomorphology Study and Erosion Assessment, Centreville Creek - Caledon, ON
- TRCA Fluvial Geomorphology Study and Erosion Assessment – Etobicoke Creek, ON
- Wetland Sediment Transport and Geomorphic Assessment – GE Canada – Guelph, ON

HAZARD ASSESSMENT (PARTIAL LIST)

- Marlborough Creek (Tributary of Jock River) Belt Width Assessment – Ottawa, ON
- Ottawa River, Petrie's Landing, Erosion Hazard Assessment – Ottawa, ON
- Feedmill Creek, Kanata West Development Area, Belt Width Assessment – Ottawa, ON (Kanata)
- Hazeldean Creek, Geomorphological Assessment – Ottawa, ON
- Tributary of the West Humber, Gursikh Temple, Geomorphological Assessment and Hazard Delineation - Brampton, ON
- Tributary of Pine Creek, Crozier & Associates, Geomorphological Assessment and Hazard Delineation - Horning's Mill, ON
- Lynde Creek, 1300 Giffard St., Hazard Assessment and Redside Dace Habitat Delineation - Whitby, ON
- Sixteen Mile Creek, Amec Foster Wheeler, Geomorphological Assessment and Meander Belt Width Delineation - Milton, ON

- West Humber River, Block 47-1 and 47-2 Landowners Group, Hazard Assessment and Redside Dace Habitat Delineation - Brampton, ON
- Wyecroft Road Improvements Class EA – Oakville, ON
- Mansewood Creek, Triovest Property, Hazard Assessment and Meander Belt Width Delineation - Town of Halton Hills, ON
- Black Creek, Geomorphological Assessment and Erosion Mitigation Study, Keelesdale Park, City of Toronto – Toronto, ON
- Burlington Bay Shoreline Erosion Study – CH, Burlington, ON
- Carruthers Creek – Pickering, ON
- East Don River – Belt Width Assessment – McMillan Lands
- East Don River – Erosion Assessment – Block 10, 11 and 12
- East Duffins Creek – Erosion Assessment
- Fletchers Creek, Derrydale Golf Club – Mississauga, ON
- Fletchers Creek, Lazarevic Property – Mississauga, ON
- Fletchers Creek, Rosedale Village – Brampton, ON
- Airport Road Class EA – Caledon, ON
- Grindstone Creek, Erosion & Sediment Transport Monitoring – Waterdown, ON
- Geomorphological Assessment and Pedestrian Bridge Replacements, Town of Oakville – Oakville, ON
- Hoover Park Drive Crossing, Fluvial Geomorphology Assessment - Stouffville, ON
- Humber River, Geomorphological Assessment and Hazard Delineation, Royal Park Homes – Kleinberg, ON
- Huttonville Creek, Hazard Assessment and Redside Dace Habitat Delineation – Mississauga, ON
- Lennon, Cahill and Wolfe Drains, Geomorphological Investigation – Windsor, ON
- Levi and Heritage Creeks, Hazard Delineation and Crossing Assessment, Heritage Road, Region of Peel – Brampton, ON
- Newtonbrook Creek, Geomorphological Investigation – Toronto, ON
- Nottawasaga River, Geomorphological Assessment and Erosion Mitigation Study, Walton Development – Alliston, ON
- Pickering Beach – Geomorphic and Hazard Assessment – Ajax, ON
- Port Darlington shoreline erosion study – Clarington, ON
- Purpleville Creek, Geomorphological Assessment, Block 41 Landowners – Vaughan, ON
- Rouge River, Markham Centre West Development Belt Width Assessment - Markham, ON
- Sediment and Erosion Control Plan, Utility Installation, DPM Energy – Aurora, ON
- Sediment and Erosion Control Plan, Utility Installation, DPM Energy – Bradford, ON
- Sheridan Creek, Geomorphological Investigation – Mississauga, ON
- Spring Creek, Erosion and Hazard Assessment – Brampton, ON
- Tributary of East Morrison Creek, Geomorphological Assessment, Star Oak Developments – Oakville, ON
- Tributary of Fairchild Creek, Geomorphological Assessment, Walton Developments – St. George, ON
- Tributary of the Humber River, Geomorphological Assessment and Meander Belt Width Delineation, Harbourview Developments – Caledon, ON
- Tributaries of Lynde Creek, Hazard Assessment and Redside Dace Habitat Delineation, BNLG, Brooklin – Whitby, ON
- Tributaries of Matheson Creek, Geomorphological Assessment and Erosion Mitigation Study, Midhurst Rose Alliance, Geranium Development – Midhurst, ON
- Tributary of the Rouge River, Headwater Assessment, Clera Developments – Markham, ON
- Tributary of Silver Creek, Geomorphological Assessment and Meander Belt Width Delineation, Town of Halton Hills – Georgetown, ON

- Tributary of Sixteen Mile Creek, Geomorphological Assessment and Meander Belt Width Delineation – Campbellville, ON
- Tributary of West Morrison Creek, Geomorphological Assessment, Star Oak Developments – Oakville, ON
- Tributaries of Willow Creek, Geomorphological Assessment and Erosion Mitigation Study, Geranium Development – Midhurst, ON
- Unnamed Tributary of Etobicoke Creek – Brampton, ON
- Urfe Creek at Brock Road, Meander Belt Width Analysis – Pickering, ON
- Weslie Creek, Geomorphological Baseline Monitoring, Emery Investments – Aurora, ON
- West Duffins Creek, Whitevale Creek, Ganatsekaigon Creek and Urfe Creek – Erosion Assessment and Fluvial Geomorphological Update – Seaton Lands, ON
- West Etobicoke Creek – Brampton, ON
- West Etobicoke Creek, Meander Belt Width Analysis – Brampton, ON
- Kirby Road Extension Scoped Class EA – Vaughan, ON

MONITORING (PARTIAL LIST)

- Jock River, Construction and Post-Construction Monitoring, Glenview Homes – Ottawa, ON
- Jock River, Construction and Post-Construction Monitoring, Mattamy Homes – Ottawa, ON
- Fraser Clarke Drain, Construction and Post-Construction Monitoring, Barrhaven Conservancy Development – Ottawa, ON
- Moore Drain, Construction Monitoring Services – Ottawa, ON (Richmond)
- Jock River, Acoustic Doppler Current Profiler Monitoring, Barrhaven Conservancy Development – Ottawa, ON
- Tributary of East Morrison Creek, Water Quality and Geomorphological Monitoring, Star Oak Developments – Oakville, ON
- Ecostorm Effectiveness Monitoring – Vaughan, ON
- Grindstone Creek, Erosion & Sediment Transport Monitoring – Waterdown, ON
- Tributary of the Humber River, Water Quality and Geomorphological Monitoring, Harbour View Development – Caledon, ON
- Kerrison Drive Bridge Construction – Ajax, ON
- Major Mackenzie Drive Widening at Bruce Creek – Markham, ON
- Rattray Marsh, Geomorphic and Sediment Transport Monitoring, Mississauga, ON
- Ravenshoe Road Widening at Zephyr Creek – Georgina, ON
- Tributary of Sixteen Mile Creek, Water Quality Monitoring – Milton, ON
- Tributaries of Sixteen Mile Creek, Water Quality and Geomorphological Monitoring, Block 2 Boyne Survey Lands – Milton, ON
- TRCA Natural Channel Design Monitoring, ON
- Taunton Road Widening at Millers Creek – Ajax, ON
- Weslie Creek, Geomorphological Baseline Monitoring, Emery Investments – Aurora, ON
- Williamson Road Bridge Construction – Brock, ON

CHANNEL/CORRIDOR RESTORATION DESIGN (PARTIAL LIST)

- Kemptville Creek, Geomorphological Assessment and Restoration Design – Kemptville, ON
- Moore Drain, Geomorphological Assessment and Channel Realignment Design – Ottawa, ON (Richmond)
- Monahan Drain, Geomorphological Support for Crossing Repair and Restoration – Ottawa, ON
- Harrison Creek, The Oskar Group, Geomorphological Assessment and Corridor Restoration Design, - East Gwillimbury, ON
- Tannery Creek, The Kerbal Group, Geomorphological Assessment and Channel Restoration Design, - Aurora, ON

- Tributary of the Rouge River, Clera Developments, Headwater Restoration Concepts - Markham, ON
- Tributary of Sixteen Mile Creek, Milton Heights, Geomorphological Assessment and Corridor Restoration Design, - Milton, ON
- Tributary of Fletcher's Creek, Geomorphological Assessment and Corridor Restoration Design - Town of Caledon, ON
- Appleby and Shoreacres Creeks, Paradise Homes, Geomorphological Assessment and Corridor Restoration Design - Burlington, ON
- Britannia Road Expansion, Tributary Sixteen Mile Creek, Mattamy Homes/Town of Milton, Geomorphological Assessment and Restoration Support, - Milton, ON
- BHVL William Hostrawser, Tributary of the Humber River, TRCA, Geomorphological Assessment and Restoration Support, Dam Removal - Brampton, ON
- Tributary of Sixteen Mile Creek, Geomorphological Assessment and Corridor Restoration Design, - Milton, ON
- Tributary of Munn's Creek, Mattamy, Geomorphological Assessment and Corridor Restoration Design, - Oakville, ON
- Tributary of Carp River, Geomorphological Assessment and Channel Restoration Design - Ottawa, ON (Kanata)
- Tributary of Spring Creek, TRCA, Geomorphological Assessment and Channel Restoration Design - Brampton, ON
- Patterson Creek and East Don River, York Region, Geomorphological Assessment and Channel Restoration Design, - Vaughan, ON
- Shannon's Creek, Davis Minardi Home Corporation, Geomorphological Assessment and Channel Restoration Design - Oakville, ON
- Tributary of Appleby Creek, Alton Community, Mattamy Development Corporation, Geomorphological Assessment and Corridor Restoration Design - Burlington, ON
- Lamont Creek, The Estates of Clearview, TMIG, Geomorphological Assessment and Channel Restoration Design - Stayner, ON

POLICY, GUIDELINES AND TECHNICAL DOCUMENTS (PARTIAL LIST)

- CSA Group Policy for Turbidity Monitoring: Addressing Gaps for Erosion and Sediment Control in Canada (2020)
- DFO/UDI Operational Statements Submission Guidance Document, ON
- CVC Applied Geomorphology Guidelines for Common Submissions, CVC, ON
- CVC/TRCA Erosion Mitigation, Stormwater Management Guidelines, CVC/TRCA, ON
- TRCA NCD Monitoring Protocol, TRCA
- Development of a shoreline erosion model, upper Great Lakes – IJC
- Review of shoreline erosion models for the Upper Great Lakes – IJC

TECHNICAL REVIEW/EXPERT WITNESS (PARTIAL LIST)

- Technical Review and Expert Witness, Grindstone Creek, Mountainview Heights – Hamilton, ON
- Expert Witness, Milton Heights, OMB, Milton, ON
- Expert Witness, North Leslie Street, OMB, Richmond Hill, ON
- Expert Witness, Indian Creek, Provincial Court, Hamilton, ON
- Technical Review of Erosion Threshold Analysis for Subcatchment SM1, Sixteen Mile Creek, Star Oak Developments – Oakville, ON

Publications (Partial List)

REFEREED JOURNAL PUBLICATIONS

Davis, L., Cockburn, J., **Villard, P.V.** (2016) Deploying action cameras to observe fish in shallow, ice-covered streams. Journal of Freshwater Ecology.

Cockburn, J., **Villard, P.V.**, Hutton, C. (2016) Addressing instream habitat suitability and hydraulic signatures of geometric units in reconstructed single thread meandering channels. Ecohydrology, ECO-15-123.R1

Kostaschuk, R.A., Best, J.L., **Villard, P.V.** (2010) The influence of dunes on mixing in a migrating salt-wedge: Fraser River estuary, Canada, Earth Surface Processes and Landforms, Special Issue Paper, 14 p.

Villard, P.V. and Church, M. (2005) Bar and dune development in Fraser River Estuary, British Columbia, Canada. Sedimentology, 52:737-756

Best, J.L., Kostaschuk, R.A., Peakall, J., **Villard, P.V.** and Franklin, M. (2005) Whole flow field dynamics and velocity pulsing within natural sediment-laden density underflows. Geology. 33 (10): 705-768

Kostaschuk, R. A., Best, J., **Villard, P.V.**, Peakall, J., and Franklin, M. (2005) Measuring velocity and sediment transport with an acoustic Doppler profiler. Geomorphology, 68: 25-37

Rennie, C. D., and **Villard, P. V.** (2004) Site specificity of bed load measurement using an acoustic Doppler current profiler, J. Geophys. Res., 109, F03003, doi:10.1029/2003JF000106.

Kostaschuk, R. A., **Villard, P.V.** and Best, J. L. (2004) Measuring and modeling shear stress in an estuarine dune field – Technical Note. Journal of Hydraulic Engineering. 130(9): 932-936

Villard, P.V. and Church, M. (2003) Bedform characteristics and bed material-load in a tidally-influenced sand-bed channel: Fraser River, British Columbia. Canadian Journal of Earth Science, 40: 1-16.

Villard, P.V. and Osborne, P. D. (2002) Visualisation of wave-induced suspension patterns over two-dimensional bedforms. Sedimentology, 49:363-378.

Villard, P.V., Osborne, P. D. and Vincent, C. E. (2000) Influence of wave groups on SSC patterns over vortex ripples, Continental Shelf Research, 20: 2391-2410.

Villard, P. and Kostaschuk, R. (1998) The relation between shear velocity and suspended sediment concentration: Fraser River, Canada. Marine Geology, 148:71-81.

Kostaschuk, R. and **Villard, P.** (1996) Flow and sediment transport over large subaqueous dunes: Fraser River, Canada. Sedimentology, 43:849-863.

REFEREED CONFERENCE PAPERS

Villard, P.V. and Christie, C. (2009) Sand transport at the delta front of the Fraser River, British Columbia. In River, Coastal and Estuarine Morphodynamics: RCEM 2009. Proceedings of the IAHR

Symposium on River, Coastal and Estuarine Morphodynamics, September 21-25, 2009, Santa Fe, Argentina.

Villard. P., Snodgrass, W., and Gyawali. B. (2008) A Simple Model for Predicting Future Channel Planform from Historical Aerial Photographs, Monograph 17. Proceedings of the Stormwater and Urban Water Systems Modeling Conference, February 21-22, 2008, Toronto, Ontario.

Villard, P.V. and R. Ness. (2006) Stormwater Management and Significant Channel Flows Below the Two-year Return. In Intelligent Modeling of Urban Water Systems. Monograph 15. Proceedings of the Stormwater and Urban Water Systems Modeling Conference February 23-24, 2006, Toronto, Ontario.

Villard, P.V., Church, M. A. and Kostaschuk, R.A. (2005) Estimating bed load in sand bedded channels using bottom tracking from an acoustic Doppler profiler. Special Publication of the International Association of Sedimentologists. 35, 107-209.

Best, J. L., Kostaschuk, R. and **Villard, P. V.** (2001) Visualization of flow fields associated with sand dunes: results from the laboratory and field. Special Publication of the Journal of Visualization, 4(4): 305-396.

Kostaschuk R. and Villard, P. (1999) Turbulent sand suspension over dunes. Special Publication of the International Association of Sedimentologists, 28:3-13.

Kostaschuk, R. and **Villard, P.** (1996) Turbulent sand suspension events: Fraser River, Canada. Coherent Flow Structures in Open Channels. (eds. P.J. Ashworth, S.J. Bennett, J.L. Best, S.J. McLelland), John Wiley & Sons Ltd., Toronto. pp. 305-320.

CONFERENCE PAPERS

Ness, R., Roberti, L., and **P. Villard**. (2006) A Monitoring Program for 'Natural' Channel Design Projects in the Greater Toronto Area, Ontario, Canada. 2006 AWRA Summer Specialty Conference Adaptive Management of Water Resources. Missoula, Montana. June 26-28, 2006.

Villard, P.V. and R. Ness. (2006) An Assessment of 'Natural" Channel' Design Projects in the Greater Toronto Area, Ontario, Canada. 2006 AWRA Summer Specialty Conference Adaptive Management of Water Resources. Missoula, Montana. June 26-28, 2006.

Villard, P.V., Parish, J. D., and Cummings, C. W. (2004) Monitoring of Natural Channel Designs: A First Step to Evaluating Design Success. Third International Conference on Natural Channel Systems, Ottawa, Ontario, CANADA from September 27 to 30th, 2004, p 8.

Kostaschuk, R.A., Blair, J., **Villard, P.V.** and Best, J.L. (2004) Morphological response of subtidal dunes to flow over a semi-diurnal tidal cycle: Fraser River, Canada. In: Hulscher, S.J.M.H. Garlan, T. and Idier, D. (editors), Marine Sandwave and River Dune Dynamics II, International Workshop, April 1-2 2004, University of Twente, The Netherlands, Proceedings, p. 160-166.

Rennie, C.D. and **Villard, P.V.** (2003) Bedload measurement in both sand and gravel using an aDcp. In 16th Canadian Hydrotechnical Conference. Canadian Society for Civil Engineers, October 22-24, 2003, Burlington, ON, 10 p.

Villard, P.V. and Parish, J. D. (2003) A Geomorphic-based protocol for assessing stream sensitivity and erosion thresholds: A tool for stormwater management. In 16th Canadian Hydrotechnical Conference. Canadian Society for Civil Engineers, October 22-24, 2003, Burlington, ON, 10 p.

Rennie, C.D., Millar, R.G. and **Villard, P.V**. (2001) Laboratory measurements of bedload transport velocity using an acoustic Doppler current profiler. 15th Hydrotechnical Conference CSCE. Victoria, 8 p.

Villard, P.V., Osborne, P. D. and Vincent, C. (1999) Influence of wave groups on SSC and mixing length over ripples in a large scale wave flume. Sediment Dynamics '99, Long Island, New York.

Villard, P.V., Osborne, P. D, and Vincent, C. (1999) Description of SSC events under wave groups. Proceedings of the 1999 Canadian Coastal Conference, Canadian Coastal Science and Engineering Association, Guelph. pp. 579-594.

Black, K. P., Osborne, P. D., Green, M. O. and **Villard, P.V.** (1997) Intra-wave suspended sediment concentrations over bedforms. Pacific Coasts & Ports '97, Christchurch. pp. 365-370.

Osborne, P. D., Black, K. P., **Villard, P.V.** and Douglass, S. (1997) Field measurements of 3-D velocity structure and suspended sediments under locally-generated waves and swell. Pacific Coasts & Ports '97, Christchurch. pp. 131-136.

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CONFERENCE ABSTRACTS, PRESENTATIONS AND POSTERS

Krompart, J., Cockburn, J., & **Villard, P.V.** (2014-2015) Evaluating a pocket wetland for flow attenuation and water quality improvements of urban runoff in Brampton, Ontario. CGU Hydrology Section, Biogeosciences Section, & Earth Surface Processes Section Eastern Student Conference, Waterloo, Canada-Ontario.

Cockburn, J. & **Villard, P.V.** (2013-2014) Urban watersheds as opportunities for Geography students to study critical physical geography. Canadian Association of Geographers Annual Meeting, St. Catharines, Canada- Ontario.

Hutton, C., Cockburn, J., & **Villard, P.V.** (2013-2014) Sub-reach habitat conditions within a recent natural channel design. CGU Hydrology and Biogeosciences Section Eastern Student Conference, Toronto, Canada- Ontario.

Villard, P.V., Rick, E., & Cockburn, J. (2013-2014) Revisiting Installed Channel Corridors Five to Ten Years after Construction with Rapid Assessment Techniques. Southern Ontario Stream Monitoring and Research Team (SOSMART) Spring Meeting, Woodbridge, Canada-Ontario.

Villard, P.V., Hutton, C., & Cockburn, J. (2013-2014) Defining Geomorphic Units and Aquatic Habitat Suitability in Restored and Natural Channels with Detailed Hydraulic Measurements. Southern Ontario Stream Monitoring and Research Team (SOSMART) Spring Meeting, Woodbridge, Canada-Ontario.

Villard, P.V., (2016) Assessing habitat suitability and hydraulic signatures of geomorphological units in restored channels. TRIECA. Toronto, Ontario.

Davis, L., Cockburn, J., **Villard, P.V.** (2016) Integrating overwinter habitat into stream restoration projects employing natural channel design. 5th International Conference on Natural Channel Design, Niagara Falls, Ontario. 26-27 Sept, 2016.

Padovan, P., Cockburn, J., **Villard, P.V.** (2016) Hydrogeomorphic adjustments in urban channel restoration projects: Highland Creek, Toronto, Ontario. 5th International Conference on Natural Channel Design, Niagara Falls, Ontario, 26-27 Sept, 2016.

Villard, P.V., Heaton, M. (2016) Review of Redside Dace Habitat Corridor Realignments: Morphology, Sedimentology and Habitat Suitability within Aged Natural Corridor Designs, 5th International Conference on Natural Channel Design Niagara Falls, Ontario, 26-27 Sept, 2016.

Villard, P.V., Fluvial system concepts and their application in Greenfield stream corridor realignment. (2015) TRIECA. Toronto, Ontario.

Villard, P.V., (2013) Turbidity monitoring: Reducing sediment loading in Redside Dace habitat. TRIECA. Toronto, Ontario.

Villard, P.V., (2012) Effective Installation of erosion controls and bioengineering. TRIECA. Toronto, Ontario.

Doucette, J., **Villard, P**, Pinilla, C, and Verhaar, P., 2012. Sediment deposition in two river mouth harbours on the shore of Lake Ontario and implications for management of dredging operations. Dredging 2012, San Diego

Doucette, J., Trenhaile, A., Shantz M., and **Villard, P.**, 2011. Development of a cohesive shoreline recession model to determine the effects of water level fluctuations in the upper Great lakes. 54th IAGLR, Duluth

Khan, I.K. and **Villard, P.V.** (2011) Assessing fish passage in restored urban watercourses. 2011 Upper Midwest Stream Restoration Symposium (PRRSUM), Oconomowoc, Wisconsin. 27 Feb, 2011.

Tabata, K. K., **Villard, P.V.** and Fernandes S. (2010) Initial Water Quality Monitoring Results for a Bioswale Corridor. 4th International Conference on Natural Channel Systems, Mississauga, Ontario, September 27-28, 2010.

Khan, I.K., **Villard, P.V.**, and Tabata, K.K. (2010) Fish passage restoration designs in urban stream channel systems. 4th International Conference on Natural Channel Systems, Mississauga, Ontario. September 27-28, 2010.

Khan, I.K.; and **Villard, P.V.** 2010. Fish passage restoration in a constrained urban corridor. 17th Annual Conference on the Great Lakes /St. Lawrence River Ecosystem, Cornwall, Ontario. May 5-6, 2010.

Tabata, K.K. and **Villard, P.V.** (2010) Naturalization and Post-Construction Evaluation of a Tributary of Stouffville Creek, Ontario. 2010 River Restoration Northwest Symposium, Stevenson, WA, Nov 2-5.

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Nodwell, J. and **Villard, P.V.** (2010) Relating Bankfull-Channel Geometry to Drainage Area for Watercourses within the Credit River Watershed. 17th Annual Conference on the Great Lakes /St. Lawrence River Ecosystem, Cornwall, Ontario.

Doucette J.S., **Villard, P.V.**, and Thomas, J.S. (2010) The Dynamics of a Barrier Bay Outlet, Rattray Marsh, Mississauga, Lake Ontario. 53rd Annual Conference International Association for Great Lakes Research (IAGLR), Toronto, Ontario, Canada, May 17-21, 2010.

P. Villard and J. Doucette, and J. Thomas, Application of Geomorphology in Watershed Restoration Planning: Sheridan Creek, Mississauga, Ontario The 6th Canadian River Heritage Conference, "Our Living Rivers: Linking Nature, People and Places through Time," Ottawa, Ontario, from June 14-17, 2009.

Tabata, K.; **Villard, P.**; Doucette, J.; and Sullivan, G. 2009. An initial evaluation of habitat enhancement structures in Byersville Creek, Peterborough, Ontario. 105th Annual Meeting of the Cordilleran Section, Geological Society of America, May 7-9, 2009. Kelowna, British Columbia. http://cgrg.geog.uvic.ca//abstracts/TabataAnAs.html

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Villard, P.V. (2005) Baseflow to Bankfull: Integrating Channel Flows Below the Two-Year Return into Watershed Management, 12th Annual International Conference on the St. Lawrence River / Great Lakes Ecosystem, Source Water Protection, May 16-18th, 2005, St. Lawrence River Institute of Environmental Sciences, Cornwall, Ontario.

Villard, P.V. and Parish, J.D. (2004) Design and Construction of Riffles in Re-naturalized Channels: Methods to Increase Channel Stability and Mimic Natural Form and Function. Third International Conference on Natural Channel Systems, Ottawa, Ontario, Canada from September 27 to 30, 2004.

Cummings, C.W. and **Villard, P.V.** (2004) A Deformable, Vegetated Gravity Structure for Bank Restoration in Bedrock Dominated Channels. Third International Conference on Natural Channel Systems, Ottawa, Ontario, Canada from September 27 to 30th, 2004.

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Ontario
Ontario Land Tribunal
Tribunal ontarien de l'aménagement du territoire

Acknowledgment Of Expert's Duty

OLT Case Number	Municipality
PL200195	City of Ottawa

1. My name is Paul Villard (*name*)
   I live at the 122 Main Street North, Milton (*municipality*)
   in the Halton Region (*county or region*)
   in the Ontario (*province*)

2. I have been engaged by or on behalf of ClubLink Corporation ULC to provide evidence in relation to the above-noted Ontario Land Tribunal (`Tribunal`) proceeding.

3. I acknowledge that it is my duty to provide evidence in relation to this proceeding as follows:

   a. to provide opinion evidence that is fair, objective and non-partisan;

   b. to provide opinion evidence that is related only to matters that are within my area of expertise;

   c. to provide such additional assistance as the Tribunal may reasonably require, to determine a matter in issue; and

   d. not to seek or receive assistance or communication, except technical support, while under cross examination, through any means including any electronic means, from any third party, including but not limited to legal counsel or client.

4. I acknowledge that the duty referred to above prevails over any obligation which I may owe to any party by whom or on whose behalf I am engaged.

Date November 11, 2021

Signature