Scott W. Horsley
Water Resources Consultant
65 Little River Road
Cotuit, MA 02635
Telephone: 508-364-7818

February 27, 2018

Jonathan M. Sachs, Chair
Wayland Zoning Board of Appeals
Wayland Town Hall
41 Cochituate Road
Wayland, MA 01778-2614

RE: Cascade Wayland 40B Review/113-119 Boston Post Road

Dear Chairman Sachs and Members of the Board of Appeals:

At the request of Protect Wayland, I have reviewed the proposed Cascade Wayland 40B project (the "Project") proposed at 113, 115, 117, and 119 Boston Post Road, Wayland, MA (the "Property"). The focus of my review is on the potential water quality impacts associated with the proposed development. I have reviewed the following documents:

1. A Comprehensive Permit Application entitled " Properties located at 113, 115, 117 & 119 Boston Post Road, Wayland, Massachusetts Assessor's Map 30 Parcel 71 and Map 30 Parcel 70" dated July 25, 2017, and revised January 2018.

2. Civil Engineering Plans "Cascade Wayland" prepared by Beals and Thomas, dated July 21, 2017 and revised January 12, 2018.

3. Drawings entitled "Cascade Wayland" dated July 21, 2017 prepared by Finegold Alexander Architects.

4. Drawings COOO, ClOl, C201, C301, C401, C501, and C502, dated November 13, 2017 prepared by Finegold Alexander Architects.

5. Stormwater Management Report dated January 12, 2018, prepared by Beals and Thomas, Inc.

6. Cascade Wayland project feedback letters to/from various individuals and organizations.

7. U.S. Environmental Protection Agency, Preliminary Data Summary of Urban Stormwater Best Management Practices, 1999.

8. Azadpour-Keeley, A, B P. Faulkner, AND J. Chen. Movement and Longevity Of Viruses In The Subsurface. U.S. Environmental Protection Agency, Washington, DC, EPA/540/S-03/500, 2003.

9. Assabet River Total Maximum Daily Load for Total Phosphorus SuAsCo Watershed, Massachusetts MADEP, DWM TMDL Report MA82B-01-2004-01 Control Number CN 201.0.

10. Vaughn, J. M., E. F. Landry, and M. Z. Thomas. 1983. Entrainment of viruses from septic tank leach fields through a shallow, sandy soil aquifer. Applied Environmental Microbiology 45:1474-1480.

11. Richard, Cronin, Pedley, Barker and Atkinson (2004) The implications of groundwater velocity variations on microbial transport and wellhead protection – review of field evidence. FEMS Microbiology Ecology 49, 17–26.

12. Theng-Theng Fong† and Erin K. Lipp (2005), Enteric Viruses of Humans and Animals in Aquatic Environments: Health Risks, Detection, and Potential Water Quality Assessment Tools. Microbiology and Molecular Biology Reviews 2005 June; 69(2): 357–371.

I have thirty years of experience as a consulting hydrologist working for government, nonprofit, and private organizations throughout the United States and abroad. As a consultant to the U.S. Environmental Protection Agency I have developed Watershed Protection Guidance documents and provided related training in 43 states nationwide. I have served on the MADEP Stormwater Advisory Committee, MADEP Sustainable Water Initiative, and the MADEP Climate Change Adaptation Advisory Committee and am currently serving on MADEP's Title 5 Wastewater

Advisory Committee. I also assisted in the preparation of the Massachusetts Smart Growth and Smart Energy Toolkit – a guidance document for Massachusetts communities for sustainable development practices. I serve as an adjunct faculty at Tufts University and Harvard Extension School where I teach graduate-level courses in Water Resources Management, Low Impact Development, and Green Infrastructure. A copy of my resume is attached.

My comments are as follows:

**General Comments**

The Project site is characterized by shallow water table (groundwater) and functions as a riparian area adjacent to a perennial stream. The Property provides important baseflow and pollutant attenuation functions to Pine Brook. Groundwater underlying the Property constantly discharges to the brook providing year-round, perennial flow. The rates of flow, temperature, and water quality are critical to sustaining the unique and valuable habitat associated with Pine Brook.

The proposed Project includes 1.65 acres of impervious surfaces and a wastewater discharge of approximately 10,000 gallons/day. To preserve the quality and habitat value of Pine Brook, the Project design should ensure that the existing flow rates, temperatures, and water quality be maintained and protected.

**Local Regulatory Framework**

The Town of Wayland has enacted several local regulations designed to protect the health and welfare of residents, the natural environment, and aquatic habitat. These include local health regulations that require minimum setbacks for septic systems to receiving waters and appropriate environmental impact assessments.

Specifically, the Wayland Board of Health Regulations for On-Site Subsurface Sewage Disposal Systems, Section II (Design Requirements), Subsection D (Distances) state "1. No sewage disposal system leaching area having a design flow of 1000 gallons per day or less, shall be constructed within 75 feet of any pond, stream, brook, river, swamp or

wetland. The distance shall be 100 feet for a facility having a design flow of greater than 1000 gallons per day. Such distances are considered minimum and may be increased for multiple dwellings or higher volume sewage discharges. These distances shall be determined by the Board of Health on an individual basis, depending upon the particular circumstances."

Subsection L (Hydrogeological Evaluation) states, "Development projects which will generate wastewater flows of 9,000 gallons per day or greater shall be required to have a hydrogeological evaluation performed by a qualified engineer or geologist, at the expense of the applicant. This evaluation will be reviewed by the Board of Health to determine that the ground and surface water is not compromised."

Subsection C4 (Leaching Facilities) states, "For systems designed to receive more than 1000 gallons per day the bottom of the leaching facility shall be at least four feet above the maximum ground water elevation and any mounding of the maximum ground water elevation which may result by an addition of the wastewater flow. Groundwater mounding calculations shall be submitted to the Board of Health for review."

These regulations are intended to protect public health and safety, and the natural environment, based upon local conditions and experience. Wayland's local regulations are particularly important here, in light of the Project's proximity to Pine Brook, with its unique characteristics and designation as an important cold water fishery providing habitat for native Eastern Brook Trout. The applicant has not shown that the significant local health and environmental issues presented by the Project, due in part to its proposed septic system design and location, are adequately protected by compliance with state standards.

**Hydrology**

A series of test pits indicate that the current (pre-development) seasonal high water table is as shallow as 3-4 feet beneath the land's surface within the proposed construction area. Ledge was also found. Both conditions limit the proper functioning of septic systems and stormwater infiltration systems at the Property, which have minimum

regulatory vertical separation distances above the high (maximum) water table (4 feet and 2 feet, respectively).

The proposed Project includes approximately 1.6 acres of impervious surfaces (parking, driveways, and roof) and proposes to infiltrate the stormwater runoff with an infiltration basin. The applicant's Stormwater Management Report states "the proposed infiltration basin has been designed to provide groundwater recharge and reduce post-development runoff up to the 100 year storm event".

MADEP Stormwater Standard 3 requires that the existing groundwater recharge rate be preserved to maintain baseflow conditions. The Standard states, "At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook." The intent of this Standard is to balance and maintain the natural hydrologic budget.

The applicant's Stormwater Management Report states, "The infiltration basin will discharge to the wetland system, consistent with the existing hydrology of the site." The report indicates that compliance with this standard will require that 0.028 acre-feet is recharged and the plan provides 0.032 acre-feet.

However, in reality, the Project's stormwater infiltration system is designed to recharge significantly more stormwater than under existing conditions. Based upon the detail drawings provided with the Civil Engineering Plans, the basin appears to be sized to store and infiltrate 2-3 times the required volume. This significantly increased recharge rate will artificially raise ambient groundwater levels on the site and alter baseflow conditions to the stream.

This substantial resulting increase in groundwater levels must be taken into account in the Project's Hydrogeologic Evaluation as a new base condition or a post-construction "steady state" for the groundwater mounding analyses.

The MADEP Stormwater Standards require a minimum of a two-foot separation between the bottom of the leaching facility and the maximum groundwater elevation. Given the significant alteration with the proposed recharge volumes and the close proximity to the proposed wastewater disposal system, this regulatory standard needs to be assessed in four steps:

1) identify the existing high groundwater elevation (determined by soil mottling and/or USGS High Groundwater Method);

2) identify a modified steady state groundwater elevation as a result of the proposed increases in annual recharge rates;

3) perform the event-based mounding analysis for the design events; and

4) the cumulative analysis must also be integrated with the proposed wastewater discharge of approximately 10,000 gallons/day at the proposed wastewater disposal field.

The current application package does not address the significant hydrologic issues presented by the Project. The shallow depths to groundwater (and ledge), coupled with the proximity of the Project to the adjacent wetlands and Pine Brook, raise serious questions about the Project's feasibility.

Specifically, the applicant has not established compliance with state septic and stormwater standards.

**Phosphorus - Eutrophication**

The proposed Project includes a wastewater disposal field with a design flow of approximately 10,000 gallons/day. The proposed leaching field is located approximately 50 feet from the adjacent wetland that borders and connects to Pine Brook. Groundwater beneath the proposed septic system flows directly to Pine Brook and discharges to the stream.

The proposed septic system is not in compliance with Wayland's Health Regulations that require at least 100 feet of separation from Pine Brook

(and possibly more based upon a hydrogeological evaluation). The local Regulations provide for the site-specific determination of a safe setback and acceptable loading of wastewater-derived pollutants to maintain ambient water quality conditions in Pine Brook.

This local control adds a critically important layer of health, safety and environmental protection beyond that offered by state standards, and should not be waived.

Wastewater discharges contain significant loads of nutrients that can cause eutrophication of surface waters if concentrations are excessive (primarily phosphorus in fresh water). Eutrophic conditions commonly include depleted oxygen levels, algae blooms, macrophyte growth and significant declines in habitat quality. These conditions can result in "impaired waters" conditions under the auspices of the Clean Water Act and the Massachusetts Surface Water Quality Standards (314 CMR 4.00). A study conducted by MADEP on the Assabet River provides guidance on appropriate threshold levels for phosphorus in streams to avoid impairment. The report states, "DEP considered all available guidance and information and best professional judgement to make permitting decisions. In this regard DEP consulted the previously cited USEPA 2000 guidance relative to in-stream phosphorus concentration that included a suggested in-stream phosphorus criteria during the summer months in ecoregion XIV of 40 ug/liter and in subregion 59 of 24 ug/liter."

According to preliminary field work conducted by EBT Environmental Consultants, Inc. on September 19, 2017, existing phosphorus concentration in Pine Brook was measured at 21 ug/liter, below the EPA threshold.

The hydrogeological evaluation to be prepared by the applicant should assess the impacts of the proposed wastewater system upon phosphorus concentrations in the stream. Given the relatively high sewage flow rates and the close proximity to the receiving water (Pine Brook) and the environmentally sensitive and unique character of the receiving water, the analysis should be conducted with conservative assumptions that include steady state conditions and long-term impacts.

## Pathogens

The Project's proposed wastewater discharge will include significant loads of pathogens including bacteria and viruses. While some bacteria are likely to be attenuated within short distances of a septic system, viruses have been shown to travel in groundwater for significant distances of 200 feet or more. An EPA report provides guidance on virus transport in groundwater (Azadpour-Keeley et al., 2003) and suggests that local hydrogeologic factors including short setbacks, travel times, and permeable geologic materials all contribute to vulnerability for virus transport.

Enteric viruses are considerably smaller than bacteria and therefore are transported more readily from septic sources through porous media such as the soils reported on this Property. They survive for longer periods of time in colder groundwater temperatures, such as those in Massachusetts. A widely referenced study demonstrated that viruses can travel distances greater than 200 feet in groundwater (Vaughn, et al. 1983).

Microbial contamination is important because, unlike most chemical contaminants, human infection and disease results from ingestion of low quantities of microbial pathogens, particularly enteric viruses (e.g., Adenoviruses, Rotaviruses, Noroviruses, Hepatitis A and E). Enteric virus infections are associated with diarrhea and gastroenteritis in humans and may also cause respiratory infections, conjunctivitis, hepatitis, and diseases that have high mortality rates, such as aseptic meningitis, encephalitis, and paralysis in immunocompromised individuals . In addition, some enteric viruses have been linked to chronic diseases such as myocarditis and insulin-dependent diabetes (Richard et. al, 2004).

The Property exhibits these vulnerable conditions and therefore warrants a careful analysis of pathogen transport to determine an appropriate setback distance from Pine Brook to ensure that pathogens are not discharged to the brook. YMCA Camp Chickami is located directly downstream of the proposed development. This facility is reported to utilize the brook and attached ponds as a play area for

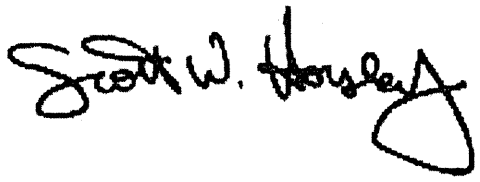
children, who would be put at risk if a major source of pathogens is introduced into Pine Brook.

Full compliance with the aforementioned Board of Health Regulations, including increased setbacks for the proposed wastewater system and a comprehensive Hydrogeological Evaluation that addresses the issues I have identified, is necessary for the protection of the Pine Brook, its habitat values and public health and safety for downstream uses such as the YMCA Camp Chickami facility.

**Floodplain Encroachment**

The proposed project will fill portions of the 100-year floodplain as identified by the Federal Emergency Management Agency (FEMA) and the Town of Wayland. This is a Wetland Resource Area called Bordering Lands Subject to Flooding under the Massachusetts Wetlands Protection Regulations and the Town of Wayland's Wetlands Protection Bylaw. At a minimum, compensatory storage is required so as not to impact downstream properties. This is not provided in the plans. The functioning of the proposed infrastructure (including wastewater, stormwater and underground parking facilities) during flood events should be fully evaluated. According to the CEI comment letter (November 22, 2017) the floodplain mapping appears to be inconsistent with site topography.

Please contact me directly with any questions that you might have.



Scott W. Horsley

# Scott W. Horsley,

Water Resources Consultant and Adjunct Faculty Lecturer

**Areas of Expertise**

- Ecosystem Management
- Integrated Water Management
- Wetland and Natural Resource Area Assessments
- Smart Growth/ Low Impact Development
- Climate Change
- Watershed Planning & Assessment
- Stormwater Management
- Training
- Meeting Facilitation

**Professional Registrations**

- LEED Accredited Professional
- LID Designer, State of Rhode Island, 2006

**Professional Affiliation**

- Adjunct Professor, Tufts University, Graduate Department of Urban and Environmental Planning and Policy

Scott Horsley has over 30 years of professional experience as a consultant to federal, state, and local jurisdictions, and private industry throughout the United States, Central America, the Caribbean, the Pacific Islands, and China. Scott has been an innovator in the environmental profession, and thrives on bringing innovative and interdisciplinary approaches to challenging projects. Scott has a strong understanding of the full range of technical, planning, and policy issues associated with water resources and land use. Scott has served as an instructor for a nationwide series of U.S. Environmental Protection Agency (EPA) workshops on water resource management. He has also served on numerous advisory boards to the EPA, the National Academy of Public Administration, Massachusetts Department of Environmental Protection (DEP), Massachusetts Executive Office of Energy and Environmental Affairs (EEA), National Groundwater Association, and Massachusetts Audubon Society. Scott has received national (EPA) and local awards (Mashpee Conservation Commission) for his work in the wetlands and stormwater management fields. Scott Horsley serves as Adjunct Faculty at Tufts University in the Graduate Department of Urban & Environmental Policy & Planning. And at the Harvard Extension School.

***REPRESENTATIVE PROJECTS***

**Cape Cod 208 Water Quality Management Plan:** Consultant to the Cape Cod Commission for the preparation of the 2014 Cape Cod 208 Plan was prepared in response to litigation filed by the Conservation Law Foundation to bring the fifteen Cape Cod towns into compliance with the Clean Water Act. Fifty-seven estuaries are impacted by excessive nutrient loading derived from wastewater, stormwater, fertilizers and natural sources. Traditional sewering options have been defeated numerous times at town meetings and are deemed to be not affordable by the voters. The plan presents an innovative alternative approach that includes a broad range of green infrastructure including shellfish restoration, permeable reactive barriers, fertilizer management, ecotoilets and other decentralized solutions. An adaptive management

# Scott W. Horsley,

Water Resources Consultant and Adjunct Faculty Lecturer

- Massachusetts Stormwater Advisory Committee
- Massachusetts Sustainable Water Management Initiative Advisory Committee
- Board of Directors, Massachusetts Rivers Alliance
- Massachusetts Climate Change Adaptation Advisory Committee

**Awards**

- Mashpee (MA) Conservation Commission Annual Environmental Achievement Award, 2002
- EPA Environmental Technology Innovator Award for Stormwater Treatment Design, 1999

**Patent**

United States Patent Number 5,549,817 for Stormwater Treatment System/Apparatus

**Academic Background**

Masters of Arts, Marine Affairs - Environmental Protection, University of Rhode Island

Bachelor of Science, Biology, Southeastern Massachusetts University

plan provides a practical framework to implement and optimize an integrated array of strategies to attain compliance with the Clean Water Act. Mr. Horsley led a team of scientists and engineers in the development of a non-traditional/green infrastructure approach and conducted dozens of public stakeholder workshops.

**Massachusetts Sustainable Water Management Initiative (SWMI):** Mr. Horsley served as an advisor to a interdisciplinary panel to develop guidelines for the restoration of stream flow in Massachusetts Rivers. The Massachusetts Water Management Act provides the regulatory structure for water withdrawals in the state. The guidance was developed to provide ecological criteria for the decision making related to permit issuance. The criteria were based upon scientific relationships between flow characteristics and two indicator fish species: trout and black dace. The guidance includes a series of possible mitigation measures and offset practices that are designed to either reduce consumptive withdrawals and/or provide return flows to balance the hydrologic budget.

**River Restoration for the Atlantic Salmon – State of Maine:** Project Manager for a hydrologic study of river systems in northeastern Maine to assess the relative impacts of various water users including the blueberry industry on the flow regime of the Narragaugus and Pleasant Rivers. The project included numerous meetings with a broad range of stakeholders including the U.S. Army Corps of Engineers, the State of Maine, blueberry industry representatives, and local government officials. The project resulted in a decision-making model and adaptive management plan to restore natural flows within the rivers for the purpose of providing an adequate habitat for the Atlantic Salmon.

**California Water Code – Department of Water Resources:** Served as Facilitator and Trainer for the implementation of Assembly Bill (AB) 3030. This project integrated groundwater and surface waters and provides the framework to develop local groundwater management plans to balance water withdrawals and recharge projects to mitigate impacts water resources. Mr. Horsley facilitated a series of workshops with stakeholders throughout the State of California.

**Ipswich River Watershed Management Plan:** Project Manager to develop a Management Plan for restoration of the Ipswich River. The Ipswich River is one of the most impacted rivers in the United States with significant flow alterations caused by excessive water withdrawals and inefficient land use practices. This Plan provides an analysis of the development patterns within the study area and the resulting hydrologic

impacts of water supply withdrawals, sewerage systems, and stormwater management. The project included coordination with an interpretation of a USGS watershed modeling project. It also provides an "Integrated Water Management" approval to a series of Recommendations designed to balance the hydrologic budget. These include water conservation, alternative water supplies, stormwater management, and land use planning. Mr. Horsley provided facilitation at a series of meetings with a broad range of stakeholders including federal and state agencies, water suppliers, local government officials and others.

**Expert Witness, Clean Water Act (Rapanos) Jurisdiction:** Expert Witness for U.S. Environmental Protection Agency (EPA) and U.S. Department of Justice (DOJ) in a case involving the filling of wetlands in Carver, MA for the purpose of constructing cranberry bogs. Scott provided expert opinions regarding the application of the guidance from the Rapanos U.S. Supreme Court decision relative to the jurisdiction of wetlands in the Weweantic River watershed. He also developed a nutrient-loading and attenuation model and has provided expert witness testimony regarding the nutrient attenuation capabilities of wetlands and their nexus to the Weweantic River. Scott has also prepared a wetland restoration plan for the cranberry bogs to enhance the nutrient attenuation capabilities of wetlands (abandoned cranberry bogs) in the watershed.

**Nutrient Management Permitting for Cape Cod**: Project Manager to the Cape Cod Water Collaborative, working with Gollege Strategies to develop an alternative MEPA permitting process for water quality restoration projects on Cape Cod and to prepare Environmental Notification Forms for three pilot projects. Three pilot projects include Bourne's Pond Inlet Widening (Falmouth), Mill Pond Dredging (Barnstable) and Parker's River Inlet Widening (Yarmouth). Each of these projects is designed to reduce nitrogen concentrations in estuarine waters by increasing flushing rates and in the case of Mill Pond by also removing a significant nitrogen source (sediments).

**Smart Growth and Smart Energy Toolkit, Massachusetts Executive Office of Environmental and Energy Affairs (EEA):** Served as a consultant to the EEA to design an outreach tool for local governments and the development community. The Toolkit includes descriptions of twenty techniques, including transfer of development rights (TDR), transit-oriented development (TOD), village center zoning districts, open space residential design (OSRD), LID, agricultural preservation, integrated water, and wastewater management, brownfields redevelopment, and the newly-legislated Chapter 40R smart growth

overlay districts. It also includes case studies and model bylaws on the twelve subject areas.

**Massachusetts Climate Change Advisory Committee, EEA:** Scott served as a member of the Coastal Zone and Oceans Subcommittee of the Climate Change Advisory Committee convened by the Secretary of EEA. The Committee was assembled to develop recommendations, strategies, and criteria to implement the *Global Warming Solutions Act* passed by the Massachusetts legislature last year. The main task of the subcommittee is to analyze strategies for adapting to the predicted impacts of climate change in the Commonwealth of Massachusetts. Among other recommendations, Scott proposed regulatory changes to accommodate the landward migration of wetland systems that will result from sea level rise.

**Taunton River Watershed Study:** Principal-in-Charge to conduct a study of the Taunton River Watershed area including the development of a hydrologic water budget GIS model, a significant public participation program and the development of a watershed manager approach/study that includes integrated water supply management, wastewater management, stormwater management and smart growth initiatives. The study area includes 43 communities and includes: the development of: eight demonstration projects that apply innovative and alternative wastewater technologies, and zoning and wetlands bylaws to provide enhanced protection of water resources.

**Innovative Wastewater and Stormwater Technologies, State of Hawaii:** Retained by US EPA Region 9 and the State of Hawaii to develop a course manual and to provide a training workshop on a broad range of innovative and alternative wastewater and stormwater technologies. This included both centralized and de-centralized wastewater solutions and a full range of innovative stormwater management techniques.

***PROFESSIONAL EXPERIENCE***

Horsley Witten Group, Inc., Founder and President, 1988 to Present
Tufts University, Adjunct Professor, 1986 to Present
IEP, Inc., Senior Environmental Scientist, 1984 to 1988
Cape Cod Planning and Economic Development Commission, Water Resources Coordinator, 1981 to 1984
Barnstable County Health Department, Environmental Research Director, 1979 to 1981

***PRESENTATIONS AND PUBLICATIONS***

Horsley, S., Perry, E. and Counsell, L, 2016, "Three Bays Estuary Watershed Restoration Plan: A Green Infrastructure Approach, Green Building Journal, Volume 11, No. 2, pp. 22-38.

Parece, T; Owen, M; Shreve-Bibb, Betsey; Niedzwiecki, Paul; Senatori,

Kristy; Perry, Erin; and Horsley, Scott; 2015; Tools to Assist Cape Cod Communities Reach Sustainable Nitrogen Reduction Goals – Technology Matrix and Adaptive Management Practices, Journal of the New England Water Environment Association.

Horsley, S., 2013, "Low Impact Development – A Climate Adaptation Strategy", Massachusetts Audubon Society Lecture Series.

Horsley, S., 2011. "Balancing Water Supply Withdrawals, Wastewater Returns and Stormwater Recharge", New England Water Works Association.

Horsley, S. November 17, 2010. "Building to Code – Protecting Homes in Coastal Floodplains," StormSmart Coasts Program, Massachusetts Coastal Zone Management, Plymouth Town Hall, MA.

Horsley, S. 2009. "Low-Impact Development: A More Sustainable Approach to Site Design," Association of Massachusetts Wetlands Scientists (AMWS) Newsletter, January 2009.

Horsley S. 2006. "Planning and Urban Design Standards" American Planning Association; Sections on Water, Hydrologic Cycle; Aquifers, Groundwater Movement and Recharge, Wiley Graphic Standards.

Horsley, S. 2005. Smart Growth Toolkit, Massachusetts Executive Office of Environmental Affairs, Boston, MA.

Horsley, S. 2004. Low impact development strategies: approaches to smart growth, presented to the Annual Meeting of the Massachusetts Association of Land Surveyors and Engineers, Plymouth, MA, September 20, 2004.

Horsley, S. 2004. Hydrology and groundwater management, in Planning and Urban Design Standards, prepared by the American Planning Association, John Wiley & Sons.

Horsley, S. 2003. Integrated coastal zone management in the Bahamas, prepared for the Inter-American Development Bank (IDB), Washington, DC.

Horsley, S. 2002. Groundwater, drinking water and stormwater protection: science and policy, in 2002 National CLE Conference, Environmental and Land Use Law, Law Education Institute, Steamboat, Colorado, January 4-9, 2002.

Horsley, S. 2000. Stormwater Management, in Proceedings of the 19th Annual Pacific Islands Conference, Protecting Our Environmental Island Style: Success Stories, Continuing Challenges, Realistic Solutions, June 20-23, 2000, American Samoa.

Horsley, S. 1997. Watershed '97 Conferences. The StormTreat System: An Innovative Stormwater Treatment Technology, Baltimore, MD.

Horsley, S. and J. Witten. 1997. Tools for Watershed Protection, US Environmental Protection Agency.

Horsley, S. and J. Witten. 1996. Coastal Watershed Protection: Tools for Local Governments, prepared under contract to U.S. EPA.

Horsley, S. 1994. Septic Systems and Coastal Water Quality - Technical Assistance Document, U.S. Environmental Protection Agency.

Horsley, S. 1992. Buttermilk Bay – A Case Study: Nitrogen Loading

Assessment, presented to U.S. EPA-sponsored Nitrogen Loading Workshop at the University of Rhode Island, Graduate School of Oceanography.

Horsley, S. and J. Moser. 1990. Monitoring Ground Water for Pesticides at a Golf Course-A Case Study on Cape Cod, Massachusetts, National Water Well Association Ground Water Monitoring Review.

Horsley, S. 1990. Nantucket Water Resources Management Plan—A Case Study, Key Note Paper, National Water Well Association, Eastern Regional Ground Water Conference.

Horsley, S., S. Roy, and M. Nelson. 1990. Golf Courses and Water Quality. Seminars.

Nelson, M., S. Horsley and S. Roy. 1990. Delineation of Aquifer vs. Wellhead Protection Areas, National Water Well Association—National Convention Association of Ground Water Scientists and Engineers.

Horsley, S. and J. Witten. 1989. Aquifer Protection. Horsley & Witten, Inc. Seminars.

Cambareri, T., M. Nelson, S. Horsley, M. Giggey and J. Pinette. 1989. Solute Transport - A Simulation of Non-Point Source Nitrogen Impacts to Ground Water and Calibration of A Predictive Analytical Model. Accepted for publication with National Water Well Association, Proceedings - Solving Ground Water Problems with Models, Indianapolis, Indiana.

Nelson, M., S. Horsley, T. Cambareri and M. Giggey. 1988. Predicting Nitrogen Concentrations in Ground Water - An Analytical Model, in Proceedings of the FOCUS Conference on Eastern Regional Ground Water Issues, National Water Well Association, Stamford, Connecticut.

Horsley, S. and J. Witten. 1988. Land Planning, Appraisal and Development in Vermont and New Hampshire. Horsley & Witten, Inc. Seminars.

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Protection Strategies. National Water Well Association, The Third Eastern Regional Ground Water Conference.

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Horsley, S. 1983. Delineating Zones of Contribution for Public Supply Wells to Protect Groundwater, in Proceedings of the National Water Well Association Eastern Regional Conference of Groundwater Management, Orlando, Florida.

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Massachusetts. Prepared by Cape Cod Planning and Economic Development Commission for the United States Environmental Protection Agency.

Horsley, S. 1982. Beyond Zoning, Municipal Ordinances to Protect Ground Water, in Proceedings of the Sixty National Groundwater Symposium, National Water Well Association, Atlanta, Georgia.

Horsley, S. 1981. The Impacts of Trace Metal Pollution of Narragansett Bay - A Case Study of the Quahog Fishery, Master's Thesis, University of Rhode Island.

Magnuson, P. and S. Horsley. 1981. Comprehensive Water Resources Monitoring Program for Cape Cod. Prepared by Cape Cod Planning and Economic Development Commission for the United States Environmental Protection Agency.

Cheney, P. and S. Horsley. 1980. Nonstructural Flood Plain Manage-ment Planning in the Connecticut River Basin, prepared by CME Associates, Inc. for the New England River Basins Commission.