Peer Review of Conservation Analysis
Stratton Hill Open Space Residential Subdivision
Preliminary Subdivision Plan

Town of Ayer

Conservation Commission

August 2022

Prepared for:

Ayer Conservation Commission

Prepared by:

Matt Burne, PWS
Senior Ecologist
BSC Group, Boston, MA
BSC Project No. 99017.00

BSC GROUP

Table of Contents

Conservation Analysis for the proposed Stratton Hill Subdivision Ayer, MA

1.0 Introduction

BSC Group, Inc. (BSC) is pleased to submit this report pertaining to our peer review of a Conservation Analysis for the Stratton Hill Open Space Residential Development (OSRD), the *Project*. The Conservation Analysis and supporting documentation were submitted by Dillis & Roy Civil Design Group, the *Representative*, as part of a Preliminary Subdivision Filing received by the Town of Ayer Conservation Commission on June 9, 2022 on behalf of Fox Meadow Realty Corporation and Moulton Construction Corporation, the *Applicants*, with additional representation by Attorney Robert L. Collins.

This report presents the findings and comments of a BSC Senior Ecologist relative to the Town of Ayer Conservation Commission's request for an evaluation of the above-referenced Conservation Analysis pursuant to the Ayer OSRD Regulations and Guidelines and addresses a variety of related questions and concerns expressed in the Commission's Request for Proposals, dated June 24, 2022. Specifically, the Conservation Commission has requested a review of the Conservation Analysis relative to the 18 tasks identified in the Ayer OSRD Regulations and Design Guidelines (2022) and the sufficiency of data presented by the Applicant in their analysis; a review of stormwater basins in their projected locations, especially as relates to the adjacent Long Pond, a regionally significant example of a Massachusetts Great Pond; the resultant Conservation Priority Ranking proposed by the Applicant that should ultimately direct the uses of the Site; analysis of potential impacts of blasting that may be required for the Project; review of potential ecological impacts of the proposed road crossing of the National Grid Right of Way that traverses the middle of the Site; verification of wetland delineation relative to an Order of Resource Area Delineation for the Site; and a permitting review for the Project.

BSC has conducted this Peer Review based on results of a site visit conducted on August 5, 2022 (see Attachment 1) and evaluation of materials submitted by the Applicant, Conservation Commission, and publicly available GIS data using MassGIS MassMapper, including the current USGS topographic map, Wellhead and Surface Water Protection Areas, FEMA Flood Zone maps, NHESP data, US Department of Agriculture soils data, Areas of Critical Environmental Concern (ACECs), Outstanding Resource Waters (ORWs) and public Water Supply resources.

1.1 Materials Reviewed

BSC has evaluated the following materials as part of our peer review of this Project:

- Preliminary Subdivision filing for Stratton Hill OSRD, received by the Town of Ayer, including:
  - "Preliminary Subdivision & Open Space Residential Development Plan in Ayer," last revised 7/22/2022
  - "Application Narrative," Robert L. Collins, June 1, 2022
  - "Conservation Analysis Pursuant to 10.1 of the Ayer Zoning Bylaw," Dillis & Roy Civil Design Group, June 30, 2021, revised August 18, 2021
  - "Rare Herpetofaunal Investigation, Sandy Pond Road, Groton, Massachusetts," Oxbow Associates, Inc., January 30, 2004

  - "Open Space Residential Development" letter, Dillis & Roy Civil Design Group, August 18, 2021
- "Stratton Hill Definitive Subdivision" Planning Board presentation slide deck, July 27, 2021
- Ayer OSRD Regulations and Design Guidelines, June 14, 2022
- Ayer Subdivision Regulations, March 10, 2020
- Ayer Zoning Bylaw, last amended October 28, 2019

Comment 1: BSC notes that the North Arrow on Sheet No. C1.1 of the revised Preliminary Subdivision Plan, Key Sheet, is incorrectly oriented.

1.2 Wetland Resource Areas

BSC has evaluated the wetland lines shown on the Preliminary Subdivision Plans for consistency with the delineation approved in an Order of Resource Area Delineation as represented in the "ANRAD Key Sheet, Stratton Hill (Off Wright Road), Ayer, Massachusetts," prepared by Ducharme & Dillis Civil Design Group, dated 3/20/20 and last revised 11/2/20. BSC notes no discrepancies between the resource area delineations as shown on the ANRAD plan and the Preliminary Subdivision & Open Space Residential Development Plan presently under review. We do note that the latter uses symbology that makes distinguishing wetland lines from topographic lines very difficult.

Comment 2: BSC recommends that the Preliminary Subdivision Plan set be revised to more clearly distinguish wetland lines from topographic lines as shown on plan sheets. Use of different symbology or color may help clarify information presented on final plans.

The Conservation Analysis includes a FEMA Flood Map (p15) with Flood Zone A occurring on the Site. This resource area (BLSF) does not appear to be shown on the Preliminary Subdivision Plans reviewed as part of this Peer Review. Regulatory Buffer Zones are also not apparent on the Preliminary Subdivision Plans.

Comment 3: BSC recommends that the Preliminary Subdivision Plan set be revised to clearly show BLSF and regulatory Buffer Zones.

2.0 Conservation Analysis Review

BSC has evaluated the Applicant's submission as it relates to the 18 Submittal Requirements for Conservation Analysis in the Ayer OSRD Regulations and Guidelines (2022).

CA Requirement	Evaluation

1	Site Context Map	The Applicant's Conservation Analysis provides site context mapping on pages 3 and 4 showing abutting parcel information contained in Ayer and Groton GIS data as directed in the *Guidelines*. The abutting open space areas, existing residential development are discussed in Section 1.0 Site Location and Regional Setting.
2	Topographic Analysis	Section 1.0 Site Location and Regional Setting presents the percentage of area on the Site with three slope categories, <10%, 10-20%, and >20%. The Topographic Exhibit Plan, Appendix D, (p85) graphically shows topographic areas with slopes exceeding 20%. BSC noted that in some areas of the Topographic Exhibit Plan that topography lines were not consistently represented at 2-foot intervals, in some locations showing fewer increments than required, though this does not necessarily affect the usefulness of this mapping. BSC notes that the scale identified on the Topographic Exhibit Plan is one-inch equals 150 feet. While the Submittal Requirements for Conservation Analysis state that the topographic map "should have a scale of one-inch equals 100 feet or more," we suspect that the intent of this requirement is to provide a closer view of the Site, such as 1:80 or 1:60. Mapping at this scale would have more value in assessing the data comprised of a Conservation Analysis.
3	Delineation of Soil Types	A Web Soil Survey is presented as Appendix C (p54) with an Area of Interest (AOI) defined totaling 146 acres (p57). The filing also includes USDA NRCS soil survey descriptions for each of 10 mapped soil units. The Applicant does not provide any functional evaluation of soils, such as suitability for crops, pasture, woodland, wildlife habitat, etc. as specified in the *Guidelines*. The data are presented but not analyzed in any meaningful way. A Prime Farmlands Map is presented on p12, though BSC notes that the figure in the Conservation Analysis does not match the current Prime Farmland Soils data in MassGIS as cited.
4	Wetlands and Buffer Zones	Wetlands are shown as approved by the Ayer Conservation Commission in an Order of Resource Area Delineation under MassDEP file number 100-445. See Comment 2 and 3 above.
5	Drainage Description	A Watershed Map is presented in Appendix B (p52) which includes the occurrence of wetlands and several unverified vernal pools, though they are unlabeled on this plan sheet. BSC notes there is no legend on this exhibit. Four (4) unmapped vernal pools are mentioned in Section 2.0 Water Resources. The largest drainage subbasin on the site contributes directly to Long Pond, but this is not discussed as a significant consideration in the resultant Conservation Prioritization.

6	Land within ACEC	The entire site is located within the Petapawag ACEC, acknowledged in one sentence in Section 5.0 Environmentally Protected Areas (p7). The Applicant has not presented any information about the ACEC or its reasons for designation, which might have bearing upon the subject Conservation Analysis.
7	FEMA 100 and 500-year Floodplain	FEMA Flood Zone A occurs on the Site adjacent to Long Pond (Flood Map, p15) and is mentioned in Section 5.0. This wetland resource area is not clearly shown on Project plans and the Site boundaries are not shown on the Flood Map in the report. It is not clear what the extent of FEMA Flood Zone A is on the Site.
8	BioMap2 Data	The Application exhibits BioMap2 Critical Natural Landscape (CNL) in Section 1.0 (p5) showing nearly the entire site located within CNL with the exception of a small segment at the south of the Site. BSC has also looked at the BioMap2 Core Habitat Wetlands, Critical Natural Landscape Upland Buffer of Wetland Core, and Core Habitat Vernal Pool Core data layers, as well as BioMap2 Core Habitat Forest Habitat data layer (Figure 1). These additional data provide important information about the distribution of valuable habitats, both upland and wetland, in the context of this Site. These data should be included in any evaluation of the ecological functions and values of a property.

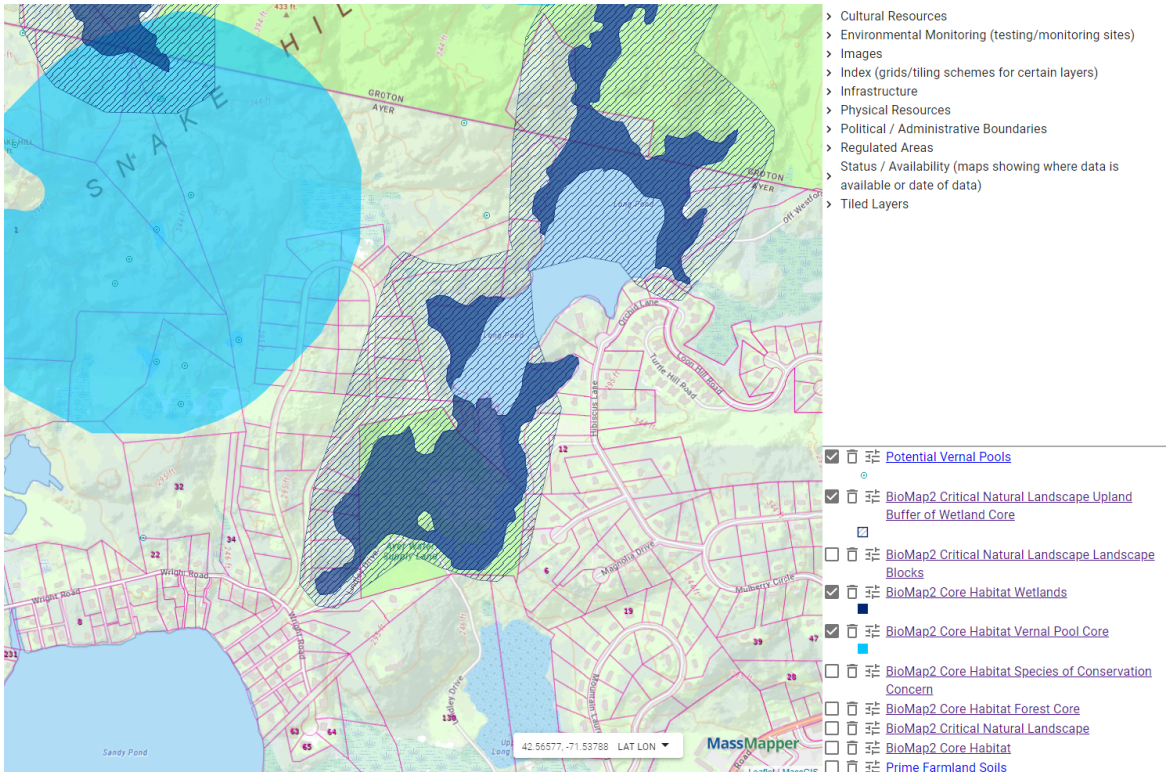


Figure 1a: NHESP BioMap2 Core Habitat Wetlands, Critical Natural Landscape Upland Buffer of Wetland Core, and Core Habitat Vernal Pool Core.

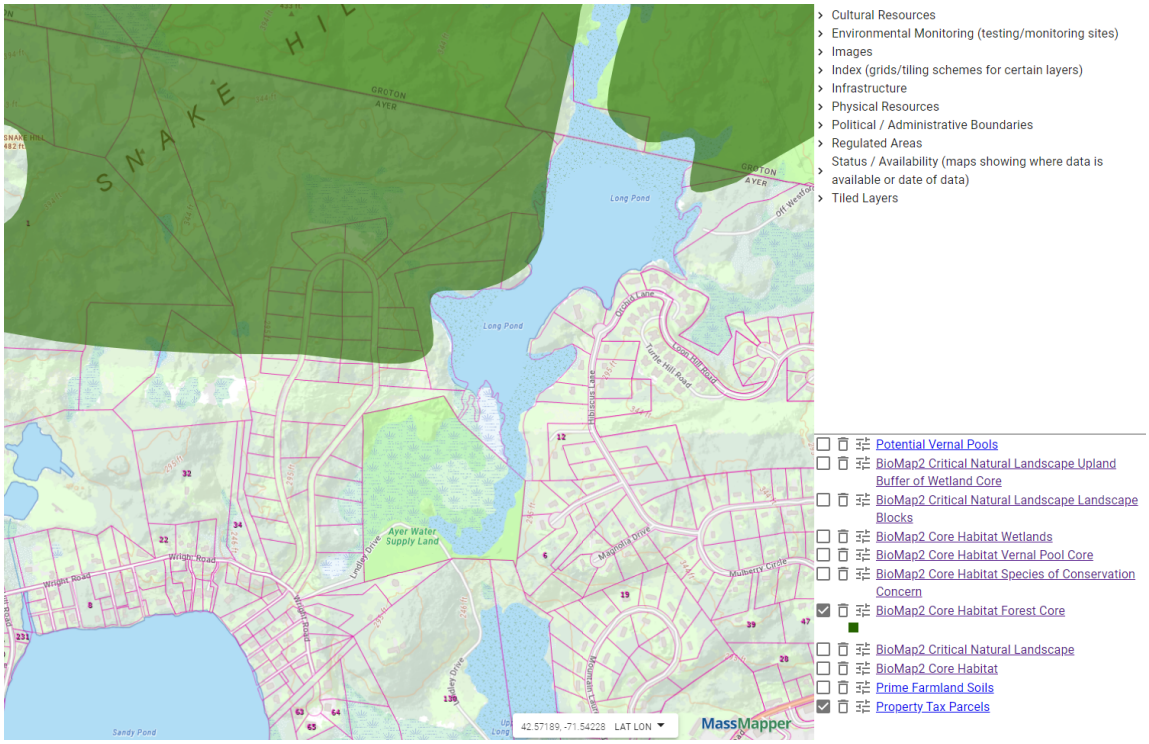


Figure 1b: NHESP BioMap2 Core Habitat Forest Habitat.

9	Wellhead/Aquifer information	The Applicant addresses the absence of Zone I, Zone II, and Interim Wellhead Protection Areas on the Site.
10	Upland Vegetation Analysis	The Conservation Analysis presents a very basic statement about the wooded nature of the Site in Section 1.0 Location & Regional Setting (p4) and an inset figure in Appendix E that shows Existing Land Cover at a scale of 1" = 500'. The Upland Vegetation Analysis is inadequate to use for drawing any conclusions about the comparative ecological value of different areas of the Site. It does not identify specimen trees, address health and condition of each vegetative type, or identify predominant species on the Site. It does not address unique or rare plant species. The inset figure showing land cover types is not useful as shown at 1:500-scale. While arguably a precise interpretation of the requirement for mapping scale in the *Guidelines*, it is not an accurate presentation of data as intended in the Conservation Analysis requirements (see general comments below).
11	Wildlife Movement Corridors	The Conservation Analysis does not address wildlife corridors or isolated natural resource areas. It does not cite (or address the lack of) any regional or local planning documents that might address wildlife habitat and corridors.
12	Wildlife Habitat	The Conservation Analysis addresses wildlife habitat in a paragraph at Section 6.0 of the report and appends the nearly 20-year old Oxbow Associates "Rare Hepetofaunal Investigation" report to address wildlife habitat values on the Site. The UMass CAPS Index of Ecological Integrity (IEI) map is included and shows the entire northern section of the Site, including the National Grid Right of Way ranking as significant to wildlife. There is no functional evaluation of wildlife habitat values on the subject Site presented by the Applicant. The Oxbow Associates report focuses on data collected well to the north of the Site on what is now MassAudubon's Rocky Hill Sanctuary. The powerline Right of Way on the Site was not part of the Oxbow study area, nor did their study include the beaver impoundment, vernal pools, or wetlands on the Site, including Long Pond and its associated wetlands. The Applicant has not addressed any of the functional values of the Site relative to wildlife. It should be noted that the Oxbow Associates herpetofaunal investigation contains data that is sensitive and should not be part of the public record. BSC recommends that the included report be removed or redacted to reduce threats to protected wildlife species. The Natural Heritage & Endangered Species Program should be consulted in regard to the inclusion of this report in any public records.
13	Scenic Vistas	The Applicant does not specifically address any potential scenic vistas. However, the varied topography, changes in elevation, and

		areas of steep slopes may provide interesting scenic vista opportunities both from the Site and from surrounding public ways.
14	Streets and Highways	This topic is not critically evaluated, but given the location of the Site, there are few options to consider under this point.
15	Future Area-wide Plans	The Applicant does not present an evaluation or analysis of potential future uses that might affect the outcome of the Conservation Ranking.
16	Other Infrastructure	Given the existing conditions of the Site, this point is adequately addressed by the Applicant.
17	Cultural and Historic Assets	BSC has verified that there are no MassHistoric Commission Inventory points or areas on or immediately adjacent to the Site. Given the proximity to a Massachusetts Great Pond, BSC recommends that the Applicant obtain an evaluation of the Site from the Massachusetts Historical Commission (MHC) for impacts to archaeological assets and assuring compliance with both federal and state statutes and regulations. Such review would be required if there is a state or federal permit required for the Project (see Project Permitting analysis below).
18	Invasive Species	The Applicant does not address invasive species in the Conservation Analysis. BSC did note the presence of invasive plant species in some locations on the Site.

3.0 Right of Way Values for Wildlife

The proposed Stratton Hill Subdivision is bisected (east to west), by a National Grid power line right-of-way (ROW). Preliminary plans suggest 16 dwelling structures proposed north of the power lines, with the ROW to be transected twice by a paved loop road as proposed. Key impacts of concern include the conversion of ROW habitat to paved roadway, the impacts of the paved roadway on habitat fragmentation, road mortality (particularly for slow-moving species such as amphibians and turtles), and the proximity of the paved roadway to Lower Long Pond and the associated wetland complexes (which are likely to be significant turtle and amphibian habitat).

3.1 Importance of transmission line ROW habitat for wildlife

Transmission line ROWs are characterized by early successional, low-growing vegetation, often dominated by mixed grasses, flowering/fruiting forbs, and scrub/shrub habitat. These conditions arise as a result of vegetation management within ROWs for compatibility with overhead electric lines (i.e. removal of trees, periodic herbicide and mechanical vegetation removal, scrub management, etc.). Within the predominantly forested habitats of New England, transmission line ROWs provide valuable early successional habitats, which are uncommon in the wider landscape. Many species benefit from these habitats; pollinating insects benefit from the higher occurrence of flowering plants found in these open successional habitats (even when the use of potentially harmful herbicides is taken into consideration)[1,2]. Birds and mammals benefit from the high occurrence of berry and fruit producing plants[3], as well as the broader variation in habitat conditions which ROWs provide. ROWs also provide important habitat for

Turtle nesting activity observed at the north road crossing of the ROW

Turtle eggshells and depredated nest

reptiles (in particular turtles), which benefit from the mixture of foraging opportunities, open bare ground suitable for nesting and basking, and adjacent forest areas (for aestivation and overwintering)[4]. While highly mobile species (birds and insects) are less likely to be impacted by the transmission line ROW being transected by the residential roadway, less mobile species (particularly turtles and amphibians), are.

[1] David L. Wagner, Kenneth J. Metzler, and Henry Frye, "Importance of Transmission Line Corridors for Conservation of Native Bees and Other Wildlife," *Biological Conservation* 235 (July 2019): 147–56, https://doi.org/10.1016/j.biocon.2019.03.042.
[2] Victoria A Wojcik and Stephen Buchmann, "POLLINATOR CONSERVATION AND MANAGEMENT ON ELECTRICAL TRANSMISSION AND ROADSIDE RIGHTS-OF-WAY: A REVIEW," *Journal of Pollination Ecology* 7, no. 3 (2012): 16–26.
[3] W.C. Bramble and W.R. Byrnes, "Thirty Years of Research on Development of Plant Cover on an Electric Transmission Right-Of-Way," *Arboriculture & Urban Forestry* 9, no. 3 (March 1, 1983): 67–74, https://doi.org/10.48044/jauf.1983.019.
[4] Mark Grgurovic and Paul R. Sievert, "Movement Patterns of Blanding's Turtles (Emydoidea Blandingii) in the Suburban Landscape of Eastern Massachusetts," *Urban Ecosystems* 8, no. 2 (June 2005): 203–13, https://doi.org/10.1007/s11252-005-4380-z; Bridget Henning and Leon Hinz, "Conservation Guidance for Blanding's Turtle (Emydoidea Blandingii) | IDEALS," INHS Technical Report (Champaign, IL: Illinois Department of Natural Resources, 2016), https://www.ideals.illinois.edu/items/98191.

3.2 Potential environmental impacts of the proposed roadway

Roadways have a number of detrimental impacts on the environment, particularly on water quality and aquatic habitats. Roads increase impervious surface area, leading to increased stormwater runoff volume, increased peak discharges, decreased response time making stormwater "flashier," and elevated flood risk[5].

Winter road salting can have highly detrimental effects on water quality and ecological status, with hazards associated with chloride-laden runoff including groundwater contamination; leaching of toxic trace metals; aquatic toxicity effects on fish, amphibians and macroinvertebrates; and impacts on water body stratification and mixing (which in turn can lead to low oxygen conditions and poor nutrient turn-over)[6,7].

Road dust (which washes off the road surface during rainfall events), can also be highly toxic to aquatic environments, containing trace metals such as copper, zinc, and platinum. In urban areas, these can frequently exceed water and sediment quality criteria in receiving waterbodies, leading to significant impacts to the health of aquatic organisms[8]. Road dust can also be a significant source of microplastic contamination, which often remains suspended (or settles extremely slowly), in constructed wetlands / detention basins, with the majority of microplastic contamination getting released into open waterbodies[9]. In waterbodies near roads, significant levels of microplastic accumulation can occur in both invertebrates and fish[10]. Road dust also contains compounds derived from rubber vehicle tires, which have been linked to mortality in a number of economically important fish species, including brook trout, rainbow trout, and some species of salmon[11]. While the road for the new subdivision will likely generate relatively low levels of contamination (due to the small size of the road, and relatively low traffic volume into the residential area), the paved driveways within the subdivision will also contribute to the contaminant load. As the toxicity effects from road runoff are cumulative, and many of the compounds involved are not effectively removed by conventional stormwater management devices, each new road and driveway adds to the cumulative water quality impacts.

Although stormwater management facilities (such as detention basins, roadside swales etc.), can mitigate for some of the above impacts, these measures rarely capture all stormwater pollution, and cannot fully mitigate for the combined impacts from road development and increased impervious surface areas[12]. The e

[5] Tony Wong, Peter Breen, and Sara Lloyd, "Water Sensitive Road Design - Design Options for Improving Stormwater Quality of Road Runoff," Technical Report (Canberra, AUS: Cooperative Research Centre for Catchment Hydrology, University of Canberra, 2000).
[6] Stuart E.G. Findlay and Victoria R. Kelly, "Emerging Indirect and Long-Term Road Salt Effects on Ecosystems," *Annals of the New York Academy of Sciences* 1223, no. 1 (2011): 58–68, https://doi.org/10.1111/j.1749-6632.2010.05942.x.
[7] J. Marsalek, "Road Salts in Urban Stormwater: An Emerging Issue in Stormwater Management in Cold Climates," *Water Science and Technology* 48, no. 9 (November 1, 2003): 61–70, https://doi.org/10.2166/wst.2003.0493.
[8] Hyun-Min Hwang et al., "Review of Pollutants in Urban Road Dust and Stormwater Runoff: Part 1. Heavy Metals Released from Vehicles," *International Journal of Urban Sciences* 20, no. 3 (September 1, 2016): 334–60, https://doi.org/10.1080/12265934.2016.1193041.
[9] Sirajum Monira et al., "Understanding the Fate and Control of Road Dust-Associated Microplastics in Stormwater," *Process Safety and Environmental Protection* 152 (August 1, 2021): 47–57, https://doi.org/10.1016/j.psep.2021.05.033.
10 Stephanie B. LaPlaca and Peter van den Hurk, "ACCUMULATION OF MICROPLASTIC AND MICRORUBBER PARTICLES IN STORMWATER POND FISH AND INVERTEBRATES," preprint (Zoology, March 4, 2022), https://doi.org/10.1101/2022.03.03.482888.
11 Markus Brinkmann et al., "Acute Toxicity of the Tire Rubber-Derived Chemical 6PPD-Quinone to Four Fishes of Commercial, Cultural, and Ecological Importance," Environmental Science & Technology Letters 9, no. 4 (April 12, 2022): 333–38, https://doi.org/10.1021/acs.estlett.2c00050.
[12] Anne J. Jefferson et al., "Stormwater Management Network Effectiveness and Implications for Urban Watershed Function: A Critical Review," *Hydrological Processes* 31, no. 23 (2017): 4056–80, https://doi.org/10.1002/hyp.11347.

fficacy of stormwater management systems declines over time, and facilities are not always managed properly to ensure ongoing functionality.

3.3 Potential wildlife/ecological impacts of the new roadway

As currently proposed, the existing transmission line ROW will be transected twice by a paved loop road, providing access to 16 residential properties on the north side of the ROW. Although it is assumed that the access road will provide vehicle access at relatively low speeds, this still provides a significant obstacle to migrating turtles and amphibians, which are likely to use both the wetland complexes to the east of the development, and the transmission line ROW to the west. Both turtles and snakes will avoid road crossings[13], resulting in disruption of their usual migration pathways, and potentially higher energy costs associated with "walking the long way round." Likely of greater impact however is the high levels of road mortality experienced by reptiles and amphibians[14], even on relatively low-speed, residential roads. Road mortality impacts on freshwater turtles can result in population level changes, particularly associated with the disproportionate road mortality risk to nesting females – female turtles tend to cross roads more frequently (in search of nest sites), and the loss of a single female turtle with eggs represents a greater population impact than the loss of a single male. The disproportionate mortality of female turtles can in turn lead to skewed sex ratios in the population, and skewed age structure (with the loss of eggs reducing the number of juvenile turtles in the population)[15].

Residential developments also pose a population risk to freshwater turtles by increasing the density of meso-predators into the area (including rats, racoons, skunks, and chipmunks)[16], direct habitat loss (paving over of areas for driveways, lawns, buildings, etc.), and habitat fragmentation (roads, driveways, and fences all block nest/breeding pond migration pathways)[17].

3.4 Recommendations Relative to the National Grid Right of Way

Comment 4: Reduce habitat fragmentation (particularly between wetlands and early-successional ROW habitats), by eliminating the section of loop road which transects the ROW. This would not only significantly improve connectivity between the ROW habitat and the wetlands to the east but would also reduce other impacts associated with the residential development (impervious surfaces, water quality impacts, habitat loss, habitat fragmentation between Lower Long Pond and the westward forest & ROW).

[13] James E. Paterson et al., "Road Avoidance and Its Energetic Consequences for Reptiles," *Ecology and Evolution* 9, no. 17 (2019): 9794–9803, https://doi.org/10.1002/ece3.5515.
[14] Frederic Beaudry, Phillip G. Demaynadier, and Malcolm L. Hunter Jr, "Identifying Hot Moments in Road-Mortality Risk for Freshwater Turtles," *The Journal of Wildlife Management* 74, no. 1 (2010): 152–59, https://doi.org/10.2193/2008-370; Chantel E. Markle et al., "The True Cost of Partial Fencing: Evaluating Strategies to Reduce Reptile Road Mortality," *Wildlife Society Bulletin* 41, no. 2 (2017): 342–50, https://doi.org/10.1002/wsb.767.
[15] David A. Steen and James P. Gibbs, "Effects of Roads on the Structure of Freshwater Turtle Populations," *Conservation Biology* 18, no. 4 (2004): 1143–48, https://doi.org/10.1111/j.1523-1739.2004.00240.x.
[16] Michael D. Knoerr, Gabrielle J. Graeter, and Kyle Barrett, "Hatch Success and Recruitment Patterns of the Bog Turtle," *The Journal of Wildlife Management* 85, no. 2 (2021): 293–302, https://doi.org/10.1002/jwmg.21989.
[17] Michael T. Jones and Paul R. Sievert, "Elevated Mortality of Hatchling Blanding's Turtles (Emydoidea Blandingii) in Residential Landscapes," *Herpet Conserv Biol* 7, no. 1 (2012): 89–94.

Comment 5: Reduce the number of crossings of the ROW with a dead-end roadway design servicing the northern section of the proposed project.

Comment 6: If the development of the loop road into a paved residential street is unavoidable, consider installation of wildlife underpasses[18,19], with well-maintained fencing along the entire perimeter[20] of the residential development. Fencing and suitable underpasses (designed to accommodate a range of wildlife), will need to be maintained in perpetuity to prevent road crossings.

Comment 7: Reduce the number of residential lots in proximity to Lower Long Pond, and/or relocate lots further away from the pond to reduce stormwater impacts, and to reduce impacts to turtle nesting and migration habitat (both direct impacts from habitat loss, and indirect impacts from residential encroachment close to turtle habitat - habitat fragmentation, increased road mortality, increased nest predation, etc.).

Comment 8: Reduce water quality and stormwater impacts from impervious areas (including the road, driveways and roofs), by implementing Low Impact Development (LID) strategies, including:

- reducing the extent of impervious surface areas (consider alternatives like gravel and porous paving for driveways);
- Installation **and maintenance** of rain gardens at each property (for roof and lot runoff);
- Installation **and maintenance** of bioretention areas, rain gardens, swales and detention ponds in shared green spaces;
- Installation **and maintenance** of oil and grease separators for pre-processing of stormwater (particularly from road and driveways, where vehicle leaks are more likely to result in these contaminants);
- Planting of trees and native vegetation (rather than lawn/turf grass), in shared green spaces.

Comment 9: Restrict the application of salt on the road and private driveways – avoid "eco-friendly" deicing products, which may in fact have a higher aquatic toxicity than normal road salt (sodium chloride - NaCl)[21].

4.0 Stormwater Management Habitat & Wildlife Impacts

The current preliminary subdivision plans include theoretical stormwater management features apparently based on the earlier subdivision conceptual plans. Basin locations are shown to be further away from road

[18] Delia R J Kaye et al., "SPOTTED TURTLE USE OF A CULVERT UNDER RELOCATED ROUTE 44 IN CARVER, MASSACHUSETTS," *ICOET Proceedings*, 2005, 8.
[19] Paul C. Heaven, Jacqueline D. Litzgus, and M. Tim Tinker, "A Unique Barrier Wall and Underpass to Reduce Road Mortality of Three Freshwater Turtle Species," *Copeia* 107, no. 1 (February 2019): 92–99, https://doi.org/10.1643/CH-18-137.
[20] Markle et al., "The True Cost of Partial Fencing."
[21] Patricia Leigh Gillis et al., "The Relative Toxicity of Road Salt Alternatives to Freshwater Mussels; Examining the Potential Risk of Eco-Friendly De-Icing Products to Sensitive Aquatic Species," *ACS ES&T Water* 1, no. 7 (July 9, 2021): 1628–36, https://doi.org/10.1021/acsestwater.1c00096.

infrastructure than is likely necessary, which would increase the overall impacts to the landscape and potentially result in harm to the environment that could be avoided. The stormwater management system has not been designed for the subdivision yet, so our review and comments are made in the abstract, with the intent to provide some insight that might guide the eventual design of such systems with a reduced impact footprint on the Site.

4.1. Potential environmental impacts of stormwater management systems

Some traditional stormwater management techniques and their possible limitations and potential ecological impacts are presented in Table 1.

***Table 1**: Common stormwater mitigation techniques, and their limitations and potential ecological impacts.*

Technique	Description	Limitations / Potential Impacts
Deep sump catch basins	Underground retention systems which trap trash, debris, and coarse sediment, and temporarily trap oil/grease.	Limited pollutant removal. Expensive to empty and maintain (which can lead to them being neglected and becoming ineffective) – it is difficult to enforce/ensure continued maintenance of these devices in the long term. Entrapment hazard for amphibians and small animals. No groundwater recharge.
Proprietary separators (various types & manufacturers)	A follow-through structure with units to remove sediment and other pollutants (depending on manufacturers specification).	Variable efficacy/reliability. Depending on the type of separator, not all pollutants will be effectively removed. Costly to maintain in good working order (which can lead to them being neglected and becoming ineffective) – it is difficult to enforce/ensure continued maintenance of these devices in the long term. No groundwater recharge.
Wet detention basins and Constructed stormwater wetlands	Both rely on water storage, followed by vegetation uptake, retention and settling.	When managed correctly (to prevent sediment accumulation and vegetation growth from filling in the basin/wetland), detention basins can be effective at removing sediments, pollutants, and reducing nutrient enrichment[22]. However, they must have sufficient size and depth to properly settle sediments and pollution[23], otherwise they may lead to increased pollution inputs to neighboring waterbodies. Wet detention ponds can provide flood water storage, and attractive habitats for wildlife (including birds and amphibians). However, they may impact bird[24] and a[25]mphibian health and breeding success through contamination – it is unclear whether detention ponds

[22] William W. Walker, "Phosphorus Removal by Urban Runoff Detention Basins," *Lake and Reservoir Management* 3, no. 1 (January 1, 1987): 314–26, https://doi.org/10.1080/07438148709354787.
[23] Peter Starzec et al., "Technical and Environmental Functioning of Detention Ponds for the Treatment of Highway and Road Runoff," *Water, Air, and Soil Pollution* 163, no. 1 (May 1, 2005): 153–67, https://doi.org/10.1007/s11270-005-0216-y.
[24] Donald W. Sparling, John D. Eisemann, and Wayne Kuenzel, "Contaminant Exposure and Effects in Red-Winged Blackbirds Inhabiting Stormwater Retention Ponds," *Environmental Management* 33, no. 5 (September 1, 2004): 719–29, https://doi.org/10.1007/s00267-003-0058-6.
[25] Matthew T. Gallagher et al., "The Role of Pollutant Accumulation in Determining the Use of Stormwater Ponds by Amphibians," *Wetlands Ecology and Management* 22, no. 5 (October 1, 2014): 551–64, https://doi.org/10.1007/s11273-014-9351-9.

		generally provide a net benefit or harm (i.e. population "source" or "sink"), for wildlife, with researchers finding mixed results across taxa. If wet detention basins are not functioning properly, they can release contaminated discharge (including sediment and heavy metals) to open waters[26], and potentially increase the risk of groundwater contamination (particularly if the basin is in a sandy area or one with a shallow water table)[27]. Constructing detention basins in a series, so that water discharged from one flows to the next (and properly maintaining all ponds), can improve both their pollution retaining potential, and the amount of habitat they provide. Similarly, ensuring that detention basin outfalls are well set back from the receiving water body, and that the outfall is naturally vegetated, can further improve discharged water quality[28].
Dry retention basins	Dry retention basins are vegetated depressions which collect stormwater runoff during high flow periods, and allow this to infiltrate into the ground. During normal operating conditions, the basin is dry, only collecting water during high flow events.	Dry retention basins have the benefit of being dry most of the time (and thus not providing breeding pools for mosquitos). However, this means that they do not provide the aquatic habitats of wet basins or constructed wetlands, and that successful planting can be more difficult (as vegetation will need to tolerate both wet and dry conditions). There is a tendency for dry basins in residential areas to just be planted with lawn grass/turf (and mown), which reduces their efficacy, and also does not provide any habitat benefits for wildlife. However, dry retention basins can provide improved water quality, even when they are not managed[29]. Similar to wet detention basins, there is an increased risk of groundwater contamination[30], particularly if the retention basin is mown and spread with fertilizer (as often happens in residential areas).

[26] David A. Lieb and Robert F. Carline, "Effects of Urban Runoff from a Detention Pond on Water Quality, Temperature and Caged Gammarus Minus (Say) (Amphipoda) in a Headwater Stream," *Hydrobiologia* 441, no. 1 (December 1, 2000): 107–16, https://doi.org/10.1023/A:1017550321076.
[27] David Fischer, Emmanuel G. Charles, and Arthur L. Baehr, "Effects of Stormwater Infiltration on Quality of Groundwater Beneath Retention and Detention Basins," *Journal of Environmental Engineering* 129, no. 5 (May 2003): 464–71, https://doi.org/10.1061/(ASCE)0733-9372(2003)129:5(464).
[28] Deonie Allen, Heather Haynes, and Scott Arthur, "Pollution from Urban Development and Setback Outfalls as a Catchment Management Measure for River Water Quality Improvement," April 1, 2016, EPSC2016-18241.
[29] Austin D. Wissler, William F. Hunt, and Richard A. McLaughlin, "Hydrologic and Water Quality Performance of Two Aging and Unmaintained Dry Detention Basins Receiving Highway Stormwater Runoff," *Journal of Environmental Management* 255 (February 1, 2020): 109853, https://doi.org/10.1016/j.jenvman.2019.109853.
[30] Fischer, Charles, and Baehr, "Effects of Stormwater Infiltration on Quality of Groundwater Beneath Retention and Detention Basins."

Bioretention basins / rain gardens	Bioretention is a technique that uses soils, plants, and microbes to treat stormwater before it is infiltrated and/or discharged. Usually, a well-drained bed of sandy soil is spread with loam, and then planted with native vegetation to adsorb and absorb sediments and pollution.	Can be effective at removing sediment (and some pollutants), reducing surface flow and increasing infiltration and groundwater recharge in small, localized areas. Can be combined with pretreatment controls (such as catch basins), to improve water quality. Effectiveness of bioretention/rain gardens will depend on the vegetation type (native species with complex above ground structures, and a mix of deep and spreading root systems, are the most effective), and maintenance of the area (if vegetation dies, or is mown back, efficacy will be significantly reduced). As well as stormwater control, rain gardens can provide habitat for wildlife, as well as enhanced aesthetic appeal. Rain gardens are most effective when carefully positioned and constructed in higher numbers to promote maximum retention and infiltration of stormwater.
Vegetated swales and drainage channels	These planted areas direct stormwater to detention basins, while also providing some stormwater services themselves (slowing the flow of runoff through vegetation, and providing some infiltration).	Most effective when planted with structurally complex (both above ground vegetation and below ground root systems), native vegetation. There is a tendency for these features (in residential areas particularly), to just be planted with lawn grass/turf (and mown), which reduces their efficacy, and also does not provide any habitat benefits for wildlife.

* *The Massachusetts Stormwater Handbook provides useful advice on the design, management, and relative efficacy of different stormwater management devices.*

4.2. Potential wildlife impacts of stormwater management systems

Stormwater management is an important strategy for mitigating many of the impacts of larger development projects, but a number of adverse impacts can result from their installation and long-term presence on the landscape. Many potential pitfalls are noted above as related to specific structure types, but BSC notes some additional generalized issues that stormwater management features can cause over longer terms.

- **Population sinks** Stormwater management basins that retain standing water during the spring and early summer can provide attractive breeding habitat for a variety of pool-breeding amphibian species. When water infiltrates, egg masses can become stranded and fail as a result. This can cause a reduction in fecundity for a breeding population of amphibians in an area.
- **Water quality** can be impacted as a result of the collection and concentration of pollutants as discussed above. Their eventual release to the environment and increasing the potential direct contact with wildlife that are attracted to stormwater management features can have adverse effects on wildlife populations.

4.3. Stormwater Management Recommendations

Comment 10: Maximize the distance between any proposed stormwater management feature and sensitive environmental resources such as Long Pond, the beaver impoundment, or other jurisdictional wetland resources.

Comment 11: Incorporate LID measures[31] (such as porous paving, rain gardens, swales, vegetated buffer strips, native plantings etc.), extensively throughout the subdivision – the more extensive the LID features, the lower the inputs to stormwater management devices will be, resulting in better performance and a reduction in the frequency with which stormwater devices need heavy maintenance. LID is also important for overall water quality, as not all pollution and runoff can be captured by stormwater management features like detention basins. Preventing the generation of stormwater in the first place is the most effective form of management.

Comment 12: Promote the incorporation of LID features which will provide both stormwater management services, while also improving the ecological integrity or wildlife habitat value of the development (for example, measures such as tree and native vegetation planting, low and no-mow areas, pond and rain garden creation, and the use of green roofs).

Comment 13: Ensure that LID and conventional stormwater management measures are sufficient to cope with expected increases in extreme weather, including periods of drought, extreme rainfall events, and more severe winter storms (due to climate change).

Comment 14: Ensure a management plan is in place to maintain all stormwater management features in perpetuity.

Comment 15: If detention basins are to be constructed (either wet or dry), ensure these are well vegetated with native vegetation, of sufficient size and depth for stormwater storage and settling of contaminants, suitably set back from receiving waters and wetlands to the maximum extent feasible on the site, and ideally have a vegetated outflow (as opposed to a riprap swale) leading to the receiving waterbody. Wet detention basins constructed in a series can also perform a similar cumulative function in reducing pollution runoff.

Comment 16: Consider the positioning of detention basins, swales and other interceptors of stormwater/runoff to not only capture runoff from impervious areas (roads, driveways, roofs, etc.), but also to intercept and filter runoff from lawns (which is often very high in nutrients from fertilizer use).

5.0 Other likely Habitat & Wildlife Impacts of the Subdivision

In addition to the short-term environmental and ecological impacts associated with construction practices (including blasting), and the long-term impacts associated with new road construction and stormwater

[31] Chandana Damodaram et al., "Simulation of Combined Best Management Practices and Low Impact Development for Sustainable Stormwater Management1," *JAWRA Journal of the American Water Resources Association* 46, no. 5 (2010): 907–18, https://doi.org/10.1111/j.1752-1688.2010.00462.x.

management, the conversion of semi-natural forest into residential subdivision will clearly have a significant ecological and environmental impact. In particular, key impacts from the residential development will include:

- Loss of habitat (both forested and scrub/shrub ROW habitats), which will be converted to residential buildings and managed yards/lawns.
- Habitat fragmentation, as the residential development will block migration pathways (particularly for relatively low-mobility animals including turtles, other reptiles, and amphibians). Lawns, driveways, roads, fences, and buildings all represent barriers of variable permeability. Some are completely unpassable (such as buildings), while others are technically passable, but may have a high deterrent effect on wildlife, or increase mortality risk. A telemetry study of Eastern box turtles found survival to be negatively impacted by time spent in suburban areas[32], although occurrence of female turtles seemed to be higher in suburban than forested areas, suggesting residential developments may act as "ecological traps". Similarly, Blanding's turtle occupancy of wetlands has been shown to be negatively related to human land disturbance, and positively related to the presence of undisturbed forest[33].
- Water quality impacts from the conversion of forested land to developed land. In addition to stormwater impacts on water quality, the development of large areas of residential lawn (close to wetlands and great ponds), is likely to result in increased nutrient and herbicide inputs to waterbodies. Herbicide inputs can significantly harm aquatic environments, including mortality of amphibians, plants, and macroinvertebrates[34]. Nutrient inputs also have a strong negative effect on waterbody health, creating algal dominated systems with low mixing, low oxygen, and low ecological value – fertilizer use is widely linked to declines in freshwater quality around the globe[35], and the proximity of residential lawns close to receiving waterbodies is widely associated with degraded water quality[36].

Given that the east side of Lower Long Pond has already been developed into low density residential areas, the west side of the pond provides important connectivity to both the forested landscape and ROW scrub-shrub/early successional habitats. Given that these open, early successional habitats are uncommon in the wider landscape, and connectivity to ROW habitats to the east of the pond is already fragmented (by Hibiscus Lane and Loon Hill Road), further fragmentation to the west of the pond may be detrimental to species which use these early successional habitat types, particularly nesting and foraging turtles.

[32] I. L. Brisbin et al., "A Long-Term Study of Eastern Box Turtles (Terrapene c. Carolina) in a Suburban Neighborhood: Survival Characteristics and Interactions with Humans and Conspecifics," *Urban Herpetology* 373 (2008): 85.
[33] Vincent K. Fyson and Gabriel Blouin-Demers, "Effects of Landscape Composition on Wetland Occupancy by Blanding's Turtles (Emydoidea Blandingii) as Determined by Environmental DNA and Visual Surveys," *Canadian Journal of Zoology* 99, no. 8 (August 2021): 672–80, https://doi.org/10.1139/cjz-2021-0004.
[34] Robert Annett, Hamid R. Habibi, and Alice Hontela, "Impact of Glyphosate and Glyphosate-Based Herbicides on the Freshwater Environment," *Journal of Applied Toxicology* 34, no. 5 (2014): 458–79, https://doi.org/10.1002/jat.2997.
[35] Bijay-Singh and Eric Craswell, "Fertilizers and Nitrate Pollution of Surface and Ground Water: An Increasingly Pervasive Global Problem," *SN Applied Sciences* 3, no. 4 (March 31, 2021): 518, https://doi.org/10.1007/s42452-021-04521-8.
[36] Syma A Ebbin, "Is the Grass Always Greener? Assessing Lawn Care Practices of Connecticut Residents," *Wrack Lines* 99 (2015).

5.1 Recommendations Pertaining to Other Wildlife Habitat Impacts

Comment 17: Restrict the development of residential plots in close proximity to wetlands and great ponds. This could help protect both water quality, and habitat connectivity for turtles and other aquatic animals.

Comment 18: Promote good lawn management practices[48], including reducing fertilizer and herbicide applications to twice a year, avoiding lawn treatment just before rain is forecast, leaving unmown or native-planted buffer edges around lawns, and using slow release and organic fertilizers.

6.0 Stratton Hill OSRD Conservation Priority Ranking

BSC finds that the Conservation Analysis presented by the Applicant does generally address the 18 requirements identified in the OSRD Regulations and Design Guidelines in terms of presenting the data requested. There are some important deficiencies, especially as relates to the evaluation of upland forest cover, wetlands and their functional values (especially Long Pond), wildlife habitat, wildlife corridors, and existing and long-term regional conservation and planning considerations.

Landscape scale data represented by available BioMap2 and UMass CAPS IEI is included in the application but does not appear to have been a factor in the resultant Conservation Priority Ranking.

A Conservation Priority Ranking for the Site is presented in Section 7.0 Areas for Conservation. While BSC agrees that in gross terms, the northern portion of the Site has great importance, the significance of the powerline Right of Way and Long Pond are not adequately addressed. It is noted that the analysis does not indicate the extent of the parcel within each identified zone in terms of simple acreage or overall percentage of the Site.

The “Low Priority” area shown on the Applicant’s Priority Conservation Areas Map appear to be too focused on the previously-delineated lot lines and road alignment, rather than an objective evaluation of conservation values based on the data. It is notable that half of the beaver impounded wetland is included in the “Low Priority” area, where that is one of the more valuable wetland features on the site. The entire powerline Right of Way is classified as Low Priority.

The Applicant does not make clear what is intended by the “Medium Priority” area. This area comprises beaver impounded wetland, vernal pools, walking trails, the steeply sloped portion of the watershed to Long Pond and its associated wetlands. These are all features with significant conservation value.

The prioritization of land within the Site does not appear to follow the *Guidelines* recommended approach of identifying Primary Conservation Areas using the data presented in the Conservation Analysis. This should include a designation of areas protected through local, state, and federal regulations and the landscape scale conservation priorities as indicated in resources such as BioMap2 and the CAPS IEI data and should address issues of relevance to conservation purposes that the Site can support.

BSC recommends that the resulting Priority Conservation Areas Map should follow the Guidelines’ approach of identifying protected areas on the Site, including natural resources and regulatory buffers as high priority areas (the beaver pond and buffers to Long Pond wetlands on the eastern side of the site are examples of features that should be included), and then identify those areas that will form important

connections to the landscape-scale resources demonstrated to be important in the variety of ecological data that is the subject of the Conservation Analysis.

7.0 General Recommendations for the OSRD Guidelines

BSC has considered the overall approach taken in the Ayer OSRD Regulations and Design Guidelines and finds that the data it requires and landscape-level analysis these data can support should provide a robust foundation for effective evaluation of a proposed project site. The actual interpretation of such data and the conclusions that the *Guidelines* seek to draw is a real challenge.

The task of evaluating those data and the resultant assignment of comparative value to portions of a site or among various sites is complex and will benefit by skilled and seasoned interpretation of all the various factors brought to light in the Conservation Analysis.

Comment 19: BSC recommends that the Conservation Commission provide significant guidance on how to assess all of the data requested as part of the Conservation Analysis process or that ecological professionals be required to contribute (at least) to the final analysis and ranking.

One example of relatively subjective measure pertains to the identification of specimen trees as part of the Upland Vegetation Analysis (Requirement 10).

Comment 20: "Specimen Tree" is not precisely defined, and BSC recommends providing more specific parameters pertaining to the designation for non-specialists to employ, or requiring a horticultural, arboreal, or ecological expert to contribute to such an evaluation.

Given the complicated nature of ecological evaluations that are the basis of the Conservation Analysis, BSC recommends that the Conservation Commission require a trained ecologist with suitable expertise and experience to certify the results of the procedures leading to the prioritization of conservation areas within a large development site.

8.0 Project Permitting Assessment

BSC has considered the project as currently proposed and previous permitting history of the proposed Project and finds the following:

Massachusetts Endangered Species Act (MESA)

The Project Site is located within a Natural Heritage & Endangered Species Program (NHESP) Priority Habitat (PH2043) and a similar proposed subdivision was subject to a Conservation and Management Permit (CMP) in 2005 (Conservation Permit No. 03-11701) based on a finding that the combined Rocky Hill & Stratton Hill Residential Developments as proposed at the time would result in the "Take" of four (4) state-listed species. It was also found that the Project would not result in the "Take" of two additional state-listed species known to occur in the vicinity of the Site.

General Condition 1 of the 2005 CMP stated that the work authorized therein "shall be completed within seven (7) years from the date of issuance. If necessary, the Permit Holder shall submit a written request to the Division [of Fisheries & Wildlife] for an extension, at which time the Division will review the Proposed Project pursuant to MESA for impacts to any state-protected rare wildlife or plant species found subsequent to issuance date of the Conservation and Management Permit."

The work permitted under Conservation Permit No 03-11701 was not completed within the permit timeframe established in Condition 1, and BSC has not been made aware of any request for extension of the state CMP being sought for the Site or Project. In the intervening years, two (2) of the four species for which the Division issued the permit have been removed from the state list of rare species. Further, the data underlying the Division's review are constantly updated with new sightings and revisions to mapped habitat, and records upon which earlier permitting decisions were made may have expired. The Agency findings and resultant actions that occurred in 2005 are informative, but do not constitute a current review of the Project.

Comment 21: The Applicant should demonstrate that a new filing has been made with the Division of Fisheries and Wildlife for the proposal currently under review. The Commission should be provided proof of filing of a MESA Project Review Checklist or dated correspondence from the Division stating the Division's disposition toward the Project relative to a Conservation and Management Permit.

Massachusetts Environmental Policy Act (MEPA)

This Project will be subject to review under the Massachusetts Environmental Policy Act (MEPA) and its regulations (301 CMR 11.00 *et seq.*) if there is an "Agency Action" such as an NHESP Conservation and Management Permit (CMP) or any other state permit requirement. MEPA sets project review thresholds that determine the level of review required by the Secretary of the Executive Office of Energy and Environmental Affairs (EOEEA) when there is a state permit that triggers MEPA review if a project exceeds certain thresholds.

The results of a MESA review as discussed above is one determinant of whether there is an Agency Action that will trigger review under MEPA, and the Applicant should verify to the Commission that there are no other state permits required for the Project (a Notice of Intent, if required, does not constitute a state permit in this context). The Project does exceed the Review Threshold at 301 CMR 11.03(11) and may exceed Review Thresholds at 11.03(1) and (2).

301 CMR 11.03(1) sets Review Thresholds for conversion of land. When MEPA review is required for a project, the regulations identify the filing requirements for a project as an ENF and Mandatory EIR if there is direct alteration of 50 or more acres of land or creation of 10 or more acres of impervious surface. An ENF and other MEPA review may be required at the Secretary's discretion if a project proposes direct alteration of 25 or more acres of land or the creation of 5 or more acres of impervious surface.

Comment 22: The Applicant should demonstrate the extent of direct alteration of land, measured in acres, that the project will require to determine which, if any, review threshold is exceeded under 301 CMR 11.03(1).

301 CMR 11.03(2) sets Review Thresholds for projects that propose work within the habitat of state-listed species. When MEPA review is required for a project, the regulations identify the filing requirements for a project as an ENF and other MEPA review if required by the Secretary for projects that propose greater than two acres of disturbance of designated Priority Habitat that results in a take of a state-listed species.

Comment 23: The project as proposed meets the review threshold at 301 CMR 11.03(2) if the Division of Fisheries & Wildlife find that a "Take" will occur for the project as currently proposed and if they require a CMP.

301 CMR 11.03(3) establish the Review Thresholds for projects that propose work within Wetlands, Waterways and Tidelands, though it appears that the Project may not exceed this threshold.

Comment 24: The Applicant should affirm that there are no state permits required associated with wetland alteration that would exceed the review threshold at 301 CMR 11.03(3). This would include an individual Water Quality Certification, for instance.

301 CMR 11.03(11) sets the Review Threshold for projects that propose work within Areas of Critical Environmental Concern. This project located within Petapawag ACEC and therefore exceeds this threshold. MEPA review would include an ENF and other MEPA review if required by the Secretary for any project within a designated ACEC, unless the project consists solely of one single family dwelling.

Comment 25: The Project as proposed meets the review threshold at 301 CMR 11.03(11).

Massachusetts Historical Commission (MHC)

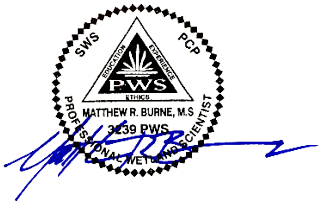
Similar to MEPA review, any "state action" such as a CMP will result in a project review by the Massachusetts Historical Commission (MHC) under 950 CMR 71. Any new construction projects that require funding, licenses, or permits from any state or federal governmental agencies must be reviewed by the MHC for impacts to historic and archaeological properties. Such review is conducted in compliance with M.G.L. Ch 9, §26-27C.

If the Project requires any state or federal permits, a Project Notification Form (PNF) will need to be filed with MHC for this review.

It has been our pleasure to review the Conservation Analysis relative to the Preliminary Subdivision Plan for the Stratton Hill Open Space Residential Subdivision in the Town of Ayer. Please do not hesitate to contact me at 617-896-4594 (office), 857-234-2476 (cell), or at mburne@bscgroup.com with any questions or concerns you may have. BSC appreciates the opportunity to be of assistance to the Commission in this matter.

Sincerely,

BSC Group, Inc.



Matt Burne, PWS
Senior Ecologist