

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

and

STATE OF MAINE
LAND USE PLANNING COMMISSION

IN THE MATTER OF

CENTRAL MAINE POWER COMPANY
Application for Site Location of Development
Act permit and Natural Resources Protection
Act permit for the New England Clean Energy
Connect ("NECEC")

L-27625-26- A-N
L-27625-TB-B-N
L-27625-2C-C-N
L-27625-VP-D-N
L-27625-IW-E-N

SITE LAW CERTIFICATION SLC-9

REBUTTAL TESTIMONY OF GROUP 4
WITNESS RON JOSEPH

On Page 42 of Central Maine Power Company's Pre-Filed Testimony, the company claims that "soft development" breaks in forested cover will create "edge effect," and therefore the project is beneficial because it will boost plant and animal diversity.

While CMP highlights "edge effect" benefits, it conveniently ignores the downside of fragmenting 53 new miles of transmission line from Quebec to the Forks. The transmission line will 1) act as a conduit for the spread of invasive, non-native plants. Japanese knotweed, Phragmites, Asiatic bittersweet, and Japanese barberry, 2) harm scarlet tanagers, goshawks, and other forest interior nesting birds that require intact forests to successfully raise young, 3) degrade the Upper Kennebec DWA, the last remaining significant deer yard in the region.

Deer in western and northern Maine require intact spruce-fir deer wintering areas. Constructing a new transmission line through the Upper Kennebec DWA would indeed create "edge effect" but that would severely compromise the integrity of the deer yard.

On page 43, CMP states that the project will cross 22 mapped deer wintering areas (DWAs), totaling 44.3 acres, as well as 39 acres located within the upper Kennebec DWA. Furthermore, CMP claims that "construction and maintenance in the existing corridor will not significantly affect the functional attributes of the DWAs intersected by the Project for the following reason:

Corridor construction will widen existing, non-forested transmission line corridors by an average of only approximately 75 feet. As such, the functional effects on these DWAs are expected to be indiscernible; after construction these DWAs are expected to function similar to the way they currently do."

The Applicant's claims that the project would result in "indiscernible" impacts and "similar functions" for deer yards are false. The Upper Kennebec DWA is located within Segment One, which entails 53 miles of new transmission line construction. The most significant deer yard along the transmission corridor will essentially be split in half during winter. Deep snows beneath the powerlines will function as a wall, prohibiting deer from crossing between the newly bisected DWA. CMP's proposed "deer corridors," consisting of trees that in eight out of 10 "deer corridors" will not be allowed to grow to full maturity, will not adequately remedy this situation. The new transmission corridor through the DWA will largely prevent deer from moving through it in winter. Deer require intact wintering areas to provide shelter, food, and escape routes from predators.

Furthermore, also on page 43 of its testimony filing, CMP states:

"In summary, the NECEC Project will create a swath of permanently maintained scrub- shrub habitat in an area with a scarcity of such habitat, and characterized by a patchwork of clear-cuts, and young and older tree (primarily softwood) regrowth. The inclusion of scrub-shrub habitat within the larger landscape, while

it will advantage some plant and animal species over others, will not adversely impact overall habitat and species diversity, and may improve it.”

This statement is also patently untrue: one need only look at Google Earth images of the proposed transmission line to clearly see that there’s no “scarcity” of scrub-shrub habitat. On the contrary, there is a scarcity of large contiguous tracts of older trees that serve as DWAs: CMP’s transmission corridor will severely damage one of last remaining DWAs in the region.

On page 60 of its testimony file, CMP proposes, as mitigation for deer yard impacts, “Revegetating disturbed soils adjacent to DWAs with wildlife seed mix specifically formulated to optimize nutritional value to wildlife during late fall and early spring when woods forage is sparse.”

This will not help deer. In fact, an early spring wildlife seed mix for deer may not be beneficial. Deer are browsers, not grazers like elk or cows. Deer will eat green clover in the spring but it causes diarrhea because they lack the micro-fauna and flora in their stomachs to digest grasses. Secondly, a late fall food plot will attract deer, but it’s unnecessary. There are adequate natural fall foods—beechnuts, acorns, beaked hazelnuts—for foraging deer. Therefore, CMP’s wildlife mix in spring and fall will provide no long-term benefit, and it’s certainly not compensation for destroying 39 acres of deer yard.

In closing, despite CMP’s claims to the contrary in its testimony, the CMP corridor will cause significant fragmentation throughout the project area. In Segment 1 of the project, the permanent clear cut will increase numbers of invasive plants, degrading forest habitat for deer and other animals. It will also fragment the most important remaining DWA in the Forks region, and CMP’s proposed “deer corridor” mitigation will not prevent this. It will also further degrade already fragmented deer habitat in the 22 DWAs in the sections where CMP will widen already existing corridor. The planting of “wildlife mix” will not help deer in crucial winter months when food is scarce (the small plants in the “wildlife mix” will be under snow). In sum, the CMP corridor will cause unreasonable impacts to DWAs for which CMP has provided inadequate mitigation.

Notarization

I, Ron Joseph, being first duly sworn, affirm that the above rebuttal testimony is true and accurate to the best of my knowledge.

Date: March 25, 2019

A handwritten signature in black ink that reads "Ron Joseph". The signature is written in a cursive style with a large, looped "R" and a clear "Joseph".

Ron Joseph

The above-named Ron Joseph made affirmation that the above testimony is true and accurate to the best of his knowledge.

Date: March 25,, 2019

A handwritten signature in blue ink that reads "Catherine B. Johnson". The signature is written in a cursive style with a large, looped "C" and a clear "Johnson".

Catherine B. Johnson, Attorney-at-law

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SITE LAW CERTIFICATION SLC-9

REBUTTAL TESTIMONY OF GROUP 4
WITNESS DR. DAVID PUBLICOVER

March 18, 2019

This testimony is presented in rebuttal to pre-filed testimony presented by CMP witnesses Gerry Mirabile, Mark Goodwin and Lauren Johnston (by adoption of Goodwin testimony). Specifically, this rebuttal testimony focuses on the issue of habitat fragmentation (Mirabile and Goodwin sections IV.c.iii). This rebuttal is relevant solely to issues before the DEP.

The testimony of these witnesses reflects the approach taken in the application, and consists of broad general statements, mischaracterization of the surrounding managed forest landscape, incorrect assumptions about the habitat benefits of the new corridor, lack of any assessment of the adverse effects of the new corridor, and unsupported conclusions that are contradicted by the extensive literature on the adverse effects of habitat fragmentation. The

testimony consists of little more than feel-good statements that do not come close to satisfying the burden of proof required by 38 MRSA §486-A.2.

Specific examples include:

- *“CMP sited the NECEC Project to minimize habitat fragmentation. CMP accomplished this by co-locating more than 70% of the new transmission line within or immediately adjacent to existing transmission line corridors, rather than creating a new corridor for the entire transmission line.”* (Mirabile p.11)
- *“Co-location of energy infrastructure is a primary consideration when minimizing impacts to existing land uses and the environment. The proposed development minimizes habitat fragmentation in this manner by utilizing existing transmission line corridors for approximately 73% of the Project.”* (Goodwin p. 15)

The fact that the majority of the line is located within existing corridors is irrelevant to assessing whether the 53.5 miles of new corridor creates an unreasonable adverse effect on the natural environment. The impact of the new corridor would be exactly the same even if it terminated at, and connected to, existing lines without any construction of new co-located line. The fact that additional line was constructed beyond the connection point with the existing corridor does not constitute minimization of impact. By this standard, construction of even more line within existing corridors would constitute even greater minimization.

- *“While this conversion of vegetation from forested to scrub/shrub will favor some species over others, the transmission line corridor will not generally impede the movement or migration of wildlife or plant species.”* (Mirabile p. 12)

The statement that the corridor will not act as a barrier to species movement is made without any supporting evidence and is directly contradicted by other sources. For example,

LUPC's 2010 Comprehensive Land Use Plan states (p. 241)¹, "*Scientists have identified fragmentation of habitat as a serious concern. Roads, utility corridors, certain types of recreation trails, structures and clearings create breaks in the landscape. These breaks can act as barriers to animals and isolate populations of both plants and animals.*" The US Fish and Wildlife Service states² that transmission lines "*act as barriers to wildlife movement and affect migration routes.*" A report by Manitoba Hydro³ stated (p. 49), "*Rights-of-way may displace or impede movements of some birds, marten and other small mammals that inhabit small territories or home ranges in mature forest or that have difficulty crossing nonforested gaps.*" The statement is even contradicted by the Applicant's own application, which states (Section 7.4.1), "*Transmission line corridors present potential direct impacts, as they may affect species movement,...*"

The fact that most species will not be affected, or that the corridor will not "generally" impede species movement, is insufficient. The failure to assess and provide evidence on which species will be adversely affected constitutes a serious flaw in the application.

- "*CMP's vegetation management practices... establishes areas of dense shrubby vegetation and taller vegetation where topographic conditions allow (e.g., steep ravines), thereby providing a vegetation bridge for wildlife movement across the NECEC corridor.*" (Goodwin p. 17)

¹ LUPC. 2010. Comprehensive Land Use Plan. Maine Department of Agriculture, Conservation and Forestry, Land Use Planning Commission, Augusta, ME.

² See <https://www.fws.gov/ecological-services/energy-development/electric-transmission.html>.

³ Manitoba Hydro. 2010. Fur, Feathers, Fins & Transmission Lines: How Transmission Lines and Rights-of-Way Affect Wildlife, 3rd Edition.

Neither the application nor the witness's testimony provides any information as to where or to what extent such topographic conditions will allow taller vegetation to be maintained.

Without such information there is no factual basis for this statement.

- *"CMP's vegetation management practices require riparian buffers, ranging from 75 to 100 feet in width measured from the top of bank, to be maintained at all stream crossings in a manner that will allow taller non-capable vegetation to persist, promoting the movement of wildlife across the corridor and increasing habitat connectivity in these areas."* (Goodwin p. 17)

Mr. Goodwin's Exhibit 3-I provides a diagrammatic representation of how vegetation will be managed within the riparian buffer zones. The diagram makes clear that even though slightly taller vegetation will be maintained outside of the wire zone, capable species (i.e. trees) will be removed and the retained vegetation will be considerably shorter than the surrounding forest. While these buffers may allow for movement of many species across the corridor, they are insufficient to provide habitat for species that avoid areas without forest cover of adequate height and density, such as marten.⁴ There is no discussion of which species may find these buffers inadequate. (In fact, there is no reference to marten, the primary umbrella species associated with mature forest habitat, anywhere in either Application Chapter 7 or CMP's pre-filed testimony.)

- *"In many cases, edge effect results in greater species diversity, and greater population density of certain species, than that observed within individual habitats."* (Mirabile p. 12)

⁴⁴ See pre-filed testimony of David Publicover (p. 13)

While true, this statement completely ignores the context of which species benefit and which species do not. The idea that the greater species diversity in edge habitats constitutes a benefit to wildlife is outmoded and contradicted by current understanding of the adverse impacts of forest edges (especially permanent high-contrast edges such as will be created and maintained by the corridor).

For example, Matlack and Litvaitis (1999, p. 210-211) ⁵state, “*For decades, forest managers emphasized edge creation in response to the observation that some forms of wildlife (notably popular game species) were abundant at edges. Now, however, edge habitat is recognized as being incompatible with the requirements of many forest species, and the proliferation of forest edges has threatened the diversity of many forest communities.*” They also state (p. 222), “*Protection of most forest species is best served by uncut forest, well away from the peculiar dynamics of human-generated forest edges.*” Hunter (1990, p. 107)⁶ notes that “*Some wildlife biologists have pointed out that even if edges are zones of high diversity and density, this does not necessarily make them ideal wildlife habitat.*”

The Applicant completely fails to provide any assessment of which species may be adversely affected by the creation of extensive permanent edge. This is critical information; Pfeifer (2017)⁷ found that species that avoided edges (and were dependent on interior forest) were more likely to be habitat specialists of high conservation concern, while species attracted to edges were more likely to be common generalist species.

⁵ Matlack, G.R. and J.A. Litvaitis. 1999. Chapter 6: Forest edges. Pp 210- 227 in: Maintaining Biodiversity in Forested Ecosystems (M.L. Hunter Jr., ed.). Cambridge University Press, Cambridge, UK.

⁶ Hunter, M.L. Jr. 1999. Wildlife, Forests and Forestry: Principles of Managing Forests for Biological Diversity. Prentiss Hall, Inc., Englewood Cliffs, NJ.

⁷ Pfeifer, M. et al. 2017. Creation of forest edges has a global impact on forest vertebrates. Nature 551: 187-191.

- *“In summary, the NECEC Project will create a swath of permanently maintained scrub-shrub habitat in an area with a scarcity of such habitat, and characterized by a patchwork of clearcuts, and young and older tree (primarily softwood) regrowth. The inclusion of scrub-shrub habitat within the larger landscape, while it will advantage some plant and animal species over others, will not adversely impact overall habitat and species diversity, and may improve it.”* (Mirabile p. 13-14)

The idea that clearing one of the largest permanent fragmenting features through a region that is globally significant because of its high level of ecological connectivity⁸ would improve overall habitat and species diversity is, to be blunt, ridiculous, and is contradicted by the extensive scientific literature on the adverse impacts of fragmentation.

There is not a scarcity of early successional habitat in the western Maine Mountains region, and the Applicant provides no evidence or analysis to support this statement. The state’s Wildlife Conservation Plan makes clear in multiple places that the type of habitat that would be maintained in the corridor (classified as Grassland-Shrubland-Early Successional) is limited in southern Maine where timber harvesting is limited and most forest is in a more mature condition. In contrast, it is mature forest that is limiting in the forests of northern and western Maine that are dominated by large actively managed commercial ownerships.

Data derived from the US Forest Service Forest Inventory and Analysis shows that over one-third of the forest in the vicinity of the new corridor consists of seedling and sapling stands (reflecting the high level of timber harvesting in the region) while less than 8% consists of sawtimber stands more than 100 years old (supporting the Wildlife Action Plan contention that

⁸ See pre-filed testimony of David Publicover, Janet McMahon (Group 1), and Rob Wood/Andy Cutko/Bryan Emerson (Group 6).

mature forest habitat is scarce in northern Maine).⁹ However, neither the Applicant nor their witnesses' testimony provide any assessment of the project's impact on mature forest habitat.

The Applicant wants to have it both ways – the project will not have a significant fragmenting impact because the region is already subject to heavy timber harvesting, but will provide a benefit through the maintenance of early successional habitat (which is already common in the region).

- *“According to the EPA ‘the IVM approach can create natural, diverse, and sustaining ecosystems, such as a meadow transition habitat. These transition landscapes, in turn, reduce wildlife habitat fragmentation and allow species to be geographically diverse, remaining in areas from which they might otherwise be excluded. A variety of wildlife species (including threatened and endangered species) consider these habitats home, such as butterflies, songbirds, small mammals, and deer. These habitats also encourage the growth of native plant species and can increase plant diversity.’”* (Goodwin p. 17)

Mr. Goodwin quotes the EPA¹⁰ in support of the habitat benefits of the new corridor. However, he conveniently excludes the opening sentences of this paragraph from the EPA web page, which read, *“While vegetation management on ROW is essential for providing safe and reliable electric power, these ROW also provide important wildlife habitats. As wildlife habitats in the United States are lost to development, these ROW become increasingly important.”*

(emphasis added)

⁹ These figures were derived from the USFS FIA Evaluator web site. They reflect FIA plots within an 18-mile radius of the approximate center of the new corridor between the Canadian border and Route 201 about 1 mile east of Whipple Pond. Because of the relatively small area these figures have a high margin of error but reflect the relative proportions of these types of habitats.

¹⁰ <https://www.epa.gov/pepp/benefits-integrated-vegetation-management-ivm-rights-way#benefit>.


This excluded sentence, as well as the phrase that Mr. Goodwin did include (“*from which they might otherwise be excluded*”) make clear that the habitat benefits cited by the EPA are intended to refer to developed landscapes where natural habitat is being lost and is increasingly limited. In these landscapes transmission line corridors can provide habitat benefits. However, it is not applicable to the landscape through which the new corridor would pass, which is comprised of extensive relatively natural forest that is not being lost to development and from which species are not being excluded. In this landscape it is the corridor that will cause the loss of habitat for native species. This omission by Mr. Goodwin creates an inappropriate impression of habitat benefits that do not apply to this landscape.

Dated: 3/18/19

by: 
David Publicover

Date: 3-18-19

The above-named David Publicover did personally appear before me and made oath as to the truth of the foregoing rebuttal testimony.


Notary Public
My Commission Expires 4-19-22

DENISE M. HORNE
Notary Public - New Hampshire
My Commission Expires April 19, 2022

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SITE LAW CERTIFICATION SLC-9

REBUTTAL TESTIMONY OF GROUP 4
WITNESS NAME: Jeffrey Reardon

DATE: March 18, 2019

This testimony is presented in rebuttal to pre-filed testimony presented by CMP witness Mark Goodwin regarding brook trout habitat and riparian buffers. This includes Issue 2 covered in Mr. Goodwin's testimony: Wildlife Habitat and Fisheries. This rebuttal testimony focuses on the discussion of impacts to brook trout habitat in Goodwin's testimony Sections IV, C, ii: Brook Trout Habitat; IV, C, iv: Buffer Strips Around Coldwater Fisheries, and Section IV, C, v: Issue 2: Conclusion. It is related solely to the issues before DEP.

Goodwin concludes that:

- *[I]t is my opinion that there will be no unreasonable disturbance to or unreasonable impact on . . . Brook Trout habitat and the project will not result in unreasonable habitat fragmentation. . . . CMP has made adequate provision for buffer strips around cold-water fisheries. (Goodwin testimony, page 22.)*

In reaching this conclusion, Goodwin relies heavily on two studies that assessed impacts of cleared transmission rights of way on cold-water fish habitat and populations: (1) Gleason, N.C. 2008. Impacts of Powerline Rights of Way on Forested Stream Habitat Western Washington,

Environmental Symposium in Rights of Way Management, 8th International Symposium, pages 665-678; and (2) Peterson, A.M. 1993 Effects of Electric Transmission Rights-of-Way on Trout in Forested Headwater Streams in New York. North American Journal of Fisheries Management, vol. 13 pp. 581-585.

I was not able to find a complete copy of the Gleason study. A colleague, TU's Senior Scientist Helen Neville, did find a copy of its abstract, which is provided below in the text of my rebuttal comments. The Peterson study is attached.

With respect to the Gleason study, Goodwin states:

- *"A study by N.C. Gleason on the impacts of power line rights of way ("ROW") on forested stream habitat found that despite the open canopy condition, water temperatures were slightly lower than in off-ROW areas and that none of the water quality parameters was significantly different between the on-ROW and off-ROW study areas. Gleason's study also found no correlation between percent canopy cover and mean percentage of fines and found no significant difference in the Benthic Index of Biotic Integrity scores between on-ROW and upstream areas."* (Goodwin testimony, page 14.)

Gleason's study did not assess the immediate impacts of ROW construction, but instead investigated existing conditions on 30-50-year-old ROWs, noting that "It is likely that the streams intersected by rights-of-way have recovered from the initial disturbances that occurred 30 to 50 years ago." The study addressed impacts on Pacific salmon species, a suite of anadromous fish in the Pacific basin with very different habitat needs and patterns of habitat use than brook trout in inland streams in Maine. Although Goodwin accurately cites some of Gleason's findings that certain parameters were not significantly different between ROW and non-ROW sites, he does not disclose Gleason's finding that canopy cover was significantly lower in ROW sites (29%) compared to non-ROW sites (75%). More importantly, he does not state Gleason's conclusion:

- *Overall, the elements show a decrease from ideal salmonid habitat conditions.* (Gleason, 2008, Abstract.)

Here is the full abstract of Gleason's study (emphasis added):

- *Abstract: Pacific Salmon *Oncorhynchus* spp. have inhabited streams of the Pacific Northwest for thousands of years. In the past century, however, many populations have suffered severe declines and even extinction, largely due to settlement of the West Coast. Hydroelectric dams, an artifact of industrialization, necessitate swaths through forests to extend powerlines from generating facilities to consumers. Rights-of-way are cleared of trees, and roads are built for equipment access. Many rights-of-way that cross streams in forested areas cause disturbances to riparian zones. Salmonids are sensitive to disturbances that lead to altered temperatures, lack of dissolved oxygen, and*

increased sedimentation. This project's objective was to quantify effects of rights-of-way on forested streams by comparing right-of-way and paired upstream habitat. Measurements included benthic macroinvertebrates, canopy cover, fish presence, water quality, and percentage of fine particles (<0.85 mm) in streambed gravel to determine suitability as spawning habitat. The only parameter that was significantly different was canopy cover with a mean of 29% in rights-of-way and 75% upstream. The parameters were expected to show degradation in the right-of-way due to opened canopy and gravel roads. Overall, the elements show a decrease from ideal salmonid habitat conditions. It is likely that the streams intersected by rights-of-way have recovered from the initial disturbances that occurred 30 to 50 years ago and have restabilized to a natural regime. It is also possible that any degradation caused by rights-of-way is masked by wider scale disturbances such as timber harvest and off-road vehicle activities.

Similarly, Mr. Goodwin selectively reports findings from the Peterson study. Goodwin writes:

- *A.M. Peterson has reported that removal of tree canopy (on new transmission line corridors) increases stream insolation during the short term, but within two years the areas are bordered by dense shrubs and emergent vegetation and water temperatures are not significantly higher than upstream forested reaches. Similarly, Peterson found that stream reaches in electric transmission ROWs were exposed to more light, had denser stream bank vegetation, were deeper and narrower, and had a greater area composed of pools. Peterson's study found that trout were more abundant in stream reaches within ROWs . . . (Goodwin testimony, page 15.)*

This summary obscures some critical details of Peterson's study. The full study as published is attached below. Among the concerns:

- This study was funded by the New York State Electric and Gas Corporation, for whom Peterson worked. This does not negate the study's findings but does call into question their interpretation and discussion by Peterson.
- Goodwin does not note Peterson's finding of a highly significant difference in physical attributes between the ROW and forest stream reaches—that Mean Shade was 83.3% in forested reaches and only 31.5% in ROW reaches.
- The results regarding stream temperatures are suspect because warm streams were omitted from the study. The Methods section of the study notes that "Intermittent, warm or polluted streams were not selected." This could significantly skew the results, if, for example, sites with groundwater inputs that maintained cool stream temperatures were kept in the study and sites without groundwater influence with warmer stream temperatures were excluded. In my professional judgement, the relatively cool stream temperatures (mean 17.0 for forested streams and 17.4 for ROW streams) recorded

during mid-day, summer conditions would strongly suggest groundwater influence if recorded under similar conditions in Maine. It should also be noted that, although the difference was not statistically significant, forested streams averaged 0.4 degrees cooler than ROW streams.

- The data and conclusions regarding trout numbers and biomass are difficult to interpret. The abstract of the study reports collection of data at 15 headwater stream crossings, but only 10 of these streams were electro fished to collect fish population data. Trout numbers were higher within the ROW reaches than in forested reaches, but trout biomass was not significantly higher. Peterson reports that a very high proportion of the fish collected were young of year (57.7%) or juveniles (39.6%), with very few adult trout (2.7%). A relatively small shift in habitat suitability towards juvenile trout vs. adult trout—for example, due to the documented reduction in mean shade (83.3% in forested reaches vs. 31.5% in ROWs)—could significantly skew trout numbers when these reaches were compared in a population so dominated by young-of-year and juvenile trout. Peterson in fact reports that this shift towards younger age classes was observed in the ROW reaches and may account for the increase in trout numbers there.
- It is of concern that while trout biomass was not significantly higher in ROW reaches than in forested reaches, total fish numbers and total fish biomass were both significantly higher. This indicates that abundance and biomass of non-trout species was significantly higher within ROWs. Peterson did not report the species of fish other than trout collected in New York, but in Maine this would likely reflect a shift to species, many of them non-native, that are significant competitors with brook trout and have been identified as a long-term threat.

Goodwin also fails to acknowledge an extensive literature that documents the importance of intact, forested riparian buffers for brook trout and other fish and wildlife. Much of this literature is specific to Maine. For example, in a review by the Maine Natural Areas Program citing six different “ecological” buffer treatments applies in Maine and New Hampshire, deMaynadier *et al*¹ emphasize the need to maintain greater than 70% canopy closure within the riparian zone, and to include 25-100-foot no-cut zones immediately adjacent to streams. The Maine Department of Inland Fisheries and Wildlife recommends “limiting the harvest of trees and alteration of other vegetation within 100 feet of streams and their associated fringe and floodplain wetlands to maintain an intact and stable mature stand of trees, characterized by heavy crown closure (at least 60 – 70%)” to protect brook trout habitat.² Similarly, Haberstock³ notes

¹ deMaynadier, P., T. Hodgman, and B. Vickery. 2007. Forest Management Recommendations for Maine's Riparian Ecosystems. Technical report submitted to the Maine Department of Inland Fisheries and Wildlife, Bangor, ME.

² ME DIFW, undated. Forest Management Recommendations for Brook Trout.

https://www.maine.gov/ifw/docs/brook_trout_factsheet_forestry.pdf

³ Trout Unlimited. 2005. Riparian Buffer and Watershed Management Recommendations for Brook Trout Habitat Conservation. Focus: Mountainous Brook Trout Watersheds of Maine and Northern New Hampshire. Report Prepared for Trout Unlimited, Augusta, Maine, by Kleinschmidt Associates, Pittsfield, Maine. Page 9.

that “a high degree of canopy closure adjacent to streams is necessary for buffers to function at optimal levels” and “is associated with several functions important for salmonid habitat including shading and organic matter inputs.” Habershtock also notes that “Intact forested riparian areas also provide organic debris inputs which directly enhance brook trout habitat through the provision of in-stream structure like tree boles, root wads and large branches.”⁴ Two of these references were attached to my pre-filed testimony. The third is attached here.

Goodwin’s testimony on buffers emphasizes CMP’s concession to allow 75-100-foot buffers to stream crossings. But this focus on width, rather than on the nature of vegetation allowed to remain within the buffer, ignores the importance of canopy closure, presence of mature tree, forested buffers, and inputs of large woody debris to instream habitat. He emphasizes buffer functions that can be provided by low ground cover or even grasses, like sediment and nutrient removal, but ignores buffer functions like large woody debris and organic matter inputs that are provided by mature trees that will not be allowed within CMPs buffers. He also exaggerates the degree to which the non-capable vegetation allowed to remain within CMPs proposed buffers will provide functions like shade. For example, Goodwin states:

- *Allowing non-capable vegetation to remain as described within the appropriate buffer will provide shading and reduce the warming effect of direct sunlight (insolation). Low ground cover will also remain within these buffers to filter any sediment or other pollutants in surface runoff. These conditions will allow the stream buffers to provide functions and values similar to those prior to transmission line construction. (Goodwin testimony, p 21.)*

This statement is directly contradicted by the only two references Goodwin cites. Gleason noted that:

- *The only parameter that was significantly different was canopy cover with a mean of 29% in rights-of-way and 75% upstream. . . Overall, the elements show a decrease from ideal salmonid habitat conditions.*

Similarly, Peterson documented that reaches in ROWS had significantly less shade than nearby forested reaches. Exhibit CMP-3-I, “Vegetation Maintenance—High Voltage Direct Current Tangent Structure Detail” clearly shows that no woody vegetation will be allowed within the 54-foot width of the “wire zone”, and that even beyond the wire zone, vegetation heights will be no more than about 15 feet. Shading from vegetation at these heights will be minimal, and large

⁴ Trout Unlimited. 2005. Riparian Buffer and Watershed Management Recommendations for Brook Trout Habitat Conservation. Focus: Mountainous Brook Trout Watersheds of Maine and Northern New Hampshire. Report Prepared for Trout Unlimited, Augusta, Maine, by Kleinschmidt Associates, Pittsfield, Maine. P. 10.

wood and other organic inputs will not occur because woody vegetation will not reach maturity, die, and be recruited into the stream channel before it is cut on the proposed 4-year cycle.

The riparian buffers proposed by CMP will be substantially reduced in function from their current status, with shading greatly reduced and large wood inputs to the stream eliminated within CMPs buffer zones. CMP significantly understates the impacts of its riparian clearing on brook trout habitat and has not made adequate provisions for buffer strips around cold-water fisheries. Indeed, in Mr. Goodwin's testimony regarding Issue IV: Compensation and Mitigation, he acknowledges these impacts:

- *The NECEC will have 11.02 linear miles of streams that will be subject to forested conversion impact.* (Goodwin testimony, p. 23.)

In evaluating the degree of impact to those 11 miles, the DEP should consider that:

- (1) The studies cited by CMP suggest that these buffers will provide far less shade than forested streams—a reduction of 75% shaded to 29% shaded in Gleason's study and 83.3% shade to 31.5% shade in Peterson;
- (2) The proposed initial clearing will remove all woody vegetation taller than 10 feet from the 150-foot width of the ROW;
- (3) The routine vegetation maintenance that will occur on a 4-year cycle will periodically cut all woody vegetation taller than 10 feet to ground level and remove this "slash" from the riparian zone. All "capable" trees within the ROW will be similarly hand cut and removed; and
- (4) Because of #2 and #3, all buffer functions that rely on large mature trees—canopy closure and related shading and temperature regulation; large woody debris recruitments; organic inputs from leaf litter—will be severely compromised.

Attachments

1. Peterson, A.M. 1993 Effects of Electric Transmission Rights-of-Way on Trout in Forested Headwater Streams in New York. North American Journal of Fisheries Management, vol. 13 pp. 581-585.
2. ME DIFW, undated. Forest Management Recommendations for Brook Trout.
https://www.maine.gov/ifw/docs/brook_trout_factsheet_forestry.pdf

Notarization

I, Jeffrey Reardon, being first duly sworn, affirm that the above testimony is true and accurate to the best of my knowledge.

Jeff M. Pearson 3/18/2019
Name Date

Maine Brook Trout Project Director

Title

Personally appeared the above-named Jeffrey Reardon and made affirmation that the above testimony is true and accurate to the best of his knowledge.

Date: 3/18/19 Notary: Ann G

Ann Young
Notary Public, State of Maine
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Effects of Electric Transmission Rights-of-Way on Trout in Forested Headwater Streams in New York

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Abstract.—Fifteen crossings of headwater streams by electric transmission rights-of-way (ROWs) in forested areas of New York State were studied to determine the effects of ROWs on habitat and populations of brook trout *Salvelinus fontinalis* and rainbow trout *Oncorhynchus mykiss*. Trout habitat and abundance in ROWs were compared with those in adjacent upstream reaches within the forest. The stream reaches in the ROWs were exposed to more light, had more dense streambank vegetation, were deeper and narrower, and had greater area composed of pools; water temperature was not significantly greater. Trout were more abundant in reaches within ROWs. The greater mean depth and more numerous pools within ROWs were believed to have caused higher densities of trout.

Headwater streams with brook trout *Salvelinus fontinalis* and rainbow trout *Oncorhynchus mykiss* are vulnerable to adverse effects from logging and road building (Chapman 1962; Burns 1972; Lynch et al. 1977). The crossing of headwater streams with electric transmission rights-of-way (ROWs) may also degrade trout streams. Such crossings usually involve the permanent removal of trees and construction of an equipment access road across the stream channel. These changes may affect water temperature, the stream channel's cross-sectional geometry, instream cover, fish food availability, and fine sediment deposition.

This study was conducted to determine (1) the effect of electric transmission ROWs upon the physical characteristics of headwater trout streams in forested areas, and (2) the effect of these changes upon trout abundance.

Study Area

This study was conducted in south-central New York State, in Delaware, Sullivan, and Chenango counties, within the Delaware Hills and Catskill Mountains of the Appalachian Uplands. Bedrock was primarily sandstone. Elevation varied from 300 to 1,000 m above mean sea level. The entire area has been glaciated, and soils are thin glacial tills except along major river valleys, where alluvial deposits occur (Thompson 1966). The area lies within the northern hardwoods section of the Laurentian mixed forest province (Bailey 1976). Forest cover is primarily sugar maple *Acer saccharum*, yellow birch *Betula allegheniensis*, American beech *Fagus grandifolia*, and eastern hemlock *Tsuga canadensis*. The area was heavily logged in the 1800s; however, mature second-growth forest

now covers approximately 75% of the land (Brooks 1981). Headwater streams tend to be clear, cold, and relatively unproductive.

ROW description.—The physical characteristics of the ROWs studied were variable. Lower-voltage lines (34 and 46 kV) were in cleared ROWs 10–30 m wide; higher-voltage lines (115, 230, and 345 kV) were in cleared ROWs 30–50 m wide. Where parallel sets of lines were constructed, ROW width was as wide as 130 m. Although ROWs usually crossed the streams at a right angle, they sometimes paralleled a stream for up to 450 m. The ROWs were 10–50 years old, and most no longer had active road access.

The vegetation among the ROWs was similar. Trees were absent or limited to scattered saplings, but there was dense growth of forbs and shrubs. Common taxa included hay-scented fern *Dennstaedtia punctilobula*, goldenrod *Solidago* spp., blackberry *Rubus* spp., and grasses. Alders *Alnus* spp. frequently occurred along the streambanks. Hardwood sprouts frequently grew from cut stumps on the streambanks.

Methods

Stream survey.—Stream surveys were conducted during July and August 1988 and 1989. Fifteen ROW crossings of forested headwater streams (first- or second-order) were selected. Care was taken to select stream crossings with no impacts from cattle grazing, logging, or beaver activity. Intermittent, warm, or polluted streams were not selected. The entire cleared ROW stream reach was studied. However, at one reach that flowed parallel to the ROW for 450 m, only the lower 30 m was studied. This was done as a practicality—to keep the reach-

es of generally equal lengths, and to detect a worst-case increase in stream temperature and other potential ROW effects. The ROW reaches averaged 29 m long but varied from 15 to 45 m long. An upstream reach of the same length and morphology (i.e., gradient, discharge, and channel pattern) was located in the forest immediately (<10 m) adjacent to the ROW edge for comparison. However, one ROW reach was 44% longer than the upstream reach due to the presence of a long, deep pool in the ROW.

The intent of the design was to enable an extensive posttreatment sample from which the effects of the ROWs on trout habitat and abundance could be assessed. One goal of this posttreatment sample was to detect not only mean habitat changes but also the "worst cases" to help identify potential adverse effects of future ROW clearing, construction, and maintenance. This is why polluted, logged, or otherwise already disturbed stream reaches were not selected. It is also why stream temperature, riffle fines, and shade were sampled in such a manner as to detect maximum differences, not mean differences.

The habitat variables selected for study were chosen from the brook trout habitat suitability index (HSI) model (Raleigh 1982). The model contains suggested methods for measurement of the variables along with more detailed descriptions of sampling procedures.

Sampling transects were established systematically across each stream reach, usually at 3-m intervals. 7–16 transects were sampled per reach depending on the length of the reach. On three shorter reaches (15, 15, and 20 m), the distance between transects was reduced to 2 m. Water velocity was measured with a Montedoro-Whitney PVM-2A velocity monitor at the middepth and midchannel of each transect. The measurements for all transects were summarized as mean velocity (m/s) for each stream reach. Wetted width was measured to the nearest 0.25 m. Water depth was measured at 0.25, 0.50, and 0.75 the width on each transect. The deepest measurement was considered to be the thalweg depth. Mean wetted width and mean water depth were computed for each stream reach. At each point where stream depth was measured (three locations per transect) the presence or absence of shade at the water's surface was recorded. A reach with 10 transects would then have 30 shade readings. The percent of points that were shaded for each reach was then calculated. All shade readings were collected between 1000 and 1600 hours, when the sun was high in the sky. Within

paired reaches, shade readings were taken within one hour of each other to minimize variation due to change in the sun's angle.

The surface area of pools and riffles was measured and mapped to scale on planform maps. The percentage of the stream reach that was pool or riffle was calculated for each reach.

Dominant substrate size was visually categorized at each transect following Raleigh (1982): 1.0 = rubble or small boulders dominant, with limited fines, large boulders, or bedrock; 0.6 = boulders, rubble, gravel, and fines equally present, or gravel is dominant; or 0.3 = large boulders, bedrock, or fines dominant, little rubble or gravel. The mean numeric values for all transects were then calculated.

Fines in riffles were sampled in the first riffle upstream and downstream from each ROW; the upstream sample represented forest conditions; the downstream sample, though in forest, represented the effects of ROWs. At each riffle, 10 samples of the top 5 cm of substrate were collected in 250-mL wide-mouthed jars. Each jar was filled in a single upstream sweep. The generally low water velocities and depths prevented significant loss of fines. These samples were returned to the laboratory, where they were passed through a 3-mm sieve. The percent of fines (<3 mm) was then determined for each sample by volume displacement, and the mean was computed.

The length of streambank and stump and tree undercuts that were greater than 5 cm and had an underlying water depth of at least 5 cm were measured within each reach and mapped to scale on planform maps. The undercuts' lengths were summed to determine the percentage of overhead bank cover within each reach.

The presence and location of streambank vegetation (grasses, shrubs, and trees) were mapped to scale on planform maps. The percentage of the stream reach dominated by grasses and shrubs, as opposed to trees, was calculated for each reach.

Water temperature was measured with a Corning PS-15 probe. One reading was taken midstream at the farthest downstream sampling transect of each ROW and upstream reach between 1000 and 1600 hours and during sunny weather. Preliminary sampling indicated that worst-case increases in water temperature occurred midchannel at the downstream end of the ROW reach.

The trout were sampled by electrofishing during August 1989. Only 10 of the 15 study streams were sampled because access restrictions prohibited sampling the remaining five streams. At each reach,

TABLE 1.—Average electrofishing trout catches as percentages of total population estimates of age-0 and older trout in seven streams in New York, 1989. Reach was designated as either on or off an electric transmission right-of-way (ROW).

Stream	Reach	Catch (% of total)	
		Grams	Numbers
Denman Brook	On ROW	99	97
	Off ROW	60	80
Lybolt Brook	On ROW	96	79
	Off ROW	98	93
Neversink Tributary	On ROW	97	96
	Off ROW	91	73
Ward Road Brook	On ROW	99	80
	Off ROW	91	85
Average		91	85

block nets were placed at the upstream and downstream ends. Three upstream passes were made with a Smith-Root pulsed-DC backpack shocker. All stunned fish were netted, counted, identified to species, measured to the nearest millimeter (total length), and weighed to the nearest 0.1 g.

All electrofishing data were corrected to standard 30-m reaches. Three-pass depletion estimates of trout standing stock (g/reach) and population (number/reach) were calculated (DeLury 1951) based upon results from 7 of the 20 sites. Sampling efficiency often exceeded 90% (Table 1).

A paired *t*-test was used to detect significant ($P \leq 0.05$) changes between habitat variables in ROWs and off and significant changes in the fish population characteristics in ROWs and off. Because the substrate value data were discontinuous, they were analyzed with the Wilcoxon signed-rank test (Snedecor and Cochran 1967). Paired *t*-tests were performed with the Statistical Analysis System (SAS Institute 1985a, 1985b).

Results

Stream Survey

Five of the 10 stream habitat variables differed significantly between the ROWs and the upstream forested reach (Table 2). The reaches in the ROWs received more direct sunlight, had more low streambank vegetation, were narrower and deeper, and had more pool area. The greater mean depth in ROWs resulted from a higher average minimum depth recorded at each transect (8.4 cm for ROW transects versus 6.4 cm for forest transects), whereas thalweg (maximum) depth was not different (13.6 cm versus 13.5 cm). Although the amount of bank cover did not differ between forested and ROW

TABLE 2.—Mean physical attributes of 15 headwater trout streams in New York, 1989. Thirty-meter reaches in cleared electric transmission ROWs were compared with adjacent upstream 30-m reaches in the forest by paired *t*-tests. The *P*-values represent the probability that the mean difference between the forested and ROW reaches was equal to zero.

Variable	Stream reach		<i>P</i>
	Forest	ROW	
Mean velocity (m/s)	0.19	0.21	0.40
Mean width (m)	3.6	2.8	0.04
Mean depth (cm)	9.5	12.1	0.02
Area of pools (%)	25.7	38.3	0.02
Substrate size	0.80	0.82	0.80 ^a
Mean riffle fines (%)	23.4	20.5 ^b	0.09
Mean shade (%)	83.3	31.5	0.01
Bank cover (%)	14.7	23.3	0.26
Earthen portion	10.1	19.5	0.05
Woody portion	4.6	3.8	0.75
Bank shrubs and grass (%)	4.6	91.8	0.01
Temperature (°C)	17.0	17.4	0.24

^a Wilcoxon signed-rank test.

^b Collected from first riffle in forest downstream of ROW edge.

reaches, its composition did. There were significantly more undercut earthen banks in the ROW than in the forested reaches, yet no significant difference in undercut stumps, trees, and logs (Table 2).

Trout abundance estimates were significantly higher in ROWs than in forested reaches (Table 3). Nine of 10 streams had more trout in the ROW than in upstream reaches. Although the difference in trout standing stock estimates between forested and ROW reaches was not significant, the difference in the standing stock of all fish (trout and nonsalmonids combined) per reach was significant (Table 3). The trout population structure was weighted heavily towards small fish in both ROW and forested reaches. Young-of-year trout (≤ 9.9

TABLE 3.—Mean population and standing stock estimates of 10 headwater stream fish communities in New York, 1989. Fishes in 30-m reaches in cleared electric transmission ROWs were compared with those in adjacent upstream 30-m reaches in the forest by paired *t*-tests.

Variable	Stream reach		<i>P</i>
	ROW	Forest	
Number of trout/reach ^a	30.8	18.9	0.01
Grams of trout/reach	342	228	0.12
Number of all fish/reach ^b	118.5	62.8	0.03
Grams of all fish/reach	585	368	0.04

^a All were brook trout except for nine rainbow trout in one ROW reach and five in the paired forested reach.

^b Includes all brook and rainbow trout.

cm) constituted 57.7% of the sample; 39.6% of the trout were juveniles (10–17.3 cm) and only 2.7% were adults (≥ 17.4 cm).

Discussion

Removal of the forest canopy in ROWs caused a significant increase in incident sunshine, which in turn encouraged a dense growth of low stream-bank vegetation. The ROWs were always bordered by a robust forb and shrub layer, and vegetation often overhung the stream channel. The grasses approached 1 m in height and usually obscured the ground completely. The darkened forest streambanks, in contrast, usually held only scattered herbs and an occasional sapling or mature tree.

The added root mass of the forb and shrub layer appears to have stabilized the streambanks and increased their resistance to erosion. In addition, the channel point bars, which were normally unvegetated even when exposed at low flows, became covered with a dense growth of tall grasses and forbs. This combination of bank and bar stabilization restricted increases in stream width during peak flows and probably resulted in increased bed erosion instead. The increased bed erosion is the probable cause of the observed increases in depth and areas of pools. This interpretation is consistent with the hydraulic geometry demonstrated by Leopold and Maddock (1953) whereby, at a constant discharge and velocity (which were present between paired reaches), any decrease in channel width must be compensated for by a corresponding increase in depth.

These changes in streambank vegetation and hydraulic geometry appear to have caused the significant difference in the nature of the bank cover. The dense root mass of the ROWs' forb and shrub layer apparently prevented the undercut upper soil horizons from sloughing off into the current as they tended to do in the forested reaches. However, the initial ROW clearing removed large streambank trees. Time and floods removed the stumps, and ROW vegetation management insured that large trees did not reappear. As a result, the relatively few undercut trees in the ROW reaches tended to be replaced with a greater amount of undercut banks.

The differences observed in trout abundance between forested and ROW reaches were likely caused by the greater water depth and pool area in the ROWs. Many of the riffle areas in the forested reaches were too shallow for fish. However, the riffles in the ROWs were deeper and yielded large

numbers of fish during the electrofishing effort. Smith (1980) noted a similar relationship in populations of brown trout *Salmo trutta* between forest and meadow reaches of a small tributary of the River Tweed, Scotland. Scarnecchia and Bergersen (1987) also found that narrower and deeper small streams yielded increased salmonid production. The ROW reach trout populations consisted of greater numbers of small trout compared with the forested reaches. This suggests that ROW stream reaches may be better habitat for young fish, perhaps increasing their survival.

Electric transmission ROWs need not constitute an adverse effect on headwater trout population densities in forested basins. They can generate positive effects as long as they do not cause stream warming to greater than 20°C and as long as long-term damage by construction equipment is avoided. The data herein suggest that the selective removal of riparian trees may increase the amount of habitable area for trout by increasing mean water depth. The greatest advantages of selective tree removal may be seen if riffles are opened to sunlight but pools are left shaded. Most of the trout in the streams studied were young of year and juveniles, and the major fishery benefit to such streams may be increased downstream recruitment to the fishery. Trees that are undercut and provide bank cover for adult trout should not be cut. Stream temperatures in managed reaches should be monitored to ensure that opening of the riparian canopy does not cause significant stream warming.

Acknowledgments

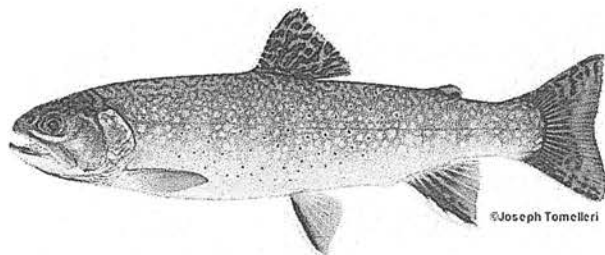
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MAINE DEPARTMENT OF
INLAND FISHERIES AND WILDLIFE



Forest Management Recommendations
for Brook Trout

Background

Brook trout (*Salvelinus fontinalis*), commonly referred to as squaretail, brookie, and speckled trout, are native to Maine and are the most preferred sport fish sought by Maine anglers. Size may vary, depending on water temperature, productivity, and food sources, but 3 year-old brook trout in Maine lakes may range from 7.5 to 17.5 inches long. Stream populations are typically slower growing, and lengths of 6 to 10 inches are more common place, although some populations mature and reproduce at lengths smaller than 6 inches.

Maine is the last stronghold for wild brook trout in the eastern United States. There are more than twice as many watersheds supporting wild populations in Maine than all of the other 16 states within the historical eastern brook trout range combined. Maine is also the only remaining state with extensive intact lake and pond dwelling populations of wild brook trout.

Brook trout require clean, cool, well oxygenated water and are very sensitive to changes in habitat and water quality. Rivers and streams typically provide spawning and nursery habitat. Adults are commonly resident in streams, but migrate throughout and between drainages to meet seasonal life history requirements.

Stream habitat suitability is maintained by the presence of intact, mature wooded riparian corridors that conserve forest soils, provide shade to reduce stream warming, protect stream water quality, provide cover for fish, and provide a source of woody debris and leaf litter from mature trees that maintain in-stream habitat for fish and the aquatic insects they feed upon. Floodplain and fringe wetlands associated with streams can be a significant source of springs and groundwater discharge that maintain stream flows and cool temperatures during warm low flow summer periods. Protection of these important riparian and wetland functions ensures that the overall health of the stream habitat and watershed is maintained.

Maine brook trout fisheries are unique and highly valuable, but they are vulnerable to habitat alteration that may be caused by poorly planned and implemented land management activities. Well planned forestry operations can protect habitat and help ensure that forests remain as forest; a compatible land use for brook trout and many other fish and wildlife.

Group 4
Exhibit
20-JR
Rebuttal

Forest Management Recommendations

Brook trout are not afforded any special state or federal regulatory protection for forestry operations, and as such management recommendations are advisory.

The MDIFW recommends following Best Management Practices (BMPs) during all road and trail building activities, as well as timber harvesting. BMPs are detailed in the booklet titled *Best Management Practices for Forestry*, which offers guidance on managing and protecting water quality, installing road-stream crossings, and providing fish passage. This booklet is available at: http://www.maine.gov/doc/mfs/pubs/bmp_manual.htm or contact the Maine Forest Service at 1-800-367-0223.

Potential harmful impacts to fish and wildlife may be further minimized by designating low impact "riparian management zones" adjacent to streams and stream-associated fringe and floodplain wetlands in forest management and harvest plans. Smaller streams may be greatly influenced by land management practices; these systems benefit the most from well-managed and intact riparian corridors.

The MDIFW also recommends limiting the harvest of trees and alteration of other vegetation within 100 feet of streams and their associated fringe and floodplain wetlands to maintain an intact and stable mature stand of trees, characterized by heavy crown closure (at least 60 – 70%) and resistance to wind-throw. In some situations wider buffers should be considered where severe site conditions (e.g., steep slope, vulnerable soils, poor drainage, etc) increase risk to soil and stand stability. Any harvest within the riparian management zone should be selective with a goal of maintaining relatively uniform crown closure.

Roast beef

Horseradish

Dijon mustard

Fresh rosemary

Fresh Thyme

Parsnips

Cauliflower

Celery root

Cooking greens