STATE OF VERMONT

SUPERIOR COURT Environmental Division Unit	ENVIRONMENTAL DIVISION Docket No. 103-9-16 Vtec
Morrisville Hydroelectric Project Water Quality	DECISION ON THE MERITS

This is an appeal of a water quality certification issued by the Agency of Natural Resources to Morrisville Water and Light for the Morrisville Hydroelectric Project located on the Lamoille River and its tributaries in north-central Vermont. Morrisville Water and Light (MWL) applied for the certification in connection with a Federal Energy Regulatory Commission (FERC) relicensing application. The Agency of Natural Resources (ANR) issued a certification on August 9, 2016, which MWL subsequently appealed to this Court on September 7, 2016. American Whitewater and the Vermont Paddlers' Club (AW/VPC), the Vermont Natural Resources Council (VNRC), and the Vermont Council of Trout Unlimited (TU) all filed cross-appeals.

Procedural History

MWL and AW/VPC each moved to file Amended Statements of Questions on December 22, 2016. In a February 7, 2017 decision, the Court granted both motions. VNRC and TU filed a joint Statement of Questions on October 17, 2016.

On June 13, 2017, we issued a decision on multiple motions to dismiss and motions for summary judgment. We dismissed MWL Questions 1, 2, 6, 8, and part of Question 3 addressing whether ANR was required by the Streamflow Procedure to consider economic and social issues when issuing certification on appeal.[1] We granted ANR's motion for summary judgment on the

[1] MWL Question 1 asks: "For all facilities whether [ANR] failed to strike a balance between competing water uses in the public interest as required by ANR Streamflow Procedure in issuing the Water Quality Certification, including, but not limited to the policy of the State of Vermont to decrease Vermont's dependence on non-renewable energy sources."

MWL Question 2 asks: "Regarding bypass flows at the Morrisville and Cady's Falls facilities on the Lamoille River, whether ANR failed to adequately consider any public benefits or detriments associated with increasing conservation flows for previously approved facilities as required by ANR Streamflow Procedure."

MWL Question 6 asks: "Whether the downstream flow and drawdown conditions for the Green River facility are in excess of what is necessary to provide a 'high quality aquatic habitat,' pursuant to the Vermont Water Quality

remaining part of MWL Question 3 addressing whether ANR was required to consider social and economic issues when issuing the certification on appeal pursuant to the Vermont Water Quality Standards (VWQS) or various Vermont statutes. Further, we granted VNRC and TU's motion for summary judgment on AW/VPC's amended Question 3 and dismissed AW/VPC's Question 14.[2] On July 20, 2017, we granted ANR's motion for summary judgment on AW/VPC Question 1.[3]

This matter was further narrowed by our March 14, 2018 decision granting ANR's motion for summary judgment on MWL Questions 10 and 11.[4] On March 23, 2018, we granted ANR's motion for summary judgement on AW/VPC's on Question 6 and partially on Question 2 (on the issue of whether ANR followed an adopted application process for the water quality certification presently on appeal).[5] At trial, however, AW/VPC moved on the record to dismiss the remaining aspect of Question 2 ("Whether ANR has adopted by procedure an application process for the certification of hydroelectric projects in Vermont under Section 401 of the federal Clean Water Act as contemplated by 10 V.S.A. §§ 1004, 1006.") which the Court granted.

Standards, and whether higher allowed downstream flows during generation, and greater winter drawdown, would provide such habitat and meet all applicable requirements of the Vermont Water Quality Standards."

MWL Question 8 asks: "Regarding the Green River facility, whether ANR failed to give due consideration to the dam safety concerns posed by spillage that would result from the restrictions on reservoir drawdown and downstream flows."

[2] AW/VPC Amended Question 3 asks: "Whether whitewater boating on the Green River during natural high flow events and during scheduled releases is a designated use protected under Section 3-04(A)(6) of the [VWQS] for Class B waters, and if so, whether the Water Quality Certification should ensure the continued opportunity for whitewater boating on the Green River during natural high flow events and during scheduled recreational releases."

AW/VPC Amended Question 14 asks: "To the extent that the Water Quality Certification renders the project uneconomical and results in decommissioning, whether the Green River Dam should be removed due to its adverse impacts."

[3] AW/VPC Question 1 asks: ("Whether [ANR] waived issuance of a Water Quality Certification for the [Project] by failing to act on the application for Water Quality Certification . . .within one (1) year of receiving an application, in accordance with Section 401(a)(1) of the Clean Water Act, 33 U.S.C. § 1341(a)(1)."

[4] MWL Question 10 asks: "Regarding the Green River facility, whether ANR failed to give due consideration to the dam safety concerns posed by spillage that would result from the restrictions on reservoir drawdown and downstream flows."

MWL Question 11 asks: "Whether the Water Quality Certification should be revised to specifically allow new flow and water level management conditions to be phased in over an extended period of time (10 years) to accommodate engineering design, permitting and construction of improvements need to implement new conditions."

[5] AW/VPC Question 6 asks: "Whether ANR has conducted any site specific flow studies documenting the impact of whitewater boating in compliance Section 3-01(C) and Section 1-02(E) of the [VWQS} and if not whether any determination by ANR regarding the impacts of whitewater boating is entitled to deference by the Court."

The Court held a trial from April 2, 2018 to April 11, 2018 at the Vermont Superior Court, Costello Courthouse in Burlington, Vermont. We conducted a half-day site visit on April 13, 2018. Thereafter, the parties jointly requested an extended post-trial briefing schedule which the Court granted.

MWL is represented by Gregory M. Eaton, Esq. and Clara E. Conklin, Esq. ANR is represented by Leslie A. Welts, Esq. and Kane H. Smart, Esq. AW/VPC is represented by Daniel P. Richardson, Esq. and Ryan P. Kane, Esq. VNRC is represented by Jon Groveman, Esq. TU is represented by Robert J. Carpenter, Esq.[6]

Findings of Fact

1. On September 9, 2015, MWL submitted an application for a water quality certification to ANR for hydroelectric facilities located on the Lamoille River and its tributaries in north-central Vermont (the Project).

2. The Project consists of four facilities: the Morrisville Facility, the Cadys Falls Facility, the Green River Facility, and the Lake Elmore Facility. These facilities were constructed between the 1890s and the 1940s.

3. Pursuant to its FERC application, MWL has sought to remove the Lake Elmore development from its FERC license.

4. The 2014 Vermont Water Quality Standards (VWQS) are applicable to the water quality certification on appeal.

5. The Project does not affect any high-quality waters. All relevant project waters are defined as Class B waters under the VWQS.

6. The Project was granted an original FERC license on August 21, 1981, which ran until April 30, 2015.

7. The Project as currently operated does not meet the VWQS.

8. On August 9, 2016, ANR issued a water quality certification to MWL with conditions pursuant to the Clean Water Act (CWA) and the VWQS.

[6] Friends of Green River Reservoir, represented by Anthony Iarrapino, Esq., the Towns of Morristown, Elmore, Eden, and Hyde Park, and self-represented litigants Christine Hallquist and Barrett M. Singer entered this matter as Interested Persons. None of these parties, however, participated in any aspect of the 8-day merits hearing. Therefore, at the close of evidence, the Court dismissed these parties as Interested Persons and converted their status to FYI only.

9. On September 7, 2016, MWL appealed the water quality certification to this Court.

Morrisville Facility

10. The Morrisville Facility is in Morristown, Vermont. The facility was originally constructed in 1924.

11. The Morrisville Facility has a small impoundment and has a dam that is approximately 216 feet long at the main spillway.

12. The facility is licensed to operate in modified run-of-river mode and both the water quality certification and MWL's proposed conditions seek to transition the facility into true run-of-river operation.

13. The Morrisville Facility currently has an inflatable crestgate installed on the dam.

14. There are two bypass reaches at the facility, a primary reach approximately 400 feet long and a secondary reach approximately 800 feet long.

15. MWL is currently required to maintain a bypass flow of 12 cubic feet per second (cfs) in the primary bypass reach. There is no required flow in the secondary bypass reach.

16. The substrate in the primary bypass reach is primarily bedrock. The reach lacks gravel and cobble substrate that would support macroinvertebrate habitat that would provide a food source to fish or other aquatic biota. Because of this, the reach is unlikely to support trout spawning or incubation.

17. At the end of the reach there is a large drop off approximately 15 feet tall.

18. Brook trout, brown trout, and rainbow trout have been found at the primary bypass reach and were used as target species.

19. Fish move through the bypass reach over the dam down the bypass reach and over the drop off to the Lamoille River. It is highly unlikely that fish move up-stream from the Lamoille River towards the dam because of the drop off.

20. The Morrisville Facility and the primary bypass reach are visible from a bridge off B Street in Morristown.

21. The Morrisville Facility is currently manually operated and does not have the necessary equipment to operate remotely.

22. MWL retained the consulting firm Gomez & Sullivan, and with participation from ANR, Gomez & Sullivan conducted a habitat-flow study within the primary bypass reach to determine the flow necessary to meet VWQS.

23. ANR, MWL, and other participating parties agreed upon the study's scope and goals.

24. Gomez & Sullivan conducted a habitat suitability analysis for adult and juvenile rainbow trout, brook trout, and brown trout (the target species).

25. Flows of 4.5, 21, 59, and 91 cfs were evaluated in the bypass reach to assess downstream passage and habitat connectivity for fish, as well as water movement and the availability for cover. These flows represented leakage flow, one-inch spill, 0.2 cubic feet per second per square mile (cfsm), and 0.4 cfsm flow scenarios.

26. From this evaluation, the analysis produced habitat-flow curves representing the amount of habitat observed at the different flows for each target species at relevant life stages.

27. Both ANR and MWL relied upon the habitat-flow curves in reaching the respective flow regime at the Morrisville Facility.

28. The Gomez & Sullivan analysis concluded that a flow of 59 cfs would provide 73% of available habitat relative to the maximum observed available habitat for adult rainbow trout, which is the most limiting habitat species, of that provided at a flow of 91 cfs.

29. In 2017, MWL consultant Meddie Perry conducted an assessment of the Project and its compliance with the relevant sections of the VWQS. Additionally, Mr. Perry created a flow-energy model to evaluate how changes in flow over time relate to hydroelectric generation. Mr. Perry also conducted an aesthetic evaluation.

30. Mr. Perry is a senior hydrogeologist with the consulting firm VHB. Mr. Perry has a Bachelor's degree in environmental science and biology and many years of relevant work experience in the area of hydrology.

31. Mr. Perry combined the results of the flow-energy model and the habitat-flow analysis to develop a flow and habitat duration analysis to evaluate the availability of habitat over time under different scenarios.

32. Mary Nealon aided Mr. Perry in his analysis of the Morrisville Facility. Ms. Nealon is a fisheries biologist with Bear Creek Environmental, LLC. Ms. Nealon and Mr. Perry used habitat

supply information from the Gomez & Sullivan study, United States Geological Survey (USGS) streamflow data from the USGS streamflow gauging station in Johnson, Vermont, and project operation information to perform a habitat time series analysis. In addition, Ms. Nealon made general habitat observations.

33. The original analysis did not include rainbow trout. An updated time series analysis was provided which analyzed that species. Both Mr. Perry and Ms. Nealon testified that their overall conclusions regarding the facility were not changed by the updated time series analysis.

34. From this, Mr. Perry concluded that a flow of 43 cfs in the primary bypass reach would provide the target species and their life stages, on annual average, 80% of the amount of suitable habitat that would be available under natural flow conditions.

35. The results also concluded that a flow of 43 cfs would provide on average annually, relative to natural flow conditions, 70% of available habitat for adult rainbow trout, 76% of habitat for juvenile rainbow trout, 79% of habitat for adult brown and brook trout, and 94% of habitat for juvenile brown and brook trout.

36. Ms. Nealon concluded that a flow of 43 cfs in the bypass reach provided adequate habitat connectivity. This allows fish that wash over the dam to move through and exit the bypass reach safely.

37. Ms. Nealon concluded that a flow of 43 cfs provided adequate cover in the forms of turbulence and depth. Ms. Nealon observed that the pool in the bypass reach and holes in the bedrock provide high quality cover for juvenile and adult trout at this flow. A flow of 43 cfs provides turbulence in the reach that would provide additional cover.

38. In 2012, Gomez & Sullivan also conducted a water quality study at the Morrisville Facility. The study monitored dissolved oxygen (DO) and temperature at the facility's then-current flow regime of 12 cfs.

39. The water quality study consisted of bi-monthly DO and temperature readings in the development's reservoir, penstock tap, and tail race; as well as observations of river flows, weather, spillage, and turbine operations during sampling. Periodic data was collected at these locations from May 2012 to October 2012. Continuous data was collected from September 6 to October 23.

40. A draft sampling plan was submitted to ANR for comments prior to beginning the study. Comments submitted by ANR were then incorporated into the final study plan, which was also submitted to ANR.

41. The water quality study concluded that the Morrisville Facility was complying with the DO and temperature requirements of the VWQS.

42. Mr. Perry concluded in his analysis of the bypass reach that a flow of 43 cfs complies with the DO and temperature requirements of the VWQS because the Gomez & Sullivan water quality study concluded that a flow of 12 cfs was in compliance with these standards.

43. Ms. Nealon concluded that a flow of 43 cfs in the primary bypass reach would meet the criteria for DO and temperature, based on the existing Gomez & Sullivan data.

44. In 2012, Gomez & Sullivan also conducted an aesthetics flow study in connection with ANR and MWL. The study was conducted pursuant to a mutually agreed upon study plan and involved a team of Gomez & Sullivan representatives, ANR representatives, and MWL representatives observing predetermined demonstration flows from predetermined vantage points.

45. Flows of 4.5, 21, 59, and 91 cfs were observed in the primary bypass reach. While there were 3 total predetermined vantage points, only one was used for the primary bypass reach. This point was located on the bridge in front of the dam, over the reach. These flows represented leakage flow, one-inch spill over the dam, 0.2 cfsm, and 0.4 cfsm flow scenarios.

46. A flow of 21 cfs in the primary bypass reach provided good aesthetic value at the primary bypass reach vantage point. This flow only provided fair aesthetic value in the secondary bypass reach. Good aesthetic value was observed in the secondary bypass reach at 59 cfs, which provided good to excellent aesthetic value in the primary bypass reach.

47. In 2017, Mr. Perry conducted an independent aesthetic evaluation of additional demonstration flows of 12, 28, 43, and 70 cfs at the Morrisville Facility.

48. Mr. Perry's concluded that a flow of 43 cfs provided a full veil of whitewater over the crest of the dam, full water levels in the reach, scenic views of the ledge within the reach, a mixture of deep pools and whitewater, and pleasant auditory aesthetics. This flow would provide for

approximately two inches of spillage over the dam. Mr. Perry concluded that a 43 cfs flow would provide good aesthetic value at the primary bypass reach.

49. At 70 cfs, Mr. Perry concluded that other than an increase in the sound of falling water, the aesthetic value of the dam itself or in the reach were not improved.

50. Changes to the equipment at the Morrisville Facility will be needed to comply with either the water quality certification's flow regime or MWL's proposal.

51. Mr. Perry testified that the proposed 43 cfs condition does not balance social and economic factors, in accord with our prior order.

52. The Morrisville Facility is currently manually operated and lacks the equipment to be operated or monitored remotely so the facility would require automated and remote controls. Additionally, the facility would require the installation of automated communications equipment and other flow-measurement devices. MWL would need to make programming changes to the existing crestgate equipment.

Cadys Falls Facility

53. The Cadys Falls Facility is in Morristown, Vermont. It was constructed in 1894 and reconstructed in 1906, 1914, and 1947.

54. The facility includes a 364-foot-long concrete dam and 186-foot spillway. Wooden panels are used as crestgates. These wooden panels are 3.5 feet high and are operated manually to adjust levels and flows.

55. The Cadys Falls Facility is manually operated and does not have the equipment necessary to operate or monitor the facility remotely.

56. The facility currently is licensed to operate in modified run-of-river mode.

57. The facility creates an approximately 150-acre impoundment, called Lake Lamoille.

58. There is a single bypass reach that is 1690 feet long. Currently, no minimum flow is required to be released into the bypass reach and the only flow in the reach is leakage from the dam. The leakage is roughly 5.5 cfs.

59. Existing flows in the bypass reach do not comply with the VWQS.

60. The bypass reach's substrate is boulder and a mixture of cobble and gravel.

61. Brook trout, brown trout, and rainbow trout are found in the bypass reach. The substrate can also support macroinvertebrates.

62. In 2012, Gomez & Sullivan, conducted a habitat-flow study in the bypass reach to determine the flow regime necessary to comply with the VWQS. The study's scope and goals were agreed upon by ANR, MWL, and other interested participating parties.

63. Flows of 48, 67, 98, 139, and 163 cfs were observed in the bypass. Three representative transects were selected. Each transect fell into the "riffles" category, selected because of their flow sensitivity.

64. The Gomez & Sullivan study determined habitat suitabilities for macroinvertebrates and adult and juvenile rainbow trout, brook trout, and brown trout. This was done through measurements of depth, velocity, and substrate collected at the three representative transects for each of the five study flows.

65. These instream flows were evaluated using a transect-based modification to the Physical Habitat Simulation Model (PHABSIM) methodology. PHABSIM is part of the U.S. Fish and Wildlife Service's Instream Flow Incremental Methodology (IFIM). IFIM is typically used to determine appropriate flow regimes in waters in which the natural flows are altered. PHABSIM modeling simulates river hydrology and habitat based on known species preferences for the specific physical habitat components of depth, velocity, and substrate. The end products are weighted usable areas, or habitat coverage, which serve as a function of streamflow at each life stage for a given species.

66. The modified PHABSIM methodology, which was employed by Gomez & Sullivan, similarly uses hydraulic information and aquatic habitat suitability index curves to understand the relationship between habitat and flow at each representative transect. Unlike the traditional PHABSIM, the modified method utilizes direct field-based measurements rather than modeling.

67. A modified PHABSIM approach is preferred over the traditional approach in steep or difficult to model reaches, like the Cadys Falls reach.

68. From this evaluation, the analysis produced habitat-flow curves representing the amount of habitat observed at the different study flows for each target species at relevant life stages.

69. The analysis concluded that a flow of 100 cfs would provide 80% of that habitat that was available for the most limiting species, adult rainbow trout, that was available at the highest observed flow, 163 cfs. A flow of 98 cfs would provide 78% of available suitable habitat for this species and a flow of 65.5 cfs would provide for approximately 60% of available suitable habitat relative to the highest observed flow.

70. Both ANR and MWL relied upon the habitat-flow curves in reaching the respective flow regime at the Cadys Falls Facility.

71. In 2017, Mr. Perry created a flow-energy model to evaluate how flow changes over time relate to hydroelectric generation using the same methodology as with the Morrisville Facility. The results of this model were combined with the results of the habitat-flow study to create a flow and habitat duration analysis evaluating the overall habitat availability under different flow regimes.

72. Ms. Nealon and Mr. Perry used habitat supply information from the Gomez & Sullivan study, USGS streamflow data from the USGS streamflow gauging station in Johnson, Vermont, and project operation information to perform a habitat time series analysis. In addition, Ms. Nealon made general habitat observations.

73. The original analysis did not include rainbow trout. An updated time series analysis was provided which analyzed that species. Both Mr. Perry and Ms. Nealon testified that their overall conclusions regarding the facility were not changed by the updated time series analysis.

74. The flow and habitat duration analysis shows that a flow of 65.5 cfs would provide an annual average of 63% of the suitable habitat that is available under a natural flow regime.

75. The results also concluded that a flow of 65.5 cfs would provide on average annually, relative to natural flow conditions, 60% of habitat for adult rainbow trout, 64% of habitat for juvenile rainbow trout, 66% of habitat of adult brown and brook trout, 72% of habitat for juvenile brown and brook trout, and 58% of habitat for macroinvertebrates.

76. A flow of 65.5 cfs, as proposed by MWL, does not provide high quality aquatic habitat in the Cadys Falls bypass reach.

77. Ms. Nealon concluded that that a flow of 90 to 100 cfs would provide high quality aquatic habitat in the reach. At trial, Ms. Nealon recommended a flow of 90 cfs to meet this standard.

78. MWL concedes that a flow of at least 90 cfs would provide high quality aquatic habitat in the reach.

79. MWL maintains that a flow of 100 cfs would result in a 21% decrease in renewable energy generation at the facility. A flow of 65.5 cfs would result in a 13% decrease in generation.

80. MWL asserts that a flow of 65.5 cfs would result in a reasonable balance between protecting and maintaining aquatic habitat in the reach and renewable energy generation.

81. In 2012, Gomez & Sullivan also performed a water quality study at the Cadys Falls Facility. The study monitored DO and temperature measurements.

82. The water quality study consisted of bi-monthly DO and temperature readings in the development's reservoir, penstock tap, and downstream in the tail race; as well as observations of river flows, weather, spillage, and turbine operations during sampling. Periodic samples were taken at these locations from May 2012 to October 2012.

83. The water quality study concluded that these locations complied with the DO and temperature requirements of the VWQS.

84. In 2012, Gomez & Sullivan also performed an aesthetic flow study of the Cadys Falls Facility with the same participants, methods, and process as at the Morrisville Facility.

85. Five individuals observed three different flows of 27.7, 77.6, and 133.3 cfs in the bypass reach. Three vantage points were assessed; one located on the bridge downstream from the dam, one within the reach, and one at the dam itself.

86. The study concluded that a flow of 133.3 cfs provided good to good/excellent aesthetic value in the reach, whereas a flow of 77.6 cfs provided fair/good to good aesthetic value, depending on the vantage point. A flow of 27.7 cfs, however, did not provide good aesthetic value in the reach.

87. In 2017, Mr. Perry conducted an independent aesthetic evaluation of additional flows within the bypass reach. Mr. Perry observed flows of 53 and 100 cfs at three vantage points within the bypass reach; one viewing the dam, one viewing the bridge, and one in the middle of the reach.

88. Mr. Perry concluded that a flow rate of 53 cfs provided good aesthetic value throughout the reach. In reaching this conclusion, Mr. Perry asserted that this flow provided a full veil of

water over the crest of the dam, the bypass reach contained full water levels, and, within the reach, there was a variety of features such as pools, visible outcrops, riffles, and whitewater. Further, the flow produced pleasant auditory effects such as rushing and babbling water. Mr. Perry concluded that increasing the flow to 100 cfs did not improve these qualities.

89. MWL's proposal of 65.5 cfs would result in some spillage over the crest of the dam.

90. The equipment currently at the Cadys Falls Facility is outdated. Equipment upgrades would be required regardless of what flow regime is mandated within the bypass reach.

Green River Facility

91. The Green River Facility is in Hyde Park, Vermont. It was originally constructed in 1947 and generation capacity was installed in 1984.

92. The facility has a 360-foot long, 105-foot high concrete arch damn. The facility is operated in a store and release mode. The facility was not designed to operate in run-of-river mode or to spill water over the dam crest.

93. The dam maintains, and uses stored water from, the Green River Reservoir. The reservoir is approximately 653 acres, has a normal maximum water elevation of 1220 feet, a maximum depth of 93 feet, and an average depth of 35 feet. The reservoir is characterized as large, and it is located in a small watershed.

94. The Green River is approximately 4.3 miles long with a culvert located on Garfield Road (Garfield Road culvert). The Garfield Road culvert likely impedes fish from traveling upstream.

95. The current operating license places conditions on the facility's conservation flows, maximum generation flows, and maximum reservoir drawdown levels.

96. Current license conditions require a continuous 5.5 cfs conservation flow into the Green River. From November to April, there is a maximum generation flow of 283 cfs. From May to October, the maximum generation flow is set at 160 cfs, except when necessary to prevent spillage over the dam.

97. Generation cycles last a minimum of six hours.

98. From May to October, a one-foot maximum fluctuation in the reservoir level is permitted from the full reservoir elevation of 1220 feet. Additionally, the reservoir is managed to protect loon nesting habitat during this time. From December 1 to April 30, a 10-foot maximum total

drawdown is allowed from this elevation (the winter drawdown). The reservoir level must be refilled no later than May 1.

99. MWL determines the actual amount of winter drawdown based on annual snowpack. The average drawdown is 3.7 feet, the maximum on record was 5.9 feet, and the minimum was 0 feet.

100. Fisheries management goals for the Green River Reservoir include protecting spawning fish, eggs, and fry from harmful water level fluctuation in the spring and early summer and maintaining the ecological integrity of the littoral zones and their habitat value for fish populations.

101. Littoral zones serve a vital role in lake and reservoir ecosystems and influence the overall productivity of the lentic system.

102. Light penetrates the littoral zones. This light produces macrophyte (plant) growth, which enables diverse species composition and habitat complexity, supporting life cycle functions at each level of the food chain.

103. Drawdowns cause dewatering of littoral zones. In the winter, these drawdowns can prevent the establishment of healthy near-shore communities which provide habitat and life cycle functions, such as forage and reproduction, for organisms serving as food sources for larger fish and wildlife.

104. Dewatering also exposes aquatic plants to drying and freezing conditions and can remove fine sediments from the near-shore area which support macrophyte growth.

105. Drawdowns are associated with reduced abundance and richness of larger, longer-lived macroinvertebrates.

106. Natural water fluctuations can promote structural and biotic diversity by providing a wider variety of habitats and conditions for different species through the disturbance.

107. The Green River Reservoir's natural fluctuation is 1.7 feet.

108. A six-foot winter drawdown, as proposed by MWL, would result in the dewatering of approximately 80 acres of near-shore habitat at the reservoir.

109. A 1.5-foot drawdown, as imposed by the 2016 water quality certification, would resulting in dewatering consistent with the limits of the reservoir's natural fluctuation.

110. In the Green River Reservoir, there are populations of smallmouth bass, chain pickerel, northern pike, yellow perch, brown bullhead, and pumpkinseed sunfish.

111. Bass species begin spawning in late-May. Spawning requires the maintenance of a stable reservoir elevation from May into July to protect the spawning, incubation, and black fry stages.

112. Two or three territorial loon pairs are typically supported from May to August during nesting season.

113. Loons are a species of great conservation need in Vermont. They nest near the edges of the water and their reproductive success can be negatively affected by water fluctuations.

114. In 2012, the consulting firm TRC conducted an aquatic resource assessment of the near-shore aquatic habitat. The assessment sought to inventory the existing habitat within the drawdown zone and assess the effect project operations have on the availability of aquatic habitat by comparison to other sites. The assessment was a cursory evaluation that failed to achieve study objectives.

115. ANR performed a littoral habitat assessment of the Green River Reservoir in 2014. The assessment sampled 17 sites at the reservoir and compared the Green River Reservoir's littoral habitat to those of reference waterbodies in Vermont.

116. The reference waterbodies were eight large naturally occurring mesotrophic lakes that were sampled by ANR in 2007 and 2008, at which 54 sites were sampled. The assessment states that these samples provided conditions of waterbody types like that of the Green River Reservoir and were of similar size and trophic status. These reference sites represented minimally impacted conditions, and a range of biological, physical, and chemical attributes that were potentially attainable in the Green River Reservoir.

117. Sites were assessed for substrate composition, aquatic plant cover, woody debris, embeddedness, odonate exuviae (dragonfly exoskeletons), and riparian habitat characteristics.

118. The assessment concluded that the reservoir's littoral zone had many areas that were highly suitable for aquatic macrophyte growth that currently lacked macrophytes and, as compared to these other lakes, the reservoir had less aquatic plant cover and odonate exuviae. The assessment concluded that this impact is consistent with water level fluctuations.

119. The 2014 littoral habitat assessment was implemented to study the effects of shoreline development and was not conducted in direct relationship with the Project.

120. In 2017, MWL consultants EcoLogic conducted a study to assess the appropriateness of a 1.5-foot winter drawdown (the EcoLogic study).

121. The study was conducted by Kurt Jirka, an associate scientist with EcoLogic. Mr. Jirka has a Bachelor's degree in wildlife ecology and a Master's in fisheries science. He has over thirty years of biological consulting experience.

122. The EcoLogic study only involved a qualitative review and contained no quantitative or comparative analysis. The participants observed the habitat and species composition along the perimeter of the reservoir and compiled a list of the macrophyte species observed. No data was collected regarding macroinvertebrates.

123. There is a self-sustaining population of brook trout located above the Garfield Road culvert. Below the culvert there are brook trout, brown trout, and rainbow trout populations. Adult brown and rainbow trout successfully spawn in the lower portion of the river.

124. Other species found in the Green River include: blacknose dace, creek cub, lake chub, longnose dace, Northern redbelly dace, pumpkinseed, slimy sculpin, longnose sucker, and white sucker.

125. Fisheries management goals for the Green River include management for wild brook, brown, and rainbow trout and improvement of the flow regime to provide high quality aquatic habitat for all life stages of trout.

126. Current conditions at the Green River do not meet the VWQS.

127. Historical data collected prior to the construction of the dam indicates the following monthly median flows: January 13.0 cfs, February 9.8 cfs, March 14.0 cfs, April 88.0 cfs, May 36.0 cfs, June 17.0 cfs, July 11.0 cfs, August 8.6 cfs, September 9.8 cfs, October 17.0 cfs, November 25.0 cfs, December 17.0 cfs.

128. The Green River provides relatively abundant spawning and incubation habitat for many fish species, but particularly trout species.

129. Overwintering and reproductive requirements are presently being supported by the Green River.

130. Habitat found along the Green River includes bedrock gorges, confined riffle-pools, confined step-pools, unconfined riffle-pools, and wetland channels.

131. Whitewater boating generally and boating on scheduled releases (together, whitewater boating) are existing uses of the Green River. Whitewater boating occurs year-round on both naturally occurring high flow events and scheduled releases.

132. MWL has provided two or three scheduled releases annually to support whitewater boating on the Green River. The releases last at least five hours.

133. MWL conducted a whitewater boating study to address the whitewater boating activities on the Green River. The study concluded that the minimum flow required to safely support whitewater boating is between 128 cfs and 140 cfs. A flow of 222 cfs provides the best flow level for a standard run and a flow of 280 cfs provides the best level for a highly challenging run.

134. Natural flows of 128 cfs or above have historically occurred within the Green River.

135. MWL asserts that natural high flows over 70 cfs will be passed downstream, outside of the winter drawdown and spring refill period. The water quality certification requires the passage of natural high flows over 128 cfs From June 1 to December 14. Additionally, natural high flows would be required to be passed after April 1 after the reservoir has been refilled.

136. Time shifting is when a naturally occurring high flow is stored for a period and then released. In the context of whitewater boating, this would result in the storage of natural high flows that occur when whitewater boating is unlikely to occur, such as overnight or during the weekdays, until whitewater boaters are likely to boat, such as daylight hours on the weekend.

137. In order for a time shifted release to be proper, it must account for timing, frequency, rate of change (ramping), magnitude and amplitude, and duration.

138. In 2012, Gomez & Sullivan, with ANR participation, conducted a habitat-flow study to quantitatively assess the relationship between flow and aquatic habitat for selected target organisms in the Green River. The study's scope and goals were agreed upon by MWL, ANR, and other participating and interested parties.

139. This study mapped the habitat along the river and collected data at nine transects. The transects were selected to be representative of various habitat conditions. Five of the transects were "spawning transects," which were transects identified as likely spawning areas.

140. Flows of 10, 75, and 160 cfs were observed. Depth, velocity, substrate, and cover measurements were collected at each flow.

141. Target species and life stages included: spawning, incubation, early fry, late fry, juvenile, and adult stages for brook, brown, and rainbow trout, spawning and incubation stages for longnose sucker, and macroinvertebrates.

142. The habitat-flow study produced habitat-flow curves used to determine the flows at which the maximum amount of suitable habitat was available for each life stage of the target species, together with a range of flows providing at least 80% of the maximum amount of suitable habitat potentially provided. The curves can be summarized as follows:

Species	Season	Flow maximizing WUA	WUA > 80% of max
Rainbow trout Spn & Inc	Spring	75 cfs	60-120 cfs
Longnose sucker Spn & Inc	Spring	40 cfs	30-120 cfs
Brook/Brown trout Spn & Inc	Fall/Winter	15 cfs	10-30 cfs

Species/life stage	Flow maximizing WUA	WUA > 80% of max
Trout species combined: early fry	4 cfs	4-5.5 cfs
Rainbow trout: late fry	15 cfs	10-40 cfs
Brook/brown trout: late fry	5.5 cfs	4-20 cfs

Species/life stage	Flow maximizing WUA	WUA > 80% of max	% of max WUA at		
			5.5 cfs	20 cfs	30 cfs
Brook trout juvenile	40 cfs	20-70 cfs	41%	84%	99%
Brook trout adult	70 cfs	30-150 cfs	31%	67%	83%
Rainbow trout juvenile	60 cfs	30-110 cfs	31%	68%	85%
Rainbow trout adult	80 cfs	50-130 cfs	13%	44%	62%

Exhibit I at 8-11.

143. Rapid flow fluctuations caused by hydropeaking (the shifting from low conservation flows to high generation flows) can impact fish populations through dewatering, stranding, disruption of spawning or migration, and habitat loss. These occurrences can have the largest effect on immobile species or life stages, because they cannot relocate to suitable habitat when the shifts occur.

144. ANR conducted dual flow analysis using the results of the habitat-flow study. This analysis accounts for species immobility and quantifies the remaining habitat available to a species and life stage under a peaking regime.

145. The dual flow analysis reached the following results:

Dual Flow Effective Habitat Analysis - Green River, Spawning Transects					
Species/Life Stage	Effective Habitat for the Base-Peak Flow Combination Shown, As a Percentage of Maximum Habitat (WUA)				
	5.5-75 cfs	5.5-140 cfs	10-75 cfs	30-75 cfs	30-140 cfs
Rainbow trout Spn & Inc	0%	0%	0.6%	20%	1%
Brook/brown trout Spn & Inc	6%	0%	7%	21%	4%
Longnose sucker Spn & Inc	36%	31%	52%	85%	65%
All trout - early fry	1%	0.4%	3%	8%	1%
Rainbow trout late fry	25%	9%	30%	41%	17%
Brook/brown trout late fry	37%	19%	39%	44%	25%
Brown trout adult	35%	29%	47%	76%	58%
Macroinvertebrates	3%	3%	12%	57%	49%

146. In 2017, Mr. Perry created a flow-energy model to assess how flows compare to a natural flow regime, evaluate how inputs to and from storage in the reservoir relate to hydroelectric generation, quantify changes in energy production resulting from different flow regimes, and analyze the aquatic habitat in the river. Mr. Perry employed the same methodology at the Green River as used at the Morrisville and Cadys Falls Facilities. Similarly, the flow-energy model was combined with the habitat-flow study in the same manner described above to develop a flow and habitat duration analysis. The flow and habitat duration analysis evaluated the overall habitat availability under different flow scenarios. Ms. Nealon aided in this analysis.

147. The original analysis did not include rainbow trout. An updated time series analysis was provided which analyzed the species. Both Mr. Perry and Ms. Nealon testified that their overall conclusions regarding the facility were not changed by the updated time series analysis.

148. Mr. Perry also reviewed Ms. Nealon's fish population study, USGS data, and Mr. Jirka's report.

149. Mr. Perry and Ms. Nealon observed flows of 5.5, 60, and 100 cfs.

150. Ms. Nealon walked the entirety of the Green River from the dam to its confluence with the Lamoille River. She characterized fish habitat throughout the river. The three main types of

habitat in the Green River are bedrock gorge, confined valley with riffle pool habitat, and unconfined valley with wetlands adjacent to the channel.

151. Ms. Nealon observed that the Green River has good channel and bank integrity under existing conditions and observed little bank erosion and scour.

152. In 2017, Ms. Nealon conducted a fish population survey in the Green River. The fish population survey sought to gain site-specific data within the river to determine whether existing conditions met the aquatic biota and habitat requirements of the VWQS. The fish population study used the Index of Biotic Integrity (IBI) and the results of the study to evaluate the fish community.

153. The IBI looks at the structure, function, and abundance of a given fish community to determine if there are deviations between the sampled community and a reference community. The IBI does not directly address the impacts of flow.

154. Ms. Nealon used electrofishing during fish population monitoring. She selected four electrofishing stations at river mile (RM) 3.5, RM 3.2, RM 2.9, and RM 0.1. At each station, Ms. Nealon and her team conducted multiple electrofishing passes. Fish population estimates were calculated based on this. Then the Cold Water IBI (CWIBI) and Mixed Water IBI (MWIBI) were used to score each station and evaluate the health of the fish.

155. The fish population monitoring and analysis indicated that there is a self-sustaining population of native trout, there is excellent natural reproduction of fish, and there is full support of aquatic biota and habitat. All life cycle functions like overwintering and reproductive requirements are maintained and protected under existing conditions.

156. MWL concluded that current conditions in the Green River are in compliance with VWQS aquatic habitat and biota requirements.

157. The Green River Facility is currently manually operated and does not have the necessary equipment to be operated remotely. The reservoir level, however, can be adjusted remotely.

158. To comply with any new flow regime, MWL would need to install utility lines, sensors, and controls to regulate flow, including an aerator turbine.

Conclusions of Law

CWA § 401(a)(1) requires that an "applicant for a federal license or permit for any activity . . . which may result in any discharge into . . . navigable waters" obtain a water quality certification (§ 401 certification) from the state to present to the federal licensing or permitting agency. 33 U.S.C. § 1341(a)(1). A § 401 certification is meant to ensure that the activity to be licensed or permitted will comply with "effluent limitations and other limitations" required by the CWA and "any other appropriate requirement of State law." 33 U.S.C. § 1341(d).

The state agency tasked with certifying the activity can impose reasonable conditions and limitations in a § 401 certification to ensure compliance with these laws. PUD No. 1 of Jefferson Cty. v. Washington Dep't of Ecology, 511 U.S. 700, 712 (1994); 33 U.S.C § 1341(d). The Vermont legislature has delegated the responsibility of administering § 401 certifications to ANR. 10 V.S.A. § 1004.

Pursuant to CWA § 303, states are required to adopt water quality standards, which are approved by the U.S. Environmental Protection Agency (EPA). 33 U.S.C. § 1313 (calling for water quality standards); 40 C.F.R. § 131 (EPA regulations regarding the procedures for establishing water quality standards). The state water quality standards adopted pursuant to CWA § 303 are among the "other limitations" that must be complied with for § 401 certification; "limitations to assure compliance with state water quality standards" also fall into the category of "other appropriate requirement[s] of state law" required by § 401 certification.[7] PUD No. 1, 511 U.S. at 713; 40 C.F.R. § 121.2(a)(3) (indicating that a § 401 certification must give "reasonable assurance" that the activity will not violate state water quality standards).

Pursuant to § 303, Vermont has adopted the VWQS. In re Clyde River Hydroelectric Project, 2006 VT 11, ¶ 3, 170 Vt. 606. The VWQS state that they are intended to achieve the goals set out in both the CWA and the first section of the Vermont Water Pollution Control Act, 10 V.S.A. § 1250. VWQS § 1-02. Any § 401 certification issued in Vermont must ensure that the activity certified will comply with the VWQS. See PUD No. 1, 511 U.S. 700; 40 C.F.R. § 121.

[7] The U.S. Supreme Court has declined to "speculate on what additional state laws, if any, might be incorporated by [the 'other appropriate requirement of state law'] language" set out in CWA § 401. See PUD No. 1, 511 U.S. at 713.

In the present matter, MWL is in the process of applying to the Federal Energy Regulatory Commission (FERC) for a license for the Project. As a part of this license application process, MWL has applied for a § 401 certification with ANR. ANR issued a § 401 certification to MWL for the Project and MWL, AW/VPC, VNRC, and TU appealed that certification to this Court. See 10 V.S.A. § 8504(a).

In considering an appeal of a § 401 certification, the Court's role is to determine whether the Project complies with the provisions of the CWA specified in § 401, the VWQS, and any other appropriate state law; and whether any conditions or limitations should be imposed within the § 401 certification to ensure compliance. See 10 V.S.A. § 8504(h) (calling for de novo review).[8] We first examine what the VWQS require from the Project in terms of supporting and maintaining the "designated" and "existing" uses of the respective waterbodies. We then consider whether ANR has appropriately interpreted and applied the VWQS in establishing the conditions of the water quality certification. This includes an evaluation of whether ANR properly construed the term "high quality aquatic habitat" in determining whether it is supplied by the proposed conditions for the Project.

We then turn our discussion to each of the three facilities individually to assess what specific limitations on their operations are necessary to satisfy the VWQS. Finally, we decide on the duration of a phase-in period, during which the Project will operate under current license conditions while MWL brings itself into compliance with the new conditions set forth in this decision.

I. Designated uses of the Project

States take a variety of considerations into account when formulating their water quality standards. Some of these considerations are self-imposed by the state, while others are required by the CWA. "Designated uses" are of the latter type; states must consider a waterbody's designated uses in setting their water quality standards, pursuant to the CWA and EPA regulations. 33 U.S.C. § 1313(c)(2)(A) (revised or new standards "shall consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon

[8] As stated in our June 13, 2017 decision, and pursuant to our vested rights doctrine, the VWQS that went into effect on October 30, 2014 are applicable to this case. See In re Morrisville Hydroelectric Project Water Quality, No. 103-9-16 Vtec, slip op. at n. 4 (Vt. Super. Ct. Envtl. Div. Jun. 13, 2017) (Walsh, J.) (citations omitted).

such uses"). These are some of the uses of the waterbody "to be achieved and protected" by state water quality standards. 40 C.F.R. § 131.10 (setting out guidelines for "Designation of uses" and describing what "the State must take into consideration" in designating uses).

Federal regulations define designated uses as "those uses specified in water quality standards for each waterbody or segment whether or not they are being attained." 40 C.F.R. § 131.3(f). The VWQS define designated uses as "any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water as set forth in §§ 3-02(A) [Class A(1) water], 3-03(A) [Class A(2) waters], and 3-04(A) [Class B waters] of these rules." VWQS § 1-01(B)(14).

States are required to define designated uses at least as specific as the uses identified in the CWA, those of drinking water supply, protection and propagation of fish, shellfish, and wildlife, recreation, agricultural, industrial, and navigation. But states do have discretion to define designated uses in more or less specific terms. 33 U.S.C §§ 1251(a) (setting out goals and policy of the CWA), 1313(c) (stating that water quality standards must take into consideration and protect the CWA purposes); 40 C.F.R. § 131.10(c) (allowing states to designate sub-categories of uses); U.S. Envt'l. Prot. Agency Water Quality Standards Handbook §§ 2.3, 4.4.1 (1994) *available at* https://www.epa.gov/wqs-tech/water-quality-standards-handbook [hereinafter EPA Handbook].

For each relevant waterbody, states are required to manage water "to achieve and maintain a level of quality that fully supports" the designated uses of that waterbody. VWQS § 3-04(A); see also 40 C.F.R. § 131.10(a) (designated uses are "to be achieved and protected"). Uses that the state defines more specifically than required by the CWA, and which are not designated, do not have to be supported under the requirements of the CWA. See, 40 C.F.R. 131.10(k)(2).

In this case, ANR is the authorized agency and must identify designated uses for waterbodies, regardless of whether those uses are fully supported at present. See, e.g., In re Stormwater Npdes Petition, No. 14-1-07 Vtec, slip op. at 1-2 (Vt. Envtl. Ct. Aug. 28, 2008) (Durkin, J.) (ANR determination that five streams did not presently support the "aquatic life" use for which the streams were designated). Designated uses in Class B waters, as here, include: aquatic biota, wildlife, and aquatic habitat; aesthetics; public water supply; irrigation of crops and other

agricultural uses; swimming and other primary contact recreational uses; and boating, fishing and other recreational uses. VWQS § 3-04(A)(1)-(6).

II. Existing uses of the Project

States must also account for "existing uses" when setting their water quality standards. Existing uses are defined by the EPA as "those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards." 40 C.F.R. § 131.3(e). The VWQS define an existing use as "a use which has actually occurred on or after November 28, 1975, in or on waters, whether or not the use is included in the standard for classification of the waters, and whether or not the use is presently occurring." VWQS § 1-01(B)(18). A state's water quality standards must include an antidegradation policy that is intended to protect "existing beneficial uses of navigable waters, preventing their further degradation." PUD No. 1, 51 U.S. at 705; 40 C.F.R. § 131.12(a) (requiring states to adopt antidegradation polices to protect and maintain existing uses).

Further, existing uses are relevant when determining whether a use was both a designated use and an existing use. If so, the use cannot be removed from the state water quality standards. 40 C.F.R. § 131.10(h)(1).

In Vermont, existing uses may be identified either through the basin planning process[9], or on a case-by-case basis "during the consideration of an application." VWQS §§ 1-03(B)(1), 1-02(D)(2) and (4). When identifying existing uses, ANR considers:

a. Aquatic biota and wildlife that utilize or are present in the waters;
b. Habitat that supports existing aquatic biota, wildlife, or plant life;
c. The use of the waters for recreation or fishing;
d. The use of water for water supply, or commercial activity that depends directly on the preservation of an existing high level of water quality; and
e. . . . the factors considered . . . above, evidence of the use's ecological significance in the functioning of the ecosystem or evidence of the use's rarity.

VWQS § 1-03(B)(1)(a)-(e).

[9] In the basin planning process, ANR develops a management strategy for each of the fifteen major drainage basin units in Vermont. The process involves coordinating conservation, mitigation, and remediation efforts of the stakeholders in the basin. directed at water quality. http://dec.vermont.gov/watershed/map/basin-planning/process.

Central to this appeal is whether or not the hydroelectric generation of the Project's facilities qualifies as a "commercial activity that depends directly on the preservation of an existing high level of water quality" under VWQS § 1-03(B)(1)(d). As discussed below, in Section IV.b, because we recognize that the Project's hydroelectric activities are existing uses, they must be factored in when determining the requirements of the VWQS.

ANR has identified some additional existing uses in the 2016 Tactical Basin Plan for the Lamoille Basin (the Basin Plan). The Basin Plan identifies swimming, recreational boating, recreational fishing, and use as a public water supply as existing uses in the basin. Additionally, for the reasons set out in our March 23, 2018 decision, which we incorporate here by reference, the Basin Plan identifies whitewater boating as an existing use on the Green River.

III. Whether ANR may impose conditions beyond what is necessary to meet the VWQS

At the core of this appeal is MWL's assertion that the conditions imposed by ANR through the 2016 water quality certification are in excess of what is necessary to ensure compliance with the CWA and the VWQS. MWL offers alternative conditions to satisfy the CWA. We must review the parties' competing standards to determine which comply with the VWQS.

The Court applies the principles of statutory construction when we interpret administrative regulations like the VWQS. In re Sheffield Wind Project, No. 252-10-08 Vtec, slip op. at 3 (Vt. Envtl. Ct. Sept. 29, 2009) (Wright, J.) (citing In re Williston Inn Grp., 2008 VT 47, ¶ 14, 183 Vt. 621; Conservation Law Found. v. Burke, 162 Vt. 115, 121 (1993)). The Court's goal is to "discern the intent of the drafters . . . by reference to the plain meaning of the regulatory language." Willison Inn Grp., 2008 VT at ¶ 14 (citing Slocum v. Dep't of Soc. Welfare, 154 Vt. 474, 478 (1990)).

The Court gives "substantial deference to an agency's interpretation of its own regulations," here, the VWQS. In re ANR Permits in Lowell Mountain Wind Project, 2014 VT 50, ¶ 15, 196 Vt. 467 (citing In re Peel Gallery of Fine Arts, 149 Vt. 348, 351 (1988)). "Absent a clear and convincing showing to the contrary, decisions made within the expertise of such agencies are presumed correct, valid and reasonable." In re Johnston, 145 Vt. 318, 322 (1985). Parties challenging ANR's interpretation "bear the burden of showing that ANR's interpretation is wholly irrational and unreasonable in relation to its intended purpose." ANR Permits, 2014 VT 50, ¶ 17

(citations omitted); see also Plum Creek Me. Timberlands, LLC v. VT. Dep't of Forests, Parks & Recreation, 2016 VT 103, ¶ 28, 203 Vt. 197; In re Costco Stormwater Discharge Permit, 2016 VT 86, ¶ 5, 202 Vt. 564.

As there are no express standards to determine compliance with the VWQS, we must look to the document in its entirety. The VWQS are intended to meet the goals of the Vermont Water Quality Policy, and the objectives of the CWA "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." VWQS § 1-02; 33 U.S.C. § 1251(a).

The VWQS Hydrology Policy provides some guidance regarding the management of water resources in the state. Pursuant to the Hydrology Policy, when determining conditions regarding water resource management, the conditions should provide a means to "preserve, to the extent practicable, the natural flow regime of waters." VWQS § 1-02(E)(1). This management "requires careful consideration of the interruption of the natural flow regime" and impacts resulting from dams. Id.

The natural flow regime is "a water's characteristic variability in flow rates and water levels, annually, seasonally, and daily, without the influence of artificial flow regulation." VWQS § 1-01(B)(30). Pursuant to the Hydrology Criteria, "[a]ny change from the natural flow regime shall provide for maintenance of flow characteristics that ensure the full support of uses and comply with the applicable water quality criteria."[10] VWQS § 3-01(C)(1)(c).

In addition, water must be managed to achieve "the level of water quality ***necessary*** to protect" existing uses of waters. VWQS § 1-03(B)(1) (emphasis added); see also VWQS § 1-03(C)(1) ("In all cases, the level of water quality ***necessary*** to maintain and protect all existing uses as well as applicable water quality criteria shall be maintained") (emphasis added). The existing uses of waters "shall be maintained and protected regardless of the water's classification." Id. Class B waters, as are at issue here, also "shall be managed to achieve and maintain a level of quality that fully supports . . . designated uses." VWQS § 3-04(A).

[10] To determine compliance with this subsection, the preferred method is site-specific flow studies. VWQS § 3-01(C)(1)(c). The studies must be "sufficiently based on scientific knowledge . . . [and] [i]n the case of aquatic habitat studies, those methodologies that are acceptable . . . include the Instream Flow Incremental Methodology (IFIM), as well as other comparable methods of evaluation deemed appropriate by the Secretary." VWQS §3-01(D)(2)(a).

The determination of what is "necessary" to support the existing uses of the waterbodies at issue, to support their designated uses, and to meet all relevant aspects of the VWQS was heavily debated by the parties' experts at trial.

a. High quality aquatic habitat

Also heavily debated were the water quality conditions necessary to support the designated use of aquatic biota, wildlife, and aquatic habitat. Pursuant VWQS § 3-04(A)(1), Class B waters, as at issue in this appeal, must support aquatic biota, wildlife, and aquatic habitat. VWQS § 3-04(A)(1). This designated use is supported by sustaining "high quality aquatic habitat" in the applicable waters. Id. The different operational regimes ANR and MWL would impose on the Project produce differing levels of habitat availability and quality. We must determine what water quality conditions contribute to high quality aquatic habitat, and which operational regime meets those conditions, to ensure compliance with the VWQS.

High quality aquatic habitat is not defined by the VWQS. The VWQS provide some guidance, however, stating that there should be "[n]o change in the reference condition that would prevent the full support of aquatic biota, wildlife, or aquatic habitat uses." VWQS § 3-04(B)(4). In a high quality habitat, "[b]iological integrity is maintained and all expected functional groups are present." Id. The habitat supports and protects "all life-cycle functions, including overwintering and reproductive requirements." Id. A reference condition is:

> [T]he range of chemical, physical, and biological characteristics of waters minimally affected by human influences. In the context of an evaluation of biological indices, or where necessary to perform other evaluations of water quality, the reference condition establishes attainable chemical, physical, and biological conditions for specific waterbody types against which the condition of waters of similar waterbody type is evaluated.

VWQS § 1-01(39).

ANR asserts that high quality aquatic habitat is provided if 80% of the total maximum habitat observed is protected in a given waterbody. We owe deference to ANR's interpretation of policy or terms when: "(1) that agency is statutorily authorized to provide such guidance; (2) complex methodologies are applied; or (3) such decisions are within the agency's 'area of expertise.'" In re Korrow Real Estate, LLC Act 250 Permit Amendment Application, 2018 VT 39, ¶ 20 (citation omitted). As stated above, the Court gives deference to ANR's interpretation of the VWQS, however, "the deference owed to agency determinations is not absolute." Korrow

Real Estate, LLC, 2018 VT 39, ¶ 21 (citation omitted). "An agency's authority to define terms within its statutory purview will be given deference unless that authority is applied 'arbitrarily and capriciously' such that it 'give[s] rise to a violation of due process.'" Id. (citing In re Woodford Packers, Inc., 2003 VT 60, ¶ 17, 175 Vt. 579).

In Vermont, the Secretary of ANR has the authority to review, establish, and revise the water quality standards. See 40 C.F.R. § 131.4(a) (giving states the authority to review, establish, and revise water quality standards); 10 V.S.A. § 1252(e) (requiring the Secretary of ANR to adopt water quality standards). As such, it is within ANR's discretion to define the terms within the VWQS and within ANR's area of expertise. High quality aquatic habitat, however, is undefined in the VWQS or in another formal document.

At trial, ANR witnesses Jeff Crocker and Rod Wentworth testified regarding ANR's interpretation of high quality aquatic habitat. ANR has often looked to the most limiting habitat approach, also known as the habitat optimization analysis, on the basis that this method is recommended in the relevant scientific literature. This sets habitat as a percentage of the maximum habitat observed, in this case, the maximum habitat observed within the relevant Gomez & Sullivan report for each respective facility, when determining what is high quality aquatic habitat.

ANR offers that, based on scientific literature, 80% is a significant threshold level, because if less than 80% of the maximum habitat value observed is provided, species may experience various stressors.[11] ANR suggests that this would lead to a decline in fish populations. No specific sources were cited or provided, however. Further, increasing the amount of habitat in any given waterbody does not necessarily correlate with an increase in actual fish populations. There are a variety of other factors that influence fish populations, including the various physical characteristics of a waterbody or other site-specific considerations.

[11] Alternatively, MWL urges us to look to a comparison between available habitat and the natural flow regime. In support of this, MWL cites to the USGS PHABSIM guidebook, which cautions users against comparing current habitat to the maximum potential habitat observed because it is not tied to a natural flow regime. Further, they assert, comparison to a natural flow regime provides a more conservative estimate when, as in this case, the point at which habitat would decrease in relation to a lessened flow is unknown. We find their clarification helpful in guiding our understanding of what could be considered high quality aquatic habitat.

ANR's approach is unwritten, not expressed in ANR's policy, and is not considered an established practice of determining high quality aquatic habitat. Instead, this is an interpretation of what might be reasonably representative of high quality habitat based on professional judgment.

Accordingly, we cannot afford ANR's interpretation deference in this matter. To give this definition deference would result in the arbitrary and capricious application of the definition, threatening a violation of due process. See Korrow Real Estate, LLC, 2018 VT 39, ¶ 21. ANR has not provided a definition for "high quality aquatic habitat" in any statute, regulation, or any other ANR guidance documents, nor has there been any evidence that this is ANR's established practice. See Id. at n. 2 (noting that ANR's methodology was an established practice and therefore not arbitrary and capriciously applied).[12]

For these reasons, we will not afford ANR deference in its definition of high quality aquatic habitat as habitat consisting of 80% or more of the maximum habitat observed. Therefore, for each of the three facilities, we consider the alternative definitions of high quality aquatic habitat provided by the parties, and the site-specific conditions in the relevant reaches, when determining whether high quality aquatic habitat is provided by the two different sets of water quality conditions advanced by ANR and MWL.

IV. Conditions to be imposed at the Project's facilities.

For a proposal to meet the VWQS, it must satisfy the Hydrology Policy (§ 1-02(E)),[13] the Hydrology Criteria (§ 3-01(C)), the Anti-Degradation Policy, the water quality criteria for Class B waters (§ 3-04(B)), the DO and temperature requirements, and fully support designated uses (§ 3-04(A)).

The VWQS also require protection of designated uses. Designated uses at the Project include: aquatic biota, wildlife, and aquatic habitat; aesthetics; public water supply; irrigation of

[12] It has not been asserted that reaching this definition required the application of complex methodologies. If so, however, we would still decline to afford the definition deference, as MWL has provided credible evidence that the comparison between habitat and flow made by ANR is not recommended as the best practice. Therefore, this approach could be considered irrational and unreasonable. Korrow Real Estate, LLC, 2018 VT 39, ¶ 21.

[13] Because the Hydrology Policy implicates the potential need for a phase-in period, we reserve discussion of the Hydrology Policy for Section VIII, Phase-In. Additionally, because the Hydrology Criteria are those criteria used to implement the Hydrology Policy, our discussion of compliance with the Hydrology Criteria at each facility occurs there as well.

crops and other agricultural uses; swimming and other primary contact recreational uses; and boating, fishing and other recreational uses. VWQS § 3-04(A)(1)-(6). At issue in the present appeal is the support of the designated uses of aquatic biota, wildlife, and aquatic habitat, aesthetics, and, to a certain extent, recreational uses.

In the sections that follow, we consider each of the three facilities independently to evaluate what operational conditions are necessary to satisfy these different aspects of the VWQS. For each facility, we compare the requirements of ANR's water quality certification against MWL's new proposed conditions to identify which hew to the dictates of the VWQS.

a. Morrisville Facility

The current conditions at the Morrisville Facility primary bypass reach do not meet the VWQS. Presently, the minimum required bypass flow in the primary bypass reach is 12 cfs. As a part of the 2016 water quality certification, ANR imposed a condition requiring a minimum bypass flow of 70 cfs and one inch of water depth to be spilled over the dam spillway for aesthetic purposes. ANR argues in favor of these conditions on appeal. MWL proposes a flow of 43 cfs and no required spill over for aesthetic purposes. MWL does not dispute the conditions imposed by the 2016 water quality certification for Morrisville Facility's secondary bypass reach. As such, the secondary bypass reach is not at issue in this appeal.

For the reasons set forth below, we conclude that MWL's proposal for the Morrisville Facility cfs flow complies with the VWQS. ANR's proposed conditions exceed what is necessary to comply with the VWQS.

Anti-Degradation Policy

Under the Anti-Degradation Policy, "[e]xisting uses of waters and the level of water quality necessary to protect those existing uses shall be maintained and protected regardless of the water's classification." VWQS § 1-03(B)(1). Existing uses in the Lamoille Basin are identified as swimming, recreational boating, recreational fishing, and use as a public water supply. 2016 Lamoille Tactical Basin Plan, p. 134. The Morrisville Facility primary bypass reach is not used as a public water supply. We therefore focus our analysis on recreational uses.[14]

[14] Recreational uses are also protected as designated uses. See VWQS § 3-04(A)(5)-(6) (naming swimming, other primary contact recreational, boating, fishing, and other recreational uses as designated uses).

At the Morrisville Facility there are limited opportunities for recreational uses within the bypass reach. First, the reach is very short and there is a large drop at the end of the reach, so recreational boating opportunities are limited. Second, the composition of the substrate within the reach does not support long-term fish habitat, so recreational fishing opportunities are limited. The 2016 water quality certification notes that there is an informal fishing location within the Morrisville Facility tailrace.

The Court did not receive evidence suggesting that recreational boating or swimming occurs within the reach. Further, the Court did not receive evidence regarding whether either MWL's proposal of 43 cfs or ANR's certification requiring 70 cfs would support either of these uses.

We conclude that MWL's proposal of 43 cfs supports aquatic biota, wildlife, and aquatic habitat by providing high quality aquatic habitat, as set forth below. The proposed cfs is a significant improvement upon the current conditions in the bypass reach. Therefore, to the extent there is recreational fishing or recreational boating within the bypass reach, these uses are supported. The Court concludes that a flow of 43 cfs supports the recreational uses within the Morrisville Facility primary bypass reach.

Water Quality Criteria for Class B Waters

Waters must comply with the general water quality criteria as well as the applicable criteria for their class designation. VWQS § 3-01; VWQS § 3-04(B) (setting water quality criteria for Class B waters). There are eleven criteria general to all waters, VWQS § 3-01(B)(1)-(11), and seven criteria specific to Class B waters, see VWQS § 3-04(B)(1)-(7). Some of the seven criteria specific to Class B waters overlap with the general criteria. This appeal focuses on the water chemistry criteria of DO and temperature.

Prior to MWL's application for water quality certification, a study was conducted by Gomez & Sullivan at all MWL facilities regarding water quality in the respective locations. The 2012 study aimed to understand the Project's present and potential impact on water quality for both DO and temperature. Gomez & Sullivan Water Quality Monitoring Study Report, April 2013, p. 6. During the study, bi-monthly and continuous readings were taken of both DO and temperature levels and general environmental observations were taken.

At the Morrisville Facility, six sampling locations were identified in the impoundment at the thalweg,[15] the dam site, the primary bypass reach, the tailrace, and downstream. The locations in the impoundment, primary bypass reach, and tailrace were continuously sampled from September to October of the study year. All other sites were periodically monitored from May to October of the study year.

ANR was given the opportunity to comment on a draft sampling plan prior to the start of the study. ANR's comments were then incorporated into the final study plan.

Dissolved Oxygen

At the Morrisville Facility, DO must be no less than 6 milligrams per liter (mg/l), with 70% saturation at all times. VWQS § 3-04(B)(2)(a). The Gomez & Sullivan Water Quality Monitoring Report concluded that the Morrisville Facility met the DO requirements in both the impoundment and bypass reach. Gomez & Sullivan Water Quality Monitoring Study Report, April 2013, p. 45.

At trial, ANR offered two reasons for why it disagrees with the Gomez & Sullivan study conclusions. First, ANR asserts that a flow of 43 cfs does not meet the VWQS for DO because at this rate there could be stagnation in the reach. This lack of circulation could cause a decrease in DO.

Second, ANR disagrees with the times at which the continuous monitoring was conducted in the Gomez & Sullivan study because the monitoring equipment was not installed until September of the monitoring year. ANR practice, it asserts, is to conduct monitoring from July 15 to September 15 of the monitoring year.

ANR conducted an additional subsequent analysis of the water chemistry at the Morrisville Facility. ANR's analysis consisted of viewing video of the flows at the facility to understand circulation in the reach. This was not done to supersede the results of the Gomez & Sullivan study but to provide ANR with assurances regarding the Gomez & Sullivan conclusions. The Court finds that ANR's approach of viewing videos of the flows is not a scientifically reliable

[15] Black's Law Dictionary notes that "thalweg" is the Old German spelling of "talweg." *Thalweg*, BLACK'S LAW DICTIONARY (5th ed. 1979). It defines "talweg" as, in relevant part, "meaning the middle or deepest or most navigable channel." *Talweg*, BLACK'S LAW DICTIONARY. The definition notes that it is frequently used as related to water boundaries. Id. Here, however, we take it to denote the middle or deepest location in the impoundment.

method of determining DO in a waterbody. Further, we note that ANR received the Gomez & Sullivan draft sampling plan and was afforded the opportunity to comment on the draft. ANR's comments were then incorporated in the final sampling plan. Because the Gomez & Sullivan study afforded ANR this opportunity, it is unclear why ANR is now asserting that the study contains a "fatal flaw." ANR Post-Trial Brief, p. 77. We conclude the Gomez & Sullivan water quality study sampling was sufficient to reach the conclusions therein.

Based upon the evidence before the Court, the Morrisville Facility is meeting the DO standards in the impoundment and the tailrace at its current flow of 12 cfs. Therefore, we are unconvinced that a significantly increased flow, improving water circulation within the reach and providing increased opportunity for water aeration by increasing water flow over the crest of the dam, will somehow decrease the DO in the reach. For these reasons, MWL's proposal of a minimum flow rate of 43 cfs meets the DO requirement of the VWQS.[16]

Temperature

At the Morrisville Facility, the current total allowable temperature increase above the ambient temperature is one-degree Fahrenheit. VWQS § 3-01(B)(1)(b). The Gomez & Sullivan Water Quality Monitoring Study Report concluded that the temperature in the reach and impoundment met this standard under existing conditions.

ANR raises the same concerns regarding the sampling data within the Gomez & Sullivan water quality study here as raised with respect to DO discussed above. For the same reasons, the Court concludes the Gomez & Sullivan water quality study sampling supports the conclusions reached therein.

As stated above, an increase in flow from 12 cfs to 43 cfs would significantly improve circulation in the reach. In the context of temperature, this increased flow limits the likelihood of the sun warming stagnant waters, a common cause of increased temperatures in a waterbody, even though the water's surface area within the reach will be increased. Further, the reach generally meets the temperature requirement of the VWQS under current conditions. The

[16] Our conclusion is further supported by ANR's assertion that flows over the 7Q10 flow, representative of a drought flow, usually maintain the DO in a waterbody to a level suitable for aquatic biota and, therefore, comply with the water chemistry requirements. Both the flow included in the 2016 water quality certification and the flow proposed by MWL exceed the 7Q10 flow.

exception of this being the July temperature readings in which there was an approximately two-degree Celsius difference between upstream and downstream conditions (the downstream conditions were cooler than the upstream conditions). July, as many parties stated at trial, is a dry month where temperature can be a concern.

A flow of 43 cfs will provide a significant improvement in flow and circulation within the reach, helping the facility to meet the temperature requirements throughout the year and significantly improving conditions during the dry summer months. Like DO, ANR asserts that flows over the 7Q10 flow in a waterbody usually maintain a temperature to a level suitable for aquatic biota and, therefore, comply with the water chemistry requirements. A flow of 43 cfs exceeds the 7Q10 flow.

We conclude, therefore, that a flow of 43 cfs will meet the temperature requirement of the VWQS.

Designated Uses

Designated uses in Class B waters include: aquatic biota, wildlife, and aquatic habitat; aesthetics; public water supply; irrigation of crops and other agricultural uses; swimming and other primary contact recreational uses; and boating, fishing and other recreational uses. VWQS § 3-04(A)(1)-(6). The waters at the Morrisville Facility are not used as a public water supply or for irrigation or agriculture. We address recreational uses above in the context of existing uses. Thus, we review the aquatic biota, wildlife, and aquatic habitat use and the aesthetic use here.

Aquatic Biota, Wildlife and Aquatic Habitat

High quality aquatic habitat must be available to support aquatic biota, wildlife, and aquatic habitat. VWQS § 3-04(A)(1). For the reasons set forth below, high quality aquatic habitat will be provided by MWL's proposal of a minimum bypass flow of 43 cfs.

The Morrisville Facility's bypass reach is relatively short, approximately 400 feet long. The substrate of the reach is primarily bedrock, which does not typically support aquatic plant life, macroinvertebrate habitat, or fish spawning habitat.[17] An increase in flow would not improve

[17] There is the potential for macroinvertebrates to spill over the dam into the reach, much like fish would, but the reach itself would not support macroinvertebrate habitat.

these physical habitat constraints. Because of this and the low flow currently in the reach, there is presently little fish and aquatic habitat.

On the right side of the tail race there is an area where water pools. At the end of the reach, there is an approximately 15-foot drop. This drop discourages fish from moving up the bypass reach from the Lamoille River. It is highly unlikely that a fish would move up the bypass reach from the Lamoille River because of the elevation of the drop and, at high flows, the speed of the water. Fish only move through the bypass reach when moving over the crest of the dam into the reach and then, if they continue, over the drop and into the main stem of the Lamoille River.

Because of the composition of the bypass' substrate, food production is not supported and there is inadequate spawning habitat in the reach. Therefore, most fish will use the reach in a transient nature. Most fish will not linger in the reach because of its lack of food resources, but they may use the reach to rest.[18]

Appropriate fish habitat includes cover in the form of adequate water depth, substrate features, and turbulence on the surface of the water. The combination of the three forms of cover obscures the bottom of the reach, which provides a place to rest away from predators. Additionally, appropriate fish habitat includes connectivity within the reach so that fish can safely move from the dam to the Lamoille River.

MWL's consultant Gomez & Sullivan, in 2012, designed methodology to study flow and aesthetic impacts of the Project. ANR's comments were incorporated into this study, which was conducted in the Fall of 2012.

At the Morrisville Facility, within the primary bypass reach, flow demonstrations and observations were performed at 4.5 cfs, 21 cfs, 59 cfs, and 91 cfs.[19] Considerations of the flow's

[18] We note that no data was provided regarding whether fish stay in the bypass reach on a long-term basis. We do, however, find credible MWL expert's assessment of the impacts the composition of the reach would have on fish staying in the reach long-term. Specifically, the substrate in the reach and its inability or unlikelihood of providing macroinvertebrate, aquatic plant life, and fish spawning habitat. Therefore, while it is theoretically possible for a fish to remain in the reach long-term, it is highly unlikely.

[19] While we have been provided with clear references for 4.5 and 21 cfs, representing a leakage flow and a 1-inch spill, respectively, descriptors of what 59 and 91 cfs represent are less clear. The relevant studies state that these flows represent 0.2 and 0.4 cfsm, respectively. We understand "cfsm" to stand for cubic feet per second per square mile but have not been provided with any further understanding of these measurements.

effects on downstream habitat connectivity, circulation, cover, and temperature were weighed. The percentage of usable habitat for the target species, adult and juvenile rainbow trout, brook, and brown trout, at each flow were calculated. These results are habitat-flow, or habitat supply, curves.

MWL consultants performed additional analysis of the primary bypass reach. Meddie Perry created a flow-energy model to evaluate how changes in flow over time relate to hydroelectric generation. Mr. Perry combined the results of the flow-energy model and the habitat-flow curves to develop a flow and habitat duration analysis that evaluated the availability of habitat over time under different flow scenarios.

Additionally, MWL consultant Mary Nealon aided Mr. Perry in his analysis of the Morrisville Facility. Ms. Nealon made general habitat observations. Ms. Nealon and Mr. Perry used habitat supply information from the Gomez & Sullivan study, USGS streamflow data from the USGS streamflow gauging station in Johnson, Vermont, and project operation information to perform a habitat time series analysis. This habitat time series analysis incorporated habitat supply curves from the Gomez & Sullivan flow study. The analysis created habitat and flow relationships for target species at specific life stages. MWL experts then created the habitat time series, which reflects how habitat varies according to the flow value and over time, specifically as related to the frequency and duration at which those flows occur. The original analysis did not include rainbow trout. An updated time series analysis was conducted which analyzed rainbow trout. Both Mr. Perry and Ms. Nealon testified that their overall conclusions regarding the facility were unchanged by the updated time series analysis.

Based upon all of this information, MWL concluded that a 43 cfs flow was appropriate for the Morrisville Facility.

At 43 cfs, as stated above, the water movement supports the DO and temperature standards which aid high quality fish habitat. A flow of 43 cfs provides fish with adequate cover both in terms of water depth and turbulence, as well as bypass substrate. Additionally, habitat connectivity and adequate depth for passage are supported at the 43 cfs flow rate, as shown by the Gomez & Sullivan report. Gomez & Sullivan Morrisville Bypass Flow Study Report, p. 13 (concluding that all flows observed provided adequate habitat connectivity and depth for

downstream passage, though a leakage flow provided difficult passage, and all flows above the leakage rate performed better).

We adopt the most limiting habitat approach when evaluating whether a proposed flow rate supports high quality fish habitat. The most limiting species is adult rainbow trout. At 43 cfs, 67% of the maximum adult rainbow trout habitat observed is provided. [20] When analyzing the habitat provided at this flow relative to the habitat provided by a natural flow regime, on an annual basis, 79% of habitat is provided for adult brook and brown trout, 70% is provided for adult rainbow trout, 94% is provided for juvenile brook and brown trout, and 76% is provided for juvenile rainbow trout. This results in an overall weighted average of 80% of habitat provided by a 43 cfs flow relative to a natural flow regime.

ANR raised concerns with the fact that MWL experts combined target organisms to reach a weighted average. This concern is based in the fact that it is unclear whether specific species or life stages are given more or less value in the weighting. While we note the concern, MWL has provided averages for each species and their life stages separate and apart from the overall weighted average, as noted above.

Further, ANR asserts that MWL included flows in the habitat time series analysis that would be uncontrollable, essentially naturally occurring high and low flows, which occur approximately 25% of the time. ANR asserts that these uncontrollable flows should not be factored into the habitat analysis. We do not find the inclusion of this data within the habitat time series analysis to be in error, largely because these uncontrollable flows do occur, even if infrequently, and do affect habitat within the bypass reach.

ANR asserts that 70 cfs, the flow condition imposed by the water quality certification, is necessary to provide high quality aquatic habitat. ANR bases this flow on the most limiting habitat approach, and the fact that this flow provides 80% of the maximum habitat observed in the Gomez & Sullivan study. We again note that this approach is not ANR's policy, but an interpretation of what could be considered high quality aquatic habitat.

[20] However, 73% of habitat is provided for juvenile rainbow trout, 94% is provided for juvenile brook and brown trout, and 78% is provided for adult brook and brown trout.

At 70 cfs, under the most limiting habitat approach (with adult rainbow trout as the most limiting species), 83% of the maximum habitat observed is provided. Further, 86% is provided for juvenile rainbow trout, 97% is provided for juvenile brook and brown trout, and 90% is provided for adult brook and brown trout.

Relative to a natural flow regime, instead of the maximum habitat observed, 70 cfs provides 90% of habitat for adult brook and brown trout, and 97% for juveniles. We do not have data comparing habitat provided for juvenile and adult rainbow trout at 70 cfs to a natural flow regime.

In the bypass reach, the rough bedrock substrate, the depth of the pool, and the turbulence provided by the dam provide cover for fish when moving through the reach. There is no spawning habitat available and there is a highly unlikely chance that significant food sources would be supported in the reach at any flow. 43 cfs provides 67% of the maximum habitat observed for the most limiting species. We have not been provided evidence regarding the significance of a 13% decrease in habitat value in relation to a most limiting species approach. Further, 70% of habitat is provided as compared to a natural flow regime and 80% of habitat is provided as an overall average. We find that using a natural flow regime approach when determining high quality aquatic habitat is reasonable considering the VWQS. See VWQS § 1-02(F) (requiring preservation of the natural flow regime "to the extent practicable."); VWQS § 2-02 (considering flow values used to determine compliance with VWQS criteria in relation to the natural flow regime); VWQS § 3-01(C)(1)(c) (determining maintenance of flow characteristics in Class B waters when changes are made to the natural flow regime).[21]

For all these reasons, we conclude that 43 cfs provides high quality aquatic habitat in the Morrisville Facility primary bypass reach.

Aesthetics

Class B waters shall be managed to maintain the designated use of aesthetics. VWQS § 3-04 (A)(2). Aesthetics include the "water character, flows, water level, bed and channel characteristics, exhibiting good aesthetic value and, where attainable, excellent aesthetic value

[21] We again note MWL's assertion that the USGS PHABSIM guidebook cautions users from comparing habitat to the maximum observed because it is not tied to a natural flow regime. This guidebook was not, however, introduced into evidence, though both Ms. Nealon's and Mr. Perry's expert reports cite to the document.

based on the Water Management Type designation." Id. Where a Class B water has not been assigned a water management type, as is the case here, the water must have "a quality that consistently exhibits good aesthetic value." VWQS § 3-04(B)(6)(d).

The parties agree that the current conditions of the Morrisville Facility do not provide good aesthetic value when viewing the dam or the bypass reach. ANR asserts that a one-inch spill of water over the dam and a flow of 70 cfs are required to meet the VWQS. MWL disagrees, offering that a spill requirement is not necessary and that a flow of 43 cfs will provide good aesthetic value. It is noted that a flow of 43 cfs would result in approximately two inches of spilled water at most times, however, during winter freeze conditions there may be no spill at this flow rate. We consider the parties' offers.

Aesthetic evaluations of the 4.5 cfs, 21 cfs, 59 cfs, and 91 cfs flows were conducted in the Gomez & Sullivan Aesthetic Flow Study.[22] At the Morrisville Facility, four individuals observed four different flow characteristics in the bypass reach and then the team evaluated the aesthetic quality of the flows. Because of the limited public visibility of the primary bypass reach, only one vantage point of the reach was utilized. This vantage point was located on the bridge over the bypass reach. This study concluded that, at the primary bypass reach, a one-inch spill over the crest of the dam at a flow of 21 cfs in the channel provided good aesthetic value.

In 2017, Mr. Perry conducted an independent aesthetic evaluation of additional demonstration flows of 12, 28, 43, and 70 cfs at the Morrisville Facility. Mr. Perry concluded that a 43 cfs flow would provide good aesthetic value at the primary bypass reach. This flow would provide for approximately two inches of spillage over the dam.

Based upon the evidence provided by the parties, we are unconvinced that a one-inch spill should be required at the Morrisville Facility to satisfy the VWQS aesthetic requirements. The dam and its bypass reach are visible only to a limited degree. While the dam itself is quite large, one must be on the bridge over the primary bypass reach, located on B Street, to view it. Otherwise, public visibility is extremely limited. Further, complying with a one-inch spill requirement may be impractical in the winter months when the impoundment behind the dam is frozen. Therefore, we conclude that a minimum spill requirement is not warranted, and we

[22] These flows represent the same flows scenarios as discussed in Footnote 19.

turn our focus to what flow rate should be required to provide good aesthetic value of the dam and the reach.

At 43 cfs, water crests and falls over a majority of the dam, resulting in a veil of water over its concrete face. This spillage will result in approximately two inches of water being spilled over the dam. Downstream, this flow results in water pooling and showing some exposed ledge and rocky features as well as visible flows. At 70 cfs, there is a full veil of water cresting over the dam, which is slightly thicker than that at 43 cfs. In the bypass reach, at 70 cfs, the channel is largely full and less of the bed and channel characteristics are apparent.

ANR asserts that the methodology employed by Mr. Perry was improper because Mr. Perry conducted the analysis alone. This concern does little to devalue his conclusions. The results of the Gomez & Sullivan aesthetic flow study, conducted by a team of four, concluded that a flow of 21 cfs in the primary bypass reach, coupled with a one-inch spill over, provided good aesthetic value. Mr. Perry's conclusion, and MWL's proposal, increases the flow rate and provides for greater spillage.

We therefore conclude that a flow of 43 cfs meets the aesthetic requirements of the VWQS for Class B waters. This flow provides good aesthetic value both at the dam and within the bypass reach. A flow of 70 cfs goes beyond what is necessary to provide good aesthetic value in the bypass reach pursuant to VWQS §§ 3-04(A)(2) and 3-04(B)(3)(d). Further, a condition requiring one-inch of spilled water over the crest of the dam is unnecessary due to the limited public visibility of the dam and the bypass reach and the impracticability of complying with the condition year-round. We find that declining to adopt a minimum spillage condition is further supported by the fact that a flow of 43 cfs will result in approximately two inches of spillage over the dam during non-freeze conditions.

b. The Morrisville Facility as an existing use pursuant to VWQS § 1-03(B)(1)(d)

The parties disagree as to whether the hydroelectric generation at the Morrisville Facility is an existing use pursuant to VWQS § 1-03(B)(1)(d) and, therefore, subject to the protection of the Anti-Degradation Policy. While this issue is not explicitly raised in any parties' Statement of Questions, the parties agree that this issue is intrinsic to the Statement of Questions. See In re Jolley Assocs., 2006 VT 132, ¶ 9, 181 Vt. 190. Thus, the issue is appropriately before the Court in

this de novo appeal. In the discussion that follows, we affirm hydroelectric generation as an existing use. We acknowledge that this finding is immaterial with regards to the conditions to be implemented at the Morrisville and Green River Facilities, because MWL's proposed conditions for both facilities satisfy the VWQS regardless of whether the facilities are categorized as existing uses or not.[23] But because of the emphasis the parties have placed on the question, and their extensive briefing on the subject, we address it here as well.

Existing uses are entitled to protection regardless of the water's classification. VWQS § 1-03(B)(1). In determining existing uses to be protected, ANR must consider, in part, "the use of the water for . . . commercial activity that depends directly upon the preservation of an existing high level of water quality." VWQS § 1-03(B)(1)(d). The parties do not debate the fact that hydroelectric generation at the Morrisville Facility is a commercial activity. Therefore, our analysis turns on whether hydroelectric generation depends upon "an existing high level of water quality." Id.

MWL asserts that hydroelectric generation depends on a high level of water quality due in large part to its reliance on a river's hydrology and flow. This is because, at any given time, the flow in a river or the water level in a reservoir must be sufficient to support generation. In addition, total suspended solids and other solids, including refuse and debris, as well as scum or sludge, must be limited. If they are not, hydroelectric intake systems can clog, which would require generation to cease or slowdown to remove the blockage. Further, turbidity, as associated with sediment, can wear down the blades of the hydroelectric turbines, decreasing generation efficiency and causing the facility to require more water to generate at equivalent rates, thus impeding overall generation. See VWQS § 3-01(C)(1) (setting the Hydrology Criteria, flow changes as related to the natural flow regime must provide flow characteristics that fully support uses and comply with water quality criteria); VWQS § 3-01(B)(4)-(5) (regulating sludge, solid refuse, settleable solids, floating solids, oil, grease, scum, or TSS as general water quality criteria); VWQS § 3-01(B)(5) (regulating TSS as water quality criteria as related to Class B waters); VWQS § 3-04(B)(1) (regulating turbidity as water quality criteria in Class B waters). For these

[23] This is not so for the Cadys Falls Facility, where its classification as an existing use does have implications for the conditions it must meet under the VWQS, as discussed in Section IV.d.

reasons, MWL asserts that hydroelectric generation is an existing use as a commercial activity reliant on a high level of water quality pursuant to VWQS § 1-03(B)(1)(d).

ANR and VNRC/TU disagree, arguing that because a hydroelectric facility could operate in waters having adequate flow but impacted by phosphorus or nitrogen, it cannot be considered reliant on a high level of water quality.[24] Additionally, they assert that because the waters are not currently high quality the section does not apply.[25] Lastly, ANR and VNRC/TU assert that hydrology, particularly as it relates to flow and volume, should not be considered as factors of water quality in the interpretation of VWQS § 1-03(B)(1)(d).

The Court gives "substantial deference to an agency's interpretation of its own regulations," here, the VWQS. In re ANR Permits in Lowell Mountain Wind Project, 2014 VT 50, ¶ 15, 196 Vt. 467 (citing In re Peel Gallery of Fine Arts, 149 Vt. 348, 351 (1988)). "Absent a clear and convincing showing to the contrary, decisions made within the expertise of such agencies are presumed correct, valid and reasonable." In re Johnston, 145 Vt. 318, 322 (1985). Parties challenging ANR's interpretation "bear the burden of showing that ANR's interpretation is wholly irrational and unreasonable in relation to its intended purpose." ANR Permits, 2014 VT 50, ¶ 17 (citations omitted); see also Plum Creek Me. Timberlands, LLC v. VT. Dep't of Forests, Parks & Recreation, 2016 VT 103, ¶ 28, 203 Vt. 197; In re Costco Stormwater Discharge Permit, 2016 VT 86, ¶ 5, 202 Vt. 564.

We do not defer to ANR's interpretation that hydroelectric generation is not an existing use because it does not require a high level of water quality pursuant to VWQS § 1-03(B)(1)(d). ANR's position is based partially on the premise that flow rate and water volume are not features

[24] ANR and VNRC/TU suggest that reliance on "an existing high level of water quality" means reliance on water that is not impaired in any way. We decline to adopt such a narrow definition of high quality water. An activity can depend on water that is of high quality in one respect, while being negligibly affected by a contaminant it may carry. For example, the Project's hydroelectric activity would be significantly impaired by water degraded by TSS, scum, or sludge. And while high loads of phosphorus or nitrates would have little to no consequence for generation, the Project still requires water of high quality with regards to these other potential impairments.

[25] The parties take up the "existing" modifier in "existing high level of water quality" to say that the Project operates without a problem at present, despite the downstream waters failing to meet the VWQS, so it is not an activity requiring an existing level of high quality water. This view puts the cart before the horse, or, better stated, the bypass reach before the dam. As a commercial activity, hydroelectric generation depends on an *input* of high quality waters, coming from upstream of the facility. It does not "depend directly[]" on the quality of downstream waters. There is no evidence before the Court showing that any of the Project's facilities are operating satisfactorily despite an input of low quality water from upstream.

of water quality, so, while hydroelectric generation is dependent on certain flow rates, it is not dependent on an aspect of water quality. This interpretation of VWQS § 1-03(B)(1)(d) is unreasonable, for the following reasons:

First, hydrology as it relates to flow, water volume, and water quality, specifically to the implementation of the Hydrology Policy and Hydrology Criteria to support designated uses, are central issues in this appeal. The Court has received extensive testimony regarding the impacts that hydrology and flow have on water quality and compliance with the VWQS. This expert input supports a finding that flow rate is an integral component in any assessment of water quality.

Second, the Hydrology Policy expressly considers flow interruptions and fluctuations because of existing and new dams or control structures when determining conditions to preserve the natural flow regime. VWQS § 1-02(E)(1). The VWQS themselves conceive of flow as a feature of water quality.

Third, the United States Supreme Court has held that the distinction between water quality and quantity is "an artificial distinction." PUD No. 1 of Jefferson Cty. v. Washington Dept. of Ecology, 511 U.S. 700, 719 (1994) (interpreting the Clean Water Act as part of a 401 certification). The Court noted that the Clean Water Act includes a broad definition of pollution. Id. (citing 33 U.S.C. § 1362(19)). Further, "[i]n many cases, water quantity is closely related to water quality." Id.

Adequate hydrology and the physical impacts of water are considered when determining adequate water quality in the other contexts at issue in this appeal. We see no reason for excluding these issues in the context of VWQS § 1-03(B)(1)(d). We therefore consider hydrology when determining if there is a high level of water quality.

Finally, to adopt the interpretation proposed by ANR would render the Anti-Degradation Policy, particularly § 1-03(B)(1)(d), unnecessary and meaningless. To read the policy so narrowly would result in a failure to provide meaningful protection to uses that are existing.[26]

[26] We further decline to adopt ANR and VNRC/TU's assertion that, because hydroelectric generation tends to degrade water quality, it cannot be an existing use. To do so would ignore the reality of the 401 certification's role. It is uncontested that the present conditions of the relevant waters do not comply with the VWQS. However, the central issue in this appeal is reaching a set of certification conditions that result in MWL's compliance with the necessary standards. Therefore, while unregulated hydroelectric generation may degrade a waterbody, the

Further, ANR and VNRC/TU argue that because hydroelectric generation was not identified as an existing use in the basin planning process and has never been determined to be an existing use before, it must be precluded from protection under the Anti-Degradation Policy.[27]

Existing uses may be identified either through the basin planning process, or on a case-by-case basis "during the consideration of an application." VWQS §§ 1-03(B)(1). Our role, in conducting our de novo review, is to determine, in part, the Project's compliance with the VWQS. See In re Morrisville Hydroelectric Project Water Quality Certification, No. 103-9-16 Vtec, slip op. at 4-5 (Vt. Super. Ct. Envtl. Div. Jun. 13, 2017) (Walsh, J.) (citing 10 V.S.A. § 8504(h)). It is therefore within the scope of our review to determine if hydroelectric generation is an existing use pursuant to VWQS § 1-03(B)(1)(d). For hydroelectric generation to be operational and efficient, a waterbody must have adequate hydrological characteristics in the form of flow and volume, it must lack physical impediments such as debris, sludge, various solids, and turbidity. While the Morrisville Facility can operate if a water is impaired for some criteria regulated by the VWQS, the waters must be high quality in the areas addressed above. For these reasons, we conclude that hydroelectric generation at the Morrisville Facility is an existing use under VWQS § 1-03(B)(1)(d) as a "commercial activity that depends directly on the preservation of an existing high level of water quality."[28]

c. Cadys Falls Facility

Current conditions at the Cadys Falls Facility bypass reach do not meet the VWQS. Under its current license, MWL is not required to pass any flow into the reach. Therefore, the only flow

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permitting regime itself stands for the proposition that, with the proper and proportional conditions, hydroelectric generation will not degrade water quality.

[27] VNRC/TU also point to two previous water quality certifications for hydroelectric facilities: a Winooksi River project from 1993 and a Deerfield River project from 1995. In the case of the both projects, they assert that ANR included in a public comment a statement that the hydroelectric generation projects can degrade water quality and, therefore, are not existing uses.

Both final water quality certifications were not appealed. Further, neither the responses to public comment nor the subsequent certifications were offered into evidence. A response to public comment regarding an unappealed certification issued over 20 years ago does not have precedential authority over the Court.

[28] We note that there have been no Vermont cases addressing the applicability of this section to hydroelectric generation projects. Maine, however, has addressed the issue as related to Maine's Anti-Degradation Policy. S.D. Warren Co. v. Maine Dep't of Envtl. Prot., 2004 WL 143367, at *5 (Super. Ct. Me. May 4, 2004). The Maine Court concluded that hydroelectric generation was an existing use that must be maintained and protected pursuant to the Anti-Degradation Policy. Id. The Court further concluded that an approximately 15% reduction in energy generation at the facility still supported the existing hydroelectric use. Id.

within the reach is leakage, resulting in a flow of approximately 5.5 cfs. As part of the 2016 water quality certification, ANR imposed a minimum bypass flow of 100 cfs and one-inch of water to be spilled over the dam crest for aesthetic purposes. In this appeal, MWL proposes a minimum bypass flow of 65.5 cfs. MWL does not propose a requirement that water be spilled over the crest of the dam. For the reasons set forth below, we adopt MWL's proposal.

Anti-Degradation Policy

Under the Anti-Degradation Policy, "[e]xisting uses of waters and the level of water quality necessary to protect those existing uses shall be maintained and protected regardless of the water's classification." VWQS § 1-03(B)(1). Existing uses in the Lamoille Basin are identified as swimming, recreational boating, recreational fishing, and use as a public water supply and irrigation. 2016 Lamoille Basin Plan, p. 134. The Cadys Falls Facility bypass is not used as a public water supply. We therefore focus our analysis on recreational uses.[29]

The 2016 water quality certification recognizes that there are three formal recreational sites associated with the Cadys Falls Facility: a boat launch within the impoundment with associated parking spaces, a portage take-out within the impoundment with two associated parking spaces, and a put-in 1,500 feet downstream from the dam. 2016 Water Quality Certification, ¶¶ 178-79. We further note that in the Lamoille Basin Plan recreational fishing at the Cadys Falls Bridge is recognized as an existing use. Lamoille Basin Plan, Appendix F, Table F3, p. 200.

At trial, we were provided with little evidence regarding the impact on existing recreational uses of any proposed flow at the Cadys Falls Facility bypass reach. This may be because in its current flow regime only 5.5 cfs is passed through the reach and recreational uses such as boating, fishing, or swimming, would only be supported when natural flows allowed.

There is a causal connection between increasing flow and improving support of recreational activities. As ANR pointed out in support of its conditions, an increase in flow will provide more consistent opportunities for recreational uses as compared to the intermittent opportunities presently available. This is also true in MWL's proposal.

[29] Recreational uses are also protected as designated uses. See VWQS § 3-04(A)(5)-(6) (naming swimming, other primary contact recreational, boating, fishing, and other recreational uses as designated uses).

ANR asserts that MWL's proposed 65.5 cfs does not meet the Anti-Degradation Policy, because MWL takes into consideration the commercial use of hydroelectric generation in support of less high quality aquatic habitat. We have been provided with no evidence on why a flow of 65.5 cfs would not support the enumerated existing uses of swimming, recreational boating, and fishing.

We have credible evidence that flows of 65.5, 90, and 100 cfs will significantly improve the flow and amount of water in the reach.[30] All three flows will provide consistent flows within the bypass reach that will provide recreational opportunities more frequently than the intermittent opportunities presently available.

Further a flow of 65.5 cfs provides an overall weighted average of 63% of the maximum available habitat relative to a natural flow regime in the bypass reach. This is a significant improvement from the amount of habitat currently available at a leakage flow. This will further support more consistent recreational fishing opportunities within the reach than those currently available.

Because a flow of 65.5 cfs will provide significantly improved flows and habitat within the bypass reach, we conclude that the flow will support the existing recreational uses in the bypass reach and therefore complies with this aspect of the Anti-Degradation Policy.

Water Quality Criteria for Class B Waters

As discussed above, waters must comply with the general water quality criteria as well as the applicable criteria for their class. VWQS § 3-01; VWQS § 3-04(B) (setting water quality criteria for Class B waters). While there are many water quality criteria for Class B waters, this appeal focuses on DO and temperature.

Gomez & Sullivan, in connection with ANR and MWL, conducted a water quality monitoring study at the Project. The study's goals and general approach are discussed above in Section IV.a. "Water Quality Criteria for Class B Waters."

At the Cadys Falls Facility, four sampling locations were identified. Two are located above the dam, at a thalweg station and farther upstream at the impoundment's linear center, one

[30] MWL expert Mary Nealon's expert report provides a description of conditions at a flow of 90 cfs.

station is at the dam's penstock tap, and the fourth is located downstream in the bypass reach. These locations were periodically monitored from May to October of the study year.

Dissolved Oxygen

At the Cadys Falls Facility, DO must be not less than 6 milligrams per liter (mg/l), with 70% saturation at all times. VWQS § 3-04(B)(2)(a). The Gomez & Sullivan Water Quality Monitoring Report concluded that the Cadys Falls Facility complied with the DO requirements of the VWQS under current conditions.

For the same reasons discussed regarding the Morrisville Facility, a flow of 65.5 cfs will support the DO requirement of the VWQS. Even under the leakage conditions currently in place, the Cadys Falls Facility meets the DO requirements and the flow exceeds the 7Q10 drought flow.

ANR asserts that the 2016 water quality certification flow of 100 cfs provides reasonable assurances that DO will be met.[31] We conclude that a significantly increased flow of 65.5 cfs in waters already meeting DO standards provides adequate assurance of compliance. This increased flow improves water circulation and provides increased opportunity for water aeration.

Therefore, we find that a flow of 65.5 cfs will meet the DO requirements of the VWQS.

Temperature

The total allowable increase above the ambient temperature is one-degree Fahrenheit at the Cadys Falls Facility. VWQS § 3-01(B)(1)(b). The Gomez & Sullivan Water Quality Monitoring Study Report concluded that the temperature at the facility met this standard under existing conditions.

A flow of 65.5 cfs would significantly improve circulation within the reach. The increased flow limits the opportunities for water to stagnate and warm in the sun. Increasing the flow significantly to a rate above the 7Q10 drought flow, resulting in these improved water characteristics of flow and circulation, would provide assurances that the facility would continue to meet this standard.

Therefore, we find a flow of 65.5 cfs will meet the VWQS temperature requirement.

Designated Uses

[31] ANR stated that a flow of 90 cfs could potentially support the DO and temperature criteria of the VWQS.

Designated uses in Class B waters include: aquatic biota, wildlife, and aquatic habitat; aesthetics; public water supply; irrigation of crops and other agricultural uses; swimming and other primary contact recreational uses; and boating, fishing, and other recreational uses. VWQS § 3-04(A)(1)-(6). Because the waters at the Cadys Falls Facility are not used as a public water supply or for irrigation or agriculture, and because recreational uses are discussed above, we analyze the aquatic biota, wildlife, and aquatic habitat use and aesthetic use here.

Aquatic Biota, Wildlife, and Aquatic Habitat

High quality aquatic habitat must be available to support aquatic biota, wildlife, and aquatic habitat. VWQS § 3-04(A)(1). For the reasons set forth below, we find MWL's proposal of 65.5 cfs does not provide high quality aquatic habitat.

The Cadys Falls Facility operates in essentially a run-of-river mode and has a single 1600-foot bypass reach. The substrate in the reach is bedrock and a mixture of gravel and cobble. This substrate composition provides mixed habitat within the reach, including both riffle habitat and deeper areas. Unlike at the Morrisville Facility, there is no physical barrier preventing or limiting downstream passage of fish in the bypass reach.

In 2012, Gomez & Sullivan conducted a study of flows at the Cadys Falls Facility concurrently with the studies at the Morrisville Facility, discussed above. Unlike the Morrisville Facility, the flow study at Cadys Falls was conducted using a modified PHABSIM methodology. This method uses transect information on the water's depth, velocity, and substrate and aquatic habitat suitability index curves to create relationships between habitat and flow at the transects selected within the bypass reach.[32]

Three transects were selected at various intervals within the reach. Flows of 48, 67, 98, 139, and 163 cfs were measured. Target species were identified as macroinvertebrates and adult and juvenile brook, brown, and rainbow trout. Both ANR and MWL referred to this study and its results in reaching their respective flow proposals and determining if these flows support the designated use of aquatic biota, wildlife, and aquatic habitat use.

[32] The modified method also uses field-based measurements as opposed to modeling to determine a transects' hydraulic characteristics. Gomez & Sullivan, Cadys Falls Bypass Reach Flow Study Report, April 2013, p. 4. The study states that this method is preferred in reaches that are difficult to model or steep, like the Cadys Falls reach. Id.

Additionally, MWL expert Mary Nealon conducted an observational evaluation of the reach at the same locations at which Gomez & Sullivan placed transects and observed flows at 54 and 100 cfs, and, in consultation with Mr. Perry, conducted a time series analysis. Ms. Nealon then concluded that a flow of 90 to 100 cfs would provide high quality aquatic habitat. At trial, Ms. Nealon recommended a flow of 90 cfs to meet this standard.

MWL concedes that a flow of 65.5 cfs fails to provide high quality aquatic habitat in the Cadys Falls Facility bypass reach. This flow provides an overall weighted average of 63% of available habitat under a natural flow regime. MWL argues this does not make their proposal unviable, however, because a flow of 65.5 cfs would support the existing use of hydroelectric generation. A discussion of why hydroelectric generation is an existing use and, for that reason, why a flow that fails to fully support a designated use can still be imposed in compliance with the VWQS is provided in Section IV.d below.

The parties agree that high quality habitat will be provided at a flow of 100 cfs. At this flow, under a natural flow regime, there is 79% of habitat available for adult brook and brown trout and 84% available for juveniles.[33] We do not have data on the percent of habitat available at a flow of 90 cfs, either under a most limiting species theory or a natural flow regime theory.

We appreciate MWL expert Mary Nealon's testimony regarding flow and note her original recommended flow range of 90 cfs to 100 cfs. Without quantitative data regarding the amount of habitat provided at 90 cfs, however, we lack the adequate basis for determining whether a flow of 90 cfs would support high quality aquatic habitat within the bypass reach.

Aesthetics

Class B waters shall be managed to maintain the designated use of aesthetics. VWQS § 3-04 (A)(2). Aesthetics include the "water character, flows, water level, bed and channel characteristics, exhibiting good aesthetic value and, where attainable, excellent aesthetic value based on the Water Management Type designation." Id. Where a Class B water has not been assigned a water management type, as is the case here, it must have "water of a quality that consistently exhibits good aesthetic value." VWQS § 3-04(B)(6)(d). The parties agree that the

[33] We do not have data on the percent of habitat available under a natural flow regime for adult or juvenile rainbow trout or macroinvertebrates.

current conditions at the Cadys Falls Facility do not provide good aesthetic value at the dam or within the reach. ANR asserts that a one-inch spill of water over the dam and a flow of 100 cfs are required to meet the VWQS. MWL disagrees, arguing 65.5 cfs with no spilled water requirement will provide good aesthetic value. We agree with MWL's proposal.

Aesthetic evaluations of these flows were also conducted in a Gomez & Sullivan Aesthetic Flow Study. At the Cadys Falls Facility, five individuals observed three different flows of 27.7, 77.6, and 133.3 cfs in the bypass reach. Three vantage points were assessed; one located on the bridge downstream from the dam, one within the reach, and one at the dam itself. The study concluded that a flow of 133.3 cfs provided good to good/excellent aesthetic value in the reach, whereas a flow of 77.6 cfs provided fair/good to good aesthetic value, depending on the vantage point. A flow of 27.7 cfs, however, did not provide good aesthetic value in the reach.

MWL expert Mr. Perry conducted aesthetic flow demonstration observations at the site. Mr. Perry observed a flow of 53 and 100 cfs at three vantage points within the bypass reach, one viewing the dam, one viewing the bridge, and one in the middle of the reach.

Through his observations, Mr. Perry concluded that a flow rate of 53 cfs provided good aesthetic value throughout the reach. Mr. Perry concluded that increasing the flow to 100 cfs did not improve the aesthetic quality.

As with the Morrisville Facility, we are unconvinced that a one-inch spill should be required. The Cadys Falls Facility dam itself is not readily visible by the public and cannot be seen from Cadys Falls Road except for a limited view from the bridge over the bypass reach. The public also has a filtered view of the dam through trees on Needles Eye Road and Griggs Road. Access to the dam is only available by a gated road. Otherwise, public visibility is extremely limited. Further, complying with a one-inch spill requirement may be impractical in the winter months when the impoundment behind the dam is frozen. Finally, MWL's proposal of 65.5 cfs will result in some spillage over the dam.

Because the dam itself is largely out of the public's sight, we conclude a one-inch spill is unnecessary and, in certain conditions, impossible or highly impracticable to comply with. Therefore, we turn our focus to what flow should be required to provide good aesthetic value in the reach.

MWL supports its proposal of 65.5 cfs by Mr. Perry's aesthetic evaluation conclusions. Through his observations, Mr. Perry concluded that a flow rate of 53 cfs provided good aesthetic value throughout the reach. Mr. Perry asserts that with this flow a full veil of water falls over the crest of the dam, the bypass reach contains full water levels, and, within the reach, there are a variety of features such as pools, visible outcrops, riffles, and whitewater. Perry Report, p. 77. Further, the flow produces pleasant auditory effects such as rushing and babbling water. Id. Mr. Perry concluded that increasing the flow to 100 cfs did not improve these qualities. Id.

ANR asserts we should give little credibility to Mr. Perry's recommendation because of flaws within his flow observations. Largely, they assert, because he conducted his observations without the advice of ANR, without ANR staff present for the observations, and because Mr. Perry was alone without a team like that used during the Gomez & Sullivan aesthetic study, his conclusions are not credible. While we find that a team approach may provide a consensus in their recommendation, we are unconvinced that the failure to include ANR, either by seeking advice or inviting ANR staff to aid in the observations themselves, alone undermines the credibility of Mr. Perry's observations.

Mr. Perry was retained in this matter in 2014, prior to this litigation. The present appeal was filed on September 7, 2016, over a year before Mr. Perry conducted his aesthetic evaluations at the Cadys Falls Facility on October 12, 2017. We do not agree with ANR that a party's expert reports and studies will lose credibility when they failed to invite or seek advice from an opposing party in a litigation, even when that opposing party has expertise in the area on which the report or study is conducted. We therefore afford his testimony on this matter the weight it deserves. The Van Sicklen Ltd/ P'ship, No. 4C1013R-EB, slip op. at 1 (Vt. Env. Bd. Sep. 28, 2001); In re Application of Lathrop Ltd. P'ship I, 2015 VT 49, ¶ 90, 199 Vt. 19.

Further, the Gomez & Sullivan study did not observe flows between 27.7 cfs, which did not provide good aesthetic values, and 77.6 cfs, which provided fair/good aesthetic value depending on the vantage point. Therefore, Mr. Perry's observations of a flow in that range are helpful in reaching a determination regarding what flow provides good aesthetic value.

Mr. Perry credibly testified that a flow of 53 cfs provides good aesthetic value within the reach and would comply with VWQS § 3-04(B)(6)(d). Further, he credibly testified that increasing

the flow to 65.5 cfs would provide an increased assurance that good aesthetic value will be provided within the reach. Finally, he concluded that increasing the flow to 100 cfs does not significantly improve the aesthetics within the bypass reach beyond what is provided at lesser flows.

As with the Cadys Falls dam itself, the bypass reach has few easily accessed vantage points. The public has a filtered view of the reach through trees on Needles Eye Road and Griggs Road and on the Cadys Falls Road bridge. Otherwise, public visibility is limited.

Therefore, we conclude that a flow of 65.5 cfs, without a one-inch spill, will provide good aesthetic value in the Cadys Falls Facility bypass reach. A flow of 100 cfs, as included in the 2016 water quality certification, exceeds that which is necessary to support good aesthetic value.

For the reasons set forth below, the failure to provide high quality aquatic habitat in the Cadys Falls Facility bypass reach does not make MWL's proposed 65.5 cfs flow unviable at the Cadys Falls Facility.

d. The Cadys Falls Facility as an existing use pursuant to VWQS § 1-03(B)(1)(d)

For the same reasons set out above with respect to the Morrisville Facility in Section IV.b, we conclude that hydroelectric generation at the Cadys Falls Facility is an existing use pursuant to VWQS § 1-03(B)(1)(d). Unlike at the Morrisville Facility, MWL's proposal does not comply with the VWQS without recognizing hydroelectric generation as an existing use. The Court now must determine whether MWL's proposal of 65.5 cfs complies with the VWQS with consideration to hydroelectric generation as an existing use.

Waters "shall be managed to achieve and maintain a level of quality that fully supports . . . designated uses," here, aquatic biota, habitat, and wildlife. VWQS § 3-04(A)-(1). "Existing uses . . . and the level of water quality necessary to protect those existing uses shall be maintained and protected." VWQS § 1-03(B)(1).

The proposals before the Court cannot support both the existing use of hydroelectric generation at the Cadys Falls Facility and the designated use of aquatic biota, habitat, and wildlife. MWL asserts that a flow of 65.5 cfs in necessary to support hydroelectric generation, while ANR asserts, and MWL concedes, that this flow would not provide high quality aquatic habitat. A flow of 100 cfs would provide high quality aquatic habitat but would result in a 21%,

or 713-megawatt hour (MWh), reduction in energy generation at the facility. MWL provided evidence, albeit thin, that at this reduced production rate they would have to shut down this facility. We conclude that imposing the 100 cfs flow would cause a reduction in energy generation that does not support the existing use of hydroelectric generation. We therefore must determine the proper balance between the two uses.

MWL's proposes a flow of 65.5 cfs. At this flow, 63% of the overall weighted average of habitat at a natural flow regime is provided. This flow results in a 35% increase in habitat availability as compared to the present leakage conditions.[34] This flow will result in a 13%, or 440-megawatt hour (MWh), reduction in energy generation.

A flow of 100 cfs, as imposed by the 2016 water quality certification, provides high quality habitat. This flow would, however, result in a 21%, or 713 MWh, reduction in energy generation. A flow of 100 cfs, providing for an approximate 55% increase in available habitat and 21% reduction in generation, does not reasonably balance these two uses.

The waters at the Cadys Falls Facility are not high quality. We therefore do not address the issue of a reduction of quality in existing high quality of waters. See VWQS § 1-03(C)(1)-(2). Instead, any flow imposed by the Court is improving water quality in a body that presently fails to meet the VWQS. Both proposals significantly improve water quality in the bypass reach, while, to differing degrees, degrading the existing use of hydroelectric generation at the Cadys Falls Facility.

A flow of 65.5 cfs meets all relevant standards except for the aquatic biota, wildlife, and habitat use. A flow of 100 cfs provides high quality habitat but exceeds what is necessary to ensure compliance with the other VWQS and fails to comply with the Anti-Degradation Policy. The 100 cfs does not reasonably balance the uses within the Cadys Falls bypass reach. We must balance the requirements that waters "shall be managed to achieve and maintain a level of quality that fully supports . . . designated uses," here, aquatic biota, habitat, and wildlife (VWQS

[34] This percentage represents a comparison between habitat available for adult brook and brown trout. Data provided for adult and juvenile brook and brown trout show that 28% and 29%, respectively, of habitat available under a natural flow regime is available at the present leakage flow. We do not have data that includes the percentages of habitat available under the leakage flow for rainbow trout or macroinvertebrates.

§ 3-04(A)-(1)), and maintain and protect "[e]xisting uses . . . and the level of water quality necessary to protect those existing uses." VWQS § 1-03(B)(1).

We conclude that a flow of 65.5 cfs reasonably balances the designated and existing uses at issue in the reach while complying with all other relevant sections of the VWQS as discussed above.[35]

e. Green River Facility

Current conditions at the Green River Facility do not meet the VWQS. Unlike the other facilities at issue in this appeal, the Green River Facility operates in store and release mode. Under existing conditions at the facility, a large reservoir is maintained behind the dam. From May to October, the reservoir is permitted a maximum fluctuation of one foot and the water levels must be managed for recreation and loon nesting habitat. During the winter, from December 30 to April 1, MWL is permitted have a winter drawdown of ten feet. The reservoir must be refilled by May 1. The minimum downstream flow year-round is 5.5 cfs. From May to October, the maximum generation flow is 160 cfs and from November to April the maximum generation flow is 283 cfs.

As a part of the 2016 water quality certification, ANR imposed multiple conditions on the Green River Facility, both with respect to the reservoir and the downstream conditions. The conditions are generally seasonal.

For the drawdown levels, ANR imposed, and argues for on appeal, a maximum reservoir fluctuation of 0.25 feet from June 1 to December 15. From December 16 to March 31, the winter drawdown, they would limit the drawdown to 1.5 feet. This drawdown would have to be refilled by May 1. Once the reservoir is refilled, MWL would be permitted a maximum reservoir fluctuation of 0.25 feet.

[35] We note that ANR expressed concern with the use of the percentage of energy reduction as a means for determining if hydroelectric generation was supported. Again, while this issue has not been addressed in Vermont, Maine has addressed the issue as related to Maine's Anti-Degradation Policy. S.D. Warren Co., 2004 WL 143367, at *5. In that case, the Court relied on the amount of energy reduced in determining whether the use was supported. Id. In doing so, the Court concluded that an approximate 15% reduction in energy generation at the facility still supported the use. Id. We also conclude that the amount of energy generation reduced is a proper means of determining whether hydroelectric generation is supported.

With respect to flow conditions, ANR imposed multifaceted conditions based on the season and relevant drawdown in the reservoir. We summarize the conditions here. First, a minimum downstream flow of inflow, 5.5 cfs, or 7 cfs from June 1 to September 30 based on drawdown. From October 1 to December 15, a minimum downstream flow of inflow, 7 cfs, or 10 cfs based on drawdown. From December 16 to March 31, flows of inflow, 6 cfs, or 8 cfs, based on drawdown. Finally, from April 1 to May 31, flows of 15 cfs, 30, cfs, 60 cfs, or inflow based on the refilling of the reservoir from the winter drawdown and general drawdown in the reservoir.

Further, maximum generation flow conditions were also imposed by the 2016 water quality certification. From June 1 to December 15, ANR imposed a maximum generation flow of 0 cfs, unless inflow is greater than 60 cfs, in which case, MWL must match the inflow. From December 16 to March 31, the maximum generation flow is 110 cfs or inflow if inflow exceeds 110 cfs. Finally, from April 1 to May 31, a maximum generation flow of 0 cfs is imposed, unless inflow is greater than 60 cfs, in which case, a maximum of 60 cfs is required until the reservoir is refilled after the winter drawdown. Then, if inflows exceed 60 cfs, MWL generation flows match the inflow.

MWL proposes alternative conditions at both the reservoir and downstream. From June 1 to December 15, MWL proposes a maximum reservoir fluctuation of 0.25 feet. From December 16 to March 31, MWL proposes a maximum winter drawdown of 6 feet, which will be determined annually based on snowpack measurements. The reservoir must be refilled by May 1. After refill, a maximum fluctuation of 0.25 feet is imposed.

The minimum downstream flows proposed by MWL are somewhat simpler than those imposed by ANR's water quality certification. From June 1 to September 30, a downstream flow of 7 cfs is imposed. From October 1 to December 15, MWL proposes a flow of 10 cfs. From December 16 to March 31, a minimum flow of 8 cfs will be imposed. Finally, from April 1 to May 31, a minimum flow of 60/30 cfs would be released. In these seasons, if inflows are less than the enumerated flow rate, then downstream flows will match inflow. MWL asserts that natural high flows over 70 cfs will be passed downstream outside of the winter drawdown and spring refill period.

Maximum generation flows from June 1 to December 15 are set at 70 cfs or inflow, if greater. From December 16 to March 31, the maximum generation flow proposed is 160 cfs or inflow, if greater. Finally, from April 1 to May 31, maximum generation flows would be set at 60 cfs, or inflow, if greater, but only if the reservoir exceeds the target water level for refill.

As discussed in detail below, because MWL's proposed flow regime supports the designated use of aquatic biota, wildlife, and aquatic habitat, and because it ensures that the VWQS's DO and temperature standards will be met, we recognize this as the flow regime suitable for water quality certification. ANR's proposed regime exceeds the requirements of the VWQS. However, because MWL's proposed winter drawdown of six-feet does not sufficiently support high quality aquatic habitat, ANR's requirement of an 18-inch drawdown will be imposed. Additionally, because neither MWL nor ANR's recommendations support the existing use of whitewater boating, the final operational conditions need to include three scheduled whitewater boating releases to comply with the VWQS.

Anti-Degradation Policy

Under the Anti-Degradation Policy, "[e]xisting uses of waters and the level of water quality necessary to protect those existing uses shall be maintained and protected regardless of the water's classification." VWQS § 1-03(B)(1). Existing uses in the Lamoille Basin are identified as swimming, recreational boating, recreational fishing, and use as a public water supply. 2016 Lamoille Basin Plan, p. 134. The Green River Facility is not used as a public water supply. We therefore focus our analysis on recreational uses.[36]

Green River

We begin our discussion with the Green River. Pursuant to our March 23, 2018 decision, the whitewater boating uses at issue in this appeal—boating on naturally occurring high flows and scheduled releases (together, the whitewater uses)—are existing uses at the Green River. In re Morrisville Hydroelectric Project Water Quality Certification, No. 103-9-16 Vtec, slip op. at 4-6 (Vt. Super. Ct. Envtl. Div. Mar. 23, 2018) (Walsh, J.). In considering whether either ANR or MWL's

[36] Recreational uses are also protected as designated uses. See VWQS § 3-04(A)(5)-(6) (naming swimming, other primary contact recreational, boating, fishing, and other recreational uses as designated uses).

proposed conditions sufficiently support the existing use of whitewater boating, we conclude that neither set of conditions sufficiently support the use.

In post-trial briefs, ANR submitted the theory that, even though whitewater boating is an existing use, the use does not need to be protected because whitewater boating does not require a higher level of water quality than the classification of the waterbody requires. ANR asserts that existing uses requiring water quality less stringent than designated uses are presumed to be fully supported when designated uses are supported. ANR asserts that whitewater boating requires less stringent water quality than the designated uses, and therefore, is supported.

The Court gives "substantial deference to an agency's interpretation of its own regulations," here, the VWQS. ANR Permits, 2014 VT 50, ¶ 15, 196 Vt. 467 (citing Peel Gallery, 149 Vt. at 351). "Absent a clear and convincing showing to the contrary, decisions made within the expertise of such agencies are presumed correct, valid and reasonable." Johnston, 145 Vt. at 322. Parties challenging ANR's interpretation "bear the burden of showing that ANR's interpretation is wholly irrational and unreasonable in relation to its intended purpose." ANR Permits, 2014 VT 50, ¶ 17 (citations omitted); see also Plum Creek Me. Timberlands, LLC, 2016 VT 103, ¶ 28; In re Costco Stormwater Discharge Permit, 2016 VT 86, ¶ 5.

Essentially, ANR asserts that only existing uses requiring more stringent water quality than designated uses are entitled to protection. This reading results in existing uses going unsupported and the Anti-Degradation Policy being rendered unnecessary. The Anti-Degradation Policy is intended to provide for meaningful protection of existing uses. VWQS § 1-03(B)(1). As a practical matter, AW/VPC provided credible evidence that the conditions imposed in the 2016 water quality certification would likely provide no actual whitewater boating opportunities. Therefore, as discussed below, while ANR's conditions may support certain designated uses, in reality they would not support the existing whitewater boating use. ANR's interpretation would therefore result in an irrational and unreasonable interpretation of the Anti-Degradation Policy. We do not defer to this interpretation.

The Green River is narrow, shallow, and very rocky. Therefore, the only potential boating uses that could be supported on the river are the whitewater uses. The minimum flow required

to support these uses is between 128 and 140 cfs. A flow of 222 cfs provides the best flow level for a standard run and a flow of 280 cfs provides the best level for a highly challenging run.

Presently, whitewater uses occur when naturally occurring high flows allow and during scheduled releases, usually scheduled through agreement between AW/VPC and MWL. Recently, except for 2013, these scheduled releases occurred 2 to 3 times a year. Both the MWL and ANR proposals will limit whitewater boating opportunities in a way that does not support the use.

Under the MWL proposal, there is no requirement to conduct scheduled releases at any time of year. In the spring, after the refill period, MWL's proposal sets a maximum generation flow of 60 cfs, or inflow, if greater, after the reservoir is refilled. Because 60 cfs is not a boatable flow, opportunities for whitewater boating would be limited to natural high flow events. At all other times of the year, the minimum downstream flow is not viable for boating, and whitewater boating would be similarly limited. In the winter, however, MWL proposes a maximum generation flow of 160 cfs. This flow would support whitewater boating when MWL chooses to generate.

ANR's conditions as set forth in the 2016 water quality certification will also impact the whitewater uses. During the winter months, MWL would be permitted to operate in store and release mode, but the certification places a maximum generation flow at 110 cfs, unless inflow exceeds that amount. 110 cfs is not a boatable flow so opportunities for whitewater boating would be limited to naturally occurring flows higher than 110 cfs. MWL, however, is not required to pass these naturally occurring high flows downstream and their passage would be dependent upon whether MWL is generating and the reservoir drawdown at that time. Whitewater boaters could not utilize the store and release operation for scheduled releases.

In the spring, the water quality certification does not permit the passing of naturally occurring high flows during the refilling period. In the summer and fall months, naturally occurring high flows must be passed down the Green River from the Green River Reservoir, however, the opportunities for boating may be limited because natural high flows may also be limited at this time. Further, during these periods, minimum downstream flows are not boatable.

Under both flow conditions, scheduled releases would not be permitted and MWL would not be able to place these releases at a time during which whitewater boaters could take advantage of the use by time shifting.

Time shifting would occur, for example, if a naturally occurring high flow were to take place overnight or on a weekday during which most whitewater boaters could not participate in the use. If time shifting were permitted, MWL could hold that natural high flow in the reservoir for a few hours or days and then release it at a time when boaters could take advantage of the opportunity, for example, during daylight hours on the weekends. If time shifting were not permitted, but naturally occurring high flows were to be passed, a boatable flow could occur but, because of its inconvenient and unsafe time, few or no boaters would be able to take advantage of it.

Central to the issue of supporting the existing use of whitewater boating is the timing of when high flow events occur. Under both ANR's conditions and MWL's proposal, naturally occurring high flow events that are boatable will be passed downstream at various times throughout the year. Just because a flow is boatable, however, does not make that flow a whitewater boating opportunity. Only scheduled releases allow for boatable flows to occur for a sufficient duration when boaters can take advantage of them.

We conclude that merely passing naturally occurring high flow is not sufficient to support the existing whitewater uses at the Green River. To adequately support the use, scheduled releases must occur at a time during which boaters can take advantage of the flows, such as weekend daylight hours. Neither the conditions imposed by ANR through the 2016 water quality certification nor the MWL proposal require scheduled releases to support whitewater boating on the Green River. Therefore, both sets of conditions as presented fail to support this existing use.[37]

[37] The Court notes that the primary focus of the Anti-Degradation Policy at the Green River Facility was whitewater boating. To the extent that recreational fishing and swimming exist at the Green River, both ANR's conditions imposed in the 2016 water quality certification and MWL's proposed conditions would support both uses on the Green River. With respect to recreational fishing, for the reasons set forth below, both proposals will support the designated use of aquatic biota, wildlife, and habitat. Further, both proposals support year-round adequate flows in the river, such that swimming would be supported, to the extent it exists.

Evidence before the Court shows that two to three scheduled releases have occurred annually and, therefore, three scheduled releases of boatable flows must occur annually, during times at which boaters may take advantage of the flows.[38]

Green River Reservoir

The Green River Reservoir is a popular recreation destination and is in the Green River Reservoir State Park. Currently, the reservoir supports the uses of recreational non-motorized boating, fishing, swimming, and camping.

MWL's proposed drawdown of six feet would be in keeping with the current drawdown conditions, which support these uses as they currently exist. Alternatively, the 1.5-foot drawdown condition imposed by the 2016 water quality certification would result in smaller fluctuations in water level at the reservoir and, for the reasons set forth below, provide high quality aquatic habitat therein. Therefore, we conclude that both proposals would support the existing recreational uses within the Green River Reservoir.

Water Quality Criteria

Waters must comply with the general water quality criteria as well as the applicable criteria for their class. VWQS § 3-01; VWQS § 3-04(B) (setting water quality criteria for Class B waters). As noted above, this appeal focuses on the DO and temperature criteria.

Gomez & Sullivan, in coordination with ANR, conducted a water quality monitoring study at the Project. The study's goals and general approach are set forth above in Section IV.a "Water Quality Criteria for Class B Waters."

At the Green River Facility, six sampling locations were identified: three within the Green River Reservoir, at the reservoir's linear center, the thalweg station, and the penstock tap; and three at various locations within the Green River, downstream from the dam at the tailrace, near Garfield Road, and near the river's confluence with the Lamoille River. The locations within the reservoir were sampled periodically from May to October of the study year, whereas the locations downstream from the dam were sampled both periodically, also from May to October,

[38] AW/VPC asserted at trial that seven annual releases would be supported by the naturally occurring flows in the Green River and would be utilized by the boating community. In its post-trial brief, it asserted that five releases would support the use. We have no evidence that scheduled releases have occurred at either frequency and we conclude that both requests exceed that which is necessary to support the use as it currently exists.

and continuously. Continuous monitoring for temperature occurred from April 26, 2012 to November 19, 2012 and continuous monitoring for DO occurred for nine days in September 2012.

Dissolved Oxygen

At the Green River Facility, DO must be not less than 6 milligrams per liter (mg/l), with 70% saturation at all times. VWQS § 3-04(B)(2)(a).

The parties agree that existing conditions do not conform to the VWQS for DO. This is largely due to the nature of the store and release operation of the dam. When drawing water from the reservoir, the water is not pulled from the top of the reservoir, but from deeper within the impoundment. Because of stratification, this is typically where low DO water accumulates.

When DO is measured at the facility's tailrace, DO does not comply with the VWQS. Further downstream, however, after the river naturally aerates the water, the waters come into compliance. MWL asserts that modifications to the facility's equipment will bring the river into compliance. ANR expert Mr. Crocker testified that he has no concerns regarding MWL's proposal regarding the DO requirements of the VWQS. Therefore, we conclude MWL's proposal will comply with the DO requirements of the VWQS.

Temperature

The total allowable increase above the ambient temperature is one-degree Fahrenheit at the Green River Facility. VWQS § 3-01(B)(1)(b). The facility is presently meeting the temperature standards and ANR does not raise concerns regarding temperature with respect to MWL's proposal.

Designated Uses

Designated uses in Class B waters include: aquatic biota, wildlife, and aquatic habitat; aesthetics; public water supply; irrigation of crops and other agricultural uses; swimming and other primary contact recreational uses; and boating, fishing and other recreational uses. VWQS § 3-04(A)(1)-(6). Unlike the Morrisville and Cadys Falls Facilities, the designated use of aesthetics is not at issue at the Green River Facility. Further, because the waters at the Green River Facility are not used as a public water supply or for irrigation or agriculture, and because recreational uses are discussed above, we analyze only the designated use of aquatic biota, wildlife, and habitat here.

High quality aquatic habitat must be available to support aquatic biota, wildlife, and aquatic habitat. VWQS § 3-04(A)(1). For the reasons set forth below, we find MWL's proposed flow regime will support high quality aquatic habitat within the Green River. ANR's flow regime imposes excessive flow requirements that go beyond the VWQS. However, MWL's proposed winter drawdown will not provide high quality aquatic habitat, while ANR's prescribed drawdown does comport with the VWQS.

Green River

The Green River is approximately 4.3 miles long and flows from the dam to its confluence with the Lamoille River. Approximately 1.5 miles downstream from the dam is a culvert at Garfield Road. This culvert prevents fish from accessing the section of the river upstream from the culvert. Fish could, however, move downstream through the culvert. There is a self-sustaining population of brook trout above the culvert as well as self-sustaining populations of both brook and brown trout below the culvert. In addition, there is a 10 to 15 foot-high falls located 3.2 miles downstream from the dam. This is potentially a year-round barrier to fish moving upstream.

Throughout the river there are various features such as riffles, pools, including step pools, runs, and falls. The channel includes bedrock, fine gravel, course gravel, cobble, boulder substrate, with in-stream vegetation, woody debris, and overhanging vegetation. The banks are vegetated and mossy. These conditions provide in-stream cover for fish.

Like at the Morrisville and Cadys Falls Facilities, Gomez & Sullivan performed a flow study at the Green River in 2012. This study developed habitat and flow relationships for the target species in the Green River at different life stages, including spawning and incubation, late fry, juvenile, and adult brook, brown, and rainbow trout, early fries of all trout, spawning and incubation for longnose suckers, and macroinvertebrates. The study utilized IFIM to assess the Green River, specifically a transect-based PHABSIM approach. This methodology allows transect information, such as depth, velocity, and substrate, to be combined with aquatic habitat suitability index curves to determine the weighted usable area of habitat as compared to flow at the selected transects.

Nine transects were identified in the Green River, five of which were specifically designated to address spawning habitat. These transects generally were spread throughout the river to study different types of habitat, including riffle, pool, and run, as well as substrate.

Data collection occurred at flows of 10 cfs and 75 cfs. An attempt was made to collect data at 160 cfs, but the velocities resulted in the stream not being wadeable.

MWL experts conducted a time series analysis to complete their understanding of the Gomez & Sullivan PHABSIM modeling, as it did at the Morrisville and Cadys Falls Facilities. The time series was based on historical flow information from the Garfield gauge.

In October 2017, Ms. Nealon conducted fish monitoring at the Green River with a team from Bear Creek Environmental and Normandeau Associates. This monitoring sought to determine if current conditions comply with the aquatic biota, wildlife, and habitat use. Four monitoring stations were selected at river miles 3.5, 3.2, 2.9, and 0.1. Two rounds of electrofishing were conducted at each station, at a minimum, and the data was analyzed using the Indices of Biotic Integrity (IBI). The Vermont Mixed Water IBI and the Coldwater IBI were used. Stations located at river mile 3.2 received an assessment of very good, and river miles 2.9 and 0.1 received assessments of excellent under the IBI.[39]

Under existing conditions, an overall weighted average of 76% of habitat, relative to the amount of habitat under a natural flow regime, is currently provided. Under MWL's proposed flow regime, an average of 95% of habitat will be provided as compared to a natural flow regime. Under the conditions imposed by the 2016 water quality certification, 111% of habitat will be available relative to a natural flow regime. An average of 76% of habitat under a natural flow regime, for the same reasons as discussed above in Section IV.a "Designated Uses", supports high quality aquatic habitat in the reach. An increase, such as under the MWL proposed flow regime, would provide further assurances that high quality habitat will be provided.

ANR has raised concerns regarding the higher flows proposed by MWL and their effect on fish populations. Specifically, ANR addressed the issue of peak flows during spawning.[40] It is ANR's opinion that peaking generally negatively affects fish populations, especially with respect

[39] River mile 3.5 was not evaluated using the IBI because it had a soft bottom.

[40] ANR again raises concerns with MWL using averages in their habitat analysis. For the same reasons as above, we do not share these concerns.

to immobile or low mobility life stages. ANR relied upon the PHABSIM Gomez & Sullivan flow study in reaching its conclusions regarding the flows in the Green River, which indicate that consistent and lower flows support high quality aquatic habitat.

Current conditions in the Green River, under a flow regime that permits maximum generation flows of 283 cfs and 160 cfs at various times of year, support abundant fish populations. Currently, there is a self-sustaining brook trout population above the Garfield Road culvert, self-sustaining populations of brook and brown trout below the culvert, and the river supports spawning habitat.

Ms. Nealon's expert report contains the results of her fish population study showing very good to excellent fish populations in the river. Mr. Wentworth opined that the Court should not give this very much weight. His opinion seems to be based on the fact that we presently lack data as to what has been going on over longer time scales with respect to fish in the Green River, such as factors that may be controlling the population, like physical habitat. Ms. Nealon's study, he opined, is a snapshot of the present population which lacks the sort of multi-annual and seasonal data which would provide a full understanding of the population. Importantly, Mr. Wentworth did not look through the study or its results thoroughly and only "flipped through."

Instead, ANR and Mr. Wentworth rely upon the PHABSIM modeling to support the 2016 water quality certification flow regime. We note that at various flows the modeling assigns a zero-habitat value. We know, however, that current flows support fish populations in the Green River in reality. While we value the information that modelling can provide, we cannot neglect the actual conditions at a given location, especially when the two contradict one another.

The fish population results are indeed a snapshot of the population at a given time. However, high quality aquatic habitat is currently being provided within the reach and, under the current regime, in which generation is permitted at very high flows, this snapshot shows that fish populations are abundant in the habitat.

We conclude that MWL's proposed flow regime, increasing habitat availability from 76% to 95% as compared to a natural flow regime in the Green River, will provide high quality aquatic habitat and therefore satisfies the aquatic biota, wildlife, and habitat designated use. ANR's flow

regime provides 111% habitat of a natural flow regime which is in excess of what the VWQS require.[41]

Green River Reservoir

The Green River Reservoir has a typical maximum water surface area of roughly 653 acres. The normal maximum water elevation is 1220 feet with a depth of 93 feet. Currently, MWL is permitted to draw down the reservoir in the winter (from December 1 to April 30) a maximum of ten feet. In practice, MWL has on average drawn the reservoir down 3.7 feet. The maximum winter drawdown occurred in the winter of 2009-2010 and was 5.9 feet.

ANR performed a littoral habitat assessment of the Green River Reservoir in 2014. The assessment sampled 17 sites at the reservoir and compared the Green River Reservoir's littoral habitat to those of reference waterbodies. The reference waterbodies were eight large mesotrophic lakes sampled by ANR in 2007 and 2008, at which 54 sites were sampled. These samples provided conditions of waterbody types like that of the Green River Reservoir. Sites were assessed for substrate composition, aquatic plant cover, woody debris, embeddedness, odonate exuviae (dragonfly exoskeletons), and riparian habitat characteristics.

The assessment concluded that the reservoir's littoral zone had many areas that were highly suitable for aquatic macrophyte growth but that currently lacked macrophytes and, as compared to these eight reference waterbodies, the reservoir had less aquatic plant cover and odonate exuviae. The assessment concluded that these impacts are consistent with those associated with water level fluctuations, such as winter drawdowns.

MWL expert Kurt Jirka conducted an evaluation of the impacts of the current drawdown and those the 2016 water quality certification would have in the Green River Reservoir. Mr Jirka conducted a site visit on July 20, 2017 and made qualitative observations of the reservoir's physical and biological attributes.

MWL asserts that a six-foot maximum winter drawdown will provide high quality aquatic habitat. This is based on Mr. Jirka's observational assessment of the reservoir's current physical

[41] VNRC and TU ask: "[w]hether hydropeaking and modified run-of-river flows in the Green River allowed in the water quality certificate issued for the Project do not comply with the VWQS, including the provisions in the standards that require support and protection of aquatic habitat and biota." In reaching the conclusion that existing conditions, which include peaking, support high quality aquatic habitat, we answer this question in the negative.

and biological attributes under the current drawdown regime. No quantitative assessment of plant presence, substrate composition, fish populations, macroinvertebrate richness, or other wildlife presence was conducted in relation with this assessment. This cursory, observational assessment of the Green River Reservoir does not support the conclusion that the current drawdown regime supports high quality aquatic habitat in the reach.

Further, ANR has provided an alternative assessment of the littoral zone. ANR's littoral habitat assessment concluded that the Green River Reservoir's littoral zone was less developed as compared with other reference waterbodies, despite having adequate substrate for aquatic biota. The assessment concluded this was a result of historical drawdown regimes at the reservoir.

Because MWL has failed to demonstrate that its proposed winter drawdown regime supports high quality aquatic habitat, we conclude that a maximum winter drawdown of six feet does not support high quality aquatic habitat within the Green River Reservoir. Further, MWL has not provided persuasive justification supporting the assertion that ANR's condition of a 1.5-foot drawdown does not comply with the VWQS. Therefore, we decline to adopt MWL's proposal and the 2016 water quality certification's condition on winter drawdown is affirmed.

f. The Green River Facility as an existing use pursuant to VWQS § 1-03(B)(1)(d)

For the same reasons as set out with respect to the Morrisville Facility, we conclude that the hydroelectric generation at the Green River Facility is an existing use pursuant to VWQS § 1-03(B)(1)(d).

We note, however, that our above analysis regarding MWL's proposed conditions at the facility does not depend on the facility's existing use status. Therefore, MWL's proposed flow conditions at the Green River Facility complies with the VWQS, even *without* the consideration of the facility's existing use status. Further, we note that MWL does not argue that it cannot operate or operate practically without the six-foot drawdown it proposed. Therefore, there is no need to balance the existing uses and our above analysis of the proposal is not affected by our conclusion that the Green River Facility is an existing use.

V. Phase-In

The Hydrology Policy states that conditions imposed should "preserve, to the extent practicable, the natural flow regime of waters." VWQS § 1-02(E)(1). Consideration must be given to existing operation of "dams, diversions, and other control structures." Id. Here, all bypass reaches and downstream flows are affected by the existence of the MWL facilities.

The Hydrology Criteria are those criteria used to implement the Hydrology Policy. For Class B waters, "[a]ny change from the natural flow regime shall provide for maintenance of flow characteristics that ensure the full support of uses and comply with the applicable water quality criteria." VWQS § 3-01(C)(1)(c).

MWL argues that the water quality certification does not comply with the Hydrology Policy because it fails to include a phase-in period during which it could implement the necessary equipment modifications and construction. MWL argues that phase-in is required based on its interpretation of the term "practicable." Because there is no definition of "practicable" in the VWQS, MWL turned to the Vermont Wetland Rules, which defines practicable or practicability as "available and capable of being done after taking into consideration logistics, existing technology and cost in light of [the] overall project purpose." Vt. Code of Regulations 12004056, § 2.28. MWL asserts it is entitled to a phase-in period because of the necessary modifications and construction, under either its own proposal or ANR's certification.

ANR asserts that a phase-in period is not authorized under the Hydrology Policy. ANR interprets "practicable" as referring to the preservation of the natural flow regime to the extent practicable, not the preservation of hydroelectric facilities to the extent practicable. ANR asserts that permitting a phase-in within the water quality certification would contravene the CWA and cites to an unreported Florida case interpreting the CWA in the context of a different permitting regime. See Miccosukee Tribe of Indians v. United States, 1998 WL 1805539, at * 16 (S.D. Fla. 1998). Further, ANR contends that there is no authority within the VWQS to permit a phase-in period and, therefore, one cannot be included. See In re Star-Kist Caribe, Inc., 1990 WL 324290, at *2 (EPA, Apr. 16, 1990).

We owe deference to ANR's interpretation of policy or terms when: "(1) that agency is statutorily authorized to provide such guidance; (2) complex methodologies are applied; or (3)

such decisions are within the agency's 'area of expertise.'" Korrow Real Estate, LLC, 2018 VT 39, ¶ 20 (citation omitted). As stated above, the Court gives deference to ANR's interpretation of the VWQS, however, "the deference owed to agency determinations is not absolute." Id., ¶ 21 (citation omitted). "An agency's authority to define terms within its statutory purview will be given deference unless that authority is applied 'arbitrarily and capriciously' such that it 'give[s] rise to a violation of due process.'" Id. (citing In re Woodford Packers, Inc., 2003 VT 60, ¶ 17, 175 Vt. 579).

In Vermont, the Secretary of ANR has the authority to review, establish, and revise the water quality standards. See 40 C.F.R. § 131.4(a) (giving states the authority to review, establish, and revise water quality standards); 10 V.S.A. § 1252(e) (requiring the Secretary of ANR to adopt water quality standards). As such, it is within ANR's discretion to define the terms within the VWQS. However, practicable is undefined in the VWQS.

It is uncontested that ANR issued a water quality certification to Green Mountain Power in 2016 which contained phase-in measures in the form of interim and immediate compliance deadlines tied to construction. Here, however, ANR asserts that a phase-in schedule is not permissible under the Hydrology Policy and, further, is not authorized by the VWQS. It is unclear why a phase-in schedule would be permissible to another permittee but impermissible here. Because ANR's interpretation has been applied arbitrarily and capriciously, we decline to afford it deference or adopt it here. See In re Champlain Coll. Maple St. Dormitory, 2009 VT 55, ¶ 10, 186 Vt. 313 *overruled on other grounds*; In re Confluence Behavioral Health, LLC, 2017 Vt. 112 (2017) (declining to adopt a zoning interpretation that has not been consistently applied).

We further note that MWL's interpretation appears to be implicitly supported by In re Clyde River Hydroelectric Project, 179 Vt. 606, 610 (2006). In that case, appellants asserted that the Water Resources Board violated the VWQS by applying different criteria to the relevant bypass reach and the rest of the river. Id. In rejecting that argument, the Vermont Supreme Court stated that the Hydrology Policy is specific to existing dams, and cites the language at issue here, emphasizing the phrase "to the extent practicable." Id. The Supreme Court's discussion supports interpreting the phrase "to the extent practicable" in a way that refers to existing dams, as opposed to the preservation of the natural flow regime.

For these reasons, we conclude that a phase-in period is permissible under the VWQS.

MWL asserts that it will require ten years to be in compliance with any flow regime imposed on it. During this time, MWL wishes to operate under its current flow regime.

The purpose of the VWQS is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." VWQS § 1-02. This is the same objective as the CWA. 33 U.S.C. § 1251 et seq. FERC licenses are valid for 30 to 50 years. Excessive delay would diminish the objectives of the VWQS and CWA.

MWL contends that it would take three to five years to implement a new flow regime at the Morrisville and Green River Facilities and four to ten years to implement a new flow regime at the Cadys Falls Facility. VNRC asserts that the upgrades to the Green River Facility could be accomplished in two to three years, in three years at the Cadys Falls Facility, and in one year at the Morrisville Facility. Further, MWL concedes that current equipment at the Morrisville Facility could potentially be reprogrammed to pass a flow of 70 cfs. Additionally, MWL concedes that existing equipment would allow for the passage of a flow of 100 cfs at the Cadys Falls Facility. However, additional equipment must be installed to fully comply and to operate each of the facilities remotely.

MWL asserts that it cannot undertake these projects concurrently due to management capabilities. MWL provided no specific expectations for equipment delivery or installation and has done no assessment of these expectations. None of the required equipment would need to be specially designed for the Project.

We first note that many of the concerns raised by MWL address economic factors outside of the scope of this Court's review, specifically with respect to the sequencing of construction. Morrisville Hydroelectric, No. 103-9-16 Vtec, slip op. at 17 (Jun. 13, 2017). Further, the general assertions provided by MWL do not support the imposition of a separate phase-in period for each facility, during which MWL would be in non-compliance with the relevant laws for one-third to one-fifth of the license period.

We conclude that a total phase-in period of four years for all three facilities is warranted. At the termination of this period, MWL must comply with all aspects of the water quality certification at all three facilities.

Conclusion and Order

For the foregoing reasons, we conclude that MWL's proposed flow regimes at the Morrisville, Cadys Falls, and Green River Facilities comply with the VWQS. We conclude, however, that a six-foot drawdown at the Green River Reservoir does not support the designated use of high quality aquatic habitat in the reservoir. Therefore, we conclude that ANR's condition limiting the winter drawdown to 18 inches is required to provide high quality aquatic habitat. Further, we conclude that the existing use of whitewater boating at the Green River must be fully supported by annually providing three scheduled whitewater boating releases, lasting for a duration of at least six hours each. Lastly, a total phase-in period of four years for all three facilities is warranted. At the termination of this period, MWL must comply with all aspects of the water quality certification at all three facilities.

This concludes the matter before the Court. A Judgment Order accompanies this merits decision.

Electronically signed on September 18, 2018 at 03:28 PM pursuant to V.R.E.F. 7(d).

Thomas G. Walsh, Judge
Superior Court, Environmental Division