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December 16, 2021

Via Electronic Filing

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Subject: Byllesby-Buck Hydroelectric Project (FERC No. 2514-186)
Filing of Updated Study Report Meeting Summary

Dear Secretary Bose:

Appalachian Power Company (Appalachian or Licensee), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the two-development Byllesby-Buck Hydroelectric Project (Project) (Project No. 2514), located on the upper New River in Carroll County, Virginia.

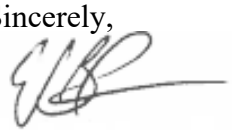
The Project is currently licensed by the Federal Energy Regulatory Commission (FERC or Commission). The Project underwent relicensing in the early 1990s, and the current operating license for the Project expires on February 29, 2024. Accordingly, Appalachian is pursuing a subsequent license for the Project pursuant to the Commission's Integrated Licensing Process (ILP), as described at 18 Code of Federal Regulations (CFR) Part 5.

Pursuant to 18 CFR § 5.15(c), Appalachian filed the Updated Study Report (USR) with the Commission on November 17, 2021. The USR filing also included notification of the USR Meeting date, time, and proposed agenda. As required by the ILP schedule, within 15 days of the USR filing, Appalachian held a virtual USR Meeting via WebEx from 9:00 am to 4:30 pm on Wednesday, December 4, 2021.

Pursuant to 18 CFR § 5.15(c)(3), Appalachian hereby files the USR Meeting summary for Commission and stakeholder review. The USR Meeting presentation is included as an attachment to the USR Meeting summary.

If there are any questions regarding this filing, please do not hesitate to contact me at (540) 985-2441 or via email at ebparcell@aep.com.

Sincerely,



Elizabeth Parcell
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Meeting Summary

Project:	Byllesby-Buck Hydroelectric Project (P-2514)
Subject:	Updated Study Report Meeting Summary
Date:	Wednesday, December 01, 2021
Location:	WebEx Virtual Meeting
Attendees:	Jonathan Magalski (AEP) Elizabeth Parcell (AEP) Fred Colburn (AEP) Sarah Kulpa (HDR) Maggie Salazar (HDR) Misty Huddleston (HDR) Ty Ziegler (HDR) Erin Settevendemio (HDR) Kerry McCarney-Castle (HDR) Joe Dvorak (HDR) Eric Mularski (HDR) Jon Studio (EDGE) Bill Green (Terracon) Jeremy Feinberg (FERC) Jody Callihan (FERC) Samantha Pollack (FERC) Laurie Bauer (FERC) Woohee Choi (FERC) Jeff Williams (VDWR) John Copeland (VDWR) Janet Norman (USFWS) Jessica Pica (USFWS) Rick McCorkle (USFWS) Joe Grist (VDEQ) Jennifer Wampler (VDCR) Angie Grooms (Landowner) David Taylor (Landowner)

Overview

This document provides the meeting summary for Appalachian Power Company's (Appalachian) Byllesby-Buck Hydroelectric Project (Project) Updated Study Report (USR) Meeting. The meeting was held via WebEx to review with stakeholders the progress and results reported in the USR, which was filed with the Federal Energy Regulatory Commission (FERC) on November 17, 2021. The USR can be accessed from either FERC's website or from AEP's website: www.aephydro.com/HydroPlant/ByllesbyBuck. A copy of the meeting presentation is included with this meeting summary as Attachment 4.

Safety Moment

Sarah Kulpa presented a safety moment on road safety and to be aware of black ice road hazards and winter driving conditions.

Welcome and Introductions (Slides 1-6)

Elizabeth Parcell introduced the Byllesby-Buck Project and the USR meeting goals and objectives, and encouraged participation and feedback. She provided an overview of the agenda and the completed and upcoming Integrated Licensing Process (ILP) schedule milestones. The studies presented in the USR were completed in the first (2020) and/or second (2021) ILP study seasons:

- Bypass Reach Flow and Aquatic Habitat Study
- Water Quality Study
- Aquatic Resources Study
- Wetlands, Riparian, and Littoral Habitat Study
- Terrestrial Resources Study
- Shoreline Stability Assessment
- Recreation Study
- Cultural Resources Study

Final study reports were filed with the USR. If revisions are made to any of the study reports based on today's discussion or comments on the USR, revised study plans will be filed with the final license application (FLA) (due to FERC February 28, 2022). The focus of today's presentation and discussion is studies or study progress not covered by the Initial Study Report (ISR) filed earlier this year or the ISR meeting held on January 28, 2021.

General Questions/Comments

Janet Norman asked for clarification regarding the deadlines for stakeholder comments. Jody Callihan confirmed that the official ILP schedule presented in FERC's Scoping Documents state December 30th as the deadline for filing comments on the Draft License Application and January 16, 2022 to file disputes on the USR meeting summary and/or comments on the USR (if any).

Water Quality Study (Slides 7-28)

Ty Ziegler (study lead) introduced the objectives, methods, and results of the Byllesby Development water quality study. He clarified that results from the Buck Development were included in the ISR, therefore, the discussion is primarily focused on the 2021 field results for the Byllesby Development.

Study Results

T. Ziegler provided a brief overview of study activities completed in 2020 and explained that at the Byllesby Development, instrumentation was only installed at the tailrace monitoring location in 2020 due to a Tainter gate open during the study period and a damaged flashboard section, which made installation at other monitoring locations unsafe. The 2020 study period was August 17 – October 8. Instrumentation at all Buck Development monitoring locations identified in the Revised Study Plan (RSP) and Study Plan Determination (SPD) was installed, measured, and presented in the ISR.

T. Ziegler then presented the results of the 2021 study season. The 2021 study period was June 15 – September 28. Instrumentation captured continuous temperature and dissolved oxygen (DO) data (15-min intervals) and discrete data (i.e., water temperature, DO, pH, and specific conductivity) during installation, data downloads (approximately every two to three weeks), and removal of the equipment. Vertical profiles were also collected at the Byllesby forebay/reservoir monitoring location during discrete data collection events. Turbidity data was collected at 5-minute intervals over a 1-week period September 29 – October 5, 2021 and an intensive 1-day effort on October 14, 2021.

Water temperatures, DO concentrations, turbidity, and pH measurements met Virginia Class IV (New River) water quality standards; with the exception of instantaneous surface water temperatures on several occasions during late-July and late-August 2021. There was little to no thermal or DO stratification at the Byllesby and Buck forebay monitoring locations. Specific conductivity and pH range results are suitable for aquatic species. Monthly chlorophyll-a grab sample results were non-detect indicating concentrations < 5 mg/cm^3.

Stakeholder Questions/Comments

J. Norman asked (reference slide *Air and Water Temperatures Upstream of Byllesby Reservoir*) the number of days water temperature was above 29 degrees Celsius (ºC), which is the maximum temperature standard for VA. T. Ziegler responded that there were approximately 4 days in late-July and 4 days in late-August that were over 29ºC on an instantaneous basis and the daily averages on those days were all less than 29ºC.

J. Norman stated (via WebEx chat box) there are a couple data points on 7/29/21 where discrete points have a 28.1 and 28.8 temperature and wondered at what time of day those were taken. Joe Dvorak answered that the discrete points were taken at approximately 11:45 a.m. on 7/29.

J. Norman asked if the “Depth” column on [study report] Table 3-3 (*Byllesby forebay temp profile*) is in feet or meters. Temperature is metric. J. Dvorak provided the answer in the WebEx chat that days over 29 ºC were as follows: Forebay Low & Mid monitoring locations: 1 (6/15) and Top location: 10; additionally several dates in June, July, and August. Durations were generally 2 hours or less, and that depth in Table 3-3 is in feet.

J. Norman asked about discrete vs. average temperatures for the water temperature standard and if at a later time in the day the temperatures would exceed a certain point higher than the state standard. R. McCorkle stated that the state’s temperature standard does not describe whether it is instantaneous or over some daily averaging period. T. Ziegler stated that HDR has 15-minute water temperature data available, and one would anticipate temperature peaks in the early to mid-afternoon.

J. Norman asked if there is a state turbidity standard for Virginia. T. Ziegler stated there is presently no numeric standard for turbidity (only a qualitative standard); the Virginia Department of Environmental Quality (VDEQ) did not have additional information to add but noted they would check.[1] S. Kulpa noted for context that the North Carolina state standard for turbidity is 25 Nephelometric turbidity units (NTU) (10 NTU for trout waters).

Angie Grooms noted that based on the study, drag rake operations don't appear to be causing the turbidity issues. She wondered whether Appalachian/HDR had any other thoughts on the turbidity she has routinely observed downstream, as well as potential sources of the fine silt or if any non-point sources had been observed? S. Kulpa asked Eric Mularski if he could speak to any origins (non-point) field teams may have observed during shoreline surveys. E. Mularski stated he did not observe any noticeable non-point sources. Joe Grist noted that the state is looking into a numeric standard. J. Grist and John Copeland stated they had no significant input on the turbidity study at this time.

J. Norman referred to Table 3-3 of the Water Quality report asking if the values are average or instantaneous. J. Dvorak answered that they are instantaneous (discrete) measurements (not an average).

J. Callihan noted that the USR did not have the forebay monitoring locations presented on the monitoring location map (but the presentation had the locations included on the map). T. Ziegler agreed; the figure in the report will be updated in the FLA to include all of the monitoring locations for the 2020 and 2021 study periods.

J. Callihan asked what the habitat was like at the upstream monitoring location. J. Dvorak noted that the instrumentation was set in approximately 8 feet of water in rapid moving water with bedrock.

J. Callihan referred to Figure 1-6 - Bottom A and Bottom B and asked why there were two separate recordings. T. Ziegler explained that due to the biofouling issues HDR deployed two sondes at each monitoring location/depth. This redundancy would reduce data loss due to biofouling.

J. Callihan asked whether the broken flashboard was next to Tainter gate 6. T. Ziegler answered that the section of broken flashboards was next to Tainter Gate #6. [Note: this was later determined to be incorrect as it was actually spillway bay #8. For context, this is still near the center of the spillway and provided a similar flow pattern to releases from Tainter Gate #6.]

Action Item (HDR): J. Callihan asked if HDR could present for each monitoring station for each day the daily min, max, and average parameters. J. Callihan explained it would be easier for calculations and

[1] As additional information for this meeting summary, after the meeting HDR confirmed from information online that currently, Virginia regulates turbidity through general narrative criteria. Specifically, Virginia's Administrative Code lists turbidity as a substance requiring control when turbidity contravenes established standards, interferes directly or indirectly with designated uses of such water, or which are harmful to human, animal, plant, or aquatic life. (9VAC25-260-20). As opposed to numeric criteria, which establish quantitative pollution concentration limits, narrative criteria use qualitative considerations to help identify unacceptable conditions of that waterbody. Narrative criteria often supplement numeric criteria or are used when the regulated pollutant is difficult to measure. On April 12, 2021, the VDEQ issued a Notice of Intended Regulatory Action to establish first-time numeric turbidity criteria for Commonwealth surface waters in response to a directive by the State Water Control Board. This criteria has not yet been established, to the best of Appalachian's knowledge.

statistics in the Environmental Assessment to see number of days standards were exceeded. (Note: this data will be provided in the final Water Quality Study Report filed with the FLA).

J. Callihan also asked if the powerhouse had tripped on September 30 (brief periods of 0 generation). Fred Colburn confirmed later in the meeting that on Sept 30th there was a Maintenance Outage that took Buck offline.

J. Callihan noted the RSP included consultation with agencies regarding the turbidity study methods prior to the fieldwork and asked if this had been done. S. Kulpa confirmed the proposal for turbidity sampling was sent to the agencies and confirmed that no comments (from the agencies) were received. J. Callihan wondered what type of turbidity instrument was used and why there are jumps in turbidity data? T. Ziegler explained that there is a footnote in the report documenting the type of turbidity sensor used and associated issues with daylight and in-situ monitoring. T. Ziegler explained that when looking at the graph, the high points represent daytime measurements, and the data troughs are at night, which are more representative of actual conditions.

J. Callihan asked for additional information about the instrumentation used for this study. T. Ziegler explained that for the continuous turbidity monitoring study, HDR rented MS5 data sondes from OTT HydroMet which was the only equipment vendor that offered in-situ continuous turbidity monitoring equipment capability. The turbidity sensors installed in the MS5 data sondes were provided by Turner Designs. The light source used for the turbidity sensors is a light emitting diode (LED) which uses infrared wavelength to measure turbidity concentrations in the water column. As a result, the daily NTU cycling effect shown on Figure 8-1 (Attachment 8 of the Water Quality Study report) at the Byllesby upstream and Buck tailrace monitoring locations is likely due to sunlight interference with the turbidity sensors (which is inherent in continuous in-situ sampling). Baseline turbidity concentrations would be during nighttime hours when sunlight interference is minimized.

J. Callihan noted that FERC's main interest was how the trash rakes were impacting turbidity in the forebay and wanted confirmation that the track rakes were extending out to the extent they appeared to be during the scoping meeting site visit, during the 2021 sampling. T. Ziegler confirmed that the rakes do extend out but he does not believe they are extending out and down to the bottom (or as far as one would think) because the trash racks are at an incline. Turbidity measurements taken adjacent to the racks do not indicate immediate turbidity or any sort of a plume. J. Callihan asked whether there was only one rake session per day on the week-long survey. T. Ziegler explained that while automated, the rakes are run at the station level, so plant personnel operate them frequently during high flow and heavy loading, however, during this study the water was low/clear so the trash rakes did not operate more than once per day (during the morning hours). HDR also returned to do an intensive one-day study where the rakes were operated approximately every 30 minutes.

J. Callihan asked why there three instrument failures and if it was appropriate to extend the data. T. Ziegler noted that HDR is unsure as to why three of the turbidity instruments failed (although it did not appear to be the turbidity sensors themselves; but more likely the data sonde operating system). It was noted that these were rental units and they have been sent back to the vendor to determine the cause of the failure. While continuous turbidity data were not collected at Byllesby, given similar run-of-river operations, design of the trash racks, and operation of the trash rakes, it is believed the turbidity results would have been similar to those collected at Buck. J. Callihan acknowledged that operation of the trash rakes every 30-minutes seems adequate for this study.

A. Grooms asked if there were any grab samples run on a bench top turbidimeter to validate sonde measurements since sonde failure rates were high. T. Ziegler explained that in addition to the continuous monitoring turbidity probe, HDR collected data side-by-side data with the rover data sonde. However, a

different technology was not used to validate readings. A. Grooms indicated that with NTU's that low, it likely wasn't necessary.

Wetlands, Riparian, and Littoral Habitat Study (Slides 29-47)

E. Mularski (study lead) introduced the Wetlands, Riparian, and Littoral Habitat Study methods and results. (Note: this study report was started and completed in 2021 and thus was not included in the ISR.)

Study Results

Approximately **95.43 acres of wetlands** were field verified:

- 50.72 acres of palustrine emergent wetlands
- 11.6 acres of palustrine scrub shrub wetlands
- 15.37 acres of palustrine forested wetlands
- 17.74 acres of rock bottom wetlands

Approximately 15,608 linear feet of riverine features were verified. Elodea was the most abundant submerged aquatic vegetation throughout the reach located close to the stream bank adjacent to wetlands. Algae was dominant in the littoral zone upstream from the Byllesby Dam where water flow was slower. Littoral Zones 6 and 8 upstream of Buck Dam exhibited the highest percentage of aquatic vegetation. The riparian area consists of approximately 177 acres and is mainly found along the shoreline, on islands, and within the bypass reach. Riverine habitats in the study area include the New River and associated tributaries. The New River is a lower perennial riverine feature on the upstream and downstream limits of the study area.

There were no observed occurrences of Virginia spirea in areas identified in the previous surveys; however, potentially suitable habitat was observed throughout the study area in rocky, low flow areas of streams, and on portions of bars and benches.

Stakeholder Questions/Comments

J. Norman asked whether drawdowns (specifically the most recent drawdown) are considered an impact to wetlands. E. Mularski and S. Kulpa acknowledged that while a drawdown could be considered an impact with adverse effects, it would be temporary. J. Norman suggested avoiding using language regarding "no impact" when there are temporary impacts. Jon Magalski noted a 2009 a study was done during a drawdown and there was no indication of impact to wetlands. J. Norman agreed that yes, there would be no change to the area/size of the community, but the drawdown would affect the use and/or function of area. Appalachian stated its intention to use clearer language in the FLA regarding wetland impacts.

J. Norman asked if HDR re-examined Virginia spirea during this survey and asked for confirmation that no instances of Virginia spirea were observed. E. Mularski noted that no occurrences of species belonging to the spirea genus were observed during the field surveys. S. Kulpa acknowledged Appalachian was not required to do a Virginia spirea survey; however, Appalachian recognized the interest and importance, and timed the wetlands survey along with the correct flowering season. The group discussed the 2021 Virginia spiraea survey findings compared to those of the 2017 survey performed by ESI. E. Mularski

noted that for the 2017 effort, 100 potential habitat patches were surveyed, but only 18 were found to contain habitat low to moderate suitability, and no occurrences of this species.

Jeremy Feinberg asked about how many acres of National Wetlands Inventory (NWI) identified wetlands versus field verification wetlands there were and if these wetlands exist in any other database. E. Mularski stated that the NWI estimated 9 acres of wetlands and the field verification estimated 12 acres. The field verification was considered a confirmation of existing wetlands and not a formal wetlands delineation. The NWI can be over or underestimated, so that's why field study results are different from the NWI database. E. Mularski also noted that there is not a state mapped wetland database. J. Norman added she is comfortable with HDR's field estimation as a surrogate for true wetland delineation. She wondered if there would be disturbance periods during the future license period, and how Appalachian will address. S. Kulpa explained that any impacts to wetlands will be addressed with formal wetland/waterbody surveys, coordination with agencies, and if necessary, permits.

J. Magalski noted that Appalachian's standard practice is to perform wetland surveys prior to land disturbance.

Terrestrial Resources Study (Slides 48-67)

E. Mularski (study lead) introduced the Terrestrial Resources Study methods and results. (Note: this study report was started and completed in 2021, thus this study was not included in the ISR.)

Study Results

Terrestrial and ecological groups and community types identified in the field were consistent with similar habitat classification descriptions depicted on The Nature Conservancy Habitat Map, which identified 10 Habitat Communities. Terrestrial animal species and/or habitat use were also documented during the study. Many invasive species were noticed at low densities scattered throughout upland areas. Significant infestations of Japanese knotweed, oriental bittersweet, and multiflora rose were located primarily in riparian areas along the reservoirs and mapped in the field. Federally Protected Species included:

- Bald eagle (*Haliaeetus leucocephalus)* – BGEPA/MBTA
- Indiana bat (*Myotis sodalist*) - Endangered
- Northern long-eared bat (*Myotis septentrionalis*) - Threatened
- Virginia spirea (*Spiraea virginiana*) - Threatened

No federally listed Critical Habitat is documented in the study area. There is nesting and roosting habitat for the bald eagle within Project vicinity. In 2017, a consultant for AEP conducted an aerial helicopter transect for the proposed Byllesby-Ivanhoe 88kV Transmission Line Retirement project (not associated with the Project relicensing). One active nest was observed on the New River approximately 0.52 miles from the transmission line corridor and approximately 0.27 miles south of the Buck Dam. An unoccupied nest was identified along the New River approximately 1.1 mile north of Buck Dam at the top of transmission line.

Stakeholder Questions/Comments

J. Norman asked whether there was any infestation of multiflora or other invasive species noted in the same locations of the potential Virginia spiraea habitat (based on habitat suitability, not historical occurrences). E. Mularski noted that he didn't recall, but this could be further analyzed, and that scour

along the shorelines is a habitat requirement. **Action Item** (HDR): Overlay Virginia spiraea potential habitat areas over areas where invasive species were observed. **Note**: Attachment 1 includes the Virginia spiraea and invasive species map. The invasive species locations and erosional areas do not appear to be affecting potential Virginia spiraea habitat.

J. Norman noted that spiraea is sensitive to competition as well as scour and asked whether high flow conditions in 2020 may have resulted in disruptive scour and removal of spiraea, and what kind of hydrology year the 2017 study followed. Appalachian and HDR representatives noted this species has not been confirmed to have been previously present within the Project boundary.

A. Grooms asked whether the eagle nest south of Buck Dam was on river right or left. J. Magalski answered the downstream nest is on river right. A. Grooms also wondered whether bobwhite quail were spotted in the agricultural areas downstream of Buck Dam, noting that several landowners have been working on bobwhite habitat improvement plans with the National Resource Conservation Service in an area about 1 -1.5 mile downstream of Buck Dam on river right. Any spotting of individuals would be great information and give landowners hope of success. E. Mularski confirmed that the field team detected bobwhite calls while surveying near the mentioned habitat improvement area.

J. Feinberg asked if HDR/Appalachian had recently updated the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPAC) database query since the monarch butterfly was recently added. **Action Item** (HDR): Run recent IPAC and update study report if necessary. **Note:** Attachment 2 includes the recent IPAC results which does include the monarch butterfly. Additional information will be provided in the FLA if needed.

J. Norman added that the Green Floater may be proposed for listing early next year.

Aquatic Resources Study (Slides 8-48)

Misty Huddleston (study lead) introduced the Aquatic Resources Study methods and objectives, and study results were presented by Jon Studio with EDGE Engineering & Science (EDGE). The Aquatic Resources Study results presented during the meeting consisted of the following sub-studies:

- Fish Community Survey
- Desktop Fish Impingement and Entrainment Study (including the Turbine Blade Strike Analysis)
- Macroinvertebrate and Crayfish Survey
- Mussel Community Study which was completed and presented in the ISR in 2020.

Study Results

Fish Community Survey: EDGE (led by J. Studio) completed the Fish Community Survey in accordance with the methods described in the RSP and SPD. The general fish community survey utilized boat and backpack electrofishing methods and gill net sets and was completed spring 2021.

There were 244 fish of 20 species collected using boat electrofishing from the Byllesby Pool, and 353 fish of 24 species from the Buck Pool. Backpack electrofishing sites yielded 48 fish representing 11 species upstream of Byllesby Dam, 156 fish of 18 species between dams, and 206 fish of 17 species downstream of Buck Dam. No Candy Darter were observed or collected in study samples. There were six Walleye collected in fall 2020 sampling efforts and three Walleye collected in the spring 2021 sampling effort.

Fish Impingement and Entrainment/Blade Strike Analysis: An assessment of impingement and entrainment risk at the intake structures was completed along with an assessment of turbine blade strike

and fish passage survival using the 2020 USFWS Turbine Blade Strike Analysis model. Blade strike probability increases with increasing fish size; but larger fish can avoid the Project intakes. Planned upgrades from Francis to Kaplan turbines (3 of 4 turbines at Byllesby and 2 of 3 turbines at Buck) will reduce strike probability and improve passage survival for Walleye and other species at the Project:

- Cumulative Walleye passage survival after turbine upgrades for average size Walleye (approx. 15 inches long) across multiple percent flow exceedance scenarios was:
  - Estimated to be between 82.8 and 88.8 percent at Byllesby
  - Estimated to be between 82.7 and 91.4 percent at Buck
- Cumulative passage survival of multiple fish size classes for all other species with turbine upgrades was estimated:
  - Between 58.3 (30-inch fish) and 96.8 percent (2-inch fish) at Byllesby
  - Between 57.5 (30-inch fish) and 97.1 percent at Buck
- Entrained fish less than 6.0 inches at Byllesby and Buck
  - Survival with existing conditions - 86 percent or higher
  - Survival with upgraded turbines - 92 percent or higher

Macroinvertebrate and Crayfish Survey:

Quality habitat was observed at seven of the eight sites; one site was classified as heavily embedded (BFQT2). Habitats consisted primarily of bedrock, boulder, cobble, and gravel substrates. Qualitative Sites were classified as relatively poor-quality habitats and consisted primarily of sand, silt, and bedrock substrates.

Two native species of crayfish were collected and identified in the field during survey efforts: the Conhaway Crayfish (*Cambarus appalachiensis*) and Spiny Stream Crayfish (*Faxonius cristavarius*). Spiny Stream Crayfish were the only crayfish species collected above Byllesby. Conhaway and Spiny Stream crayfishes were collected at sites between Byllesby and Buck and downstream of Buck. No invasive species were collected at any of the sites during the study.

Stakeholder Questions/Comments

J. Norman asked about the location of the most downstream sample site in relation to furthest upstream documented occurrence for the candy darter. J. Studio clarified that the most downstream study site was located approximately 800-900 meters below Buck Dam, while the nearest known occurrence of Candy Darter is located over 5 miles downstream of Buck Dam. J. Studio noted that the survey methods would have been appropriate to detect candy darter, if it were present in the survey area.

Jessica Pica asked for an explanation for the 1.5 value used in the calculation of the intake approach velocity and requested confirmation that through-rack velocity calculations were not provided in the study report. T. Ziegler provided a description of each of the values used in the intake approach velocity calculation, including the “14” in the calculation which represents the total height of the intake structure. T. Ziegler stated that the 1.5 value is a multiplier used in the calculation to provide an estimate of the intake approach velocity. The 1.5 multiplier is a general rule of thumb used in hydraulic analyses to approximate the area from which units pull water within the water column. Using 1.5x the unit opening is a more conservative (i.e., higher) estimation of the intake velocity versus using the entire water column height. T. Ziegler also confirmed that through-rack velocity calculations were not required by the Revised Study Plan.

J. Norman requested additional details and explanation on the flow exceedance values used in the turbine blade strike analysis. S. Kulpa directed J. Norman and others to review the detailed data table provided in Table 5.14 of Attachment 2 of Appendix C to the USR, which shows the flow values

associated with each percent flow exceedance referenced in the presentation and USR. J. Norman asked if J. Pica had any concerns regarding the data presented for Walleye impingement/entrainment. J. Callihan reminded the group that the results presented for Walleye depend on fish swim speeds and represent only those fish that have already been identified as susceptible to impingement/entrainment at the Project intake structures. J. Callihan further emphasized that the data assumes that Walleye would be moving downstream in a way that they would encounter the intake structures, and Walleye are unlikely to be moving downstream on a regular basis. J. Copeland agreed, stating that adult Walleye are more likely to seek habitats upstream. R. McCorkle stipulated that Walleye typically seek habitat appropriate for their specific life stage. M. Huddleston summarized the discussion, concluding that based on life history traits of the species, Walleye have a low likelihood of encountering the intakes and Project turbines.

R. McCorkle pointed out that the number of blades identified in the presentation (5 blades per Kaplan turbine) differed from what was presented in the Draft License Application (DLA) (6 blades per Kaplan turbine). S. Kulpa checked the vendor specifications and confirmed that new Mavel Kaplan turbines would have 5 blades per turbine and that this information will be corrected/confirmed in the FLA. S. Kulpa further noted that as presently proposed, unit upgrades would commence upon new license issuance and proceed at approximately one per year until 5 units have been upgraded (3 at Byllesby, 2 at Buck). HDR did not try to account for the varying unit technology over the new license term in this analysis. The remaining Francis unit at each development would be operated in a last-on/first-off manner following upgrades of the other units.

J. Norman asked for additional clarification to be provided for Tables 5-13 and 5-14 of Attachment 2 of Appendix C to the USR so that it is clear to which of the flow scenarios the results pertain. J. Callihan: also asked if the row of values that were the exact same in Table 5-13 was a typo. **Action Item** (HDR): M. Huddleston stated that it was a typo and will update the tables for clarity and share revised tables. **Note:** The updated tables are provided in Attachment 3.

J. Norman asked whether the intake velocity calculations were field verified and S. Kulpa directed her to the discussion in the ISR referring to the 15-degree angle of the trash racks which created unfavorable conditions for field measurements. J. Pica further confirmed that she was unaware of any studies that have performed field verification of desktop velocity calculations where the trash racks were angled. T. Ziegler stated that not only are the racks inclined, but the acoustic Doppler current profiler (ADCP) would need to be far enough away so the beam does not intersect the bar racks, which would require a large distance, meaning the values would no longer be representative of the existing approach velocities at the intake. J. Pica asked if there were any additional detailed drawings/information/calculations for the approach velocity. T. Ziegler indicated that the only calculations provided in the USR are included in the text since the formulas are straightforward for calculating approach velocity, unlike the more complex calculations required for through-screen velocity (which were not required). Available historical design drawings were included as an attachment to the study report.

J. Callihan requested clarification on the use of “fixed blade turbines” and asked if the turbines are adjustable over a range of flows and how spilling operations may be modified as units are ramped up and down. J. Dvorak clarified that the term “fixed blade” refers to a design where the pitch of the turbine blades is fixed and cannot be changed. With fixed blades, the range of usable flow is controlled by a combination of the turbine/generator specifications. S. Kulpa noted that upgrading the units is expected to result in a significant increase in efficiency and power generation (in megawatt-hours annually) and will be designed to operate over a larger range of flows.

There were no questions about or further discussion on the Macroinvertebrate and Crayfish Survey.

Bypass Reach Flow and Aquatic Habitat Study (Slides 113-134)

Study Results

T. Ziegler (study lead) introduced the study, methodology, and results for the Bypass Reach Flow and Aquatic Habitat Study. He explained that the Buck Development study was covered in the ISR, therefore, the focus of the USR is predominantly the Byllesby Development. The following tasks have been completed:

- Completed desktop habitat mapping and evaluation of Project inflows
- Assembled Habitat Suitability Index (HSI) criteria
- Developed model calibration target flow recommendations
- Collected field data during target flow releases into each bypass reach
- Developed and calibrated 2-D hydraulic model for each study area
- Used model to simulate potential available habit in each study area at the model calibration target flows

The Byllesby bypass reach consists of deep and shallow pools and shoal habitat types dominated by larger substrate sizes. Habitat model results indicate suitable habitat for species and life stages that prefer deep and/or slow-moving water. Increasing flow only has a marginal effect on depths and velocities. As a result, the amount of available habitat in the bypass reach is very similar over the modeled flow range (between 11 – 194 cubic feet per second [cfs]).

Questions/Comments

With respect to the “cover” variable, J. Norman asked if a single spot could have instream and overhead vegetation and how does one arrive at the percentage for vegetation. T. Ziegler stated that the study report will be clarified. **Action Item** (HDR): Add clarification and any necessary updates to Table 6-1 in the revised study report to be filed with the FLA.

J. Norman asked why HDR used the four target flows (11, 88, 158, 194 cfs). T. Ziegler stated that required target flows and range of flows were required that could be modeled up to 360 cfs. J. Norman didn’t realize that the four flows were extrapolated up to 360 cfs. T. Ziegler stated that it is more important to model lower flows correctly due to the uncertainty of bed roughness.

J. Norman asked about the velocity heat map. J. Dvorak created it for the presentation (not in the report), but HDR will add into the report. **Action Item** (HDR): Add depth and velocity “heat maps” to the revised study report to be filed with the FLA.

Woohee Choi asked about the 2-D model and the mesh sizes near the Tainter gates/inflow boundary. J. Dvorak explained that the Integrated Catchment Model (ICM) uses terrain-sensitive meshing which automatically adjusts mesh element sizes based on slope of the terrain. The Byllesby model setup limits height variation between adjacent mesh elements to no more than 0.25’. The model minimum mesh size is 2.5 square feet. This setup results in mesh elements that are approximately 5 square feet in the vicinity of the Tainter gates, and each Tainter gate is modeled using approximately 6-8 elements.

J. Norman questioned the best way to interpret the habitat results maps. T. Ziegler explained how flow descends from the spillway and pointed out Tainter Gate #6. J. Norman asked if Tainter Gate #6 would

be used for operating procedures for releasing flows. J. Callihan asked if the powerhouse is operating, is the 360 cfs (or inflow) minimum flow release provided downstream via generation or at the spillway. (Appalachian and HDR confirmed that it is provided at the powerhouse but noted that the run-of-river operation of the Project typically trumps the minimum flow, and there are only a few days in a typical year where the minimum flow requirement would be triggered.) The group discussed that if powerhouse flows were cut off, it appears the side channel and crossover channel would be altered. J. Norman asked if HDR had any results representing no powerhouse flow with the 360 cfs released at the spillway. J. Callihan stated that he understood the agencies were more concerned with stranding of Walleye at Buck than at Byllesby. F. Colburn added description of the two approaches on how Appalachian opens the gates and explained how the flows are managed during outages. HDR confirmed that a 360 cfs release at the spillway had not been previously modeled but could be modeled; however, the group agreed that providing the minimum flow at the powerhouse provides more habitat benefits.

J. Norman and T. Ziegler extended the conversation regarding modeling at Byllesby and what the benefits would be regarding flow releases. Modeling different flow scenarios shows impacts of different flow scenarios. J. Norman noted that USFWS is interested in understanding the impacts of flow modifications downstream of Byllesby when the powerhouse is offline.

J. Callihan asked if there were Walleye in the area and if this exercise is warranted (at Byllesby). J. Callihan asked a follow-up question about the Buck flow model and if there is an escape pathway under the existing required ramping rate for Walleye (qualify connectivity and body depth of Walleye). Walleye stranding has been previously stated as a significant concern to agencies.

J. Copeland confirmed that Walleye do use the reach below Byllesby but agreed that the Buck bypass reach is a larger concern.

T. Ziegler stated that at Buck Tainter Gate #1 is operated so ramping doesn't affect the side channel. A spillway flow of at least 5,000 cfs is needed to barely make a difference in water surface elevation at the lower end of the side channel (opposite side of the spillway from Tainter Gate #1). Much higher spillway flows would be needed to inundate the side channel (which occurs infrequently). When this does happen, and as these higher flows recede, there is currently no continuous escape route and a few isolated pools develop along the upper end of the side channel.

J. Callihan asked if the new Obermeyer gates reduce the frequency of flashboard failures at Buck. F. Colburn replied that installation of the Obermeyer gates at Buck does reduce the frequency of flashboard failures and reduces stress and strain on the boards, however, flashboard leakage and breakage does still happen mainly as the result of deterioration due to age of the wooden flashboards and number of flashboard sections. Appalachian does not perform general maintenance of the flashboards on a set frequency, because doing so requires a drawdown of the reservoir; repairs are made as needed and as can be completed during reservoir drawdowns for flashboard repair or other Project maintenance purposes. J. Callihan noted that replacing flashboards would require a drawdown/agency consultation. F. Colburn confirmed that agency consultation is done prior to any drawdowns.

Action Item (Appalachian): Because of limited time at the USR meeting to revisit the Buck model outputs and potential conditions or modifications of interest to agencies and stakeholders, Appalachian and HDR will plan to set up a separate, follow-up WebEx meeting for late January.

Recreation Study (Slides 136-147)

Maggie Salazar (study lead) reviewed the Recreation Study goals and results and provided an overview of the Project and non-Project Recreation Facilities.

Study Results

M. Salazar explained that the Recreation Study was completed in 2020 and gave a brief overview of the tasks and findings of the study. HDR found consistent recreation usage at most of the Project and non-Project facilities with usage peaking on weekends, holidays, and warmer months. The New River Trail provides a unique opportunity to access most of the recreation facilities in otherwise remote locations. The trail camera and online survey results indicated that fishing and canoe/kayaking were the primary recreation activities. The Buck Dam Canoe Portage was the only Project recreation facility that saw very little recreation usage, likely because it is inaccessible except by boat.

M. Salazar then presented the proposed Loafers Rest Fishing Trail and enhancements to the Loafers Rest Non-Project facility.

Questions/Comments

J. Norman asked what area would be covered by the Recreation Management Plan. S. Kulpa replied the Recreation Management Plan would encompass Project and Non-Project facilities within/in the vicinity of the FERC Project boundary.

A. Grooms stated that she appreciated the proposed Loafer's Rest improvements and asked if there has been any progress on the Thompson Campground. S. Kulpa stated she did not have any information regarding the campground, and the state agencies did not comment. David Taylor asked whether the existing walking trail at Loafers Rest would be upgraded since it is currently in poor condition. S. Kulpa said Appalachian will take the comment under consideration in preparation of the draft Recreation Management Plan (presently scheduled for development and distribution to stakeholders in advance of or with the FLA). The Virginia Department of Wildlife Resources (VDWR) agreed that the proposed Loafers Rest enhancements and fishing trail reflected what they had suggestions as improvements. D. Taylor expressed the importance of population growth in the area due to new economic development in the area, especially as it relates to usage of the New River Trail and A. Grooms concurred.

Samantha Pollak requested that the FERC Project boundary be added to any recreation map in the draft Recreation Management Plan and FLA. S. Pollak also asked about Fowler's Ferry and M. Salazar confirmed that Fowler's Ferry is outside of the Project boundary. S. Pollak asked about other recreation intended uses at Byllesby VDWR Boat Launch. J. Copeland stated that VDWR's recreation usage allows for boating and fishing. Maggie Salazar confirmed boating and fishing accounted for most of the use occurring at the Byllesby VDWR Boat Launch.

S. Pollak wondered whether drawdowns and flooding occurred often and how much the Byllesby VDWR Boat Launch was impacted by these. E. Parcell confirmed drawdowns typically happen once every other year and J. Copeland confirmed that flooding happens a few times a year. E. Parcell described Appalachian's typical process for early notification (where feasible) of agencies and stakeholders of planned drawdowns and methods for publishing this information to various outlets.

The Wildlife Viewing Plan is on the VDWR website.

Action Item (HDR): Jennifer Wampler asked for FERC Project Boundary (kmz or shp) and requested a follow-up meeting to discuss recreation, given limited attendance by the Virginia Department of Conservation and Recreation (VDCR) at the USR meeting. Appalachian and HDR will coordinate with agencies to schedule this meeting, after the new year. **Note:** The FERC Project boundary was sent (via email from M. Salazar) to J. Wampler on December 9th, 2021.

Shoreline Stability Assessment (Slides 69-82)

E. Mularski (study lead) introduced the Shoreline Stability Assessment goals and results. (Note: this study was started and completed in 2021, and therefore was not presented in the ISR.)

Study Results

A survey of the Project's reservoirs, bypass reaches, and tailrace areas was performed to characterize the shoreline, with the focus on erosion or shoreline instability using the Bank Erosion Hazard Index (BEHI). Approximately 7.25 miles of New River Shoreline was assessed. Approximately 80% of shoreline was stable and did not exhibit active erosion. Banks with some level of visible erosion had higher bank height ratios, moderate root depth, low to moderate surface protection, and moderate to high bank angles. No areas were categorized as having very high or extreme erosion potential.

Questions/Comments

No comments or questions were raised on this study.

Cultural Resources Study (Slides 148-154)

Bill Green (study lead) reviewed the Cultural Resources Study methods and results by Terracon Consultants, Inc.

Study Results

B. Green reviewed the 2020 field survey results. Most of the Area of Potential Effects (APE) is either steeply sloped or contains deeply buried historic alluvial deposits with little to no chance of containing significant archaeological resources. There is little to no erosion or other Project-related effects in any portions of the APE.

One 47.5-acre area located at the northeastern end of the Project has the potential for containing archaeological resources. The area currently is not experiencing any project-related effects. However, should ground disturbing activities take place in this area, a Phase I archaeological survey would be required in this area. (Note: this is the area of Loafer's Rest)

Three above-ground historic resources – the Byllesby and Buck Hydroelectric Facilities and the Norfolk and Western Railroad Cripple Creek Extension – are eligible for inclusion in the National Register of Historic Places (NRHP). All three were revisited and evaluated during the fieldwork and all three remain eligible for listing in the NRHP. It is Terracon's opinion that no historic properties are currently being affected by continued Project operations.

Questions/Comments

S. Pollak asked if the State Historic Preservation Officer (SHPO) had provided concurrence on this study. S. Kulpa reminded the group that SHPO had concurred on the APE, but no comments have been received from SHPO or Tribes on the Cultural Resources Study Report.

S. Pollak asked about naming conventions to the Byllesby-Buck Dam and Bill Green explained the difference in the report (due to naming conventions of previous investigations). S. Pollack asked about disturbance due to turbine replacement since the Byllesby Dam is listed on the NRHP. S. Kulpa and B. Green noted that modifications to electromechanical equipment inside the powerhouses are commonly included in the categorical exclusions/activities exempt from SHPO consultation in the Project's HPMP (under development). SHPO will have the opportunity to review the HPMP and consultation-exempt activities proposed within. E. Parcell noted that Appalachian has historically consulted SHPO prior to physical modifications of NRHP-eligible structures.

Next Steps and Discussion

E. Parcell reviewed comment deadline dates and upcoming activities.

Final Comments

J. Callihan asked F. Colburn about the 360 cfs minimum flow release. S. Kulpa shared HDR's speculation that this existing license requirement may be a relic of the operating mode (modified peaking) for the Project from the previous license.

J. Norman asked whether the turbine upgrades would result in extended periods of powerhouse outages. F. Colburn confirmed that the majority of the unit upgrade activities do not require a full station outage, as each unit has its own headgate that can be lowered to dewater the unit.

J. Callihan asked if future bypass reach flow modeling would simply be desktop work. T. Ziegler said yes, any future bypass reach flow modeling output would not require for additional fieldwork and can be run fairly quickly.

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Attachment 1

Attachment 1 – Potential Virginia Spiraea and Invasive Species Habitat

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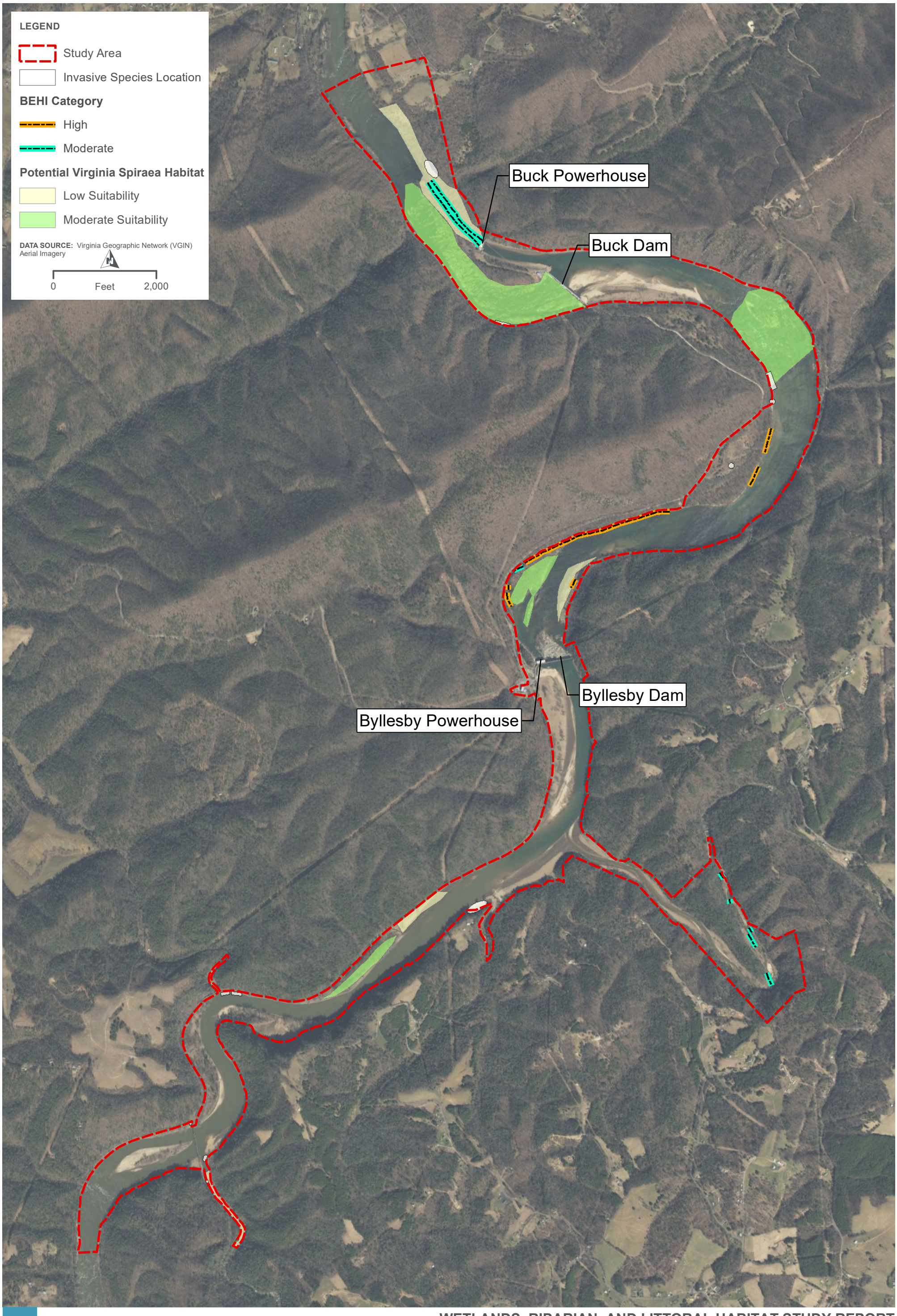

WETLANDS, RIPARIAN, AND LITTORAL HABITAT STUDY REPORT

POTENTIAL VIRGINIA SPIRAEA AND RIPARIAN HABITAT

Attachment 2

Attachment 2 – IPaC Results

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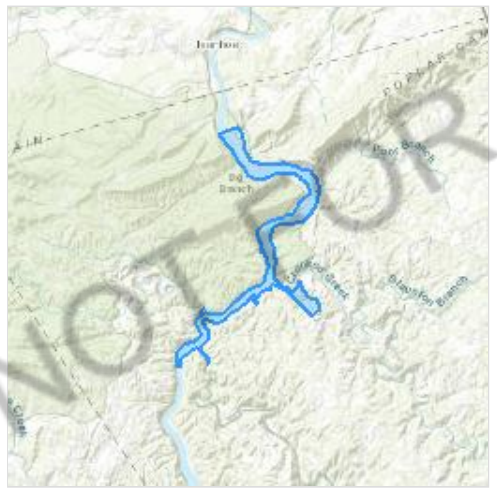
IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Carroll County, Virginia



Local office

Virginia Ecological Services Field Office

(804) 693-6694
(804) 693-9032

6669 Short Lane
Gloucester, VA 23061-4410

http://www.fws.gov/northeast/virginiafield/

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Indiana Bat Myotis sodalis Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat Myotis septentrionalis Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Virginia Spiraea Spiraea virginiana Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1728	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)

Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Aug 31
Black-billed Cuckoo Coccyzus erythropthalmus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10
Black-capped Chickadee Poecile atricapillus practicus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Apr 10 to Jul 31
Canada Warbler Cardellina canadensis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Eastern Whip-poor-will Antrostomus vociferus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

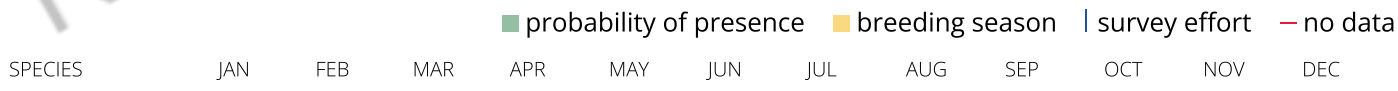
Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

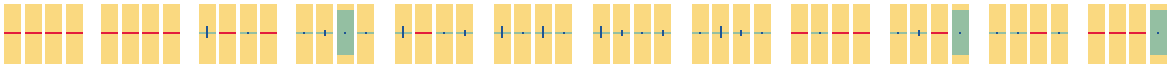
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

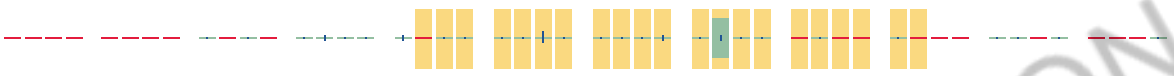
Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



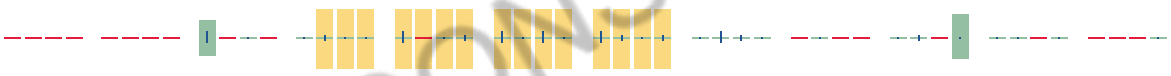
Bald Eagle
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



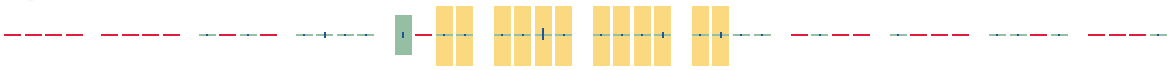
Black-billed Cuckoo
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



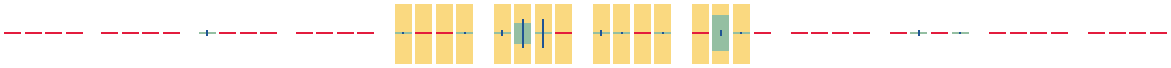
Black-capped Chickadee
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



Canada Warbler
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Eastern Whip-poor-will BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Wood Thrush BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring

in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

WETLAND INFORMATION IS NOT AVAILABLE AT THIS TIME

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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Attachment 3

Attachment 3 – Impingement and Entrainment Updated Tables

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Table 5-13. Turbine Blade Strike Probability by Project Configuration and Fish Length Under No Spill Operations[1]

Project Dam	Turbine Type	Fish Length Class (inches)								
		2	4	6	8	10	15	20	25	30
Existing Conditions – Francis Turbines Under No Spill Operations										
Byllesby	Existing (4 Francis Turbines)	4.5%	8.8%	13.3%	17.8%	22.1%	33.3%	44.5%	55.4%	66.6%
Buck	Existing (3 Francis Turbines)	4.5%	8.7%	13.2%	17.7%	21.9%	32.9%	44.0%	54.8%	65.9%
Proposed Conditions – Upgraded Turbines Under No Spill Operations										
Byllesby Proposed Condition	New Kaplan (Units 1, 2 & 3)	2.2%	4.3%	6.5%	8.7%	10.8%	16.3%	21.7%	27.1%	32.5%
	Existing Francis	4.5%	8.8%	13.3%	17.8%	22.1%	33.3%	44.5%	55.4%	66.6%
	Average Strike Probability[2]	2.8%	5.4%	8.2%	11.0%	13.6%	20.5%	27.4%	34.2%	41.0%
Buck Proposed Condition	New Kaplan (Units 1 & 2)	2.1%	4.0%	6.1%	8.1%	10.1%	15.2%	20.3%	25.3%	30.4%
	Existing Francis	4.5%	8.7%	13.2%	17.7%	21.9%	32.9%	44.0%	54.8%	65.9%
	Average Strike Probability[2]	2.9%	5.6%	8.4%	11.3%	14.0%	21.1%	28.2%	35.1%	42.2%

1) Assumes all flows directed to turbine units and with only minimum required bypass flows or spillage.
2) Reflects blended average strike probability for the 1 remaining Francis turbine and the 2(Buck), 3(Byllesby) proposed Kaplan turbines.

Table 5-14. Walleye Downstream Passage Survival Estimates for Existing and Proposed Project Configurations Under Four Spill Scenarios.

Project	Turbine Configuration	Flow Exceedance %	Volume Spill (CFS)	Spill Route Selection Probability	Turbine Strike Mortalities	Spillway Mortalities	Cumulative Downstream Passage Survival
Byllesby	Existing	4	230	0.0389	32.1%	0.2%	67.7%
Byllesby	Existing	3	1128	0.1657	24.9%	0.4%	74.7%
Byllesby	Existing	2	2355	0.2931	20.8%	0.6%	78.6%
Byllesby	Existing	1	5094	0.4728	15.9%	1.4%	82.7%
Byllesby	Proposed	4	425.6	0.0720	17.0%	0.2%	82.8%
Byllesby	Proposed	3	1324.3	0.1945	14.8%	0.4%	84.8%
Byllesby	Proposed	2	2551.2	0.3175	11.4%	0.8%	87.8%
Byllesby	Proposed	1	5290.3	0.491	9.4%	1.9%	88.8%
Buck	Existing	12	123	0.0336	28.3%	0.1%	71.1%
Buck	Existing	10	421	0.1063	27.2%	0.3%	72.5%
Buck	Existing	8	816	0.1874	24.3%	0.4%	75.2%
Buck	Existing	6	1427	0.2872	22.7%	0.8%	76.5%
Buck	Existing	4	2370	0.4010	16.1%	1.3%	82.6%
Buck	Existing	2	4495	0.5594	14.1%	1.8%	84.1%
Buck	Existing	1	7234	0.6714	9.1%	2.1%	88.8%
Buck	Proposed	12	92	0.0253	17.2%	0.1%	82.7%
Buck	Proposed	10	391	0.0987	17.5%	0.5%	82.0%
Buck	Proposed	8	786	0.1805	15.4%	0.5%	84.1%
Buck	Proposed	6	1397	0.2812	14.0%	1.1%	84.9%
Buck	Proposed	4	2340	0.3959	12.4%	0.93%	86.7%
Buck	Proposed	2	4465	0.5557	7.6%	1.8%	90.6%
Buck	Proposed	1	7204	0.6687	6.5%	2.1%	91.4%

Attachment 4

Attachment 4 – USR Meeting Presentation

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Byllesby-Buck Hydroelectric Project

Updated Study Report Meeting
December 1, 2021

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Updated Study Report

- Appalachian is pursuing a new license for the Byllesby-Buck Project (Project) pursuant to the Commission's Integrated Licensing Process (ILP), as described at 18 Code of Federal Regulations (CFR) Part 5.

- The Updated Study Report (USR) filed on November 17, 2021 describes the methods and results of the studies conducted in support of preparing an application for new license for the Project.

- The Federal Energy Regulatory Commission's (FERC) regulations at 18 CFR §5.15(f) require Appalachian Power Company (Appalachian) to hold a meeting with participants and FERC staff within 15 days of filing the USR.

- The purpose of the USR Meeting is to discuss study results.

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Meeting Agenda

Topic	Schedule
Welcome and Introduction	9:00 AM – 9:15 AM
Water Quality Study	9:15 AM – 10:15 AM
Wetlands, Riparian, and Littoral Habitat Study	10:15 AM – 10:35 AM
Terrestrial Resources Study	10:35 AM – 10:55 AM
Morning Break	10:55 AM – 11:10 AM
Shoreline Stability Assessment	11:10 AM – 11:30 AM
Aquatic Resources Study • Fish Community • Impingement and Entrainment • Macroinvertebrate and Crayfish	11:30 AM – 12:30 PM
Lunch Break	12:30 PM – 1:00 PM
Bypass Reach Flow and Aquatic Habitat Study	1:00 PM – 2:00 PM
Afternoon Break	2:00 PM – 2:10 PM
Recreation Study	2:10 PM – 3:10 PM
Cultural Resources Study	3:10 PM – 3:30 PM
Discussion, Questions, and Next Steps	3:45 PM – 4:00 PM

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Completed ILP Milestones

Date	Milestone
January 7, 2019	Appalachian Filed NOI and PAD (18 CFR §5.5, 5.6)
March 8, 2019	FERC Issued Notice of PAD/NOI and Scoping Document 1 (SD1) (18 CFR §5.8(a))
April 10-11, 2019	FERC Conducted Scoping Meetings and Site Visit (18 CFR §5.8(b) (viii))
June 21, 2019	Appalachian Filed Proposed Study Plan (PSP) (18 CFR §5.11(a))
July 18, 2019	Appalachian Held Study Plan Meeting (18 CFR §5.11(e))
October 18, 2019	Appalachian Filed RSP (18 CFR §5.13(a))
November 18, 2019	FERC Issued the SPD (18 CFR §5.13(c))
July 27, 2020	Appalachian Submitted First Quarterly Report, ILP Study Update, and Request for Extension of Time File ISR
August 10, 2020	FERC Issued Order Granting Appalachian Extension of Time and Filing of ISR
August – November 2020	Appalachian Conducted First Season of Field Studies (18 CFR §5.15(a))
October 27, 2020	Appalachian Submitted Second Quarterly Progress Report (18 CFR §5.15(b))
January 18, 2021	Appalachian Submitted ISR (18 CFR §5.15(c)(1))
January 28, 2021	Appalachian Hosted ISR Meeting (18 CFR §5.15(c)(2))
February 12, 2021	Appalachian Filed ISR Meeting Summary (18 CFR §5.15(c)(3))
April 30, 2021	Appalachian Filed Third Quarterly Progress Report
July 27, 2021	Appalachian Filed Fourth Quarterly Study Progress Report
Spring – Fall 2021	Appalachian Conducted Second Year of Studies
October 1, 2021	Appalachian Filed Draft License Application (DLA) (18 CFR §5.16(a))
November 2, 2021	Appalachian Filed Fifth Quarterly Study Progress Report
November 17, 2021	Appalachian Filed Updated USR (18 CFR §5.15(f))

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Studies Approved in the SPD

FERC's November 18, 2019 Study Plan Determination (SPD) for the Project directed Appalachian to conduct eight studies:

1. Bypass Reach Flow and Aquatic Habitat Study
2. Water Quality Study
3. Aquatic Resource Study
4. Wetlands, Riparian, and Littoral Habitat Study
5. Terrestrial Resources Study
6. Shoreline Stability Assessment
7. Recreation Study
8. Cultural Resources Study

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Upcoming ILP Milestones

Date	Milestone
December 1, 2021	*Appalachian Host USR Meeting (18 CFR §5.15(f))*
December 16, 2021	Appalachian File USR Meeting Summary (18 CFR §5.15(f))
December 31, 2021	Stakeholders File Comments on DLA (18 CFR §5.16(e))
January 15, 2022	Stakeholders File Disagreements with USR Meeting Summary (18 CFR §5.15(f)(4)) (if necessary)
February 14, 2022	Appalachian File Response to USR Meeting Summary Disagreements (18 CFR §5.15(f)(5)) (if necessary)
February 28, 2022	Appalachian File Final License Application (18 CFR §5.17)

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Water Quality Study

Byllesby Forebay 7.31.2019

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Water Quality Study

Study Goal: Conduct a study to support an analysis of the potential Project-related effects on water quality

Specific Objectives:

- Gather baseline water quality data sufficient to determine consistency of existing Project operations with applicable Virginia state water quality standards and designated uses
- Provide data to determine the presence and extent, if any, of temperature or dissolved oxygen (DO) stratification in the Byllesby and Buck impoundments
- Provide data to support a Virginia Water Protection Permit application (CWA Section 401 Certification)
- Provide information to support evaluation of whether additional or modified protection, mitigation, and enhancement (PM&E) measures may be appropriate for the protection of water quality at the Project

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Water Quality Study Area

Water Quality Study

Study Status

Appalachian conducted the Water Quality Study in accordance with the schedule and methods described in the RSP and SPD.

Study Periods

- 2020 study period: August 17 – October 8

  Results presented at the ISR meeting on January 28, 2021

  Monitoring locations:

  – Byllesby tailrace location

  – Buck forebay, tailrace, and bypass reach locations

- 2021 study period: June 15 – September 28

  Monitoring locations:

  – Byllesby upstream, forebay, tailrace, and bypass reach

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Water Quality Study

Study Methods

- Temperature and DO data collected at 15-minute intervals
- Discrete data collected during equipment installation, download events, and demobilization (temperature, DO, pH, and specific conductivity)
- Vertical profile data collected during discrete data collection events
- Turbidity data collected at 5-minute intervals over a 1-week period September 29 – October 5, 2021 and an intensive 1-day effort on October 14, 2021
- Turbidity and chlorophyll-a grab samples collected at the Byllesby and Buck forebays (July, August, and September 2021)

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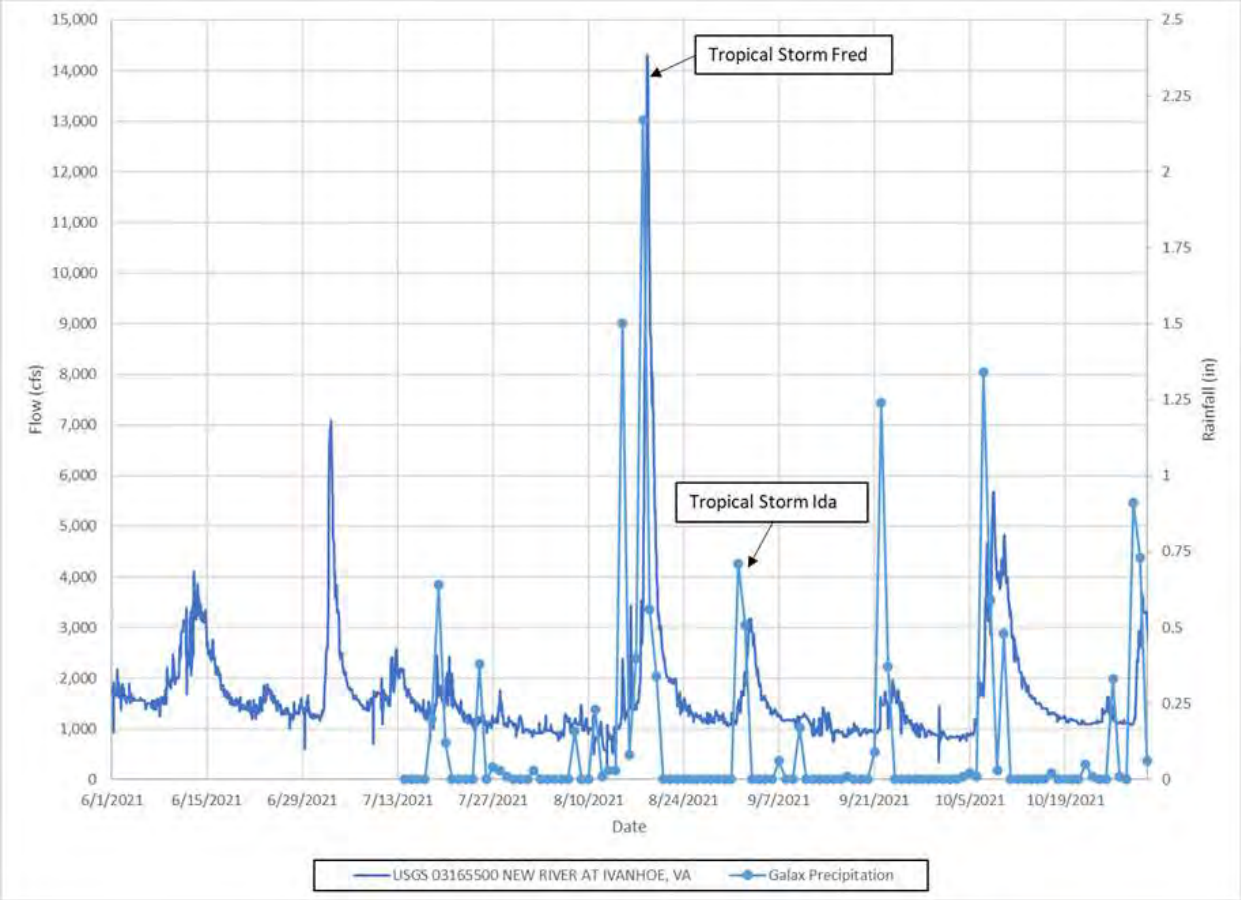
2021 Project Hydrology



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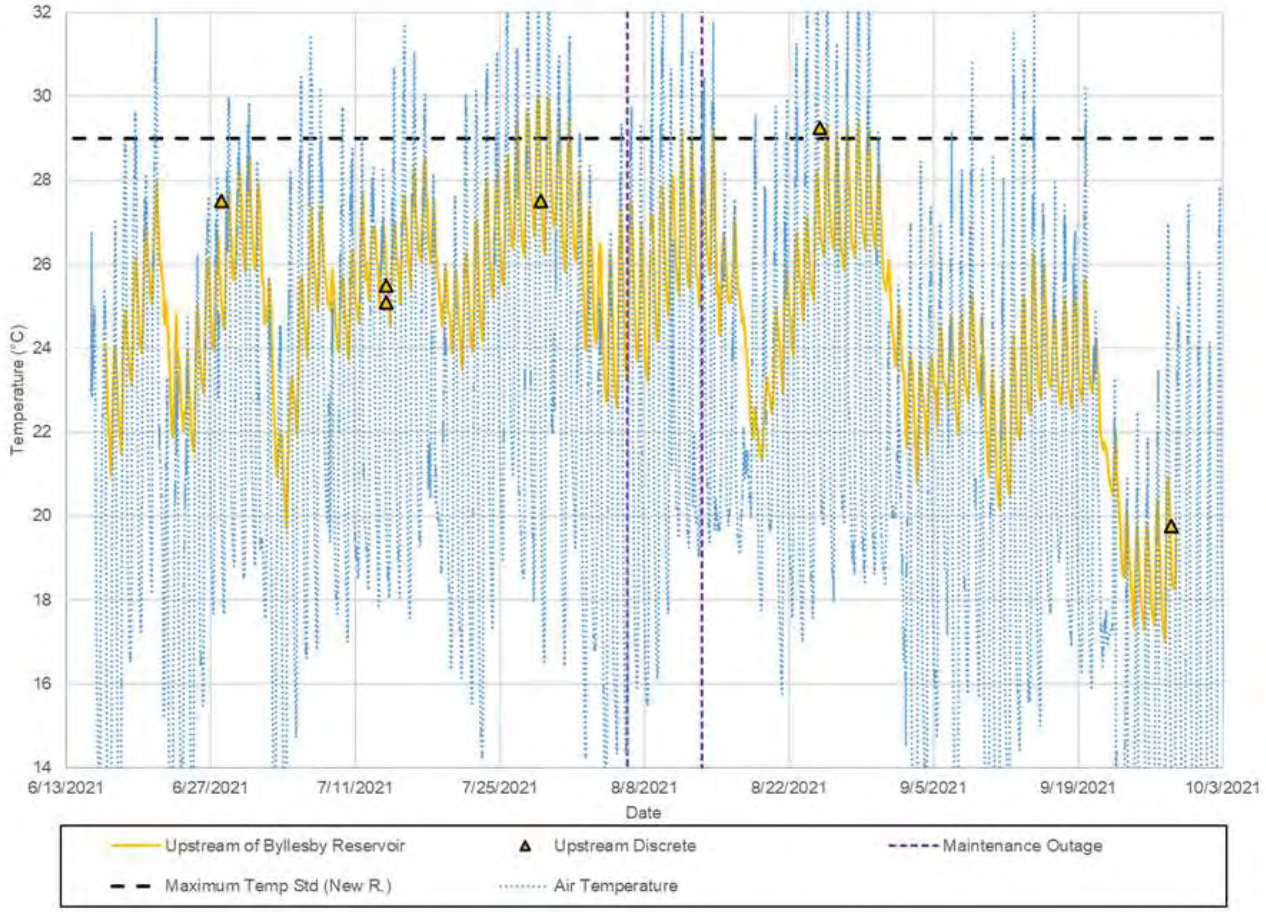
Air & Water Temperatures Upstream of Byllesby Reservoir



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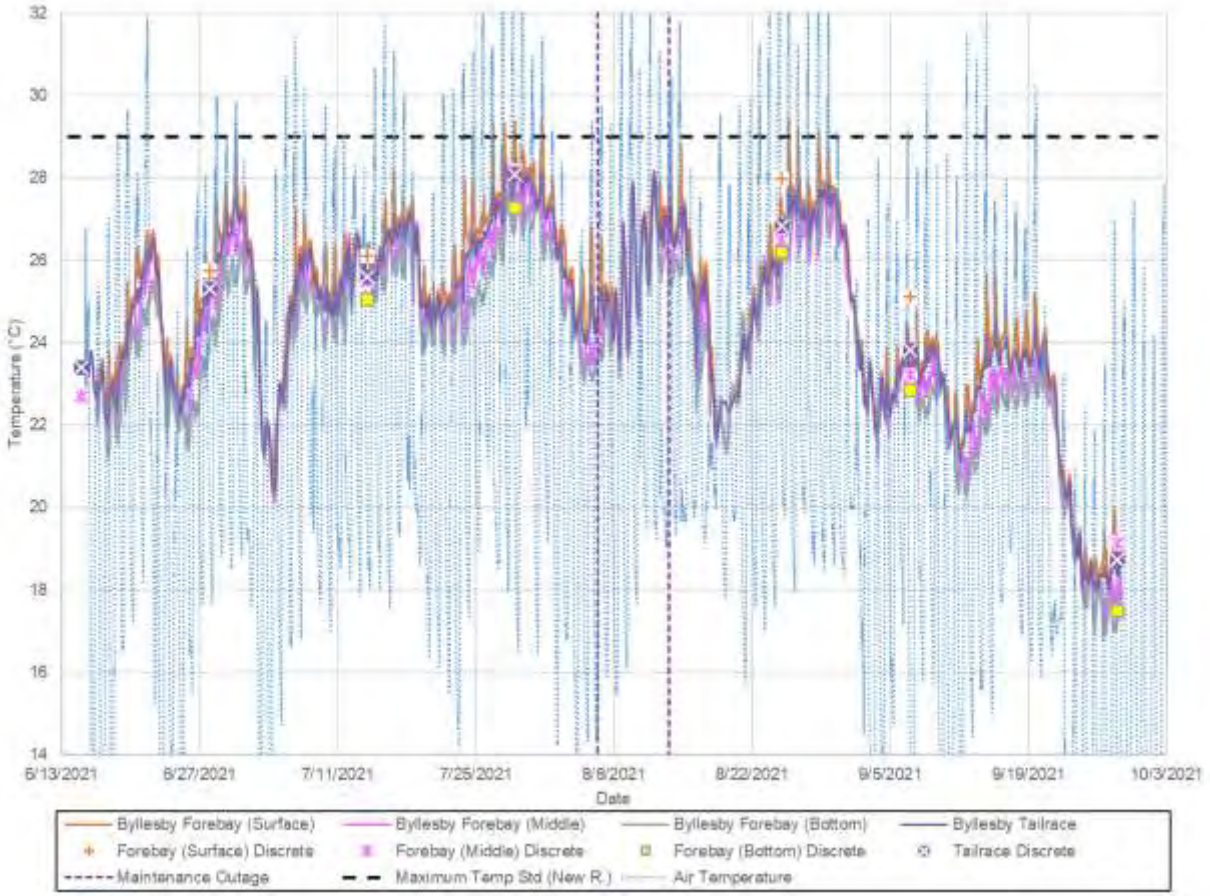
Air & Water Temperatures Byllesby Forebay & Tailrace



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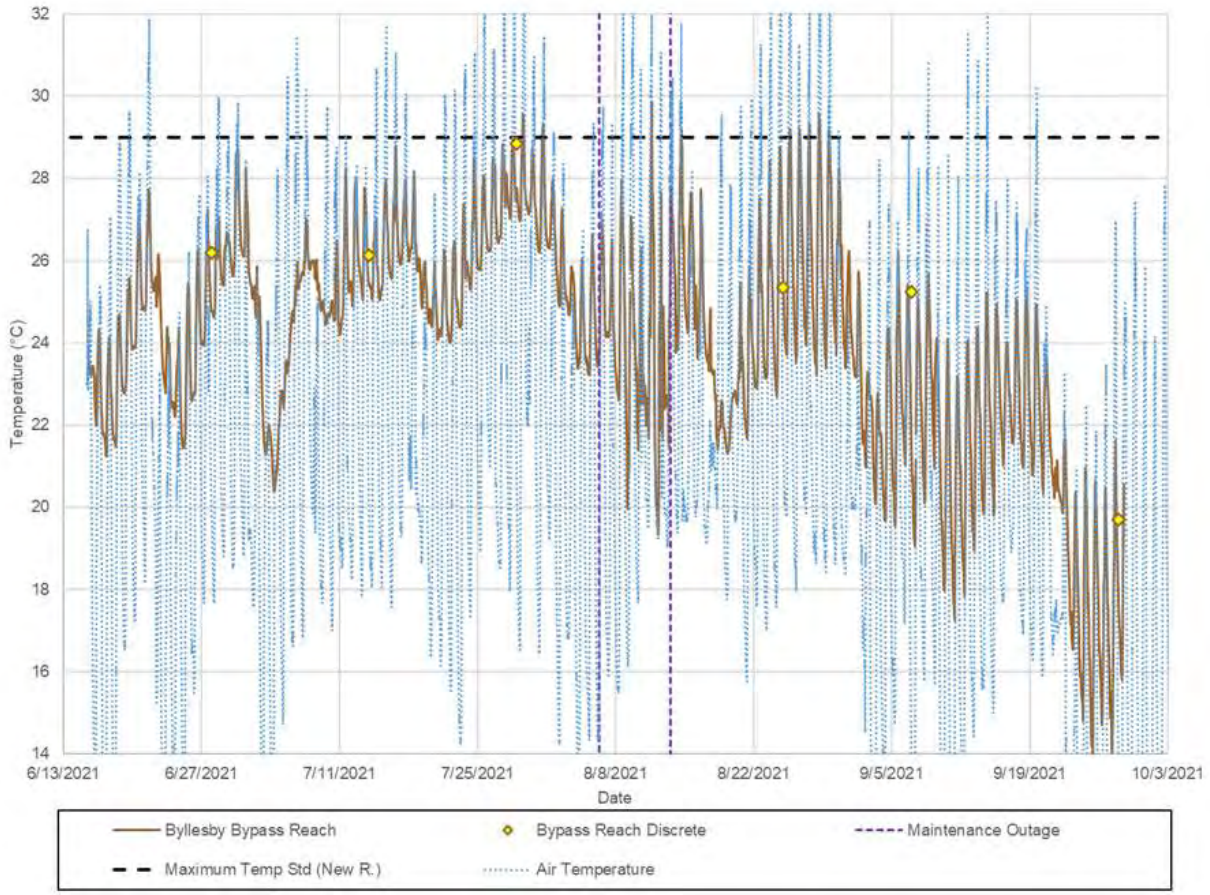
Air & Water Temperatures Byllesby Bypass Reach



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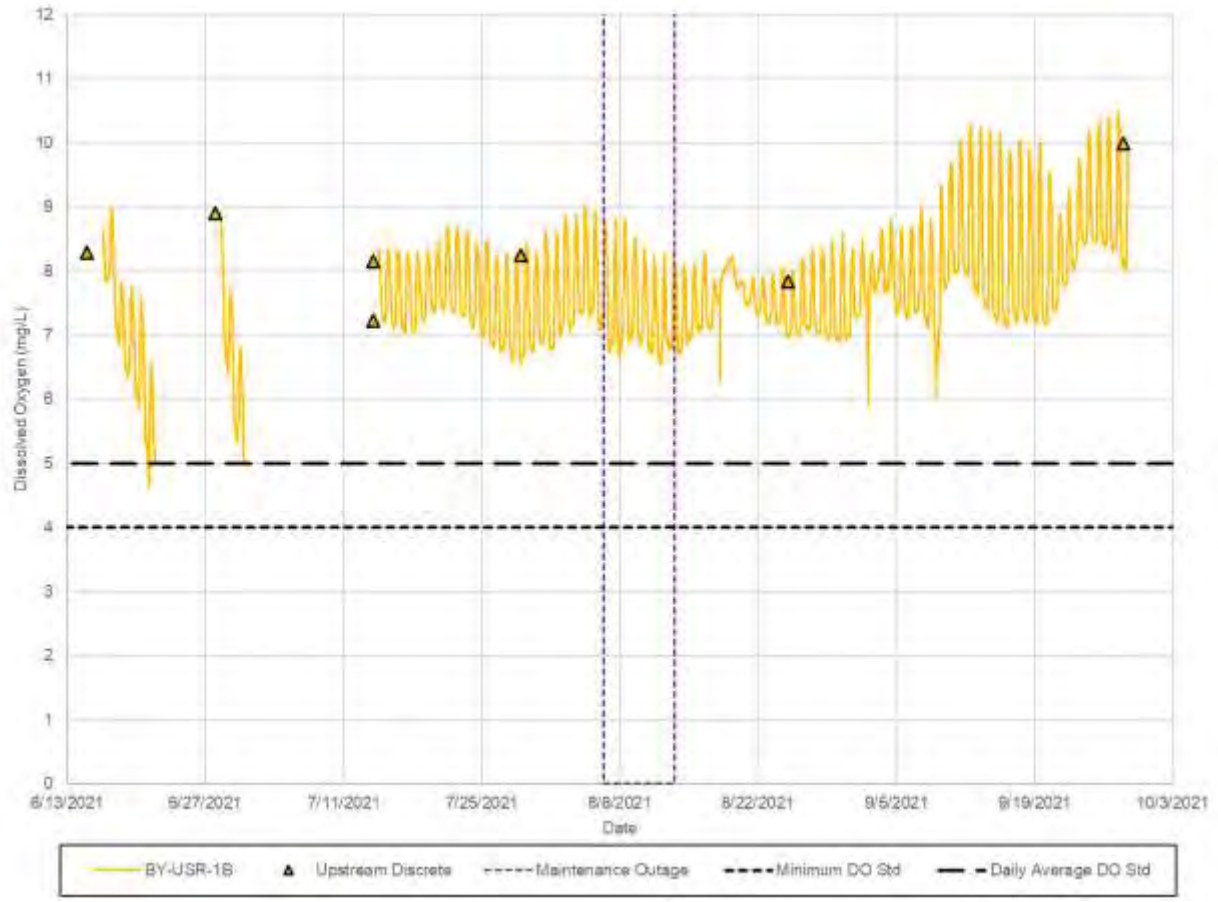
Dissolved Oxygen
Byllesby Upstream Location



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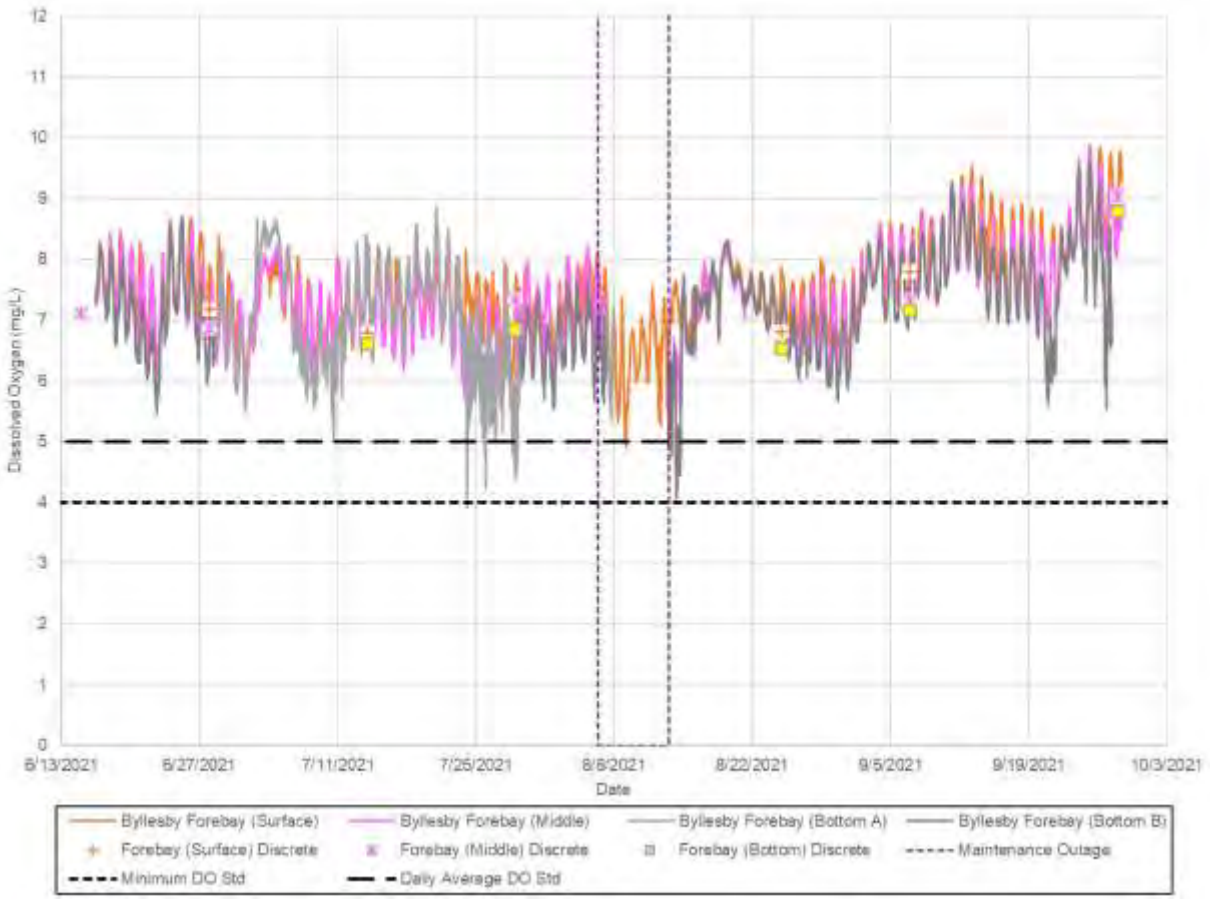
Dissolved Oxygen Byllesby Forebay



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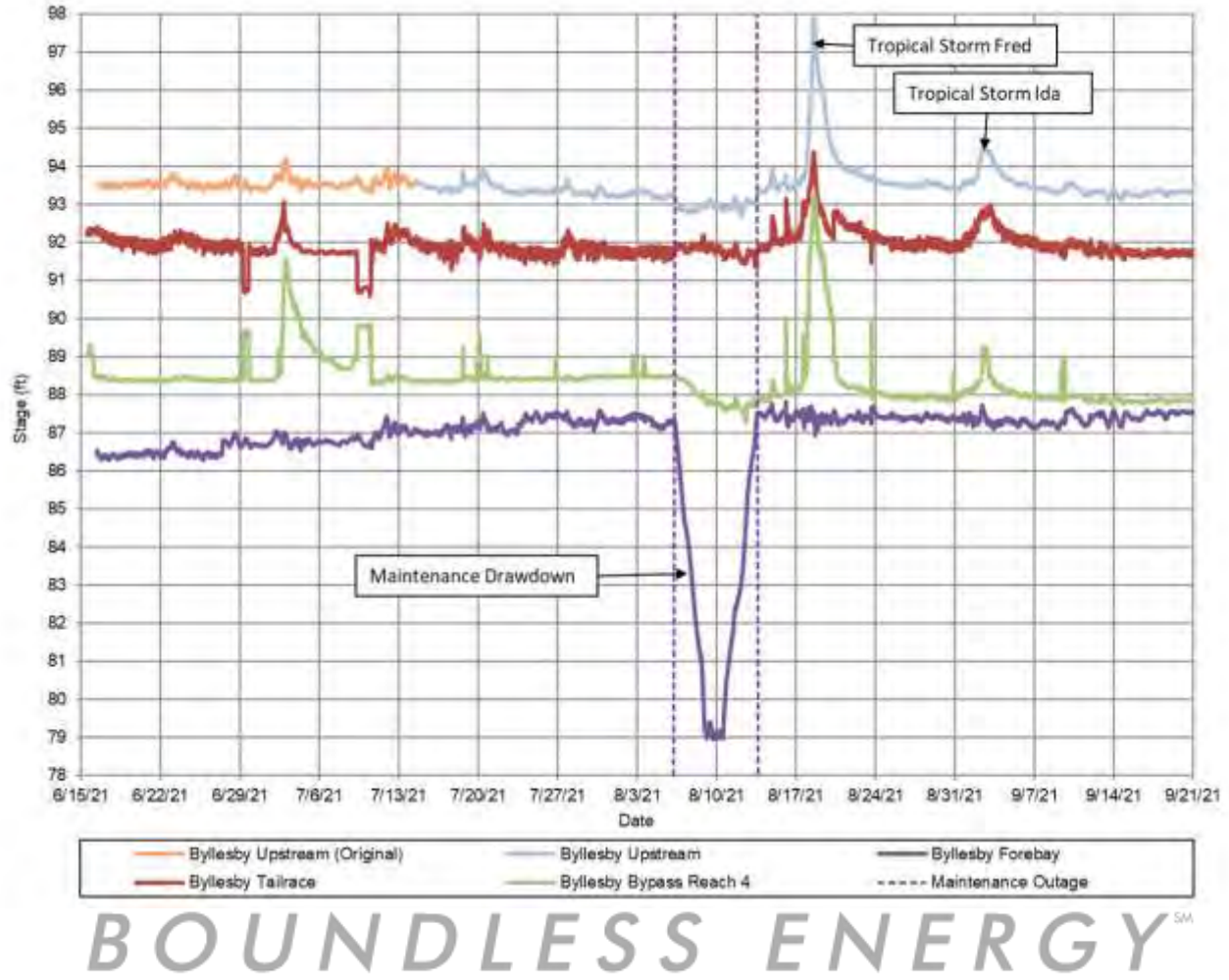
Byllesby Water Surface Elevations



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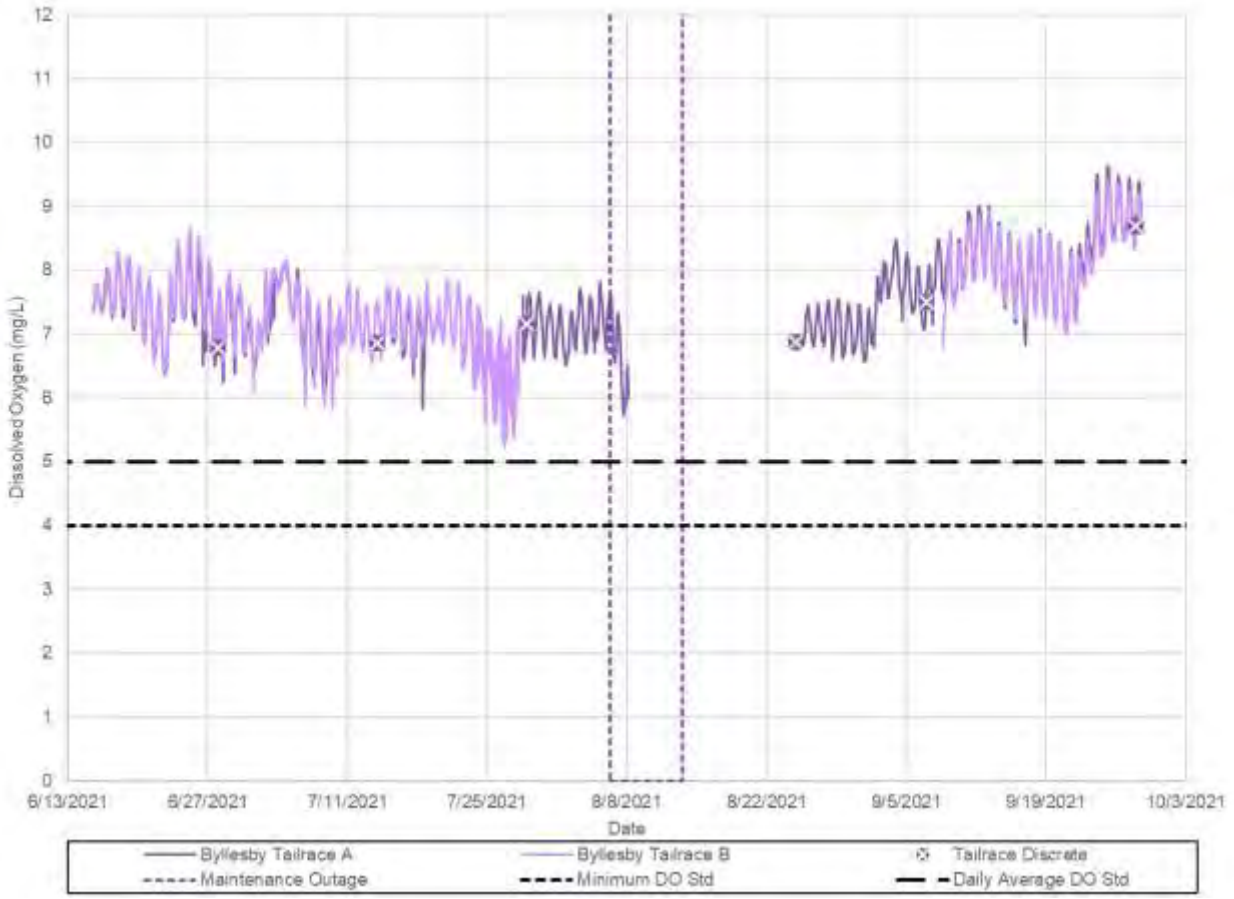
Dissolved Oxygen Byllesby Tailrace



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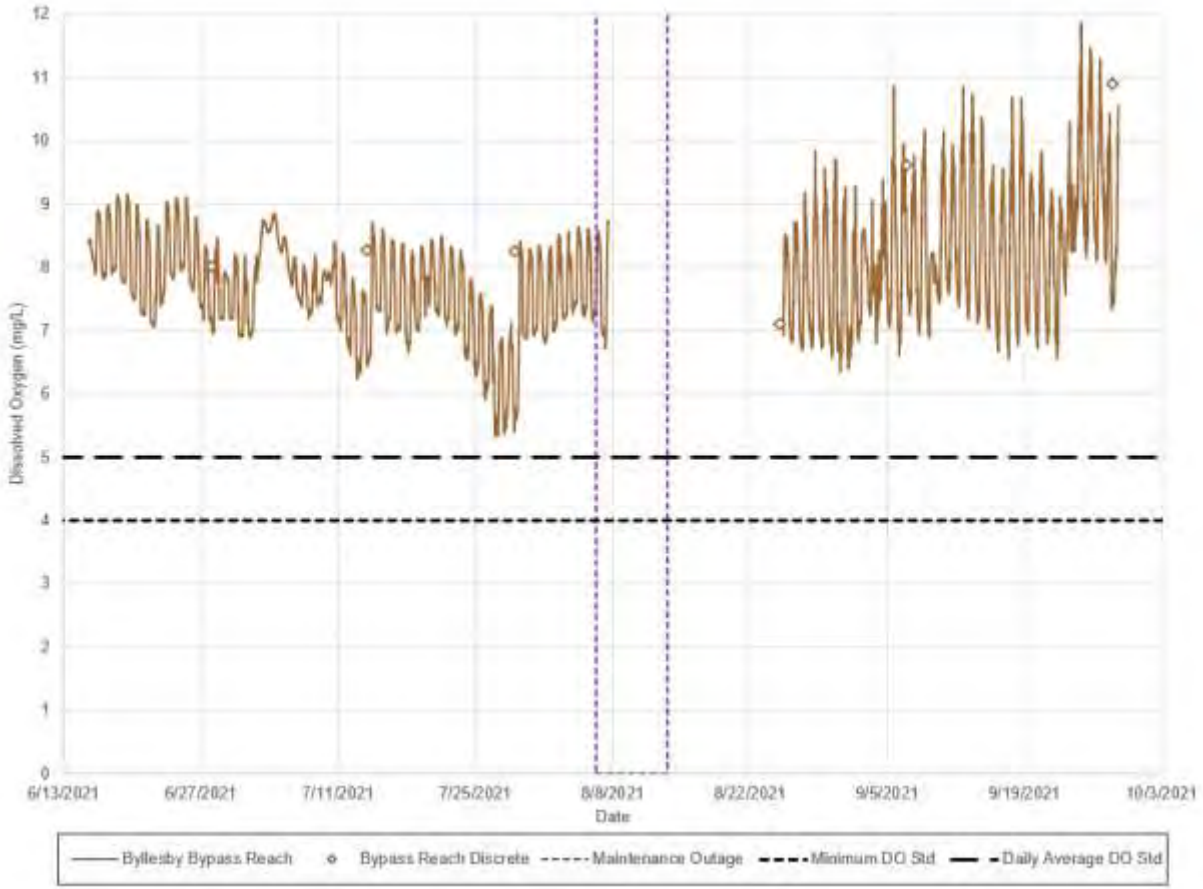
Dissolved Oxygen Byllesby Bypass Reach



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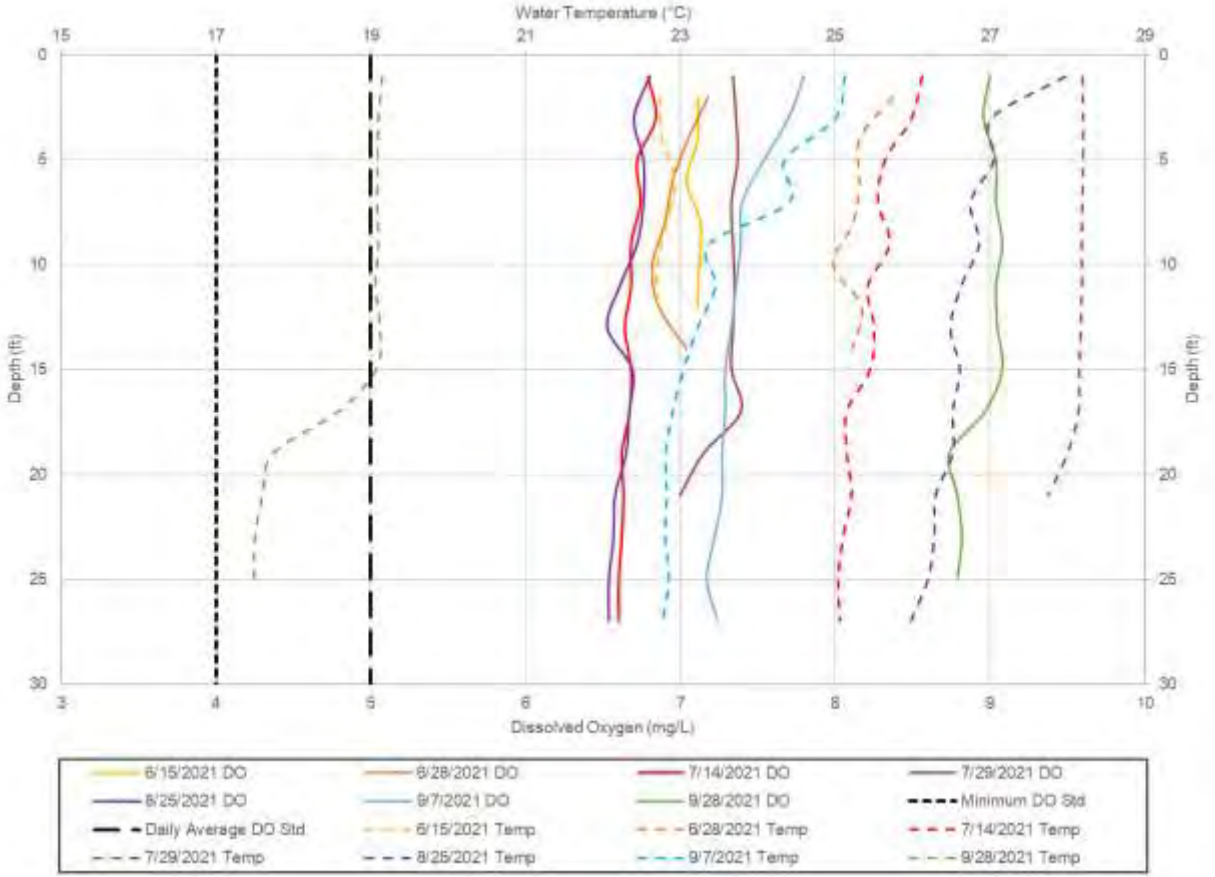
Byllesby Forebay Vertical Profiles Temperature and DO



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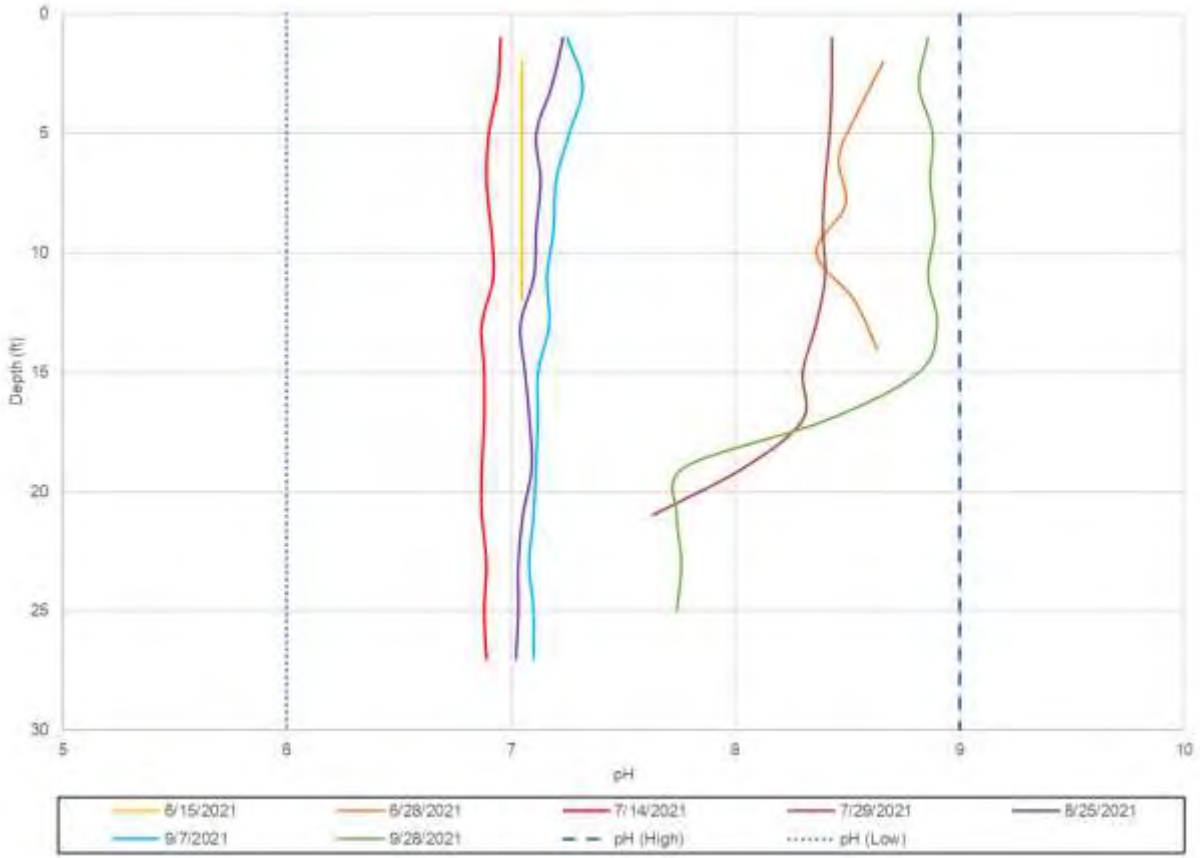
Byllesby Forebay Vertical Profiles - pH



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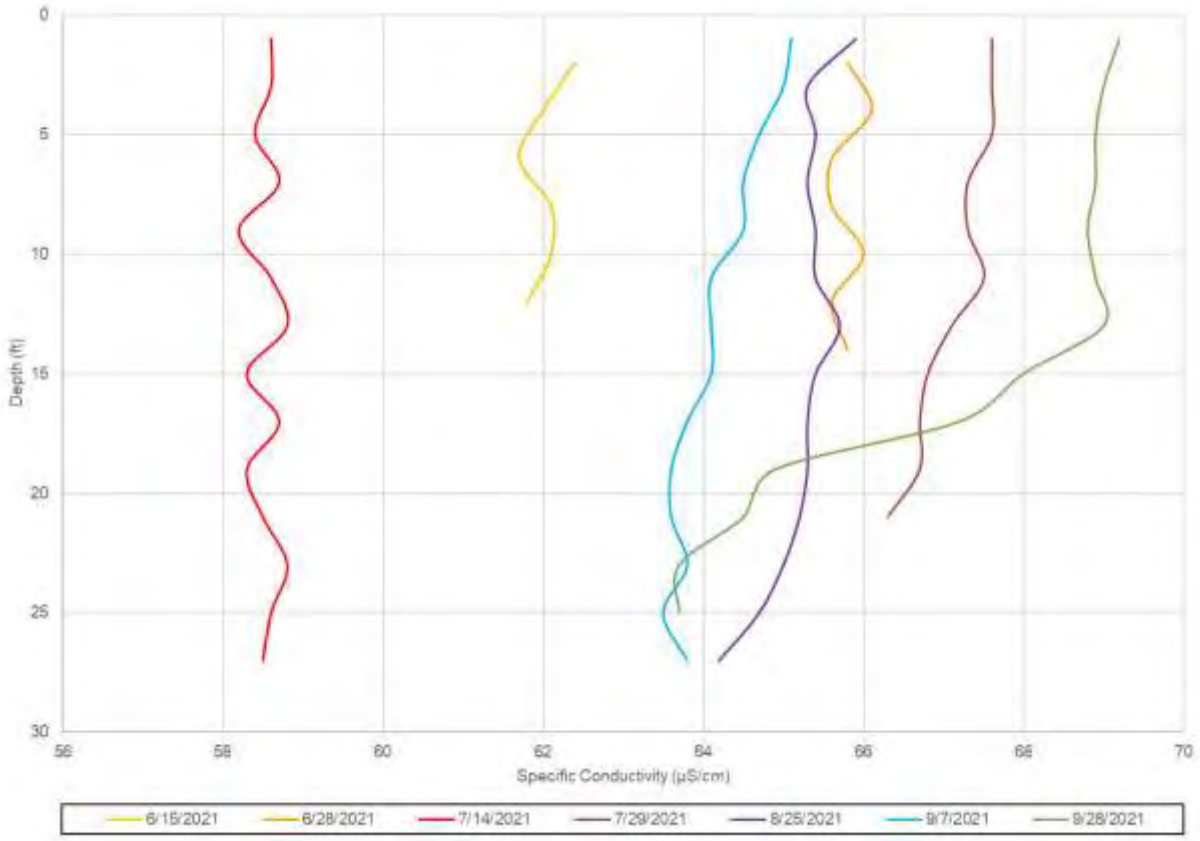
Byllesby Forebay Vertical Profiles Specific Conductivity



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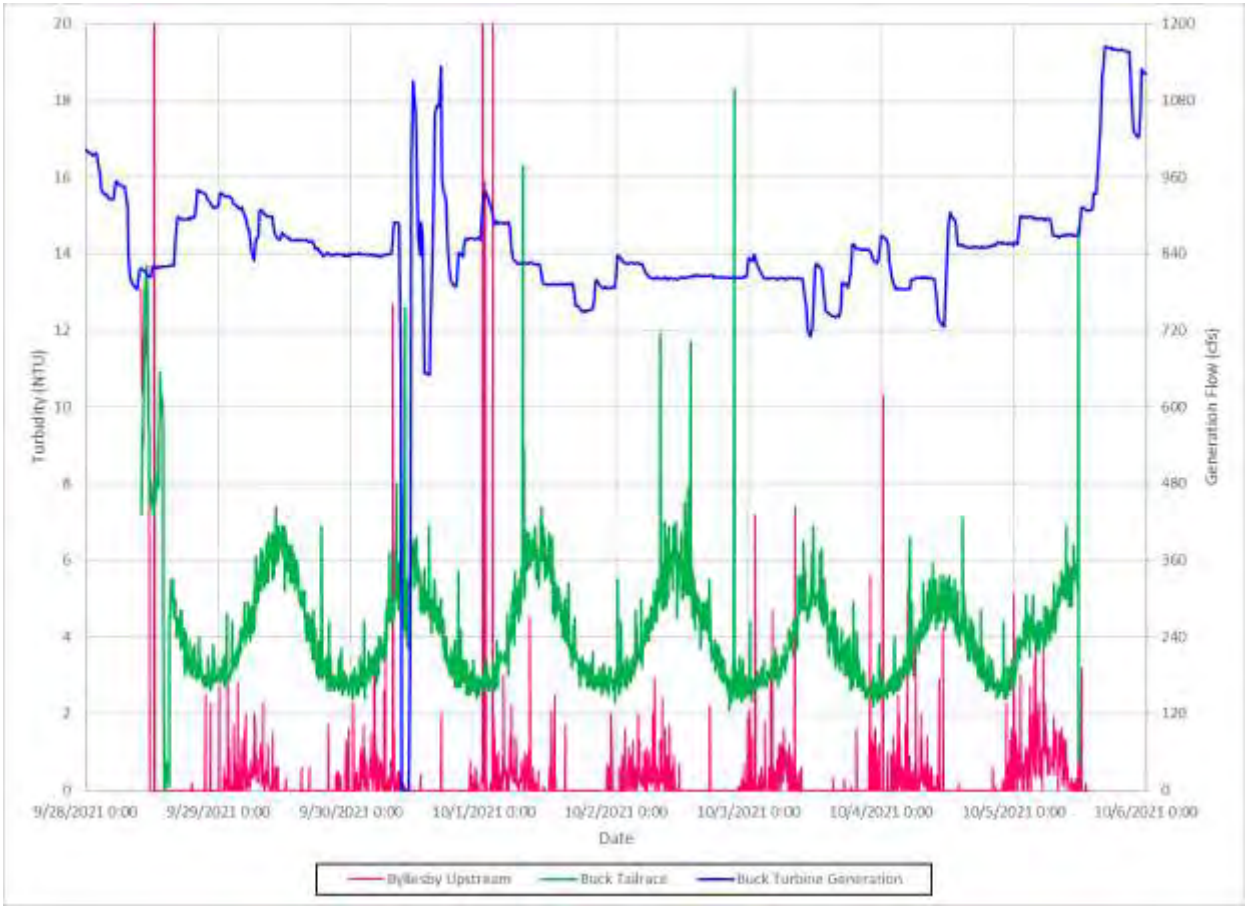
Continuous Turbidity
September 29 – October 5, 2021



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Continuous Turbidity & Drag Rake Operations October 14, 2021

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Water Quality Study Summary and Conclusions

- Water temperatures, DO concentrations, turbidity, and pH measurements met Virginia Class IV (New River) water quality standards; with the exception of instantaneous surface water temperatures on several occasions during late-July and late-August 2021
- Little to no thermal or DO stratification at the Byllesby and Buck forebay monitoring locations
- Specific conductivity and pH range is suitable for aquatic species
- Monthly chlorophyll-a grab sample results were non-detect indicating concentrations < 5 mg/cm^3

Byllesby Forebay and Spillway 9.9.2020

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Water Quality Study Summary and Conclusions

- Maximum turbidity concentrations from grab samples were 16.9 NTU (Byllesby) and 8.0 NTU (Buck)
- Continuous monitoring also yielded relatively low turbidity concentrations (typically < 12 NTU) with no discernible effects from station operations
- As a result, no need for additional PM&E measures to protect water quality at the Project

Buck Forebay Area
9.9.2021

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Variances from FERC-approved Study Plan

The Water Quality Study was conducted in conformance with the Commission's SPD.

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Wetlands, Riparian, and Littoral Habitat Study

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Wetlands, Riparian, and Littoral Habitat Study – Goals & Objectives

Study Goal: Conduct a study to identify and characterize the existing wetlands, waterbodies, and riparian and littoral vegetative habitats (including emergent and submergent aquatic vegetation beds)

Specific Objectives:

- Perform a desktop characterization using the USFWS National Wetlands Inventory (NWI), USGS National Hydrography Dataset (NHD), the VDEQ Wetland Conditional Assessment Tool (WetCAT), and other resources include GIS based topographic maps, hydrology, aerial imagery, and soil surveys to identify and describe, approximate, and classify wetlands and waterbodies within the study area.

- Perform a field verification to confirm the location of dominant vegetative communities, and vegetation classifications identified in the desktop survey.

- Field verification included identification of littoral and instream vegetation in the study area to characterize the availability of littoral, submerged, and emergent vegetative habitat.

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Wetlands, Riparian, and Littoral Habitat Study

Specific Objectives (continued):

- Develop a GIS based map using the results of the desktop characterization and field verification to identify the locations of wetlands and waterbodies according to the Cowardin Classification System.
- Riparian communities were classified according to the VDCR Natural Communities of Virginia Ecological Groups and Communities Types.
- The desktop and field verification was used to evaluate the potential for Project effects on wetlands, riparian, and littoral habitat within the study area.

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Study Methods

Desktop Study

- An initial desktop study was carried out to identify areas likely to contain wetlands, riparian, and littoral habitat and estimate the amount of each resource area.
  - USFWS NWI – estimated approximately 0.2 acres of freshwater forested/shrub wetlands and 9.6 acres of freshwater emergent wetlands.
  - VDEQ WetCAT – no resources were identified.
- Data collected during the desktop survey including the USGS topographic maps and NHD, elevation data, high-resolution orthoimagery, and NRCS soils survey were used to create habitat characterization base maps that were used to facilitate the field verification efforts.

Study Methods

Field Verification

Wetlands and Waterbodies: July 20 – July 22, 2021

- Wetland areas and streams identified in the desktop study were field-verified, but not formally delineated (i.e., no flagging or boundary marking), using the USACE Wetland Delineation Manual and Eastern Mountains and Piedmont Regional Supplement and USACE Regulatory Guidance OHWM Identification Guidance.
- Wetland scientists used handheld GPS units to estimate the boundaries of wetlands and waterbodies identified form the desktop survey as well as new surface waters not indicated on the desktop mapping.
- Identified waterbodies were photo-documented and USACE Wetland Determination Data Forms were completed at each representative wetland type.
- Data collected in the field was used to digitize the boundaries of existing wetland and waterbodies in GIS.

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Study Methods

Field Verification

Riparian Zone: July 20 – July 22, 2021

- Identification of vegetative community types by recording dominant species of vegetation at three strata (tree, sapling/shrub, and herb)
- HDR biologists used regional field guides and plant identification mobile apps to assist with identifying plans to genus and species level.
- Riparian zones identified within the study area best resembled Piedmont/Mountain Floodplain Forests and Swamps as described in the VDCR Natural Communities of Virginia Ecological Groups and Community Types.

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Study Methods

Field Verification

Littoral Zone: July 20 – July 22, 2021

- Four main categories of aquatic plans include (1) algae, (2) emergency aquatic vegetation, (3) submerged aquatic vegetation, and (4) floating plants.
- Transect-based surveys were performed to characterize littoral zone aquatic habitats within the study area. **Seven transect lines** were evaluated in each of the Project reservoirs and **four transect lines** were evaluated in the tailrace and bypasses portions downstream of each dam.
- In the reservoirs - transects were **oriented parallel** to the shoreline in boat accessible areas.
- In the tailrace and bypass reaches - transects were **oriented perpendicular to the shoreline** to include littoral zones along the stream margins and potential shallows where emergent or submergent vegetation may occur.
- Transects were 100 meters in length and 1.0-square meter in area (i.e., quadrants) spaced equally along the transect line at 10-meter intervals (at all but two transects). Transects were assessed for the presence/absence of aquatic plants. The scientific name of each vegetation species was recorded during the survey.
- A vegetation sampling throw rake was deployed at each sample area on transect lines (when feasible) to capture any non-visible submerged aquatic vegetation.

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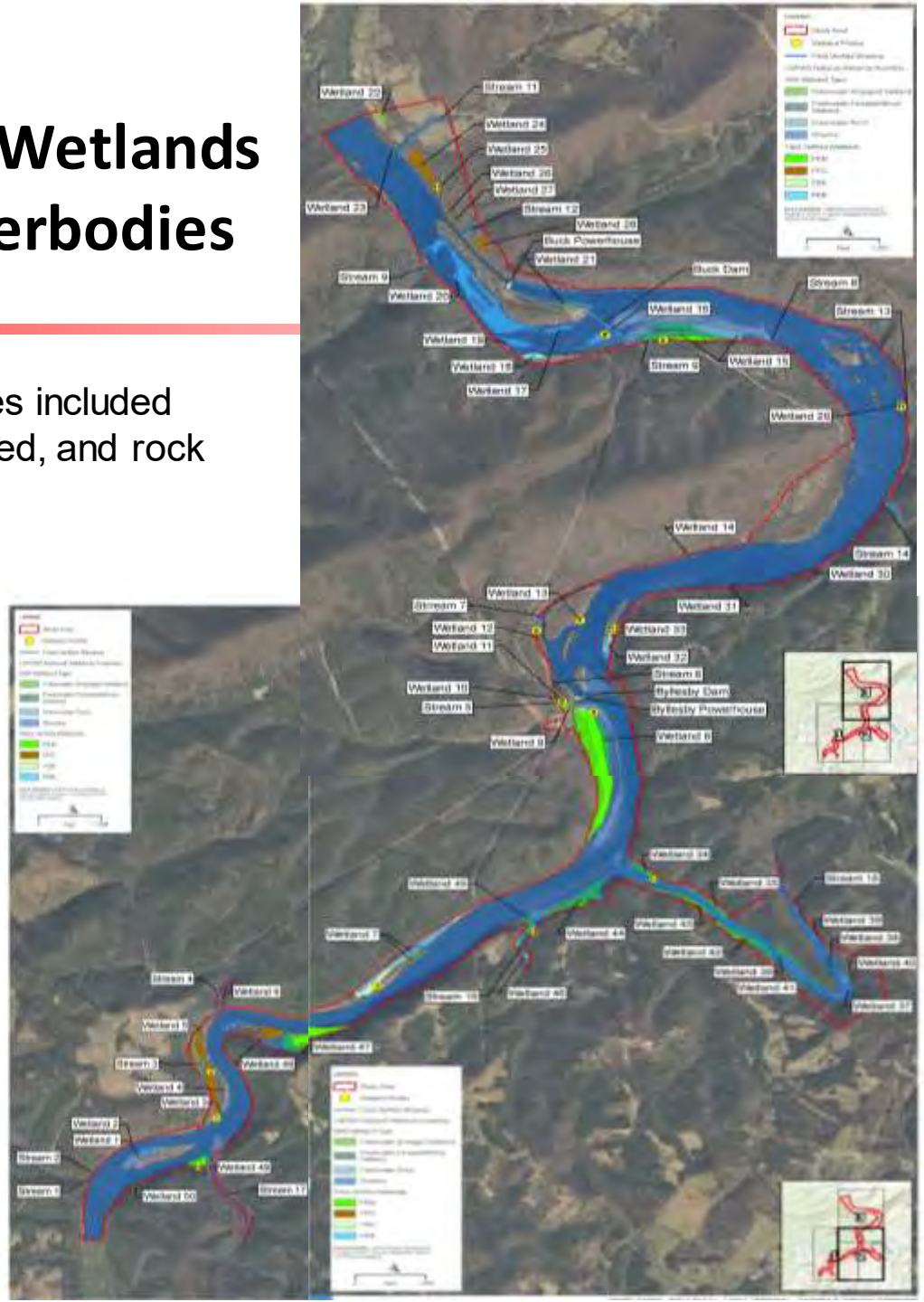
Results – Wetlands and Waterbodies

- Cowardin et. al (1979) wetland cover types included palustrine (emergent, scrub-shrub, forested, and rock bottom) and riverine systems
- Approximately **95.43 acres of wetlands** were field verified
  - 50.72 acres of palustrine emergent wetlands
  - 11.6 acres of palustrine scrub shrub wetlands
  - 15.37 acres of palustrine forested wetlands
  - 17.74 acres of rock bottom wetlands
- Approximately 15,608 liner feet of riverine features were verified.



Results – Palustrine Forested Wetlands

- Located in higher floodplains and point bars of the New River.
- Dominant vegetation consisted of American sycamore, box elder, red maple, black walnut , and silver maple.
- The majority of understory included Japanese stilt grass, reed canary grass, false nettle, highbush blackberry and smart weed.
- Wetland hydrology indicators included soil saturation, high water tables, and areas of standing waters.
- Hydric soils indicators included depleted matrix and redox dark surface.

Results - Palustrine Scrub-Shrub Wetlands

- Located in floodplains of the New River, typically adjacent to emergent wetlands
- The shrub vegetation consisted of American sycamore, box elder, and silver maple. The herbaceous vegetation included canary reed, grass, deer tongue, falsenettle, and soft rush.
- Wetland hydrology indicators included soil saturation, high water tables, and areas of standing waters
- Soils were mostly silt and clay and exhibited hydric soils indicators.

Results - Palustrine Emergent Wetlands

- Located as fringe wetland and floodplain wetlands along the shoreline floodplains of the New River.
- Herbaceous species is dominant and included Japanese stilt grass, soft rush, canary reed grass, deer tongue grass, cattails, falsenettle, bulrush, and woolgrass.
- Wetland hydrology indicators included soil saturation, high water tables, and areas of standing water.
- Soils were mostly silt and clay and exhibited hydric soils indicators such as depleted matrix and redox dark surface.

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Results - Palustrine Rock Bottom Wetlands

- Seasonally flooded to intermittently exposed trees, shrubs, and herbaceous vegetation on boulder and cobble deposition bars, or less frequently bedrock exposures, on the shores and islands of high-gradient streams (primarily within the bypass reaches).
- Dominant trees include American sycamore, alder, and willow.
- Dominant herbaceous vegetation includes spike rush , cattails, asters, smart weed, and water willow.
- The substrate of these wetlands consisted of angular bed rock and sand bars with organic material.
- Pools of surface water were present throughout with patchy vegetation.

Results - Riverine Habitats

- Riverine habitats in the study area include the New River and associated tributaries. The New River is a lower perennial riverine feature on the upstream and downstream limits of the study area.
- There are several perennial tributaries that flow into the New River including Chestnut Creek, Crooked Creek, Rocky Branch, Poor Branch, Big Branch, and Brush Creek along with eight unnamed tributaries.
- The dominant tree vegetation in these types of wetlands include American sycamore, boxelder, cattails and reed canary grass.
- The dominant substrate included cobble to boulder sized rock along with bedrock.
- There are four intermittent streams that flow into the New River.

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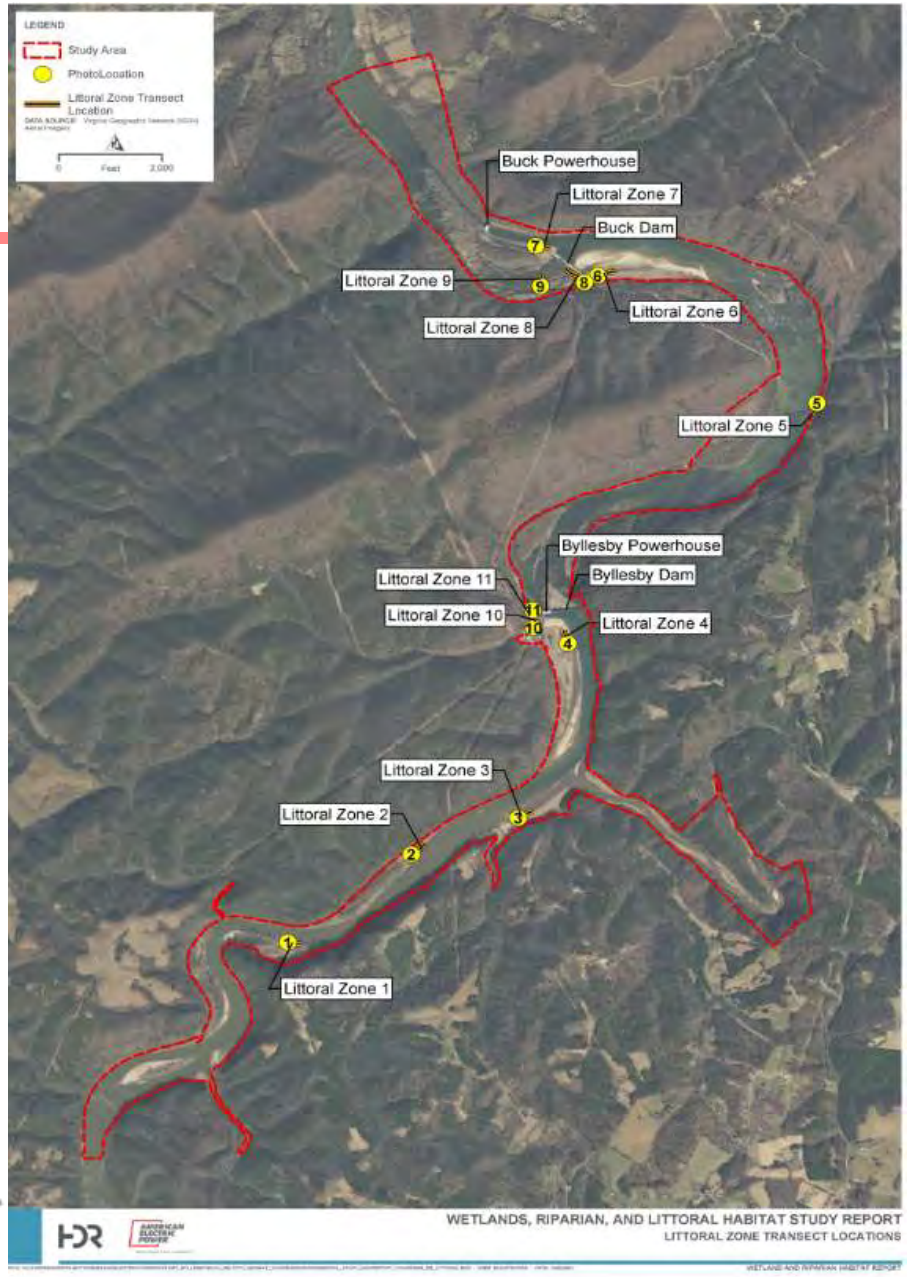
Results - Littoral Habitats

- Seasonally flooded to intermittently exposed herbaceous vegetation along depositional bars on the shores of the reservoirs and within the rock exposures of the bypass reaches.
- Substrates consisted of angular bed rock and depositional bars of sand and organic material. Pools of surface water were present throughout the surveyed littoral zones with patchy vegetation growth in areas that were above water level.
- Littoral zone vegetation included Elodea Spp, algae, curly-leafed pondweed, Parrot's feather, Broad leaf pondweed, smartweeds, spike rush, bulrush, rice cut grass, soft rush, water willow, shallow sedge. Curly-leafed pondweed is considered to be a non-native invasive species.

Results - Littoral Habitats

- Elodea was the most abundant SAV throughout the reach located close to the stream bank adjacent to wetlands.
- Algae was dominant in the littoral zone upstream from the Byllesby Dam where water flow was slower.
- Littoral Zones 6 and 8 upstream of Buck Dam exhibited the highest percentage of aquatic vegetation.



Results – Riparian Habitats

The riparian area consists of approximately 177 acres and is mainly found along the shoreline, on islands, and within the bypass reach.

- Varies in width from 5 to 520 feet wide.
- Dominant vegetation in the over story includes black walnut, black cherry, red maple, Northern red oak, Eastern red cedar, Virginia pine, black willow, American sycamore, sugar maple , box elder, chestnut oak, green ash, and white pine.
- The understory typically included blackberry, mountain laurel, and witch hazel .
- The herbaceous vegetation consisted of Christmas fern, mayapple, wingstem, bedstraw, muscadine grape, Virginia creeper, cinnamon fern, and poison ivy.
- Non-native invasive species were present and included Japanese knotweed, multiflora rose, oriental bittersweet, and Tree of Heaven.

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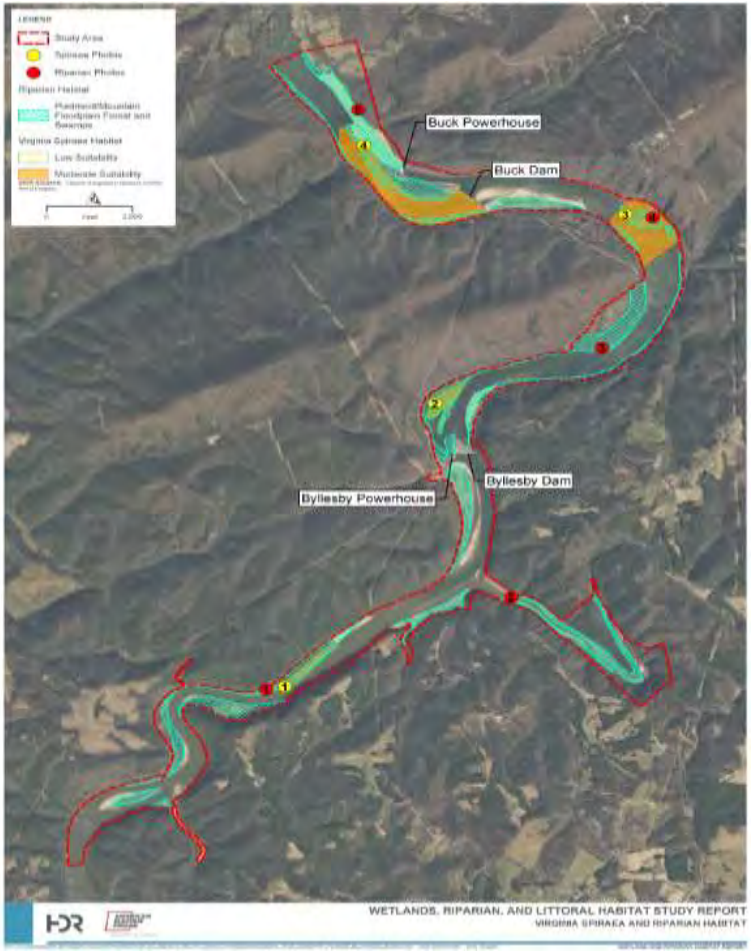
Virginia Spiraea and Riparian Habitat

- There were no observed occurrences of **Virginia spirea (*Spiraea virginiana*)** in areas identified in the previous surveys; however, potentially suitable habitat was observed throughout the study area in rocky, low flow areas of streams, and on portions of bars and benches.
- Figure shows the location of potential Virginia spiraea habitat and provides a classification of low suitability or moderate suitability.
- More details regarding Virginia spirea are **included in the Terrestrial Resources Study** (next).



Wetland, Riparian, and Littoral Habitat Study – Project Impacts

- Periodic drawdowns for Project maintenance have the potential to temporarily dewater wetland, riparian, or littoral areas.
- Longer drawdowns may cause soils in wetland areas to lose saturation which may result in loss of wetland vegetation.
- Sediment accumulation is slowly occurring at location within and around the impoundments in some cases lead to the creation of new wetlands.
- Dredging may be required if the sediment interferes with Project operations and may require authorization from applicable environmental regulatory agencies.
- Operations and maintenance of the Project are not anticipated to have any short- or long-term, unavoidable, adverse impacts on wetland, riparian, and littoral resources.

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Variances from FERC-approved Study Plan

The Wetlands, Riparian, and Littoral Habitat Study was conducted in conformance with the Commission's SPD.

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Terrestrial Resources Study

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Terrestrial Resources Study

Study Goal: Conduct a study to identify and characterize the existing terrestrial habitats and resources.

Specific Objectives:

- Perform a desktop characterization of upland vegetation types using the Nature Conservancy's (TNC) Terrestrial Habitat Map.
- Classify identified plant communities according to the Virginia Department of Conservation and Recreation (VDCR) Natural Communities of Virginia Classification of Ecological Groups and Communities Types.
- Perform a characterization of the upland habitat types in relation to wildlife species know to existing or inhabit or directly observed during the field visit.
- Develop a map of upland vegetative communities and identify the locations of any invasive plant species observed during the field visit.

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Terrestrial Resources Study

Federally Protected Species

- Bald eagle (*Haliaeetus leucocephalus)* – BGPA/MBTA
- Indiana bat (*Myotis sodalist*) - Endangered
- Northern long-eared bat (*Myotis septentrionalis*) - Threatened
- Virginia spirea (*Spiraea virginiana*) - Threatened
- No Critical Habitats at this location

**No surveys for protected bat species were not conducted as part of the relicensing effort since the proposed improvement plans and Project activities are not expected to involve clearing of trees in upland forested communities that provided habitat for roosting or maternity colonies.*

Terrestrial Resources Study

Bald Eagle (*Haliaeetus leucocephalus*)

- Nesting and roosting habitat within Project vicinity
- ESI conducted an aerial helicopter transect in March 2021 for the proposed Byllesby-Ivanhoe 88kV Transmission Line Retirement project (not associated with the Project relicensing)
  - One active nest was observed on the New River approximately 0.52 miles from the transmission line corridor and approximately 0.27 miles south of the Buck Dam.
  - An unoccupied nest was identified along the New River approximately 1.1 mile north of Buck Dam at the top of transmission line.
  - Three individual bald eagles were observed.
  - Project-related activities are not expected to adversely affect this species.
  - Coordination with the USFWS if future operations, modifications, or developments have the potential to affect bald eagles.

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Terrestrial Resources Study

Virginia spirea (*Spiraea virginiana*)

- Listed as federally threatened and state endangered
- Historically reported by the USFWS upstream of Byllesby Dam
- No documentation or verification of any historic presence or exact location.
- ESI performed habitat and presence/absence surveys for the Virginia spirea in 2017. No species were identified.
- HDR biologists re-investigated the habitat patch locations identified in ESI report.
- Suitable habitat was photo-documented in the field.
- No individual species belonging to the Spiraea genus were identified.

Terrestrial Resources Study - Methods

- **Desktop Mapping**
  - High resolution aerial imagery
  - TNC Terrestrial Habitat Map
  - Virginia Natural Heritage Data Explorer
  - Virginia Invasive Plant Species List
  - Virginia Department of Wildlife Resources Fish and Wildlife Information Services List (list generated 511 total species, 342 were terrestrial species).

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Terrestrial Resources Study

- **Field Verification** (May 26 through May 28, 2021).
  - Applicable field regional field guides and plant identification mobile apps to identify plants to genus and species level.
  - Dominant species of upland vegetation (tree, shrub, and herb strata) were recorded and characterized according to VDCR guidance.
  - Locations of significant invasive species populations were georeferenced and photographed using the ArcGIS Collector mobile app.
  - Recorded observations of terrestrial animal species and recorded general ecological community where they were observed.

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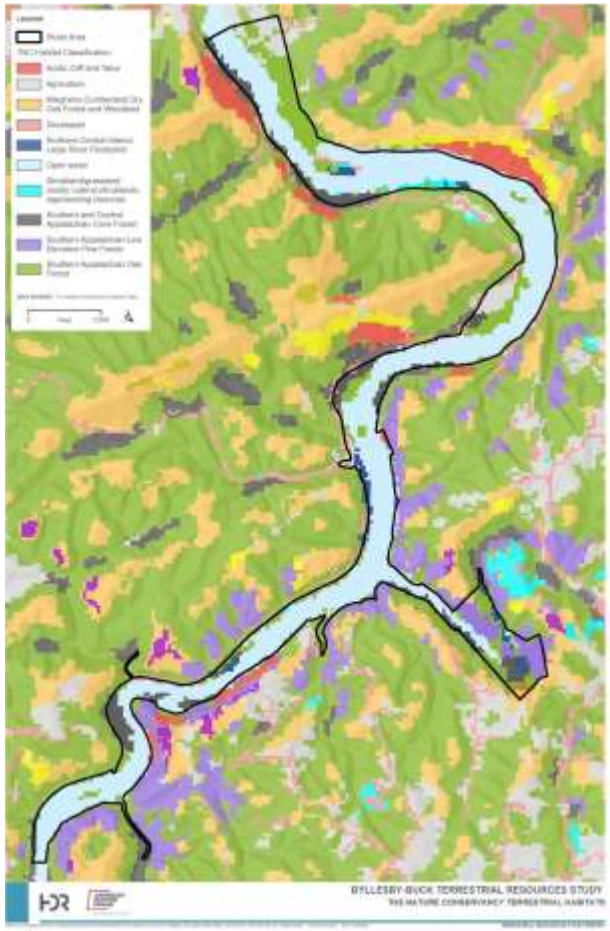
Terrestrial Resources Study – Desktop Results

The TNC Terrestrial Habitat Map identified 10 Habitat Communities including:

- Acidic Cliffs and Talus – 0.30%
- Agricultural – 4.25%
- Allegheny-Cumberland Dry Oak Forest and Woodland – 0.32%
- Developed Areas – 1.73%
- Open Water – 61.63%
- Northern-Central Interior Large River Floodplains – 2.60%
- Shrubland/grassland, regenerating clear-cuts – 0.85%
- Southern Appalachian and Central Appalachian Cove Forest – 8.75%
- Southern Appalachian Low Elevation Pine Forests – 3.61%
- Southern Appalachian Oak Forests – 15.96%



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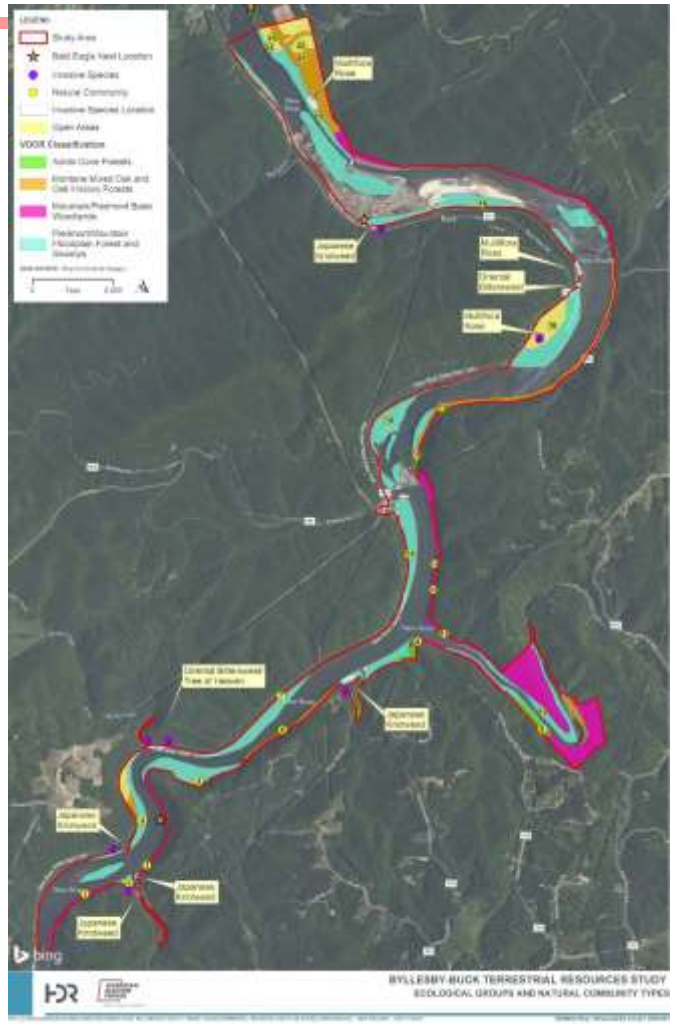
Terrestrial Resources Study

Field Verification

Four upland ecological groups and communities types were identified (using VDCR guidance)

- Acidic Cove Forest– 2.22%
- Montane Mixed Oak and Oak Hickory Forest – 12.80%
- Open Areas – 8.17%
- Mountain/Piedmont Basic Woodlands – 20.06%
- Piedmont/Mountain Floodplain Forests and Swamps – 56.75%



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Terrestrial Resources Study

Acid Cove Forests - 2.22%

- Group contains mixed hardwoods and hardwood hemlock forests of montane habitats occupying moist lower slopes, ravines, and coves underlain by sandstone, quartzite, granite, and other acidic bedrock.
- Overstory species included tulip poplar, eastern hemlock , American basswood, sweet birch, chestnut oak, shagbark hickory, and white pine.
- Understory species included flowering dogwood, witch hazel, striped maple, spicebush, wineberry with areas of dense, evergreen shrub layers including great rhododendron and mountain laurel.
- Herbaceous species included galax, trilliums, black cohosh, jewelweed, spotted lady's thumb, mayapple, wood-nettle, Virginia strawberry, violets, polypody ferns, and Christmas fern.

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Terrestrial Resources Study

Montane Mixed Oak and Oak Hickory Forest – 12.8%

- Group contains a relatively diverse, mixed oak and oak-hickory forest of submesic (moist) to subxeric (dry) mountain slopes and crests mostly between 2,000 feet and 4,000 feet elevation.
- Overstory species included Chestnut oak, northern red oak, white oak, shagbark hickory, mockernut hickory, sourwood, tulip poplar, white pine, silver maple, black locust, and yellow buckeye.
- Understory species included witch hazel, striped maple, and maple-leaved viburnum.
- Herbaceous species included galax, Jack in the pulpit, spotted ladys' thumb, wood nettle, fire pink, violets, New York fern and wood ferns.

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Terrestrial Resources Study

Open Areas – 8.17%

- Observed around the existing hydropower infrastructure and transmission right of way. One agricultural area was observed in the furthest downstream extent east of the New River.
- Plant species American sycamore, tulip polar, eastern redcedar, black cherry, black locust, green ash, Virginia pine, blackberry, Chinese lespedeza, Japanese clover, wingstem, goldenrods, deertongue, common dandelion, wild mint, red clover, partridge pea, plantain, ground ivy, Cherokee sedge, and Japanese honeysuckle.

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Mountain/Piedmont Basic Woodlands – 20.06%

- Group represented by deciduous and mixed woodlands of xeric (dry), rocky habitats with patches of exposed outcrop barrens.
- Overstory species included Chestnut oak, northern red oak, shagbark hickory, mockernut hickory, silver maple, black cherry, white ash, and Virginia pine.
- Understory species included eastern redcedar, eastern redbud, eastern hophornbeam, slippery elm, witch hazel, blueberry, with localized patches of evergreen shrubs including great rhododendron and mountain laurel.
- Herbaceous species included smooth solomon's seal, rattlesnake weed, common mullein, licorice fern, polypody ferns, wood ferns, reindeer moss, Virginia creeper, and poison ivy.

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Terrestrial Resources Study

Piedmont/Mountain Floodplain Forests and Swamps – 56.75%

- Group represented by temporary to seasonally flooded forests along the New River.
- Overstory species included American sycamore, boxelder, northern red oak, white oak, willow oak, American basswood, honey locust, black walnut, black gum, black cherry, tulip polar, red maple, silver maple, and green ash.
- Understory species included black willow, persimmon, silky dogwood, redbud, alders, elderberry, and spicebush.
- Herbaceous species included black cohosh, beggar-ticks, mayapple, bedstraw, arrow-arum, arrowheads, marsh dayflower, false nettle, clearweed, marsh seedbox, lizards's tail, soft rush, blunt spikerush, winged monkey flower, Virginia spiderwort, American bur-reed, broadleaf cattail, reed canary grass, rice cutgrass, deertongue, woolgrass, cinnamon fern, Christmas fern, Virginia creeper, and poison ivy.

Scientific Name	Common Name	Community Type
HERPETOFAUNA		
Chelydra serpentina	Common snapping turtle	Piedmont/Mountain Floodplain Forest & Swamps
Pantherophis alleghaniensis	Eastern ratsnake	Piedmont/Mountain Floodplain Forest & Swamps
Pantherophis guttatus	Red cornsnake	Piedmont/Mountain Floodplain Forest & Swamps
Pseudacris crucifer	Spring peeper	Piedmont/Mountain Floodplain Forest & Swamps
Thamnophis sirtalis	Eastern gartersnake	Montane Mixed Oak and Oak Hickory Forests
BIRDS		
Agelaius phoeniceus	Red-winged blackbird	Piedmont/Mountain Floodplain Forest & Swamps
Aix sponsa	Wood duck	Piedmont/Mountain Floodplain Forest & Swamps
Branta canadensis	Canada goose	Piedmont/Mountain Floodplain Forest & Swamps
Butoe jamaicensis	Red-tailed hawk	Open Areas
Cathartes aura	Turkey vulture	Open Areas
Cardinalis cardinalis	Northern cardinal	Piedmont/Mountain Floodplain Forest & Swamps
Colinus virginianus	Northern bobwhite	Open Areas
Dumetella carolinensis	Gray catbird	Mountain/Piedmont Basic Woodlands
Haliaeetus leucocephalus	Bald eagle	Piedmont/Mountain Floodplain Forest & Swamps
Meleagris gallopavo	Eastern wild turkey	Piedmont/Mountain Floodplain Forest & Swamps Mountain/Piedmont Basic Woodlands
Spizella pusilla	Field sparrow	Open Areas
Pandion haliaetus	Osprey	Piedmont/Mountain Floodplain Forest & Swamps
Zenaida macroura carolinensis	Mourning dove	Open Areas
MAMMALS		
Canis latrans	Coyote	Open Areas
Castor canadensis	Beaver	Piedmont/Mountain Floodplain Forest & Swamps
Lontra canadensis	North American river otter	Piedmont/Mountain Floodplain Forest & Swamps
Sylvilagus floridanus mallurus	Eastern cottontail	Open Areas
Odocoileus virginianus	White-tailed deer	All Communities
Ondatra zibethicus	Common muskrat	Piedmont/Mountain Floodplain Forest & Swamps
Sciurus niger vulpinus	Eastern fox squirrel	Piedmont/Mountain Floodplain Forest & Swamps
Sciurus carolinensis pennsylvanicus	Northern gray squirrel	Montane Mixed Oak and Oak Hickory Forests Mountain/Piedmont Basic Woodlands
Tamias striatus	Common eastern Chipmunk	Piedmont/Mountain Floodplain Forest & Swamps
Ursus americanus	Black bear	Mountain/Piedmont Basic Woodlands

Wildlife Resources

VDWR Fish and Wildlife Information Services Report

- Total of 511 animal species (including terrestrial and aquatic species) are likely to occur within a 3-mile radius.
- Of these 511 species, 342 are terrestrial species, 127 are aquatic species, and 42 are semi-aquatic species
- Wildlife species directly observed or signs of their presence

Scientific Name	Common Name	Virginia Invasiveness Rank[1]	Natural Community Location
Ailanthus altissima	Tree-of-Heaven	High	Piedmont/Mountain Floodplain Forest & Swamps
Berberis thunbergii	Japanese Barberry	Medium	Montane Mixed Oak and Oak Hickory Forests
Celastrus orbiculatus	Oriental Bittersweet	High	Piedmont/Mountain Floodplain Forest & Swamps Open Lands
Elaeagnus pungens	Thorny Olive	Low	Piedmont/Mountain Floodplain Forest & Swamps
Lespedeza cuneata	Sericea Lespedeza	High	Piedmont/Mountain Floodplain Forest & Swamps Open Lands
Lonicera japonica	Japanese Honeysuckle	High	Piedmont/Mountain Floodplain Forest & Swamps
Ligustrum sinense	Chinese Privet	High	Montane Mixed Oak and Oak Hickory Forests Mountain/Piedmont Basic Woodlands
Murdannia keisak	Marsh dewflower	High	Piedmont/Mountain Floodplain Forest & Swamps
Microstigium viminium	Japanese stiltgrass	High	Piedmont/Mountain Floodplain Forest & Swamps
Reynoutria japonica	Japanese knotweed	High	Piedmont/Mountain Floodplain Forest & Swamps
Rosa multiflora	Multiflora Rose	High	Piedmont/Mountain Floodplain Forest & Swamps Open Lands Montane Mixed Oak and Oak Hickory Forests
Rubus phoenicolasius	Wineberry	High	Acid Cove Forests
Sorghum halepense	Johnson Grass	High	Open Areas
Urtica dioica	European Stinging Nettle	High	Montane Mixed Oak and Oak Hickory Forests Mountain/Piedmont Basic Woodlands

Invasive Species

- Several species on VDCR's Virginia Invasive Species Plant List were identified throughout the study area.
  - Many species were noticed at low densities scattered throughout the study area and not feasible to map each individual location.
  - Significant infestations were mapped in the field.

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Terrestrial Resources Study - Invasive Species

- Significant infestations of Japanese knotweed, oriental bittersweet, and multiflora rose were located primarily in riparian areas along the reservoirs.

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Terrestrial Resources Study

Summary

- Terrestrial and ecological groups and community types identified in the field were consistent with similar habitat classification descriptions depicted on The Nature Conservancy Habitat Map.
- Many invasive species were noticed at low densities scattered throughout upland areas
- Significant infestations of Japanese knotweed, oriental bittersweet, and multiflora rose were located primarily in riparian areas along the reservoirs.

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Terrestrial Resources Study

Project Impacts on Terrestrial Resources

- Continued operation and maintenance over the new license term is not anticipated to have any short- or long-term adverse impacts on terrestrial resources.
- Continue to operate the existing run-of-river mode for the protection of multiple resources.
- Vegetation management activities suing mostly mechanical removal techniques (e.g. mowing) on a as-needed basis.
- No extensive clearing is proposed. Trees for that provide habitat for habitat for roosting or maternity colonies for Indiana bat and northern long-eared bat and nesting and roosting trees for bald eagles would not be impacted.
- Appalachian would coordination with the USFWS and other applicable environmental resources agencies should Project operations, modifications, or development of recreational facilities affect federally protected species.

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Variances from FERC-approved Study Plan

The Terrestrial Resources Study was conducted in conformance with the Commission's SPD.

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Morning Break

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Shoreline Stability Assessment

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Shoreline Stability Assessment

Study Goal and Objectives:

- Survey the Project's reservoirs, bypass reaches, and tailrace areas to characterize the shoreline, with the focus on erosion or shoreline instability using the Bank Erosion Hazard Index (BEHI)
- Inventory, map, and document any areas of erosion or shoreline instability; and
- Prioritize any areas where remedial action or further assessment may be needed.

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Shoreline Stability Assessment

Background and Existing Information:

- Existing vegetation is extensive along the shorelines of Project reservoirs (which helps limit the extent and severity of erosion).
- Common causes of normal bank/shoreline erosion include wave action, significant changes in water levels, rill/gullies, bank rotation, and seepage/frost wedge.
- Accumulation of sediment along the shoreline has formed permanent riparian wetland communities, increasing protection against shoreline erosion.
- Areas of shoreline erosion are mainly concentrated in areas absent of vegetation or in areas susceptible to high flows during run-off events, such as the transition areas between riverine and reservoir at the upper limits of the study area, the rapids between the dams and the tailrace below Buck Dam, and in the larger tributaries such as Crooked Creek and Chestnut Creek.

Shoreline Stability Assessment - Methods

Desktop Review

- ESRI Geographic Information System data, Virginia Geographic Information Network aerial photos, USGS topographic maps, and NRCS soil surveys to assess bank composition and erosion potential in the study area.

Field Survey (July 20-22, 2021)

- The shoreline was assessed in the field for susceptibility to erosion and the need and potential for remediation.
- Bank stability and erosion potential for this study effort was analyzed using the Rosgen (2001) BEHI method and the West Virginia Department of Environmental Protection (WVDEP) complete BEHI procedure (WVDEP 2015).

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Shoreline Stability Assessment Study

BEHI Methodology:

- Assesses physical and geomorphic properties of the streambank to validate the probable sources of bank instability using stream bank variables.
- The metrics used to estimate BEHI include ratio of bank height to bankfull height (BH), ratio of root depth to bank height (RDH), root density percentage (RD), surface protection percentage (SP), and bank angle in degrees (BA).
- These metrics are associated with scores and are totaled to categorize the overall condition of the stream reach assessed.
- *Near Bank Stress was not evaluated and sediment loading was not calculated as part of this study.*

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Shoreline Stability Assessment

Description of Rosgen Metrics for BEHI Evaluation

- Ratio of bank height to bankfull height (BH) – Ratio of bank height to bankfull height. Common bankfull indicators in stable streams include top of bank, top of point bars, and other changes in channel slope. (e.g. top of bank height is 2 feet and bankfull height is 1.5 foot = 1.3)
- Ratio of root depth to bank height (RDH) – Ratio of the average plant root depth to the bank height as percent (e.g. root extending 2 feet into a 4 foot tall bank = 50%).
- Root density percentage (RD) – is the proportion of the streambank surface covered (and protected) by plant roots. (e.g. a bank whose slope is half covered with roots = 50%)
- Surface protection percentage (SP) – is the percentage of the stream bank covered by plant roots, downed logs, branches, rocks, etc.
- Bank angle in degrees (BA) – is the angle of the “lower bank” – the bank from the waterline at base flow to the top of bank, as opposed to benches that are higher on the floodplain. Bank angles greater than 90% occur on undercut banks.

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Shoreline Stability Assessment

Stream Characteristics used to develop BEHI and Ratings

BEHI Category	Bank height	BH Score	Root Depth	RDH Score	Root Density	RD Score	Surface Protection	SP Score	Bank Angle	BA Score	Total Score
V. low	1.0-1.1	1.45	90-100	1.45	80-100	1.45	80-100	1.45	0-20	1.45	≤7.25
Low	1.1-1.2	2.95	50-89	2.95	55-79	2.95	55-79	2.95	21-60	2.95	7.26-14.75
Moderate	1.3-1.5	4.95	30-49	4.95	30-54	4.95	30-54	4.95	61-80	4.95	14.76-24.75
High	1.6-2.0	6.95	15-29	6.95	15-29	6.95	15-29	6.95	81-90	6.95	24.76-34.75
V. high	2.1-2.8	8.5	5-14	8.5	5-14	8.5	10-14	8.5	91-119	8.5	34.76-42.50
Extreme	>2.8	10	<5	10	<5	10	<14	10	>119	10	42.51-50

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Shoreline Stability Assessment - Results

- Approximately 7.25 miles of New River Shoreline was assessed.
- Approximately 80% of shoreline was stable and did not exhibit active erosion.
- Banks with some level of visible erosion had higher bank height ratios, moderate root depth, low to moderate surface protection, and moderate to high bank angles.
- No areas were categorized as having very high or extreme erosion potential.

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Shoreline Stability Assessment

BEHI Scores for Erosion Areas

Erosion Area	Length (linear ft)	Average of BH Score	Average of RDH Score	Average of RD Score	Average of SP Score	Average of BA Score	Average of Total Score by Category	Category
Erosion Area 1	286	2.95	6.95	6.95	6.95	4.95	28.75	High
Erosion Area 2	92	4.95	8.50	8.50	6.95	4.95	33.85	High
Erosion Area 3	199	4.95	2.95	4.95	4.95	4.95	22.75	Moderate
Erosion Area 4	3,006	4.95	6.95	4.95	1.45	6.95	25.25	High
Erosion Area 5	423	6.95	4.95	6.95	2.95	4.95	26.75	High
Erosion Area 6	508	6.95	4.95	6.95	2.95	4.95	26.75	High
Erosion Area 7	190	4.95	4.95	4.95	2.95	6.95	24.75	Moderate
Erosion Area 8	141	4.95	4.95	4.95	2.95	6.95	24.75	Moderate
Erosion Area 9	92	6.95	4.95	4.95	4.95	6.95	28.75	High
Erosion Area 10	107	4.95	4.95	2.95	4.95	6.95	24.75	Moderate
Erosion Area 11	295	4.95	4.95	2.95	4.95	6.95	24.75	Moderate
Erosion Area 12	261	1.45	4.95	2.95	4.95	6.95	21.25	Moderate
Erosion Area 13	215	4.95	4.95	2.95	4.95	6.95	24.75	Moderate
Erosion Area 14	1,587	1.45	4.95	2.95	4.95	6.95	21.25	Moderate
Erosion Area 15	1,550	1.45	2.95	1.45	2.95	2.95	11.75	Low

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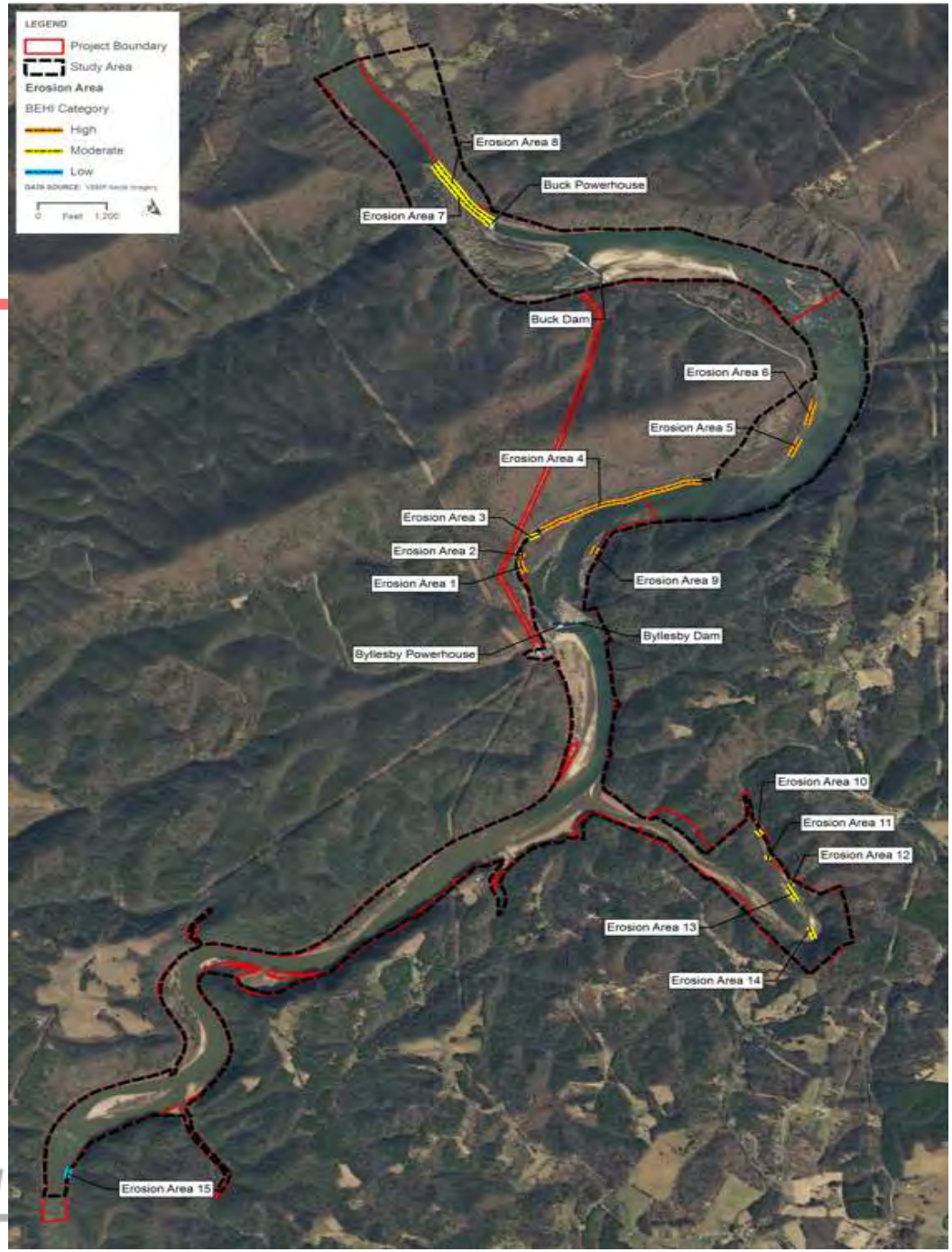
- High erosion potential: Erosion Areas 1, 2, 4, 5,6, and 9.
- Moderate erosion potential: Erosion Areas 3, 7, 8, and 10-14
- Low erosion potential: Erosion Area 15

Note that erosion categories, i.e., "high", "moderate", etc. are from Rosgen (2001). Category assignment is a quantitative process; however, consideration should be given to all factors (and the contribution of factors) that contribute to a specific score/category



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Shoreline Stability Assessment

Erosion Area 9: “High”

Erosion Area 10: “Moderate”

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Shoreline Stability Assessment

Erosion Area 13: “Moderate”

Erosion Area 15: “Low”

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Shoreline Stability Assessment

Summary and Discussion

- Approximately 80% of shoreline was stable and did not exhibit any active erosion.
- Erosion Areas 1, 2, 4, and 9 categorized as “high” are located downstream of Byllesby Dam and most susceptible to erosion.
- Erosion Areas 1 & 2 are adjacent to the New River Trail State Park.
- Erosion Area 4, 5, & 6 are adjacent to the New River Trail State Park, but further the multi-use trail and road are further away from the river.
- Existing bedrock and extensive established vegetation along the shorelines limit erosion potential.
- Overall, the visual inspection of the Project shoreline indicated stable banks and only localized streambank erosion.
- Appalachian proposes to continue operating the Byllesby and Buck developments as currently operated, including run-of-river operations and maintenance of existing vegetation and buffer areas.
- Appalachian does not proposed remediation of any shoreline areas in the Project Boundary at this time.

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Variances from FERC-approved Study Plan

The Shoreline Stability Assessment was conducted in conformance with the Commission's SPD.

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Aquatic Resources Study: Fish Community Survey

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Fish Community Survey

- **Study Goal:** Obtain current information on the fish community in the New River in the vicinity of the Project to support an analysis of Project effects
- **Specific Objectives:**
  - Collect comprehensive baseline of the existing fish community in the vicinity of the Project
  - Compare current fish community data to historical data to evaluate changes to species composition, abundance, or distribution
  - Confirm intake velocities to evaluate the potential of fish impingement or entrainment

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Fish Community Survey

Study Status

- Appalachian completed the Fish Community Survey in accordance with the methods described in the RSP and SPD.
  - General fish community survey utilizing boat and backpack electrofishing methods and gill net sets was completed spring 2021
  - Completed assessment of impingement and entrainment at the intake structures
  - Completed passage survival assessment using USFWS Turbine Blade Strike Analysis model
  - Mussel Study was completed and presented in the ISR in 2020 and is not covered in this presentation

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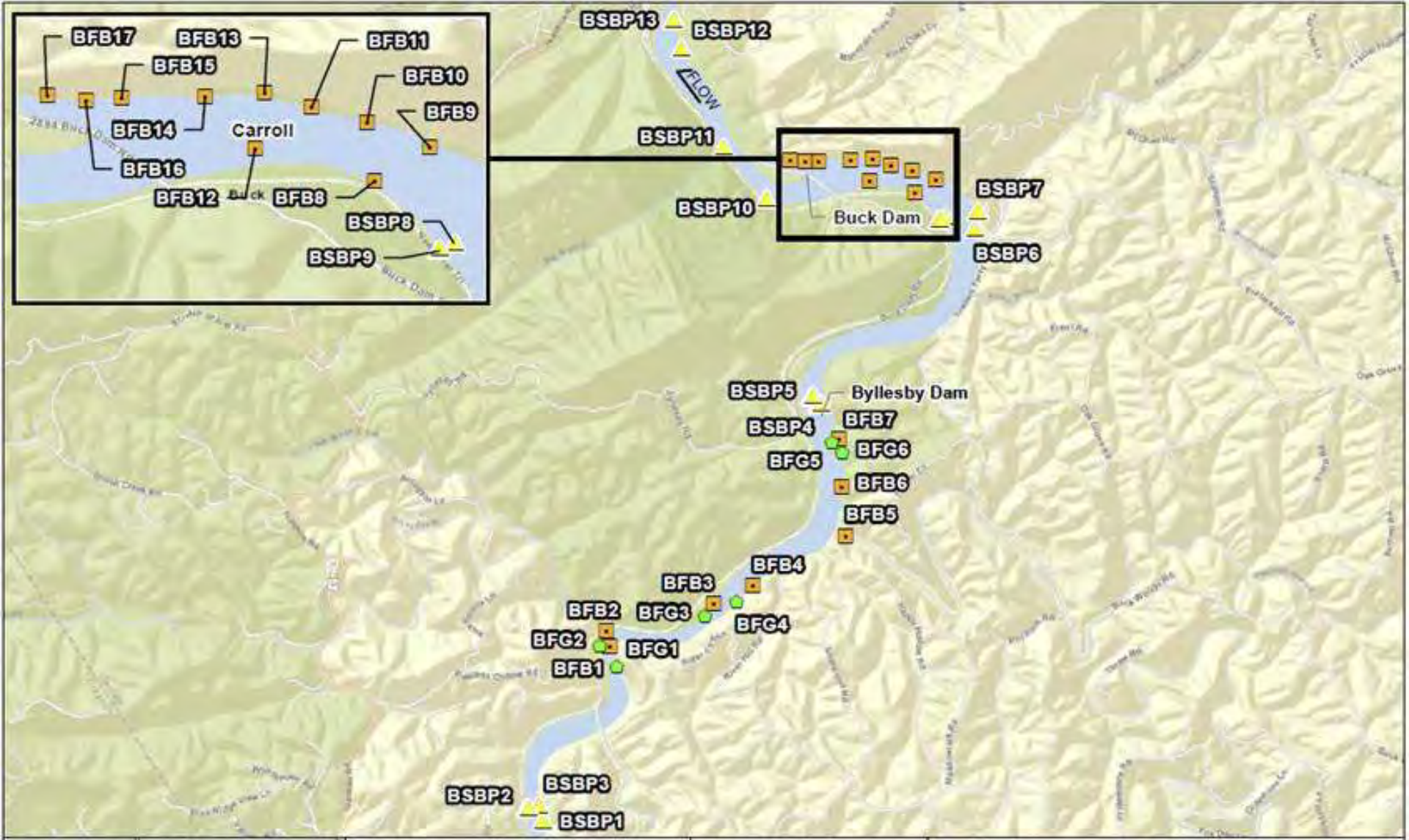
Fish Community Survey Methods

Sampling Method	No. Sites	Sampling Dates	
		Fall 2020	Spring 2021
Boat Electrofishing	17	Oct 22, 24-25	April 25-26, May 27
Backpack Electrofishing	13	*	April 20-23
Gillnet Sets	6	Nov 9-11, 18-20	April 20-24

- Fish ID to species, enumerated, and examined for anomalies; up to 30 individuals per taxon measured and weighed
- Calculated catch per unit effort (CPUE) as number of fish per minute and H'; Shannon index and compared results to those from historical studies



Legend

Fish Sample Location

- Backpack electrofishing
- Boat Electrofishing - 100-meter survey extent
- Gillnet - 36.5-meter survey extent

N

0 0.6 1.2

Kilometers

Scale: 1:51,181

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Byllesby-Buck Dam Fish Community Study

Figure 1
Overall Byllesby-Buck project area including backpack electrofishing (BSBP), boat electrofishing (BFB), and gillnet (BFG) survey sites on the New River in Carroll County, Virginia

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Fish Community Survey Results by Method

- Boat Electrofishing Sites
  - 597 fish representing 32 species at 17 sites
  - CPUE was 0.3 – 14.2 fish/minute in Byllesby pool versus 0.5 – 9.5 fish/minute in the Buck pool
  - Diversity (H') was 2.32 in Byllesby pool and 2.26 in the Buck pool
- Backpack Electrofishing Sites
  - 410 fish representing 24 species at 13 sites
  - CPUE of 1.7 fish/minute above Byllesby; 3.5 fish/minute between Byllesby and Buck; and 7.6 fish/minute downstream of Buck Dam
  - Diversity was 1.92 in above Byllesby Dam; 1.97 between Byllesby and Buck; and 1.98 downstream of Buck Dam
- Gillnet Sites
  - 112 fish representing 10 species at 6 sites in Byllesby Pool
  - CPUE from 0.5 to 22 fish per net set, and was 66% higher in spring
  - Diversity was 1.43

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Fish Community Survey Results by Location

- Upstream of Byllesby Dam
  - 7 boat and 3 backpack electrofishing sites, 6 gillnet sites
  - 404 fish, 26 species, 5 species exclusive to this reach
- Between Byllesby and Buck dams
  - 10 boat and 6 backpack electrofishing sites
  - 509 fish from 33 species, 7 species exclusive to this reach

- Downstream of Buck Dam
  - 4 backpack electrofishing sites
  - 206 fish from 17 species, 2 species exclusive to this reach

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Fish Community Survey Results - Walleye

- Collected in 3 of 6 sites with lower gradient bed slopes over sand and silt substrates
- Collected in upper, middle, and lower sections of the Byllesby pool
- 6 Walleye collected in fall 2020
- 3 Walleye collected in spring 2021

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Aquatic Resources: Fish Impingement and Entrainment Study

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Fish Impingement and Entrainment Study

Study Status

- Appalachian completed the Fish Impingement and Entrainment Study in accordance with the methods described in the RSP and SPD.
  - Assessed impingement and entrainment risk at the intake structures and estimated entrainment rates
  - Completed turbine and spillway passage survival assessment using the USFWS Turbine Blade Strike Analysis model based on existing conditions
  - Repeated model evaluation for proposed turbine upgrades
    - Byllesby - Replace 3 of 4 Francis turbines with Kaplan turbines
    - Buck – Replace 2 of 3 Francis turbines with Kaplan turbines

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Fish Impingement and Entrainment Study

Assessment Methods

- 2020 Study Efforts – presented in ISR
  - Compiled intake specifications, flow characteristics, and calculated approach velocity, identified target species/groups
  - Assessed potential of impingement or entrainment including intake avoidance, size exclusion, and early life stage entrainment
  - Estimated entrainment rates based on 33 facilities in EPRI database
- 2021 Study Efforts – presented in USR
  - Estimated fish passage and blade strike survival using USFWS turbine blade strike analysis model for two scenarios at the two developments
    - Assessed for current design and operations
    - Assessed for anticipated conditions after proposed turbine upgrades at Byllesby and Buck

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Proposed Turbine Upgrades

Parameters	Byllesby		
	Existing Conditions	Proposed Upgrade Conditions	
Turbine Number/Type	4 Francis	3 Kaplan	1 Francis
Number of Blades	5	5	16
Turbine Discharge (cfs)	1,467	1,348	1,467

Parameters	Buck		
	Existing Conditions	Proposed Upgrade Conditions	
Turbine Number/Type	3 Francis	2 Kaplan	1 Francis
Number of Blades	16	5	16
Turbine Discharge (cfs)	1,180	1,195	1,180

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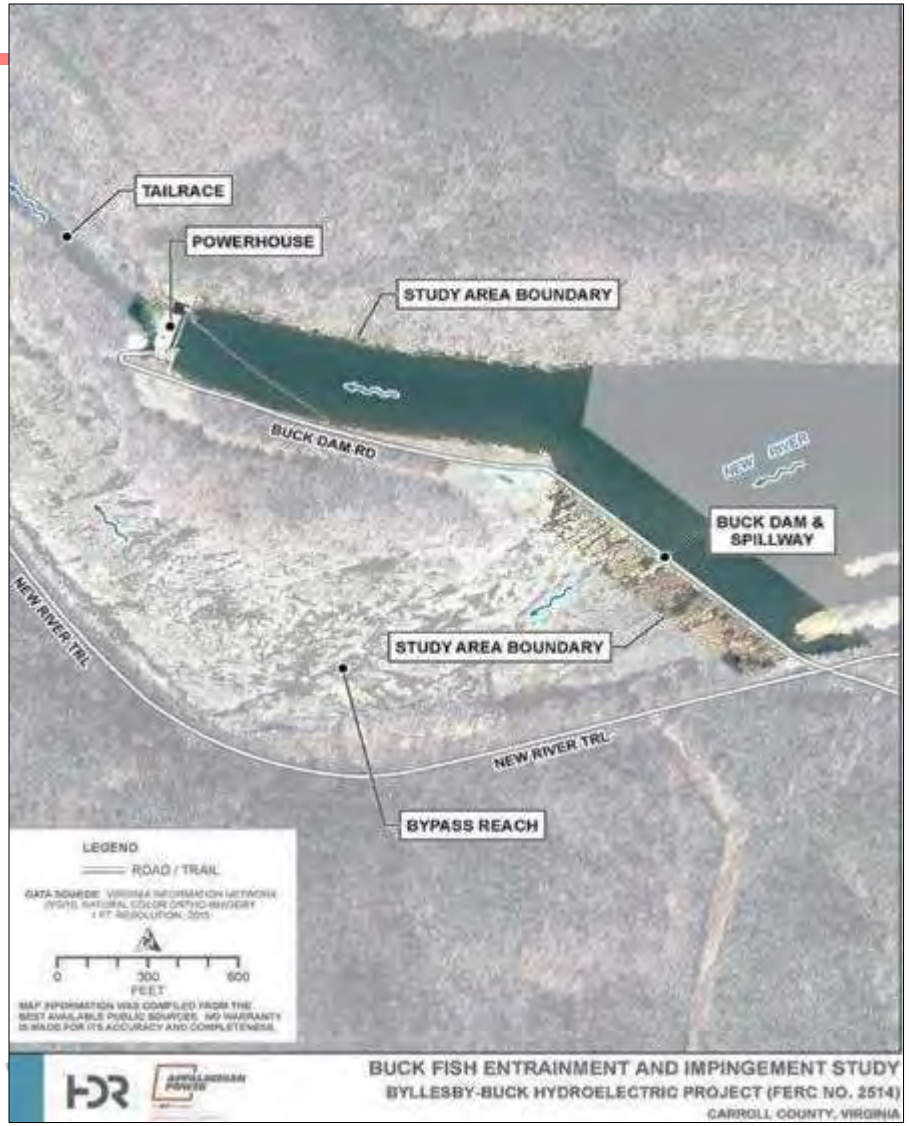
Fish Impingement and Entrainment Study



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Fish Impingement and Entrainment Study

USFWS Turbine Blade Strike Analysis (TBSA)

- Modeled turbine blade strike and survival probability and spillway passage mortality under two operational scenarios
  - Typical/normal flow conditions – no spill beyond required min bypass flows
    - Fish size classes: 2, 4, 6, 8, 10, 15, 20, 25, and 30 inches
    - Route probabilities based on equal flow distribution to 4 turbines (1,467 cfs per unit)
  - Spilling conditions* – flows distributed to turbines or spillway based on project-specific flow exceedance percentiles
    - Fish size classes: based on site-specific Walleye data (mean length of 13.5 inches with standard deviation of 1.5 inches)
    - Route probabilities based on equal flow distribution to 4 turbines and spilling based on flow exceedances (4, 3, 2, and 1 percent)

*The probability of a fish passing through a turbine or via spill was assumed to be in direct proportion to the volume of flow passing through each route. A spillway and bypass passage survival rate of 97 percent was assumed based on the average of 136 survival tests conducted with juvenile salmonids on the Columbia river (Amaral et al. 2013).

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Fish Impingement and Entrainment Study

Downstream Fish Passage Assessment

- Model analysis of two operational scenarios was performed for two turbine conditions
  - Existing conditions - Maximum flows based on turbine capacity of the existing Francis turbines
    - Flows distributed equally between 4 existing Francis turbines
  - Proposed conditions - Maximum flows based on turbine capacity with installation of the proposed upgrade to Kaplan turbines
    - Flows distributed based on proportion of flow capacity of combined Kaplan and Francis turbines
- Analyses were performed separately for Byllesby and Buck developments

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Fish Impingement and Entrainment Study

Intake Approach Velocities

- With existing turbines
  - Byllesby – 5,868 cfs / (143 ft x 14 ft x1.5) = 2.0 ft/sec (fps)
  - Buck – 3,540 cfs / (104 ft x 14 ft x 1.5) = 1.6 fps
- With upgraded turbines
  - Byllesby – 5,511 cfs / (143 ft x 14 ft x1.5) = 1.84 fps
  - Buck - 3,570 cfs / (104 ft x 14 ft x 1.5) = 1.63 fps

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Fish Impingement and Entrainment Study –Blade Strike Model Results

Project Dam	Turbine Type	Average Turbine Blade Strike Probability								
		Fish Length Class (inches)								
		2	4	6	8	10	15	20	25	30
Byllesby										
Existing	4 Francis (existing)	4.5%	8.8%	13.3%	17.8%	22.1%	33.3%	44.5%	55.4%	66.6%
Proposed	3 Kaplan (new), 1 Francis (existing)	2.8%	5.4%	8.2%	11.0%	13.6%	20.5%	27.4%	34.2%	41.0%
Buck										
Existing	3 Francis (existing)	4.5%	8.7%	13.2%	17.7%	21.9%	32.9%	44.0%	54.8%	65.9%
Proposed	2 Kaplan (new), 1 Francis (existing)	2.9%	5.6%	8.4%	11.3%	14.0%	21.1%	28.2%	35.1%	42.2%

Fish Impingement and Entrainment Study –Blade Strike Model Results

Cumulative Downstream Passage Survival (Percent) for Walleye							
	Flow Volume Exceedance Percentiles						
Byllesby Development	**1**	**2**	**3**	**4**			
Existing Conditions	82.70%	78.60%	74.70%	67.70%			
Proposed Upgrades	88.80%	87.80%	84.80%	82.80%			
Buck Development	**1**	**2**	**4**	**6**	**8**	**10**	**12**
Existing Conditions	88.80%	84.10%	82.60%	76.50%	75.20%	72.50%	71.10%
Proposed Upgrades	91.40%	90.60%	86.70%	84.90%	84.10%	82.00%	82.70%

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Fish Impingement and Entrainment Study

Turbine Blade Strike Results Summary

- Cumulative Walleye passage survival after turbine upgrades
  - Between 82.8 and 88.8 percent at Byllesby
  - Between 82.7 and 92.4 percent at Buck
- Cumulative passage survival all other species with turbine upgrades
  - Between 58.3 (30-inch fish) and 96.8 percent at Byllesby
  - Between 57.5 (30-inch fish) and 97.1 percent at Buck
- Entrained fish less than 6.0 inches at Byllesby and Buck
  - Survival with existing conditions - 86 percent or higher
  - Survival with upgraded turbines - 92 percent or higher

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Variances from FERC-approved Study Plan

Variances from FERC-approved Study Plan:

- Intake velocity
  - Unable to evaluate with ADCP due to high flow events and station operation
  - Determined using desktop calculation
  - Angled trashracks would require ADCP measurement some distance upstream
- Backpack electrofishing methods
  - Proposed two seasons but unable to complete during fall 2020 due to precipitation and high flows

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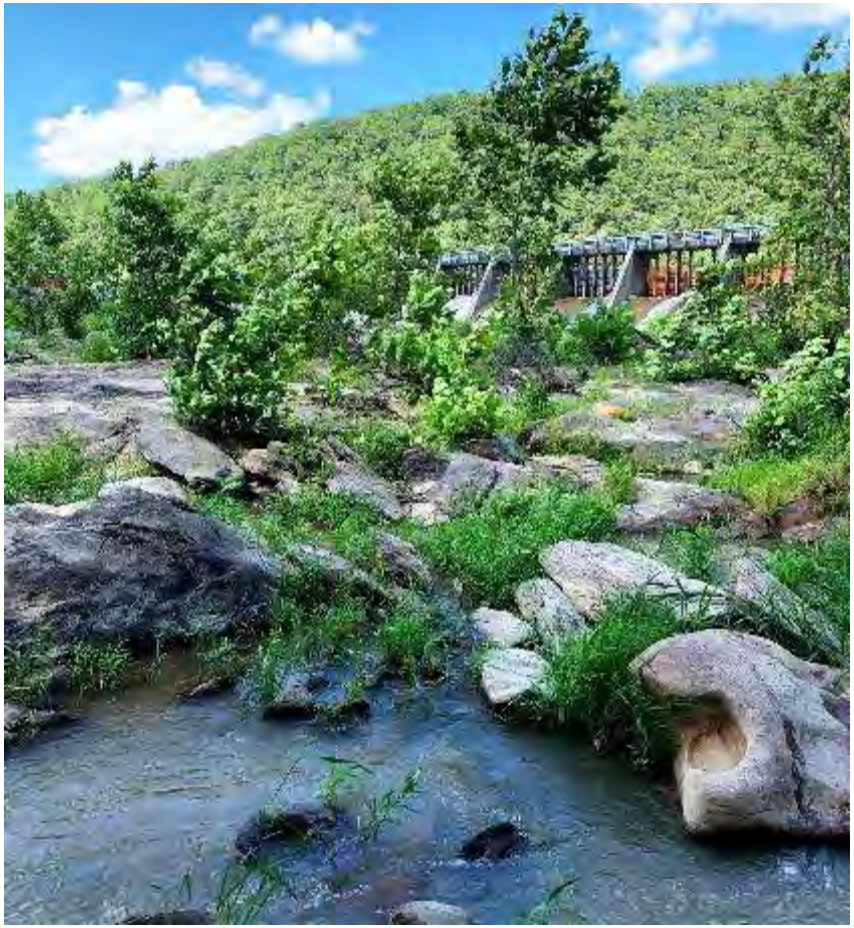
Aquatic Resources: Macroinvertebrate and Crayfish Survey



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Macroinvertebrate and Crayfish Survey

Study Goal:

- Obtain current information on the benthic aquatic community in the New River in the vicinity of the Project to support an analysis of Project effects.

Specific Objectives:

- Quantify the amount of benthic habitat available for macroinvertebrates and crayfish within each bypass reach;
- Collect a baseline of existing macroinvertebrate and crayfish communities in the vicinity of the Project using two temporally independent sampling efforts (fall 2020 index period and spring 2021 index period)

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Macroinvertebrate and Crayfish Survey

Study Status:

- Appalachian completed study activities for the Benthic Aquatic Resources Study in accordance with the schedule and methods described in the RSP and SPD
- Fall sampling performed October 6 – 8, 2020
- Coordinated with agencies to receive waiver of instream work time of year restrictions
- Spring sampling performed April 20 – 23, 2021

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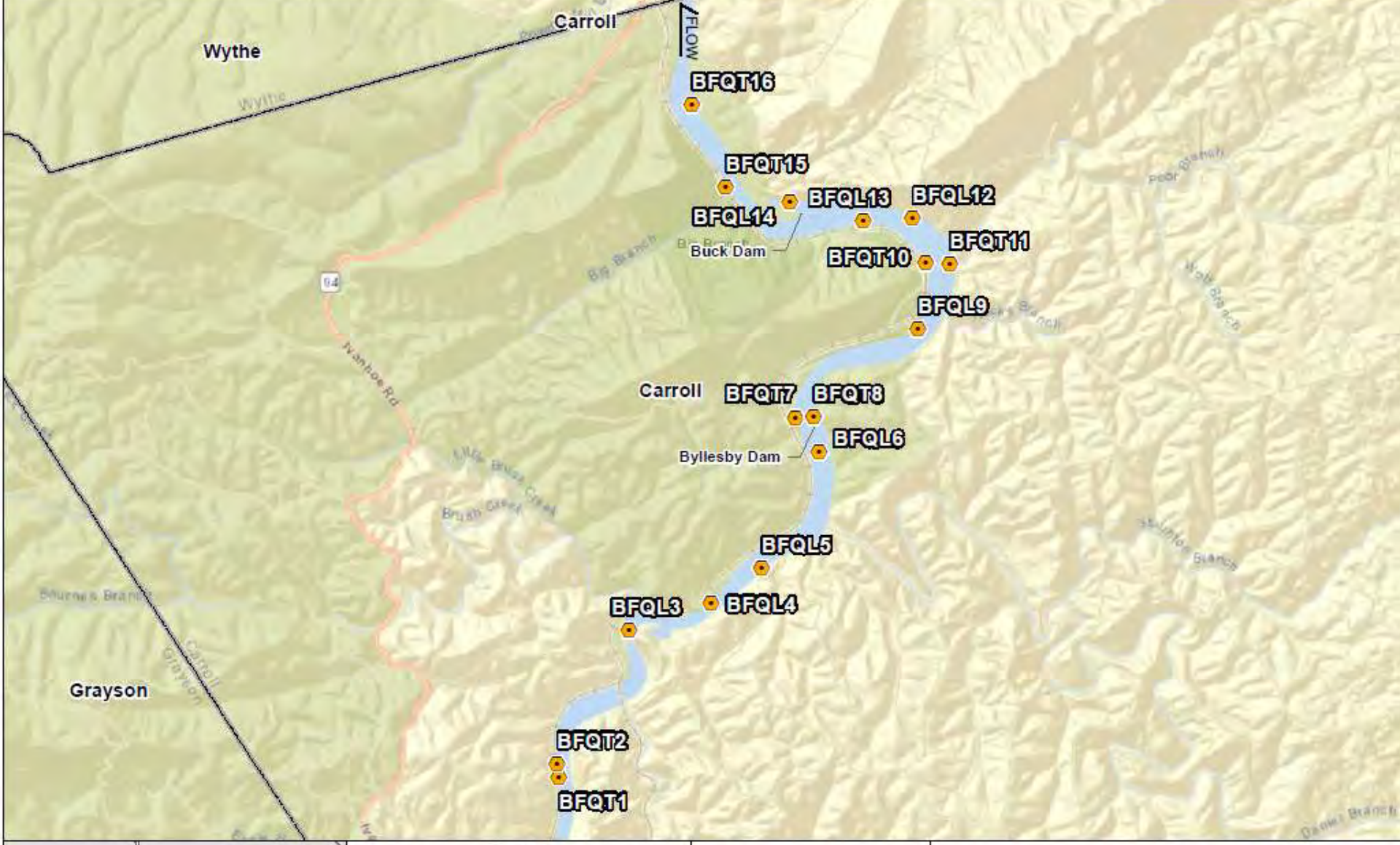
Macroinvertebrate and Crayfish Survey

Summary of Study Methods

- Quantitative Samples
  - 8 riffle/run sites along 100-m transects, two sites upstream of Byllesby Dam, four sites between Byllesby and Buck Dam, and two sites downstream of Buck Dam
  - Each site consists of 6 kick net sets composited into one sample
  - Each sample equals approximately 2 square meters
  - Crayfish data supplemented with seine hauls

- Qualitative Samples
  - 8 pool sites, four sites upstream of Byllesby Dam and four sites between Byllesby and Buck Dam
  - 20 dip-net grabs of representative habitats in proportion to their availability
  - Each sample covers approximately 1 linear meter of habitat



Legend

- Macroinvertebrate Sample Location
- County Boundary

N

0 0.75 1.5

Kilometers

Scale: 1:59,055

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American Electric Power
Byllesby-Buck Benthic Aquatic Resource

Figure 1
Overall Byllesby-Buck project area including quantitative (BFQT) and qualitative (BFQL) macroinvertebrate survey sites on the New River in Carroll County, Virginia.

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Macroinvertebrate and Crayfish Survey

Summary of Study Results

- Quantitative Sites
  - Good quality habitat at seven of the eight sites; one site heavily embedded (BFQT2)
  - Habitats consisted primarily of bedrock, boulder, cobble, and gravel substrates

- Qualitative Sites
  - Relatively poor habitat at all sites
  - Habitat consisted primarily of sand, silt, and bedrock substrates

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Macroinvertebrate and Crayfish Survey

Summary of Study Results – Macroinvertebrate Metrics

- Upstream of Byllesby Dam
  - 49 taxa from 2 quantitative and 4 qualitative sites
  - 4 of 6 sites ranked good based on Hilsenhoff Biotic Index (HBI*) values
  - VSCI** in riffles from 57.3 (fall) and 65.9 (spring) and pools were from 35.8 (fall) and 26.9 (spring)
- Between Byllesby and Buck dams
  - 53 taxa from 4 quantitative and 4 qualitative sites
  - HBI values were good to very good to excellent
  - VSCI in riffles from 62.9 (fall) and 54.9 (spring) and pools from 39.5 (fall) and 36.0 (spring)
- Downstream of Buck Dam
  - 30 taxa from 2 quantitative sites
  - Sites generally good to very good based on HBI values
  - VSCI in riffles from 58.8 (fall) and 59.0 (spring)

**HBI measures the health of the stream community based on their pollution tolerance.

**VSCI measures level of site impairment compared to regional stream conditions.

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Macroinvertebrate and Crayfish Survey

Summary of Study Results - Crayfish

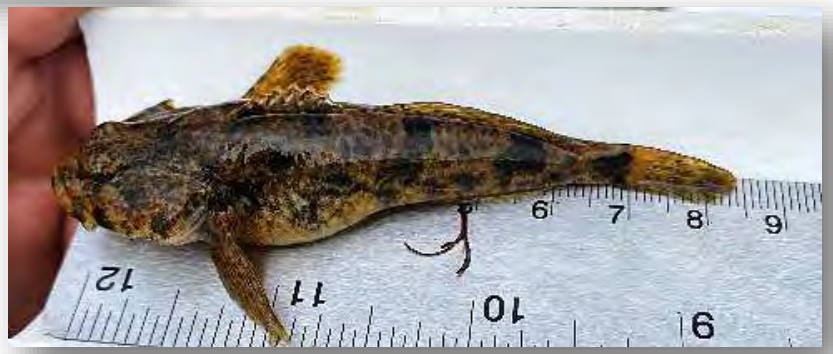
- Two native species of crayfish collected and identified in the field during survey efforts
  - Conhaway Crayfish (*Cambarus appalachiensis*)
  - Spiny Stream Crayfish (*Faxonius cristavarius*)
- Spiny Stream Crayfish collected above Byllesby
- Conhaway and Spiny Stream crayfishes collected at sites between Byllesby and Buck and downstream of Buck
- No invasive species collected

Variances from FERC-Approved Study Plan

- The Fish Community Study was conducted in conformance with the Commission's RSP and SPD.

Walleye

Kanawha Sculpin



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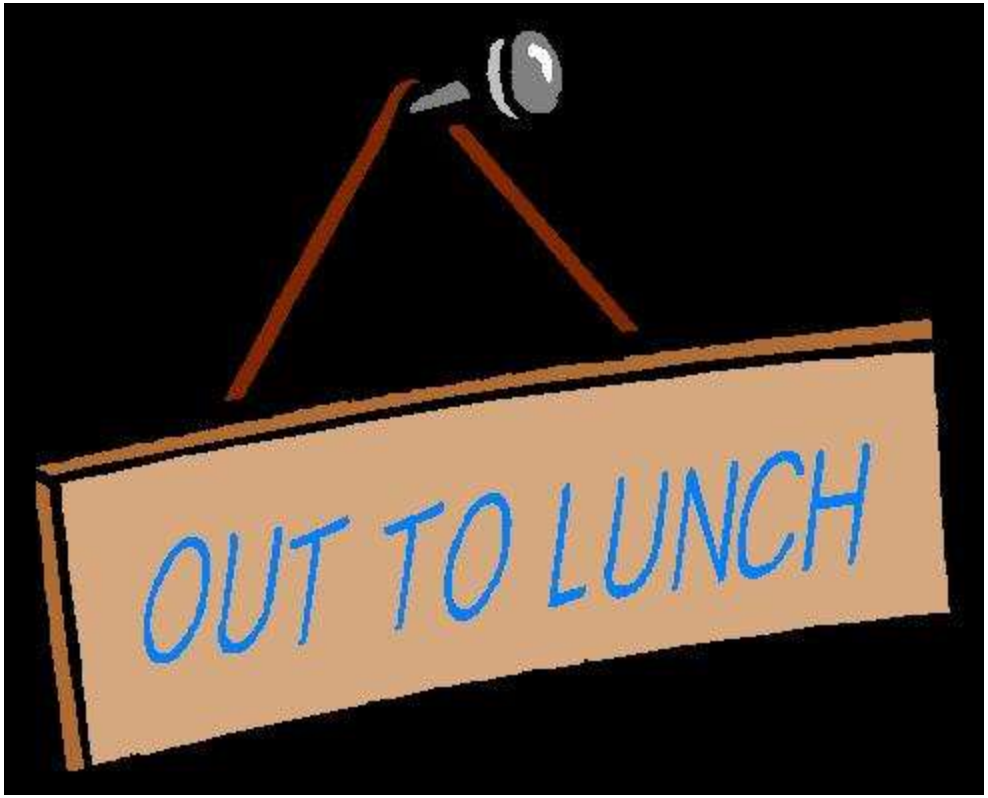
30-Minute Lunch Break



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Bypass Reach Flow and Aquatic Habitat Study

Byllesby Bypass Reach 7.28.2021
Flow 88 cfs

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Bypass Reach Flow and Aquatic Habitat Study

Study Goal: Conduct a flow and habitat assessment of the bypass reaches and tailrace areas for the Byllesby and Buck developments using desktop, field survey, and hydraulic/habitat modeling methodologies

Specific Objectives

- Delineate and quantify aquatic habitats and substrate types within the bypass reaches
- Identify and characterize locations of habitat management interest within the bypass reaches
- Determine surface water travel times and water surface elevation responses at various gate openings to:
  - Evaluate the existing ramping rates (Buck only) required by the existing license
  - Evaluate potential available habitat under the existing 360 cfs minimum downstream flow requirement
  - Evaluate potential seasonal minimum flow releases in the bypass reach

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Bypass Reach Flow and Aquatic Habitat Study

Study Status

Appalachian conducted the Bypass Reach Flow and Aquatic Habitat Study in accordance with the methods described in the RSP and SPD.

Study Periods

- Buck study period: August 17 – October 8, 2020
  - 2-D model development and habitat model results at the calibration flows were presented at the ISR meeting on January 28, 2021
- Byllesby study period: July 28 – September 9, 2021
  - 2-D model development and habitat model results at the calibration flows will be presented at the USR meeting on December 1, 2021

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Bypass Reach Flow and Aquatic Habitat Study

Study Methods and Results

- Completed desktop habitat mapping and evaluation of Project inflows
- Assembled Habitat Suitability Index (HSI) criteria
- Developed model calibration target flow recommendations
- Collected field data during target flow releases into each bypass reach
- Developed and calibrated 2-D hydraulic model for each study area
- Used model to simulate potential available habit in each study area at the model calibration target flows

Byllesby Study Area

BYLLESBY DEVELOPMENT BYPASS REACH STUDY AREA

BYLLESBY-BUCK HYDROELECTRIC PROJECT (FERC NO. 2514)

CARROLL COUNTY, VIRGINIA

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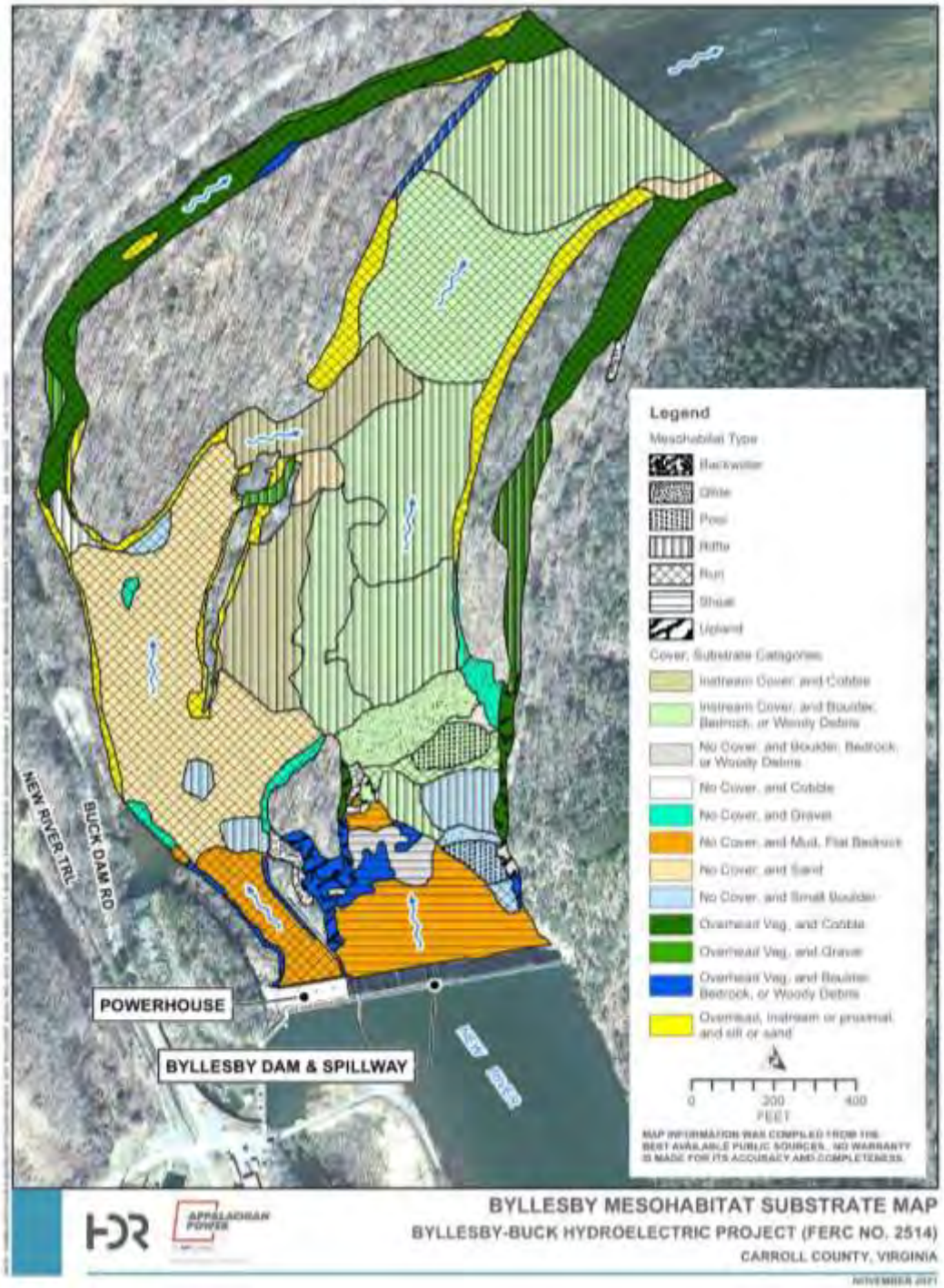
Byllesby Mesohabitat Substrate Map



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Byllesby Aquatic Habitat Characteristics

Habitat Characteristic	Area (acres)	Percent (%)
Cover		
Instream Cover	18.7	46.5
No Cover	12.3	30.8
Overhead Vegetation	9.1	22.7
Substrate		
Boulder, Bedrock, or Woody Debris	17.4	43.4
Cobble	8.0	20.1
Sand	6.4	15.9
Mud or Flat Bedrock	3.2	7.9
Silt or Sand	2.6	6.5
Small Boulder	1.5	3.7
Gravel	1.1	2.6
Mesohabitat		
Run	17.7	44.2
Riffle	16.4	41.0
Shoal	2.9	7.2
Glide	1.3	3.3
Upland	0.9	2.2
Pool	0.6	1.4
Backwater	0.5	0.7

Byllesby Bypass Reach 7.31.2019 Leakage Flow (11 cfs)

Byllesby Side Channel 9.09.2021 47 cfs

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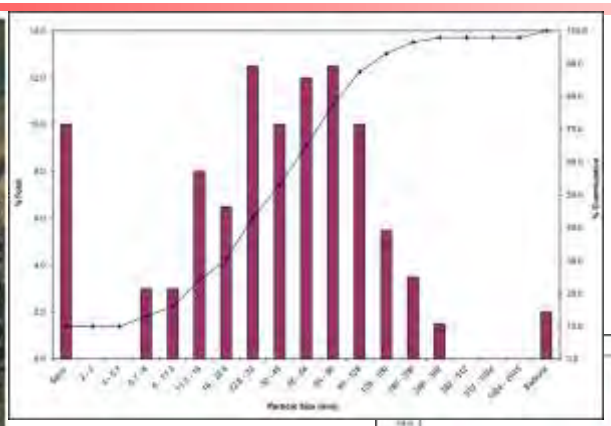
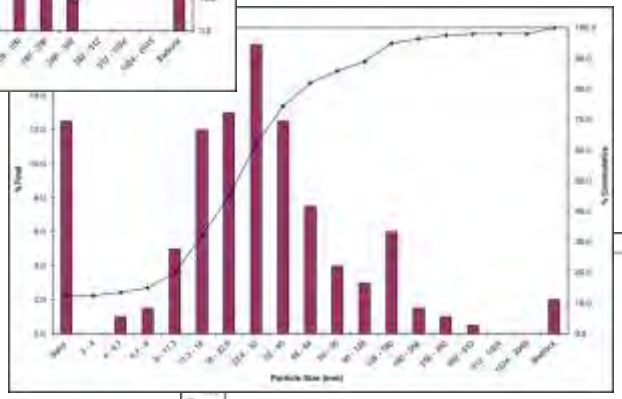
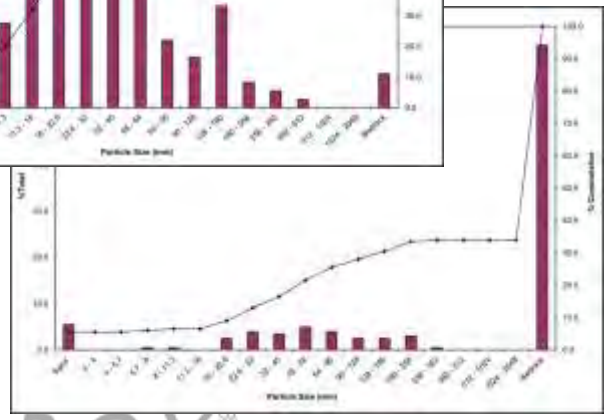
Particle Size Distribution Results Byllesby Study Area



Side Channel



Cross-over Channel



Bypass Reach

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Species of Interest Walleye and Guilds

Species or Guild	Life Stage/ Category	Representative
Walleye	Adult	--
	Juvenile	--
	Fry	--
	Spawning	--
Shallow-Slow Guild	Fine substrate, no cover	Redbreast Sunfish spawning
	All substrate with aquatic vegetation	Silver Redhorse Young-of-Year
	Coarse substrate	Generic shallow-slow guild
Shallow-Fast Guild	Moderate velocity with coarse substrate	Generic shallow-fast guild
Deep-Slow Guild	Cover	Redbreast Sunfish Adult
	No cover	Generic deep-slow guild
Deep-Fast Guild	Slightly weighted for fine substrate, Cover	Silver Redhorse adult
	Coarse-mixed substrate	Shorthead Redhorse adult

Walleye
Courtesy: Virginia DWR

Redbreast Sunfish
Courtesy: Virginia DWR

Silver Redhorse
Courtesy: USGS

Shorthead Redhorse
Courtesy: Iowa DNR

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Byllesby 2-D Hydraulic Model Calibration Flows

Measured Flows:

- Leakage: 11 cfs (upper photo)
- Low: 88 cfs
- Middle: 158 cfs
- High: 194 cfs (lower photo)

Byllesby Bypass Reach 9.08.2021 Flow 11 cfs

Byllesby Bypass Reach
9.09.2021 Flow 194 cfs

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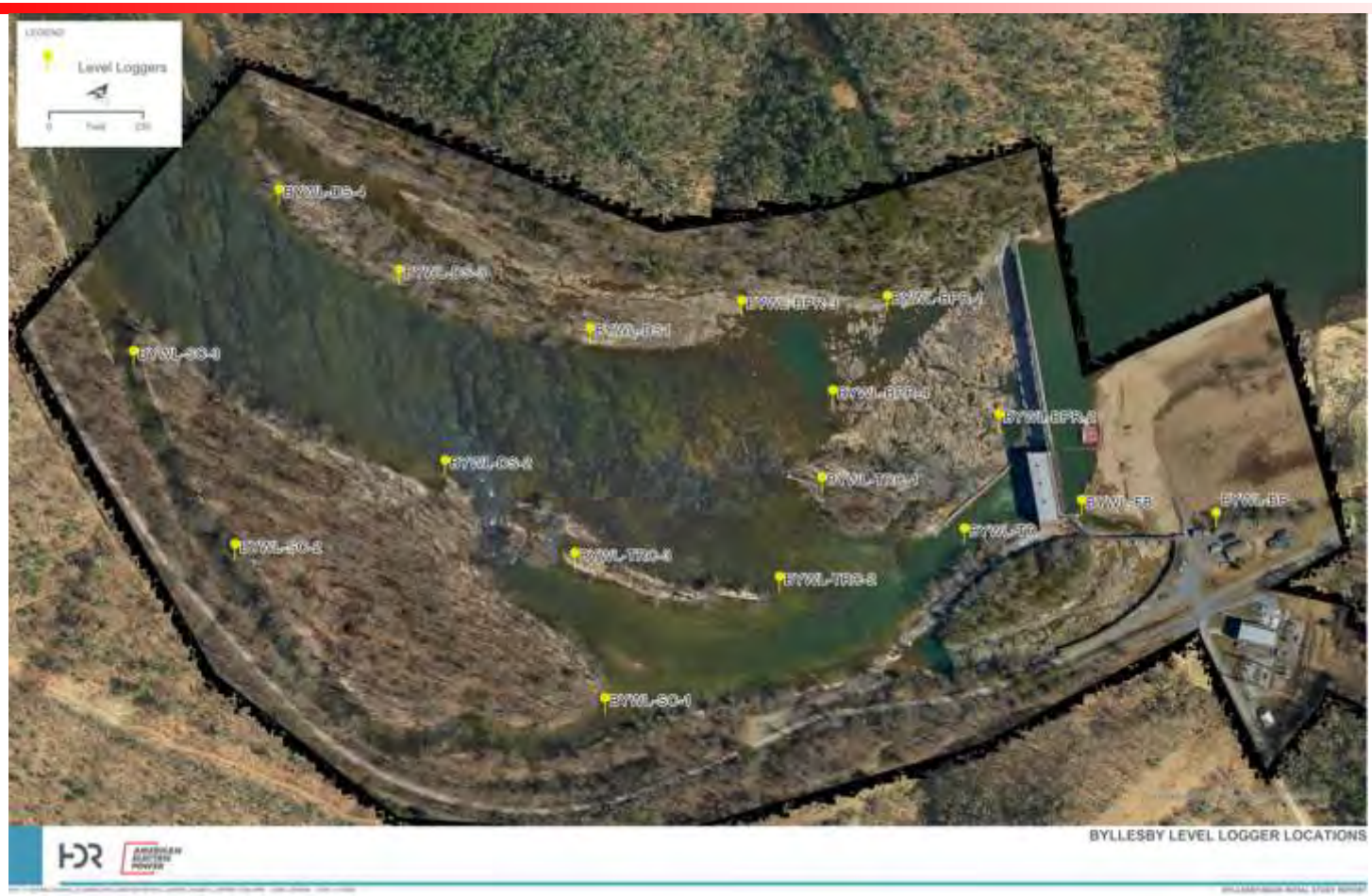
Byllesby 2-D Hydraulic Model Water Surface Elevation Monitoring



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Byllesby 2-D Hydraulic Model Calibration Results

Bypass Reach Flow	Level Logger Time (hr:min)	Model Time (hr:min)	Level Logger Delta (hr:min)	Modeled vs Measured WSEL Average Delta*	
				Percentage	Magnitude (ft)
Day 1 (Leakage)	N/A	N/A	N/A	0.01%	0.2
Day 2 (Low)	N/A	N/A	N/A	-0.02%	-0.3
Day 3 (Mid)	0:06	0:05	0:01	0.01%	0.1
Day 4 (High)	0:02	0:01	0:01	0.01%	0.2

*WSEL comparisons made at level logger locations

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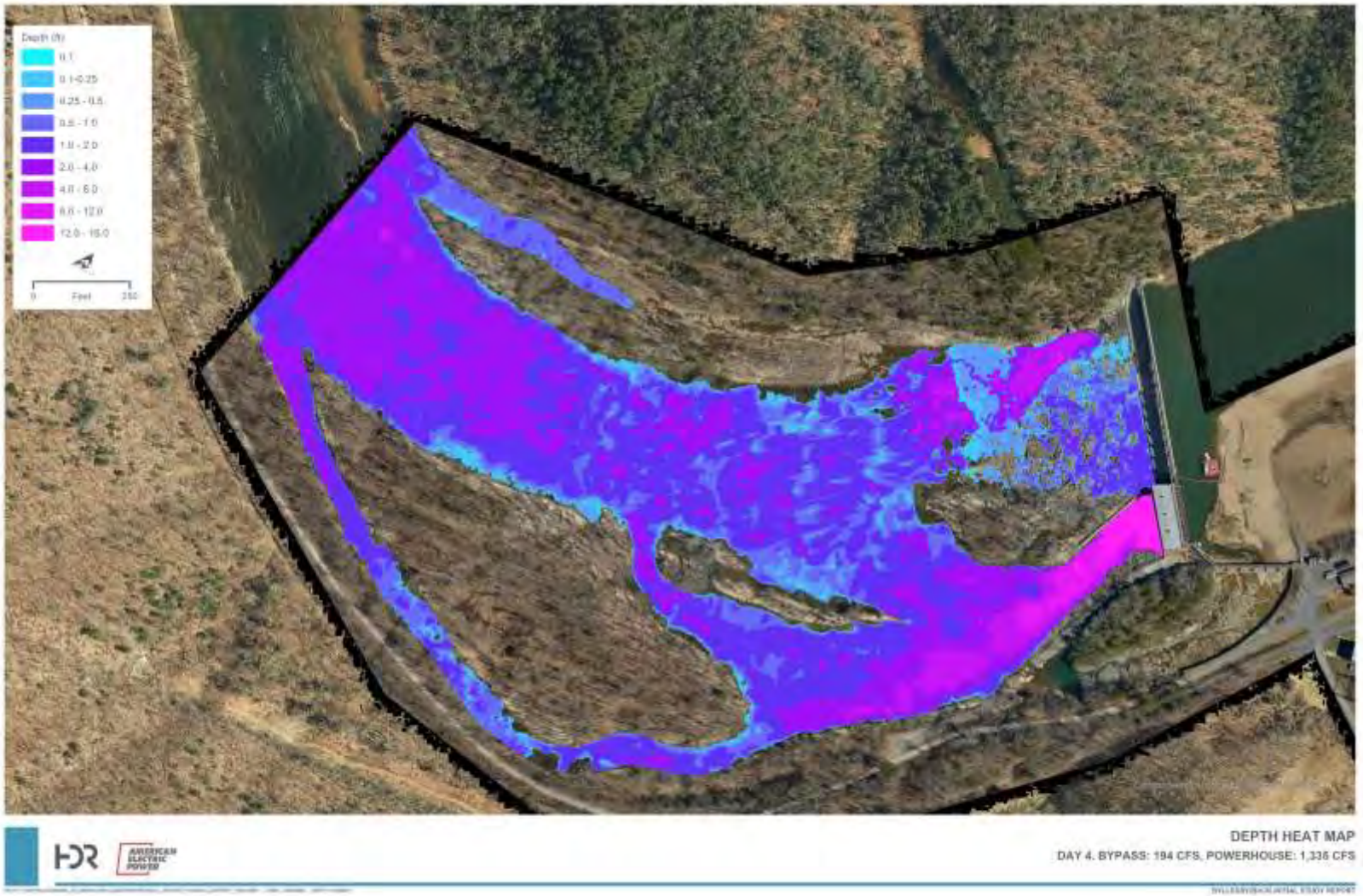
Byllesby 2-D Hydraulic Model Calibration Results: Depth



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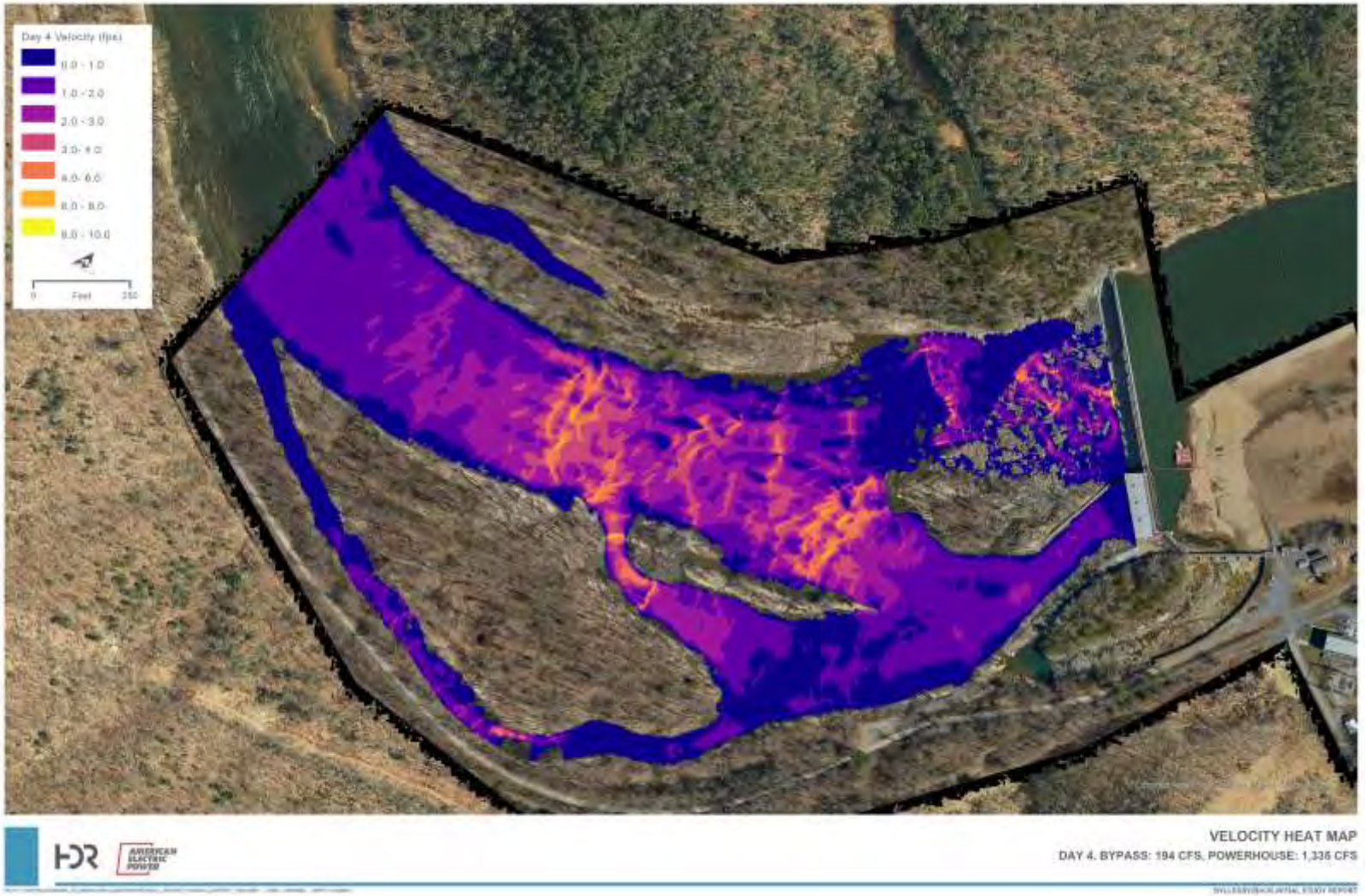
Byllesby 2-D Hydraulic Model Calibration Results: Velocity



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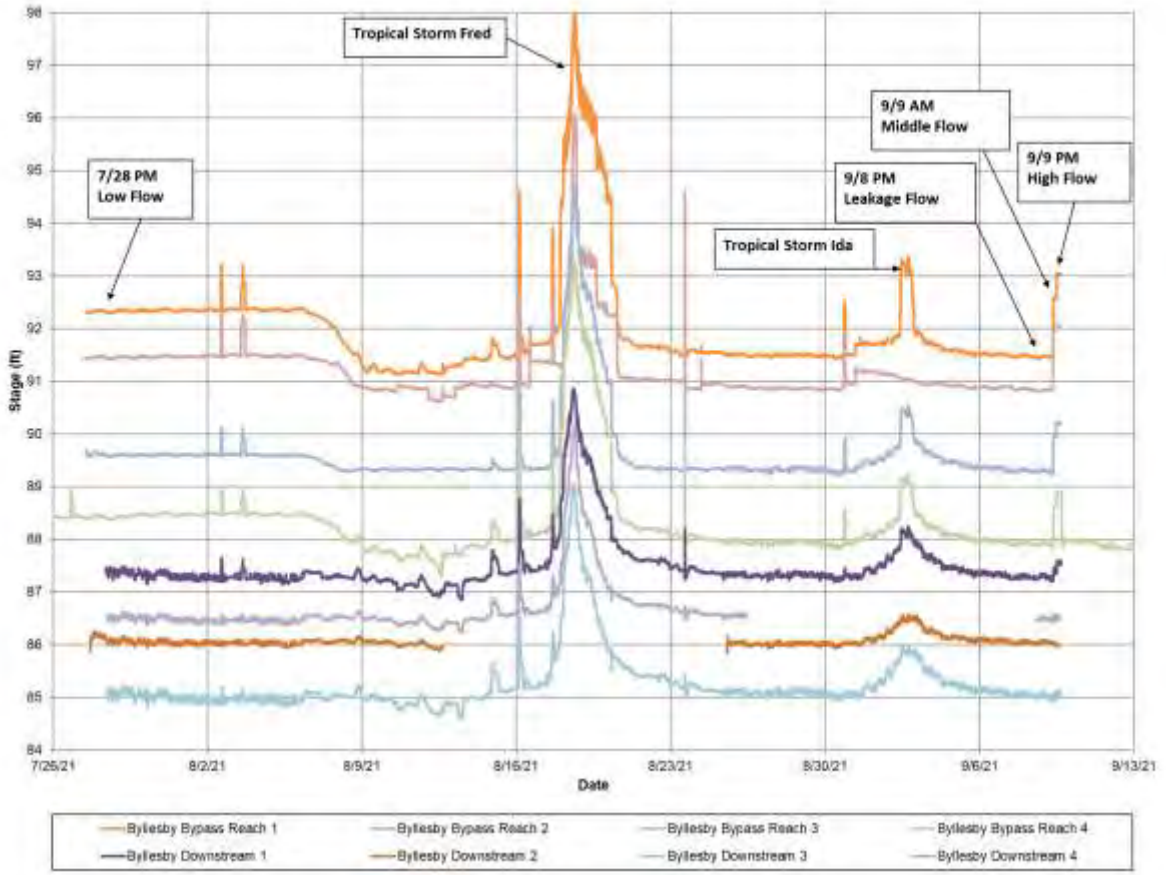
Byllesby Bypass and Downstream Reach: Water Surface Elevations



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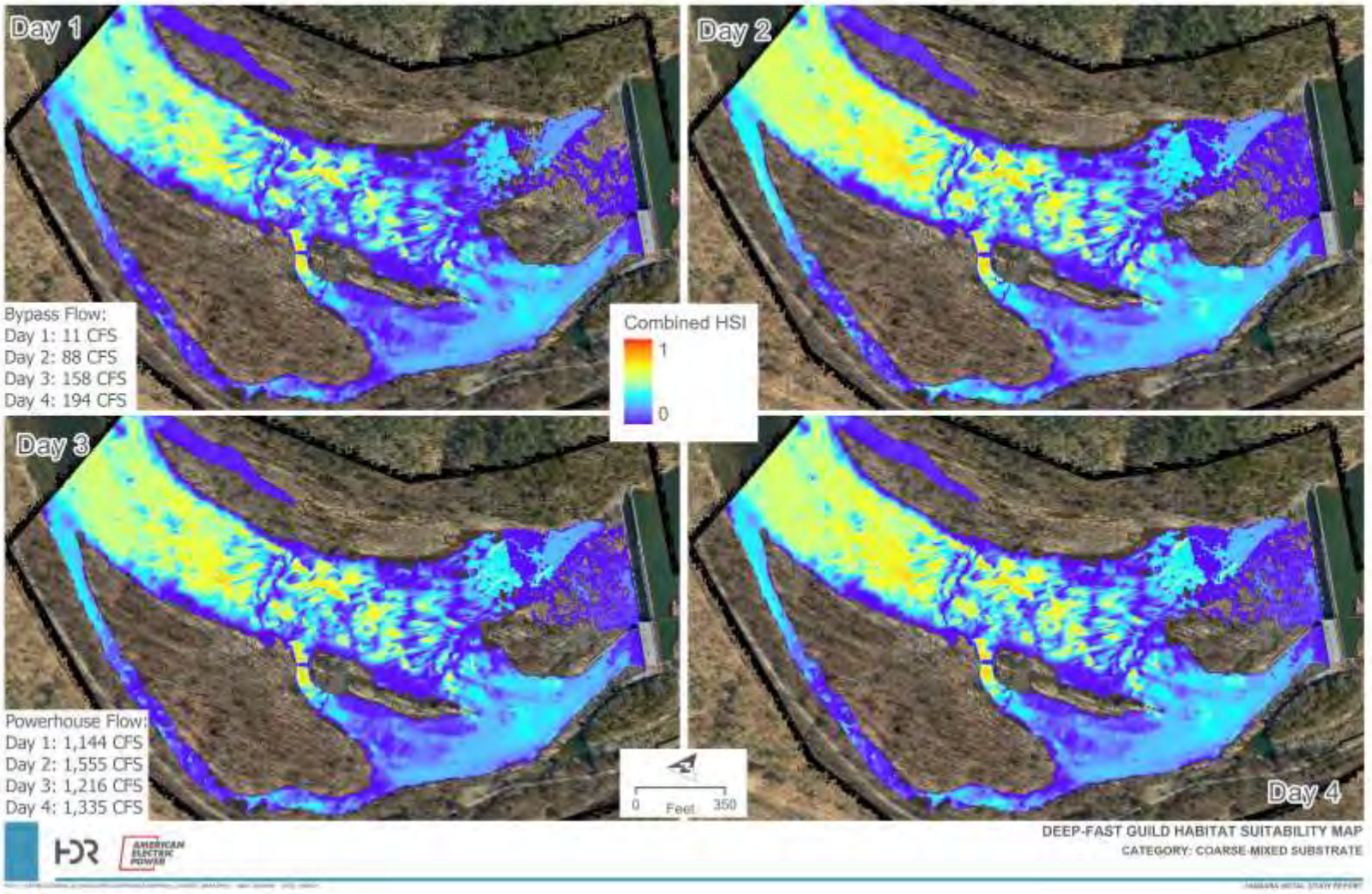
Habitat Results: Deep-Fast Guild



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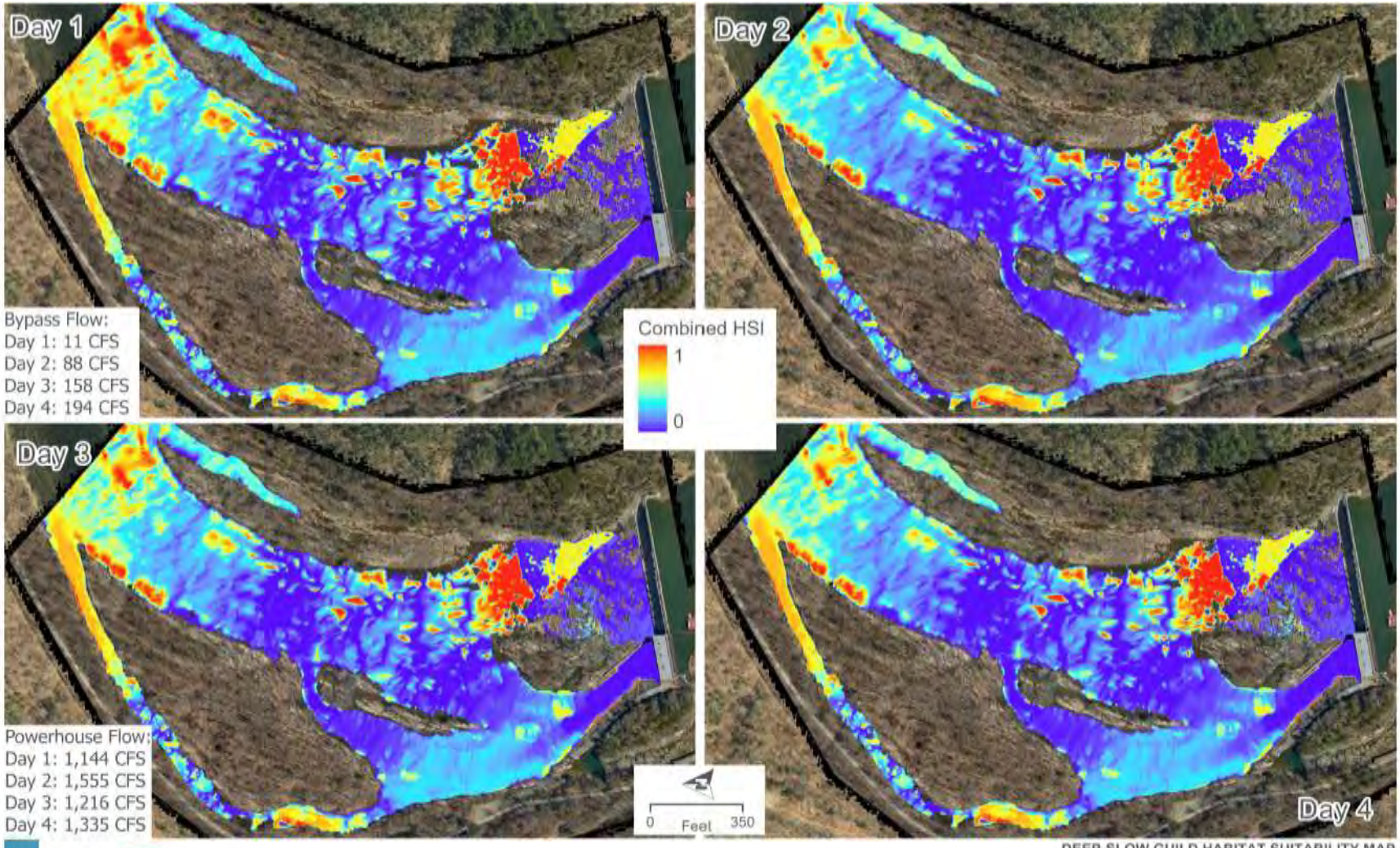
Habitat Results: Deep-Slow Guild



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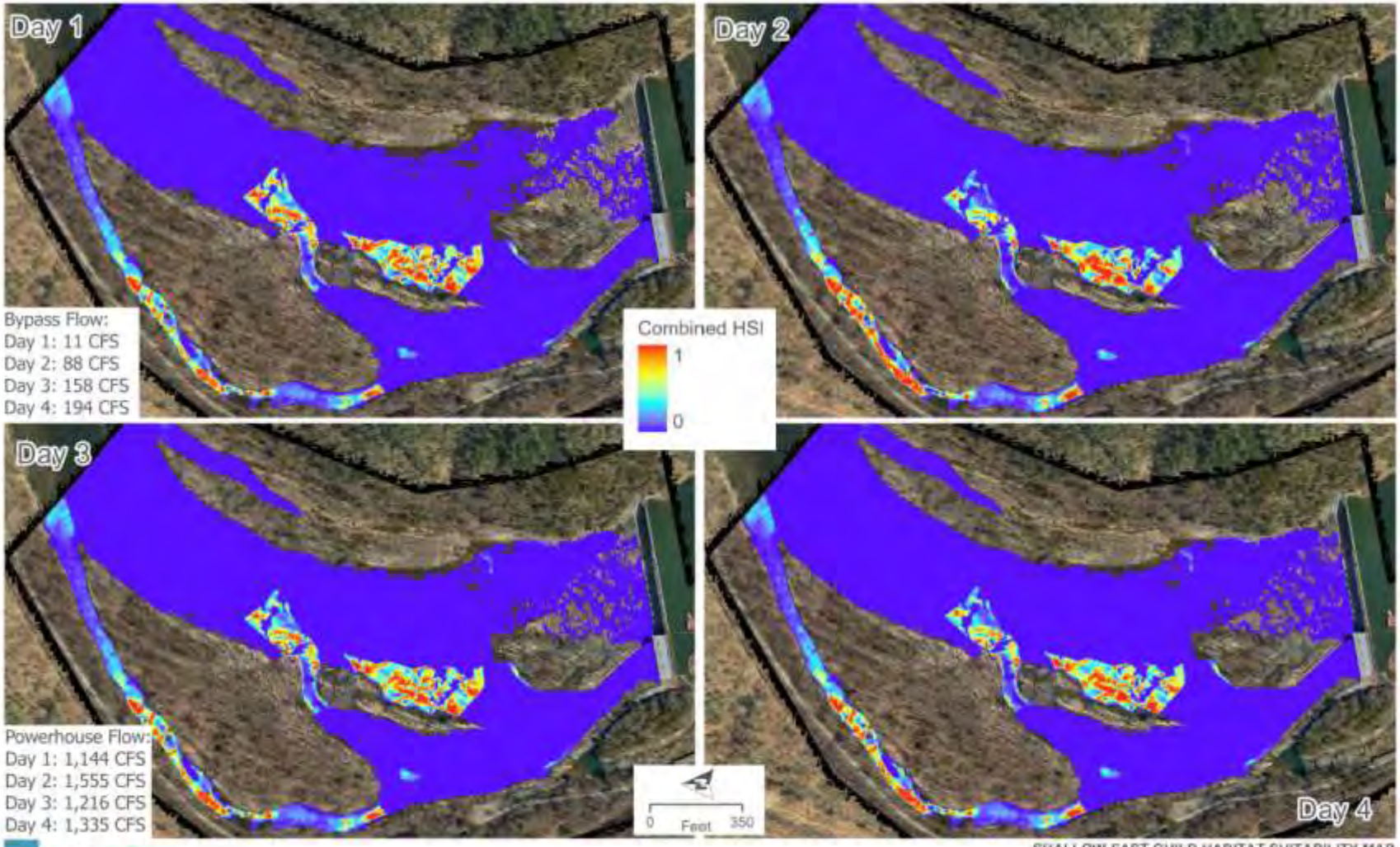
Habitat Results: Shallow-Fast Guild



SHALLOW-FAST GUILD HABITAT SUITABILITY MAP

CATEGORY: MODERATE VELOCITY WITH COARSE SUBSTRATE

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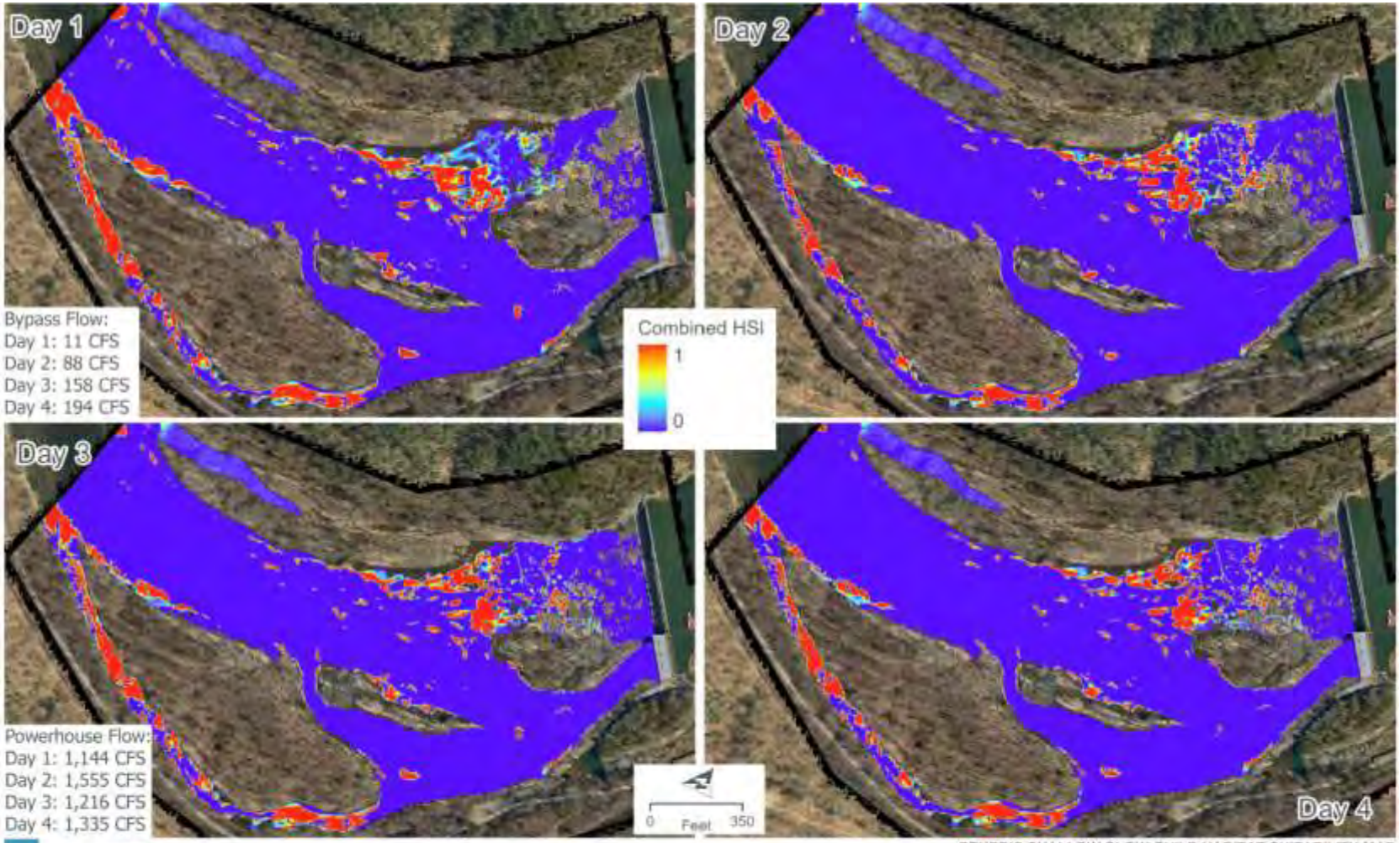
Habitat Results: Shallow-Slow Guild



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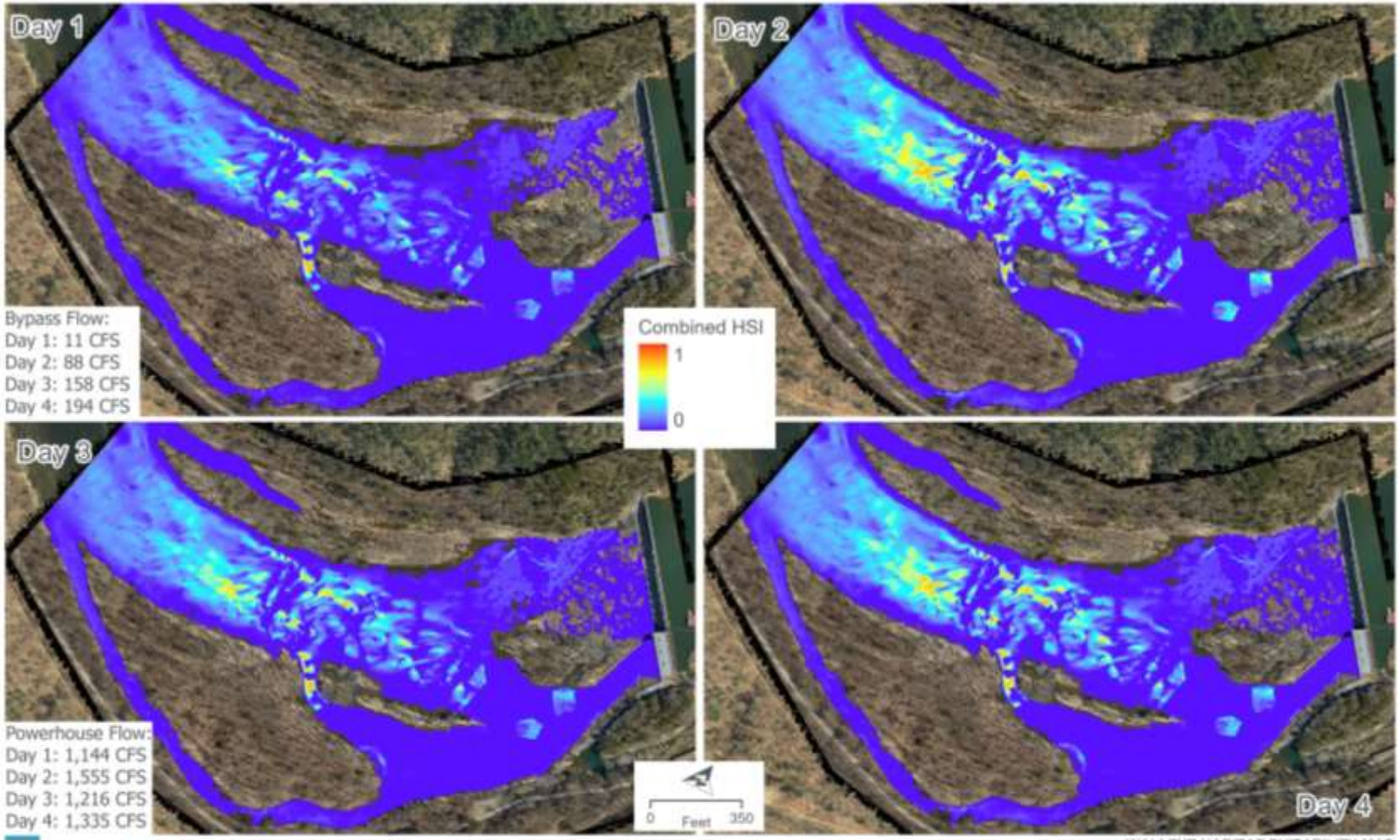
Habitat Results: Walleye Spawning



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Byllesby Bypass Reach Summary and Conclusions

- The bypass reach consists of deep and shallow pools and shoal habitat types dominated by larger substrate sizes
- Habitat model results indicate suitable habitat for species and life stages that prefer deep and/or slow-moving water
- Increasing flow only has a marginal effect on depths and velocities
- As a result, the amount of available habitat in the bypass reach is very similar over the modeled flow range (between 11 – 194 cfs)

Byllesby Bypass Reach 9.8.2021
Leakage Flow 11 cfs

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Variances from FERC-approved Study Plan

The Bypass Reach Flow and Aquatic Habitat Study was conducted in conformance with the Commission's SPD.

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15-minute break

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Recreation Study

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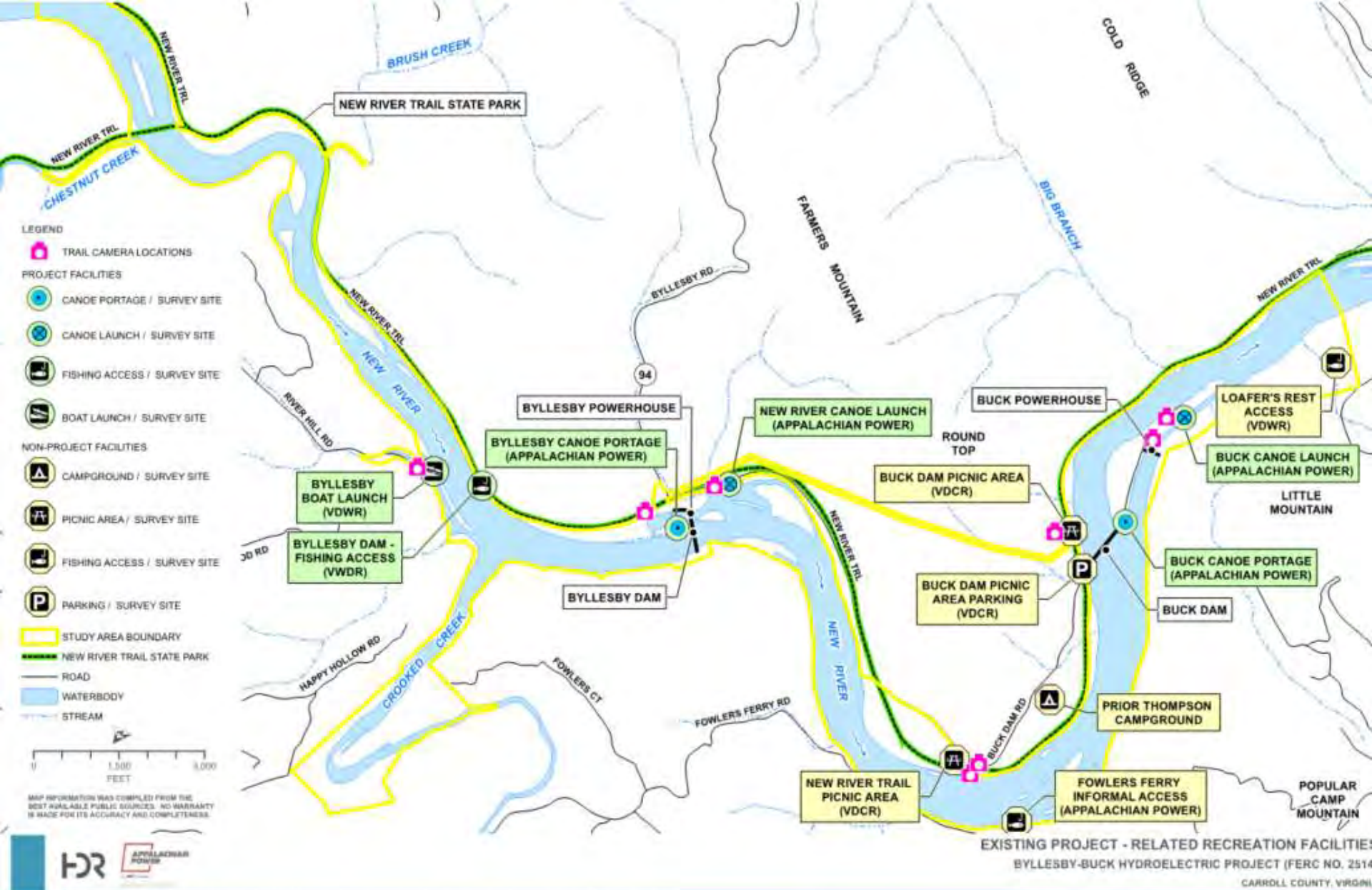
Recreation Study

Study Status

Appalachian completed the Recreation Study in accordance with the methods described in the RSP and SPD.

The approved Study Plan defines four primary tasks for the Recreation Study:

- Recreation Facility Inventory and Condition Assessment
- Site Visit with Stakeholders
- Recreation Use Visitor Online Survey
- Recreation Use Documentation



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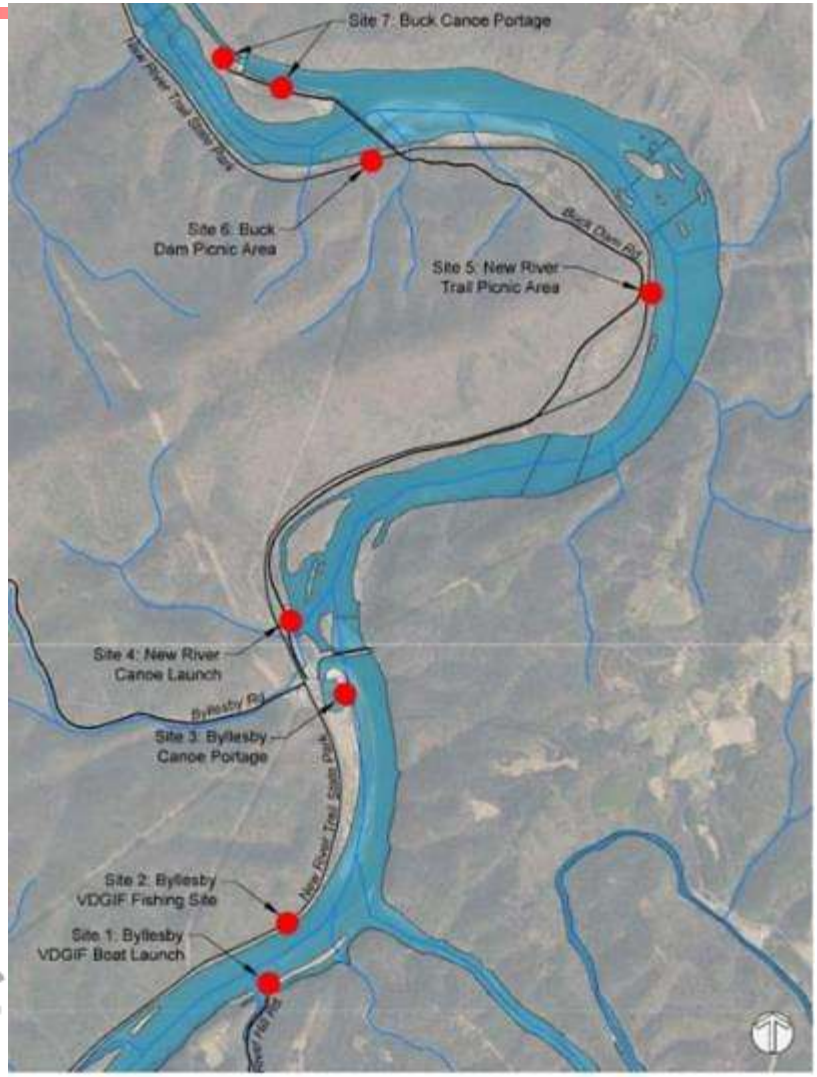
Project and Non-Project Recreation Facilities Studied

Recreation Facility	Recreation Facility Inventory and Condition Assessment	Site Visit with Stakeholders	Recreation Visitor Use Online Survey	Recreational Use Documentation - Trail Camera
Byllesby Development				
Byllesby VDWR Boat Launch	x	x	x	x
Byllesby Canoe Portage	x	x	x	x
New River Canoe Launch	x	x	x	x
VDWR Fishing Site	x			
Buck Development				
Buck Dam Picnic Area	x	x	x	x
New River Trail Picnic Area	x	x	x	x (Upper and Lower)
Buck Dam Canoe Portage	x	x	x	x
Loafer's Rest			x	x (Buck tailrace)

Recreation Study: Recreation Facility Inventory and Condition Assessment

Land Planning Design Associates (LPDA), conducted a Recreation Facility Inventory and Condition Assessment of seven Project and Non-Project recreation facilities.

LPDA recorded specific criteria for each facility and completed a qualitative assessment of the condition of the facilities.



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Recreation Study: Recreation Visitor Use Online Survey

- From April 21, 2020 to December 1, 2020, Appalachian received 142 responses to the online survey.
- Provided a method for existing and potential recreation visitors to respond and provide feedback on recreation opportunities for Project and Non-Project facilities.
- Outreach methods included: posted signs, coordinated with stakeholders, included in ILP Progress Report, and social media.

Primary Activity	Use (%)
Fishing	48
Canoeing/kayaking	20
Sight-seeing	11
Biking	9
Picnicking	4
Hiking	2
Hunting	2
Wildlife Viewing	2
Swimming	1

Recreation Study: Recreation Use Documentation

Summary of Study Methods

- Eight trail cameras were installed from October 2019 - November 2020.
- Recorded time, temperature, date, and recreation usage.

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Recreation Study Summary

- Consistent recreation usage at most of the Project and Non-Project facilities, with usage peaking on the weekends, holidays, and warmer months, as anticipated.
- The New River Trail provides a unique opportunity to access most of the recreation facilities in otherwise remote locations.
- The trail camera and online survey results indicated that fishing and canoe/kayaking were the primary recreation activities.
- The Buck Dam Canoe Portage was the only Project recreation facility that saw very little recreation usage, likely because it is inaccessible except by canoe/kayak.

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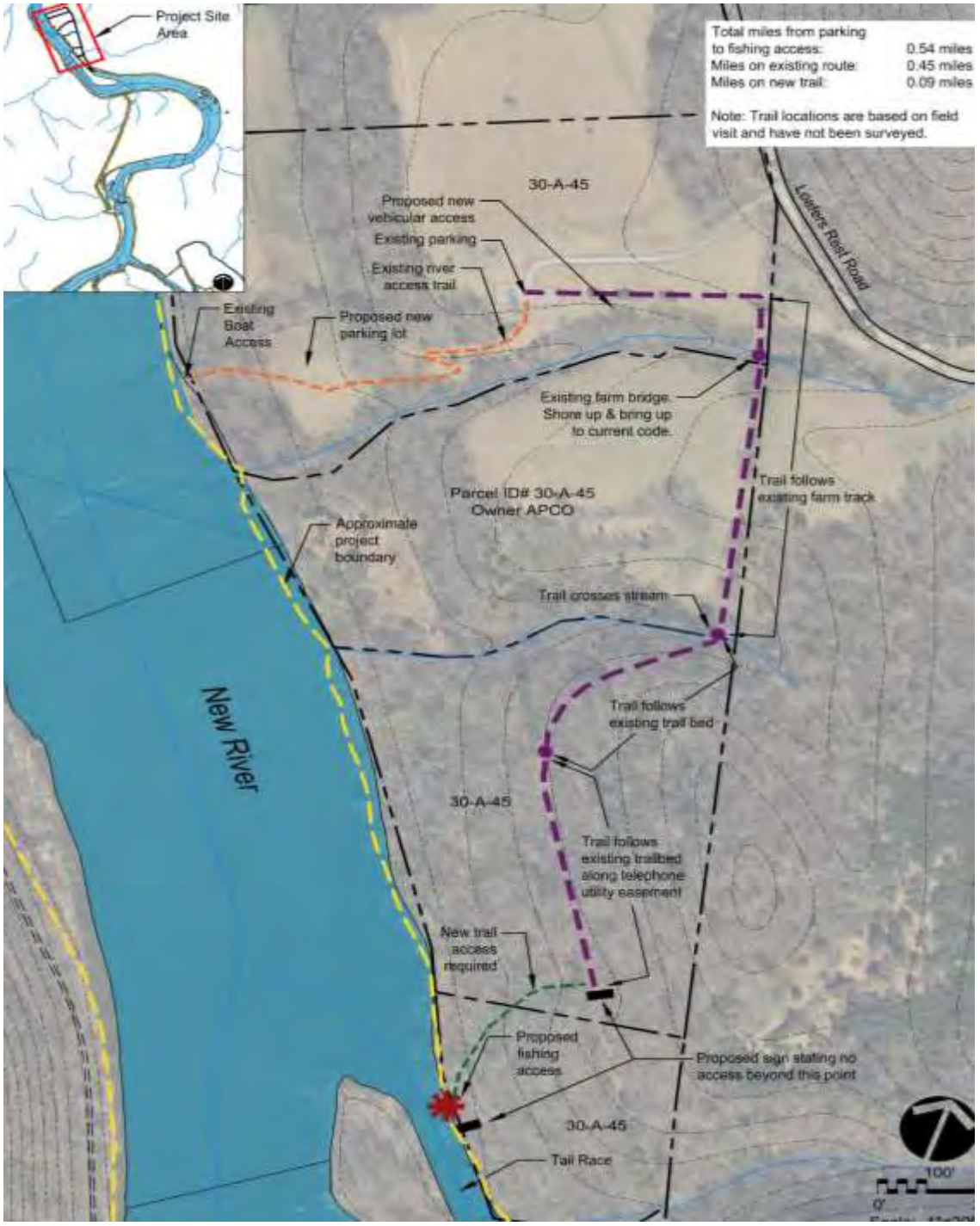
Recreation Study: Site Visit with Stakeholders to Discuss Existing and Future Recreational Opportunities

- Documentation of the virtual meeting (October 21, 2020) and site visit (October 28, 2020).

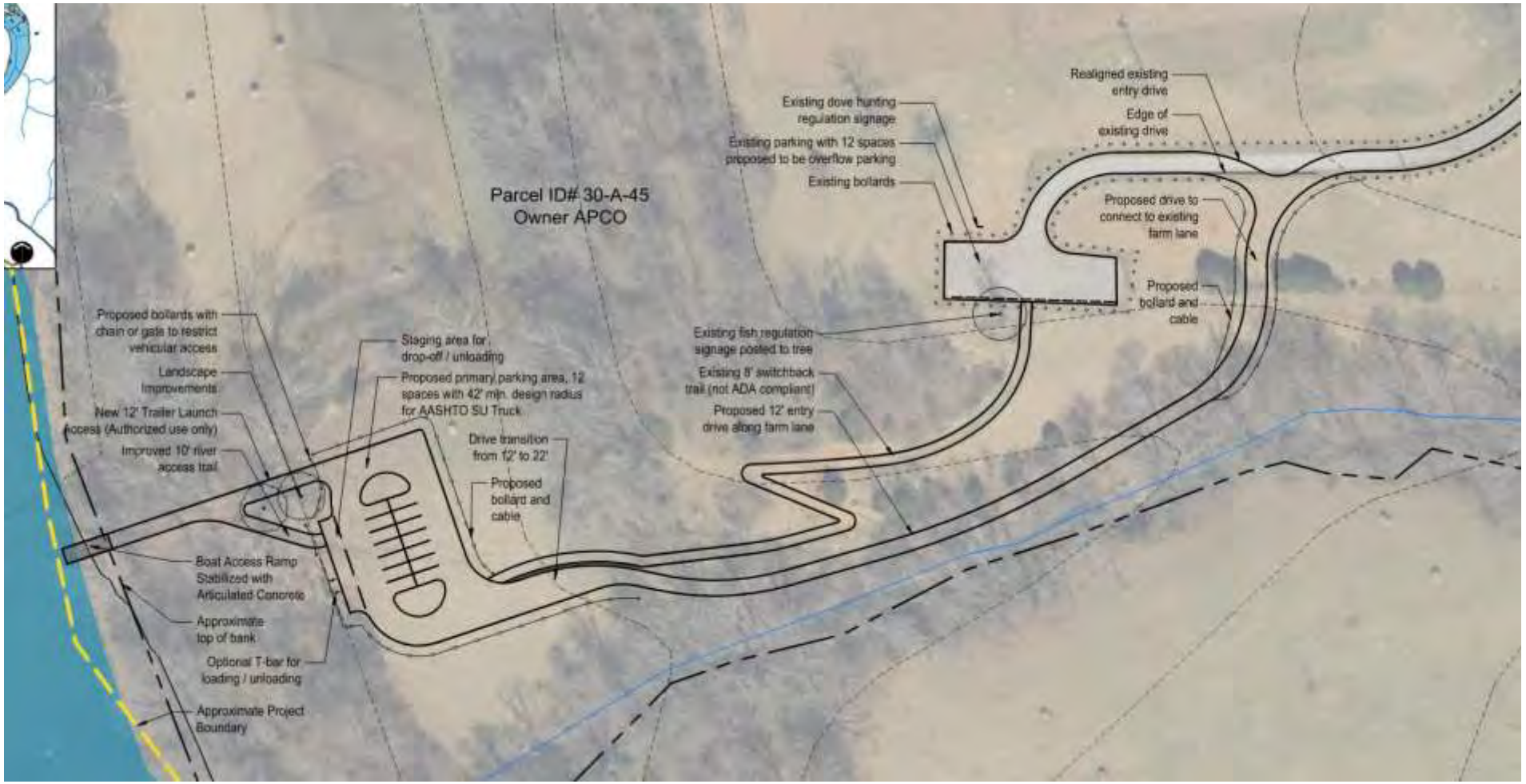
2021 site visits and meetings included:

- Site visit to the VDWR Loafer's Rest recreation facility with VDWR, Appalachian, and Appalachian's consultants on March 24, 2021.
- Conference call with VDWR, Appalachian, and Appalachian's consultants for the Recreation Study on June 29, 2021 to discuss priorities for potential Project and Non-Project recreation facility improvements and to introduce preliminary concepts for development of the VDWR Loafer's Rest recreation facility.

Proposed Loafer's Rest Fishing Trail



Proposed
Loafer's Rest Improvements



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Variances from FERC-approved Study Plan

The Recreation Study was conducted in conformance with the Commission's SPD.

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Cultural Resources Study

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Cultural Resources Study

Tasks completed in the Cultural Resources Study:

- Consultation for the APE Determination (Task 1),
- Background Research and Archival Review of the Study Area (Task 2),
- Phase I Reconnaissance Survey of the Area of Potential Effects (APE) (Task 3).
- Inventory of Traditional Cultural Properties (TCPs) (Task 4).
  - No TCPs Identified
- Update to the Cultural Resources Management Plan (Task 5)
  - *ongoing

Cultural Resources Study Findings

Terracon conducted an archaeological assessment of the Project APE in October 2020, and geomorphological investigations occurred in October 2020 and April 2021.

- Most of the APE is either steeply sloped or contains deeply buried historic alluvial deposits with little to no chance of containing significant archaeological resources.
- There is little to no erosion or other Project-related effects in any portions of the APE.
- One 47.5-acre area located at the northeastern end of the Project has the potential for containing archaeological resources. The area currently is not experiencing any project-related effects. However, should ground disturbing activities take place in this area, a Phase I archaeological survey would be required in this area.

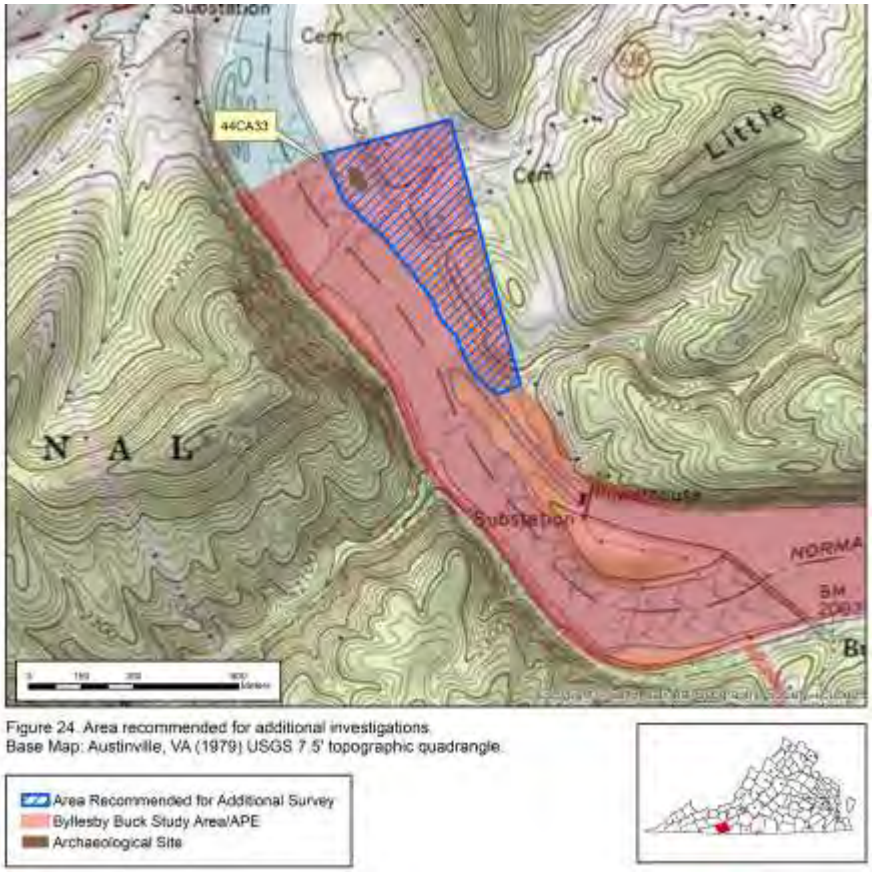

Figure 24. Area recommended for additional investigations.
Base Map: Austinville, VA (1979) USGS 7.5' topographic quadrangle.

Cultural Resources Study Findings

Three above-ground historic resources – the Byllesby and Buck Hydroelectric Facilities and the Norfolk and Western Railroad Cripple Creek Extension – are eligible for inclusion in the National Register of Historic Places (NRHP). All three were revisited and evaluated during the fieldwork and all three remain eligible for listing in the NRHP.

- It is Terracon's opinion that no historic properties are currently being affected by continued Project operations.

None of the resources identified through Terracon's research will be affected by the Project.

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Variances from FERC-approved Study Plan

The Cultural Resources Study was conducted in conformance with the Commission's SPD. The final Study Report was filed with the Draft License Application on October 1, 2021 and is not included in the USR (PRIV). A draft Historic Resources Management Plan will be filed with the Final License Application in 2022.

USR Meeting: Stakeholder Participation

- Appalachian will file the Updated Study Report Meeting Summary with FERC by December 16, 2021.
- Meeting summary disagreements, requests for modifications to studies, or requests for new studies should be filed with FERC by January 15, 2022.
  - If requesting modifications to studies, stakeholders must take into account FERC's Criteria for Modification of Approved Studies (18 CFR § 5.15(d)).
  - If requesting new studies, stakeholders must take into account FERC's 7 Criteria for New Study (18 CFR § 5.15(e)).
- Stakeholders File Comments on the DLA with FERC by December 31, 2021.
- Appalachian will file responses to meeting summary disagreements by February 14, 2022.
- Stakeholders can contact Appalachian with questions or comments:

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Closing

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