

Path Forward Committee Meeting
9:30 AM on November 2, 2021
Remote Access Only (see next slides)



Remote Access Options

Equipment Type	Access Information	Notes
Computers with microphones and speakers	Join Microsoft Teams Meeting Please mute your microphone unless you want to provide input.	Press control and click on this link to bring up Microsoft Teams through the internet. You can view the screen share and communicate through your computer's speakers and microphone
Computers without audio capabilities, or audio that is not working	Join Microsoft Teams Meeting (888) 404-2493 Passcode: 371 817 961# Please mute your phone unless you want to provide input.	Follow instructions above Turn down your computer speakers, mute your computer microphone, and dial the toll-free number through your phone and enter the passcode
Phone only	(888) 404-2493 Passcode: 371 817 961# Please mute your phone unless you want to provide input.	Dial the toll-free number and enter the passcode

Remote Access Guidelines

- This meeting will open 10 minutes prior to the first meeting start time (e.g., MRSW) to allow users to **test equipment** and ensure communication methods are working
- If you dial in through your phone, mute your microphone and turn down your speakers to **avoid feedback**
- Unless you are speaking, please mute your computer or device microphone and phone microphone to **minimize background noise**

Agenda

- Opening comments
- Modeling and Regulatory Support Status
- Status of the UNRBA Stage I Existing Development Interim Alternative Implementation Approach (IAIA)
- Status of Proposed Chlorophyll-a Site Specific Standards for High Rock Lake
- Plan for Statistical Model Development and Evaluation of Regulatory Options Relative to the Water Quality Standard
- Communications Support
- Other Status Items
- Closing Comments

Modeling and Regulatory Support (MRS) Status

Watershed Analysis Risk Management Framework (WARMF) Modeling Status

- The WARMF model for the Falls Lake watershed has been calibrated for stream flows and water quality and approved for developing the lake water quality models
 - MRSW approved August 27, 2021
 - PFC approved September 7, 2021
- The watershed model output is being post-processed to identify the major sources of loading to the lake
- The subject matter experts are reviewing this information
- This information will provide the best available picture of what sources in the watershed fall into the “controllable” category and lay the foundation on the feasibility and potential effectiveness of management actions to reduce nutrient inputs

WARMF Watershed Model Report

- Model inputs and calibration results have been drafted
- Loading comparisons of WARMF to other loading estimates for Falls Lake have been evaluated (daily and annual)
- Loading allocation sections will be drafted soon
- The report will be reviewed by Forrest then the MRSW then PFC before being submitted to DWR in January

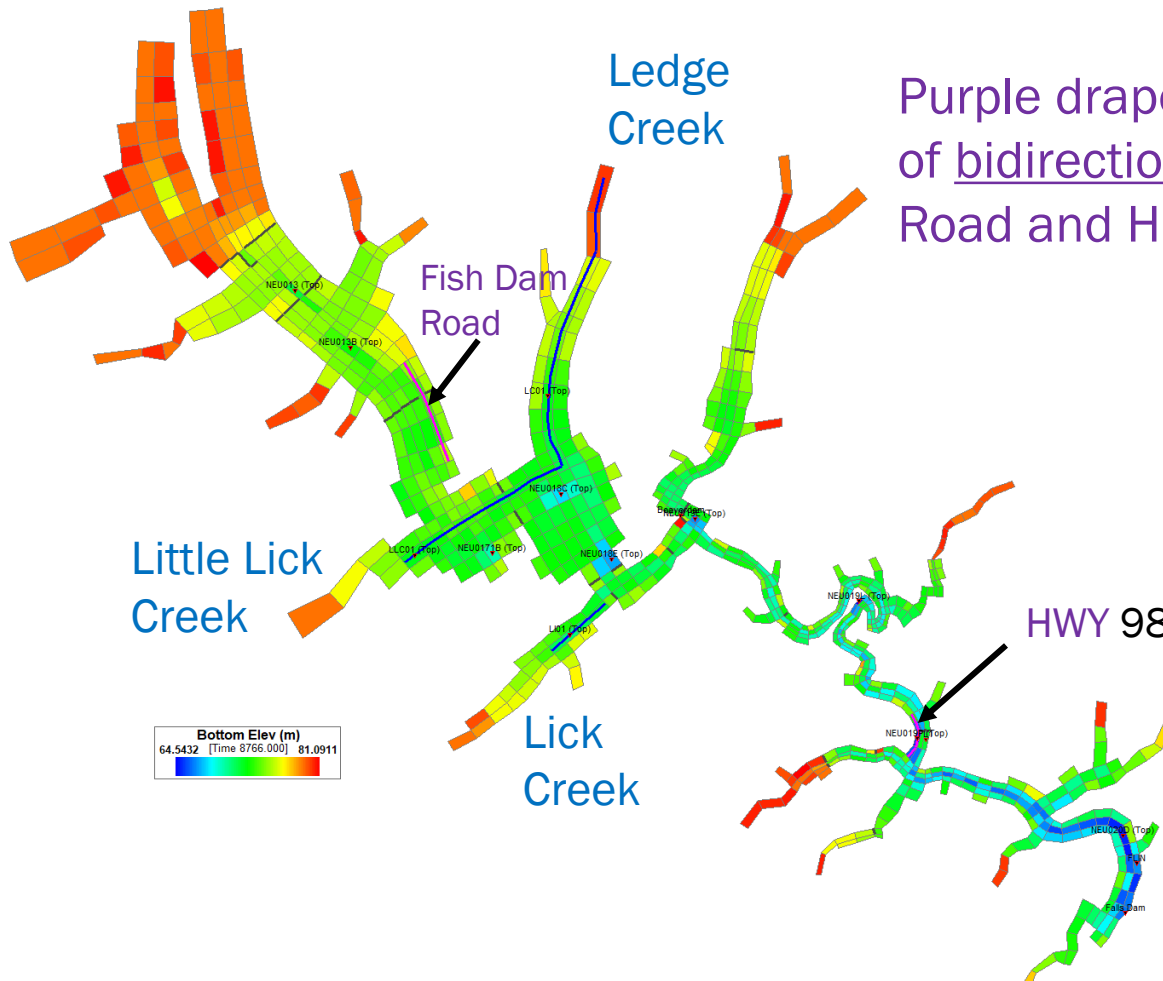
Environmental Fluid Dynamics Code (EFDC) Simulated Water Movement

- Modelers met with Dr. Rick Luettich in September to review simulated water movement compared to research studies
- The periods of modeling and Dr. Luettich's research do not overlap, but the simulated magnitudes and directions of water movement are similar
- Subsequent slides include screen shots from a simulation video that shows the magnitude and direction of water movement in Falls Lake
- Dynamic Solutions will also show a simulation video during the meeting

EFDC Water Quality Modeling

- DWR monitors lake arms above Highway 50 at 3 locations
 - Little Lick Creek arm at LLC01
 - Ledge Creek arm at LC01
 - Lick Creek arm at LI01
- At the October MRSW meeting, DWR suggested reviewing simulated layer depth at the lake-arm monitoring stations to ensure that the layer-averaging approach recommended by the modelers would apply to lake arms

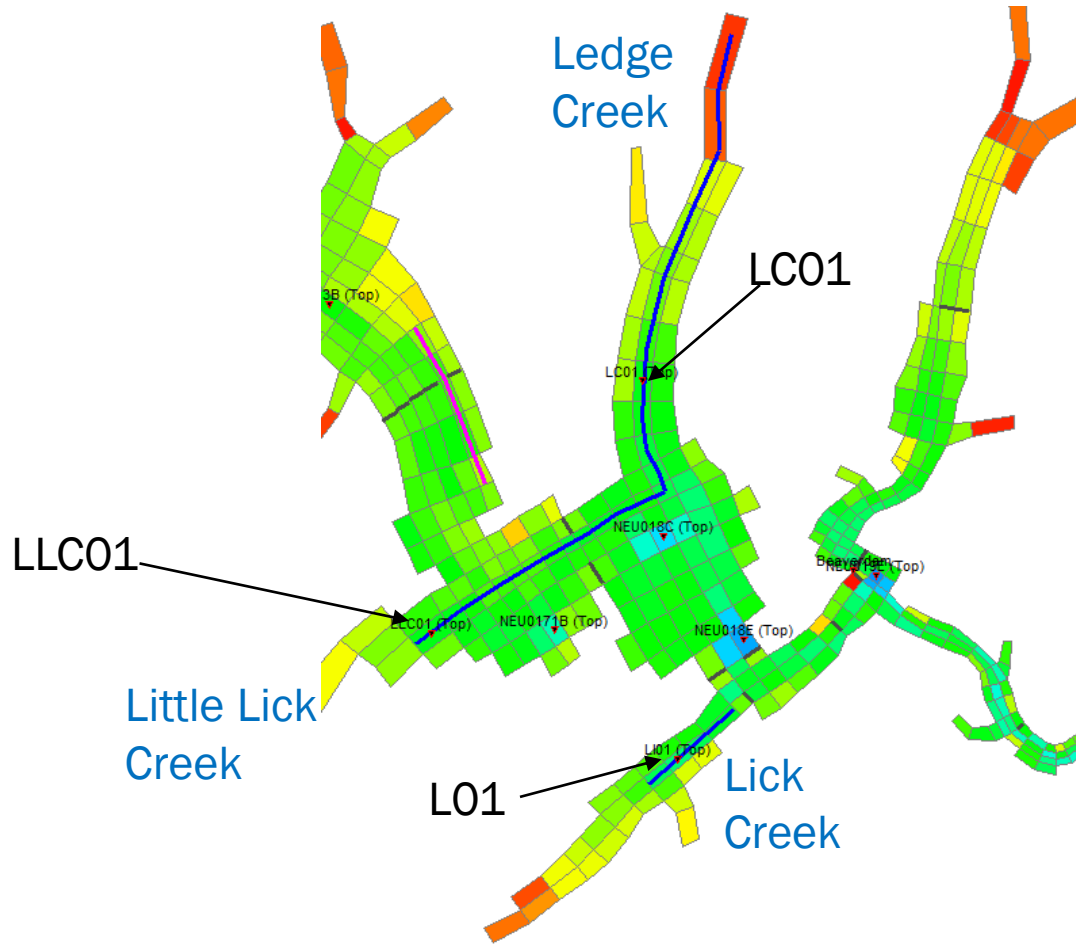
EFDC Modeling Grid



Purple drape lines for the videos of bidirectional flow at Fish Dam Road and Highway 98

Blue “drape lines” correspond to the videos and screen shots showing the layering at the three DWR lake arm sites

Location of DWR Lake Arm Monitoring Stations

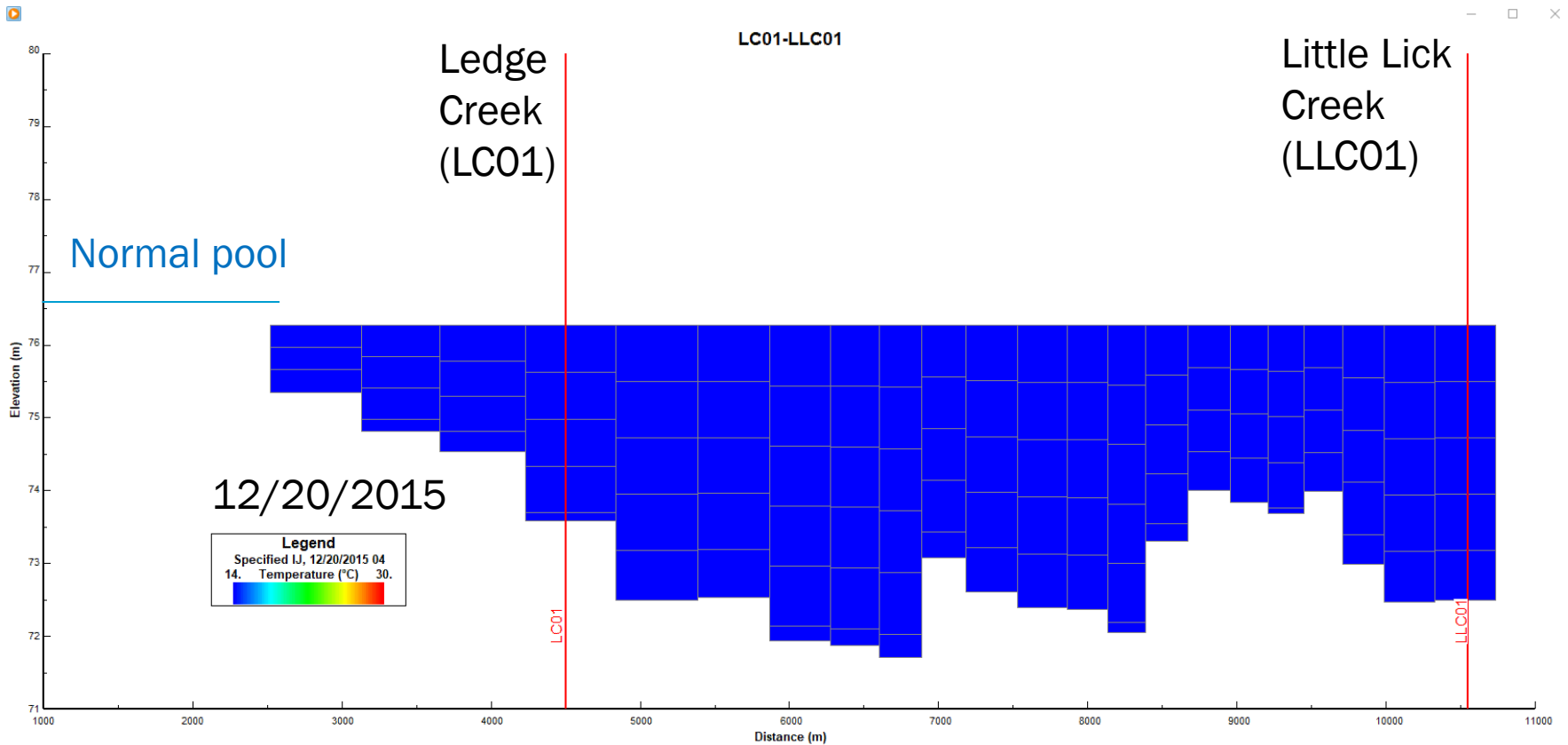


Note that the depth of the water indicated by the green is similar to other locations monitored along the mainstem of the lake.

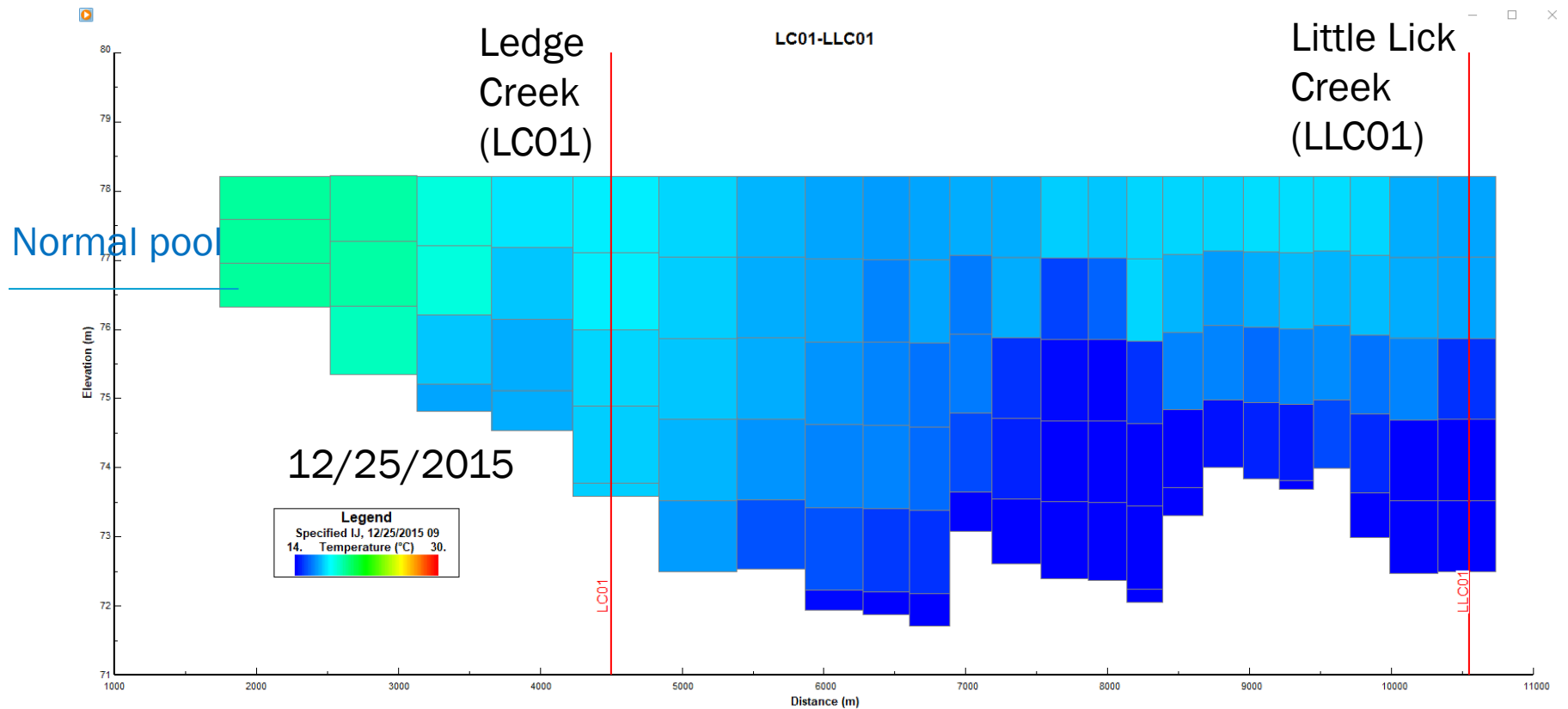
These locations do not extend into the uppermost part of the arm.

Blue “drape lines” correspond to the videos and screen shots showing the layering at the three DWR lake arm sites

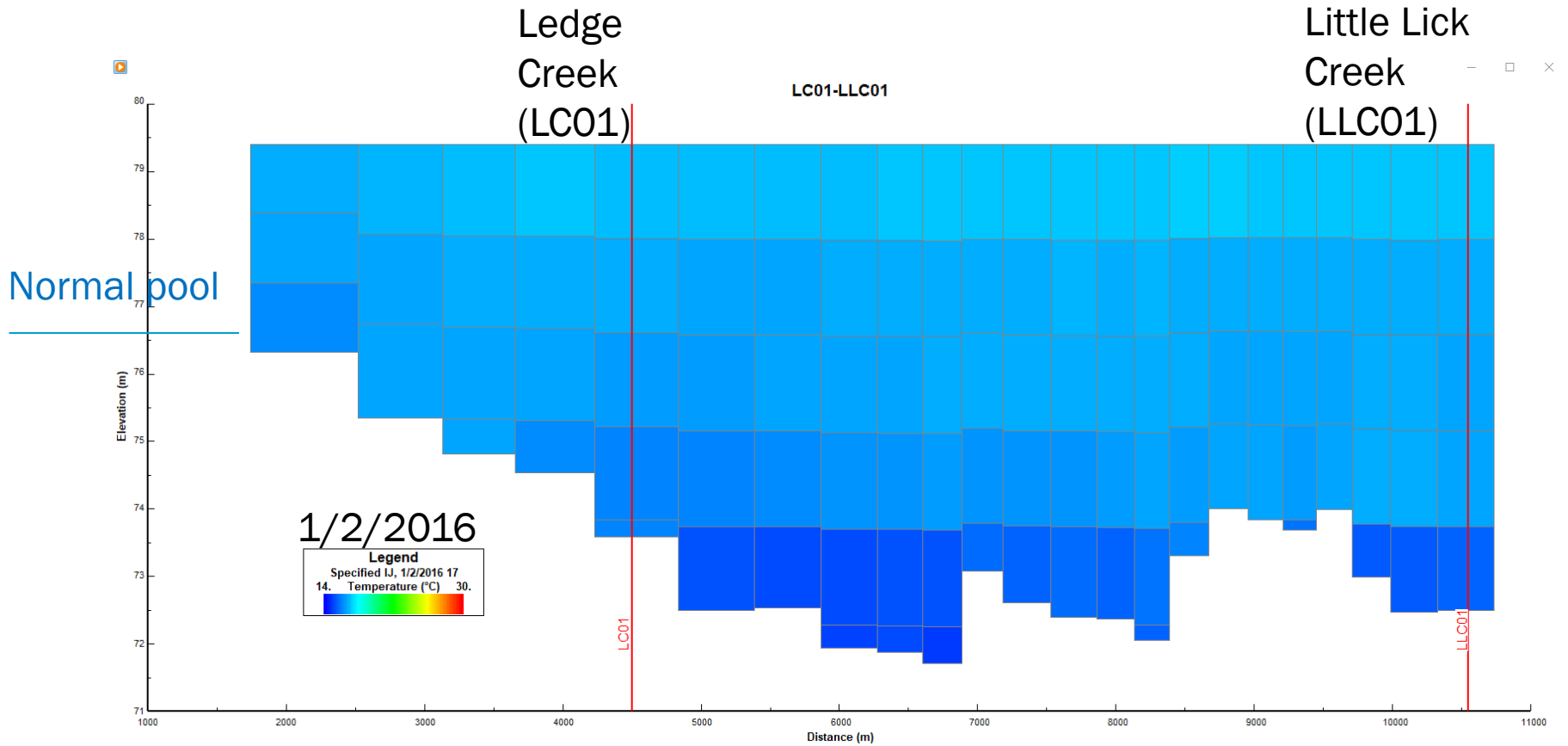
Vertical Layering along LC01-LLC01 Drape Line during Lower Stages (minimum 3 layers on the left with similar layer thickness to mainstem)



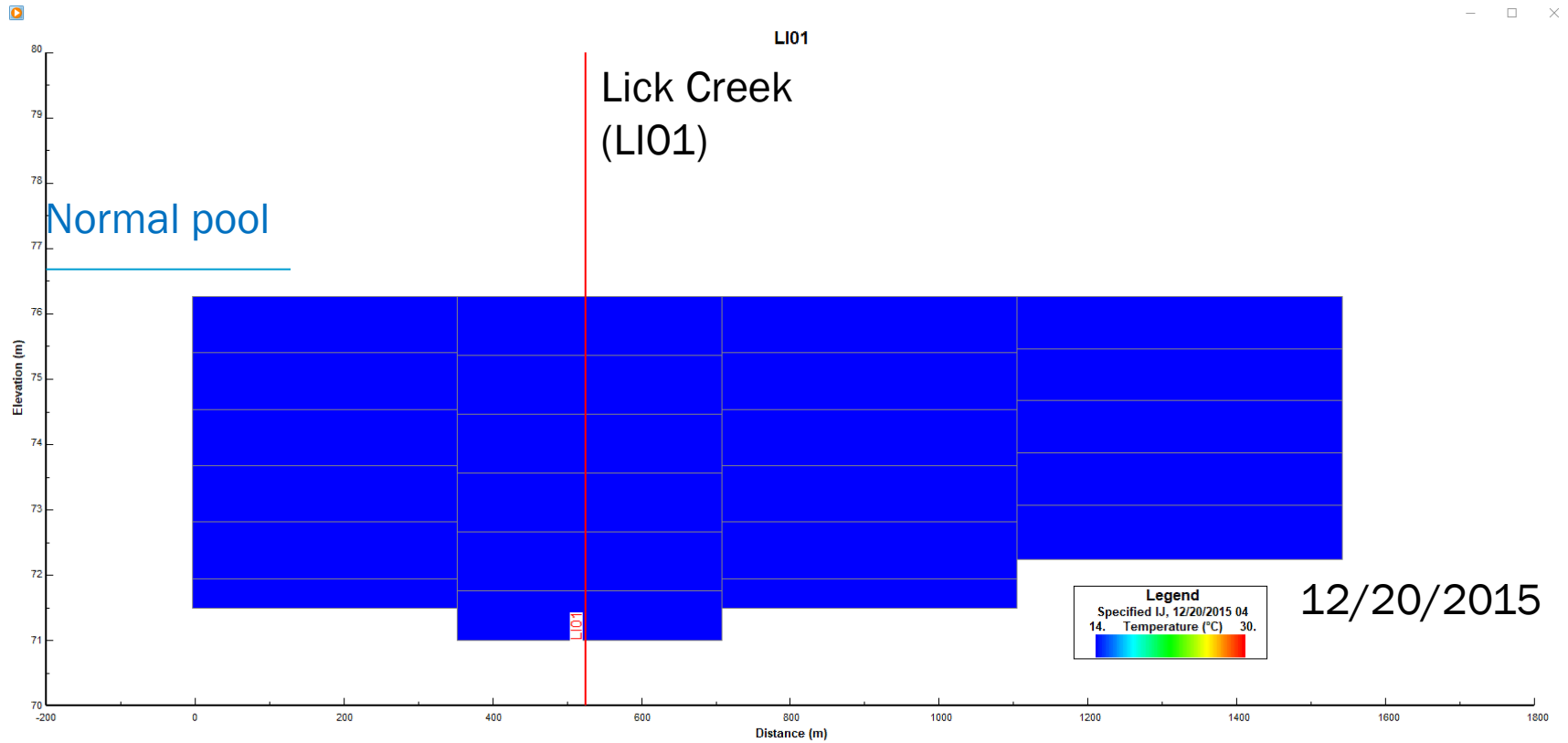
Vertical Layering along LC01-LLC01 Drape Line during Medium Stages (minimum 3 layers on the left with similar layer thickness to mainstem)



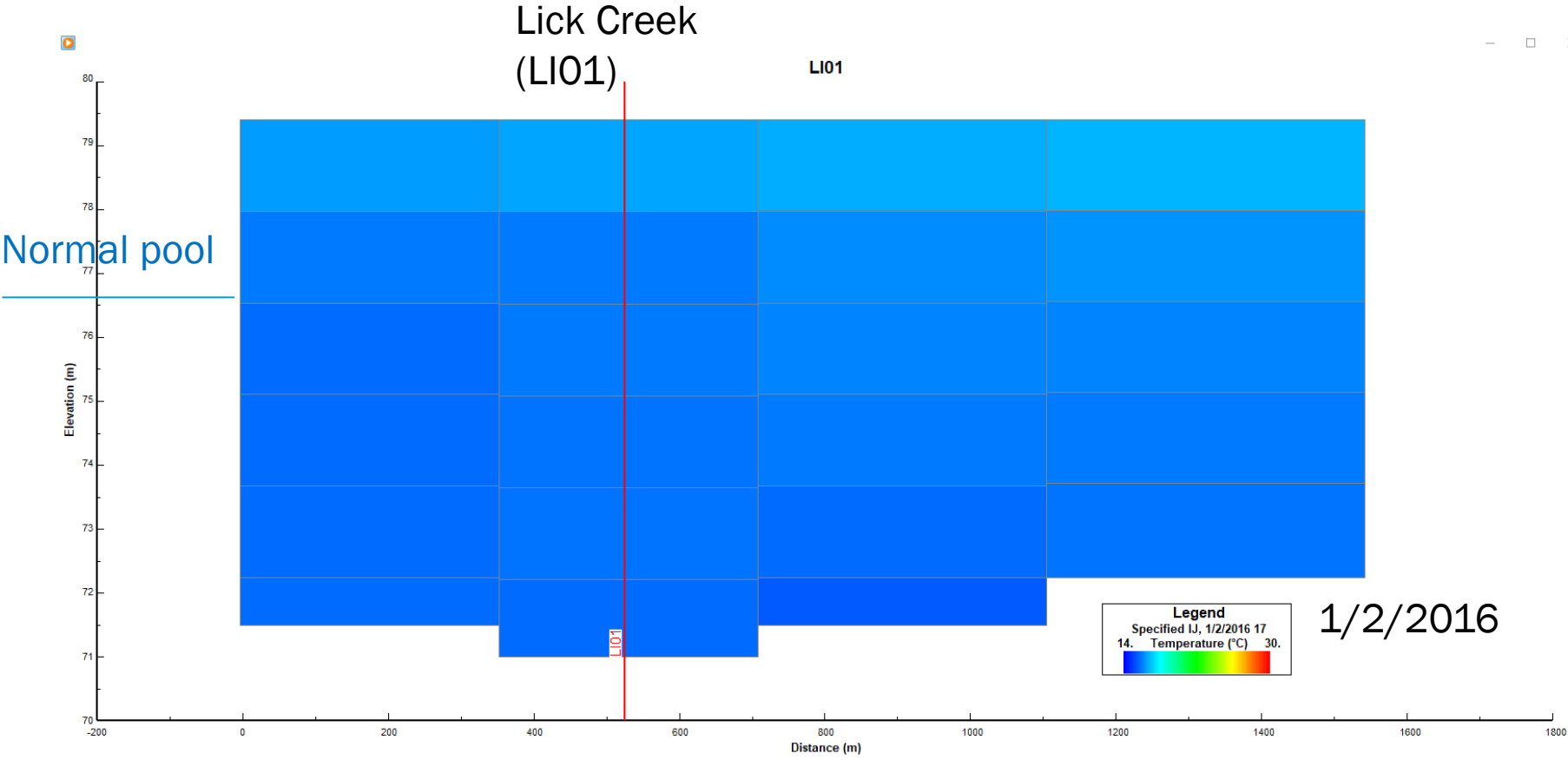
Vertical Layering along LC01-LLC01 Drape Line during Lower Stages (minimum 3 layers on the left with similar layer thickness to mainstem)



Vertical Layering along LI01 Drape Line during Lower Stages

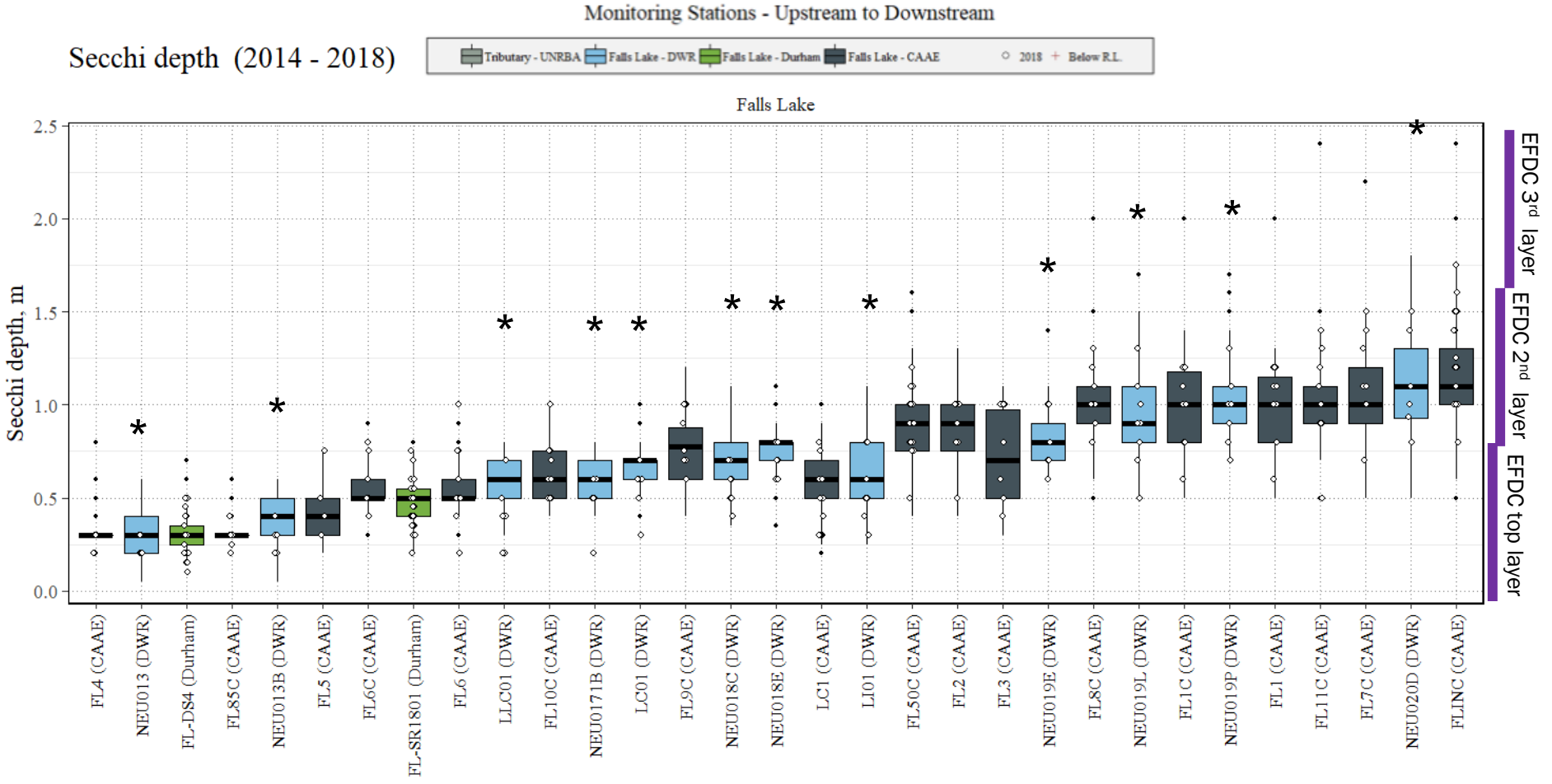


Vertical Layering along LI01 Drape Line during Higher Stages



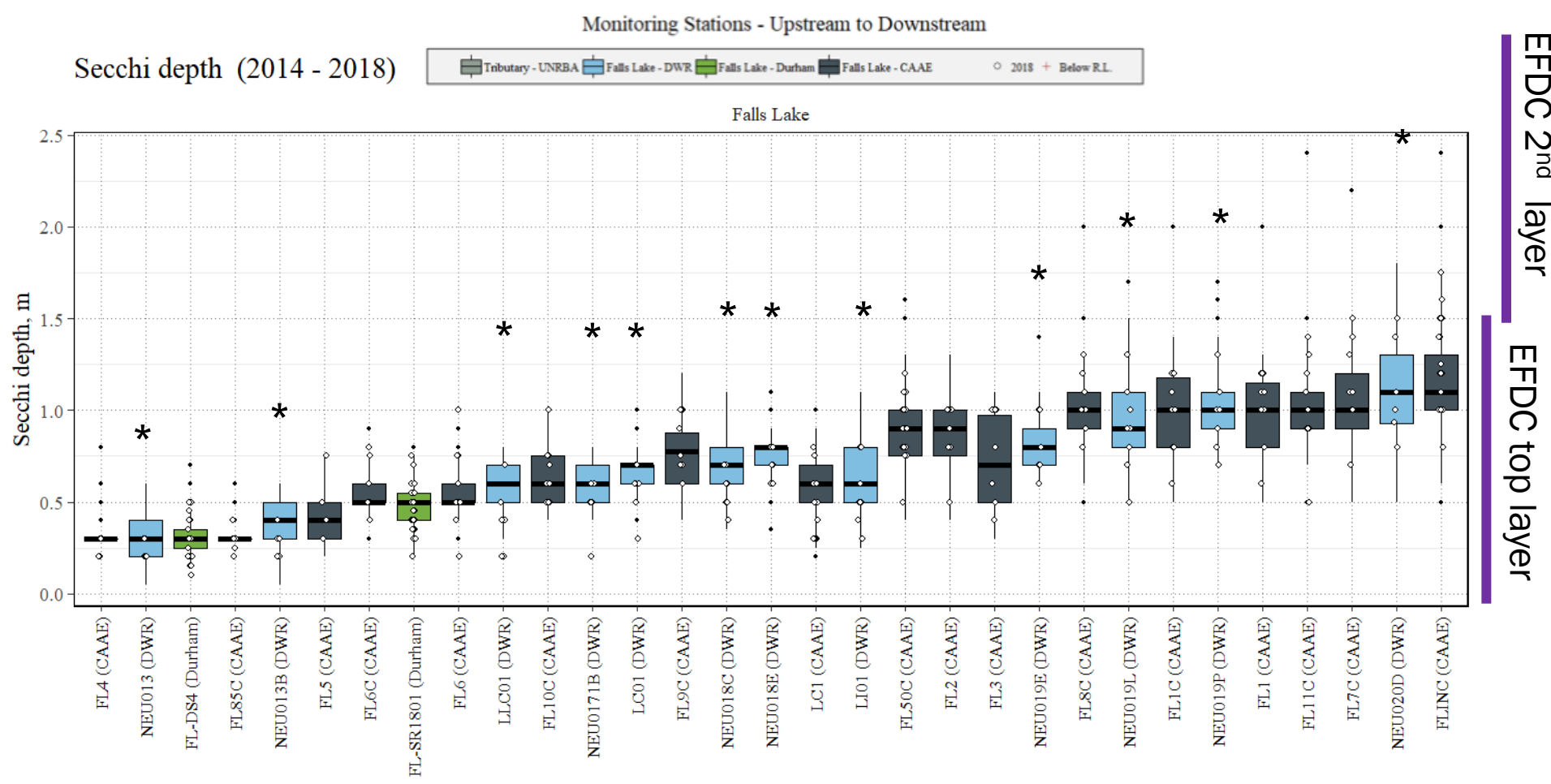
Per the UNRBA Modeling QAPP, the EFDC model will be calibrated to the DWR lake monitoring stations. The “*” on the figure shows the approximate photic depth, twice the 75th percentile Secchi depth (i.e., two times the top of the box).

When lake levels are below normal pool, layer thickness is approximately 0.75 meters.



Per the UNRBA Modeling QAPP, the EFDC model will be calibrated to the DWR lake monitoring stations. The “*” on the figure shows the approximate photic depth, twice the 75th percentile Secchi depth (i.e., two times the top of the box).

When lake levels are above normal pool, layer thickness is approximately 1.25 meters.



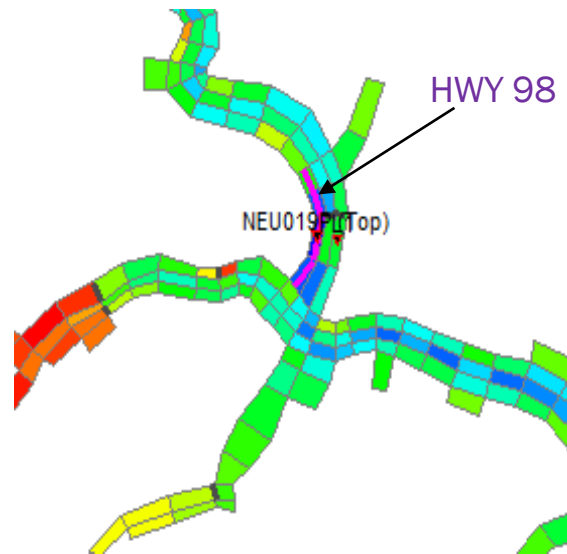
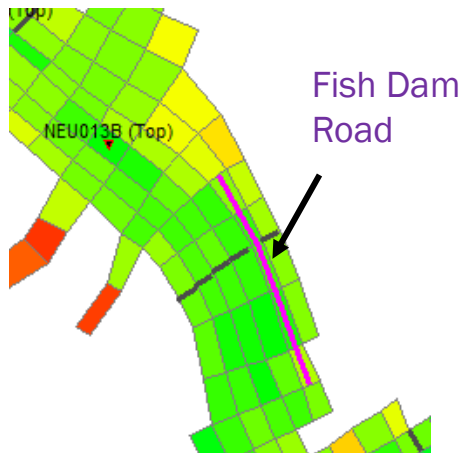
Revised Recommendation for EFDC Layering Based on Water Level

EFDC Layers to Average for Water Quality Calibration and Comparison to Photic Zone Composites

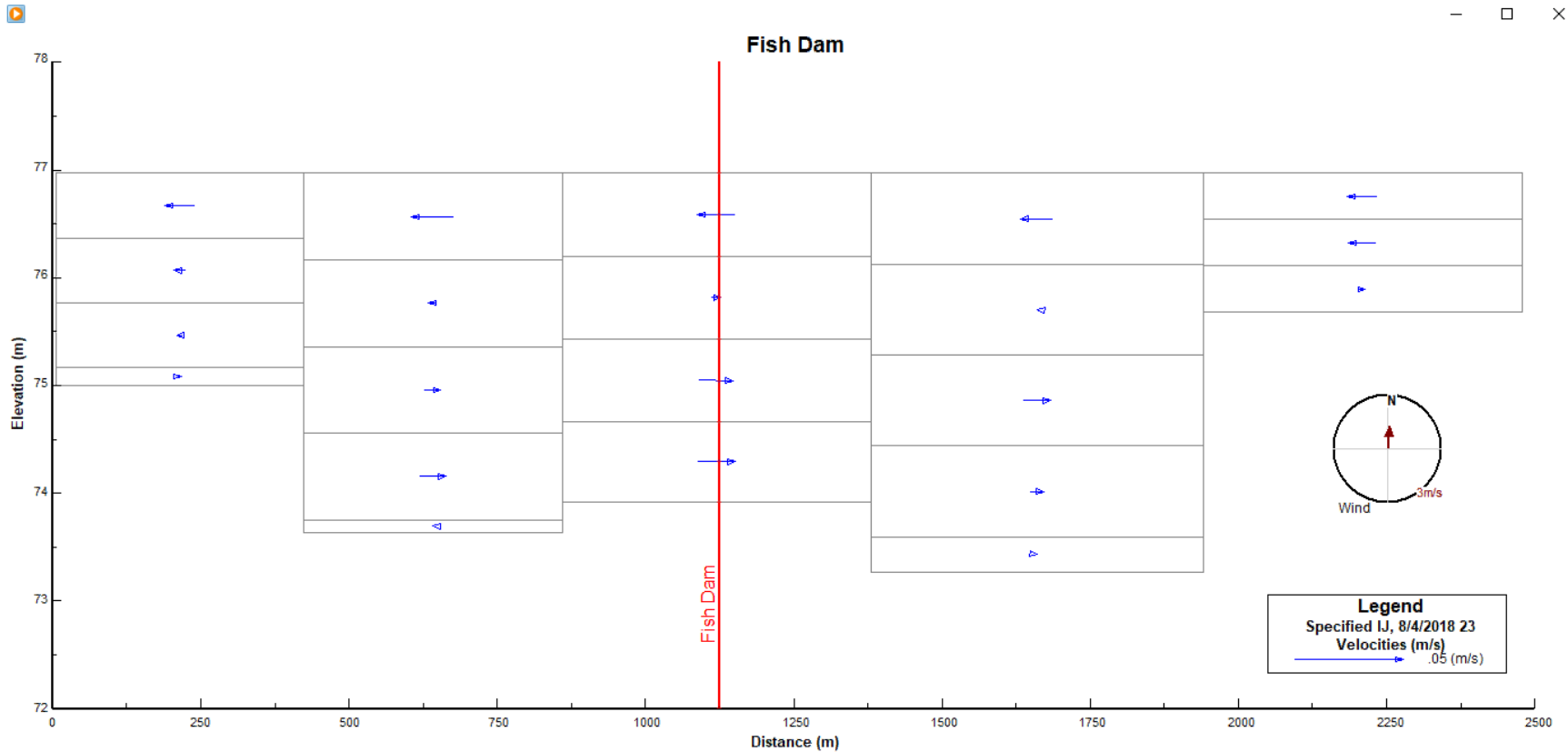
Stations	When water level is below normal pool	When water level is above normal pool
NEU013,13B	Top layer	Top layer
LLC01; LC01; LI01; NEU017B,18C,18E,19E,19L,19P	Top 2 layers	Top layer
NEU020D	Top 3 layers	Top 2 layers

Location of Water Movement Screen Shots and Videos

Purple drape lines for the videos of bidirectional flow at Fish Dam Road and Highway 98

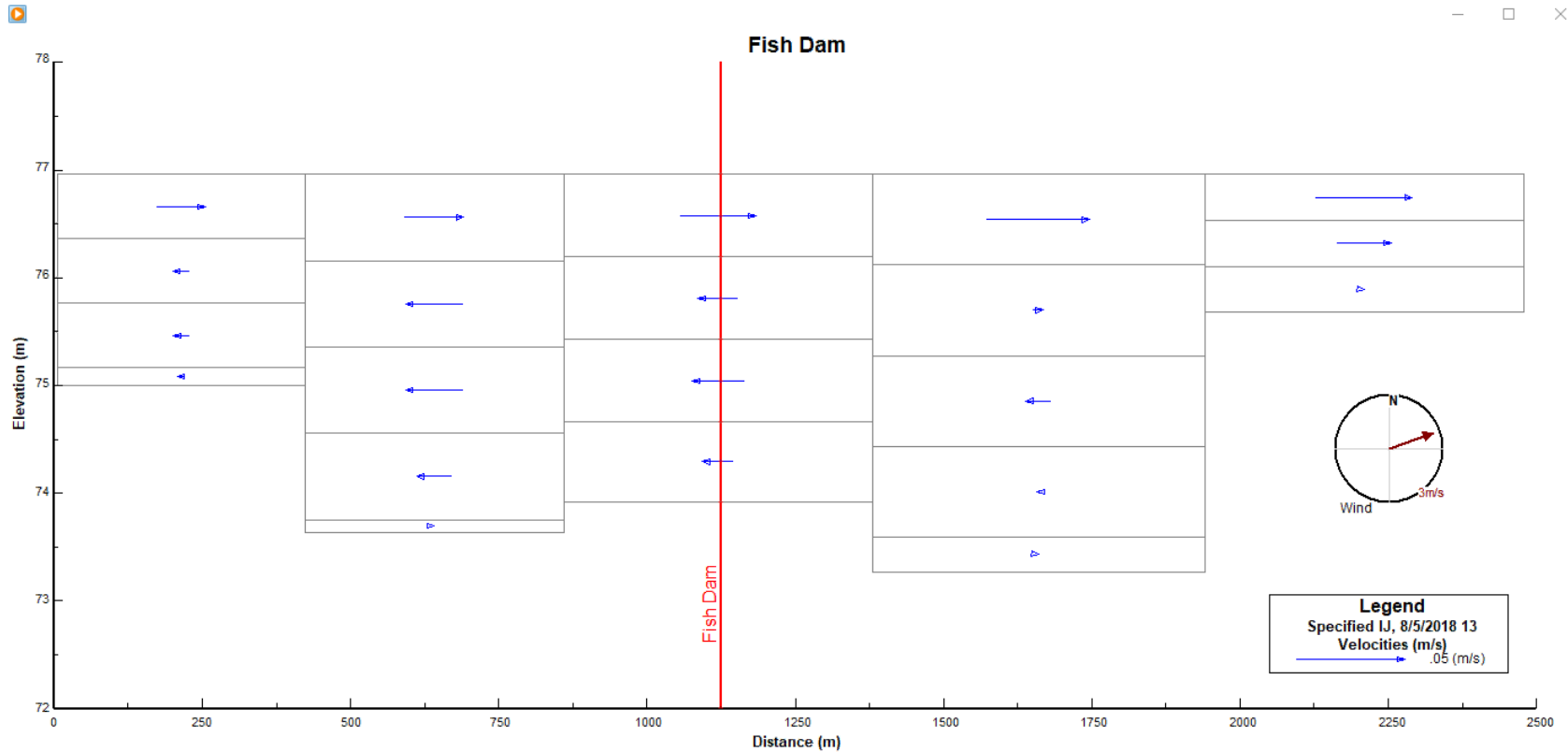


Bidirectional Flow at Fish Dam on 8/4/2018 23:00



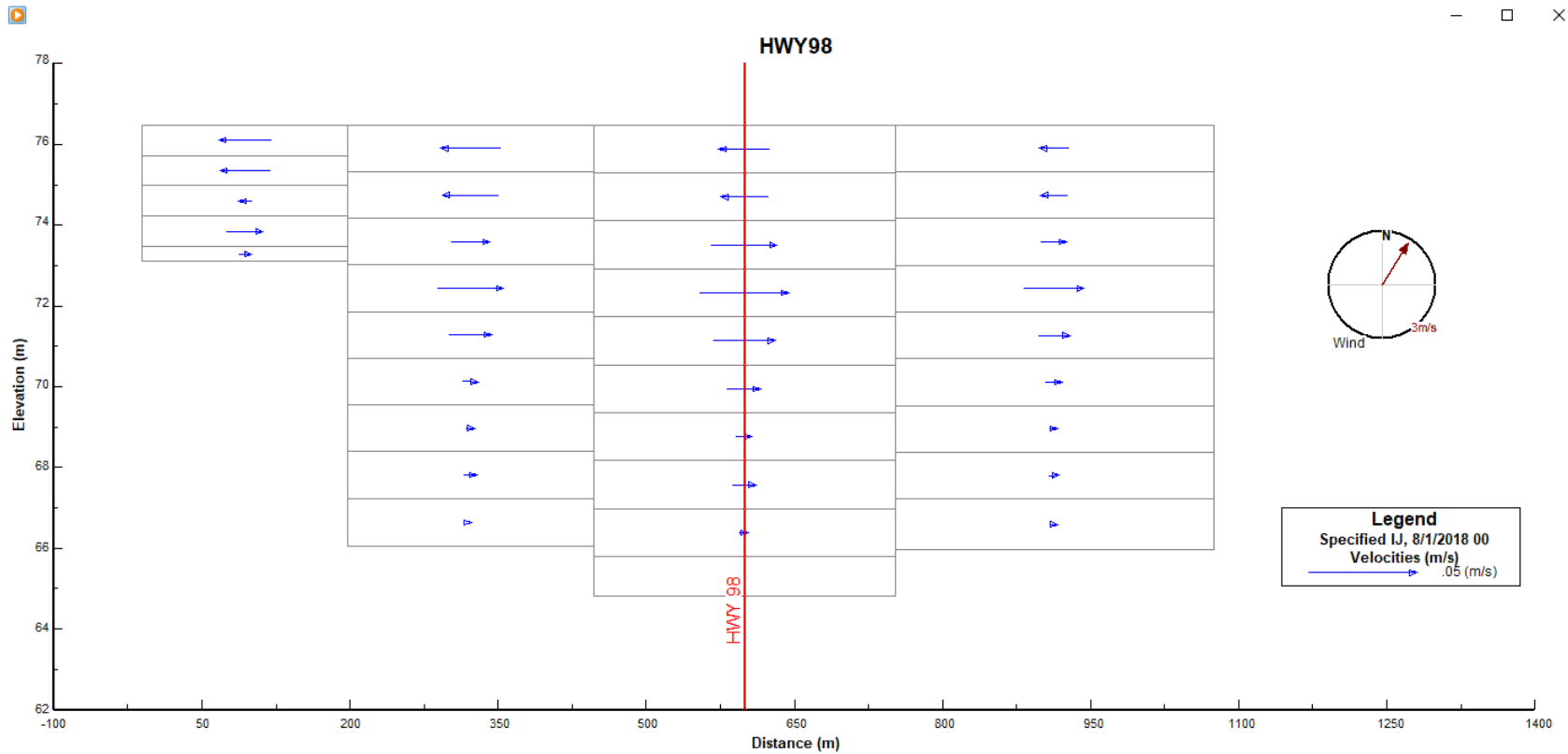
Arrows to the right indicate flow toward the dam

Bidirectional Flow at Fish Dam on 8/5/2018 13:00



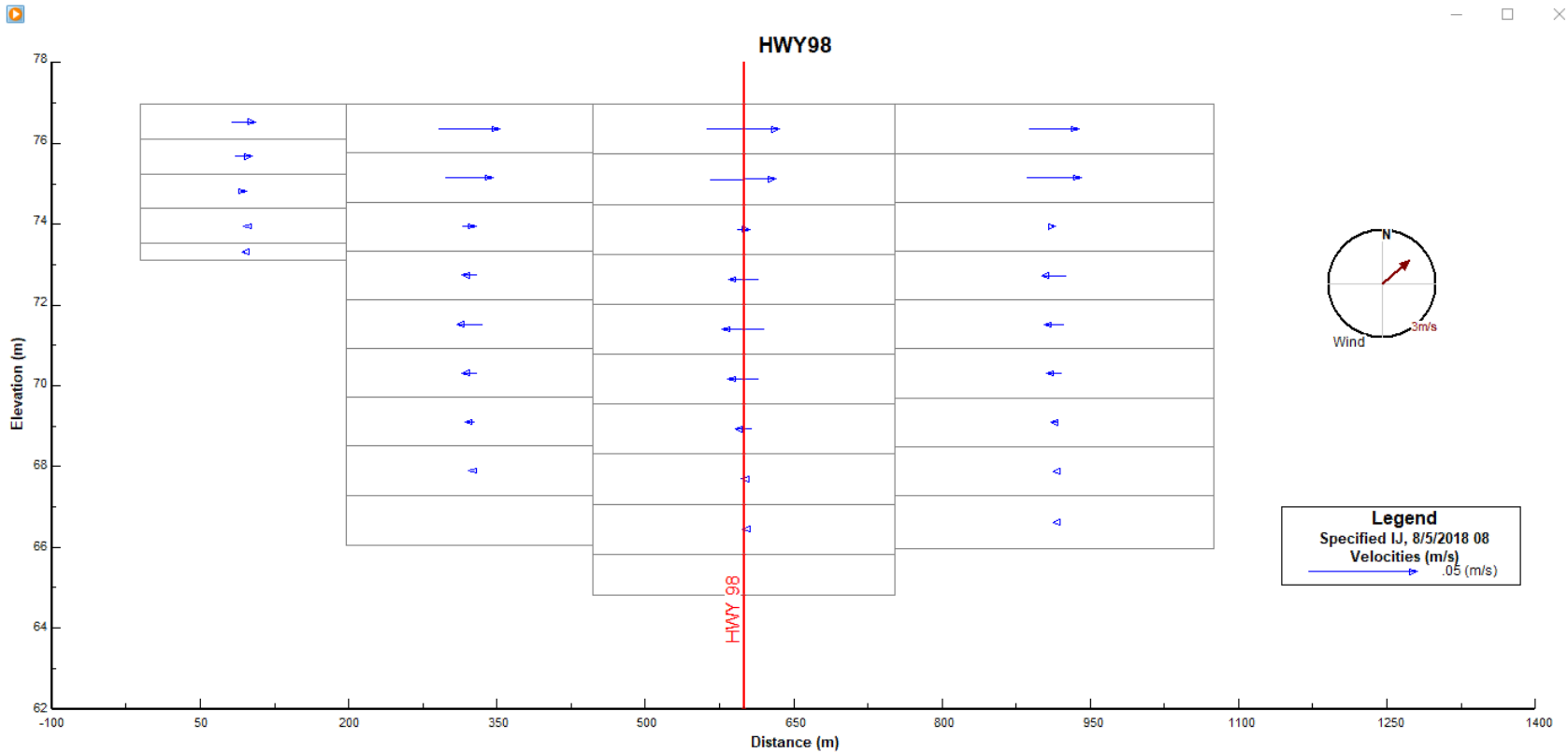
Arrows to the right indicate flow toward the dam

Bidirectional Flow at HWY 98 on 8/1/2018 00:00



Arrows to the right indicate flow toward the dam

Bidirectional Flow at HWY 98 on 8/5/2018 08:00



Arrows to the right indicate flow toward the dam

Water Movement Videos

Scenario Screening Workgroup Status

- Developing a selection process for choosing scenarios and a preliminary list of scenarios to evaluate
- The 7th meeting for workgroup was held September 20, 2021
- Two subgroups of this workgroup are working on scenario forms for scenarios preliminarily assigned a high priority
- The workgroup will meet again in November to conclude its charge and bring recommendations to the MRSW and PFC

Multi-year UNRBA Stage II Re-examination Timeline

★ In progress
✓ Completed

Coordination with the UNC Collaboratory and Extensive Communication Efforts

NCEMC adopts Falls Lake Nutrient Management Strategy NCAC.2B.0275

2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023

1
Planning

2
Monitoring

3
Modeling

4
Developing New Strategy

✓
Planning for the Re-examination

✓
Developed and Submitted Monitoring QAPP

✓
Began Monitoring August 2014

✓
Continued Monitoring

✓
Developed Modeling QAPP

✓
Modeling QAPP Approved February 2018

✓
Completed Monitoring Program

✓
Compiling Data and Configure Models

✓
Calibrate Watershed Model

★
Calibrate Lake Models

Evaluate Scenarios, Costs/Benefits, Management Actions

Propose Revised Strategy

**Status of the UNRBA Stage I
Existing Development Interim
Alternative Implementation
Approach (IAIA)**

Status of the IAIA Program

- A reporting tool has been developed to assist the IAIA participants in tracking eligible projects and compliance with the Program
- The draft tool has been reviewed by the IAIA Reporting Workgroup:
 - Sandi Wilbur and Lance Fontaine, City of Durham
 - Terry Hackett, Town of Hillsborough
 - John Huisman, DWR
- The “[About Us](#)” page on the www.unrba.org website has been updated to include a copy of the revised Bylaws including the UNRBA IAIA Program Document.

Review and discussion of the IAIA Reporting Tool

Status of Proposed Chlorophyll-a Site Specific Standards for High Rock Lake

Status of Proposed Chlorophyll-a Site Specific Standards for High Rock Lake

- In July, the EMC voted to send the proposed High Rock Lake Site Specific Water Quality Standard out to public hearing.
 - The official public notice was issued in the September 1st edition of the NC Register.
 - The hearing was held virtually on October 28th
 - Comment period ends on November 15th
- Proposal is precedent setting for site specific chlorophyll-a criteria in NC lakes and reservoirs and will likely affect the process for Falls Lake site specific standards.
- At the September 15, 2021, Board meeting, the Board reaffirmed authorization of the Executive Director to comment on this rule-making precedent
- UNRBA comments were submitted on October 26, 2021

Plan for Statistical Model Development and Regulatory Options for the Chlorophyll-a Water Quality Standard

Planning for Development of a Petition for Site Specific Criteria

- A primary task for the legal team is to begin consideration of a petition for site specific criteria for Falls Lake
- The UNRBA Statistical Model of Falls Lake will be used to support this effort
- Evaluation of other State's site-specific standards for chlorophyll-a and nutrient-related standards is ongoing.
- The legal team and the statistical modeling team are coordinating on this effort as well as with Dr. Marty Lebo and the Environmental Finance Center funded by the UNC Collaboratory.
- Evaluation of other State's site-specific standards for chlorophyll-a and nutrient-related standards is ongoing.

Statistical Modeling Framework

- Designed to incorporate many types of data, information, and expert knowledge
- Inform decision making using a structured tool
- Test management scenarios for impacts
 - Loading
 - Lake water quality
 - Designated uses
- Understand the relationships among parameters (e.g., if “this” goes up, what is the likelihood “that” will go up?)
- Can incorporate additional considerations like cost benefit analysis
- Useful for the evaluation of setting site specific criteria

Falls Lake Information Overview

Inputs to Falls Lake

- Inflow volume & timing
 - USGS flow gauge data
 - Wet vs. dry conditions
 - Storm events
- Concentrations (or loads) of nutrients, sediment, organic matter in inflows
 - Local watershed and lake data
 - Management scenarios based on WARMF watershed model
 - Empirical estimates using historic data
- Climate
- Atmospheric deposition
- Lake outflows and withdrawals
 - USGS flow gauge data below the dam
 - City of Raleigh withdrawal data

Water quality & processes in Falls Lake

- Organic Carbon
 - Particulate/Dissolved
 - Watershed/Algal
- Dissolved Oxygen
 - Surface/Hypolimnetic
 - Spatial extent of anoxia
 - Percent of time or percent of volume hypoxic, anoxic
- Nitrogen
 - Inorganic/Organic
 - Sediment release
 - N-fixation, denitrification
- Phosphorus
 - Particulate/Dissolved
 - Sediment release
- Algae
 - Chlorophyll-a
 - Species Composition
 - Biomass
 - Toxin release
- pH
- Clarity (Secchi Depth)
- Residence time
- Temperature

Water Quality Standards

Designated Uses

- Safe drinking water
 - Taste, Odor
 - DBPs
 - TOC removal
 - Filter clogging
- Aquatic Life
 - Dissolved Oxygen
 - Fish Kills
- Recreation
 - Fishing (DO stress, food)
 - Swimming (pH, algal mats, odor, clarity)
- Flood control

WQ Criteria

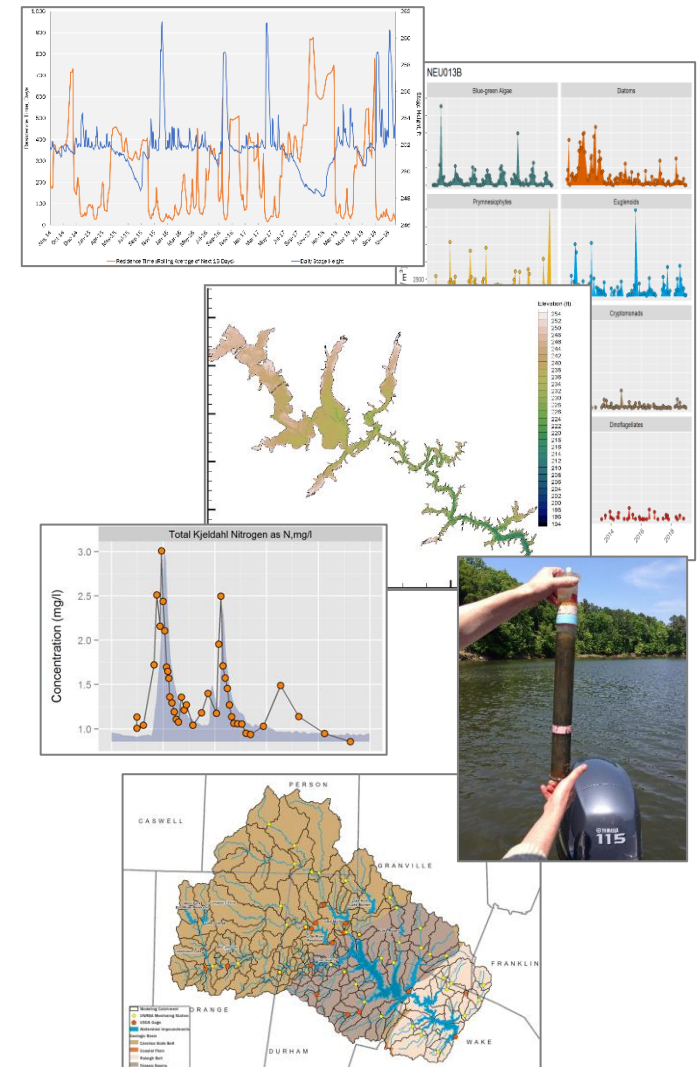
- Dissolved oxygen
- pH
- Chlorophyll-a
 - 90th percentile
 - Geomean
 - Arithmetic mean
- Total organic carbon (SDWA)

Data and WARMF/EFCD Model Driven

Probabilistic/Bayesian Predictions

Falls Lake is the Most Studied Reservoir in NC

- Watershed stream flow and water quality data and lake water quality data
 - UNRBA, USGS, DWR, local governments, CAAE
- Lake bathymetry, water movement, stage
 - UNRBA, UNC Collaboratory, USACE
- Lake sediments, special studies
 - UNRBA, UNC Collaboratory, EPA, DWR
- Loading estimates to the lake
 - WARMF, 2019 Monitoring Report (LOADEST and GAM)



USGS: U.S. Geological Survey, DWR: Division of Water Resources, CAAE: Center for Applied Aquatic Ecology, WARMF: Watershed Analysis Risk Management Framework GAM: general additive models

Data Sets Acquired

- Local (extended through 2020)
 - Tributary water quality data and flow data
 - Lake water quality data
 - Lake levels
- National
 - National Aquatic Resource Surveys National Lakes Assessment (NARS-NLA) (2007, 2011, 2017)
 - National Eutrophication Survey
 - One Health Harmful Algal Bloom System (OHHABS) (requested)
- Loading models
 - General Additive Models developed for the 2019 Annual Monitoring Report
 - WARMF model simulations

Next Steps for Model Development

- Follow up with CDC staff to obtain OHHABS data
- Continuing meeting virtually with local experts to discuss available information on satisfaction with designated uses
- Continue compiling data and models to begin model building

Communications Support

Continued Coordination with the UNC Collaboratory

- The UNRBA and UNC Collaboratory met virtually to discuss research studies for FY22
- The Falls Lake researchers will continue presenting at upcoming UNRBA MRSW and PFC meetings to ensure the modeling team is integrating these studies into the models
- The UNRBA Modeling Team has been and will continue to reach out to the Falls Lake researchers as the modeling progresses to ensure the best science and available information is incorporated
- The UNRBA Executive Team is coordinating with staff from the Environmental Finance Center to provide information that may be relevant to their Year 3 scope of work

UNRBA Technical Stakeholder Workshop

- The UNRBA Technical Stakeholder Workshop was postponed until FY2022 (this fiscal year) due to COVID-19 and the Collaboratory/UNRBA Symposium.
- Anticipate first half of meeting to provide an update on model calibration for WARMF and EFDC and loading summaries to Falls Lake
- Second half is typically small group sessions; potential topics include review and stakeholder input of
 - Discussion of scenarios under consideration
 - Data sources for the statistical model
 - Output metrics for the statistical model
- Recent developments with COVID-19 will likely require either holding the workshop virtually or delaying until early 2022

Meetings with DWR, DEQ, and EPA

- DEQ leadership
- DWR planning and modeling groups
- The Executive Director and his team discussed the modeling project with Tim Wool at EPA Region 4 on August 30th 2021
- Fred Andes at Barnes and Thornburg is looking into opportunities (conferences/meetings) to highlight the work of the UNRBA to EPA

External Stakeholder Communication Needs

- Objectives continue to be reviewed relative to communication opportunities with stakeholders.
- To support the re-examination process and achieve broad support for the UNRBA recommendations, additional outreach to external stakeholders including DWR, DEQ, and other interested stakeholders is needed;
- Coordination with local leaders to convey messages and facilitate outreach will be necessary.
- This effort will require the support of the UNRBA membership, staff and Board representatives.
- As a reminder, the [Infographic](#) and [Fast Facts](#) are available online <https://upperneuse.org/resource-library>
- An [Overview of the Work of the UNRBA](#) provided to the UNC Collaboratory for inclusion in their reporting is available online <https://nutrients.web.unc.edu/resources/>

Other Status Items

Ongoing Items

- An audit was conducted by Winston, Williams, Creech, Evans & Co., LLP. The results of the audit will be presented by Carleen Evans at the November 17, 2021, Board Meeting.
- Intensive workgroup activity and management of expectations and resources—A lot to do between now and recommendations in 2023
- Ongoing DEQ/DWR Items
 - MOA
 - Neuse Watershed Model Information Session – Delivery Factors for WWTP

Future Meetings as Currently Scheduled:

Next BOD Meeting: November 17, 2021, 9:30 AM to Noon

Next MRSW or PFC Meeting: December 7, 2021, 9:30 AM to Noon

Closing Comments Additional Discussion