Request for More Information

May 10, 2024

SENT VIA EMAIL

TOWN OF DURHAM-DPW
C/O RICH REINE
100 STONE QUARRY DR
DURHAM NH 03824

Re: NHDES Wetlands Bureau File 2024-00344, Mill Pond Dam Removal, Durham

Dear Applicant:

The New Hampshire Department of Environmental Services (NHDES) Wetlands Bureau reviewed the above-referenced Standard Dredge and Fill Wetlands Permit Application (Application). Pursuant to RSA 482-A:3, XIV(a)(2) and Rules Env-Wt 100 through 900, NHDES Wetlands Bureau determined the following additional information is required to complete its evaluation of the Application:

Prior to NHDES receiving the Application, NHDES provided a Technical Review Comment Memo dated January 9, 2024, by Kevin Lucey, Habitat Coordinator, NHDES Coastal Program and William Thomas, River Restoration Coordinator, NHDES Dam Removal & River Restoration Program (the "Memo") (attached).

1. The application references the Oyster River Dam at Mill Pond Feasibility Study (dated November 2020) (FS) in several locations regarding many responses to the above-referenced rules, please provide the FS.

2. The application included a waiver request of Env-Wt 307.13(d) as you have not received consent from abutters for impacts within 10 feet of their properties. Has there been any further communications with these abutters? Was a request for their consent mailed via USPS certified mail/return receipt?

3. In accordance with Env-Wt 311.06(g), the application provided the Natural Heritage Bureau of the NH DNCR (NHB) memo containing the NHB identification number, results, and recommendations from NHB; however, the application did not include the requested follow-up with NHB per their November 16th, 2020 memo nor the December 21, 2023 email.

4. In accordance with Env-Wt 311.06(i), as this project is in the Oyster River local advisory committee (LAC) jurisdiction, provide a statement of whether the applicant has received comments from the LAC and, if so, how the applicant has addressed the comments (attached).

5. As previously raised in Item 4 of the Memo, proposing stones cross-vanes within the stream channel restoration design contradicts Env-Wt 514.02(b)(3) as the design adversely affects the stream course such that water flow will be transported by the stream channel in a manner that the stream maintains it dimensions, general pattern, and slope with nonnatural raising of the channel bed elevation along the stream bed profile. Further, there is no information corroborating the necessity of the cross-vanes particularly as stream flows on average within the Oyster River have a median and mean of 19 ft3/s and 27 ft3/s, respectively. Please address the issues raised in Item 4 of the Memo.

6. The application asserts compliance with Env-Wt 514.02(d) as the plans referenced comply with the applicable design standard(s) but no rationale is provided pursuant to Env-Wt 514.03(c)(6).

7. Per Rule Env-Wt 514.04(i), revise the stream restoration project design to be in accordance with NEH 654, Stream Restoration Design, dated August, 2007, Natural Resources Conservation Service of the U.S. Department of Agriculture (NRCS), available as noted in Appendix B.

8. The proposed stormwater outfalls to be riprapped must provide the project-specific information required for a proposed outflow structures as indicated in Env-Wt 516.03. Item 2 of the Memo raised concerns relative to stormwater discharge locations, please address these concerns.

9. The following assertion in the Application is not correct, "Note that although some sediment will be excavated to accomplish the Project goal of restoring/reconstructing the Oyster River channel within the Project area to a stabile configuration, this is not a dredging project. Consequently, we have not explicitly addressed Env-Wt 523." The excavation within the Oyster River of accumulated sediment is defined as dredging pursuant to Env-Wt 102.59 *"Dredge" means to dig, excavate, or otherwise disturb the contour or integrity of the bank or bed of a wetland, surface water, or other jurisdictional area.* Therefore, compliance with Env-Wt 523 must be achieved.

10. While the Application mentioned contaminated soils in many sections, a plan must be submitted identifying all known potential sources of soil or water contamination; and if potential sources are documented, provide the method of sampling for contaminants and a plan to manage contaminated materials in accordance with Env-Wt 523.03(g) and (h). Item 5 of the Memo requested a Sediment Management Plan to address these rules as well.

11. Items 1 and 2 of the Memo raises serval concerns relative to and necessitate responses pursuant to the project-specific information required in Env-Wt 523.03 for the proposed dredging project.

12. Item 2 of the Memo identified inconsistencies of the dredge volume and were not addressed in the Application. In accordance with Env-Wt 523.03(a)(1), provide a description of the material and area to be dredged, including the volume of material to be dredged, in cubic yards for projects in public waters. In accordance with Env-Wt 523.03(a)(2), provide a description of the material and area to be dredged, including the square footage of the area to be dredged for non-public waters or wetlands. This information is also required to satisfy Env-Wt 525.03(d)(3).

13. Item 3 of the Memo raised concerns relative to Env-Wt 524 and Env-Wt 525, please address.

14. In accordance with Env-Wt 603.03(a)(2), depict documented shellfish sites, existing salt marsh, salt marsh migration pathways, the 100-year floodplain, and eel grass beds that might be impacted by the proposed project.

15. In accordance with Env-Wt 603.02(d), explain all recommended methods and other considerations to protect the natural resource assets during and as a result of project construction in accordance with Env-Wt 603.04, Env-Wt 311.07, and Env-Wt 313. As stated in Item 1 of the Memo, "Given that there are commercial oyster farms and recreational molluscan shellfish harvest areas near the mouth of the Oyster River, located approximately 2.5 miles downstream of the Mill Pond Dam Removal Project, NHDES Shellfish Program recently initiated consultation with the Food and Drug Administration (FDA) regarding dam removal sediment management relative to the requirements of National Shellfish Sanitation Program. Consultation is ongoing."

16. In accordance with Env-Wt 605.01(b), in addition to the avoidance and minimization requirements in Env-Wt 307, Env-Wt 311.07, Env-Wt 313, and Env-Wt 603.04, ensure that the proposed project in coastal areas does not impair commerce of the general public. Specifically, numerous oyster farms are located downstream. The follow statement in Section 5.3.4 of the Application is very alarming, "Regarding ecological risk, the study results indicated that sediment samples collected throughout the study area contained concentrations of PAHs and/or metals with a moderate to high potential for adverse effects to ecological receptors (marine and/or freshwater). This in in conflict with the statute, ***RSA482-A:1 Finding of Public Purpose. –*** *It is found to be for the public good and welfare of this state to protect and preserve its submerged lands under tidal and fresh waters and its wetlands, (both salt water and fresh-water), as herein defined, from despoliation and unregulated alteration, because such despoliation or unregulated alteration will adversely affect the value of such areas as sources of nutrients for finfish, crustacea,*

shellfish and wildlife of significant value, will damage or destroy habitats and reproduction areas for plants, fish and wildlife of importance, will eliminate, depreciate or obstruct the commerce, recreation and aesthetic enjoyment of the public, will be detrimental to adequate groundwater levels, will adversely affect stream channels and their ability to handle the runoff of waters, will disturb and reduce the natural ability of wetlands to absorb flood waters and silt, thus increasing general flood damage and the silting of open water channels, and will otherwise adversely affect the interests of the general public.

17. In accordance with Env-Wt 603.08(a), using current predicted NOAA tidal datum for the location, and tying field measurements to NAVD 88, field observations of at least 3 tide events, including at least one minus tide event, must be located to document the range of the tide in the proposed location, and must show the levels listed in Env-Wt 603.08(a)(1) through (7). In accordance with Env-Wt 603.08(b), to support how water depths were determined, in the application project narrative, provide the date, time of day, and weather conditions when water depths were recorded, and the name and license number of the licensed land surveyor who conducted the field measurements. Specially, observe the highest observable tide line at a higher new or full moon.

Please submit the required information as soon as practicable. Pursuant to RSA 482-A:3, XIV(a)(2), **the required information must be received by NHDES Wetlands Bureau within 60 days of the date of this request (no later than July 11, 2024), or the Application will be denied**. Should additional time be necessary to submit the required information, an extension of the 60-day time period may be requested. Requests for additional time must be received prior to the deadline in order to be approved. In accordance with applicable statutes and regulations, the applicant is also expected to provide copies of the required information to the municipal clerk and all other interested parties.

Pursuant to RSA 482-A:3, XIV(a)(3), NHDES Wetlands Bureau will approve or deny the Application within 30 days of receipt of all required information, or schedule a public hearing, if required by RSA 482-A or associated rules.

If you have any questions, please contact me at Eben.Lewis@des.nh.gov or (603) 559-1515.

Sincerely,

Eben M. Lewis
Southeast Region Supervisor, Wetlands Bureau
Land Resources Management, Water Division

enclosures

ec: Peter Walker VHB
Amy Lamb, NHB
Kevin Lucey, Habitat Coordinator, NHDES Coastal Program
William Thomas, River Restoration Coordinator, NHDES Dam Removal & River Restoration Program
Chris Nash, NHDES Shellfish Program
James O'Rourke, NHDES Waste Site Remediation
Durham Conservation Commission
Oyster River LAC

Technical Review Comment Memo

From:
Kevin Lucey, Habitat Coordinator, NHDES Coastal Program
William Thomas, River Restoration Coordinator, NHDES Dam Removal & River Restoration Program

To:
Richard K. Reine, M.S.C.E., CA, Director of Public Works, Durham
April Talon, PE, Town Engineer, Durham

Cc: Peter Walker, Principle, Environmental Services, Vanasse Hangen Brustlin, Inc.

Date: January 9, 2024

Re: Technical review comments for the proposed Mill Pond Dam Removal Project, Oyster River

The purpose of this technical review memo is to convey comments in response to our review of various reports pertaining to the Mill Pond Dam Removal Project and previous meetings convened between NHDES, Town of Durham and your agent, VHB on June 15, 2023, July 12, 2023, September 25, 2023, November 6, 2023, and December 7, 2023. Please note these are not intended as regulatory requirements, rather guidance identifying areas where more clarification, evaluation and/or potential data collection may be needed before advancing the project.

1. **Sediment/Soil Contaminants**
    a. According to information provided to NHDES by the Town/VHB, our understanding of sediment/soil quality pertaining to the Mill Pond Dam Removal Project, is as follows:
        i. A total of 21 sediment contaminant samples were acquired by the Town in 2009 and 2020.
            a. Eighteen of the 21 sediment contaminant samples were collected from benthic areas impounded by the Mill Pond Dam.
            b. Three of the 21 sediment contaminant samples were collected from the benthic areas downstream of the Mill Pond Dam.
        ii. An additional 10 sediment contaminant samples that were collected from benthic areas of Great Bay between 2000 and 2006 by EPA's National Coastal Assessment were recently evaluated by VHB to determine background conditions of the downstream tidal reach of the Oyster River. (Note: NHDES staff for this Project have not been provided with the analyzed/contextualized results of the NCA data for the selected sites in the tidal portion of the Oyster River. Consequently, we are unable to comment on the individual results for each of those samples).
        iii. When sediment contaminant results were compared to ecological screening criteria, it was found that:

a. All sediment samples collected from benthic areas impounded by the Mill Pond Dam were found to exceed a high ecosystem risk threshold for at least one constituent. Most samples had a combination of multiple constituents with high ecosystem risk exceedances and moderate ecosystem risk exceedances.

b. It should be noted that SED 13, SED 14, and SED1, which represent the Middle and Hammel Brook Impoundments, have sediment contaminant results that are generally dominated by low ecosystem risk results for most constituents (except for high ecosystem risk for Barium, and moderate ecosystem risk for Arsenic and several PAH's). That said, these 3 samples represent a ~0.80 mile reach of river, which relative to the volume of impounded sediment within this reach, which may not be representative of the entire reach of the Middle and Mainstem Impoundments.

c. The downstream sediment samples from the National Coastal Assessment exhibited moderate ecosystem risk exceedances across multiple constituents at the 10 sites evaluated. One NCA sample (05-248A) exhibited a high ecosystem risk exceedance for metals.

d. With regard to ecosystem risk and based on the data provided, the contaminants of concern at the Mill Pond Dam Removal Project include: multiple PAH constituents, mercury, barium, lead, cadmium, silver, and arsenic.

iv. When the sediment quality results were compared to NHDES Soil Standards, it was found that:

a. Among the metals, only Arsenic was found to exceed the S-1 criteria.

i. On page 63 of the Feasibility Study (FS), VHB provides the following rationale with regard to background concentrations of Arsenic in NH: "The S-1 standard for arsenic is based on typical background concentrations found in soils in the State of New Hampshire (SHA, 1998). Considering the larger sediment quality dataset for the study (i.e., including samples collected from within Mill Pond and further downstream of the dam), the average detected concentration of arsenic is 12 mg/kg, with the range of reported concentration between 7 and 17 mg/kg. As noted above, the relatively narrow range of arsenic concentrations (reported just above or below the S-1 standard) and relatively consistent spatial distribution (exceedances of the S-1 Standard in both upstream and downstream locations) are indicative of a naturally occurring background condition; therefore, newly exposed sediments are unlikely to represent an additional or unacceptable risk to human health."

b. Aside from the S-1 soil standard exceedance for Arsenic listed above, the only other soil standard exceedances among the 21 Town samples

occurred at Samples SED 2 and SED 3, which exhibited slight S-1 exceedances for benzofluoranthene and benzopyrene.

c. It is worth noting that sediment samples (SED 13 and SED 14) collected from Hammel Brook did not exceed soil standard exceedances. SED1 (collected from the Middle Impoundment) only exceeded the S-1 soil standard for Arsenic.

b. Given that there are commercial oyster farms and recreational molluscan shellfish harvest areas near the mouth of the Oyster River, located approximately 2.5 miles downstream of the Mill Pond Dam Removal Project, NHDES Shellfish Program recently initiated consultation with the Food and Drug Administration (FDA) regarding dam removal sediment management relative to the requirements of National Shellfish Sanitation Program. Consultation is ongoing.

c. Based on the series of meetings convened with NHDES over the past 6 months, we have learned that only a portion (~4,530 CY) of the contaminated sediments impounded by the Mill Pond Dam are proposed to be actively removed, which has raised many questions about the fate of the remaining impounded contaminated sediments and their potential negative effect on downstream resources. Based on our experience with the Sawyer Mill Dams Removal Project in Dover and Gonic Dams Removal Project in Rochester, NHDES has required those projects to remove or stabilize-in-place all accumulated sediment that exceed high ecosystem risk criteria.

d. We offer the following comments on future sediment sampling that arose during our internal review:

i. PFAS Data Gap– On page 6 of the project background, the report states: "*Testing for per- and polyfluoroalkyl substances (PFAS) is not recommended at this time since the presence of these compounds are not anticipated given the due diligence review findings*."

a. Additional consultation with the NHDES Environmental Health Program and Waste Division is recommended to consider additional testing to inform dam removal sediment handling and disposal.

2. Sediment Volume and Transport

a. Section 3.2.4.1 of the FS indicates that "based on particle size distribution of samples obtained and model derived hydraulic parameters, particle stability analysis were performed". The following bulleted items attempt to ascertain which hydraulic parameters were included in the model:

i. Does the sediment transport analysis consider tidal inundation?

1. If not, the model may underestimate sediment transport volumes. Upon dam removal, the former impoundment will be subject to tidal effects, which through bi-directional flow, increased frequency of higher water surface elevations (caused by the combined effect of freshwater discharge, tidal flow, and storm surge) will increase the tidal prism and associated scour potential of ebbing flow, which could increase sediment transport potential from the former impoundment. One

particular area of concern for increased sediment mobilization is from the floodplain wetlands on river left of the Mill Pond subunit.

ii. Does the sediment transport analysis consider stormwater discharge?

1. If not, the model may underestimate sediment transport volumes. Upon dam removal, rather than discharging to surface water, the stormwater outlets on river left will discharge through impounded sediments, which could increase sediment transport of accumulated and contaminated sediments.

b. Tables 3.2.16 - 3.2.20 published in the FS show a range of sediment transport potential from the impoundment over time based on different river discharge events. While this sediment transport analysis has been helpful to inform feasibility, these tables are difficult to interpret and require additional clarification for the permitting phase. Specifically, more detailed and more certain information is needed to better represent the total volume of sediment, potentially mobile volume of sediment, and sediment management strategies (remove, stabilize in place, passive transport) for each subunit of the project site.

i. It should be noted that the sediment transport volume estimates provided in the FS do not account for the active channel restoration that is currently proposed, making it impossible for NHDES to fully understand the total and mobile volume of sediment affected by this project.

ii. The following comments pertain to sediment volume estimates provided in Tables 3.2.16 - 3.2.20 for Hammel Brook (as summarized in the table below). Currently, the impounded portion of Hammel Brook has no discernable channel due to sedimentation caused by the hydrologic conditions created by the dam. Upon dam removal, Hammel Brook will cut through accumulated sediments as the low flow/bankfull channel connects with the mainstem Oyster River.

1. The results in Tables 3.2.16 - 3.2.20 showing that no sediment will transport from Hammel Brook during the bankfull event and only 0.7 CY of sediment will transport from Hammel Brook during the 10 year event does not seem realistic.

2. NHDES staff conducted a very simple sediment volume calculation of the 2,000 ft long reach of Hamel Brook to the confluence with the Oyster River based on the predicted 18’ channel width at the mean annual flow and an estimated 2.5’ depth of accumulated sediment, which totaled 3,333 CY, significantly greater than VHB’s estimate of 284 CY of sediment transport from Hammel Brook over 50 years that was presented in the FS.

Summary of values presented in the FS		
Reference Flood Event	**Total Sediment Volume Transported from Hammel Brook**	
	ft^3	**CY**
Mean Annual	1,538	57
2 year	0.0	0
10 Year	2	.07
100 Year	135	5
50 Year Extended Period Simulation	7,769	284

c. During the 11/6/23 meeting, VHB shared a new table Downstream Sediment Transport Quantities, which simplifies earlier sediment volumes estimate, but still leaves significant questions and concerns.

Downstream Sediment Transport Quantities

	Change	Volume Transported Downstream	Comments
Total Mobilized Sediment from Oyster River (50-year simulation)	--	9,780 CY Total	Feasibility Study Model: Assumes dam removal only with no active channel stabilization outside of dam footprint
Active Channel Restoration: Off-Site Disposal	(-4,530 CY)	5,250 CY Total	Material excavated from Mill Pond impoundment as part of active channel restoration
Potential Additional Capture in Mill Pond	(-1,330 CY)	3,920 CY Total	Volume of "scour hole" at upstream end of Mill Pond below proposed grade control (elevation 4.0 ft)
Average Annual Transport	**--**	**78 CY/year**	**Average volume of sediment/year over 50-year simulation time period.**

Table of sediment transported downstream of Newmarket Road over a 50-year period. All quantities are in cubic yards (CY). Total sediment volume quantity is from Feasibility Study sediment transport analysis. Active Channel Restoration quantity represents material excavated and removed off-site during construction. Additional capture represents potential additional material captured within the Mill Pond impoundment. Average annual transport is total sediment volume divided by number of years and is not a yearly prediction.

i. It appears that this new table has a calculation error caused by different methods for calculating sediment volumes of the Mill Pond subunit. It appears that the "Active Channel Restoration: Off-Site Disposal" volume of 4,530 CY was calculated from engineering plans prepared for the active channel restoration; whereas the "Total Mobilized Sediment from Oyster River" volume of 9,780 CY was calculated from the sediment transport analysis published in Table 3.2.20 of the FS. The "Downstream Sediment Transport Quantities Table" shows 4,530 CY as the volume of sediment to be removed, however, the FS analysis shows that only 2,369 CY will transport from the Mill Pond Unit. This creates a delta of 2,161 CY, which was then subtracted from the "Total Mobilized Sediment from Oyster River" volume. In NHDES' calculations in table below that doesn't subtract the over excavation amount from the total mobile volume, it appears that the total quantity that could transport to Great Bay is 6,081 CY.

	Change	Volume Transported Downstream
Total Mobile Sediment From Oyster River (50Yr)		9780 CY
Active Channel Restoration (Off-site disposal) *amount predicted in sed transport model	(63,982 ft^3)2369 CY*	7411 CY
Active Channel (Over Excavation /Not deducted from total mobile volume)	2161 CY	
Potential In pond capture	1330 CY	6081 CY

ii. "VHB's Downstream Sediment Transport Quantities" table above indicates that 1,330 CY of contaminated sediment will deposit in the scour hole ("pool"). For the following reasons, we have concerns with this sediment capture concept:

1. We believe its plausible that the pool will remain a high energy environment due to the bedrock geomorphology and the significant the hydrologic inputs/hydraulic effects of College Brook, Oyster River mainstem, and Hammel Brook.
2. Additionally, it appears the character of the upstream sediments in the middle impoundment are comprised of a higher proportion of organic matter, silts, and clays, which are more likely to become mobilized into the water column during storm events rather than deposit in the pool.
3. Regardless, this in-pond sediment capture rationale is attempting to make a regulatory distinction where there is none. Upon dam removal, the pool will become a tidal resource and subject to the same considerations and protections of other downstream tidal resources.

iii. Using an average annual sediment transport estimate of 78 CY/ Year is not an appropriate method of characterizing the rate of sediment transport upon dam removal. A more likely scenario is that sediment transport will occur in large pulses, with the largest volumes of sediment expected to transport in the nearer term (3-5 years) under moderate discharge events. In fact, the Tables 3.2-16 -19 within the FS already calculated those more realistic sediment transport values, as follows:

Mean Annual Flood Event	3,991 ft^3	148 CY
2 Year Flood Event/ Bankfull	19,856 ft^3	735 CY
10 Year Flood Event	26,073 ft^3	966 CY
100 Year Flood Event	17,976 ft^3	666 CY

1. The most reasonably foreseeable design event that has the greatest potential for initial bed load transport post dam removal that has already been modeled is the 10-year design event, which is presented in

in Table 3.2.-19. Table 3.2-19 depicts that 26,073 cubic feet (966 CY) of sediment will transport from Middle, Mainstem and Hammel Brook during that design event.

2. The sediment transport analysis presented in the FS jumps from evaluating a 10 Year Flood Event to a 100 Year Flood Event, creating a significant gap in understanding sediment transport potential for the all flood events in between a 10 year and 100 year flood event.

3. In the absence of improved modeling results, we would recommend that the 10-year sediment transport value of ~1,000 CY be considered as the minimum potential adverse effect (caused by sediment volume) from a single flood event that could occur from passive sediment strategy for the areas upstream of Mill Pond. That said, it is also reasonably foreseeable that multiple flood events could happen in succession in one year.

d. In summary, it has been difficult for NHDES to understand the total and mobile sediment volumes for this dam removal project due to volume estimation methods and interim products that are inconsistent with the FS. In the bullets above, we have identified the potential for greater volumes of potentially mobile sediment than has been presented to date. Because of the significant complexity of the hydraulic setting, perhaps a different and simpler method for calculating potentially mobile sediment should be determined. One idea is to imagine a fully adjusted condition of the river, which would be accomplished by estimating the bankfull width along the entire reach affected by the dam removal and multiplying it by the expected scour depth based on known inverts.

3. Re-vegetation Plan

a. With regard to tidal datum reference elevations and resultant conditions upon dam removal. The FS indicated that:

i. MHHW was 4.4'. Now its 3.6'. NHDES understands that this revised number is based on measured data from the wagon hill living shoreline project. Has this new tidal water elevation data been locally referenced to indicators of tidal inundation such as water stains and debris on the bridge or dam? This would be a valuable step.

ii. Figure 3.2-10 shows "Dam Removal Predicted Tidal Influence and Wetland habitats". Considering the significant change (lowering) of the predicted water surface elevation for MHHW that dictates the upgradient presence of upstream tidal wetlands, an updated figure that predicts tidal inundation and resultant plant communities would be valuable for restoration project development and implementation. This revised figure should accommodate for:

1. The preferred alternative (Active channel)

2. Settling of impounded sediments in the floodplain wetlands.

3. Near term expectations of sediment transport in upstream reaches.

b. Due to the unique setting of this head of tide dam, a comprehensive re-vegetation strategy will be necessary.

i. Adequate predictions of tidal wetland plant community are necessary that consider future: salinity, hydroperiod, aspect, canopy cover, as well as the amount of settling that is expected upon dewatering impounded sediments.

ii. We would recommend detailed restoration plans to stabilize sediments in the riverbank floodplains on river right and river left of the Mill Pond sub unit. The plan to restore the river left floodplain wetland should account for the different tidesheds (east and west).

c. There is significant infestation of invasive buckthorn on the banks of the Hammel Brook oxbow at the head of the impoundment. Upon dam removal, the dewatered sediments at the head of the impoundment are at risk of being colonized by buckthorn.

d. What is the ownership of the bed of the impoundment/river? Have contacts been made with upstream landowners to plant and monitor any areas found to be private property?

4. Active Channel Restoration

a. VHB has indicated that a grade control/cross vein/boulder weir structure is necessary at the upstream extent of the active channel to help mitigate the extent of head-cutting in the channel in the middle impoundment and Hamel Brook.

i. We have significant doubts that the proposed grade control structure will prevent/arrest/slow bed load transport of the upstream reaches. Normally grade control structures that are designed to arrest bed load transport are embedded within a channel with competent streambed material upstream and downstream of the grade control structure. In this case, because of the 200+ ft long and 20 ft deep pool that is located upstream of the proposed grade control structure, instead of holding the stream bed in place, this cross vein will only increase water surface elevation of the upstream reach, effectively backwatering areas of the mainstem river and floodplain wetlands. To date, no hydraulic modeling results have been provided to NHDES that indicate that the cross vein will perform as purported (i.e., reduce upstream headcut and lead to more sediment deposition in the pool).

ii. In addition to doubts about the effectiveness of the cross vein for the intended purposes, we are very concerned that the cross vein may have multiple unintended consequences that have yet to be considered, including the following:

1. The cross vein will increase upstream water surface elevation during normal flow, which will cause impounded sediments in upstream reaches to become regularly saturated. These impounded sediments are largely comprised of organic sediments, silts and clays, which are easily erodible. The concern is that by backwatering the upstream reaches with a cross vein, the impounded sediments in the upstream reach will be held in suspension, making them more readily subject to scour. This is of particular concern when also considering the significant hydrologic inputs of College Brook and Oyster River that will discharge directly into the backwater created by the cross vein. So, rather than reducing sediment transport from upstream reaches, our concern is

that the cross vein may end up accelerating channel scour of the upstream reaches.

2. By backwatering the upstream river channel and river bank wetlands with the proposed cross vein, the hydroperiod of upstream wetlands and river channel will change from the expected dam removal condition (i.e., irregularly flooded tidal wetlands) to regularly or permanently flooded tidal wetlands. Hydroperiod is critically important to the establishment of native tidal wetland plant communities that would be expected with a dam out condition (i.e., brackish riverbank tidal wetlands and high marsh tidal wetlands). If the upstream areas are too wet, no vegetation will establish.
3. The other related and significant concern of impounding freshwater with a cross vein is that it will very likely improve conditions for invasive phragmites, particularly toward the upland edges throughout the reach and at stormwater outfall on river left.
4. By backwatering the upstream river channel, the proposed design will create lentic water conditions, which carries the similar risks of water quality impairments and poor instream habitat conditions that exist within the existing impoundment.
5. By increasing the riverbed elevation within the active channel, we would be concerned of the potential for the mainstem to re-route into adjacent floodplains through avulsion of less resistant unconsolidated channel bottom on river left.
6. By increasing riverbed elevation within the active channel, the newly perched channel could go dry for a longer durations, affecting fish and wildlife as well as recreational boating.

5. Sediment Management Plan

a. To date, we have not received enough information to come to a consensus that it is acceptable (when considering both sediment quality and quantity) to allow the impounded sediment to transport downstream.

b. Due to concerns about the quality, quantity, and transport of impounded contaminated sediments into Great Bay, we suggest preparing a standalone sediment management plan (SMP). The SMP would summarize the due diligence investigations conducted during the Feasibility Study, incorporate new data and agency feedback, and include the detailed descriptions of all the proposed practices for sediment management during the dam removal construction project. The SMP would be organized based on the units defined in previous VHB publications (see map below), which represent the hydrologic and hydraulic complexity of the site and will provide the appropriate resolution for managing all of the details of this complex work. For the Mill Pond unit, we would recommend that the results be depicted as 4 sub-units (i.e., active channel, floodplain right, floodplain left (East), floodplain left (West)). Otherwise, the SMP would include the following:

i. Longitudinal profiles of the impounded reaches of the oyster river, including depth to refusal results and representative channel cross section and the total volume and total mobile volume of sediment impounded by the Mill Pond Dam.

ii. The quality of impounded sediments, comparison to upstream and downstream background conditions.

iii. Ecological and human health risk rationale for proposed sediment management strategies.

iv. Hydraulic model result that show performance of proposed project elements (eg. Active channel/cross vein) at critical flow periods (water depth, water surface extent, velocities, and sheer stress information relative to the transport of impounded sediments).

v. Description of sediment management strategies:

    1. The locations and volumes of sediment that would be actively removed and the methods and practices to remove sediments.

    2. The locations and volumes of sediment that could be stabilized in place and the methods and practices to stabilize sediments.

    3. The locations and volumes of sediment that are proposed for passive downstream transport and estimated locations of sediment deposition.