Hoffman, Andrew

From: Hoffman, Andrew
Sent: Thursday, October 1, 2020 10:48 AM
To: 'Peter L. Britz'
Cc: hull.richard@epa.gov; Chris Buckman; Mongeon, Robin; Kenison, Karlee; YuhasKirn, Sarah; Wimsatt, Mike; Soukup, James; Tilton, Mary Ann; Price, David
Subject: RE: Treatment Memo
Attachments: MEMO-Coakley Surface Water Treatment_NHDES_final_Comments.docx; HB 494 final-version.pdf

Peter,

Thank you for providing this Memo on the CLG's proposal to implement a treatment system to remove PFAS from surface waters of Berrys Brook. We offer the comments below and imbedded in the attached original Memo for your consideration in modifying the design with the intent of improving the likelihood of a successful pilot study.

The activities described seem more intended as a pilot study than full-scale implementation. It may be more prudent to refer to this initial deployment of the BAM treatment technology as a 'Pilot Study'. This would reduce the expectations of the outcome, giving the Group more flexibility in modifying and improving on the design based on data gathered from the testing. The Memo would also benefit from a description of the objectives of the work (Pilot Study). Without a clear statement as to what the objectives are, it is difficult to measure success. By referring to the work as a 'Pilot Study' and stating the objective as 'evaluating the effectiveness of the BAM technology at treating the site-specific PFAS compounds/concentrations' (or similar), allows for a broader definition of success. As currently written, the Memo seems to describe full-scale implementation of the BAM technology, which would imply failure if performance monitoring suggests there is not a "substantial reduction of the contaminants entering Berry's Brook from the Coakley Landfill Superfund Site" as required by HB 494. This could reflect negatively on the BAM technology and force the CLG to move in another direction, rather than simply modifying/tweaking the design/application of the BAM.

As a component of the design of this Pilot Study, the CLG should evaluate the impacts to existing wetlands and modify the design based on input from the NHDES Wetlands Bureau to ensure compliance with applicable substantive requirements.

With regard to the proposed deployment of the BAM technology, we agree that the engineered channel south of Breakfast Hill Road is a good location to pilot study the technology. The angular morphology of the channel is more conducive to BAM blanket deployment than a natural channel and will allow better evaluation of the effectiveness of the material. Once the effectiveness of the BAM blankets has been demonstrated in an engineered channel, application of the technology in natural channels at other areas of the Site (east side of the culvert for example) could be considered in the future as part of full-scale implementation. The Memo states that "*One end of each blanket placed in the channel will be anchored to each side of the channel at the water surface, allowing for the flow of water over and under the blankets thus facilitating the greatest surface area to be in contact with the water".* This implies that the blankets will only be attached to either side of the channel in one location (at the water surface) and allowed to 'flutter' in the flow. Without additional attachment points, it would seem that the blanket would simply float on the water surface trailing from the two attachment points. Also, "*allowing for the flow of water over and under the blankets"* does not seem like an effective way to maximize water contact with the blanket and its contents. It would seem that anchoring the blanket to the bottom of the channel by burying the bottom several inches in the channel substrate (might need to place some 1.5-inch stone to armor this seam) and not allowing underflow of the blanket would be a more effective approach to force water through the blanket. At times of high flow, when the flow capacity of the system is overwhelmed, water can still flow over the top of the blankets to prevent upstream flooding. Note that the height of the blankets (i.e. the highest point at which they are attached to the sides of the engineered channel) should be determined based on an analysis of flood stage(s) and not selected randomly. Multiple attachment points will be needed along the sides to minimize leakage around the sides and thereby maximize treatment.

The product literature provided for the BAM technology (attached, as provided after Memo submission) did not include any discussion of the contact time needed for effective adsorption of the PFAS. The treatability study referenced an initial concentration of 213 ppt PFOA+PFOS (total PFAS loading was 802 ppt). Recent sampling results from SW-110, located just downstream from the proposed BAM deployment area, show a total PFOA+PFOS concentration of 190-220 ppt. The BAM treatability test showed complete removal of the PFAS after 48 hours but it is not clear how this would correlate with the envisioned deployment configuration at Coakley. The use of resins and GAC in canisters as part of POET systems to treat drinking water typically require a minimum contact time of 3-5 minutes to get sufficient absorption to remove PFAS compounds. The Memo does not discuss the thickness of the blankets or what the expected contact time between the surface water and the treatment media within the blankets is likely to be. It may be that the contact time is insufficient to allow appreciable absorption of the PFAS. The study may therefore want to evaluate the effectiveness of varying thicknesses of BAM blankets. The Memo suggest that up to four (4) blankets may be deployed in series along the engineered channel. The Group may want to consider using different thickness blankets at each of the four locations and then testing in between the four series of blankets to evaluate the PFAS reduction as the surface water moves through the blanket series. This will allow a side-by-side comparison and evaluation of the impact of blanket thickness on PFAS removal.

The Memo states that samples will be collected roughly every 3 weeks. Given the relatively short timeframe available this fall for the Pilot Study testing, the CLG may want to consider collapsing the schedule and doing more frequent testing (once per week) over a shorter overall timeframe to gather the data needed to evaluate the effectiveness of the technology so that adjustments and improvements can be developed during the winter months when the system is not deployed. This shorter, more intensive testing approach is more consistent with a Pilot Study than full-scale implementation and would further support describing the work as such (see earlier discussion).

Lastly, the CLG may want to consider installation of a metal grate or wire mesh upstream of the blankets to screen out any larger floating debris such as sticks or logs to protect the blankets. The grate could be installed at the upstream end of the engineered channel. This will also facilitate maintenance of the system, as it will be easier to removed debris from a rigid grate or screen than a pliable blanket.

And, as we've discussed with EPA, the implementation of the pilot study to address HB 494 cannot delay or interfere with the implementation of the remedy as required by the ROD, and any ongoing or future investigation activities as directed by EPA such as the upcoming well installation and pumping test.

Upon incorporating comments, please have the memo and supporting documents uploaded to OneStop.

Let me know if you would like to discuss these comments in more detail.
Thank you,
Drew

***Andrew Hoffman**, P.E.*
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From: Peter L. Britz <plbritz@cityofportsmouth.com>
Sent: Thursday, September 17, 2020 3:16 PM
To: Hoffman, Andrew <Andrew.J.Hoffman@des.nh.gov>
Cc: hull.richard@epa.gov; Chris Buckman <cbuckman@cesincusa.com>
Subject: Treatment Memo

Hello Drew:

Here is a memo describing the work the Coakley Landfill Group is planning, through its contractor CES, to comply with HB-494.
If you have questions or need additional information please do not hesitate to contact me.
Regards,
Peter

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Peter Britz
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CES INC Engineers • Environmental Scientists • Surveyors

MEMO

To: Peter Britz, Coakley Landfill Group

From: Christopher Buckman

Re: Surface Water Treatment Options – House Bill 494

Date: September 17, 2020

New Hampshire House Bill 494 (HB 494) requires that the New Hampshire Department of Environmental Services (NHDES) propose a remedy to "ensure the substantial reduction of the contaminants entering Berrys Brook from the Coakley Landfill Superfund site." The Coakley Landfill Group (CLG) has evaluated available treatment technologies feasible in design and implementation to address HB 494 requirements.

HB 494 does not define specific contaminants to be addressed, however, the United States Environmental Protection Agency (USEPA) and NHDES focus has primarily been on per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. Given that 1,4-dioxane has generally not been detected in surface water samples outside the groundwater management zone (GMZ), this discussion of the proposed remedy will focus on reducing PFAS concentrations in general.

Investigations to date have demonstrated that PFAS in overburden and shallow bedrock groundwater discharge to the large wetland complex located west of the landfill. This complex ultimately becomes Berrys Brook, although a defined stream channel does not exist until the north end of the wetland complex, near Breakfast Hill Road, approximately 3,000 feet north of the landfill (**Figure 1**). Except during significant rain events, it appears that most or all of the PFAS entering the wetland complex result from the discharge of groundwater to the surface. This is supported by regular flow (baseflow) observed within the stream channel during prolonged periods of no measurable precipitation. During rain events, PFAS found in landfill stormwater discharge is also a source of contamination to the complex. For the reasons provided in this letter, the area near Breakfast Hill Road where the defined stream channel exists is the most appropriate location for treating PFAS that enter Berrys Brook from the Site. Although the treatment will not occur until after the PFAS has entered the headwaters of Berrys Brook, the system described below appears to be the most feasible way to treat the groundwater and periodic stormwater flows containing PFAS discharging to what becomes Berrys Brook.

The approach to treatment options will be the implementation of a passive remedy that requires minimal maintenance and provides an assessment of concentration reduction. The recommended remedy has proven capability to absorb PFAS and is designed to provide a reduction in PFAS concentrations in surface water exiting the GMZ. The treatment area, as illustrated on **Figure 1**, is generally located at the north end of the GMZ, west of the former railroad easement, and east

Commented [SJ1]: Recommend that this be called a 'pilot study' to assess the effectiveness of the proposed alternative; and not full scale implementation. State the objectives of the work in the intro section so it is clear what is intended to be accomplish with this effort. Success will be measured by comparison against the stated objectives.

Commented [HA2]: Consider appending final version of HB 494.

Commented [HA3]: Evaluation of treatment technologies is not presented in this memo. Consider modifying this sentence as follows "The CLG has prepared this work plan for implementing a pilot-scale treatment system to address the requirements of HB 494 (attached)."

Commented [HA4]: Although these contaminants have been the focus of recent investigations, it is important to pointed out that the ongoing implementation of the remedy and the achievement of the cleanup goals included in the ROD and ESDs is the focus of EPA's oversight, along with the investigation and risk evaluation of new contaminants.

Commented [HA5]: The limited case studies available do not provide a high level of confidence in this treatment media.

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of the residential property located at 368 Breakfast Hill Road (where private well R-3 is located). Although this area is not within the current GMZ boundary, the area was submitted to the NHDES for inclusion within a proposed GMZ expansion area in December 2018.

The viability of the remedy will be based on its effective reduction of PFAS from the surface water. It is understood that bypass during high precipitation events and seasonal treatment during warm weather months (April through October), will be considered during implementation. These considerations will include placement within the treatment area to limit potential for flow restriction and seasonal deployment to avoid freezing conditions that may reduce remedy effectiveness. This technology allows for the addition of individual components to assess the additive benefit of each and determine which system element or combination of elements provides the best overall approach. Current commercially available technologies developed and tested for the removal of PFAS are focused primarily on the treatment of soil or groundwater, where the application, mixing, or rates of treatment can be more easily controlled. With variable rates of flow, changes in seasonal contaminant concentrations, icing over of the Brook during winter, sediment loading, and potential for contribution from multiple source areas, the treatment of surface water requires a different approach.

TREATMENT TECHNOLOGY

The following treatment technology has been shown to reduce the concentration of PFAS in groundwater (soil mixing and permeable reactive barriers) and offers a potential for application in the passive treatment of surface water. The treatment of surface water has not been as widely investigated or implemented as that for soil and groundwater, in large part due to limited established surface water regulatory standards. The passive treatment option discussed below is capable of being scaled to address future objectives and take into consideration the characteristics of the identified treatment area.

Commented [SJ6]: Provide documentation of this. The information included in Attachment A is not very detailed and no data on PFAS removal is provided. I would assume that ORIN has performed some treatability testing on the BAM; it would be good to see those data referenced.

Bioavailable Absorbent Media (BAM)

BAM is a recycled cellulose bio-mass product that provides a substrate for contaminant absorption. The characteristics of BAM, analogous to that of granular activated carbon (GAC), allows for a large surface area per unit weight of material for sorption to take place. BAM is a trademark material manufactured and marketed by ORIN Technologies, LLC. (ORIN). Implementation to date has been primarily though soil blending and injection; however, ORIN has been treating surface water and stormwater passively through deployment of floating booms and curtains/blankets containing BAM (**Attachment A**) within stormwater vaults and is comparable to the passive treatment of surface water being proposed at the Site.

Commented [HA7]: What does this material look like? What are its physical properties (e.g., density, etc). What would happen if the material were released to the environment?

Commented [HA8]: Describe briefly and provide spec sheet.

Commented [HA9]: Attachment A does not provide details of such surface water treatment.

Commented [SJ10]: Should this be 'compatible with' or 'appropriate for' ?

EVALUATION REQUIREMENTS

BAM requires specific criteria for proper evaluation that include, but are not limited to, information on flow rates, defining a test area or fixture to hold the media, access to the treatment area, and a sampling schedule to determine the effectiveness of the remedy components. Flow rate measurements will be made as part of the surface water evaluation, with baseline flow measurements scheduled following beaver dam removal and prior to deployment of the remedy. Access to the proposed treatment area has been coordinated between the New Hampshire Department of Transportation and CES through the execution of an access agreement dated August 19, 2020. It is anticipated that BAM will provide the needed flexibility with regards to meeting HB 494 implementation requirements with little maintenance required beyond deployment. This maintenance includes sampling for assessment of PFAS removal and periodic inspection for debris removal (leaves and detritus) and water passage.

Commented [SJ11]: Not sure how useful baseline measurements will be. Better to get actual flow rates during deployment so that you can combine flow volumes with PFAS concentrations to calculate mass flux.

The concerned here is contact time, which is why it would be good to include the treatability test data from ORIN.

Treatment Area

The treatment area is at the north end of the GMZ and located where Berrys Brook transitions from flow within an engineered channel and box culvert to a natural channel (**Figure 1**). The south end of this transition is currently identified by the presence of a beaver dam where a surface water impoundment has been created. The portion of the treatment area selected for deployment of the remedy is the channel that exits the wetland headwaters of Berrys Brook immediately north of the dam before entering a box culvert and heading east under the railroad easement to the outfall located south of Breakfast Hill Road (**Figure 1**). This location provides regular flow throughout the year, is clearly defined with no outside contribution from railroad easement drainage features, and is an area easily accessible for implementation and monitoring. These characteristics, together with the length, width, and depth of the channel, supports the deployment of BAM-filled blankets.

The area located behind the current beaver dam impoundment is well-suited for the deployment of floating booms; however, this impoundment will undergo changes in width and depth following the removal of the beaver dam and will require reassessment for remedy options following dam removal (**Figure 1**). As such, the use of blankets within the channel will be the primary focus of the remedy assessment once surface water levels reach an equilibrium level following dam removal as discussed below. Beaver mitigation and dam removal efforts are ongoing at the time of this memorandum.

Evaluation Sampling

The evaluation of BAM effectiveness will require defined sample locations for pre- and post-treatment free from the dilution that may occur via other sources of surface drainage (railroad easement ditches) with long-term viability determined based on the effectiveness of PFAS removal in attaining the criterion set forth in HB 494.

Baseline sampling will occur in conjunction with the regular Fall groundwater and surface water sampling event required under the GMP. This sampling is typically completed in late September/early October of each year and will include the establishment of sampling locations up-gradient (just prior to entering channel) and down-gradient of the treatment system. The down-gradient, or post-treatment, location will be identified within the specified channel where water that has been in contact with the BAM can be sampled for an evaluation of PFAS removal. The nearest downstream surface water sampling location (SW-110) will continue to be sampled as part of the Fall event but will not be considered a representative post-treatment sample due to the contribution of untreated surface drainage (i.e., easement ditches and surface runoff) and unknown contribution to surface water from within the inaccessible box culvert by infiltration and seepage of precipitation.

The first BAM component to be evaluated will be blankets placed within the channel as identified above. One end of each blanket placed in the channel will be anchored to each side of the channel at the water surface allowing for the flow of water over and under the blankets thus facilitating the greatest surface area to be in contact with the water. It is currently anticipated that up to four blankets will be deployed in the channel, spaced evenly along its length. Pre-treatment sampling will occur upstream of the blankets with post-treatment samples collected downstream, immediately before where the channel enters the box culvert under the easement.

Initial post-treatment sampling will occur every three weeks following deployment (up to three total post-treatment samples for this season). Due to the current schedule, it is proposed that the blankets will be removed in November to reduce the likelihood of damage to the blankets from freezing or the buildup of ice. The effectiveness of the blankets will be evaluated based on their achievement of a substantial reduction of PFAS in the surface water. Recommendations will be made for the deployment of blankets in the Spring of 2021 and whether the evaluation of floating

Commented [HA12]: Provide a more detailed schematic of this channel with dimensional measurements, construction materials, etc.

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Commented [HA13]: And also potentially between each blanket series to evaluate the progression of PFAS removal as surface water moves through the entire treatment system.

Commented [HA14]: "At the water surface"? So water will be allowed to flow underneath the blankets? Should/could the blankets be secured to the bottom of the channel or even integrated into the channel substrate?

Commented [SJ15]: This needs some clarification. Seems like leakage will occur beneath and around the blankets. Water will preferentially flow along the path of least resistance so you will get increased flow under and over the blankets, limiting their effectiveness at reducing the PFAS concentration. The only way to get water to flow thru the blanket as opposed to around it would be to seal it off around the edges/bottom and extend it high enough so the water doesn't overtop the media under normal flow conditions. Overtopping under high flow conditions will be required to prevent flooding.

Commented [SJ16]: Recommend the collection of samples between each blanket series as well to assess the incremental removal rate. This will be data needed for full-scale design. This will also be critical to gauge breakthrough times which will be needed to define the replacement schedule.

Commented [SJ17]: This should be more clearly defined as part of the Objectives. May be prudent to use a percentage reduction in lieu of stated concentrations.

booms (or other BAM products) will be required upstream of the blankets. Each system component deployed as part of the remedy will be evaluated separately to assess the benefit each has on the overall reduction of PFAS with changes in system design based on review of post-treatment analytical results.

Should the evaluation of floating booms be needed as part of the remedy implementation, a sampling location immediately upstream of the booms will be established for pre-treatment collection. Post-treatment sampling for the booms will be performed at the blanket evaluation pre-treatment location. Analysis will be completed for the full list of PFAS compounds as included in **Attachment B** to allow for a more direct comparison with surface water samples collected in accordance with the GMP .

IMPLEMENTATION SCHEDULE

The selected remedy will be implemented during Fall 2020 following beaver mitigation efforts and dam removal. Beaver mitigation will be completed by the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS), with dam removal completed by the CLG. It is anticipated that following dam removal, the equalization of water levels within the wetland complex (east and west of the easement) will be required and will be monitored through periodic visual observation of surface water levels and the gauging of water levels within piezometers located in each area. These piezometers will be installed in locations as proposed in the Surface Water Evaluation Scope of Work (CES, 2020) and include locations PZ-8 and PZ-9; however, may require the installation of a surface water gauging location between BB-1 and BB-2 to provide information on stabilized surface water levels.

Commented [SJ18]: Consider the possibility of installing a physical strainer to remove floating debris upstream of the blankets to help minimize clogging. Something like a metal screen of some sort.

Commented [HA19]: Not sure I understand. So the booms will be placed, if determined necessary, upgradient of the blanketed channel? A schematic would be helpful. The booms will merely treat water at the surface and/or at depth?

Commented [SJ20]: With the low water levels, this may be minimal

Commented [HA21]: This location is not shown on Figure 1.

FIGURE 1

ATTACHMENT A

ATTACHMENT B