Environmental Stewardship Department/
New Bedford Conservation Commission

City of New Bedford
Jonathan F. Mitchell, Mayor

Response to comments received on the
***Draft Immediate Response Action Plan Modification* for New Bedford High School**

The following are comments (shown in italics) which were received by the City of New Bedford (City) on the above-named report. The City's response follows each comment.

Comment 1: *The IRA Plan proposes the installation of a combined hydraulic control and venting system. A vacuum blower will remove vapor-phase contaminants from a recovery well and vapors will be directed through a vessel containing activated carbon to capture organics prior to being vented through an existing unused exhaust stack to the outside air. The plan does not provide information on the location or height of the exhaust stack. To prevent contaminants from re-entering NBHS via classroom unit ventilators, exhaust should be vented well above the height of the two-story portion of the NBHS building. During the warmer months of the year, vapors extracted from the sub-surface will be at a lower temperature than ambient air. Cool exhaust vapors may collect along the roof of the building instead of readily dissipating. If the location of the exhaust vent is too near, unit ventilators that provide fresh air to the classrooms may actually draw vapors into classrooms. The Massachusetts Department of Public Health (MDPH) suggests using a portable weather station to collect meteorological information from the roof of the building and using that data to model the behavior of vapors released into ambient air to design a safe and effective exhaust system. Data from a meteorological station could be used to determine the height of the exhaust stack and the level of pressure (or alternatively depressurization) that would need to be applied to exhaust to ensure rapid and complete dispersion.*

Response: The localized subslab vapor collection system will be conducted in accordance with MassDEP policy (Off-Gas Treatment of Point-Source Remedial Air Emissions, Policy #WSC-94-150). That policy states that "…off-gas control systems (e.g., activated carbon, incineration, catalytic or thermal oxidation, or biotreatment units) must be designed, constructed, and operated in a manner that:

> (1) as specified in 310 CMR 40.0040(5), ensures the continuous reduction of at least 95% of the emitted oil and hazardous material, on a weight basis, or reduction to background level, whichever concentration is higher;
>
> (2) does not expose down-wind receptors to concentrations exceeding a level of No Significant Risk; and
>
> (3) does not expose down-wind receptors to nuisance odor conditions."

By discharging the vapors through a 200-pound granular activated carbon (GAC) canister, the

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concentrations are expected to achieve background levels. TRC will test vapors before and after the GAC treatment at intervals specified by the MassDEP Policy. The concentration of vapors entering the carbon will be used to estimate the timing for GAC replacement. If breakthrough is detected, the GAC vessel will be changed out.

Since the emissions will be treated to achieve background conditions, the stack height does not need to be altered and meteorological conditions do not need to be taken into consideration.

Comment 2: *The IRA Plan proposes using an existing unused exhaust stack for the venting system exhaust; however, it does not mention whether the integrity of the existing exhaust stack has been verified. MDPH recommends re-sleeving the exhaust vent prior to use to prevent contaminants from the venting system from re-entering occupied space through cracks that may exist in the stack. Alternatively, MDPH recommends depressurizing the exhaust stack by installing a mechanical exhaust fan at the top of the stack. Depressurizing the stack would result in clean air being drawn into the stack through any cracks, as opposed to exhaust being pushed out through cracks into the school. Installing a mechanical exhaust fan at the top of the stack with adequate horsepower would also facilitate the rapid dispersal of pollutants from the venting system.*

Response: Per 310 CMR 40.0424 (1), such design details were not a necessary element of the Modified IRA Plan. However, the stack has since been inspected by TRC and was determined to be in good condition.

The carbon treatment is designed to achieve background conditions, so it is not necessary to sleeve the exhaust vent or depressurize the exhaust stack.

Comment 3: *Exhaust from the venting system will contain significant quantities of water vapor. MDPH recommends taking the high water content of the exhaust into consideration when selecting an in-line filtration system for the venting system.*

Response: If moisture accumulates, TRC will install a knockout drum.

Comment 4: *MDPH would like to draw attention to the fact that the combined hydraulic control and venting system may draw in other contaminants un-related to the non-aqueous phase liquid (NAPL) contamination. Contaminants such as radon and hydrogen sulfide would not be addressed by the in-line carbon filter. Given the property's history as a disposal site and the proximity of the proposed hydraulic control and venting system to the school's underdrain system which communicates with the City's sewer system, the presence of hydrogen sulfide in exhaust is plausible. The plan should include analysis of system exhaust for these potential contaminants, and contingency plans should be in place to address these and other unrelated contaminants if necessary.*

Response: Regarding hydrogen sulfide, this compound is not expected to be encountered because the groundwater samples collected from this area have exhibited relatively high concentrations of oxygen. Hydrogen sulfide is a product of an anaerobic (oxygen deficient) environments. MDPH's comment that hydrogen sulfide that may be present in the city sewer system might be pulled back into the storm drain and underdrain systems by the 2 horsepower (hp) blower located over 1,000 feet from the junction of the storm system and the sanitary sewer system is highly improbable.

Radon is not a contaminant of concern to be addressed at this site. Note, too, that radon abatement systems do not include treatment other than ambient air venting. Nevertheless, GAC is an effective treatment for radon.

The anticipated schedule for sampling and analysis of system exhaust will not include analysis for radon, hydrogen sulfide, or other unrelated constituents.

Comment 5: *An operation and maintenance plan for the combined hydraulic control and venting system should be included as part of the IRA Plan Modification. Such a plan should specify the frequency with which the components of this system should be checked to ensure proper functioning. If a portion of this system should fail, it is possible that un-treated vapors or groundwater may be released. Motorized parts of this system, such as the two blowers, may be particularly vulnerable to corrosion because they will be in constant contact with damp air and chlorinated solvent vapors. In addition, system filters and granulated activated carbon vessels may become clogged or saturated. The operation and maintenance plan should include instructions on how to verify that all system components are functioning properly and when to conduct preventative maintenance (e.g., changing filter media).*

Response: A detailed operation and maintenance plan is typically prepared subsequent to system installation and startup and is not a necessary element of an IRA Plan. The concerns noted by MDPH are routine elements of operation and maintenance (O&M) for this type of system.

The IRA Plan Modification states that aqueous effluent samples will be collected on days 1, 3, 5 and 7, followed by weekly samples until week 4, then monthly samples during system operation. Air emission samples will be collected week 1, week 2, week 4, and then monthly during system operation. The system will be inspected during each visit. In addition, inspection by a certified treatment plant operator will be performed on a quarterly basis (or more frequently) as required by 310 CMR 40.0041(9). Also, the system will be equipped with an "autodialer" to notify system operators immediately of a potential problem via telephone.

Comment 6: *The IRA Plan states that the primary goal of the hydraulic control system is to prevent the migration of contaminated groundwater via the underdrain system. If it is likely that migration has occurred by this route in the past, it would be beneficial to gain a better understanding of the flow patterns and structural integrity of the underdrain system to determine if contaminated groundwater has migrated to other portions of the NBHS property or if it has primarily discharged into the City sewer system.*

Response: The City has an excellent understanding of the flow patterns in the underdrain system. The underdrain system is designed to divert flow from the center of the B-Block at the school to the perimeter drains and then to the City storm sewer. Figures showing the layout of the underdrain system have been provided in previous IRA submittals.

The structural integrity of the underdrain system is a minor concern since it is constructed of 6-inch slotted PVC set in coarse stone gravel. In the unlikely event of a break in the 6-inch PVC, water would be expected to follow the same path in the gravel.

Evidence of trace concentrations of chlorinated solvents in the storm sewer system was presented in an earlier IRA status report. Previous IRA status submittals have demonstrated that contaminant migration beyond the school footprint is insignificant.

Comment 7: *The IRA Plan states that the design flow rate for the hydraulic control system is based on hydraulic calculations included in Table 1; however, no calculations were included in the plan. The revised IRA Plan should include hydraulic calculations demonstrating that the proposed hydraulic control system is capable of maintaining groundwater at a level below the underdrain system during periods of high water flow. Information should be provided describing the lateral extent of the system's influence and whether the City's sewer system can accommodate the additional flow produced by the system. As part of the ongoing IRA investigation, an inspection utilizing a camera identified damaged sections of the City's sanitary sewer line adjacent to the southern portion of the NBHS property. MDPH suggests conducting a similar inspection of the sewer line to which the hydraulic control system will discharge, to verify that effluent will be transported off site to the City's waste water treatment plant and will not re-enter groundwater at the NBHS property.*

Response: The inadvertently omitted table is attached herein and will be provided as Appendix A to the IRA Modification. The notification letters in Appendix A will become Appendix B.

The hydraulic calculations shown in the attached table indicate a flow rate of 3 to 4 feet under high water conditions. Previous pumping at well MW-27R has had a sustained flow rate of less than 2 gallons per minute (gpm). TRC plans to monitor the influence of the pumping and add a second recovery well if necessary. The design flow rate (of 2 to 4 gpm) is not considered to be a strain on the City treatment system under any plausible scenario.

The NBHS sewer will be transporting clean (treated) water in addition to routine conveyance of sanitary wastes. There has been no evidence of discharge of sanitary wastes to the groundwater (it would have been detected in groundwater sampling on the NBHS property) and there is no concern regarding the discharge of treated wastes to the groundwater. Further inspection of the sewer line is not warranted.

Comment 8: *The IRA Plan proposes advancing a series of soil borings using a GeoProbe® direct push unit in combination with a Membrane Interface Probe System (MIPS) to better delineate the lateral and vertical extent of the NAPL source area beneath the Mechanical Room. The plan proposes advancing borings along a 2.5-foot grid within an 8-ft radius of monitoring well MW-27R and limiting the depth of the borings to 12 feet below floor level. The advantages of the MIPS technology are that it provides real-time data and avoids the cost associated with laboratory analysis. Given these qualities, it would seem to make sense to let measured VOC levels and local geology guide the lateral and vertical extent of the investigation, rather than establishing pre-determined limits. Given that VOC concentrations two to three times the*

Massachusetts Contingency Plan's GW-2 standards have also been detected in monitoring well MW-32, it would seem to be appropriate to include this well in the area being investigated.

Response: The plan is to start with a grid, then to expand this based on real-time data until the horizontal and vertical extent of the non-aqueous phase liquid (NAPL) have been defined. Conventional soil sampling with laboratory analyses would then be performed at selected locations to confirm the findings of the MIPS investigation. Although lateral explorations could extend closer to MW-32 than the initial grid, groundwater data from this well do not indicate that it is near to or within the NAPL.

Comment 9: *MDPH suggests that the IRA Plan include a description of the procedure to be followed for filling and sealing the borings advanced in the Mechanical Room after the investigation, in order to prevent contaminant vapors and groundwater from entering the Mechanical Room.*

Response: This level of detail is not appropriate for an IRA Plan. Such details will be provided following completion of the task in an IRA Status or Completion Report.

Comment 10: *The IRA Plan does not describe the sub-surface geology of the Mechanical Room. Given the relatively close spacing of the proposed soil borings, are there any concerns about the stability of the soil? Has the soil stability beneath the Mechanical Room been characterized?*

Response: Given the small diameter of the Geoprobe borings, stability of the soil beneath the Mechanical Room is not a concern.

Table 1.
Estimate of Sustainable Pumping Rate
New Bedford High School
New Bedford, MA

Statement of Problem:

TRC is planning to install a pumping system in a 4-inch diameter groundwater recovery well (MW-27R) to lower groundwater below the elevation of an underdrain system below the building. Based upon observations during drilling, the elevation of the underdrain is estimated to be approximately 82 feet. Estimate the pumping rate at the recovery well that is required to achieve this objective.

Background Information:

The area of interest is located near a mechanical room inside the New Bedford High School. The geology below the concrete floor consists of the following:

- Approximately 4 feet of fine to medium sand with gravel;
- Approximately 3 feet (average) of fine sand;
- Approximately 4 feet of silt and sand; and
- Bouldery Glacial Till.

Groundwater is present at a depth of approximately 2.3 feet below the floor of the building. Assuming that the fine sand is not contributing significant amounts of water to the recovery well and represents the bottom of the primary water-bearing soil unit beneath the building, the saturated thickness of the primary water-bearing soils is estimated to be approximately 1.7 feet. With a pump, the available drawdown at the recovery well is assumed to be approximately 1.5 feet or less (assume sand and gravel layer could be fully drained).

Water levels in certain monitoring wells were monitored during previous groundwater extraction events from MW-27R using a vactor truck. These data have been used to estimate the hydraulic properties of the primary water-bearing soils beneath the New Bedford High School. Based upon analysis of time versus drawdown data, the transmissivity and storage coefficients were estimated as follows:

Equations: $T = [(0.183)(Q)]/\Delta s$ and $S = [(2.25)(T)(t_0)]/r^2$

Where:
T = Transmissivity (ft^2/day)
Q = Pumping rate at recovery well MW-27R (ft^3/day);
Δs = Change in drawdown over one log cycle (feet);
t_0 = Projected time where drawdown is 0 (days); and
r = distance from pumping well to observation well where measurements were made (feet).
S = Storage Coefficient, Unitless

Well	Q (ft^3/day)	Δs (feet)	T (ft^2/day)	t_0 (days)	r (feet)	S (unitless
MW-27	327	0.076	748	2.1E-06	8.5	4.9E-05
MW-32	558	0.13	837	0.0076	17	0.05
		Geomean:	791			0.002

Supporting figures used to estimate Δs are attached.

Assumptions

1. Water-bearing formation is homogenous and isotropic. Based upon a review of Transmissivity, there is some variability in hydraulic properties. By using averages, the potential for error is minimized.
2. Water-bearing unit is uniform thickness and infinite in areal extent. This assumption is reasonable based upon stratigraphy presented on boring logs and shown on attached cross sections.
3. The water-bearing unit receives no recharge. This assumption is reasonable as the area where groundwater is extracted is beneath a building and there are no significant sources of vertical recharge to soils beneath the building.
4. Water removed from storage is discharged instantaneously when head is lowered;
5. Pumped well fully penetrates the water-bearing unit. This assumption is accurate based upon well construction and site geology.
6. Pumping well is 100 percent efficient. All wells are not 100 percent efficient. Therefore, drawdown will be underpredicted at the pumping well.
7. Laminar flow exists throughout water-bearing unit. This is a reasonable assumption except immediately adjacent to the pumping well.
8. Water table has no slope prior to pumping. This assumption is reasonable based upon water level data obtained from site observation wells.

To estimate the pumping rate for a 100 percent efficient recovery well, used the Theis Equation;

$s = [(Q*W(u))/(4*\pi*T)]$ $u = [(r^2*S)/(4*T*t)]$

Where:
$W(u)$ = Theis Well Function of u (from Driscoll, F.A., 1986. Groundwater and Wells. The Johnson Division, St. Paul, MN;
t = time since pumping started (days); and
r = distance from pumping well to where drawdown is predicted (feet).

All other parameters as previously defined.

Estimate pumping rate that allows for 1.5 feet of drawdown at MW-27R (assume sand and gravel layer fully dewatered).

Proposed Q (gpm)	Proposed Q (ft^3/day)	Permissible Drawdown (feet)	Predicted Drawdown (feet)	Tranmissivity (ft^2/day)	Storage Coefficient (unitless)	u (unitless)	W(u) (unitless)	r (feet)	t (days)
Estimate Maximum Permissible Pumping Rate									
3	578	1.7	1.1	791	0.002	5.3E-09	18.4783	0.5	30
4	770	1.7	1.4	791	0.002	5.3E-09	18.4783	0.5	30
5	963	1.7	1.8	791	0.002	5.3E-09	18.4783	0.5	30
Estimate Drawdown at Distance of 10 feet, 20 feet and 30 feet from Extraction Well									
3	578	NA	0.7	791	0.002	4.7E-06	11.6907	15	30
3	578	NA	0.6	791	0.002	1.9E-05	10.2939	30	30
4	770	NA	0.9	791	0.002	4.7E-06	11.6907	15	30
4	770	NA	0.8	791	0.002	1.9E-05	10.2939	30	30

Targeting 3 to 4 gpm should be adequate to dewater the permeable sand and gravel unit contributing water to the underdrains to a distance of 20 to 30 feet from recovery well. When compared to water levels from January which appear to be higher than other monitoring events, the water levels within 30 feet are predicted to be less than 81.6 feet in elevation or approximately 3 feet below the elevation of the floor. Pumping rates are generally consistent with extraction rates during vactor extraction events from well MW-27R. Pumping rates will be less during dry periods as transmissivity will be reduced.