ADVISORY OPINION
IMPACT OF CREC FACILITY ON WATER SUPPLY & USE IN DISTRICT
&
WELL REMEDIATION

DRAFT FOR PUBLIC REVIEW & COMMENT

INTRODUCTION

Invenergy Thermal Development, LLC (Invenergy) filed an application with the State of Rhode Island Energy Facilities Siting Board (EFSB) to construct and operate a combined-cycle electric generating facility on Wallum Lake Road, in Burrillville, RI. This facility, designated the Clear River Energy Center (CREC) is rated for a nominal power generation capacity of 850 to 1,000 megawatts (MW) when firing with natural gas. The facility will normally fire with natural gas (primary fuel) provided from the adjacent Spectra Energy Algonquin Compressor Station however, the system will be capable of firing with ultra-low sulfur diesel fuel, in the event that sufficient natural gas supply is unavailable.

The CREC facility requires a supply of water to provide makeup for steam generation, cooling and other applications. Because the proposed facility is designed to utilize air-cooled condensers (rather than water-cooled) the total water requirements are reduced. Water is proposed to be supplied from the Pascoag Utility District (PUD) Well #3/3A that has been out-of-service since 2001 due to contamination of the PUD wellfield with gasoline fuel contamination. To facilitate the use of water from PUD Well #3./3A Invenergy proposes to provide a groundwater treatment system using granular activated carbon (GAC) for removal of organic contaminants including MTBE, BTEX compounds, TBA, etc.

The pre-treated groundwater would be pumped from the PUD wellfield in a 10”Ø HDPE transmission pipeline. This pipeline, approximately 13,558 feet in total length, would extend from a point of connection at Silver Lake Avenue along Grove Street, Laurel Hill Avenue, Church Street and Wallum Lake road (RI Rt. 100) to the CREC facility. Invenergy projects an average water demand of 102,240 gpd (0.102 MGD), with a summer load demand of 224,640 gpd (0.225 MGD). When firing with diesel fuel in the winter, the water demand is anticipated to be 924,489 gpd (0.925 MGD). Documents filed by Invenergy indicate that the CREC facility is expected to be firing with diesel fuel for 5 days per year (winter) although up to 45 diesel firing is requested. The pre-treated water produced from PUD Well #3/3A will be non-potable, and will remain totally segregated from the municipal water distribution system. Invenergy will construct a dedicated public water supply well at the CREC site to provide potable water to the facility.

The CREC facility will generate process wastewater including blowdown from steam generators and evaporative coolers, reject and backwash wastewater from the high purity water treatment systems, cleaning and sanitary wastewater. This wastewater shall be discharged via a 4”Ø HDPE force main extending approximately 8,570 ft. along Wallum Lake Road, to a point of connection into the existing municipal sewer, approximately 30 ft. west of the intersection with Old Wallum

Lake Road, in Pascoag, RI. Invenergy projects an average wastewater discharge volume of 69,120 gpd (0.069 MGD), with a summer discharge volume of 89,280 gpd (0.089 MGD). When firing with diesel fuel in the winter, the wastewater discharge is anticipated to be 200,160 gpd (0.200 MGD).

Pursuant to the Notice of Designation to the Pascoag Utility District (the District) received from the Energy Facility Siting Board, dated March 10, 2016, the District has been requested to provide an informational advisory opinion regarding certain issues and impacts related to the evaluation of the Invenergy Thermal Development LLC's application to construct the Clear River Energy Center in Burrillville, RI, filed in Docket No. SB-2015-06. Specifically, the advisory opinion is to address the potential impacts of the proposed CREC facility upon water supply and use in the District, and also how the water produced by Well #3/3A will be remediated.

ISSUE 1 - Impact of Proposed Water Withdrawals Upon Clear River Watershed & Long Term Availability of Water for Public Water System:

Background:

Invenergy plans to pump water from PUD Well #3/3A to meet the process water requirements at the CREC facility which is located at the approximate mid-point within the Clear River Watershed. The effective or safe watershed/aquifer capacity is established by RIDEM and the RI Water Resources Board, using the Streamflow Depletion Methodology (SDM) (RIDEM, 2010). This methodology establishes the "Natural 7Q10" (lowest 7 consecutive day average flow that occurs once every 10 years) flow for each drainage basin, and then determines the allowable streamflow depletion as a percent of the Natural 7Q10. The allowable depletion for each month varies on the basis of the 'Bioperiod" classification, with the months of July, August and September having the lowest allowable depletion, 30% of the Natural 7Q10.

The Clear River Watershed (45.5 sq. mi.) has a natural 7Q10 of approximately 5.1 MGD, therefore the dry season (30% of 7Q10) is approximately 1.53 MGD, for the entire watershed. Invenergy has established an average daily summer season demand of approximately 225,000 gpd, or 0.225 MGD, which equates to approximately 15% of the maximum streamflow depletion allocation for the Clear River Watershed. CREC has further assessed alternatives to reduce the facility water requirements and reports that summer season demands could be reduced to 165,000 gpd (0.165 MGD).

Discussion of Potential Impact:

The watershed is impacted by both the total water withdrawals, and also by the location of the withdrawal within the watershed. The proposed CREC withdrawal (Well #3/3A) is at the approximate mid-point within the Clear River Watershed, in close proximity to a proposed new water supply wellfield (Clear River Infiltration Gallery) recently submitted by the District to RIDEM, for review. The sub-watersheds upgradient and contributing to Well #3/3A encompass several drainage systems including the Pascoag River drainage (8.22 sq. miles) (USGS 01111265 Pascoag River at Bridgeton, RI), Mowry Brook (1.9 square miles) (USGS 01111267 Mowry

Brook at Bridgeton, RI), and the Wilson Reservoir - Clear River drainage (12.5 square miles) (USGS 01111261 Clear River at North Rd/Laurel Hill, RI). Collectively these three drainages encompass some 22.6 square miles. Approximately 1/4 mile downstream from the proposed infiltration gallery/Well #3/3A site the Clear River watershed area was established to be 24.4 sq. mi (USGS 01111270 - Clear River at Harrisville, RI). Interpolating the measurements supports an assessment of a 23.35 sq. mile area contributing to the Well #3/3A site.

Table 1 presents the allowable streamflow depletion for the Clear River as a ratio or percentage of the 7Q10 low flow. For purposes of calculating allowable streamflow depletion for a specific withdrawal or basin using SDM, the percentages of 7Q10 from Table 1 are applied to the natural 7Q10 for the relevant stream or river. Table 2 presents a summary of the Allowable Streamflow Depletion, based upon the RIDEM Streamflow Depletion Methodology Report and calculations presented in 2010 (RIDEM SEM 2010). This methodology determined a Natural 7Q10 of 5.1 MGD for the Clear River, based upon a total drainage area of 45.5 square miles and an adjusted unit 7Q10 of 0.122 MGD per square mile. Using a maximum 30% depletion allocation (Class 3) results in an allowable depletion of 1.53 MGD. Assuming a contributing drainage area of 23.35 square miles for the proposed infiltration gallery, results in a Natural 7Q10 of 2.62 MGD and an **allowable depletion of 0.785 MGD, at the location of Well #3/3A**.

Table 1 – Monthly Allowable Streamflow Depletion as % of 7Q10

Month	Bio-Period	Hydro-Period	Allowable Depletion
October	Spawning & Out-Migration	Medium-Low	60%
November	Overwinter	Medium	120%
December	Overwinter	Medium	120%
January	Overwinter & Channel Forming	High	180%
February			180%
March	Anadromous Spawing		180%
April			180%
May		Medium	120%
June	Peak Resident Spawning	Medium-Low	60%
July	Resident Spawning, Rearing Growth, Out-Migration	Low	30%
August			30%
September			30%

Table 2 – Allowable Streamflow Depletion Calculations

Source	Location	Area Adjusted 7Q10	Drainage Area	Natural 7Q10	Class	SDM Allowable Depletion	Method
		MGD/mi^2	Sq. Mi.	MGD	-----	Class 3[1]	-----
RIDEM SDM 2010	Clear R. USGS Gage 01111330	0.112	45.5	5.1	3	1.53 MGD	4
Calculated	Clear R. Infiltration Gallery Site	0.112	23.25	2.62	3	0.785 MGD	Area Adjusted

Note 1: Class 3 = 30% of 7Q10

The existing water withdrawals from the Clear River watershed are summarized in the RI Water Resources Board 2012 Strategic Plan, augmented by USGS studies and the pertinent Water Supply System Management Plans, summarized in Table 3, below. This table identifies a total average demand day (ADD) withdrawal allocation from the watershed of 1.179 MGD.

Table 3 – Existing Water Demands – Clear River Sub-Basin

Water Use/Demand	Estimated Use
Existing ADD Withdrawal:	
Self-Supply[1]	0.400 MGD
Commercial	0.122 MGD
Industrial	0.007 MGD
Agricultural	0.040 MGD
Harrisville Fire District	0.260 MGD
Pascoag Utility District (via HFD)	0.300 MGD
Pascoag Utility District – Well #5	0.050 MGD
Total Existing Demand Allocation	**1.179 MGD**
Self-Supply Recharge (85%)	**(0.340 MGD)**
Net ADD Watershed Withdrawal	**0.839 MGD**
Municipal Demand Peaking Factor[1]	**1.39**
Projected MDD Net Withdrawal	**1.077 MGD**
Allowable Streamflow Depletion[3]	**1.53 MGD**

Note 1: Self-Supply is 85% returned to watershed via OWTS's
Note 2: Municipal Peaking Factor (1.39) applied to HFD and PUD demands.
Note 3: Table 2 – RIDEM SDM 2010

The Pascoag Utility District has determined a summer maximum demand day (MDD) peaking factor of 1.39, and it is believed that Harrisville will have a similar, or greater, peaking factor. AWWA M32 guidelines and good engineering practice recommend that municipal water systems satisfy the MDD demands through system source capacity, rather than distribution storage that is intended to meet peak hourly and fire flow demands. Applying the peaking factor only to the Harrisville (HFD) and Pascoag Utility District demands in conjunction with an assumed 85% OWTS recharge of the self-supply allocation, results in a calculated maximum day demand of 1.077 MGD.

It should be noted that the self-supply withdrawals are assumed to be up to 85% returned to the watershed via recharge from on-site wastewater treatment systems. Additionally, the significant proportion of the Harrisville and Pascoag districts are sewered therefore water withdrawals will be partially recharged to the Clear River at the Burrillville POTW. However, the peak cumulative consumptive use and total water withdrawal during peak flow was available from the USGS Water Availability Study from Barlow (2003), Water-Resources Investigations Report 03-4190 for the Clear River at Oakland. USGS Gage 01111330, summarized in Table 4, below.

Table 4 – Average Water Withdrawals, Low Flow – Clear River at Oakland

Sub-basin	5-year Average Basin Withdrawal Rates (MGD)			
	June	July	August	Sept

Clear River	1.344	1.402	1.289	1.379

(Barlow 2003, Water-Resources Investigations Report 03-4190)

The Barlow (2003) analyses indicate that the Clear River watershed is approaching its maximum streamflow depletion allocation of 1.53 MGD during summer demand conditions. Pascoag Utility District has reduced total water demands by approximately 15% (approx. 0.045 MGD) since the Barlow (2003) study was completed. However, while reducing overall watershed withdrawals provides benefit regarding streamflow depletion, the present level of calculated NET withdrawals remains at approximately 70% of the allowable low flow streamflow depletion (1.53 MGD). **This leaves a very small margin for any future increases in municipal water demands placing the watershed at potentially significant risk**.

A further assessment of the water withdrawals at the Well #3/3A location within the Clear River Watershed was performed, assuming the implementation of the proposed Clear River Infiltration Gallery to supply Pascoag Utility District. Assuming that all of the Harrisville, industrial and commercial withdrawals are downstream, the remaining withdrawals include approximately 50% of the self-supply plus the Pascoag withdrawals projected to occur from this location.

Table 5 – Existing Water Demands – Well #3/3A Contributing Area

Water Use/Demand	Estimated Use
Existing ADD Withdrawal:	
Self-Supply[1]	0.200 MGD
Pascoag Utility District (via HFD)	0.300 MGD
Pascoag Utility District – Well #5	0.050 MGD
Total Existing Demand Allocation	**0.550 MGD**
Self-Supply Recharge (85%)	**(0.170 MGD)**
Net ADD Watershed Withdrawal	**0.380 MGD**
Municipal Demand Peaking Factor[1]	**1.39**
Projected MDD Net Withdrawal	**0.516 MGD**
CREC Summer Demand (Max)	**0.225 MGD**
Projected MDD/CREC Net Withdrawal	**0.741 MGD**
CREC Summer Demand (Min.)	**0.165 MGD**
Projected MDD/CREC Net Withdrawal	**0.681 MGD**
Allowable Streamflow Depletion[3]	**0.785 MGD**

Note 1: Self-Supply is 85% returned to watershed via OWTS's
Note 2: Municipal Peaking Factor (1.39) applied to PUD demands.
Note 3: See Table 2 – Calculated SDM for Drainage Area

This analysis indicates that the existing MDD Net Withdrawal (0.516 MGD) is approximately 66% utilization of the low flow period streamflow depletion allocation (0.785 MGD). However, adding the proposed CREC withdrawal will increase the utilization to 87% to 94% of the low flow period streamflow depletion allocation. **This leaves minimal margin for any future increases in municipal water demands, compromising the ability of the watershed to meet future municipal water demands**.

Pascoag Utility District has proposed to implement a new water supply wellfield along the south bank of the Clear River (Clear River Infiltration Gallery). The work completed to date to support this application to RIDEM has included extensive studies of the Clear River, the watershed, the underlying aquifer, contaminant threats and includes development of a comprehensive groundwater model and recharge zone assessment. In the absence of a comprehensive evaluation of the proposed CREC water demands, including development of a groundwater model to assess aquifer and watershed impact, the District has substantial concerns that the CREC water withdrawals could compromise the ability of the District to provide water from the proposed infiltration gallery. Additionally, there are concerns regarding potential contaminant threats to the proposed new water source, from the pumping of Well #3/3A.

Summary & Conclusions:

The analysis by Pascoag Utility District indicates that while the Clear River Watershed is presently within the defined low flow period streamflow depletion allocation (1.53 MGD), the addition of the proposed CREC water demands would compromise the ability of the watershed to meet future municipal water supply requirements, both in the total watershed and more significantly, in the portion of the water shed at the point of withdrawal at Well #3/3A. The maximum depletion would occur in the stretch of the Clear River between the proposed Infiltration Gallery site (and Well #3/3A location, and the Burrillville POTW, at which point substantial recharge occurs. This stretch of the Clear River is already compromised from the standpoint of water quality.

A substantially more detailed evaluation of the proposed water demands, the total and net withdrawals (including CREC) and the impact upon the Clear River Watershed is necessary to fully assess the potential impacts. This should include a comprehensive groundwater model evaluation of the proposed CREC pumping withdrawals, particularly in conjunction with the withdrawals from the proposed Clear River Infiltration Gallery, to assess overall aquifer and watershed impacts, zone of contribution, impact upon boundary conditions, etc.

ISSUE 2 - Impact of Proposed CREC Water Withdrawals Upon Water Quality in Aquifer and Contaminant Threats to Proposed PUD Groundwater Source:

Background:

Pascoag Utility District has submitted (June 9, 2016) a Request for Preliminary Determination and a Request for a Groundwater Withdrawal Permit to RI Department of Environmental Management (RIDEM) for a proposed new water supply wellfield along the south bank of the Clear River (Clear River Infiltration Gallery). The preparatory work to support this application included an extensive evaluation of contaminant threats, a water quality monitoring and pumping test program, and development of a groundwater model to assess the response of the Clear River watershed and underlying aquifer to various pumping rates. This evaluation included a detailed assessment of the Mobil Gasoline Service Station contaminant plume that resulted in the loss of Well #3/3A from service in 2001.

The proposed infiltration gallery site is located approximately 2,700 ft. from the MTBE/BTEX contaminant plume extending from the Main Street Mobil Service Station at 24 N Main St. in Pascoag. The inactive Well 3/3A is located approximately 1,200 feet west of the proposed Gallery. Periodic monitoring of the groundwater elevations and contaminant concentrations in this well, and nearby observation/monitoring wells, has determined that regional groundwater flow paths under non-pumping conditions demonstrate a strong gradient to the north (Figure 4-5), **away from the proposed infiltration gallery site**. The result of this regional hydraulic gradient is the proposed infiltration gallery will receive water from different locations than the area of the contaminant plume. Additionally, as determined by the pumping test program and the groundwater model developed to support the RIDEM Application, the proposed infiltration gallery will extract the vast majority of its water via adjacent stream water infiltration through the streambed and does not affect hydrologic perturbation of the fractured bedrock aquifer, which has been shown to be a significant mechanism for the transport of MTBE. (Allen and Boving 2006).

Discussion of Potential Impact:

Based upon the research and finding of the District's assessment it is strongly believed that activation of Well #3/3A to provide water supply to the CREC facility will modify the direction of the existing contaminant plume, such that it will move in the direction of Well #3/3A. This in turn will draw MTBE/BTEX contaminants into closer proximity to the proposed Clear River Infiltration Gallery that is intended to provide water for the District.

CREC has proposed to execute an 8-hour step pumping test and a 24-hour constant rate pumping test to assess the ability of Well #3/3A to produce the required amount of water to support the CREC operations. A constant rate pumping test program of 5 to 10 days duration, a comprehensive groundwater monitoring program, and development of a comprehensive groundwater model are critical to assessing and developing an understanding of the impact of pumping Well #3/3A upon the contaminant plume, the transport of organic contaminants, and the potential impact upon the proposed Clear River Infiltration Gallery. Specific outstanding questions that remain include, but are not limited to the following:

- Impact of Well #3/3A pumping upon the present location and direction of fuel contaminant plume – will extended pumping from Well #3A result in changing the direction of the plume, and drawing the plume into Well #3/3A?
- Impact of pumping Well #3A upon local/regional groundwater hydrology and drawing water from other areas not presently affected.
- Will a change in direction and size of contaminant plume impact non-public water supply wells in area?
- Will pumping of Well #3/3A serve as a "cut-off" of contamination and protect the proposed Clear River Infiltration Gallery withdrawals;
- If use of Well #3/3A is discontinued at some point in future (2, 3, 5 10 years) what is potential impact of changing location of contaminant plume, upon the proposed Clear River Infiltration Gallery.

Additionally, there is a need for long-term monitoring of groundwater elevations and water quality to assess impact of pumping upon local/regional hydrology, groundwater quality and treatment requirements;

Summary & Conclusions:

No determination of the impact of pumping of Well #3/3A can be made until a comprehensive pumping test and water quality monitoring program have been completed, followed by the development of a comprehensive groundwater model and assessment of the recharge zone, impact upon the contaminant plume, and impact upon the proposed Clear River Infiltration Gallery.

ISSUE 3 - Design of Groundwater Treatment System – Safety, Security, Contaminant Threats, Operations, Risk Minimization and Cost:

Background:

Invenergy has proposed to pre-treat the groundwater pumped from Well #3/3A, to remove organic fuel contaminants (MTBE, BTEX compounds, TBA, etc.). Based upon review of a "*Preliminary GAC Treatment System Process Plan*" drawing provided by Invenergy, the system will utilize a granular activated carbon treatment process, conforming to the following design criteria:

Table 6 – Groundwater Treatment System Design Criteria

Treatment Plant Capacity	700 gpm
No. of Treatment Trains	2
Train Operating Configuration	Parallel
Flowrate per Train	350 gpm
No. of Vessels per Train	2
Filter Vessel Operating Configuration	Series, Lead/Lag
Vessel Dimensions	8.0 ft. Ø x 9.5 ft. S/S
Filter GAC Capacity (lbs./filter unit)	10,000 lbs.
Approx. GAC Volume/Filter Vessel	234 ft^3
Filter X-Section GAC Bed Area	50.24 ft^2
Approx. GAC Bed Depth	4.7 ft. (56.2")
Empty Bed Contact Time (@ 700gpm)	10 Minutes
Carbon Use Rate (lbs./1,000 gallons)	0.25/1,000
Backwash Loading Rate	10 gpm/ft^2
Backwash Flowrate	500 gpm
Backwash Duration	15 Minutes
Spent Backwash Water Volume/Backwash Event	7,500 gallons

The filter trains will operate in parallel with each train accepting 50% (350 gpm) of the water discharged from Well #3/3A. The filters are designed for downflow operation and counterflow (upflow) backwash to flush solids from the carbon media beds. The preliminary design includes provision of a sample tap between the 2 filter vessels installed in series, in each train. Samples are proposed to be obtained periodically to test for MTBE. When breakthrough of the lead filter vessel occurs, the lead vessel will be removed from service for GAC replacement and the lag vessel will be placed into the lead position to continue treatment. When the GAC is replaced into the off-line vessel, it shall be placed back into service in the "lag" position, behind the lead vessel, thereby assuring that GAC utilization will be efficient and maximum reserve capacity is provided to prevent VOC contaminant breakthrough into the finished water.

The intent of this design is to utilize the initial manual monitoring of the MTBE breakthrough the lead filter vessels to determine the time to breakthrough. Following establishment of the time to breakthrough, the subsequent GAC replacement events shall be scheduled to occur in ½ the time required for the initial change out. The intent is to assure that the GAC is changed within the acceptable time duration, without having to depend upon the periodic manual, MTBE sampling/monitoring events. Based upon the anticipated carbon usage of 0.25 lbs, per 1,000 gallons of treated water, the operating cycle is anticipated to be 15 months, between GAC change out events.

Filter backwash will occur after each media change out and also based upon the differential pressure loss across the filter beds. Each filter train will be provided a dedicated backwash system consisting of two (2), 10,000 gallon tanks and a dedicated backwash pump. One (1) tank will provide filtered water for backwash makeup and the 2nd tank will be used to store the spent backwash water. The anticipated backwater water volume is 7,500 gallons per backwash event.

<u>Discussion of Potential Impacts</u>:

Treatability testing, including monitoring and evaluation of the various organic contaminants present in the groundwater, should be used to determine the optimum operating criteria for the system. It is expected that the contaminant concentrations will change over time as pumping of Well #3/3A is expected to move the existing contaminant plume towards Well #3/3A. The design of the system and the monitoring program should consider the results and finding of the pumping test program and groundwater monitoring program requested in Issue #2, above.

The treatability testing program must include a comprehensive assessment of carbon use rates, empty bed contact time, VOC contaminant leakage and breakthrough characteristics, monitoring requirements, and carbon change out frequency and volume. This must further include an assessment of operating costs, to assure adequate financial capability to maintain system operation and performance;

Critical design considerations also include, but are not limited to, the following:

- The GAC treatment system must be designed to handle the <u>maximum</u> anticipated contaminant load, and the complete range of operating flowrates.
- Waste Residuals Management - means for waste residuals handling and disposal must be comprehensively developed in plan to assure no contaminant threats to aquifer;
- Treatment system must be designed with redundant/standby capacity (minimum 2 trains) to assure treatment capability is always available and on-line;
- The treated water specification must be to "Non-Detectable" MTBE and other contaminants (TBA, BTEX, etc.);
- On-line, real-time monitoring must be provided to assure and document performance of treatment system and quality of water discharged into force main to CREC facility.

- Standby power supply must be provided to assure continued operation in the event of the loss of primary power;

The design documentation should include a summary of the calculations related to the rates of contaminant removal and carbon loading rates, system hydraulics, carbon use rates, etc. It is necessary for the design to include a detailed operating description of the entire system, and also include a Response Action Plan. This plan would describe response actions to be taken for scenarios including: (1) equipment failure, (2) release of untreated or partially treated water, (3) detection of contaminants in the carbon effluent above the treatment criteria. The plan should include the technology, protocol and contacts for notifying operating personnel, PUD offices and others as required.

The system and building design must consider and address issues of leak detection and secondary containment. Secondary containment must be provided for equipment containing untreated or partially treated well water with sufficient volume to contain any water leakage that might occur prior to sensing by an automatic leak detection system and equipment shutdown.

A comprehensive monitoring, control and alarming system should be incorporated into the system scope and design. On-line, real-time monitoring must be provided to assure and document performance of treatment system and quality of water discharged to the force main and the CREC facility. In addition to monitoring the VOC concentration in the treated effluent, key monitoring parameters include filter vessel operating pressures and differential pressure, filter vessel operating flowrates and treated water volume, force main flowrate and pressure, backwash and finished water storage tank level monitoring, etc. The monitoring system should include data logging and local and remote monitoring capability.

The site environmental controls during construction must be defined and established to assure protection of the environment, downstream receptors, and personnel.

<u>Summary & Conclusions</u>:

No determination of the viability of the GAC groundwater treatment system can be made at this time, until a comprehensive pumping test and water quality monitoring program have been completed, followed by the development of a comprehensive groundwater model and assessment impact upon the contaminant plume and anticipated groundwater characterization, execution of treatability studies and preparation of the detailed design of the proposed GAC Filtration treatment system, and the building and infrastructure to house the system..

<u>ISSUE 4</u> - Well #3/3A Pumping Station & Transmission Main:

<u>Background</u>:

Invenergy proposes to pump the pre-treated groundwater produced by Well #3/3A in a 10”Ø, HDPE pipeline, approximately 13,558 feet from a point of connection at Silver Lake Avenue along Grove Street, Laurel Hill Avenue, Church Street and Wallum Lake road (RI Rt. 100) to the CREC facility. Preliminary design drawings for this force main have been provided to the

District for Review, however no description of the pumping system, monitoring instrumentation or controls has been provided.

Discussion of Potential Impact:

The proposed pipeline alignment is principally along Grove Street, Laurel Hill Avenue and Wallum Lake Road that include buried gas and/or water mains, as well as drainage infrastructure. Additionally these roads are critical transportation routes. The District has serious concerns regarding protection of existing buried utilities, traffic control and maintenance of right-of-way, and separation from existing municipal water pipelines. An additional, significant concern is the means of monitoring the quality of the effluent from the GAC system that is treating the groundwater pumped from Well #3/3A, to assure there is no breakthrough of VOC contaminants, that would be conveyed in the water transmission pipeline.

Summary & Conclusions:

Insufficient information has been provided at this time to allow a thorough assessment of the proposed pipeline construction materials and methods, scheduling, safety, traffic control and protection of existing utility systems, monitoring instrumentation and controls.

The District believes there is a critical need for an on-line, real-time VOC monitoring system for the proposed groundwater treatment system to assure no release of contaminants into the water transmission pipeline.

ISSUE 5 - CREC Wastewater Discharge Transmission Sewer and Contaminant Threats:

Background:

The CREC facility will generate process wastewater including blowdown from steam generators and evaporative coolers, reject and backwash wastewater from the high purity water treatment systems, cleaning and sanitary wastewater. This wastewater shall be discharged via a 4”Ø HDPE force main extending approximately 8,570 ft. from the CREC facility along Wallum Lake Road, to a point of connection into the existing municipal sewer, approximately 30 ft. west of the intersection with Old Wallum Lake Road, in Pascoag, RI. Preliminary design drawings for this force main have been provided to the District for Review, however no description of the wastewater pumping system, monitoring instrumentation or controls has been provided.

Discussion of Potential Impact:

Wallum Lake Road is a critical transportation routes and the District has serious concerns regarding protection of existing buried utilities, traffic control and maintenance of right-of-way. The wastewater generated by the CREC facility could contain contaminant VOC’s if they pass through the groundwater treatment system, and also contaminants from the water treatment systems and treatment of the cooling water in the CREC facility. The presence of any concentrated VOC or other contaminants in the CREC wastewater represents a potential new contamination threat when discharged to the municipal sewer system serving the Pascoag community and ultimately discharging to the Burrillville PORW.

The CREC discharge will require a wastewater discharge permit issued by either RIDEM or the Burrillville Sewer Commission that will establish discharge limits for the various contaminants that could be in the CREC wastewater. The District believes it is critical that monitoring of the wastewater at the CREC facility include on-line, real-time monitoring of critical VOC's of concern, to assure there is now concentration of such contaminants in the CREC wastewater that would pose a threat to the Pascoag and Harrisville communities that the sewers pass through, to the Burrillville POTW.

Summary & Conclusions:

Insufficient information has been provided at this time to allow a thorough assessment of the proposed wastewater pipeline construction materials and methods, scheduling, safety, traffic control and protection of existing utility systems, monitoring instrumentation and controls.

The District believes there is a critical need for an on-line, real-time VOC monitoring system for the proposed CREC wastewater discharge to assure no release of contaminants into the water transmission pipeline.

ISSUE 6 - Contaminant Plume Transport and Risk Potential:

Background:

Process water needed by Invenergy's facility is to be provided from PUD Well #3/3A. As previously discussed, the well was shut down in 2001 due to the presence of gasoline contamination originating from the Mobil station. The contamination includes BTEX (benzene, toluene, ethylbenzene and xylenes), gasoline additives such as MTBE and TBA, and various other Volatile Organic Compounds (VOC) associated with gasoline. RIDEM and others have documented that the contamination resides in a large portion of both the upper and lower portions of the aquifer that feeds the well, including fractured bedrock. The same studies have determined that the highly fractured bedrock is hydraulically coupled with the unconsolidated aquifer and the contained groundwater likely contributes to the water drawn from Well #3/3A. Additionally, the highest concentrations of gasoline contaminants have been measured in the deeper portions of the aquifer, including bedrock. A pumping test conducted by RIDEM in 2005 for Well #3/3A found that the MTBE concentration increased as the pumping test proceeded until the pumping rate was decreased and, finally, terminated.

Most of these contaminants are volatile compounds that exhibit a significant vapor pressure at room temperature and are likely to vaporize into air. Most contaminants possess a high Henry's Constant, which causes preferential vaporization from contaminated groundwater into the air spaces found in soil. RIDEM conducted testing in the past to assess the impact of groundwater contaminants on the indoor air quality within several occupied buildings and residences. Elevated VOC concentrations were found in several residences. Measures were undertaken to remedy elevated VOC concentrations. A 2015 report by CDR Maquire and Sovereign compared existing groundwater contaminant concentrations in monitoring wells to threshold concentrations that represent a potential risk for intrusion of contaminant vapors from groundwater into the indoor air of occupied buildings. The contaminant concentration in groundwater for several monitoring wells exceeded the threshold value, indicating that additional study is required to evaluate the risk.

Discussion of Potential Impact:

The planned long term pumping of Well #3A may mobilize the deeply residing contaminants, allow the contaminants to migrate to other locations, and increase contaminant concentrations in the upper aquifer and pumping well. The contaminant plume will change in shape, size and concentration, possibly impacting areas in the well field and town that presently are not impacted. These potential changes present two issues. First, an increasing concentration of contaminants in Well #3/3A will likely affect the design of the required treatment system and increase the cost of replacing activated carbon.

Secondly, continued long term pumping of Well #3A may cause gasoline contaminants residing in fractured bedrock and in the unconsolidated deep aquifer to mobilize and migrate horizontally and vertically, thereby potentially posing a dynamic threat to the indoor air quality in nearby and hydraulically downgradient residences or occupied buildings. The indoor air quality may exceed the health thresholds.

Summary & Conclusions:

A long term pumping test of Well #3A is recommended to evaluate contaminant concentrations and migration in the well field and Well #3A. Vapor intrusion into residences and occupied buildings must be assessed using multiple lines of evidence and testing for existing and anticipated groundwater concentrations resulting from the long term pumping of Well #3A. In addition, a groundwater model should be developed that includes a detailed assessment of groundwater quality throughout the well field including areas near the former Mobil Station. It should also model, to the extent possible, the vertical distribution of contaminants in the unconsolidated aquifer and in fractured bedrock under short and long term pumping conditions using the most recently determined aquifer parameters.