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January 11, 2017

Via Electronic Mail and Hand Delivery

Todd Anthony Bianco, EFSB Coordinator
RI Energy Facility Siting Board
89 Jefferson Boulevard
Warwick, RI 02888

Re: Invenergy Thermal Development LLC's Application to Construct and Operate the Clear River Energy Center in Burrillville, Rhode Island
Docket No.: SB-2015-16

Dear Mr. Bianco:

In accordance with the Energy Facility Siting Board's ("Board's) October 20, 2016 Order, and on behalf of Invenergy Thermal Development LLC and the Clear River Energy Project ("Invenergy"), please find enclosed an original and ten (10) copies of Invenergy's revised Water Supply Plan in support of Invenergy's Application pending before the Board. This revised Water Supply Plan substitutes for or supersedes all previously filed information regarding the water supply plans for the Clear River Energy Center Project.

Please let me know if you have any questions.

Very truly yours,

ALAN M. SHOER
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Enclosures

cc: Service List

SB-2015-06 Invenergy CREC Service List as of 12/12/2016

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ess group

WATER SUPPLY PLAN

Clear River Energy Center
Burrillville, Rhode Island

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FOR SUBMITTAL TO:
State of Rhode Island Energy Facility Siting Board
Public Utilities Commission
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January 11, 2017

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1.0 INTRODUCTION

Since the filing of the Energy Facility Siting Board (EFSB) Application on October 28, 2015 and consideration of the many concerns expressed by the Community over use of local water supplies and possible use of water from a previously-contaminated Pascoag Utility District (PUD) groundwater well for process water for the Clear River Energy Center (CREC or Facility), an alternative water supply plan has been developed. This document provides details on the proposed source of process water for the facility and the proposed methodologies for the management of both the process wastewater and sanitary wastewater that will be generated by the Facility.

Although the proposed changes and alternatives increase the overall operating cost of the Facility, this Water Plan is based on viable alternatives that minimize water consumption for process use and avoids the construction of both a water supply pipeline and a wastewater sewer line for the process wastewater, both of which had previously been proposed.

In a joint letter submitted by the Town of Burrillville, dated October 5, 2016, CREC agreed to provide certain details to meaningfully evaluate any Water Plan proposed for the Facility. The details provided in the following sections address all of the information requested by the Town of Burrillville in its letter, as identified below;

1. The source of process water (from a municipality or water system, with details), **[Section 2.0]**;
2. The identity of the municipality or water system, **[Section 2.0]**;
3. Quantity of water available on a daily basis in gallons per day, **[Section 2.3.2]**;
4. Quality of water from a chemical standpoint, **[Section 2.0]**;
5. Routing or transport of water from the source to the proposed facility **[Section 2.0]**;
6. Expected treatment of water at source and/or at the facility for use at the facility **[Section 2.2.1]**;
7. If water treatment of water at source and/or at the facility for use at the facility **[Section 2.2.1]**;
8. If water treatment is required, conceptual process and instrumentation diagram, expected size and location of building to be used for treatment, and the proposed treatment operator, **[All water treatment will be performed within the Facility on the site; Appendix A]**;
9. Identification of a redundant/contingent process water source, **[Section 2.0]** and;
10. The proposed location of the discharge of water from the plant and the expected volume and chemical content of the water at discharge **[Section 3.0 and Section 3.1.1]**.

2.0 WATER SUPPLY

Water for use at the Facility will be supplied from the Town of Johnston, Rhode Island under a long term water supply agreement and delivered to the Facility via public roads by trucks owned and/or leased by the Facility. Back-up or contingent water will be supplied by private trucking supplier(s) who draw their water from the CREC source and/or other potable water sources. Since the Facility will own and/or lease its own water supply trucks, other municipal or private water suppliers could operate as redundant/contingent process water transportation capability should water from the Town of Johnston water supply system be unavailable to the Facility. CREC has also secured commitments from a private trucking company, Benn Water & Heavy Transport Corp., to supply water to the Facility. *See* **Appendix G**.

The Town of Johnston purchases its municipal water from the Providence Water supply system which has its own water reservoirs and water treatment facility.

The long term agreement with the Town of Johnston has been signed, with approval from the Johnston Town Council on January 10, 2017 to meet the needs of the Facility. *See* **Appendix F**. Since trucking of the water will be the method of transport for all alternative water suppliers, these alternative suppliers become the back-up or contingent water suppliers to the Facility.

Whether water is supplied by truck from the Town of Johnston or private water suppliers, the overall result will be that only water of drinking water quality will be used at the Facility to meet its process water requirements. No local water supplies, other than a small on-site drinking water well to support the need for on-site potable water, will be utilized by the Facility. As previously explained to the EFSB, CREC initially proposed using a local source for water supply (Pascoag Utility District [PUD's] contaminated Well #3A). Notwithstanding a signed letter of intent (LOI) with PUD, PUD elected to terminate the LOI. Also, the other local water supplier, Harrisville Fire District, voted not to supply water to CREC. As indicated in the Status Report filed with the EFSB on December 12, 2016, Invenergy Thermal Development LLC (Invenergy) identified the City of Woonsocket as a potential source to supply water to the Facility via a pipeline or trucking. In order to pursue alternative or contingent sources, Invenergy approached the Town of Johnston during the end of December 2016.

The Town of Johnston municipal water system obtains its water supply from Providence Water and is considered a consecutive water system. A consecutive water system is defined by the Rhode Island Department of Health (RIDOH) as "a public water system that receives some or all of its finished water from one or more wholesale systems. Delivery may be through a direct connection or through the distribution system of one or more consecutive systems". As such, the capacity of the Town of Johnston water system to be able to support the water demands of the CREC facility is provided by the capacity of the Providence Water system.

The principal water source for Providence Water is the Scituate Reservoir and its five tributary reservoirs, collectively referred to as the Scituate Reservoir Complex. The Scituate Reservoir Complex has a total storage capacity of 41.3 billion gallons and a net storage capacity of 39.8 billion gallons. The Providence Water treatment plant (Phillip J. Holton Water Purification Plant) processes 100% of the surface water supply from the Scituate Reservoir Complex and has a capacity of 144 MGD. This plant is the largest treatment facility in New England.

Figure 2.1 provides a map of the proposed route of the water delivery trucks from the Town of Johnston to the Facility. The water delivery trucks will use state roads, to the extent feasible, to make deliveries to the Facility. Costs associated with the installation of a water truck filling station at a point on the Town of Johnston water supply system and any other necessary appurtenances will be covered entirely by the Facility.

The Facility will continue to work with the Town of Johnston to obtain all necessary permits and/or local approvals, subject to EFSB oversight, as applicable, for installation of the water truck filling station on the municipal water supply system of the Town of Johnston.

2.1 Water Supply Pipeline Alternative

As an alternative to trucking water to the Facility, a water pipeline to deliver water to the Facility was considered. To be viable a water pipeline would need to be constructed to the closest municipal water supply of a size that could meet the needs of the Facility and that of the municipal water supply customers into the future. A water pipeline was initially considered to deliver water to the Facility from the City of Woonsocket.

Suppling water to the Facility, from the City of Woonsocket, would require a dedicated water supply pipeline that would extend from a connection point in the City's low pressure zone, approximately 1.75 miles to the west of the Mount St. Charles storage tank, via a new 12-inch transmission main to the

Facility site a distance of approximately 14 miles and requiring numerous bridge and/or wetland crossings.

Figure 2.2 provides a map of the alternative water pipeline route that was considered for this dedicated water supply pipeline to the Facility. This dedicated water pipeline would have been installed in existing State roads.

After full consideration of this alternative water supply option for the Facility, this alternative was determined to be not desirable as a result of the overall cost of the water pipeline, its long term maintenance costs, concerns over securing the necessary approvals for installing the pipeline in State roads, concerns regarding construction and concerns over the numerous bridge or alternative wetland crossings that would have been required to complete the route of the water pipeline to the Facility. When considering these facts and comparing the alternative of the CREC water use redesign option to reduce water demand, the redesign option utilizing truck delivery was selected. As a result, the water plan for the Facility will rely on trucking water from the Town of Johnston's water system with contingent/redundant supply from private water suppliers, if needed.

2.2 Water Use

A modern energy efficient gas fired combined cycle electric generating facility is not the classical power plant of the past. The overall efficiency of the generation processes has significantly increased over recent years, and as a result, the amount of fuel used, air emissions produced, water used and wastewater produced have been significantly reduced, compared to older generation technologies.

Modern combined cycle electric generating facilities in New England are primarily fueled by natural gas, and at times in the cold winters when natural gas supplies are under severe stress, some electric generation plants are required by the electric grid operator (ISO-NE) to fire distillate oil to conserve the natural gas supplies for home heating and commercial use. Water use by combined cycle electric generating facilities increases when distillate oil is fired, as water is used in the combustion process to control the temperature of the combustion flame significantly reducing emissions that otherwise would have occurred. Conditions that lead to a need to fire distillate oil are typically infrequent and short in duration in New England and although daily water use increases during distillate oil firing it does not significantly impact overall annual water consumption of the Facility.

In a combined cycle power plant, the majority of the electricity (approximately two-thirds) is generated by a gas fired combustion turbine, which is tied to an electrical generator. Waste exhaust heat from the combustion turbine is recovered and used to generate steam in a "Heat Recovery Steam Generator" (HRSG) that uses the waste heat to generate high pressure steam used to spin a more conventional steam turbine which is also tied to an electrical generator. In some combined cycle generation facilities such as the proposed Facility, the steam turbine and the gas turbines share the same shaft saving space in the overall plant configuration. The term "combined cycle" is derived from the two types of turbines involved (gas and steam turbines).

After passing through the steam turbine the exhaust steam, now devoid of its useful energy, must be condensed back into water in a steam condenser and the condensed water is then reused in the cycle and pumped back to the HRSG. To condense the steam, the Facility features a dry cooling system, which is similar to the cooling provided by a typical automobile radiator, which cools by the use of ambient air supplied by fans.

The use of a dry cooling system by the proposed Facility reduces the amount of water and wastewater generation by more than 90% from that which would have otherwise been required if a more conventional wet cooling tower had been selected. Most power plants in New England use wet cooling and as a result consume considerably more water per megawatt (MW) of electricity generated. Although dry cooling costs more, Invenergy has selected the dry cooling system for this site to minimize water use.

The use of a dry cooling system also considerably reduces the amount of wastewater that will be generated by the Facility, eliminating cooling tower blowdown that would have been required to control the cooling water chemistry if a more conventional wet cooling tower system had been proposed.

2.2.1 Additional Water Recycling / Water Use Reduction

To support the alternative of supplying the Facility by truck delivery of water, the Facility's process water systems, on-site water treatment system, and wastewater collection system have been re-designed to further minimize water use and to decrease the amount of trucking required to supply water to the Facility.

The water demand for CREC was originally designed based on the supply of water from the PUD Well #3A. As part of that use, water demand from the well was maintained at a relatively high level so as to have a high flow through the well such that it would help the well remediation process. Once use of Well #3A was no longer possible CREC began to evaluate alternatives which included reducing water use and wastewater generation by the inclusion of various water recycling features, tightening standards for steam evaporative losses from the steam cycle, reduction in the frequency of use of evaporative cooling in the summer for cooling the air inlet to the combustion turbines and by substitution of a trailer mounted demineralization system to replace the previously considered reverse osmosis (RO) and electrodeionization (EDI) systems. These features will significantly reduce overall water use and wastewater generation by the Facility albeit with a higher operating cost to the Facility.

The Facility plans to limit winter distillate oil firing to that which can be supported by drawing down the Facility's on-site water storage tanks and to re-fill these tanks only on an extended trucking schedule. Further discussion of this is included in **Section 2.4**. Although the proposed Facility has already committed to incorporate a dry cooling system, which will significantly reduce water use and wastewater generation by 90% from that which other combined cycle electric generating facilities in New England use, the re-designed Facility will incorporate further water reduction features that will support the option of supplying the Facility by truck delivery of water and eliminate use and concerns over local water supplies.

The amount of water used by the Facility will vary with the level of generation output and will vary seasonally to meet the needs of specific processes within the Facility. For the re-designed Facility, the major water uses will be; high purity demineralized water for steam cycle makeup (required throughout the year) to replace losses from the steam system, water evaporated from the evaporative cooling system during warm periods to provide incremental output and efficiency and high purity water for injection into the combustion turbine combustors to control emissions (only needed when firing distillate oil which will typically occur only if needed in the dead of winter). It is important to note that water injected into the combustion turbines to control air emissions, when required to fire oil, is a consumptive water use; the water is evaporated into the combustion turbine exhaust and does not result in an associated wastewater flow.

Other than the three specific water uses identified above, the balance of water use within the Facility for normal operations is for miscellaneous low volume plant services such as general housekeeping, floor/equipment drains and at times, for general maintenance of the Facility.

A separate potable drinking water system will be used to separate these uses from the process water uses, and the Facility will include an on-site sanitary wastewater collection and treatment system consisting of a septic tank and associated leaching field. Sanitary wastewater will be collected in a separate sewer drain system and will not be commingled with process wastewaters.

The following provides a description of the specific changes that have been made to the Facility's water and wastewater systems from that which were originally included in the EFSB Application. Refer to **Appendix A** for schematics of the revised Facility water and wastewater treatment systems.

a) Cycle Makeup Water Treatment System Change

The most significant water reduction has been achieved by replacing the RO/EDI system with a trailer mounted demineralization system which eliminates water losses from the RO/EDI system used to control RO system chemistry and prevent chemical scaling within the RO membranes.

The raw water supplied to the Facility contains dissolved ions such as sodium (Na^{+}), calcium (Ca^{++}), and chloride (Cl^{-}). Positively charged ions are called cations and negatively charged ions are called anions. The original concept for treating the makeup water was the use of a RO system which operates by separating the cations/anions in the incoming raw water and concentrating these ions in a reject stream. The reject stream is about 25 percent of the incoming raw water flow rate but contains 95-98% of the dissolved cations/anions from the incoming water stream. An RO/EDI system sized to process 100 gpm of water would generate a 25 gpm reject stream. The reject stream from the RO/EDI system is typically discharged from the plant as wastewater.

The new proposed water treatment system would use mobile demineralizer trailers to treat the makeup water. Each mobile demineralizer trailer would house a pre-assembled cation vessel, an anion vessel and a mixed bed polishing vessel that are each filled with distinct ion-exchange resins to remove cations and anions from the water. Once the trailer is set in place, the operator hooks the raw water line to the trailer inlet water connection. As the incoming water flows through these vessels, the cations are exchanged for H^{+} ions and the anions are exchanged for OH^{-} ions. These ions then combine to form neutral water.

Once the ion-exchange capacity of a resin bed is exhausted, the mobile trailer is shipped off-site for regeneration. Unlike the RO system, mobile demineralizer trailers do not generate a wastewater stream. For each gallon of incoming water treated, one gallon of demineralized water is produced.

Mobile demineralizer trailers were initially not considered for CREC because the cost to rent these is higher than the cost of a permanently installed RO/EDI system.

There are numerous suppliers of mobile demineralizer trailer systems in the United States. One potential supplier of these systems is General Electric (GE). The GE trailers would likely be dispatched from the GE East Hartford Service Center in Connecticut. The throughput of each trailer depends on the concentration of dissolved ions in the raw water that is processed. If, for example the total dissolved ion concentration in the raw water was 135 mg/L, each demineralizer trailer could generate about 1,200,000 gallons of demineralized water prior to needing to be sent off-site for chemical regeneration. Based on the annual average cycle makeup water demand, this is equivalent to approximately one trailer needing to be regenerated per month. To provide operational flexibility and avoid trailer demurrage charges, a higher volume of water may be processed through the demineralizer trailers than required for plant operation and the excess water stored in the demineralized water storage tank. Each demineralizer trailer is able to make approximately 400 gallons per minute of demineralized water from the municipal water supplied to the Facility.

Trailer mounted demineralization systems also provide an advantage to operators of electric generation facilities in that the trailer demineralizer suppliers have a high level of expertise in the operation and production of demineralized water and can provide remote monitoring of demineralized water production using remote sensing technologies built into the demineralization trailer units.

Trailer mounted demineralization systems are chemically regenerated off-site at the supplier's regeneration facility and thus, eliminate the need for on-site storage of chemicals that would have been required if the ion exchange treatment systems had to be regenerated on-site. Although the trailer mounted demineralization systems operate at an overall higher operating cost, they are effective in reducing on-site water use and do not generate wastewaters on-site.

Appendix B provides a brochure that supplies further details on trailer mounted demineralization systems. The trailer mounted demineralization systems will be monitored remotely by both the suppliers of these trailers who are trained in the operation and maintenance of these systems and the Facility. There is no specific operator's license required for operation of the trailer mounted demineralization systems such as is required for operators in municipal drinking water treatment facilities.

Reverse osmosis treatment systems that had been considered previously, although they operate at high chemical efficiency and provide an overall lower operating cost for the production of demineralized water, are not necessarily water efficient, as a portion of the water to be treated must be wasted as an RO reject stream in order to control the chemistry within the RO membranes and to avoid the formation of chemical scales that would destroy the membranes potentially requiring full membrane replacement. The RO reject stream in electric generating facility's that use wet cooling systems can be recycled to the wet cooling tower and thus, in these type of facilities do not result in a wastewater stream requiring discharge.

b) <u>HRSG Blowdown Recovery</u>

HRSG blowdown is water intentionally removed from the HRSG steam drums to control the concentration of impurities during evaporation of water. The impurities in the steam must be controlled to low levels to reduce erosion and fouling of the HRSG and steam turbine components and to minimize operating and maintenance costs to maintain high reliability. Common steam impurities include sodium, chloride, silica and iron.

HRSG blowdown is still high quality water that is lower in mineral content than the municipal water supplied to the Facility and can be recycled after filtration to remove suspended solids (low levels of boiler system corrosion products). The re-designed water treatment systems will employ a filter to remove suspended solids from the HRSG blowdown and because the total dissolved salts in the blowdown are considerably lower than the municipal water treated by the on-site demineralizer trailers can be recycled to the Facility's Service/Fire Water tank after cooling as shown by the revised water balances provided in **Appendix C**.

In a typical plant configuration, the HRSG blowdown is routed to blowdown tanks that are vented to the atmosphere. The hot, pressurized blowdown stream flashes in the blowdown tank and some of the fluid is lost as vapor through the vent. The remaining condensed fluid is hot and therefore quenched with service water to 140° F before it is discharged from the facility as wastewater.

In order to conserve water, a means of recovering the flashed steam from the blowdown tank vents will be incorporated into the design. This may include installation of a heat exchanger on the blowdown tank vent line to condense most of the flashed steam, or possibly a cascading blowdown scheme between the high pressure and intermediate pressure steam systems can be used to allow recovery of heat and lowering of the blowdown system pressure. During detailed design of the plant, the final design of recovering the flashed steam will be evaluated and incorporated into the CREC system. A heat exchanger will also be installed on the blowdown tank liquid drain line to cool the collected condensate to less than 140°F. The cooled HRSG blowdown condensate will be filtered to remove any suspended solids (corrosion products from the boiler cycle) before routing the filtered water to the facility service water (SW) tank for reuse in the plant.

High temperature resistant cartridge filters are typically utilized for this type of application. The cartridge filter provides inline iron filtration. When the differential pressure across the cartridge filter reaches a predetermined set point, new elements will be installed and the used elements disposed as solid waste. During detailed design of the plant, the best option for filtering the condensate will be identified for incorporation into the system.

c) Evaporative Cooler Operating Changes

To increase combustion turbine efficiency, an evaporative cooler vaporizes water in the turbine inlet air stream, thereby cooling the air and increasing its density (mass flow). As water evaporates, the dissolved species are concentrated in the water circulated through the coolers. To prevent scaling, a portion of the circulating water is removed as evaporative cooler blowdown and fresh water added to the cooler system. Makeup to the evaporative cooler consists of a blend of demineralized water and service water.

In order to conserve water, a higher proportion of demineralized water will be utilized in the cooler makeup water to increase cycles of concentration and reduce blowdown. With a 50/50 blend of service water and demineralized water, the cycles of concentration has been increased from five to seven reducing the overall water use and wastewater required for evaporator system blowdown.

With the revised operational changes, the evaporative cooler makeup flow will be up to approximately 4,600 gallons per hour (total both units) when the evaporative coolers are used. Note that the amount of water used by the evaporative coolers is dependent on ambient temperatures and relative humidity and as a result the evaporative cooler makeup will often be well below the 4,600 gallons per hour estimate.

d) Facility Wastewater Recovery and Recycle

The last water recycling feature is a wastewater treatment system that will treat wastewater from various miscellaneous service water uses such as floor and equipment drains by employing an oil/water separator for bulk oil removal and a filtration system intended to remove suspended solids and any oil that could escape the upstream oil/water separator. Floor and equipment drains are essentially potable water that has been drained from various pieces of equipment or been used to wash down the operating floor of the facility. Good housekeeping practices can eliminate this wastewater flow since there is little real need to wash the operating floors as opposed to alternative dry sweeping methods. Although the expected wastewater flows associated with the miscellaneous service water uses are expected to be low, they can be recovered with diligence to the removal of any oil that might be present.

Wastewater from the floor and equipment drains will be collected in a wastewater collection tank. The tank serves to collect large volumes of water generated in batch operations such as area wash-downs and in the summer when evaporative coolers may be in operation. With the water conservation design changes described above, the only wastewater streams during normal operation would be wastewater that is discharged from the oil/water separator(s) that will need further treatment before it can be recycled. This wastewater stream is basically plant service water but with a higher concentration of oil/grease and suspended solids.

The wastewater will therefore be treated to remove suspended solids and oil/grease. The treated water will be clean water which will be recycled back to the plant Service/Fire Water

Storage tank for reuse. For this type of application, the suspended solids are typically removed by filtration using cartridge filters. During plant transient conditions, such as start-up, when large volumes of wastewater may be generated, an alternate filtration technology such as a pre-coat filtration system may be used. Therefore, the final technology will be selected during detailed design after reviewing the expected transient wastewater flows relative to available filtering technologies. As discussed above, use of cartridge filters does not generate a wastewater stream. A pre-coat filter can be configured to provide a dry waste product suitable for landfill. Any wastewater stream that might be generated by the filtration system will be collected in a wastewater disposal tank or sump and hauled off-site for disposal at a POTW or other facility licensed to receive and treat these wastewaters.

The filtered wastewater may still contain low amounts of oil/grease. The oil/grease can be removed by several types of filter pre-coats such as activated carbon, solka floc (essentially ground paper pulp), or ground walnut shells. As an alternative, special types of oil removing cartridge filters whose elements are designed with high affinity for oil can be used. Again, the equipment selection will be finalized during detailed design of the plant.

Additional technical brochures for various water and wastewater treatment technologies discussed in this section are included in **Appendix D**.

2.2.2 Water Sources

Given the high efficiency of the Facility when compared to older generating facilities in New England, the Facility is expected to operate at full output throughout the majority of the year. Facilities that operate at full load throughout the year are described as having a high capacity factor. The water supply to the Facility must be from a reliable source that can meet the water quality and quantity requirements.

The following provides an analysis of the capacity of the primary water supply source, the Town of Johnston water system (supplied by the Providence Water system), to meet the requirements of the Facility. A review of any other identified water supplier will be performed, as necessary.

The Town of Johnston water supply system is supplied solely by the Providence Water system which is supplied from the Scituate Reservoir and its five tributary reservoirs, all of which combine to make up the Scituate Reservoir Complex. Under the re-designed Facility, process water will be provided by the Town of Johnston water system (supplied by Providence Water) via trucks.

The source of potable water for the Facility during its operation will be from an on-site potable well to be permitted principally through the Rhode Island Department of Health (RIDOH). It is currently expected that the well will be completed in bedrock and that the needs of the facility can be supplied by a single well with a yield less than 10,000 gpd. Based on the anticipated number of employees at the facility (approximately 25 employees), it is estimated that the average daily demand for the facility will be less than 1,000 gpd.

2.3 Source Capacity

This section provides more detail on the water demand for the Facility during each season and the capability of the Town of Johnston which indirectly is the Providence Water municipal water system to meet the water demands of the Facility.

2.3.1 Facility Water Demand

The proposed Facility has been configured as a nominal 850-1,000 MW, energy efficient, dual-fuel combined cycle power plant that will utilize dry cooling to conserve water use. The Facility's daily water demand will vary depending on plant load, ambient air temperature and the fuel used in firing the Facility. Although the Facility will utilize natural gas as its primary fuel, during the winter season if natural gas supplies coming into New England are in short supply or constrained, the gas turbines can be fired by ultra-low sulfur distillate (ULSD), as requested by Independent System Operator New England (ISO-NE). The Facility's water demand while firing ULSD increases from that used while firing natural gas and only for the period of time that the ULSD fuel is required.

The re-designed Facility's daily water demand with both combustion turbines firing natural gas under full-load normal conditions will be approximately 15,840 gallons per day (gpd),a full-load summer condition (approximately 3 months of year) will be approximately 18,720 gpd. During the summer months, in order to operate the Facility under optimal conditions to maximize electricity generation, it may be desired at times to operate the evaporative coolers; although this mode of operation is optional, the frequency of operation can be controlled to only that required to maximize electricity generation from the Facility as the on-site water supply tanks may permit. According to the revised water balances, presented in **Appendix C**, operation of the evaporative coolers would require up to approximately 4,600 gallons per hour of operation. The water for operation of the evaporative coolers would be a mix of demineralized water and/or the service water drawn from their respective water storage tanks and water provided by delivery via trucks.

During the infrequent periods when the Facility is requested to fire one of the gas turbines on oil, the additional daily water demand for the re-designed Facility will be approximately 724,320 gpd for each day of oil firing which will be met by on site storage. Although the total water use of the Facility increases when firing ULSD oil, the total number of days that the Facility will be required to fire oil will typically be determined by the grid operator (ISO-NE) based on the severity of winter conditions when there is a need to conserve natural gas for heating needs of the region. The additional water to support oil-firing conditions would be obtained by drawing down the on-site demineralized water storage tank and/or the service water tank. The on-site water tanks will be refilled after a winter oil firing event by trucked water supplied from the municipal water supplier. The rate of filling of the on-site tanks to replenish water used during winter oil firing will depend on the number of water trucks making delivery to the Facility. **Section 2.4** provides a table showing the number of daily truck deliveries required meeting the normal process water makeup requirements of the Facility and the incremental number of trucks required to refill the on-site water storage tanks to replenish water consumed as a result of winter oil firing.

Appendix C includes four revised water balances developed for the revised water use plans for the Facility. The water balances cover the full range of operating conditions for the Facility expected throughout a typical year. These water balances have been modified to reflect the water use by the Facility when using the Town of Johnston water supply via the trucking option and using all of the water recycling features discussed above. Each of these water balances reflects the Facility operating under a full load condition (maximum output) so the water flows are the maximum expected for each operating case.

- Water balance WMB-01 (Sheet 1 of 4) depicts water flows for the average annual operating condition (average annual air temperature not average annual flow).
- Water balance WMB-01 (Sheet 2 of 4) depicts ambient summer conditions (typically three months of the year) when firing natural gas and with the option of using evaporative coolers for cooling the inlet air to the combustion turbines. As previously noted, operation of the evaporative coolers requires additional water usage estimated at up to 4,600 gallons per hour of operation. This mode is used when high ambient temperatures warrant.
- Water balance WMB-01 (Sheet 3 of 4) depicts water flows for the ambient winter operating condition when firing natural gas.

- Water balance WMB-01 (Sheet 4 of 4) depicts a winter condition if the Facility were requested by the electric grid operator ISO-NE to fire distillate oil on one combustion turbine. As previously noted, oil firing of one of the combustion turbines requires additional water usage estimated at 724,320 gpd.

These four water balances identify all of the major operational water uses and associated wastewater sources throughout the year with each flow reported in gallons per minute when the Facility is operated on water obtained via trucks from the Town of Johnston municipal water system.

Table 2.1 then identifies the daily water use, daily wastewater generated, and daily consumptive or evaporative losses by the Facility at its maximum generation output for each of these four operating conditions.

Table 2.1
Daily Water Use, Wastewater Generated and Evaporative Losses

Operating Season and Fuel	Water Use	Wastewater Generated	Consumptive Evaporative Loss
Average Ambient *Firing Natural Gas*	15,840 gpd	1,440 gpd	14,400 gpd
Summer* *Firing Natural Gas* *Potential for Evaporative Cooling*	18,720 gpd	1,440 gpd	17,280 gpd
Winter Ambient *Firing Natural Gas*	15,840 gpd	1,440 gpd	14,400 gpd
Winter** *Firing Natural Gas* *Potential for Oil Firing*	15,840 gpd	1,440 gpd	14,400 gpd

NOTES:
gpd – gallons per day
*Evaporative cooling Summer water demand – 4,600 gallons per hour additional if/when used
**Additional water demand – Oil Firing – 724,320 gpd will be provided by drawing down on-site storage tanks and re-filling these tanks by truck deliveries to the Facility

Gas Versus Distillate Oil Firing

The natural gas supply to New England is delivered via pipeline from outside of the region. Historically, expansion of the natural gas supply into the region was not pursued because natural gas was more expensive than distillate oil. With the major expansion in natural gas supply in the U.S., there has been a significant reduction in the price of natural gas, and as a result, many major gas pipeline companies are pursuing projects to expand their delivery capacity into the region. As a result, once these natural gas pipeline expansions are complete, the pressures on the regional natural gas distribution system that historically have forced the use of distillate oil firing will be lessened.

To put the above in perspective, over the last five years with the current limited pipeline capacity into the region, there has been an average of only five days per year when gas fired electric generation were asked to switch to distillate oil. Five days per year means, if the Facility had existed for the last five years, the Facility would have fired natural gas 98.6% of the time. Not all of the electric generating facilities in New England have the capability of firing oil; and most, if not all are limited by the amount of on-site oil and/or water stored on site.

Projecting forward with the natural gas pipeline expansions underway and the growth of renewables throughout New England, whose output is not tied to the natural gas supply, the total annual days of oil firing should lessen with the increasing supplies of natural gas and renewables helping to reduce winter shortage of this critical fuel to the region. The Facility will limit winter distillate oil firing to that which can be supported by drawing down the Facility's on-site water storage tanks and to re-fill these tanks only on an extended trucking schedule to reduce traffic impacts on the community.

2.3.2 Ability of Source to Meet Facility Demand

The following section discusses the capability of the Town of Johnston water system (supplied by Providence Water) to meet the Facility's projected water demand. A filling station will be established within the Town of Johnston that would allow trucking of water to the Facility.

The Town of Johnston municipal water system obtains its water supply from Providence Water and is considered a consecutive water system. As such, the capacity of the Town of Johnston water system to be able to support the water demands of the CREC facility is dependent on the capacity of the Providence Water system.

The principal water source for Providence Water is the Scituate Reservoir Complex. The safe yield of the Scituate Reservoir Complex (Scituate Reservoir and associated tributary reservoirs) has been determined to be 92 MGD, and taking into consideration the requirement to release 9 MGD downstream, to the Pawtuxet River, results in a net Safe Yield of 83 MGD, as detailed in the 2010 Water Supply System Management Plan (WSSMP; Pare 2010).

Table 2.2 below provides actual and projected water demands (residential, commercial, industrial and governmental uses) for the Providence municipal water system as provided in the 2010 WSSMP (Pare, 2010).

Table 2.2
Average and Maximum Day Demands

Water Supplier	2007 (Actual)		2015 (Projected)		2030 (Projected)	
	ADD (MGD)	MDD (MGD)	ADD (MGD)	MDD (MGD)	ADD (MGD)	MDD (MGD)
Providence Water (Method 1)	68.14	113.5	71.3	119	76	126.9
Providence Water (Method 2)			68.7	114.7	71	118.6

NOTES: ADD – average day demand; MDD – maximum day demand
Method 1 – uses wholesaler based projections
Method 2 – PWSB Population Based Projections

In the 2010 WSSMP, Providence Water states that the safe yield (83 MGD) provides the Providence Water Supply Board (PWSB) with ample supply for the current and projected future average daily water demand. The WSSMP also states that the maximum day demand is available through reserve system storage (storage reservoirs) and short-term drafting of the reservoir complex.

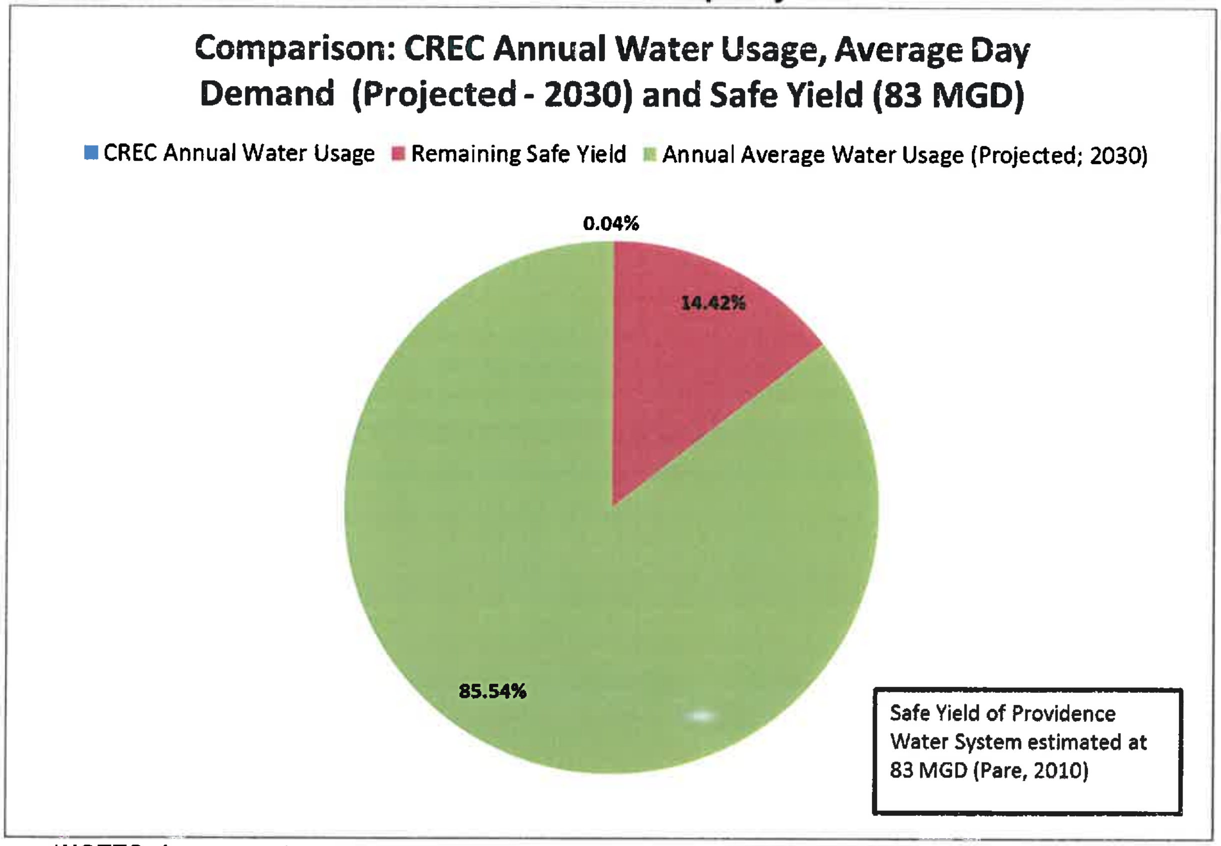
Table 2.3 presents the population projections for the cities and towns that receive some or all of their municipal water from the Providence Water system, an important factor in the future planning for water use by the community (Rhode Island Statewide Planning Program, 2013). Also included are the population growth projections for the entire state of Rhode Island. Based on these projections, it would be anticipated that the water demand for residential uses would be expected to remain consistent or experience a slight increase within the next 25 years.

Table 2.3
Population Projections

City/Town	Count	Projections		
	2010	2020	2030	2040
Barrington	16,310	15,933	15,914	15,569
Bristol	22,954	23,009	23,638	23,770
Coventry	35,014	36,108	38,037	39,172
Cranston	80,387	80,270	82,133	82,270
E. Greenwich	13,146	13,459	14,048	14,342
E. Providence	47,037	44,188	42,602	40,195
Johnston	28,769	29,035	29,996	30,327
Lincoln	21,105	21,857	23,038	23,750
No. Providence	32,078	31,403	31,475	30,895
Providence	178,042	180,583	187,547	190,601
Smithfield	21,430	22,023	23,136	23,766
Warren	10,611	10,015	9,640	9,083
Warwick	82,672	79,243	77,751	74,701
West Greenwich	6,135	7,140	8,287	9,234
West Warwick	29,191	28,502	28,496	27,902
Totals	**624,881**	**622,768**	**635,738**	**635,577**
% Change	**- -**	**-0.34%**	**1.74%**	**1.71%**
RI Population	**1,052,567**	**1,049,177**	**1,070,677**	**1,070,104**
% Change	**- -**	**-0.32%**	**1.72%**	**1.67%**

Source: RI Population Projections (Rhode Island Statewide Planning Program, April 2013)

Figure 2.3
Water Source Capacity*



***NOTES**: Assessment assumes:

- 8 hours per day of evaporative cooling for 90 days per year
- 3 days of oil firing per year

The above graph (**Figure 2.3**) provides a conservative comparison of the total annual water usage of the Facility (shown in blue) compared to the net Safe Yield of the Providence Water System (83 MGD) and the projected average day demand (ADD) for 2030 (71 MGD) using the Method 2 projections as detailed in **Table 2.2**. The Method 2 projections (which assume approximately 4.2 % growth in ADD through 2030) were utilized in this evaluation since they are more comparable to the projected population growth within the Providence Water service area (approximately 1.7% growth in population through 2030) and still allow for additional growth in other water uses (e.g., commercial, industrial, governmental). The above clearly shows that the annual amount of water required for the Facility is a small fraction of the available capacity of the Providence Water supply system and will not impact their ability to supply water to their current or future customers.

Based on this evaluation, it is clear that the existing capacity of the Providence Water system, based on the net safe yield of 83 MGD, is more than sufficient to meet the water demands of CREC, as well as the current and projected water needs of the communities that it supplies on an annual basis.

2.4 Water Supply Trucking

The option of trucking water to the Facility and disposing of wastewater generated by the Facility is a viable solution to meet the operational requirements of the Facility in the absence of use of local water supplies. This approach requires an increase in the number of truck deliveries to the Facility to support this option of supplying water to the Facility and for disposal of wastewater from the Facility.

Table 2.4 and **Table 2.5** below are provided to identify the number of potential water truck trips (deliveries) required per day based on the expected operation of the Facility. Two tables have been provided to separate the expected daily number of truck deliveries required to provide water for process makeup to the Facility during typical operations from those trucks needed to re-fill the on-site water storage tanks that may have been drawdown as a result of winter distillate oil firing.

Table 2.4
Typical Gas-Fired Operating Scenarios

Operating Condition	Water Usage (gpd)	# of Truck Trips Per Day
Annual Average Ambient Condition	15,840	2.0
Summer Ambient Condition	18,720	2.3

Evaporative Cooling is optional and is used primarily in the Summer and because New England Summers have high variability in temperature and humidity, evaporative cooling is not necessary for all days and seldom is used at night because nighttime humidity levels reduce the effectiveness of evaporative cooling.

Table 2.5
Additional Trucks Trips - Re-Fill Water Tanks After Oil Firing

Condition	# of Additional Water Truck Trips Per Day
3-Days Oil Firing; 1 month Refill	9.1
3-Days Oil Firing; 2 month Refill	4.5

NOTES: assumes 724,320 gpd for each oil firing day

Table 2.4 identifies the range in truck deliveries required assuming each truck holds approximately 8,000 gallons per truck for the various typical operating scenarios. The range in the number of truck deliveries for normal operations is typically from 2 to 3 trucks per day. On those exceptional days when evaporative cooling might be needed, CREC will utilize on-site storage and replenish the on-site storage over time.

Table 2.5 shows a range of water truck delivery periods when replenishment is required for the on-site storage tanks. Winter oil firing may not be required in all years. Whether these additional truck deliveries are required is outside of the control of the Facility. **Table 2.5** demonstrates that the total truck deliveries can be reduced by stretching out the number of days allowed to re-fill the on-site water storage tanks.

The revised traffic analysis is included as **Appendix E**.

3.0 WASTEWATER

As a result of the reduction in the overall water use by the Facility, the amount of wastewater that will be generated by the Facility will also be significantly reduced, allowing use of trucking wastewater from the Facility as the method of wastewater disposal.

Discharge of wastewater from the Facility will be by trucking wastewater to POTWs or other privately-owned facilities in the area licensed to receive and treat industrial wastewater. Any wastewater considered for receipt by any POTW or privately owned facility licensed to treat industrial wastewater must meet the overall quality and compositional requirements to be accepted by those facilities for treatment and discharge under their operating permits.

The projected wastewater composition for wastewater generated by the Facility has been developed in **Table 3.1,** based on the water quality of the Town of Johnston municipal drinking water supply. Although drinking water quality varies between municipal water suppliers in Rhode Island, the overall composition of these municipal water supplies are of high quality and have similar overall chemical composition. As a result, although **Table 3.1** has been developed for the Town of Johnston municipal water supply, **Table 3.1** is representative of the Facility wastewater composition that will be generated by use of any municipal water supply in Rhode Island.

3.1 Wastewater

The majority of wastewater generated by the re-designed Facility's water and wastewater collection/treatment system will be from the steam generator (HRSG) blowdown, the reduced use of evaporative cooler blowdown (summer only if/when used) and miscellaneous plant services water uses and sanitary wastewater from the operating staff.

Sanitary wastewater will be collected within a separate sanitary sewer system and will be treated in an on-site wastewater disposal facility employing a septic tank and on-site leaching field. Miscellaneous service water uses generate industrial wastewater within the Facility such as customary house cleaning required for any industrial complex, are low volume wastewater that can be recovered in part by an on-site wastewater treatment system consisting of a filtration system to remove suspended solids and any residual oil not removed by the on-site oil/water separator. The filtration system will be selected in the final design and will either be a cartridge or pre-coat type filtration system selected based on effectiveness for oil and suspended solids removal and operating costs.

The blowdown from the HRSG will also be recycled through a filtration system that will be either a cartridge or pre-coat type filtration used to filter the HRSG blowdown and allow this demineralized water to be recycled back to the Service/Fire Water Storage tank. HRSG blowdown is high quality water of low overall salt content and is reusable once filtered to remove any suspended solids (boiler system corrosion products) and can be recycled to the Service Water/Fire Water Tank for treatment by the on-site trailer mounted demineralizer system.

Table 2.1 provides the expected seasonal daily wastewater flows from the re-designed Facility that will need to be discharged by trucking this wastewater to a POTW or privately-owned treatment works or facility. Any wastewaters to be disposed of off-site will need to be characterized to ensure these wastewaters are properly disposed of by those facilities licensed to receive and treat this wastewater or otherwise utilize these wastewaters.

The Facility's daily industrial wastewater discharge flow while firing either natural gas or distillate oil is expected to be approximately 1,440 gpd. This wastewater flows is representative of the vast majority of operating hours for the Facility.

3.2 Wastewater Discharge Limits

On November 19, 1982, under 40 CFR 423, the U.S. Environmental Protection Agency (USEPA) developed and promulgated effluent limits applicable to the Steam Electric Power Generating Point Source Category. The Categorical Effluent Standards issued in 1982 were described as applicable to "discharges resulting from the operation of a generating unit by an establishment primarily engaged in the generation of electricity for distribution and sale, which results primarily from a process utilizing fossil-type fuel (coal, oil, or gas) or nuclear fuel in conjunction with a thermal cycle employing the steam water system as the thermodynamic medium."

The USEPA, on June 7, 2013, proposed revisions to the regulation issued in 1982 aimed at strengthening the controls from certain steam electric power plants by revising these technology-based effluent limitation guidelines and standards for the steam electric generating point source category. The USEPA finalized this revision to 40 CFR Part 423 on September 30, 2015.

The revised Categorical Effluent Standards are applicable to a wide range of technologies used in the electric generating sector from coal, oil and nuclear facilities of all sizes and configurations. These Categorical Effluent Standards also apply to modern gas fired combined cycle generating facilities because combined cycle generating facilities employ as part of the overall facility design "a thermal cycle employing the steam water system."

In developing the Categorical Effluent Standards, the USEPA had to consider a wide range of generating technologies employing many different materials of construction of the steam water systems. Conventional steam boiler cycles built in the 1950s, 1960s and 1970s are still in operation in many areas of the country, and as such, the wastewaters from these facilities reflect the materials of construction that included significant use of copper alloys both in the boiler systems and often in the steam condensers of these facilities. As a result, significant focus was placed on effluents from these facilities for a range of heavy metals, especially copper, and the USEPA has included a specific limit on copper in the discharges from steam electric generating facilities.

Many of the USEPA proposed Categorical Effluent Standards are also focused on coal-based power plants and coal gasification technologies that have the wide range of wastewaters associated with coal ash and coal based power plant emission control systems, which are not applicable to gas fired combined cycle power plants.

In developing the revised regulations, the USEPA specifically focused on the Categorical Effluent Standards applicable to new Steam Electric Power Generating facilities discharging to POTWs.

In developing the new standards, the USEPA defined Low Volume Waste Sources as "wastewater from all sources including but not limited to ion exchange water treatment systems, water treatment evaporator blowdown, laboratory and sampling streams, boiler blowdown, floor drains, cooling tower basin cleaning wastes and recirculating house services water systems. Sanitary and air conditioning wastes and carbon capture wastewaters are not included."

As a result, wastewaters generated by most modern combined cycle generating facilities fit the definition of Low Volume Wastewaters under the revised USEPA Steam Electric Point Source Category.

CREC has reviewed the recently revised categorical pretreatment standards. The attached **Table 3.1** provides information on the composition of the Town of Johnston (Providence Water) water supply and provides a projection of the industrial wastewater composition from the Project. **Table 3.1** does not include a projection of the wastewater compositions for sanitary wastewaters as these will be managed separately from the industrial wastewater and disposed of in an on-site septic tank and leaching field which is commonly employed for these wastes. **Table 3.1** also identifies the recently promulgated effluent pretreatment discharge standards for those facilities discharging to a POTW. USEPA reviewed wastewaters generated by combined cycle electric generating facilities and required pre-treatment standards for those facilities discharging their wastewaters to POTW facilities. This review found that these wastewaters are compatible for discharge to POTWs, found that these waters could benefit by the removal of suspended solids provided by the settling processes of the POTWs and found only one metal of concern prevalent in some electric generating facilities employing wet cooling systems using copper alloys in their cooling system. Since the Facility does not employ a wet cooling system, there will be no copper in the discharge from any wet cooling system.

As shown on **Table 3.1**, the wastewater discharged from the Facility will meet the Categorical Pretreatment Standards applicable to discharges to POTWs without any additional treatment. Some

POTWs and private wastewater treatment facilities may have site specific discharge limits that will be uniquely applicable to those facilities based on their discharge permits. Table 3.1 identifies these as discharge specific limits (DSLs) to identify these as separate of the Categorical Pretreatment Standards. Other than sanitary wastewaters generated by the Facility's operating staff, no wastewater generated at the Facility will be disposed of on the Facility's site.

All discharges from the Facility are projected to meet all applicable Categorical Pretreatment Standards and any additional standards that might be imposed by the POTW's receiving this wastewater. Upon commencing operation, all wastewaters generated at the Facility will be thoroughly sampled and characterized to confirm that the composition of any wastewater generated by the Facility meets with the plans for its disposal.

Table 3.1
Projected Wastewater Quality

Parameters[1]	Units	Johnston Supply to CREC	Projected CREC Wastewater Quality	Categorical Pretreatment Standards Applicable to Discharges to POTWs[2]
Specific Conductivity	µS/cm	173	58	Not Regulated
TDS	mg/L as CaCO3	94	32	Not Regulated
pH	S.U.	10.2	6-9	6.0 – 9.0
Calcium	mg/L	15.0	4.9	Not Regulated
Magnesium	mg/L	0.7	0.23	Not Regulated
Potassium	mg/L	1.0	0.31	Not Regulated
Sodium	mg/L	12.0	4.1	Not Regulated
Total Alkalinity	mg/L as CaCO3	16.5	5.4	Not Regulated
Bicarbonate (HCO3)	mg/L	NA	16	Not Regulated
Hardness	mg/L as CaCO3	42.0	14	Not Regulated
Chloride	mg/L	20.5	6.9	Not Regulated
Fluoride	mg/L	0.70	0.7	Not Regulated
Nitrate (N)	mg/L	<0.10	0.1	Not Regulated
Sulfate (SO4)	mg/L	23.5	7.7	Not Regulated
Total Silica (SiO2)	mg/L	3.9	1.9	Not Regulated
Dissolved Silica (SiO2)	mg/L	3.9	1.3	Not Regulated
Total Suspended Solids	mg/L	ND	66.7	DSL
Total Organic Carbon (TOC)	mg/L	1.8	4.3	DSL
Oil/Grease	mg/L	NA	10	DSL
Ammonia - N (NH4)	mg/L	<0.02	2.0	≤ 30
Nitrite (N)	mg/L	0.0002	0.00	DSL
Ortho Phosphate (PO4)	mg/L	<0.10	0.1	DSL
Residual Chlorine	mg/L	0.44	0.0	DSL
Biochemical Oxygen Demand	mg/L	NA	0.15	≤ 300
Total Aluminum	mg/L	<0.01	0.0	DSL
Total Antimony	mg/L	<0.001	0.0	DSL
Total Arsenic	mg/L	<0.004	0.0	ND
Total Barium	mg/L	0.01	0.0	DSL
Total Beryllium	mg/L	<0.001	0.0	DSL
Total Cadmium	mg/L	<0.001	0.0	DSL
Total Chromium	mg/L	<0.001	0.0	DSL
Total Copper	mg/L	0.03	0.0	1.0
Total Manganese	mg/L	<0.01	0.0	DSL
Total Iron	mg/L	0.05	0.69	DSL
Total Lead	mg/L	0.02	0.0	ND
Total Mercury	mg/L	<0.0002	0.0	DSL
Total Nickel	mg/L	<0.001	0.0	DSL
Total Selenium	mg/L	<0.005	0.0	DSL
Total Silver	mg/L	<0.001	0.0	DSL
Total Thallium	mg/L	<0.001	0.0	DSL
Temperature	F	173	58	≤ 150
NOTES: DSL – Each POTW may have site specific discharge limits required by their respective discharge permits				

3.3 Wastewater Trucking

The truck trips required to manage the process wastewater have been developed based on the following assumptions:

- process wastewater generated at the Facility will be approximately 1,440 gpd; and
- capacity of the trucks used to remove this wastewater from the Facility for treatment and disposal is 3,200 gallons per truck

Based on these assumptions, approximately 3 truck trips per week will be necessary for the management of the process wastewater. The actual frequency of these truck trips will be dependent on the volume of the process wastewater holding tank.

The revised traffic analysis is included as **Appendix E**.

4.0 REVISED TRAFFIC ANALYSIS

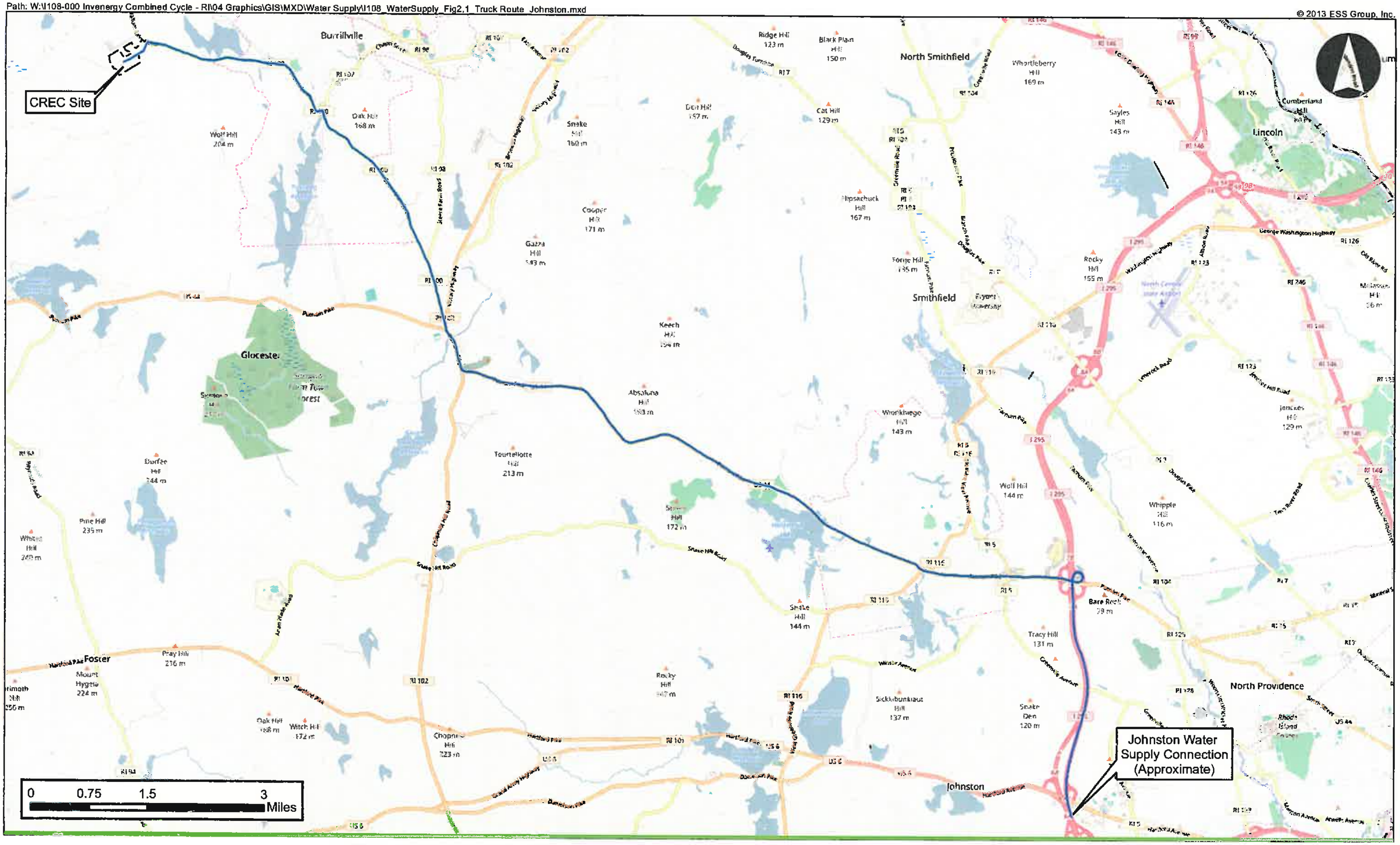
McMahon Associates (McMahon) prepared a traffic analysis to reflect the current water supply option for CREC. *See* **Appendix E**. This analysis is a supplement to the original Traffic Impact Study (TIS) for CREC dated May 2016.

McMahon concluded the following:

- Conclusions of the TIS in terms of peak hour traffic operations remain valid;
- Proposed truck routes are able to accommodate the proposed increase in truck traffic as a result of the proposed CREC facility operations; and
- Truck routes would not experience significant additional deterioration due to the transport of water to the site.

Figures

Date: 1/9/2017
Path: W:\I108-000 Invenergy Combined Cycle - RI\04 Graphics\GIS\MXD\Water Supply\I108_WaterSupply_Fig2.1_Truck Route_Johnston.mxd



Clear River Energy Center
Burrillville, Rhode Island

1 inch = 9,000 feet

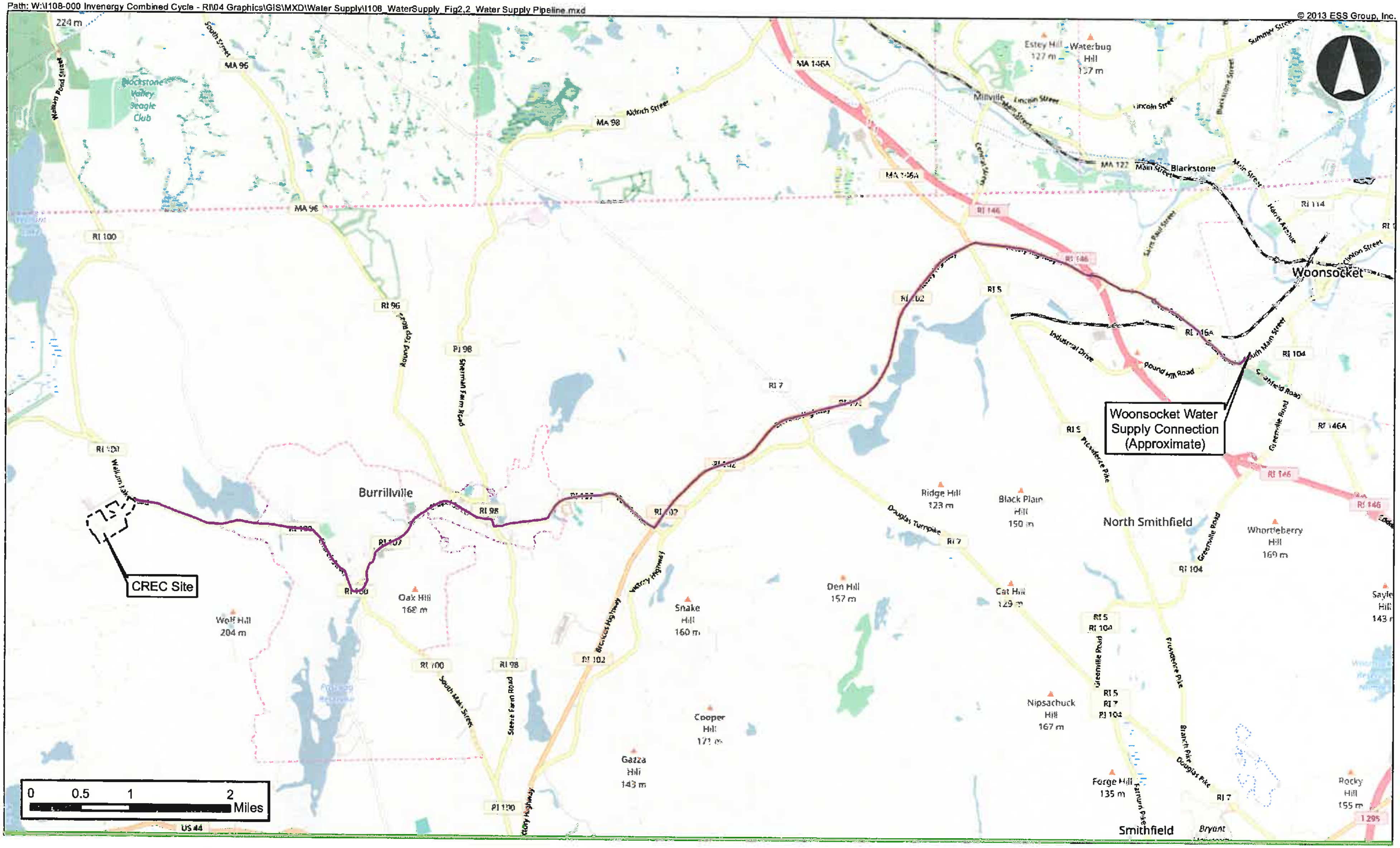
Source: 1) Invenergy, Site Location, 2016
2) ESS, Pipeline/Trucking Routes, 2017

ESS group
environmental consulting & engineering services

Water Supply Truck Route

Figure 2.1

Date: 1/9/2017
Path: W:\I108-000 Invenergy Combined Cycle - RI\04 Graphics\GIS\MXD\Water Supply\I108_WaterSupply_Fig2.2_Water Supply Pipeline.mxd



Clear River Energy Center
Burrillville, Rhode Island

1 inch = 7,000 feet

Source: 1) Invenergy, Site Location, 2016
2) ESS, Pipeline/Trucking Routes, 2017

ESS group
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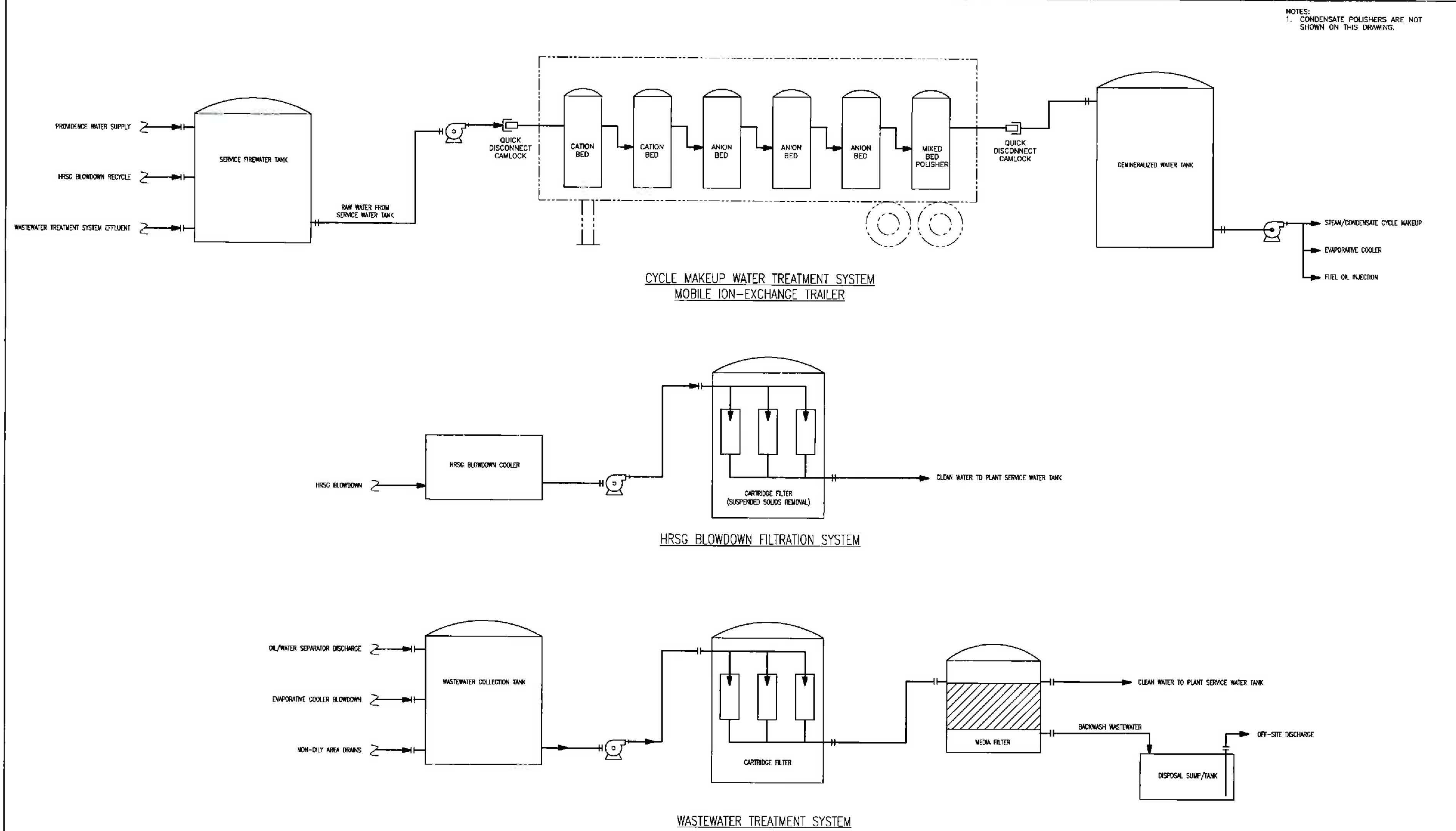
Alternative Water Supply Pipeline

Figure 2.2

Appendix A

CREC Water and Wastewater Treatment Systems



HDR
HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION	DWN	ENGR	CHK	APPV
A	06 JAN 17	FOR INFORMATION	PVJ	ASH	XXX	XXX

**PRELIMINARY
NOT FOR
CONSTRUCTION
OR
RECORDING**

**INVENERGY, LLC
CLEAR RIVER ENERGY CENTER**

**CLEAR RIVER ENERGY CENTER
WATER AND WASTEWATER
TREATMENT SYSTEMS**

FILENAME: M1203-0WT-238926.dwg
SCALE: NONE
SHEET: **238926-0WT-M1203**

Appendix B

Mobile Demineralizer Trailers System Brochures

MobileFlow*

Description and Use

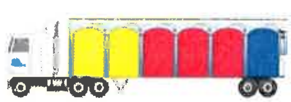
GE offers the world's largest fleet of mobile water treatment systems, providing demineralization, filtration, softening, and deoxygenation treatment, quickly and efficiently – available for either emergency, supplemental, or extended term service.

All aspects of treatment, from system analysis and design through installation, maintenance, upgrades and emergency response are available. Included are immediate system backup, complete analytical laboratory, application and engineering consultants, qualified Field Service Representatives (FSR's), regional service centers, and a 24-hour dispatch and control center.

Each MobileFlow* system contains six rubber-lined ASME code steel tanks of uniform size, with a patented piping system to allow operation in series or parallel. The system can be operated by FSR's, your plant personnel or remotely monitored. Automatic shutdown features protect from power failure, excess pressure and off-specification water. Regional service centers perform regeneration quality control checks on every unit. Demineralization treatment is available in as little as two hours plus transit time. Other special applications may require additional time.

Typical Applications

Demineralization



Premium 10% cross-linked cation resins and porous Type I strong base anion resins are standard in custom loading of the MobileFlow system.

Regeneration of ion exchange resins at service centers provides the highest conversions for economical production of ultra pure water. A proprietary rinse is used on the selected resins to prevent any residual QC test water from remaining in the trailer when it is delivered to the user. Off-site resin regeneration gives the customer the use of a true zero discharge system.

Filter Media | Mixed Bed Resin | DEOX Media | Strong Base Anion Resin | Cation Resin

Formalized resin purchase specifications include specific test procedures and quality limits to ensure that the products are free of manufacturing impurities, and can meet the most stringent specifications.

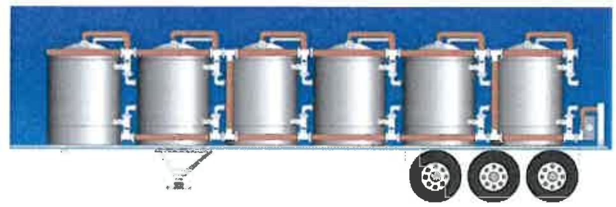
Filtration

GE stands alone in filtration capability, having pioneered in-line coagulation for the mobile water treatment industry. The MobileFlow system takes advantage of a proprietary dual media filter that is treated with a biocide, acid, and hot water after each use to protect against cross-contamination from various surface water sources.

We guarantee the effluent quality for influents up to 50 NTU and the system can also treat water up to 100 NTU. Treatment flow rates are dependent upon the influent turbidity values. Typically, flow rates up to 600 GPM per trailer are possible with influent values of less than 10 NTU.

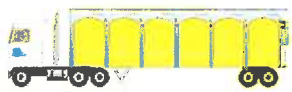
Deoxygenation

Our patented DEOX* process provides a water quality of less than 1 ppb dissolved oxygen, with 0.5 ppb typically measured. Clients in the pulp and paper, petrochemical, refinery, and utility industries have benefited by our capability to deoxygenate water from virtually any source, including municipal, well, raw surface water, condensate, and demineralized water. This service is readily available on an emergency basis, and is also typically utilized during by-pass of the client's deaerator for inspections and repairs.



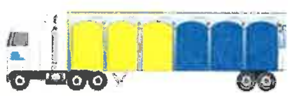
The MobileFlow system incorporates an exclusive piping system linking six rubber-lined ASME code pressure vessels. The international version (shown here) has three axles and the U.S. version has two.

Softening



The MobileFlow system provides softening at high flow rates, routinely producing water at 600 GPM, and can be reconfigured to produce 1,000 GPM per trailer. Mobile and quickly available, this application can be provided with either exchange service off-site regeneration) or on-site regeneration. A MobileFlow unit has a softening capacity in excess of 15 million grains.

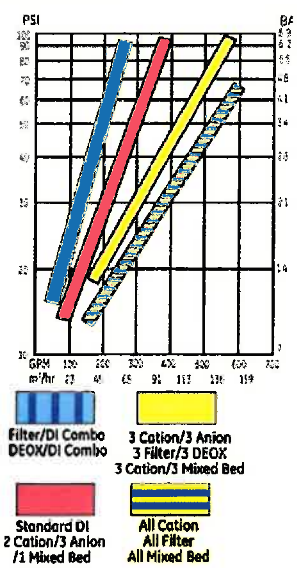
Condensate Polishing



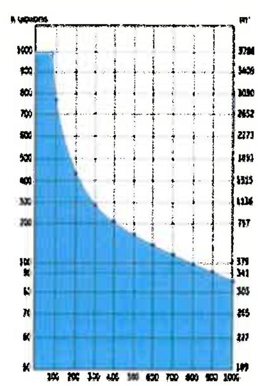
Utilizing a cation/mixed bed configuration, condensate can be polished to remove crud loading and trace ionic contaminants during unit start-ups or for longer-term requirements. The 10% cross-linked cation resin is strong enough to withstand aggressive temperatures and crud loads of the condensate while keeping the mixed bed resins clean for final ionic contaminant removal without interference.

General Properties

MobileFlow Pressure Drop at 60°F (16°C)



Demineralizer Capacity



Dimensions and weights	
Overall length with tractor	60'-0"
Trailer length	43'-0"
Trailer height	13'-6"
Trailer width	8'-0"
Gross trailer operating weight	90,000 lbs.
Electrical	
Electrical power requirements	110V, 20 amps
Specifications	
Inlet/outlet connections	2.5" NST, male fire hose, 3 inlet, 3 outlet Also available: 4" 150 psi flange or 4" NST male fire hose, 1 inlet, 1 outlet
Pressure vessels	6 per trailer, ASME code, 100 psi (7 bar) W.P., rubber lined
Resin capacity	Over 5 million grains (Demineralization)
Outlet resin trap	8" with suitable mesh element
Suitable media	Ion exchange resins, synthetic adsorbents, activated carbon, granular filter media, etc.
Instrumentation	• Two conductivity meters, one with strip chart recorder and alarm or telog recorder, with alarm • High/Low temperature alarms • Complete pressure instrumentation • Rate of flow indicator • Totalizing flow meter
Controls	• Adjustable pressure reducing valve on inlet • Isolation valves on all pressure vessels • Automatic shutdown system • External audible alarms
Heating	Propane fueled, thermostat controlled system for freeze protection to -20°F

Further Information

For more about the Emergency and other services please call number below:

US toll free 800 446 8004 or 757-855 9000

evoqua
WATER TECHNOLOGIES

MOBILE DEMINERALIZERS SYSTEMS

MOBILE DI FOR MAXIMUM VERSATILITY

For over thirty years, Evoqua Water Technologies has met the short-term and emergency treated water needs of its customers using Mobile Demineralizer (DI) trailers. These trailers are the treatment of choice for zero-discharge applications and seasonal treated water needs. A reliable and extensive service network, an ever-expanding trailer fleet, and strategically located regeneration facilities allow Evoqua Water Technologies to serve its large North American customer base quickly and effectively.

Mobile DI services allow customers to meet their treated water needs without on-site waste generation, hazardous chemical handling or capital investment. Evoqua uses the following trailers to match customers' exact capacity and flow needs with the right solution:

- MT 5500 - This versatile DI trailer is normally configured with six vessels: two cations, three anions, and one mixed bed. Each vessel holds up to 100 ft^3 of resin for a nominal capacity of five million grains. Depending upon configuration, flow rates range from 100-400 gpm.
- MT 5000 - A six-vessel trailer with a nominal five million grain capacity. This two-train trailer offers 300 gpm per train (600 gpm total).
- MT 4500 - A four-vessel trailer, includes a weak-base anion vessel. With flows of 200 gpm and capacities of up to four million grains on certain feedwaters, this trailer is ideally suited for water with high free mineral acidity.
- MT 3000 - A three-vessel trailer with a nominal three million grain capacity and flow rates to 200 gpm.

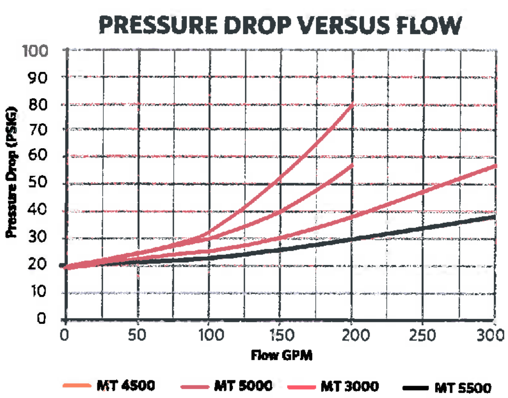
Typical Uses:

- Capacity expansions
- Zero discharge applications
- Pilot plant water needs
- Interim use until a permanent system is installed
- Process water quality changes
- Existing demineralization system environmental salt discharge problems
- Scheduled shutdowns
- Seasonal water needs
- Emergency water needs

A TRAILER FOR EVERY NEED

Series	MT 3000	MT 4500	MT 5000	MT 5500
	Effective for lower flow rate and low TDS water applications (especially for power industry)	Effective in low alkalinity/high FMA (free mineral acidity) applications	Highest flow rate per trailer in the industry, completely automatic two-train system	Versatility with 6x100 ft^3 vessels, the 5500 can be configured to provide highest capacity or most effective flow rate
Nominal exchange capacity (kgr)*	3,000	4,500	5,000	5,000
Vessels	3 tanks/trailer	4 tanks/trailer	6 tanks/trailer	6 tanks/trailer
Vessel composition	Carbon steel	Carbon steel	Carbon steel	Carbon steel
Vessel lining	Vulcanized rubber	Vulcanized rubber	Vulcanized rubber	Vulcanized rubber
ASME	Yes	Yes	Yes	Yes
Flow rate (gpm) min./max.	50/200	50/200	50/600	50/400
Inlet pressure (psig) min./max.	45/100	50/100	40/100	40/100
Inlet/outlet hose connections	2.5" Minimum	2.5" Minimum	2.5" Minimum	2.5"-4" Minimum
Weight (lbs.) shipping/operating	35,000/42,000	47,000/62,000	60,000/84,500	58,000/84,500
Dimensions - Length x Width x Height	32' x 8' x 13.5'	32' x 8' x 13.5'	43' x 8' x 13.5"	48' x 8.5' x 13.5'
Trailer electrical requirements	115 V, single phase, 60 hz, 10 amps			
Heater electrical requirements	(2) 115 V, single phase, 60 hz, 30 amps			
Instrumentation	Flow indicator and totalizer on main header; pressure gauges and sample ports; conductivity meters on primary and polish outlet ports			
Feedwater requirements	Turbidity < 3 NTU — Free chlorine < 0.25 ppm			
Typical water service quality	Conductivity: 1.0 - 0.1 µS-cm and silica leakage < 20 ppb			

*Based on a 1 µS-cm end point



*These pressure drops are from the inlet of the trailer to the outlet connection. The MT 5000 has two trains @ 300 gpm each.

evoqua WATER TECHNOLOGIES

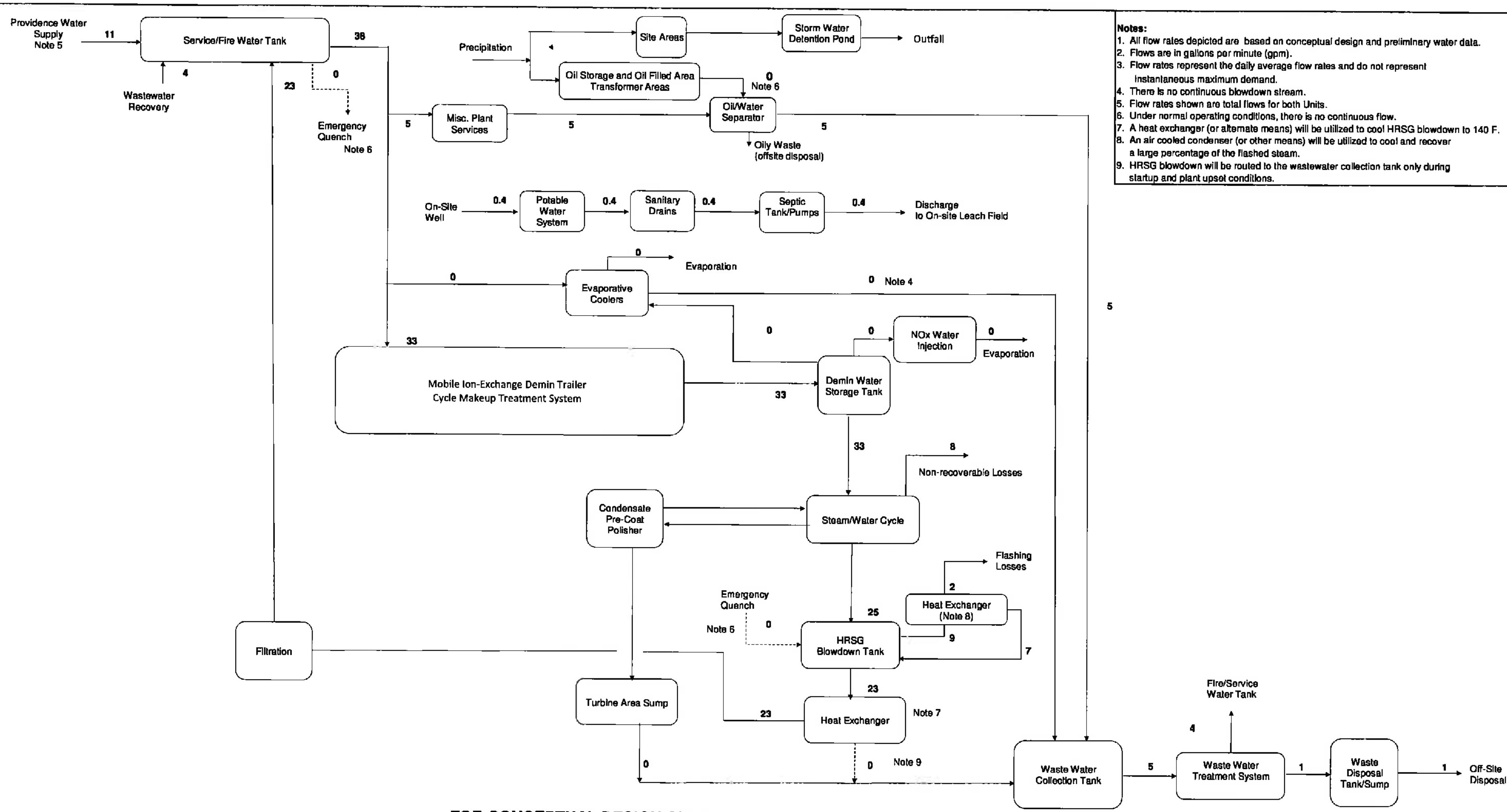
4800 North Point Parkway, Suite 250, Alpharetta, GA 30022

+1 (800) 435-3223 (toll-free) +1 (978) 614-7233 (toll) www.evoqua.com

Appendix C

Revised Facility Water Balances

www.essgroup.com



Notes:
1. All flow rates depicted are based on conceptual design and preliminary water data.
2. Flows are in gallons per minute (gpm).
3. Flow rates represent the daily average flow rates and do not represent instantaneous maximum demand.
4. There is no continuous blowdown stream.
5. Flow rates shown are total flows for both Units.
6. Under normal operating conditions, there is no continuous flow.
7. A heat exchanger (or alternate means) will be utilized to cool HRSG blowdown to 140 F.
8. An air cooled condenser (or other means) will be utilized to cool and recover a large percentage of the flashed steam.
9. HRSG blowdown will be routed to the wastewater collection tank only during startup and plant upset conditions.

FOR CONCEPTUAL DESIGN ONLY

HDR

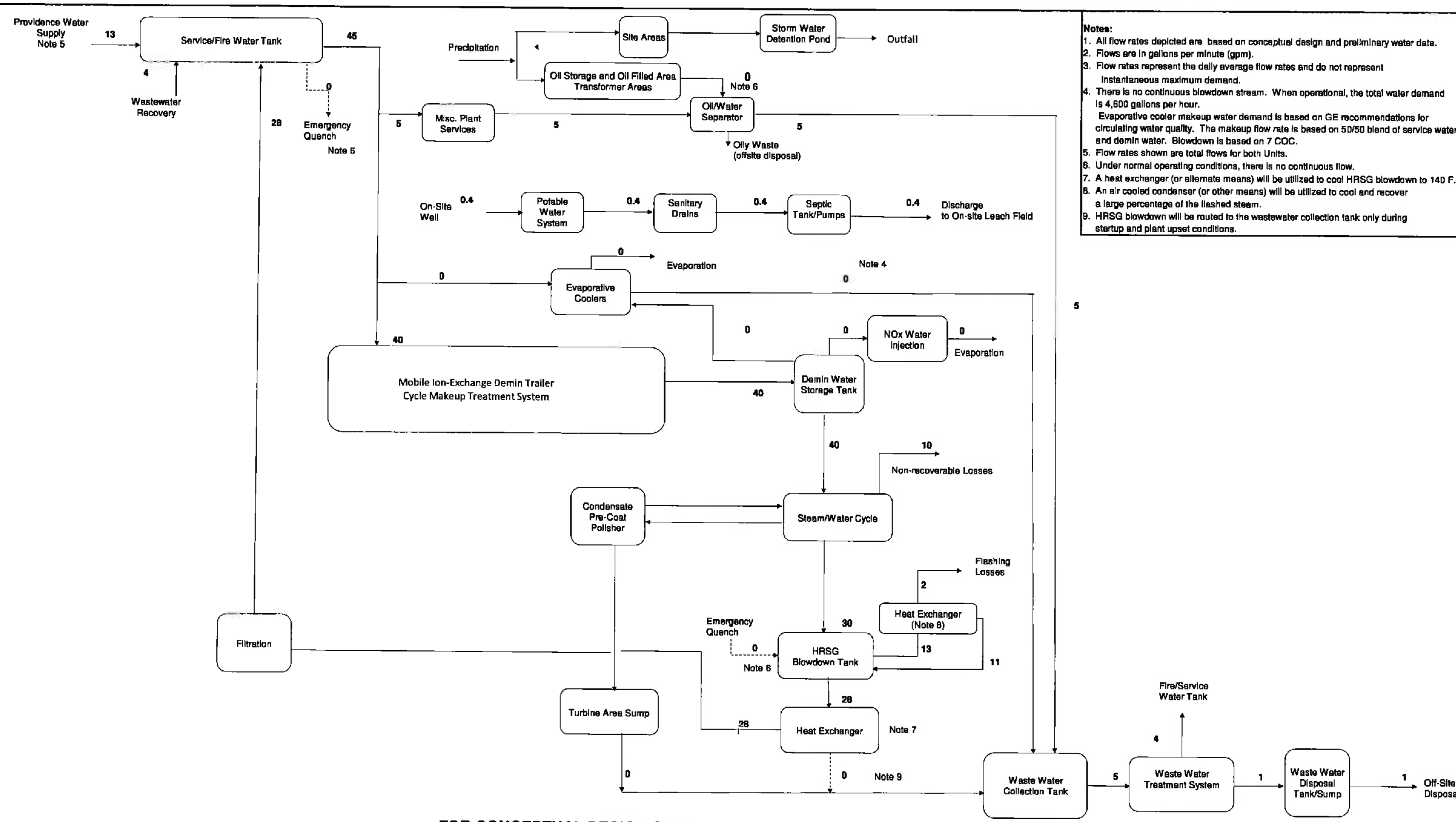
Conceptual Design Basis	01/11/2017	
Demin Water Makeup Demand	1.0% of IP+HP Steam Flow	GE HB Case 7 (issued 3/31/2016)
Potable Water Demand	20 personnel, 50 gal per day, 3 shifts	
Ambient Conditions	51.8°F / 74%RH	
Fuel Oil Injection	None	

Invenergy

RHODE ISLAND
Two 1 x 1 COMBINED CYCLE

NATURAL GAS FIRED WATER MASS BALANCE
Two 1 X 1 GE 7HA.02 - Dry Cooling
Average Ambient Conditions - Full Load

Project: 238926
Drawing: WMB-01 SHEET 1-4
Rev. N3



Notes:
1. All flow rates depicted are based on conceptual design and preliminary water data.
2. Flows are in gallons per minute (gpm).
3. Flow rates represent the daily average flow rates and do not represent instantaneous maximum demand.
4. There is no continuous blowdown stream. When operational, the total water demand is 4,600 gallons per hour.
   Evaporative cooler makeup water demand is based on GE recommendations for circulating water quality. The makeup flow rate is based on 50/50 blend of service water and demin water. Blowdown is based on 7 COC.
5. Flow rates shown are total flows for both Units.
6. Under normal operating conditions, there is no continuous flow.
7. A heat exchanger (or alternate means) will be utilized to cool HRSG blowdown to 140 F.
8. An air cooled condenser (or other means) will be utilized to cool and recover a large percentage of the flashed steam.
9. HRSG blowdown will be routed to the wastewater collection tank only during startup and plant upset conditions.

FOR CONCEPTUAL DESIGN ONLY

HDR

Conceptual Design Basis	01/11/2017	
Demin Water Makeup Demand	1.0% of IP+HP Steam Flow	GE HB Case 3 (Issued 3/31/2016)
Potable Water Demand	20 personnel, 50 gal per day, 3 shifts	
Ambient Conditions	90°F / 45%RH / Fired / Evap Cooler ON	
Fuel Oil Injection	None	

Invenergy

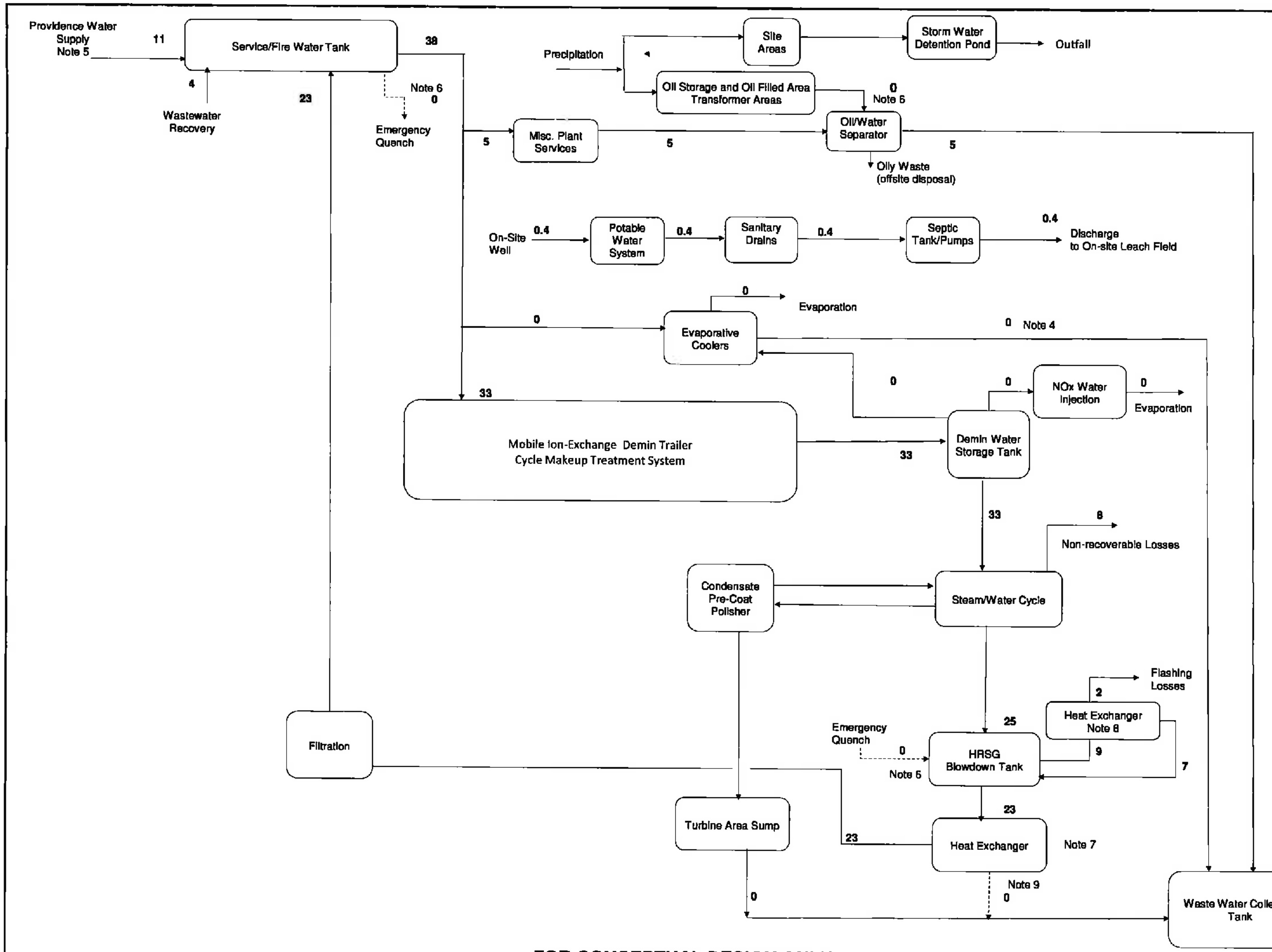
RHODE ISLAND
Two 1 x 1 COMBINED CYCLE

NATURAL GAS FIRED WATER MASS BALANCE
Two 1 X 1 GE 7HA.02 - Dry Cooling
Summer Ambient Conditions - Full Load

Project: 238926

Drawing: WMB-01 SHEET 2-4

Rev: N3



Notes:
1. All flow rates depicted are based on conceptual design and preliminary water data.
2. Flows are in gallons per minute (gpm).
3. Flow rates represent the daily average flow rates and do not represent instantaneous maximum demand.
4. There is no continuous blowdown stream.
5. Flow rates shown are total flows for both Units.
6. Under normal operating conditions, there is no continuous flow.
7. A heat exchanger (or alternate means) will be utilized to cool HRSG blowdown to 140 F.
8. An air cooled condenser (or other means) will be utilized to cool and recover a large percentage of the flashed steam.
9. HRSG blowdown will be routed to the wastewater collection tank only during startup and plant upset conditions.

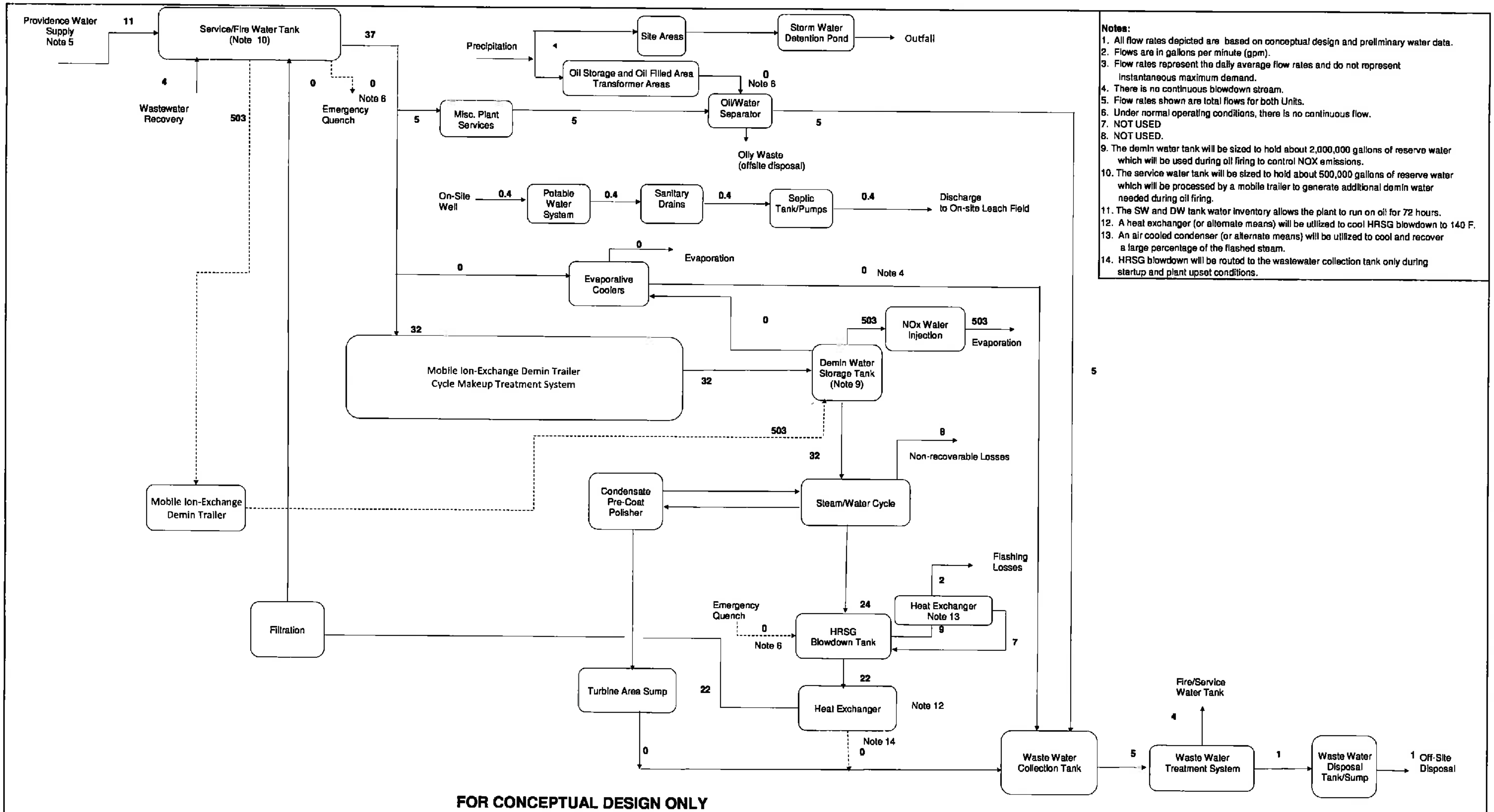
FOR CONCEPTUAL DESIGN ONLY

Conceptual Design Basis	01/11/2017	
Demin Water Makeup Demand	1.0% of IP+HP Steam Flow	GE HB Case 10 (Issued 3/31/2016)
Potable Water Demand	20 personnel, 50 gal per day, 3 shifts	
Ambient Conditions	20°F / 60%RH	
Fuel Oil Injection	None	

Invenergy

RHODE ISLAND
Two 1 x 1 COMBINED CYCLE
NATURAL GAS FIRED WATER MASS BALANCE
Two 1 X 1 GE 7HA.02 - Dry Cooling
Winter Ambient Conditions - Full Load

Project	Drawing
238926	WMB-01 SHEET 3-4
	Rev N3



Notes:

1. All flow rates depicted are based on conceptual design and preliminary water data.
2. Flows are in gallons per minute (gpm).
3. Flow rates represent the daily average flow rates and do not represent instantaneous maximum demand.
4. There is no continuous blowdown stream.
5. Flow rates shown are total flows for both Units.
6. Under normal operating conditions, there is no continuous flow.
7. NOT USED
8. NOT USED.
9. The demin water tank will be sized to hold about 2,000,000 gallons of reserve water which will be used during oil firing to control NOX emissions.
10. The service water tank will be sized to hold about 500,000 gallons of reserve water which will be processed by a mobile trailer to generate additional demin water needed during oil firing.
11. The SW and DW tank water inventory allows the plant to run on oil for 72 hours.
12. A heat exchanger (or alternate means) will be utilized to cool HRSG blowdown to 140 F.
13. An air cooled condenser (or alternate means) will be utilized to cool and recover a large percentage of the flashed steam.
14. HRSG blowdown will be routed to the wastewater collection tank only during startup and plant upset conditions.

FOR CONCEPTUAL DESIGN ONLY

HDR

Conceptual Design Basis	01/11/2017	
Demin Water Makeup Demand	1.0% of IP+HP Steam Flow	GE HB Case 18 (Issued 3/31/2016)
Potable Water Demand	20 personnel, 50 gal per day, 3 shifts	
Ambient Conditions	20°F / 60%RH	
Fuel Oil Injection	Operational	

Invenergy

RHODE ISLAND
Two 1 x 1 COMBINED CYCLE
OIL (1 UNIT ONLY) FIRED WATER MASS BALANCE
Two 1 X 1 GE 7HA.02 - Dry Cooling
Winter Ambient Conditions - Full Load

Project	Drawing
238926	WMB-01 SHEET 4-4
	Rev
	N3

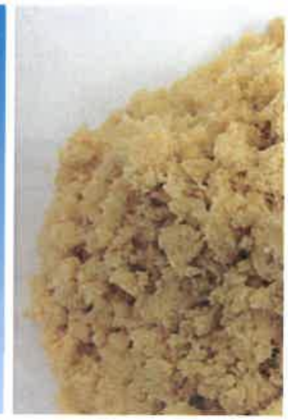
Appendix D

Water and Wastewater Treatment Technology Brochures

Powdex® Condensate Filter Demineralizer

GRAVER
WATER SYSTEMS






Graver's patented Powdex® condensate polishing system is a precoat filter demineralizer which provides both suspended solids removal and ion exchange capability in a single unit. The process utilizes powdered ion exchange resin in combination with fiber materials to form a precoat on specially designed filter septa. This Powdex® precoat provides excellent filtration performance and rapid ion exchange kinetics that can be optimized to meet changes or upsets in cycle chemistry. The Powdex system is chemical-free, uses ion exchange resin for a single use and subequently disposed off without the temperature constraints of typical deep bed polishers. The result is the perfect system to ensure fast starts and long term steam cycle operation by meeting the effluent quality needed to satisfy the high demands of today's utility and industrial applications.

Advantages of Condensate Polishing

- Elimination and control of harmful impurities, both dissolved and insoluble resulting in increased thermal efficiency, turbine protection from deposits and increased overall plant efficiency
- Quicker startups decrease the time necessary for the plant to achieve full generating capacity
- Extension of the boiler lifetime due to exposure to "cleaner" water
- Backup protection in the case of suspended solids or dissolved contamination from a condenser tube leak or rupture
- Decrease/elimination of blow-down resulting in decreased makeup water requirements and increased thermal efficiency
- Reduced maintenance on the turbine/boiler system from both a labor and cleaning chemical usage
- Reduced or elimination of blowdown during normal operation

Typical Applications:

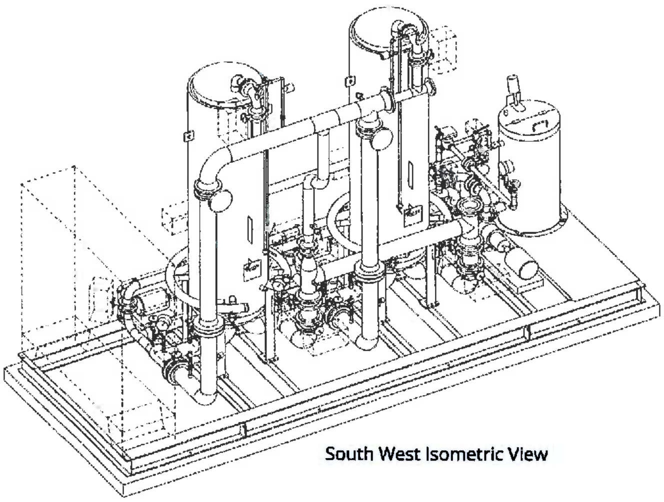
- Used in power (nuclear and fossil): Condensate treatment, heat recovering steam generators, and combined cycle plants especially with air cooled condensers
- Used in petrochemical and chemical steam generation: Condensate treatment for industrial boilers

Powdex Features

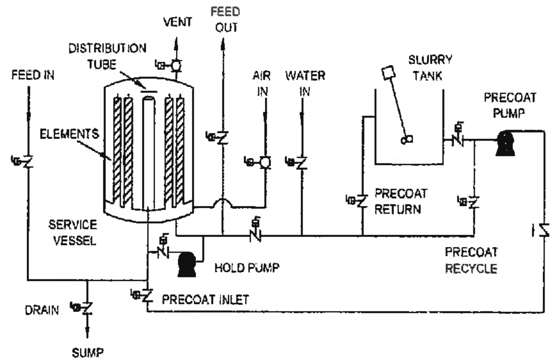
- Superior suspended solids and corrosion by-product removal
- Filtration and ion exchange in a single unit
- Elimination of chemical handling
- Reduced generation of wastewater
- Lower overall system cost (capital + operating)
- Smaller equipment footprint compared to deep bed + Filtration
- Low ΔP (Pressure drop)
- Protection of steam loop assets such as Boiler, Turbine, Condenser, etc

Powdex® Condensate Filter Demineralizer

GRAVER
WATER SYSTEMS



South West Isometric View



Powdex Service Vessel			Nominal Pipe Size			Utilities				Dimensions - Ft.		Shipping Weights - lbs			Operating Weights - lbs		
Model No. Notes (1)	Nom. Diam. In.	Max Flow GPM	In/ Outlet Size In.	Vent Size In.	Drain Outlet In. -3	B/W Water GPM -5	Waste Vol. Gal.	B/W Air Makeup SCFM -6	Total Air SCF	Filter Module (ea) LxWxClear -7	Precoat Module LxWxClear	Filter Module Each	Precoat Module	Air Surge Tank	Filter Module Ea.	Precoat Module	Air Surge Tank
GP-24-0238-X-C-3	24	428	4	2	3	27	600	43	34	19'-0"x7'-3"x16'-7"	Included	20,000	incl.	1,500	26,000	incl.	1,500
GP-30-0378-X-C-3	30	660	6	2.5	3	42	1000	66	527	20'-0"x7'-3"x17'-0"	Included	21,000	incl.	2,000	34,500	incl.	2,000
GP-36-0546-X-C-3	36	951	8	2.5	4	59	1300	95	761	21'-0"x7'-6"x17'-6"	Included	22,000	Incl.	2,500	40,000	Incl.	2,500
GP-42-0882-X-C-3	42	1536	8	3	6	96	2000	154	1229	13'-0"x 9'-0"x17'- 9"	Included	18,000	incl.	3,000	35,000	incl.	3,000
GP-48-1176-X-C-3	48	2048	10	3	6	128	2700	205	1638	13'-6"x 9'-0"x18'- 0"	Included	19,000	Incl.	4,000	40,000	Incl.	4,000
GP-54-1582-X-C-3	54	2755	10	4	6	172	3500	275	2204	14'-0"x 9'-0"x18'- 3"	Included	20,000	incl.	5,000	45,000	incl.	5,000
GP-60-2002-X-C-3	60	3486	12	4	8	218	4500	349	2789	8'-9"x 7'-6"x18'- 5"	7'- 6"x 7'-0"x13'- 1"	22,000	6,000	6,000	40,000	8,500	6,000
GP-66-2436-X-C-3	66	4242	12	4	8	265	5500	424	3394	11'-0"x 9'-9"x18'- 8"	10'- 0"x 9'-0"x13'- 1"	24,000	11,000	7,500	38,000	19,000	7,500
GP-72-2940-X-C-3	72	5120	12	6	10	320	6600	512	4096	11'-6"x10'-0"x18'-10"	10'- 6"x 9'-0"x13'- 1"	27,000	11,200	9,500	45,000	20,000	9,500
GP-78-3444-X-C-3	78	5998	14	6	10	375	7800	600	4798	12'-0"x11'-5"x19'- 7"	11'- 0"x 9'-6"x13'- 1"	30,500	11,500	10,000	53,000	21,500	10,000
GP-84-4032-X-C-3	84	7022	16	8	10	439	8900	704	5616	14'-0"x12'-6"x20'-0"	13'-6"x11'-6"x13'-1"	50,000	17,000	12,500	87,000	33,000	12,500

Notes:

(1) For X digit substitute N=nylon, P=polypropylene, M=316SS; for C digit substitute design pressure in psig.
(2) Average design flow rate is typically 75% of maximum but can be restricted to 50% for high loading rates.
(3) Drain pipe size represents discharge pipe size to customers open gravity drain.
(4) One hold pump per Powdex vessel.
(5) Backwash water required at 25 psi. Rates based on air surge type backwash for 238 ft2 units and larger.
(6) Air surge makeup rate based on one minute recovery time. Divide by recovery time to obtain required rate at 80 psi.
(7) Overhead clearance includes provision for element replacement.

Contact Us

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New Providence, NJ 07974

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F: 908 516 1401
E: info@graver.com

PENTAIR

CREC - HRSG Blowdown Filter

PENTEK POLYDEPTH SERIES
POLYPROPYLENE CARTRIDGES

MULTIPLE MICRON RATINGS FOR A WIDE VARIETY OF APPLICATIONS

Pentair Pentek§ Polydepth§ Filtration Cartridges are constructed of thermally bonded polypropylene microfibers to ensure high efficiency. The filter incorporates a rigid polypropylene center core for increased collapse strength and durability. This thermal bonded micro-fiber construction has minimal fiber release, consistent flow rate and superior filtration performance. It also is not brittle or prone to breakage problems like resin-bonded cartridges.

Unique micro-grooves provide added surface area. The Polydepth Cartridge will not impart taste, odor or color to the liquid being filtered, which makes it ideal for food and beverage applications. The recommended temperature limit of 40-175°F (4.4-79.4°C) allows it to be used in many hot water applications. Additionally, the polypropylene construction provides superior chemical resistance and is not prone to bacterial attack.

Available in different lengths from 9.75" up to 40". Unlike competitive cartridges, the longer lengths are not manufactured by gluing shorter cartridges together. They are continuous cartridges that cannot separate during use and do not sacrifice filtering surface area.

FEATURES/BENEFITS

Thermally bonded polypropylene micro-fiber construction for higher filtration efficiency

Consistent flow rate and superior filtration performance

Will not impart taste, odor or color to water being filtered

Ideal for a wide variety of industrial filtration

Nominal 1, 5, 10, 25, 50 micron rating

Lengths: 10", 20", 30", 40"

SPECIFICATIONS

Filter Media – Polypropylene

Temperature Rating – 40-175°F (4.4-79.4°C)

NSF COMPONENT

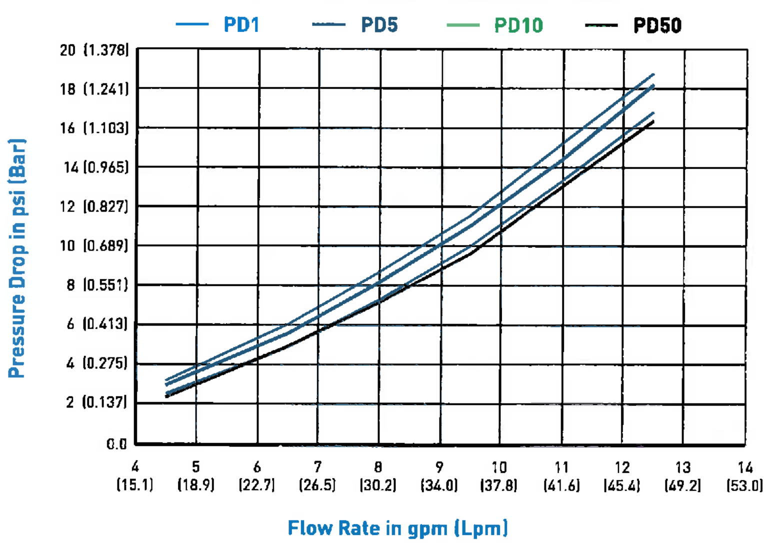
PD-1-934, PD-5-934, PD-10-934, PD-25-934, PD-50-934, PD-1-20, PD-5-20, PD-10-20, PD-25-20 and PD-50-20 are Tested and Certified by NSF International to NSF/ANSI Standard 42 for material requirements only.

SPECIFICATIONS AND PERFORMANCE

MODEL #	PART #	MAXIMUM DIMENSIONS	RATING* (NOMINAL)	INITIAL ΔP (PSI) @ FLOW RATE (GPM)
PD-1-934	155748-43	2.32" x 9.88" (59 mm x 251 mm)	1 micron	<2 psi @ 2 gpm (<0.14 bar @ 7.6 Lpm)
PD-5-934	155749-43	2.32" x 9.88" (59 mm x 251 mm)	5 micron	<2 psi @ 2 gpm (<0.14 bar @ 7.6 Lpm)
PD-10-934	155750-43	2.32" x 9.88" (59 mm x 251 mm)	10 micron	<2 psi @ 2 gpm (<0.14 bar @ 7.6 Lpm)
PD-25-934	155751-43	2.32" x 9.88" (59 mm x 251 mm)	25 micron	<2 psi @ 2 gpm (<0.14 bar @ 7.6 Lpm)
PD-50-934	155752-43	2.32" x 9.88" (59 mm x 251 mm)	50 micron	<2 psi @ 2 gpm (<0.14 bar @ 7.6 Lpm)
PD-1-20	155755-43	2.32" x 20" (59 mm x 508 mm)	1 micron	<2 psi @ 5 gpm (<0.14 bar @ 19 Lpm)
PD-5-20	155756-43	2.32" x 20" (59 mm x 508 mm)	5 micron	<2 psi @ 5 gpm (<0.14 bar @ 19 Lpm)
PD-10-20	155757-43	2.32" x 20" (59 mm x 508 mm)	10 micron	<2 psi @ 5 gpm (<0.14 bar @ 19 Lpm)
PD-25-20	155758-43	2.32" x 20" (59 mm x 508 mm)	25 micron	<2 psi @ 5 gpm (<0.14 bar @ 19 Lpm)
PD-50-20	155759-43	2.32" x 20" (59 mm x 508 mm)	50 micron	<2 psi @ 5 gpm (<0.14 bar @ 19 Lpm)
PD-1-30	155762-43	2.32" x 30" (59 mm x 762 mm)	1 micron	<2 psi @ 7 gpm (<0.14 bar @ 26.5 Lpm)
PD-5-30	155763-43	2.32" x 30" (59 mm x 762 mm)	5 micron	<2 psi @ 7 gpm (<0.14 bar @ 26.5 Lpm)
PD-10-30	155764-43	2.32" x 30" (59 mm x 762 mm)	10 micron	<2 psi @ 7 gpm (<0.14 bar @ 26.5 Lpm)
PD-25-30	155765-43	2.32" x 30" (59 mm x 762 mm)	25 micron	<2 psi @ 7 gpm (<0.14 bar @ 26.5 Lpm)
PD-1-40	155769-43	2.32" x 40" (59 mm x 1016 mm)	1 micron	<2 psi @ 9 gpm (<0.14 bar @ 34 Lpm)
PD-5-40	155770-43	2.32" x 40" (59 mm x 1016 mm)	5 micron	<2 psi @ 9 gpm (<0.14 bar @ 34 Lpm)
PD-25-40	155772-43	2.32" x 40" (59 mm x 1016 mm)	25 micron	<2 psi @ 9 gpm (<0.14 bar @ 34 Lpm)

*Not Performance Tested or Certified by NSF

PD Series Pressure Drop vs. Flow Rate



Data shown reflects the performance of 10" cartridges. 20", 30" and 40" cartridge pressure drops can be estimated by dividing the psi above by 2, 3 and 4 respectively at the same flow rate.

PENTAIR

WATER QUALITY SYSTEMS
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310094 REV D SE16

CREC Wastewater Oil/Grease Filter

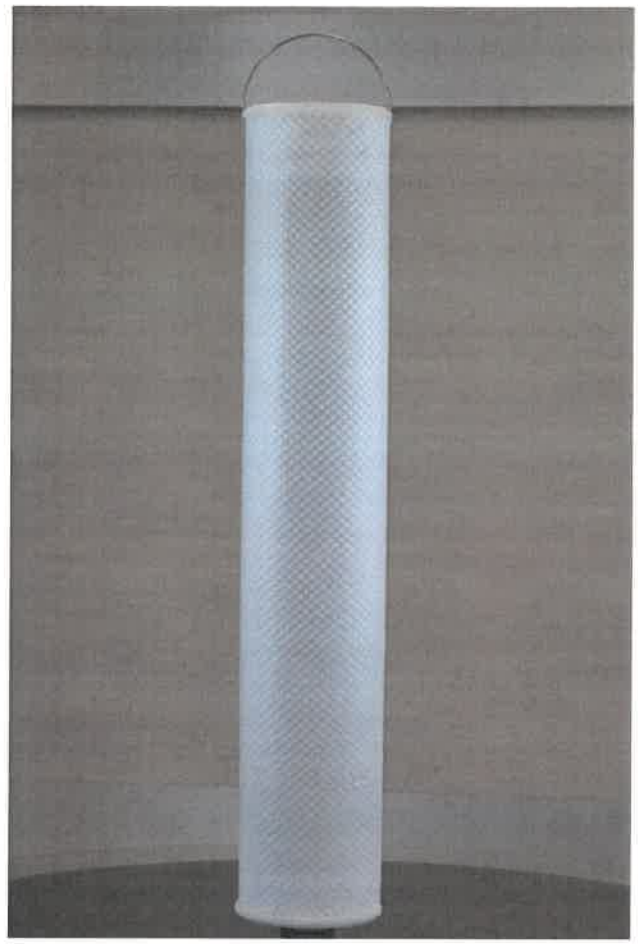
ES740-002-05-15

COST EFFECTIVE FILTRATION

FTC introduces its new 740 Emerald Series "Oil Guzzler" cartridge for eliminating oil from water.

The media in this unique cartridge combines the effects of adsorption and absorption to enhance its oil removal efficiency. The components of construction for this particular cartridge are polypropylene and a non-toxic, non-hazardous, non-corrosive, environmentally friendly petroleum bonding agent.

One 740 "OIL GUZZLER" is designed to hold greater than six liters of oil before reaching the maximum differential pressure of 35 PSI. The rapid differential pressure increase mechanism provides a positive indication of cartridge change-out time prior to any oil bypass.



MATERIALS OF CONSTRUCTION

Filter Media:	Proprietary Polymer
Center Core:	Polypropylene
Netting:	Polypropylene
End Caps:	Polypropylene

OPERATING SPECIFICATIONS

Maximum Operating Conditions:
185°F (85°C) Continuous Operating Temp

Recommended Flow Rate for Optimal Oil Loading: 15 GPM Per 40" of filter length

Maximum Recommended Differential Pressure: 35 PSID

Filter Oil Capacity: 6.6 Liters

PH Specifications: Neutral: 6.5 to 7

Toxicity: Product is non-toxic, non-hazardous, non-corrosive and can be incinerated

Surfactants: Surfactants will disperse the oil into solution requiring a longer resonance time for the adsorbtion/absorbtion.

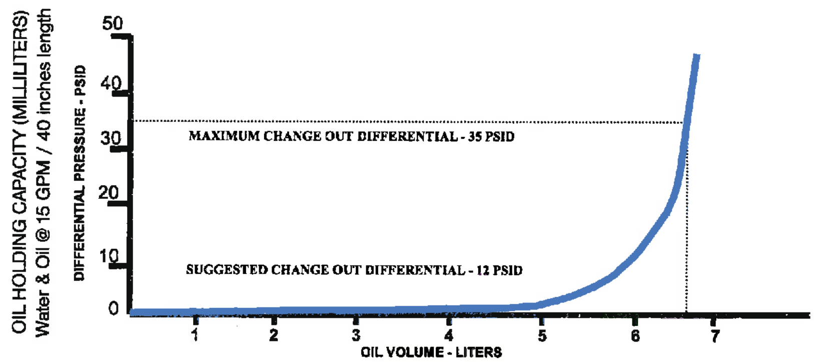
CONTAMINANTS REMOVED

1, 1, 2-Trichloroethane
1, 1-Dichloroethane
1, 1-Dichloroethylene
1, 2, 3-Trichloropropane
1, 2-Dichloroethane
1, 2-Dichloropropane
Acetone
Benzene
BHC'S
Benzo Compounds
Carbon Tetrachloride
Chlorine
DBCP
Diedrin
Diesel Fuel
Endrin
Ethers
Flourens (some)
Gasoline
Halogenated Hydrocarbons
Lindane
Methylene Chloride
Napthalenes
Nitro Compounds
PCB's
Petroleum Oils
Phenol Compounds
Phthalotes
Pyrens
Tetrachloroethylene
THM'S
Toluene Compounds
Toxaphene
Trichloroethylene (TCE)
Xylenes

SEPARATION EFFICIENCY

OIL HOLDING CAPACITY

DATA FOR 740 "OIL GUZZLER" @ 40 INCHES LENGTH
OIL CHALLENGE OF 400 PPM WITH LESS THAN 5 PPM OIL EFFLUENT



WARNING

Propylene and Ethylene Glycols will coat the Bonding Agent Polymer causing premature blinding and failure of the media.

CARTRIDGE CODING

ES	—	74	9	—	H	40	6
EMERALD SERIES		SERIES NUMBER 74 - 740 Style (6.25" OD)	9 - Polyester outer wrap		MEDIA H - Hydrocarbon Removal Polymer	LENGTH 35 - 35" 40 - 40"	O-RING SIZE 6 - 226 o-ring

PENTAIR

CREC - Wastewater TSS Removal

PENTEK WP-BB SERIES
POLYPROPYLENE STRING-WOUND CARTRIDGES

DESIGNED FOR A VARIETY OF APPLICATIONS REQUIRING SEDIMENT REDUCTION

Pentair‡ Pentek‡ WP-BB Series Cartridges are manufactured in 10" and 20" lengths and in 4.5" diameters from a durable polypropylene string that is wound around a rigid polypropylene core. The WP-BB Cartridges are an economical solution to reduce fine sediment including rust, sand and scale particles.

The material in the WP-BB Cartridges is a fibrous polypropylene media wound in a precise pattern around a polypropylene core, providing greater surface area to maintain high flow rates. The WP-BB Cartridges are manufactured using an anti-static agent during the winding process to reduce the electrical charges produced during the winding process.

These string-wound cartridges are capable of withstanding temperatures up to 165°F (73.9°C), and will accommodate flow rates between 10 and 65 GPM with minimal pressure drop.

WP-BB Series Cartridges are suitable for a wide range of sediment applications including municipal and well water, and are chemical resistant so they can be used with many industrial fluids.

Note: The anti-static agent used in the WP-BB Cartridges may cause some foaming during start up of a new cartridge. If foaming is an application issue, we recommend using the WPX-BB Series.

FEATURES/BENEFITS

String-wound design reduces fine sediment from a variety of fluids

Economically priced

Lengths: 10", 20"

Also available in 0.5*, 1, 5, 10 & 25 micron ratings

*Not intended for the removal of microbial pests including viruses, bacteria and cysts.

SPECIFICATIONS

Filter Media – fibrous polypropylene fiber cord

Temperature Rating – 40-165°F (4.4-73.9°C)

SPECIFICATIONS AND PERFORMANCE

MODEL #	PART #	MAXIMUM DIMENSIONS	RATING (NOMINAL)*	INITIAL ΔP (PSI) @ FLOW RATE (GPM)*
WP.5BB97P	355212-43	4.5" x 9.88" (114 mm x 251 mm)	0.5 micron	<5 psi @ 10 gpm (<0.3 bar @ 38 Lpm)
WP1BB97P	355213-43	4.5" x 9.88" (114 mm x 251 mm)	1 micron	<4 psi @ 15 gpm (<0.3 bar @ 57 Lpm)
WP5BB97P	355214-43	4.5" x 9.88" (114 mm x 251 mm)	5 micron	<3 psi @ 20 gpm (<0.2 bar @ 76 Lpm)
WP10BB97P	355215-43	4.5" x 9.88" (114 mm x 251 mm)	10 micron	<1 psi @ 20 gpm (<0.1 bar @ 76 Lpm)
WP25BB97P	355216-43	4.5" x 9.88" (114 mm x 251 mm)	25 micron	<1 psi @ 20 gpm (<0.1 bar @ 76 Lpm)
WP1BB20P	355222-43	4.5" x 20" (114 mm x 508 mm)	1 micron	<6 psi @ 30 gpm (<0.4 bar @ 114 Lpm)
WP5BB20P	355223-43	4.5" x 20" (114 mm x 508 mm)	5 micron	<6 psi @ 40 gpm (<0.4 bar @ 151 Lpm)
WP25BB20P	355225-43	4.5" x 20" (114 mm x 508 mm)	25 micron	<5 psi @ 40 pm (<0.3 bar @ 151 Lpm)

*Based on manufacturer's internal testing.
WARNING: Do not use with microbiologically unsafe or of unknown quality water without adequate disinfection before or after the system.

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247662 REV B MY15

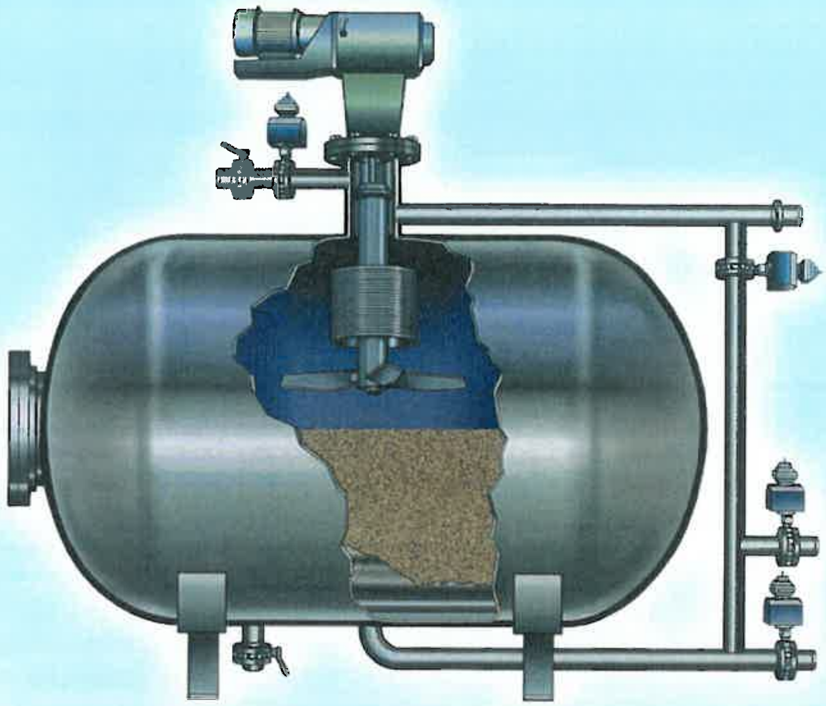
FILTRA SYSTEMS™

FILTRATION SYSTEMS TECHNOLOGY

HYDROMATION DEEP BED FILTER

95% To 99% Removal Of Suspended Solids
90% To 99% Removal Of Suspended Oils
Flow Rates To 12,000 GPM (410,000 Bpd) Per Unit
Filter Media Scrubbing During Backwash Cycle
Permanent Crushed Black Walnut Shell Media

*patented design



High throughput filtration of oily process water & industrial wastewater.

Filter out suspended solids and hydrocarbons.

Hydromation Deep Bed filtration systems give you double the throughput efficiency of conventional deep-bed sand or graded mixed-media filters. Under normal operating conditions, they remove 95 to 99% of suspended solids, 90 to 99% of insoluble hydrocarbons, without the use of chemicals.

In the oil field, Hydromation Deep Bed filters are used to remove suspended solids and hydrocarbons from produced water, surface water, sea water, rivers, lakes and well water. In metal working, power generating, municipal, chemical and petrochemical applications, they treat and remove suspended solids, oily residues, ash and metallic hydroxides from industrial liquids.

Media scrubbing cycle prevents filter bed fouling.

Unique to Hydromation Deep Bed filters is a patented media scrubbing cycle that fully reconditions the filter media during each backwash cycle. This scrubbing cycle is initiated automatically whenever the filter bed becomes dirt laden. A change in pressure differential across the filter bed, or an automatic preset time signal, activates backwashing.

The current design incorporates the high intensity of a mixer to vigorously agitate the media bed during the scrubbing cycle. The mixer is combined with the separating efficiency of a rotating backwash scrubber screen to produce the optimum separating of the scrubbed media from the backwash concentrate.

Energy Efficient.

The mixer provides a savings of over 85% in energy consumption for the backwash cycle. It also allows high efficiency scrubbing to be done inside the filter, reducing the requirements for external valves, piping and inefficient recirculation pumps, and providing additional savings in capital equipment costs. In addition, this design allows almost continuous dirty influent feed to the filter.

High efficiency minimizes maintenance and downtime.

The Hydromation Deep Bed filter system design ensures maximum throughput efficiency and low operating costs. Here's why...

- System flux rates are high; up to 25 gpm/ft^2 of filter bed surface area.
- Only process water is used for backwash make-up, eliminating the expense of a separate clean water source.
- Backwash discharge volume is only 0.5% of throughput, compared to three to ten times that amount for conventional filters, reducing clean water storage and backwash disposal costs.
- Media cleaning involves less than 1% of cycle time, compared to four to six times that amount for conventional filters.
- Permanent filter media is reconditioned during each backwash cycle.
- No chemicals, polymers, surfactants or air sparging are required for backwash. This simplifies operation and reduces your operating costs.

Horizontal and vertical models for flexibility.

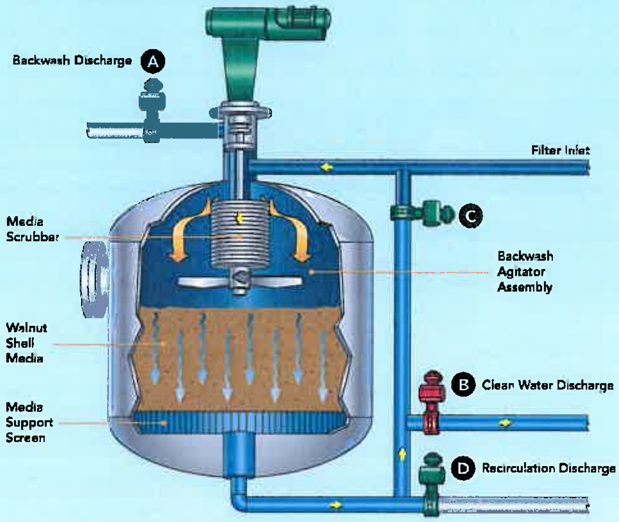
Filtra Systems builds eleven standard vertical and nine horizontal Hydromation Deep Bed models. Vertical models provide a flow rate range from 70 gpm to 2800 gpm per unit, while horizontal models provide flow rates from 1,200 gpm to 12000 gpm per unit, each depending on the application. Units are preassembled at the factory and shipped to the site skid mounted, ready for installation.

Engineered and supported to meet your needs.

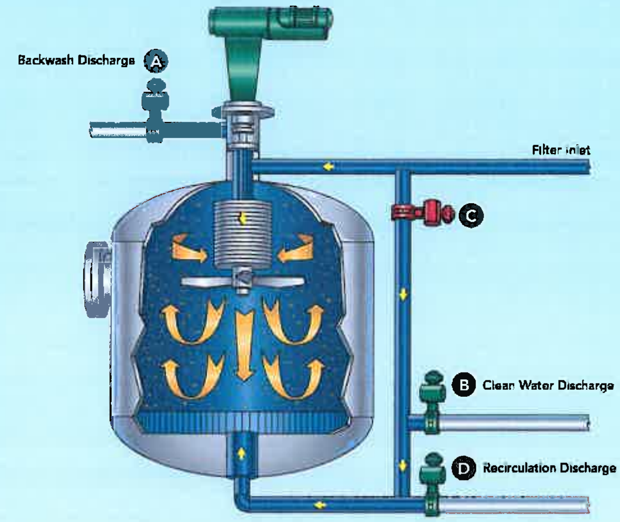
Hydromation Deep Bed filters provide proven operations with pressure, vacuum or gravity flow to meet your specific on-site requirements. Engineered and built-to-spec units are also available. Filtra Systems Company provides engineering, lab analysis, installation and service support, worldwide.

HOW Hydromation® Deep Bed Filter WORKS

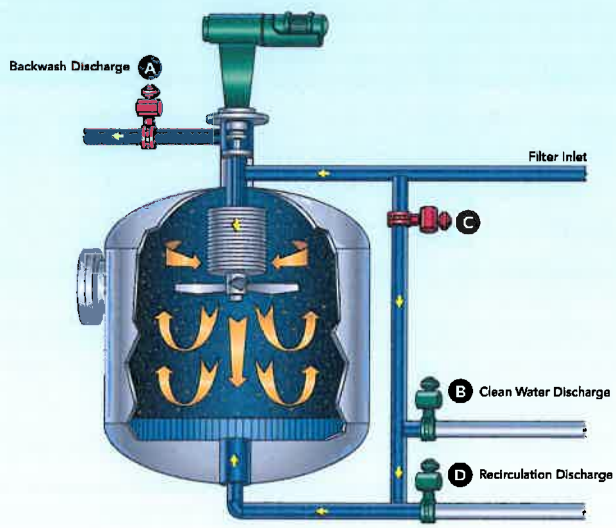
1. Filtration Cycle



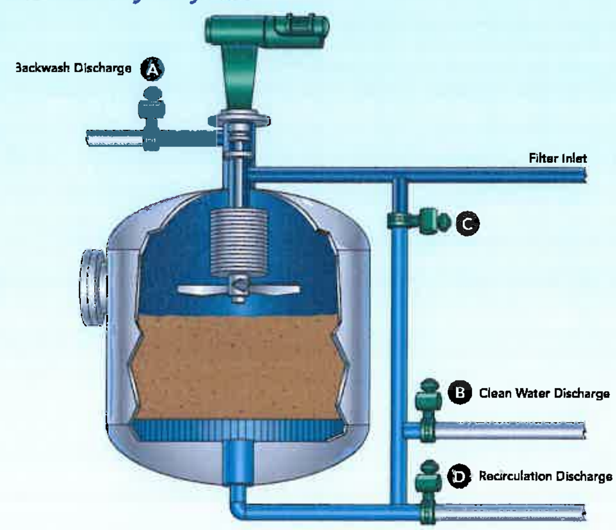
2. Agitation Cycle



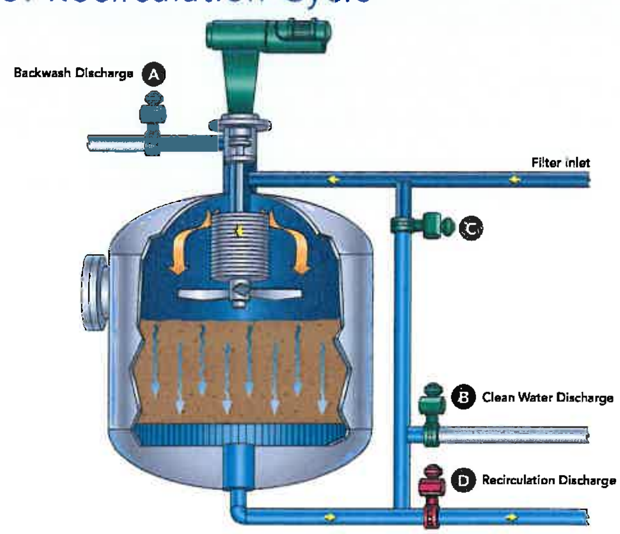
3. Backwash Cycle



4. Delay Cycle



5. Recirculation Cycle

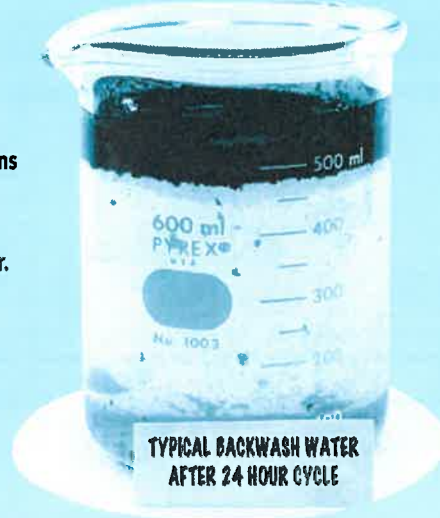


Filter Sequence of Operation and Valve Position

● indicates valve is open: all other valves are closed.

CYCLE	A	B	C	D	TIME
Filtration		●			"x" Hrs.
Agitation			●		30 Sec.
Backwash	●		●		8 Min.
Delay					15 Sec.
Recirculation				●	3 Min.

Clean Water
Backwash Water (concentrated)
Dirty Water
Walnut Shells



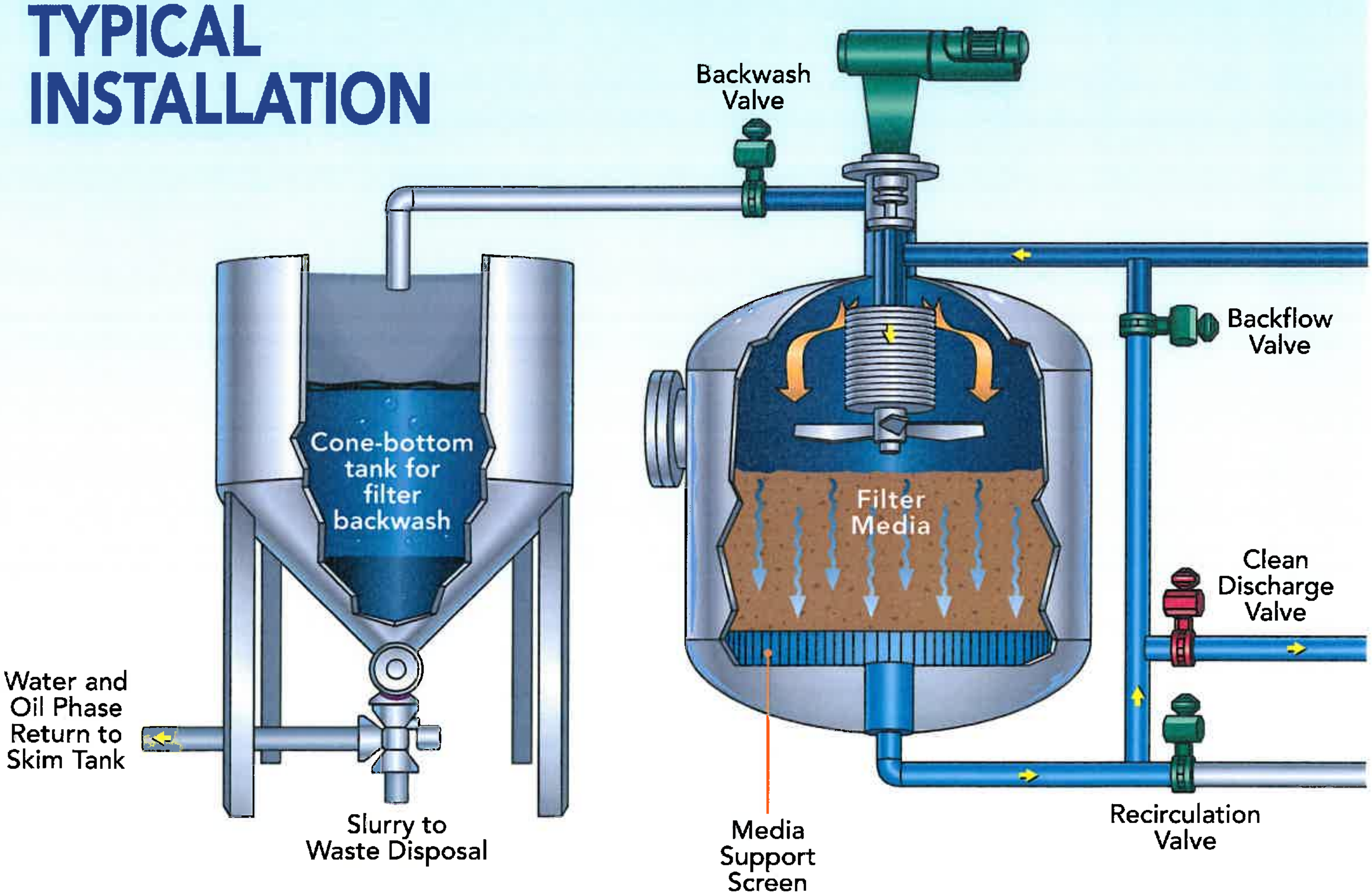
The suspended hydrocarbons in this beaker illustrate how efficient the filter is at separating oil from water.

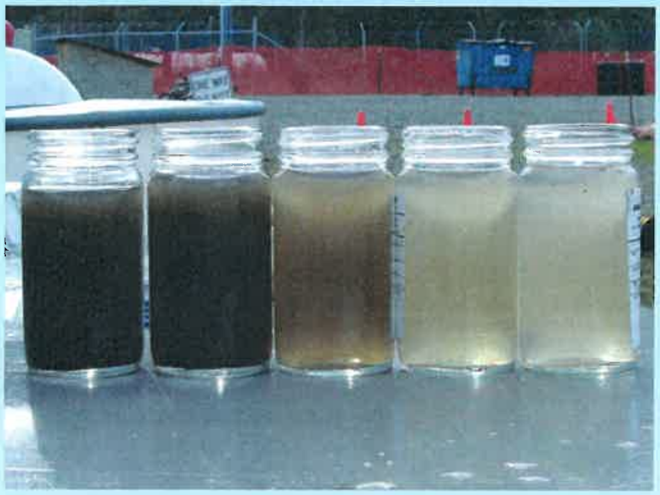
Continuous filtration systems for cleaning oily process water and industrial waste water.

Walnut shell filter media technology was developed and introduced by Hydromation more than three decades ago.
Only a Hydromation Deep Bed Filter will give you the confidence of assured clear effluent, maintenance-free operation and production efficiency payback-year after year.

To determine the appropriate filter size, flux rate and system design requirements, Filtra-Systems provides laboratory analysis and on-site pilot filter test services.

TYPICAL INSTALLATION

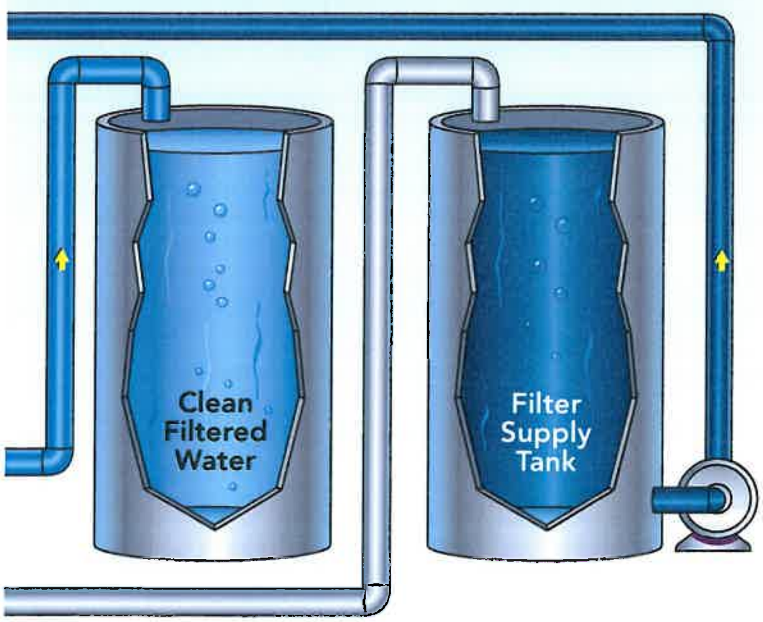




The Hydromation Deep Bed filter utilizes the kinetic model of a Continuously Stirred Tank Reactor (CSTR) to efficiently and completely remove contaminant's during every media regeneration cycle.

The above photo shows backwash water samples taken over the 8-minute backwash interval (0, 2, 4, 6, 8 min samples). The backwash water at the end of the 8-minute cycle is as clean as the inlet process water, illustrating the regeneration cycle is complete. 100% recovery in less than 10 minutes, due to the vigorous agitation and maximized efficiency.

Maximizing backwash (regeneration) efficiently allows the unit to have the smallest required backwash volume, shortest offline cycle time, eliminates channeling or short cycling, and guarantees that the media bed is completely cleaned, cycle after cycle.



TYPICAL INSTALLATIONS

A steel producer uses the filter to remove oil from their continuous caster water. The filter operates at 625 gpm.

A Canadian oil company process oily water in a SAGD, steam generation application. The unit operates at 3,500 gpm

A Government Agency use the filter to remove Creosote Oils, PCPs, and NAPL,s from Groundwater. The unit operates at 400 gpm.

CUSTOMERS

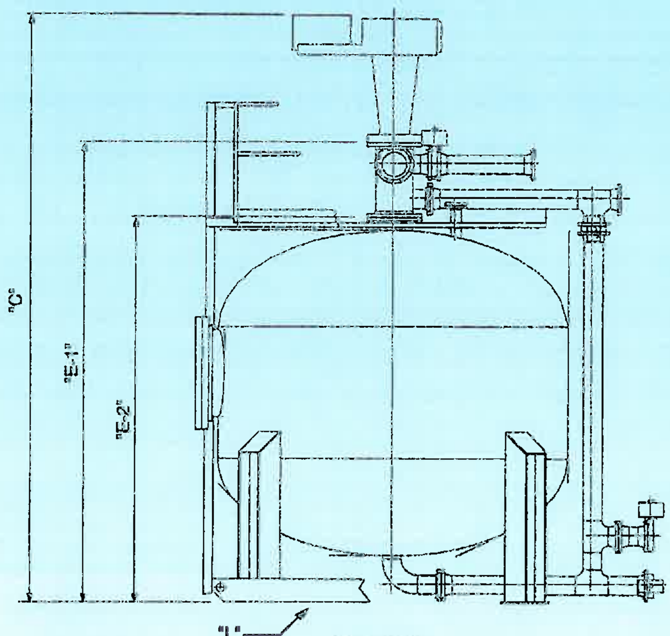
- Aera Energy
- Army Corps of Eng.
- BP Chemicals
- Chevron
- Compania Minera Collahuasi
- Conco Phillips
- Dayton Power & Light
- Detroit Edison
- Devon Energy
- EnCana
- Hawaiian Electric
- Husky Oil
- Imperial Oil
- Inland Steel
- International Paper
- Kuwait Oil Company
- Occidental Petroleum
- PDVSA
- SunCor
- Weirton Steel

PREVIOUS APPLICATIONS

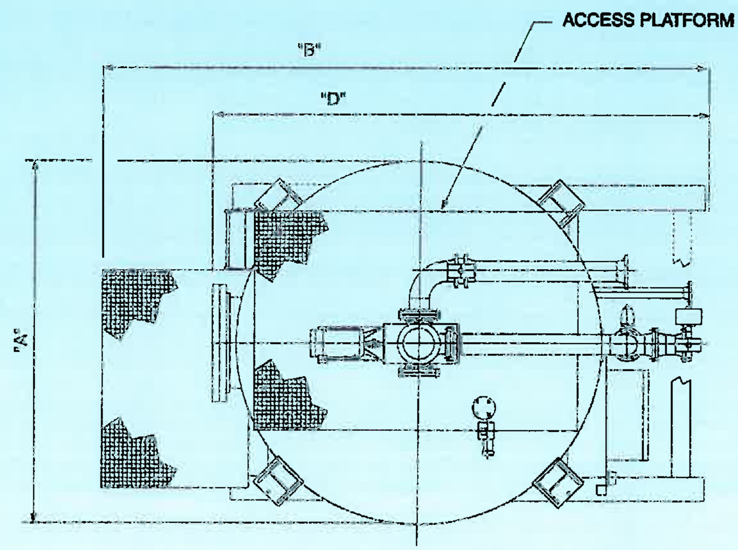
- Cooling tower water
- Continuous caster water (steel/aluminum)
- Steel mill process water
- Power plant process/waste water
- Refinery process water
- Oil field produced water
- Oil field injection water
- Groundwater Remediation
- Chemical Plant Waste Water
- Stream Assisted Gravity Drainage Feed Water

SPECIFICATIONS

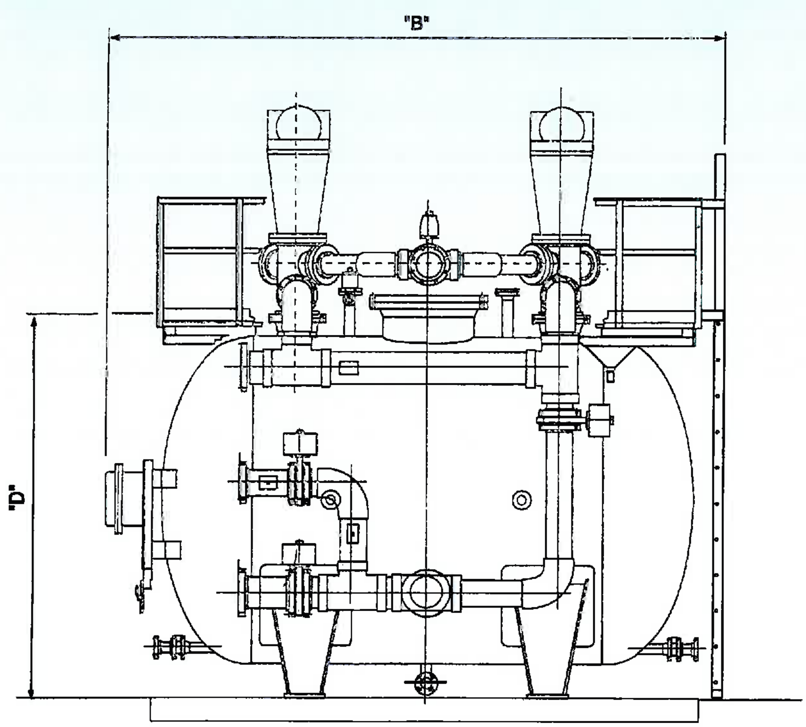
Vertical Filters

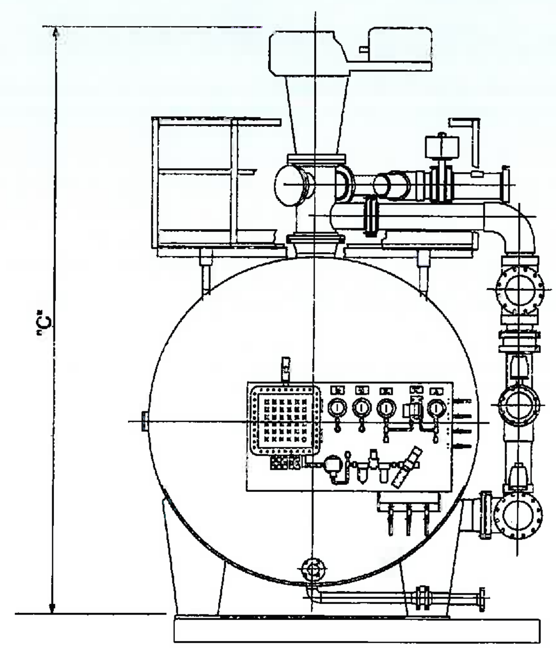


ELEVATION



Horizontal Filters





PLAN VIEW

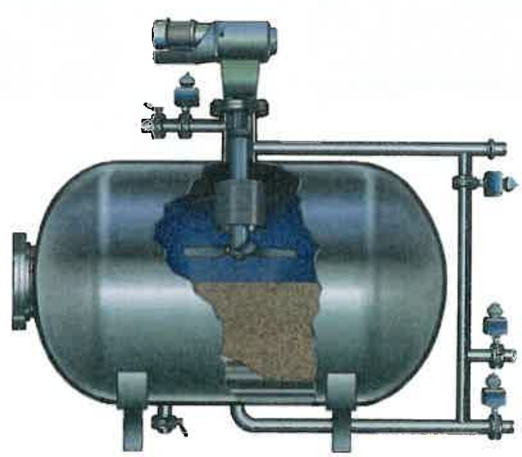
APPROXIMATE DIMENSIONS AND WEIGHTS - VERTICAL FILTERS

Filter Model	Installed			Shipping			"L"	Weight (lbs.)	Weight (lbs.)
	"A" Width	"B" Length	"C" Height	"D" Length	"E-1" Height	"E-2" Height	Optional Skid	Shipping	Operating
FDB-7P	3'-6"	8'-6"	11'-3"	5'-6"	7'-7"		4'	2,350	6,800
FDB-12P	4'-6"	9'-6"	12'-6"	6'-6"	8'-8"		4'	3,095	9,450
FDB-19P	5'-3"	11'-9"	13'-1"	8'-6"	9'-5"		4'	5,600	20,490
FDB-28P	6'-1"	12'-6"	13'-6"	9'-6"	9'-10"		6'	7,580	31,560
FDB-39P	7'-1"	13'-0"	14'-0"	10'-0"	10'-3"		6'	9,695	42,390
FDB-50P	8'-1"	14'-3"	14'-11"	11'-3"	11'-2"		8'	10,020	47,550
FDB-64P	9'-1"	15'-6"	15'-10"	12'-6"	12'-1"		8'	11,510	58,425
FDB-78P	10'-2"	16'-6"	17'-0"	13'-6"		*11'-2"	8'	13,200	69,500
FDB-95P	11'-2"	17'-6"	18'-1"	14'-6"		*11'-10"	8'	19,490	82,525
FDB-113P	12'-2"	18'-6"	18'-7"	15'-6"		*12'-5"	8'	25,775	95,550
FDB-133P	13'-4"	18'-8"	18'-9"	15'-8"		*12'-5"	8"	60,000	140,000

* Vessel may be shipped in the horizontal position
Larger units available upon request — consult factory for quotation

APPROXIMATE DIMENSIONS AND WEIGHTS - HORIZONTAL FILTERS

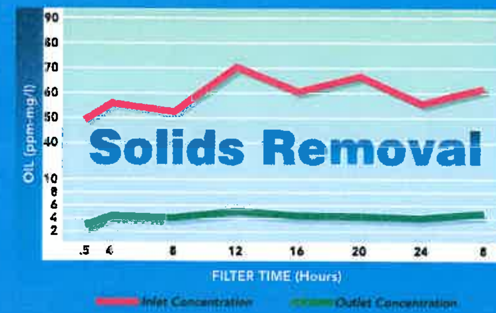
Filter Model	"A" Width	"B" Length	"C" Height	"D" Shipping Height	"L" Optional Skid	Weight (Lbs) Shipping	Weight (Lbs) Operating
FDB-122P	11'-1"	16'-11"	16'-6"	12'-9"	8'	38,500	101,655
FDB-162P	11'-1"	21'-5"	16'-6"	12'-9"	8'	45,000	125,000
FDB-170P	11'-2"	22'-2"	16'-6"	12'-9"	8'	97,000	168,000
FDB-243P	11'-3"	30'-5"	16'-6"	12'-9"	8'	65,500	181,190
FDB-324P	11'-4"	39'-5"	16'-6"	12'-9"	8'	85,950	237,500
FDB-340P	11'-5"	40'-0"	16'-6"	12'-9"	8'	162,000	360,000
FDB-405P	11'-5"	48'-5"	16'-6"	12'-9"	8'	106,500	293,575
FDB-486P	11'-6"	57'-5"	16'-6"	12'-9"	8'	126,850	349,800
FDB-510P	11'-6"	42'-8"	21'-2"	13'-5"	8'	230,000	552,000



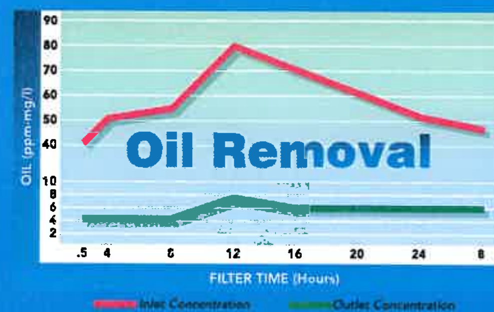
PERFORMANCE

Seawater Filtration Test Performance					
FLUX RATE gpm/ft²	% Particle Removal Efficiency Particle Size in Microns				
	16.0-20.0	8.0-10.0	4.0-5.0	2.0-2.5	1.0-1.25
15	100.0	100.0	99.6	99.3	98.5
20	100.0	100.0	98.8	98.3	97.5
25	100.0	97.9	97.7	97.4	96.3

Location: North Sea – Bergen, Norway
Influent: Chlorinated Seawater, 0.5 – 1.5 ppm
Suspended Solids 1.0 mg/l, Turbidity: 0.18 NTU
Water Temp: 50°F



Typical Efficiency Curves



SITE SPECIFIC INSTALLATIONS

OIL AND GAS INDUSTRIES

- A California Oil producer filters 35,000 gpm of produced water for enhanced oil recovery steam flood.
- In Canada, an oil company processes over 16,000 gpm of water for use in Steam Assisted Gravity Drainage (SAGD) applications.
- Oil producers filter produced water from deep well aquifers. Once purified the water is then injected for flood enhanced oil recovery. The units operate at 10,000 gpm.

INDUSTRIAL PROCESS WATER

- A power company process filters the water in fly ash ponds, prior to river discharge. The units operate at 4,000 gpm.
- In steel production plants, filters are used to remove the oil from a continuous casting operation. These units operate at 6,500 gpm.
- A chemical manufacture filters a variety of process water streams, prior to deep well injection for disposal. The unit operates at 750 gpm.

ENVIRONMENTAL PROJECTS

- In Colorado, our filters are being used for groundwater remediation work. The groundwater was contaminated by fuel oils leaking from a boilerat a former paper mill. The unit operates at300 gpm. Once cleanup is completed, the water rights will be issued to the state for agriculture use.
- A metal producer utilizes a filter to recover PCBs from non-contact caster water. The filter processes 8,000 gpm and discharges into a fish bearing stream.
- A US EPA Superfund Site processes 70 gpm of groundwater containing PCPs and DNAPLs. The filter discharges into a fish bearing water system. Once the cleanup is completed, the land will be converted into a city park.

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PRECOAT FILTRATION

Business Unit I

Filtration- and Separation

The terms *precoating filtration system* or *precoat filter* are used as collective terms for various different filter constructions. In most cases, however, the combination of process and apparatus is meant by these terms. These terms which are mostly used arbitrarily, often lead to misunderstandings and ought therefore be replaced by the following definition.

Precoat filtration systems are technical separation process steps which in the simpliest case comprises a filter, a feeding pump and the corresponding connecting lines including the feedback of the product. Precoat basin, dosage pumps and instrumentation equipment are supplementing the basis equipment depending on the process.

Construction and operation of precoat filtration systems are depend primarily on the kind of product which has to be filtered and secondarily on the method the process is based upon.

Precoat filtration is a special filtration process in which the filter media is flushed on a base, e.g. a woven wire cloth, prior to the actual filtration operation.

The heart of a precoat filtration system is therefore any kind of filter which is according to its construction suitable for the precoat filtration. In other words: only by the method and not by the type of construction a filter can be defined as precoat filter. Therefore, beside the classic construction types such as candle or vertical leaf filters very often layer filters, filter presses and vacuum drum filters are used in precoat filtration systems.

Application:

Precoat filtration systems were mainly desingned for the filtration of medium to difficult filtrable suspensions. They are particularly suitable for the discontinuous filtration of large batches and/or for continuous processes. The easy adaptability to semiautomatic or fully automatic operation processes is an important factor. A series of typical seperating tasks in various industrial areas is listed below:

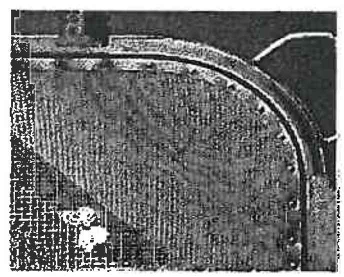
Examples for applications:

- filtration of liquid sugar and molasses by meant of activated carbon
- processing and purification of circulating systems for rolling oil, hone oil, grinding agents and coolants
- separation of bleaching earth in the edible oil refining
- purification of electrolyte solutions in the galvanic industry
- seperation of catalysts in hydrogenation units
- seperation of catalysts in the process for hardening of fats
- purification of beer and wine
- purification of herbicides and insecticides
- removing oil from condensates and processing

Filter types:

The following types of filters are used in precoat systems:

- vertical leaf filter (Niagara filter)
- horizontal (centrifugal) pressure leaf filter
- candle filter
- filter press
- layer filter
- rotating drum filter



Pre-coating:

The process of precoating or pre-flushing is done by means of a suspension which is pumped round via the filter. This suspension consists of the actual precoat material and a suitable carrier liquid. Typical products for the precoating are siliceous earth, perlites and cellulose as well as mixtures of the before mentioned or solids contained in the liquid which is to be filtered such as bleaching earth, activated carbon, catalysts a.s.o.. Besides special liquids suitable for the corresponding product in many cases already filtered product is used as carriers liquid. In the simpliest case the unfiltered product is the carrier liquid and contains the precoat material, e. g. in the filtratration of carrier catalyzers from hardened edible oils.

Security or final filters:

In the typical types of filters for precoat filtration systems in which metal or plastic woven wire cloths are used as basis for the pre-coating, the pores are wider than the particles of the used precoat material. i.e. only by building a bridgeformations of the precoat particles a fine filtration coat can be formed. These processes are the reasons for the excellent cleaning characteristics of such filter elements. Their good suitability for semi-automatic and fully automatically operating processes resides in this feature. The disadavantage of this principle is clearly the lability of the pre-coat, i. e. ist sensitivity to operational disruptions or product variations.

That means that in applications in which the product is not allowed to have more than a certain content of particles, a „security or final filter system" is required. Layer filters or candle filters are representing the majority of the security filters which are often also referred to as polishing filter or police filter. By the use of pre-manufactured filter layers as support for the pre-coating materials the additional security filter can be omitted as these filters are representing precoated filter and security system in one.

For this branch of filtration technology our Business Unit I offers optimized wire mesh media for most different filtration devices and applications. Above all within the field of the precoat filtration a wide range programme of high tensile PZ and KPZ wire cloths is available. The most attention is paid to the field of filter media for centrifugal filters and Niagara filters for the chemical industry and the food industry (filtration of beer).

Optimized in terms of their usage the woven wire cloths can be manufactured as discs or ready cut to the size required. According to the requirement the wire cloth can also be supplied in ultrasonic cleaned form.

In addition to the supply of filter media we offer as well customer specific solutions in the field of ready-made filter cartridges/cylinders or special constructions. In the field of application in this area we are using - if possible - an existing standard production programme on filter candle basis.

Due to the large market share typical GKD filter wire cloths are available at short notice in ready-made form.

Pz - Microdur Cloth

article no..	type	meshes per inch (25,4 mm)	thickness of cloth in mm	filter opening model in µm	filter opening absolute in µm	water permeability in l /(cm² x min) Δp = 200 mbar	air-** permeability in l /(m²xs) Δp = 2 mbar
19370140	PZ 14	615 x 132	0,20	14	17 - 20	3,2	650
19370170	PZ 17	615 x 128	0,21	17	22 - 25	6	590
19370270	PZ 25 S	615 x 102	0,24	25	40 - 48	5,9	980
19370410	PZ 40	287 x 71	0,35	40	50 - 55	6,2	1260
19370510	PZ 50	171 x 51	0,57	50	64 - 72	7,1	1500
19370610	PZ 60	171 x 46	0,57	60	82 - 94	8,1	1920
19370810	PZ 80 S	128 x 36	0,77	80	98 - 106	7,1	2260
19371000	PZ 100 L	171 x 33	0,60	100	96 - 111	9,3	3500
19371501	PZ 150 S	107 x 20	1,03	150	200 - 215	9,1	3800
19371570	PZ 200 S	63 x 18	1,34	200	210 - 225	11,3	3750
14375600	KPZ 55	325 x 39	0,73	55	64 - 70	7,3	2200
19342001	KPZ 75	400 x 120	0,25	75	72 - 78	13,6	3920

Plain Dutch Weave

article no.	type	meshes per inch (25,4 mm)	thickness of cloth in mm	filter opening		water-permeability in l /(cm² x min) Δp = 200 mbar	air-** permeability in l / (m^{-2}xs) Δp = 2 mbar
				model in µm	absolute in µm		
13372305	GT	50 x 250	0,31	40	55-61	10,00	2670
13371400	GT	30 x 150	0,49	65	100-110	9,60	3480
13370705	GT	24 x 110	0,74	85	117-125	8,40	2960
13370170	GT	12 x 64	1,22		280-300	11,50	4350

Twilled Dutch Weave

article no.	type	meshes per inch (25,4 mm)	thickness of cloth in mm	filter opening		water permeability in l /(cm² x min) Δp = 200 mbar	air-** permeability in l / (m^{-2}xs) Δp = 2 mbar
				model in µm	absolute in µm		
14372701	KT	80 x 700	0,25	25	35 - 38	6,20	700
14371700	KT	32 x 360	0,55	80	95 - 105	5,50	1300

Support Cloth

article no.	meshes per inch (25,4 mm)	meshes per cm²	aperture in mm	wire diameter in mm	wire diameter in inch (25,4 mm)	* weight in kg / m²	open area in %
10378760	4,5	3	4,20	1,40	0,035	4,46	56
10378821	4	2	4,75	1,60	0,0630	5,16	56

Intermediate Cloth

	per inch (25,4 mm)	per cm²	in mm	in mm	in inch (25,4 mm)	in kg / m²	in %
10375530	20	59	1,00	0,30	0,0076	0,87	59
10377926	8	10	2,48	0,70	0,0178	1,95	60
10377950	8	11	2,50	0,50	0,0200	1,06	69

* the density factor calculated with is 7.85 kg/dm³ for steel

** measured values of the air permeability per DIN 53887 - B, deviation ± 10 %
Each woven wire cloth is also available in different stainless grades.

Appendix E

McMahon Traffic Analysis

McMAHON
TRANSPORTATION ENGINEERS & PLANNERS

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January 10, 2017

John Niland, P.E.
Director Business Development
Invenergy LLC
One South Wacker Drive, Suite 1800
Chicago, IL 60606

RE: **Traffic Analysis for Water Source Option**
Clear River Energy Center - Burrillville, Rhode Island

McMahon Associates has prepared a traffic analysis to reflect the current water supply option for the proposed Clear River Energy Center (CREC) in Burrillville, Rhode Island. This memorandum is intended as a supplement to the original Traffic Impact Study (TIS) for the Clear River Energy Center dated May of 2016 and provides details on the traffic operations adjacent to the proposed site as well as the condition of the roadway along the truck route to the proposed site, relative to the water supply source.

Water Connection Analysis

The revised analysis follows a decision by the Pascoag Utility District and the Harrisville Fire District to not grant the facility access to the their water resources. Instead, water will be delivered to CREC by truck from Johnston, Rhode Island. The capacity of each water truck is approximately 8,000 gallons, resulting in an average of 2 trucks accessing the site per day during typical operations. The water demand reductions were in part created by the use of trailer mounted mobile treatment to demineralize the water through mobile demineralization trailers. Each trailer has a capacity of approximately 1,200,000 gallons before the trailer needs to be replaced. The trailer will therefore need to be replaced once every twenty five days during typical operating conditions. Additionally, the reduced water demand is also creating the potential of waste water disposal by truck, as the disposal volume is also substantially less. The expected wastewater discharge from the site is approximately 1,440 GPD. The trucks carrying wastewater have a capacity of 3,200 gallons, resulting in one truck accessing the facility every two days to transport wastewater.

Ammonia Trucks

As previously discussed in the TIS dated May 2016, there are also aqueous ammonia trucks that access the site. The TIS describes a bi-monthly occurrence of ammonia trucks assessing the site and therefore, these trucks were not previously included in traffic projections. The frequency has since been revised to approximately once every other day. While the traffic impacts are still minimal, these vehicles have been included in traffic projections for the proposed facility.

Oil Fired Events

In extreme winter weather conditions, the CREC's ability to run on natural gas may be inhibited, and therefore, the facility may need to run on oil for a short duration, as described in the TIS. In such a case, the facility will require oil and additional water to run. The CREC is proposed to have an onsite tank with capacity for 2,250,000 gallons of water for such an event. Similarly, the site is also proposed to have an oil tank with capacity for 2,000,000 gallons. The capacity of these two tanks can service an oil fired event lasting up to three days without additional resources.

After an oil fired event, the tanks will need to be replenished. Previously in the TIS, the oil trucks were planned to be replenished over a short duration, resulting in an estimate 3 to 4 trucks per hour or approximately 32 oil trucks per day. In an effort to reduce the traffic impacts of the truck deliveries following an oil fired event, the duration of time to refill the onsite tanks has been extended. Approximately 11 trucks per day will access the CREC facility to replenish the water tanks and approximately 7 trucks per day will access the facility to replenish the oil tanks as well as an additional demineralization trailer for a total of 19 trucks. The time required to replenish the tanks depends on the duration of the oil fired event. Typically, these events do not have a duration that would totally deplete the on-site tanks. In a worse-case scenario where the tanks were depleted, the oil and water truck deliveries required to replenish the on-site supple would occur over a longer period which is not expected to exceed one month. This results in approximately 19 trucks per day in order to replenish the tanks after the occurrence of an oil fired event, and this number excludes the 3 trucks per day that would be needed for typical operations. It should be noted that based on the on-site storage volumes of water truck deliveries can be suspended for a significant length of time during severe winter storms and resume once the roadways are cleared.

Therefore, after the occurrence of an oil fired event, there will be approximately 22 trucks per day expected to access the site, (11 water replenish, 7 oil, 2 ammonia/waste water discharge/demin trailers, and 2 typical water supply).

Peak Hour Truck Traffic

The majority of truck traffic transporting materials to the CREC facility will do so outside of peak hours; however, to be conservative, it was assumed that approximately 25% of these truck trips will occur during the weekday morning peak hour and weekday afternoon peak hours. Throughout the course of the year under normal operating procedures, this amounts to one truck in each of the peak hours (one truck entering and one truck exiting), resulting in two peak hour truck trips, as shown in Table 1.

Table 1: Normal Site Truck Trip Generation

	Weekday Daily			Weekday AM Peak Hour			Weekday PM Peak Hour		
Description	In	Out	Total	In	Out	Total	In	Out	Total
Normal Weather Operations(1)	3	3	6	1	1	2	1	1	2

(1) Based on normal weather water truck generation

During the oil fired operations and in the days following the oil fired events during which the on-site water and oil tanks are being replenished, an additional three trucks are expected to access the site during each peak hour, or six truck trips (three trucks trips entering, three truck trips exiting). As part of the truck analysis presented in the TIS, it was previously assumed that the oil fired event alone would require four vehicles per hour to replenish the onsite tanks. Since duration of time to replenish these tanks has been extended, the number of daily and hourly trips associated with an oil fired event has been reduced. Therefore, despite the increase in the daily number of trucks due to the water deliveries, there is an overall reduction in peak hour truck trips from four trucks to three trucks (two trucks resulting from the oil fired event and one truck for typical water operations). A comparison of the expected daily and peak hour truck trip generation is shown in Table 2 below.

Table 2: Oil Fired Event Truck Trip Generation

	Weekday Daily			Weekday AM Peak Hour			Weekday PM Peak Hour		
Description	In	Out	Total	In	Out	Total	In	Out	Total
Oil Fired Event (Tank Replenishment) (1)	19	19	38	2	2	4	2	2	4
Ambient Weather Operations(2)	3	3	6	1	1	2	1	1	2
Total Oil Fired Event Operations	22	22	44	3	3	6	3	3	6

(1) Based on oil fired event tank replenishment

(2) Based on ambient weather water truck generation

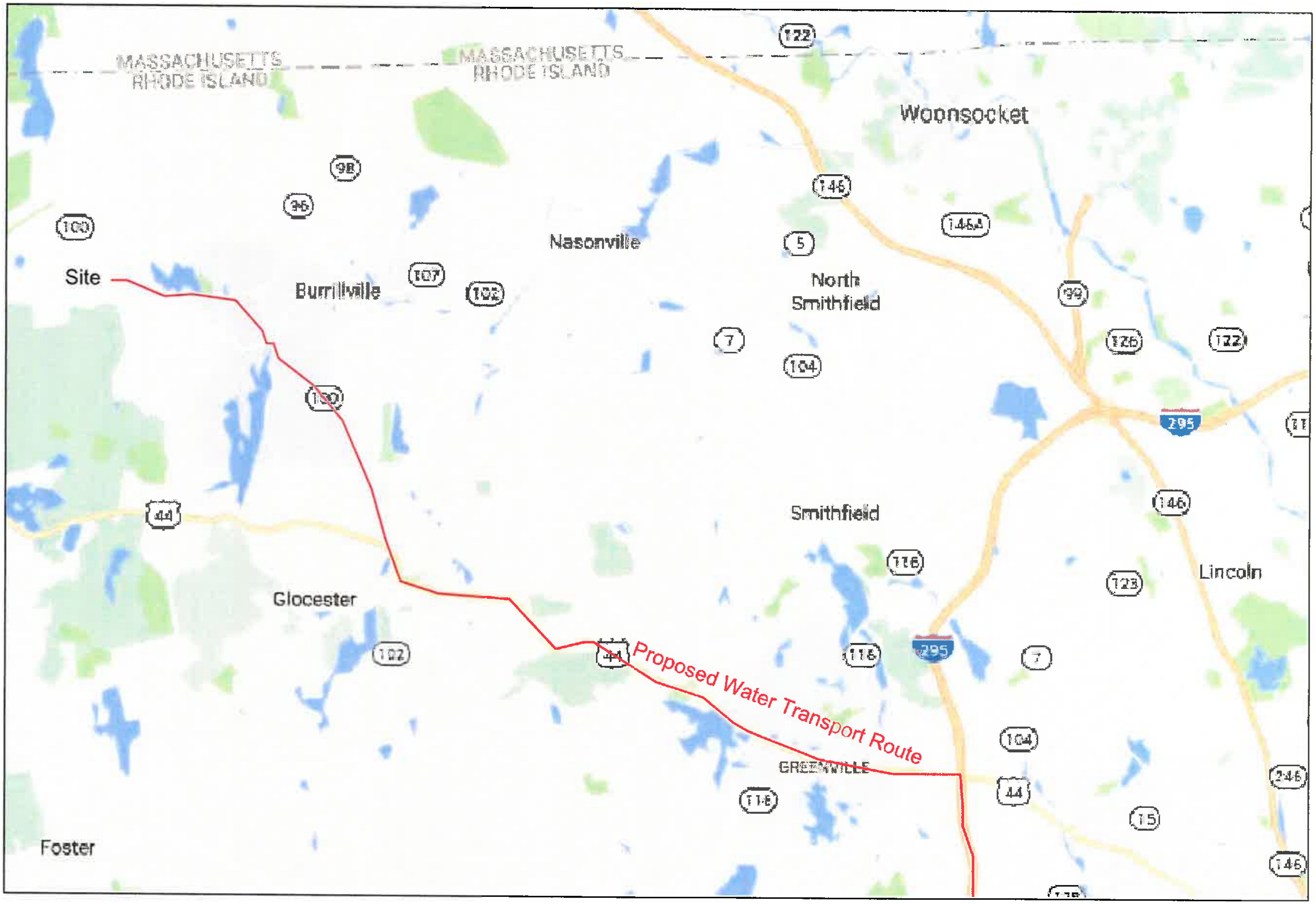
In terms of traffic operations during peak periods, the number of truck trips has been reduced by two truck trips (one truck entering, one truck exiting) during the weekday morning and weekday afternoon, in comparison to the analysis presented in the original traffic report. The change in projected traffic volume has little impact on the traffic operations for study area roadways and intersections analyzed. The revised traffic projections result in very minor decreases in delay and no change in level-of service (LOS) at the study area intersections, as compared to the delay and LOS originally reported. All movements at the intersection of Pascoag Main Street at South Main Street are still expected to operate at LOS C or better during the weekday morning peak hour and LOS E or better during the weekday afternoon peak hour. All movements at the intersection of Pascoag Main Street at Church Street are expected to continue to operate at LOS C or better during the weekday morning peak hour and LOS D during the weekday afternoon peak hour. The critical exiting movement at the proposed site driveway is still expected to operate at LOS A during both the weekday morning and weekday afternoon peak hours. All movements within the study area intersections are expected to operate under capacity and at acceptable levels-of service.

Roadway Impacts

Potential roadway impacts resulting from delivery of water from Johnston were evaluated and are discussed below.

Water trucks accessing the proposed facility from Johnston would utilize I-295 north to US Route 44 west in Smithfield, to Route 100 north in Glocester. This is the same route that was evaluated in a previous study as the primary truck route to the site for construction vehicles. As these are all high-level, State maintained highways, the previous study found this route to be suitable for the additional expected construction truck traffic. Based on this, the route would continue to be suitable for the additional expected truck traffic necessary to operate the facility.

Based on the projected volume of additional trucks noted above, and assuming all water trucks are within legal weight limits, the truck water delivery option from Johnston will not produce significant additional burden on the State Highways along the route(s) proposed as noted above.



CREC Water Transport Routes
Burrillville, RI

Conclusion

The following conclusions have been drawn based on the analysis provided:

- Two alternatives were considered to transport water to the CREC facility. The preferred alternative is to transport water by truck to the site.
- Transporting water to the facility by truck would result in approximately three (for average ambient condition) additional trucks per day accessing the site.
- Revisions were made to the ammonia delivery schedule since the TIS was published in May 2016. An ammonia truck will deliver to the site once every other day.
- Revisions were also made to the oil fired event delivery schedule. After an oil fired event, trucks will deliver oil and water to the facility to replenish the on-site tanks at a rate of 19 trucks per day.
- The estimated peak hourly traffic during the peak time of the facility is approximately three trucks or six truck trips (three trucks entering, three trucks exiting) during both the weekday morning and weekday afternoon peak hours, which is less than what was originally analyzed as part of the May 2016 TIS. Therefore, the conclusions of the TIS in terms of peak hour traffic operations remain valid.
- The proposed truck route to the facility would be I-295 north/US 44 west/Route 100 north which was evaluated in a previous study.
- The proposed truck route is able to accommodate the increase in truck traffic as a result of the proposed CREC facility operations. This route would not experience significant additional deterioration due to the transport of water to the site.

Very truly yours,

Maureen Chlebek

Maureen Chlebek, P.E., PTOE
General Manager - Rhode Island

Appendix F

Agreement Between Clear River Energy LLC And the Town of Johnston

WATER SUPPLY AND ECONOMIC DEVELOPMENT AGREEMENT

THIS WATER SUPPLY AND ECONOMIC DEVELOPMENT AGREEMENT (this "**Agreement**") is entered into as of January 6, 2017 (the "Effective Date"), by and between the Town of Johnston, a municipal corporation organized under the laws of the State of Rhode Island ("**Johnston**" or "**the Town**"), and Clear River Energy LLC, a limited liability company organized under the laws of the State of Delaware ("**CREC**"). Johnston and CREC may each be referred to herein individually as a "Party", and collectively as "Parties".

RECITALS

WHEREAS, Johnston is a municipal corporation located in Providence County, Rhode Island, and the owner and operator of a water system which currently provides municipal water services to residents of Johnston, Rhode Island, (the "**Water System**");

WHEREAS, CREC is the developer of a nominal one thousand (1,000) MW modern, energy efficient, dual-fuel combined cycle, thermal energy generation facility (the "**Project**"), which subject to licensure by the Rhode Island Energy Facility Siting Board, will be constructed and operated on certain real property located in Burrillville, Rhode Island;

WHEREAS, in connection with the operation of the Project, CREC requires a reliable source of water in sufficient quantities to meet the Project's demand;

WHEREAS, CREC has designed the Project such that its water demand has been reduced to the point where water can be delivered to the Project by truck;

WHEREAS, if Johnston becomes the primary water supply to the Project, it is desirable for CREC to develop a dedicated facility in Johnston to take delivery of water (the "Water Transport Facility");

WHEREAS, the development of a Water Transport Facility creates a unique economic development opportunity in Johnston;

WHEREAS, Johnston has the available water supply capacity and has agreed to supply the Project with a reliable source of water in sufficient quantities to meet the Project's demand on the terms and conditions set forth herein;

WHEREAS, CREC and Mayor Joseph Polisena have negotiated terms for the benefit of the Project and the Town of Johnston in terms of economic development;

WHEREAS, the Project requires redundancy in water supply; and

WHEREAS, Johnston desires to be the primary water supplier or is willing to serve as the secondary source of water supply for the Project.

NOW THEREFORE, in consideration of the mutual covenants contained herein and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the Parties hereby agree as follows:

1. **Recitals**. The foregoing recitals are hereby incorporated herein by this reference.

2. **Water Supply**.

Approved MSB

(a) Flow Rate. During the Term (defined below), CREC will purchase from Johnston and Johnston shall supply to CREC potable, treated water meeting all applicable state and federal purity standards ("**Potable Water**") for use by and in connection with the Project. Johnston shall supply the Project's daily Water Demand (defined below). With both combustion turbines operating on natural gas at full-load average ambient conditions, the daily water demand for the Project will be supplied by trucks that are filled at a location located within the Town limits. The following approximate number of trucks required to satisfy the water usage rates are based upon the assumption that the trucks have a maximum capacity of 7,200 gallons.

(i) Average Operating Conditions. CREC estimates water usage rates during the summer season of approximately 13 GPM, or 18,720 GPD. In turn, CREC estimates that up to 3 truck deliveries per day will be required to satisfy expected water use needs of the Project. However, up to five (5) trucks a day may be necessary for certain operational occurrences and weather related impacts. This is the Average Demand Flow Rate.

(ii) Replenishing On-Site Storage. Once an oil event happens CREC would need to replenish the water tanks which would require an additional 10 to 11 water trucks per day over that required in subsection (i), above, for approximately 30 days. This is the Maximum Demand Flow Rate.

(b) Point of Delivery. Johnston shall deliver all Potable Water pursuant to this Agreement through a mutually designated point of delivery ("**Point of Delivery**") at the Water Transport Facility, or if Johnston is a secondary supply, a designated hydrant of point of delivery, which shall be equipped with a Water Meter (defined below) and backflow preventer. CREC shall take title to the Potable Water at the Point of Delivery.

(c) Quantity/Quality. Johnston shall immediately notify CREC of any condition in the Water System of which it learns may affect the quality or quantity of water supplied to CREC by Johnston.

3. **Water Supply Terms.**

(a) Water Supply Rates.

(i) *Rate.* As full consideration for Johnston's supply of Potable Water to the Project up to the Maximum Demand Flow Rate, CREC shall pay to Johnston the rate otherwise applicable to all customers located with the Town's service area per one hundred (100) standard cubic feet of Potable Water supplied to the Project. The Town shall not establish a rate applicable solely to CREC.

(ii) *Invoices.* Within thirty (30) days following the end of the quarter of the calendar year in which the commercial operations date of the Project occurs, Johnston shall send an invoice to CREC detailing CREC's usage as shown on the applicable water meter ("Water Meter"), any usage during the invoiced period by Additional Users (in order to determine any O&M Fee Adjustment or Water Supply Payment Adjustment, if any), and the amount due from CREC for its usage pursuant to this Agreement (an "**Invoice**"). CREC and Johnston agree that quarterly payment for the first three quarters of the calendar year will be based on actual usage and that the quarterly payment for the fourth quarter of the calendar year will be based on the greater of actual usage or the dollar amount required to meet the minimum annual payment. Johnston shall thereafter send an Invoice to CREC within thirty (30) days following each successive quarter during the Term.

(iii) *Audit.* Johnston shall maintain records documenting all relevant costs and usage by CREC and any Additional Users, and Johnston shall make the same available to CREC for viewing and copying upon reasonable notice. CREC shall have the right, within thirty (30) days following receipt of any Invoice, to dispute any item shown on such Invoice (including, without limitation, the payment due and usage) by giving written notice to Johnston of such dispute. Following CREC's delivery of any such dispute notice, the Parties shall work in good faith to determine whether the relevant Invoice contains incorrect information or whether the Water Meter has transmitted incorrect information.

(b) Capacity Reserve for Johnston to Serve the Secondary Source of Water Supply.

(i) *Secondary Supply Delivery.* If Johnston is the secondary source of water supply, the Town will identify a hydrant(s) or point of delivery within Johnston that is serviced by Johnston Water where trucks owned or contracted by CREC could be filled on an as needed basis subject to the above water supply rates. "Secondary Source of Water Supply" is defined to mean that CREC has a Water Supply and Economic Development Agreement within the City of Woonsocket as the "Primary Water Supplier".

(ii) *Capacity Reserve Payment.* If Johnston is the Secondary Source of Water Supply, CREC will pay to the Town of Johnston Two Hundred Thousand and 00/100 ($200,000.00) Dollars per year for capacity reserve for Johnston to act as the Secondary Source of Water Supply for the Project. Said annual payment will commence upon commercial operations of the Project and shall extend for a ten (10) year term with CREC having two, five (5) year options to extend. In addition, CREC shall pay the Town for any water consumed from the Town as the Secondary Source of Water Supply at the rates set forth in Section 3(a).

4. **Economic Development Terms (Johnston Serving as a Primary Water Supplier to the Project).**

(a) Development and Location of Water Transport Facility. CREC will purchase a parcel of real estate within Johnston that is served by Johnston water. CREC will either construct a new Water Transport Facility or recondition an existing building, should there be a suitable building on the selected site. CREC will work with appropriate staff from Johnston to identify a suitable parcel. CREC also reserves the flexibility to lease and develop a suitable parcel. Notwithstanding, CREC and Johnston shall enter into a payment in lieu of taxes agreement (the "PILOT Agreement") applicable to the Water Transport Facility including all associated trucks, equipment and other real and tangible property for a term of twenty (20) years. The payments under the PILOT Agreement shall be in lieu of any and all taxes, assessments, levies, and/or tariffs that may be in existence or may be enacted relative to the Water Transport Facility, the associated trucks, equipment and all related real and tangible property. The payments in lieu of such taxes by CREC to the Town of Johnston shall be Two Hundred Thousand and 00/100 ($200,000.00) Dollars per year for the twenty (20) year term of the PILOT Agreement.

(b) Direct Payment to Johnston General Fund for Taxpayer Relief. During the term of this Agreement, CREC shall pay to the Johnston General Fund for taxpayer relief the sum of Five Hundred Thousand and 00/100 ($500,000.00) Dollars per year with a three (3%) percent escalation every year. Said payments will commence upon commercial operation of the Project.

(c) Contribution. For the first five (5) years of this Agreement, CREC will make a contribution to Johnston of Two Hundred Thousand and 00/100 ($200,000.00) per year that will be utilized for youth programs at the Administration's discretion. Said contributions will commence upon commercial operation of the Project.

(d) Termination of Economic Development Payments. The economic development payments as set forth in subparagraphs (a)-(c), above, shall continue during the term of this Agreement, so long as the Project remains licensed by the Rhode Island Energy Facility Siting Board, the Water Transport Facility continues to operate and be supplied water in the amounts set forth herein, and there has been no material breach of this Agreement. If during the term of this Agreement, such an event occurs, payments shall cease.

(e) Secondary Source of Water Supply. The Town, if it becomes the Secondary Source of Water Supply, shall not be entitled to the payments defined in this Section, notwithstanding any other provisions in this Agreement.

5. **Term.** This Agreement shall be for an initial term ("Initial Term") commencing on the Effective Date and continuing until the twentieth (20th) anniversary of the date after the Project begins commercial operations (the "**Term**"). CREC has the exclusive option of extending the Agreement for successive five (5) year period. CREC can terminate the Agreement after the Initial Term for any reason by providing written notice to the Town.

6. **Termination.**

(a) Notice. CREC shall have the right to terminate this Agreement for Cause effective upon written notice from CREC to Johnston. Following CREC's termination of this Agreement, neither Party shall have any obligation to the other Party under this Agreement. As used herein, "**Cause**" means CREC's decision (in its sole discretion) to either (i) discontinue the development of the Project prior to the commencement of construction of the Project as a result of CREC's inability to secure the necessary permits, licenses or regulatory approvals for the Project or obtain financing for the Project; (ii) suspension or termination of the Project's licensure; or (iii) CREC's decision to terminate commercial Project operations; or (iv) in the event that the Town is in breach of this Agreement.

7. **Representations and Warranties.**

(a) CREC's Representations and Warranties. CREC hereby represents, warrants and covenants to Johnston that:

(i) CREC has the unrestricted right and authority to execute this Agreement. Each person signing this Agreement on behalf of CREC is authorized to do so. Upon execution by all Parties hereto, this Agreement shall constitute a valid and binding agreement enforceable against CREC in accordance with its terms.

(ii) CREC has the ability to adjust its daily Water Demand through the use of on-site storage tanks and other operational adjustments between the Standard Demand Flow Rate and the Increased Demand Flow Rate when operating on natural gas. CREC also has the ability to adjust its daily demand for truck deliveries for any of the Demand Flow Rates by relying on such on-site tanks.

(b) Johnston's Representations and Warranties. Johnston hereby represents, warrants and covenants to CREC that:

(i) Johnston is the sole owner of the Water System and has been explicitly authorized to enter into this Agreement pursuant to an approved resolution of the Johnston Town Council attached hereto as Exhibit A (the "**WSA Approval**").

(ii) Johnston has the unrestricted right and authority to supply the Water Demand to CREC.

(iii) Johnston has the unrestricted right and authority to execute this Agreement. Each person signing this Agreement on behalf of Johnston is authorized to do so. Upon execution by all Parties hereto, and upon approvals as may be required by Johnston as a regulated water supplier, this Agreement shall constitute a valid and binding agreement enforceable against Johnston in accordance with its terms.

(iv) No litigation is pending, and, to the best of Johnston's knowledge, no actions, claims or other legal or administrative proceedings are pending, threatened or anticipated with respect to, or which could affect, the Water System or the ability to deliver the Water Demand. If Johnston learns that any such litigation, action, claim or proceeding is threatened or has been instituted, Johnston shall promptly deliver notice thereof to CREC and provide CREC with periodic updates of the status of said litigation, action, claim or proceeding that is ongoing.

8. **Assignment**.

(a) Collateral Assignments. CREC shall have the absolute right in its sole and exclusive discretion, without obtaining the consent of Johnston, to finance, mortgage, encumber, hypothecate, pledge or transfer to one or more Mortgagees (defined below) any and all of the rights granted hereunder, and/or any or all rights and interests of CREC in and to the Project.

(b) Non-Collateral Assignments. CREC shall have the right, without the prior consent of Johnston, to sell, convey, assign or transfer any or all of its rights hereunder provided such transfer is related to the Project. CREC shall be relieved of all of its obligations arising under this Agreement from and after the effective date of such transfer, provided such rights and obligations have been assumed by such transferee.

(c) Acquisition of Interest. The acquisition of all interests, or any portion of interest, in CREC by another person shall not require the consent of Johnston or constitute a breach of any provision of this Agreement and Johnston shall recognize the person as CREC's proper successor.

(d) Assignment by the Town. The Town may assign this Agreement and the obligations hereunder to an entity that has acquired or leased the Town's water system so long as said entity enters into an agreement in a form acceptable to CREC, acceptance shall not unreasonably be withheld, acknowledging the obligations to supply water under the terms hereof. Notwithstanding, if the Town becomes the Primary Water Supplier to the Project, then the payments under Section 4, hereof, shall continue to be made to the Town for the term of this Agreement, despite such assignment, so long as the new operator of the Town's water system is in compliance of the terms and conditions of this Agreement.

9. **Mortgagee Protection**. In the event that any document memorializing a security interest in this Agreement or in any part of the Project (a "**Mortgage**"), is entered into by CREC, then any person who is the mortgagee, grantee or beneficiary of a Mortgage (a "**Mortgagee**") shall, for so long as its Mortgage is in existence and until the lien thereof has been extinguished, be entitled to the protections set forth in this Section 9. CREC shall send written notice to Johnston of the name and address of any such Mortgagee;

provided that failure of CREC to give notice of any such Mortgagee shall not constitute a default under this Agreement and shall not invalidate such Mortgage.

(a) Notice of Default; Opportunity to Cure. As a precondition to exercising any rights or remedies as a result of any default of CREC, Johnston shall give a Notice of Default (defined below) to each Mortgagee of which it has notice, concurrently with delivery of such notice to CREC. In the event Johnston gives a Notice of Default, the following provisions shall apply:

(i) The Mortgagee shall have the same period after receipt of the Notice of Default to remedy the default, or cause the same to be remedied, as is given to CREC, plus, in each instance, the following additional time periods: (i) thirty (30) days in the event of any monetary default; and (ii) sixty (60) days in the event of any non-monetary default. The Mortgagee shall have the absolute right to substitute itself for CREC and perform the duties of CREC hereunder for purposes of curing such default. Johnston expressly consents to such substitution, agrees to accept such performance. Johnston shall not take any action to terminate this Agreement in law or equity prior to the expiration of the cure periods available to a Mortgagee as set forth above.

(ii) Neither the bankruptcy nor the insolvency of CREC shall be grounds for terminating this Agreement as long as all material obligations of CREC under the terms of this Agreement are performed by the Mortgagee in accordance with the terms hereunder.

(b) New Agreement to Mortgagee. If this Agreement terminates because of CREC's default or if this Agreement is rejected or disaffirmed pursuant to bankruptcy law or other law affecting creditors' rights, Johnston shall, upon written request from any Mortgagee within ninety (90) days after such event, enter into a new water supply agreement on the following terms and conditions:

(i) The terms of the new agreement shall commence on the date of termination, rejection or disaffirmance and shall continue for the remainder of the Term and subject to the same terms and conditions set forth in this Agreement.

(ii) The new agreement shall be executed within thirty (30) days after receipt by Johnston of written notice of the Mortgagee's election to enter a new agreement, provided said Mortgagee: (i) pays to Johnston all monetary charges payable by CREC under the terms of this Agreement up to the date of execution of the new agreement, as if this Agreement had not been terminated, rejected or disaffirmed; (ii) performs all other obligations of CREC under the terms of this Agreement, to the extent performance is then due and susceptible of being cured and performed by the Mortgagee; and (iii) agrees in writing to perform, or cause to be performed, all non-monetary obligations which have not been performed by CREC and would have accrued under this Agreement up to the date of commencement of the new agreement, except those obligations which constitute non-curable defaults.

(iii) At the option of the Mortgagee, the new agreement may be executed by a designee of such Mortgagee without the Mortgagee assuming the burdens and obligations of CREC thereunder.

(iv) The provisions of this Section 8 shall survive the termination, rejection or disaffirmance of this Agreement and shall continue in full force and effect thereafter to the same extent as if this Section 9 were a separate and independent contract made by Johnston, CREC and such Mortgagee, and, from the effective date of such termination, rejection or disaffirmation of this Agreement to the date of execution and delivery of such new agreement, such Mortgagee may use and enjoy the Potable Water without hindrance by Johnston or any person claiming by, through or under Johnston, provided that all of the conditions for a new agreement as set forth herein are complied with.

(c) Mortgagee's Consent to Amendment, Termination or Surrender. Notwithstanding any provision of this Agreement to the contrary, the Parties agree that so long as there exists an unpaid Mortgage, this Agreement shall not be modified or amended and Johnston shall not accept a cancellation, termination or release of this Agreement from CREC prior to expiration of the Term without the prior written consent of the Mortgagee. This provision is for the express benefit of and shall be enforceable by such Mortgagee.

(d) No Waiver. No payment made to Johnston by a Mortgagee shall constitute an agreement that such payment was, in fact, due under the terms of this Agreement; and a Mortgagee, having made any payment to Johnston pursuant to Johnston's wrongful, improper or mistaken notice or demand, shall be entitled to the return of any such payment.

(e) Estoppel Certificates, Etc. Johnston shall execute such estoppel certificates (certifying as to such matters as CREC may reasonably request, including without limitation that no default by CREC then exists under this Agreement, if such be the case) and/or consents to assignment (whether or not such consent is actually required) as CREC, any transferee of CREC or Mortgagee may reasonably request from time to time. The failure of Johnston to deliver any estoppel certificate within fifteen (15) days after CREC's written request therefor shall be conclusive evidence that (i) this Agreement is in full force and effect and has not been modified; (ii) any amounts payable by CREC to Johnston have been paid through the date of such written request; (iii) there are no uncured defaults by CREC; and (iv) the other certifications requested by CREC in its estoppel, are in fact, true and correct.

10. **Default/Remedies.**

(a) Default. If a Party defaults in or otherwise fails to perform an obligation under this Agreement, the non-defaulting Party shall not have the right to exercise any remedies hereunder if the default is cured by the defaulting Party within sixty (60) days of receiving written notice of such default specifying in detail the default and the requested remedy (a "**Notice of Default**"); provided, that if the nature of the default requires, in the exercise of commercially reasonable diligence, more than sixty (60) days to cure, the non- defaulting Party shall not have the right to exercise any remedies hereunder as long as the defaulting Party commences performance of the cure within sixty (60) days of receipt of Notice of Default and thereafter completes such cure with commercially reasonable diligence. Further, if the Parties have a good faith dispute as to whether a payment is due hereunder, the alleged defaulting Party may deposit the amount in controversy (not including claimed consequential, special, exemplary or punitive damages) into escrow with any reputable third party escrowee, or may interplead the same, which amount shall remain undistributed and shall not accrue interest penalties, and no default shall be deemed to have occurred, until final decision by a court of competent jurisdiction or upon agreement by the Parties. No such deposit shall constitute a waiver of the defaulting Party's right to institute legal action for recovery of such amounts.

(b) Remedies. Except as qualified by Section 9 regarding Mortgagee Protections, should a default remain uncured beyond the applicable cure periods, the non-defaulting Party shall have the right to exercise any and all remedies available to it at law or in equity, all of which remedies shall be cumulative, including the right to enforce this Agreement by injunction, specific performance or other equitable relief.

11. **Indemnities.** Each Party (the "**Indemnifying Party**") shall defend, indemnify, and hold harmless the other Party (the "**Indemnified Party**"), including its agents, servants, employees, affiliates,

contractors, licensees, invitees, and/or elected officials, from and against all liability, damage, loss, costs, (including reasonable attorneys' fees) claim, demands, and actions of any nature whatsoever for any personal injury, death, physical damage or fines which arise out of or are connected with, or claimed to arise out of or be connected with, the Indemnifying Party's violation of any applicable water use regulations, hazardous materials regulations, or regulations promulgated by RIDEM and/or RIDOH.

12. **Notice**. All notices or other communications required or permitted by this Agreement, including payments to Johnston, shall be in writing and shall be deemed given when personally delivered to Johnston or CREC, the same day if sent via facsimile with confirmation, or the next business day if sent via overnight delivery or five (5) days after deposit in the United States mail, first class, postage prepaid, certified, addressed as follows:

If to Johnston:

1385 Hartford Ave
Johnston RI 02919

Fax: 401-553-8835
Attn: Mayor

If to CREC:

c/o Invenergy LLC
One S. Wacker Drive, Suite 1800
Chicago, Illinois 60606
Fax: 312-224-1444
Attn: General Counsel

Either Party may change its address for purposes of this paragraph by giving written notice of such change to the other Parties in the manner provided in this paragraph.

13. **Notice of Primary or Secondary Supplier Status**. CREC shall provide Johnston with written notice on or before Jan 12, 2017 as to whether Johnston will serve as a primary or secondary supplier. If Johnston is a secondary supplier, the payments under Section 4 above, would not be applicable.

14. **Miscellaneous.**

(a) Emergency. Either party may terminate or suspend its obligations under this Agreement by reasonable advance written notice to the other in order to protect the public health and safety of its agents, servants, employees, affiliates, contractors, licensees, invitees and inhabitants pursuant to a written declaration of a health or safety emergency by either Party. Both Parties shall forthwith thereafter jointly address any such issues so as to promptly remedy the same and effectuate the intention and purposes of this Agreement.

(b) Force Majeure. If performance of this Agreement or of any obligation hereunder is prevented or substantially restricted or interfered with by reason of an event of Force Majeure (defined below), the affected Party, upon giving notice to the other Party, shall be excused from such performance to the extent of and for the duration of such prevention, restriction or interference, and the time to so perform herein shall be extended for such period of time. The affected Party shall use its reasonable efforts to avoid or remove such causes of nonperformance and shall continue performance hereunder whenever such causes are removed. As used herein, Force Majeure" means fire, earthquake, flood, or other casualty, condemnation or accident; strikes or labor disputes; war, civil strife or other violence; any law, order, proclamation, regulation, ordinance, action, demand or requirement of any government agency or utility; or any other act or condition beyond the reasonable control of a Party hereto.

(c) Successors/Assigns. This Agreement shall inure to the benefit of and be binding upon CREC and Johnston and, to the extent provided in any assignment or other transfer permitted hereunder, any transferee, and their respective heirs, transferees, successors and assigns, and all persons claiming under them.

(d) Entire Agreement/Amendments. This Agreement, together with all exhibits attached hereto, constitutes the entire agreement between Johnston and CREC respecting its subject matter, and supersedes any and all oral or written agreements. All of the provisions of any exhibit hereto shall be treated as if such provisions were set forth in the body of this Agreement and shall represent binding obligations of each of the Parties as part of this Agreement. Any agreement, understanding or representation respecting the Property, or any other matter referenced herein not expressly set forth in this Agreement or a previous writing signed by both Parties is null and void. No purported modifications or amendments, including without limitation any oral agreement (even if supported by new consideration), course of conduct or absence of a response to a unilateral communication, shall be binding on either Party unless in a writing signed by both Parties. Provided that no material default in the performance of CREC's obligations under this Agreement shall have occurred and remain uncured, Johnston shall cooperate with CREC in amending this Agreement from time to time to include any provision that may be reasonably requested by CREC for the purpose of implementing the provisions contained in this Agreement or for the purpose of preserving the security interest of any transferee of CREC or Mortgagee.

(e) Legal Matters. This Agreement shall be governed by and interpreted in accordance with the laws of the State of Rhode Island. If the Parties are unable to resolve amicably any dispute arising out of or in connection with this Agreement, they agree that such dispute shall be resolved in the state courts located in the Providence County, Rhode Island. The Parties agree that any rule of construction to the effect that ambiguities are to be resolved in favor of either Party shall not be employed in the interpretation of this Agreement and is hereby waived. The prevailing Party in any action or proceeding for the enforcement, protection or establishment of any right or remedy under this Agreement shall be entitled to recover its reasonable attorneys' fees and costs in connection with such action or proceeding from the non-prevailing Party.

(f) Partial Invalidity. Should any provision of this Agreement be held, in a final and unappealable decision by a court of competent jurisdiction, to be either invalid, void or unenforceable, the remaining provisions hereof shall remain in full force and effect, unimpaired by the holding.

(g) Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original and all of which when taken together shall constitute one and the same document.

(h) Partnership. Nothing contained in this Agreement shall be construed to create an association, joint venture, trust or partnership, covenant, obligation or liability on or with regard to any one or more Parties in this Agreement.

(i) Contingencies to Agreement. This Agreement is expressly subject to and conditioned upon the Project securing final licensure from the Rhode Island Energy Facility Siting Board with all applicable appeals periods having expired, said licensure remaining in full force and effect during the Term hereof, and the Project coming to financial closure on Project finance on terms deemed acceptable to CREC in CREC's sole discretion. If said contingencies are not satisfied, the obligations of CREC and/or CREC hereunder do not come into force and effect.

[*signatures on following page*]

IN WITNESS WHEREOF, CREC and Johnston, acting through their duly authorized representatives, have executed this Agreement with the intent that it be effective as of the Effective Date, and certify that they have read, understand and agree to the terms and conditions of this Agreement.

JOHNSTON:

TOWN OF JOHNSTON

By: ____________________
Name: Joseph M. Polisena
Title: Mayor

By: ____________________
Name: William J. Conley Jr. Esq.
Title: Solicitor, as Authorized by the Town Council for the Town of Johnston having ratified this Agreement on January 10, 2017. Said resolution ratifying the Agreement as attached hereto as **Exhibit A.**

CREC:

CLEAR RIVER ENERGY LLC,
a Delaware limited liability company

By: ____________________
Name: James J. Shield
Title: Vice President

EXHIBIT A

WSA Approval

[*see attached*]

Town of Johnston

RESOLUTION OF THE TOWN COUNCIL

No. 2017-5

In Favor: 5 Opposed: ∅

Council President Date 1/10/2015

Be it resolved that:

Whereas, *The Town is desirous of entering into an agreement for the sale of water; and;*

Now, therefore, be it resolved that we, the members of the Johnston Town Council hereby ratify and authorize Mayor Joseph M. Polisena to enter into the attached Water Supply and Economic Development Agreement between the Town of Johnston and Clear River Energy, LLC for the purchase of water from the Town of Johnston.

Resolution 2017-5 shall become effective immediately upon the date of its passage.

Robert V. Russo, Councilman
District-4

Robert J. Civetti, Councilman
District-5

Richard J. DelFino III, Councilman
District-1

Anthony A. Verardo, Councilman
District-2

David J. Santilli, Councilman
District-3

Attest
Vincent P. Baccari, Jr., Town Clerk

A TRUE COPY ATTEST JAN 11 2016

Town Clerk

Official Document

Appendix G

Memorandum of Agreement Between Clear River Energy LLC and Benn Water & Heavy Transport Corp.

VIA E-MAIL

January 6, 2017

Benn Water & Heavy Transport, Corp.
c/o Charles Soloveitzik, Esq.
Two Elm Street
Westerly, RI 02891

Re: Clear River Energy Center located in Burrillville, Rhode Island (the "Project") Memorandum of Agreement to Enter Into Water Supply and/or Transport Agreement

Dear Attorney Soloveitzik:

This Memorandum of Agreement to enter into a Water Supply and/or Water Transport Agreement (this "**MOA**") expresses the intent of Clear River Energy LLC, a Delaware limited liability company ("**CREC**"), and Benn Water & Heavy Transport, Corp. ("**Benn Water**") to have Benn Water supply and/or transport water necessary for operation of the proposed Clear River Energy Center (the "Project") to be located in Burrillville, Rhode Island (collectively, the "**Transaction**"). CREC and Benn Water are sometimes referred to in this MOA as a "**Party**" or collectively as the "**Parties**".

The Project will require a secure source(s) of potable process water for its use in generating electric power. The Parties, therefore, have agreed to pursue the Transaction, the basic terms of which are as follows:

1. **Water Supply**. Subject to a Water Supply and/or Water Transport Agreement, Benn Water has the right to supply water up to the quantities described below.

2. **Water Transport**. In the event, CREC secures alternate services of water supply, Benn Water would transport and/or supplement CREC's transport of water from a supply "Point of Delivery" to the Project as requested.

3. **Water Usage**. CREC estimates that the water usage rates required for the Project will vary somewhat throughout the year. The following approximate number of trucks required to satisfy the water usage rates are based upon the assumption that the trucks have a maximum capacity of 7,200 gallons.

    a. Normal Operations. CREC estimates water usage rates during the year of approximately 13 GPM, or 18,720 GPD. In turn, CREC estimates that up to 3 truck deliveries per day will be required to satisfy the water use needs of the Project.

    b. Replenishing On-Site Storage. CREC may need to replenish the on-site water storage tanks which would require up to an additional 10 to 11 water trucks per day for a total of about 13 trucks per day for approximately 30 days.

4. **Due Diligence**. CREC, at its sole cost and expense, will retain a consultant to work with Benn Water to conduct all necessary due diligence with regard to Benn Water's source water, water chemistry, adequate volumes, and Benn Water's ability to deliver required volumes both in the summer and winter seasons. Due diligence will be completed within twenty (20) days and to

CREC's sole satisfaction. CREC agrees to reimburse Benn Water for all reasonable professional costs incurred with regard to the due diligence conducted in finalizing the Water Supply Agreement by and between the Parties.

5. **Water Supply and/or Water Transport Agreement**. In the event Due Diligence is completed to CREC's sole satisfaction, the Parties will negotiate in good faith and enter into a long-term water supply and/or transport agreement (the "Water Supply and/or Transport Agreement") governing said supply and/or transport, which shall include, at minimum, the terms outlined herein.

6. **Payment Terms**. The terms of payment and transport capacity reserve with regard to the proposed Water Supply and/or Transport Agreement are confidential and are therefore, set forth in **Schedule 1** attached hereto and incorporated herein.

7. **Delivery Off-Peak**. Benn Water agrees to provide deliveries of water to the Project site off-traffic peak and beyond regular business hours of operation, as required by CREC.

8. **Water Delivery**. Benn will provide specifications for insulated, stainless steel tanks with internal valves for winter season delivery.

9. **Other Commercial Terms**. The Parties agree to negotiate other standard commercial terms in good faith.

10. **Confidentiality/Public Announcement.**

    a. The Parties each agree to keep confidential the existence, status, or terms and conditions of this MOA, including, without limitation, any compensation or lack of compensation hereunder (collectively, the "Confidential Information"), and not to disclose or otherwise convey any portion of the Confidential Information to any person other than the disclosing Party's attorneys, employees, family members, affiliates, potential third party power purchasers, potential financing parties, agents or representatives and other personal advisors who need to know such information for the purpose of assisting the disclosing Party in connection with this MOA or pursuant to lawful process, subpoena or court order; provided the disclosing Party in making such disclosure advises the party receiving the information of the confidentiality of the information and obtains the agreement of said party not to disclose the information. It is further understood and agreed by the Parties that money damages may not be a sufficient remedy for any breach of this Section 10 and that the non-disclosing Party shall be entitled to seek specific performance and injunctive or other equitable relief as a remedy for any such breach without the necessity of posting bond. Such remedies shall not be deemed to be the exclusive remedy for breaches of this Section 10, but shall be in addition to all other remedies that may be available at law or equity.

    b. The Parties shall consult with each other on the desirability, timing and substance of any press release or public announcement, publicity statement or other public disclosure relating to this Transaction or the fact that negotiations between us are being held. Each Party agrees not to make any such public disclosures without the prior written consent of the other Party as to the content and timing of such disclosure; *provided, however,* that either Party may make such disclosures as are required to comply with applicable law.

the Effective Date, and certify that they have read, understand and agree to the terms and conditions of this Memorandum of Agreement

BENN WATER:	**CREC:**
Benn Water & Heavy Transport, Corp., a Rhode Island corporation,	Clear River Energy LLC, a Delaware limited liability company
By: Jeffrey K Benn	By: Bryan Schueler
Name: JEFFREY K BENN	Name: Bryan Schueler
Title: PRESIDENT	Title: Vice President
Date: 1-9-16	Date: