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Conceptual Design Report Haverstraw Water Supply Project

Prepared for

United Water New York

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Section 3. Raw Water Supply and Storage

3.1 Plant Capacity and Flow

The water treatment plant will be constructed in three (3) phases with an initial production capacity of 2.5 million gallons per day (mgd) and ultimate production capacity of 7.5 mgd. In-plant usage and process wastewater is approximately 25% of raw water flow in the worst case, when the salinity of the raw water is high and all the water needs to be treated for desalination. River water will be withdrawn during approximately 12 hours during each day to obtain optimal raw water quality. Therefore, peak withdrawal rates will be two times the raw water process flow.

Table 3-1 Plant Flow Ranges

	Daily Production Capacity	Minimum Firm Daily Raw Water Capacity	Required Raw Water Intake Capacity
Phase 1 Flow, MGD	**2.5**	**3.4**	**6.7**
Phase 2 Flow, MGD	**5.0**	**6.7**	**13.3**
Phase 3 Flow, MGD (Ultimate)	**7.5**	**10**	**20**

3.2 Intake System

3.2.1 Intake System Evaluation

Several intake screen alternatives were considered. The intake design represented in this document was based upon evaluation of water quality, environmental impact and maintenance and operation considerations. A technical memorandum on the screening alternatives is included in Appendix E.

3.2.2 Design Concept

Wedge-wire screen intake is considered the most appropriate screening alternative. Source water will be withdrawn from the Hudson River through proposed wedge-wire basket screens in a tee configuration. Screens will be pile bent supported at the required location and depth in the water column to provide optimal water quality related to salinity and clearance from boats and floating debris. The proposed wedge-wire screen system will be maintained free of obstruction by use of an automated air cleaning system.

The proposed intake screen system will be connected to the intake pumping station by a raw water intake pipe, constructed below the river bottom. The raw water pumping station will be equipped with vertical turbine pumps. The raw water will be pumped to raw water storage tanks that will provide diurnal storage.

3.2.3 Intake Screen

Table 3-2 provides information describing the proposed intake screen system. A single tee screen is proposed. Air will be provided to each side of the tee screen individually, to minimize the size of the air supply line, compressor and receiver tank.

Table 3-2 Intake Screen

Type	Wedge wire tee screens with air supply to each screen
Number	1
Material	316 Stainless Steel
Diameter and Length, feet	4.5 x 15.25
Maximum through slot velocity, (at maximum intake capacity) fps	0.5
Screen slot opening, mm	2
Minimum screen submergence at low tide	To Be Determined[1]

(1) Typically, the minimum submergence for the screen is ½ diameter to minimize vortexing. The required minimum submergence will be determined during detailed design, and following the pilot plant study, additional water quality analysis, as well as, consideration of navigational and safety requirements.

3.2.3.1 Air Cleaning System

An air burst compressor, receiver and piping system will be provided to deliver 3 screen volumes of air to each individual screen over a period of 1 to 2 seconds. The air compressor system will be designed to recharge the receiver system in 30 minutes or less.

One screen will be provided with air supply lines. Air flow (start/stop) will be controlled by pneumatic operated bubble tight butterfly valves located in close proximity to the air receiver. The compressor and receiver will be located at the raw water pumping station. Valve control will normally be based on time interval. A backup control system will be provided based on a set point maximum differential head through the screens.

Table 3-3 provides additional information on the air cleaning system.

Table 3-3 Air Cleaning System

Air Supply Line	
Number	2
Diameter	6
Length, feet	1000±
Material	316 ss
Compressor	
Type	Skid mounted rotary screw or reciprocating
Number	2
Controls	Backboard mounted control panel, HOA switch for each compressor, auto alternation, low pressure alarm, receiver ready lights
Pressure, psi	140
Horsepower	25
Receiver	
Number	1 with auxiliary for valve control
Capacity, gallons	2,200

3.3 Intake Pumping Station

3.3.1 Design Concept

The station will house four 6.7 mgd pumps. Two pumps will be equipped with adjustable frequency drives (AFD). Two AFD pumps will be installed under Phase 1, and one additional constant speed pump for each of Phases 2 and 3. The station will be designed to provide a firm capacity of 20 mgd with 3 pumps in service.

Table 3-4 Pump Design Criteria

Item	Requirement
Number of pumps	4
Pump Capacity, each	6.7 MGD
Type of Pump	Vertical Turbine
Type of Drive	Two with AFDs / Two with Constant Speed Induction Motor
Motor Size / Voltage	160 horsepower (hp) / 480 volts
Design Operating Point	6.7 mgd /approximately 101 feet

Table 3-4 summarizes the static head conditions used to size the pumps. The number and capacity of the pumps was selected so that the pumping station discharge would provide the capacity required per phase.

Table 3-5 Raw Water Pumping Station and Tank

	Average River Level	Minimum River Level
Hudson River Elevation	0.0	3.5
Intake Pumping Station Operating floor Elevation	9.0	9.0
Raw Water Storage Tank Depth	32.0	32.0
Raw Water Storage Tank Overflow Elevation	62.0	62.0
Static head (feet)	62.0	58.5
Total Design Head (TDH) (feet) (1)	104.0	100.5

(1) TDH based on 20 mgd, 1,200 feet 36 inch diameter intake pipeline, 7,500 feet 30 inch diameter discharge pipeline, C factor of 120 and 4 feet head loss assumed for discharge piping in pumping station.

Both vertical turbine and horizontal centrifugal pumps were considered for this application. Vertical turbine pumps require less space and smaller building footprint, are generally more efficient, and allow the motors to be located above all flood levels without consideration of suction lift. These pumps may be configured to withdraw from a wet well or a hard piped can-type configuration. A pumping station configured with can pumps and hard piped suction lines may be more economical than a larger wet well sump arrangement. Horizontal centrifugal pumps would require the pumping facilities to be below grade and minimal river levels to avoid suction lift and associated priming systems. The dry well foot print would likely be larger than a wet well for vertical turbine pumps. Vertical turbine pumps were selected for preliminary design. Conceptual drawings for this facility are based on use of can type pumps. Final pumping station configuration will be re-evaluated based on final location and subsurface conditions.

3.3.2 Location

For the purpose of this report, the location is assumed to be at the US Gypsum sint in the Town of Haverstraw. Site selection study and land acquisition discussions are ongoing. Once the site is selected, a site-specific plan will be developed for implementation purposes.

3.3.3 Site Survey

A site survey of the Marina area was performed by Atzl, Scatassa & Zigler, Land Surveyors and Engineers, P.C. (Atzl). The site survey shows 1 ft contour intervals and identifies existing structures and easements including Joint Regional Sewage Board easement. The site survey is included in Appendix F.

3.3.4 Geotechnical Information

A geotechnical investigation will be conducted after final location of the intake pumping station is selected.

3.3.5 Pumping Station Site Layout

A paved parking area will be located adjacent to the building, and a driveway will provide access to the building. The parking area will provide space for parked vehicles and a turn-around area. In the event the pumps need to be removed through openings in the roof, a crane truck and flatbed truck will use the access road as a staging area. See Figure 3-1 for the pumping station layout.

3.3.6 Pumping Facility Layout

Four pumps will be provided (one as standby) to handle the maximum flow of 20-mgd. The pump station will have separate electrical, mechanical and generator rooms. Upon full scale design, the pump station may include separate visiting and auditorium rooms for the public and school children to visit the facilities. See Figure 3-2 for the pumping station drawing.

Figure 3-1 Pumping Station Site Layout

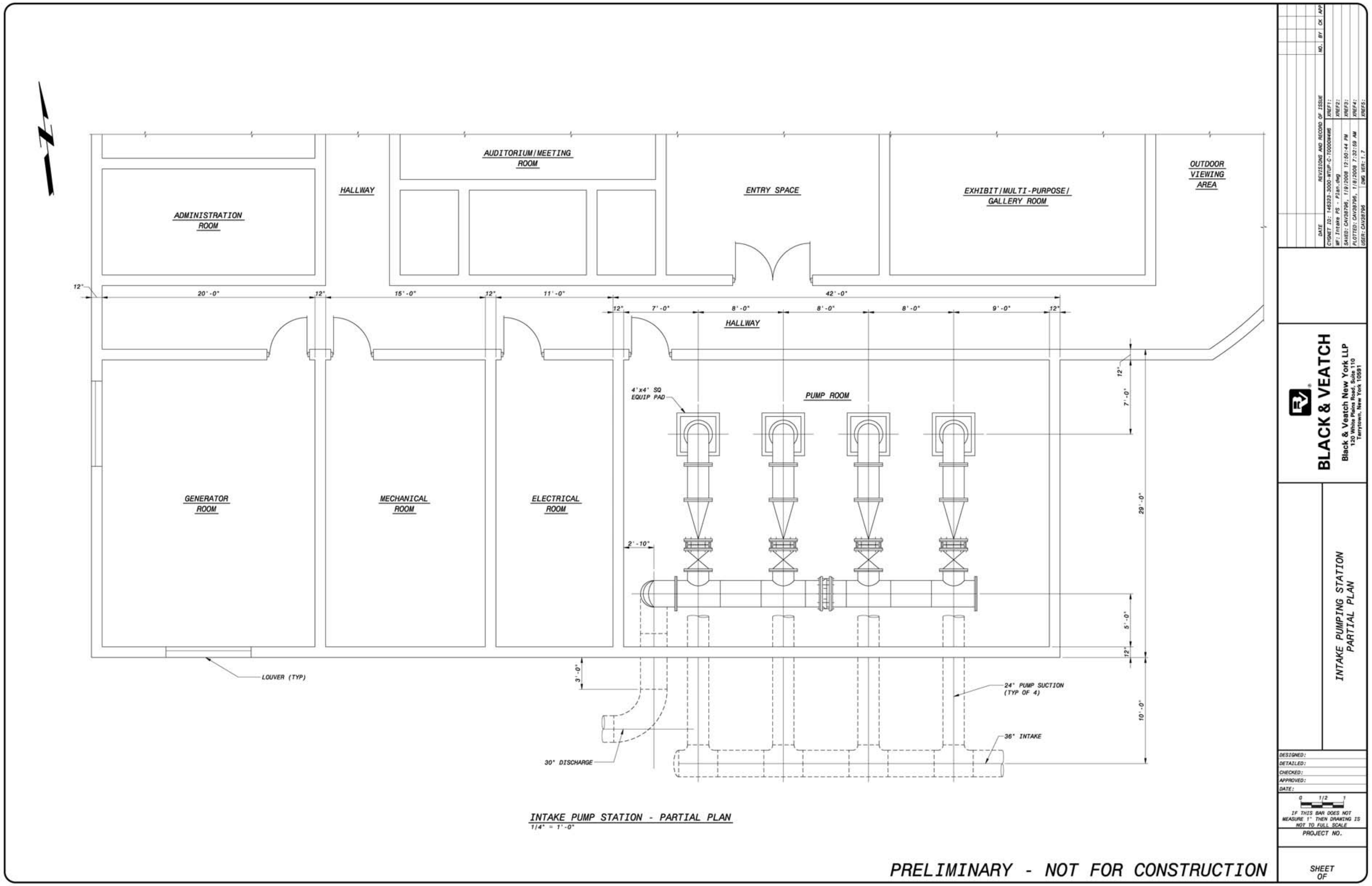

Figure 3-2 Raw Water Pumping Station Layout

3.4 Raw Water Pipelines

3.4.1 Intake Pipeline

One intake pipeline is proposed to convey water from the intake screen in the Hudson River to the pump station. The intake pipeline will be 36 inch diameter and will extend approximately 1000 to 1200 feet into the Hudson River. The pipeline will be tunneled based on further evaluation related to location and subsurface conditions. Assuming use of hard piped can type pumps, individual 24-inch pump suction lines will be connected to each pump. Table 3-6 provides additional information for the intake pipe.

Table 3-6 Additional Information on Intake Pipeline

Material	Ductile iron, cement lined
Pipe Configuration	
Number	1
Diameter, inches	36
Intake Pipe velocity, fps	
1 pump operating at 6.7 mgd	1.5
2 pumps operating at 13.4 mgd	2.9
3 pumps operating at 20 mgd	4.4

3.4.2 Raw Water Conveyance Pipe

Raw water will be conveyed to the raw water storage tanks at the water treatment plant through a single 30 inch pipeline. Routing of this main will be investigated during the preliminary design to coordinate with existing utilities and easements.

3.5 Raw Water Storage Tanks

3.5.1 Raw Water Storage Analysis

Raw water storage is primarily considered to provide buffer against any drastic changes in water quality of the river. Secondarily, raw water storage can be used to take advantage of the diurnal effect of tidal activity on the salinity in the river. Preliminary data indicates that this effect is minimal. However, during pilot study, salinity will be measured continuously, and the benefits of storage of low salinity water during low tide periods, if any will be evaluated.

For this preliminary evaluation, raw water storage of 12 hours has been assumed, to provide sufficient storage to buffer raw water needed for the facility. If storage of water during low salinity periods has substantial benefit, this volume is sufficient, as only 6 hours of storage is needed to capture the low salinity water during low tides. To prevent potential algae growth, the raw water storage tanks will be covered. In the event of a spill in the river, impacted raw water will either be returned to the river, or treated as appropriate. For the initial phase (design finished water capacity of 2.5 mgd), two raw water storage tanks, each at 1.9 million gallons (MG) are considered. For future phases, a third storage tank of the same capacity will be added.

3.5.2 Raw Water Storage Tank Design

Two water storage tanks will be constructed during the initial phase and an additional tank will be constructed in Phase 2. The three water tanks will be identical. Table 3-7 summarizes the tanks' parameters.

Table 3-7 Storage Tank Parameters

Parameter	Value
Number of Tanks	
Phase 1	2
Phase 2	1
Total	3
Diameter, ft	100
Side Water Depth, ft	32
Storage Time, hours	12
Storage Capacity Per Tank, MG	1.9
Total Storage Capacity, MG	5.7
Effective Total Storage Capacity, MG (assuming 3 feet minimum depth)	5.1