CITY OF HOPEWELL

Hopewell Regional Wastewater Treatment Facility
Alternative 4A-1 Light Phase 2 Improvements

Technical Memorandum
PPEA Design Basis

Hopewell Nutrient Partners

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MAY 2, 2014

To:	City of Hopewell		
From:	HDR Engineering, Inc. Bill M'Coy, P.E. Drew Zirkle, P.E.	Project:	HRWTF Alternative 4A-1 Light Phase 2 Improvements
CC:	Design File QA/QC Review		
Date:	May 2, 2014	Job No:	216773

1.0 Background & Purpose

HDR Engineering completed a conceptual design based on the Hopewell Regional Wastewater Treatment Facility (HRWTF) Alternative 4A-1, Phase 2 Preliminary Engineering Report (PER). During the design and estimating process, there were changes to the design basis outlined in the PER. For the purposes of this TM, the term "PER" refers to the PER dated September 2012 and the PER Addendum dated September 2013. The purpose of this Technical Memorandum is to define and compare the basis of design outlined in the PER to the HRWTF Alternative 4A-1 Light Phase 2 PPEA design.

2.0 Design Flows & Loadings

The design Honeywell flows and loads have not changed from what was presented in the PER, but additional loads were added in the PER Addendum to reflect wastewater characterization data collected during the pilot study. Table 2.1 depicts the Honeywell design average and peak day flows with respective loads.

Table 2.1: Updated Total Honeywell Flows and Loads to HRWTF

	PER Design Basis		PPEA Design Basis	
Parameter	**Design Average**	**Peak Day**	**Design Average**	**Peak Day**
Flow, mgd	9.3	11.2	9.3	11.2
BOD, lbs/d	35,545	109,137	35,545	109,137
COD, lbs/d	74,645	232,461	74,645	232,461
TSS, lbs/d	2,751	11,021	2,751	11,021
TKN, lbs/d	8,064	11,629	8,064	11,629
NO_x-N, lbs/d	512	825	512	825
Alkalinity, lbs/d	12,371		12,371	

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	PER Design Basis		PPEA Design Basis	
Parameter	**Design Average**	**Peak Day**	**Parameter**	**Design Average**
Estimated Additional Wastewater Characteristics[1]				
TVSS, lbs/d	*1,939*	*7,769*	*1,939*	*7,769*
sBOD, lbs/d	*31,716*	*97,381*	*31,716*	*97,381*
gfCOD, lbs/d	*65,397*	*203,660*	*65,397*	*203,660*
ffCOD, lbs/d	*42,055*	*130,967*	*42,055*	*130,967*
TP, lbs/d	*40*	*48*	*40*	*48*
Ortho-P, lbs/d	*6*	*7*	*6*	*7*
STKN, lbs/d	*7,452*	*10,746*	*7,452*	*10,746*
NH_3-N, lbs/d	*5,308*	*7,654*	*5,308*	*7,654*

[1] Additional wastewater characteristics are estimated by assuming pilot Honeywell ratios are constant. Ratios are multiplied by design loads to estimate corresponding loads at each condition.

The design flow and loads for the segregated treatment system influent based on the 40% Honeywell condition have not changed from what was presented in the PER. Table 2.2 summarizes the influent flows and loads for the segregated treatment system at the 40% Honeywell condition.

Table 2.2: Combined Influent Flows and Load to Segregated Treatment System at 40% Honeywell Condition

	PER Design Basis		PPEA Design Basis	
Parameter	**Design Average**	**Peak Day**	**Design Average**	**Peak Day**
Total Flow, mgd	19.7	33.6	19.7	33.6
Domestic Primary Effluent Flow, mgd	16.0	29.7	16.0	29.7
Honeywell Flow, mgd	3.7	3.9[2]	3.7	3.9[2]
BOD, lbs/d	38,757	79,722	38,757	79,722
CBOD, lbs/d	34,881	71,750	34,881	71,750
TSS, lbs/d	20,631	38,548	20,631	38,548
COD, lbs/d	92,859	185,584	92,859	185,584
TKN, lbs/d	9,516	11,515	9,516	11,515
NO_x-N, lbs/d	285	474	285	474
Alkalinity, lbs/d	28,855		28,855	
Estimated Additional Wastewater Characteristics[1]				
TVSS, lbs/d	*17,856*	*32,971*	*17,856*	*32,971*
sCBOD, lbs/d	*30,611*	*65,398*	*30,611*	*65,398*
gfCOD, lbs/d	*67,221*	*142,024*	*67,221*	*142,024*
ffCOD, lbs/d	*52,226*	*104,557*	*52,226*	*104,557*
TP, lbs/d	*588*	*1,080*	*588*	*1,080*
Ortho-P, lbs/d	*361*	*668*	*361*	*668*
STKN, lbs/d	*8,252*	*10,068*	*8,252*	*10,068*
NH_3-N, lbs/d	*6,913*	*8,301*	*6,913*	*8,301*

[1] Additional wastewater characteristics are estimated by assuming pilot domestic primary effluent and Honeywell ratios are constant.

[2] Maximum Honeywell flow at peak day is capped to keep maximum Combined Influent flow at 33.6 mgd.

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World Water Work's pilot testing results indicate that 100% Honeywell flow can be treated. However, as noted in Section 3.1 of the PER Addendum, treating Honeywell flows above 40% could introduce nitrification inhibition in the MBBR treatment system and nutrient deficiencies in the UNOX system. It is proposed that the Phase 2 improvements be designed to convey up to 100% of the Honeywell design flow to the segregated treatment system so that the capabilities of the system can be tested full-scale after system startup. The design flow and loads for the segregated treatment system influent based on the 100% Honeywell condition are shown in Table 2.3.

Table 2.3: Combined Influent Flows and Load to Segregated Treatment System at 100% Honeywell Condition

	PER Design Basis		PPEA Design Basis	
Parameter	**Design Average**	**Peak Day**	**Design Average**	**Peak Day**
Total Flow, mgd	19.7	33.6	19.7	33.6
Domestic Primary Effluent Flow, mgd	16.0	29.7	16.0	29.7
Honeywell Flow, mgd	See Footnote 2	See Footnote 2	See Footnote 2	See Footnote 2
BOD, lbs/d	60,084	145,204	60,084	145,204
CBOD, lbs/d	54,076	130,684	54,076	130,684
TSS, lbs/d	22,282	45,160	22,282	45,160
COD, lbs/d	137,647	325,061	137,647	325,061
TKN, lbs/d	14,354	18,492	14,354	18,492
NO_x-N, lbs/d	593	969	593	969
Alkalinity, lbs/d	36,278		36,278	
Estimated Additional Wastewater Characteristics[1]				
TVSS, lbs/d	*19,024*	*37,632*	*19,024*	*37,632*
sCBOD, lbs/d	*49,709*	*123,826*	*49,709*	*123,826*
gfCOD, lbs/d	*106,600*	*264,220*	*106,600*	*264,220*
ffCOD, lbs/d	*77,549*	*183,137*	*77,549*	*183,137*
TP, lbs/d	*612*	*1,109*	*612*	*1,109*
Ortho-P, lbs/d	*364*	*672*	*364*	*672*
STKN, lbs/d	*12,740*	*16,516*	*12,740*	*16,516*
NH_3-N, lbs/d	*10,109*	*12,893*	*19,024*	*37,632*

[1]Additional wastewater characteristics are estimated by assuming pilot domestic primary effluent and Honeywell ratios are constant.

[2]Maximum Honeywell flow at peak day is capped to keep design average Combined Influent at 19.7 mgd and maximum Combined Influent at 33.6 mgd.

3.0 Gravelly Run Pump Station & Force Main

A new submersible pump station is proposed to convey up to 100% Honeywell flow to the segregated treatment system. Table 3.1 details the Gravelly Run Pump Station (GRPS) design criteria.

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Table 3.1: Gravelly Run Pump Station

	PER Design Basis	PPEA Design Basis
Item	**Description**	**Description**
No. of Pumps	3(2 Operating/1Standby)	3(2 Operating/1Standby)
Type	Submersible Non-Clog Centrifugal	Submersible Non-Clog Centrifugal
Manufacturer	-	Flowserve
Model	-	12MSX21A
Capacity	3,750 gpm / 72-ft TDH	3,750 gpm / 72-ft TDH
Firm Capacity	10.8 mgd	10.8 mgd
Motor	150 hp	125 hp
Drive Type	VFD	VFD
Discharge Diameter	10-inches	12-inches
No. of Channel Grinders	1	1
Channel Grinder Capacity, Each	-	13.9 mgd
Manufacturer	-	JWC Environmental

The proposed submersible pump station will be similar to the Alternative 4A-1 Light, Phase 1, Contract 2, First Street Pump Station (FSPS) design. The FSPS has a capacity of 14.7 mgd with four submersible non-clog centrifugal pumps rated at 3,400 gpm (3 duty / 1 standby) and two emergency bypass connections. The FSPS was constructed with a new electrical building, mechanical building and standby generator. The pump station's influent channel houses two 7.3 mgd channel grinders, with stop plates for isolating each grinder. Two 50% capacity grinders were used to accommodate servicing one grinder while maintaining one in operation. A trench-type wet well with a self-cleaning ogee ramp and slide gate was installed to facilitate cleaning due to the large amounts of fats, oil and grease in the collection system.

The proposed GRPS will deviate from the FSPS design as follows:

1. Firm capacity of the GRPS will be 10.8 mgd with three submersible non-clog centrifugal pumps rated at 3,750 gpm (2 duty / 1 standby). Two emergency bypass connections will be constructed.

2. A saddle type manhole will be constructed on the existing 16-inch sanitary sewer. In addition, a new 16-inch sanitary sewer and manhole will be constructed.

3. One channel grinder with a design capacity of 13.9 mgd will be provided.

4. A trench-type wet well will be constructed without a self-cleaning ogee ramp and slide gate. Large amounts of fats, oil and grease are not expected since the influent wastewater is from the Honeywell industry. The wet well will have an epoxy coating system, but not a PVC liner.

5. The new pump station will utilize the existing 300 kW stand-by diesel generator and fuel tank.

6. The overall footprint of the GRPS will be approximately 20-ft wide x 35-ft long. The bottom of the the pump station base slab will be approximately 27-ft below grade.

7. It is expected that new permanent and temporary easement will be required to construct the pump station and electrical and mechanical buildings.

The pump station will have a new 24-inch ductile iron (DI) force main that ties into the existing 24-inch North Interceptor Force Main at the Gravelly Run Pump Station. The new pump station will convey Honeywell flow through the existing 24-inch DI force main to a new flow control structure located in the vicinity of the 36-inch Rock Tenn connection. Honeywell flow will be split at this flow control structure and discharged back into the North Interceptor and into a new 28-inch HDPE force main. This new 28-inch HDPE force main will discharge flow into the existing 48-inch plug valve in the 48-inch RWI line at Hummel Ross Road installed under Phase 1.. A 24-inch line stop and insertion plug is required to block flow from Rock Tenn to separate the existing 24-inch North Interceptor Force Main from the 36-inch Rock Tenn Force Main.

A new 12-inch HDPE force main is proposed from Gravelly Run Pump Station to the 36-inch Rock Tenn connection to convey flow from Virginia American Water Company (VAWCO). The 12-inch force main will tie into an existing 12-inch gate valve on the 36-inch Rock Tenn force main which was installed as part of the 42-inch North Interceptor Force Main repairs. Table 3.2 details the new 12-inch and 28-inch force mains.

Table 3.2: 12-inch & 28-inch Force Mains

	PER Design Basis	PPEA Design Basis
Item	**Description**	**Description**
Force Main Serving VAWCO		
Inside Diameter	12-inch	12-inch
Length	1,400 LF	1,420 LF
Material	DI or HDPE	HDPE DR-21
Force Main Serving Honeywell		
Inside Diameter	24-inches (Existing and New)	24-inch (Existing) 28-inch (New)
Length	1,400 LF (Existing) 3,100 LF (New)	1,400 LF (Existing) 1,250 LF (New)
Material	DI or HDPE	DI (Existing) HDPE DR-21 (New)

A flow control structure is proposed to convey Honeywell flow to either the industrial treatment side (via the North Interceptor) or the Domestic PTF and segregated treatment system (via the 48-inch RWI line). The flow control structure will consist of two flow control valves with two flow meters and will be located above ground on a concrete pad. The 24-inch force main will be ductile iron where it transitions above-grade. There will be a 24-inch bypass around each flow control valve and flow meter for means of servicing the valve and meter. Table 3.3 details the valves and flow meters proposed.

Table 3.3: Flow Control Structure

	PER Design Basis	PPEA Design Basis
Item	**Description**	**Description**
Flow Control Valves		
No. of Control Valves	-	2
Size	-	14-inch
Type	-	Plug Valve
Flow Meters		
No. of Flow Meters	-	2
Size	-	14-inch
Type	-	Magnetic Flow Meter
Electrode Material	-	316 SST
Bypass	-	Yes
Bypass Size	-	24-inch

4.0 Primary Clarifier Effluent Channel Modifications

Primary effluent flow from the domestic chlorine contact tank will exit the north end of the channel through an existing 36-inch connection, where it is conveyed through a new 42-inch line to the MBBR Influent Pump Station wet well. A A concrete wall and slide gate in the effluent channel will separate the domestic primary clarifiers from the industrial primary clarifiers. Table 4.1 details the gates and operation.

Table 4.1: Primary Clarifier Water Control Gates

	PER Design Basis	PPEA Design Basis
Item	**Description**	**Description**
Primary Clarifier Effluent Weir Box		
No. of Gates	2	1
Type	Slide Gate	Slide Gate
Operation	-	Yoke Mounted Gear Hand Crank
Opening Direction	-	Upward
Size	-	5-ft x 6-ft
Material	-	Aluminum Gate 316 SST Stem
Manufacturer	-	Golden Harvest

5.0 MBBR Influent Pump Station

The pump station conveys flow through a 36-inch DI force main to the MBBR tank influent channel. A 30-inch flow meter and isolation valve are proposed above ground outside the pump station on a concrete pad. There will be no bypass since the line can be taken out of service to maintain the flow meter. The design criteria for the MBBR Influent Pump Station and flow meter are listed in Table 5.1.

Table 5.1: MBBR Influent Pump Station & Flow Meter

	PER Design Basis	PPEA Design Basis
Item	**Description**	**Description**
No. of Pumps	4(3 Operating/1Standby)	4(3 Operating/1Standby)
Type	Vertical Turbine Solids Handling	Vertical Turbine Solids Handling
Manufacturer	-	Flowserve
Model	-	20MVX-A
Capacity	7,700 gpm / 65-ft TDH	7,700 gpm / 46-ft TDH
Firm Capacity	33.3 mgd	33.3 mgd
Motor	200 hp	150 hp
Drive Type	VFD	VFD
Discharge Diameter	18-inches	20-inches
Spare Parts	-	Impeller, Bearings, Mechanical Seals
Flow Meter		
No. of Flow Meters	-	1
Size	-	30-inch
Type	-	Magnetic Flow Meter
Electrode Material	-	316 SST
Bypass	-	No

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Table 5.2 details the code classification and building construction for the MBBR Influent Pump Station.

Table 5.2: MBBR Influent Pump Station Code Classification & Building Construction

	PER Design Basis	PPEA Design Basis
Item	**Description**	**Description**
Code Classification		
Building Gross Square Footage	EL 15.00 = 907 sf EL 32.50 = 2,232 sf	EL 15.00 = 907 sf EL 32.50 = 520 sf
No. of Stories	1	1
Height Above Grade	-	16-ft
Occupancy Classification	-	F-2
Exterior Wall Fire Rating	-	No
Type of Construction	-	II-B
Fire Sprinkled	-	No
ADA Accessible	-	No
Number of Exits	5	3
Building Construction		
Substructure	-	Concrete Footer with Slab on Grade
Superstructure	-	Precast Double Tees
Interior Wall	-	12-inch CMU
Exterior Wall	-	4-inch Split-Faced CMU Veneer
Roof	Standing Metal Seam with Skylights	Styrene Butadiene Styrene (SBS) Modified Bitumen with Skylights

6.0 MBBR Treatment System

The MBBR treatment system will be designed and supplied by World Water Works. HDR completed subsurface soil borings in the location of the MBBR tank footprint proposed in the PER. After evaluating the soil borings, HDR was concerned with the slope stability and potential wetland impacts. As a result, the tank footprint was reduced by lowering the tank foundation and increasing the side water depth by 7 feet, thus eliminating concerns with slope stability and wetland impacts. Table 6.1 details the design basis for the MBBR treatment system.

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Table 6.1: MBBR Treatment System

Item	PER Design Basis Description	PPEA Design Basis Description
MBBR Tanks		
No. of Tanks	6	5
Width Per Tank	46-ft	46-ft
Side Water Depth	18-ft	25-ft
Length	Cell 1 (Anoxic): 65-ft Cell 2 (BOD Oxidation): 39-ft Cell 3 (Nitrification): 51-ft Cell 4 (Nitrification): 51-ft	Cell 1 (Anoxic): 48.84-ft Cell 2 (BOD Oxidation): 35.17-ft Cell 3 (Nitrification): 40.34-ft Cell 4 (Nitrification): 23.98-ft
Volume Per Train / Total	1.28 Mgal / 7.66 Mgal	1.28 Mgal / 6.38 Mgal
Anoxic Volume Per Train / Total	0.40 Mgal / 2.42 Mgal	0.42 Mgal / 2.10 Mgal
BOD Volume Per Train / Total	0.24 Mgal / 1.45 Mgal	0.30 Mgal / 1.51 Mgal
Nitrification Volume Per Train / Total	0.63 Mgal / 3.79 Mgal	0.55 Mgal / 2.77 Mgal
Media		
Type	High Density Polyethylene	High Density Polyethylene
Specific Gravity	0.96 g/cm^3	0.96 g/cm^3
Length	12 mm	12 mm
Effective Surface Area	650 m^2/m^3	650 m^2/m^3
Media Volume		14,872 m^3
Media Fill by Volume	Cell 1: 50% Cells 2-4: 65%	Cell 1: 50% Cells 2-4: 67%
Liquid Volume Displacement	8 %	8%
Anoxic Cell Screens (Cell 1)		
Screen Opening Size (all screens)	5 mm	5 mm
Media Retention Screen Type	Flat Panel	Flat Panel
No. of Media Retention Screen (per tank)	3	(10) 2-ft x 4-ft 304L SST Screens (40) 4-ft x 4-ft 304L SST Screens
Maximum Screen Headloss	4-inches	4-inches
Foam Opening Screen Type	Flat Panel	Flat Panel
No. of Foam Opening Screens (per tank)	4	(3) 2-ft x 4-ft 304L SST Screens
Drain Opening Screen Type	Flat Panel	Flat Panel
No. of Drain Opening Screen (per tank)	1	(2) 2-ft x 2-ft 304L SST Screens
Aerobic Cell Screens (Cells 2-4)		
Media Retention Screen Type	Cylindrical	Cylindrical
No. of Media Retention Screens per cell/tank	12 / 72	(14 / 42) 16-inch dia x 10-ft long
Maximum Screen Headloss	4-inches	4-inches
Foam Opening Screen Type	Flat Panel	Flat Panel
No. of Foam Opening Screens Per Cell / Tank	3 / 9	3 / 9 (2-ft x 4-ft 304L SST Screens)
Drain Opening Screen Type	Flat panel	Flat panel
No. of Drain Opening Screens Per Tank	1 / 3	(10) 2-ft x 2-ft 304L SST Screens
Drain Cover Screen Type	Flat Panel	Flat Panel
No. of Drain Cover Screens Per Tank / Total	1 / 6	1 / 5
Anoxic Cell Mixing System		
Mixer Type	Submersible	Submersible
No. of Mixers Per Cell / Total	4 / 24	6 / 30
Mixer HP, Each	12 hp	9 hp
Mixing Energy Per Train	23 W/m^3	-
NPW for Foam		
No. of Spray Branches Per Train	-	3
Size and Material	-	2-inch, 304L SST
Spray Nozzle Size and Material	-	½-inch, 304L SST

Item	PER Design Basis Description	PPEA Design Basis Description
Aeration System		
Type	Coarse Bubble	Coarse Bubble
No. of Diffuser Grids per cell / total	Cell 2: 3 / 18 Cell 3: 4 / 24 Cell 4: 4 / 24	Cell 2: 3 / 15 Cell 3: 3 / 15 Cell 4: 2 / 10
Grid Pipe Diameter	1-inch	1-inch
Manifold Pipe Diameter	6-inch	Cell 2: 8-inch / 6-inch Cell 3: 6-inch / 4-inch Cell 4: 4-inch / 3-inch
Air Pipe Material	304 Stainless Steel	304 Stainless Steel
Diffuser Type	Circular Orifice in 1-inch SST Pipe	Circular orifice in 1-inch 304L SST Pipe
DO Concentration	2.0, minimum	2.0, minimum
SOTE	1.1	1.1
Alpha Factor	Cell 2: 0.9 Cells 3-4: 0.8	Cell 2: 0.9 Cells 3-4: 0.8
Air Sparge Air Flow Requirements	100 scfm	100 scfm
Air Supply Valves		
No. Motor Operated Air Flow Control Valves Per Cell / Total (Size)	Cell 2: 3 / 18 Cell 3: 4 / 24 Cell 4: 4 / 24	Cell 2: 1 / 6 (12-inch) Cell 3: 1 / 6 (10-inch) Cell 4: 1 / 6 (6-inch)
No. Isolation Valves Per Cell / Total	-	Cell 2: 3 / 18 (8-inch) Cell 3: 3 / 18 (6-inch) Cell 4: 2 / 12 (4-inch)
Type	-	Butterfly
Material	-	316 SST
Air Supply Flow Meters		
Manufacturer	-	Sierra
Type	-	Insertion - Thermal Mass
No. Per MBBR Train	-	3
Total	-	15
Process Air Flow Requirements		
Minimum	20,200 scfm	8,400 scfm (Assumes 1 Train Out of Service, 2,100 scfm per Train is Minimum Mixing Requirement
Design Average	29,300 scfm	22,350 scfm
Peak Day	40,400 scfm	28,100 scfm
Minimum Pressure at Top of Drop Leg	-	11.25 psig
Dissolved Oxygen Monitoring		
No. of DO Probes	1	6
Location of Probes	Tank No. 1 – Cell 2	Train's 2 & 4 – Cells 2,3,4
pH Monitoring		
No. of pH Probes	2	2
Location	Influent and Effluent Channels	Influent and Effluent Channels
Chemical Analyzers		
No. of Analyzers	-	2
Location	-	Influent and Effluent Channels
Type	-	ChemScan
Model	-	UV-6101

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Item	PER Design Basis Description	PPEA Design Basis Description
Parameters Analyzed	-	Nitrate (0.1 – 20 mg/L as N Nitrite (0.1 – 10 mg/L as N Ammonia (0.1 – 20 mg/L as N Phosphorus (0.1 – 5 mg/L as P
Enclosure Type / Size	-	FRP (6-ft x 6-ft x 7.5-ft Tall)
Spare Parts	-	(4) Sets of Filters, 3 Months of Reagent, (6) Filter Elements
MBBR Recycle Pumps		
Number (100% Recycle)	(2 Operating, 1 Standby)	(2 Operating, 1 Standby)
Number (200% Recycle)	(3 Operating, 0 Standby)	(3 Operating, 0 Standby)
Type	Axial Flow, End Suction	Axial Flow, End Suction
Capacity	9,120 gpm at 20-ft TDH	9,120 gpm at 20-ft TDH
Minimum Flow	3,333 gpm	5,762 gpm
Total Capacity	39.4 mgd	39.4 mgd
Motor size	75	50
Drive Type	VFD	VFD
Suction size	16-inches	18-inches
Discharge size	16-inches	18-inches
MBBR Recycle Force Main	36-inches	36-inches
Manufacturer	-	ITT Goulds
Model	-	AF-18x18-18
MBBR Recycle Flow Meter		
No. of Flow Meters	1	1
Size	36-inch	30-inch
Type	Magnetic Flow Meter	Magnetic Flow Meter
Electrode Material	-	316 SST
Bypass	No	No
Influent Channel Water Control Gates		
No. of Gates	6	10
Type	Weir Gates	Weir Gates
Purpose	Media Retention	Media Retention
Operation	-	Yoke Mounted Dual Operator with Interconnecting Shaft
Size	20-ft	2-ft x 5-ft (Wide)
Opening Direction	Downward	Downward
Material	-	Aluminum Gate 316 SST Stem
Manufacturer	-	Golden Harvest
Effluent Channel Water Control Gates		
No. of Gates	6	10
Type	Slide Gate	Slide Gate
Purpose	Process Train Isolation	Process Train Isolation
Operation	-	Yoke Mounted Hand Wheel Operated
Size	20-ft (Width)	6-ft x 5-ft (Width)
Opening Direction	Upward	Upward
Material	-	Aluminum Gate / 316 SST Stem
Manufacturer	-	Golden Harvest
Effluent Channel DAF Splitter Box		
No. of Gates	4	4
Type	Slide Gate	Weir Gate
Purpose	Flow Split for DAF Units	Flow Split for DAF Units

Item	PER Design Basis Description	PPEA Design Basis Description
Operation	-	Yoke Mounted Dual Operator with Interconnecting Shaft
Size	10-ft (Width)	4-ft x 10-ft (Width)
Opening Direction	Downward	Downward
Material	-	Aluminum Gate / 316 SST Stem
Manufacturer	-	Golden Harvest

In addition, there will be non-potable water hose bibs and reels located on top of the MBBR tank walkways for washing down equipment.

The hydraulic profile is based on an MBBR recyle rate of 100%. It may be necessary to lower the recycle rate below 200% during periods of peak influent flow. This will be evaluated during final design.

7.0 Blower Building

The blower building will be located north of the MBBR treatment system. There will be three blowers, one single-stage and two multi-stage blowers. Table 7.1 details the design criteria for the blowers.

Table 7.1: Blower Building

Item	PER Design Basis Description	PPEA Design Basis Description
Process Air Flow Requirements		
Minimum	20,200 scfm	8,400 scfm
Design Average	29,300 scfm	22,350 scfm
Peak Day	40,400 scfm	28,100 scfm
Blowers		
Type	(2) Single-Stage (2) Multi-Stage	(1) Single-Stage (2) Multi-Stage
Manufacturer	-	Single-Stage – Siemens Turblex Multi-Stage - Hoffman
Model	-	Single-Stage – STC-GO (44-SV-GL225) Multi-Stage - 671
Capacity	13,100 scfm (each)	Single-Stage – 16,800 scfm Multi-Stage – 15,000 scfm
Discharge Pressure	-	13.5 psi
Motor	Single-Stage – 800 hp Multi-Stage – 900 hp	Single-Stage – 1,250 hp Multi-Stage – 1,250 hp
Drive Type	-	Constant Speed (Soft Start)
Enclosures	-	No
Common Discharge Diameter	42-inches	36-inches
Spare Parts	-	Bearings, O-rings, Gaskets and Seals, Oil Filter Cartridges, Inlet Air Filters
Flow Meter on 36-inch Discharge Header		
No. of Flow Meters	-	1
Manufacturer	-	Sierra
Type	-	Insertion - Thermal Mass

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Table 7.2 details the code classification and building construction for the Blower Building. In addition, there will be a 10-ft wide overhead rollup door for equipment access with a 10-ton bridge crane to service the blowers.

Table 7.2: Blower Building Code Classification & Building Construction

	PER Design Basis	PPEA Design Basis
Item	**Description**	**Description**
Code Classification		
Building Gross Square Footage	3,397 sf	2,940 sf
No. of Stories	1	1
Height Above Grade	-	23 ft
Occupancy Classification	-	F-2
Exterior Wall Fire Rating	-	No
Type of Construction	-	II-B
Fire Sprinkled	-	No
ADA Accessible	-	No
Number of Exits	3	4
Building Construction		
Substructure	-	Concrete Footer with Slab on Grade
Superstructure	-	Metal Frame
Interior Wall	-	Metal Panel with Insulation
Exterior Wall	-	Metal Panel
Roof	Metal Standing Seam	Metal Standing Seam

8.0 Dissolved Air Flotation Building

The Dissolved Air Flotation (DAF) building is located north of the Blower Building. There will be three DAF units supplied by World Water Works. Each DAF unit will have a 30-inch plug valve on the influent connection and a 36-inch plug valve on the effluent connection for isolation. Table 8.1 details the design criteria for the DAF Building.

Table 8.1: DAF Building Design Criteria

	PER Design Basis	PPEA Design Basis
Item	**Description**	**Description**
DAF units		
No. Units	4	3
Manufacturer	-	World Water Works
Model	-	RSP-20L
Frame Material	Polypropylene	Polypropylene
Capacity per unit / total	6,500 / 26,000	8,652 / 26,000
Total Firm Capacity	37.4	37.4
Inlet Connection Size	36	36
Outlet Connection Size	48	36
Solids Connection Size	6	6
No. of Air Pumps	3 per DAF, 12 Total	3 per DAF, 9 Total
Manufacturer	-	Nikuni
Model	-	M80SP
Air Pump and Air Supply Material	-	304 SST
Air Pump HP	40 each, 480 total	40 hp
No. of Rake Drive Motors	1 per DAF, 4 total	1 per DAF, 3 total
Rake Drive Motor	5 hp each, 20 total	5 hp each
Vent Hood	-	No
DAF Solids Pumps		
Number	2 (1 operating, 1	5 (1 operating per DAF Unit, 1

	standby)	standby per DAF Pair)
Type	Progressing Cavity	Progressing Cavity
Design Solids Concentration	2%	2-4%
	PER Design Basis	**PPEA Design Basis**
Item	**Description**	**Description**
Design Capacity	250 gpm	335 gpm
Discharge Pressure	20 psi	34 psi
Motor Horsepower	15 hp	20 hp
Compressor for DAF Sludge Valves		
Number	2 (1 operating, 1 standby)	2 (1 operating, 1 standby)
Horsepower, Each	3 hp	5 hp
Design Flowrate	10 scfm	38.2 scfm
Design Pressure	80 psi	175 psi
Manufacturer	-	Curtis
Model	-	CVD969B 2-Stage Duplex with Curtis RNP-50 Refrigerated Dryer
Polymer Feed System		
Polymer Type	Dry	Dry
Manufacturer	-	ProMinent Fluid Controls
Model	-	Polyrex 870
Polymer Storage	Super Sack	Super Sack
Bulk Bag Frame & Hoist	Yes	Yes
Polymer Feed Capacity	130 lb/hr	48 lb/hr
Percent Solution	-	0.5%
Mix/Age Tanks Volume	4,000 gal each	870 gal each
Mix/Age Tank Material	-	304 SST
Mix/Age Tanks Diameter	8.5-ft	6-ft
Post Water Dilution Skid	_	Yes
Polymer Metering Pumps		
Pumps	5 (4 operating, 1 standby)	4 (3 operating, 1 standby)
Type	-	Progressing Cavity
Manufacturer	-	Netzsch
Model	-	NM031BY01L06B
Capacity	-	13 gpm at 38 ft TDH
Firm Capacity	-	13 gpm (One Pump Per DAF Unit)
Motor	-	1.5 hp
Drive Type	-	VFD
Discharge Diameter	-	1.5-inch

The polymer feed system capacity is based on a 7.0 mg/L dose at the design average flow of 19.7 mgd.

Proposed are two 10-ft wide overhead doors for the polymer feed system and a 10-ft wide overhead door to the DAF room. Four removable, insulated wall panels are proposed in front of each DAF unit. The removable wall panel dimensions are approximately 14-ft x 24-ft. Table 8.2 details the code classification and building construction for the DAF building.

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Table 8.2: DAF Building Code Classification & Building Construction

Item	PER Design Basis Description	PPEA Design Basis Description
Code Classification		
Building Gross Square Footage	8,860 sf	9,110 sf
No. of Stories	1	1
Height Above Grade	-	29-ft
Occupancy Classification	-	F-2
Exterior Wall Fire Rating	-	No
Type of Construction	-	II-B
Fire Sprinkled	-	No
ADA Accessible	-	No
Number of Exits	3	4
Building Construction		
Substructure	-	Concrete Footer with Slab on Grade
Superstructure	-	Metal Frame
Interior Wall	-	Metal Panel with Insulation
Exterior Wall	-	Metal Panel
Roof	Metal Standing Seam	Metal Standing Seam

9.0 Sodium Hydroxide Facility

A sodium hydroxide facility consisting of three sodium hydroxide storage tanks and pump feed room is proposed north of the MBBR tanks. Sodium hydroxide will be fed into the MBBR influent mixing chamber to control pH. Table 9.1 identifies the design criteria for the facility.

Table 9.1: Sodium Hydroxide Facility

Item	PER Design Basis Description	PPEA Design Basis Description
Design Criteria		
Type	Sodium Hydroxide, 50% Solution	Sodium Hydroxide, 50% Solution
Maximum Feed Rate	8,700 gpd	8,700 gpd
Design Average	3,040 gpd	3,040 gpd
Minimum Feed Rate	625 gpd	625 gpd
Sodium Hydroxide Tanks		
No. of Storage Tanks	3	3
Indoor / Outdoor	Indoor	Outdoor
Storage Tank Material	FRP	Carbon Steel
Storage Tank Volume Each / Total	13,650 / 40,950 gal	13,350 / 40,050 gal
Heat Trace & Insulated	-	Yes (2" insulation)
Single Wall or Double Wall	-	Single Wall with Concrete Containment Area
Size	-	12-ft Diameter x 17-ft Height
Days of Storage at Average flow / Max Flow	13 / 5	13 / 5
Chemical Metering Pumps		
No. Metering Pumps	4 (3 Operating, 1 Standby)	4 (3 Operating, 1 Standby)
Capacity	130 gph	132.1 gph
Manufacturer	-	ProMinent Fluid Controls (Skid Mounted)

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Item	PER Design Basis Description	PPEA Design Basis Description
Type	-	Diaphragm
Model	-	Sigma 3 Control
Rated Backpressure	-	100 psi
Controls	-	Standard ProMinent Control Panel with PLC

Table 9.2 details the code classification and building construction for the Sodium Hydroxide Facility.

Table 9.2: Sodium Hydroxide Facility Code Classification & Building Construction

Item	PER Design Basis Description	PPEA Design Basis Description
Code Classification		
Building Gross Square Footage	N/A	N/A
No. of Stories	1	1
Height Above Grade	-	25-ft
Occupancy Classification	-	F-2
Exterior Wall Fire Rating	-	Yes (Between Building and Storage Area)
Type of Construction	-	II-B
Fire Sprinkled	-	No
ADA Accessible	-	No
Number of Exits	5	3
Building Construction		
Substructure	-	Concrete Footer with Slab on Grade
Superstructure	-	Canopy with Galvanized Steel Supports
Interior Wall	-	8-inch CMU (Pump Building)
Exterior Wall	-	4-inch Split-Faced CMU Veneer
Roof	Metal Standing Seam	Metal Standing Seam – Canopy SBS Modified Bitumen – Pump Building

10.0 Supplemental Phosphorus

HRWTF has facilities in the existing Chemical Building to store and feed supplemental phosphorus to the UNOX system. Two types of supplemental phosphorus are used: a 35% phosphoric acid solution and a 15% sodium dihydrogen phosphate solution. The Phase 2 PPEA project includes installation of new metering pumps and chemical feed piping to deliver these supplemental phosphorus solutions to the MBBR treatment system. The number and size of pumps to be installed have not been determined.

Table 10.1: Supplemental Phosphorus Feed to MBBR Influent

Item	PER Design Basis Description	PPEA Design Basis Description
Design Criteria		
35% Phosphoric Acid Solution		
Average Feed Rate (40% Honeywell at Current Conditions)	-	2.2 gph
Maximum Feed Rate (100% Honeywell at 2040 Conditions)	-	35 gph
15% Sodium Dihydrogen Phosphate Solution		

Item	PER Design Basis Description	PPEA Design Basis Description
Average Feed Rate (40% Honeywell at Current Conditions)	-	5.4 gph
Maximum Feed Rate (100% Honeywell at 2040 Conditions)	-	87 gph

11.0 Chlorine Contact Tank

A new chlorine contact tank is proposed north of the new MBBR Influent Pump Station. The tank is designed to meet SCAT criteria for 20 minute detention time a peak day flow and 30 minutes at design average flow. Table 11.1 details the design criteria for the new tank.

Table 11.1: Chlorine Contact Tank

Item	PER Design Basis Description	PPEA Design Basis Description
Design Criteria		
Number of Tanks	-	2
Dimensions, each	-	260-ft x 10-ft
Side Water Depth	-	12-ft
Chemical Induction Mixers		
No. of Mixers	-	2
Manufacturer	-	Siemens
Model	-	WT WaterChamp Model SWC20F
Motor	-	20 hp
Chemical Metering Pumps		
No. Metering Pumps	-	2 (Installed in parallel with existing pumps)
Capacity (each)	-	1.0 – 17.2 gph
Manufacturer	-	Prominent Fluid Controls (Skid Mounted)
Type	-	Diaghragm
Controls	-	(2) Prominent Dulcometer DACa Controllers and ORP sensors

12.0 UNOX Modifications

The proposed UNOX modifications consist of installing four new vertical turbine mixers in the first stage of the UNOX tanks. It has been assumed that the existing tank top slab is in good condition and does not require rehabilitation to support the new mixers and aerators. The proposed improvements are detailed in Table 12.1.

Table 12.1: UNOX Modifications

Item	PER Design Basis Description	PPEA Design Basis Description
Stage 1 Vertical Mixers		
Stage 1 Volume, total	1.45 Mgal	1.45 Mgal
No. of Trains	4	4
Stage 1 Volume, per train	0.36 Mgal	0.36 Mgal
Minimum Mixing Requirements	30 hp/Mgal	15 hp/Mgal
No. Mixers per stage	4	1
hp per Mixer / Total hp per stage	2.5 / 10	15 / 15
Total Mixer HP	40	60
Manufacturer	-	Invent
Type	-	Hyperbolic
Model	-	HCM/2500
Material	-	FRP

13.0 Oxycharger

A new Oxycharger is proposed for additional reaeration. The proposed oxycharger is detailed below in Table 13.1.

Table 13.1: Oxycharger

Item	PER Design Basis Description	PPEA Design Basis Description
Oxycharger Static Aerator		
No. of Aerators	1	1
Manufacturer	-	Parkson
Model	-	3-Stage Mark II
Material	-	304 SST

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