Tetrapak

Final Beverage Plant

Process Description

PROCESS OVERVIEW

P9408-EA05-01 Section 1

1 PROCESS OVERVIEW

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1.1 PROCESS OVERVIEW

EWT to provide a water treatment solution for PGF III Limited's new water bottling plant. On site consists of 4 boreholes with a total raw water output of 3600 m^3/day. Boreholes 1 and 2 authorised for natural mineral water, boreholes 3 and 4 authorised for spring water. Client requirements are to produce mineral water from boreholes 1 and 2, spring water from boreholes 3 and 4, and an additional 1440 m^3/day for soft drink production from Reverse Osmosis production.

EWS water treatment plant will consist of three process streams/columns and a chemical plant-:

The three process streams are-:

A.) Stream 1 – Spring Water and Natural Water Filtration
B.) Stream 2 – Spring Water and Natural Water Filtration
C.) Reverse Osmosis System

The chemical plant will consist of-:

D.) Bulk chemical storage
E.) Chemical distribution

A.) The Spring Water and Natural Mineral Water filtration system will primarily consist of-:
1. Raw Water Feed Pumps
2. Aeration Contact Vessel
3. Multimedia Filter
4. Filox Filter
5. Fluoride Filter
6. Backwash/Thermal Sanitisation Pumps

B.) The Bulk Chemical Storage will primarily consist of-:
1. Acid Mother-Daughter configuration storage
2. Caustic storage tank

C.) Chemical Distribution
1. Acid Regen Station
2. Caustic Regen Station
3. Acid Addition/Rinse Pump
4. Caustic Addition/Rinse Pump

D.) The Reverse Osmosis Column primarily consists of-:
1. Raw Water Feed Pumps
2. Pre-Filtration Filter Housings
3. Feed Water Storage Tank
4. Reverse Osmosis Feed Pumps
5. Antiscalent Dosing
6. Sodium Metabisulfite (SBS) Dosing

7. Reverse Osmosis
8. CIP (clean in place) consisting of CIP tank and Pump
9. Ultra Violet (UV) Unit
10. Treated Water Final Filter

Spring Water & Natural Mineral Filtration Streams

The borehole feedwater pumps will supply water to a Tetrapak valve matrix which will be repumped through duty/assist feed pumps, through a Mazzei / venturi sterile air filtered air injection point, to aerate the water and into the aeration vessel where contact time will be increased, to naturally oxidise Iron and Manganese into an insoluble form . Any remaining air will be vented at the top of the vessel.

The aerated water will then be filtered by the Multi-Media filter that includes a manganese dioxide sand, various grades of filter sand and anthracite. The vessel has been designed to filter the insoluble iron from the aeration stage and further oxidise any soluble iron or manganese. To address concerns raised by MEG regarding ammonium levels, the filter is designed to establish Nitrosomonas & Nitrobacter bacteria to remove the ammonium. This vessel is designed to backwashed periodically as required to remove particulate loading and recondition the beds. The inlet and outlet pressure will be continually monitored.

Once the water has passed through the Multi-Media filter it will then pass through a Filox Filter, containing a catalytic media, to produce <10ppb Iron and Manganese treated water. This vessel, as with the multimedia filter will be backwashed periodically as required to remove particulate loading and recondition the beds. The inlet and outlet pressure will be continually monitored.

Once the water has passed through the Filox filter, it will pass through the Fluoride Filter, which contains an activated alumina oxide media. A proportion of the inlet feed, will bypass the vessel in order to generate a treated water blend which meets target fluoride levels. This processed water is then stored in the treated water tanks.

Caustic Soda and Sulphuric acid are used for fluoride filter media regeneration. Caustic chemical will be stored in a 15000 litre chemical storage tank. Acid will be stored in a mother-daughter storage configuration.
Each chemical supply line is fed with RO permeate water and has a dedicated regen station and chemical feed pump.

Each vessel in each stream has the capability to be thermally sanitised using the dedicated backwash/thermal sanitisation feed pumps.

The RO system is designed to further condition the treated borehole water from the spring and mineral water filtration streams. There is an additional towns water back up supply to the RO system.
During normal operation, treated Water from the Spring and Mineral Water filtration streams will supply the RO Feed Tank. From the RO Feed Tank, the duty/standby RO feed pumps will supply the Reverse Osmosis unit.
Should the town supply back up be required, town water will be supplied to the Pre-Filter duty/stand by pumps. These pumps will operate on an alternative basis and pump town water through the pre-filters and into the RO Feed Tank. Upstream, at the inlet/feed of the RO, there is SBS and Antiscalent dosing. The SBS dosing system has a dedicated chemical storage tank and dosing pump. The SBS serves as a free chlorine inhibitor to the RO.
The Antiscalent dosing system also has a dedicated chemical storage tank and dosing pump. The antiscalent serves as a preventive maintenance chemical to reduce scaling on the membrane. In addition, there is raw water quality measurement and feedback in the feed line to the RO, to regulate the chemical conditioning, to overcome raw water quality fluctuations.

RO permeate will pass through a UV system and final filter before being sent to treated water storage.
The RO unit has been designed to integrate nanofiltration to increase standard recovery from 75% to 85 %, by recycling part of the concentrate flow.
Reverse osmosis CIP (clean in place) will be done using bespoke RO cleaning chemicals as and when required.

1.2 DESIGN CRITERIA

The design of the treatment plant detailed in this scope is based on receiving water from the borehole water supply per the analysis contained in our site survey report. Further analysis ofall 4 boreholes over an extended time period will be required to validate our design assumptions.

INFLUENT WATER DETAILS

The design of the plant is based on receiving feed water with the characteristics summarisedin the table below.

Table 1: Feed water

Parameter	**Units**	**Minimum**	**Average**	**Maximum***	**Design Value****
Iron	µg/l	870	1150	1280	1536
Manganese	µg/l		19	26	31.2
Fluoride	µg/l	1700	1780	1900	2280
Ammonium	µg/l	130	162	210	252
Nitrite	µg/l	7	23.7	32	38.4
Silt Density Index	-		3.2		3.84
Turbidity	NTU		18.5		22.2
pH	-	7.0	7.2	7.4	7.2***
Raw Water Feed Flowrate @4 bar dynamic pressure	m^3/hr	$60m^3$/hper stream		$80m^3$/h per stream	

* Maximum value from sample analyses

** Maximum value plus 20%

*** Average value used for Fluoride filter design

PLANT PERFORMANCE

The following section describes the projected plant performance which is subject to correct plant operation in accordance with the O&M Manual and the operator guidelines provided and receiving influent within the agreed parameters.

POST TREATMENT

Table 2: Design Product Water Quality – Filtered water

Parameter	**Units**	**Value**
Iron	µg/l	<10
Manganese	µg/l	<20
Fluoride	µg/l	<1200
Nitrite*	µg/l	<10
Silt Density Index	-	<0.8
Turbidity	NTU	<1.0

* The performance of this stage is highly dependent on the levels of ammonia, oxygen andorganic content in the feed water.

Table 3: Design Product Water Quality – Reverse Osmosis water

Parameter	**Units**	**Value**
Additional to table 2 above:		
Conductivity	µS	10-40

WATER EFFICIENCY / WASTE FLOWS

Scheme: 2 Streams x 60-85m^3/hr

Scheme	Feed water m^3	Treated water m^3	Wastewater	Efficiency %
2 Streams MaximumBorehole capacity 150m^3/hr	959,016 m^3/yr	936,000 m^3/yr	23,016 m^3/yr	97.6
RO + NF recovery1 skid Per hour of operation	69.7 m^3/hr	60 m^3/hr	9.7 m^3/hr	86.1

Above figures calculated on 24/5 weekly working, 52 weeks per year, with one backwash orregen of each filter per week.

RO figures calculated per hour of operation.