

Tertiary Filtration

Key Considerations for Operational Efficiency

May 25, 2018

Tina Hanson, PE

GARVER

TACWA

Agenda

- Tertiary Filtration Technologies - Overview
- Key Consideration - Hydraulics
- Key Consideration – Algae Control
- Key Consideration – Backwash Volume & Pressure
- SAWS Leon Creek WRC Filter Design

Tertiary Filtration Technologies

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There are multiple options to choose from for tertiary or advanced filtration

Gravity/Barrier Filtration

- Bridge filters
- Sand filtration
- Membranes
- Cloth Filters

Media Filtration / Nutrient Removal

- Denitrification Filter

Cloth media filtration provides solids or precipitant removal

Effluent TSS polishing: < 5 mg/L

Reuse or membrane Pretreatment

Phosphorus removal

Cloth media filtration technology is a mature technology

Since early 1990's

Benefits of high flux in small footprint

Several process technology manufacturer's

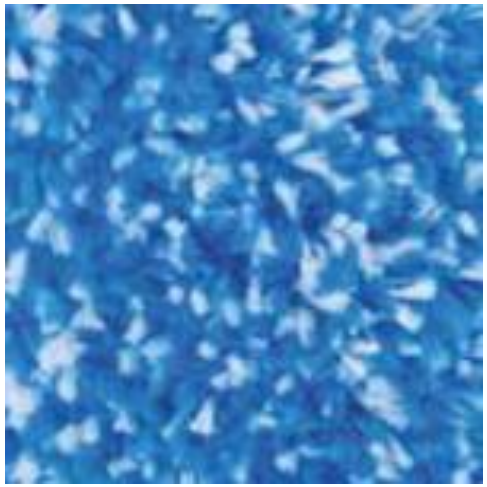
Cloth media filtration offers several geometries & media

Vertical disc - most common

Drum and diamond lateral geometries

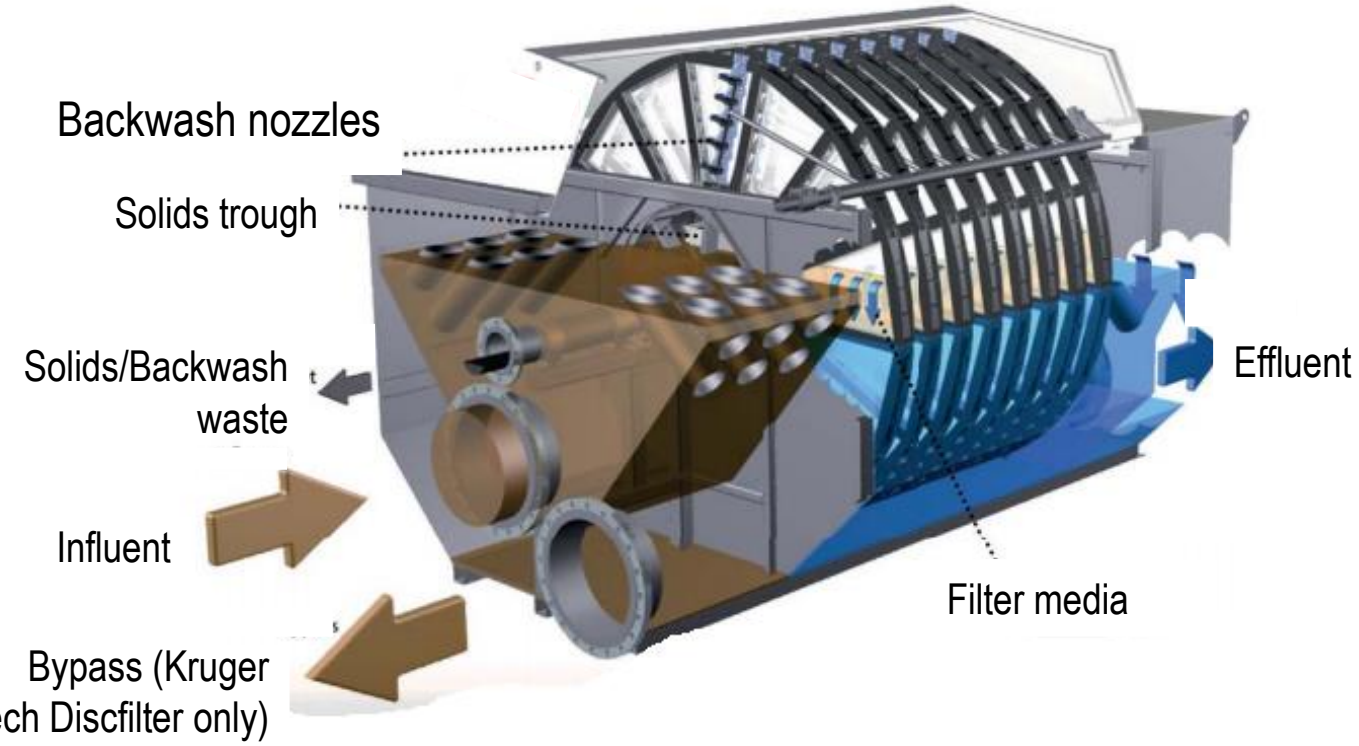
Woven and pile media

Cloth media depth filtration removes particles by entrapping them in the pile media and by straining



Cloth media surface filtration removes particles by straining

10-micron media



- Filtrate is used as backwash
- The backwash pump serves the backwash nozzles
- Backwash waste exits by gravity
- Media is partially submerged in filtrate
- Inside-out operation

Cloth media filtration outside-in disc filter offers several benefits

Individual vertical disc with common or individual disc filtrate/effluent collection

Complete submergence – 100% active filter area

Can utilize existing basins

Cloth media filtration inside-outside disc filter configuration

Solids removal: filter by vacuum pump

Settled solids by pump

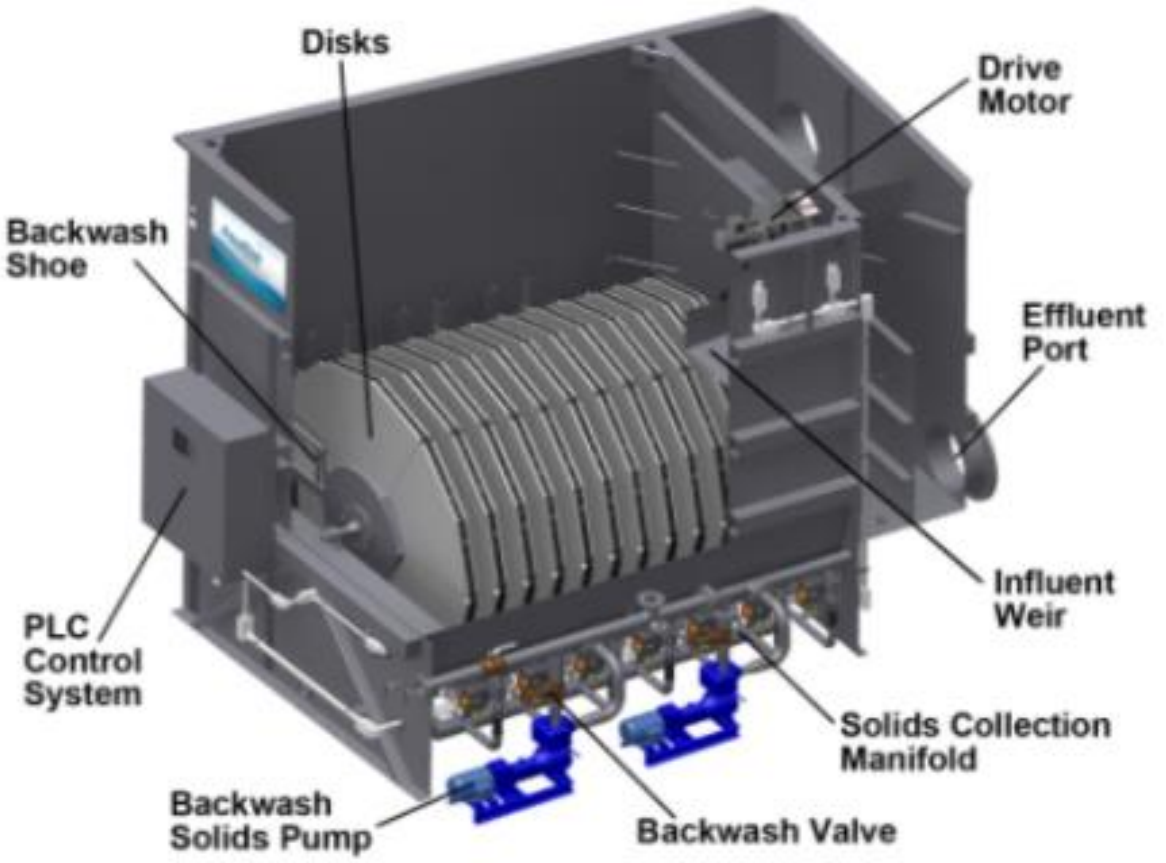
Reject/Backwash: water source – filtrate

Quantity – 1 - 3% of applied flow

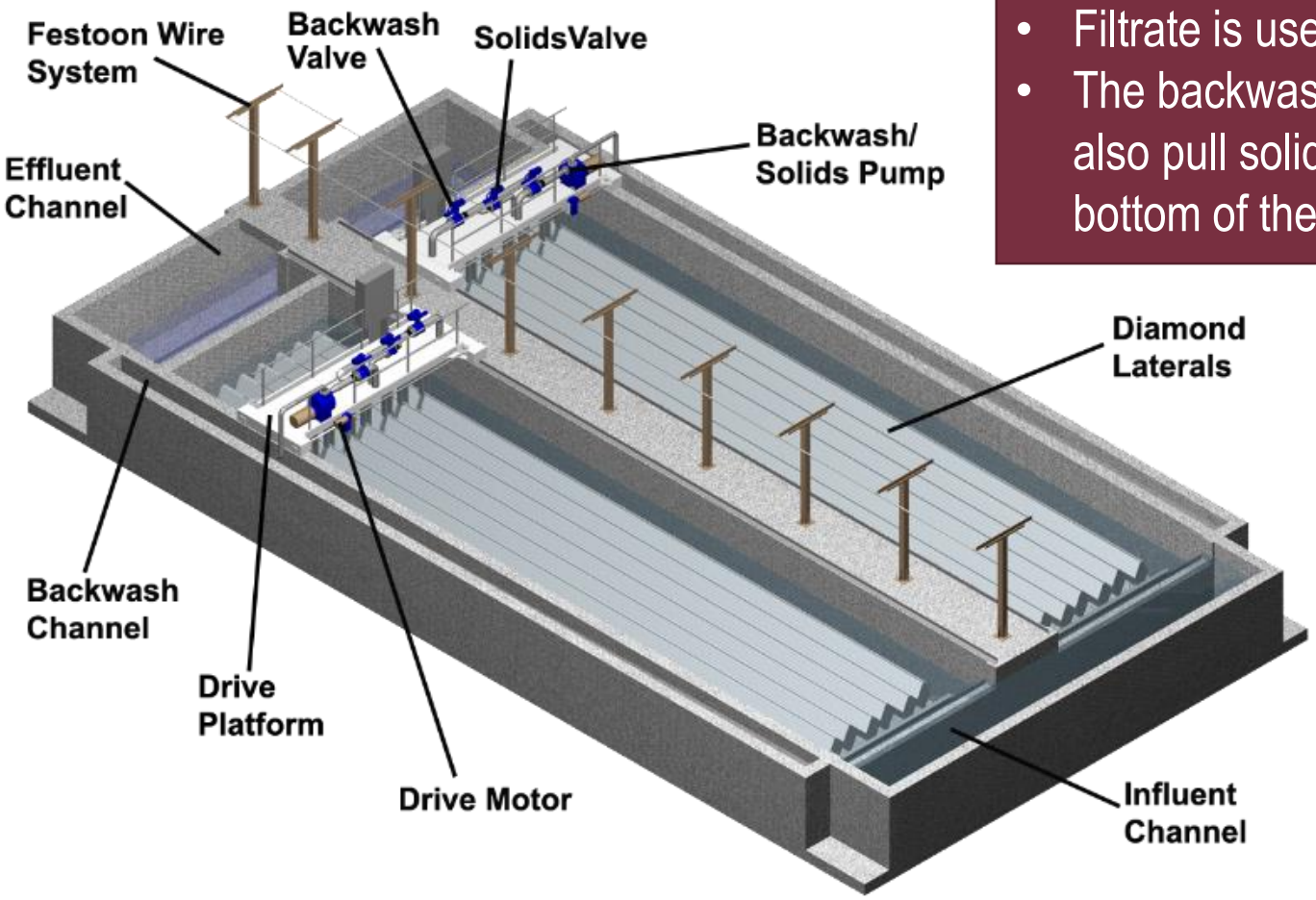
Filtration is active as only a small portion of the media area is backwashed

AquaDiamond and AquaDisk Filters provide cloth media depth filtration

- Media is fully submerged in filter influent
- Outside-in operation



AquaDiamond and AquaDisk Filters provide cloth media depth filtration



- Filtrate is used as backwash
- The backwash pump can also pull solids from the bottom of the tank

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Cloth media filtration inside-out disc filter offers several benefits

Panels connected to central feed drum

Submergence – 65%, thus 65% active filter area

Can utilize existing basins

Cloth media filtration outside-in disc filter configuration

Solids removal: pressure wash media

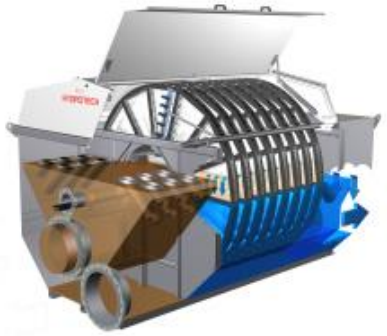
Settled solids by pump

Reject/Backwash: water source – filtrate

Quantity – 0.5 - 3% of applied flow

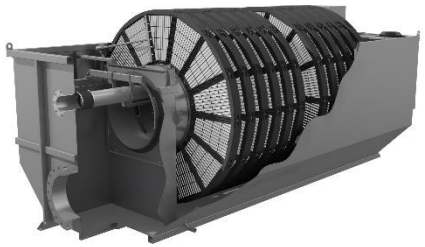
Filtration is active as only a small portion of the media area is backwashed

Cloth media surface filtration systems – additional manufacturers



Kruger Hydrotech
Inside-Out

Westech SuperDisc
Inside-Out



Evoqua Forty-X
Outside-In

Key Considerations - Hydraulics

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Hydraulics are critical for efficient filtration

Equal distribution across all units is critical

Influent flume and weirs

CFD modeling can confirm flow distribution

Key Considerations – Algae Control

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Algae control is also critical for efficient filtration

Algae will reduce filtration efficiency

Backwash volumes and pressures increase

Control provided by covers and/or chlorine

Key Considerations – Backwash volume and pressure

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Adequate backwash volume and pressure is also critical for efficient filtration

Adequate volume – 6.0 gpm/sf of media

Pressure to clean media (vacuum or spray)

Solids removal – both media and basin

Leon Creek WRC

Filter Design Considerations

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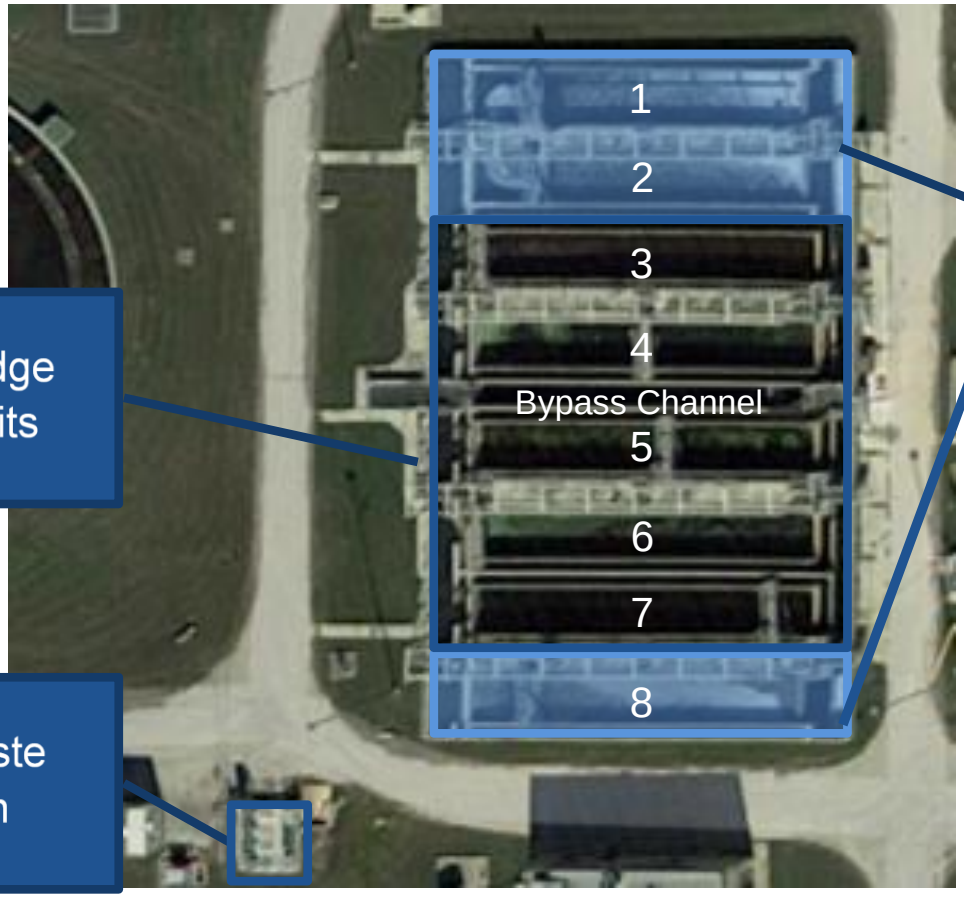
The Leon Creek WRC has 3 AquaDiamond filters and 5 traveling bridge filters



5 Traveling Bridge Sand Filter Units

3 AquaDiamond Cloth Media Depth Filter Units

Backwash Waste Pump Station

The existing AquaDiamond filters have performed well

95% of filtrate TSS samples < 2 mg/L

Filters receive 2.6 mg/L-Cl_2 on average for algae control

On average, filter backwash is 3.9% of the effluent flow

Design criteria for the filter expansion include:

Parameter	Value
Capacity - Average Daily/Peak 2-hr Flow	≥ 12-24/24-48 MGD
Filter Influent TSS	10 – 41 mg/L
Filter Effluent TSS	<2 mg/L
Maximum Filtration Rate	6.5 gpm/sf[1,2]
Average Media Pore Size	≤ 30 microns[1]
Filter media must be resistant to chlorine and protected from the environment[1]	
Note 1: Per 30 TAC §217.190 and 30 TAC §217.193 Note 2: Filters are not required by the Leon Creek WRC's permit, so maintaining 6.5 gpm/sf with one unit out of service is not required.	

Garver evaluated multiple alternatives for filtration improvements

Alternative 1A Layout

- 1 AquaDiamond Filter

Alternative 1B Layout

- 2 AquaDiamond Filters

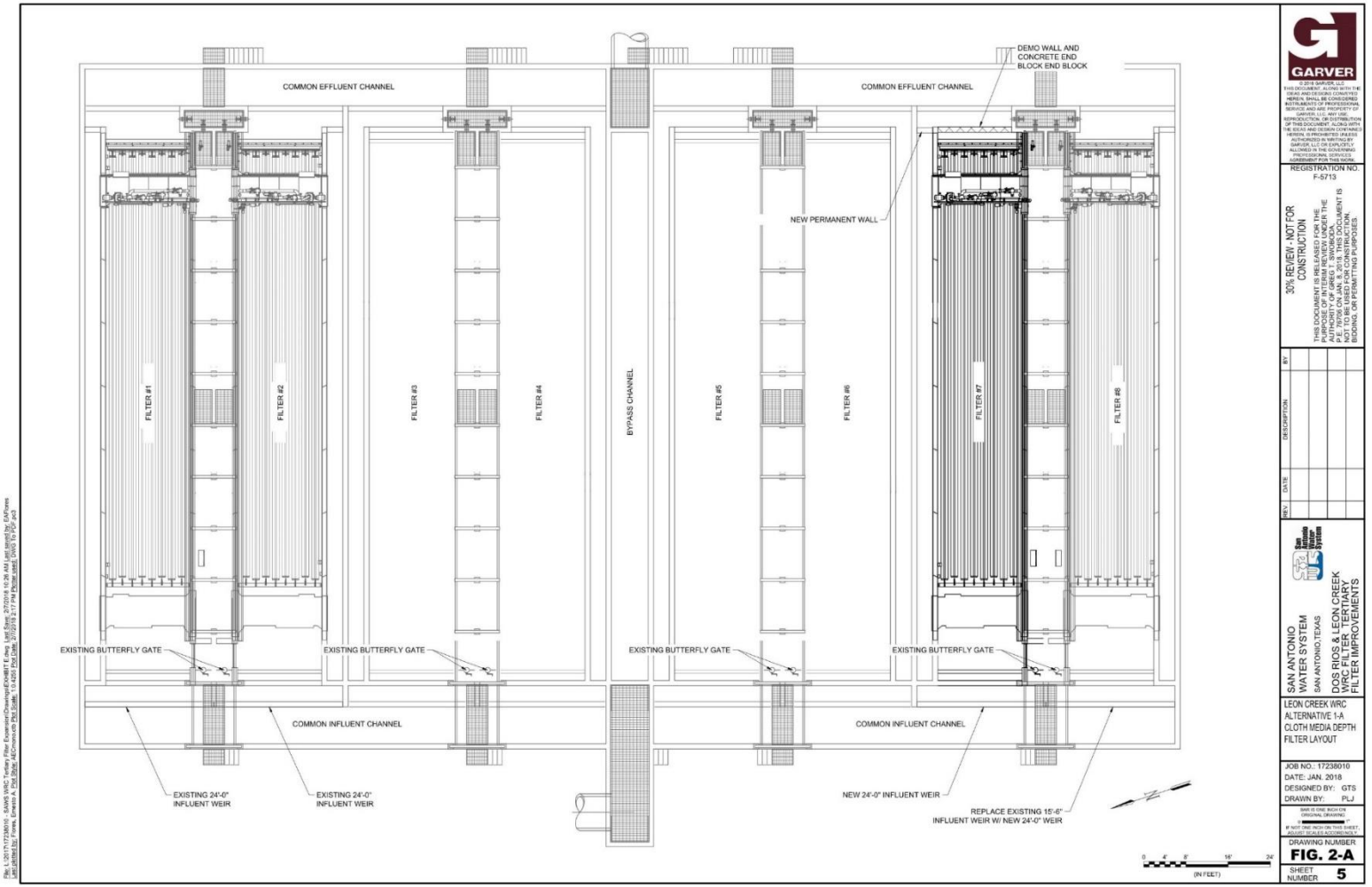
Alternative 2A Layout

- 2 Disk Filter Units

Alternative 2B Layout

- 4 Disk Filter Units

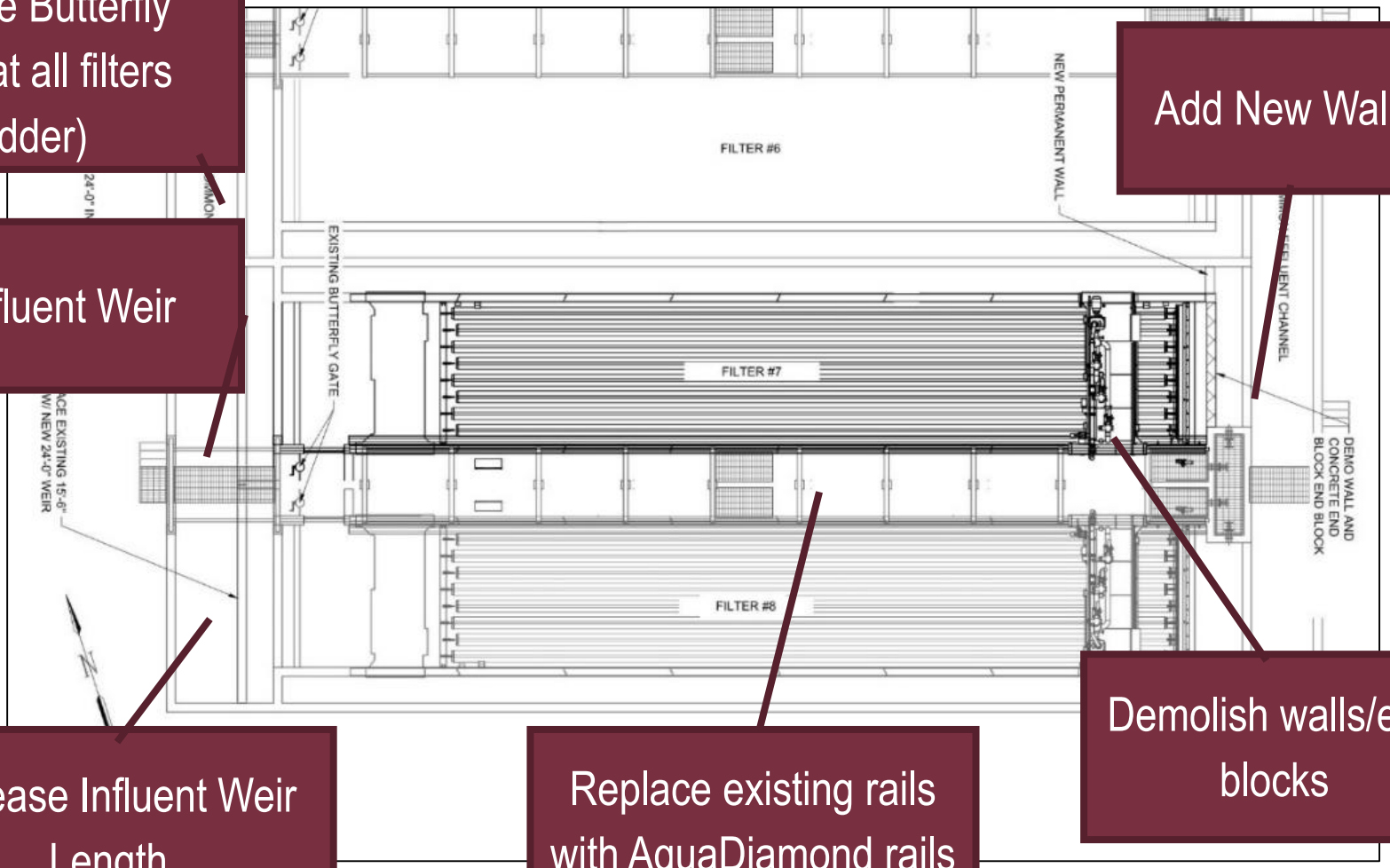
Alternative 1A Layout
1 AquaDiamond Filter



Alternative 1A Layout
1 AquaDiamond Filter

Replace Butterfly Gates at all filters (Adder)

New Influent Weir



Add New Wall

Increase Influent Weir Length

Replace existing rails with AquaDiamond rails

Demolish walls/end blocks

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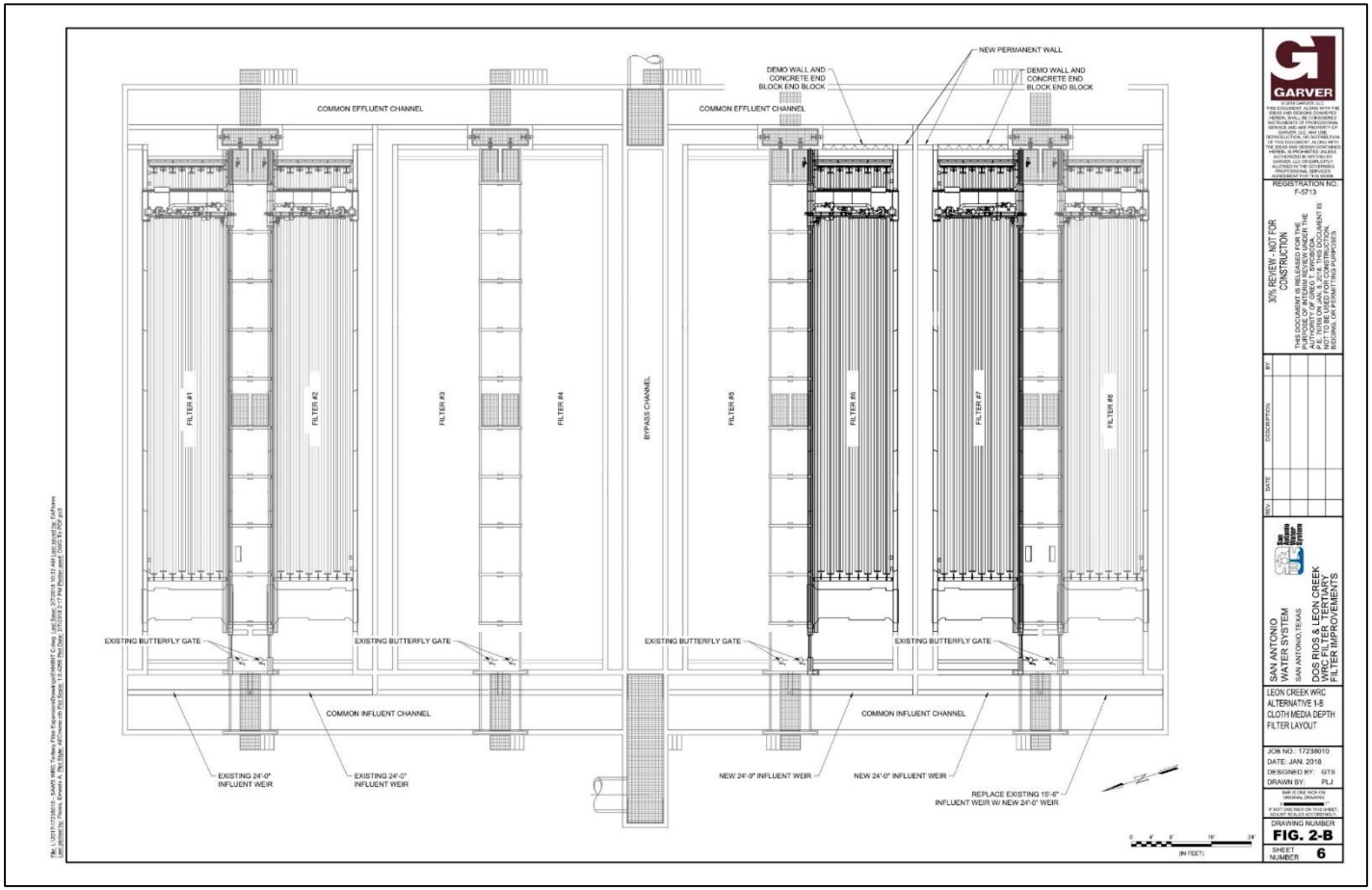
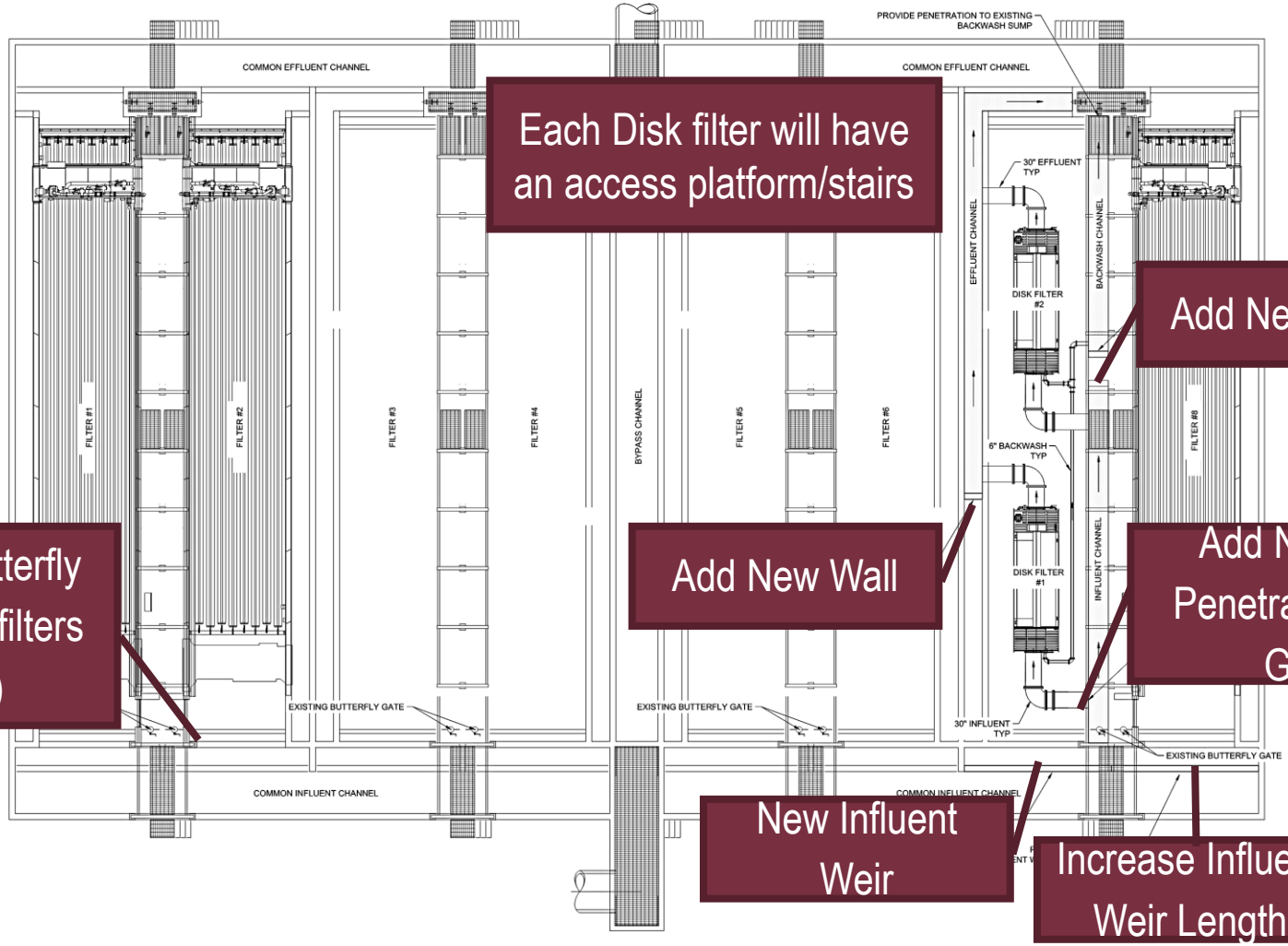
Alternative 1B Layout
2 AquaDiamond Filters



Alternative 1 Design Capacity

Item	Units	Alternative 1A	Alternative 1B
Number of New Units	-	1	2
Total Effective Surface Area	sf	2,560	5,120
Capacity of New Units at 6.5 gpm/sf	MGD	24	48
Average Day Conditions			
Filtration Rate in New Units	gpm/sf	3.3	3.3
Capacity Added	MGD	12	24
Total Filter Capacity	MGD	48 (4 filters)	60 (5 filters)

Alternative 2A Layout
2 Disk Filter Units



Each Disk filter will have an access platform/stairs

Add New Walls

Replace Butterfly Gates at all filters (Adder)

Add New Wall

Add New Wall Penetrations with Gates

New Influent Weir

Increase Influent Weir Length

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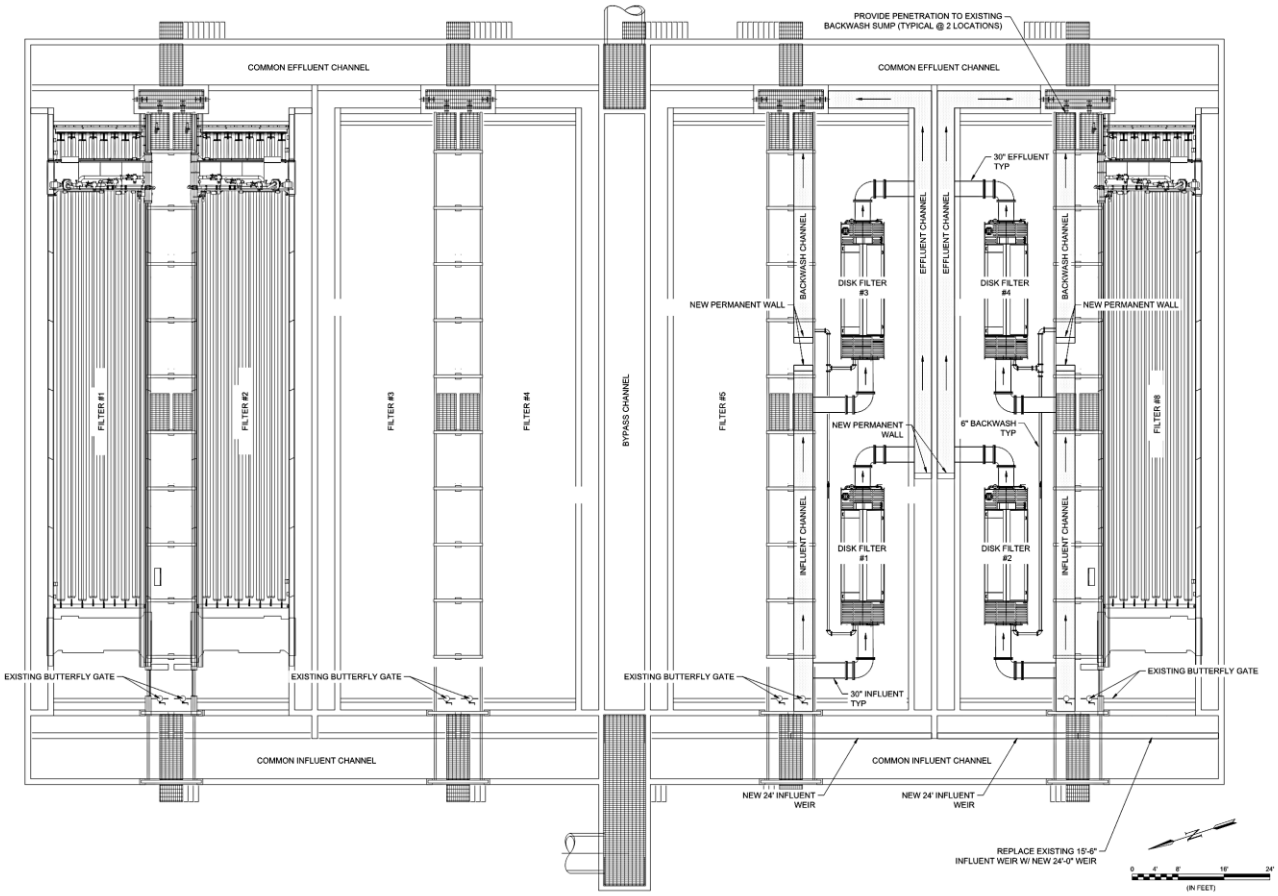
Alternative 2B Layout
4 Disk Filter Units



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Alternative 2 Design Capacity

Item	Units	Alternative 2A	Alternative 2B
Number of New Units	-	2	4
Total Effective Surface Area	sf	2,160	4,310
Capacity of New Units at 6.5 gpm/sf	MGD	20	40
Average Day Conditions			
Filtration Rate in New Units	gpm/sf	3.9	3.9
Capacity Added	MGD	12	24
Total Filter Capacity	MGD	48	60

Leon Creek WRC

Hydraulics

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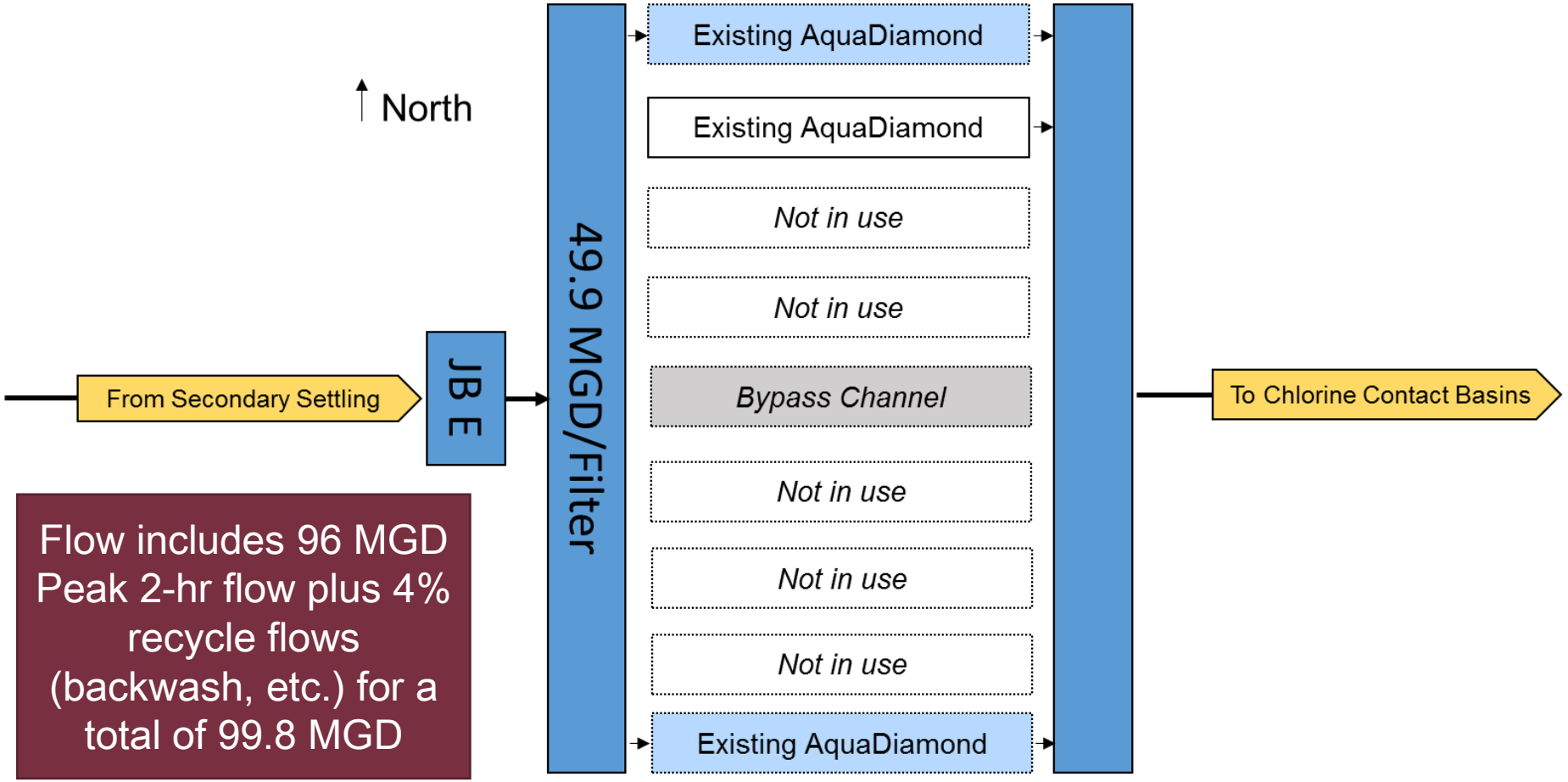
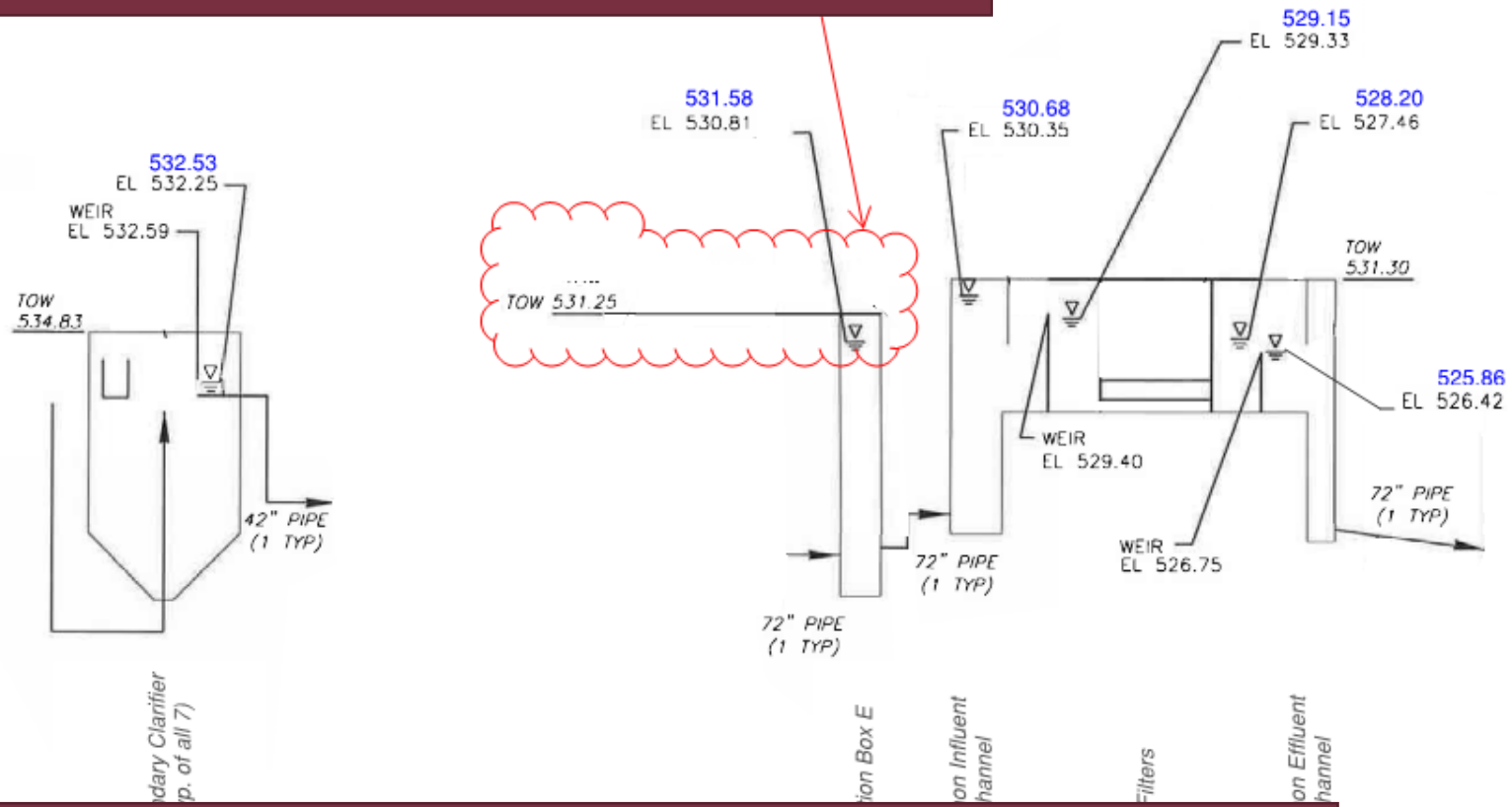
Leon Creek WRC Filter Facility Existing Hydraulics



Flow includes 96 MGD Peak 2-hr flow plus 4% recycle flows (backwash, etc.) for a total of 99.8 MGD

Leon Creek WRC Filter Facility Existing Hydraulics

Existing system loses freeboard @ 42 MGD, floods @ 87 MGD



WSE at P2HF = 96 MGD (+3.84 MGD Backwash recycle between SCs and filters)

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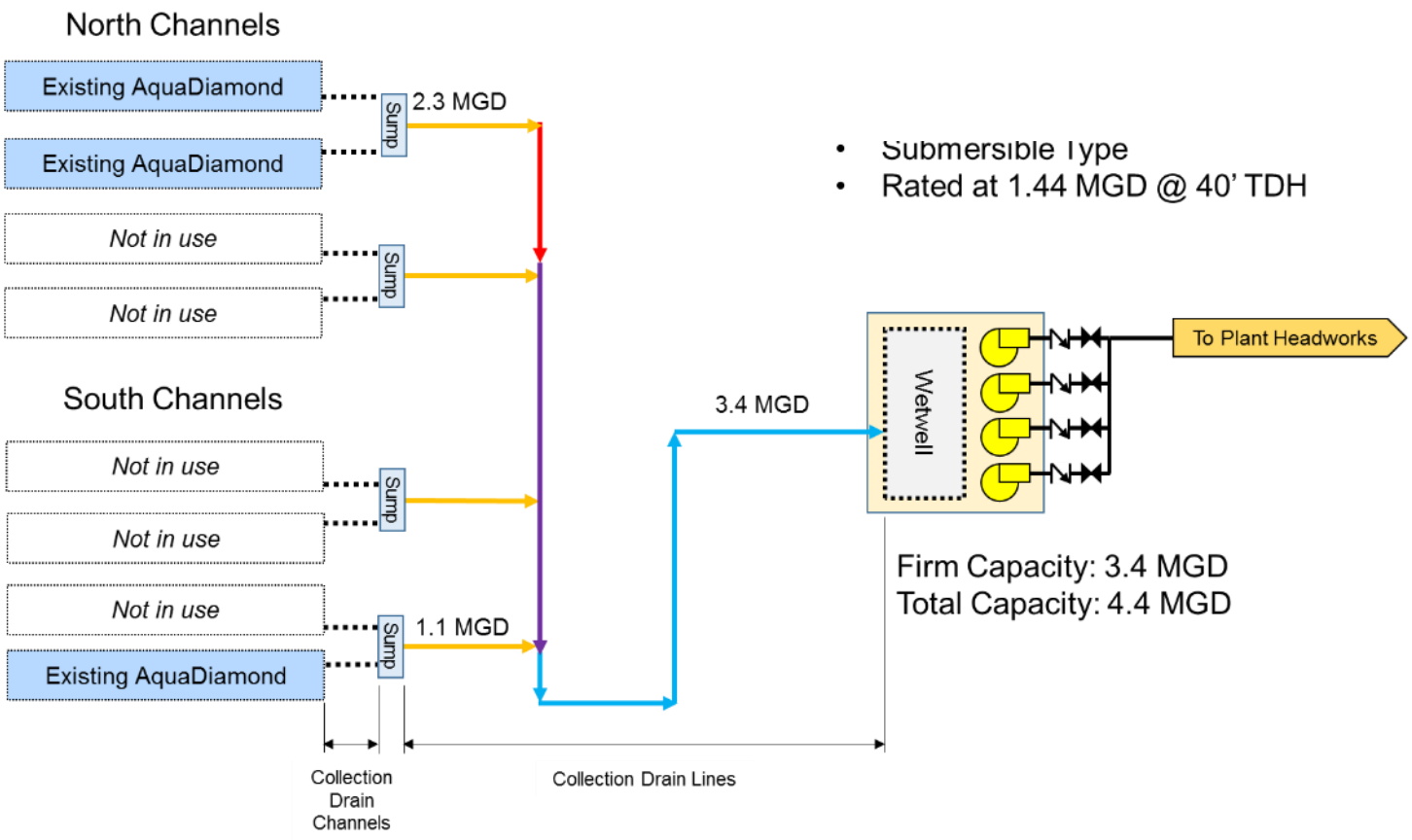
Leon Creek WRC
Existing Backwash Waste Pump System



Existing Backwash System at the Leon Creek WRC

LEGEND

- 8" Pipe
- 10" Pipe
- 14" Pipe
- 16" Pipe
- Open Channels
- Pump Discharge Lines (Dia. Varies)

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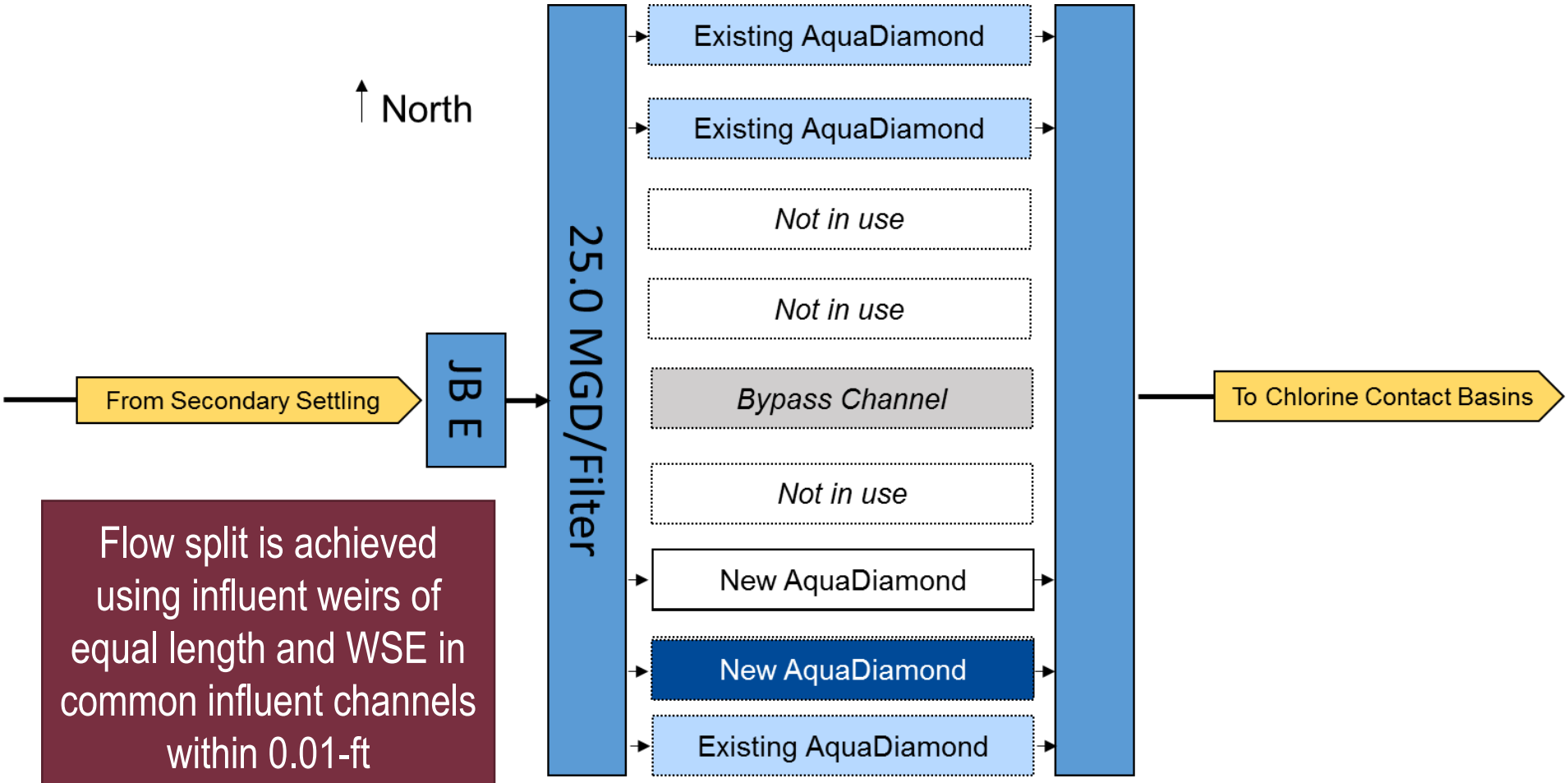
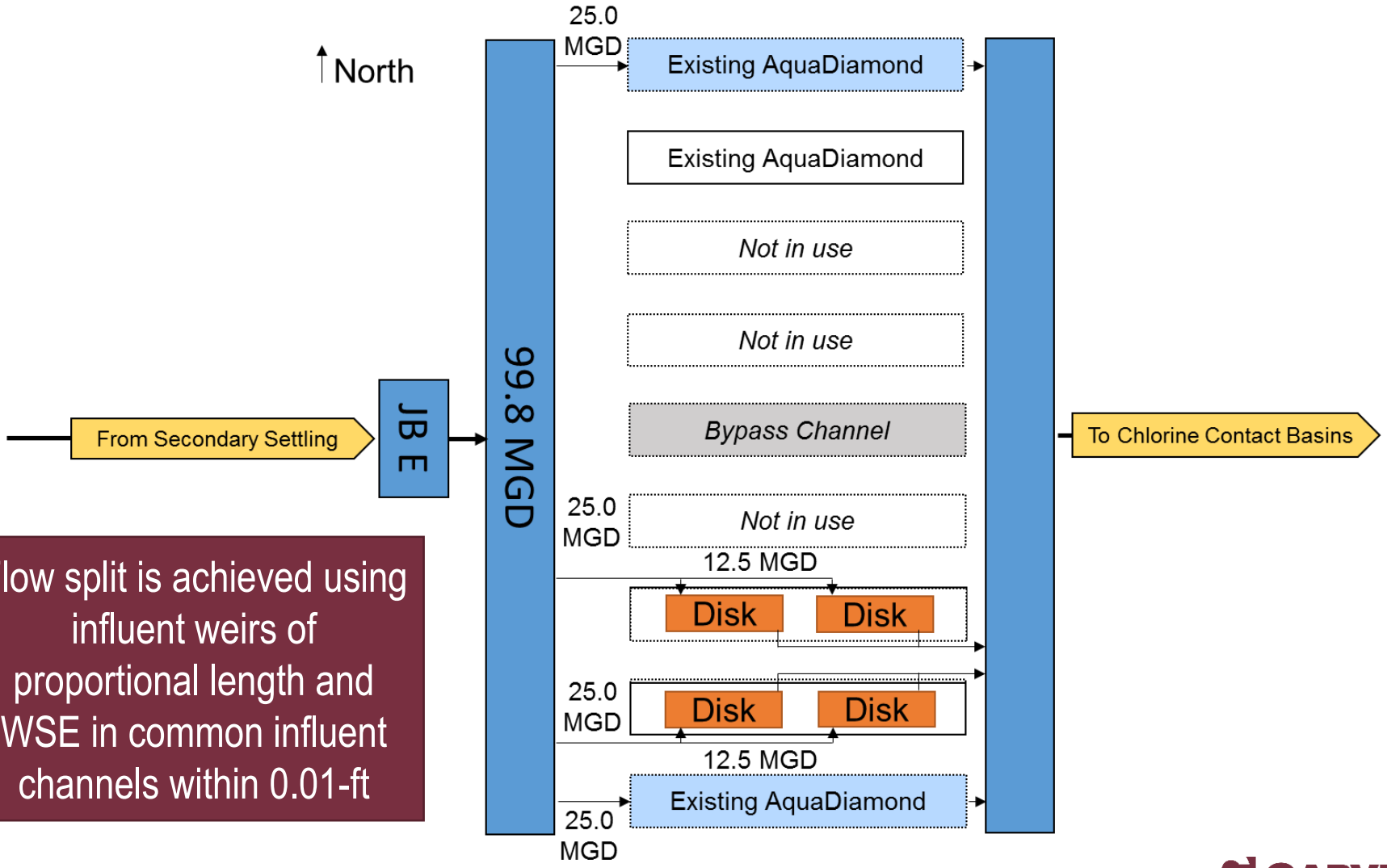
Leon Creek WRC Filter Facility Alternative 1 - Hydraulics (AquaDiamonds)



Flow split is achieved using influent weirs of equal length and WSE in common influent channels within 0.01-ft

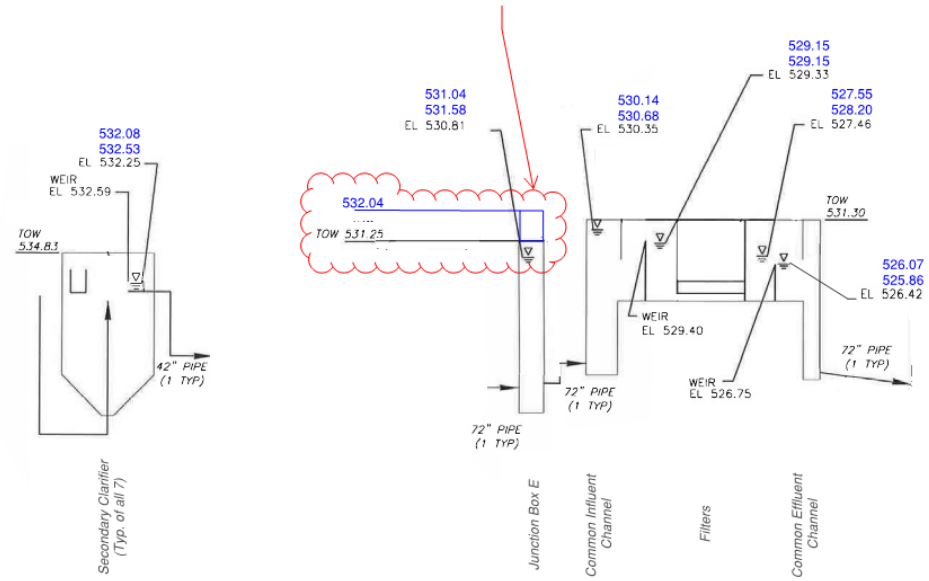
Leon Creek WRC Filter Facility Alternative 2 - Hydraulics (Disk Filters)



Flow split is achieved using influent weirs of proportional length and WSE in common influent channels within 0.01-ft

On the proposed hydraulic profile filter headloss is limited to 1.60-ft

Garver recommends raising wall.
With new filters and existing T/Wall, system loses freeboard @ 61 MGD, doesn't flood at 100+ MGD
New filters and new T/Wall maintains freeboard & does not flood at 100+ MGD



WSE at P2HF = 96 MGD (+ 3.84 MGD Backwash recycle between SCs and filters):

532.08 Garver Analysis - New
532.53 Garver Analysis - Existing
EL 532.59 CP&Y Analysis (@ 70 MGD)

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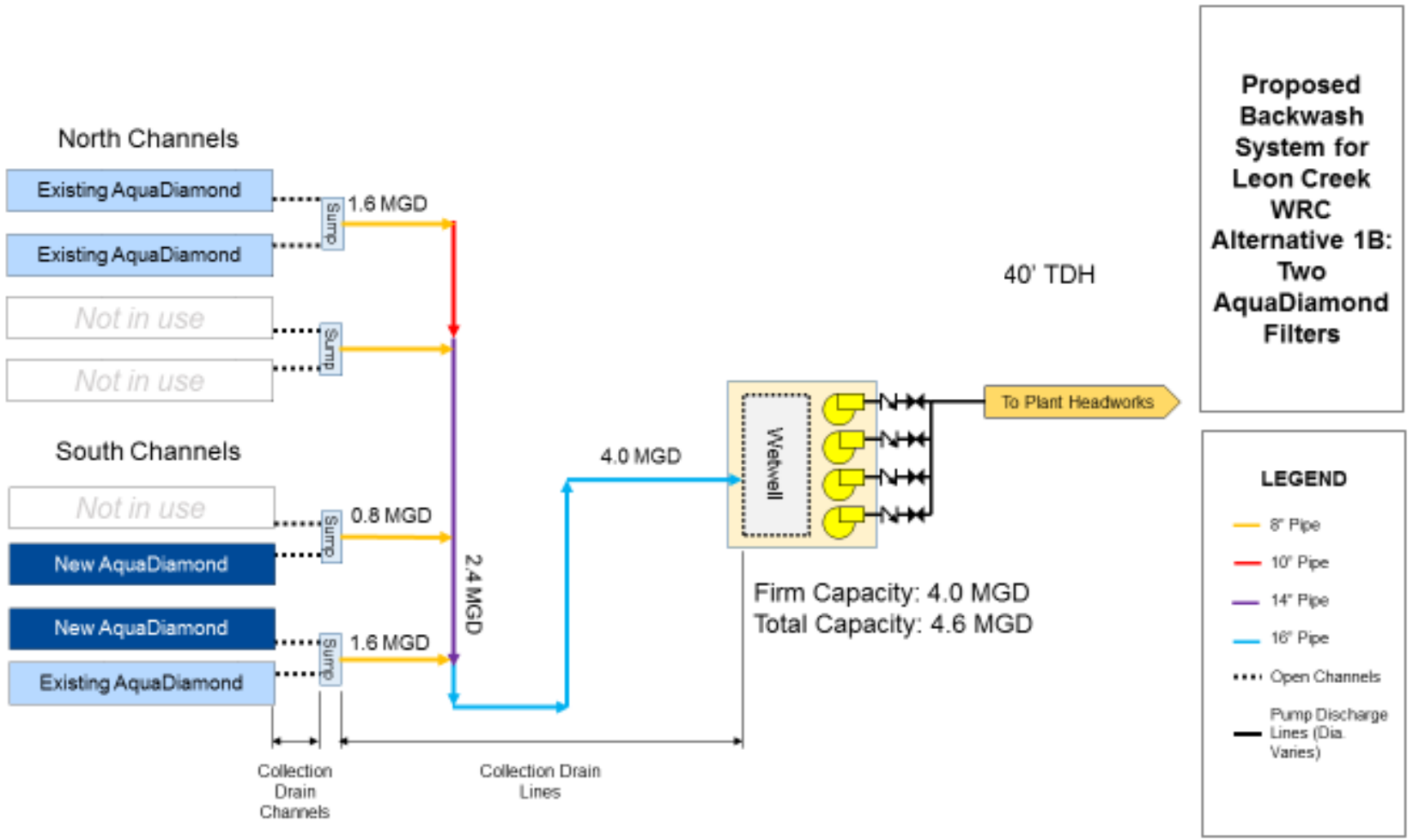
Leon Creek WRC Backwash Waste Pump System Hydraulics – Alternative 1



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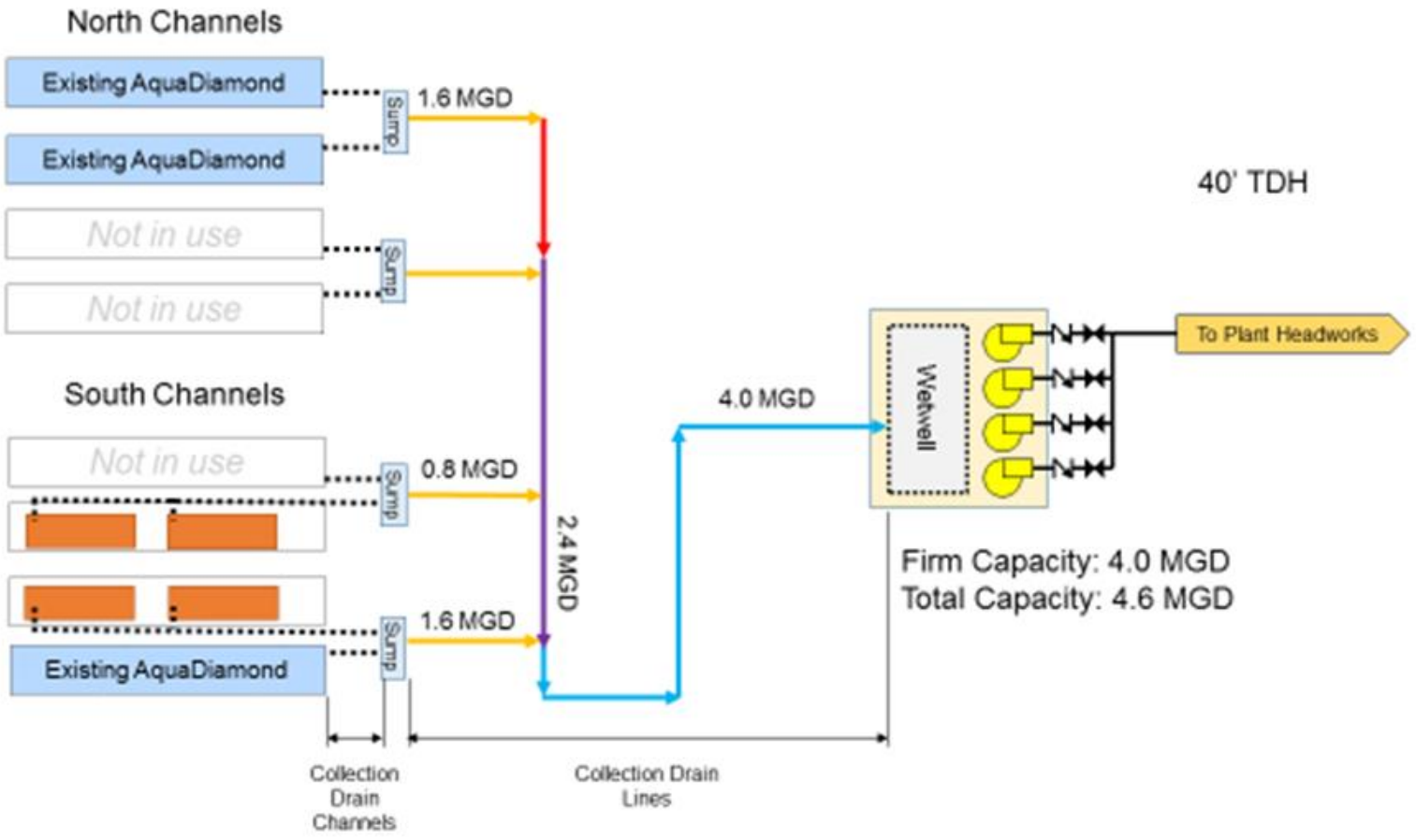
Leon Creek WRC Backwash Waste Pump System Hydraulics – Alternative 2



Proposed Backwash System for Leon Creek WRC Alternative 2B: Four Cloth Disk Filters

LEGEND

- 8" Pipe
- 10" Pipe
- 14" Pipe
- 16" Pipe
- Open Channels
- Pump Discharge Lines (Dia. Varies)

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Leon Creek WRC

Structural Modifications

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Existing filter channel(s) will be rehabilitated and retrofitted with new filters

Repair major cracks

Cover any exposed aggregate/steel

Repair minor cracks

Leon Creek WRC

Estimated Life Cycle Costs

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Life Cycle Costs Included

Replacement of Media, Backwash Pumps, Drive Chains or Wheels, Guide Wheels, and Seals

Labor for Inspection, Cleaning, and Lubrication

Power Consumption of Backwash Pumps and Drive Motors

Chlorine Usage

Life Cycle Costs - Annual Chlorine for AquaDiamonds and Disk Filters

Item	Quantity	Units
Expected dose	3.5/2.5	mg/L
Average day flow	41	MGD
Average usage	1,200	ppd
Chlorine Cost	0.21	$/lb
Annual Cost	91,700	$

20-Year Net Present Value

Alternative	NPV
1A – 1 AquaDiamond Filter	$5.33M
2A – 2 Cloth Disk Filters	$5.39M
1B – 2 AquaDiamond Filters	$8.31M
2B – 4 Cloth Disk Filters	$8.54M

1.4% interest, 1.8% inflation



Questions?

May 25, 2018

Tina Hanson, PE

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Leon Creek WRC

Construction Sequencing

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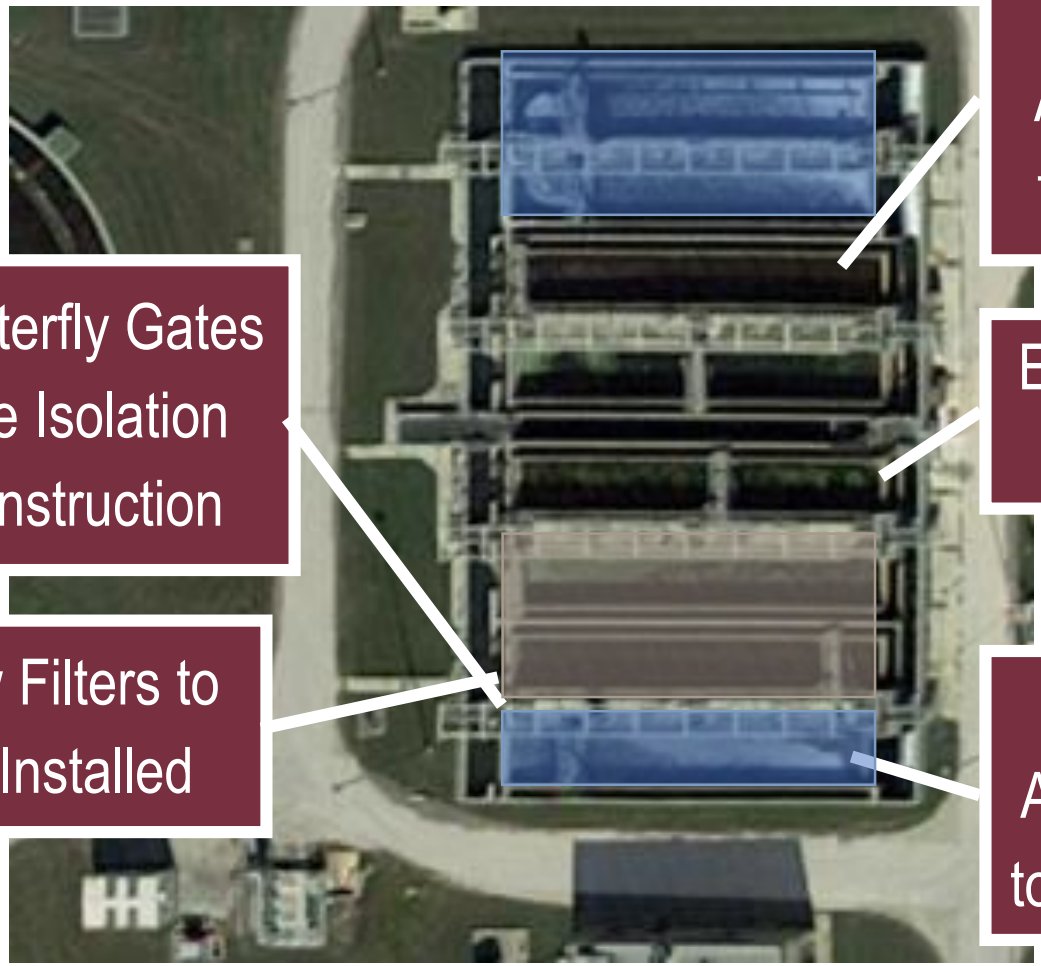
Construction Sequencing



2 Existing AquaDiamond Filters to Remain in Service

Existing Butterfly Gates will Provide Isolation During Construction

Existing Bypass Channel

New Filters to be Installed

Existing AquaDiamond Filter to Remain in Service

Construction of Filter Channels is expected to take 13 Months