FLOW vs. VOLUME DESIGN

FORTERRA

Forterra Stormwater Management Systems

January 2018

Bio Clean

Presented by: Michael Kusch

Flow or Volume Base Design

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Check List Questions

- Type of Treatment?
- *screening, separation, media filtration, membrane filtration, biofiltration.*
  - Quantity or Quality? Or both. What are the local regulations.
- Volume Required? Only if there are hydro modification requirements.
- If Not, Do Flow Based Design
- If Storage needed- put BMP downstream and do Volume Based Design.


EXPLORE
YOUR
OPTIONS

Presentation Agenda

- Key Terms (industry lingo)
- Treatment Flow
- Treatment Volume
- Hydromodification/Volume Control

Key Terms

- CFS – measurement of flow (cubic feet per second) 1 cfs = 448.8 gpm
- Rational Method – equation used to calculate treatment flow rate. Expressed at Q = C x I x A
- Impervious Coefficient = amount of pervious Vs. impervious surface for a drainage area

Sizing Method Comparison

Flow Based vs. Volume Based

Rational Method = Flow Based

Water Quality Flow • Q = C x I x A

- Q = Water Quality Flow Rate (cfs)
- C = impervious coefficient (0 to 1.0)
- I = Treatment Intensity (in/hr) (2.45”)
- A = Area (acres)

Volume Based

Water Quality Volume • V = C x (D/12) x (A*43560)

- V = Water Quality Volume (cu ft)
- C = impervious coefficient (0 to 1.0)
- D = Design Storm Depth (in) **(1.1”)**
- A = Area (acres)

Stormwater Flow Designs

Basin	A	B	C
3 MONTH Q	3.55	2.12	2.67
10 YR. Q (cfs)	10.7	8.5	7.5
Drainage Area (ac)	1.58	0.96	1.19
Weighted runoff “C”	.92	.90	.92

Original UGD Storage Volumes:

Basin A = 6200 CF
Basin B = 0 – space limitations
Basin C = 6100 CF

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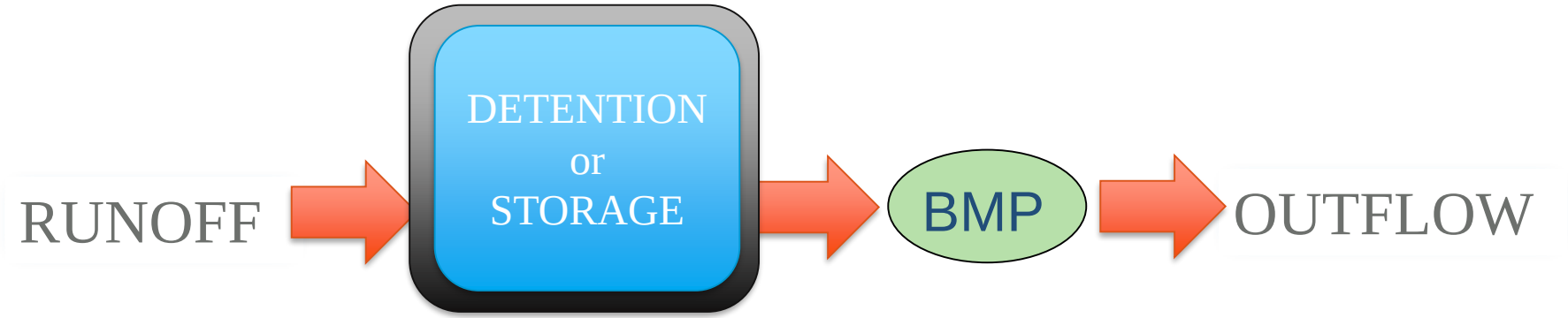
Volume Based Design

DETENTION
& BMP Hydraulically Connected

RUNOFF=Usually designed to capture First Flush 1.1”
= Pre-existing conditions.

Volume Based Design

DETENTION
& BMP Hydraulically Disconnected



RUNOFF=Usually designed to capture First Flush 1.1”
= Pre-existing conditions.

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FINAL SPECIFIC PLAN
&
CONSTRUCTION DRAWINGS
BURKITT COMMONS

BURKITT ROAD AND NOLENSVILLE ROAD
NASHVILLE, DAVIDSON COUNTY, TENNESSEE
COUNCIL DISTRICT 31 - FABIAN BEDNE

SHEET INDEX

DAVIDSON COUNTY TAX MAP 186
PARCELS 26.00 & 40.00

WILLIAMSON COUNTY TAX MAP 33
PARCEL 82.03

OWNER / DEVELOPER

REGENT HOMES
6901 LENOX VILLAGE DRIVE, STE. 107
NASHVILLE, TN 37211
P: (615) 456-1341
CONTACT: JOHN BEYER
E-MAIL: john.beyer@regenthomes-tn.com

ENGINEER

CIVIL SITE DESIGN GROUP, PLLC
630 SOUTHGATE AVE, STE. A
NASHVILLE, TN 37203
P: (615) 248-9999
F: (615) 251-9575
CONTACT: KEVIN GANGAWARE, P.E.
E-MAIL: keving@civil-site.com

CIVIL·SITE DESIGN GROUP

2015SP-084-002
SWGR T2016040332

JOB NO.: 16•023•01

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Burkitt Commons

- Owner/Developer: Newco-Burkitt/LLC
- Program Manager - The Parent Company
- Consulting Engineer- Civil-Site Design Group
  Sean DeCoster, PE & Chris Goodman ,PE
- Grading Contractor- Humerick

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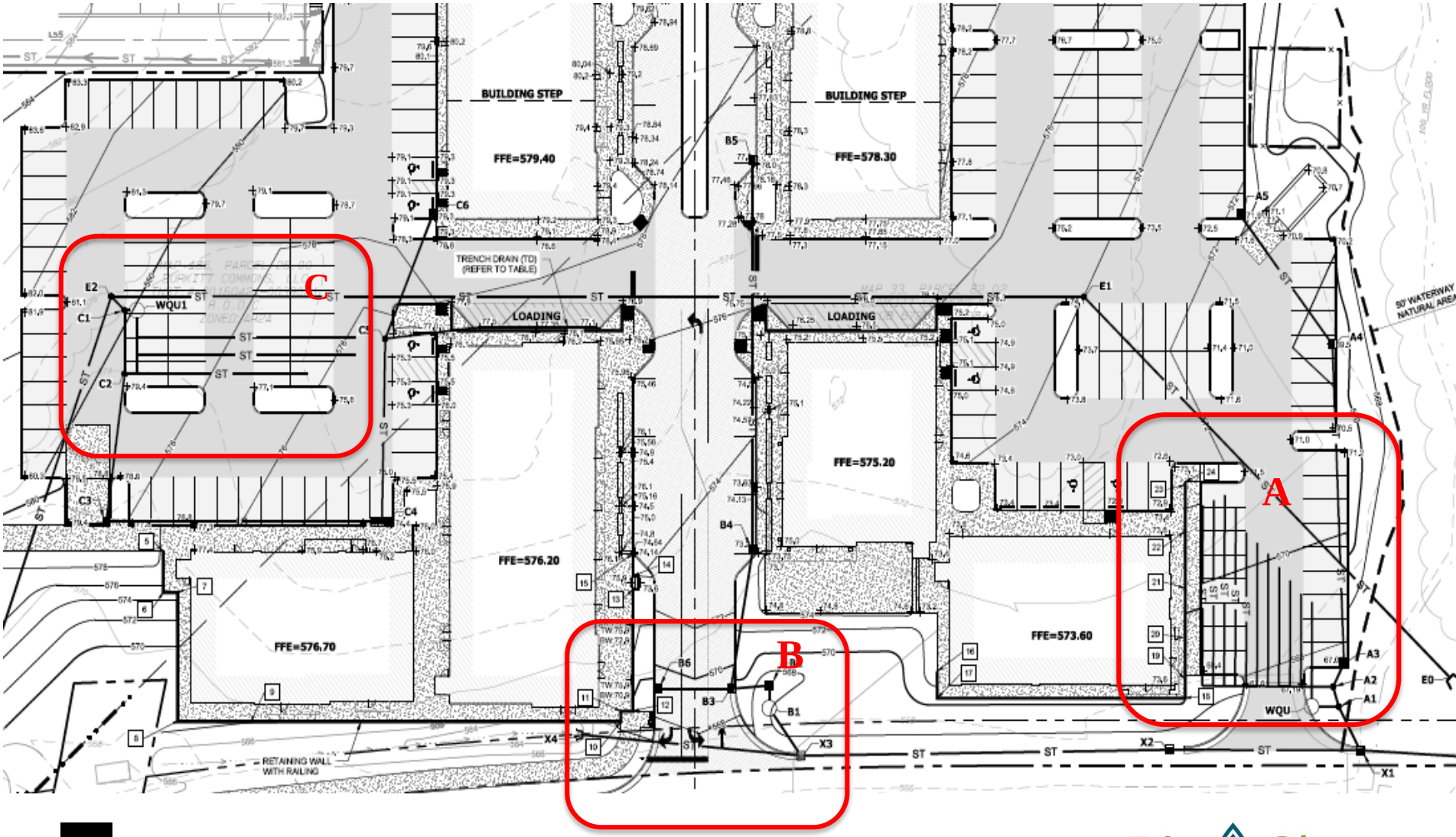
Burkitt Commons-Before-Volume Based



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Volume based

- **Basin A**

Membrane Filter SWQU + UGD- would require an 8 x 8 Kraken Filter unit + 655LF of 42” pipe UGD

- **Basin B**

Membrane Filter only-No detention- 8 x 16 unit

- **Basin C**

Membrane filter SWQU + UGD –would require 8 x 8 kraken Filter unit + 270 lf of 60” pipe UGD

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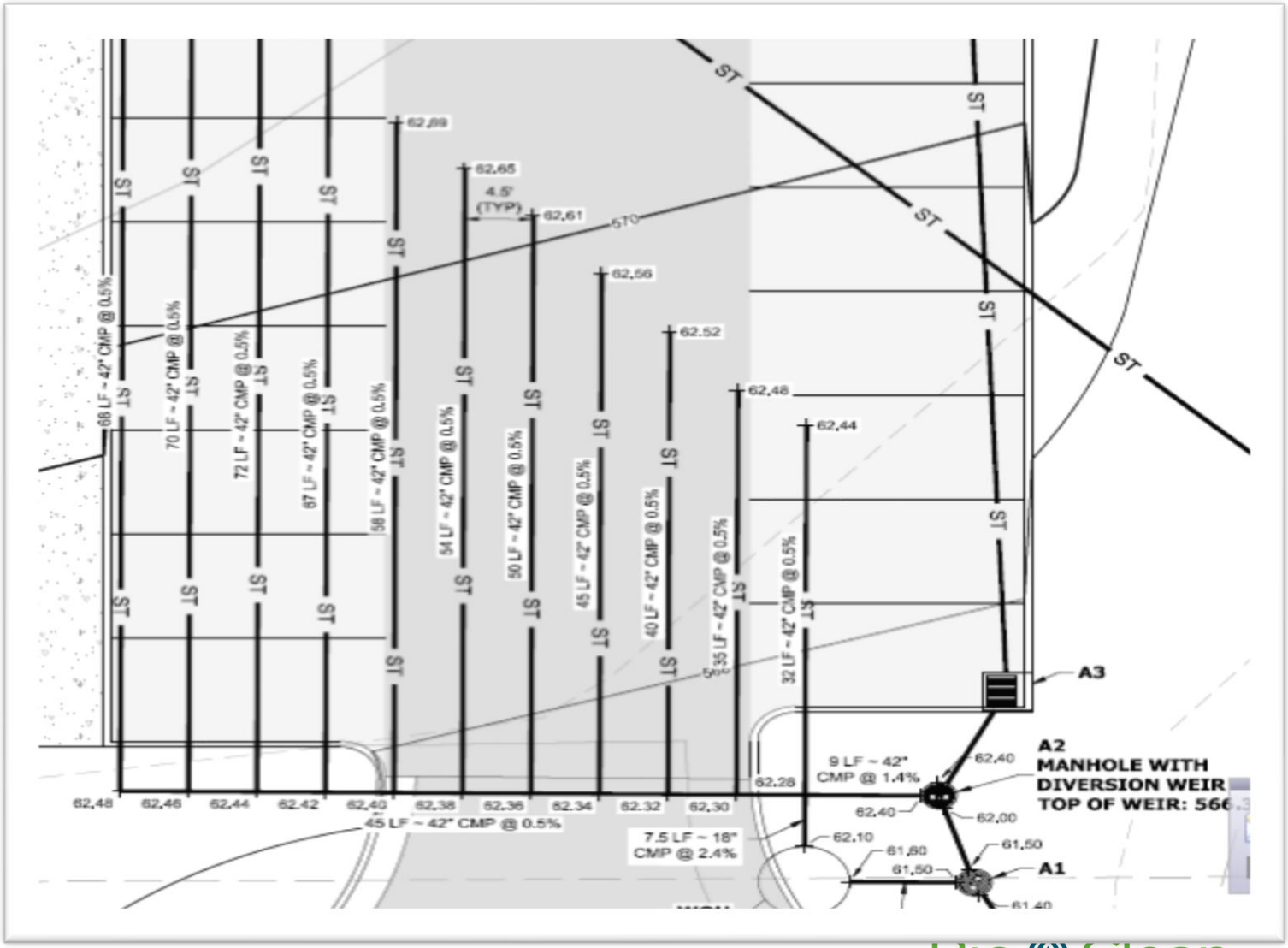
Before-Volume Based (Basin A)

UGD
42”- 655 LF



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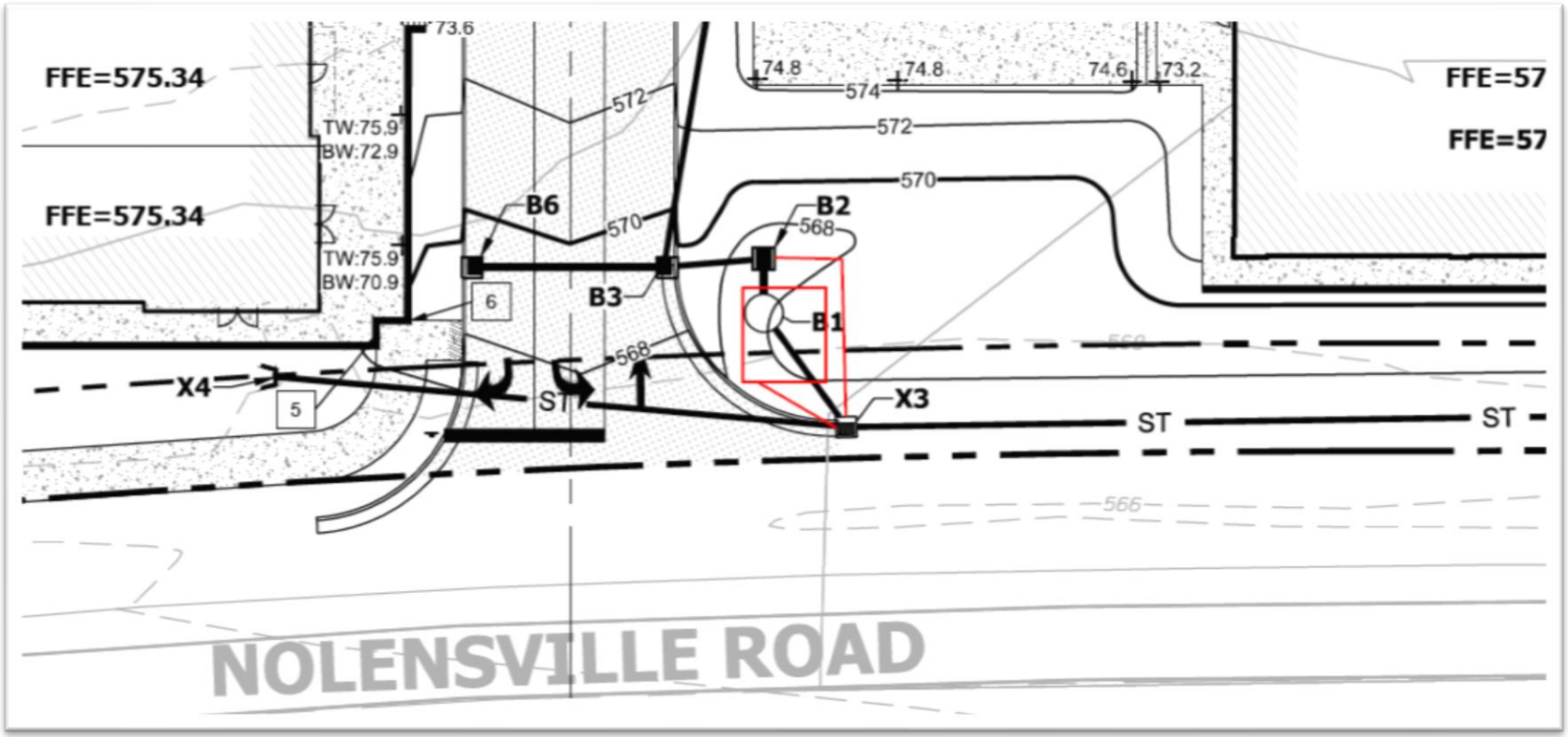
Basin B- Always Flow Based



No room for UG Storage

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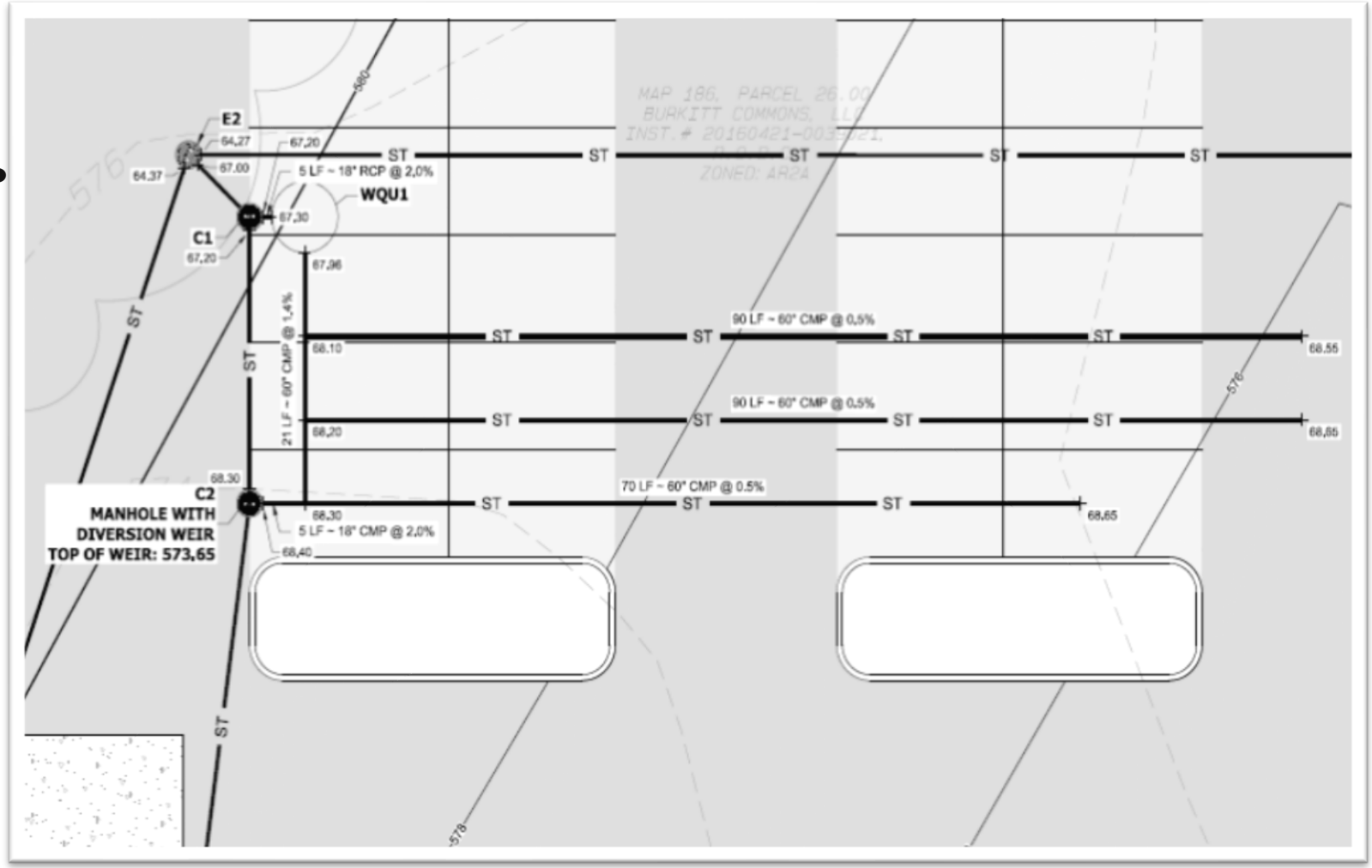
BASIN C-before- Volume Based

UGD
60” CMP
270 LF



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Engineers all done –everything buttoned up..

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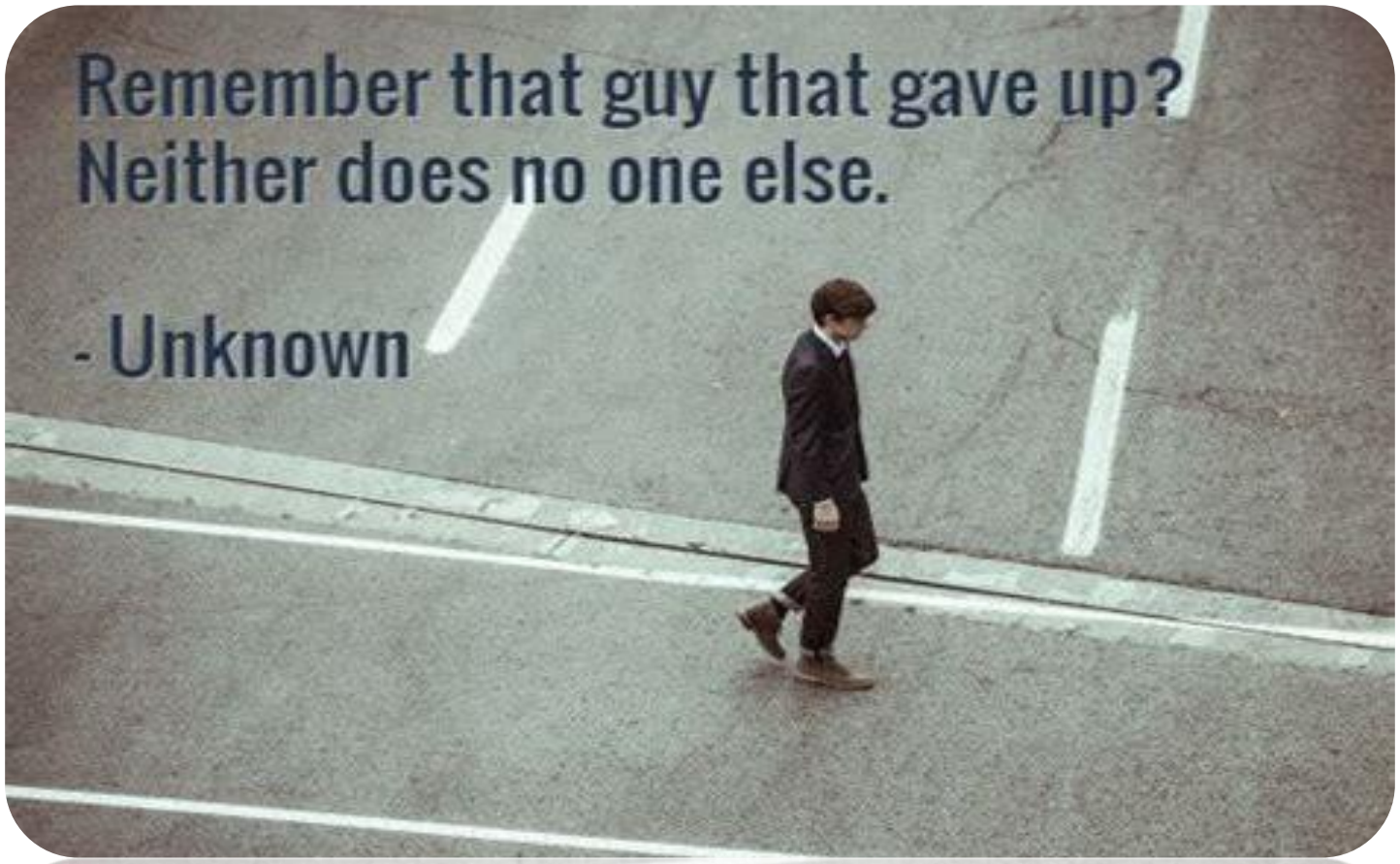
#3 Month Flows Too Large for Filter Unit..

3 MONTH Q	3.55	2.12	2.67



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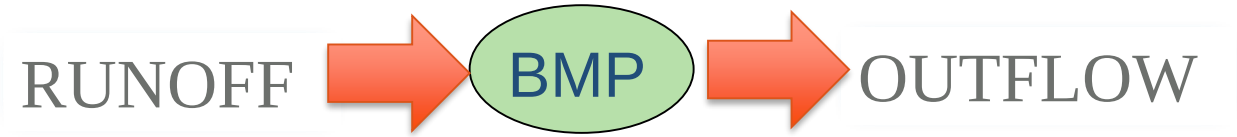
EXPLORE
YOUR
OPTIONS

Flow Based Design



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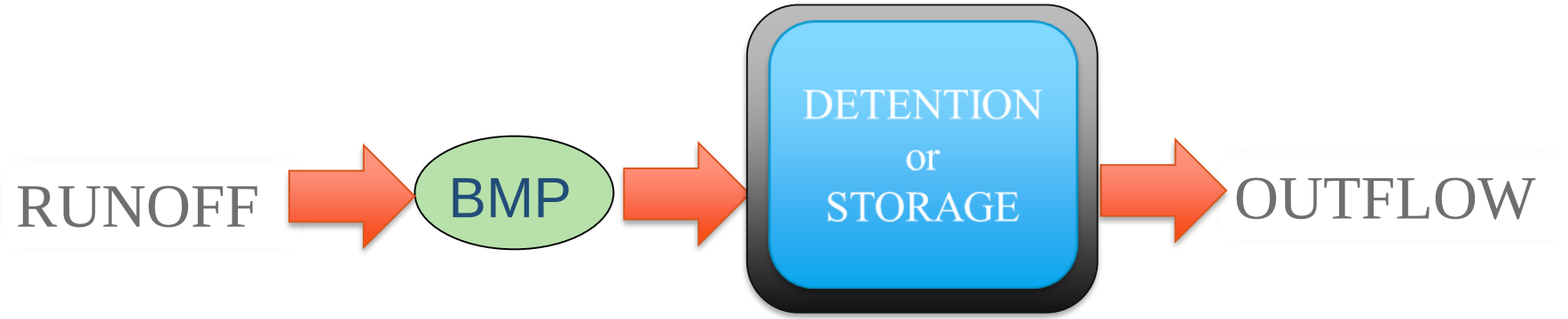
Flow Based Design



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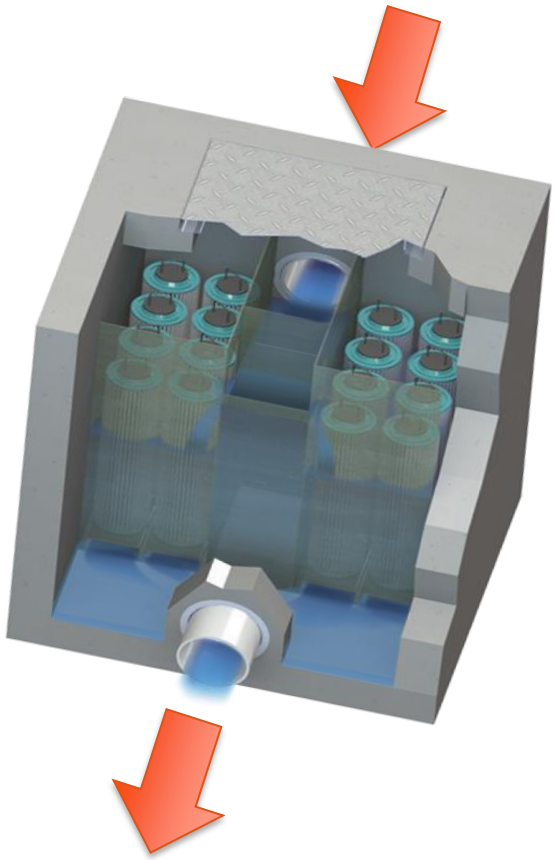
Flow Based Design

RUNOFF



OUTFLOW

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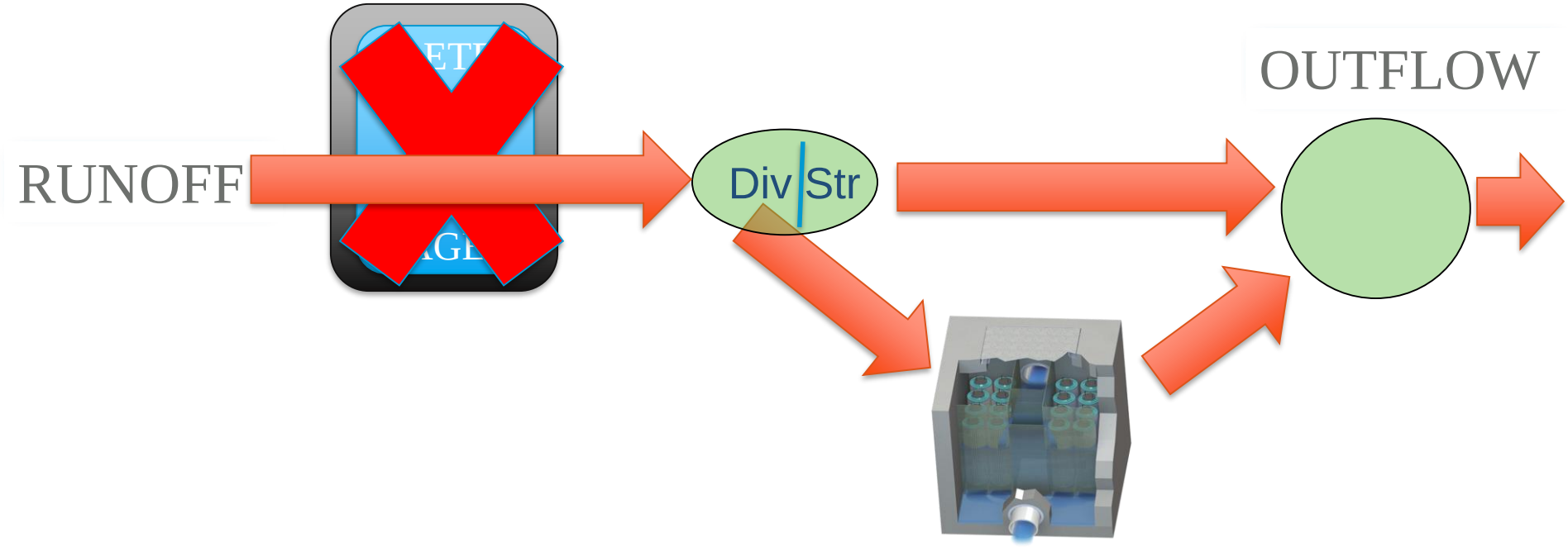
BURKITT CASE STUDY



RUNOFF=Usually designed to capture First Flush 1.1”
= Pre-existing conditions.

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Flow based

- **Basin A**

Membrane Filter SWQU only Eliminated Pain of Detention

Size now -10 x 20 Kraken membrane Filter unit w/ 5 x 5 Diversion structure

- **Basin B**

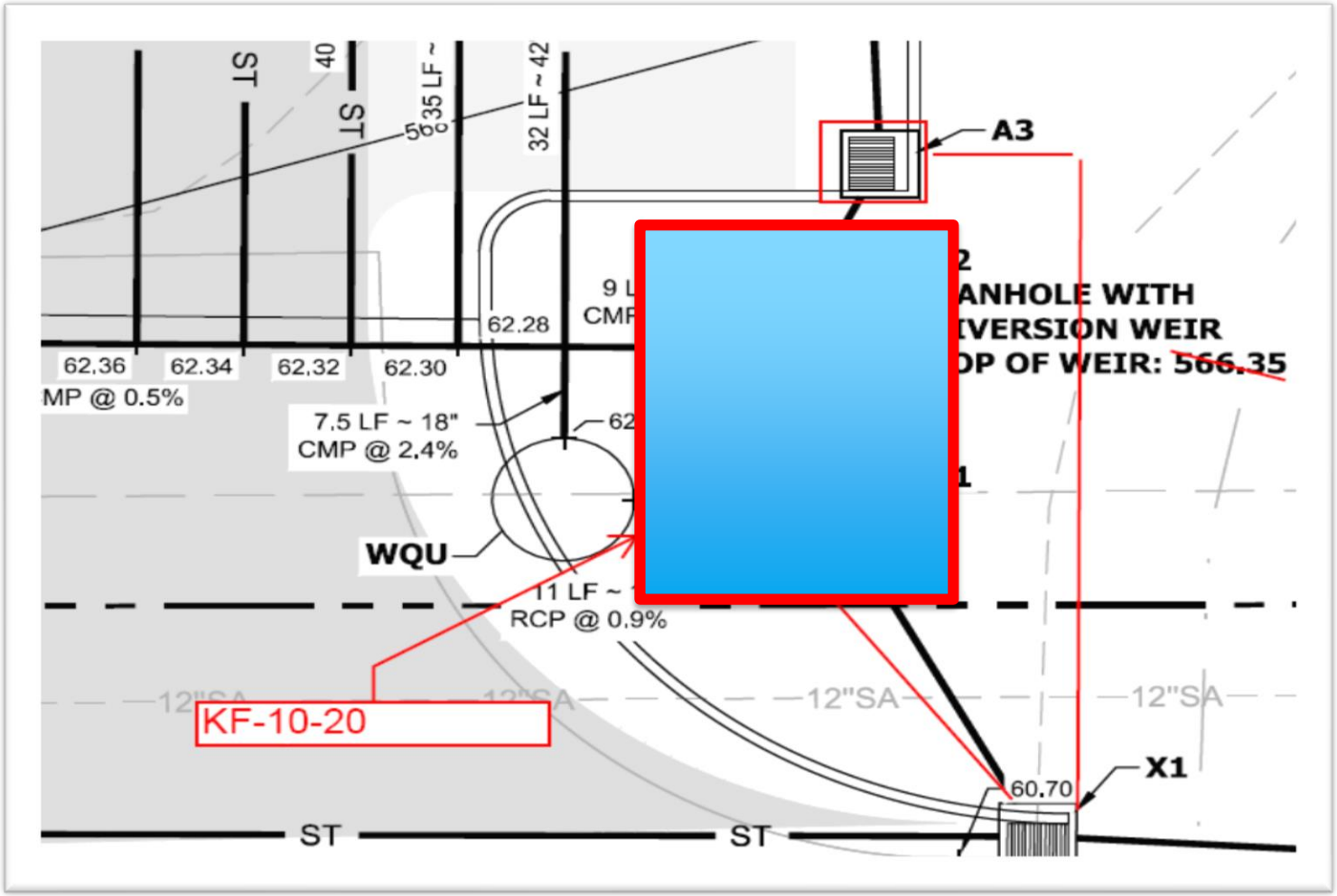
Membrane Filter only-No detention- 8 x 16 unit

- **Basin C**

Membrane Filter SWQU only Eliminated Pain of Detention

Size now -10 x 14 Kraken membrane Filter unit w/ 5 x 5 Diversion structure

AFTER-Flow Based (Basin A)



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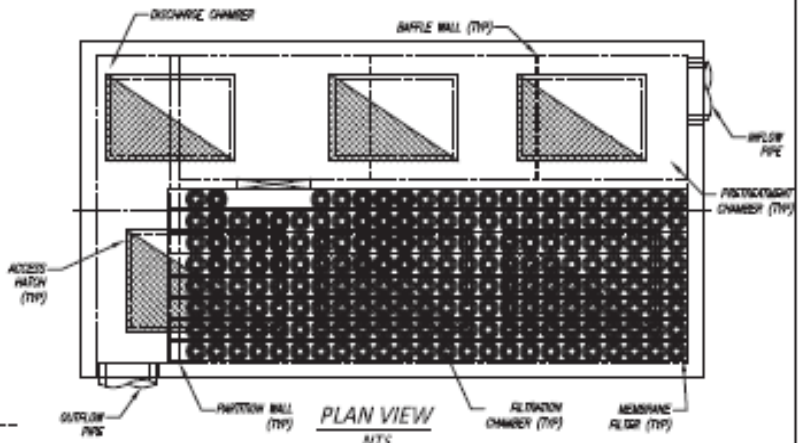
SITE SPECIFIC DATA*			
PROJECT NUMBER	4217		
PROJECT NAME	BURNITT COMMERCIAL		
PROJECT LOCATION	NASHVILLE, TN		
STRUCTURE ID	W01		
WATER QUALITY FLOW RATE (CFS)			3.50
PEAK FLOW RATE (CFS)			OFFLINE
PEAK STORM DURATION (YEARS)			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	563.80	RCP	18"
OUTLET PIPE 1	562.80	RCP	18"
RIM ELEVATION	567.75		
SURFACE LOADING REQUIREMENT			INDIRECT
FRAME AND COVER			(3) 2.5'x4' (3) 3'x5'
CORROSIVE SOIL CONDITIONS			
KNOWN GROUNDWATER ELEVATION			
NOTES: UPSTREAM BYPASS TOP OF WEIR = 565.57'. RECOMMEND VAULT IS RELOCATED APPROXIMATELY 3' EAST TO AVOID HATCH/CURBING CONFLICT *PER ENGINEER OF RECORD			

KF PERFORMANCE DATA	
CARTRIDGE HEIGHT (IN)	30.75
CARTRIDGE FLOW RATE (GPM)	8.50
NUMBER OF CARTRIDGES	188
TOTAL TREATMENT FLOW RATE (CFS)	3.56
SEDIMENT STORAGE CAPACITY (CF)	72.18

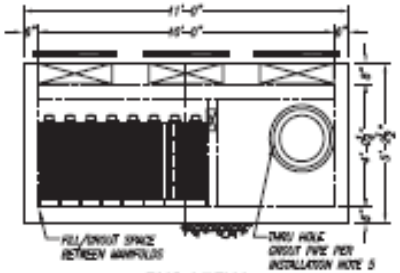
KF STORAGE CAPACITIES				
SEDIMENT CHAMBER CAPACITY				
	LENGTH (FT)	WIDTH (FT)	HEIGHT (FT)	TOTAL (CF)
CHAMBER 1	5.67	4.57	1.50	38.87
CHAMBER 2	11.48	4.57	0.50	26.23
FILTRATION CHAMBER CAPACITY*				
CHAMBER 1	13.67	2.88	0.25	3.54
CHAMBER 2	13.67	2.88	0.25	3.54
*VOLUME OF FILTERS SUBTRACTED IN STORAGE CAPACITY				



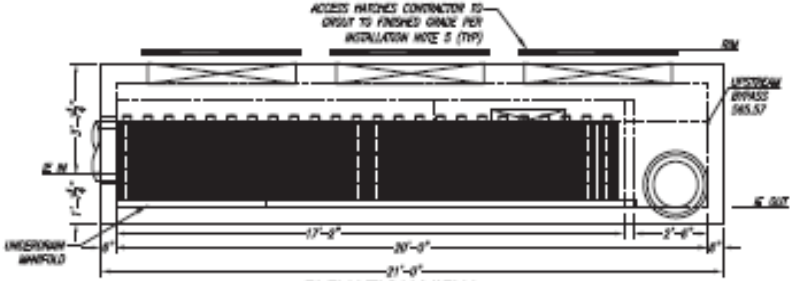
PLAN VIEW
NTS


PRETREATMENT CHAMBER SECTION
NTS

Kraken A – 10 x 20



END VIEW
NTS



ELEVATION VIEW
NTS

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS, AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE KRAKEN UNIT AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. MANUFACTURER RECOMMENDS A 6"-12" LEVEL ROCK BASE, UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH).
4. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. ALL COVERS SHALL BE SHIPPED LOOSE. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.

GENERAL NOTES

1. BIO CLEAN TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS, AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS, AND ACCESSORIES PLEASE CONTACT BIO CLEAN.

BIO CLEAN ENVIRONMENTAL SERVICES, INC.
bioclean@environmental.com
P 760.433.7640 F 760.433.3176

KF-10-20
MEMBRANE FILTRATION SYSTEM WITH PRETREATMENT
STANDARD DETAIL

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Diversion Structure-A3

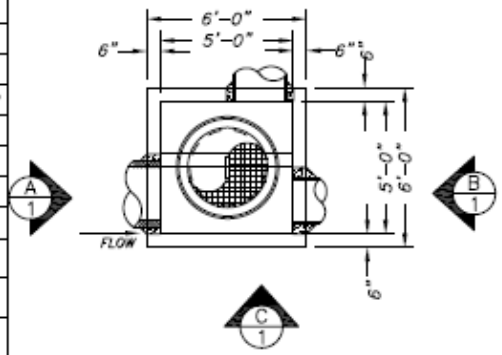
SITE SPECIFIC DATA			
PROJECT NUMBER		4217.00	
PROJECT NAME		BURKITT COMMONS COMMERCIAL	
PROJECT LOCATION		NASHVILLE, TN	
STRUCTURE ID		A3	
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	562.30	N/A	18"
INLET PIPE 2	N/A	N/A	N/A
DIVERSION	562.30	N/A	18"
OUTLET PIPE	562.30	N/A	24"
RIM ELEVATION	567.06		
SURFACE LOAD	INDIRECT		
FRAME & COVER	ø36"		
TOP OF WEIR		563.37	
BOTTOM ELEVATION		561.80	

NOTES: INVERTS/PIPE SIZE RECOMMENDATIONS, TO VERIFY WITH EOR.

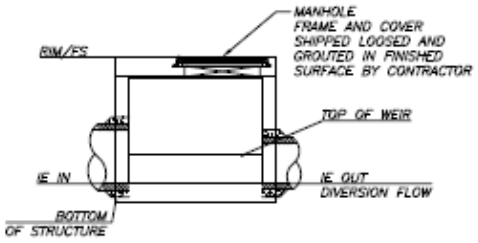
BIO CLEAN DIVERSION WEIR STRUCTURE

MODEL: BC-DS-5-5

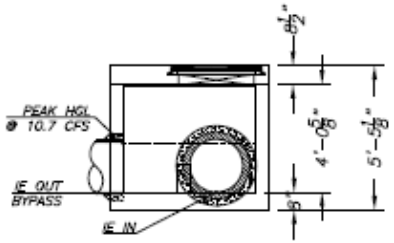
APPROVED BY ENGINEER



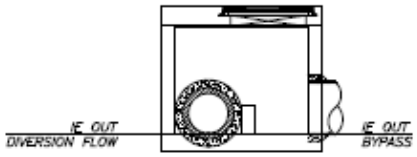
PLAN VIEW



VIEW C



VIEW A



VIEW B

Notes:
1. CONCRETE 28 DAY COMPRESSIVE STRENGTH f'c=5,000 PSI.
2. REINFORCING: ASTM A-615, GRADE 60.
3. SUPPORTS AN H20 LOADING AS INDICATED BY AASHTO.
4. JOINT SEALANT: BUTYL RUBBER SS-S-00210
5. INFLOW/OUTFLOW PIPE INVERTS MUST BE INSTALLED TO ELEVATIONS SHOWN ON THIS DRAWING/PLANS.
6. INFLOW/OUTFLOW PIPES CANNOT PROTRUDE BEYOND INSIDE WALL OF STRUCTURE.

PATENTED
AND PATENTS PENDING

BIO CLEAN ENVIRONMENTAL
PO BOX 869, OCEANSIDE, CA
P 760.433.7640 F 760.433.3179
BIO CLEAN DIVERSION WIER
MODEL: BC-DS-5-5
DATE: 12/02/07 SCALE: - NTS
DRAFTER: UNITS - FEET-INCHES

BIO CLEAN ENVIRONMENTAL SERVICES, INC.

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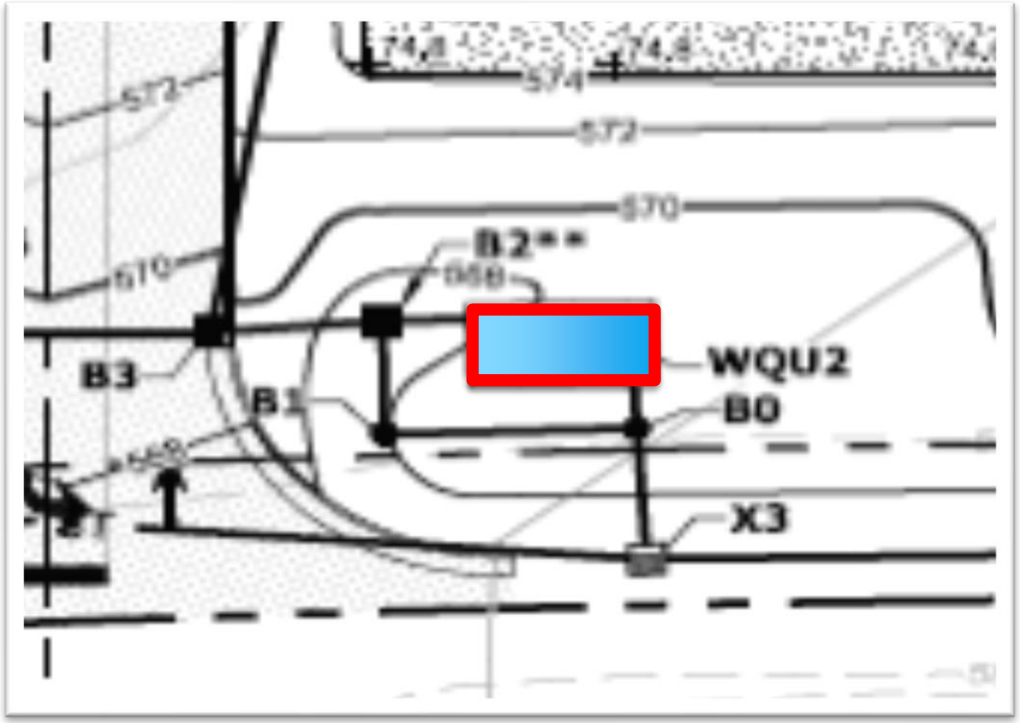
Basin B- Stayed Same



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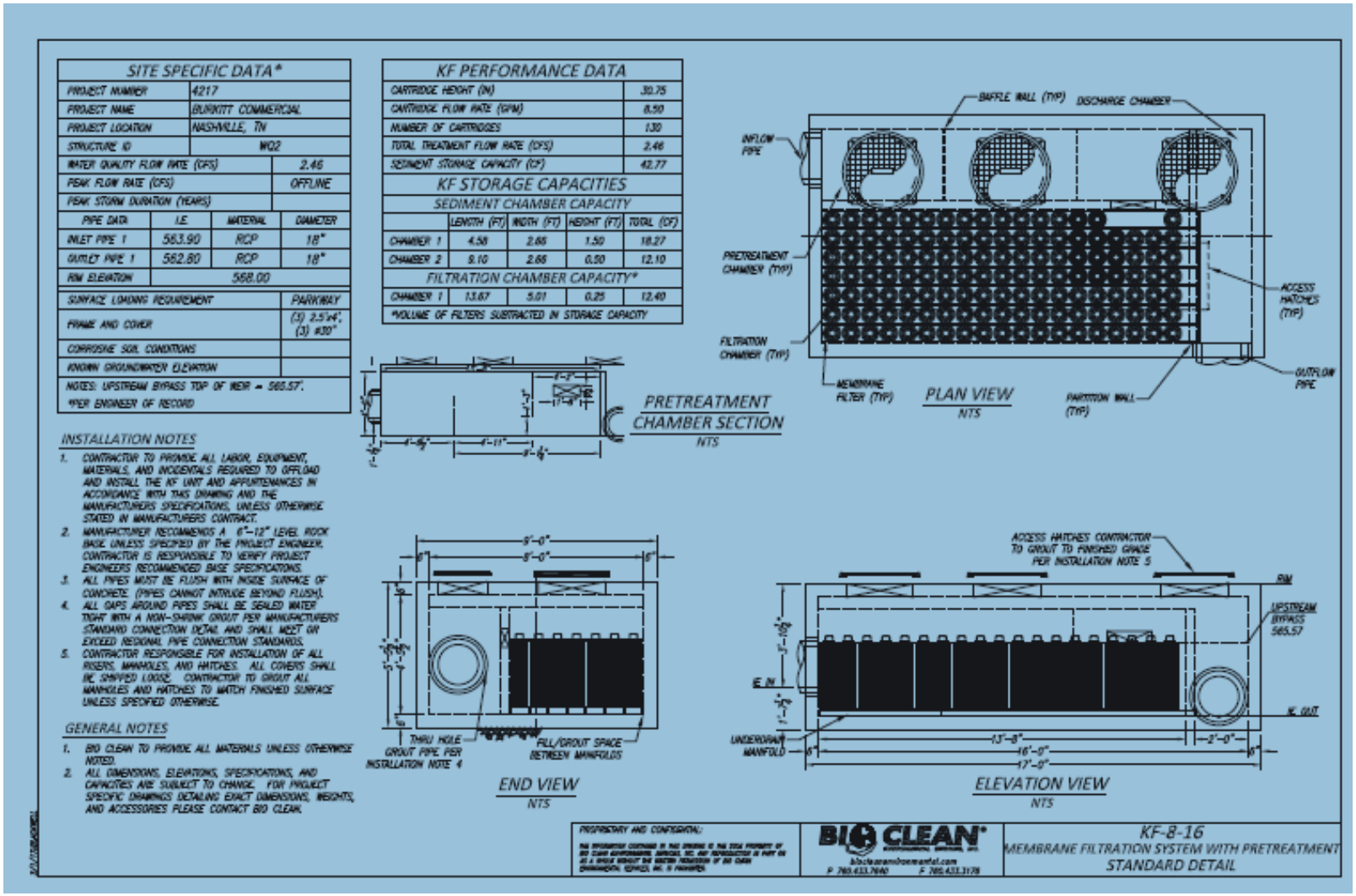
Kraken B - 8 x 16



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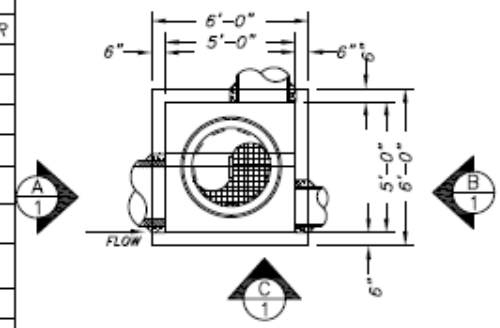
Diversion Structure-B2

SITE SPECIFIC DATA			
PROJECT NUMBER		4217.00	
PROJECT NAME		BURKITT COMMONS COMMERCIAL	
PROJECT LOCATION		NASHVILLE, TN	
STRUCTURE ID		B2	
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	563.80	N/A	15"
INLET PIPE 2	N/A	N/A	N/A
DIVERSION	563.80	N/A	15"
OUTLET PIPE	563.80	N/A	24"
RIM ELEVATION	568.00±		
SURFACE LOAD	PARKWAY		
FRAME & COVER	ø36"		
TOP OF WEIR		565.37	
BOTTOM ELEVATION		563.30	
NOTES: INVERTS/PIPE SIZE RECOMMENDATIONS, TO VERIFY WITH EOR.			

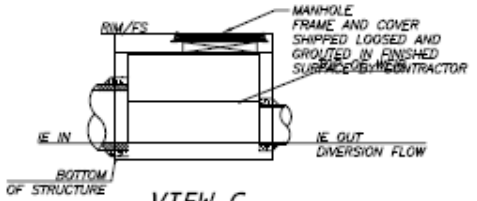
BIO CLEAN DIVERSION WEIR STRUCTURE

MODEL: BC-DS-5-5

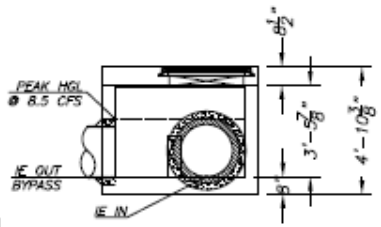
APPROVED BY ENGINEER



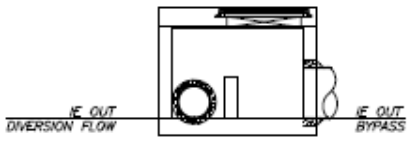
PLAN VIEW



VIEW C



VIEW A



VIEW B

PATENTED AND PATENTS PENDING

Notes:
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2. REINFORCING: ASTM A-615, GRADE 60.
3. SUPPORTS AN H20 LOADING AS INDICATED BY AASHTO.
4. JOINT SEALANT: BUTYL RUBBER SS-S-00210
5. INFLOW/OUTFLOW PIPE INVERTS MUST BE INSTALLED TO ELEVATIONS SHOWN ON THIS DRAWING/PLANS.
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P 760.433.7640 F 760.433.3179
BIO CLEAN DIVERSION WIER
MODEL: BC-DS-5-5
DATE: 12/02/07 SCALE: - NTS
DRAFTER: UNITS - FEET-INCHES

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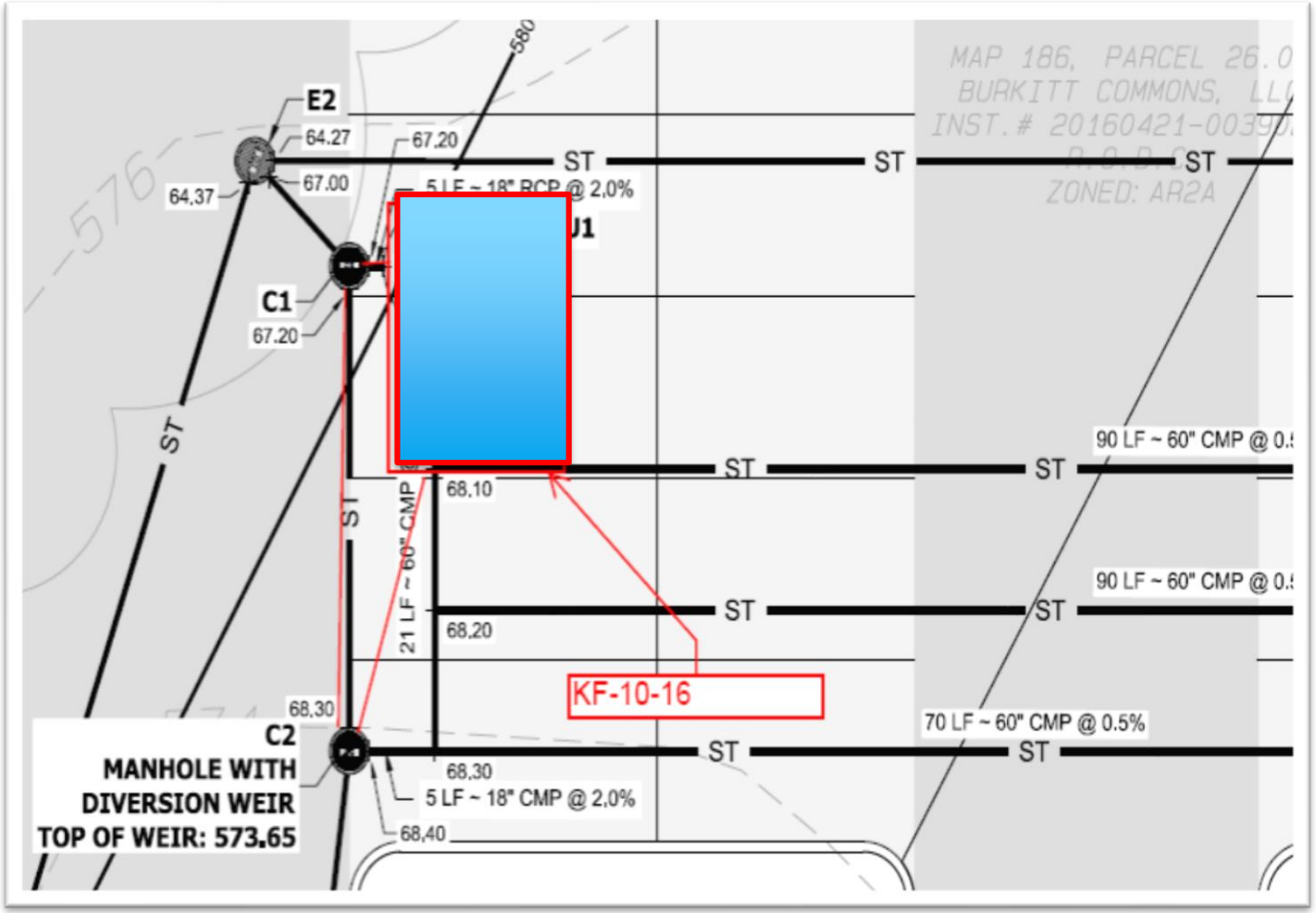
BASIN C- After - Flow Based



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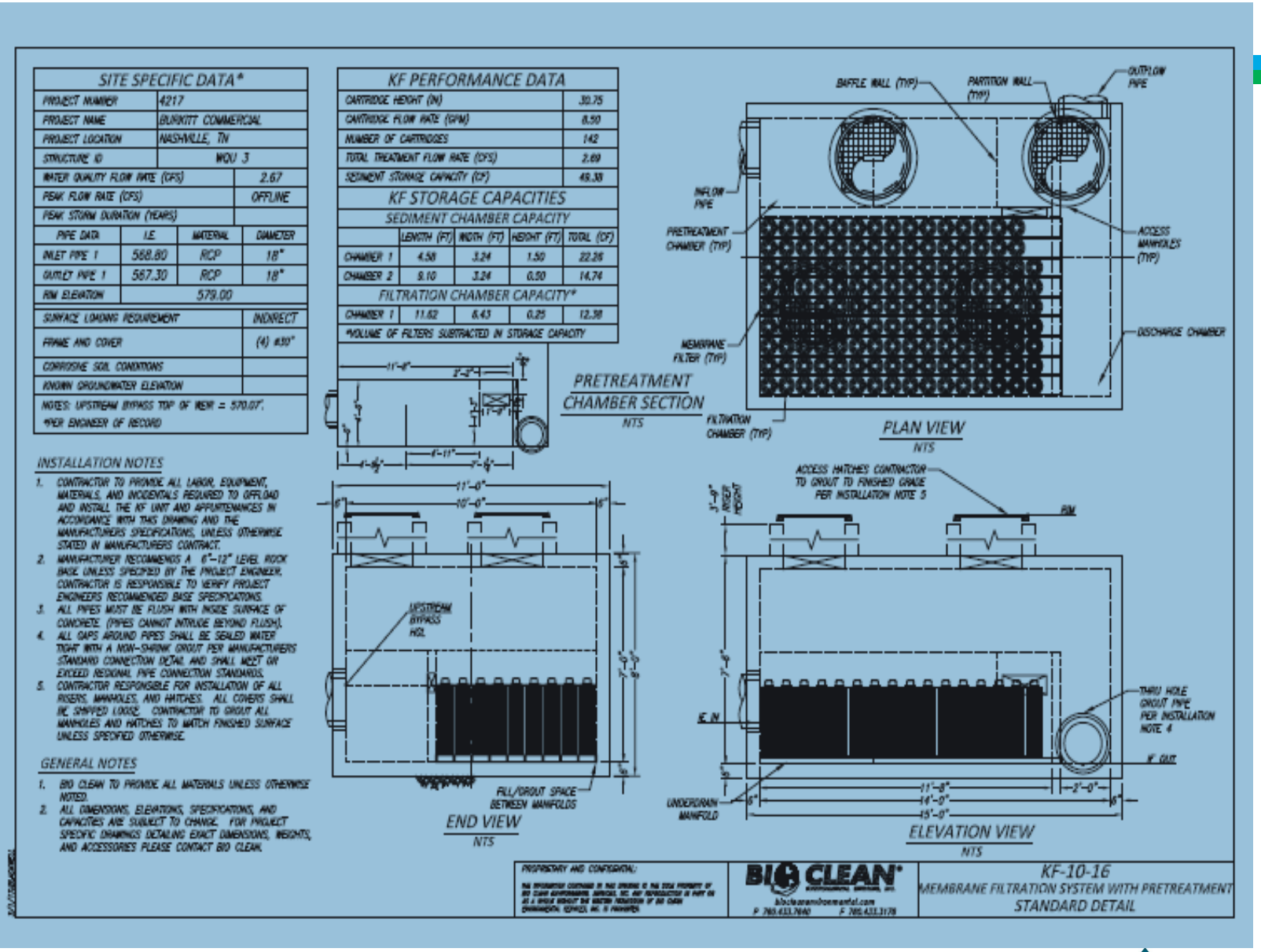
Kraken C- 10 x 16



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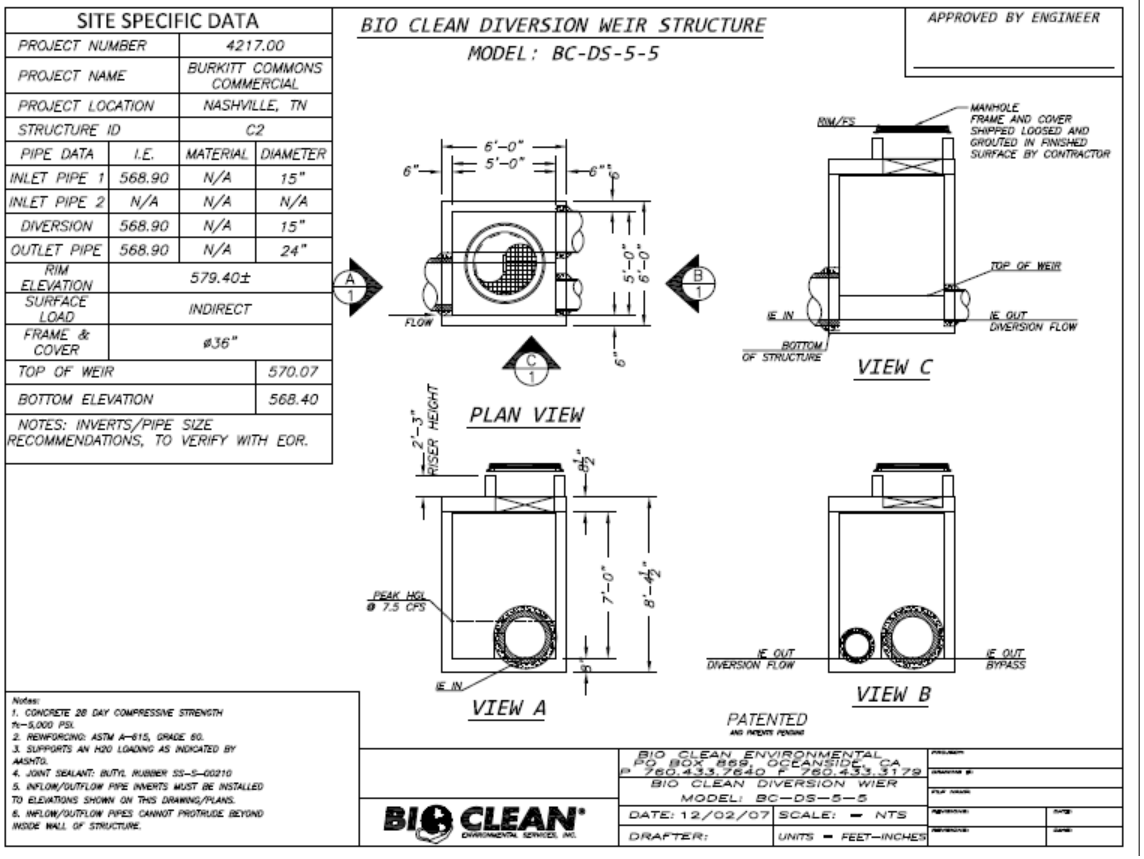
Diversion Structure-C2



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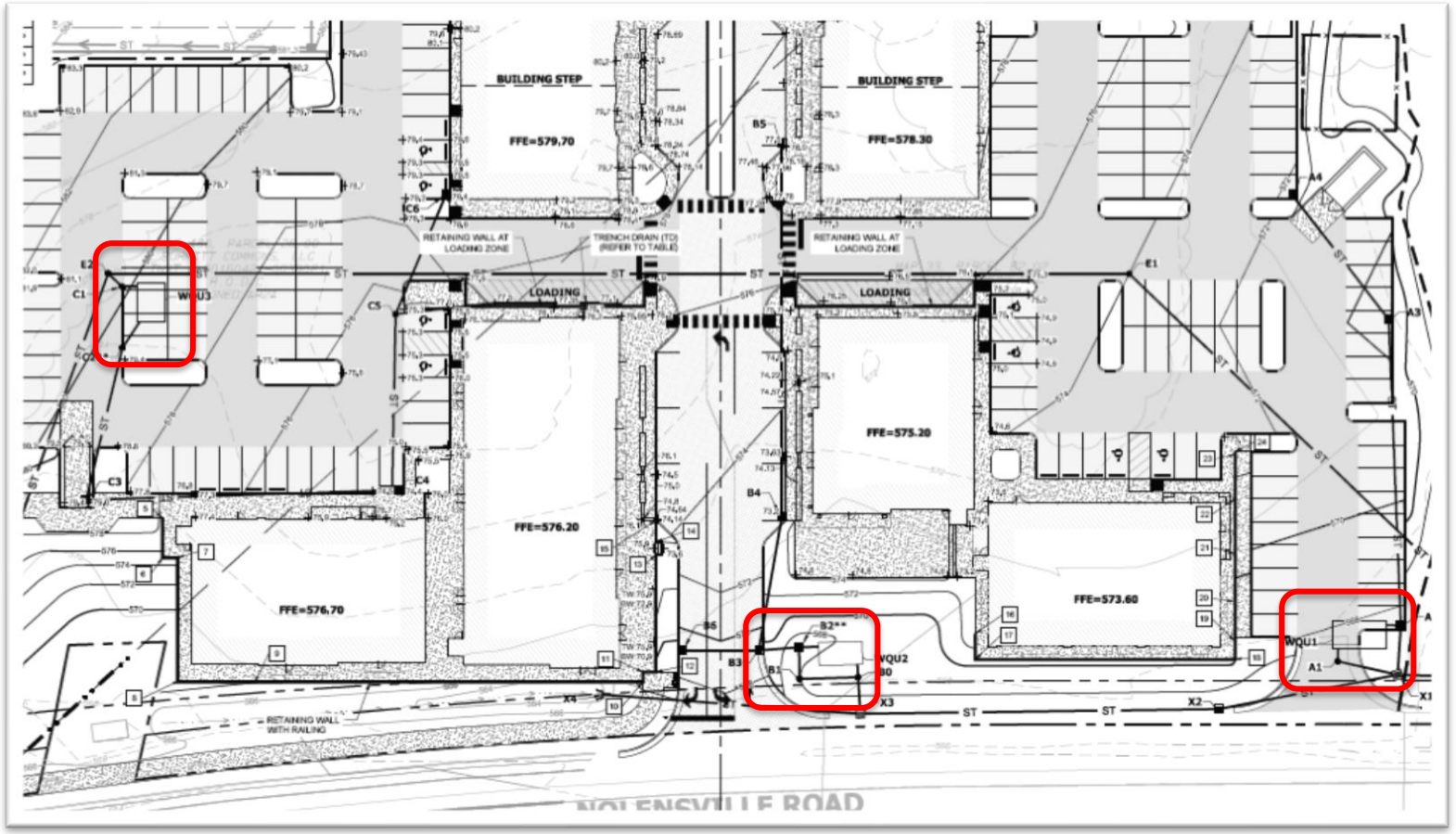
AFTER- Flow Base- Saving $$$



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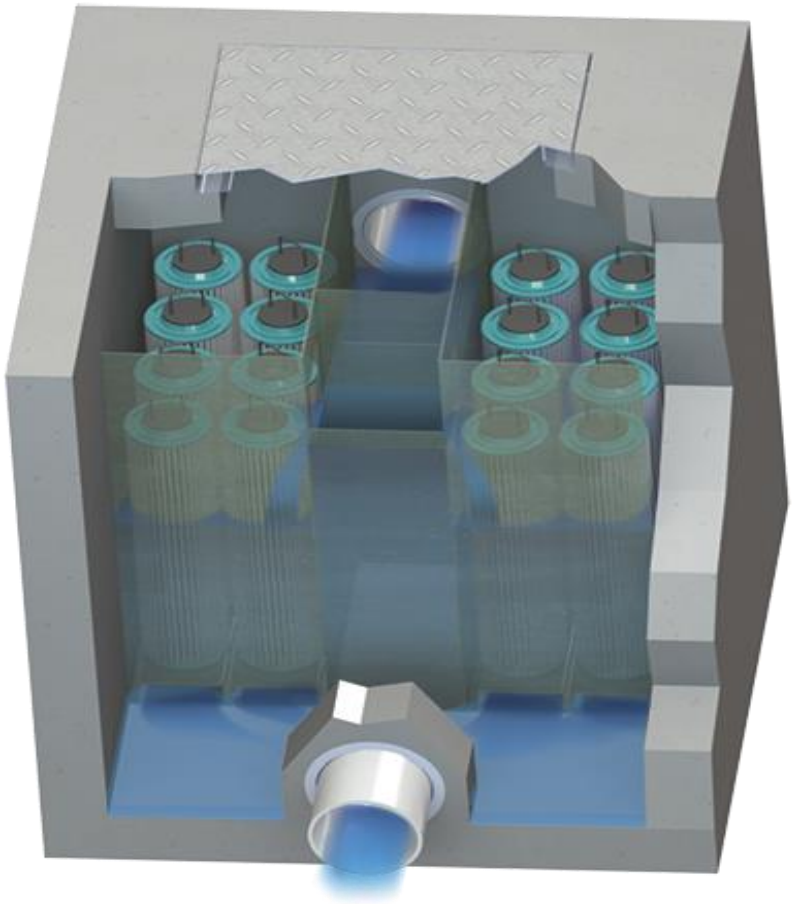
Why Kraken?

- Others were reviewed!

- Kraken only filter technology w/ internal bypass
- Easiest and lowest maintenance costs !

Kraken Filter (membrane filtration)



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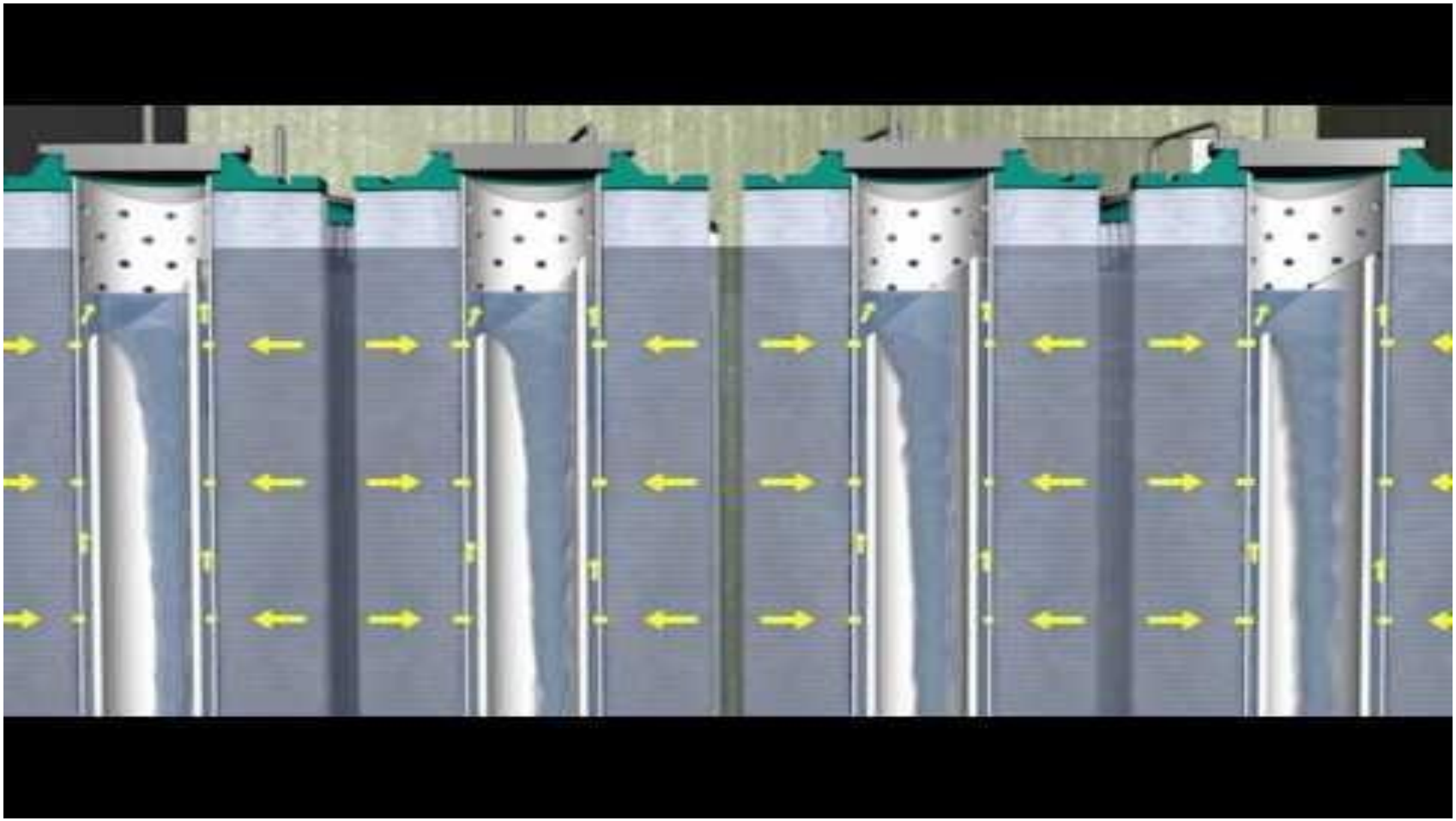

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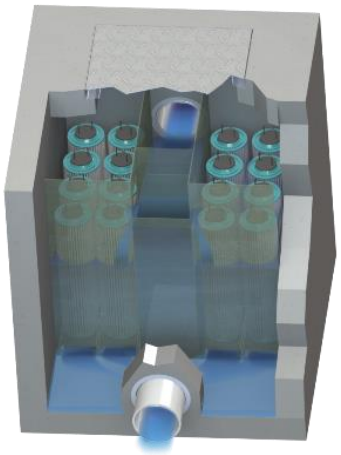
Kraken Filter (membrane filtration)

Agency	Product	Type	Date
WA DOE	Kraken	GULD 80% TSS, 50% TP	2017
NJCAT/NJDEP	Kraken	80% TSS	2016
City of Nashville, TN	Kraken	Accepted; 80% TSS Removal	2016

State of Washington TAPE GULD Basic Phosphorus

Conditional Use

Level Approval



DEPARTMENT OF ENVIRONMENTAL PROTECTION NEW JERSEY

NJCAT Corporation for Advanced Technology

FORTERRA

BioClean

Kraken Filter

- ADVANTAGES -

- Low Maintenance Costs
- No Media to Replace
- Washable & Reusable Cartridges
- Smallest Footprint of Any System
- No Sump Chamber as with Tentacle Type Systems

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Kraken Filter (membrane filtration)

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Bio Clean


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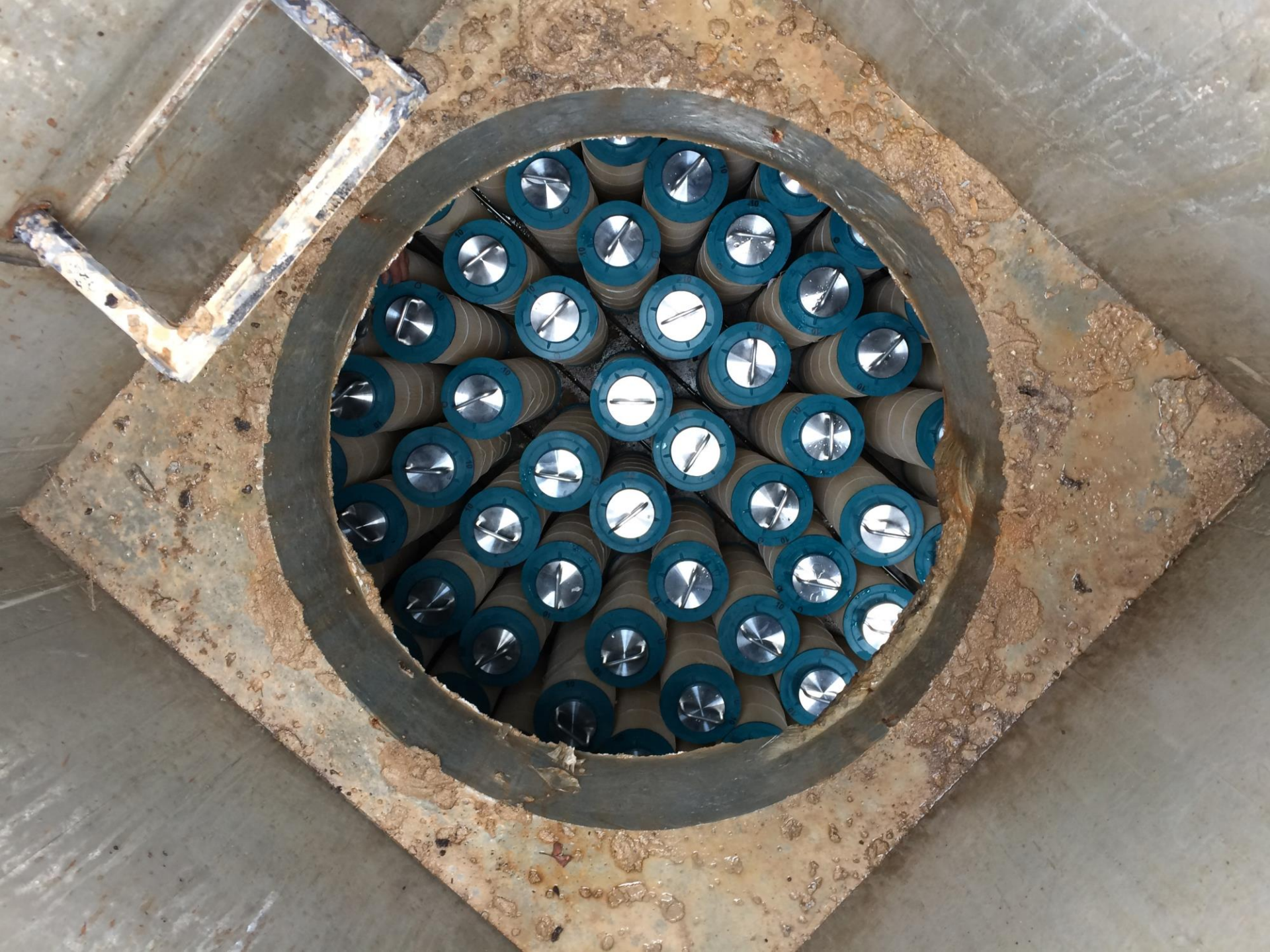
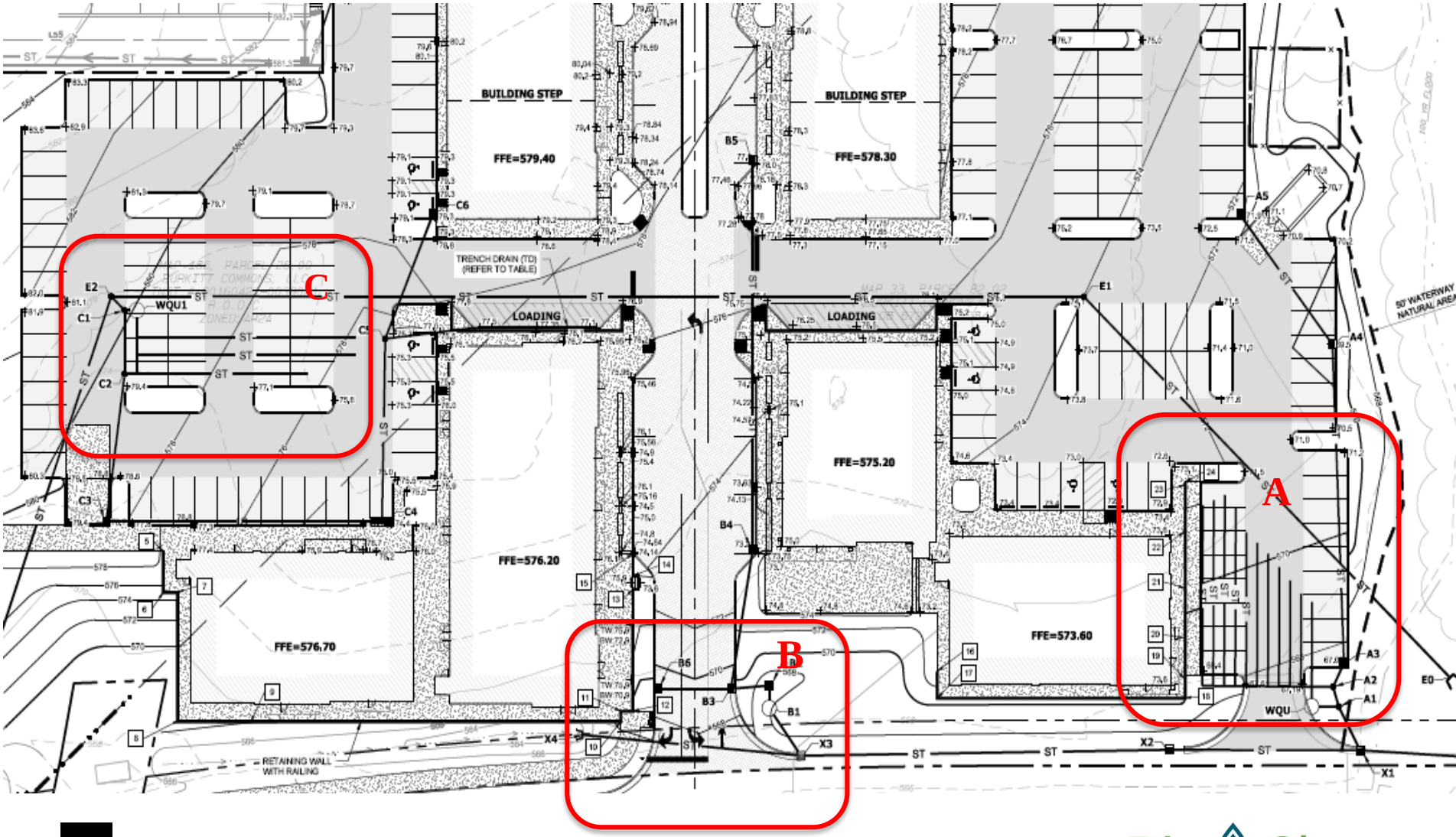


Burkitt Commons-Before-Volume Based



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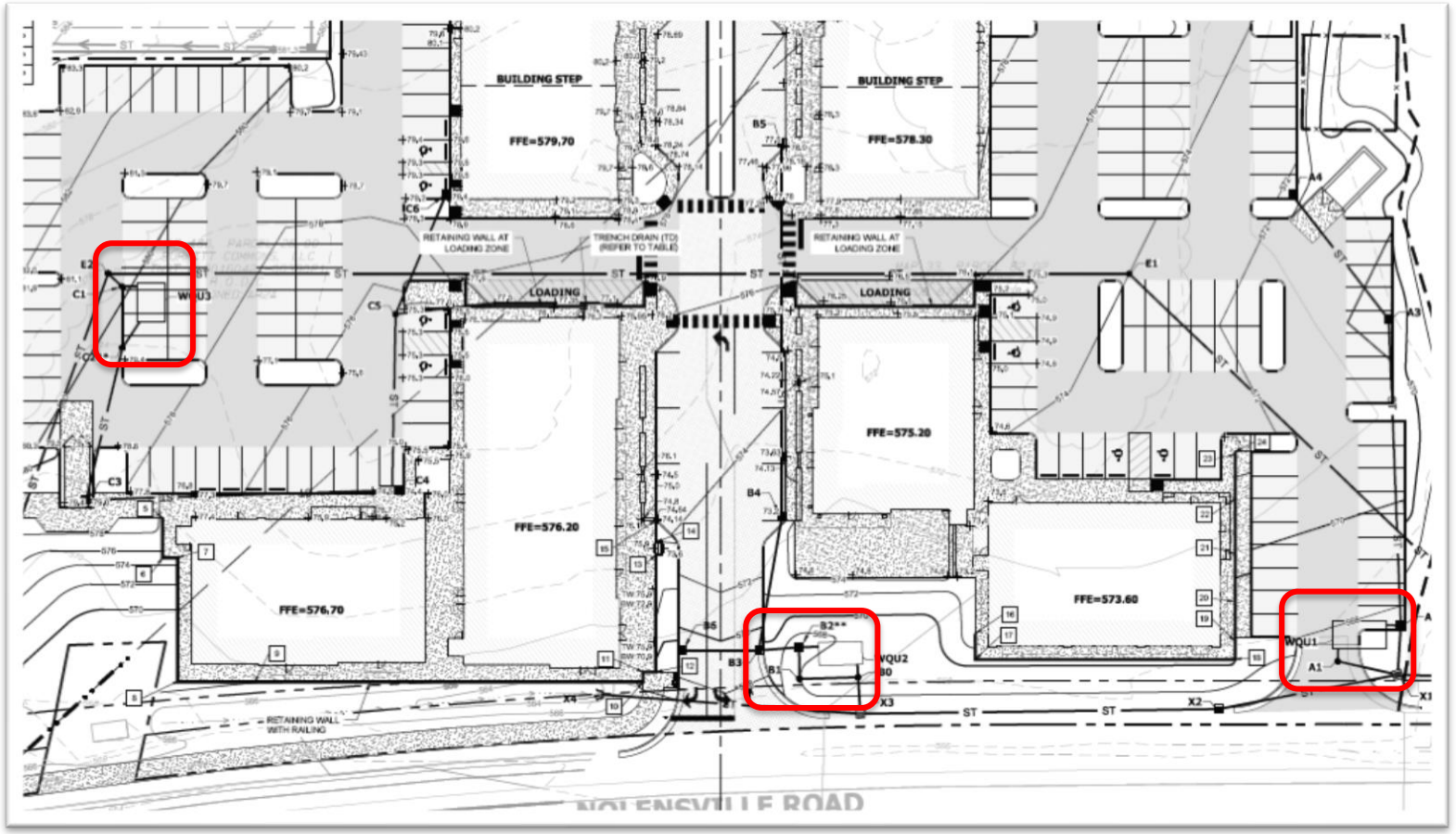
AFTER- Flow Base- Saving $$$



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Take Away

- Eliminated Costly Underground Storage
  - Expensive limestone rock blasting/hammering digging
  - OSHA- confined space entry (CMP multi barrel entry)
  - Expensive - media replacement & shipping
  - Dangers of Flexible piping under parking lot

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Pipe Chambers Eliminated-
Expensive Rock Excavation Eliminated

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Questions & Answers

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