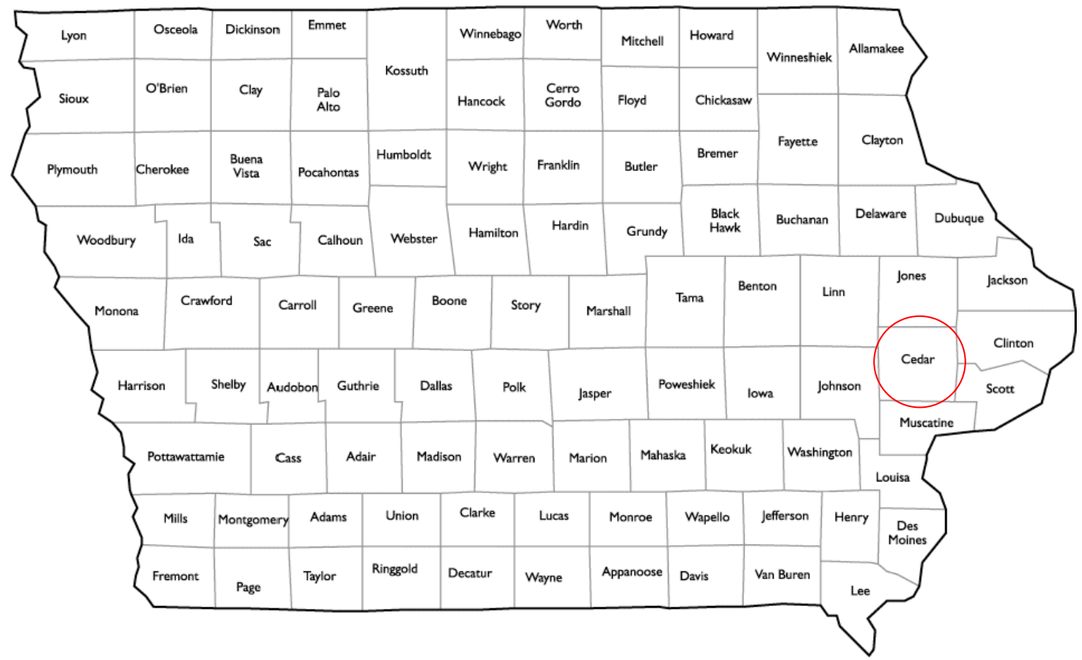
SATURATED BUFFER CONSTRUCTION PLANS

CEDAR CO, IOWA

SECTION 18 - T79N - R4W



INDEX OF SHEETS

811 Know what's below. Call before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

6/30/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

ENGINEERING CLASS 2

		DATE
DESIGNED BY	ANDREW MACKRILL	6/27/2023
DRAWN BY	ANDREW MACKRILL	6/27/2023
CHECKED BY	ANDY CRAIG, PE, TSP	6/30/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 6

Staking Control Points(NAD 1983 State Plane Iowa South US Survey Feet)				
Point	Description	Northing	Easting	Elevation
1	WCS	607684.1	2228485.8	594.5
2	Distribution Line	608194.2	2228503.6	596.3
3	Distribution Line	608023.3	2228497.2	595.2
4	Distribution Line	607867.1	2228492.2	595.4
5	Distribution Line	607491.7	2228480.4	593.6
6	Distribution Line	607294.6	2228475.1	593.3
7	Benchmark	605598.3	2228463.9	595.6

PLAN VIEW

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 605598.3
Easting: 2228463.9
Elevation: 595.6
Note: Benchmark is along the road in the southern part of the field

0 100 200 Feet

N

Legend

- Proposed 6" Perforated CPT Distribution Line
- Proposed 6" Non-Perforated CPT
- Proposed 6" CMP Outlet
- Existing 6" CPT Main
- Proposed Water Control Structure
- 2' Contours
- Staking Point

8+99.94
8+00.00
7+00.00
6+00.00
5+00.00
4+00.00
3+00.00
2+00.00
1+00.00
0+00.00
0+00.00 30.94

1 2 3 4 5 6

Existing 6" Tile

Buffer Cross Section, See Sheet 3

New 6" CMP Outlet With Rodent Guard

900' of 6" CPT at 0.0% Grade

DESIGNED BY ANDREW MACKRILL 6/27/23
DRAWN BY ANDREW MACKRILL 6/27/23
CHECKED BY ANDY CRAIG, PE, TSP 6/30/23
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DATE

PLAN MAP

ESE Ecosystem Services Exchange Valuing Conservation

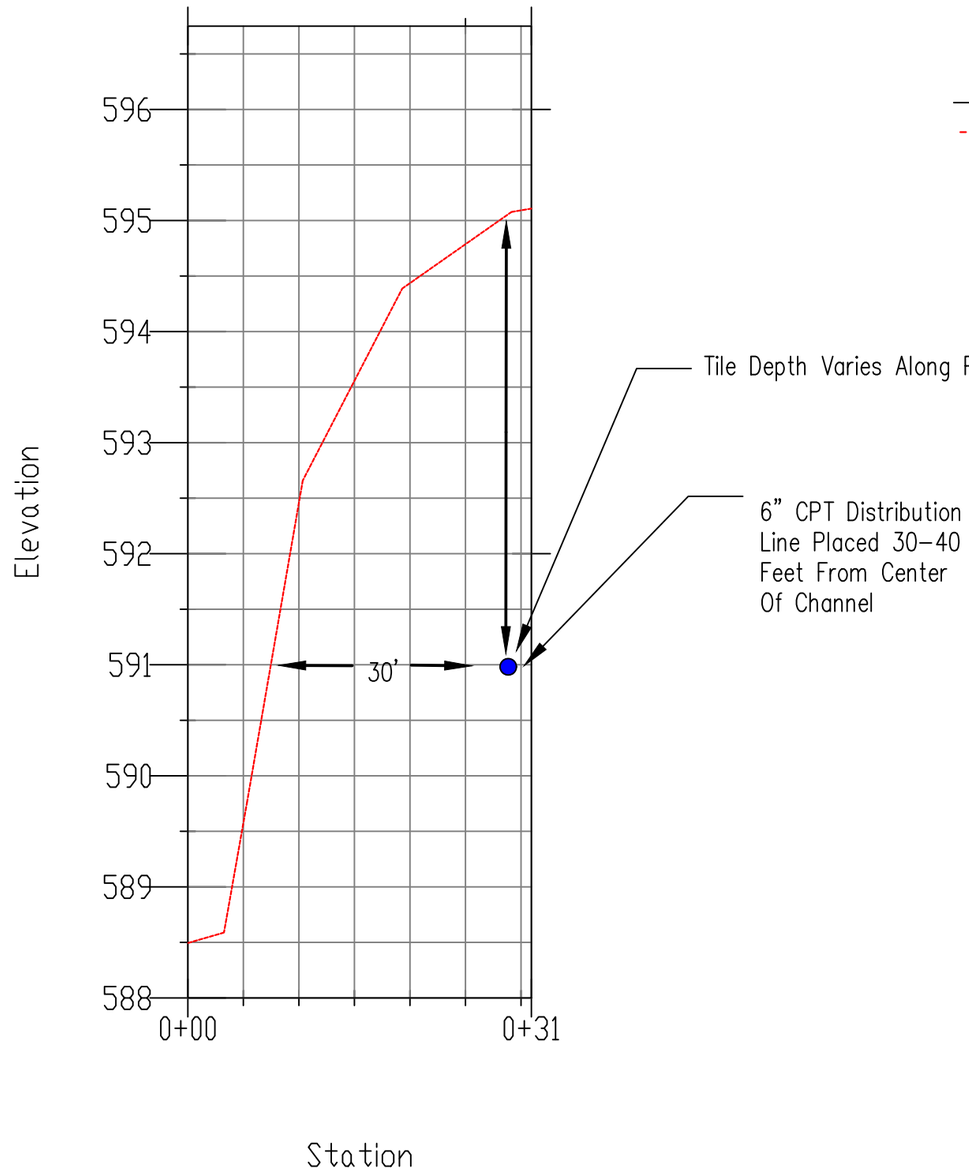
FILE NAME

DRAWING SET
SHEET 2 OF 6

LANDOWNER

LOCATION SECTION 18 - T79N - R4W

Cross-Section



LANDOWNER		LOCATION	SECTION 18 - T79N - R4W

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CHECKED BY ANDY CRAIG, PE, TSP 6/30/23
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DATE

BUFFER AND BANK CROSS SECTION

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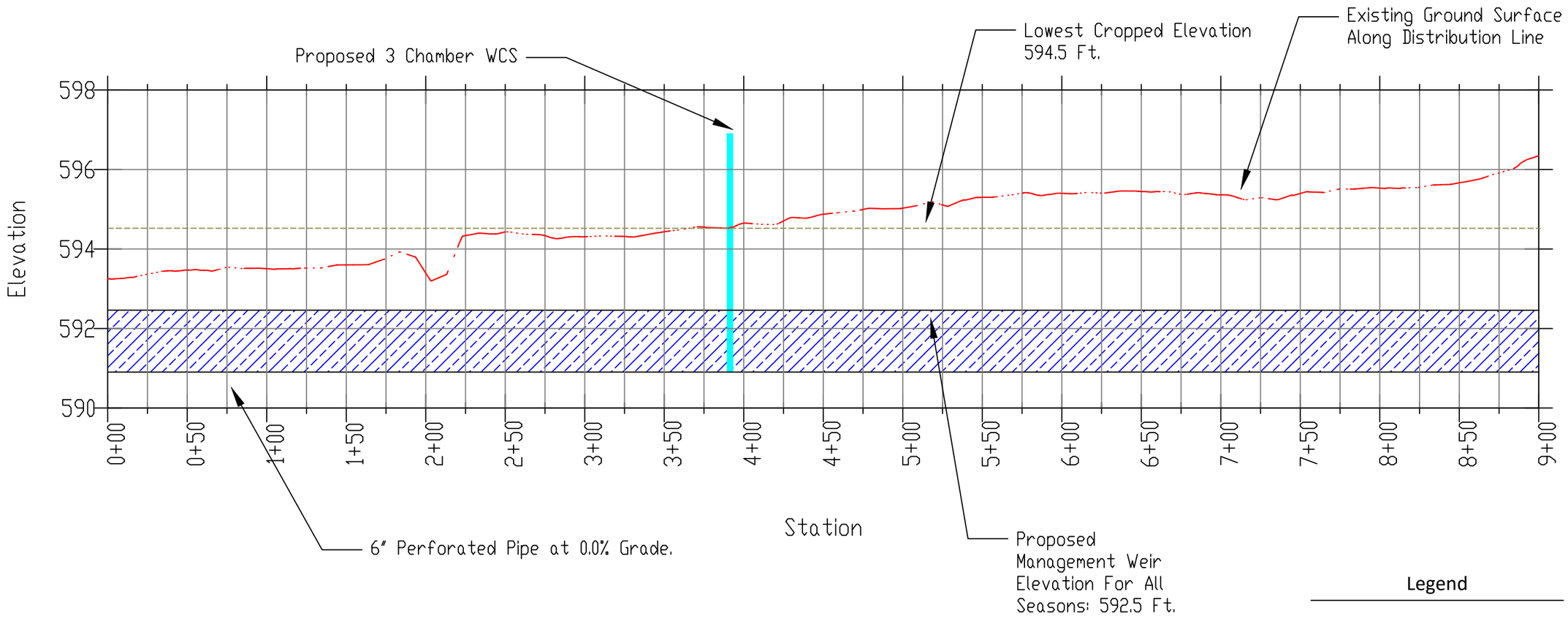
FILE NAME
'

DRAWING SET
SHEET 3 OF 6

Profile Along Distribution Line



Legend

- All Season Water Table
- Proposed Water Control Structure
- Proposed 6" CPT Distribution Line
- Existing Ground Surface
- Lowest Farmed Elevation

LANDOWNER	[illegible]	LOCATION	SECTION 18 - T79N - R4W

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PROFILE ALONG DISTRIBUTION LINE

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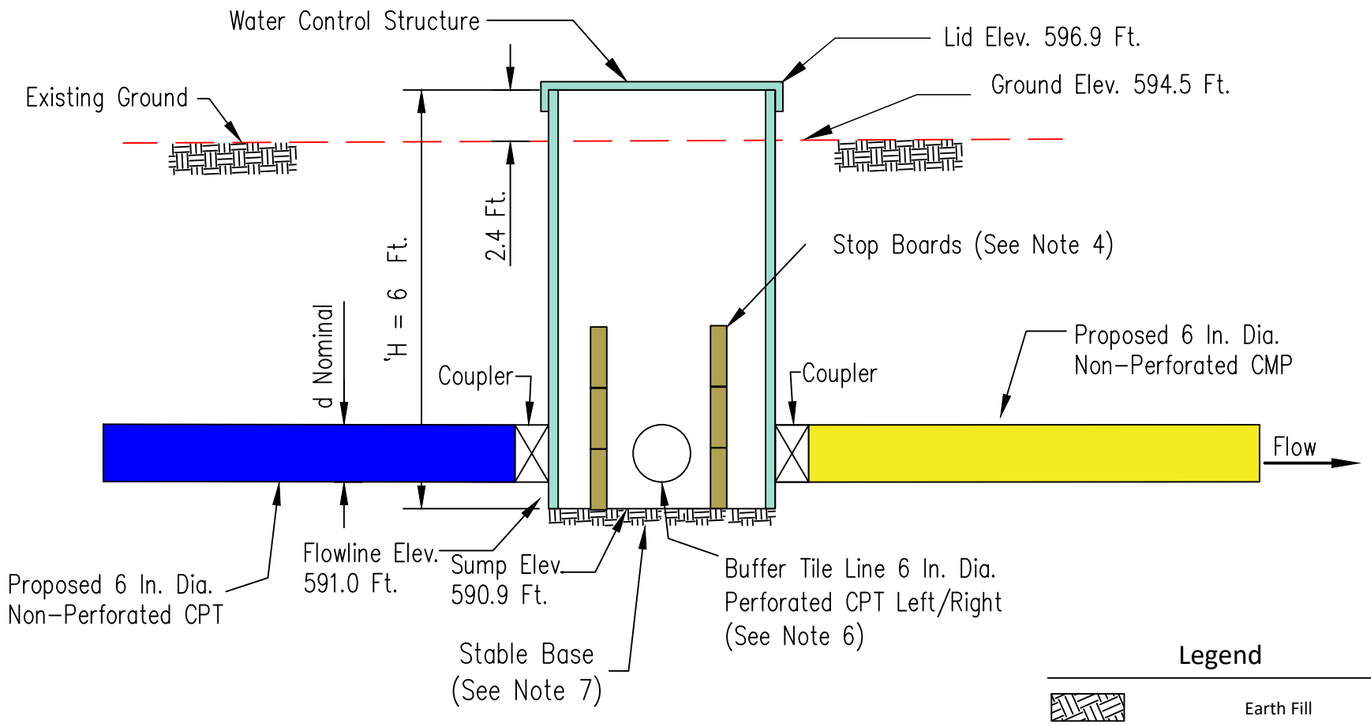
Valuing Conservation

FILE NAME

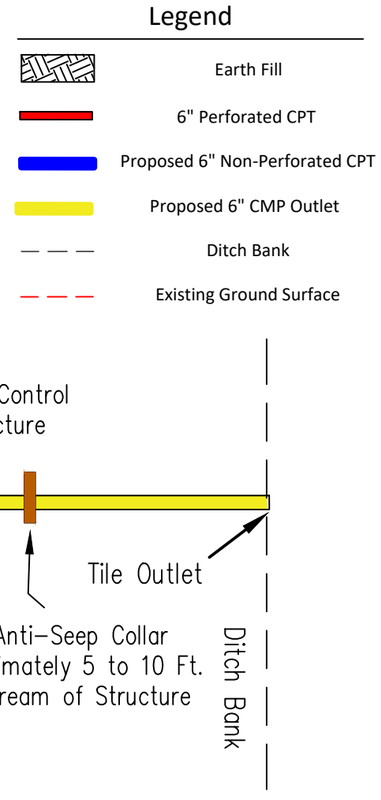
DRAWING SET
SHEET 4 OF 6



TYPICAL SECTION

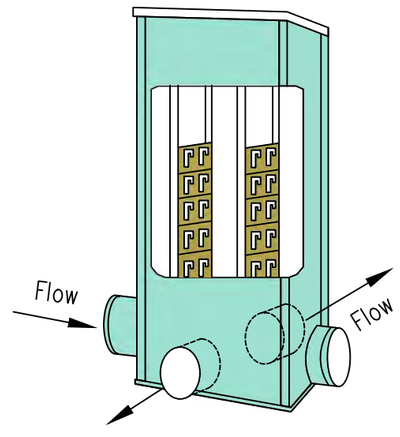
QUANTITIES*		NRCS SPEC
Water Control Structure 3– Compartment H = 6 ft. d = 6 in.	1	IA-21, IA-26, CPS-587
6" Non-perforated Pipe (ft)	20	IA-21, IA-45
6" CMP Outlet Pipe with Rodent Guard (ft)	35	IA-604, IA-620
6" Perforated CPT (ft) Buffer Tile Line	900	IA-21, IA-45, IA-46
3'x3' Anti Seep Collar	1	CPS-587

*Quantities Do Not Include Couplers



PLAN

NOTES:
1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, both upstream, and downstream. Pipe shall be PVC, dual–wall PT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745.
3. Couplings between the water control section and the non–perforated tile shall be water tight.
4. Stop boards shall provide water tight seals under a minimum of 1 foot pressure head.
5. Mark location of structure using steel t–post or manufactured marker flag for safety in the field.
6. Install buffer tile parallel to ditch or stream, according to profile provided with the construction plans. Pipe shall remain on grade and drain towards the WCS.
7. Place structure and pipe coupler on a stable base. A stable base may be compacted earth or compacted fill sand.
8. Excavated material placed around structure and pipes must be hand compacted in 4" lifts.



IN–LINE CONTROL STRUCTURE

LANDOWNER		LOCATION	SECTION 18 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 6/27/23
DRAWN BY ANDREW MACKRILL 6/27/23
CHECKED BY ANDY CRAIG, PE, TSP 6/30/23
APPROVED BY
DATE

3 CHAMBER STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 5 OF 6

CONSTRUCTION NOTES

1. Tile elevations are based Maverick Tile Finder probe depths. A fiberglass cable with imbedded wire is fed into the outlet and located with a utility device. These values may not be exact, but are believed to be accurate. Factors such as sediment in the pipe, flowing water in the pipe, and wire location within the pipe may affect depth readings. Notify ESE at least 48 hours before conducting the investigation so that a qualified ESE representative can be onsite during the investigation.
2. Avoid excessive disturbance of buffers or grassed water ways during construction. If re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded according to NRCS Conservation Practice Standard 342 – Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
3. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion. Contact ESE for assistance with construction inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the existing tile and setting WCS.
   b. Distribution pipe has been laid and capped.
4. Any product planned for use in construction must be approved by ESE prior to construction. Provide documentation to ESE of all materials used in construction, including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths.
   b. Photos and invoices or product information for water control structures.
5. Construction tolerances are +/-0.5ft on distribution line location, and +/-0.1 ft. on all elevations. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by ESE and will be noted in the as-built plan.
6. When installing the distribution line, pay special attention so that other outlets in the buffer are not damaged or broken. Although an investigation of the buffer will have already been completed, not all outlets are able to be located depending on site conditions at the time. If another tile line or outlet is encountered, contact an ESE representative for consultation. They will decide if the tile line is able to be incorporated into the system, or if a section of the distribution line needs to be replaced as non-perforated pipe to prevent water loss.
7. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-604	Saturated Buffer
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 18 - T79N - R4W

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CHECKED BY ANDY CRAIG, PE, TSP 6/30/23
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CONSTRUCTION NOTES

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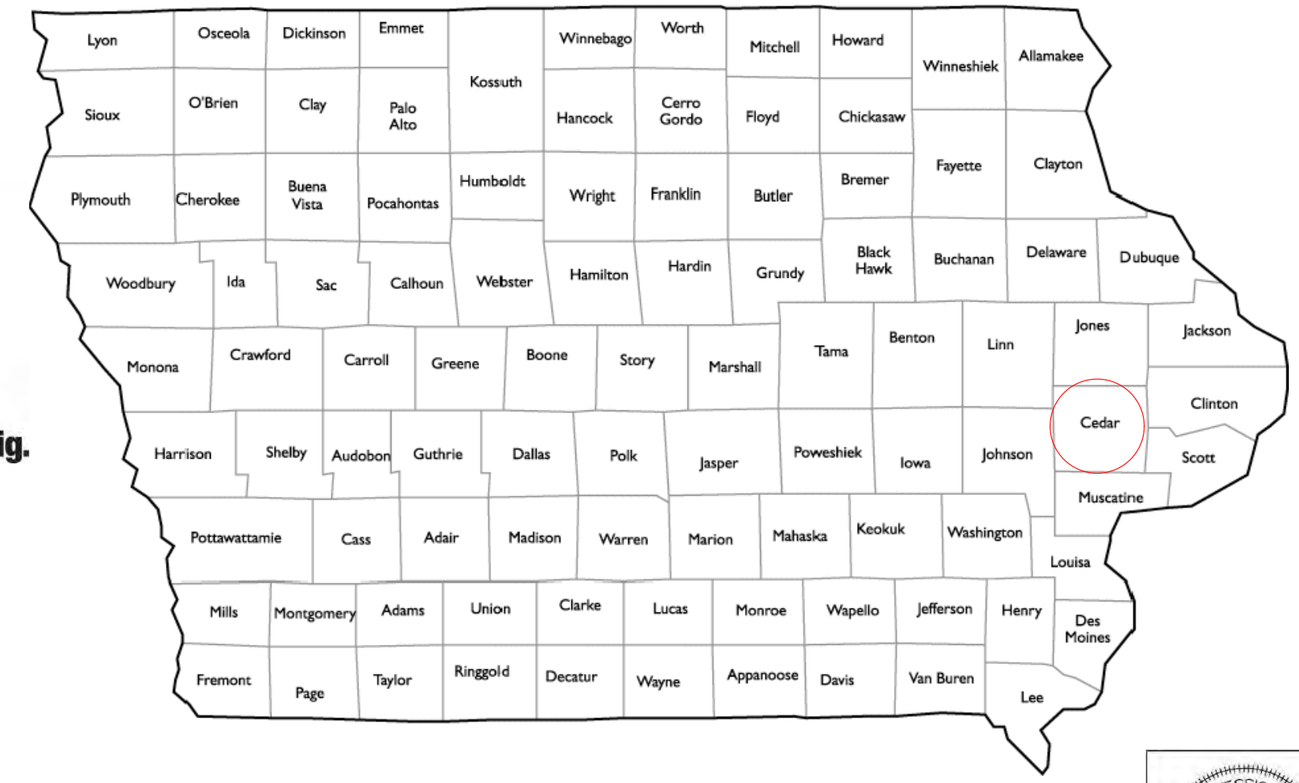
FILE NAME
PA

DRAWING SET
SHEET 6 OF 6

DENITRIFYING BIOREACTOR CONSTRUCTION PLANS

CEDAR COUNTY, IOWA

SECTION 15- T79N - R4W



INDEX OF SHEETS

811 Know what's **below.** **Call** before you dig.

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ENGINEERING CLASS 3

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

8/28/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

		DATE
DESIGNED BY	ANDY MACKRILL, TSP	8/28/2023
DRAWN BY	ANDY MACKRILL, TSP	8/28/2023
CHECKED BY	ANDY CRAIG, PE, TSP	8/28/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 7

Staking Control Points (NAD 1983 State Plane Iowa South US SURVEY FEET)				
Point	Description	Northing	Easting	Elevation
1	Southeast Corner BIO	609875.1	2244512.9	697.8
2	Southwest Corner BIO	609881.9	2244494.0	698.0
3	Northwest Corner BIO	609957.4	2244521.0	697.4
4	Northeast Corner BIO	609950.6	2244539.9	697.5
5	Inlet WCS (3-chamber)	609856.0	2244497.4	697.8
6	Outlet WCS (2-chamber)	609947.9	2244543.3	697.5
7	Benchmark	609751.8	2244469.1	701.9

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 609751.8
Easting: 2244469.1
Elevation: 701.9

0 25 50 Feet

N

Legend

- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 10" CPT Main
- Proposed 10" Non-Perf CPT Main
- Proposed 10" CMP Outlet
- Bioreactor Footprint
- Water Control Structure
- Benchmark
- 2 Foot Contours

1+00.00
0+00.00
0+30.00
0+00.00
1
2
3
4
5
6
7

Approx. Grade 1.2% Connecting to Existing Outlet.

New 10" CMP Outlet With Rodent Guard

DESIGNED BY ANDY MACKRILL 8/28/23
DRAWN BY ANDY MACKRILL 8/28/23
CHECKED BY ANDY CRAIG 8/28/23
APPROVED BY

PLAN MAP

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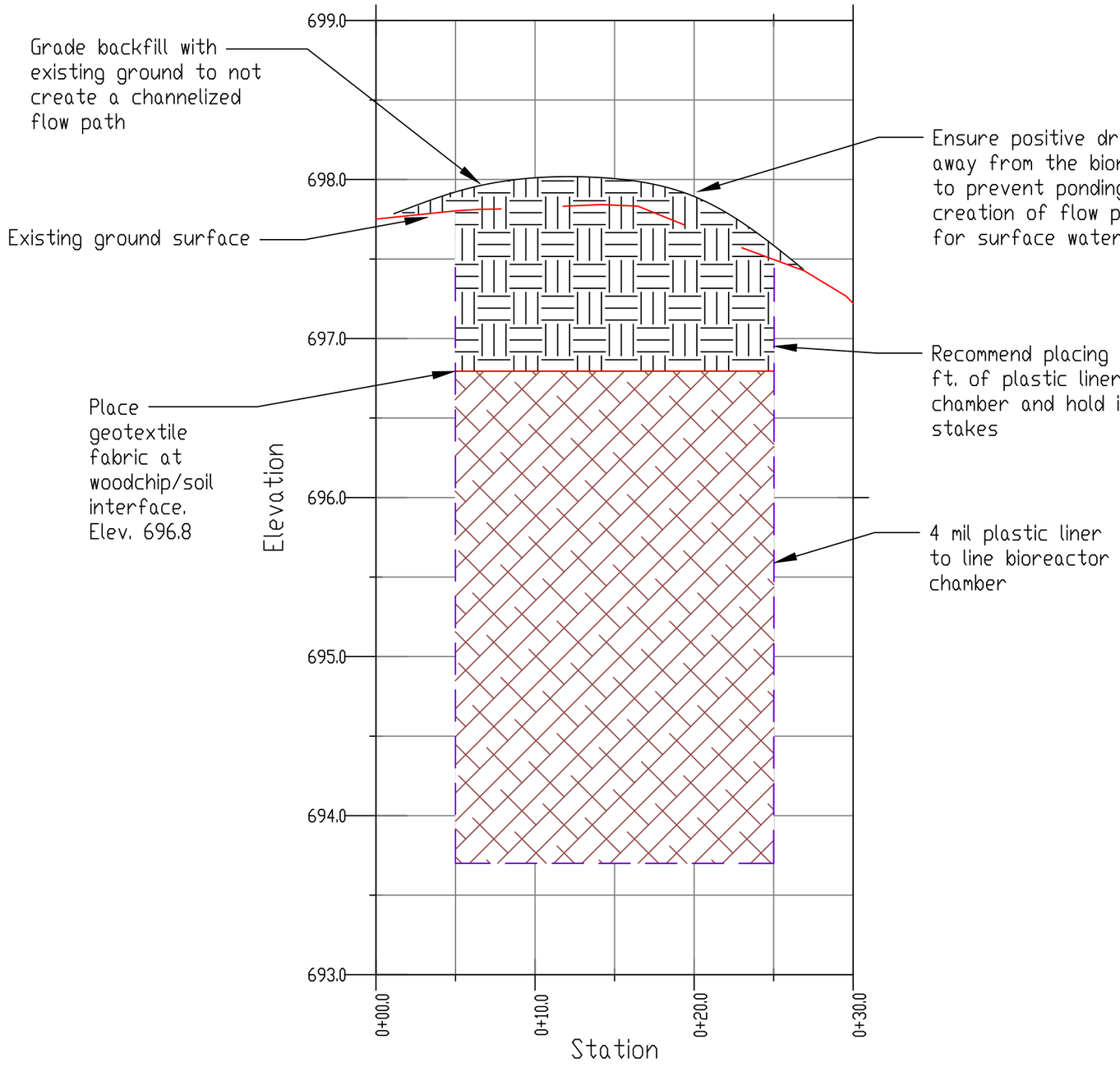
FILE NAME

DRAWING SET
SHEET 2 OF 7

LANDOWNER | LOCATION | SECTION 15 - T79N - R4W

Cross-Section



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface

DESIGNED BY	ANDY MACKFILL
DRAWN BY	ANDY MACKFILL
CHECKED BY	ANDY CRAIG
APPROVED BY	
DATE	8/28/23
DATE	8/28/23
DATE	8/28/23

CROSS SECTION VIEW

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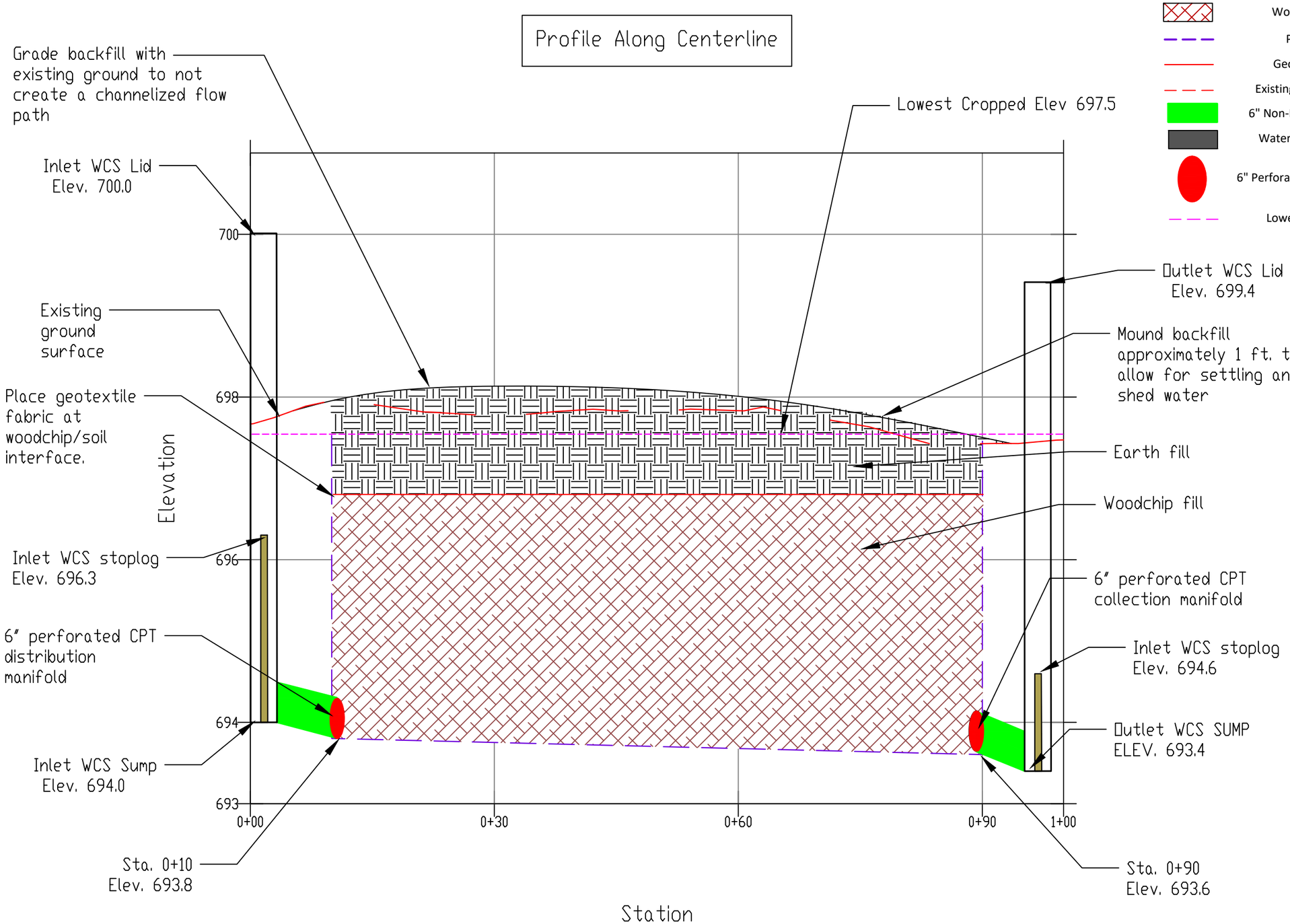
FILE NAME

DRAWING SET

SHEET 3 OF 7

LANDOWNER		LOCATION	SECTION 15 - T79N - R4W

Profile Along Centerline



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- 6" Non-Perforated CPT Pipe
- Water Control Structure
- 6" Perforated CPT Manifold Pipe
- Lowest Cropped Area

DESIGNED BY	ANDY MACKFILL
DATE	8/28/23
DRAWN BY	ANDY MACKFILL
DATE	8/28/23
CHECKED BY	ANDY CRAIG
DATE	8/28/23
APPROVED BY	

PROFILE ALONG CENTERLINE

ESE Ecosystem Services Exchange — Valuing Conservation

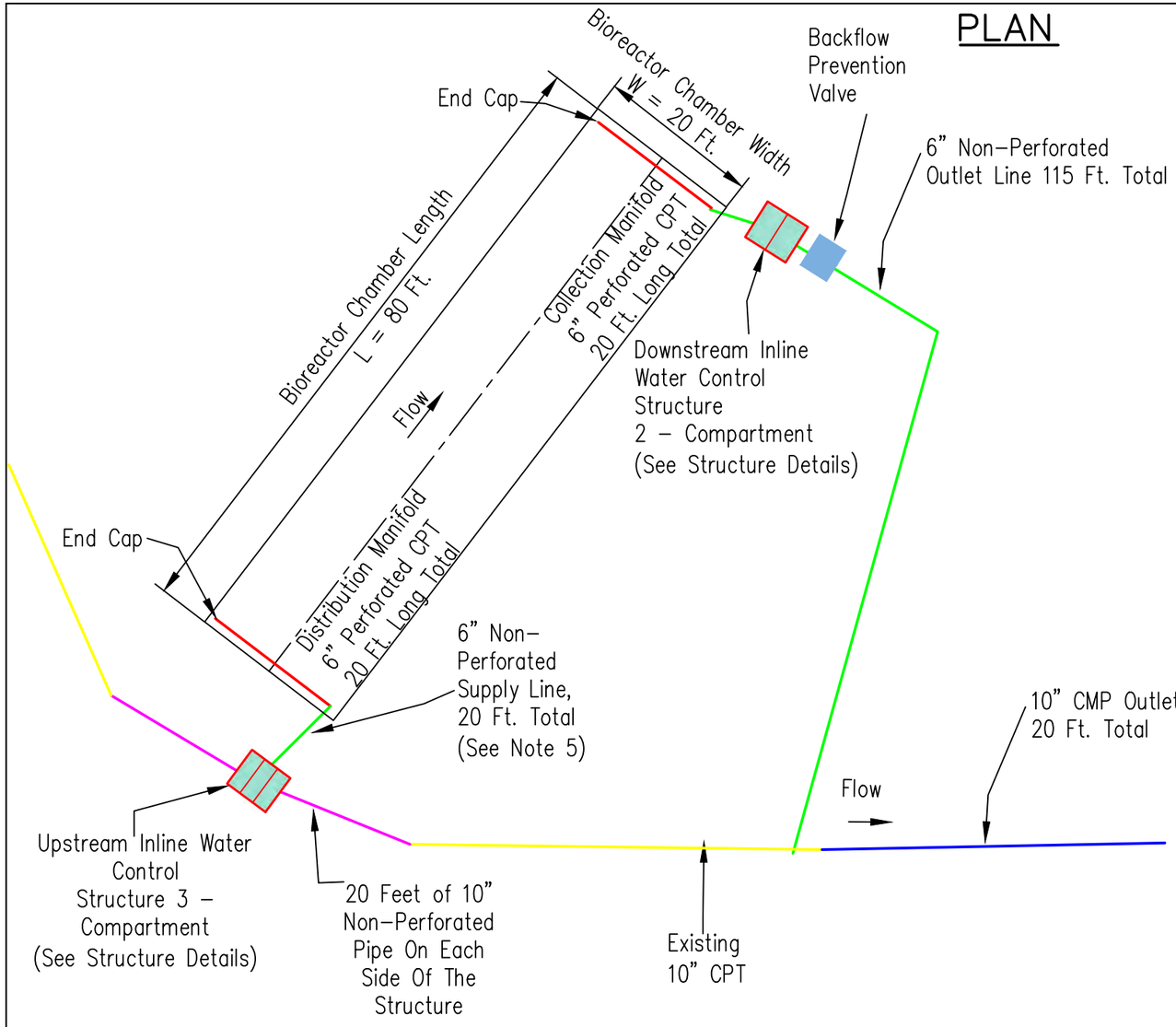
FILE NAME

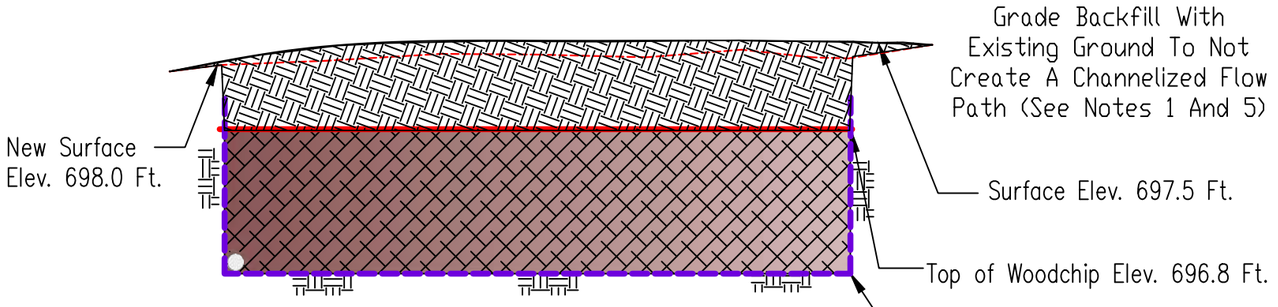
DRAWING SET

SHEET 4 OF 7

LANDOWNER		LOCATION	SECTION 15 - T79N - R4W

PLAN





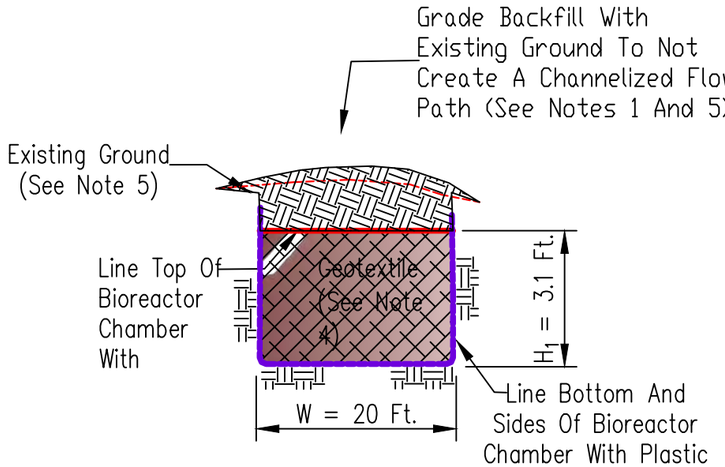
ELEVATION

Legend

- Earth Fill
- Woodchip Media
- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 10" CPT Main
- Proposed 10" CMP Outlet
- Proposed 10" Non-Perforated CPT
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- Bioreactor Footprint

NOTES:

1. All disturbed non-crop construction areas shall be stabilized by seeding or mulching within 14 days of conclusion of construction activities. This seeding and seed mixture shall meet the NRCS Conservation Practice Standard IA-342 (Critical Area Seeding) or other program requirements to replace previous grass stand.
2. Line bottom and sides of bioreactor chamber with plastic, minimum 4 mil thickness. Overlap any splices at least 6 inches. Lap seams in direction of flow so water flows over top of seam. Wrap plastic carefully around tiles that enter/exit the chamber; no need to seal around tiles.
3. Woodchips shall not contain woods known to have tannin, such as oak, cedar, or redwood. Woodchips shall be reasonably free of soil and other contaminants nor contain loose composting materials. Wood chips shall be around 1"long by ½" thick with minimal fines. They shall be processed through a chipper and not through a grinder. Do not use any wood that has been treated for ground contact. ESE has the right to reject any woodchips which do not meet specifications.
4. Geotextile shall be non-woven, Class II, and meet the requirements of Iowa Construction Specification IA-95, Geotextile. Overlap a minimum of 6 inches at all seams.
5. Grade site for positive drainage away from the bioreactor chamber. Spread soil in designated location away from bioreactor.
6. See Plan Map for benchmark coordinates.



SECTION A-A

LANDOWNER		LOCATION	SECTION 15 - T79N - R4W

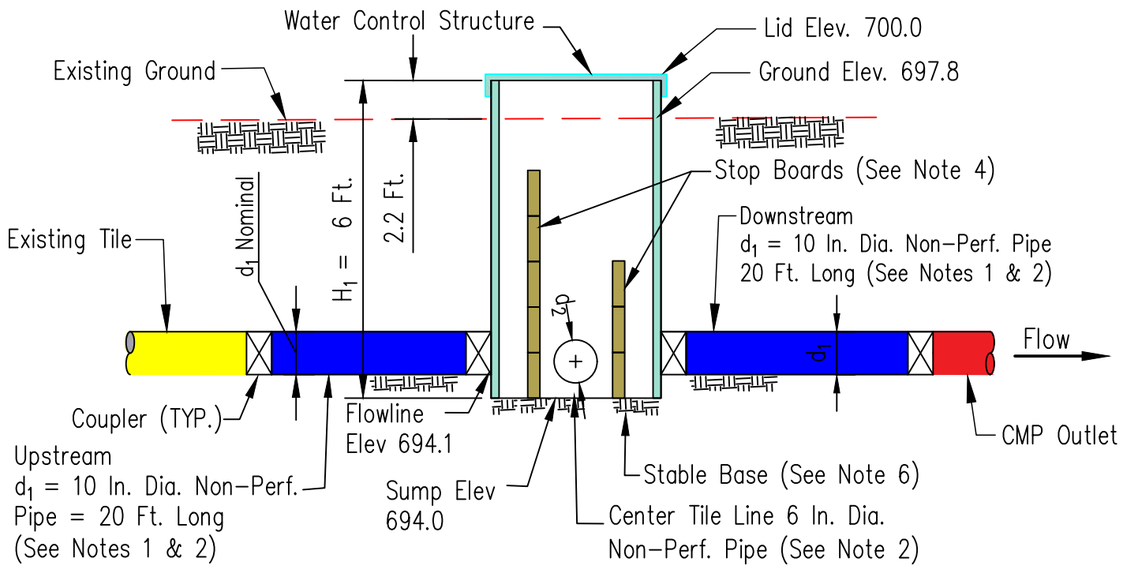
DESIGNED BY ANDY MACKFILL 8/28/23
DRAWN BY ANDY MACKFILL 8/28/23
CHECKED BY ANDY CRAIG 8/28/23
APPROVED BY

BIOREACTOR DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

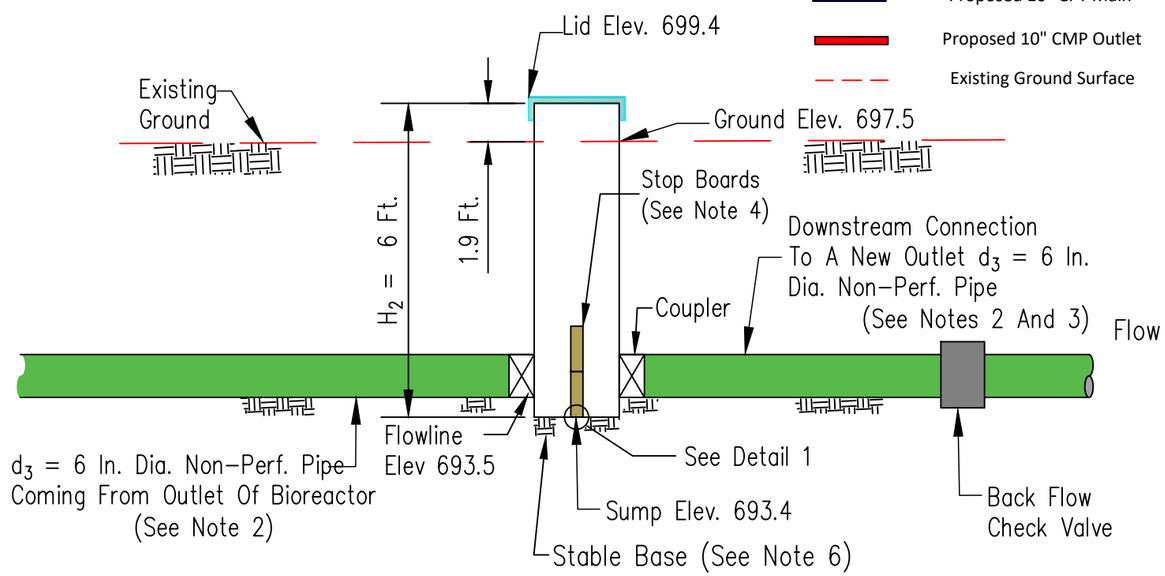
FILE NAME

DRAWING SET
SHEET 5 OF 7



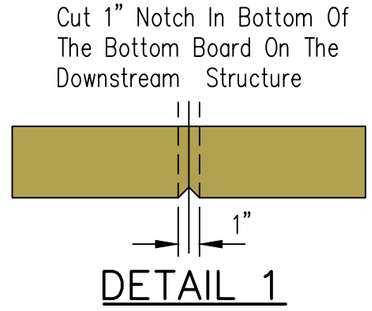
TYPICAL SECTION
UPSTREAM STRUCTURE

QUANTITIES*	
Water Control Structure, 3 Chamber H_1 = 6 ft. d_1 = 10 in. d_2 = 6 in.	1
Water Control Structure, 2 Chamber H_2 = 6 ft. d_3 = 6 in.	1
10" Non-perforated Pipe (ft)	40
10 CMP Outlet Pipe With Rodent Guard (ft)	25
6" Non-perforated Pipe (ft)	135
6" Perforated CPT (ft)	40
6" End Cap	2
Wood Chips (cu. yd.)	203
4 Mil Plastic (sq. yd.)**	291
Geotextile (sq. yd.)	178
Excavation (cu. yd.)	243
Earth Fill (cu. yd.)	89
6" Backflow Check Valve	1

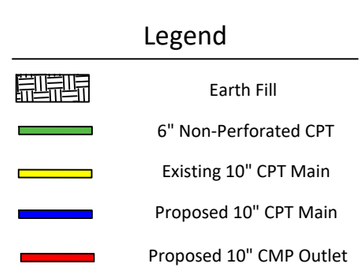


TYPICAL SECTION
DOWNSTREAM STRUCTURE

* Quantities do not include tile/pipe couplers or extra material for geotextile/plastic overlap
** Accounts for 1 ft. overhang around perimeter

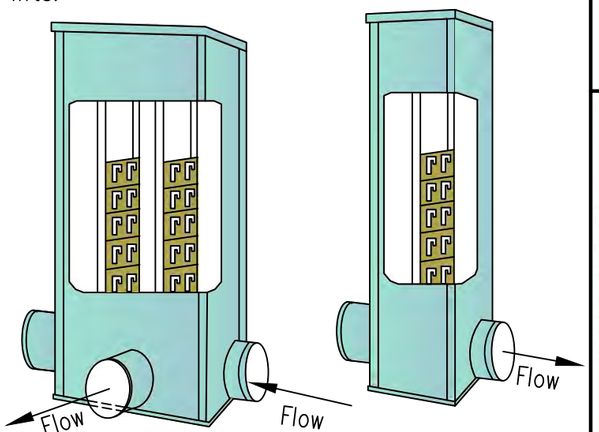


DETAIL 1



Side Port Is On The
(Circle One) Left/Right
Side Of Structure,
Looking Downstream

NOTES:
1. Install a minimum of 20 feet of non-perforated pipe adjacent to the water control structure, on all lines: upstream, downstream and center. Pipe must be PVC, dual-wall CPT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745. Check valve must conform to ASTM D 3034 with SDR35 pipe or stronger.
3. Couplings between the water control structures and the non-perforated tile must be watertight.
4. Stop boards must provide must tight seals under a minimum of 1 foot pressure head (except notched board).
5. Appropriately mark bioreactor perimeter to avoid vehicle, implement, or livestock traffic.
6. Place structure and pipe coupler on a stable base. A stable base may be compacted earth, compacted fill sand, or a concrete pad. Extend the stable base no less than 1 foot beyond structure.
7. Excavated material placed around structure and pipes shall be hand compacted in 4" lifts.



IN-LINE CONTROL STRUCTURES

DATE	
DESIGNED BY ANDY MACKRILL	8/28/23
DRAWN BY ANDY MACKRILL	8/28/23
CHECKED BY ANDY CRAIG	8/28/23
APPROVED BY	

STRUCTURE DETAIL

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME

DRAWING SET
SHEET 6 OF 7

LANDOWNER		LOCATION	SECTION 15 - T79N - R4W

CONSTRUCTION NOTES

1. Tile elevations are based on Maverick tile probe depths and are to be considered accurate within margin of error of the instrument.
2. If any surface inlets are currently attached to the tile main or plan to be in the future, they shall be replaced with water quality inlets to minimize trash entry into the tile line before construction of the bioreactor begins.
3. Avoid excessive disturbance of any buffers or grassed water ways during construction. However, if re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded within 14 days according to NRCS Conservation Practice Standard IA-342 Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
4. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion.
5. All carbon media to be placed in the bioreactor shall come from an ESE approved vendor or approved with ESE staff prior to transportation and placement.
6. Contact an ESE representative for inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the bioreactor chamber and tile line trenches
   b. After placing the water control structures and bioreactor manifolds
   c. After placement of carbon media, before backfilling with soil
   d. After connections to existing tile and final grading
7. Any product planned for use in construction must be approved by ESE prior to construction. Save and provide documentation to an ESE representative of all materials used in construction including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths
   b. Photos and invoices for quantity and quality of woodchips/carbon media
   c. Photos and invoices or product information to detail quantity and quality of plastic and geotextile fabric
   d. Photos and invoices or product information for water control structures
8. Construction tolerances are +/-0.5ft on bioreactor chamber dimensions, and +/-0.1 ft. on all elevations. Outlet WCS sump (bottom) must be below the elevation of the bioreactor chamber at the outlet end. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by a representative from ESE and will be noted in the as-built plan.
9. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.
10. All work shall be performed according to the IA construction and practice specifications in the table below.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-95	Geotextile
IA-605	Denitrifying Bioreactor
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 15 - T79N - R4W

DESIGNED BY ANDY MACKFILL 8/28/23
DRAWN BY ANDY MACKFILL 8/28/23
CHECKED BY ANDY CRAIG 8/28/23
APPROVED BY

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

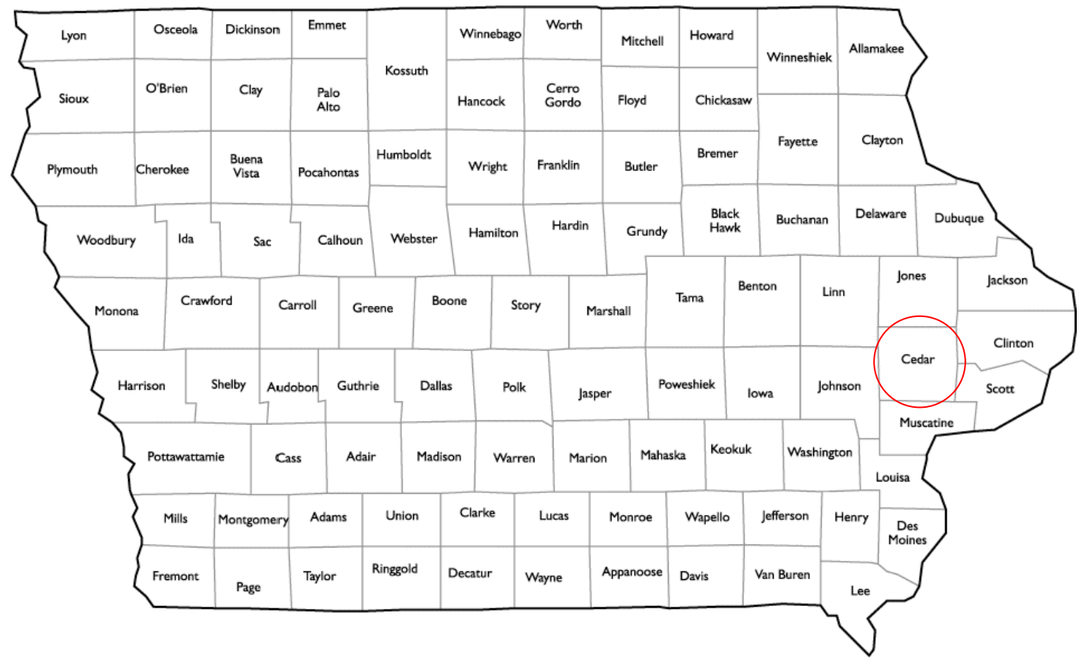
FILE NAME

DRAWING SET
SHEET 7 OF 7

SATURATED BUFFER CONSTRUCTION PLANS

CEDAR CO, IOWA

SECTION 14 - T79N - R4W



INDEX OF SHEETS

811 Know what's below. Call before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

6/30/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

ENGINEERING CLASS 2

		DATE
DESIGNED BY	ANDREW MACKRILL	6/24/2023
DRAWN BY	ANDREW MACKRILL	6/24/2023
CHECKED BY	ANDY CRAIG, PE, TSP	6/30/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 6

PLAN VIEW

Staking Control Points(NAD 1983 State Plane South US Survey Feet)				
Point	Description	Northing	Easting	Elevation
1	WCS	609246.9	2246533.9	694.7
2	Distribution Line	609133.5	2246603.7	694.5
3	Distribution Line	609048.5	2246656.8	694.1
4	Distribution Line	6078921.6	2246729.6	694.6
5	Distribution Line	608735.0	2247065.9	694.0
6	Distribution Line	608578.6	2247165.6	694.0
7	Benchmark	609359.8	2246203.8	695.0

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 609359.8
Easting: 2246203.8
Elevation: 695.0

0 100 200 Feet

N

Benchmark

Existing 10" Main to be diverted to the East

New 12" CMP Outlet With Rodent Guard

950' of 6" CPT at 0.0% Grade

Buffer Cross Section, See Sheet 3

Existing 6" main to be replaced with 12" Non-perf CPT

Existing 6" Main with no flow to be bypassed

1 0+00.00
2 1+00.00
3 2+00.00
4 3+00.00
3+00.00+10.00
5 7+00.00
6 9+00.00 9+50.00
7

Legend

- Proposed 6" Perforated CPT Distribution Line
- Proposed 12" Non-Perforated CPT
- Proposed 12" CMP Outlet
- Existing 10" CPT Main
- Existing 6" CPT Main
- Proposed 10" Non-Perf CPT
- Proposed Water Control Structure
- 2' Contours
- Benchmark
- Staking Point

DESIGNED BY ANDREW MACKRILL DATE 6/24/23
DRAWN BY ANDREW MACKRILL 6/24/23
CHECKED BY ANDY CRAIG 6/30/23
APPROVED BY

PLAN MAP

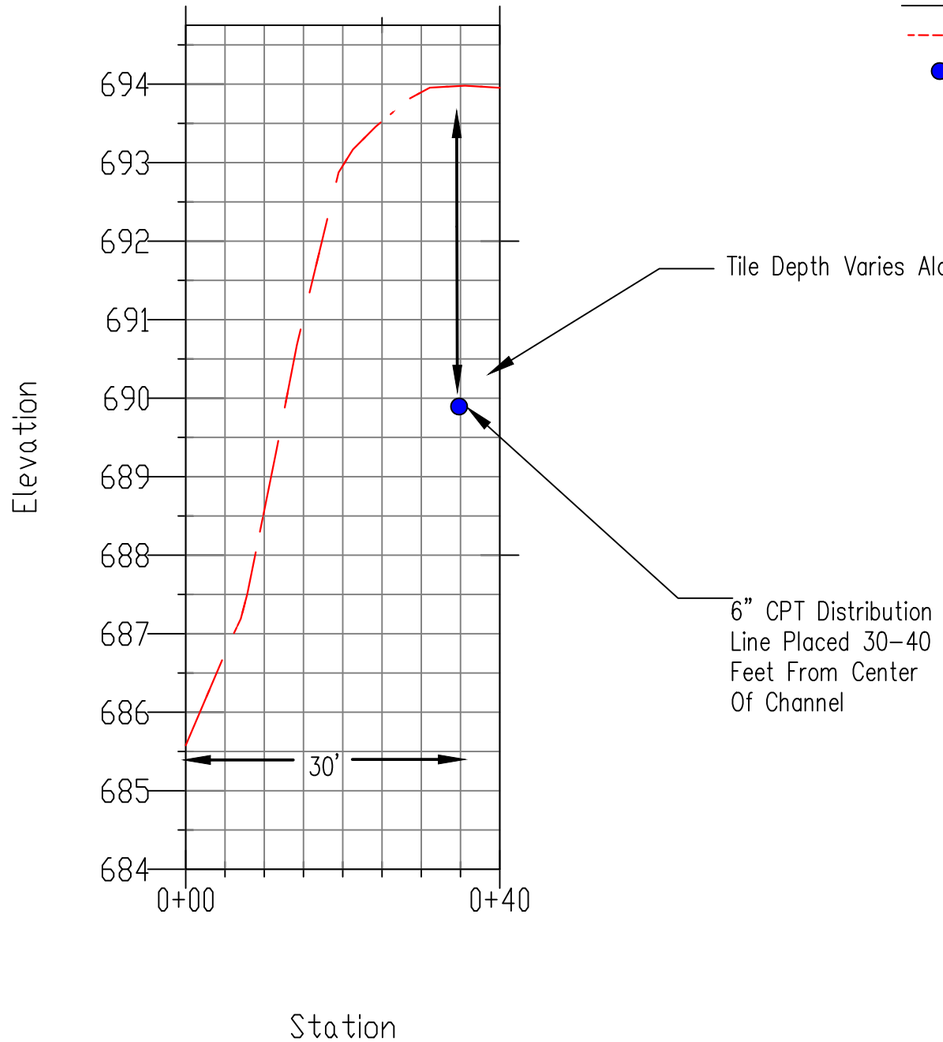
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 2 OF 6

LANDOWNER | LOCATION | SECTION 14 - T79N - R4W

Buffer Cross-Section



LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 6/24/23
DRAWN BY ANDREW MACKRILL 6/24/23
CHECKED BY ANDY CRAIG 6/30/23
APPROVED BY
DATE

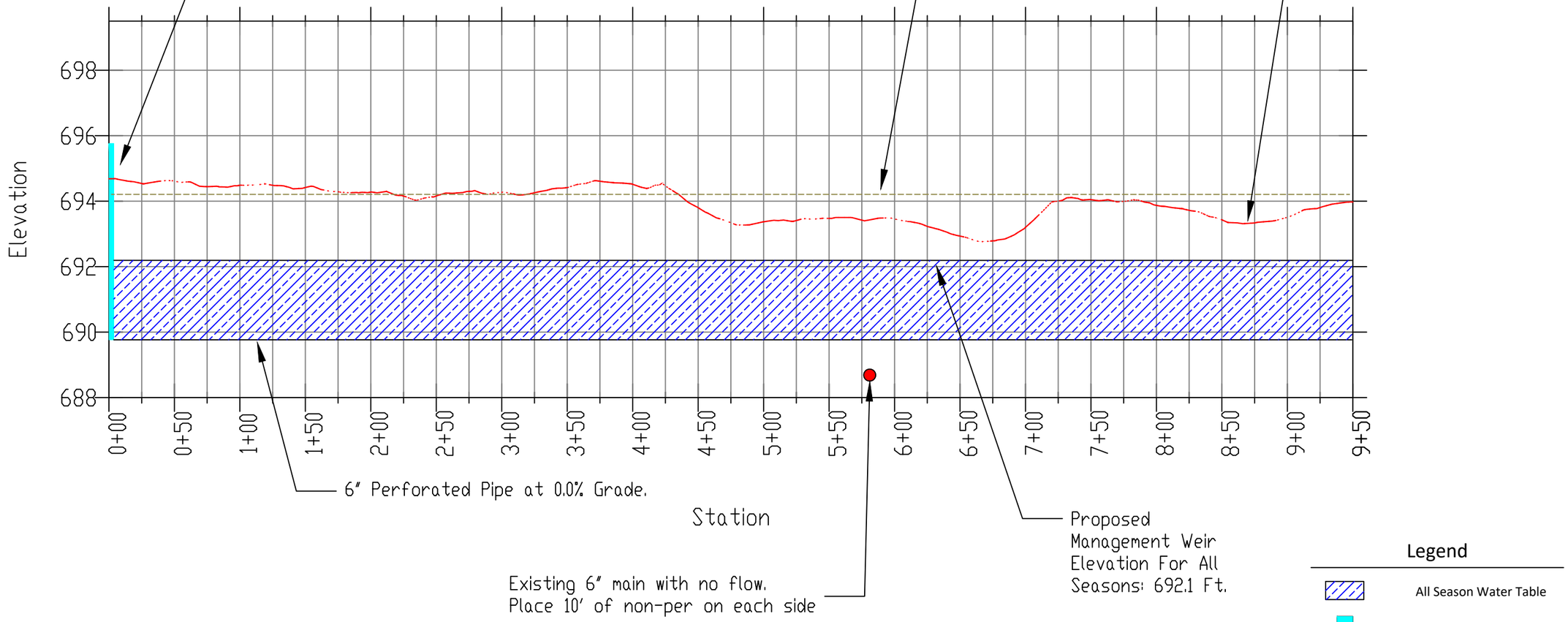
BUFFER AND BANK CROSS SECTION

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 3 OF 6

Profile Along Distribution Line



Legend

- All Season Water Table
- Proposed Water Control Structure
- Proposed 6" CPT Distribution Line
- Existing Ground Surface
- Lowest Farmed Elevation

LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 6/24/23
DRAWN BY ANDREW MACKRILL 6/24/23
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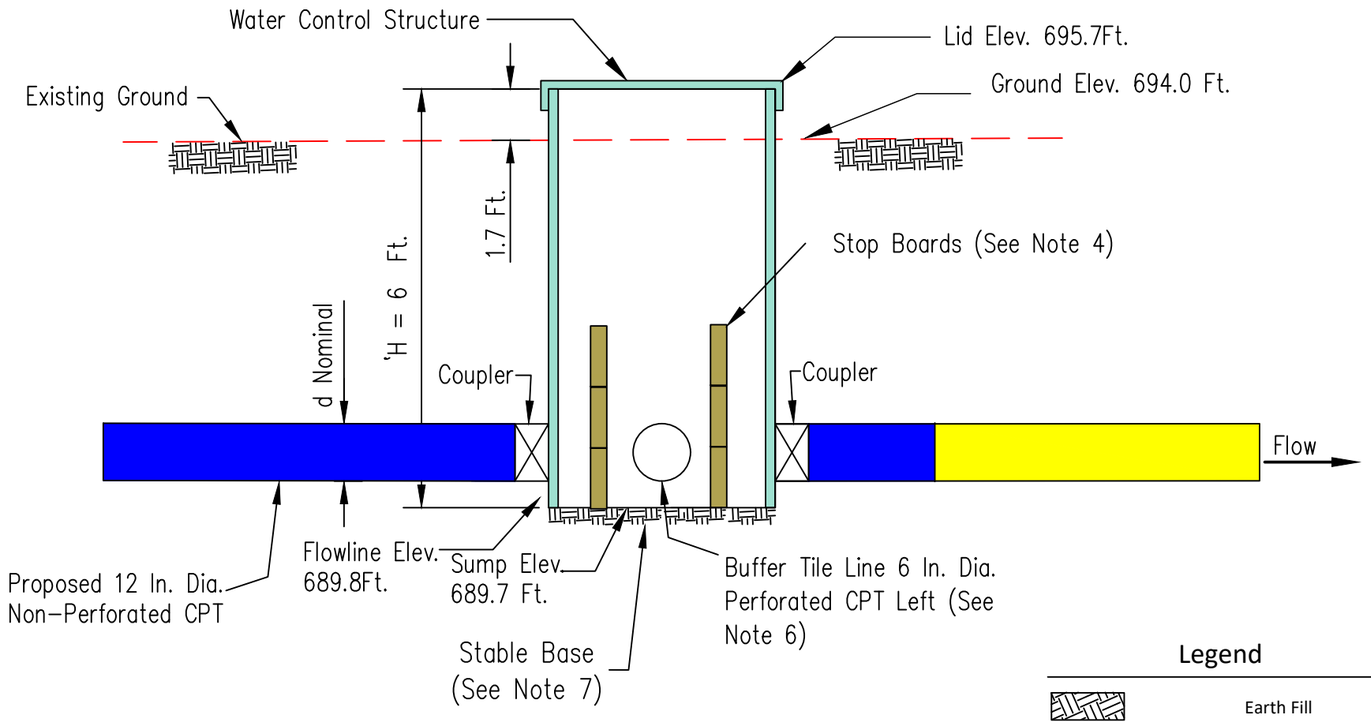
PROFILE ALONG DISTRIBUTION LINE

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

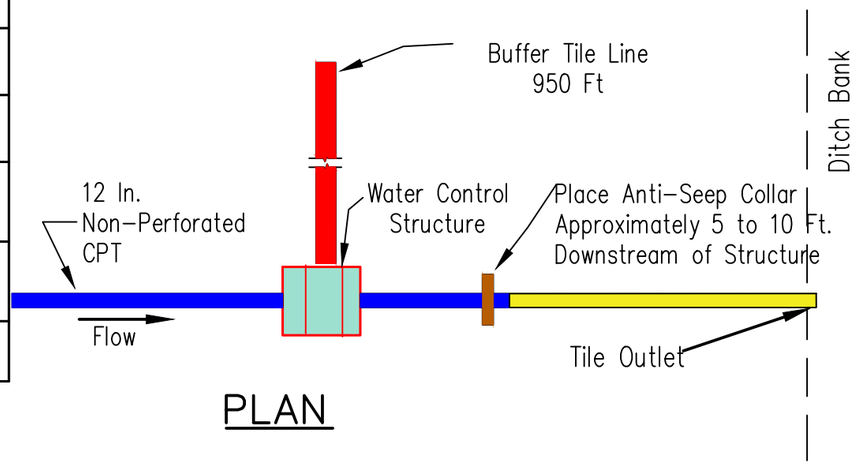
DRAWING SET
SHEET 4 OF 6



TYPICAL SECTION

QUANTITIES*		NRCS SPEC
Water Control Structure 3– Compartment H = 6 ft. d = 12 in.	1	IA-21, IA-26, CPS-587
10" Non–perforated Pipe (ft)	155	IA-21, IA-45
6" Non–perforated Pipe (ft)	20	IA-21, IA-45
12" Non–perforated Pipe (ft)	30	IA-21, IA-45
12" CMP Outlet Pipe With Rodent Guard (ft)	20	IA-604, IA-620
6" Perforated CPT (ft) Buffer Tile Line	930	IA-21, IA-45, IA-46
3'x3' Anti Seep Collar	1	CPS-587

*Quantities Do Not Include Couplers



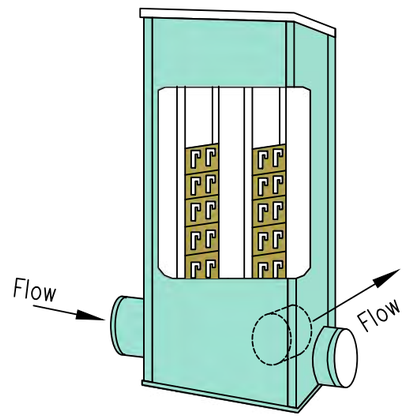
PLAN

Legend

- Earth Fill
- 6" Perforated CPT
- Proposed 12" CMP Outlet
- Proposed 12" Non-Perforated CPT
- Ditch Bank
- Existing Ground Surface

NOTES:

1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, both upstream, and downstream. Pipe shall be PVC, dual–wall PT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745.
3. Couplings between the water control section and the non–perforated tile shall be water tight.
4. Stop boards shall provide water tight seals under a minimum of 1 foot pressure head.
5. Mark location of structure using steel t–post or manufactured marker flag for safety in the field.
6. Install buffer tile parallel to ditch or stream, according to profile provided with the construction plans. Pipe shall remain on grade and drain towards the WCS.
7. Place structure and pipe coupler on a stable base. A stable base may be compacted earth or compacted fill sand.
8. Excavated material placed around structure and pipes must be hand compacted in 4" lifts.



IN–LINE CONTROL STRUCTURE

LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 6/24/23
DRAWN BY ANDREW MACKRILL 6/24/23
CHECKED BY ANDY CRAIG 6/30/23
APPROVED BY

3 CHAMBER STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 5 OF 6

CONSTRUCTION NOTES

1. Tile elevations are based Maverick Tile Finder probe depths. A fiberglass cable with imbedded wire is fed into the outlet and located with a utility device. These values may not be exact, but are believed to be accurate. Factors such as sediment in the pipe, flowing water in the pipe, and wire location within the pipe may affect depth readings. Notify ESE at least 48 hours before conducting the investigation so that a qualified ESE representative can be onsite during the investigation.
2. Avoid excessive disturbance of buffers or grassed water ways during construction. If re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded according to NRCS Conservation Practice Standard 342 – Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
3. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion. Contact ESE for assistance with construction inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the existing tile and setting WCS.
   b. Distribution pipe has been laid and capped.
4. Any product planned for use in construction must be approved by ESE prior to construction. Provide documentation to ESE of all materials used in construction, including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths.
   b. Photos and invoices or product information for water control structures.
5. Construction tolerances are +/-0.5ft on distribution line location, and +/-0.1 ft. on all elevations. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by ESE and will be noted in the as-built plan.
6. When installing the distribution line, pay special attention so that other outlets in the buffer are not damaged or broken. Although an investigation of the buffer will have already been completed, not all outlets are able to be located depending on site conditions at the time. If another tile line or outlet is encountered, contact an ESE representative for consultation. They will decide if the tile line is able to be incorporated into the system, or if a section of the distribution line needs to be replaced as non-perforated pipe to prevent water loss.
7. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-604	Saturated Buffer
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DATE
DESIGNED BY ANDREW MACKRILL 6/24/23
DRAWN BY ANDREW MACKRILL 6/24/23
CHECKED BY ANDY CRAIG 6/30/23
APPROVED BY

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

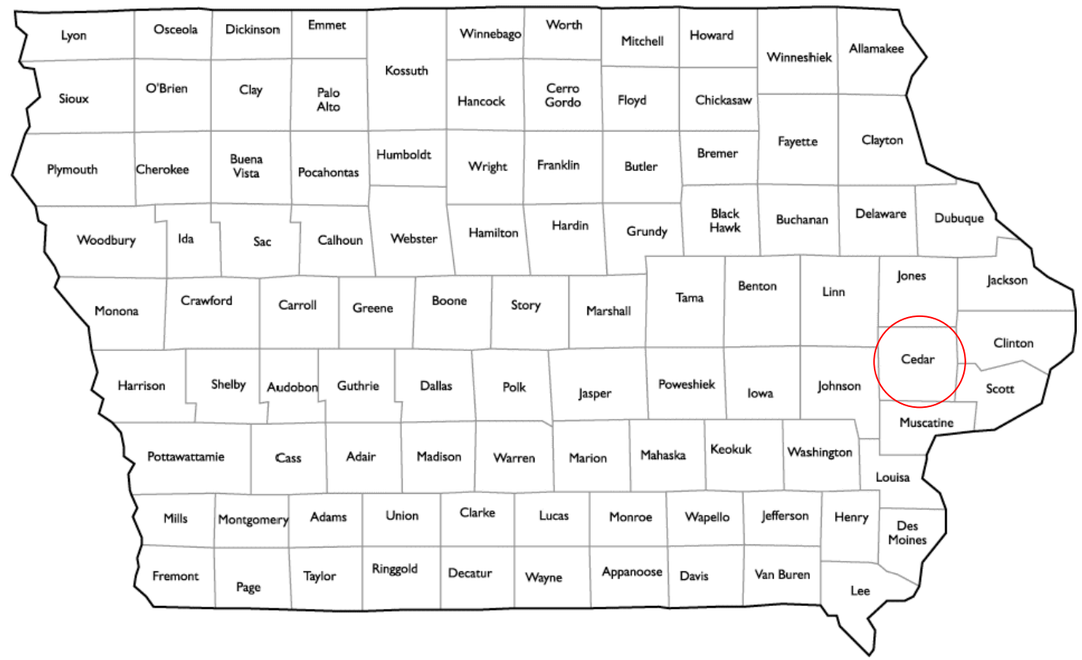
FILE NAME

DRAWING SET
SHEET 6 OF 6

SATURATED BUFFER CONSTRUCTION PLANS

CEDAR CO, IOWA

SECTION 14 - T79N - R4W



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LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

6/30/2023

Andy J. Craig, P.E.
License number: 20832

My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

ENGINEERING CLASS 2

		DATE
DESIGNED BY	ANDREW MACKRILL	6/24/2023
DRAWN BY	ANDREW MACKRILL	6/24/2023
CHECKED BY	ANDY CRAIG	6/30/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 6

Staking Control Points(NAD 1983 State Plane South US Survey Feet)				
Point	Description	Northing	Easting	Elevation
1	WCS	609375.0	2246258.0	693.8
2	Distribution Line	609355.5	2246122.6	694.3
3	Distribution Line	609158.8	2245759.9	695.2
4	Distribution Line	609135.3	2245607.9	696.5
5	Distribution Line	609157.2	2245550.2	696.4
6	Distribution Line	609673.3	2244851.3	696.9
7	Benchmark	609359.8	2246203.8	695.0

PLAN VIEW

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 609359.8
Easting: 2246203.8
Elevation: 695.0

0 100 200 Feet

N

1636' of 6" CPT at 0.0% Grade

Benchmark

Existing 6" Main with no flow to be bypassed

Existing 6" main to be diverted to the east

New 12" CMP Outlet With Rodent Guard

Buffer Cross Section, See Sheet 3

Legend

- Proposed 6" Perforated CPT Distribution Line
- Proposed 12" Non-Perforated CPT
- Proposed 12" CMP Outlet
- Existing 10" CPT Main
- Existing 6" CPT Main
- Proposed 6" CPT
- Proposed Water Control Structure
- 2' Contours
- Benchmark
- Staking Point

DATE
DESIGNED BY ANDREW MACKRILL 6/24/23
DRAWN BY ANDREW MACKRILL 6/24/23
CHECKED BY ANDY CRAIG 6/30/23
APPROVED BY

PLAN MAP

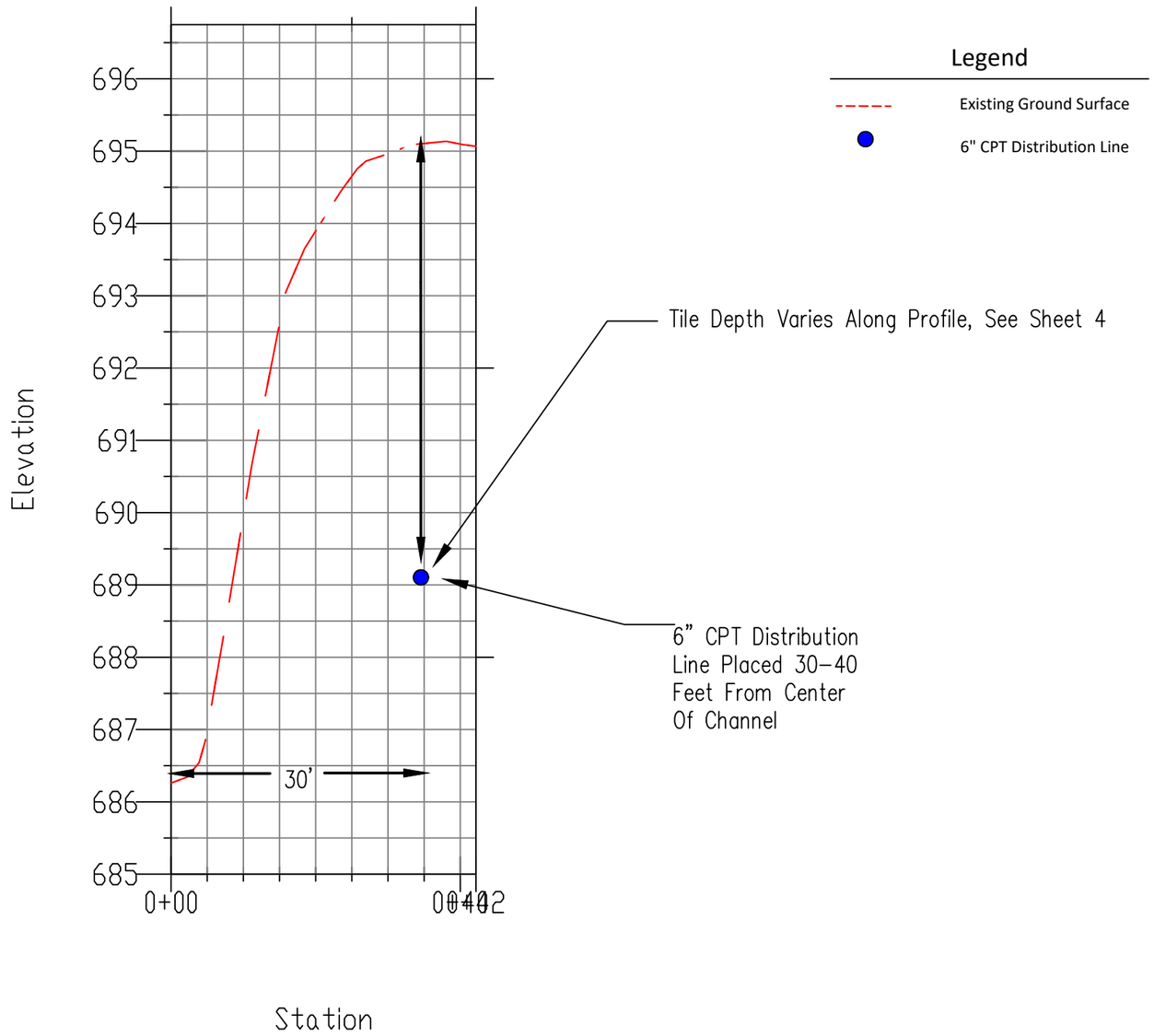
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 2 OF 6

LANDOWNER | LOCATION SECTION 14 - T79N - R4W

Buffer Cross-Section



LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 6/24/23
DRAWN BY ANDREW MACKRILL 6/24/23
CHECKED BY ANDY CRAIG 6/30/23
APPROVED BY
DATE

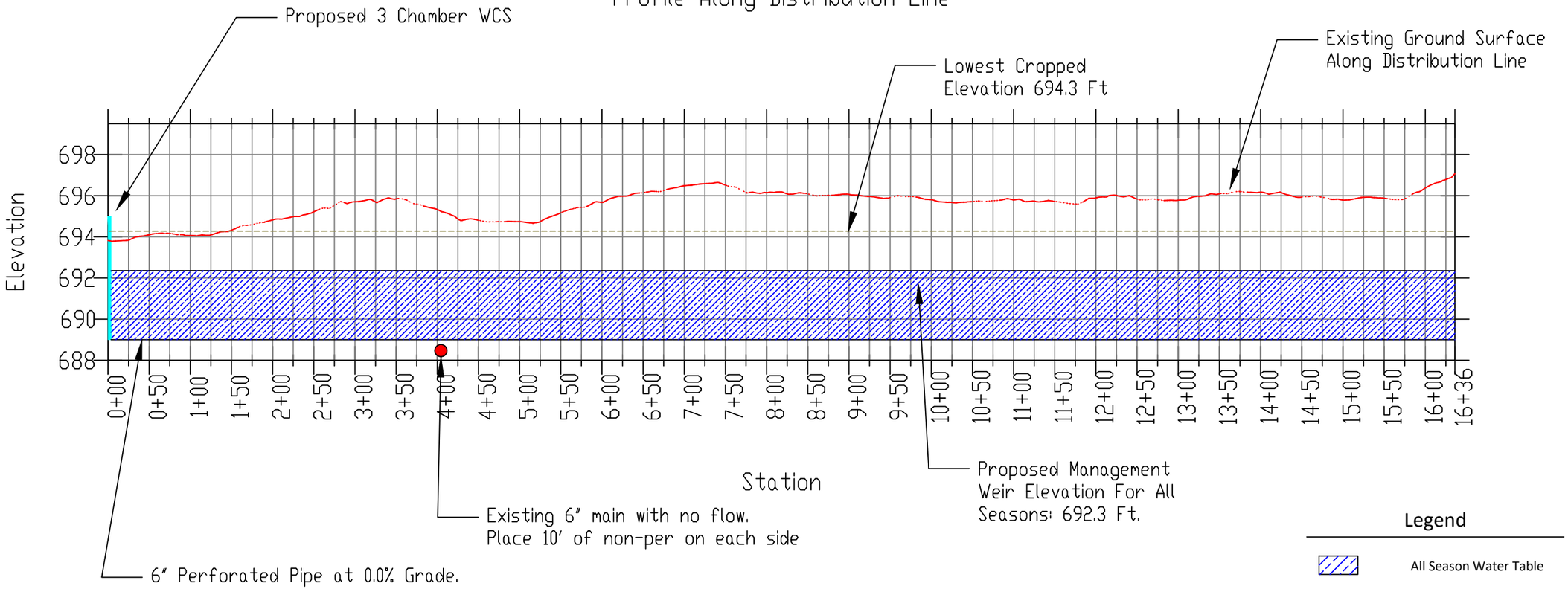
BUFFER AND BANK CROSS SECTION

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 3 OF 6

Profile Along Distribution Line



Legend

- All Season Water Table
- Proposed Water Control Structure
- Proposed 6" CPT Distribution Line
- Existing Ground Surface
- Lowest Farmed Elevation

LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 6/24/23
DRAWN BY ANDREW MACKRILL 6/24/23
CHECKED BY ANDY CRAIG 6/30/23
APPROVED BY

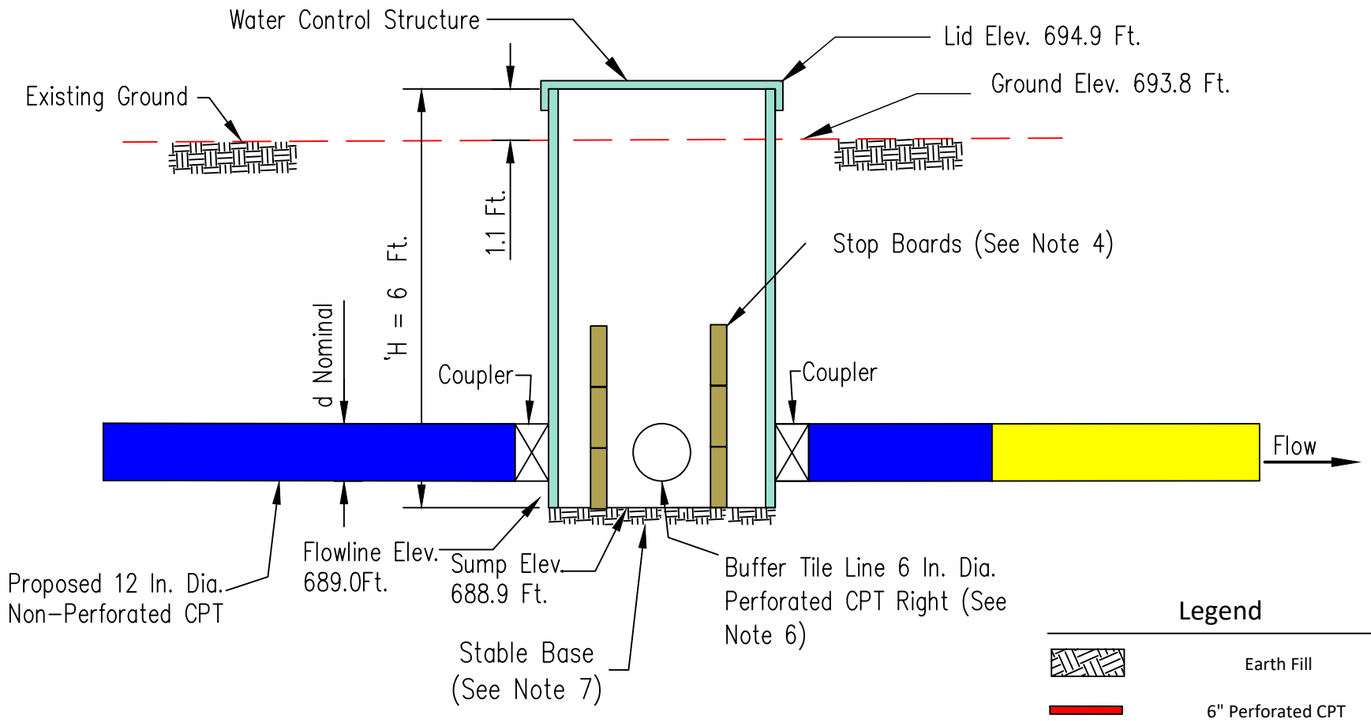
DATE

PROFILE ALONG DISTRIBUTION LINE

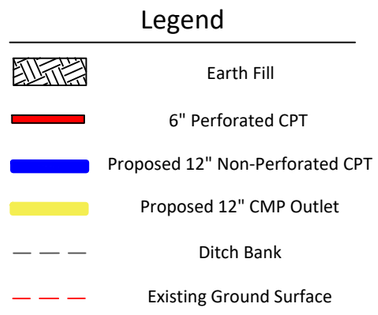
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 4 OF 6

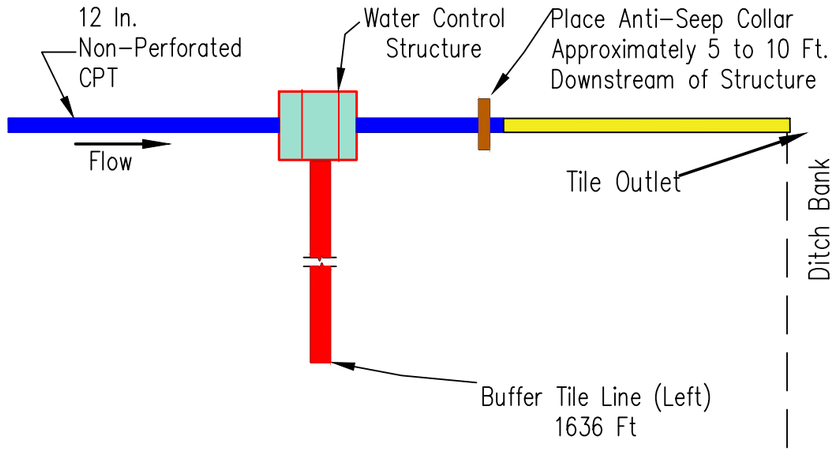


TYPICAL SECTION



QUANTITIES*		NRCS SPEC
Water Control Structure 3- Compartment H = 6 ft. d = 12 in.	1	IA-21, IA-26, CPS-587
6" Non-perforated Pipe (ft)	145	IA-21, IA-45
12" Non-perforated Pipe (ft)	32	IA-21, IA-45
12" CMP Outlet Pipe With Rodent Guard (ft)	20	IA-604, IA-620
6" Perforated CPT (ft) Buffer Tile Line	1616	IA-21, IA-45, IA-46
3'x3' Anti Seep Collar	1	CPS-587

*Quantities Do Not Include Couplers



PLAN

NOTES:
1. Install a minimum of 20 feet of non-perforated pipe adjacent to the water control structure, both upstream, and downstream. Pipe shall be PVC, dual-wall PT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745.
3. Couplings between the water control section and the non-perforated tile shall be water tight.
4. Stop boards shall provide water tight seals under a minimum of 1 foot pressure head.
5. Mark location of structure using steel t-post or manufactured marker flag for safety in the field.
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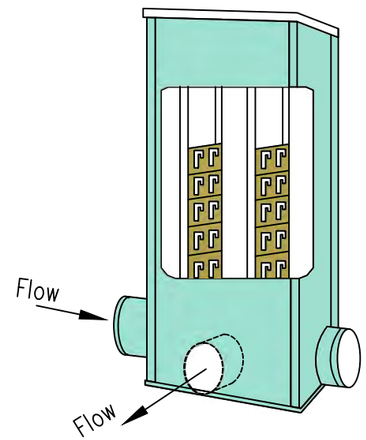
8. Excavated material placed around structure and pipes must be hand compacted in 4" lifts.



IN-LINE CONTROL STRUCTURE

LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DATE
DESIGNED BY ANDREW MACKRILL 6/24/23
DRAWN BY ANDREW MACKRILL 6/24/23
CHECKED BY ANDY CRAIG 6/30/23
APPROVED BY

3 CHAMBER STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
F

DRAWING SET
SHEET 5 OF 6

CONSTRUCTION NOTES

1. Tile elevations are based Maverick Tile Finder probe depths. A fiberglass cable with imbedded wire is fed into the outlet and located with a utility device. These values may not be exact, but are believed to be accurate. Factors such as sediment in the pipe, flowing water in the pipe, and wire location within the pipe may affect depth readings. Notify ESE at least 48 hours before conducting the investigation so that a qualified ESE representative can be onsite during the investigation.
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Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-604	Saturated Buffer
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 6/24/23
DRAWN BY ANDREW MACKRILL 6/24/23
CHECKED BY ANDY CRAIG 6/30/23
APPROVED BY

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

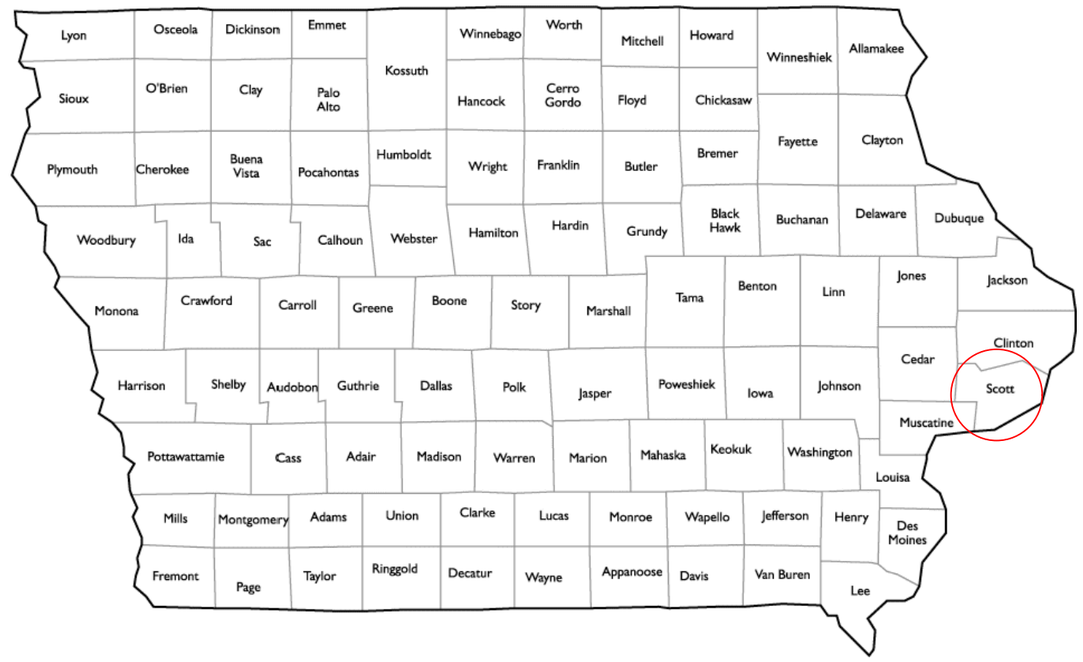
FILE NAME

DRAWING SET
SHEET 7 OF 7

SATURATED BUFFER CONSTRUCTION PLANS

SCOTT CO, IOWA

SECTION 07 - T78N - R2E



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I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

8/3/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

ENGINEERING CLASS 2

		DATE
DESIGNED BY	ANDREW MACKRILL	8/3/2023
DRAWN BY	ANDREW MACKRILL	8/3/2023
CHECKED BY	ANDY CRAIG, PE, TSP	8/3/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 6

Staking Control Points(NAD 1983 State Plane Iowa South US Survey Feet)				
Point	Description	Northing	Easting	Elevation
1	WCS	583890.8	2386401.3	724.4
2	Distribution Line	583816.5	2386599.4	725.1
3	Distribution Line	583879.0	2386451.4	724.6
4	Distribution Line	583911.1	2386375.0	724.4
5	Distribution Line	583970.2	2386237.3	724.1
6	Distribution Line	584051.1	2386048.8	723.7
7	Benchmark	584044.6	2386028.2	720.4

Buffer Cross Section, See Sheet 3

Benchmark

Existing 8" Tile

600' of 6" CPT at 0.0% Grade

New 8" CMP Outlet With Rodent Guard

PLAN VIEW

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 584044.6
Easting: 2386028.2
Elevation: 720.4

0 100 200 Feet

N

Legend

- Proposed 6" Perforated CPT Distribution Line
- Proposed 8" Non-Perforated CPT
- Proposed 8" CMP Outlet
- Existing 8" CPT Main
- Proposed Water Control Structure
- 2' Contours
- Benchmark
- Staking Point

LANDOWNER		LOCATION	SECTION 07 - T78N - R2E

DATE
DESIGNED BY ANDREW MACKRILL 8/3/23
DRAWN BY ANDREW MACKRILL 8/3/23
CHECKED BY ANDY CRAIG, PE, TSP 8/3/23
APPROVED BY

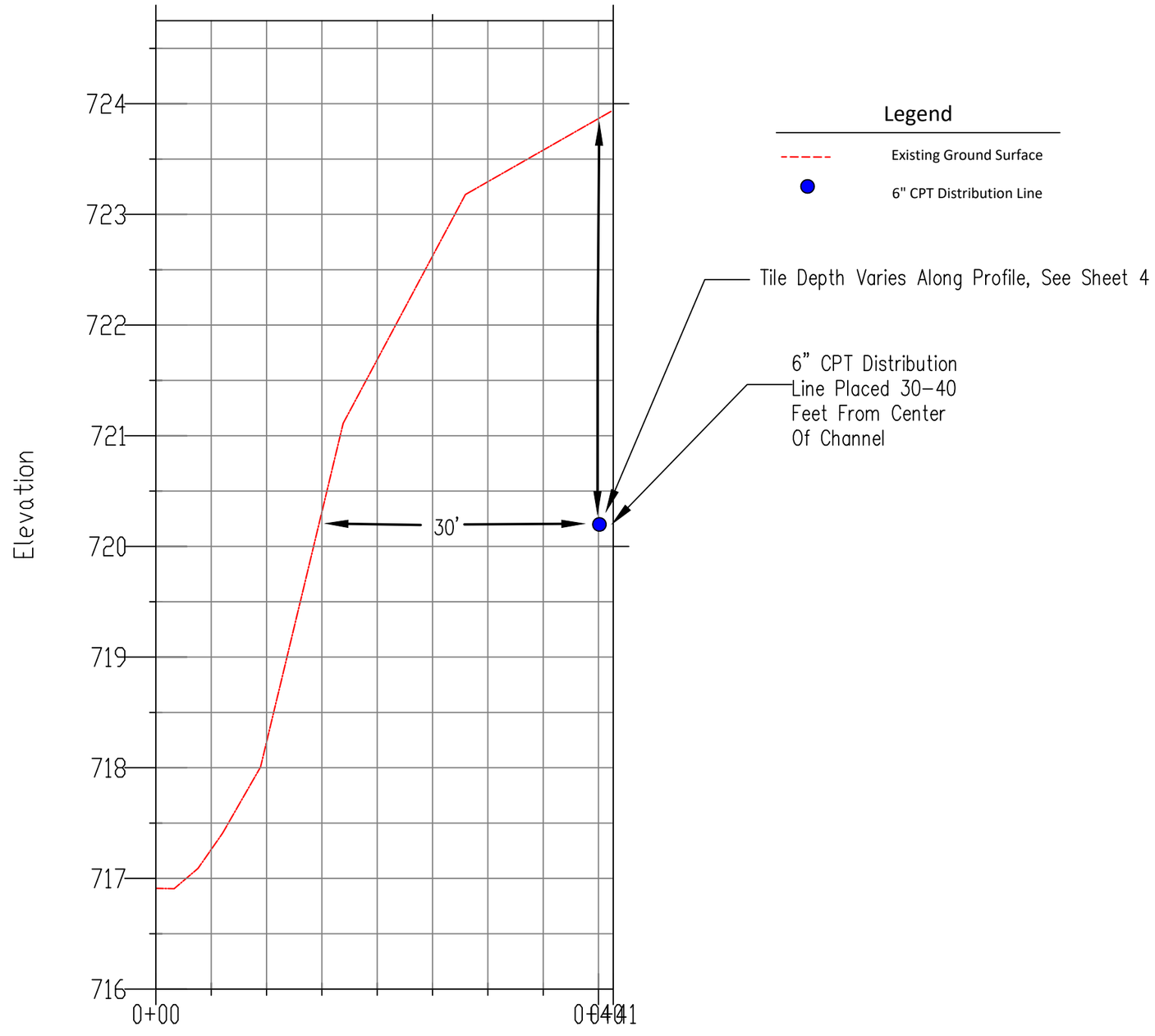
PLAN MAP

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 2 OF 6

Cross-Section



LANDOWNER		LOCATION	SECTION 07 - T78N - R2E

DESIGNED BY ANDREW MACKRILL 8/3/23
DRAWN BY ANDREW MACKRILL 8/3/23
CHECKED BY ANDY CRAIG, PE, TSP 8/3/23
APPROVED BY

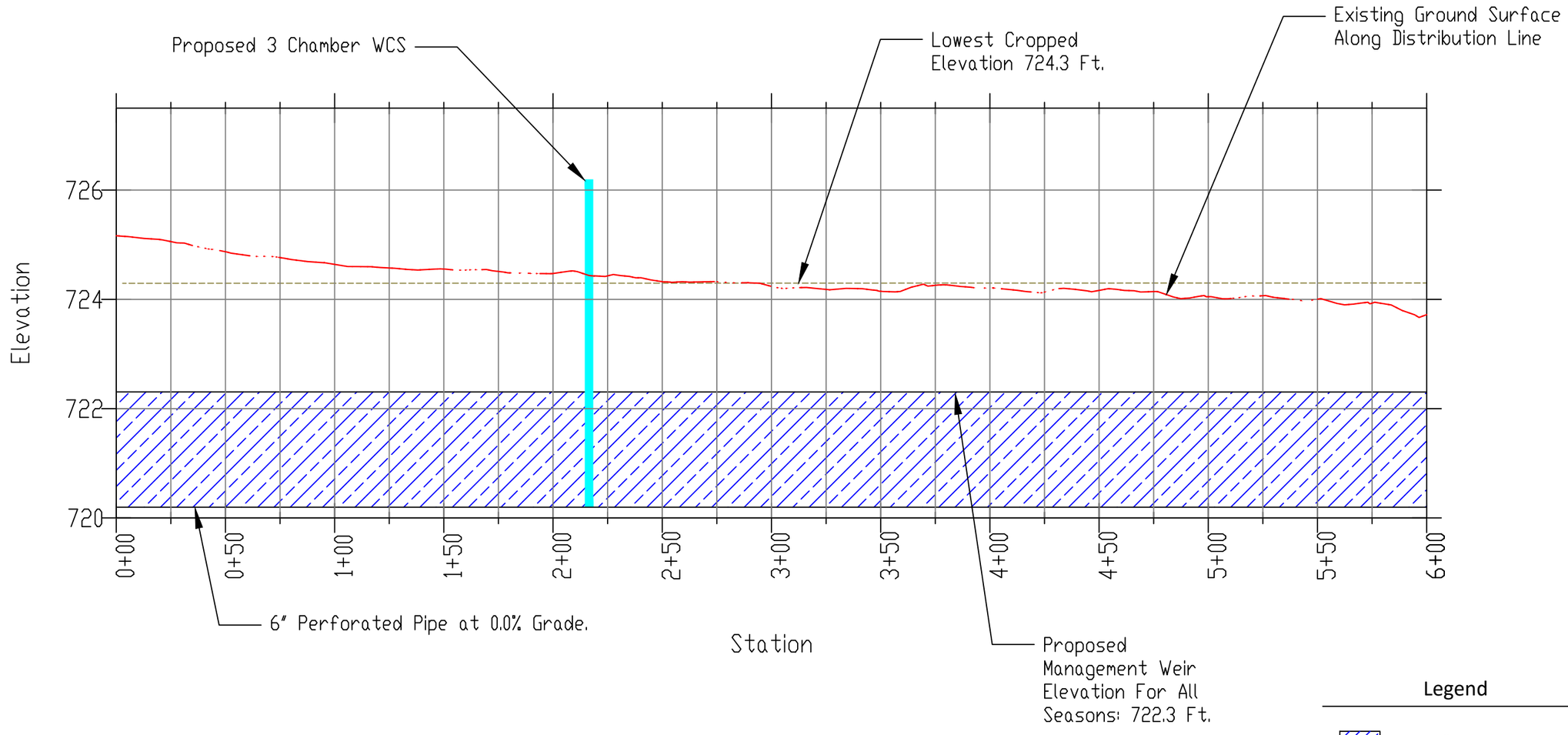
BUFFER AND BANK CROSS SECTION

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 3 OF 6

Profile Along Distribution Line



Legend

- All Season Water Table
- Proposed Water Control Structure
- Proposed 6" CPT Distribution Line
- Existing Ground Surface
- Lowest Farmed Elevation

LANDOWNER	[redacted]	LOCATION	SECTION 07 - T78N - R2E

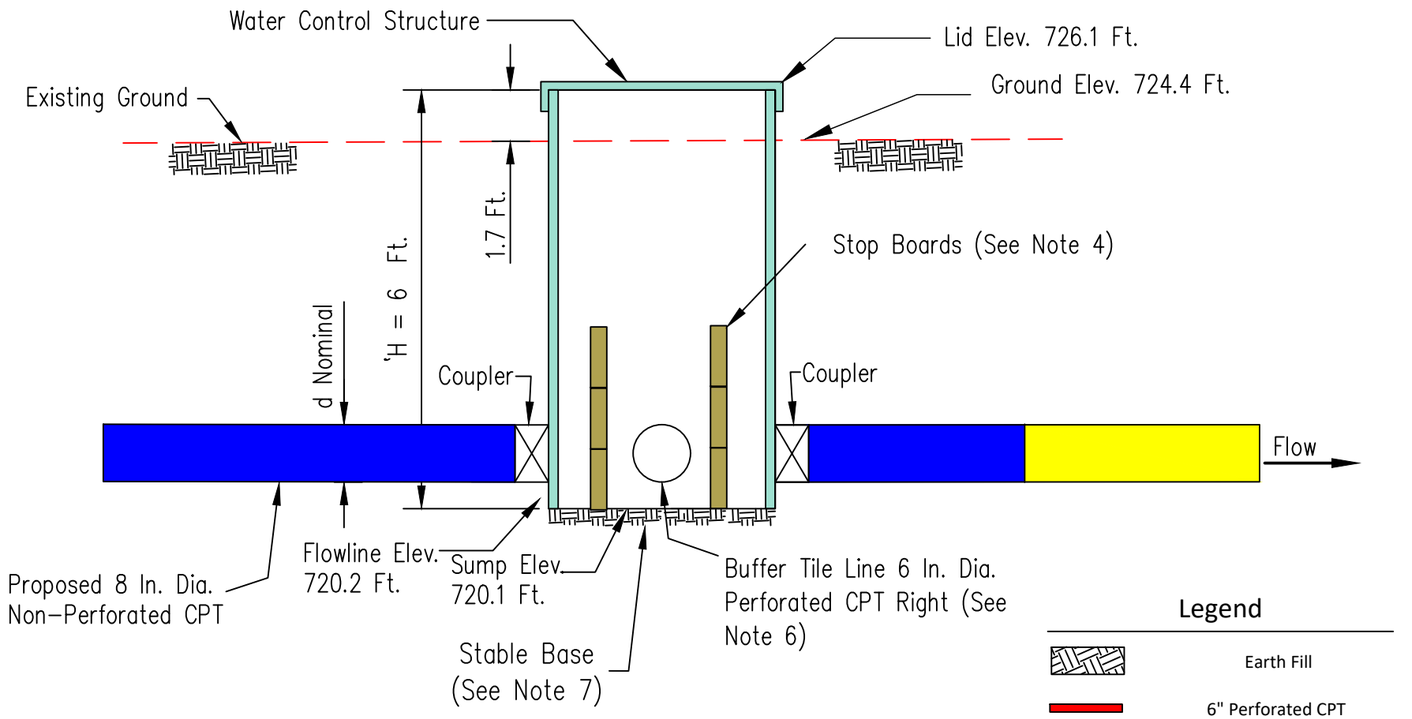
DESIGNED BY ANDREW MACKRILL 8/3/23
DRAWN BY ANDREW MACKRILL 8/3/23
CHECKED BY ANDY CRAIG, PE, TSP 8/3/23
APPROVED BY

PROFILE ALONG DISTRIBUTION LINE

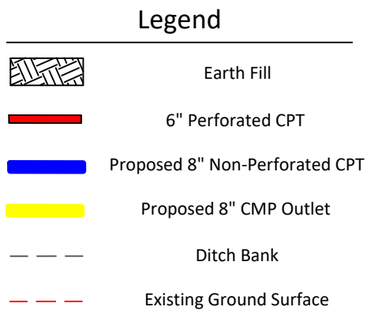
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME [redacted]

DRAWING SET
SHEET 4 OF 6

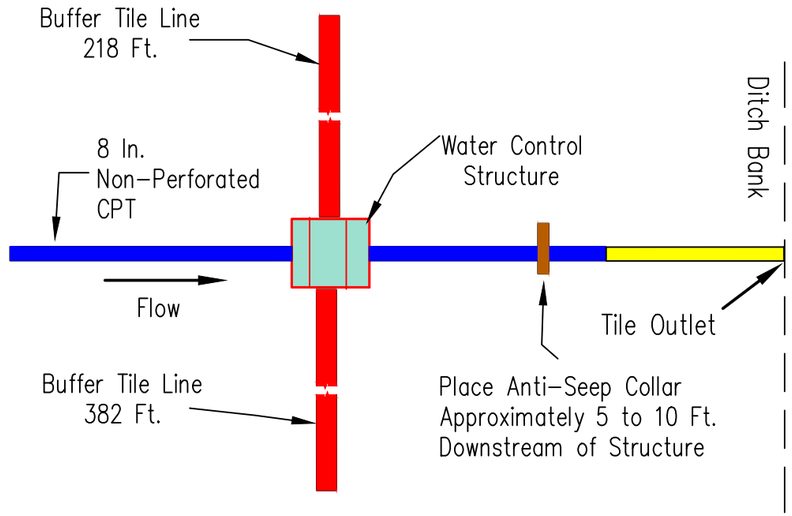


TYPICAL SECTION



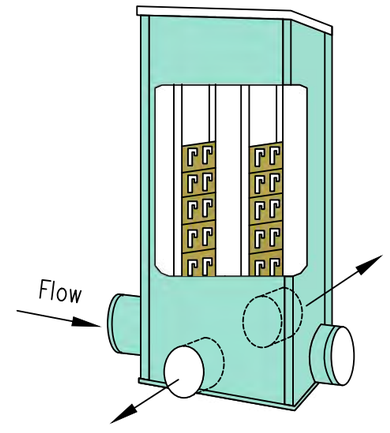
QUANTITIES*		NRCS SPEC
Water Control Structure 3– Compartment H = 6 ft. d = 8 in.	1	IA-21, IA-26, CPS-587
8" Non–perforated Pipe (ft)	30	IA-21, IA-45
8" CMP Outlet Pipe With Rodent Guard (ft)	20	IA-604, IA-620
6" Perforated CPT (ft) Buffer Tile Line	600	IA-21, IA-45, IA-46
3'x3' Anti Seep Collar	1	CPS-587

*Quantities Do Not Include Couplers



PLAN

NOTES:
1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, both upstream, and downstream. Pipe shall be PVC, dual–wall PT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745.
3. Couplings between the water control section and the non–perforated tile shall be water tight.
4. Stop boards shall provide water tight seals under a minimum of 1 foot pressure head.
5. Mark location of structure using steel t–post or manufactured marker flag for safety in the field.
6. Install buffer tile parallel to ditch or stream, according to profile provided with the construction plans. Pipe shall remain on grade and drain towards the WCS.
7. Place structure and pipe coupler on a stable base. A stable base may be compacted earth or compacted fill sand.
8. Excavated material placed around structure and pipes must be hand compacted in 4" lifts.



IN–LINE CONTROL STRUCTURE

LANDOWNER		LOCATION	SECTION 07 - T78N - R2E

DESIGNED BY ANDREW MACKRILL 8/3/23
DRAWN BY ANDREW MACKRILL 8/3/23
CHECKED BY ANDY CRAIG, PE, TSP 8/3/23
APPROVED BY
DATE

3 CHAMBER STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 5 OF 6

CONSTRUCTION NOTES

1. Tile elevations are based Maverick Tile Finder probe depths. A fiberglass cable with imbedded wire is fed into the outlet and located with a utility device. These values may not be exact, but are believed to be accurate. Factors such as sediment in the pipe, flowing water in the pipe, and wire location within the pipe may affect depth readings. Notify ESE at least 48 hours before conducting the investigation so that a qualified ESE representative can be onsite during the investigation.
2. Avoid excessive disturbance of buffers or grassed water ways during construction. If re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded according to NRCS Conservation Practice Standard 342 – Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
3. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion. Contact ESE for assistance with construction inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the existing tile and setting WCS.
   b. Distribution pipe has been laid and capped.
4. Any product planned for use in construction must be approved by ESE prior to construction. Provide documentation to ESE of all materials used in construction, including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths.
   b. Photos and invoices or product information for water control structures.
5. Construction tolerances are +/-0.5ft on distribution line location, and +/-0.1 ft. on all elevations. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by ESE and will be noted in the as-built plan.
6. When installing the distribution line, pay special attention so that other outlets in the buffer are not damaged or broken. Although an investigation of the buffer will have already been completed, not all outlets are able to be located depending on site conditions at the time. If another tile line or outlet is encountered, contact an ESE representative for consultation. They will decide if the tile line is able to be incorporated into the system, or if a section of the distribution line needs to be replaced as non-perforated pipe to prevent water loss.
7. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-604	Saturated Buffer
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 07 - T78N - R2E

DESIGNED BY ANDREW MACKRILL 8/3/23
DRAWN BY ANDREW MACKRILL 8/3/23
CHECKED BY ANDY CRAIG, PE, TSP 8/3/23
APPROVED BY
DATE

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

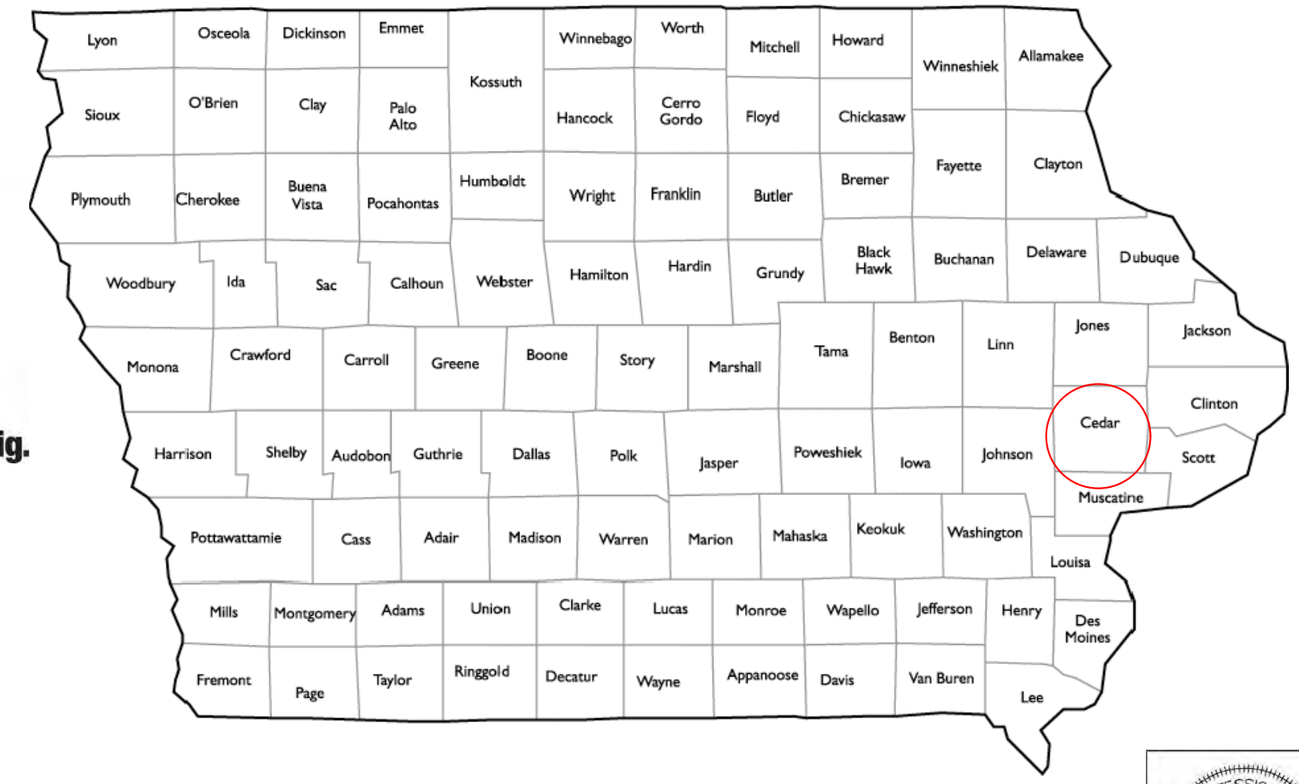
FILE NAME

DRAWING SET
SHEET 6 OF 6

DENITRIFYING BIOREACTOR CONSTRUCTION PLANS

CEDAR COUNTY, IOWA

SECTION 03- T79N - R04W



INDEX OF SHEETS

811 Know what's **below.** **Call** before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

ENGINEERING CLASS 2

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

8/15/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

		DATE
DESIGNED BY	ANDY MACKRILL, TSP	8/15/2023
DRAWN BY	ANDY MACKRILL, TSP	8/15/2023
CHECKED BY	ANDY CRAIG, PE, TSP	8/15/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 7

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Located approx. 420 Ft. North of outlet
Northing: 621088.2
Easting: 2243032.1
Elevation: 716.1

0 25 50 Feet

N

Staking Control Points (NAD 1983 State Plane Iowa South US SURVEY FEET)				
Point	Description	Northing	Easting	Elevation
1	Southeast Corner BIO	620616.7	2243058.1	716.5
2	Southwest Corner BIO	620606.8	2243046.7	716.9
3	Northwest Corner BIO	620652.8	2243007.8	717.9
4	Northeast Corner BIO	620662.7	2243019.3	717.4
5	Inlet WCS (3-chamber)	620679.3	2243003.3	717.8
6	Outlet WCS (2-chamber)	620620.7	2243058.7	716.5
7	Benchmark	621088.2	22430321.1	716.1

5
4
3
6
1
2
0+00.00
0+25.00
0+00.00
0+80.00

New 6" CMP Outlet
With Rodent Guard

Approx. Grade 4.2%
Connecting to
Existing Outlet.

Legend

- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 6" CPT Main
- Proposed 6" CMP Outlet
- Bioreactor Footprint
- Water Control Structure
- Benchmark
- 2 Foot Contours

DESIGNED BY ANDY MACKRILL 8/15/23
DRAWN BY ANDY MACKRILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY
DATE

PLAN MAP

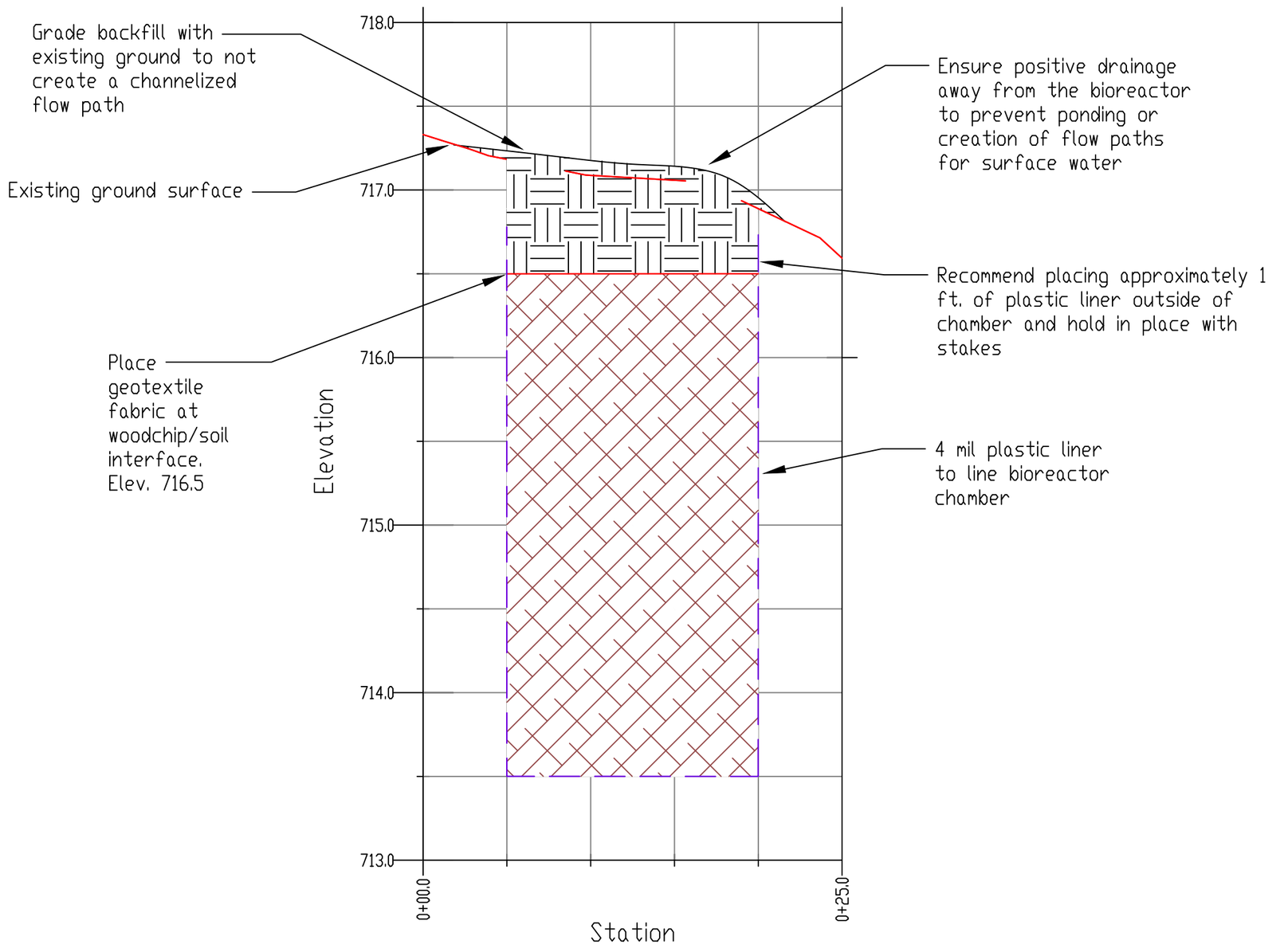
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 2 OF 7

LANDOWNER | LOCATION | SECTION 03 - T79N - R04W

Cross-Section



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface

DESIGNED BY ANDY MACKFILL 8/15/23
DRAWN BY ANDY MACKFILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY

CROSS SECTION VIEW

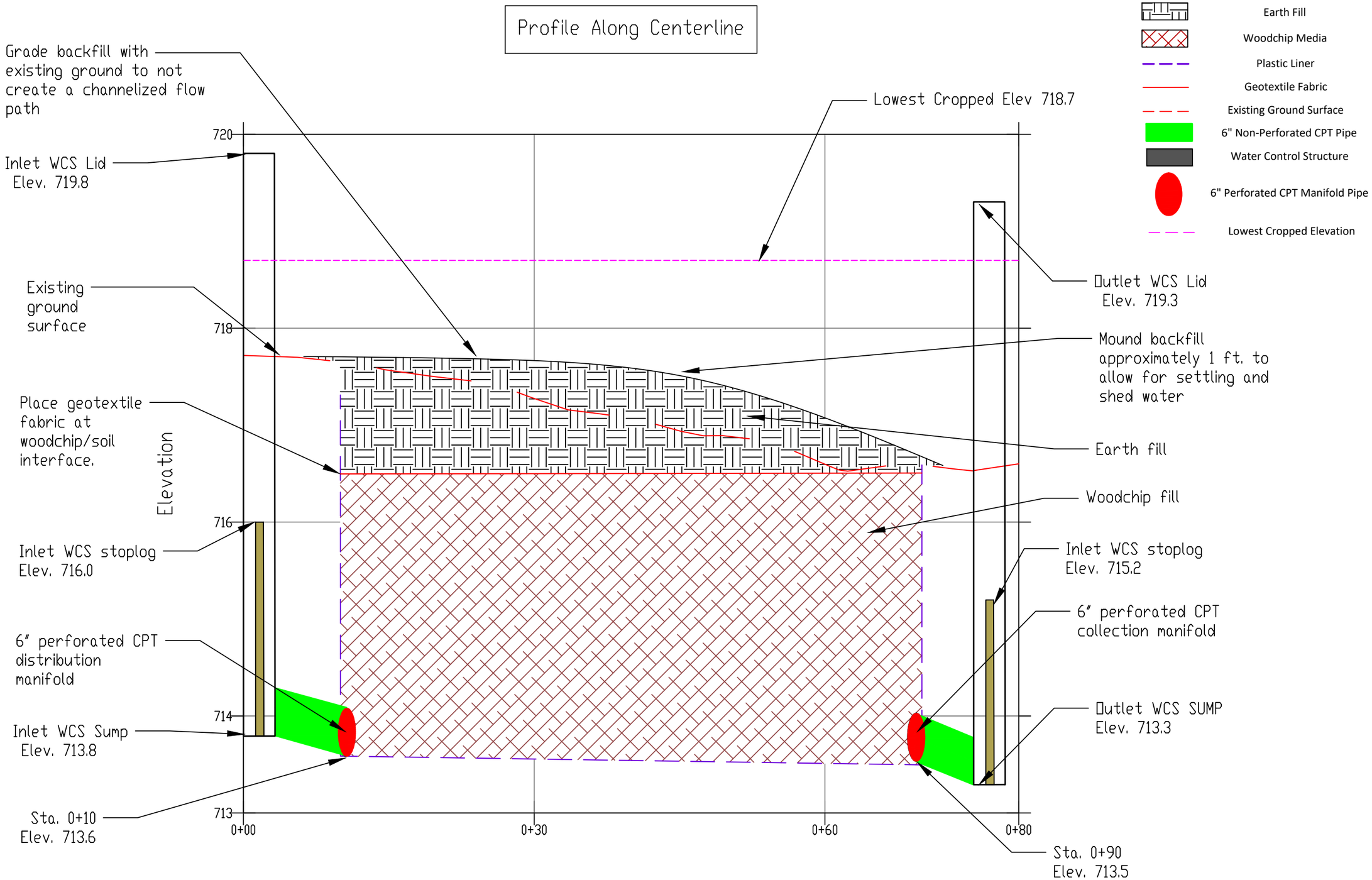
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
‹

DRAWING SET
SHEET 3 OF 7

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

Profile Along Centerline



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- 6" Non-Perforated CPT Pipe
- Water Control Structure
- 6" Perforated CPT Manifold Pipe
- Lowest Cropped Elevation

DESIGNED BY	ANDY MACKFILL
DRAWN BY	ANDY MACKFILL
CHECKED BY	ANDY CRAIG
APPROVED BY	
DATE	8/15/23
DATE	8/15/23
DATE	8/15/23

PROFILE ALONG CENTERLINE

ESE Ecosystem Services Exchange *Valuing Conservation*

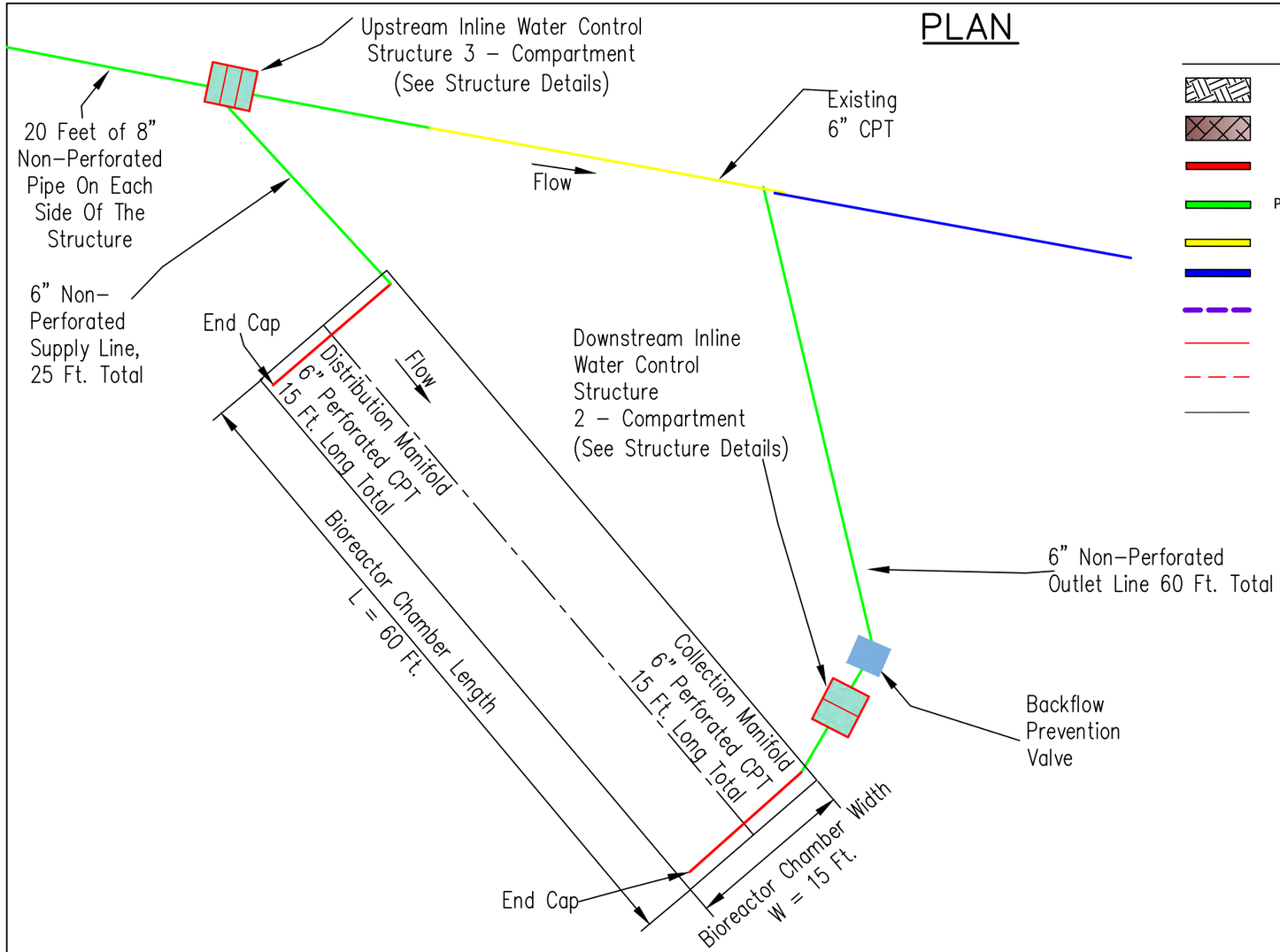
FILE NAME

DRAWING SET

SHEET 4 OF 7

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

PLAN

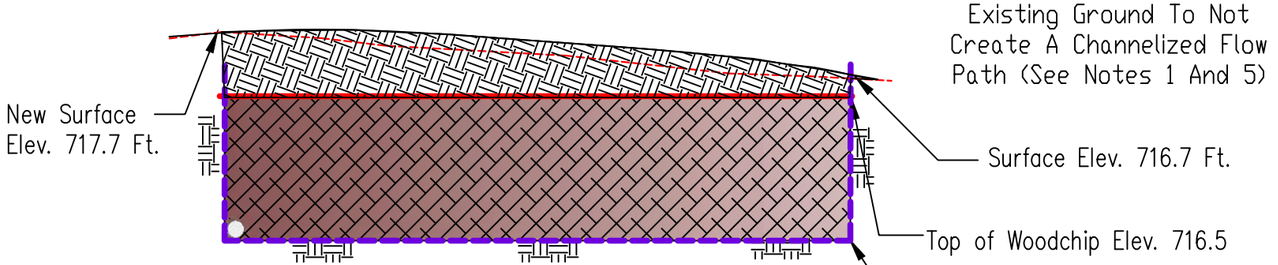


Legend

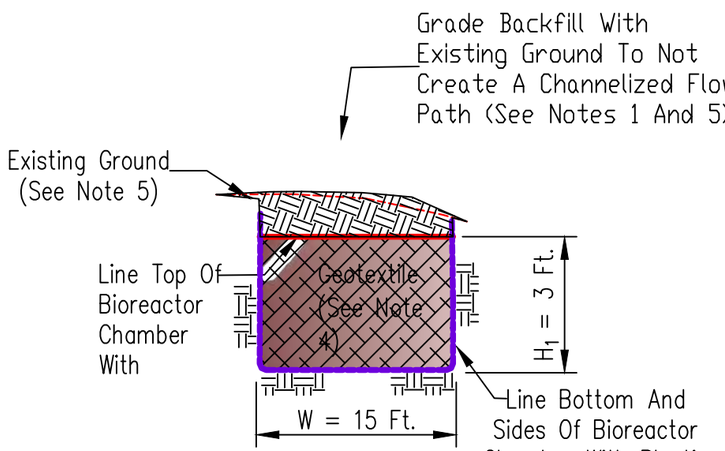
- Earth Fill
- Woodchip Media
- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 6" CPT Main
- Proposed 6" CMP Outlet
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- Bioreactor Footprint

NOTES:

1. All disturbed non–crop construction areas shall be stabilized by seeding or mulching within 14 days of conclusion of construction activities. This seeding and seed mixture shall meet the NRCS Conservation Practice Standard IA–342 (Critical Area Seeding) or other program requirements to replace previous grass stand.
2. Line bottom and sides of bioreactor chamber with plastic, minimum 4 mil thickness. Overlap any splices at least 6 inches. Lap seams in direction of flow so water flows over top of seam. Wrap plastic carefully around tiles that enter/exit the chamber; no need to seal around tiles.
3. Woodchips shall not contain woods known to have tannin, such as oak, cedar, or redwood. Woodchips shall be reasonably free of soil and other contaminants nor contain loose composting materials. Wood chips shall be around 1"long by ½" thick with minimal fines. They shall be processed through a chipper and not through a grinder. Do not use any wood that has been treated for ground contact. ESE has the right to reject any woodchips which do not meet specifications.
4. Geotextile shall be non–woven, Class II, and meet the requirements of Iowa Construction Specification IA–95, Geotextile. Overlap a minimum of 6 inches at all seams.
5. Grade site for positive drainage away from the bioreactor chamber. Spread soil in designated location away from bioreactor.
6. See Plan Map for benchmark coordinates.



ELEVATION



SECTION A–A

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

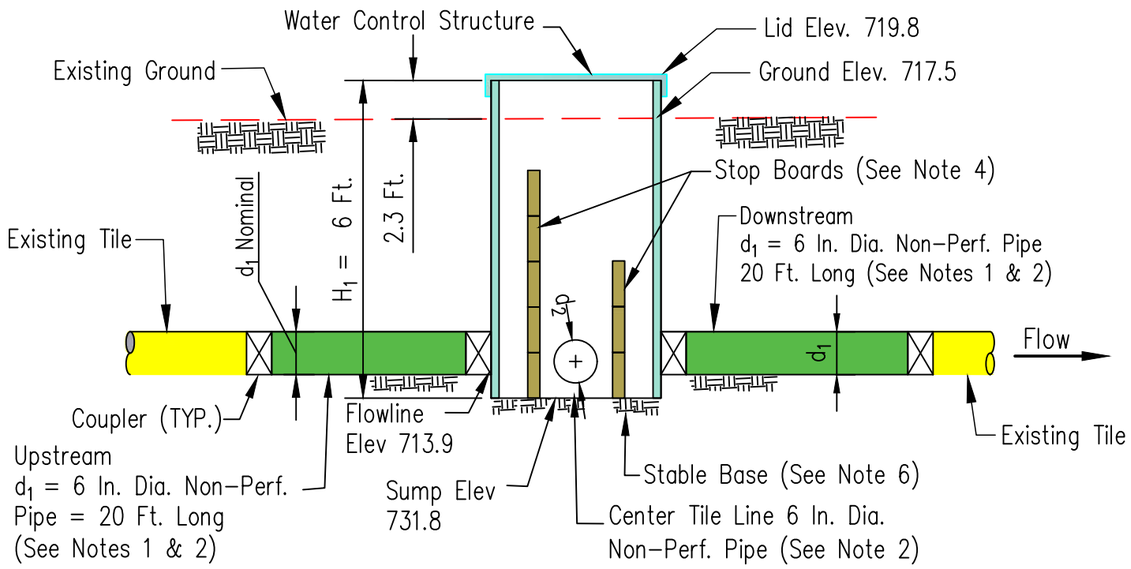
DESIGNED BY ANDY MACKFILL 8/15/23
DRAWN BY ANDY MACKFILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY

BIOREACTOR DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

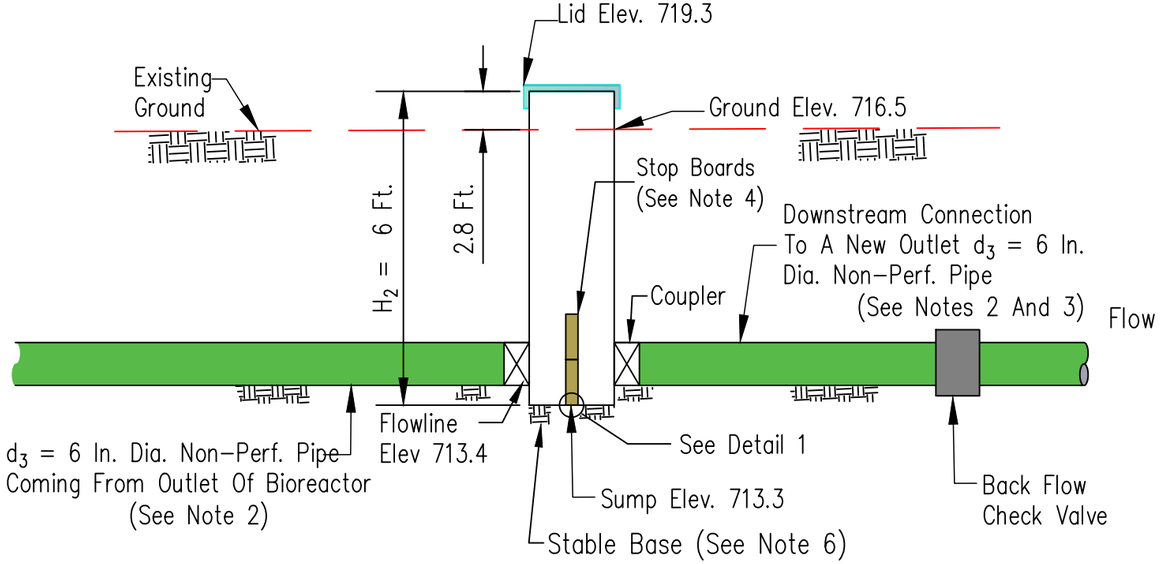
FILE NAME

DRAWING SET
SHEET 5 OF 7



TYPICAL SECTION
UPSTREAM STRUCTURE

QUANTITIES*	
Water Control Structure, 3 Chamber H_1 = 6 ft. d_1 = 6 in. d_2 = 6 in.	1
Water Control Structure, 2 Chamber H_2 = 6 ft. d_3 = 6 in.	1
6" Non-perforated Pipe (ft)	125
6" CMP Outlet Pipe With Rodent Guard (ft)	20
6" Perforated CPT (ft)	30
6" End Cap	2
Wood Chips (cu. yd.)	110
4 Mil Plastic (sq. yd.)**	183
Geotextile (sq. yd.)	100
Excavation (cu. yd.)	134
Earth Fill (cu. yd.)	50
6" Backflow Check Valve	1

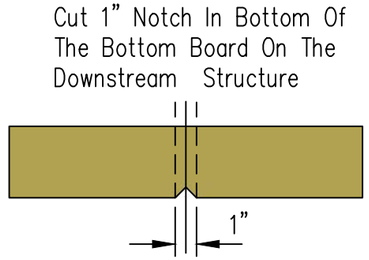


TYPICAL SECTION
DOWNSTREAM STRUCTURE

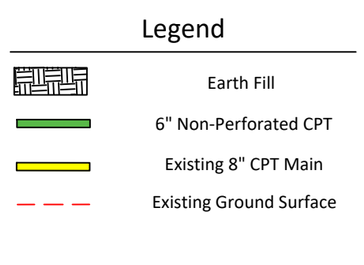
Side Port Is On The (Circle One) Left/Right Side Of Structure, Looking Downstream

* Quantities do not include tile/pipe couplers or extra material for geotextile/plastic overlap

** Accounts for 1 ft. overhang around perimeter

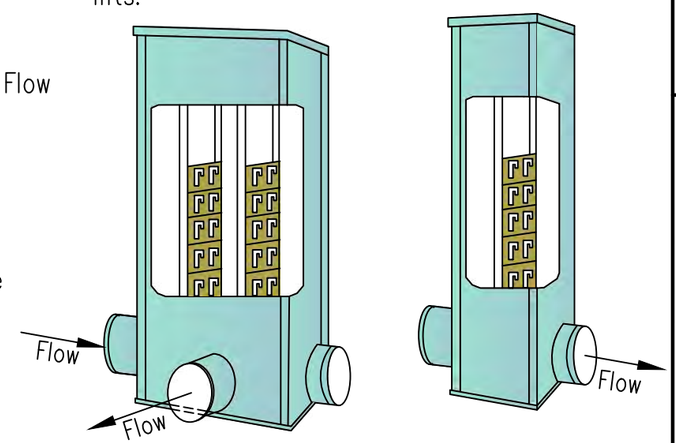


DETAIL 1



NOTES:

1. Install a minimum of 20 feet of non-perforated pipe adjacent to the water control structure, on all lines: upstream, downstream and center. Pipe must be PVC, dual-wall CPT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745. Check valve must conform to ASTM D 3034 with SDR35 pipe or stronger.
3. Couplings between the water control structures and the non-perforated tile must be watertight.
4. Stop boards must provide must tight seals under a minimum of 1 foot pressure head (except notched board).
5. Appropriately mark bioreactor perimeter to avoid vehicle, implement, or livestock traffic.
6. Place structure and pipe coupler on a stable base. A stable base may be compacted earth, compacted fill sand, or a concrete pad. Extend the stable base no less than 1 foot beyond structure.
7. Excavated material placed around structure and pipes shall be hand compacted in 4" lifts.



IN-LINE CONTROL STRUCTURES

DESIGNED BY ANDY MACKRILL 8/15/23
DRAWN BY ANDY MACKRILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY

STRUCTURE DETAIL

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME

DRAWING SET
SHEET 6 OF 7

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

CONSTRUCTION NOTES

1. Tile elevations are based on Maverick tile probe depths and are to be considered accurate within margin of error of the instrument.
2. If any surface inlets are currently attached to the tile main or plan to be in the future, they shall be replaced with water quality inlets to minimize trash entry into the tile line before construction of the bioreactor begins.
3. Avoid excessive disturbance of any buffers or grassed water ways during construction. However, if re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded within 14 days according to NRCS Conservation Practice Standard IA-342 Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
4. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion.
5. All carbon media to be placed in the bioreactor shall come from an ESE approved vendor or approved with ESE staff prior to transportation and placement.
6. Contact an ESE representative for inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the bioreactor chamber and tile line trenches
   b. After placing the water control structures and bioreactor manifolds
   c. After placement of carbon media, before backfilling with soil
   d. After connections to existing tile and final grading
7. Any product planned for use in construction must be approved by ESE prior to construction. Save and provide documentation to an ESE representative of all materials used in construction including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths
   b. Photos and invoices for quantity and quality of woodchips/carbon media
   c. Photos and invoices or product information to detail quantity and quality of plastic and geotextile fabric
   d. Photos and invoices or product information for water control structures
8. Construction tolerances are +/-0.5ft on bioreactor chamber dimensions, and +/-0.1 ft. on all elevations. Outlet WCS sump (bottom) must be below the elevation of the bioreactor chamber at the outlet end. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by a representative from ESE and will be noted in the as-built plan.
9. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.
10. All work shall be performed according to the IA construction and practice specifications in the table below.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-95	Geotextile
IA-605	Denitrifying Bioreactor
IA-620	Underground Outlet

LANDOWNER	[illegible]	LOCATION	SECTION 03 - T79N - R04W

DESIGNED BY ANDY MACKFILL 8/15/23
DRAWN BY ANDY MACKFILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY ____
DATE

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

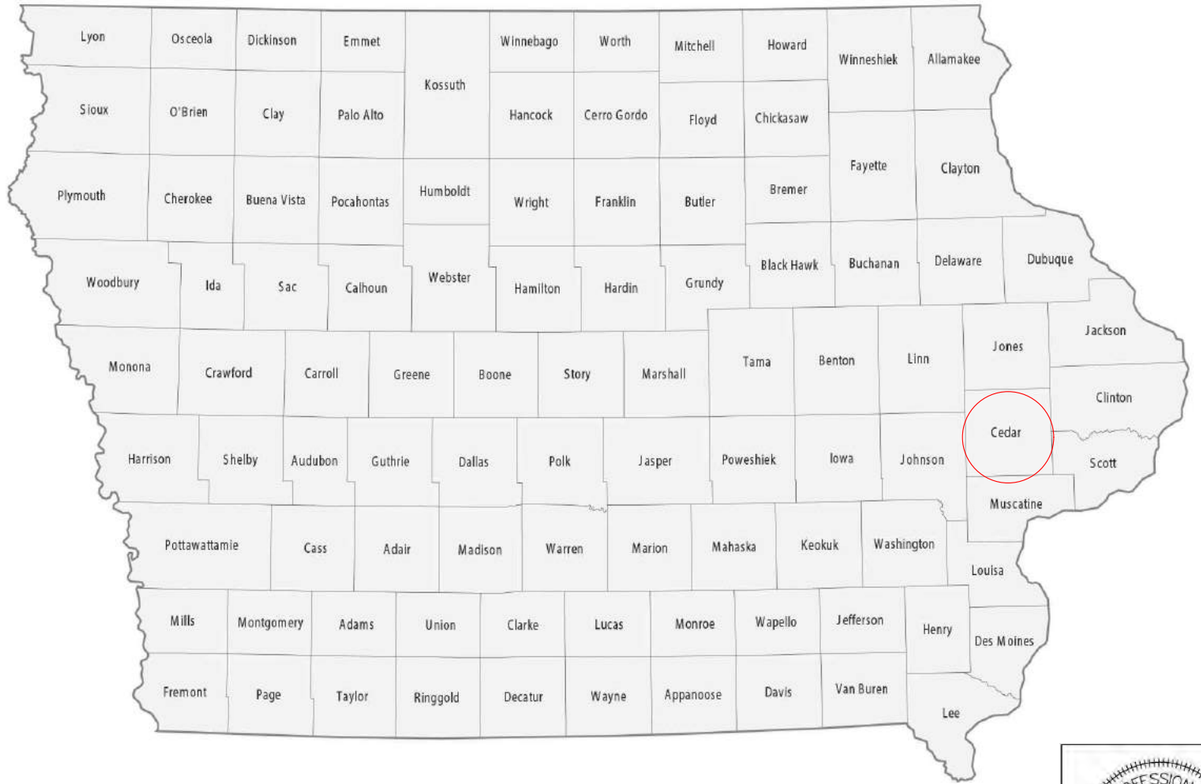
FILE NAME

DRAWING SET
SHEET 7 OF 7

DENITRIFYING BIOREACTOR CONSTRUCTION PLANS

CEDAR COUNTY, IOWA

SECTION 33- T79N - R4W



INDEX OF SHEETS

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ENGINEERING CLASS 3

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

09/08/2023

Andy J. Craig, P.E.

License number: 20832

My license renewal date is December 31,2023.

Pages or sheets covered by this seal: All

		DATE
DESIGNED BY	BEN REINHART	09/08/2023
DRAWN BY	BEN REINHART	09/08/2023
CHECKED BY	ANDY CRAIG, PE	09/08/2023
APPROVED BY		

ESE Ecosystem Services Exchange *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 7

Benchmark:
Top of Lath Hub, located approx. 320 ft. southeast of planned outlet structure on north side of railroad ditch (NAD83, Iowa South, USFt)
Northing: 590861.645
Easting: 2238550.906
Elevation: 669.6

0 25 50 Feet

N

Staking Control Points (NAD83, Iowa South, USFt)				
Point	Description	Northing	Easting	Elevation
1	Benchmark	590861.645	2238550.906	669.6
2	Inlet WCS (3-chamber)	591167.285	2238340.485	667.1
3	Outlet WCS (2-chamber)	591060.953	2238311.689	669.0
4	Northwest Corner BIO	591111.247	2238244.863	669.1
5	Northeast Corner BIO	591126.983	2238257.206	669.4
6	Southeast Corner BIO	591077.610	2238320.153	668.3
7	Southwest Corner BIO	591061.873	2238307.810	669.1

2
5
4
6
7
3
0+00.00
0+50.00
0+30.00
0+00.00
1+00.00

Approx. Grade 0.13% to existing main.

New 8" CMP Outlet with Rodent Guard

Legend
- Existing 8" CPT Main
- Proposed 8" Non-Perf CPT Main
- Proposed 6" Non-Perf CPT
- Proposed 6" Perf CPT
- Proposed 8" CMP Outlet
- Bioreactor Footprint
- Staking Points
- Water Control Structure
- 2-Ft Contours

DATE
DESIGNED BY BEN REINHART 09/08/23
DRAWN BY BEN REINHART 09/08/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

PLAN MAP

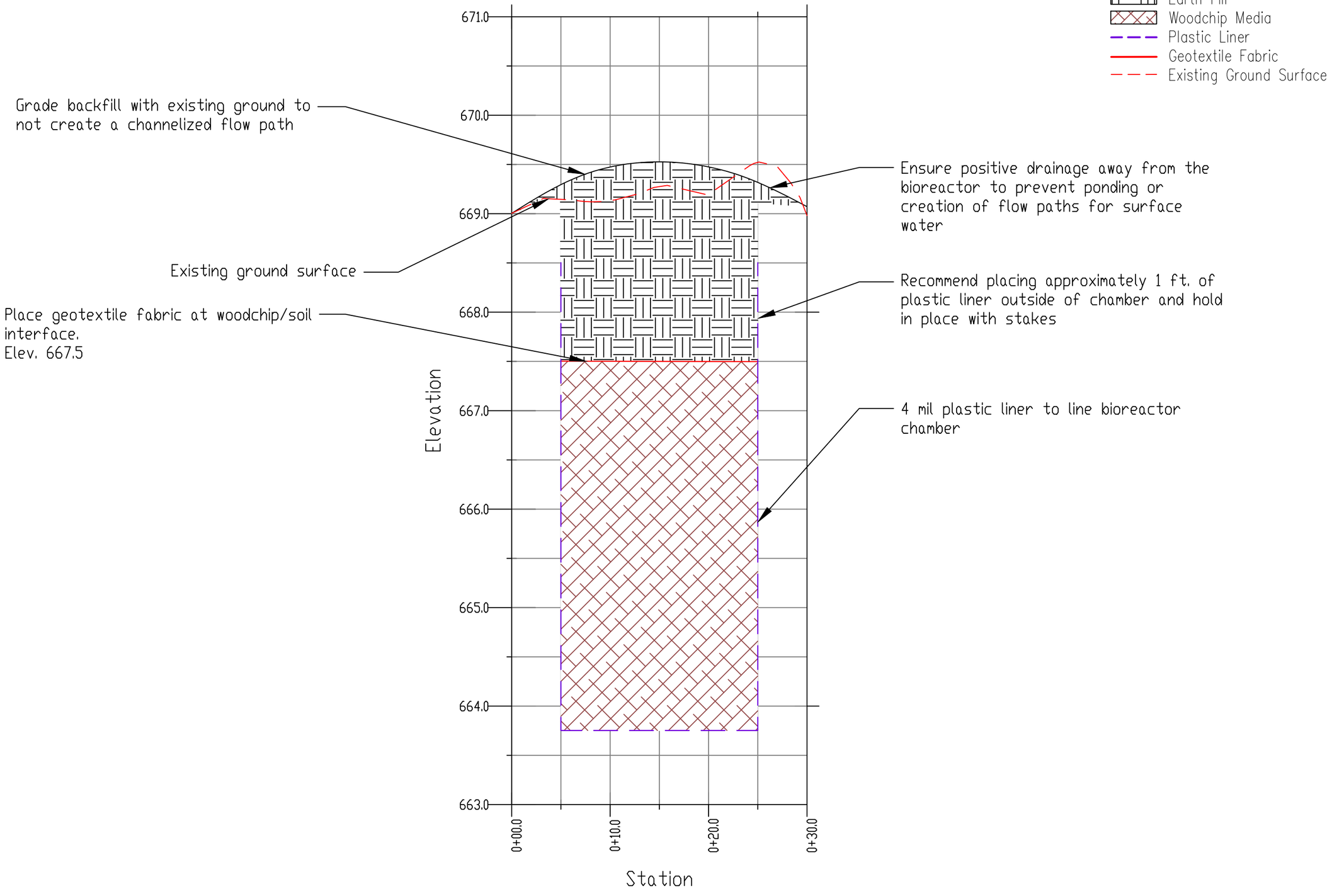
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
JI

DRAWING SET
SHEET 2 OF 7

LANDOWNER | LOCATION | SECTION 33 - T79N - R4W

Bioreactor Cross Section



LANDOWNER		LOCATION	SECTION 33 - T79N - R4W

DESIGNED BY BEN REINHART 09/08/23
DRAWN BY BEN REINHART 09/08/23
CHECKED BY ANDY CRAIG, PE 09/08/23
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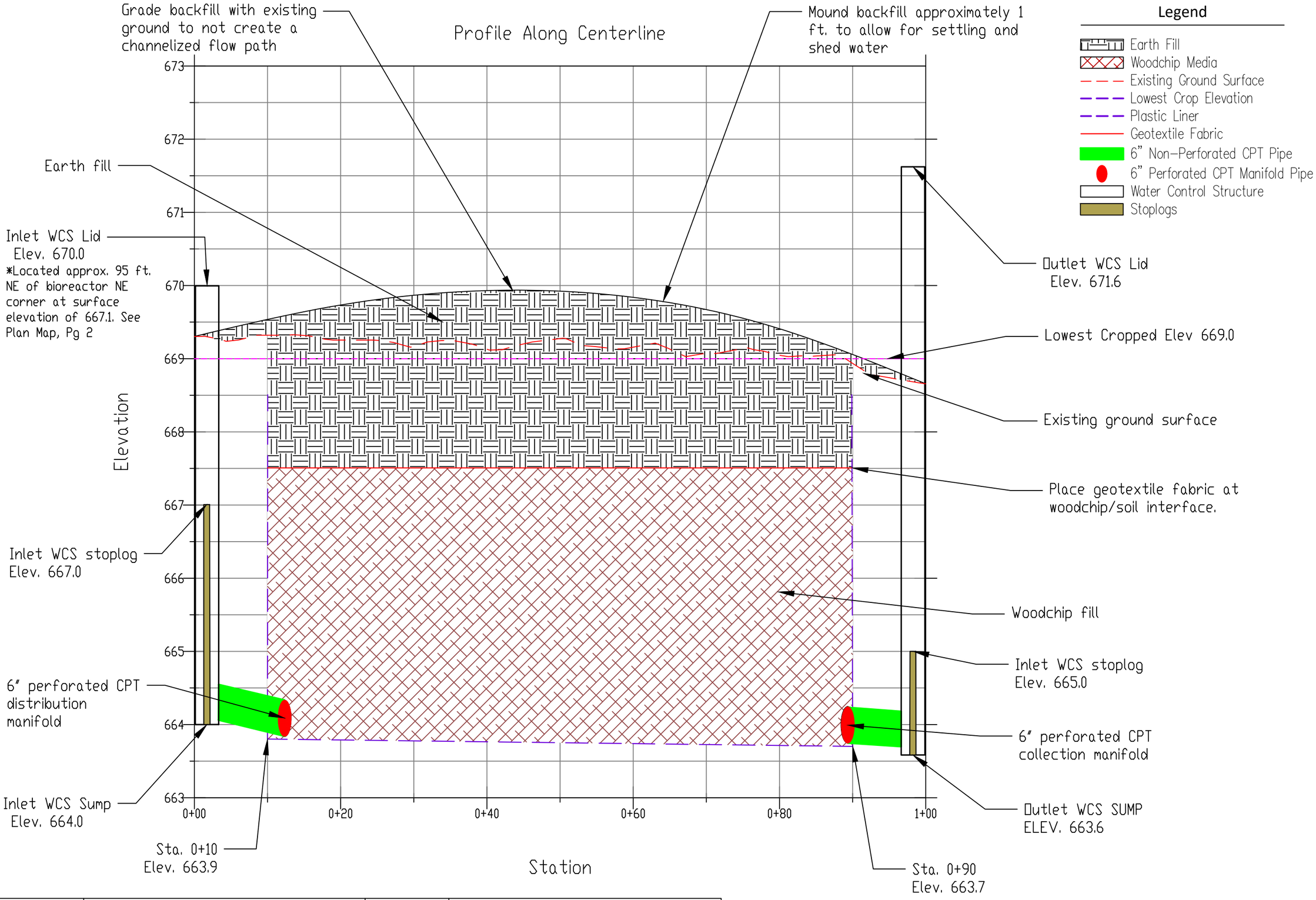
CROSS SECTION VIEW

ESE Ecosystem Services Exchange
Valuing Conservation

FILE NAME

DRAWING SET
SHEET 3 OF 7

Profile Along Centerline



Legend

- Earth Fill
- Woodchip Media
- Existing Ground Surface
- Lowest Crop Elevation
- Plastic Liner
- Geotextile Fabric
- 6" Non-Perforated CPT Pipe
- 6" Perforated CPT Manifold Pipe
- Water Control Structure
- Stoplogs

DATE	09/08/23
DESIGNED BY	BEN REINHART
DRAWN BY	BEN REINHART
CHECKED BY	ANDY CRAIG, PE
APPROVED BY	

PROFILE ALONG CENTERLINE

ESE Ecosystem Services Exchange — Valuing Conservation

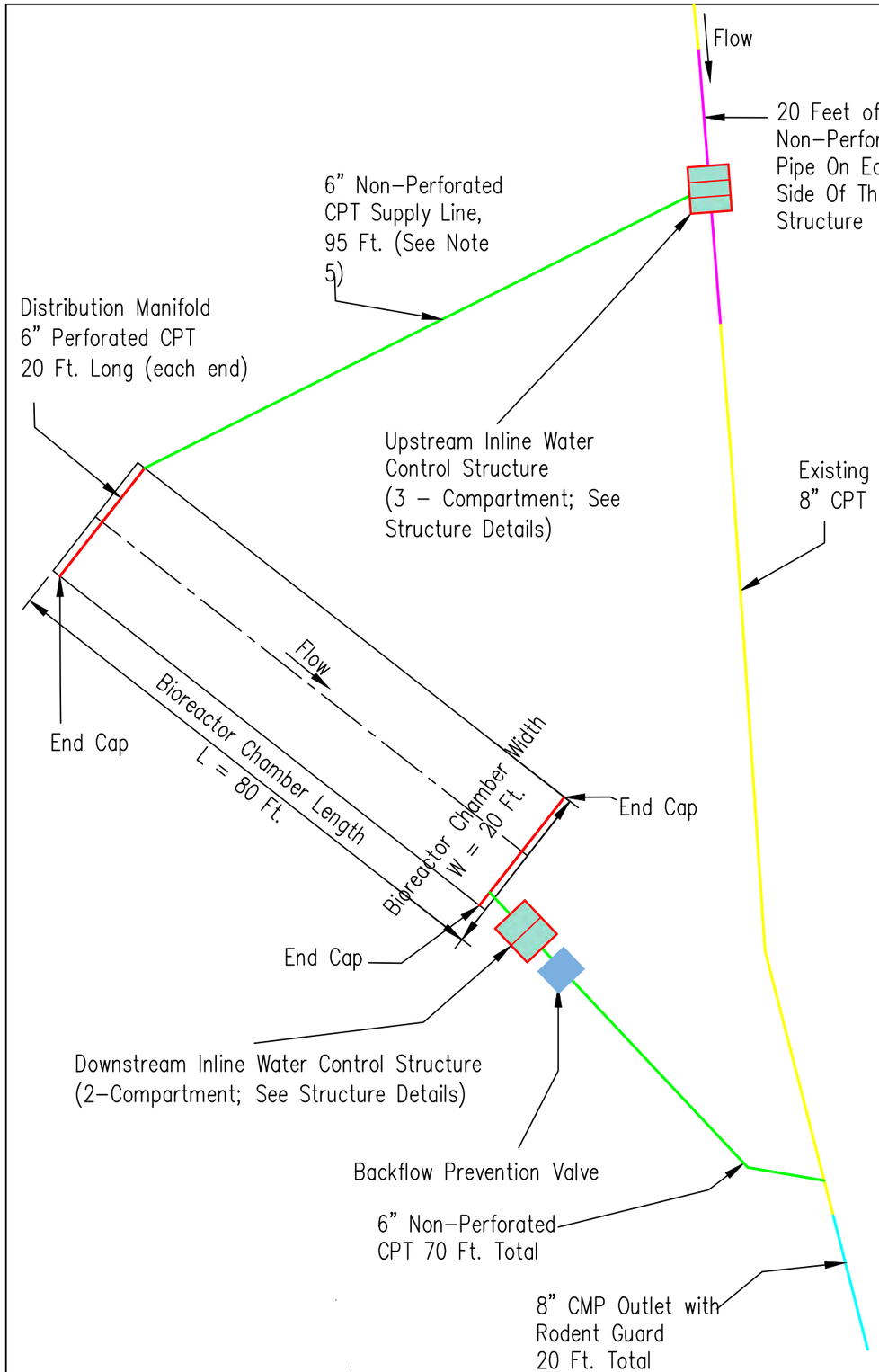
FILE NAME

DRAWING SET

SHEET 4 OF 7

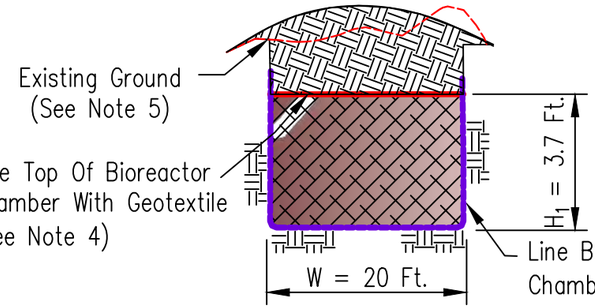
LANDOWNER		LOCATION	SECTION 33 - T79N - R4W

PLAN



SECTION A-A

Grade Backfill With Existing Ground To Not Create A Channelized Flow Path (See Notes 1 And 5)

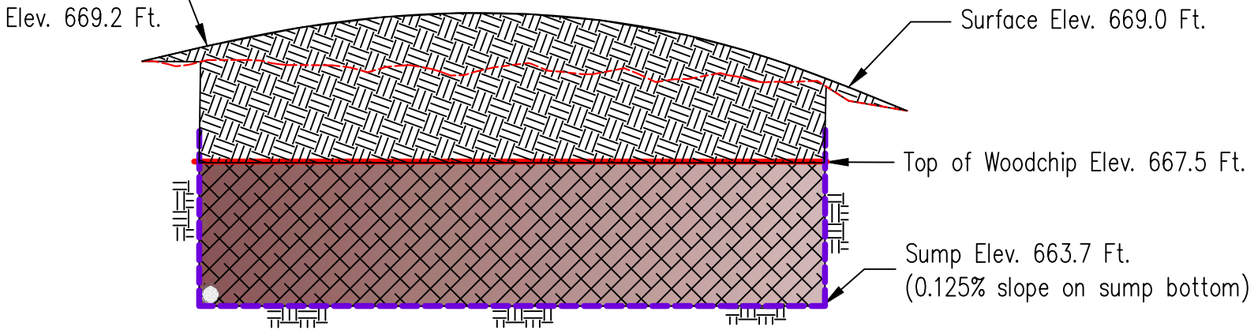


Legend

- Earth Fill
- Woodchip Media
- Existing 8" Perf CPT Main
- Proposed 8" Non-Perf CPT
- Proposed 6" Non-Perf CPT
- Proposed 6" Perf CPT
- Proposed 8" CMP Outlet
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- Bioreactor Footprint

ELEVATION

Grade Backfill With Existing Ground To Not Create A Channelized Flow Path (See Notes 1 And 5)



NOTES:

1. All disturbed non-crop construction areas shall be stabilized by seeding or mulching within 14 days of conclusion of construction activities. This seeding and seed mixture shall meet the NRCS Conservation Practice Standard IA-342 (Critical Area Seeding) or other program requirements to replace previous grass stand.
2. Line bottom and sides of bioreactor chamber with plastic, minimum 4 mil thickness. Overlap any splices at least 6 inches. Lap seams in direction of flow so water flows over top of seam. Wrap plastic carefully around tiles that enter/exit the chamber; no need to seal around tiles.
3. Woodchips shall not contain woods known to have tannin, such as oak, cedar, or redwood. Woodchips shall be reasonably free of soil and other contaminants nor contain loose composting materials. Wood chips shall be around 1-inch long by ½-inch thick with minimal fines. They shall be processed through a chipper and not through a grinder. Do not use any wood that has been treated for ground contact. ESE has the right to reject any woodchips which do not meet specifications.
4. Geotextile shall be non-woven, Class II, and meet the requirements of Iowa Construction Specification IA-95, Geotextile. Overlap a minimum of 6 inches at all seams.
5. Grade site for positive drainage away from the bioreactor chamber. Spread soil in designated location away from bioreactor.
6. See Plan Map for benchmark coordinates.

LANDOWNER		LOCATION	SECTION 33 - T79N - R4W

DATE
DESIGNED BY BEN REINHART 09/08/23
DRAWN BY BEN REINHART 09/08/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

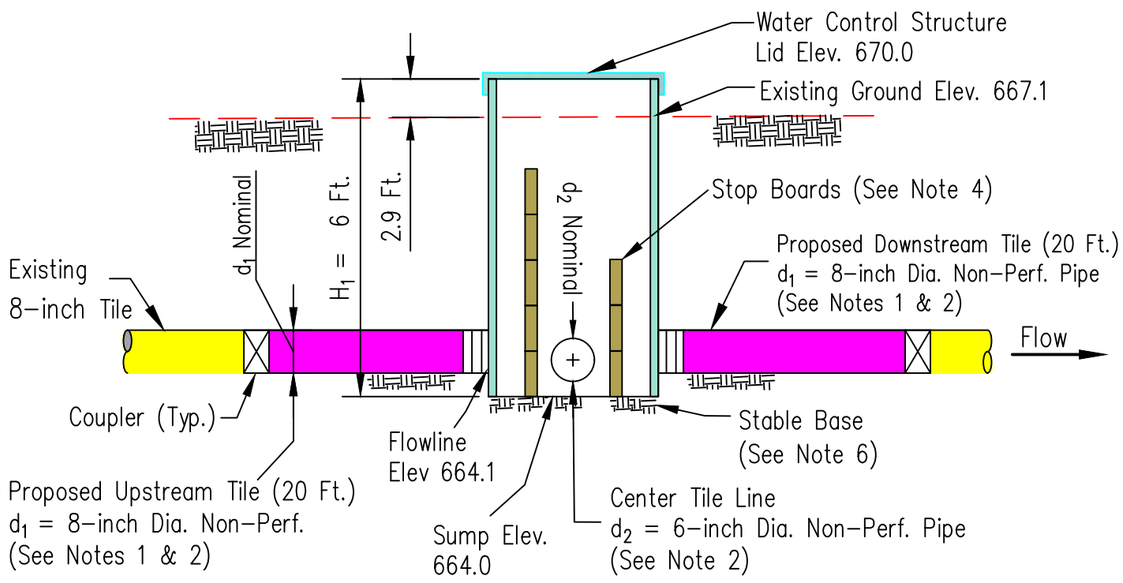
BIOREACTOR DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

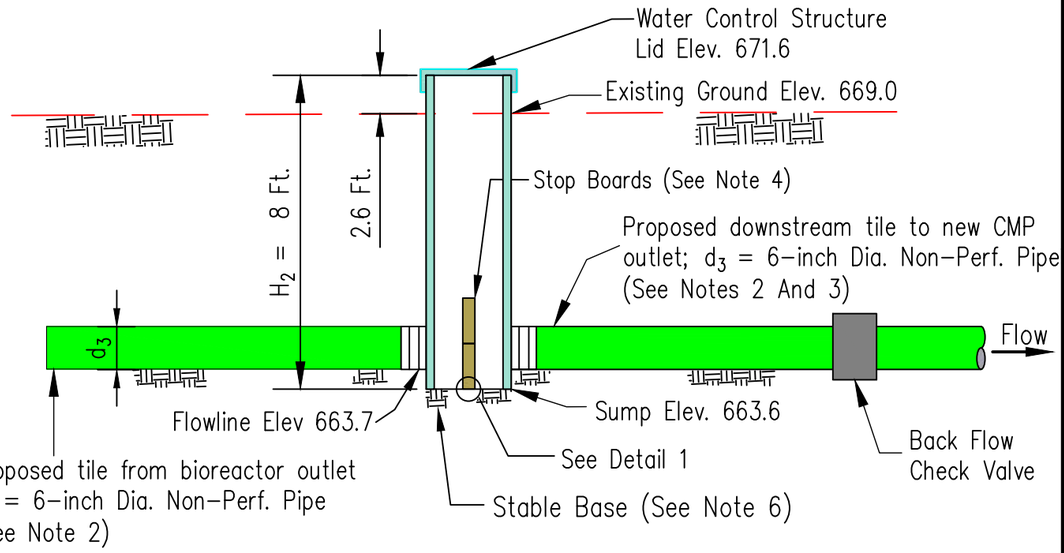
FILE NAME

DRAWING SET
SHEET 5 OF 7

TYPICAL SECTION
UPSTREAM 3–COMPARTMENT STRUCTURE



TYPICAL SECTION
DOWNSTREAM 2–COMPARTMENT STRUCTURE



QUANTITIES*

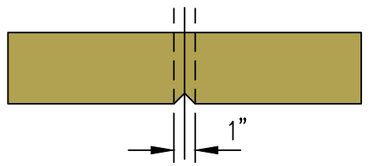
Water Control Structure, 3 Chamber (H_1 = 6 ft. | d_1 = 8 in. | d_2 = 6 in.)	1
Water Control Structure, 2 Chamber (H_2 = 8 ft. | d_3 = 6 in.)	1
8" Non–perforated Pipe (ft)	40
6" Non–perforated Pipe (ft)	165
6" Perforated CPT (ft)	40
8" CMP Outlet with Rodent Guard (ft)	20
6" End Cap (each)	3
Wood Chips (cu. yd.)	242
4 Mil Plastic (sq. yd.)**	307
Geotextile (sq. yd.)	178
Excavation (cu. yd.)	309
Earth Fill (cu. yd.)	119
6" Backflow Check Valve (each)	1

* Quantities do not include tile/pipe couplers or extra material for geotextile/plastic overlap
** Accounts for 1 ft. overhang around perimeter

NOTES:
1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, on all lines: upstream, downstream and center. Pipe must be PVC, dual–wall CPT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745. Check valve must conform to ASTM D 3034 with SDR35 pipe or stronger.
3. Couplings between the water control structures and the non–perforated tile must be watertight.
4. Stop boards must provide must tight seals under a minimum of 1 foot pressure head (except notched board).
5. Appropriately mark bioreactor perimeter to avoid vehicle, implement, or livestock traffic.
6. Place structure and pipe coupler on a stable base. A stable base may be compacted earth, compacted fill sand, or a concrete pad. Extend the stable base no less than 1 foot beyond structure.
7. Excavated material placed around structure and pipes shall be hand compacted in 4" lifts.

DETAIL 1

Cut 1" Notch In Bottom Of The Bottom Board On The Downstream Structure

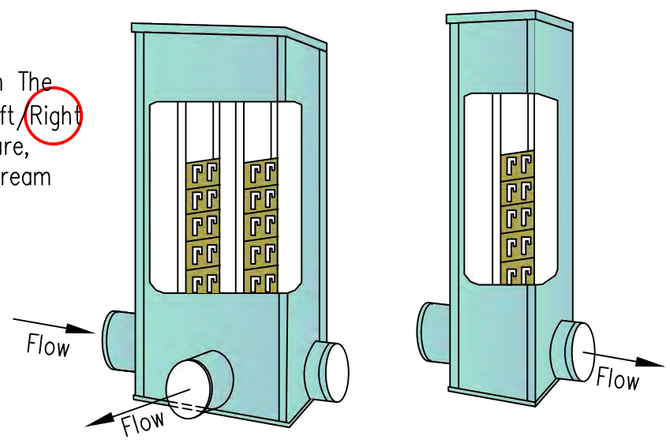


Legend

- Earth Fill
- Existing 8" Perf CPT Main
- Proposed 8" Non–Perf CPT
- Proposed 6" Non–Perf CPT
- Existing Ground
- Control Structure Stoplogs

IN–LINE CONTROL STRUCTURES

Side Port Is On The (Circle One) Left/Right Side Of Structure, Looking Downstream



LANDOWNER		LOCATION	SECTION 33 – T79N – R4W

DESIGNED BY BEN REINHART 09/08/23
DRAWN BY BEN REINHART 09/08/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

STRUCTURE DETAIL

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME

DRAWING SET
SHEET 6 OF 7

CONSTRUCTION NOTES

1. Tile elevations are based on Maverick tile probe depths and are to be considered accurate within margin of error of the instrument.
2. If any surface inlets are currently attached to the tile main or plan to be in the future, they shall be replaced with water quality inlets to minimize trash entry into the tile line before construction of the bioreactor begins.
3. Avoid excessive disturbance of any buffers or grassed water ways during construction. However, if re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded within 14 days according to NRCS Conservation Practice Standard IA-342 Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
4. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion.
5. All carbon media to be placed in the bioreactor shall come from an ESE approved vendor or approved with ESE staff prior to transportation and placement.
6. Contact an NRCS representative for inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the bioreactor chamber and tile line trenches
   b. After placing the water control structures and bioreactor manifolds
   c. After placement of carbon media, before backfilling with soil
   d. After connections to existing tile and final grading
7. Any product planned for use in construction must be approved by ESE prior to construction. Save and provide documentation to an NRCS representative of all materials used in construction including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths
   b. Photos and invoices for quantity and quality of woodchips/carbon media
   c. Photos and invoices or product information to detail quantity and quality of plastic and geotextile fabric
   d. Photos and invoices or product information for water control structures
8. Construction tolerances are +/-0.5ft on bioreactor chamber dimensions, and +/-0.1 ft. on all elevations. Outlet WCS sump (bottom) must be below the elevation of the bioreactor chamber at the outlet end. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by a representative from ESE or NRCS and will be noted in the as-built plan.
9. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.
10. All work shall be performed according to the IA construction and practice specifications in the table below.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-95	Geotextile
IA-605	Denitrifying Bioreactor
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 33 - T79N - R4W

DESIGNED BY BEN REINHART 09/08/23
DRAWN BY BEN REINHART 09/08/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

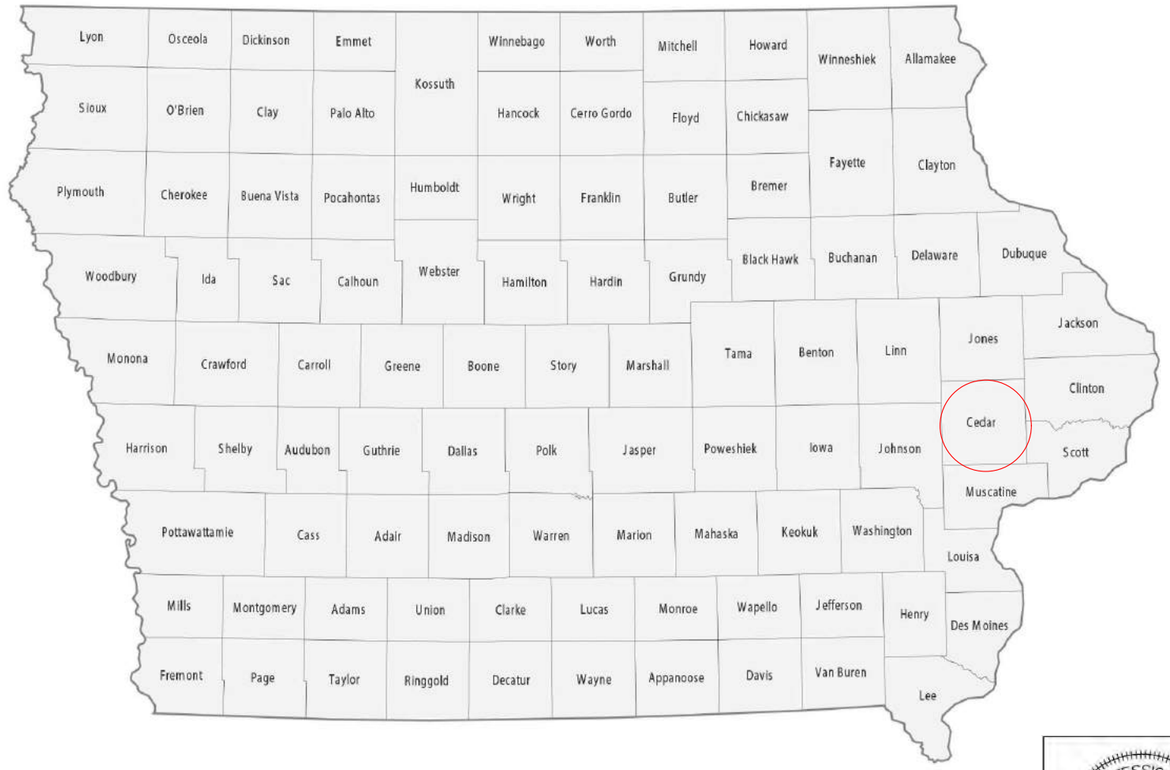
FILE NAME

DRAWING SET
SHEET 7 OF 7

DENITRIFYING BIOREACTOR CONSTRUCTION PLANS

CEDAR COUNTY, IOWA

SECTION 33- T79N - R4W



INDEX OF SHEETS

811 Know what's **below.** **Call** before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

ENGINEERING CLASS 5

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

09/08/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31,2023.
Pages or sheets covered by this seal: All

		DATE
DESIGNED BY	BEN REINHART	09/07/2023
DRAWN BY	BEN REINHART	09/07/2023
CHECKED BY	ANDY CRAIG, PE	09/08/2023
APPROVED BY		

ESE Ecosystem Services Exchange *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 7

Benchmark:
Top of Lath Hub (NAD83, Iowa South, USFt)
Northing: 590014.512
Easting: 2237384.267
Elevation: 667.7

0 25 50 Feet

N

Staking Control Points (NAD83, Iowa South, USFt)				
Point	Description	Northing	Easting	Elevation
1	Benchmark	590014.512	2237384.267	667.7
2	Inlet WCS (3-chamber)	590093.9491′	2237190.5790′	665.5
3	Outlet WCS (2-chamber)	589985.6505′	2237259.1809′	665.9
4	Northwest Corner BIO	590038.5199′	2237180.6080′	665.3
5	Northeast Corner BIO	590060.8792′	2237203.5004′	665.6
6	Southeast Corner BIO	590003.6480′	2237259.3985′	666.2
7	Southwest Corner BIO	589981.2888′	2237236.5061′	665.8

2
5
4
6
7
3
1
0+00.00
0+50.00
0+40.00
1+00.00

Approx. Grade 0.18% to existing outlet.

New 12" CMP Outlet with Rodent Guard

Legend

- Existing 12" CPT Main
- Proposed 12" Non-Perf CPT Main
- Proposed 8" Non-Perf CPT
- Proposed 6" Non-Perf CPT
- Proposed 6" Perf CPT
- Proposed 12" CMP Outlet
- Bioreactor Footprint
- Staking Points
- Water Control Structure
- Benchmark
- 2-Ft Contours

DATE
DESIGNED BY BEN REINHART 09/07/23
DRAWN BY BEN REINHART 09/07/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

PLAN MAP

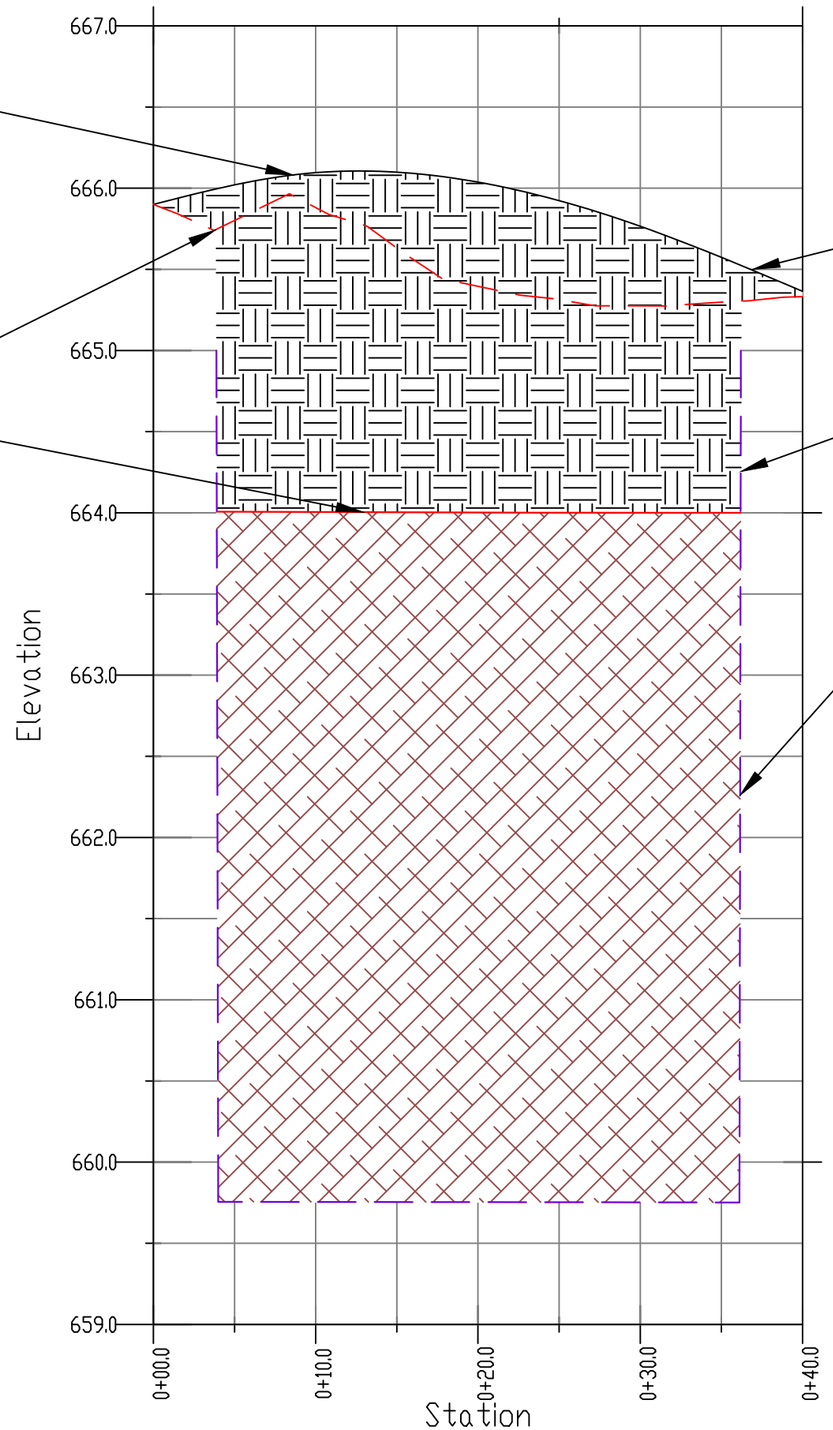
ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME

DRAWING SET
SHEET 2 OF 7

LANDOWNER | LOCATION | SECTION 33 - T79N - R4W

Bioreactor Cross Section



Grade backfill with existing ground to not create a channelized flow path

Existing ground surface

Place geotextile fabric at woodchip/soil interface.
Elev. 664.0

Ensure positive drainage away from the bioreactor to prevent ponding or creation of flow paths for surface water

Recommend placing approximately 1 ft. of plastic liner outside of chamber and hold in place with stakes

4 mil plastic liner to line bioreactor chamber

Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface

DESIGNED BY BEN REINHART 09/07/23
DRAWN BY BEN REINHART 09/07/23
CHECKED BY ANDY CRAIG, PE 09/08/23
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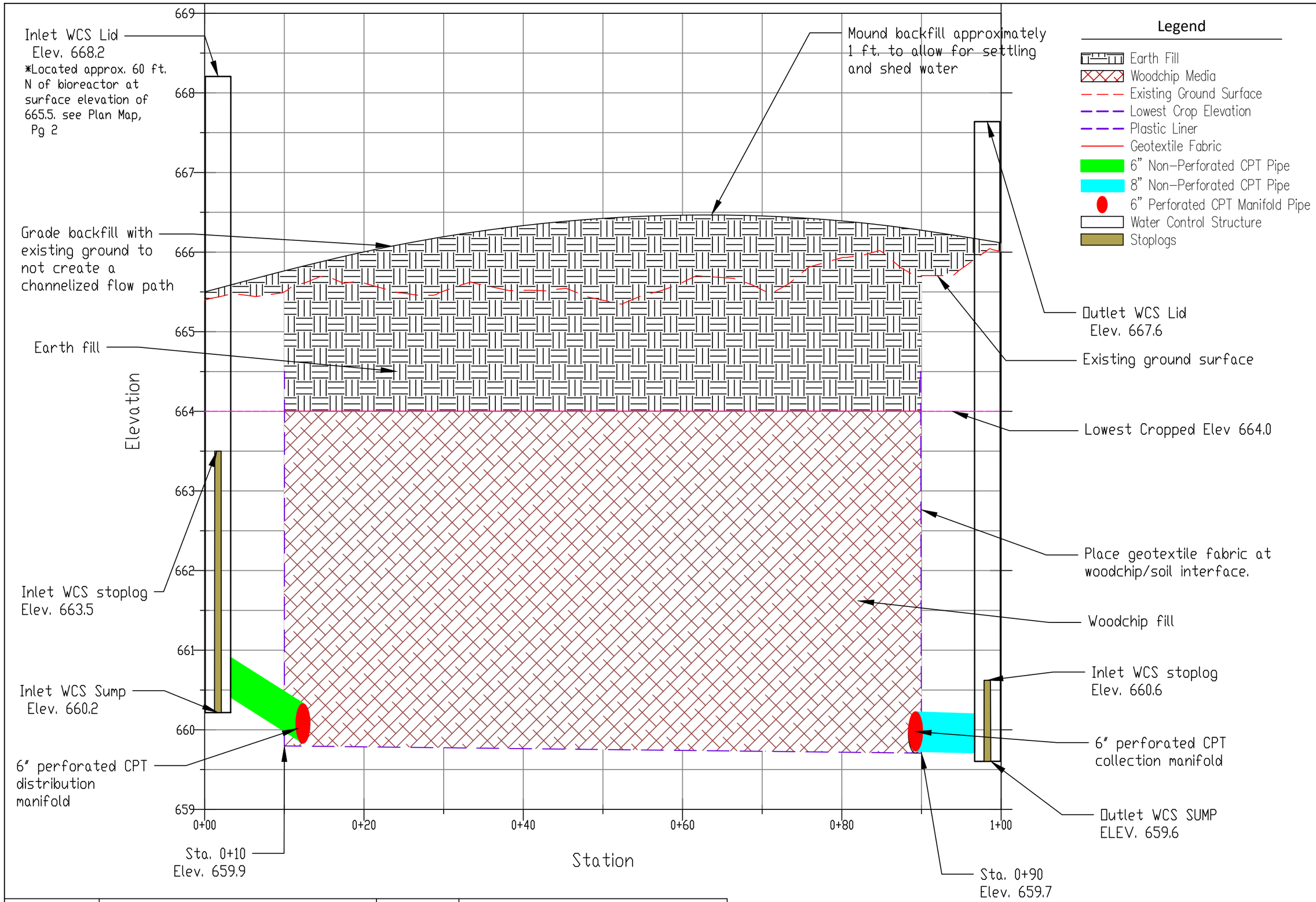
CROSS SECTION VIEW

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME
.

DRAWING SET
SHEET 3 OF 7

LANDOWNER		LOCATION	SECTION 33 - T79N - R4W



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PROFILE ALONG CENTERLINE

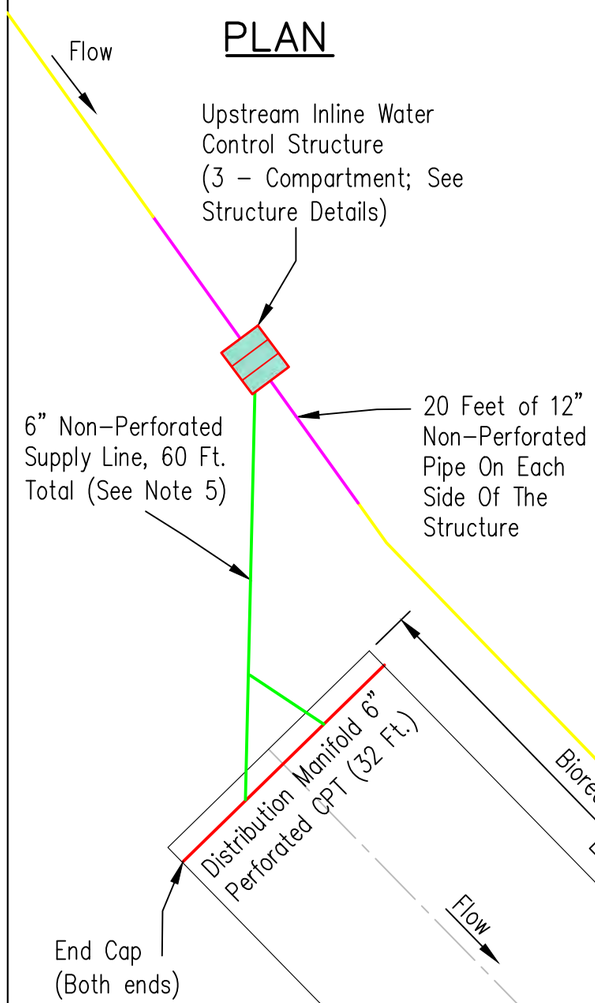
ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME

DRAWING SET
SHEET 4 OF 7

LANDOWNER		LOCATION	SECTION 33 - T79N - R4W

PLAN

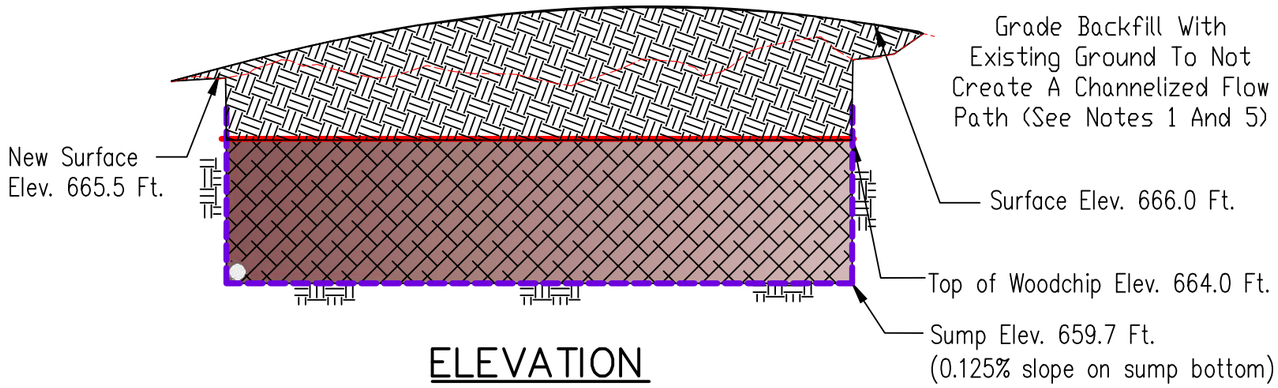


Legend

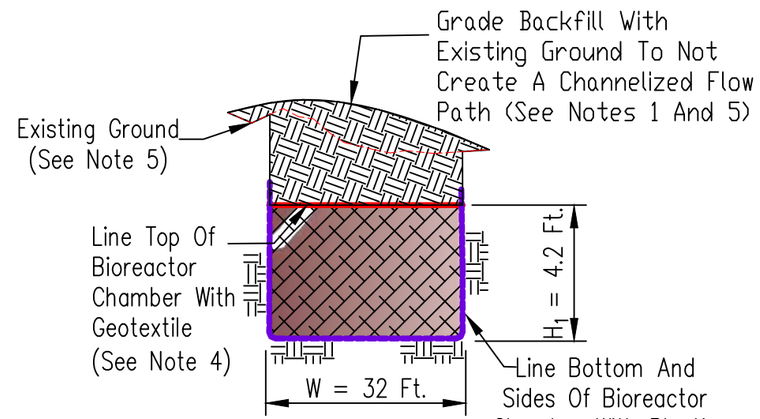
- Earth Fill
- Woodchip Media
- Existing 12" Perf CPT Main
- Proposed 12" Non–Perf CPT
- Proposed 8" Non–Perf CPT
- Proposed 6" Non–Perf CPT
- Proposed 6" Perf CPT
- Proposed 12" CMP Outlet
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- Bioreactor Footprint

NOTES:

1. All disturbed non–crop construction areas shall be stabilized by seeding or mulching within 14 days of conclusion of construction activities. This seeding and seed mixture shall meet the NRCS Conservation Practice Standard IA–342 (Critical Area Seeding) or other program requirements to replace previous grass stand.
2. Line bottom and sides of bioreactor chamber with plastic, minimum 4 mil thickness. Overlap any splices at least 6 inches. Lap seams in direction of flow so water flows over top of seam. Wrap plastic carefully around tiles that enter/exit the chamber; no need to seal around tiles.
3. Woodchips shall not contain woods known to have tannin, such as oak, cedar, or redwood. Woodchips shall be reasonably free of soil and other contaminants nor contain loose composting materials. Wood chips shall be around 1–inch long by ½–inch thick with minimal fines. They shall be processed through a chipper and not through a grinder. Do not use any wood that has been treated for ground contact. ESE has the right to reject any woodchips which do not meet specifications.
4. Geotextile shall be non–woven, Class II, and meet the requirements of Iowa Construction Specification IA–95, Geotextile. Overlap a minimum of 6 inches at all seams.
5. Grade site for positive drainage away from the bioreactor chamber. Spread soil in designated location away from bioreactor.
6. See Plan Map for benchmark coordinates.



ELEVATION



SECTION A–A

LANDOWNER		LOCATION	SECTION 33 – T79N – R4W

DESIGNED BY BEN REINHART 09/07/23
DRAWN BY BEN REINHART 09/07/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

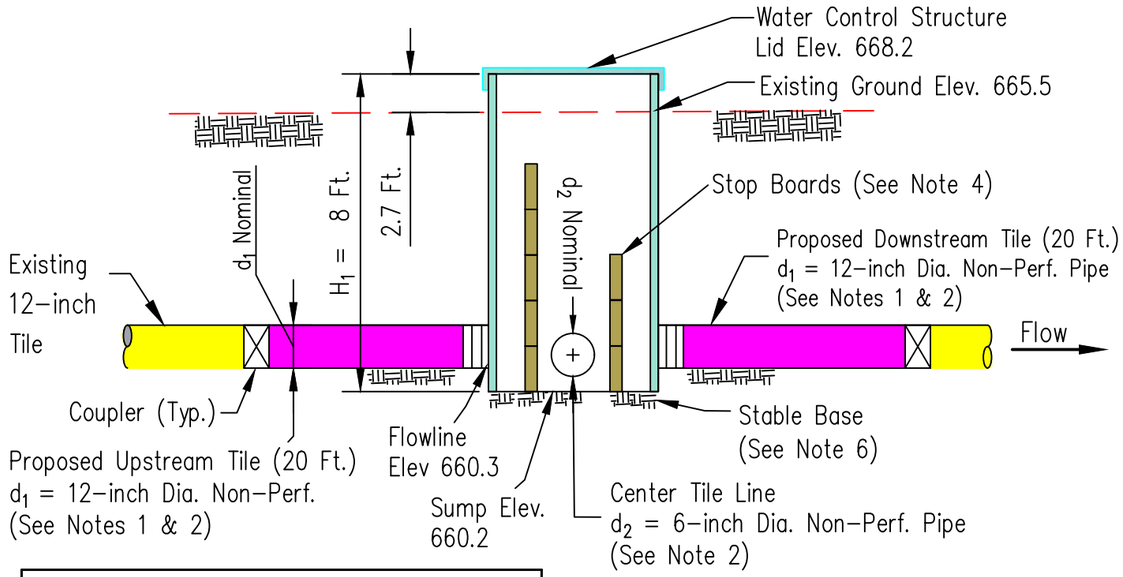
BIOREACTOR DETAIL

ESE Ecosystem Services Exchange *Valuing Conservation*

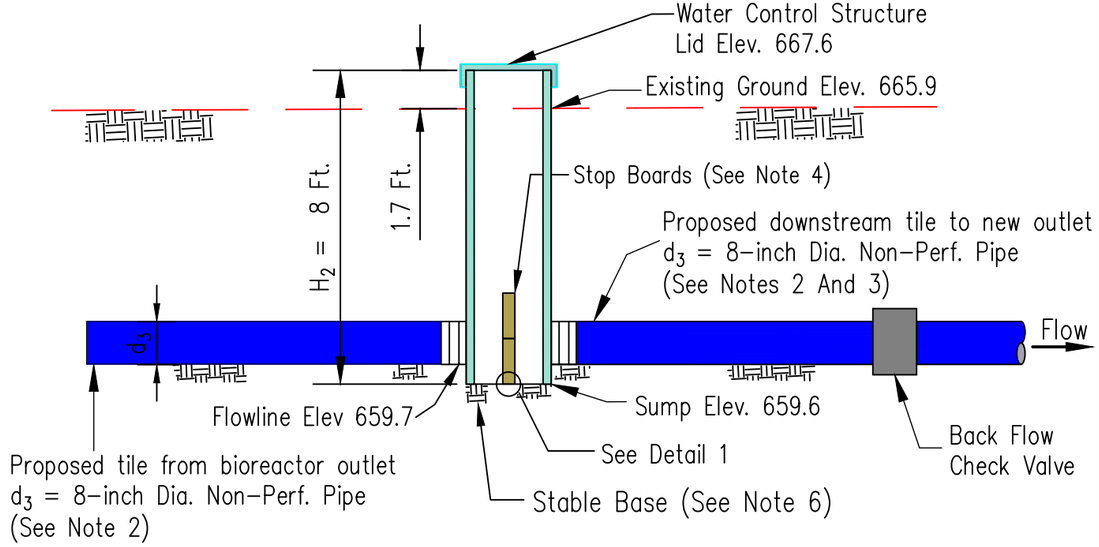
FILE NAME
.

DRAWING SET
SHEET 5 OF 7

TYPICAL SECTION
UPSTREAM 3–COMPARTMENT STRUCTURE



TYPICAL SECTION
DOWNSTREAM 2–COMPARTMENT STRUCTURE



QUANTITIES*	
Water Control Structure, 3 Chamber (H_1 = 8 ft. | d_1 = 12 in. | d_2 = 6 in.)	1
Water Control Structure, 2 Chamber (H_2 = 8 ft. | d_3 = 8 in.)	1
12" Non–perforated Pipe (ft)	40
8" Non–perforated Pipe (ft)	80
6" Non–perforated Pipe (ft)	60
6" Perforated CPT (ft)	64
12" CMP Outlet with Rodent Guard (ft)	20
6" End Cap (each)	4
Wood Chips (cu. yd.)	439
4 Mil Plastic (sq. yd.)**	448
Geotextile (sq. yd.)	285
Excavation (cu. yd.)	541
Earth Fill (cu. yd.)	190
8" Backflow Check Valve (each)	1

* Quantities do not include tile/pipe couplers or extra material for geotextile/plastic overlap

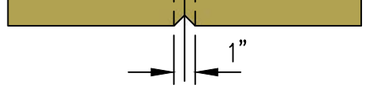
** Accounts for 1 ft. overhang around perimeter

NOTES:

1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, on all lines: upstream, downstream and center. Pipe must be PVC, dual–wall CPT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745. Check valve must conform to ASTM D 3034 with SDR35 pipe or stronger.
3. Couplings between the water control structures and the non–perforated tile must be watertight.
4. Stop boards must provide must tight seals under a minimum of 1 foot pressure head (except notched board).
5. Appropriately mark bioreactor perimeter to avoid vehicle, implement, or livestock traffic.
6. Place structure and pipe coupler on a stable base. A stable base may be compacted earth, compacted fill sand, or a concrete pad. Extend the stable base no less than 1 foot beyond structure.
7. Excavated material placed around structure and pipes shall be hand compacted in 4" lifts.

DETAIL 1

Cut 1" Notch In Bottom Of The Bottom Board On The Downstream Structure

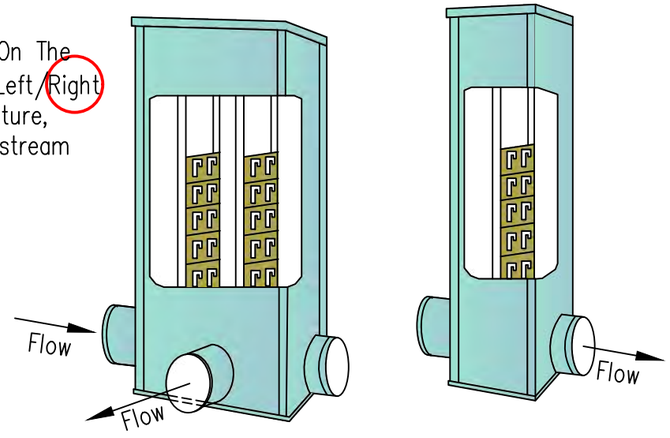


Legend

- Earth Fill
- Existing 12" Perf CPT Main
- Proposed 12" Non–Perf CPT
- Proposed 8" Non–Perf CPT
- Existing Ground
- Control Structure Stoplogs

IN–LINE CONTROL STRUCTURES

Side Port Is On The (Circle One) Left/Right Side Of Structure, Looking Downstream



DESIGNED BY BEN REINHART	DATE 09/07/23
DRAWN BY BEN REINHART	09/07/23
CHECKED BY ANDY CRAIG, PE	09/08/23
APPROVED BY	

STRUCTURE DETAIL

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME

DRAWING SET

SHEET 6 OF 7

LANDOWNER		LOCATION	SECTION 33 – T79N – R4W

CONSTRUCTION NOTES

1. Tile elevations are based on Maverick tile probe depths and are to be considered accurate within margin of error of the instrument.
2. If any surface inlets are currently attached to the tile main or plan to be in the future, they shall be replaced with water quality inlets to minimize trash entry into the tile line before construction of the bioreactor begins.
3. Avoid excessive disturbance of any buffers or grassed water ways during construction. However, if re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded within 14 days according to NRCS Conservation Practice Standard IA-342 Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
4. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion.
5. All carbon media to be placed in the bioreactor shall come from an ESE approved vendor or approved with ESE staff prior to transportation and placement.
6. Contact an NRCS representative for inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the bioreactor chamber and tile line trenches
   b. After placing the water control structures and bioreactor manifolds
   c. After placement of carbon media, before backfilling with soil
   d. After connections to existing tile and final grading
7. Any product planned for use in construction must be approved by ESE prior to construction. Save and provide documentation to an NRCS representative of all materials used in construction including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths
   b. Photos and invoices for quantity and quality of woodchips/carbon media
   c. Photos and invoices or product information to detail quantity and quality of plastic and geotextile fabric
   d. Photos and invoices or product information for water control structures
8. Construction tolerances are +/-0.5ft on bioreactor chamber dimensions, and +/-0.1 ft. on all elevations. Outlet WCS sump (bottom) must be below the elevation of the bioreactor chamber at the outlet end. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by a representative from ESE or NRCS and will be noted in the as-built plan.
9. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.
10. All work shall be performed according to the IA construction and practice specifications in the table below.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-95	Geotextile
IA-605	Denitrifying Bioreactor
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 33 - T79N - R4W

DESIGNED BY BEN REINHART 09/07/23
DRAWN BY BEN REINHART 09/07/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

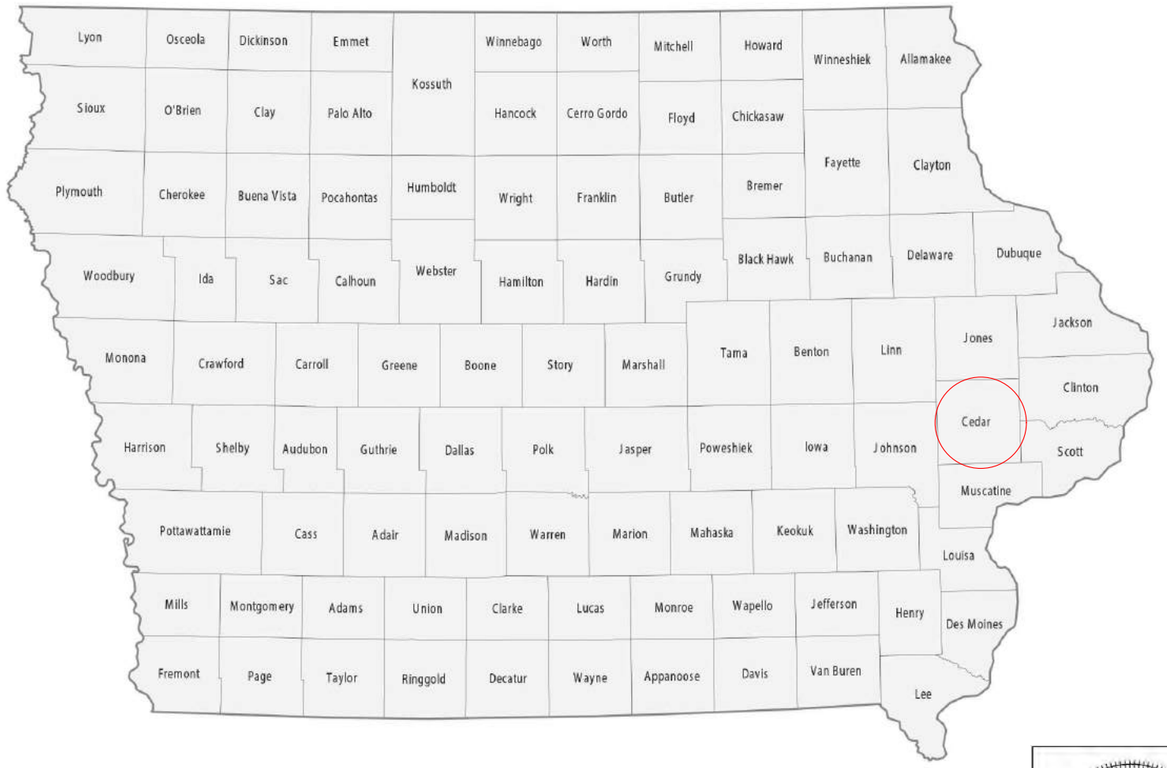
FILE NAME

DRAWING SET
SHEET 7 OF 7

DENITRIFYING BIOREACTOR CONSTRUCTION PLANS

CEDAR COUNTY, IOWA

SECTION 33- T79N - R4W



INDEX OF SHEETS

811 Know what's **below.** **Call** before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

ENGINEERING CLASS 4

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

09/08/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31,2023.
Pages or sheets covered by this seal: All

		DATE
DESIGNED BY	BEN REINHART	09/06/2023
DRAWN BY	BEN REINHART	09/06/2023
CHECKED BY	ANDY CRAIG, PE	09/08/2023
APPROVED BY		

ESE Ecosystem Services Exchange *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 7

Benchmark:
Top of Lath Hub (NAD83, Iowa South, USFt)
Northing: 590014.512
Easting: 2237384.267
Elevation: 667.7

0 25 50 Feet

N

Staking Control Points (NAD83, Iowa South, USFt)				
Point	Description	Northing	Easting	Elevation
1	Benchmark	590014.512	2237384.267	667.7
2	Inlet WCS (3-chamber)	590041.832	2237245.005	665.9
3	Outlet WCS (2-chamber)	590005.404	2237323.116	666.1
4	Northwest Corner BIO	590050.600	2237250.118	665.7
5	Northeast Corner BIO	590069.713	2237266.233	665.7
6	Southeast Corner BIO	590018.146	2237327.395	666.1
7	Southwest Corner BIO	589999.033	2237311.280	666.0

0+00.00
0+35.00
0+50.00
0+00.00
1+00.00
5
4
2
6
7
3
1

Reconnect to new section of 8" non-perforated CPT, ensuring positive drainage to outlet

New 8" CMP Outlet with Rodent Guard

Legend
- Existing 8" CPT Main
- Proposed 8" Non-Perf CPT Main
- Proposed 6" Non-Perf CPT
- Proposed 6" Perf CPT
- Proposed 8" CMP Outlet
- Bioreactor Footprint
- Staking Points
- Water Control Structure
- Benchmark
- 2-Ft Contours

DATE
DESIGNED BY BEN REINHART 09/06/23
DRAWN BY BEN REINHART 09/06/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

PLAN MAP

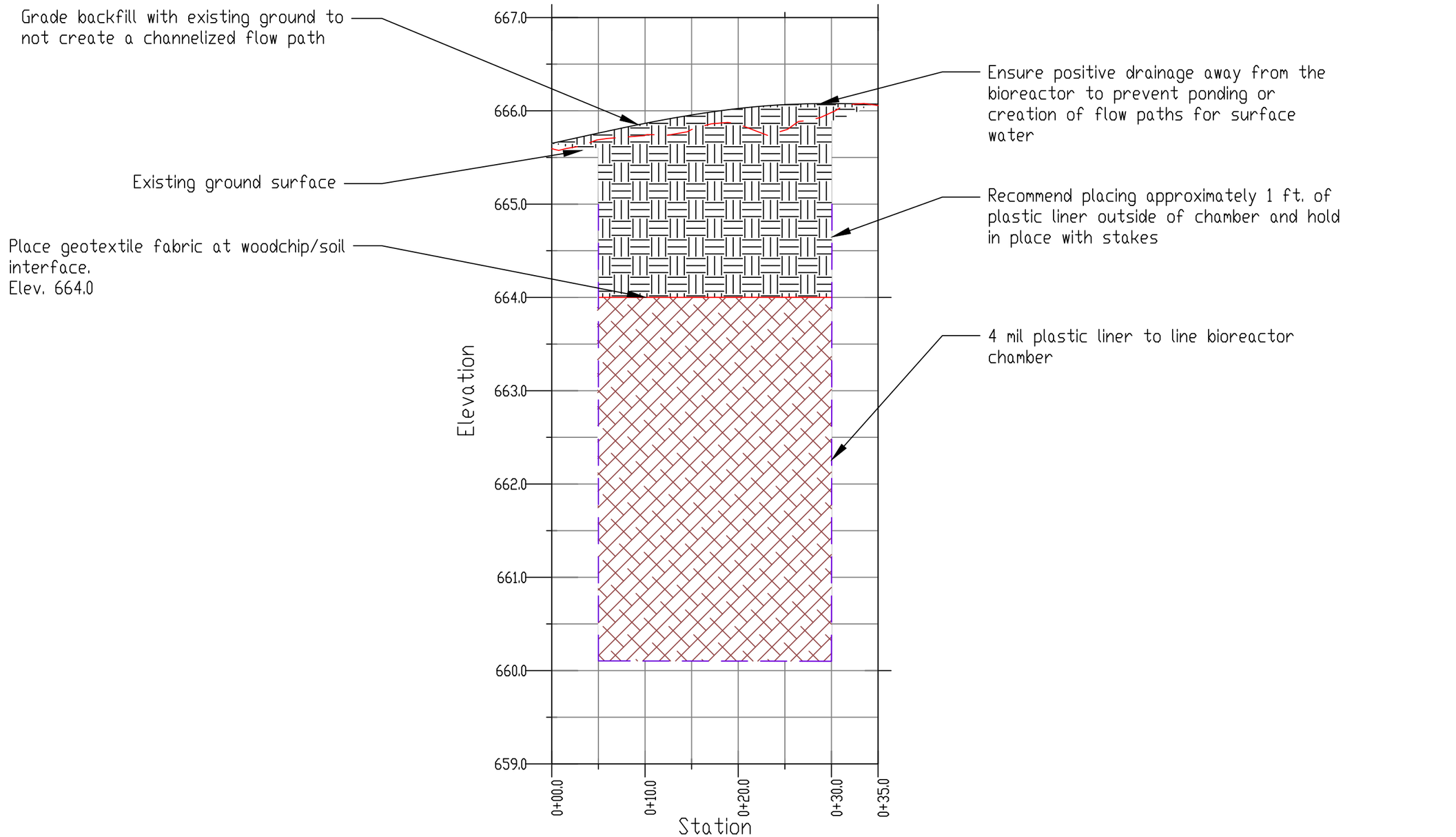
ESE Ecosystem Services Exchange
Valuing Conservation

FILE NAME
.

DRAWING SET
SHEET 2 OF 7

LANDOWNER	JOHN BLACK	LOCATION	SECTION 33 - T79N - R4W

Bioreactor Cross Section



LANDOWNER		LOCATION	SECTION 33 - T79N - R4W

DESIGNED BY BEN REINHART 09/06/23
DRAWN BY BEN REINHART 09/06/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

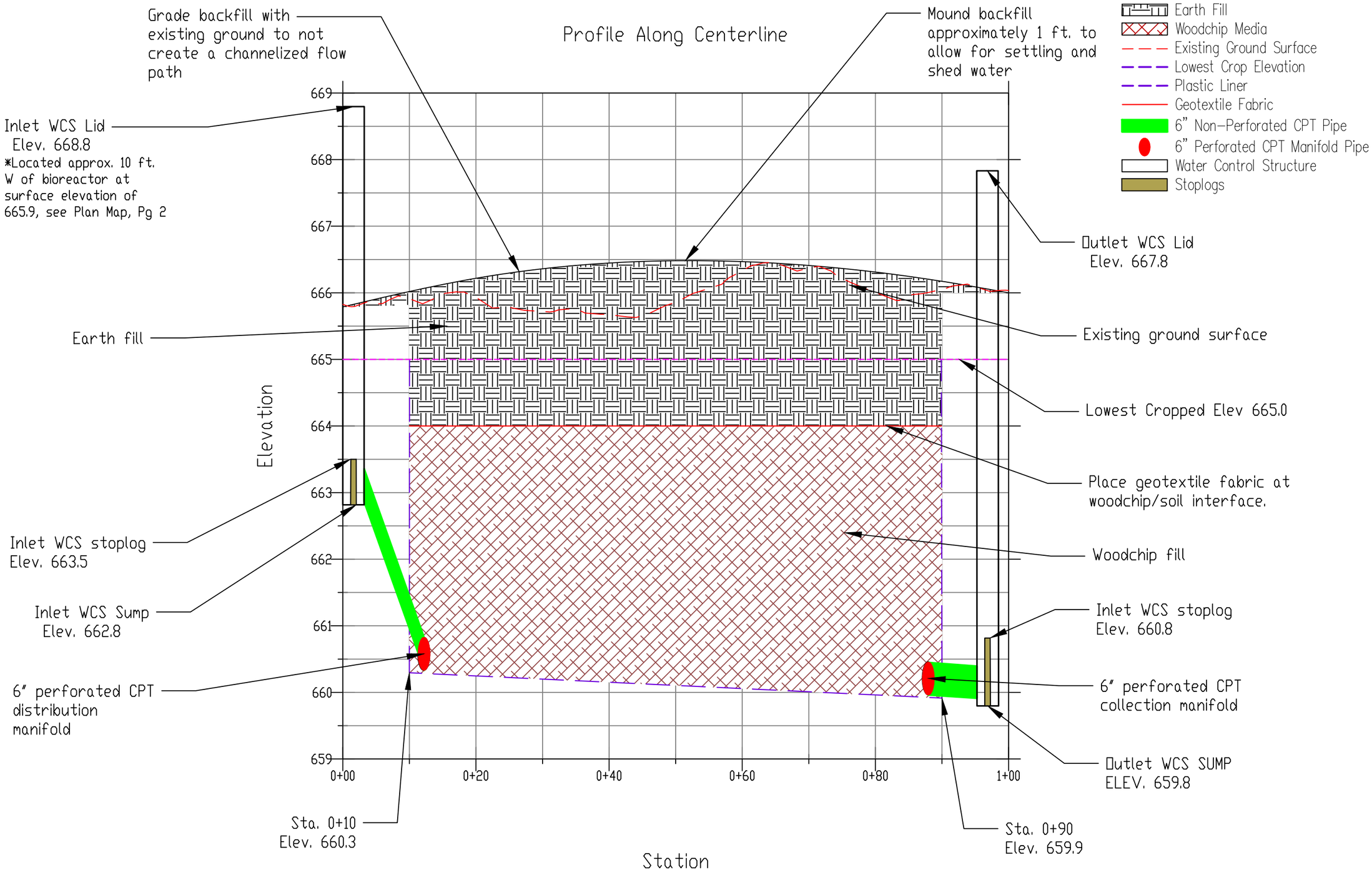
CROSS SECTION VIEW

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME
JI

DRAWING SET
SHEET 3 OF 7

Profile Along Centerline



Legend

- Earth Fill
- Woodchip Media
- Existing Ground Surface
- Lowest Crop Elevation
- Plastic Liner
- Geotextile Fabric
- 6" Non-Perforated CPT Pipe
- 6" Perforated CPT Manifold Pipe
- Water Control Structure
- Stoplogs

DESIGNED BY BEN REINHART	09/06/23
DRAWN BY BEN REINHART	09/06/23
CHECKED BY ANDY CRAIG, PE	09/08/23
APPROVED BY	

PROFILE ALONG CENTERLINE

ESE Ecosystem Services Exchange — Valuing Conservation

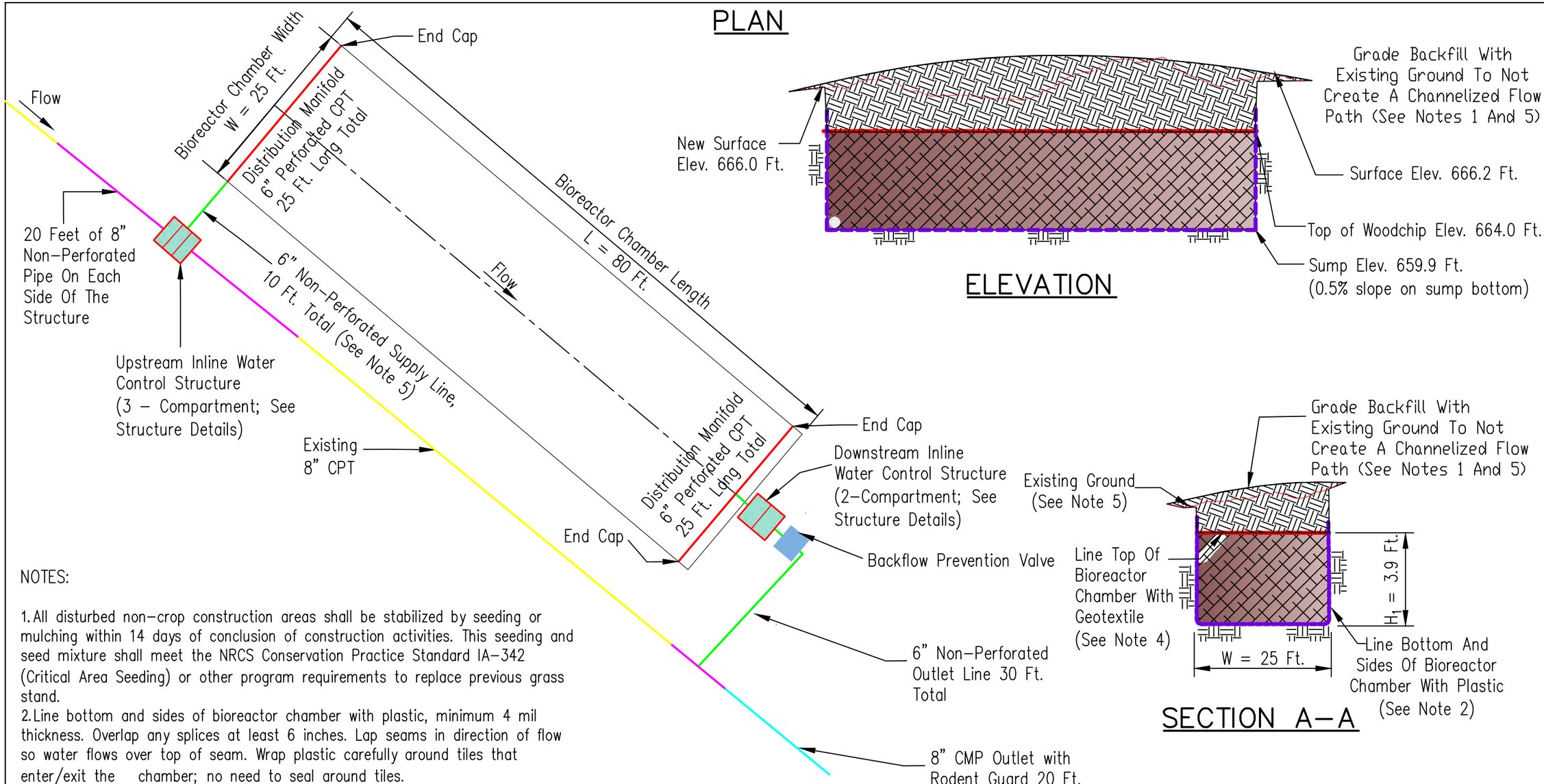
FILE NAME

DRAWING SET

SHEET 4 OF 7

LANDOWNER		LOCATION	SECTION 33 - T79N - R4W

PLAN



ELEVATION

SECTION A-A

NOTES:

1. All disturbed non-crop construction areas shall be stabilized by seeding or mulching within 14 days of conclusion of construction activities. This seeding and seed mixture shall meet the NRCS Conservation Practice Standard IA-342 (Critical Area Seeding) or other program requirements to replace previous grass stand.
2. Line bottom and sides of bioreactor chamber with plastic, minimum 4 mil thickness. Overlap any splices at least 6 inches. Lap seams in direction of flow so water flows over top of seam. Wrap plastic carefully around tiles that enter/exit the chamber; no need to seal around tiles.
3. Woodchips shall not contain woods known to have tannin, such as oak, cedar, or redwood. Woodchips shall be reasonably free of soil and other contaminants nor contain loose composting materials. Wood chips shall be around 1-inch long by ½-inch thick with minimal fines. They shall be processed through a chipper and not through a grinder. Do not use any wood that has been treated for ground contact. ESE has the right to reject any woodchips which do not meet specifications.
4. Geotextile shall be non-woven, Class II, and meet the requirements of Iowa Construction Specification IA-95, Geotextile. Overlap a minimum of 6 inches at all seams.
5. Grade site for positive drainage away from the bioreactor chamber. Spread soil in designated location away from bioreactor.
6. See Plan Map for benchmark coordinates.

Legend

- Earth Fill
- Woodchip Media
- Existing 8" Perf CPT Main
- Proposed 8" Non-Perf CPT
- Proposed 6" Non-Perf CPT
- Proposed 6" Perf CPT
- Proposed 8" CMP Outlet
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- Bioreactor Footprint

LANDOWNER		LOCATION	SECTION 33 - T79N - R4W

DESIGNED BY BEN REINHART 09/06/23
DRAWN BY BEN REINHART 09/06/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

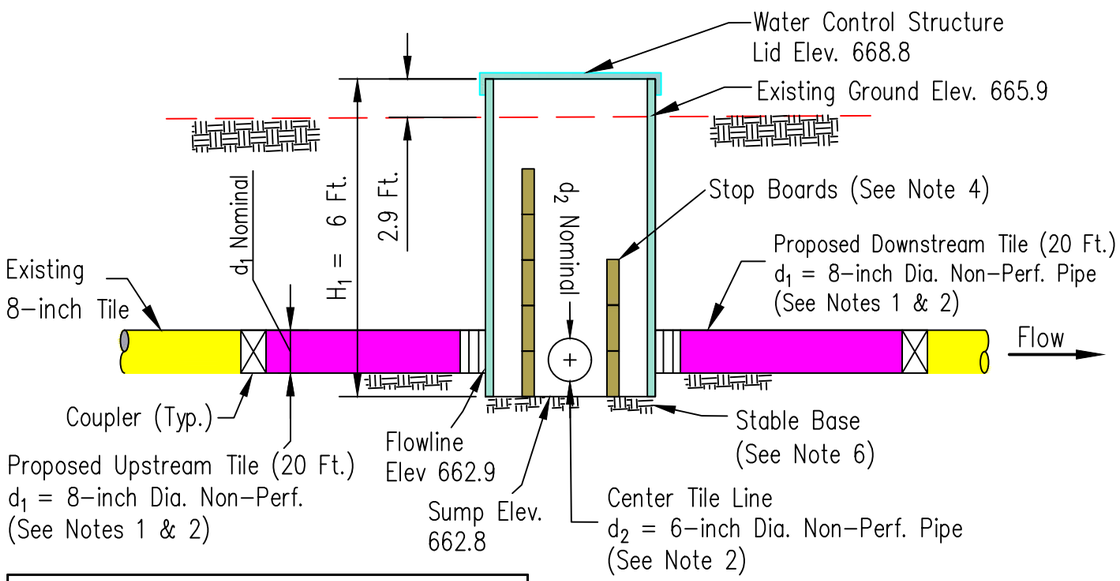
BIOREACTOR DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

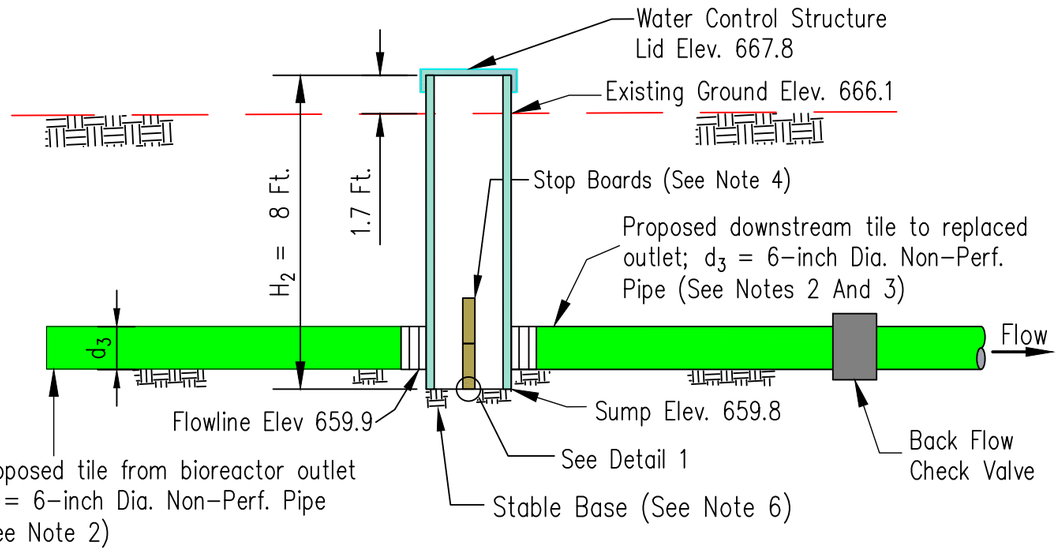
FILE NAME

DRAWING SET
SHEET 5 OF 7

TYPICAL SECTION
UPSTREAM 3–COMPARTMENT STRUCTURE



TYPICAL SECTION
DOWNSTREAM 2–COMPARTMENT STRUCTURE



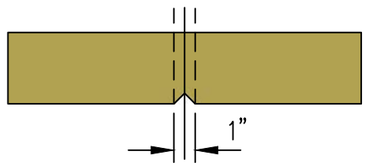
QUANTITIES*	
Water Control Structure, 3 Chamber (H_1 = 6 ft. | d_1 = 8 in. | d_2 = 6 in.)	1
Water Control Structure, 2 Chamber (H_2 = 8 ft. | d_3 = 6 in.)	1
8" Non–perforated Pipe (ft)	50
6" Non–perforated Pipe (ft)	40
6" Perforated CPT (ft)	50
8" CMP Outlet with Rodent Guard (ft)	20
6" End Cap (each)	3
Wood Chips (cu. yd.)	318
4 Mil Plastic (sq. yd.)**	365
Geotextile (sq. yd.)	223
Excavation (cu. yd.)	430
Earth Fill (cu. yd.)	178
6" Backflow Check Valve (each)	1

* Quantities do not include tile/pipe couplers or extra material for geotextile/plastic overlap
** Accounts for 1 ft. overhang around perimeter

NOTES:
1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, on all lines: upstream, downstream and center. Pipe must be PVC, dual–wall CPT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745. Check valve must conform to ASTM D 3034 with SDR35 pipe or stronger.
3. Couplings between the water control structures and the non–perforated tile must be watertight.
4. Stop boards must provide must tight seals under a minimum of 1 foot pressure head (except notched board).
5. Appropriately mark bioreactor perimeter to avoid vehicle, implement, or livestock traffic.
6. Place structure and pipe coupler on a stable base. A stable base may be compacted earth, compacted fill sand, or a concrete pad. Extend the stable base no less than 1 foot beyond structure.
7. Excavated material placed around structure and pipes shall be hand compacted in 4" lifts.

DETAIL 1

Cut 1" Notch In Bottom Of The Bottom Board On The Downstream Structure

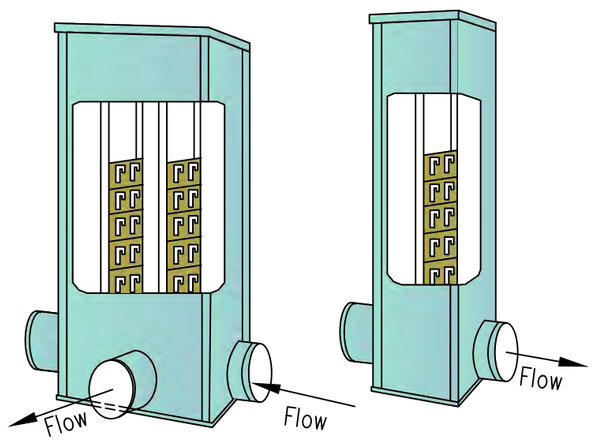


Legend

- Earth Fill
- Existing 8" Perf CPT Main
- Proposed 8" Non–Perf CPT
- Proposed 6" Non–Perf CPT
- Existing Ground
- Control Structure Stoplogs

IN–LINE CONTROL STRUCTURES

Side Port Is On The (Circle One) Left/Right Side Of Structure, Looking Downstream



DESIGNED BY	BEN REINHART	DATE	09/06/23
DRAWN BY	BEN REINHART		09/06/23
CHECKED BY	ANDY CRAIG, PE		09/08/23
APPROVED BY			

STRUCTURE DETAIL

ESE Ecosystem Services Exchange — Valuing Conservation

FILE NAME

DRAWING SET
SHEET 6 OF 7

LANDOWNER		LOCATION	SECTION 33 – T79N – R4W

CONSTRUCTION NOTES

1. Tile elevations are based on Maverick tile probe depths and are to be considered accurate within margin of error of the instrument.
2. If any surface inlets are currently attached to the tile main or plan to be in the future, they shall be replaced with water quality inlets to minimize trash entry into the tile line before construction of the bioreactor begins.
3. Avoid excessive disturbance of any buffers or grassed water ways during construction. However, if re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded within 14 days according to NRCS Conservation Practice Standard IA-342 Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
4. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion.
5. All carbon media to be placed in the bioreactor shall come from an ESE approved vendor or approved with ESE staff prior to transportation and placement.
6. Contact an NRCS representative for inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the bioreactor chamber and tile line trenches
   b. After placing the water control structures and bioreactor manifolds
   c. After placement of carbon media, before backfilling with soil
   d. After connections to existing tile and final grading
7. Any product planned for use in construction must be approved by ESE prior to construction. Save and provide documentation to an NRCS representative of all materials used in construction including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths
   b. Photos and invoices for quantity and quality of woodchips/carbon media
   c. Photos and invoices or product information to detail quantity and quality of plastic and geotextile fabric
   d. Photos and invoices or product information for water control structures
8. Construction tolerances are +/-0.5ft on bioreactor chamber dimensions, and +/-0.1 ft. on all elevations. Outlet WCS sump (bottom) must be below the elevation of the bioreactor chamber at the outlet end. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by a representative from ESE or NRCS and will be noted in the as-built plan.
9. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.
10. All work shall be performed according to the IA construction and practice specifications in the table below.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-95	Geotextile
IA-605	Denitrifying Bioreactor
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 33 - T79N - R4W

DESIGNED BY BEN REINHART 09/06/23
DRAWN BY BEN REINHART 09/06/23
CHECKED BY ANDY CRAIG, PE 09/08/23
APPROVED BY

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

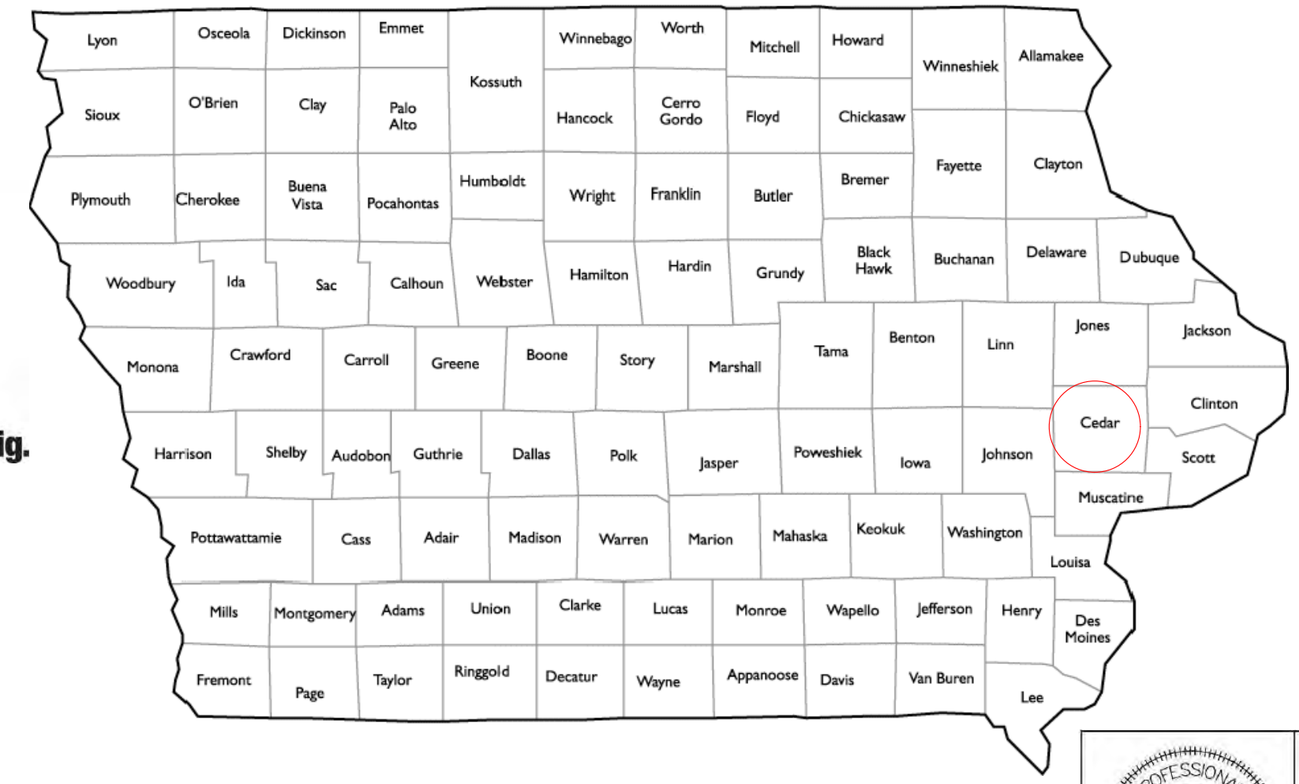
FILE NAME

DRAWING SET
SHEET 7 OF 7

DENITRIFYING BIOREACTOR CONSTRUCTION PLANS

CEDAR COUNTY, IOWA

SECTION 04- T80N - R02W



INDEX OF SHEETS

811 Know what's **below.** **Call** before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

ENGINEERING CLASS 3

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

9/22/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

		DATE
DESIGNED BY	ANDY MACKRILL, TSP	9/18/2023
DRAWN BY	ANDY MACKRILL, TSP	9/18/2023
CHECKED BY	ANDY CRAIG, PE, TSP	9/22/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 7

Benchmark:
Top of Lath (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 650901.3
Easting: 2297078.6
Elevation: 739.1

0 25 50 Feet

N

Staking Control Points (NAD 1983 State Plane Iowa South US SURVEY FEET)				
Point	Description	Northing	Easting	Elevation
1	Southeast Corner BIO	650763.5	2297074.7	737.7
2	Southwest Corner BIO	650765.3	2297054.7	737.7
3	Northwest Corner BIO	650845.2	229706.2	738.2
4	Northeast Corner BIO	650843.3	2297082.0	738.1
5	Inlet WCS (3-chamber)	650771.2	2297051.9	737.7
6	Outlet WCS (2-chamber)	650714.9	2297054.0	737.1
7	Benchmark	650901.3	2297078.6	739.1

New 6" CMP Outlet
With Rodent Guard

Replace existing outlet
New Elev : 731.5

0+00.00
0+30.00
1+00.00

Legend

- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 6" CPT Main
- Proposed 6" CMP Outlet
- Bioreactor Footprint
- Water Control Structure
- Benchmark
- 2 Foot Contours

DESIGNED BY ANDY MACKRILL 9/18/23
DRAWN BY ANDY MACKRILL 9/18/23
CHECKED BY ANDY CRAIG 9/22/23
APPROVED BY

PLAN MAP

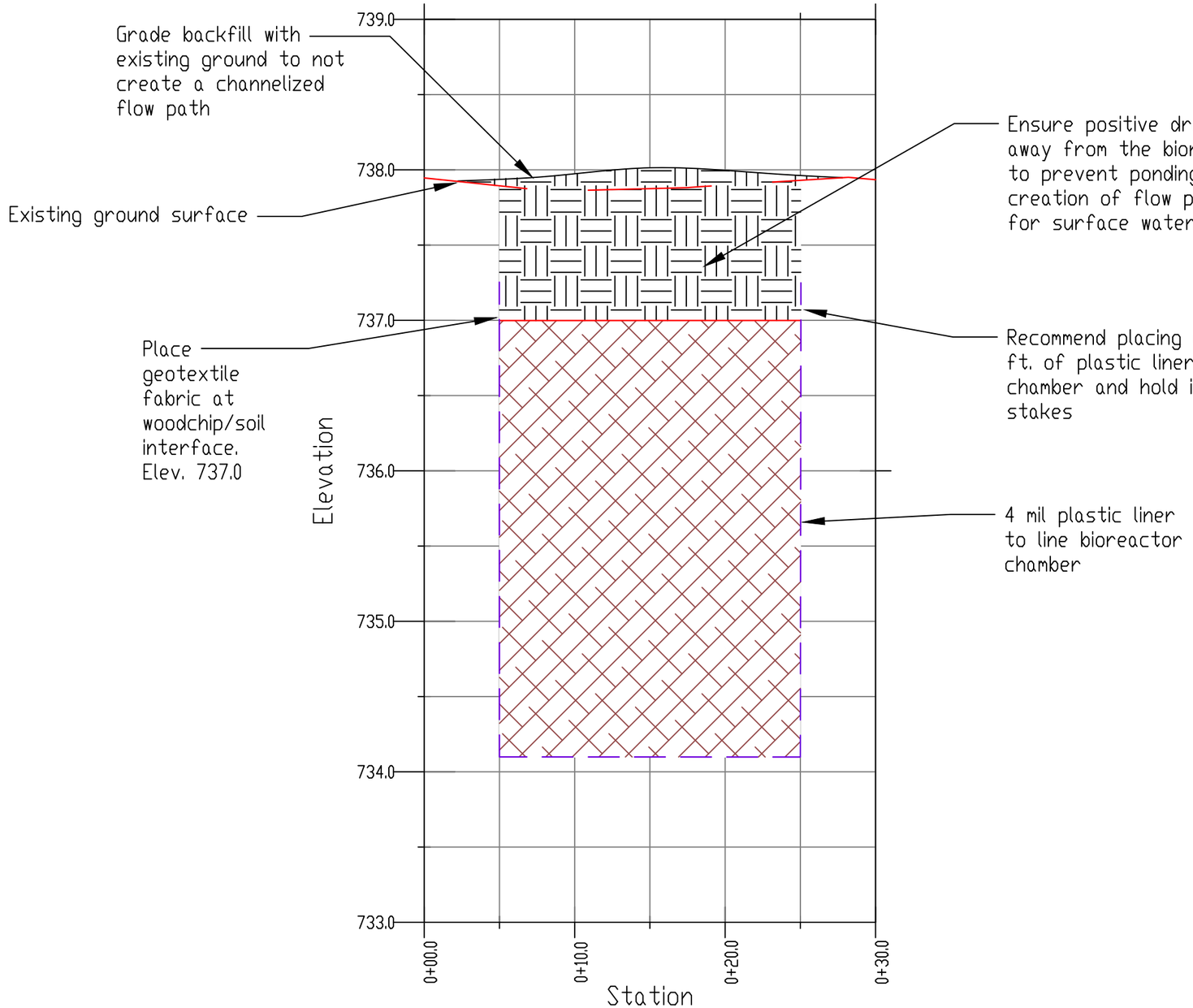
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 2 OF 7

LANDOWNER | LOCATION | SECTION 04 - T80N - R02W

Cross-Section



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface

DESIGNED BY ANDY MACKFILL	DATE 9/18/23
DRAWN BY ANDY MACKFILL	9/18/23
CHECKED BY ANDY CRAIG	9/22/23
APPROVED BY	

CROSS SECTION VIEW

ESE Ecosystem Services Exchange *Valuing Conservation*

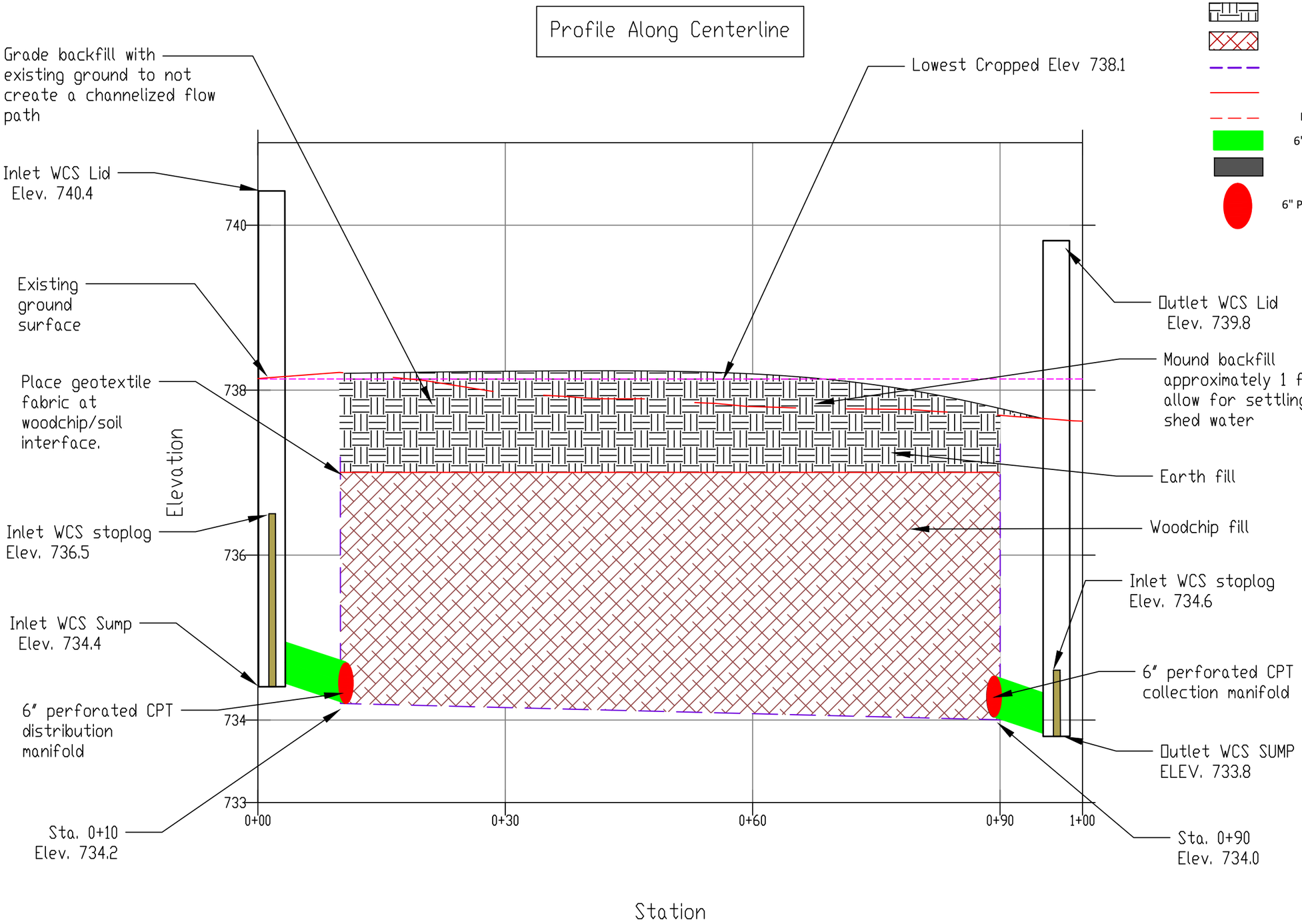
FILE NAME

DRAWING SET

SHEET 3 OF 7

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

Profile Along Centerline



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- 6" Non-Perforated CPT Pipe
- Water Control Structure
- 6" Perforated CPT Manifold Pipe

DESIGNED BY ANDY MACKFILL	DATE 9/18/23
DRAWN BY ANDY MACKFILL	9/18/23
CHECKED BY ANDY CRAIG	9/22/23
APPROVED BY	

PROFILE ALONG CENTERLINE

ESE Ecosystem Services Exchange — Valuing Conservation

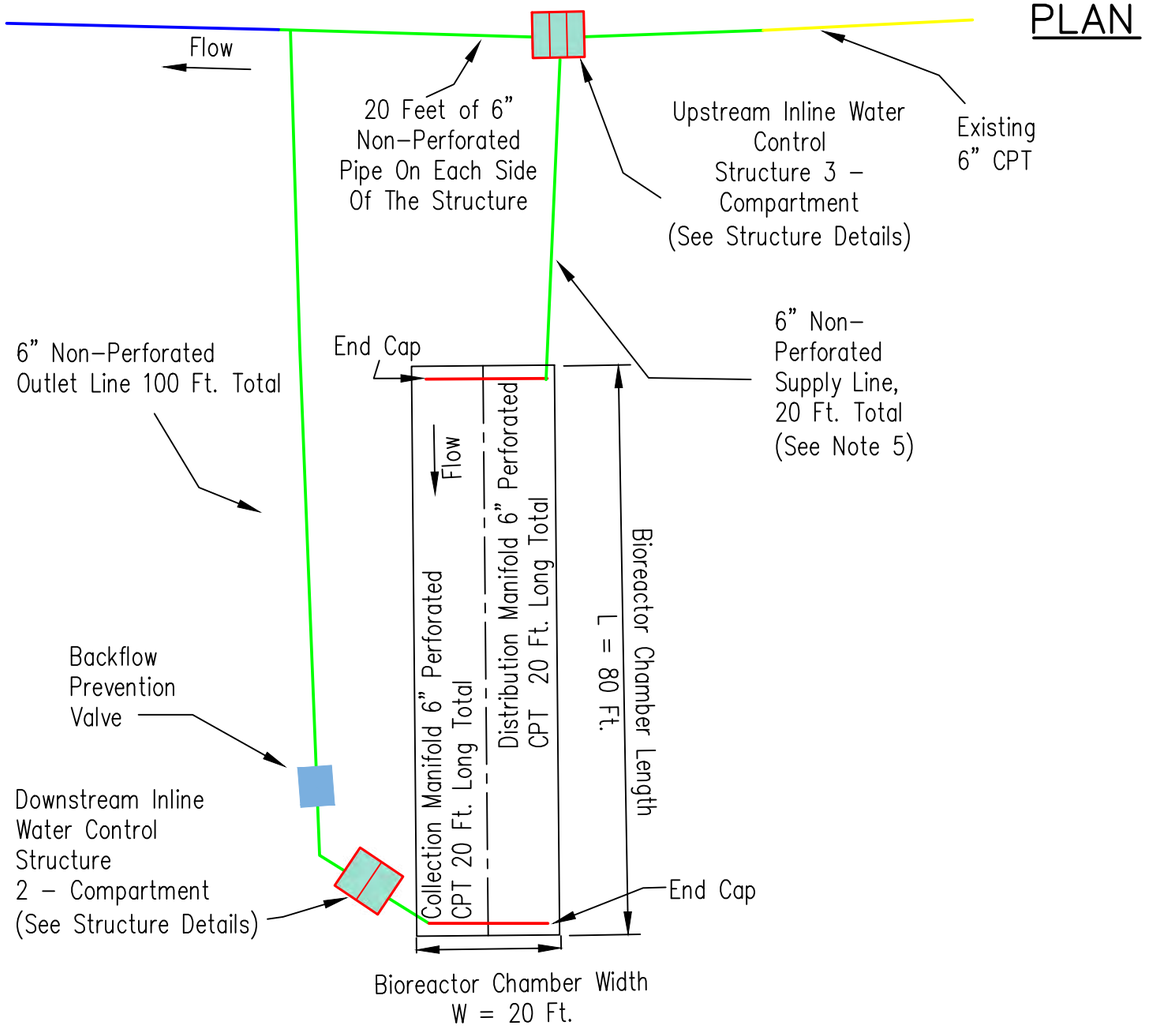
FILE NAME

DRAWING SET

SHEET 4 OF 7

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

PLAN

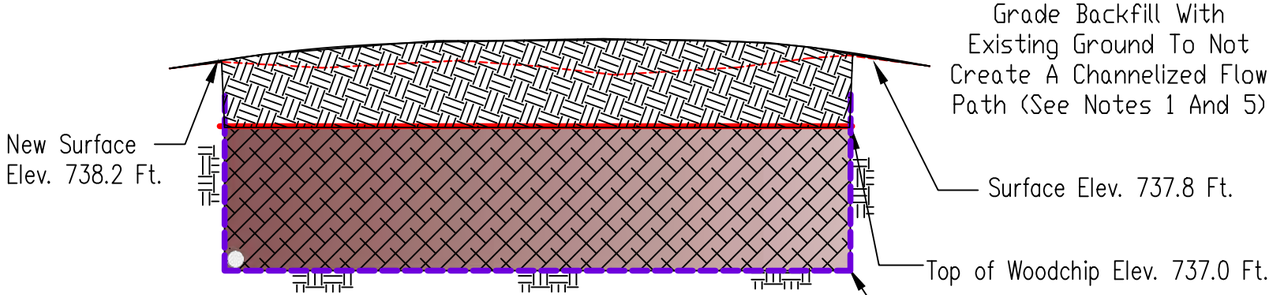


Legend

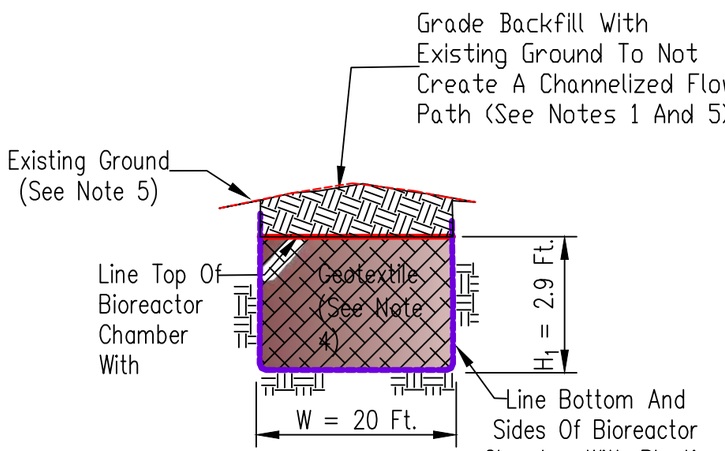
- Earth Fill
- Woodchip Media
- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 6" CPT Main
- Proposed 6" CMP Outlet
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- Bioreactor Footprint

NOTES:

1. All disturbed non-crop construction areas shall be stabilized by seeding or mulching within 14 days of conclusion of construction activities. This seeding and seed mixture shall meet the NRCS Conservation Practice Standard IA-342 (Critical Area Seeding) or other program requirements to replace previous grass stand.
2. Line bottom and sides of bioreactor chamber with plastic, minimum 4 mil thickness. Overlap any splices at least 6 inches. Lap seams in direction of flow so water flows over top of seam. Wrap plastic carefully around tiles that enter/exit the chamber; no need to seal around tiles.
3. Woodchips shall not contain woods known to have tannin, such as oak, cedar, or redwood. Woodchips shall be reasonably free of soil and other contaminants nor contain loose composting materials. Wood chips shall be around 1"long by ½" thick with minimal fines. They shall be processed through a chipper and not through a grinder. Do not use any wood that has been treated for ground contact. ESE has the right to reject any woodchips which do not meet specifications.
4. Geotextile shall be non-woven, Class II, and meet the requirements of Iowa Construction Specification IA-95, Geotextile. Overlap a minimum of 6 inches at all seams.
5. Grade site for positive drainage away from the bioreactor chamber. Spread soil in designated location away from bioreactor.
6. See Plan Map for benchmark coordinates.



ELEVATION



SECTION A-A

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

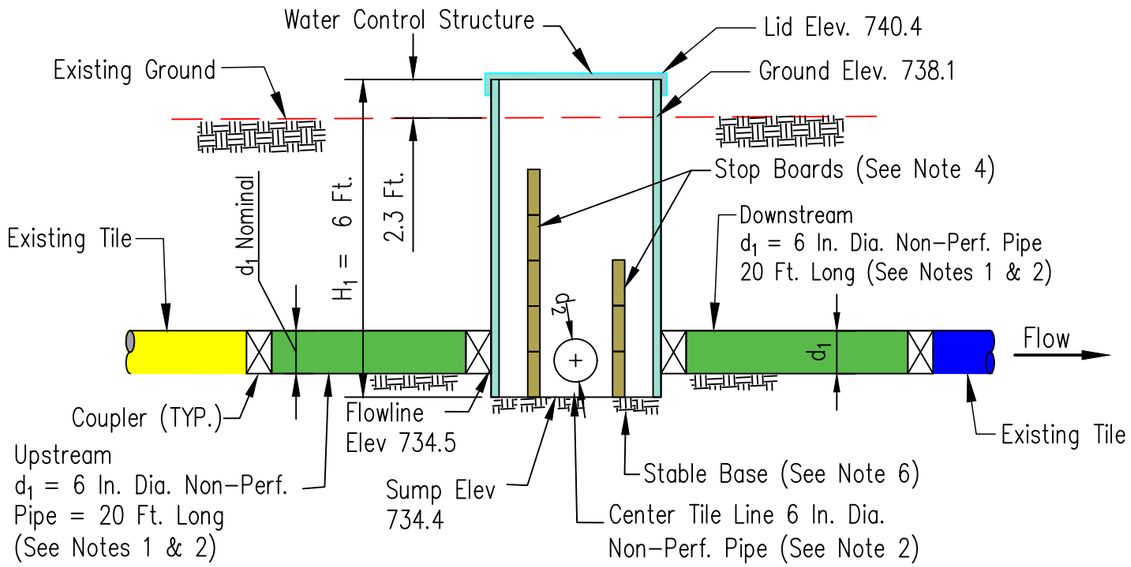
DESIGNED BY ANDY MACKFILL 9/18/23
DRAWN BY ANDY MACKFILL 9/18/23
CHECKED BY ANDY CRAIG 9/22/23
APPROVED BY

BIOREACTOR DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

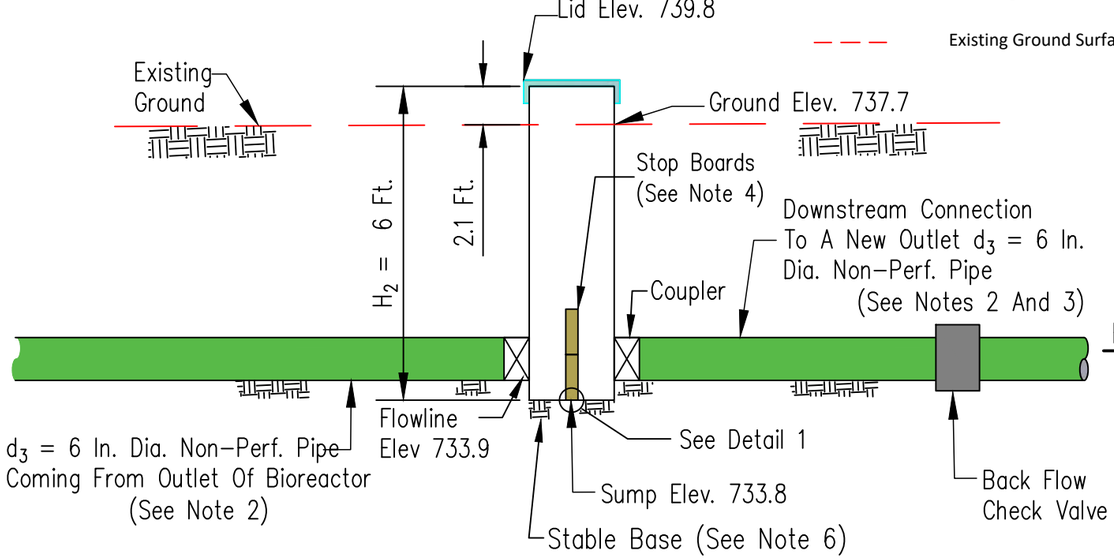
FILE NAME

DRAWING SET
SHEET 5 OF 7



TYPICAL SECTION
UPSTREAM STRUCTURE

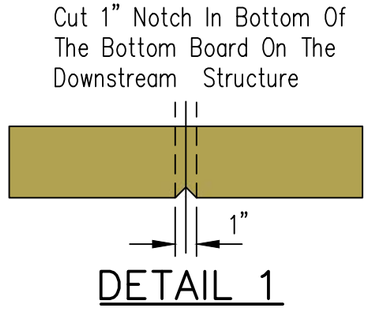
QUANTITIES*	
Water Control Structure, 3 Chamber H_1 = 6 ft. d_1 = 6 in. d_2 = 6 in.	1
Water Control Structure, 2 Chamber H_2 = 6 ft. d_3 = 6 in.	1
6" Non-perforated Pipe (ft)	175
6" CMP Outlet Pipe With Rodent Guard	20
6" Perforated CPT (ft)	40
6" End Cap	2
Wood Chips (cu. yd.)	190
4 Mil Plastic (sq. yd.)**	285
Geotextile (sq. yd.)	178
Excavation (cu. yd.)	232
Earth Fill (cu. yd.)	89
6" Backflow Check Valve	1



TYPICAL SECTION
DOWNSTREAM STRUCTURE

* Quantities do not include tile/pipe couplers or extra material for geotextile/plastic overlap

** Accounts for 1 ft. overhang around perimeter



DETAIL 1

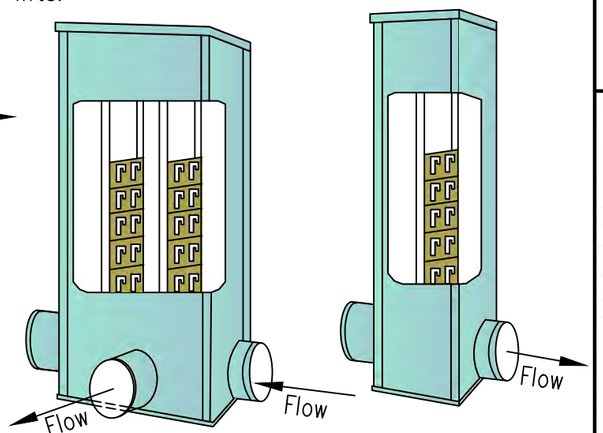
Legend

- Earth Fill
- Proposed 6" Non-Perforated CPT
- Proposed 6" CMP Outlet
- Existing 6" CPT Main
- Existing Ground Surface

Side Port Is On The (Circle One) Left/Right Side Of Structure, Looking Downstream

NOTES:

1. Install a minimum of 20 feet of non-perforated pipe adjacent to the water control structure, on all lines: upstream, downstream and center. Pipe must be PVC, dual-wall CPT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745. Check valve must conform to ASTM D 3034 with SDR35 pipe or stronger.
3. Couplings between the water control structures and the non-perforated tile must be watertight.
4. Stop boards must provide must tight seals under a minimum of 1 foot pressure head (except notched board).
5. Appropriately mark bioreactor perimeter to avoid vehicle, implement, or livestock traffic.
6. Place structure and pipe coupler on a stable base. A stable base may be compacted earth, compacted fill sand, or a concrete pad. Extend the stable base no less than 1 foot beyond structure.
7. Excavated material placed around structure and pipes shall be hand compacted in 4" lifts.



IN-LINE CONTROL STRUCTURES

DATE	
DESIGNED BY ANDY MACKFILL	9/18/23
DRAWN BY ANDY MACKFILL	9/18/23
CHECKED BY ANDY CRAIG	9/22/23
APPROVED BY	

STRUCTURE DETAIL

Ecosystem Services Exchange
Valuing Conservation

FILE NAME

DRAWING SET
SHEET 6 OF 7

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

CONSTRUCTION NOTES

1. Tile elevations are based on Maverick tile probe depths and are to be considered accurate within margin of error of the instrument.
2. If any surface inlets are currently attached to the tile main or plan to be in the future, they shall be replaced with water quality inlets to minimize trash entry into the tile line before construction of the bioreactor begins.
3. Avoid excessive disturbance of any buffers or grassed water ways during construction. However, if re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded within 14 days according to NRCS Conservation Practice Standard IA-342 Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
4. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion.
5. All carbon media to be placed in the bioreactor shall come from an ESE approved vendor or approved with ESE staff prior to transportation and placement.
6. Contact an ESE representative for inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the bioreactor chamber and tile line trenches
   b. After placing the water control structures and bioreactor manifolds
   c. After placement of carbon media, before backfilling with soil
   d. After connections to existing tile and final grading
7. Any product planned for use in construction must be approved by ESE prior to construction. Save and provide documentation to an ESE representative of all materials used in construction including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths
   b. Photos and invoices for quantity and quality of woodchips/carbon media
   c. Photos and invoices or product information to detail quantity and quality of plastic and geotextile fabric
   d. Photos and invoices or product information for water control structures
8. Construction tolerances are +/-0.5ft on bioreactor chamber dimensions, and +/-0.1 ft. on all elevations. Outlet WCS sump (bottom) must be below the elevation of the bioreactor chamber at the outlet end. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by a representative from ESE and will be noted in the as-built plan.
9. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.
10. All work shall be performed according to the IA construction and practice specifications in the table below.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-95	Geotextile
IA-605	Denitrifying Bioreactor
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

DESIGNED BY ANDY MACKFILL 9/18/23
DRAWN BY ANDY MACKFILL 9/18/23
CHECKED BY ANDY CRAIG 9/22/23
APPROVED BY
DATE

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

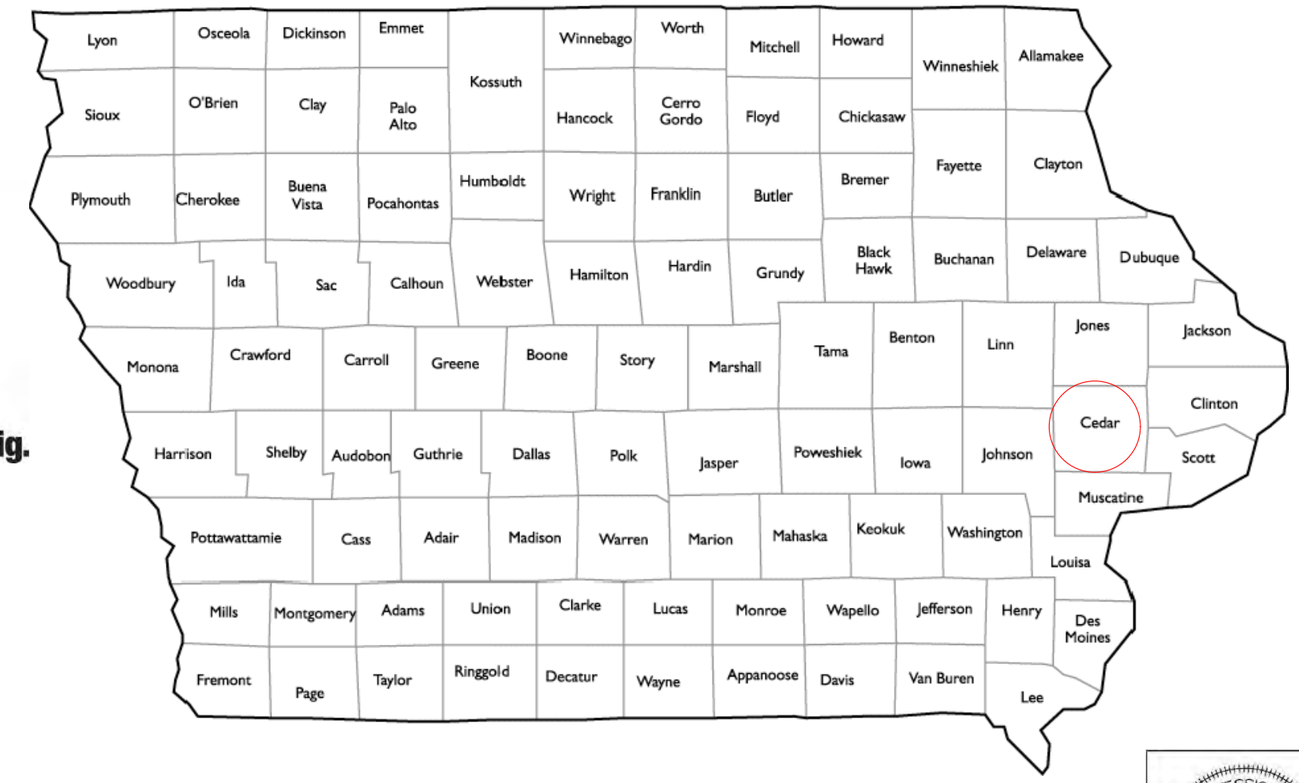
FILE NAME

DRAWING SET
SHEET 7 OF 7

DENITRIFYING BIOREACTOR CONSTRUCTION PLANS

CEDAR COUNTY, IOWA

SECTION 04- T80N - R02W



INDEX OF SHEETS

811 Know what's **below.** **Call** before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

ENGINEERING CLASS 3

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

8/15/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

		DATE
DESIGNED BY	ANDY MACKRILL, TSP	8/15/2023
DRAWN BY	ANDY MACKRILL, TSP	8/15/2023
CHECKED BY	ANDY CRAIG, PE	8/15/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 7

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 651977.0
Easting: 2300334.3
Elevation: 738.6

0 25 50 Feet

N

Staking Control Points (NAD 1983 State Plane Iowa South US SURVEY FEET)				
Point	Description	Northing	Easting	Elevation
1	Southeast Corner BIO	651941.0	2300524.3	737.6
2	Southwest Corner BIO	651935.6	2300504.9	737.8
3	Northwest Corner BIO	652012.9	2300483.5	737.6
4	Northeast Corner BIO	652018.3	2300502.8	737.8
5	Inlet WCS (3-chamber)	652021.3	2300473.8	737.6
6	Outlet WCS (2-chamber)	651936.1	2300498.5	737.9
7	Benchmark	651977.0	2300334.3	738.6

5
4
3
7
2
1
6
0+00.00
0+30.00
0+00.00
1+00.00

Legend

- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 10" CPT Main
- Proposed 10" Non-Perf CPT Main
- Proposed 10" CMP Outlet
- Bioreactor Footprint
- Water Control Structure
- Benchmark
- 2 Foot Contours

New 10" CMP Outlet With Rodent Guard

Approx. Grade 1.8% Connecting to Existing Outlet.

DESIGNED BY ANDY MACKRILL 8/15/23
DRAWN BY ANDY MACKRILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY
DATE

PLAN MAP

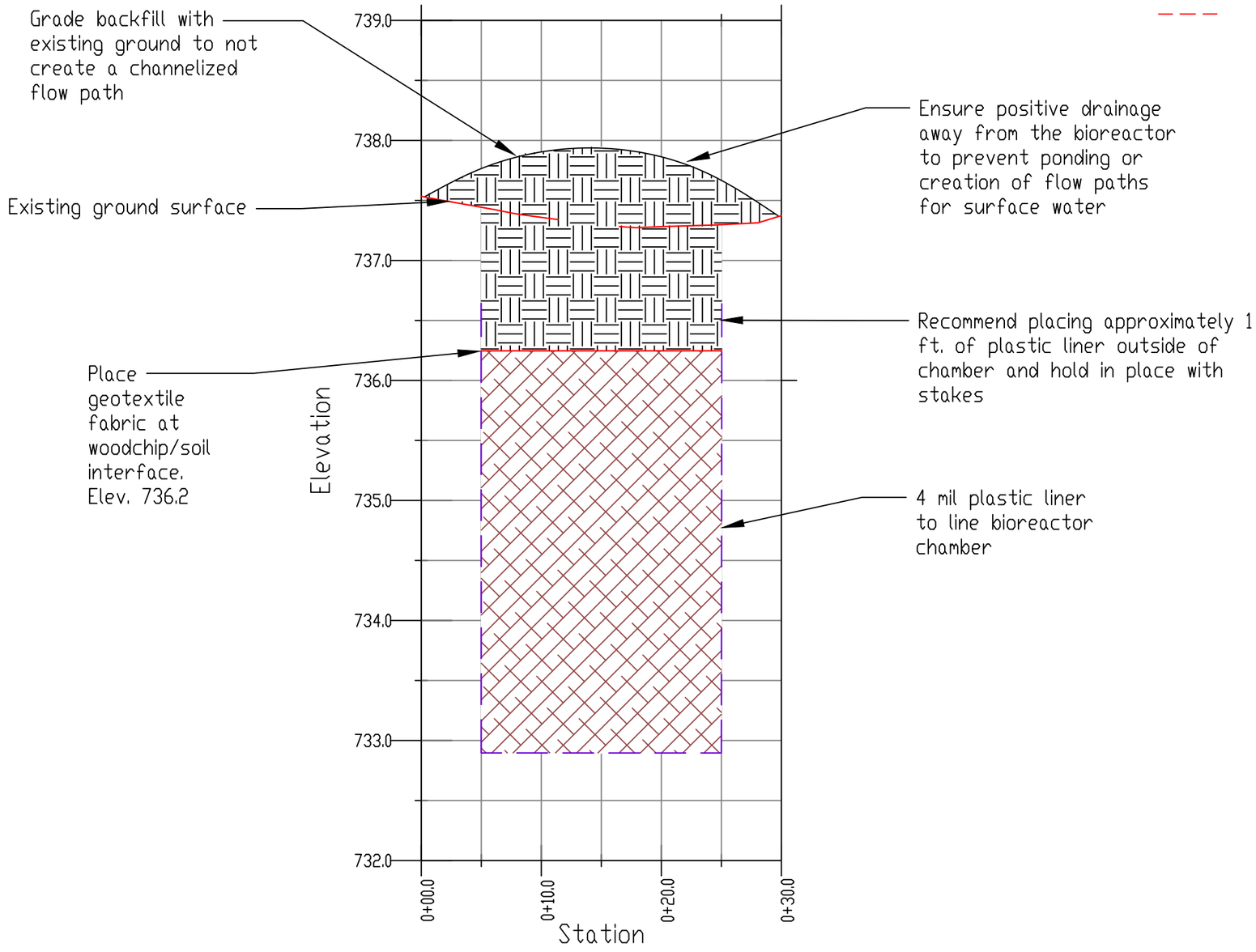
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 2 OF 7

LANDOWNER | LOCATION | SECTION 04 - T80N - R02W

Cross-Section



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface

DESIGNED BY	ANDY MACKFILL
DRAWN BY	ANDY MACKFILL
CHECKED BY	ANDY CRAIG
APPROVED BY	
DATE	8/15/23
	8/15/23
	8/15/23

CROSS SECTION VIEW

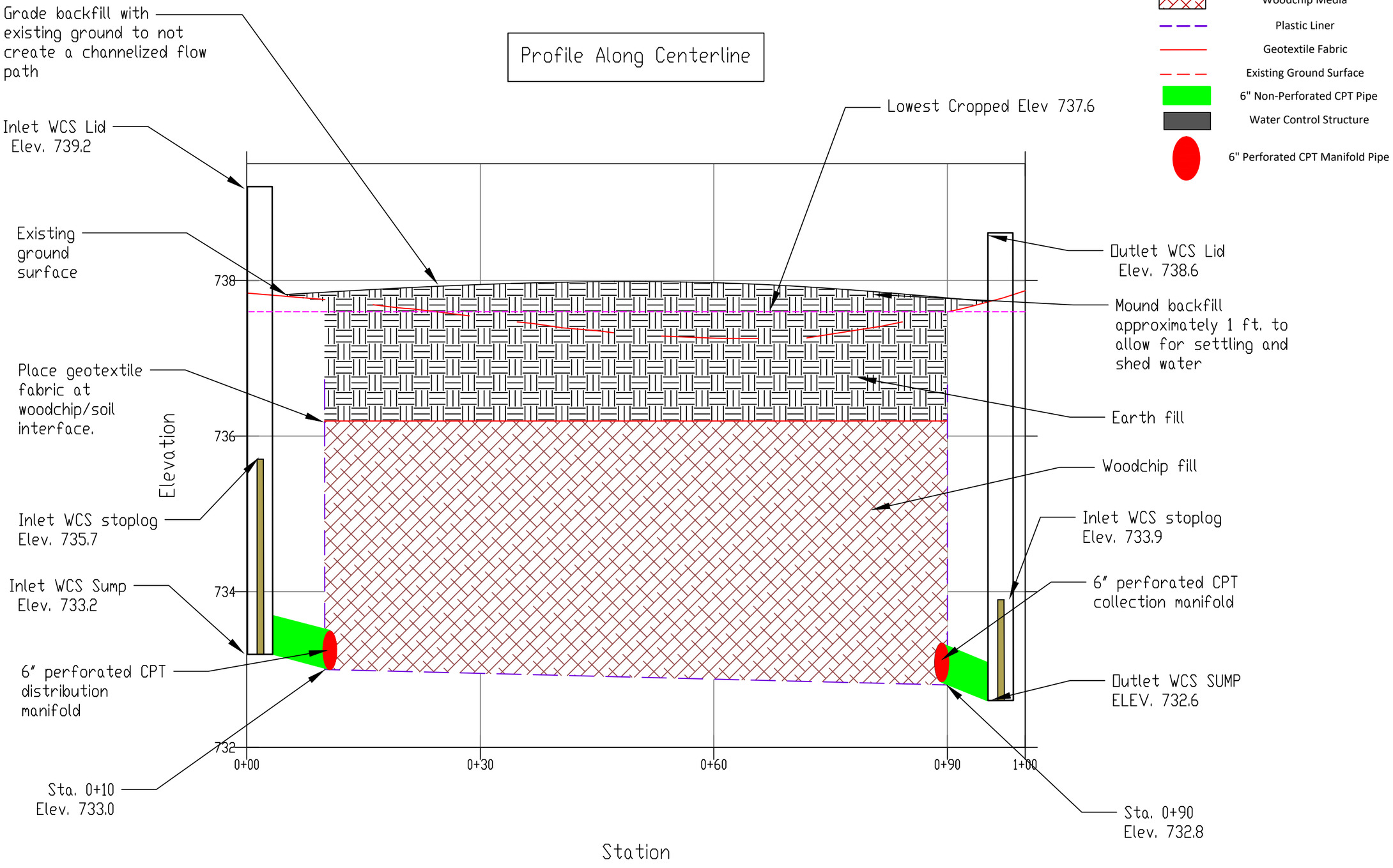
Ecosystem Services Exchange
Valuing Conservation

FILE NAME

DRAWING SET
SHEET 3 OF 7

LANDOWNER	[illegible]	LOCATION	SECTION 04 - T80N - R02W

Profile Along Centerline



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- 6" Non-Perforated CPT Pipe
- Water Control Structure
- 6" Perforated CPT Manifold Pipe

		DATE
DESIGNED BY	ANDY MACKFILL	8/15/23
DRAWN BY	ANDY MACKFILL	8/15/23
CHECKED BY	ANDY CRAIG	8/15/23
APPROVED BY		

PROFILE ALONG CENTERLINE

ESE Ecosystem Services Exchange *Valuing Conservation*

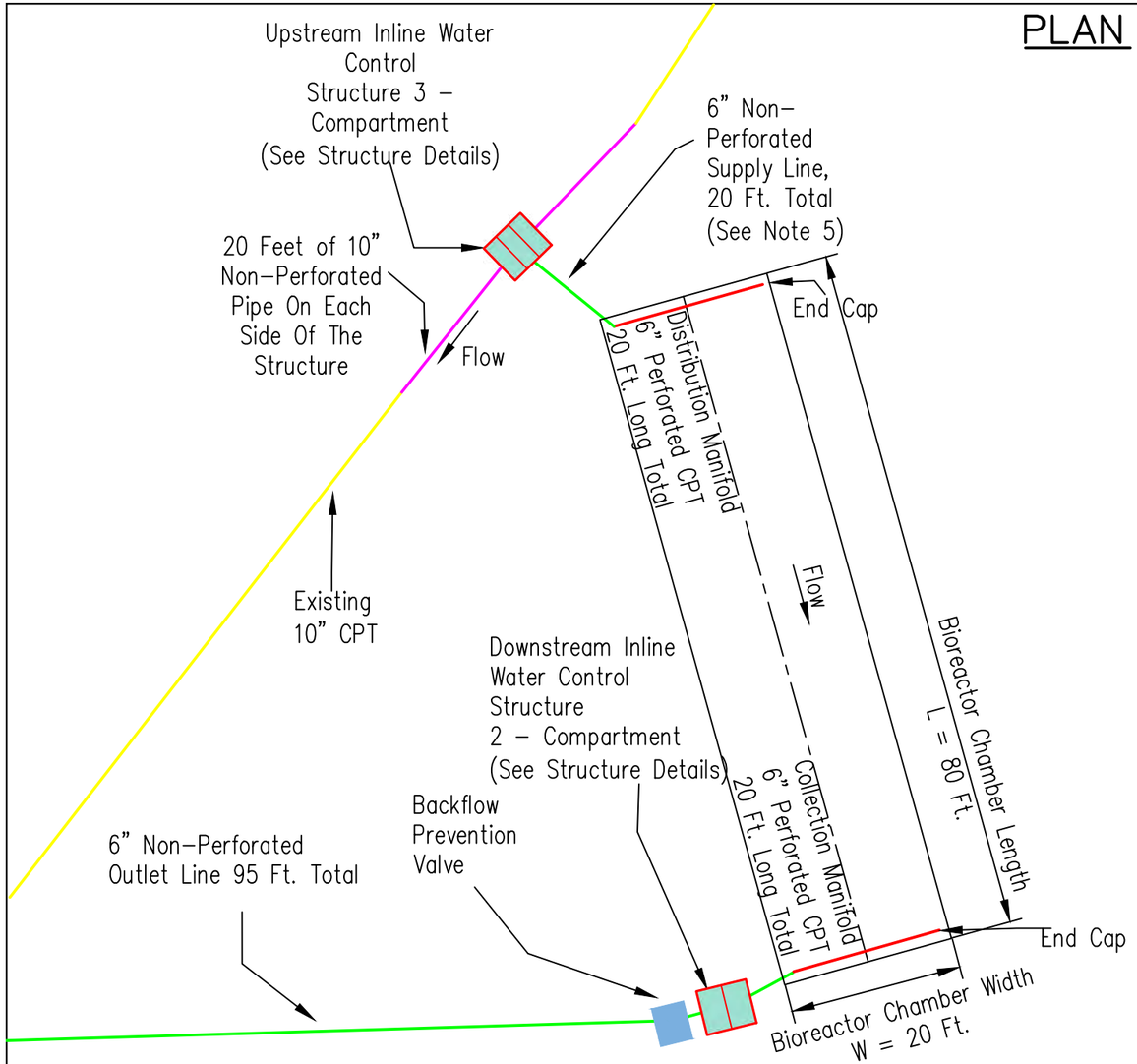
FILE NAME

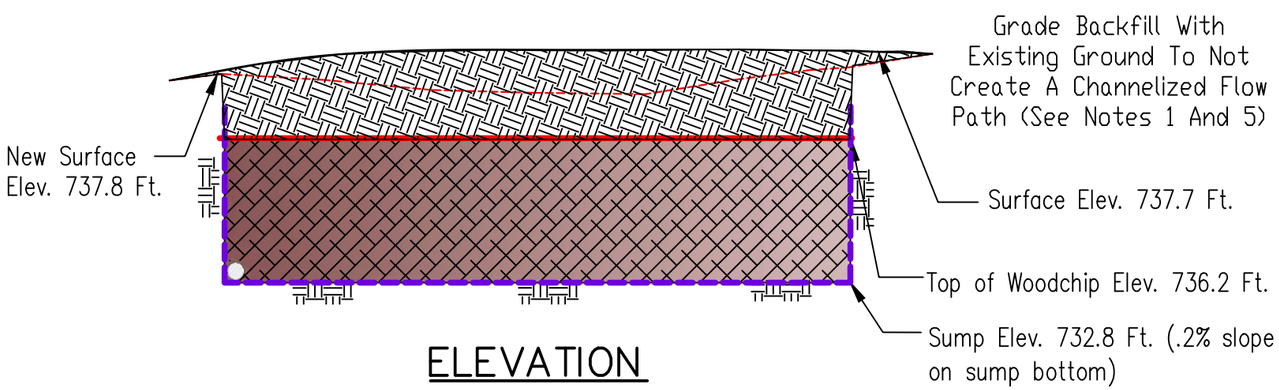
DRAWING SET

SHEET 4 OF 7

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

PLAN





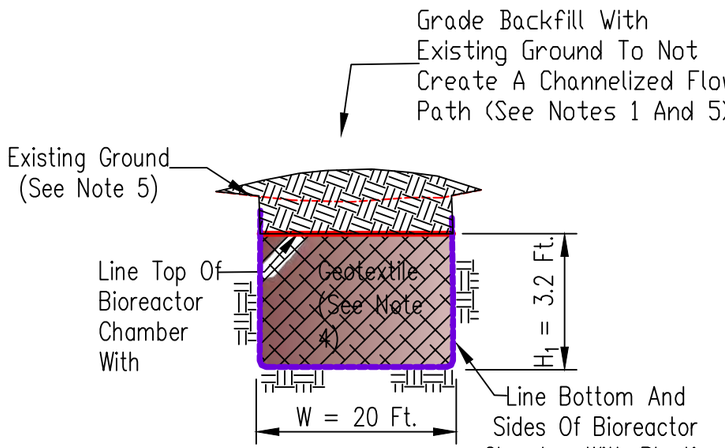
ELEVATION

Legend

- Earth Fill
- Woodchip Media
- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 10" CPT Main
- Proposed 10" Non-Perforated CPT
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- Bioreactor Footprint

NOTES:

1. All disturbed non-crop construction areas shall be stabilized by seeding or mulching within 14 days of conclusion of construction activities. This seeding and seed mixture shall meet the NRCS Conservation Practice Standard IA-342 (Critical Area Seeding) or other program requirements to replace previous grass stand.
2. Line bottom and sides of bioreactor chamber with plastic, minimum 4 mil thickness. Overlap any splices at least 6 inches. Lap seams in direction of flow so water flows over top of seam. Wrap plastic carefully around tiles that enter/exit the chamber; no need to seal around tiles.
3. Woodchips shall not contain woods known to have tannin, such as oak, cedar, or redwood. Woodchips shall be reasonably free of soil and other contaminants nor contain loose composting materials. Wood chips shall be around 1"long by ½" thick with minimal fines. They shall be processed through a chipper and not through a grinder. Do not use any wood that has been treated for ground contact. ESE has the right to reject any woodchips which do not meet specifications.
4. Geotextile shall be non-woven, Class II, and meet the requirements of Iowa Construction Specification IA-95, Geotextile. Overlap a minimum of 6 inches at all seams.
5. Grade site for positive drainage away from the bioreactor chamber. Spread soil in designated location away from bioreactor.
6. See Plan Map for benchmark coordinates.



SECTION A–A

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

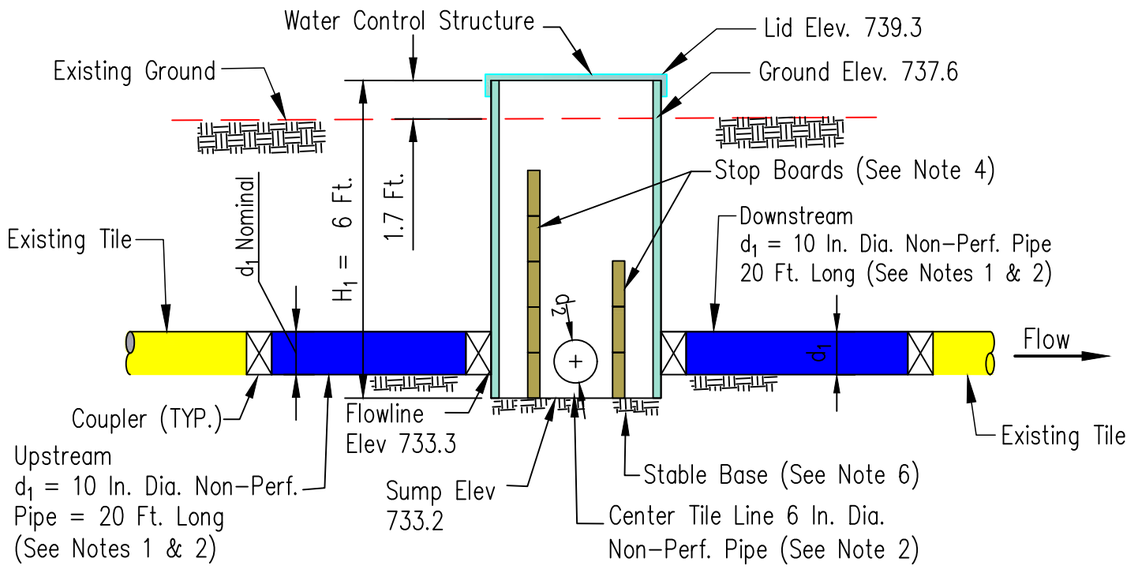
DESIGNED BY ANDY MACKFILL 8/15/23
DRAWN BY ANDY MACKFILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY

BIOREACTOR DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

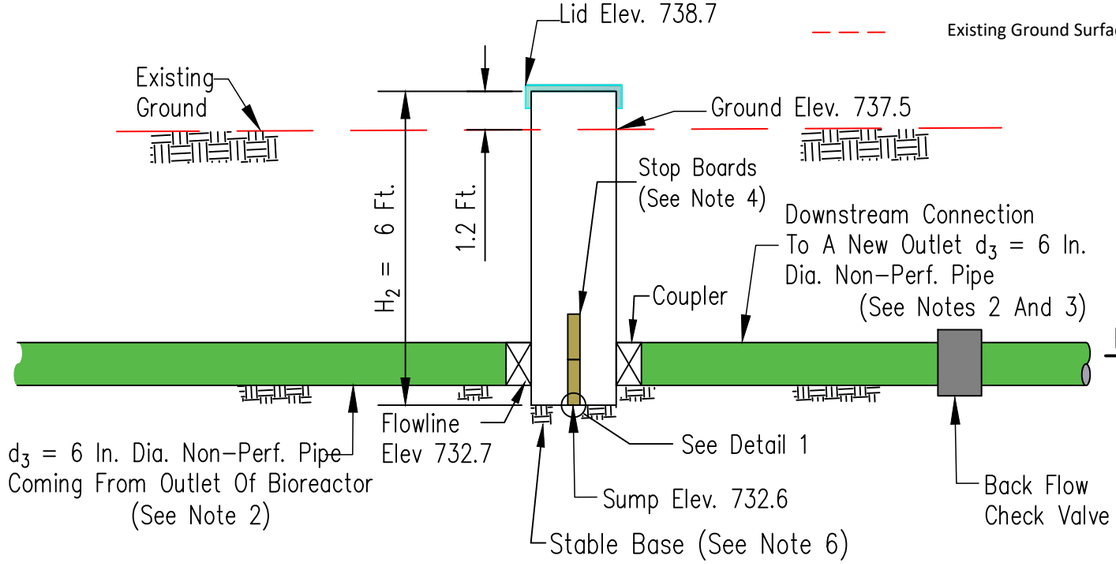
FILE NAME

DRAWING SET
SHEET 5 OF 7



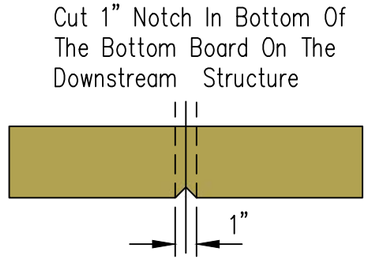
TYPICAL SECTION
UPSTREAM STRUCTURE

QUANTITIES*	
Water Control Structure, 3 Chamber H_1 = 6 ft. d_1 = 10 in. d_2 = 6 in.	1
Water Control Structure, 2 Chamber H_2 = 6 ft. d_3 = 6 in.	1
10" Non-perforated Pipe (ft)	40
10" CMP Outlet Pipe with Rodent Guard (ft)	20
6" Non-perforated Pipe (ft)	115
6" Perforated CPT (ft)	40
6" End Cap	2
Wood Chips (cu. yd.)	209
4 Mil Plastic (sq. yd.)**	293
Geotextile (sq. yd.)	178
Excavation (cu. yd.)	291
Earth Fill (cu. yd.)	131
6" Backflow Check Valve	1

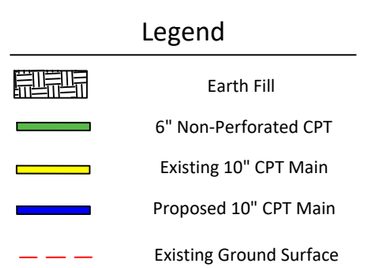


TYPICAL SECTION
DOWNSTREAM STRUCTURE

* Quantities do not include tile/pipe couplers or extra material for geotextile/plastic overlap
** Accounts for 1 ft. overhang around perimeter



DETAIL 1



Side Port Is On The
(Circle One) Left/Right
Side Of Structure,
Looking Downstream

NOTES:
1. Install a minimum of 20 feet of non-perforated pipe adjacent to the water control structure, on all lines: upstream, downstream and center. Pipe must be PVC, dual-wall CPT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745. Check valve must conform to ASTM D 3034 with SDR35 pipe or stronger.
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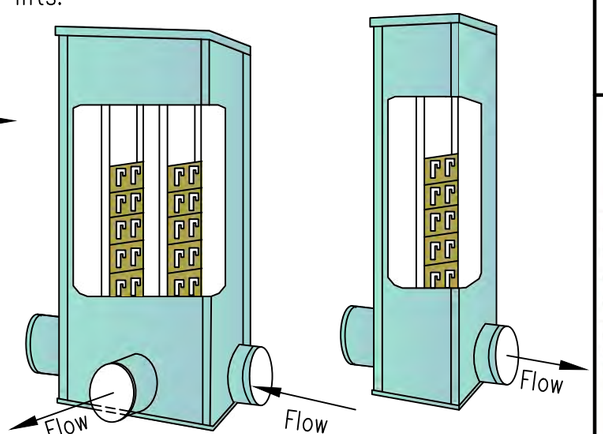

IN-LINE CONTROL STRUCTURES

DATE	
DESIGNED BY ANDY MACKRILL	8/15/23
DRAWN BY ANDY MACKRILL	8/15/23
CHECKED BY ANDY CRAIG	8/15/23
APPROVED BY	

STRUCTURE DETAIL

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME

DRAWING SET
SHEET 6 OF 7

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

CONSTRUCTION NOTES

1. Tile elevations are based on Maverick tile probe depths and are to be considered accurate within margin of error of the instrument.
2. If any surface inlets are currently attached to the tile main or plan to be in the future, they shall be replaced with water quality inlets to minimize trash entry into the tile line before construction of the bioreactor begins.
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   b. Photos and invoices for quantity and quality of woodchips/carbon media
   c. Photos and invoices or product information to detail quantity and quality of plastic and geotextile fabric
   d. Photos and invoices or product information for water control structures
8. Construction tolerances are +/-0.5ft on bioreactor chamber dimensions, and +/-0.1 ft. on all elevations. Outlet WCS sump (bottom) must be below the elevation of the bioreactor chamber at the outlet end. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by a representative from ESE and will be noted in the as-built plan.
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IA-6	Seeding and Mulching for Protective Cover
IA-95	Geotextile
IA-605	Denitrifying Bioreactor
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

DESIGNED BY ANDY MACKFILL 8/15/23
DRAWN BY ANDY MACKFILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY
DATE

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

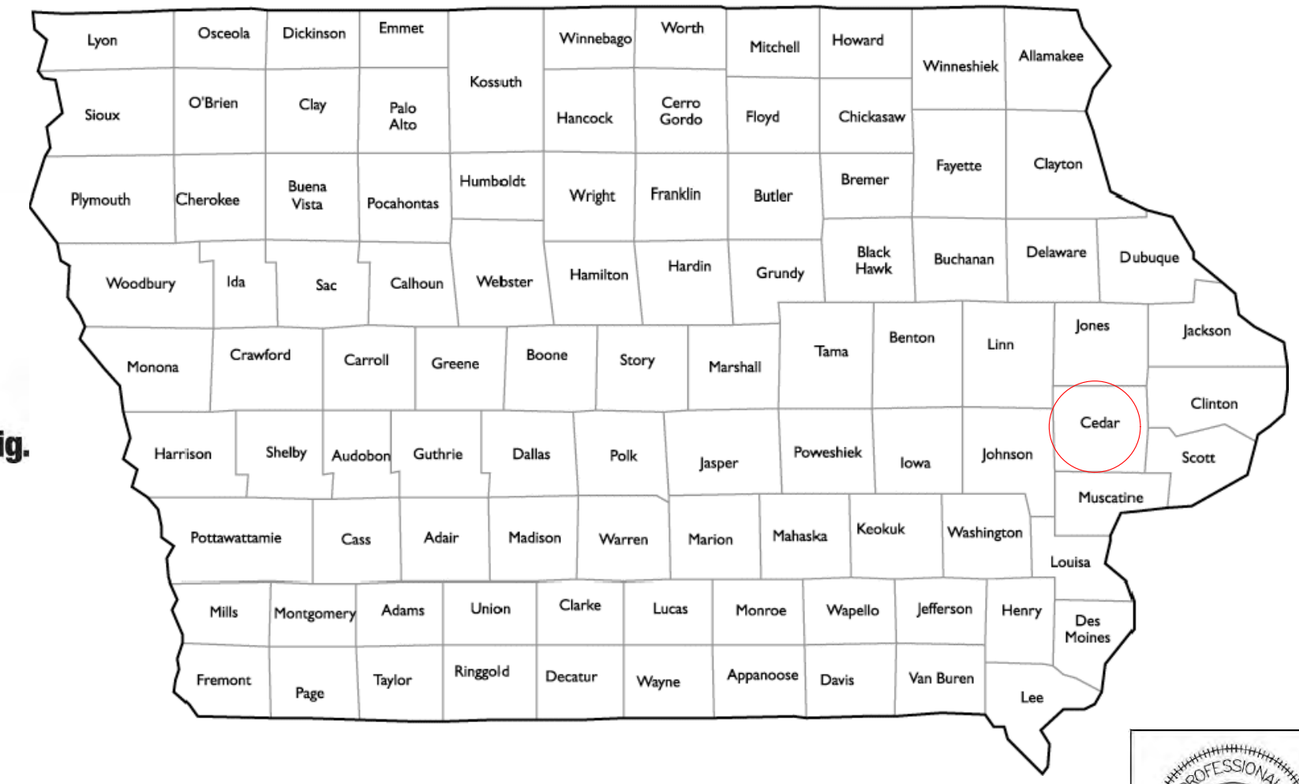
FILE NAME

DRAWING SET
SHEET 7 OF 7

DENITRIFYING BIOREACTOR CONSTRUCTION PLANS

CEDAR COUNTY, IOWA

SECTION 04- T80N - R02W



INDEX OF SHEETS

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I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

8/15/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

ENGINEERING CLASS 3

		DATE
DESIGNED BY	ANDY MACKRILL, TSP	8/15/2023
DRAWN BY	ANDY MACKRILL, TSP	8/15/2023
CHECKED BY	ANDY CRAIG, PE	8/15/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 7

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 650952.2
Easting: 2299579.0
Elevation: 736.0

0 25 50 Feet

N

Staking Control Points (NAD 1983 State Plane Iowa South US SURVEY FEET)				
Point	Description	Northing	Easting	Elevation
1	Southeast Corner BIO	650977.4	2299657.0	736.9
2	Southwest Corner BIO	650967.2	2299639.6	736.4
3	Northwest Corner BIO	651036.3	2299599.0	736.4
4	Northeast Corner BIO	651046.5	2299616.4	736.9
5	Inlet WCS (3-chamber)	651022.5	2299583.4	736.0
6	Outlet WCS (2-chamber)	650965.3	2299637.6	736.3
7	Benchmark	650952.2	2299579.0	736

0+00.00
4
3
5
0+30.00
0+00.00
1+00.00
1
2
6
7

Approx. Grade 5.0% Connecting to Existing Outlet.

New 8" CMP Outlet With Rodent Guard

Legend

- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 8" CPT Main
- Proposed 8" Non-Perf CPT Main
- Proposed 8" CMP Outlet
- Bioreactor Footprint
- Water Control Structure
- Benchmark
- 2 Foot Contours

DESIGNED BY ANDY MACKRILL 8/15/23
DRAWN BY ANDY MACKRILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY

PLAN MAP

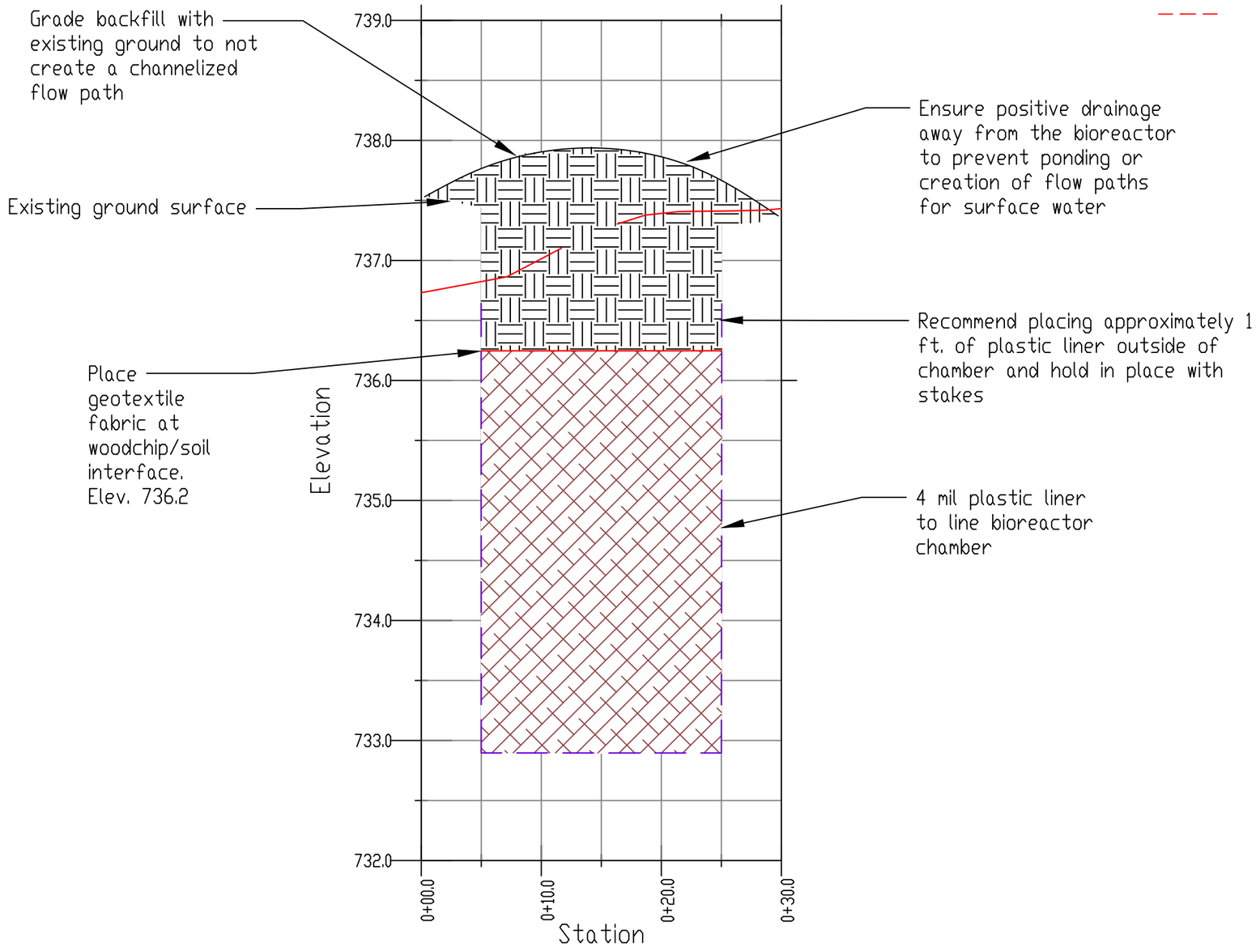
ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME

DRAWING SET
SHEET 2 OF 7

LANDOWNER | LOCATION | SECTION 04 - T80N - R02W

Cross-Section



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface

DESIGNED BY	ANDY MACKFILL
DRAWN BY	ANDY MACKFILL
CHECKED BY	ANDY CRAIG
APPROVED BY	
DATE	8/15/23
	8/15/23
	8/15/23

CROSS SECTION VIEW

ESE Ecosystem Services Exchange — Valuing Conservation

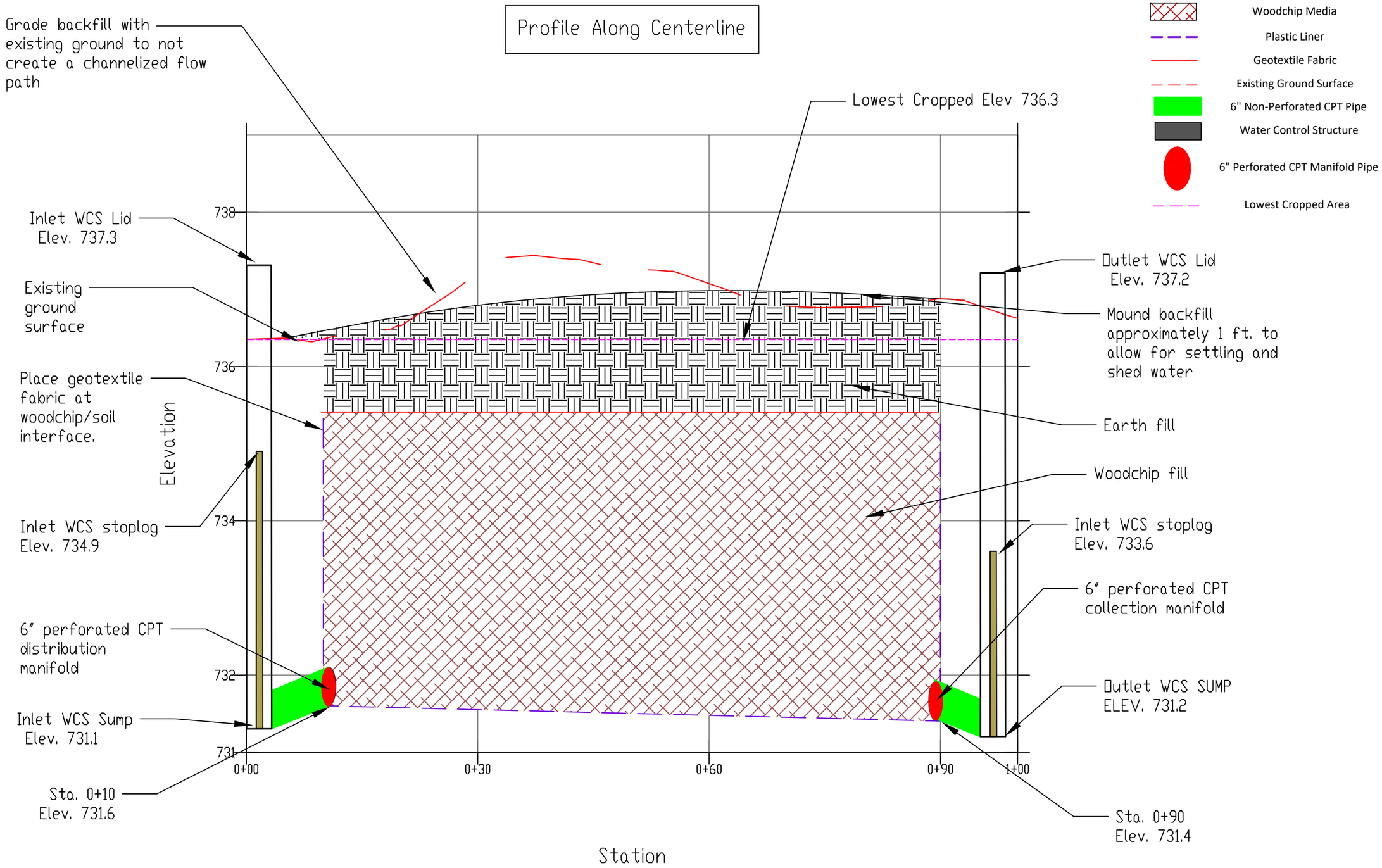
FILE NAME

DRAWING SET

SHEET 3 OF 7

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

Profile Along Centerline



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- 6" Non-Perforated CPT Pipe
- Water Control Structure
- 6" Perforated CPT Manifold Pipe
- Lowest Cropped Area

DESIGNED BY ANDY MACKFILL	DATE 8/15/23
DRAWN BY ANDY MACKFILL	8/15/23
CHECKED BY ANDY CRAIG	8/15/23
APPROVED BY	

PROFILE ALONG CENTERLINE

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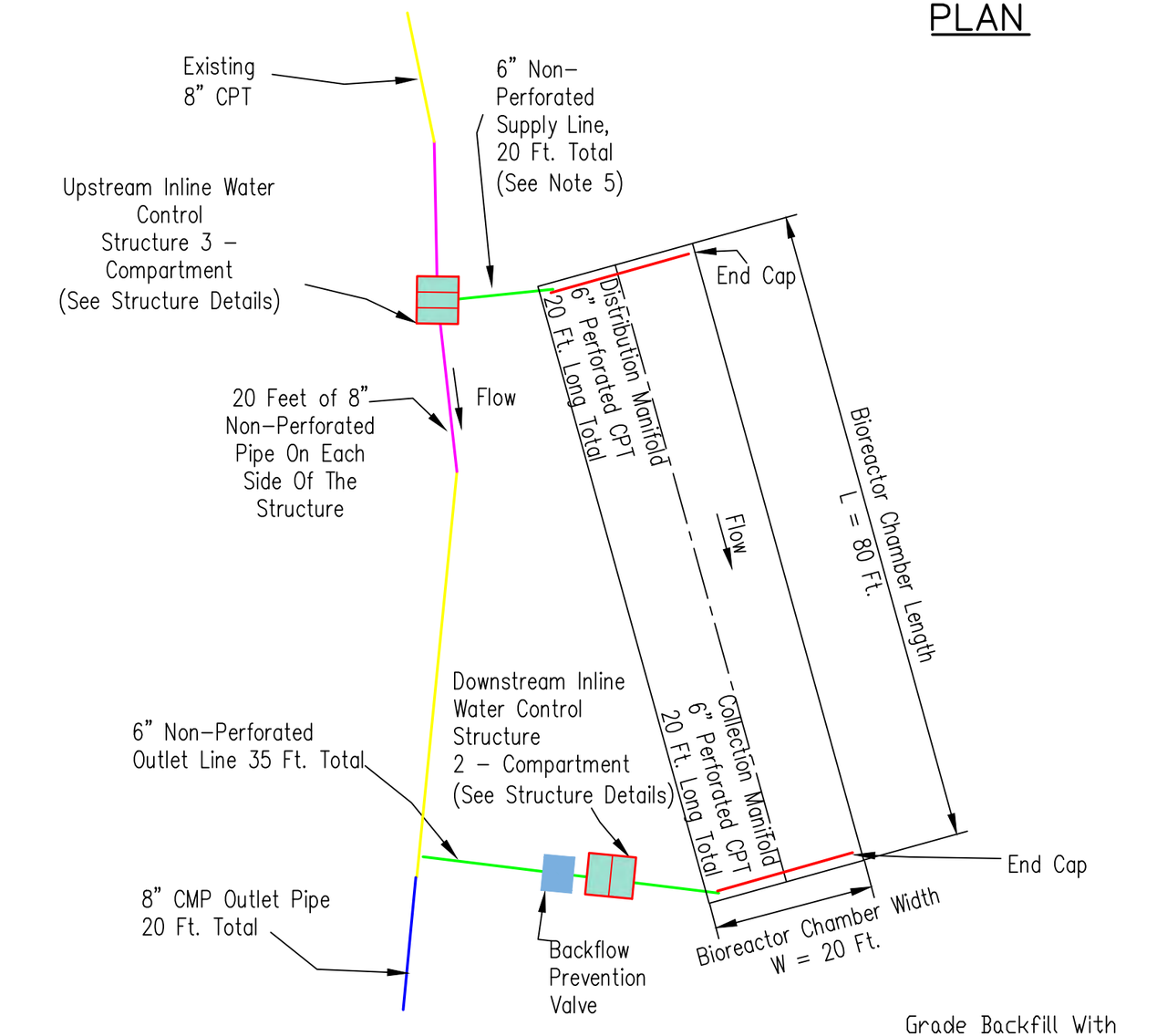
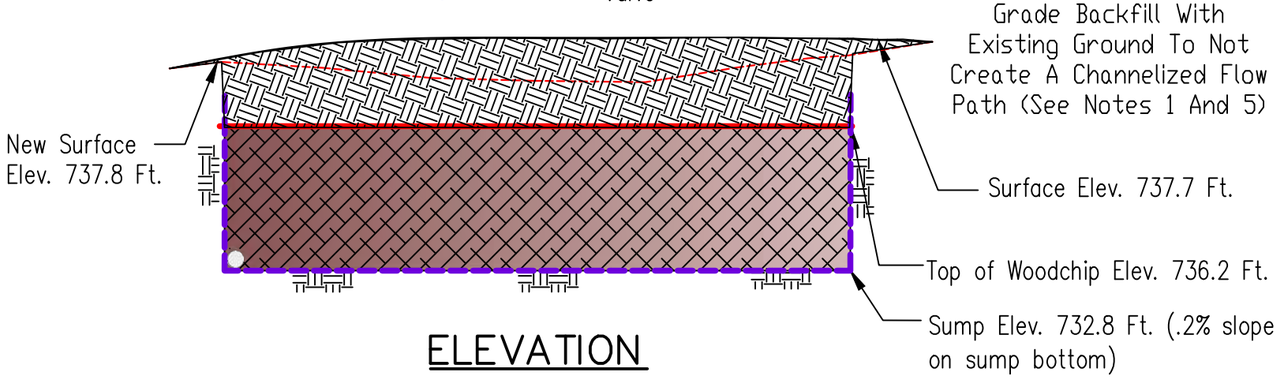
FILE NAME

DRAWING SET
SHEET 4 OF 7

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

PLAN





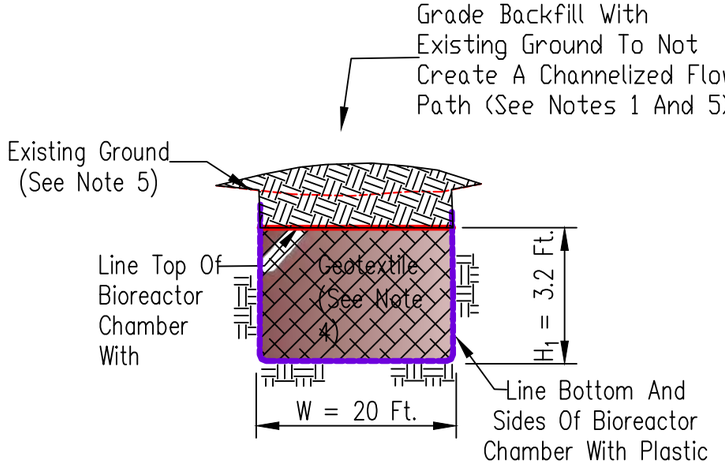
ELEVATION

Legend

- Earth Fill
- Woodchip Media
- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 8" CPT Main
- Proposed 8" Non-Perforated CPT
- Proposed 8" CMP Outlet
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- Bioreactor Footprint

NOTES:

1. All disturbed non-crop construction areas shall be stabilized by seeding or mulching within 14 days of conclusion of construction activities. This seeding and seed mixture shall meet the NRCS Conservation Practice Standard IA-342 (Critical Area Seeding) or other program requirements to replace previous grass stand.
2. Line bottom and sides of bioreactor chamber with plastic, minimum 4 mil thickness. Overlap any splices at least 6 inches. Lap seams in direction of flow so water flows over top of seam. Wrap plastic carefully around tiles that enter/exit the chamber; no need to seal around tiles.
3. Woodchips shall not contain woods known to have tannin, such as oak, cedar, or redwood. Woodchips shall be reasonably free of soil and other contaminants nor contain loose composting materials. Wood chips shall be around 1"long by ½" thick with minimal fines. They shall be processed through a chipper and not through a grinder. Do not use any wood that has been treated for ground contact. ESE has the right to reject any woodchips which do not meet specifications.
4. Geotextile shall be non-woven, Class II, and meet the requirements of Iowa Construction Specification IA-95, Geotextile. Overlap a minimum of 6 inches at all seams.
5. Grade site for positive drainage away from the bioreactor chamber. Spread soil in designated location away from bioreactor.
6. See Plan Map for benchmark coordinates.



SECTION A-A

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

DESIGNED BY ANDY MACKFILL 8/15/23
DRAWN BY ANDY MACKFILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY

BIOREACTOR DETAIL

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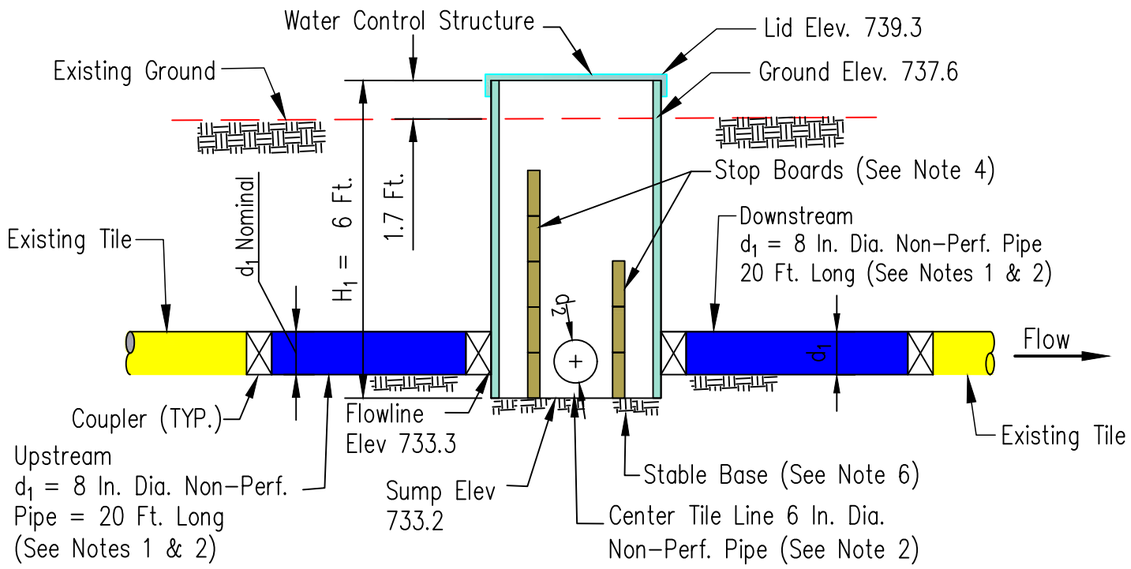
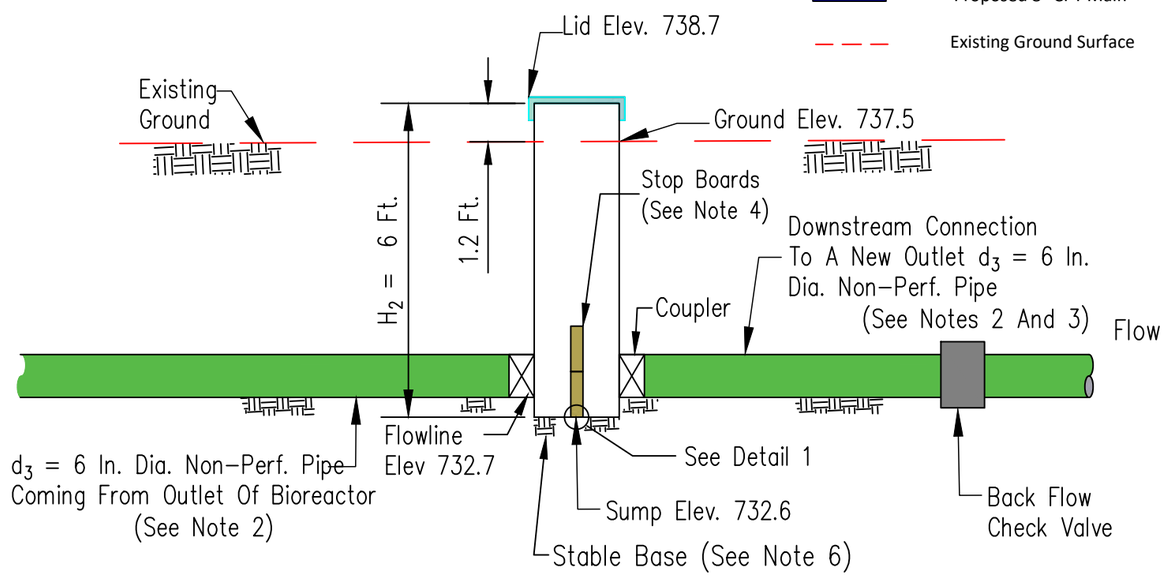
SHEET 5 OF 7



TYPICAL SECTION
UPSTREAM STRUCTURE

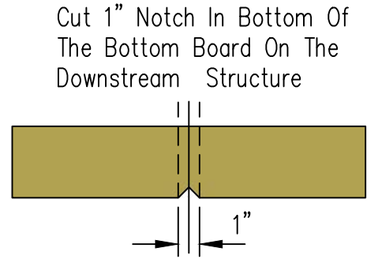
QUANTITIES*	
Water Control Structure, 3 Chamber H_1 = 6 ft. d_1 = 8 in. d_2 = 6 in.	1
Water Control Structure, 2 Chamber H_2 = 6 ft. d_3 = 6 in.	1
8" Non-perforated Pipe (ft)	40
8" CMP Outlet Pipe With Rodent Guard (ft)	20
6" Non-perforated Pipe (ft)	80
6" Perforated CPT (ft)	40
6" End Cap	2
Wood Chips (cu. yd.)	255
4 Mil Plastic (sq. yd.)**	313
Geotextile (sq. yd.)	178
Excavation (cu. yd.)	320
Earth Fill (cu. yd.)	119
6" Backflow Check Valve	1



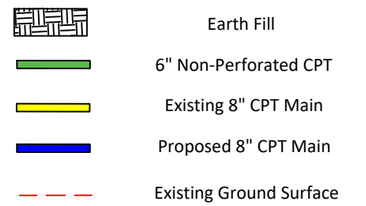
TYPICAL SECTION
DOWNSTREAM STRUCTURE

* Quantities do not include tile/pipe couplers or extra material for geotextile/plastic overlap

** Accounts for 1 ft. overhang around perimeter

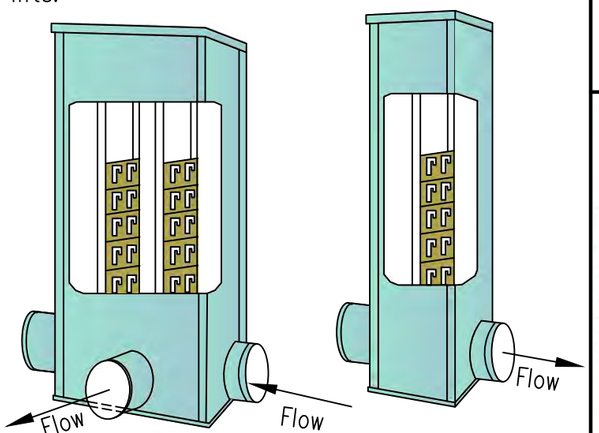


DETAIL 1



Side Port Is On The
(Circle One) Left/Right
Side Of Structure,
Looking Downstream

NOTES:
1. Install a minimum of 20 feet of non-perforated pipe adjacent to the water control structure, on all lines: upstream, downstream and center. Pipe must be PVC, dual-wall CPT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745. Check valve must conform to ASTM D 3034 with SDR35 pipe or stronger.
3. Couplings between the water control structures and the non-perforated tile must be watertight.
4. Stop boards must provide must tight seals under a minimum of 1 foot pressure head (except notched board).
5. Appropriately mark bioreactor perimeter to avoid vehicle, implement, or livestock traffic.
6. Place structure and pipe coupler on a stable base. A stable base may be compacted earth, compacted fill sand, or a concrete pad. Extend the stable base no less than 1 foot beyond structure.
7. Excavated material placed around structure and pipes shall be hand compacted in 4" lifts.



IN-LINE CONTROL STRUCTURES

DESIGNED BY ANDY MACKRILL	DATE 8/15/23
DRAWN BY ANDY MACKRILL	8/15/23
CHECKED BY ANDY CRAIG	8/15/23
APPROVED BY	

STRUCTURE DETAIL

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FILE NAME

DRAWING SET
SHEET 6 OF 7

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

CONSTRUCTION NOTES

1. Tile elevations are based on Maverick tile probe depths and are to be considered accurate within margin of error of the instrument.
2. If any surface inlets are currently attached to the tile main or plan to be in the future, they shall be replaced with water quality inlets to minimize trash entry into the tile line before construction of the bioreactor begins.
3. Avoid excessive disturbance of any buffers or grassed water ways during construction. However, if re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded within 14 days according to NRCS Conservation Practice Standard IA-342 Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
4. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion.
5. All carbon media to be placed in the bioreactor shall come from an ESE approved vendor or approved with ESE staff prior to transportation and placement.
6. Contact an ESE representative for inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the bioreactor chamber and tile line trenches
   b. After placing the water control structures and bioreactor manifolds
   c. After placement of carbon media, before backfilling with soil
   d. After connections to existing tile and final grading
7. Any product planned for use in construction must be approved by ESE prior to construction. Save and provide documentation to an ESE representative of all materials used in construction including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths
   b. Photos and invoices for quantity and quality of woodchips/carbon media
   c. Photos and invoices or product information to detail quantity and quality of plastic and geotextile fabric
   d. Photos and invoices or product information for water control structures
8. Construction tolerances are +/-0.5ft on bioreactor chamber dimensions, and +/-0.1 ft. on all elevations. Outlet WCS sump (bottom) must be below the elevation of the bioreactor chamber at the outlet end. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by a representative from ESE and will be noted in the as-built plan.
9. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.
10. All work shall be performed according to the IA construction and practice specifications in the table below.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-95	Geotextile
IA-605	Denitrifying Bioreactor
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 04 - T80N - R02W

DESIGNED BY ANDY MACKFILL 8/15/23
DRAWN BY ANDY MACKFILL 8/15/23
CHECKED BY ANDY CRAIG 8/15/23
APPROVED BY ____
DATE

CONSTRUCTION NOTES

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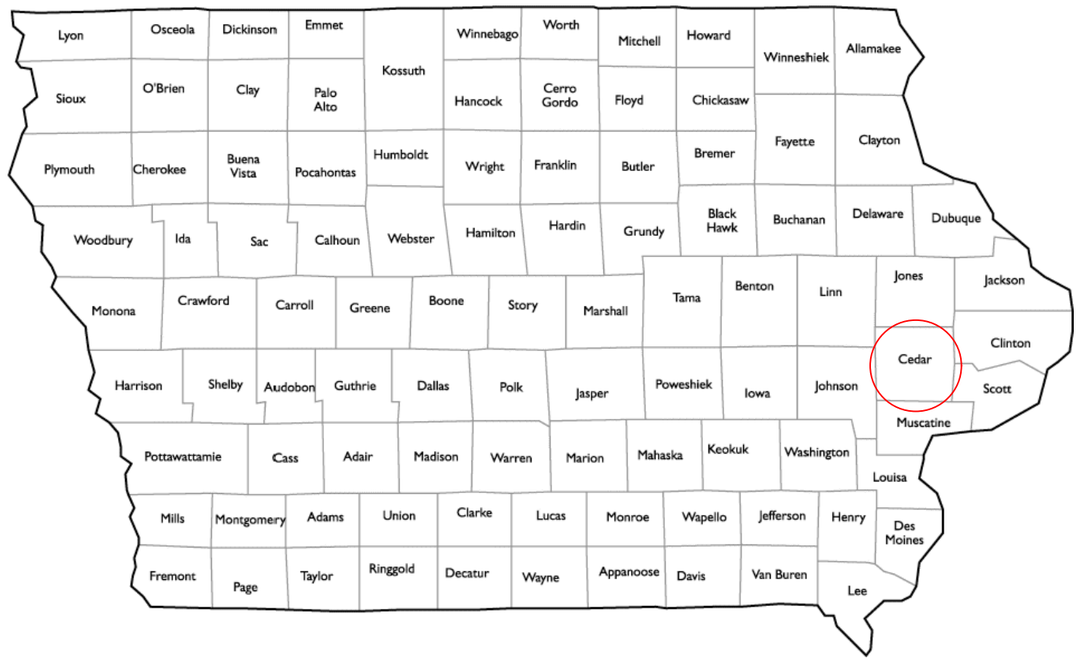
FILE NAME
' '

DRAWING SET
SHEET 7 OF 7

SATURATED BUFFER CONSTRUCTION PLANS

CEDAR CO, IOWA

SECTION 08- T79N - R02W



INDEX OF SHEETS

811 Know what's below. Call before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

6/21/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

ENGINEERING CLASS 2

		DATE
DESIGNED BY	ANDREW MACKRILL	6/21/2023
DRAWN BY	ANDREW MACKRILL	6/21/2023
CHECKED BY	ANDY CRAIG, PE, TSP	6/21/2023
APPROVED BY		

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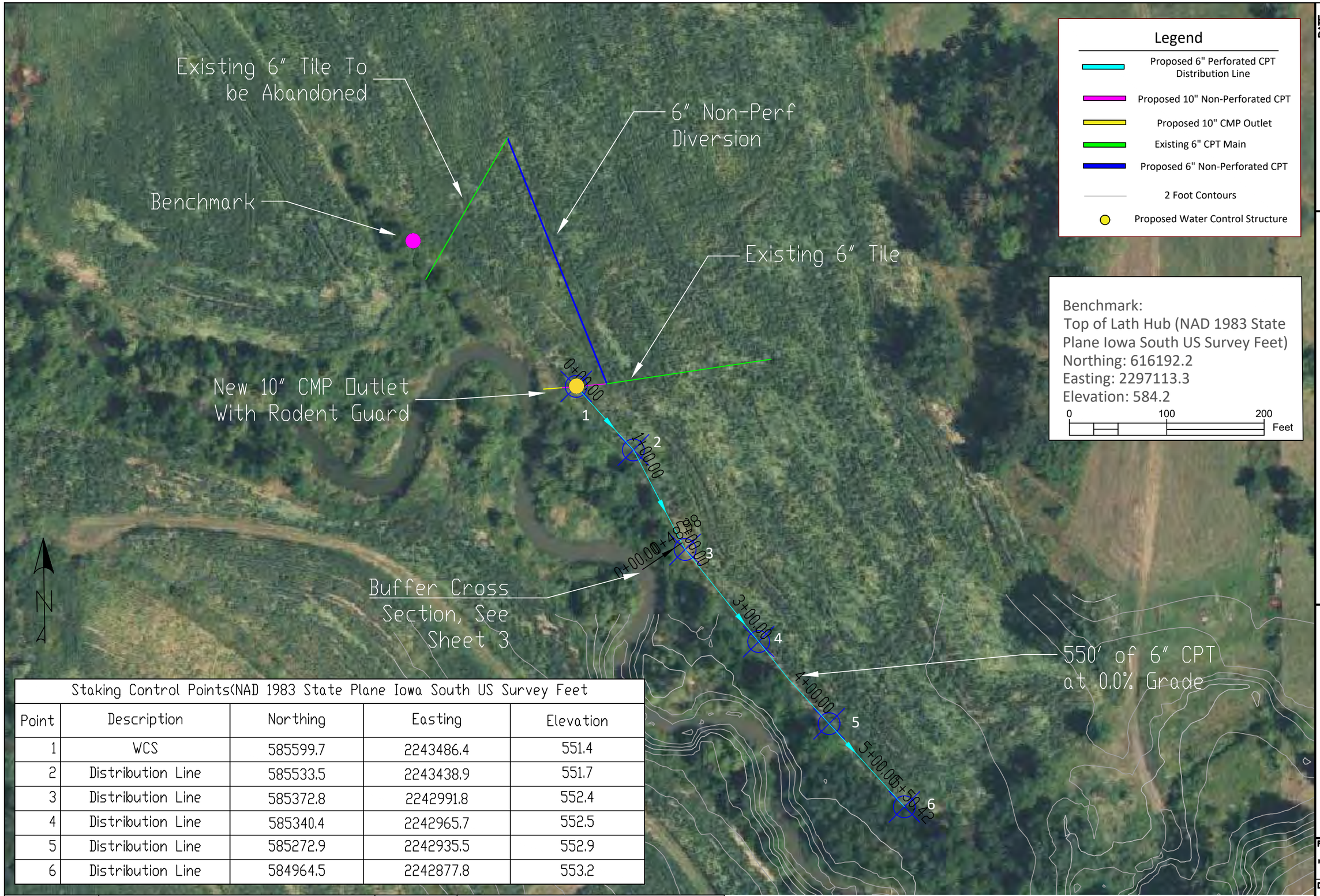
COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 6



Legend

- Proposed 6" Perforated CPT Distribution Line
- Proposed 10" Non-Perforated CPT
- Proposed 10" CMP Outlet
- Existing 6" CPT Main
- Proposed 6" Non-Perforated CPT
- 2 Foot Contours
- Proposed Water Control Structure

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 616192.2
Easting: 2297113.3
Elevation: 584.2

0 100 200 Feet

Staking Control Points(NAD 1983 State Plane Iowa South US Survey Feet

Point	Description	Northing	Easting	Elevation
1	WCS	585599.7	2243486.4	551.4
2	Distribution Line	585533.5	2243438.9	551.7
3	Distribution Line	585372.8	2242991.8	552.4
4	Distribution Line	585340.4	2242965.7	552.5
5	Distribution Line	585272.9	2242935.5	552.9
6	Distribution Line	584964.5	2242877.8	553.2

LANDOWNER		LOCATION	SECTION 08 - T79N - R2W

DATE
DESIGNED BY ANDREW MACKRILL 6/21/23
DRAWN BY ANDREW MACKRILL 6/21/23
CHECKED BY ANDY CRAIG, PE, TSP 6/21/23
APPROVED BY

PLAN MAP

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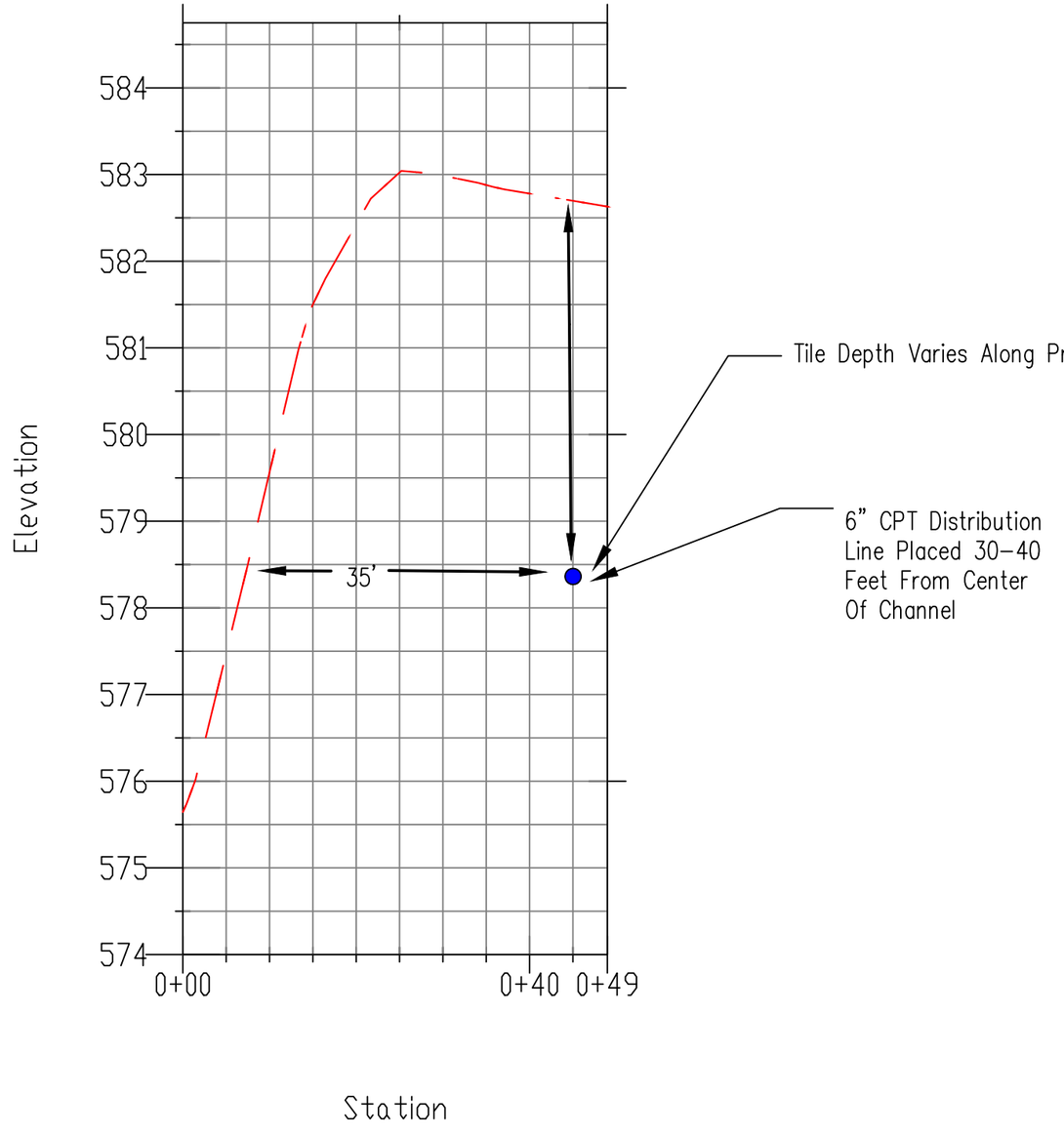
FILE NAME

DRAWING SET
SHEET 2 OF 6

Bank Cross Section



LANDOWNER		LOCATION	SECTION 08 - T79N - R2W

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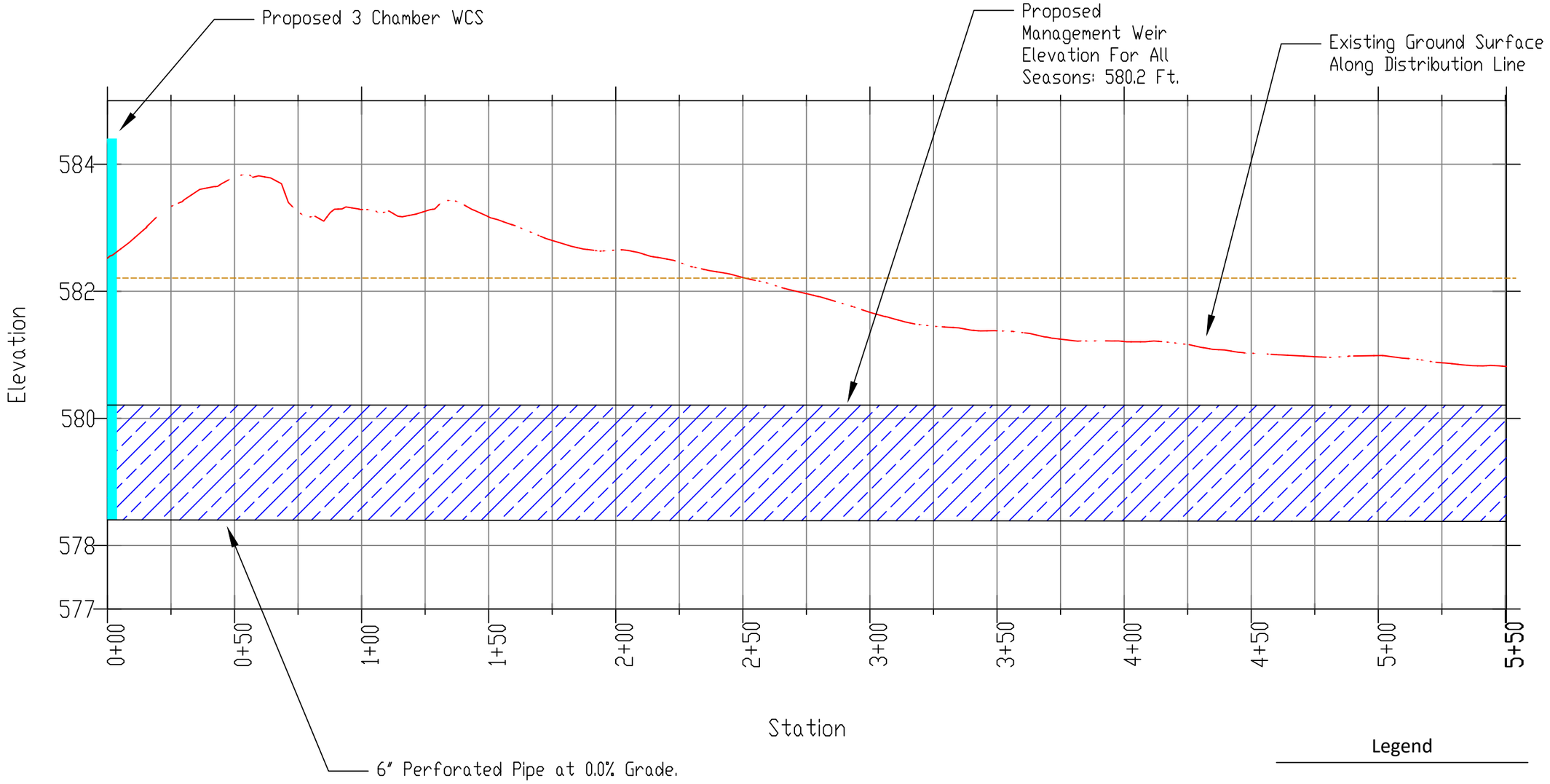
BUFFER AND BANK CROSS SECTION

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME

DRAWING SET
SHEET 3 OF 6

Profile Along Distribution Line



Legend

- All Season Water Table
- Proposed Water Control Structure
- Proposed 6" CPT Distribution Line
- Existing Ground Surface
- Lowest Crop Surface

LANDOWNER		LOCATION	SECTION 08 - T79N - R2W

DESIGNED BY ANDREW MACKRILL 6/21/23
DRAWN BY ANDREW MACKRILL 6/21/23
CHECKED BY ANDY CRAIG, PE, TSP 6/21/23
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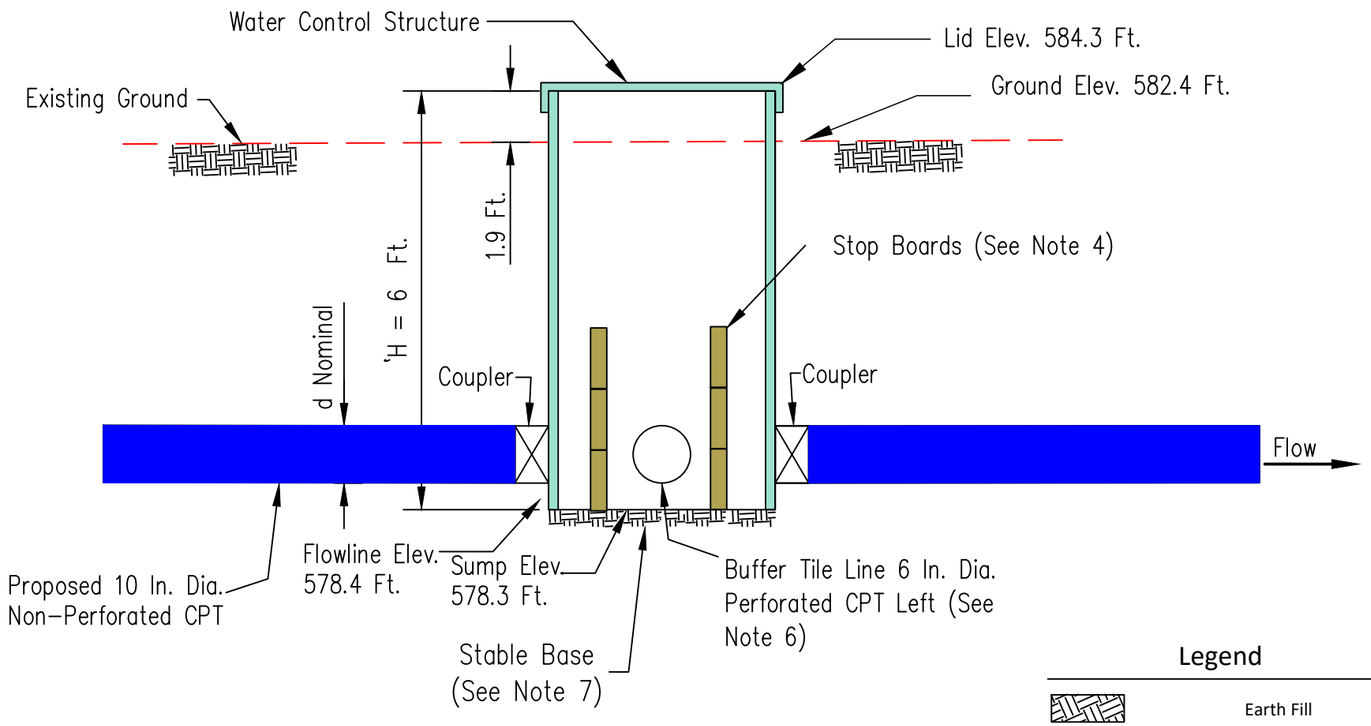
PROFILE ALONG DISTRIBUTION LINE

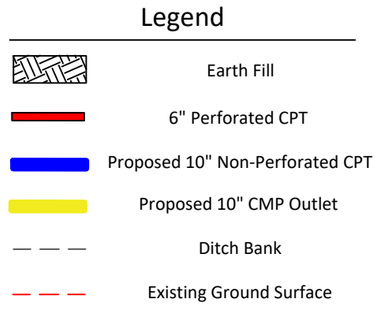
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
-

DRAWING SET
SHEET 4 OF 6

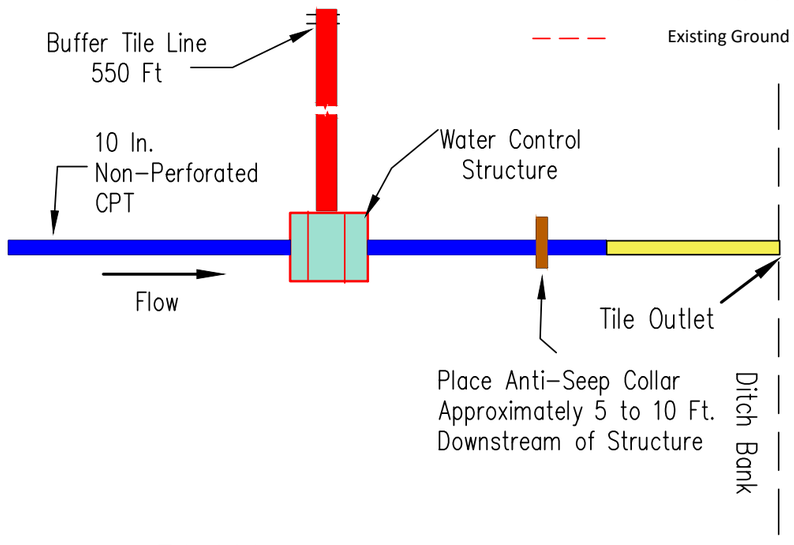


TYPICAL SECTION



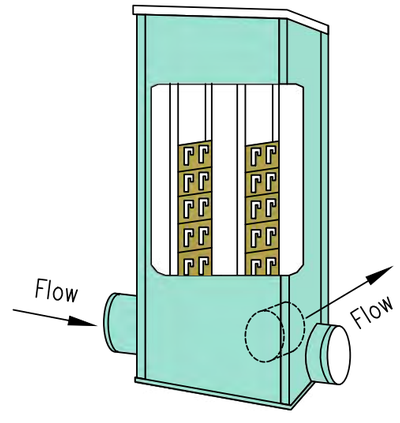
QUANTITIES*		NRCS SPEC
Water Control Structure 3– Compartment H = 6 ft. d = 10 in.	1	IA-21, IA-26, CPS-587
10" Non-perforated Pipe (ft)	40	IA-21, IA-45
10" CMP Outlet Pipe With Rodent Guard (ft)	20	IA-604, IA-620
6" Perforated CPT (ft) Buffer Tile Line	550	IA-21, IA-45, IA-46
6" Non-perforated Pipe (ft)	275	IA-21, IA-45
3'x3' Anti Seep Collar	1	CPS-587

*Quantities Do Not Include Couplers



PLAN

NOTES:
1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, both upstream, and downstream. Pipe shall be PVC, dual–wall PT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745.
3. Couplings between the water control section and the non–perforated tile shall be water tight.
4. Stop boards shall provide water tight seals under a minimum of 1 foot pressure head.
5. Mark location of structure using steel t–post or manufactured marker flag for safety in the field.
6. Install buffer tile parallel to ditch or stream, according to profile provided with the construction plans. Pipe shall remain on grade and drain towards the WCS.
7. Place structure and pipe coupler on a stable base. A stable base may be compacted earth or compacted fill sand.
8. Excavated material placed around structure and pipes must be hand compacted in 4" lifts.



IN–LINE CONTROL STRUCTURE

LANDOWNER		LOCATION	SECTION 08 - T79N - R2W

DESIGNED BY ANDREW MACKRILL 6/21/23
DRAWN BY ANDREW MACKRILL 6/21/23
CHECKED BY ANDY CRAIG, PE, TSP 6/21/23
APPROVED BY
DATE

STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 5 OF 6

CONSTRUCTION NOTES

1. Tile elevations are based Maverick Tile Finder probe depths. A fiberglass cable with imbedded wire is fed into the outlet and located with a utility device. These values may not be exact, but are believed to be accurate. Factors such as sediment in the pipe, flowing water in the pipe, and wire location within the pipe may affect depth readings. Notify ESE at least 48 hours before conducting the investigation so that a qualified ESE representative can be onsite during the investigation.
2. Avoid excessive disturbance of buffers or grassed water ways during construction. If re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded according to NRCS Conservation Practice Standard 342 – Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
3. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion. Contact ESE for assistance with construction inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the existing tile and setting WCS.
   b. Distribution pipe has been laid and capped.
4. Any product planned for use in construction must be approved by ESE prior to construction. Provide documentation to ESE of all materials used in construction, including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths.
   b. Photos and invoices or product information for water control structures.
5. Construction tolerances are +/-0.5ft on distribution line location, and +/-0.1 ft. on all elevations. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by ESE and will be noted in the as-built plan.
6. When installing the distribution line, pay special attention so that other outlets in the buffer are not damaged or broken. Although an investigation of the buffer will have already been completed, not all outlets are able to be located depending on site conditions at the time. If another tile line or outlet is encountered, contact an ESE representative for consultation. They will decide if the tile line is able to be incorporated into the system, or if a section of the distribution line needs to be replaced as non-perforated pipe to prevent water loss.
7. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-604	Saturated Buffer
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 08 - T79N - R2W

DESIGNED BY ANDREW MACKRILL 6/21/23
DRAWN BY ANDREW MACKRILL 6/21/23
CHECKED BY ANDY CRAIG, PE, TSP 6/21/23
APPROVED BY

CONSTRUCTION NOTES

Ecosystem Services Exchange
Valuing Conservation

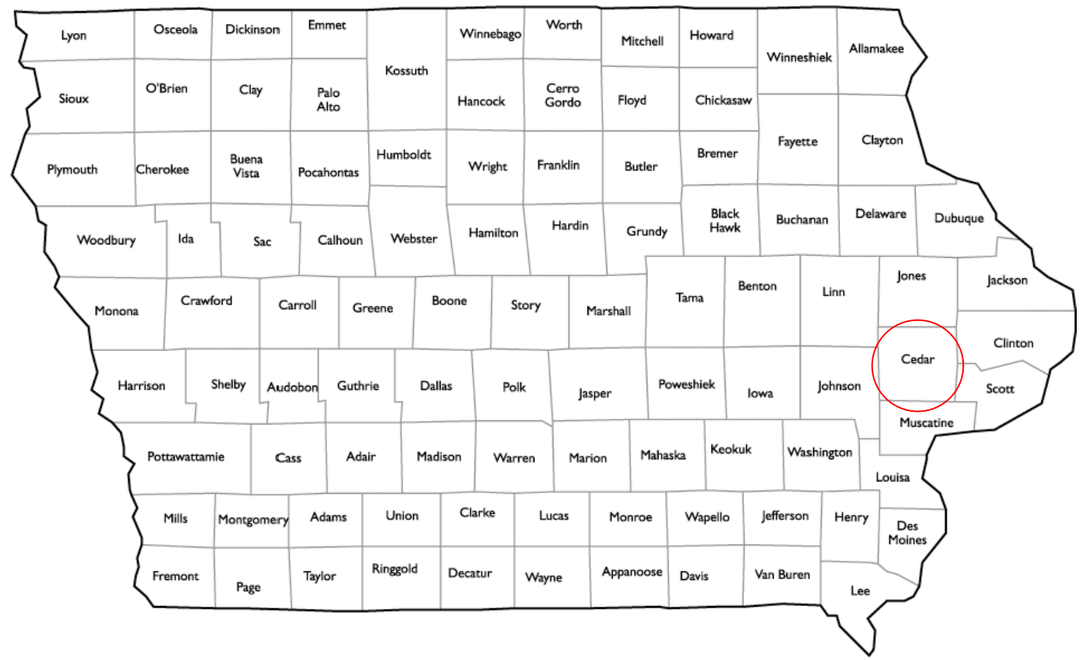
FILE NAME

DRAWING SET
SHEET 6 OF 6

SATURATED BUFFER CONSTRUCTION PLANS

CEDAR CO, IOWA

SECTION 14 - T79N - R4W



INDEX OF SHEETS

811 Know what's below. Call before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

8/10/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

ENGINEERING CLASS 2

		DATE
DESIGNED BY	ANDREW MACKRILL	8/10/2023
DRAWN BY	ANDREW MACKRILL	8/10/2023
CHECKED BY	ANDY CRAIG, PE, TSP	8/10/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 6

Staking Control Points(NAD 1983 State Plane Iowa South US Survey Feet)				
Point	Description	Northing	Easting	Elevation
1	WCS	608190.5	2247105.7	692.4
2	Distribution Line	607927.1	2247279.4	692.3
3	Distribution Line	608070.7	2247302.8	692.8
4	Distribution Line	608135.5	2247129.3	692.2
5	Distribution Line	608269.6	2247119.5	692.9
6	Distribution Line	608445.7	2246971.2	693.1
7	Distribution Line	608522.5	2246987.5	696.9
8	Benchmark	607731.9	2247379.2	692.8

PLAN VIEW

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 607731.9
Easting: 2247379.2
Elevation: 692.8

0 100 200 Feet

N

Legend

- Proposed 6" Perforated CPT Distribution Line
- Proposed 8" Non-Perforated CPT
- Proposed 8" CMP Outlet
- Existing 8" CPT Main
- Proposed Water Control Structure
- 2' Contours
- Benchmark
- Staking Point

8+00.00
7
7+00.00
6
6+00.00
5
5+00.00
1
4+00.00
0+35.88
0+00.00
4
3+00.00
2+00.00
3
1+00.00
0+00.00
2
8

New 8" CMP Outlet With Rodent Guard

Buffer Cross Section, See Sheet 3

Existing 8" Tile

800' of 6" CPT at 0.0% Grade

Benchmark

DESIGNED BY ANDREW MACKRILL 8/10/23
DRAWN BY ANDREW MACKRILL 8/10/23
CHECKED BY ANDY CRAIG, PE, TSP 8/10/23
APPROVED BY

PLAN MAP

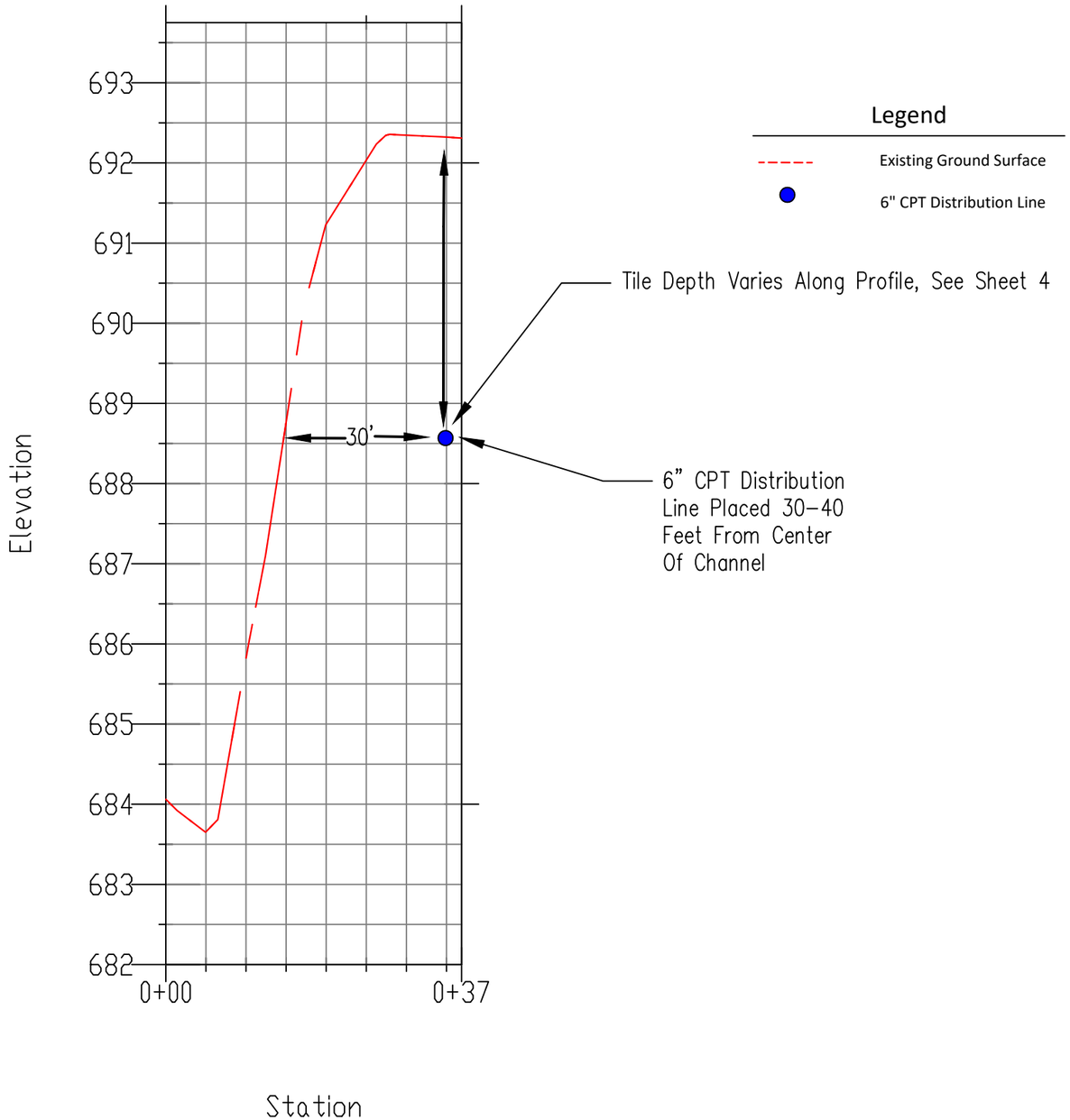
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 2 OF 6

LANDOWNER | LOCATION | SECTION 14 - T79N - R4W

Cross-Section



LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 8/10/23
DRAWN BY ANDREW MACKRILL 8/10/23
CHECKED BY ANDY CRAIG, PE, TSP 8/10/23
APPROVED BY

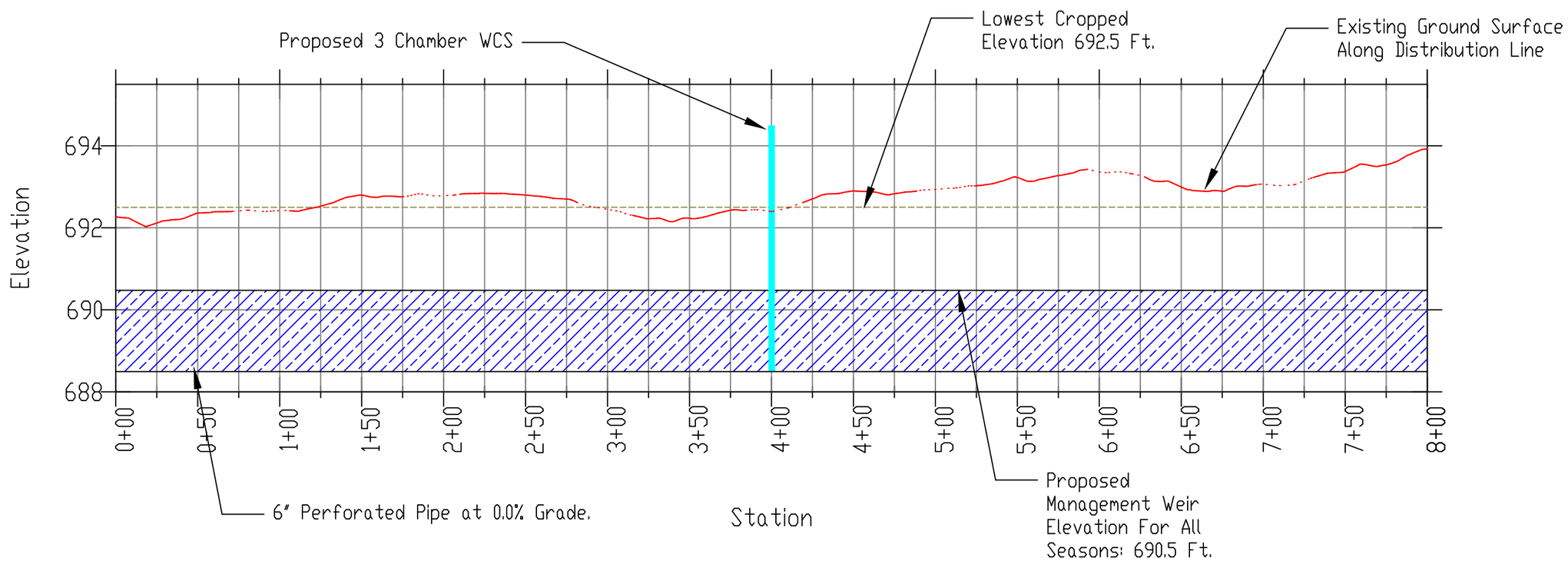
BUFFER AND BANK CROSS SECTION

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME
'

DRAWING SET
SHEET 3 OF 6

Profile Along Distribution Line



Legend

- All Season Water Table
- Proposed Water Control Structure
- Proposed 6" CPT Distribution Line
- Existing Ground Surface
- Lowest Farmed Elevation

LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

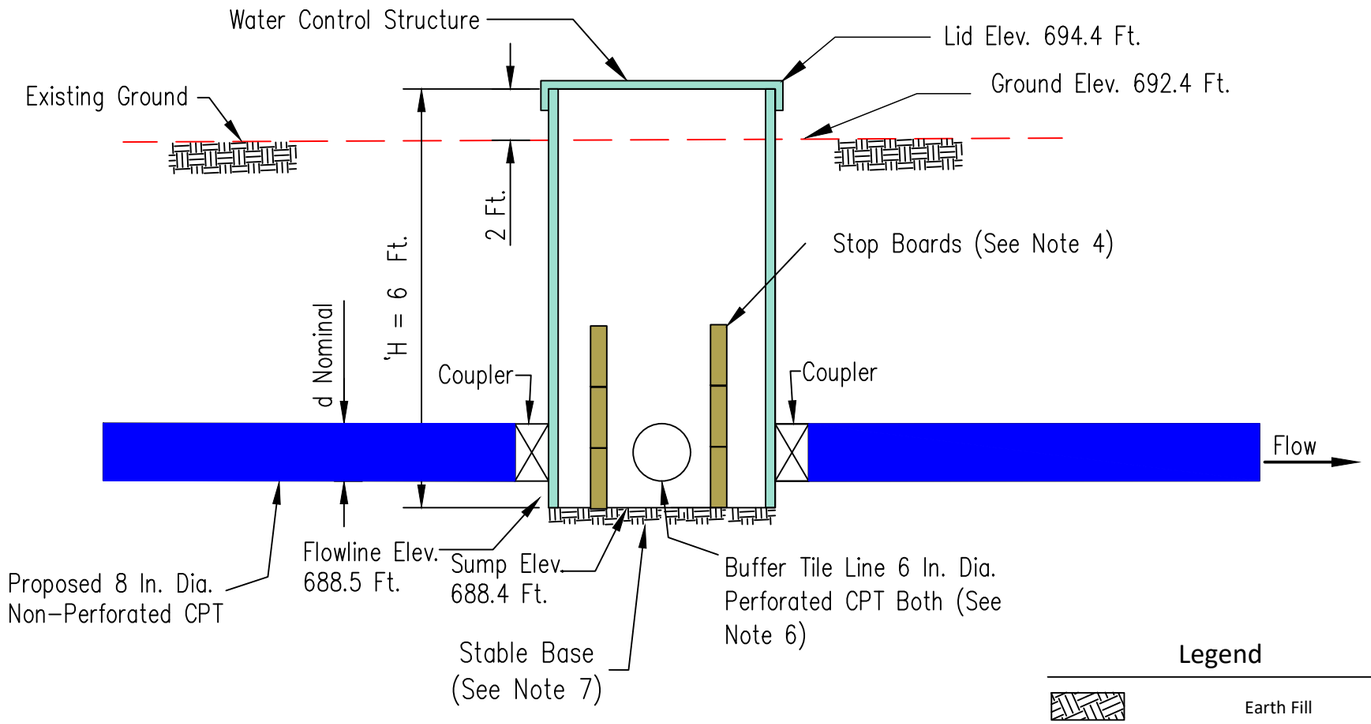
DESIGNED BY ANDREW MACKRILL 8/10/23
DRAWN BY ANDREW MACKRILL 8/10/23
CHECKED BY ANDY CRAIG, PE, TSP 8/10/23
APPROVED BY

PROFILE ALONG DISTRIBUTION LINE

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

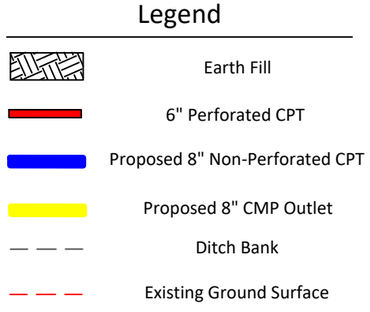
DRAWING SET
SHEET 4 OF 6

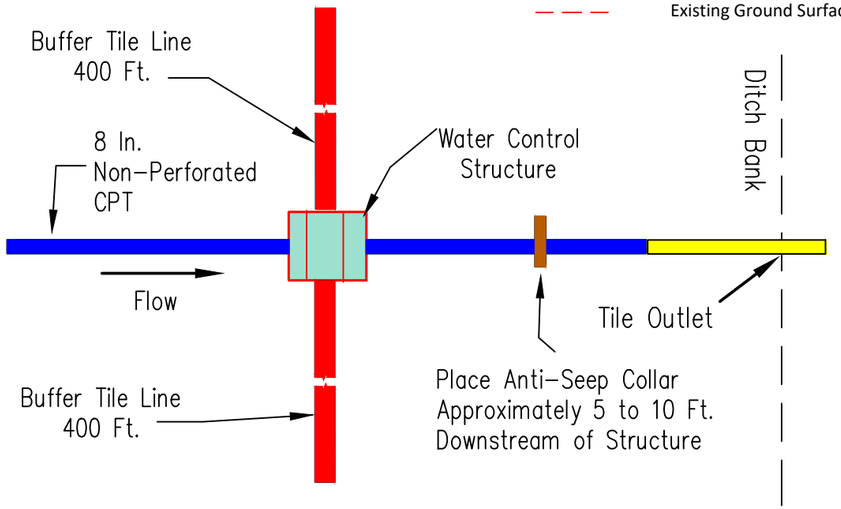


TYPICAL SECTION

QUANTITIES*		NRCS SPEC
Water Control Structure 3– Compartment H = 6 ft. d = 8 in.	1	IA-21, IA-26, CPS-587
8" Non-perforated Pipe (ft)	40	IA-21, IA-45
8" CMP Outlet Pipe With Rodent Guard (ft)	20	IA-604, IA-620
6" Perforated CPT (ft) Buffer Tile Line	800	IA-21, IA-45, IA-46
3'x3' Anti Seep Collar	1	CPS-587

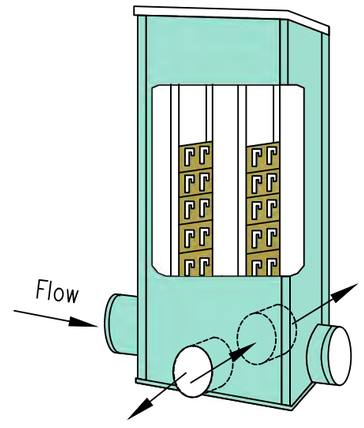
*Quantities Do Not Include Couplers





PLAN

NOTES:
1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, both upstream, and downstream. Pipe shall be PVC, dual–wall PT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745.
3. Couplings between the water control section and the non–perforated tile shall be water tight.
4. Stop boards shall provide water tight seals under a minimum of 1 foot pressure head.
5. Mark location of structure using steel t–post or manufactured marker flag for safety in the field.
6. Install buffer tile parallel to ditch or stream, according to profile provided with the construction plans. Pipe shall remain on grade and drain towards the WCS.
7. Place structure and pipe coupler on a stable base. A stable base may be compacted earth or compacted fill sand.
8. Excavated material placed around structure and pipes must be hand compacted in 4" lifts.



IN–LINE CONTROL STRUCTURE

LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DATE
DESIGNED BY ANDREW MACKRILL 8/10/23
DRAWN BY ANDREW MACKRILL 8/10/23
CHECKED BY ANDY CRAIG, PE, TSP 8/10/23
APPROVED BY

3 CHAMBER STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 5 OF 6

CONSTRUCTION NOTES

1. Tile elevations are based Maverick Tile Finder probe depths. A fiberglass cable with imbedded wire is fed into the outlet and located with a utility device. These values may not be exact, but are believed to be accurate. Factors such as sediment in the pipe, flowing water in the pipe, and wire location within the pipe may affect depth readings. Notify ESE at least 48 hours before conducting the investigation so that a qualified ESE representative can be onsite during the investigation.
2. Avoid excessive disturbance of buffers or grassed water ways during construction. If re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded according to NRCS Conservation Practice Standard 342 – Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
3. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion. Contact ESE for assistance with construction inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the existing tile and setting WCS.
   b. Distribution pipe has been laid and capped.
4. Any product planned for use in construction must be approved by ESE prior to construction. Provide documentation to ESE of all materials used in construction, including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths.
   b. Photos and invoices or product information for water control structures.
5. Construction tolerances are +/-0.5ft on distribution line location, and +/-0.1 ft. on all elevations. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by ESE and will be noted in the as-built plan.
6. When installing the distribution line, pay special attention so that other outlets in the buffer are not damaged or broken. Although an investigation of the buffer will have already been completed, not all outlets are able to be located depending on site conditions at the time. If another tile line or outlet is encountered, contact an ESE representative for consultation. They will decide if the tile line is able to be incorporated into the system, or if a section of the distribution line needs to be replaced as non-perforated pipe to prevent water loss.
7. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-604	Saturated Buffer
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 14 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 8/10/23
DRAWN BY ANDREW MACKRILL 8/10/23
CHECKED BY ANDY CRAIG, PE, TSP 8/10/23
APPROVED BY

CONSTRUCTION NOTES

Ecosystem Services Exchange
Valuing Conservation

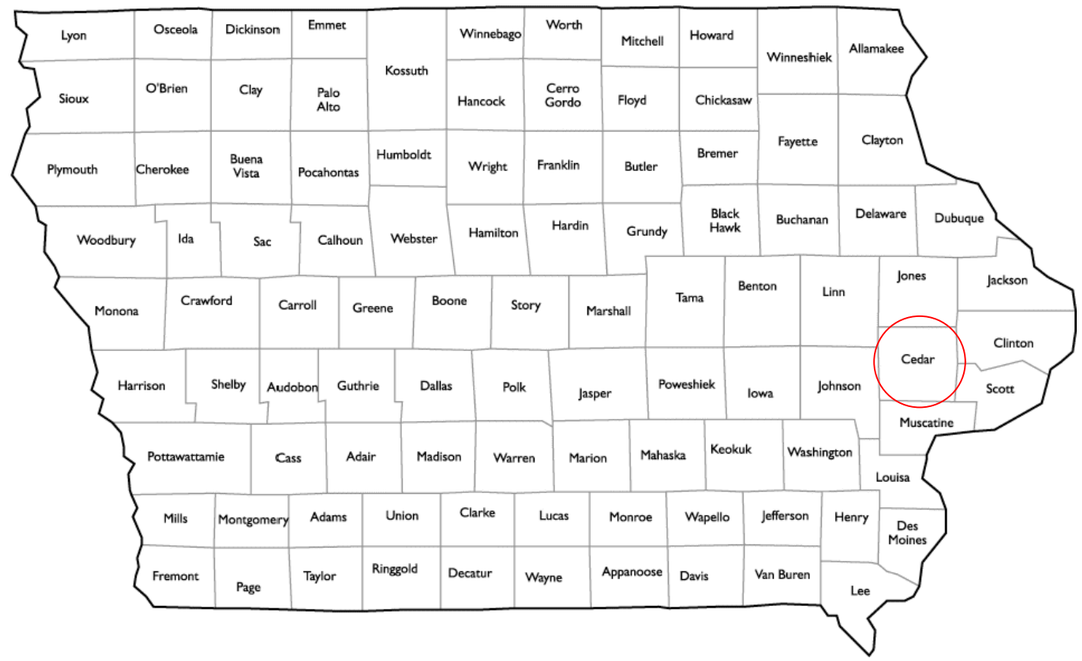
FILE NAME

DRAWING SET
SHEET 6 OF 6

SATURATED BUFFER CONSTRUCTION PLANS

CEDAR CO, IOWA

SECTION 34- T80N - R4W



INDEX OF SHEETS

811 Know what's below. Call before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

7/13/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

ENGINEERING CLASS 2

		DATE
DESIGNED BY	ANDREW MACKRILL	7/10/2023
DRAWN BY	ANDREW MACKRILL	7/10/2023
CHECKED BY	ANDY CRAIG, PE, TSP	7/13/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 6

Staking Control Points (NAD 1983 State Plane Iowa South US Survey Feet)				
Point	Description	Northing	Easting	Elevation
1	WCS	622999.9	2241686.0	721.6
2	Distribution Line	623868.1	2241578.9	722.1
3	Distribution Line	623141.7	2241465.8	722.6
4	Distribution Line	623225.6	2241334.6	723.7
5	Distribution Line	623339.2	2241158.3	724.2
6	Distribution Line	623448.6	2240986.2	724.6
7	Benchmark	623045.0	2241697.6	721.6

PLAN VIEW

Benchmark:
Top of Lath Hub (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 623045.0
Easting: 2241697.6
Elevation: 721.6

0 100 200 Feet

N

Legend

- Proposed 6" Perforated CPT Distribution Line
- Proposed 6" Non-Perforated CPT
- Proposed 6" CMP Outlet
- Existing 6" CPT Main
- Proposed Water Control Structure
- 2' Contours
- Benchmark
- Staking Point

Buffer Cross Section, See Sheet 3

New 6" CMP Outlet With Rodent Guard

Benchmark

831' of 6" CPT at 0.0% Grade

Existing 6" Tile

6
8+21.50
8+00.00
7+00.00
5
6+00.00
5+00.00
0+37.19
0+00.00
4
4+00.00
3+00.00
3
2+00.00
2
1+00.00
7
0+00.00
1

DESIGNED BY ANDREW MACKRILL DATE 7/11/23
DRAWN BY ANDREW MACKRILL 7/11/23
CHECKED BY ANDY CRAIG 7/13/23
APPROVED BY

PLAN MAP

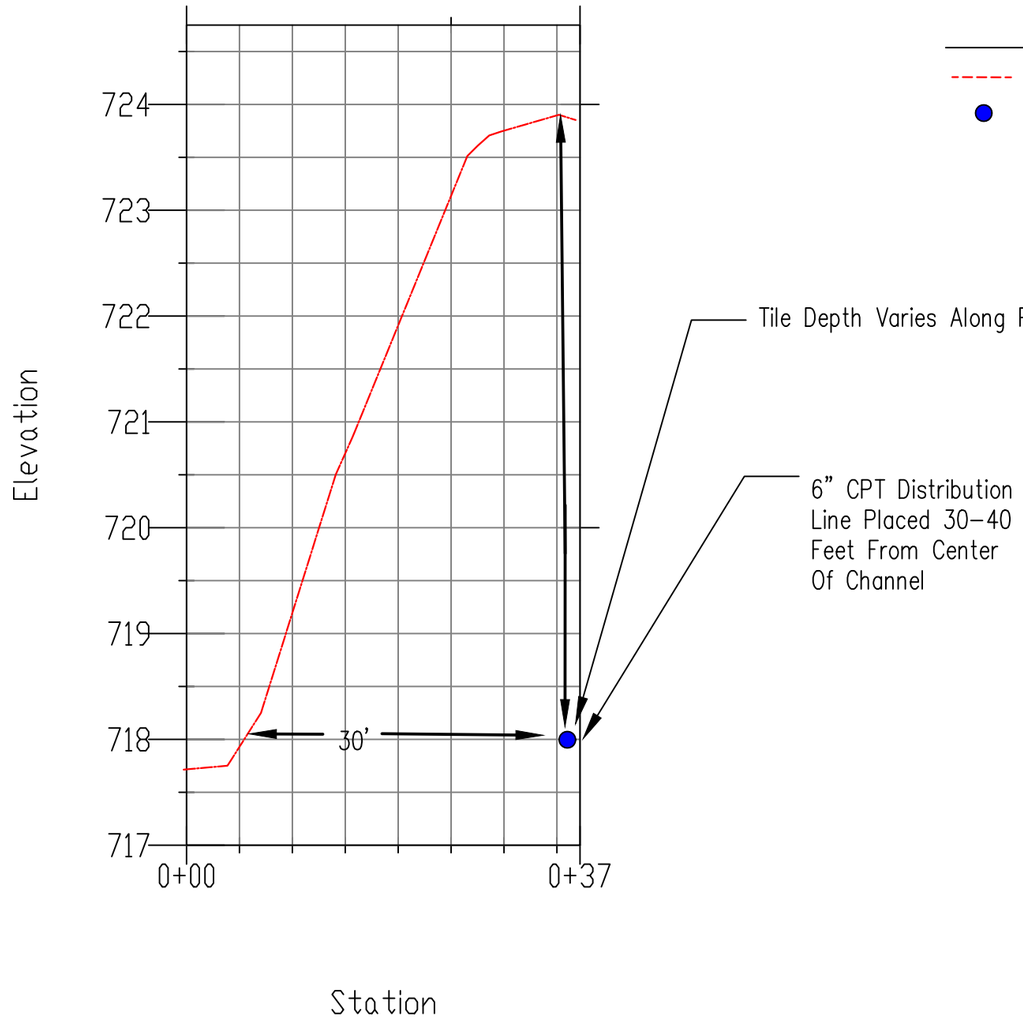
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 2 OF 6

LANDOWNER | LOCATION SECTION 34 - T80N - R4W

Buffer Cross-Section



LANDOWNER		LOCATION	SECTION 34 - T80N - R4W

DESIGNED BY ANDREW MACKRILL 7/11/23
DRAWN BY ANDREW MACKRILL 7/11/23
CHECKED BY ANDY CRAIG 7/13/23
APPROVED BY

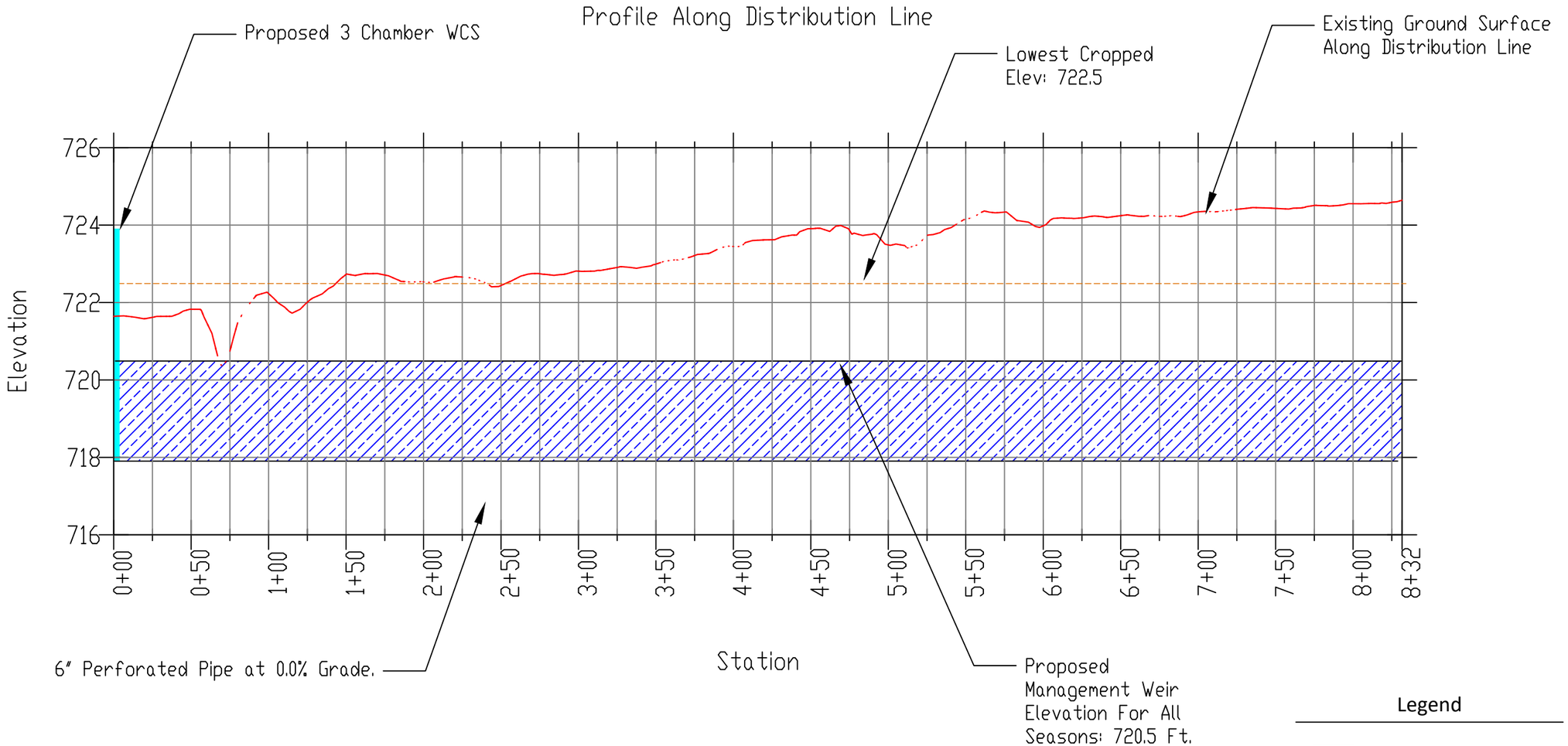
BUFFER AND BANK CROSS SECTION

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
L

DRAWING SET
SHEET 3 OF 6

Profile Along Distribution Line



Legend

- All Season Water Table
- Proposed Water Control Structure
- Proposed 6" CPT Distribution Line
- Existing Ground Surface
- Lowest Cropped Elevation

LANDOWNER		LOCATION	SECTION 34 - T80N - R4W

DESIGNED BY ANDREW MACKRILL 7/11/23
DRAWN BY ANDREW MACKRILL 7/11/23
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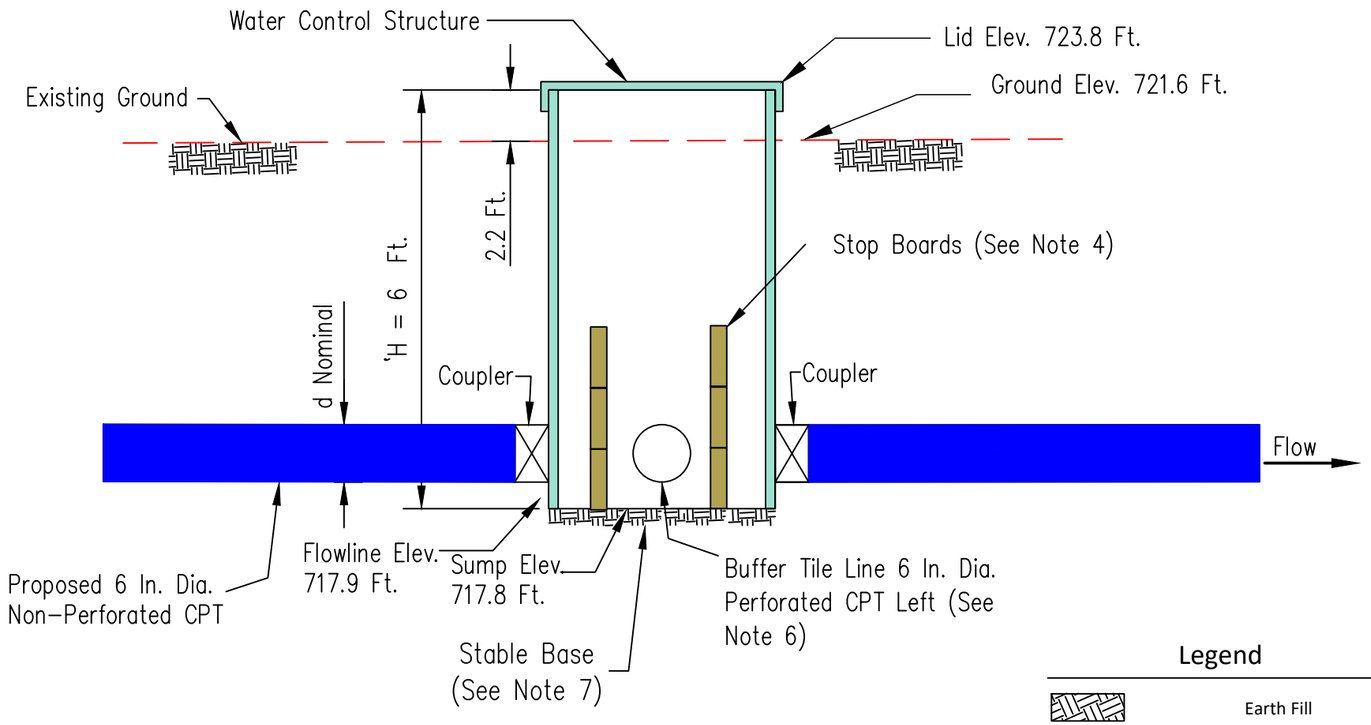
APPROVED BY

PROFILE ALONG DISTRIBUTION LINE

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME
L

DRAWING SET
SHEET 4 OF 6



TYPICAL SECTION

QUANTITIES*		NRCS SPEC
Water Control Structure 3– Compartment H = 6 ft. d = 6 in.	1	IA-21, IA-26, CPS-587
6" Non-perforated Pipe (ft)	40	IA-21, IA-45
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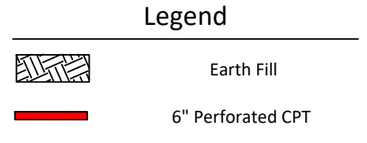

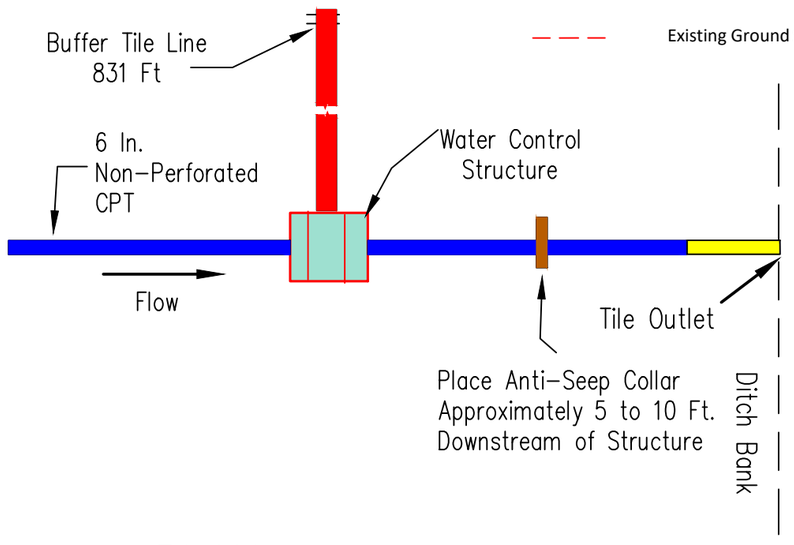

PLAN

NOTES:
1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, both upstream, and downstream. Pipe shall be PVC, dual–wall PT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745.
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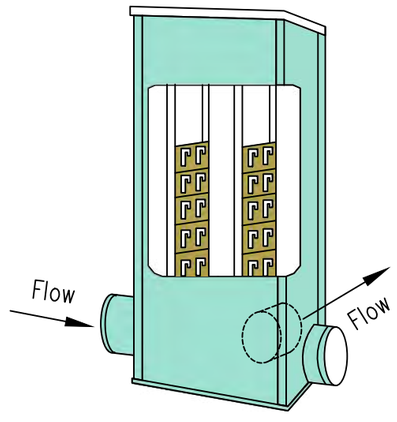

IN–LINE CONTROL STRUCTURE

DATE	
DESIGNED BY ANDREW MACKRILL	7/11/23
DRAWN BY ANDREW MACKRILL	7/11/23
CHECKED BY ANDY CRAIG	7/13/23
APPROVED BY	

3 CHAMBER STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 5 OF 6

LANDOWNER		LOCATION	SECTION 34 - T80N - R4W

CONSTRUCTION NOTES

1. Tile elevations are based Maverick Tile Finder probe depths. A fiberglass cable with imbedded wire is fed into the outlet and located with a utility device. These values may not be exact, but are believed to be accurate. Factors such as sediment in the pipe, flowing water in the pipe, and wire location within the pipe may affect depth readings. Notify ESE at least 48 hours before conducting the investigation so that a qualified ESE representative can be onsite during the investigation.
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Specification No.	**Specification Description**
IA-1	Site Preparation
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IA-6	Seeding and Mulching for Protective Cover
IA-604	Saturated Buffer
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 34 - T80N - R4W

DESIGNED BY ANDREW MACKRILL 7/11/23
DRAWN BY ANDREW MACKRILL 7/11/23
CHECKED BY ANDY CRAIG 7/13/23
APPROVED BY

CONSTRUCTION NOTES

Ecosystem Services Exchange
Valuing Conservation

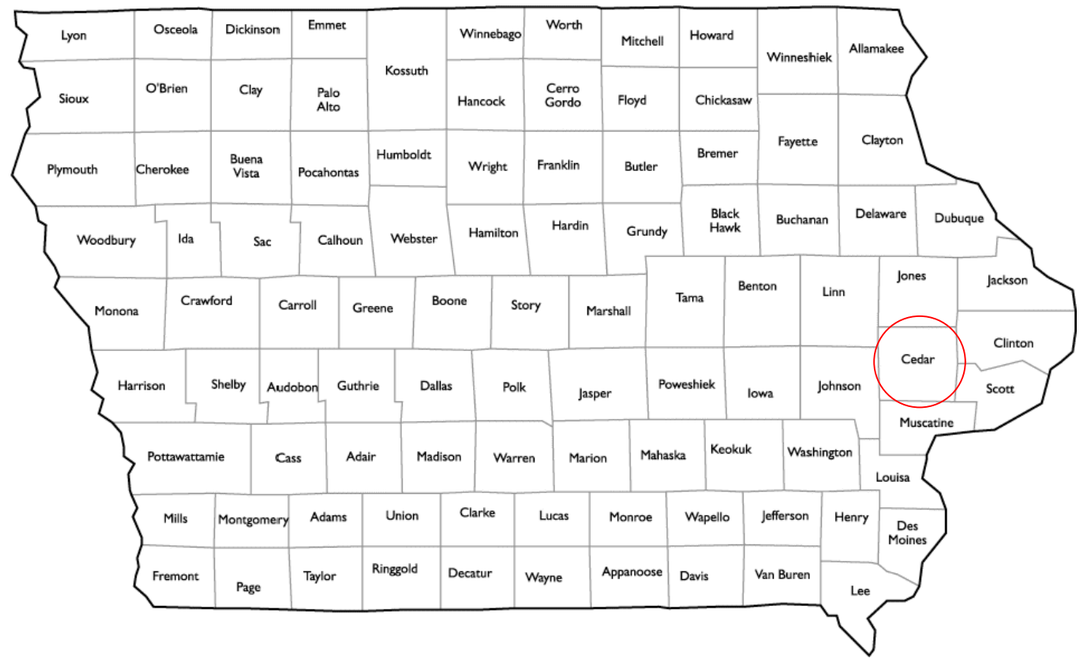
FILE NAME
1

DRAWING SET
SHEET 6 OF 6

SATURATED BUFFER CONSTRUCTION PLANS

CEDAR CO, IOWA

SECTION 19 - T79N - R4W



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LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

7/13/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2025.
Pages or sheets covered by this seal: All

ENGINEERING CLASS 2

		DATE
DESIGNED BY	ANDREW MACKRILL	7/11/2023
DRAWN BY	ANDREW MACKRILL	7/11/2023
CHECKED BY	ANDY CRAIG, PE, TSP	7/13/2023
APPROVED BY		

ESE Ecosystem Services Exchange — *Valuing Conservation*

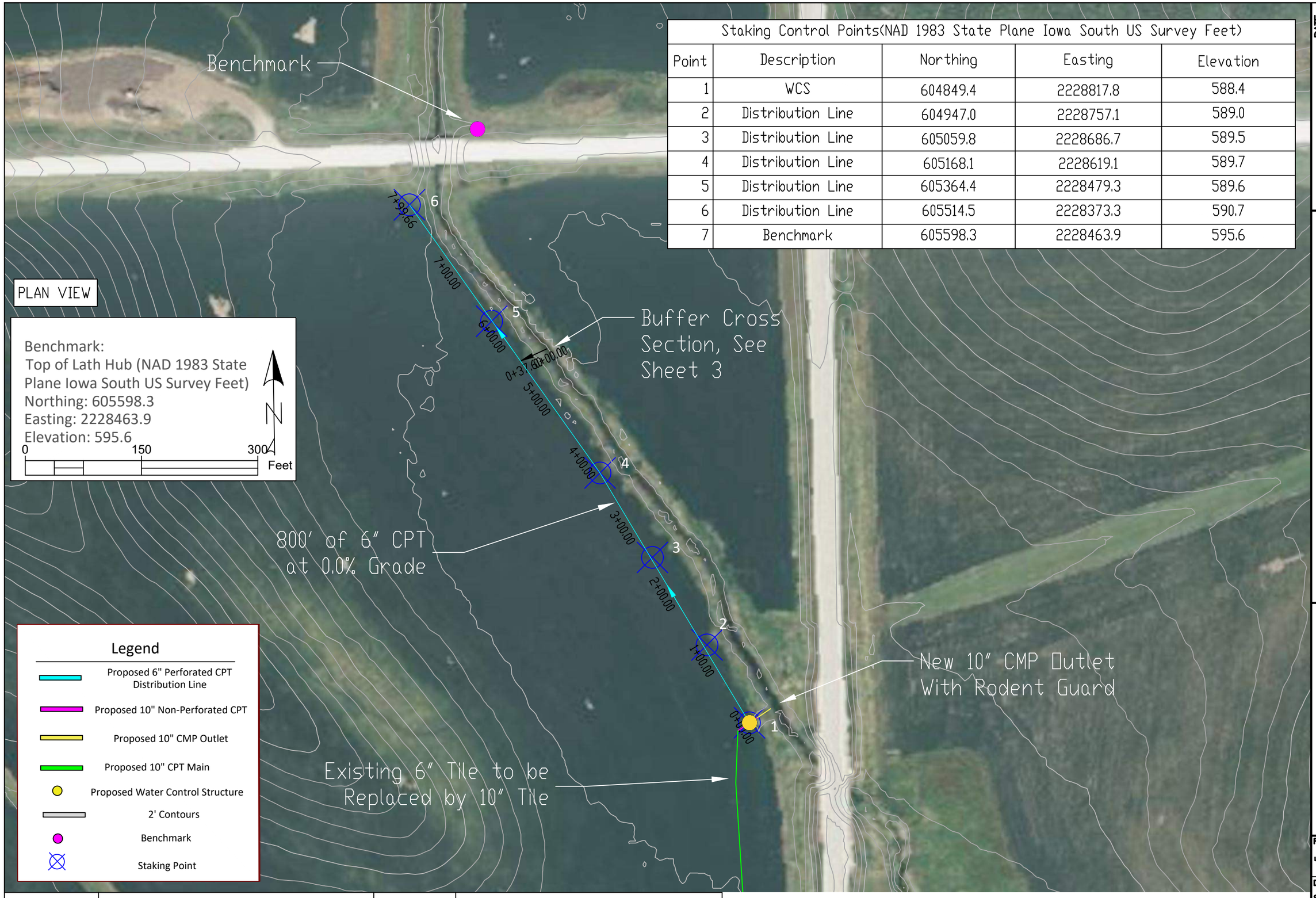
COVER SHEET

FILE NAME

l

DRAWING SET

SHEET 1 OF 6



Staking Control Points(NAD 1983 State Plane Iowa South US Survey Feet)

Point	Description	Northing	Easting	Elevation
1	WCS	604849.4	2228817.8	588.4
2	Distribution Line	604947.0	2228757.1	589.0
3	Distribution Line	605059.8	2228686.7	589.5
4	Distribution Line	605168.1	2228619.1	589.7
5	Distribution Line	605364.4	2228479.3	589.6
6	Distribution Line	605514.5	2228373.3	590.7
7	Benchmark	605598.3	2228463.9	595.6

DESIGNED BY ANDREW MACKRILL 7/11/23
DRAWN BY ANDREW MACKRILL 7/11/23
CHECKED BY ANDY CRAIG, PE, TSP 7/13/23
APPROVED BY
DATE

PLAN MAP

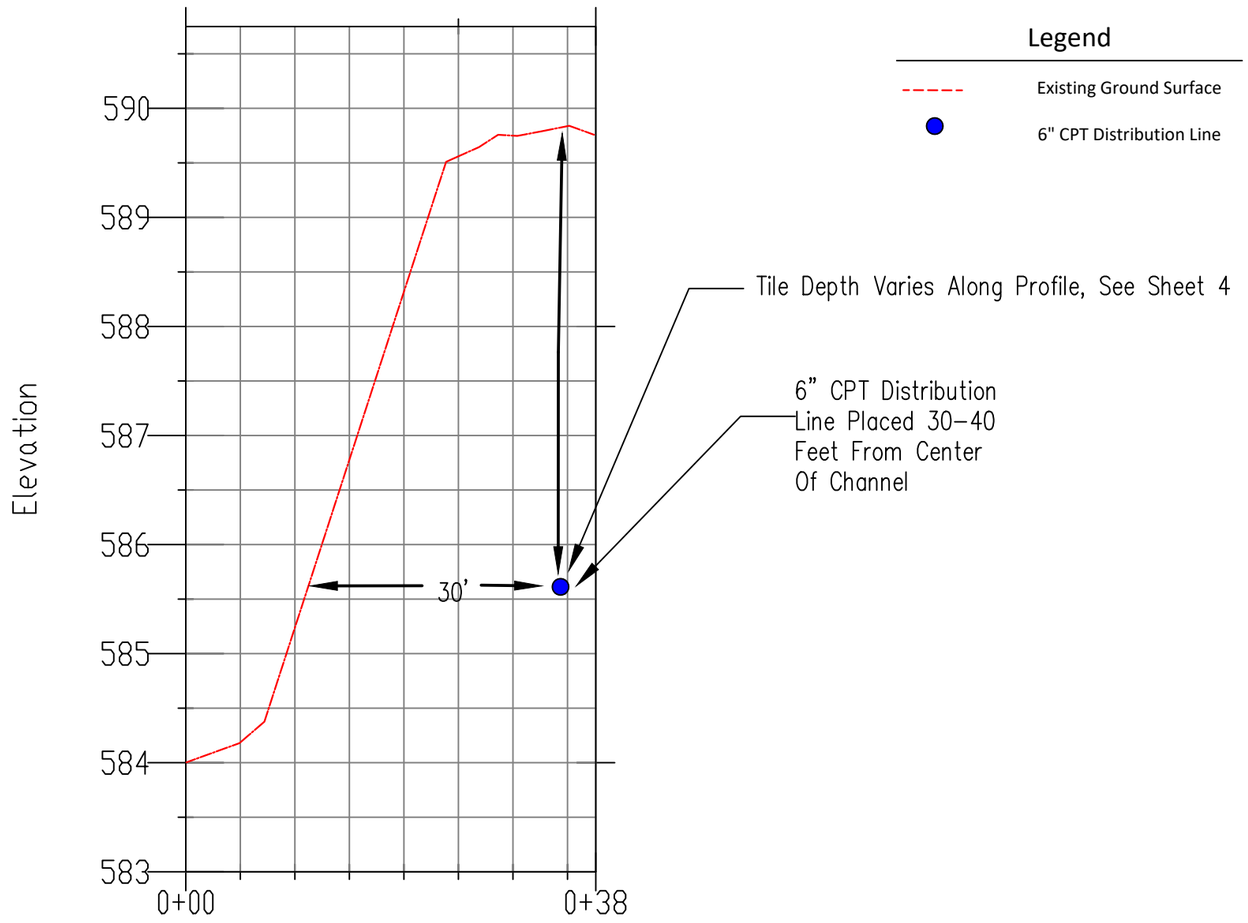
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
L

DRAWING SET
SHEET 2 OF 6

LANDOWNER | LOCATION | SECTION 19 - T79N - R4W

Buffer Cross-Section



LANDOWNER		LOCATION	SECTION 19 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 7/11/23
DRAWN BY ANDREW MACKRILL 7/11/23
CHECKED BY ANDY CRAIG, PE, TSP 7/13/23
APPROVED BY

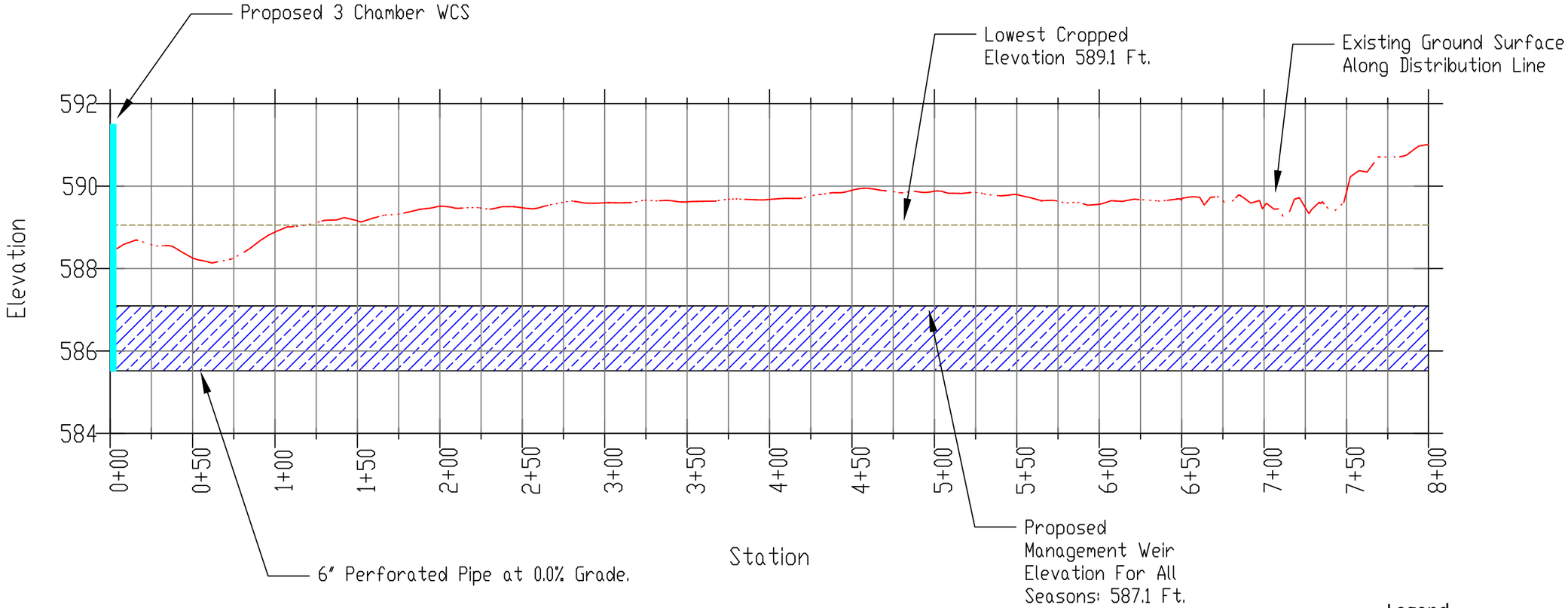
BUFFER AND BANK CROSS SECTION

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
L

DRAWING SET
SHEET 3 OF 6

Profile Along Distribution Line



Legend

- All Season Water Table
- Proposed Water Control Structure
- Proposed 6" CPT Distribution Line
- Existing Ground Surface
- Lowest Farmed Elevation

LANDOWNER		LOCATION	SECTION 19 - T79N - R4W

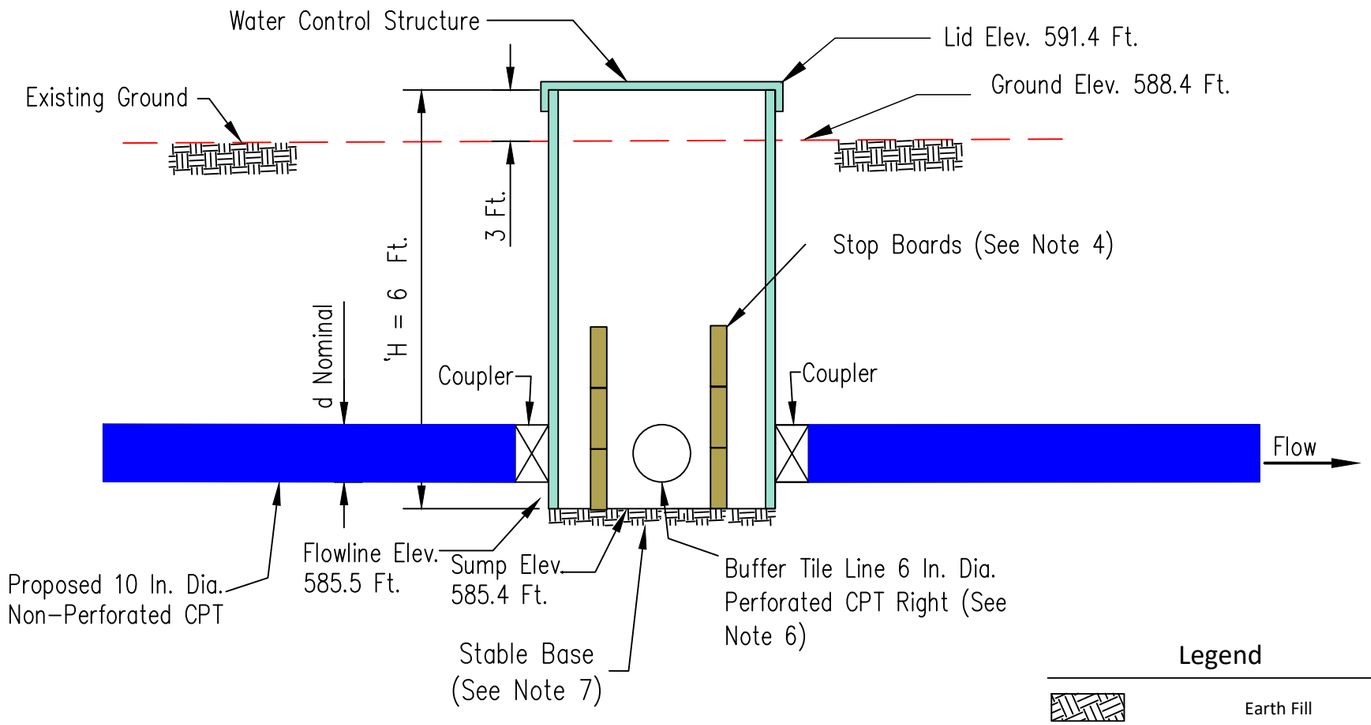
DESIGNED BY ANDREW MACKRILL	DATE 7/11/23
DRAWN BY ANDREW MACKRILL	7/11/23
CHECKED BY ANDY CRAIG, PE, TSP	7/13/23
APPROVED BY	

PROFILE ALONG DISTRIBUTION LINE

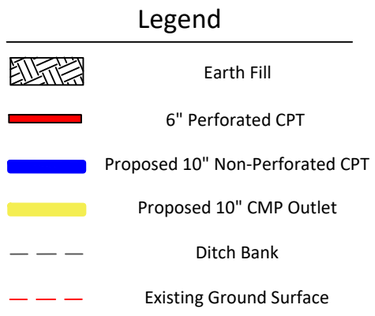
ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME
-

DRAWING SET
SHEET 4 OF 6

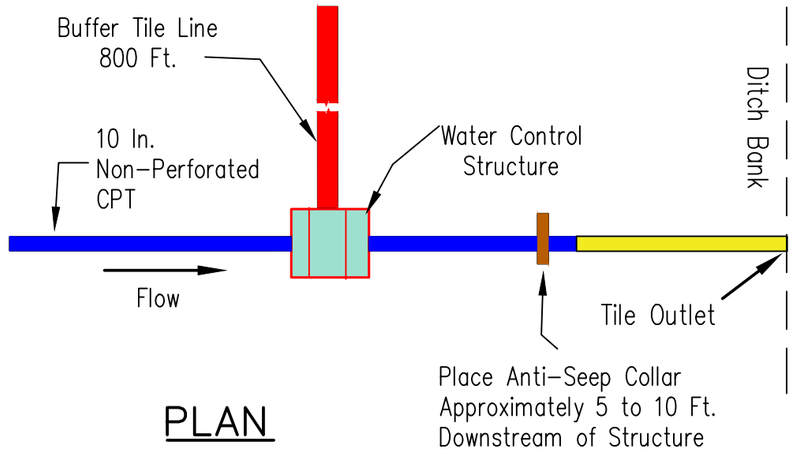


TYPICAL SECTION



QUANTITIES*		NRCS SPEC
Water Control Structure 3– Compartment H = 6 ft. d = 10 in.	1	IA-21, IA-26, CPS-587
10" Non–perforated Pipe (ft)	40	IA-21, IA-45
10" CMP Outlet Pipe With Rodent Guard (ft)	20	IA-604, IA-605
6" Perforated CPT (ft) Buffer Tile Line	800	IA-21, IA-45, IA-46
3'x3' Anti Seep Collar	1	CPS-587

*Quantities Do Not Include Couplers



PLAN

NOTES:
1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, both upstream, and downstream. Pipe shall be PVC, dual–wall PT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745.
3. Couplings between the water control section and the non–perforated tile shall be water tight.
4. Stop boards shall provide water tight seals under a minimum of 1 foot pressure head.
5. Mark location of structure using steel t–post or manufactured marker flag for safety in the field.
6. Install buffer tile parallel to ditch or stream, according to profile provided with the construction plans. Pipe shall remain on grade and drain towards the WCS.
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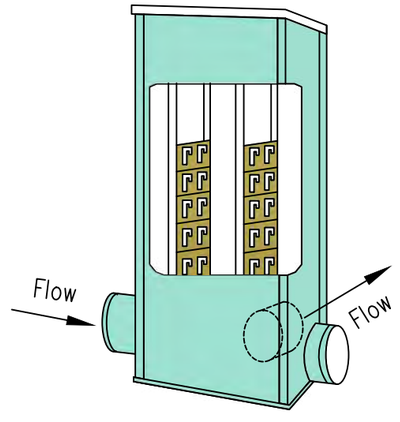


IN–LINE CONTROL STRUCTURE

LANDOWNER		LOCATION	SECTION 19 - T79N - R4W

DATE
DESIGNED BY ANDREW MACKRILL 7/11/23
DRAWN BY ANDREW MACKRILL 7/11/23
CHECKED BY ANDY CRAIG, PE, TSP 7/13/23
APPROVED BY

3 CHAMBER STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
-

DRAWING SET
SHEET 5 OF 6

CONSTRUCTION NOTES

1. Tile elevations are based Maverick Tile Finder probe depths. A fiberglass cable with imbedded wire is fed into the outlet and located with a utility device. These values may not be exact, but are believed to be accurate. Factors such as sediment in the pipe, flowing water in the pipe, and wire location within the pipe may affect depth readings. Notify ESE at least 48 hours before conducting the investigation so that a qualified ESE representative can be onsite during the investigation.
2. Avoid excessive disturbance of buffers or grassed water ways during construction. If re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded according to NRCS Conservation Practice Standard 342 – Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
3. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion. Contact ESE for assistance with construction inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the existing tile and setting WCS.
   b. Distribution pipe has been laid and capped.
4. Any product planned for use in construction must be approved by ESE prior to construction. Provide documentation to ESE of all materials used in construction, including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths.
   b. Photos and invoices or product information for water control structures.
5. Construction tolerances are +/-0.5ft on distribution line location, and +/-0.1 ft. on all elevations. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by ESE and will be noted in the as-built plan.
6. When installing the distribution line, pay special attention so that other outlets in the buffer are not damaged or broken. Although an investigation of the buffer will have already been completed, not all outlets are able to be located depending on site conditions at the time. If another tile line or outlet is encountered, contact an ESE representative for consultation. They will decide if the tile line is able to be incorporated into the system, or if a section of the distribution line needs to be replaced as non-perforated pipe to prevent water loss.
7. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-604	Saturated Buffer
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 19 - T79N - R4W

DESIGNED BY ANDREW MACKRILL 7/11/23
DRAWN BY ANDREW MACKRILL 7/11/23
CHECKED BY ANDY CRAIG, PE, TSP 7/13/23
APPROVED BY

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

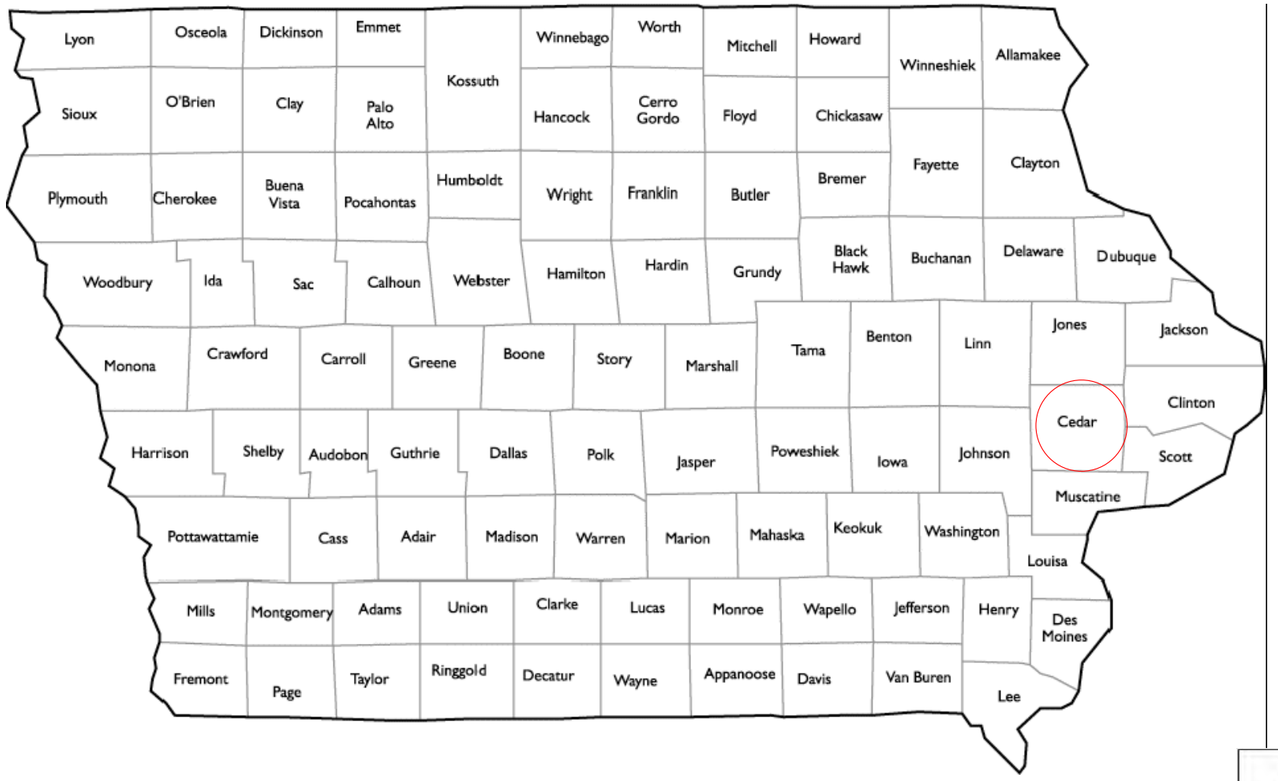
FILE NAME

DRAWING SET
SHEET 6 OF 6

DENITRIFYING BIOREACTOR CONSTRUCTION PLANS

CEDAR COUNTY, IOWA

SECTION 03- T79N - R04W



INDEX OF SHEETS

811 Know what's **below.** **Call** before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

ENGINEERING CLASS 5

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

LICENSED PROFESSIONAL ENGINEER — Andy J. Craig 20832 — IOWA

9/22/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31,2023.
Pages or sheets covered by this seal: All

		DATE
DESIGNED BY	ANDY MACKRILL, TSP	9/18/2023
DRAWN BY	ANDY MACKRILL, TSP	9/18/2023
CHECKED BY	ANDY CRAIG, PE, TSP	9/22/2023
APPROVED BY		

ESE Ecosystem Services Exchange *Valuing Conservation*

COVER SHEET

FILE NAME

|

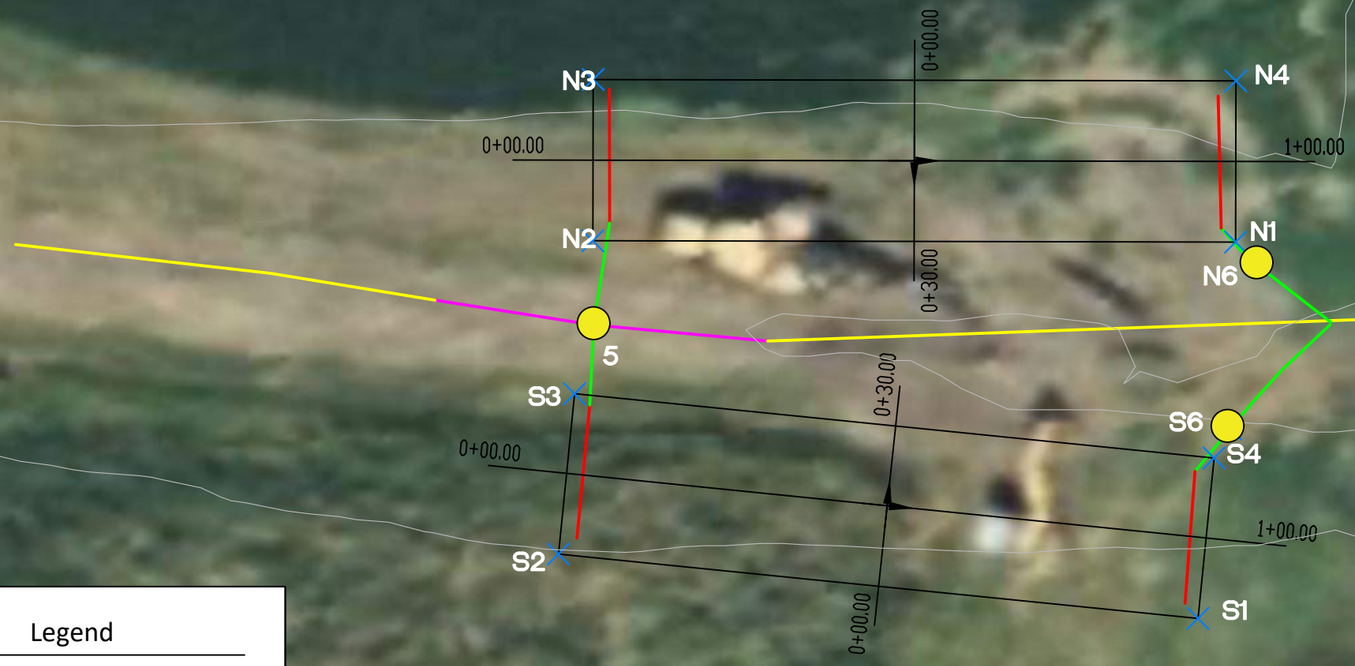
DRAWING SET

SHEET 1 OF 10

Benchmark:
Top of Lath Post 215 Feet North of Buffer Location (NAD 1983 State Plane Iowa South US Survey Feet)
Northing: 618658.2
Easting: 2241927.9
Elevation: 724.6

0 25 50 Feet

Staking Control Points (NAD 1983 State Plane Iowa South US SURVEY FEET)				
Point	Description	Northing	Easting	Elevation
N1	Southeast Corner BIO	618453.7	2241911.8	719.1
N2	Southwest Corner BIO	618453.9	2241831.6	718.7
N3	Northwest Corner BIO	618474.0	2241831.7	720.2
N4	Northeast Corner BIO	618473.8	2241911.9	720.3
5	Inlet WCS (3-chamber)	618443.4	2241831.8	718.3
N6	Outlet WCS (2-chamber)	618451.0	2241914.4	718.9



Legend

- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 15" CPT Main
- Proposed 15" Non-Perf CPT Main
- Bioreactor Footprint
- Water Control Structure
- 2 Foot Contours

Staking Control Points (NAD 1983 State Plane Iowa South US SURVEY FEET)				
Point	Description	Northing	Easting	Elevation
S1	Southeast Corner BIO	618406.7	2241907.1	720.7
S2	Southwest Corner BIO	618414.8	2241827.3	720.0
S3	Northwest Corner BIO	618434.8	2241829.4	718.4
S4	Northeast Corner BIO	618426.8	2241909.1	718.6
5	Inlet WCS (3-chamber)	618443.4	2241831.8	718.3
S6	Outlet WCS (2-chamber)	618430.4	2241911.2	718.1

DESIGNED BY ANDY MACKRILL 9/18/23
DRAWN BY ANDY MACKRILL 9/18/23
CHECKED BY ANDY CRAIG 9/22/23
APPROVED BY
DATE

PLAN MAP

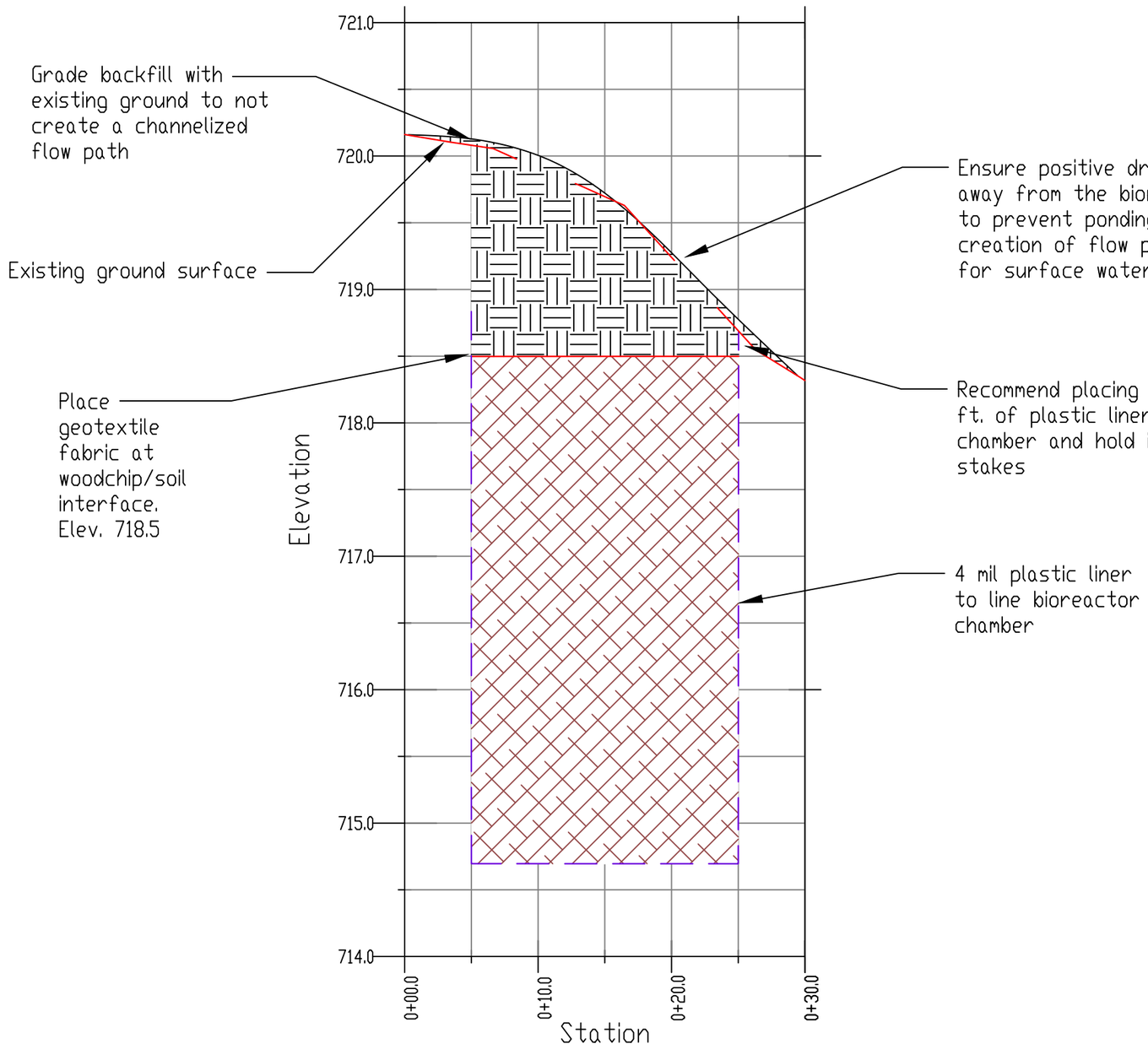
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
c

DRAWING SET
SHEET 2 OF 10

LANDOWNER | LOCATION | SECTION 03 - T79N - R04W

Cross-Section (N)



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

DESIGNED BY ANDY MACKFILL	DATE 9/18/23
DRAWN BY ANDY MACKFILL	9/18/23
CHECKED BY ANDY CRAIG	9/22/23
APPROVED BY	

CROSS SECTION VIEW (N)

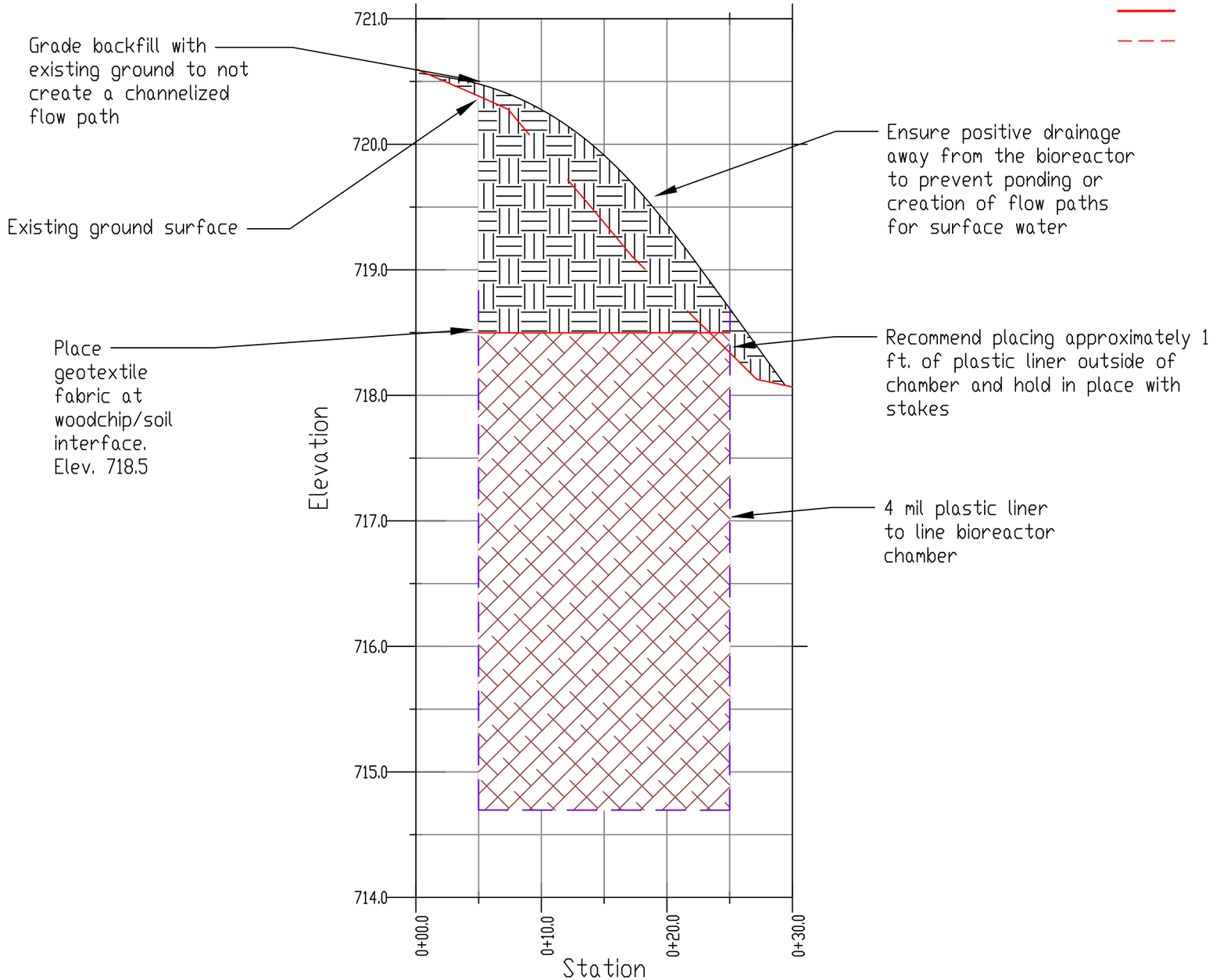
ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME

DRAWING SET

SHEET 3 OF 10

Cross-Section (S)



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface

DESIGNED BY ANDY MACKFILL	DATE 9/18/23
DRAWN BY ANDY MACKFILL	9/18/23
CHECKED BY ANDY CRAIG	9/22/23
APPROVED BY	

CROSS SECTION VIEW (S)

ESE Ecosystem Services Exchange *Valuing Conservation*

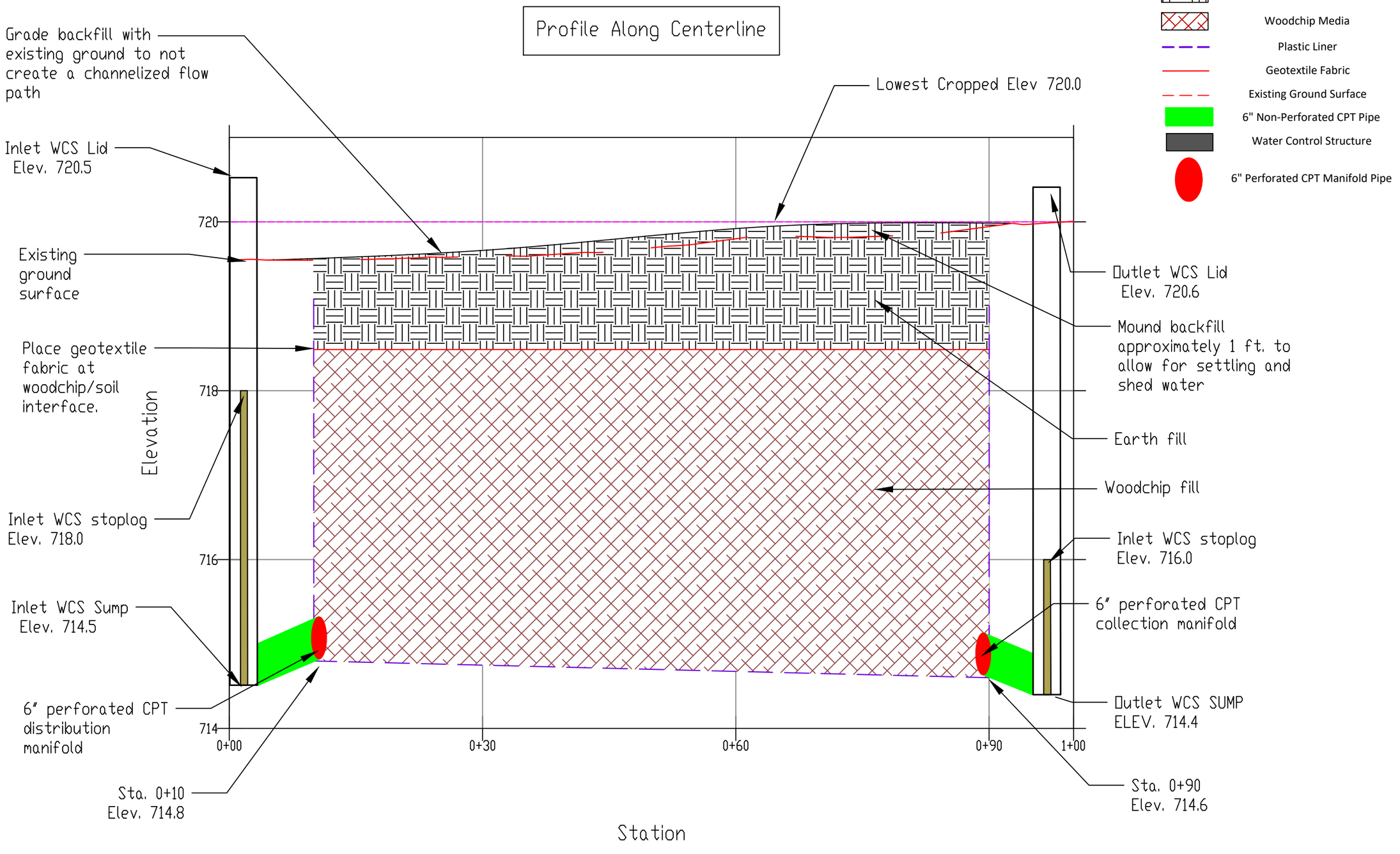
FILE NAME

DRAWING SET

SHEET 4 OF 10

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

Profile Along Centerline



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- 6" Non-Perforated CPT Pipe
- Water Control Structure
- 6" Perforated CPT Manifold Pipe

DESIGNED BY	ANDY MACKFILL
DRAWN BY	ANDY MACKFILL
CHECKED BY	ANDY CRAIG
APPROVED BY	
DATE	9/18/23
	9/18/23
	9/22/23

PROFILE ALONG CENTERLINE (N)

ESE Ecosystem Services Exchange *Valuing Conservation*

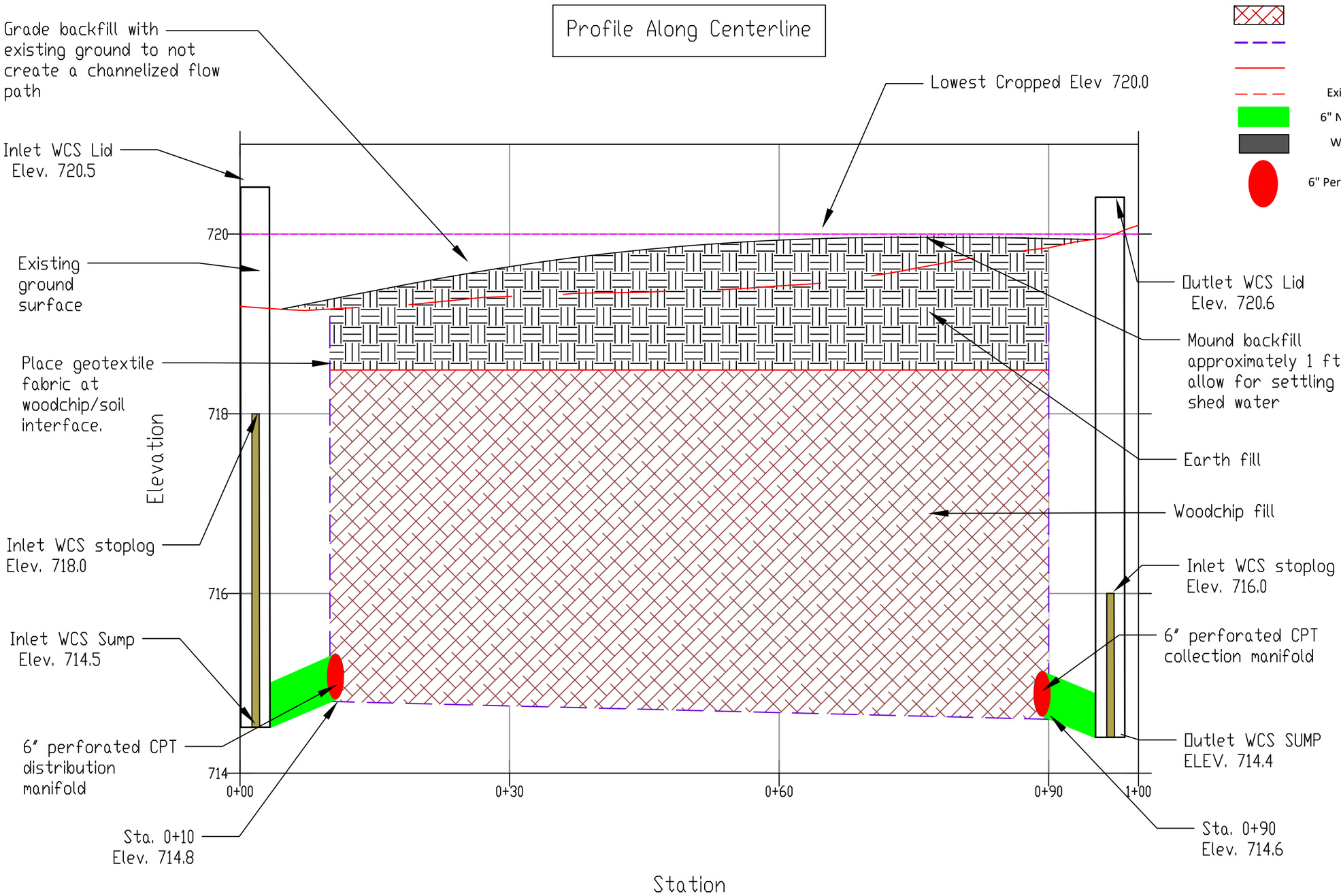
FILE NAME

DRAWING SET

SHEET 5 OF 10

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

Profile Along Centerline



Legend

- Earth Fill
- Woodchip Media
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- 6" Non-Perforated CPT Pipe
- Water Control Structure
- 6" Perforated CPT Manifold Pipe

DESIGNED BY	ANDY MACKFILL
DATE	9/18/23
DRAWN BY	ANDY MACKFILL
DATE	9/18/23
CHECKED BY	ANDY CRAIG
DATE	9/22/23
APPROVED BY	

PROFILE ALONG CENTERLINE (S)

ESE Ecosystem Services Exchange — Valuing Conservation

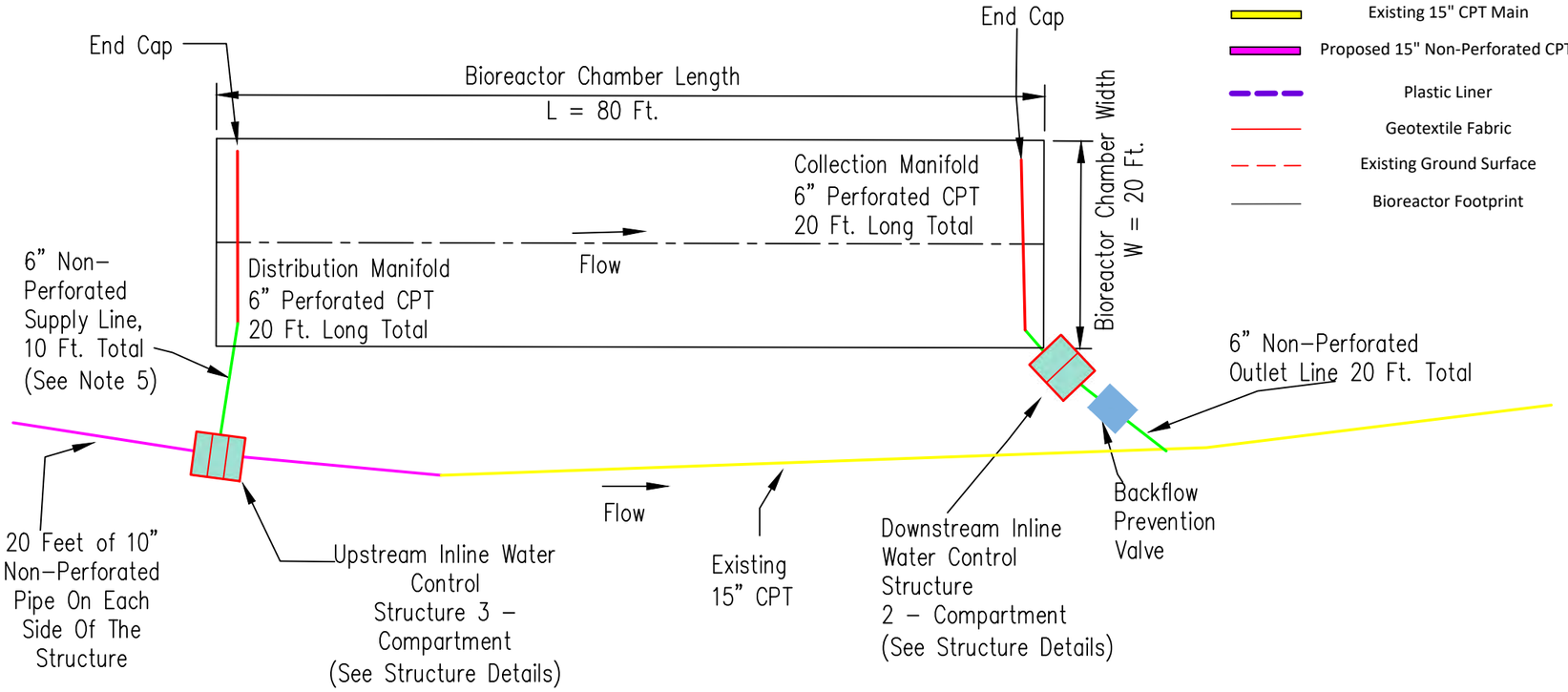
FILE NAME

DRAWING SET

SHEET 6 OF 10

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

PLAN

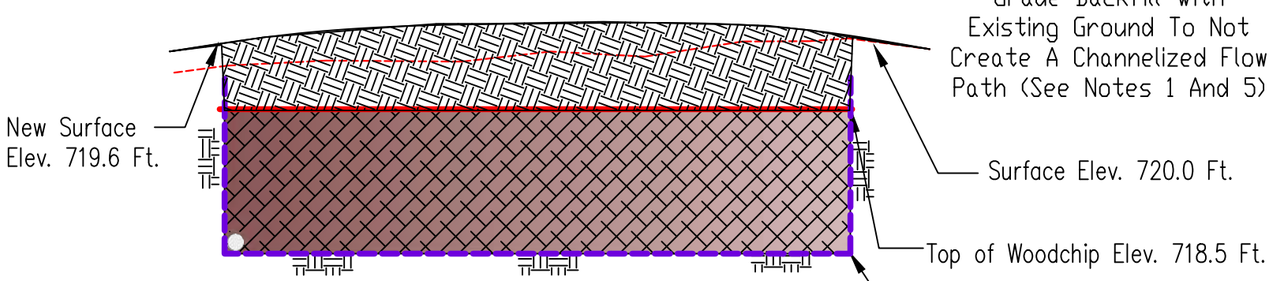


Legend

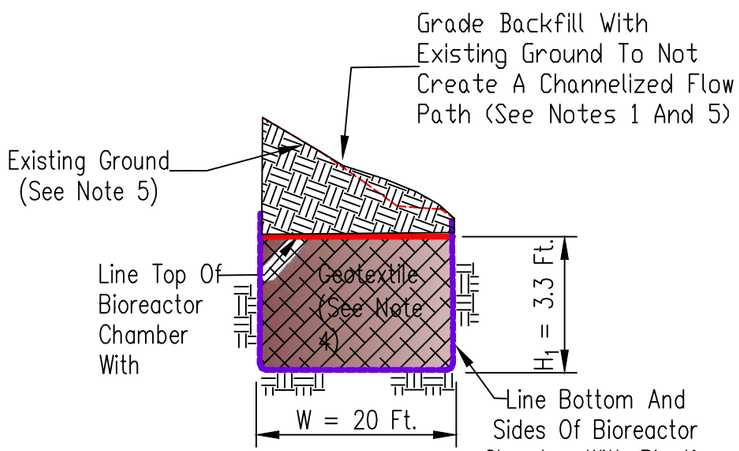
- Earth Fill
- Woodchip Media
- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 15" CPT Main
- Proposed 15" Non-Perforated CPT
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- Bioreactor Footprint

NOTES:

1. All disturbed non-crop construction areas shall be stabilized by seeding or mulching within 14 days of conclusion of construction activities. This seeding and seed mixture shall meet the NRCS Conservation Practice Standard IA-342 (Critical Area Seeding) or other program requirements to replace previous grass stand.
2. Line bottom and sides of bioreactor chamber with plastic, minimum 4 mil thickness. Overlap any splices at least 6 inches. Lap seams in direction of flow so water flows over top of seam. Wrap plastic carefully around tiles that enter/exit the chamber; no need to seal around tiles.
3. Woodchips shall not contain woods known to have tannin, such as oak, cedar, or redwood. Woodchips shall be reasonably free of soil and other contaminants nor contain loose composting materials. Wood chips shall be around 1"long by ½" thick with minimal fines. They shall be processed through a chipper and not through a grinder. Do not use any wood that has been treated for ground contact. ESE has the right to reject any woodchips which do not meet specifications.
4. Geotextile shall be non-woven, Class II, and meet the requirements of Iowa Construction Specification IA-95, Geotextile. Overlap a minimum of 6 inches at all seams.
5. Grade site for positive drainage away from the bioreactor chamber. Spread soil in designated location away from bioreactor.
6. See Plan Map for benchmark coordinates.



ELEVATION



SECTION A-A

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

DESIGNED BY ANDY MACKFILL 9/18/23
DRAWN BY ANDY MACKFILL 9/18/23
CHECKED BY ANDY CRAIG 9/22/23
APPROVED BY

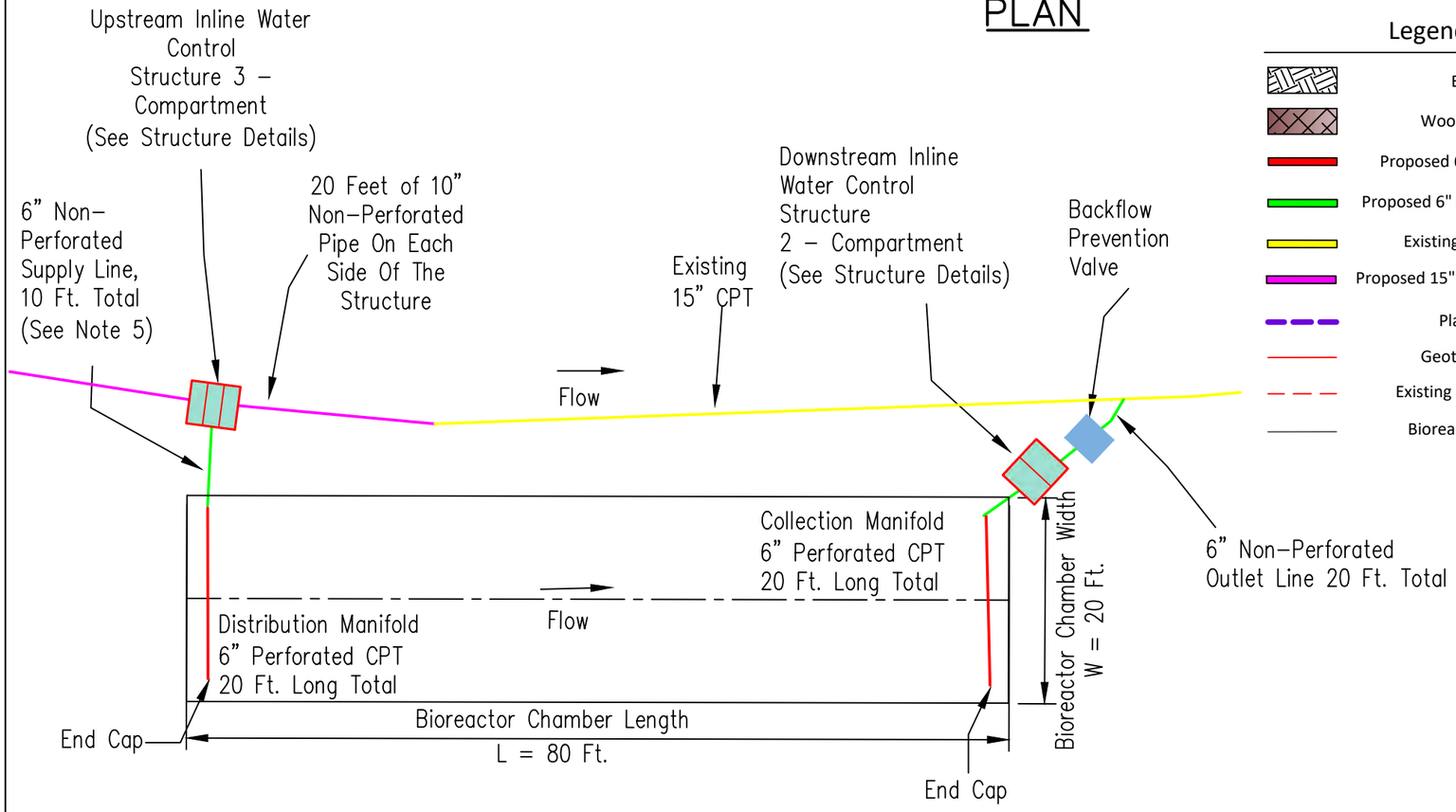
BIOREACTOR DETAIL (N)

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 7 OF 10

PLAN

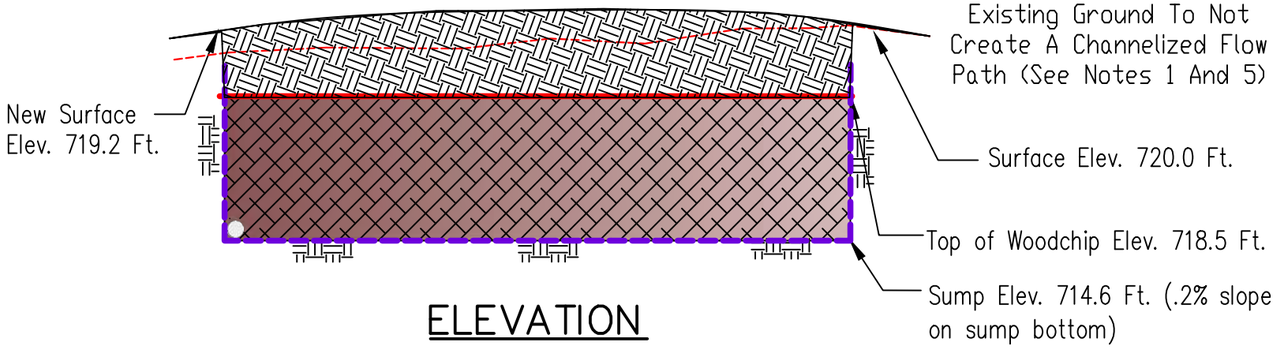


Legend

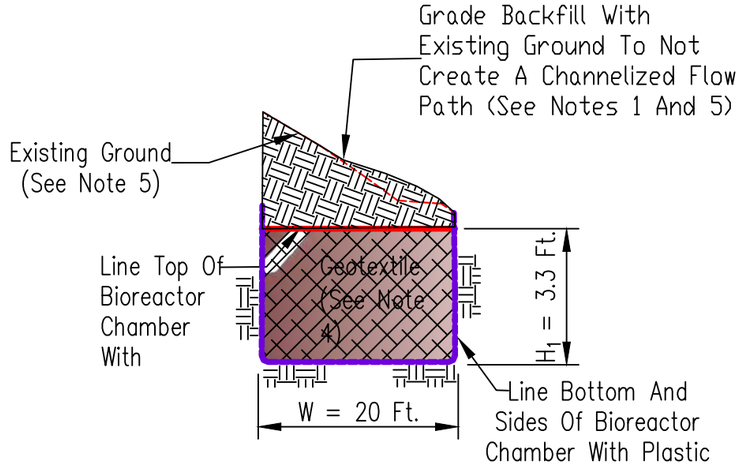
- Earth Fill
- Woodchip Media
- Proposed 6" Perforated CPT
- Proposed 6" Non-Perforated CPT
- Existing 15" CPT Main
- Proposed 15" Non-Perforated CPT
- Plastic Liner
- Geotextile Fabric
- Existing Ground Surface
- Bioreactor Footprint

NOTES:

1. All disturbed non–crop construction areas shall be stabilized by seeding or mulching within 14 days of conclusion of construction activities. This seeding and seed mixture shall meet the NRCS Conservation Practice Standard IA–342 (Critical Area Seeding) or other program requirements to replace previous grass stand.
2. Line bottom and sides of bioreactor chamber with plastic, minimum 4 mil thickness. Overlap any splices at least 6 inches. Lap seams in direction of flow so water flows over top of seam. Wrap plastic carefully around tiles that enter/exit the chamber; no need to seal around tiles.
3. Woodchips shall not contain woods known to have tannin, such as oak, cedar, or redwood. Woodchips shall be reasonably free of soil and other contaminants nor contain loose composting materials. Wood chips shall be around 1"long by ½" thick with minimal fines. They shall be processed through a chipper and not through a grinder. Do not use any wood that has been treated for ground contact. ESE has the right to reject any woodchips which do not meet specifications.
4. Geotextile shall be non–woven, Class II, and meet the requirements of Iowa Construction Specification IA–95, Geotextile. Overlap a minimum of 6 inches at all seams.
5. Grade site for positive drainage away from the bioreactor chamber. Spread soil in designated location away from bioreactor.
6. See Plan Map for benchmark coordinates.



ELEVATION



SECTION A–A

LANDOWNER	[illegible]	LOCATION	SECTION 03 - T79N - R04W

DESIGNED BY ANDY MACKRILL 9/18/23
DRAWN BY ANDY MACKRILL 9/18/23
CHECKED BY ANDY CRAIG 9/22/23
APPROVED BY

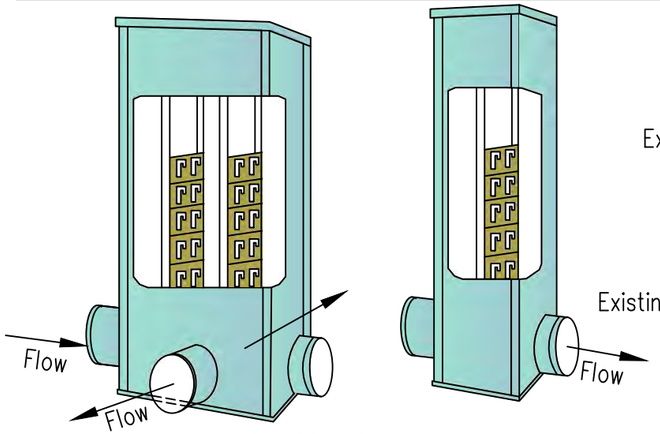
BIOREACTOR DETAIL (S)

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

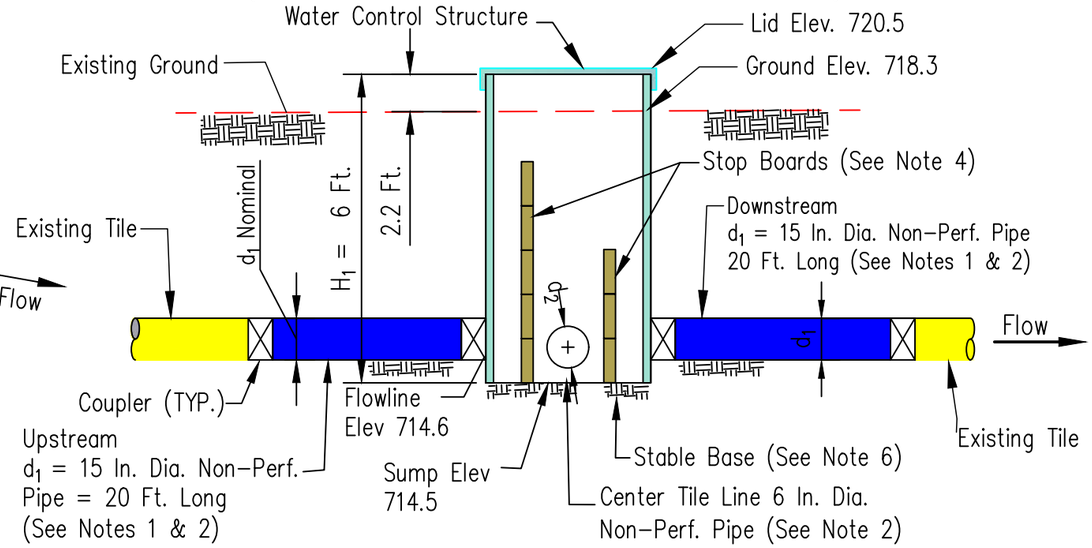
DRAWING SET
SHEET 8 OF 10

IN–LINE CONTROL STRUCTURES

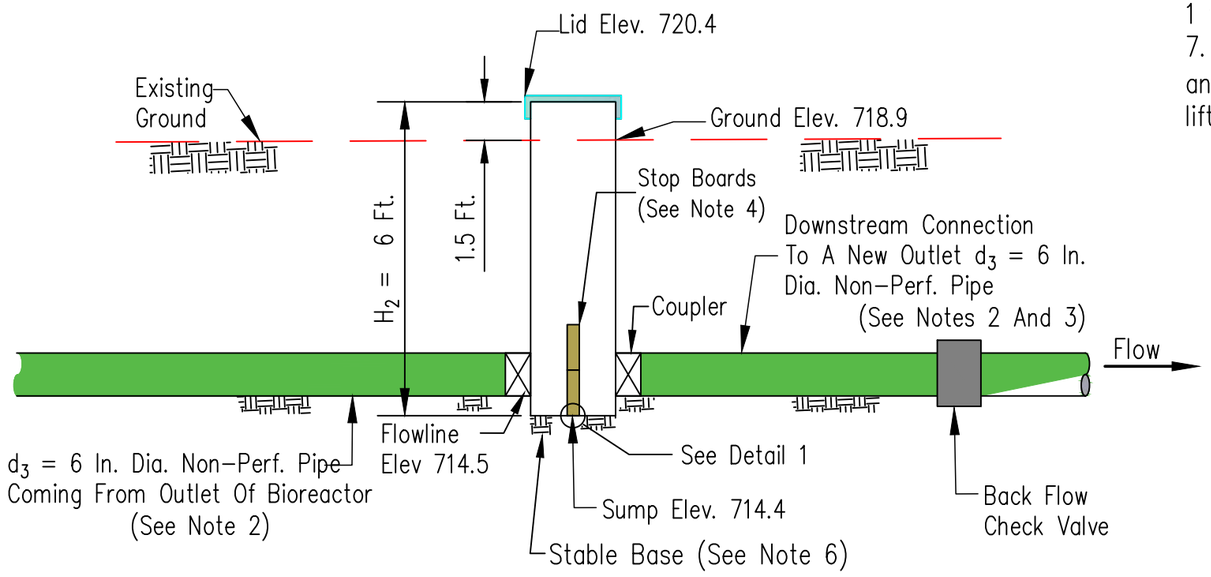


One Side Port Each on
LEFT AND RIGHT Sides
Of Structure

TYPICAL SECTION
UPSTREAM STRUCTURE
(ONE SHARED BY BIOREACTORS N AND S)



TYPICAL SECTION
DOWNSTREAM STRUCTURE
(ONE EACH OF BIOREACTORS N AND S)



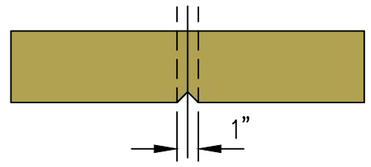
QUANTITIES*	
Water Control Structure, 3 Chamber H_1 = 6 ft. d_1 = 15 in. d_2 = 6 in.	1
Water Control Structure, 2 Chamber H_2 = 6 ft. d_3 = 6 in.	2
15" Non–perforated Pipe (ft)	40
6" Non–perforated Pipe (ft)	60
6" Perforated CPT (ft)	80
6" End Cap	4
Wood Chips (cu. yd.)	431
4 Mil Plastic (sq. yd.)**	592
Geotextile (sq. yd.)	357
Excavation (cu. yd.)	546
Earth Fill (cu. yd.)	213
6" Backflow Check Valve	2

* Quantities do not include tile/pipe couplers or extra material for geotextile/plastic overlap
** Accounts for 1 ft. overhang around perimeter

NOTES:
1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, on all lines: upstream, downstream and center. Pipe must be PVC, dual–wall CPT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745. Check valve must conform to ASTM D 3034 with SDR35 pipe or stronger.
3. Couplings between the water control structures and the non–perforated tile must be watertight.
4. Stop boards must provide must tight seals under a minimum of 1 foot pressure head (except notched board).
5. Appropriately mark bioreactor perimeter to avoid vehicle, implement, or livestock traffic.
6. Place structure and pipe coupler on a stable base. A stable base may be compacted earth, compacted fill sand, or a concrete pad. Extend the stable base no less than 1 foot beyond structure.
7. Excavated material placed around structure and pipes shall be hand compacted in 4" lifts.

DETAIL 1

Cut 1" Notch In Bottom Of
The Bottom Board On The
Downstream Structure



Legend

- Earth Fill
- 6" Non-Perforated CPT
- Existing 15" CPT Main
- Proposed 15" CPT Main
- Existing Ground Surface

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

DESIGNED BY ANDY MACKFILL 9/18/23
DRAWN BY ANDY MACKFILL 9/18/23
CHECKED BY ANDY CRAIG 9/22/23
APPROVED BY

STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 9 OF 10

CONSTRUCTION NOTES

1. Tile elevations are based on Maverick tile probe depths and are to be considered accurate within margin of error of the instrument.
2. If any surface inlets are currently attached to the tile main or plan to be in the future, they shall be replaced with water quality inlets to minimize trash entry into the tile line before construction of the bioreactor begins.
3. Avoid excessive disturbance of any buffers or grassed water ways during construction. However, if re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded within 14 days according to NRCS Conservation Practice Standard IA-342 Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
4. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion.
5. All carbon media to be placed in the bioreactor shall come from an ESE approved vendor or approved with ESE staff prior to transportation and placement.
6. Contact an ESE representative for inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the bioreactor chamber and tile line trenches
   b. After placing the water control structures and bioreactor manifolds
   c. After placement of carbon media, before backfilling with soil
   d. After connections to existing tile and final grading
7. Any product planned for use in construction must be approved by ESE prior to construction. Save and provide documentation to an ESE representative of all materials used in construction including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths
   b. Photos and invoices for quantity and quality of woodchips/carbon media
   c. Photos and invoices or product information to detail quantity and quality of plastic and geotextile fabric
   d. Photos and invoices or product information for water control structures
8. Construction tolerances are +/-0.5ft on bioreactor chamber dimensions, and +/-0.1 ft. on all elevations. Outlet WCS sump (bottom) must be below the elevation of the bioreactor chamber at the outlet end. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by a representative from ESE and will be noted in the as-built plan.
9. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.
10. All work shall be performed according to the IA construction and practice specifications in the table below.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-95	Geotextile
IA-605	Denitrifying Bioreactor
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 03 - T79N - R04W

DESIGNED BY ANDY MACKFILL 9/18/23
DRAWN BY ANDY MACKFILL 9/18/23
CHECKED BY ANDY CRAIG 9/22/23
APPROVED BY
DATE

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

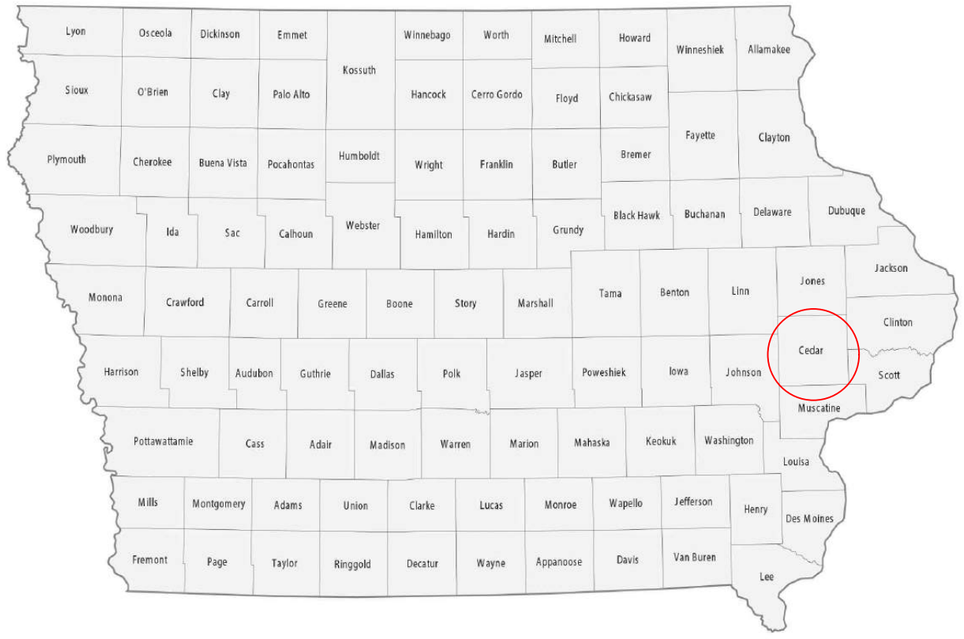
FILE NAME

DRAWING SET
SHEET 10 OF 10

SATURATED BUFFER CONSTRUCTION PLANS

CEDAR CO, IOWA

SECTION 27 - T81N - R3W



INDEX OF SHEETS

811 Know what's below. Call before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

LICENSED PROFESSIONAL ENGINEER
Andy J. Craig
20832
IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

07/28/2023

Andy J. Craig, P.E.
License number: 20832

My license renewal date is December 31, 2023.
Pages or sheets covered by this seal: All

ENGINEERING CLASS 2

		DATE
DESIGNED BY	BEN REINHART	07/26/2023
DRAWN BY	BEN REINHART	07/26/2023
CHECKED BY	ANDY CRAIG, PE, TSP	07/28/2023
APPROVED BY		

ESE
Ecosystem Services Exchange
Valuing Conservation

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 6

PLAN VIEW

Benchmark:
Top of Lath Hub (NAD83, Iowa South, US Survey Feet)
● Located approx. 1300 feet south of buffer
Northing: 659854.067
Easting: 2273128.708
Elevation: 780.7

0 200 400 Feet

N

Staking Control Points (NAD83, Iowa South, US Survey Feet)

Point	Description	Northing	Easting	Elevation
1	Benchmark	659854.067	2273128.708	780.7
2	Control Structure	661568.251	2273606.063	788.8
3	Distribution Line	661956.235	2273612.031	790.1
4	Distribution Line	661856.741	2273616.636	789.2
5	Distribution Line	661757.247	2273621.240	788.5
6	Distribution Line	661657.773	2273625.612	788.8
7	Distribution Line	661467.419	2273604.834	788.0
8	Distribution Line	661404.562	2273527.607	787.6
9	Distribution Line	661333.164	2273458.548	787.8
10	Distribution Line	661260.000	2273391.313	789.1
11	Distribution Line	661145.697	2273290.983	787.1

Legend

- Proposed 6" Perforated CPT Distribution Line
- Proposed 6" Non-Perforated CPT
- Proposed 6" CMP Outlet
- Proposed Water Control Structure
- Existing 6" CPT Main
- Existing 4" CPT Main
- Benchmark
- Staking Points
- 2' Contours

205th St

950' of 6" CPT at 0.0% Grade

New 6" CMP Outlet with Rodent Guard

Additional tile outlet on north side of waterway. Cross with 40' of non-perforated 6" distribution line.

Existing 6" Tile

Existing 4" Tile
Minimal drainage area. Could be connected to 6" outlet upstream of control structure with 90' of 4" non-perforated CPT (see dashed line). Otherwise, cross with 40' of non-perforated 6" distribution line.

Buffer Cross Section, See Sheet 3

DATE
DESIGNED BY BEN REINHART 07/26/23
DRAWN BY BEN REINHART 07/26/23
CHECKED BY ANDY CRAIG, PE, TSP 07/28/23
APPROVED BY

PLAN MAP

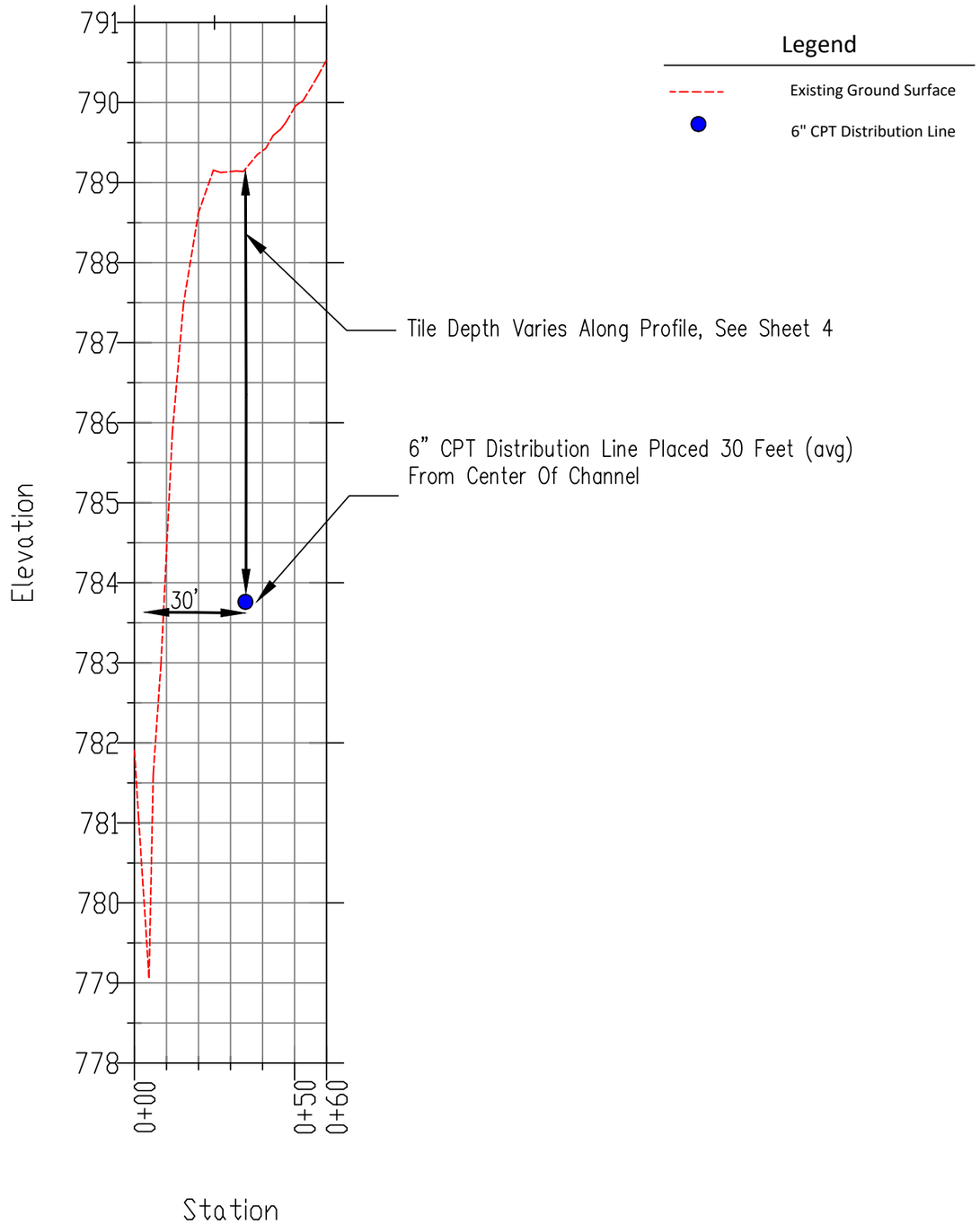
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
s

DRAWING SET
SHEET 2 OF 6

LANDOWNER | LOCATION SECTION 27 - T81N - R3W

Buffer Cross Section



LANDOWNER		LOCATION	SECTION 27 - T81N - R3W

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BUFFER AND BANK CROSS SECTION

ESE Ecosystem Services Exchange
Valuing Conservation

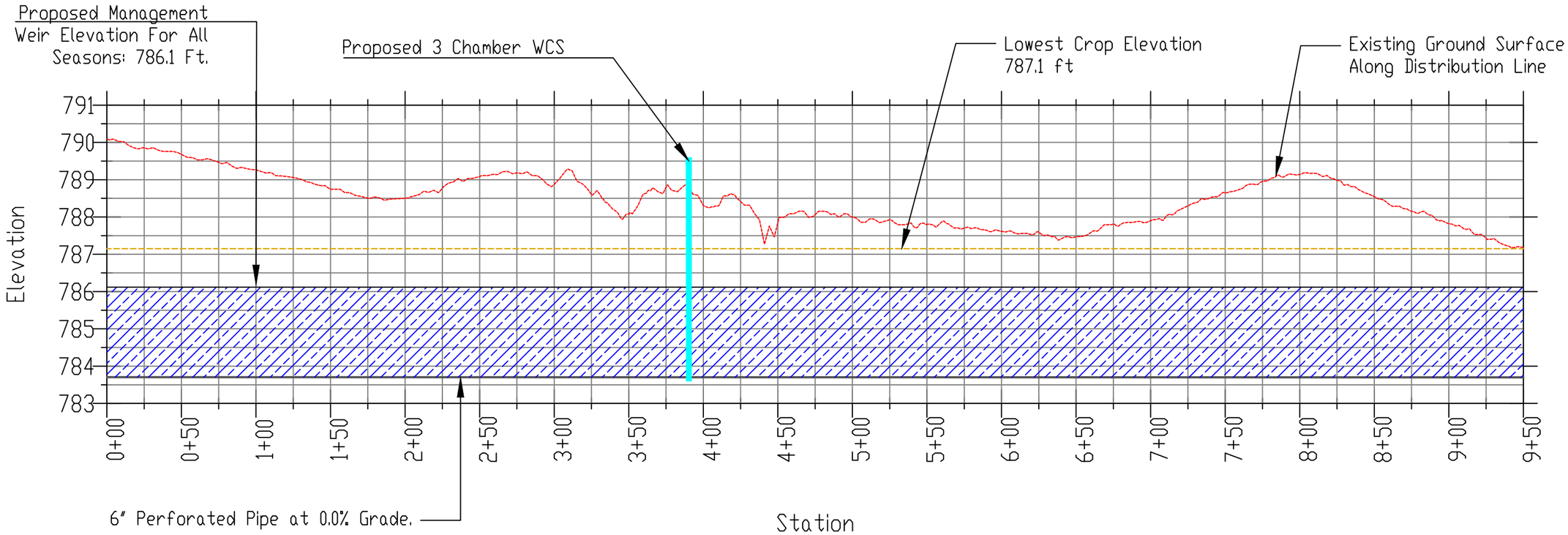
FILE NAME

DRAWING SET
SHEET 3 OF 6

Legend

- All Season Water Table
- Proposed Water Control Structure
- Proposed 6" CPT Distribution Line
- Existing Ground Surface
- Lowest Crop Elevation

Profile Along Distribution Line



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APPROVED BY	
DATE	07/26/23
	07/26/23
	07/28/23

PROFILE ALONG DISTRIBUTION LINE

ESE Ecosystem Services Exchange *Valuing Conservation*

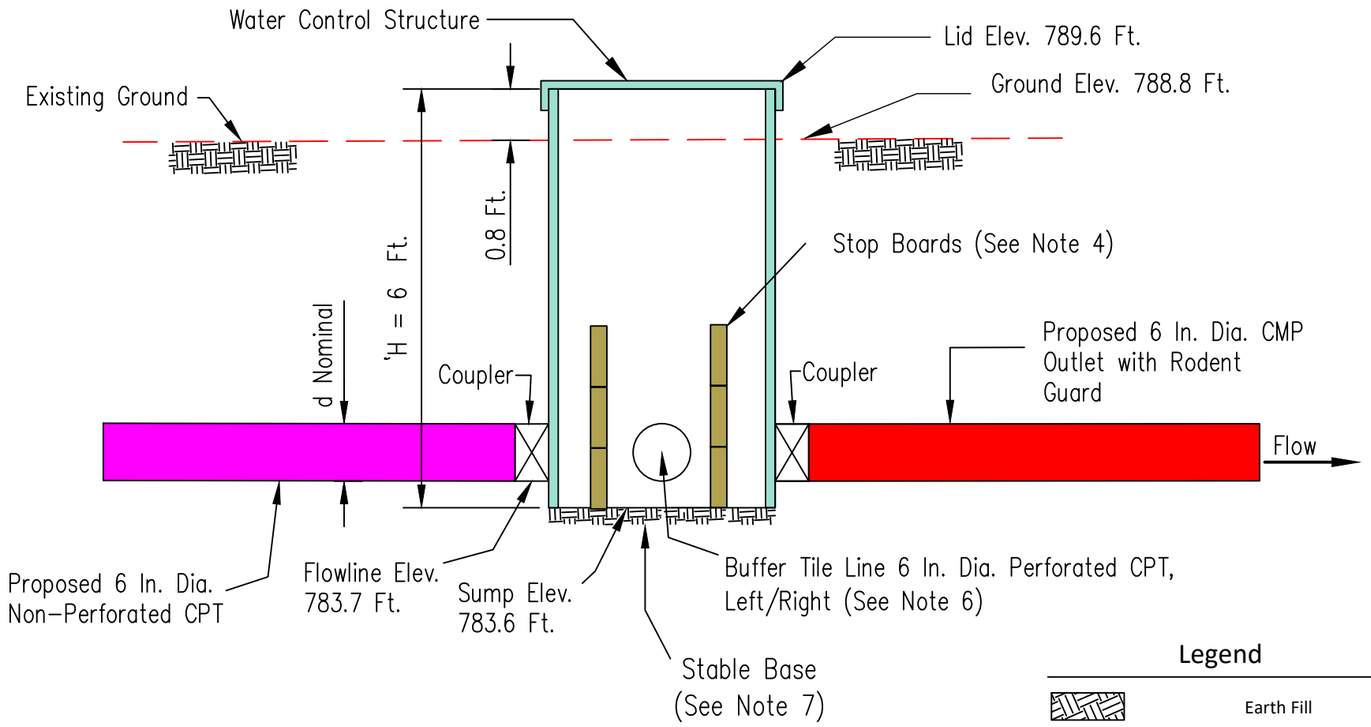
FILE NAME

Se

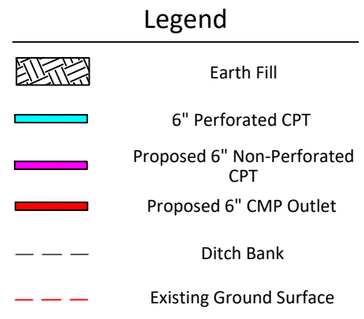
DRAWING SET

SHEET 4 OF 6

LANDOWNER		LOCATION	SECTION 27 - T81N - R3W

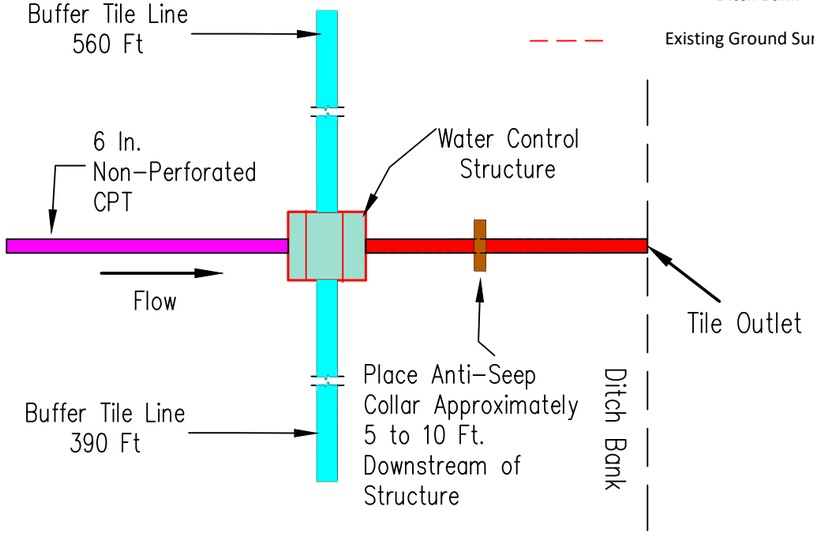


TYPICAL SECTION



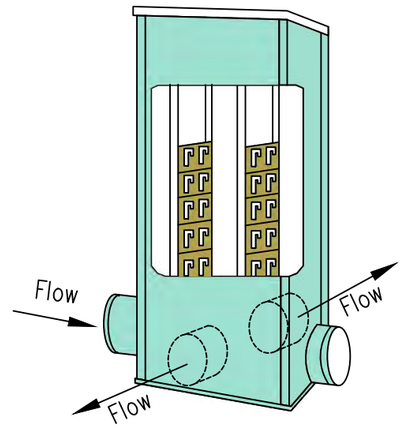
QUANTITIES*		NRCS SPEC
Water Control Structure 3– Compartment H = 6 ft. d = 6 in.	1	IA-21, IA-26, CPS-587
6" Non–perforated CPT (ft)	20	IA-21, IA-45
6" CMP Outlet with Rodent Guard	20	IA-604, IA-620
6" Perforated CPT (ft) Buffer Tile Line	870	IA-21, IA-45, IA-46
6" Non–perforated CPT (ft) See Plan Map, Sheet 2	80	IA-21, IA-45, IA-46
3'x3' Anti Seep Collar	1	CPS-587

*Quantities Do Not Include Couplers



PLAN

NOTES:
1. Install a minimum of 20 feet of non–perforated pipe adjacent to the water control structure, both upstream, and downstream. Pipe shall be PVC, dual–wall PT, or CMP.
2. PVC pipe shall conform to ASTM Standard D2241 or D1785, with material 1120 or 1220. Dual wall CPT must conform to ASTM Standard F2306 or F2648. CMP must conform to ASTM Standard A760 or B745.
3. Couplings between the water control section and the non–perforated tile shall be water tight.
4. Stop boards shall provide water tight seals under a minimum of 1 foot pressure head.
5. Mark location of structure using steel t–post or manufactured marker flag for safety in the field.
6. Install buffer tile parallel to ditch or stream, according to profile provided with the construction plans. Pipe shall remain on grade and drain towards the WCS.
7. Place structure and pipe coupler on a stable base. A stable base may be compacted earth or compacted fill sand.
8. Excavated material placed around structure and pipes must be hand compacted in 4" lifts.



IN–LINE CONTROL STRUCTURE

LANDOWNER		LOCATION	SECTION 27 - T81N - R3W

DATE
DESIGNED BY BEN REINHART 07/26/23
DRAWN BY BEN REINHART 07/26/23
CHECKED BY ANDY CRAIG, PE, TSP 07/28/23
APPROVED BY

3 CHAMBER STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME
Sak

DRAWING SET
SHEET 5 OF 6

CONSTRUCTION NOTES

1. Tile elevations are based Maverick Tile Finder probe depths. A fiberglass cable with imbedded wire is fed into the outlet and located with a utility device. These values may not be exact, but are believed to be accurate. Factors such as sediment in the pipe, flowing water in the pipe, and wire location within the pipe may affect depth readings. Notify ESE at least 48 hours before conducting the investigation so that a qualified ESE representative can be onsite during the investigation.
2. Avoid excessive disturbance of buffers or grassed water ways during construction. If re-vegetation is needed, contact the local NRCS Field Office for guidance. All disturbed areas that will not be cropped shall be seeded according to NRCS Conservation Practice Standard 342 – Critical Area Planting. Seeding adjacent to the grassed waterway shall match the waterway seeding to the closest extent practical.
3. Excavated material not used for backfill shall be removed from the site or spoiled in such a manner as to prevent flow disruption, channelizing, or erosion. Contact ESE for assistance with construction inspection after the following activities to ensure minimal effort is needed to correct potential errors:
   a. After excavating the existing tile and setting WCS.
   b. Distribution pipe has been laid and capped.
4. Any product planned for use in construction must be approved by ESE prior to construction. Provide documentation to ESE of all materials used in construction, including:
   a. Tile tags, invoices, or photos detailing the product type and manufacturer, ASTM designations, and total lengths.
   b. Photos and invoices or product information for water control structures.
5. Construction tolerances are +/-0.5ft on distribution line location, and +/-0.1 ft. on all elevations. If circumstances during construction change dimensions or elevations outside of these tolerances they must be approved by ESE and will be noted in the as-built plan.
6. When installing the distribution line, pay special attention so that other outlets in the buffer are not damaged or broken. Although an investigation of the buffer will have already been completed, not all outlets are able to be located depending on site conditions at the time. If another tile line or outlet is encountered, contact an ESE representative for consultation. They will decide if the tile line is able to be incorporated into the system, or if a section of the distribution line needs to be replaced as non-perforated pipe to prevent water loss.
7. Proper cultural resources documentation shall be completed by the local NRCS office prior to construction. If any cultural resources are identified during construction, work will stop immediately and the NRCS Archeologist will be notified.

Iowa Construction and Practice Specifications	
Specification No.	**Specification Description**
IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-604	Saturated Buffer
IA-620	Underground Outlet

LANDOWNER		LOCATION	SECTION 27 - T81N - R3W

DATE
DESIGNED BY BEN REINHART 07/26/23
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APPROVED BY

CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

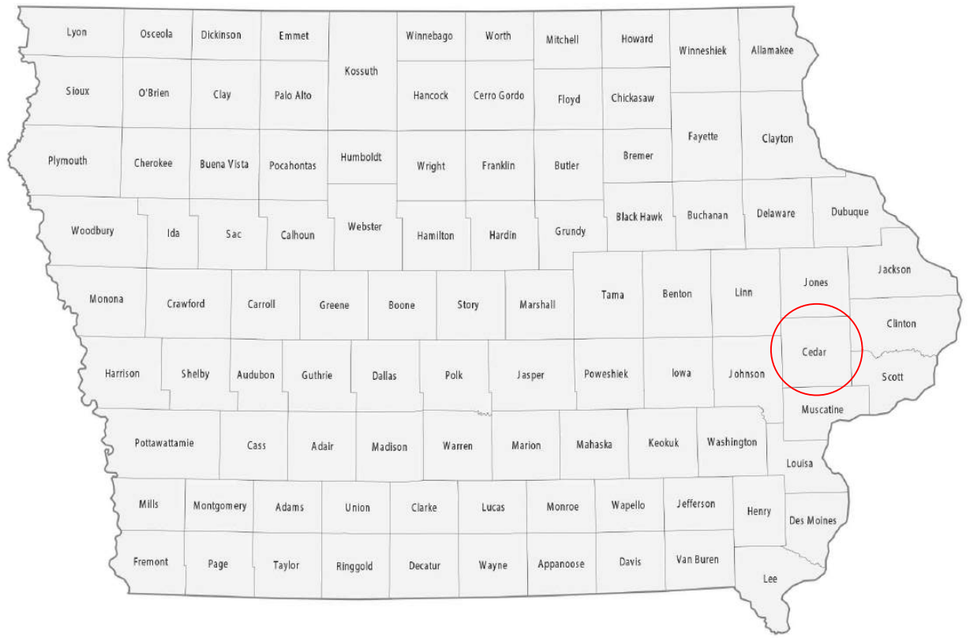
FILE NAME

DRAWING SET
SHEET 6 OF 6

SATURATED BUFFER CONSTRUCTION PLANS

CEDAR CO, IOWA

SECTION 27 - T81N - R3W



INDEX OF SHEETS

811 Know what's below. Call before you dig.

THE CONTRACTOR IS RESPONSIBLE FOR CALLING IOWA ONE CALL AT 1-800-292-8989 AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION

LICENSED PROFESSIONAL ENGINEER
Andy J. Craig
20832
IOWA

I hereby certify that to the best of my professional knowledge, judgement and belief, these plans meet applicable NRCS conservation practice standards, that this engineering document was prepared by me or under my direct personal supervision, and that I am a duly licensed Professional Engineer under the laws of the State of Iowa

07/28/2023

Andy J. Craig, P.E.
License number: 20832
My license renewal date is December 31, 2023.
Pages or sheets covered by this seal: All

ENGINEERING CLASS 2

		DATE
DESIGNED BY	BEN REINHART	07/26/2023
DRAWN BY	BEN REINHART	07/26/2023
CHECKED BY	ANDY CRAIG, PE, TSP	07/28/2023
APPROVED BY		

ESE Ecosystem Services Exchange
Valuing Conservation

COVER SHEET

FILE NAME

DRAWING SET

SHEET 1 OF 6

PLAN VIEW

Benchmark:
Top of Lath Hub (NAD83, Iowa South, US Survey Feet)
Northing: 659854.067
Easting: 2273128.708
Elevation: 780.7

0 200 400 Feet

N

Staking Control Points (NAD83, Iowa South, US Survey Feet)

Point	Description	Northing	Easting	Elevation
1	Benchmark	659854.067	2273128.708	780.7
2	Control Structure	659684.503	2273169.259	779.5
3	Distribution Line	659399.224	2273159.985	779.5
4	Distribution Line	659485.379	2273211.153	779.3
5	Distribution Line	659585.720	2273217.773	779.3
6	Distribution Line	659770.048	2273135.854	780.0
7	Distribution Line	659868.559	2273145.583	780.8
8	Distribution Line	659968.414	2273163.918	780.1
9	Distribution Line	660066.667	2273139.388	780.3
10	Distribution Line	660148.697	2273083.603	781.0
11	Distribution Line	660226.757	2273019.869	782.0

Legend

- Proposed 6" Perforated CPT Distribution Line
- Proposed 6" Non-Perforated CPT
- Proposed 6" CMP Outlet
- Proposed Water Control Structure
- Existing 6" CPT Main
- Benchmark
- Staking Points
- 2' Contours

925' of 6" CPT at 0.0% Grade

Existing 6" Tile

New 6" CMP Outlet with Rodent Guard

Buffer Cross Section, See Sheet 3

Jefferson Ave

210th St

11 10 9 8 7 6 5 4 3 2 1

0+00.00 0+50.00 1+00.00 1+50.00 2+00.00 2+50.00 3+00.00 3+50.00 4+00.00 4+50.00

DATE
DESIGNED BY BEN REINHART 07/26/23
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PLAN MAP

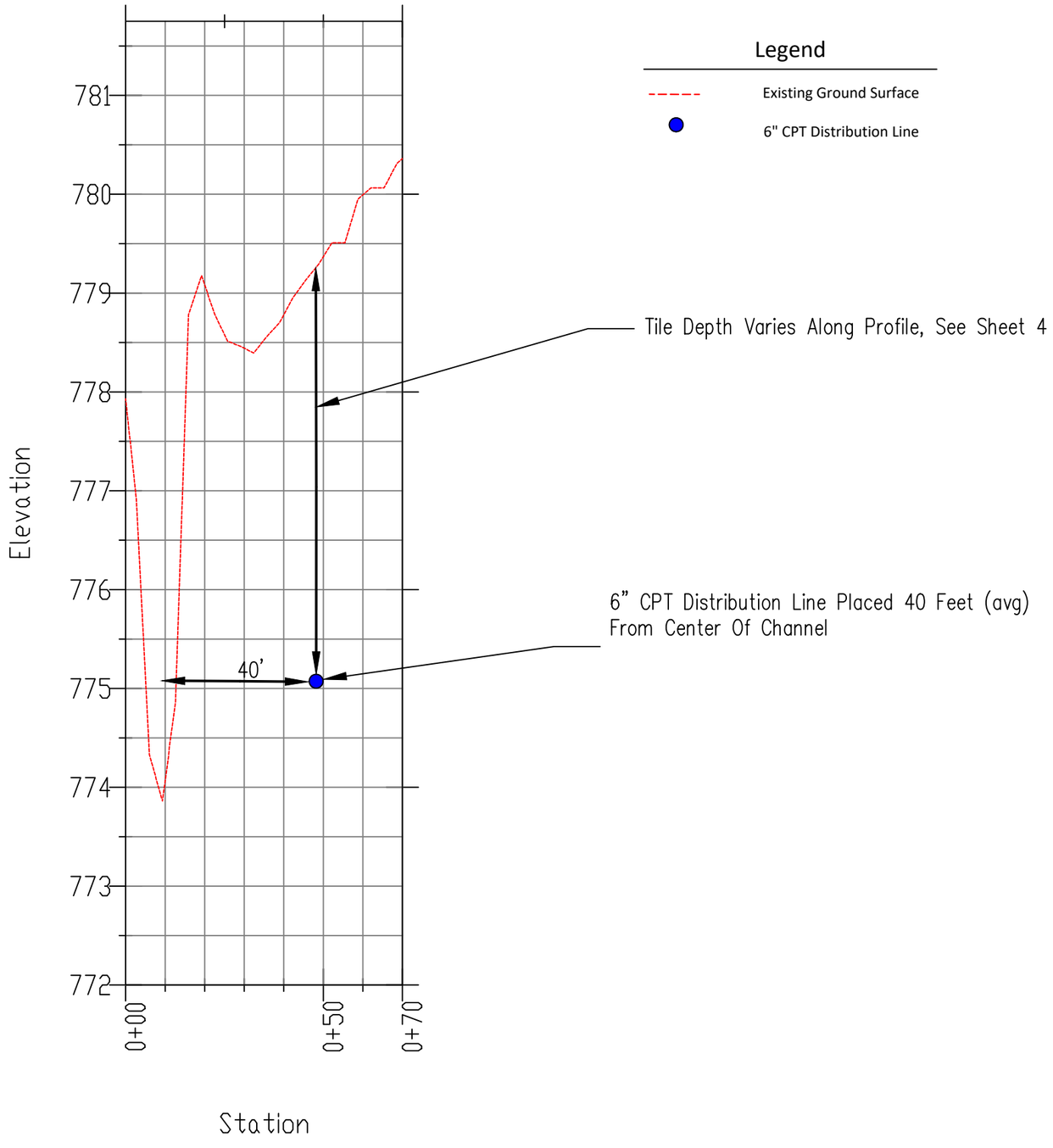
ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 2 OF 6

LANDOWNER | LOCATION | SECTION 27 - T81N - R3W

Buffer Cross Section



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BUFFER AND BANK CROSS SECTION

ESE Ecosystem Services Exchange *Valuing Conservation*

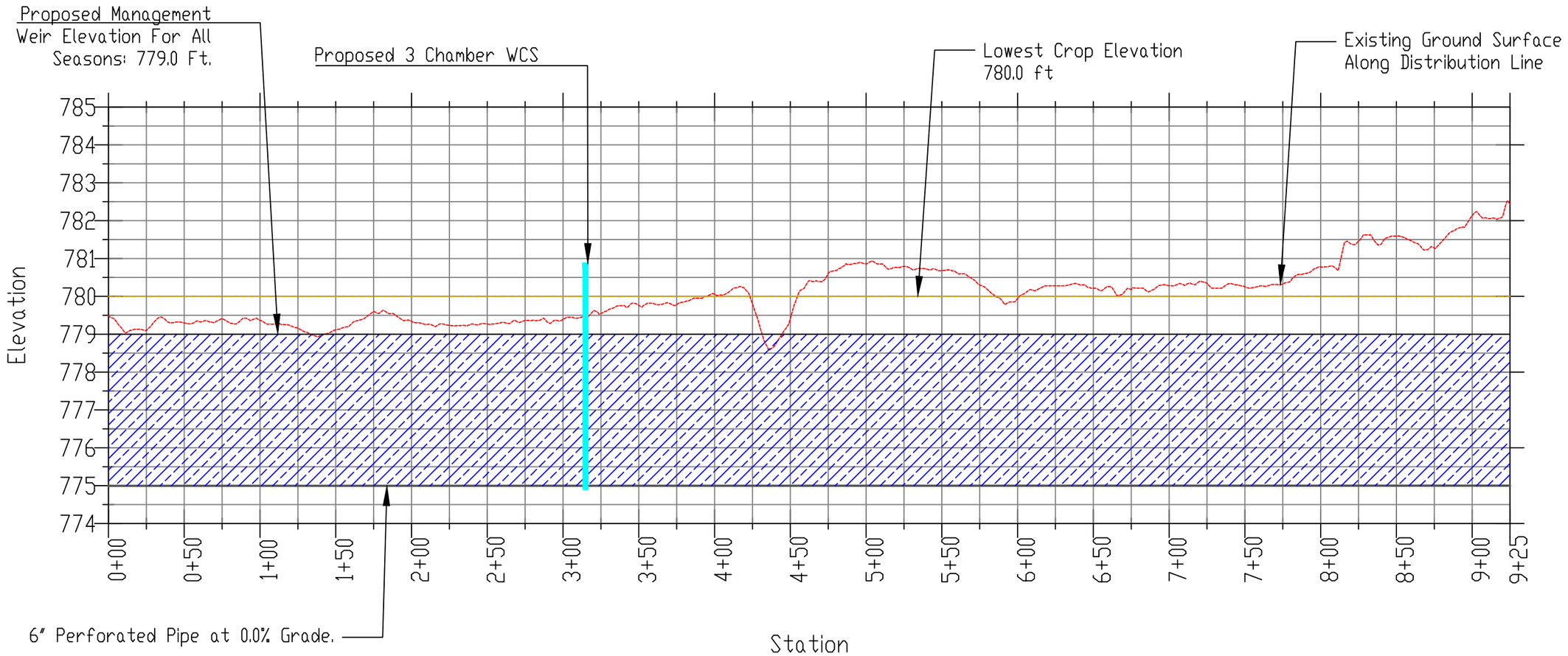
FILE NAME

DRAWING SET

SHEET 3 OF 6

LANDOWNER		LOCATION	SECTION 27 - T81N - R3W

Profile Along Distribution Line



DESIGNED BY BEN REINHART DATE 07/26/23
DRAWN BY BEN REINHART 07/26/23
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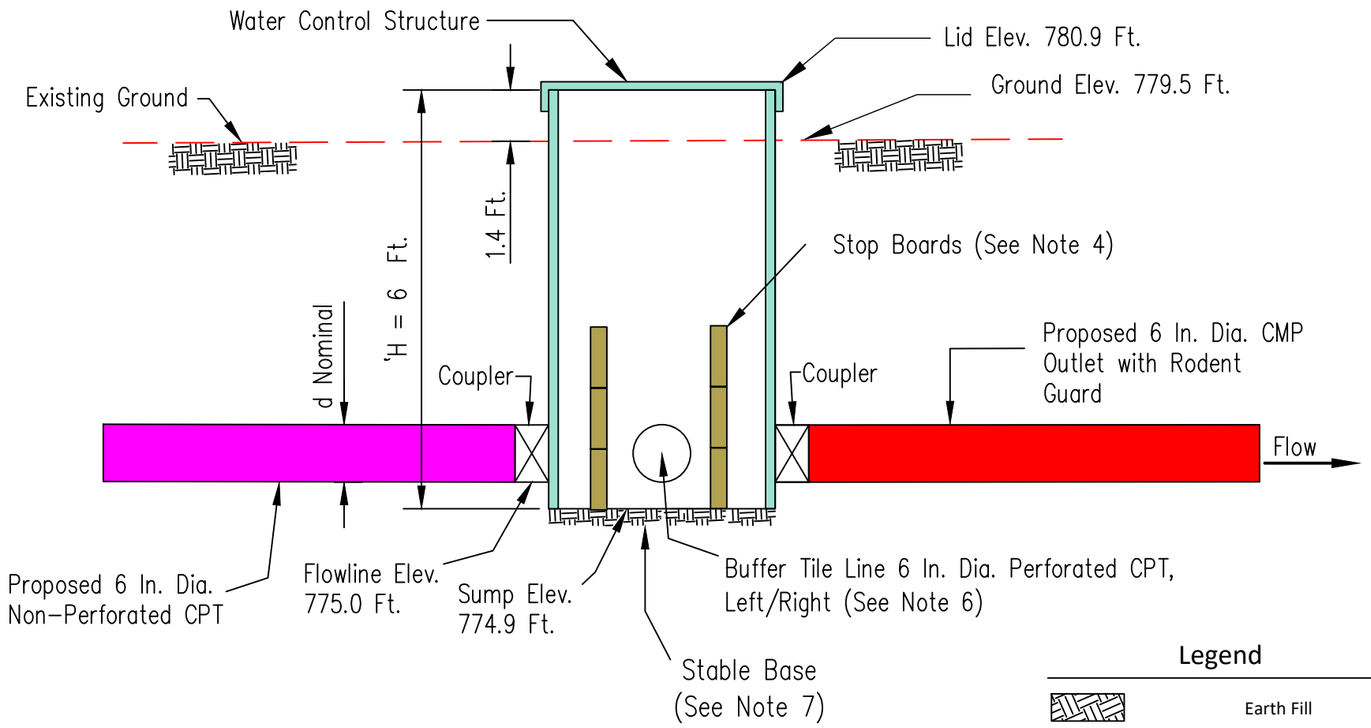
PROFILE ALONG DISTRIBUTION LINE

ESE Ecosystem Services Exchange Valuing Conservation

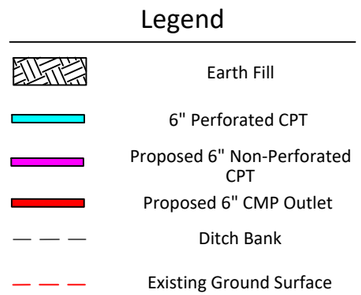
FILE NAME

DRAWING SET
SHEET 4 OF 6

LANDOWNER		LOCATION	SECTION 27 - T81N - R3W



TYPICAL SECTION



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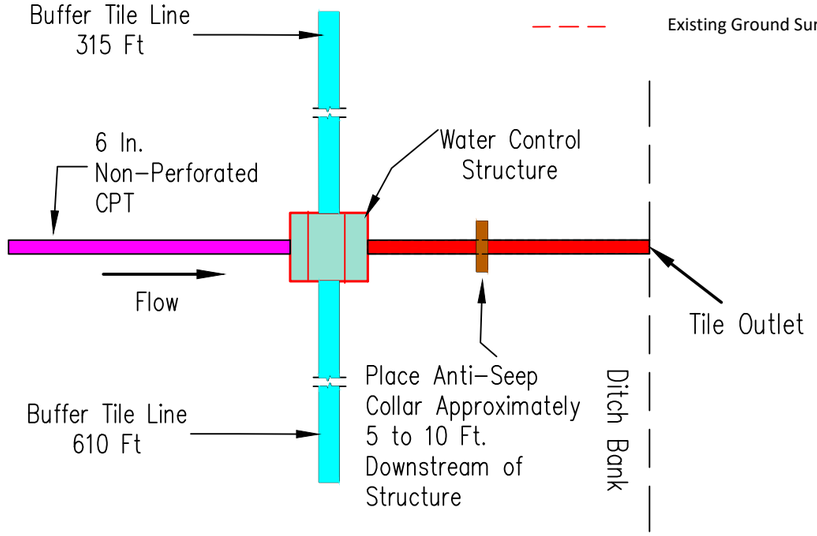

PLAN

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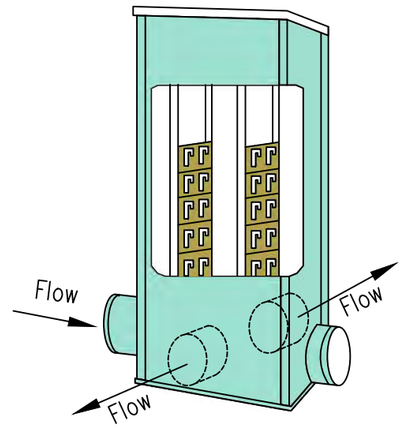

IN–LINE CONTROL STRUCTURE

LANDOWNER		LOCATION	SECTION 27 - T81N - R3W

DATE
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3 CHAMBER STRUCTURE DETAIL

ESE Ecosystem Services Exchange Valuing Conservation

FILE NAME

DRAWING SET
SHEET 5 OF 6

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LANDOWNER		LOCATION	SECTION 27 - T81N - R3W

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CONSTRUCTION NOTES

ESE Ecosystem Services Exchange *Valuing Conservation*

FILE NAME
s

DRAWING SET
SHEET 6 OF 6