Breakpoint Nutrient Reduction Wetland

Carroll County, Iowa

Design Report

Project No. 210779.18

Prepared For:

Iowa Department of Agriculture and Land Stewardship (IDALS)

Project Design Team:

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Prepared: October 29, 2024

PROJECT SUMMARY

The purpose of this project is to construct a traditional breakpoint nutrient reduction wetland located several miles East of Lanesboro in Carroll County, Iowa. The construction of this dam will result in the establishment of a water quality wetland that treats water prior to entrance to Purgatory Creek. Target criteria and design guidelines used for the wetland establishment are in accordance with Iowa NRCS Construction Practice Standard Pond (CPS 378), Grade Stabilization Structure (CPS 410), and Constructed Wetland (CPS 656).

Pond is accomplished by the following:

- Storing water for erosion control and flow detention.
- Improving water quality.

Grade Stabilization Structure is accomplished by the following.

- Reducing erosion.
- Improving water quality.

Constructed Wetland is accomplished by the following:

- Improving water quality of storm water runoff, tile drainage outflow and other waterflows.

The intent is to collect water from the watershed in a nutrient reduction wetland with the purpose of improving water quality. The wetland (located in the E ½ of the NE1/4 Section 13, T85, R33W) will include construction of an earth dam. A steel sheet pile outlet will serve to control the depth of the normal pool within the resulting wetland and discharge downstream to Purgatory Creek to the West. A water control structure/CMP drawdown structure with a filter diaphragm is proposed to allow draining of the wetland for maintenance. A wave bench and stilling basin are to be constructed on the earth dam. The proposed pool fill borrow is intended to expand the normal pool area and decrease the overall depth of the wetland.

EXISTING CONDITIONS

The wetland has a surface and subsurface drainage watershed of 317 acres. The drainage area was delineated using statewide LiDAR. Delineated drainage areas for the wetland are generally undeveloped aside from use as farm ground. Adjacent homes and other infrastructure are built on higher elevation than the wetland area. Typically, around the 1175’ elevation for nearby homes. The wetland is located at a pinch point of two natural drainage paths draining from the north and from the east. The bottom elevation of the proposed wetland is at approximately 1100’. The normal pool area of the wetland is 1107’ which provides a maximum depth of 7’ in the wetland. The wetland area consists primarily of Coland clay loam and Wadena loam which are poorly drained hydric soils and well drained non hydric soils respectively.

DESIGN ASSUMPTIONS & PROCEDURES

Wetland Sizing

To achieve targets for water quality, a permanent pool elevation was identified to provide a pool area between 0.5% and 2% of the total contributing watershed area. The pool area is graded so less than 50% of the pool area will be three (3) feet in depth. An easement area containing the

100-year storm bounce is proposed based on hydraulic routings for a 100yr-24hr design storm. Several principal spillway outlet configurations were evaluated to decrease drop height. Due to site restriction, no separate auxiliary spillway is proposed, in consideration with CPS 378-Pond requirements, the capacity of the principal spillway has been sized to pass the 50 yr-24hr design storm with at least 2 feet of freeboard.

Utilizing the watershed boundary, a composite hydrologic soil group classification as established for the watershed. The longest flow path and grade(s) were established utilizing LiDAR elevations and AutoCAD software. Initial peak flows (Qn) and time of concentration (Tc) values were assessed using NOAA's Atlas-14, NRCS MSE3 rainfall distributions, and TR-55 methodology. HydroCAD was the software used to provide peak flows inflows and routings. A summary of the flow comparison is provided in the following table:

Q_n	RECURRENCE INTERVAL		
	25yr	**50yr**	**100yr**
StreamStats (317 AC)	323 CFS	423 CFS	535 CFS
TR-55 Analysis (HydroCAD)	388 CFS	599 CFS	820 CFS

Basin Flow/Storm Characteristics:

DRAINAGE AREA:	317 Acres
TC:	1.17 Hours
Longest Flow Path:	1.09 Miles
10yr-24hr:	4.47 Inches
25yr-24hr:	5.59 Inches
50yr-24hr:	6.56 Inches
100yr-24hr:	7.63 Inches

Hydrologic Soil Group & RCN

HSG: "B" – RCN = - 69 –	104 Acres
HSG: "C" – RCN = - 83 -	91 Acres
HSG: "D" – RCN = - 86 –	122 Acres

Weighted Average RCN=80

Hydraulic Design & Routings

Stage Storage for the project is evaluated at elevations above the proposed permanent pool area (1107.0). The design includes grading to expand the pool area and provide fill material for the deep pool. This grading is planned to expand the permanent pool and is tentatively planned based on soils, but is subjective to change based on soil suitability. Fill material from the earthen dam is planned to be taken from a borrow site near Purgatory Creek.

A steel sheet pile trapezoidal weir was selected as the principal spillway. The bottom width was iteratively adjusted until the 50-year storm could be passed with 2 feet of freeboard. The 100-year event was modelled to evaluate the outlet structure and easement area. The location and placement of the weir was selected to reduce the weir drop height to less than 10 feet and minimize impacts to farming operations, subsequently no auxiliary spillway is proposed.

Flow Statistics

25yr Peak Outflow:	379 CFS	50yr Peak Outflow:	563 CFS
25yr Peak Water Elevation:	1108.88	50yr Peak Water Elevation:	1109.41
25yr Time to Peak:	13.06 HR	50yr Time to Peak:	13.34 HR

100yr Peak Outflow:	778 CFS
100yr Peak Water Elevation:	1109.93
100yr Time to Peak:	13.20 HR

Principal Spillway

Bottom Width:	40 FT
Bottom (Crest) Elevation:	1107.0
Sideslopes:	3H:1V
Top Elevation:	1111.5

Stilling Basin

Length:	47 FT
Width:	37 FT
Sideslopes:	3H:1V
Floor Elevation:	1098.0
Crest Elevation:	1099.0

Auxiliary Spillway

NONE

Earthen Dam

Dam Length:	307 FT
Dam Height:	13.5 FT
Top Width:	12 FT
Sideslopes:	4H:1V
Wavebench Width:	20 FT
Wavebench Slope:	10H:1V

Wetland Stage Storage*	
Wetland Storage (Post Construction)	
Elevation (FEET)	Cumulative Storage Volume (AC-FT)
1100	0.00
1101	0.09
1102	0.25
1103	0.49
1104	0.81
1105	1.46
1106	2.80
1107 (Normal Pool)	4.70
1108	6.96
1109	9.59
1110	12.62
1111	16.081
1111.5 (Top of Dam)	17.98

*Stage storage information was calculated using topographic data supplemented with USGS 2020 LiDAR.

The earthen dam is proposed to be overbuilt to an elevation of 1112.25 with a twelve (12) foot top width to account for any potential soil settlement. In consideration of soil information, the earthen dam is proposed with a larger wave berm and 4:1 slopes to provide additional seepage and slope protection.

The wetland will be equipped with a drawdown structure to allow vegetation to be established and as a way to provide dry access for future maintenance activities. The drawdown structure is proposed as a 24 inch diameter slotted riser with a 15 inch diameter corrugated metal pipe (CMP) conduit through the embankment. The conduit will be fitted with a sand filter diaphragm to protect against piping and seepage along the conduit.

The stilling basin was designed using guidance from the Iowa NRCS Standard Drawing 1411 (IA-1411) “Steel Sheet Pile Drop Structure.” The standard drawing stilling basin dimensions are listed for weir drop heights of 2 feet to 6 feet. The design of the stilling basin for this project was based on a weir drop height of 9 feet. The dimensioning for the stilling basin on this project was

extrapolated for the weir drop height of 9 feet. The dimensioning of the stilling basin on this project is 47 feet long by 37 feet wide. The normal stilling basin pool is 50 feet long by 43 feet wide and 1 foot deep.

Sediment Storage

Sediment storage was evaluated using spreadsheet forms developed by the NRCS, available soil information on the USGS Web Soil Survey, aerial photography, and field survey information. Below the normal pool elevation, there is 4.70 acre-feet of storage available. Included in the appendices is the prepared sediment life analysis. Consideration is given to tile infrastructure, depressional areas, highly erodible areas, and land slope for determining areas subject to sheet and rill erosion.

SURVEY

Survey was performed by JEO Consulting Group, Inc. on March 21st and 22nd of 2023. The weather was 30°F and sunny on March 21st and 30°F and partly cloudy on March 22nd. A Utility One Call Design Locate was completed on March 10th, 2023. The source of property information on the project is from surveyed pins, Carroll County Recorder plats, deeds, and easements. A final easement plat was recorded with Carroll and Greene counties for portions of the easement in the respective counties.

SOILS & GEOTECHNICAL INFORMATION

A site review was done in tandem with a desktop review of the USGS Web Soil Survey to identify and avoid potential sources of granular materials for the structure borrow and wetland suitability. Borrow areas identified for dam fill are designated based on topography that lends itself to the project and soil series. Geotechnical exploration was completed by Certified Testing Services, Inc. (CTS) on August 23rd, 2023 and November 8, 2023. Soils around the proposed pool area were generally clayey sands depth of 10'. A borrow site was identified adjacent to Purgatory Creek which consisted primarily of lean clay with sand. The reports determined that material available at the borrow site would be suitable for use as embankment fill. The design intends on all embankment and core trench fill materials to be sourced from the borrow site and any other material excavated from the dam footprint or pool areas to be used as fill in the borrow site to replace the material removed for use as embankment fill.

DOWNSTREAM IMPACTS

The proposed wetland is directly downstream from a confluence of two subdivisions of a larger watershed. Directly downstream of the proposed wetland is farm ground and Purgatory Creek. The drainage path to Purgatory Creek is approximately 800'. From visual investigation there are no dwellings immediately downstream of the proposed wetland. Downstream of Purgatory Creek, there is one dwelling located on 130th Street, approximately one mile. There is also a bridge located over Purgatory Creek on 130th Street. There are no expected impacts to any dwellings or structures due to the construction of the wetland.

PERMITTING

Environmental impacts review and permitting are to be completed by IDALS. There are currently no anticipated impacts with the construction of the dam and wetland. Mitigation measures are currently not anticipated with the construction of the dam and wetland.

DESIGN DRAWINGS & APPENDICES

Included in the plans are stage storage and discharge tables for the wetland and summary tables for spillways. Included in the appendices is the Opinion of Probably Construction Cost, Atlas 14 tabular rainfall information, Civil 3D cut/fill report, structure discharge summary files, and HydroCAD routing summaries.

REFERENCES, SOFTWARES & CALCULATORS

Multiple references, softwares, and calculators were used for the design and development of these wetlands. Listed below is a list of these that were used for key design components.

Hydrology & Hydraulics

NOAA Atlas 14 .....Precipitation Frequency
Web Soil Survey .....Soil Properties & Elevations
Esri ArcGIS ArcPro.....T_c and Curve Numbers
HydroCAD 10.20-3a 2023 .....Outflow Discharge Curves
.....Inflows and Outflows
.....Reservoir Routing
Autodesk AutoCAD 2023 .....Stage Storage
USGS National Map .....2020 Iowa LiDAR Data

Sincerely,

Juan A. Arellanes, PE

Water Resources Engineer

Enc: Appendices

APPENDICES

1.	Drainage Area Delineations	1 page(s)
2.	NOAA Atlas 14 Precipitation Data	2 page(s)
3.	Carroll Wetland H&H Modeling Report	13 page(s)
4.	Stage Storage Data	1 Page(s)
5.	Curve Number Calculations	1 Page(s)
6.	Historical Imagery of Area	4 page(s)
7.	AutoCAD Cut/Fill Report	2 Page(s)
8.	Hydrologic Soil groups	5 Page(s)
9.	Color Shaded Elevation Map	1 Page(s)


Drainage Area Delineation
317 Acres
Apple Ave
B Ave
B Ave
B Ave
120th St
120th St
120th St
120th St
120th St
Purgatory Creek

NOAA Atlas 14 Precipitation Data

Point precipitation frequency estimates (inches)
NOAA Atlas 14 Volume 8 Version 2
Data type: Precipitation depth
Time series type: Partial duration
Project area: Midwestern States
Location n: Iowa USA
Station Name: -
Latitude: 42.1780°
Longitude: -94.6260°
Elevation (USGS): None None

PRECIPITATION FREQUENCY ESTIMATES

by duratio	1	2	5	10	25	50	100	200	500	1000
5-min:	0.381	0.446	0.561	0.665	0.82	0.949	1.09	1.24	1.45	1.62
10-min:	0.558	0.653	0.821	0.973	1.2	1.39	1.59	1.81	2.12	2.37
15-min:	0.681	0.797	1	1.19	1.46	1.7	1.94	2.21	2.58	2.89
30-min:	0.981	1.15	1.45	1.72	2.13	2.48	2.84	3.24	3.8	4.26
60-min:	1.26	1.5	1.93	2.33	2.94	3.44	3.99	4.58	5.42	6.1
2-hr:	1.53	1.85	2.42	2.94	3.74	4.41	5.13	5.92	7.04	7.95
3-hr:	1.68	2.05	2.71	3.32	4.25	5.04	5.9	6.83	8.16	9.25
6-hr:	1.97	2.38	3.13	3.84	4.93	5.87	6.89	8.01	9.62	10.9
12-hr:	2.3	2.7	3.45	4.16	5.26	6.21	7.25	8.4	10	11.4
24-hr:	2.66	3.04	3.77	4.47	5.59	6.56	7.63	8.83	10.6	12
2-day:	3	3.44	4.26	5.02	6.19	7.19	8.28	9.48	11.2	12.6
3-day:	3.26	3.75	4.63	5.44	6.66	7.69	8.8	10	11.7	13.1
4-day:	3.5	4.02	4.95	5.79	7.05	8.1	9.22	10.4	12.1	13.5
7-day:	4.15	4.75	5.78	6.69	8.03	9.13	10.3	11.5	13.2	14.6
10-day:	4.74	5.4	6.52	7.49	8.9	10	11.2	12.5	14.2	15.6
20-day:	6.46	7.29	8.68	9.84	11.5	12.8	14	15.4	17.2	18.5
30-day:	7.92	8.92	10.5	11.9	13.7	15.1	16.4	17.8	19.6	20.9
45-day:	9.82	11	13	14.5	16.5	18	19.5	20.9	22.6	23.9
60-day:	11.5	12.9	15.1	16.8	19	20.6	22.1	23.5	25.2	26.3

PRECIPITATION FREQUENCY ESTIMATES AT UPPER BOUND OF 90% CONFIDENCE INTERVAL

by duratio	1	2	5	10	25	50	100	200	500	1000
5-min:	0.472	0.552	0.696	0.826	1.06	1.23	1.43	1.66	1.97	2.21
10-min:	0.691	0.809	1.02	1.21	1.55	1.8	2.1	2.43	2.89	3.24
15-min:	0.843	0.986	1.24	1.48	1.89	2.2	2.56	2.96	3.52	3.95
30-min:	1.21	1.42	1.8	2.14	2.75	3.21	3.75	4.35	5.19	5.83
60-min:	1.55	1.86	2.4	2.9	3.8	4.47	5.26	6.15	7.41	8.36
2-hr:	1.87	2.26	2.97	3.62	4.79	5.67	6.71	7.87	9.53	10.8
3-hr:	2.04	2.49	3.3	4.05	5.42	6.46	7.67	9.04	11	12.5
6-hr:	2.37	2.86	3.77	4.63	6.23	7.44	8.88	10.5	12.8	14.6
12-hr:	2.73	3.21	4.11	4.96	6.57	7.79	9.25	10.9	13.3	15.1
24-hr:	3.12	3.57	4.43	5.27	6.91	8.14	9.64	11.4	13.8	15.7
2-day:	3.47	3.99	4.94	5.84	7.52	8.79	10.3	12	14.5	16.4
3-day:	3.75	4.31	5.34	6.29	8.01	9.32	10.9	12.6	15	16.9
4-day:	4	4.61	5.68	6.67	8.42	9.75	11.3	13.1	15.5	17.4
7-day:	4.7	5.38	6.56	7.62	9.46	10.9	12.5	14.3	16.7	18.6

10-day:	5.34	6.08	7.35	8.48	10.4	11.9	13.5	15.4	17.9	19.8
20-day:	7.17	8.1	9.66	11	13.2	14.8	16.6	18.6	21.3	23.3
30-day:	8.73	9.84	11.7	13.2	15.5	17.3	19.3	21.4	24.1	26.1
45-day:	10.7	12.1	14.2	16	18.6	20.5	22.6	24.8	27.5	29.6
60-day:	12.5	14	16.5	18.4	21.2	23.3	25.5	27.7	30.4	32.5

PRECIPITATION FREQUENCY ESTIMATES AT LOWER BOUND OF 90% CONFIDENCE INTERVAL

by duratio	1	2	5	10	25	50	100	200	500	1000
5-min:	0.317	0.371	0.464	0.546	0.654	0.736	0.811	0.879	0.985	1.07
10-min:	0.464	0.543	0.68	0.8	0.958	1.08	1.19	1.29	1.44	1.56
15-min:	0.566	0.662	0.829	0.976	1.17	1.31	1.45	1.57	1.76	1.9
30-min:	0.816	0.955	1.2	1.42	1.7	1.92	2.12	2.31	2.59	2.81
60-min:	1.05	1.25	1.6	1.92	2.35	2.67	2.98	3.26	3.7	4.02
2-hr:	1.29	1.55	2.02	2.44	3.02	3.46	3.87	4.26	4.85	5.3
3-hr:	1.42	1.72	2.27	2.77	3.46	3.98	4.48	4.95	5.67	6.21
6-hr:	1.68	2.02	2.65	3.23	4.06	4.68	5.29	5.88	6.76	7.43
12-hr:	1.98	2.32	2.95	3.54	4.38	5.01	5.63	6.23	7.15	7.84
24-hr:	2.31	2.64	3.25	3.84	4.7	5.35	6	6.64	7.61	8.35
2-day:	2.62	3.01	3.71	4.34	5.24	5.92	6.57	7.2	8.16	8.89
3-day:	2.87	3.3	4.06	4.74	5.66	6.36	7.01	7.64	8.58	9.3
4-day:	3.09	3.55	4.36	5.07	6.01	6.72	7.38	8	8.94	9.65
7-day:	3.7	4.22	5.12	5.9	6.88	7.63	8.3	8.91	9.84	10.5
10-day:	4.25	4.83	5.81	6.64	7.66	8.43	9.11	9.72	10.6	11.3
20-day:	5.84	6.58	7.81	8.81	9.94	10.8	11.5	12.1	13	13.7
30-day:	7.2	8.1	9.54	10.7	11.9	12.8	13.5	14.1	14.9	15.5
45-day:	8.98	10.1	11.8	13.1	14.4	15.4	16.1	16.6	17.3	17.8
60-day:	10.5	11.8	13.8	15.3	16.6	17.7	18.3	18.7	19.3	19.8

Date/time (GMT): Mon Apr 3 18:53:30 2023
pyRunTime: 0.0378217697144

Carroll Breakpoint Wetland
Prepared by JEO Consulting Group

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2yr	MSE 24-hr	3	Default	24.00	1	3.04	2
2	10yr	MSE 24-hr	3	Default	24.00	1	4.47	2
3	25yr	MSE 24-hr	3	Default	24.00	1	5.59	2
4	50yr	MSE 24-hr	3	Default	24.00	1	6.56	2
5	100yr	MSE 24-hr	3	Default	24.00	1	7.63	2

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	5P	1,101.00	1,100.00	90.0	0.0111	0.025	0.0	15.0	0.0
2	5P	1,102.00	1,101.00	110.0	0.0091	0.025	0.0	15.0	0.0

Summary for Pond 5P: Proposed Breakpoint Wetland

Inflow Area = 317.588 ac, 0.00% Impervious, Inflow Depth = 1.28" for 2yr event
Inflow = 157.07 cfs @ 13.12 hrs, Volume= 33.878 af
Outflow = 144.46 cfs @ 13.38 hrs, Volume= 29.173 af, Atten= 8%, Lag= 15.6 min
Primary = 144.36 cfs @ 13.38 hrs, Volume= 29.172 af
Secondary = 0.10 cfs @ 13.38 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 1,108.02' @ 13.38 hrs Storage= 7.028 af

Plug-Flow detention time= 99.5 min calculated for 29.173 af (86% of inflow)
Center-of-Mass det. time= 41.5 min (943.4 - 901.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,100.00'	17.983 af	**Custom Stage Data**Listed below

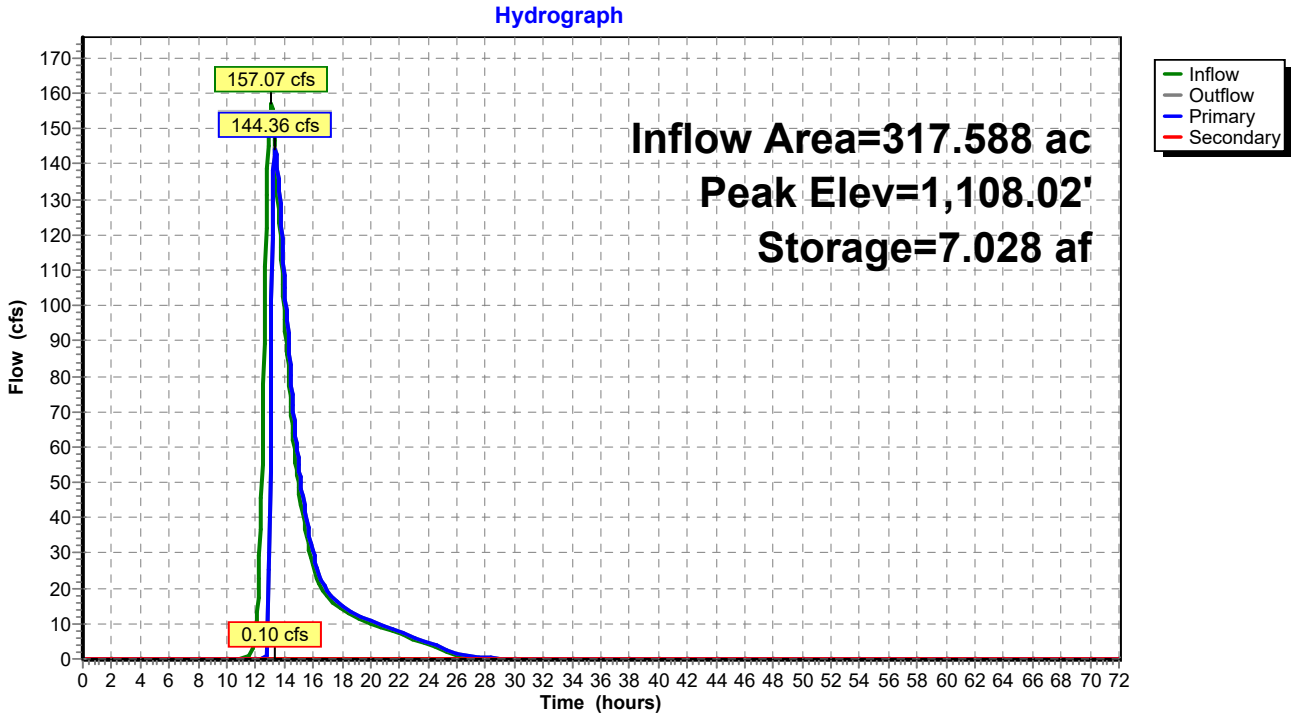
Elevation (feet)	Cum.Store (acre-feet)
1,100.00	0.000
1,101.00	0.086
1,102.00	0.248
1,103.00	0.488
1,104.00	0.805
1,105.00	1.463
1,106.00	2.801
1,107.00	4.705
1,108.00	6.963
1,109.00	9.586
1,110.00	12.615
1,111.00	16.081
1,111.50	17.983

Device	Routing	Invert	Outlet Devices
#1	Primary	1,107.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 5.00 5.50 Width (feet) 40.00 46.00 52.00 58.00 64.00 70.00 73.00
#2	Secondary	1,101.00'	**15.0" Round CMP_Round 15"** L= 90.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,101.00' / 1,100.00' S= 0.0111 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.23 sf
#3	Device 2	1,108.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 7.00 Width (feet) 4.00 4.00
#4	Device 3	1,102.00'	**15.0" Round CMP_Round 15"** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,102.00' / 1,101.00' S= 0.0091 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.23 sf

Primary OutFlow Max=144.10 cfs @ 13.38 hrs HW=1,108.02' (Free Discharge)
└─**1=Custom Weir/Orifice** (Weir Controls 144.10 cfs @ 3.27 fps)

Secondary OutFlow Max=0.05 cfs @ 13.38 hrs HW=1,108.02' (Free Discharge)
└─**2=CMP_Round 15"** (Passes 0.05 cfs of 8.42 cfs potential flow)
└─**3=Custom Weir/Orifice** (Weir Controls 0.05 cfs @ 0.51 fps)
└─**4=CMP_Round 15"** (Passes 0.05 cfs of 0.45 cfs potential flow)

Pond 5P: Proposed Breakpoint Wetland



Summary for Pond 5P: Proposed Breakpoint Wetland

Inflow Area = 317.588 ac, 0.00% Impervious, Inflow Depth = 2.44" for 10yr event
Inflow = 292.01 cfs @ 12.98 hrs, Volume= 64.470 af
Outflow = 280.91 cfs @ 13.13 hrs, Volume= 59.765 af, Atten= 4%, Lag= 8.7 min
Primary = 278.73 cfs @ 13.13 hrs, Volume= 59.589 af
Secondary = 2.18 cfs @ 13.13 hrs, Volume= 0.176 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 1,108.56' @ 13.13 hrs Storage= 8.428 af

Plug-Flow detention time= 61.7 min calculated for 59.724 af (93% of inflow)
Center-of-Mass det. time= 27.3 min (924.3 - 897.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,100.00'	17.983 af	**Custom Stage Data** Listed below

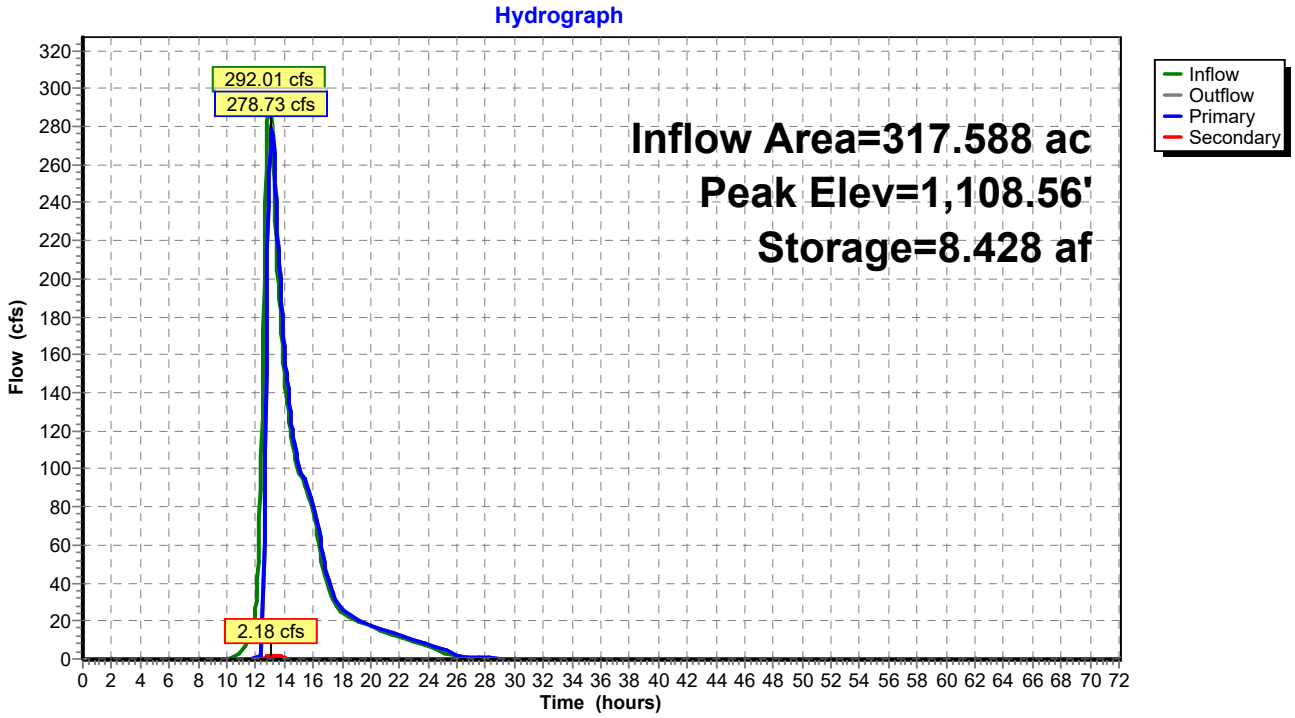
Elevation (feet)	Cum.Store (acre-feet)
1,100.00	0.000
1,101.00	0.086
1,102.00	0.248
1,103.00	0.488
1,104.00	0.805
1,105.00	1.463
1,106.00	2.801
1,107.00	4.705
1,108.00	6.963
1,109.00	9.586
1,110.00	12.615
1,111.00	16.081
1,111.50	17.983

Device	Routing	Invert	Outlet Devices
#1	Primary	1,107.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 5.00 5.50 Width (feet) 40.00 46.00 52.00 58.00 64.00 70.00 73.00
#2	Secondary	1,101.00'	**15.0" Round CMP_Round 15"** L= 90.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,101.00' / 1,100.00' S= 0.0111 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.23 sf
#3	Device 2	1,108.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 7.00 Width (feet) 4.00 4.00
#4	Device 3	1,102.00'	**15.0" Round CMP_Round 15"** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,102.00' / 1,101.00' S= 0.0091 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.23 sf

Primary OutFlow Max=278.35 cfs @ 13.13 hrs HW=1,108.56' (Free Discharge)
└─**1=Custom Weir/Orifice** (Weir Controls 278.35 cfs @ 4.00 fps)

Secondary OutFlow Max=2.18 cfs @ 13.13 hrs HW=1,108.56' (Free Discharge)
└─**2=CMP_Round 15"** (Passes 2.18 cfs of 8.75 cfs potential flow)
└─**3=Custom Weir/Orifice** (Passes 2.18 cfs of 5.45 cfs potential flow)
└─**4=CMP_Round 15"** (Outlet Controls 2.18 cfs @ 1.78 fps)

Pond 5P: Proposed Breakpoint Wetland



Summary for Pond 5P: Proposed Breakpoint Wetland

Inflow Area = 317.588 ac, 0.00% Impervious, Inflow Depth = 3.41" for 25yr event
Inflow = 387.74 cfs @ 12.95 hrs, Volume= 90.339 af
Outflow = 379.15 cfs @ 13.06 hrs, Volume= 85.634 af, Atten= 2%, Lag= 6.7 min
Primary = 376.42 cfs @ 13.06 hrs, Volume= 85.306 af
Secondary = 2.74 cfs @ 13.06 hrs, Volume= 0.328 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 1,108.88' @ 13.06 hrs Storage= 9.275 af

Plug-Flow detention time= 49.0 min calculated for 85.575 af (95% of inflow)
Center-of-Mass det. time= 23.1 min (917.6 - 894.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,100.00'	17.983 af	**Custom Stage Data** Listed below

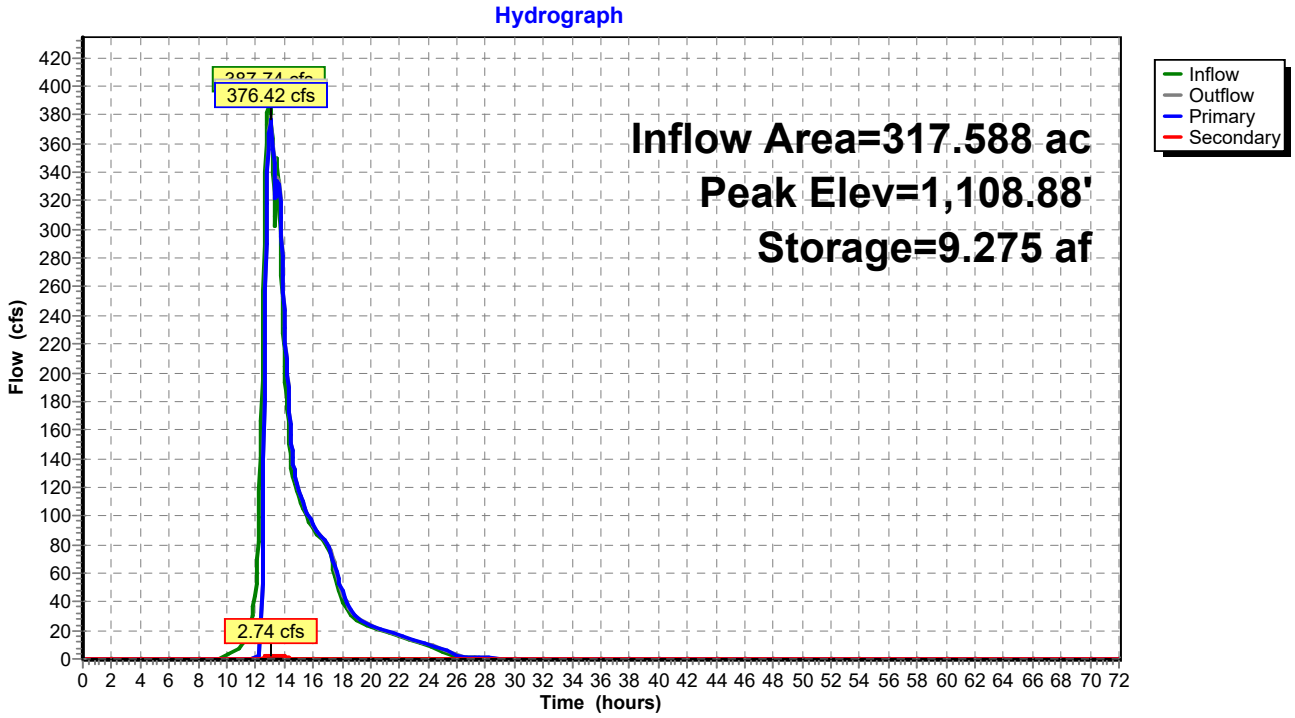
Elevation (feet)	Cum.Store (acre-feet)
1,100.00	0.000
1,101.00	0.086
1,102.00	0.248
1,103.00	0.488
1,104.00	0.805
1,105.00	1.463
1,106.00	2.801
1,107.00	4.705
1,108.00	6.963
1,109.00	9.586
1,110.00	12.615
1,111.00	16.081
1,111.50	17.983

Device	Routing	Invert	Outlet Devices
#1	Primary	1,107.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 5.00 5.50 Width (feet) 40.00 46.00 52.00 58.00 64.00 70.00 73.00
#2	Secondary	1,101.00'	**15.0" Round CMP_Round 15"** L= 90.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,101.00' / 1,100.00' S= 0.0111 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.23 sf
#3	Device 2	1,108.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 7.00 Width (feet) 4.00 4.00
#4	Device 3	1,102.00'	**15.0" Round CMP_Round 15"** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,102.00' / 1,101.00' S= 0.0091 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.23 sf

Primary OutFlow Max=375.95 cfs @ 13.06 hrs HW=1,108.88' (Free Discharge)
└**1=Custom Weir/Orifice** (Weir Controls 375.95 cfs @ 4.38 fps)

Secondary OutFlow Max=2.74 cfs @ 13.06 hrs HW=1,108.88' (Free Discharge)
└**2=CMP_Round 15"** (Passes 2.74 cfs of 8.94 cfs potential flow)
└**3=Custom Weir/Orifice** (Passes 2.74 cfs of 10.82 cfs potential flow)
└**4=CMP_Round 15"** (Outlet Controls 2.74 cfs @ 2.23 fps)

Pond 5P: Proposed Breakpoint Wetland



Summary for Pond 5P: Proposed Breakpoint Wetland

Inflow Area = 317.588 ac, 0.00% Impervious, Inflow Depth = 4.29" for 50yr event
Inflow = 598.92 cfs @ 13.24 hrs, Volume= 113.541 af
Outflow = 562.98 cfs @ 13.34 hrs, Volume= 108.836 af, Atten= 6%, Lag= 5.7 min
Primary = 559.52 cfs @ 13.34 hrs, Volume= 108.392 af
Secondary = 3.46 cfs @ 13.34 hrs, Volume= 0.444 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 1,109.41' @ 13.34 hrs Storage= 10.814 af

Plug-Flow detention time= 42.2 min calculated for 108.761 af (96% of inflow)
Center-of-Mass det. time= 20.5 min (906.6 - 886.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,100.00'	17.983 af	**Custom Stage Data**Listed below

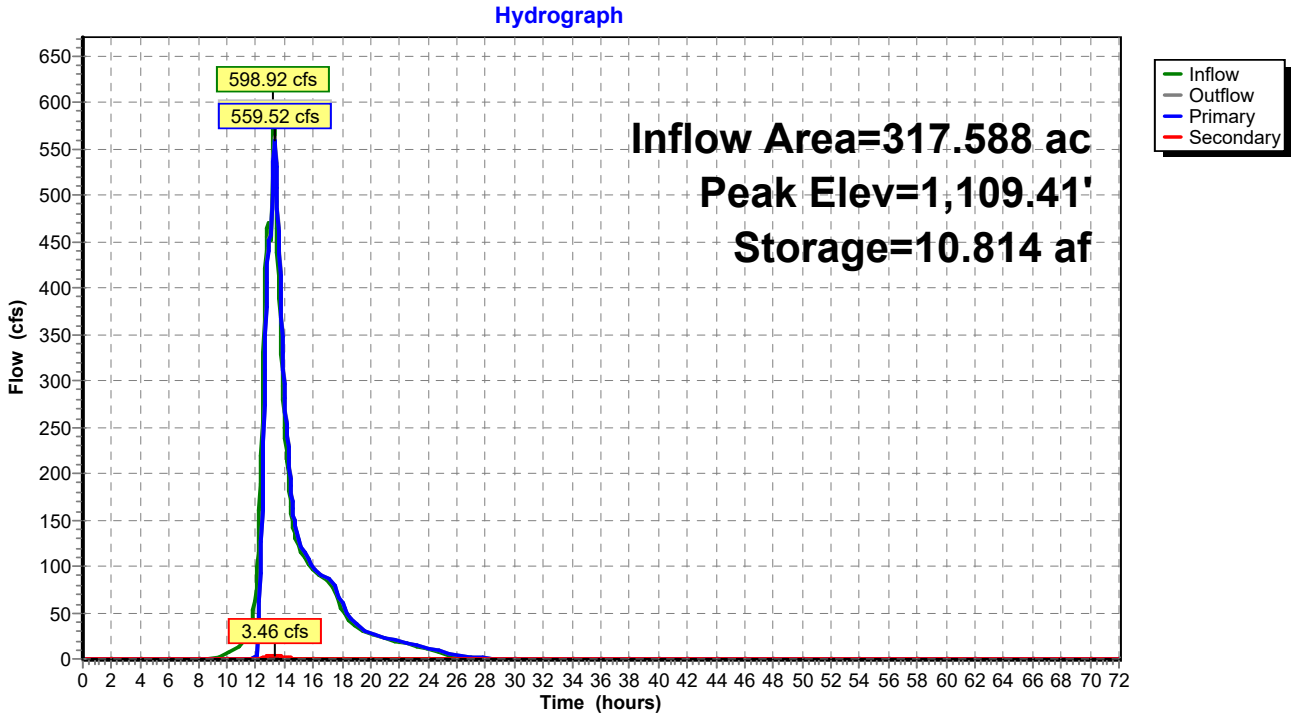
Elevation (feet)	Cum.Store (acre-feet)
1,100.00	0.000
1,101.00	0.086
1,102.00	0.248
1,103.00	0.488
1,104.00	0.805
1,105.00	1.463
1,106.00	2.801
1,107.00	4.705
1,108.00	6.963
1,109.00	9.586
1,110.00	12.615
1,111.00	16.081
1,111.50	17.983

Device	Routing	Invert	Outlet Devices
#1	Primary	1,107.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 5.00 5.50 Width (feet) 40.00 46.00 52.00 58.00 64.00 70.00 73.00
#2	Secondary	1,101.00'	**15.0" Round CMP_Round 15"** L= 90.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,101.00' / 1,100.00' S= 0.0111 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.23 sf
#3	Device 2	1,108.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 7.00 Width (feet) 4.00 4.00
#4	Device 3	1,102.00'	**15.0" Round CMP_Round 15"** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,102.00' / 1,101.00' S= 0.0091 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.23 sf

Primary OutFlow Max=557.92 cfs @ 13.34 hrs HW=1,109.40' (Free Discharge)
└**1=Custom Weir/Orifice** (Weir Controls 557.92 cfs @ 4.92 fps)

Secondary OutFlow Max=3.46 cfs @ 13.34 hrs HW=1,109.40' (Free Discharge)
└**2=CMP_Round 15"** (Passes 3.46 cfs of 9.24 cfs potential flow)
└**3=Custom Weir/Orifice** (Passes 3.46 cfs of 21.74 cfs potential flow)
└**4=CMP_Round 15"** (Outlet Controls 3.46 cfs @ 2.82 fps)

Pond 5P: Proposed Breakpoint Wetland



Summary for Pond 5P: Proposed Breakpoint Wetland

Inflow Area = 317.588 ac, 0.00% Impervious, Inflow Depth = 5.28" for 100yr event
Inflow = 819.64 cfs @ 13.09 hrs, Volume= 139.713 af
Outflow = 777.52 cfs @ 13.20 hrs, Volume= 135.008 af, Atten= 5%, Lag= 6.6 min
Primary = 773.47 cfs @ 13.20 hrs, Volume= 134.456 af
Secondary = 4.06 cfs @ 13.20 hrs, Volume= 0.552 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 1,109.93' @ 13.20 hrs Storage= 12.409 af

Plug-Flow detention time= 37.0 min calculated for 134.914 af (97% of inflow)
Center-of-Mass det. time= 18.8 min (897.3 - 878.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,100.00'	17.983 af	**Custom Stage Data** Listed below

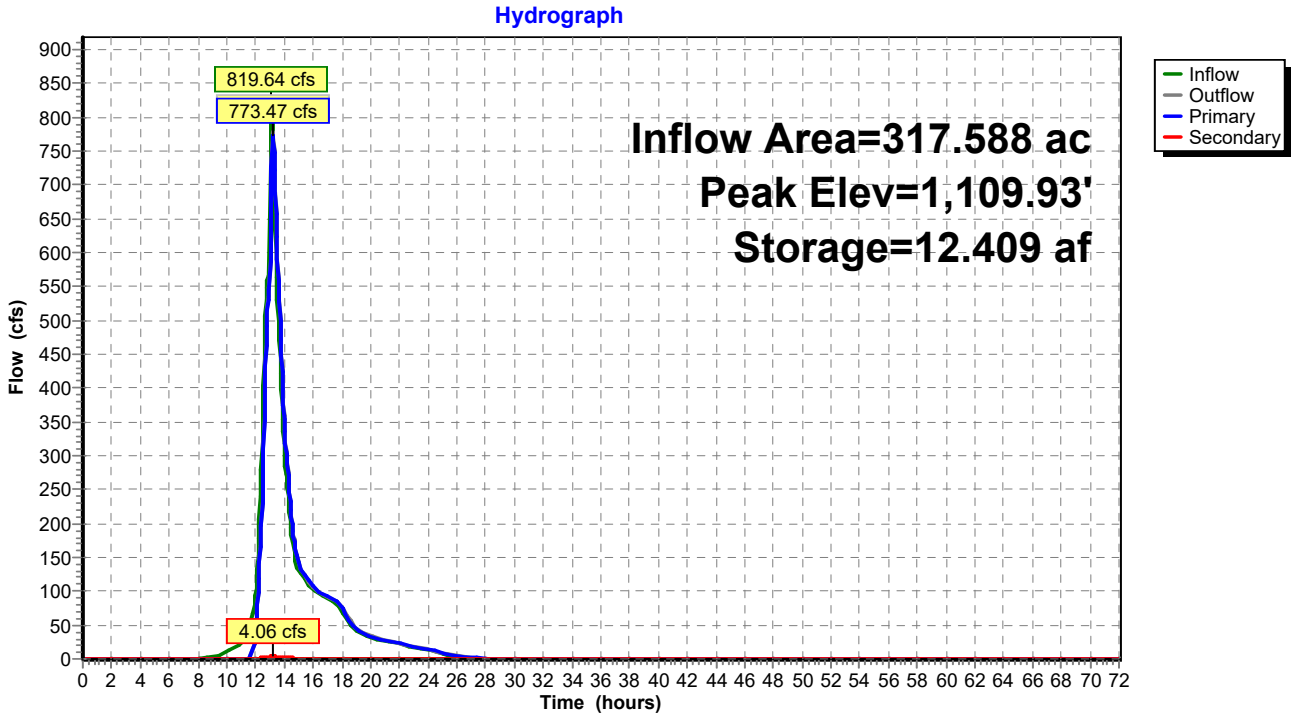
Elevation (feet)	Cum.Store (acre-feet)
1,100.00	0.000
1,101.00	0.086
1,102.00	0.248
1,103.00	0.488
1,104.00	0.805
1,105.00	1.463
1,106.00	2.801
1,107.00	4.705
1,108.00	6.963
1,109.00	9.586
1,110.00	12.615
1,111.00	16.081
1,111.50	17.983

Device	Routing	Invert	Outlet Devices
#1	Primary	1,107.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 2.00 3.00 4.00 5.00 5.50 Width (feet) 40.00 46.00 52.00 58.00 64.00 70.00 73.00
#2	Secondary	1,101.00'	**15.0" Round CMP_Round 15"** L= 90.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,101.00' / 1,100.00' S= 0.0111 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.23 sf
#3	Device 2	1,108.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 7.00 Width (feet) 4.00 4.00
#4	Device 3	1,102.00'	**15.0" Round CMP_Round 15"** L= 110.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,102.00' / 1,101.00' S= 0.0091 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.23 sf

Primary OutFlow Max=772.81 cfs @ 13.20 hrs HW=1,109.93' (Free Discharge)
└**1=Custom Weir/Orifice** (Weir Controls 772.81 cfs @ 5.40 fps)

Secondary OutFlow Max=4.06 cfs @ 13.20 hrs HW=1,109.93' (Free Discharge)
└**2=CMP_Round 15"** (Passes 4.06 cfs of 9.53 cfs potential flow)
└**3=Custom Weir/Orifice** (Passes 4.06 cfs of 35.14 cfs potential flow)
└**4=CMP_Round 15"** (Outlet Controls 4.06 cfs @ 3.30 fps)

Pond 5P: Proposed Breakpoint Wetland



Events for Pond 5P: Proposed Breakpoint Wetland

Event	Inflow (cfs)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)	Elevation (feet)	Storage (acre-feet)
2yr	157.07	144.46	144.36	0.10	1,108.02	7.028
10yr	292.01	280.91	278.73	2.18	1,108.56	8.428
25yr	387.74	379.15	376.42	2.74	1,108.88	9.275
50yr	598.92	562.98	559.52	3.46	1,109.41	10.814
100yr	**819.64**	**777.52**	**773.47**	**4.06**	**1,109.93**	**12.409**

Stage Storage Calculations

Elevation	Depth	Incremental Area (sf)	Area (sf)	Area (AC)	Volume (cf)	Volume (acre feet)	Cum. Volume (cf)	Cum. Volume (acre feet)	
1100.00	0.00	2326.02	2326.02	0.05	0.00	0.00	0.00	0.00	
1101.00	1.00	2867.97	5193.99	0.12	3760.01	0.09	3760.01	0.09	
1102.00	2.00	3729.55	8923.54	0.20	7058.77	0.16	10818.77	0.25	
1103.00	3.00	3009.10	11932.64	0.27	10428.09	0.24	21246.86	0.49	
1104.00	4.00	3789.35	15721.99	0.36	13827.32	0.32	35074.18	0.81	
1105.00	5.00	25835.70	41557.69	0.95	28639.84	0.66	63714.02	1.46	
1106.00	6.00	33473.17	75030.86	1.72	58294.28	1.34	122008.29	2.80	
1107.00	7.00	15793.75	90824.61	2.09	82927.74	1.90	204936.03	4.70	NWL
1108.00	8.00	15105.34	105929.95	2.43	98377.28	2.26	303313.31	6.96	
1109.00	9.00	16668.77	122598.72	2.81	114264.34	2.62	417577.64	9.59	
1110.00	10.00	18664.06	141262.78	3.24	131930.75	3.03	549508.39	12.61	
1111.00	11.00	19439.28	160702.06	3.69	150982.42	3.47	700490.81	16.08	
1111.50	11.50	9903.62	170605.68	3.76	82826.94	1.90	783317.75	17.98	T.O.D.

CONTOUR ELEVATION (FT)	CONTOUR AREA (AC)	CUMULATIVE VOLUME, AVG. END (AC-FT)
1100	0.05	0.00
1101	0.12	0.09
1102	0.20	0.25
1103	0.27	0.49
1104	0.36	0.81
1105	0.95	1.46
1106	1.72	2.80
1107	2.09	4.70
1108	2.43	6.96
1109	2.81	9.59
1110	3.24	12.61
1111	3.69	16.08
1111.5	3.76	17.98

EROSION AND SEDIMENT DELIVERY WORKFLOW
CAR853313A - NUTRIENT REDUCING WETLAND
CARROLL COUNTY, IOWA
PREPARED BY: NATHAN BLANKMAN 4/25/2021

Drainage Area	317.39	AC	
Storage Capacity at Principal Spillway Elevation	3.68	AC-FT	
Average Annual Runoff	5.8	IN	USGS ATLAS HA-212
Average Annual Inflow Volume	153.41	AC-FT	
Ratio: Capicity/Inflow	0.02		
Trap Efficiency	95	%	Brune 1953
Average Annual Sheet & Rill Erosion	5	TN/AC/YR	WSS T-Factor
Depressional area not subject to sediment delivery	137.57	AC	Aerial Imagery and Land Slopes
Area subject to sheet and rill erosion	179.82	AC	
Average annual sheet erosion	899.1	TN/YR	
Delivery Ratio	7.5	%	NRCS Erosion & Sediment Delivery Chart -1
Sheet and Rill Erosion Delivered to Site	67.4325	TN/YR	
Adjustment for LRA 103	1.3		Rohlf 2003
Adjusted Sheet erosion (100% Delivered)	87.66225	TN/YR	
Average Annual Gully Erosion	0.156	FT^3/FT	NRCS Erosion & Sediment Delivery
Length of Gully Erosion	3082	FT	Estimated for 2019 spring aerial
In-Place Density of gully material	80	PCF	Estimate at 85% of SPD of typical CL
Average annual gully erosion (100% Delivered)	19.23168	TN/YR	
Total Sediment Delivered	106.9	TN/YR	
Total Sediment Trapped	101.5	TN/YR	
Above Pool Accretion	20	%	Small Structures Sedimentation.xlsx
Above Pool Accretion	20.3	TN/YR	
Below Pool Accretion	80	%	Small Structures Sedimentation.xlsx
Below Pool Accretion	81.2	TN/YR	
Suspended Sediment Density	1300	TN/AC-FT	NEH-Section 3 Chapter 8
Below Pool Accreation	0.06	AC-FT/YR	
Estimated Sediment Life	***58.9***	***Years***	

USER INPUT

Curve Number Calculations

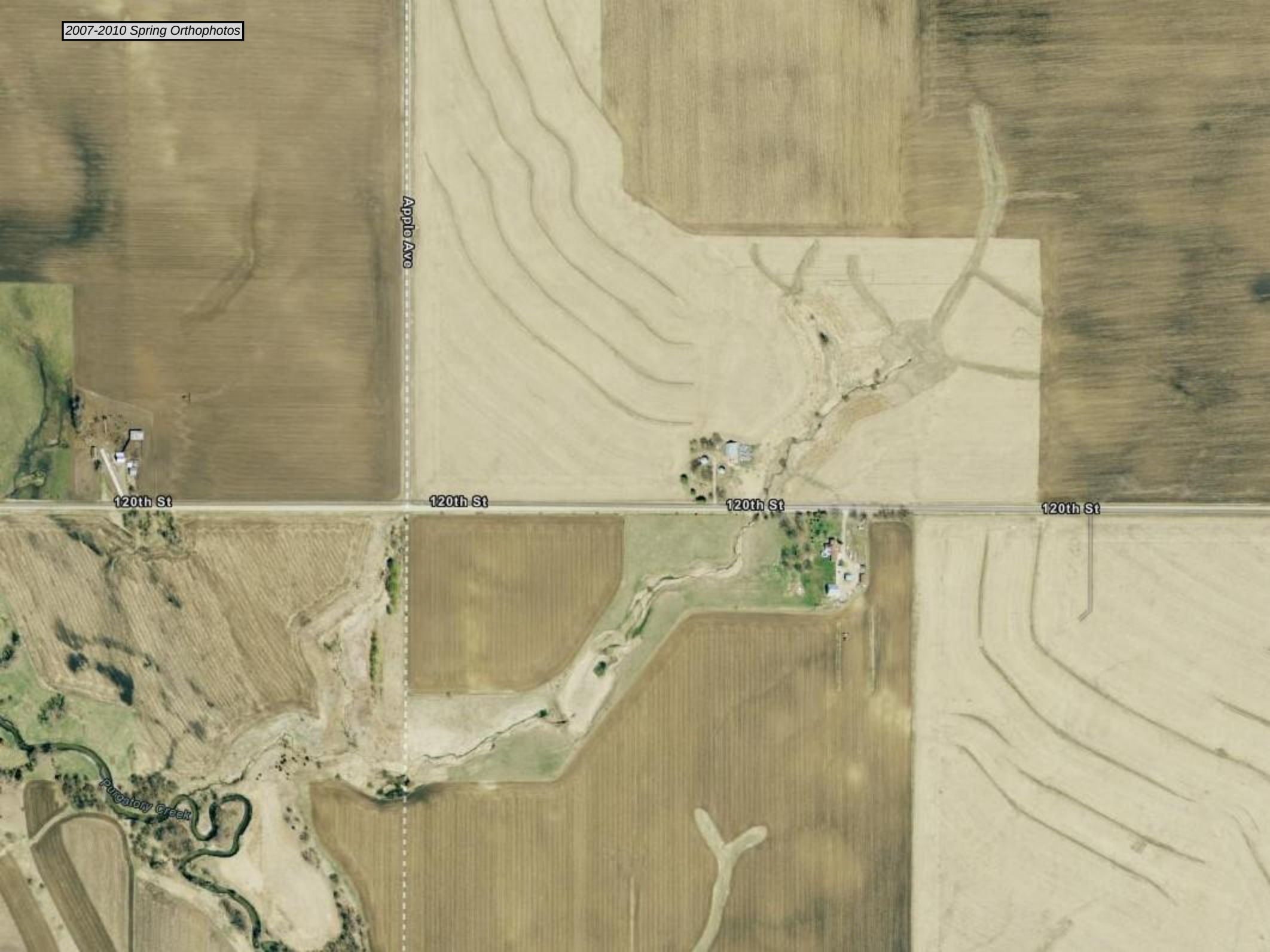
Cover Description	Map Unit	Hydrologic Soil Group	Area	CN	Area*CN
Straight Row Crop	55	C/D	42.39591	89	3773.236
Straight Row Crop	108	B	12.81188	78	999.3263
Straight Row Crop	108C2	B	2.03618	78	158.822
Brush - brush-weed-grass mixture with brush the major element - Fair Condition	108	B	3.255257	56	182.2944
Brush - brush-weed-grass mixture with brush the major element - Fair Condition	108C2	B	5.180647	56	290.1163
Meadow	135	C/D	6.436455	71	456.9883
Straight Row Crop	138B	C	41.76601	85	3550.111
Meadow	138B	C	1.067355	71	75.78223
Straight Row Crop Contoured & Terraced	203	B/D	3.886283	81	314.7889
Straight Row Crop	203	B/D	5.083678	89	452.4473
Straight Row Crop	L62G	B	0.301791	78	23.53967
Straight Row Crop	107	C/D	30.81387	89	2742.434
Meadow	107	C/D	3.814096	78	297.4994
Straight Row Crop	138B2	C	26.77585	85	2275.947
Straight Row Crop	138C	B	1.621947	78	126.5118
Meadow	138C	B	1.789922	58	103.8155
Farmsteads - buildings, lanes, driveways, and surrounding lots	138C	B	1.492792	74	110.4666
Straight Row Crop	138C2	B	18.39553	78	1434.852
Meadow	138C2	B	2.505326	58	145.3089
Farmsteads - buildings, lanes, driveways, and surrounding lots	138C2	B	2.04736	74	151.5046
Meadow	138D2	B	9.894812	58	573.8991
Straight Row Crop	507	C/D	14.90721	89	1326.742
Meadow	585B	C/D	1.650402	78	128.7313
Straight Row Crop Contoured & Terraced	638C2	B	11.88923	70	832.2463
Straight Row Crop Contoured & Terraced	638D2	B	5.562649	70	389.3854
Straight Row Crop	L62E2	B	1.645902	78	128.3804
Straight Row Crop	L138B	B	4.929006	78	384.4625
Straight Row Crop	L138C2	B	2.057564	78	160.49
Meadow	L138B	B	2.030073	58	117.7443
Meadow	L138C2	B	10.29731	58	597.2442
Straight Row Crop Contoured & Terraced	55	C/D	28.75675	81	2329.297
Straight Row Crop Contoured & Terraced	138B	C	4.756141	78	370.979
Straight Row Crop Contoured & Terraced	138B2	C	17.05794	78	1330.52
Straight Row Crop Contoured & Terraced	138C2	B	4.138659	70	289.7062
Water	W		1.112133		
Totals			334.1639		

CN Weighted Average
79.67831592

	HSG B	HSG C	HSG D
CN	69.3093	83.16631	85.82666
Acre	103.8838	91.4233	137.7447

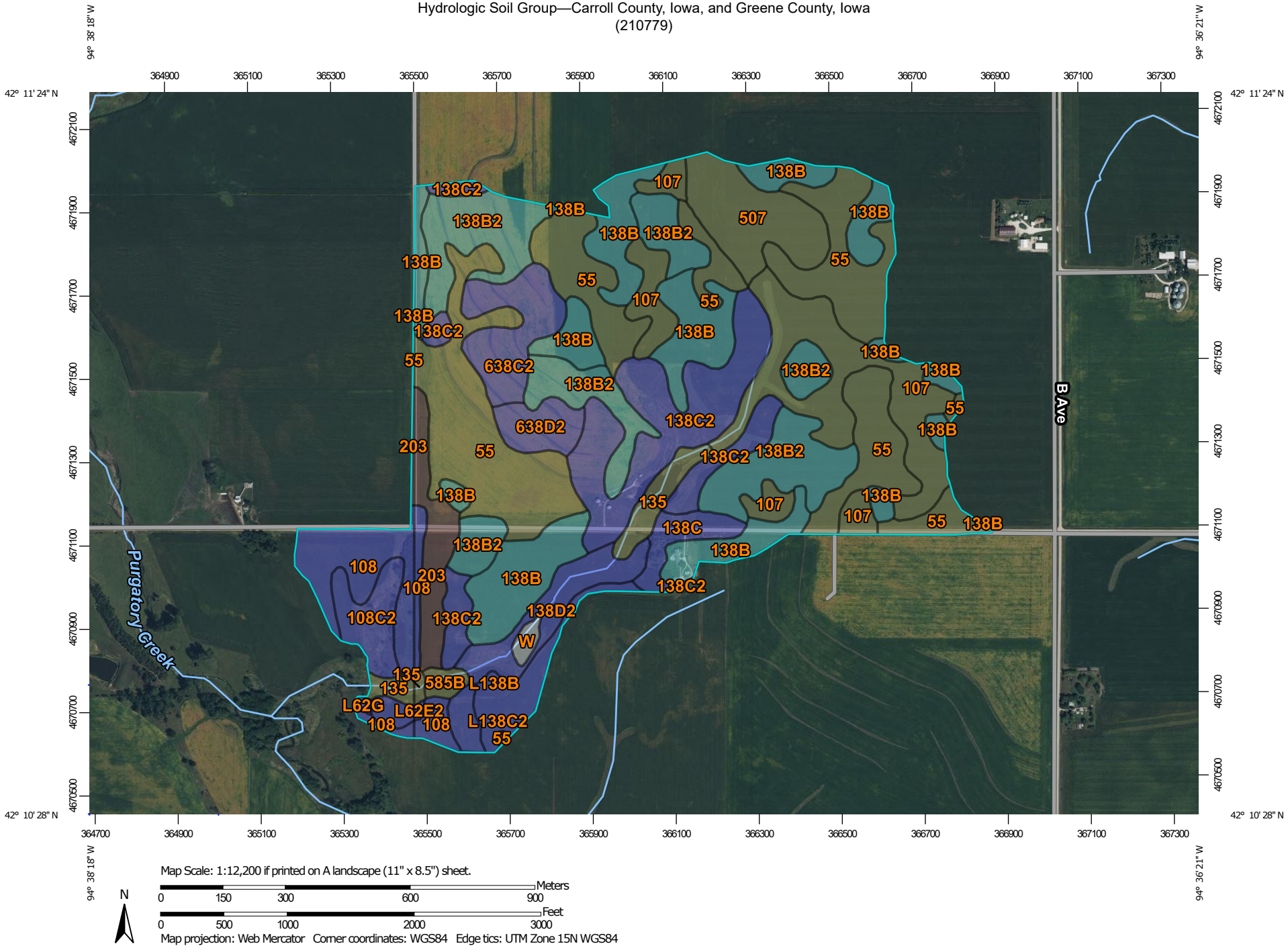

1960s Orthophotos
Apple Ave
120th St
120th St
120th St
120th St
Purgatory Creek


1990s Orthophotos
Apple Ave
120th St
120th St
120th St
120th St
Purgatory Creek


2007-2010 Spring Orthophotos
Apple Ave
120th St
120th St
120th St
120th St
Pumpkin Creek


2016-2018 Spring Orthophotos
Apple Ave
120th St
120th St
120th St
120th St
120th St
Purgatory Creek
Purgatory Creek

Hydrologic Soil Group—Carroll County, Iowa, and Greene County, Iowa
(210779)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Carroll County, Iowa
Survey Area Data: Version 27, Sep 2, 2022

Soil Survey Area: Greene County, Iowa
Survey Area Data: Version 28, Sep 2, 2022

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 5, 2021—Oct 14, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
55	Nicollet clay loam, 1 to 3 percent slopes	C/D	0.1	0.0%
108	Wadena loam, 0 to 2 percent slopes	B	12.8	3.8%
108C2	Wadena loam, 6 to 12 percent slopes, moderately eroded	B	7.2	2.1%
135	Coland clay loam, 0 to 2 percent slopes, occasionally flooded	C/D	1.6	0.5%
138B	Clarion loam, 2 to 6 percent slopes	C	0.0	0.0%
203	Cylinder loam, 0 to 2 percent slopes	B/D	0.4	0.1%
L62E2	Storden loam, Bemis moraine, 10 to 22 percent slopes, moderately eroded	B	1.4	0.4%
L62G	Belview loam, Bemis moraine, 22 to 40 percent slopes	B	0.3	0.1%
Subtotals for Soil Survey Area			**23.9**	**7.1%**
Totals for Area of Interest			**338.9**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
55	Nicollet clay loam, 1 to 3 percent slopes	C/D	71.6	21.1%
107	Webster clay loam, 0 to 2 percent slopes	C/D	34.8	10.3%
108	Wadena loam, 0 to 2 percent slopes	B	4.0	1.2%
135	Coland clay loam, 0 to 2 percent slopes, occasionally flooded	C/D	4.9	1.5%
138B	Clarion loam, 2 to 6 percent slopes	C	50.6	14.9%
138B2	Clarion loam, 2 to 6 percent slopes, moderately eroded	C	45.0	13.3%
138C	Clarion loam, 6 to 10 percent slopes	B	5.0	1.5%
138C2	Clarion loam, 6 to 10 percent slopes, moderately eroded	B	35.8	10.6%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
138D2	Clarion loam, 9 to 14 percent slopes, moderately eroded	B	9.4	2.8%
203	Cylinder loam, 0 to 2 percent slopes	B/D	8.8	2.6%
507	Canisteo clay loam, 0 to 2 percent slopes	C/D	14.9	4.4%
585B	Coland-Spillville complex, 1 to 5 percent slopes	C/D	1.7	0.5%
638C2	Clarion-Storden complex, 6 to 10 percent slopes, moderately eroded	B	12.1	3.6%
638D2	Omsrud-Storden complex, 10 to 16 percent slopes, moderately eroded	B	5.6	1.7%
L62E2	Storden loam, Bemis moraine, 10 to 22 percent slopes, moderately eroded	B	0.2	0.1%
L138B	Clarion loam, Bemis moraine, 2 to 6 percent slopes	B	7.0	2.1%
L138C2	Clarion loam, Bemis moraine, 6 to 10 percent slopes, moderately eroded	B	2.4	0.7%
W	Water		1.2	0.3%
Subtotals for Soil Survey Area			**315.0**	**92.9%**
Totals for Area of Interest			**338.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Cut/Fill Report

Generated: 2024-08-05 08:11:41

By user: nblankman

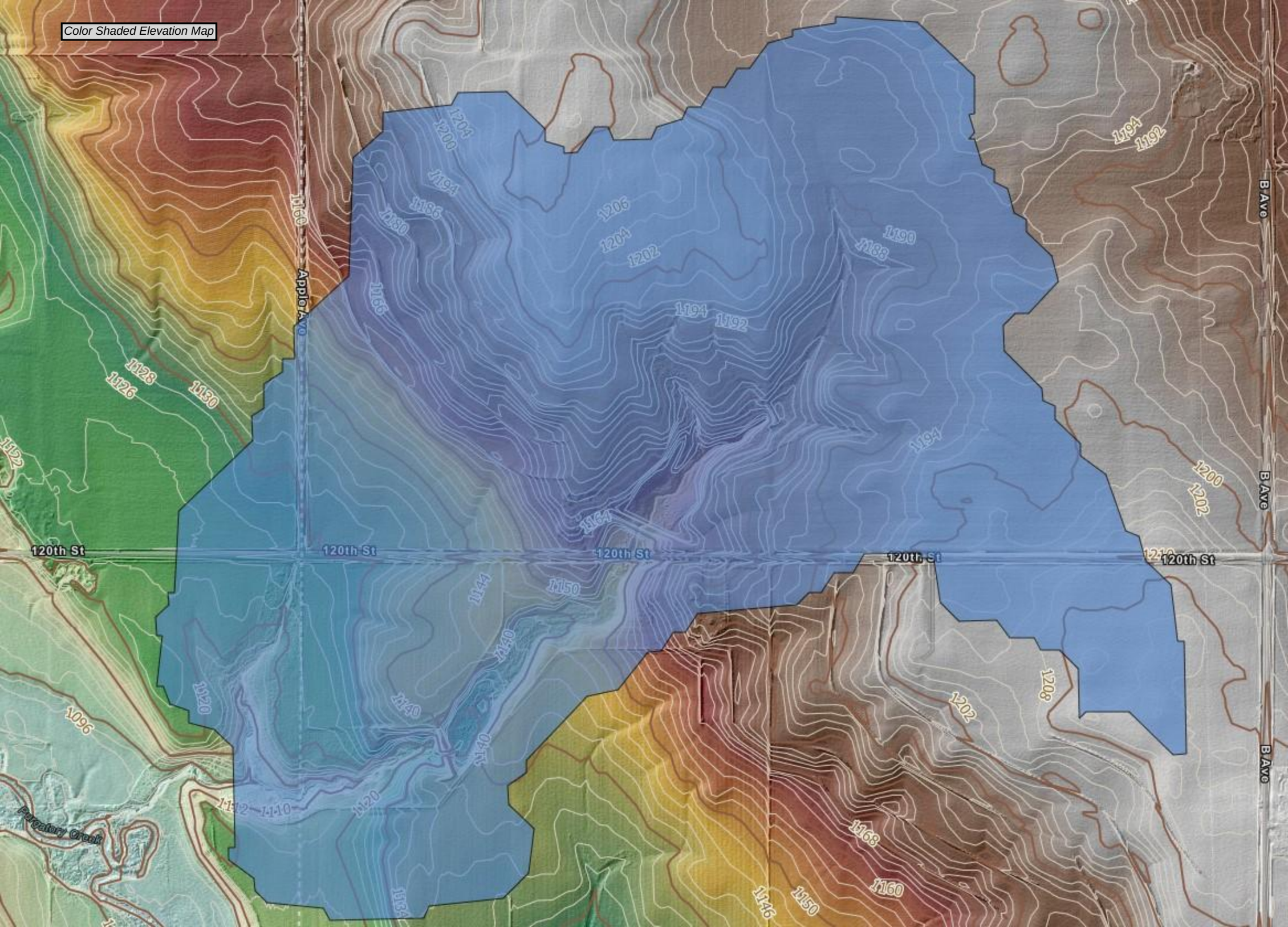
Drawing: J:\Projects\210779.18 - IDALS Carroll County Breakpoint Nutrient Reduction Wetlands - CAR853313A\7 Design\2 Drawings\Base\J:\Projects\210779.18 - IDALS Carroll County Breakpoint Nutrient Reduction Wetlands - CAR853313A\7 Design\2 Drawings\Base\R-210779.18-Grading.dwg

Volume Summary

Name	Type	Cut Factor	Fill Factor	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
vol-deep pool fill n	full	1.000	1.000	6953.57	0.12	455.23	455.11<Fill>
vol-wetland extension	full	1.000	1.000	28665.04	3378.69	0.00	3378.68<Cut>
VOL - CORE TRENCH	full	1.000	1.000	4992.03	587.73	0.00	587.73<Cut>
VOL-DAM	full	1.000	1.000	21968.54	151.35	2489.08	2337.73<Fill>
vol-borrow	full	1.000	1.000	106254.32	5026.22	0.62	5025.59<Cut>
Vol-Swale	full	1.000	1.000	8643.80	533.18	0.09	533.09<Cut>
vol-1100	full	1.000	1.000	2326.02	0.03	80.40	80.36<Fill>
vol-eg+trench compared to pg-dam	full	1.000	1.000	21968.54	0.00	0.00	0.00<Cut>
vol-deep pool fill s	full	1.000	1.000	6309.42	0.06	313.41	313.34<Fill>
vol-const top	full	1.000	1.000	5846.46	0.00	117.88	117.88<Fill>

Totals				
	2d Area (Sq. Ft.)	**Cut** (Cu. Yd.)	**Fill** (Cu. Yd.)	**Net** (Cu. Yd.)
Total	213927.75	9677.37	3456.71	6220.66<Cut>

* Value adjusted by cut or fill factor other than 1.0


Color Shaded Elevation Map
120th St
120th St
120th St
120th St
120th St
Apple Ave
B Ave
B Ave
B Ave
Purgatory Creek