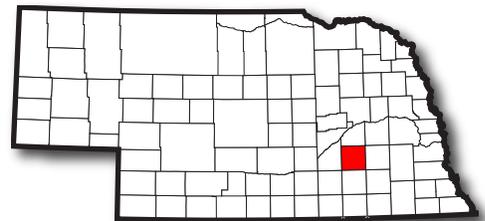


Floodplain Study



York County, Nebraska and Incorporated Areas



NEBRASKA
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Department of Economic Development

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November 2011

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**FLOODPLAIN STUDY
YORK COUNTY, NEBRASKA
NEBRASKA DEPARTMENT OF NATURAL RESOURCES
November 2011**

I. PURPOSE OF STUDY

The purpose of this study was to update and revise the approximate 1-percent annual chance floodplain boundaries for the geographic area of York County using new Light Detection And Ranging (LiDAR) (Reference 1) and Aerial Photography (Reference 2). The study was based on approximate methods as approved by Federal Emergency Management Agency (FEMA) and prepared according to the FEMA Guidelines and Specifications for Flood Hazard Mapping Partners. The study has produced Work Maps, which are intended to be accepted and published by FEMA as the digital flood insurance rate maps (DFIRMs) in the future.

The hydrologic and hydraulic analyses for the approximate 1-percent annual chance floodplain were performed by the Nebraska Department of Natural Resources (NDNR) in cooperation with the Nebraska Department of Economic Development (NDED). It was done under the authority of Nebraska's Revised Statutes, which gives the NDNR the power and authority to provide local governments having jurisdiction over flood-prone lands with technical data and maps adequate to develop or support reasonable floodplain management regulation.

II. AREA STUDIED

This floodplain study covers the geographic area of York County, Nebraska, including the Cities of Henderson and York, the Villages of Benedict, Bradshaw, Gresham, Lushton, McCool Junction, Thayer, and Waco, and the unincorporated area of York County (referred to collectively herein as York County). The scope and methods of study were proposed to and agreed upon by NDNR, the communities, and the NDED.

The approximate analyses were used to study those areas having low development potential or minimal flood hazards. For this study NDNR revised and updated the hydrologic and hydraulic analyses for all approximate studies using new LiDAR and Aerial photography.

Existing detailed studies for the City of York, as described in the 1978 City of York FIS Report, were also incorporated (Reference 3). These floodplain boundaries were digitized from the existing effective maps and incorporated into the new working maps. These areas were selected with priority given to all known flood hazards and areas of projected development or proposed construction until 1977. The Floodway Data Tables for these studies are provided in Exhibit 1. The limits of detailed studies are also indicated on the Flood Profiles (Exhibit 2) and on the Work Maps (Exhibit 3).

III. HYDROLOGY

A. APPROXIMATE STUDIES

Approximate analyses were performed on all streams within York County that contained at least one square mile of drainage area and did not have a detailed study. The 1-percent annual chance discharges for these reaches were developed from the Strahm and Admiraal Regression Equations (Reference 4) by NDNR. The Strahm and Admiraal Equations (Reference 4) were selected after a regression comparison analysis was performed on the four sets of Nebraska Regression Equations. These equations were from published studies of flow frequency in Nebraska and include Strahm and Admiraal (Reference 4), Soenksen (Reference 5), Cordes and Hotchkiss (Reference 6), and Beckman (Reference 7). The four sets were evaluated based on the equations' reliability, sensitivity, and applicability. The equations were also compared to a discharge-frequency relationship developed using Water Resources Council Bulletin 17B (Reference 8) procedures.

The approximate analysis was performed using the NDNR N-FACT tool (Reference 9). The N-FACT tool uses a Digital Elevation Model (DEM) to calculate the regression equation parameters such as drainage area and stream lengths. N-FACT then plugs these parameters into the regression equation to come up with the 1-percent annual chance discharges.

B. DETAILED STUDIES

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community. Please refer to the 1978 City of York FIS Report (Reference 3) for more information. The following is an excerpt from the 1978 City of York FIS Report:

The frequency-discharge information for Beaver Creek was computed by utilizing regional information developed by Emil Beckman of the U.S. Geological Survey (USGS) for the State of Nebraska (Reference 7) and the Natural Resources Conservation Service (NRCS and formerly SCS) Computer Program TR-20 (Reference 10). A discharge was selected based on information for both methods. Frequency discharge information for Tributaries A, B, C, D, E, and York Ditch were calculated by the same method.

The peak discharge-drainage area relationships for York County provided by the 1978 City of York FIS Report are given in Table 1 - Summary of Discharges (Reference 3).

TABLE 1 - SUMMARY OF DISCHARGES

<u>Flooding Source and Location</u>	<u>Drainage Area (Square Miles)</u>	<u>Peak Discharges (cubic feet per second)</u>			
		<u>10-Percent-Annual-Chance</u>	<u>2-Percent-Annual-Chance</u>	<u>1-Percent-Annual-Chance</u>	<u>0.2-Percent-Annual-Chance</u>
BEAVER CREEK At County Road 15.5 miles above the mouth	133	4,065	7,755	9,374	17,185
TRIBUTARY A At the mouth	1.6	560	1,075	1,300	2,390
Main Avenue	0.6	260	440	523	780
TRIBUTARY B At the mouth	2.3	997	1,865	2,231	4,090
TRIBUTARY C At the mouth	1.7	552	1,070	1,298	2,380
YORK DITCH Nobes Road	0.24	246	325	350	430

IV. HYDRAULIC ANALYSIS

A. APPROXIMATE STUDIES

For approximate areas, the NDNR N-FACT tool is used to compute the flood elevations using the normal depth method (Reference 9). NDNR N-FACT tool then makes a 1-percent annual chance water surface that can be compared to the LiDAR surface to create the new floodplain boundary.

B. DETAILED STUDIES

The detailed studies of the Beaver Creek, Tributary A, Tributary B, Tributary C were performed with the U.S. Army Corps of Engineers’ HEC-2 program (Reference 11), and have not changed since the 1978 City of York FIS Report. Portions of Tributary A, and all of York Ditch were studied via LOMR effective August 27, 2009 (Reference 12). They were not re-studied in this floodplain study for York County. The floodway data tables and the flood profiles were from the 1978 City of York FIS Report (Reference 3) and are presented in Exhibits 1 and 2. For further information please refer to the 1978 City of York FIS Report (Reference 3) or the LOMR dated August 27, 2003 (Reference 12).

The profile baselines depicted on the Work Map represent the hydraulic modeling baselines that match the flood profiles in this floodplain study. As a result of improved

topographic data, the profile baseline in some cases, may deviate significantly from the channel centerline or appear outside the 1-percent-annual-chance floodplain boundary.

V. VERTICAL DATUM

All flood elevations shown in this floodplain study are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that the current effective FIRM panels and FIS are in NGVD29, and adjacent communities may also be referenced to NGVD29. This may result in differences in Base Flood Elevations (BFEs) across the corporate limits between the communities. The average conversion factor that was used to convert the data in this floodplain study to NAVD88 was calculated using the U.S. Army Corps of Engineers' Corpcon program (Reference 13). The data points used to determine the conversion are listed in Table 2.

TABLE 2 - VERTICAL DATUM CONVERSION

<u>Quad Name</u>	<u>Corner</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Conversion from NGVD29 to NAVD88</u>
Waco	NE	41.000	-97.375	0.620
York North	NE	41.000	-97.500	0.643
Bradshaw	NE	41.000	-97.625	0.669
Henderson NE	NE	41.000	-97.750	0.719
Utica SW	NE	40.875	-97.375	0.623
York South	NE	40.875	-97.500	0.646
York SW	NE	40.875	-97.625	0.679
Henderson	NE	40.875	-97.750	0.719
Exeter	NE	40.750	-97.375	0.584
Fairmont	NE	40.750	-97.500	0.604
Grafton	NE	40.750	-97.625	0.617
Bixby	NE	40.750	-97.750	0.686
			Average:	0.651

For more information on NAVD88, see the FEMA publication entitled Converting the National Flood Insurance Program to the North American Vertical Datum of 1988 (Reference 14), or contact the Vertical Network Branch, National Geodetic Survey, Coast and Geodetic Survey, National Oceanic and Atmospheric Administration, Silver Spring, Maryland 20910 (Internet address <http://www.ngs.noaa.gov>).

VI. FLOOD BOUNDARY

The 1-percent-annual-chance flood has been adopted as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. The delineated floodplain boundaries are available as either paper Work Maps or as GIS shapefiles on a CD.

For each stream studied by detailed methods, the 1- and 0.2-percent-annual-chance floodplain boundaries have been digitized off of the current effective FIRM panels. See Table 3 below for effective dates. All approximate areas have been redelineated by methods mentioned above. The digitized portions have been incorporated with the new 1-percent-annual-chance floodplain boundaries on the Work Maps. Please find the community and their current effective panel dates listed in Table 3.

TABLE 3 - CURRENT FIRM PANEL EFFECTIVE DATES

<u>Community</u>	<u>Community #</u>	<u>Panels</u>	<u>Effective Date</u>
Benedict	310250	310250A	12/01/2001
Henderson	310378	310378A	09/04/1986
McCool Junction	310236	0005A	09/04/1987
Waco	N/A	N/A	N/A
York, City of	310237	0005B, 0010B	09/29/1978
York County	310486	0001B, 0002B, 0003B, 0004B, 0005B	09/01/1986

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the Work Map (Exhibit 3). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

VII. BIBLIOGRAPHY AND REFERENCES

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EXHIBIT 1 – FLOODWAY DATA TABLES

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BEAVER CREEK								
A	81840	411	2700	3.47	1567.2	1567.2	1568.0	0.8
B	81893	75	903	10.37	1567.2	1567.2	1568.1	0.9
C	82104	347	3053	3.07	1569.2	1569.2	1569.7	0.5
D	83318	381	2465	3.80	1569.9	1569.9	1570.4	0.5
E	87226	260	1884	4.98	1574.0	1574.0	1574.3	0.3
F	91027	566	3467	2.70	1577.0	1577.0	1577.4	0.4
G	91080	190	948	9.89	1577.0	1577.0	1577.4	0.4
H	91344	730	5817	1.61	1578.5	1578.5	1579.5	1.0
I	93298	308	2251	4.16	1579.1	1579.1	1580.0	0.9
J	101746	278	2808	3.34	1583.9	1583.9	1584.6	0.7
K	105389	224	1503	6.24	1586.3	1586.3	1587.2	0.9
L	109190	893	4453	2.11	1589.4	1589.4	1590.4	1.0
M	119962	750	2554	3.67	1589.4	1589.4	1590.4	1.0
N	110352	917	5155	1.82	1590.2	1590.2	1591.2	1.0
O	112411	102	1063	8.82	1590.5	1590.5	1591.5	1.0
P	113362	1080	10576	0.89	1591.8	1591.8	1592.8	1.0
Q	115157	474	2787	3.36	1592.0	1592.0	1593.0	1.0
R	115526	101	1202	7.80	1592.2	1592.2	1593.0	0.8
S	115896	715	3222	2.91	1593.5	1593.5	1594.5	1.0
T	116952	237	2507	3.74	1594.5	1594.5	1595.3	0.8
U	118114	854	6229	1.46	1595.0	1595.0	1595.9	0.9
V	118219	267	2725	3.34	1595.2	1595.2	1596.1	0.9
W	119434	521	5589	1.63	1596.8	1596.8	1597.8	1.0
X	122179	313	3306	2.75	1597.9	1597.9	1598.9	1.0
Y	125242	299	2634	3.45	1600.0	1600.0	1600.9	0.9
Z	126456	297	3387	2.68	1600.5	1600.5	1601.4	0.9

¹Feet above the mouth.

**TABLE
4**

NEBRASKA DEPARTMENT OF NATURAL RESOURCES

**YORK COUNTY, NE
AND INCORPORATED AREAS**

FLOODWAY DATA

BEAVER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BEAVER CREEK (CONTINUED)								
AA	128462	585	5260	1.73	1601.0	1601.0	1601.9	0.9
AB	133267	335	2011	4.52	1602.5	1602.5	1603.2	0.7
AC	138283	561	2537	3.58	1607.7	1607.7	1607.7	0.0
AD	140448	751	2392	3.80	1609.3	1609.3	1609.3	0.0
AE	140659	39	525	17.32	1609.3	1609.3	1609.3	0.0
AF	140765	1334	8794	1.03	1614.6	1614.6	1614.6	0.0
AG	143563	722	3738	2.43	1614.8	1614.8	1614.9	0.1
AH	146098	318	2401	3.79	1615.4	1615.4	1615.9	0.5

¹Feet above the mouth.

TABLE 4

NEBRASKA DEPARTMENT OF NATURAL RESOURCES

**YORK COUNTY, NE
AND INCORPORATED AREAS**

FLOODWAY DATA

BEAVER CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
TRIBUTARY A								
A	422	127	296	4.39	1579.1	1574.6 ²	1575.6 ²	1.0
B	1584	129	290	4.46	1581.8	1581.8	1581.8	0.0
C	3221	130	290	4.46	1589.1	1589.1	1589.6	0.5
D	3538	361	3980	0.32	1606.1	1606.1	1606.1	0.0
E	5333	250	945	1.19	1606.1	1606.1	1606.1	0.0
F	6125	176	237	3.99	1606.4	1606.4	1606.4	0.0
G	6336	42	117	8.12	1614.5	1614.5	1615.2	0.7
H	6442	256	1792	0.52	1615.3	1615.3	1616.3	1.0
I	7709	104	399	2.37	1615.3	1615.3	1616.3	1.0
J	8606	30	63	8.30	1617.7	1617.7	1618.2	0.5
K	8765	20	70	7.50	1619.8	1619.8	1620.5	0.7
L	9504	100	850	0.62	1630.0	1630.0	1630.0	0.0
M	10190	65	525	0.98	1633.9	1633.9	1633.8	0.1

¹Feet above the mouth.

²Elevation computed without consideration of backwater effects from Beaver Creek.

TABLE 4

NEBRASKA DEPARTMENT OF NATURAL RESOURCES

**YORK COUNTY, NE
AND INCORPORATED AREAS**

FLOODWAY DATA

TRIBUTARY A

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
TRIBUTARY B								
A	2798	105	484	4.60	1603.5	1603.5	1604.5	1.0
B	3062	166	723	3.09	1605.6	1605.6	1606.6	1.0
C	3590	169	794	2.81	1606.3	1606.3	1607.3	1.0
D	3854	303	1186	1.88	1607.9	1607.9	1608.3	0.4
E	4066	206	659	3.38	1608.1	1608.1	1608.4	0.3
F	4594	350	2423	0.52	1616.4	1616.4	1616.8	0.4
G	5597	292	977	1.29	1616.4	1616.4	1616.8	0.4
H	6494	113	362	3.49	1617.2	1617.2	1617.4	0.2
I	6917	8	73	17.15	1622.9	1622.9	1622.9	0.0

¹Feet above the mouth.

**TABLE
4**

NEBRASKA DEPARTMENT OF NATURAL RESOURCES

**YORK COUNTY, NE
AND INCORPORATED AREAS**

FLOODWAY DATA

TRIBUTARY B

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
TRIBUTARY C								
A	792	101	623	2.08	1598.9	1595.5 ²	1595.5 ²	0.0
B	1003	10	80	16.08	1598.9	1595.5 ²	1595.5 ²	0.0
C	1109	450	2300	0.57	1601.0	1601.0	1601.0	0.0
D	2798	128	192	6.74	1601.3	1601.3	1601.3	0.0
E	4013	145	365	3.54	1608.8	1608.8	1608.8	0.0
F	5069	119	208	5.56	1613.7	1613.7	1613.7	0.0
G	5386	186	816	1.41	1621.6	1621.6	1621.6	0.0
H	6970	78	134	7.56	1623.0	1623.0	1623.0	0.0
I	7181	8	63	16.01	1628.6	1628.6	1628.6	0.0

¹Feet above the mouth.

²Elevation computed without consideration of backwater effects from Beaver Creek.

TABLE 4

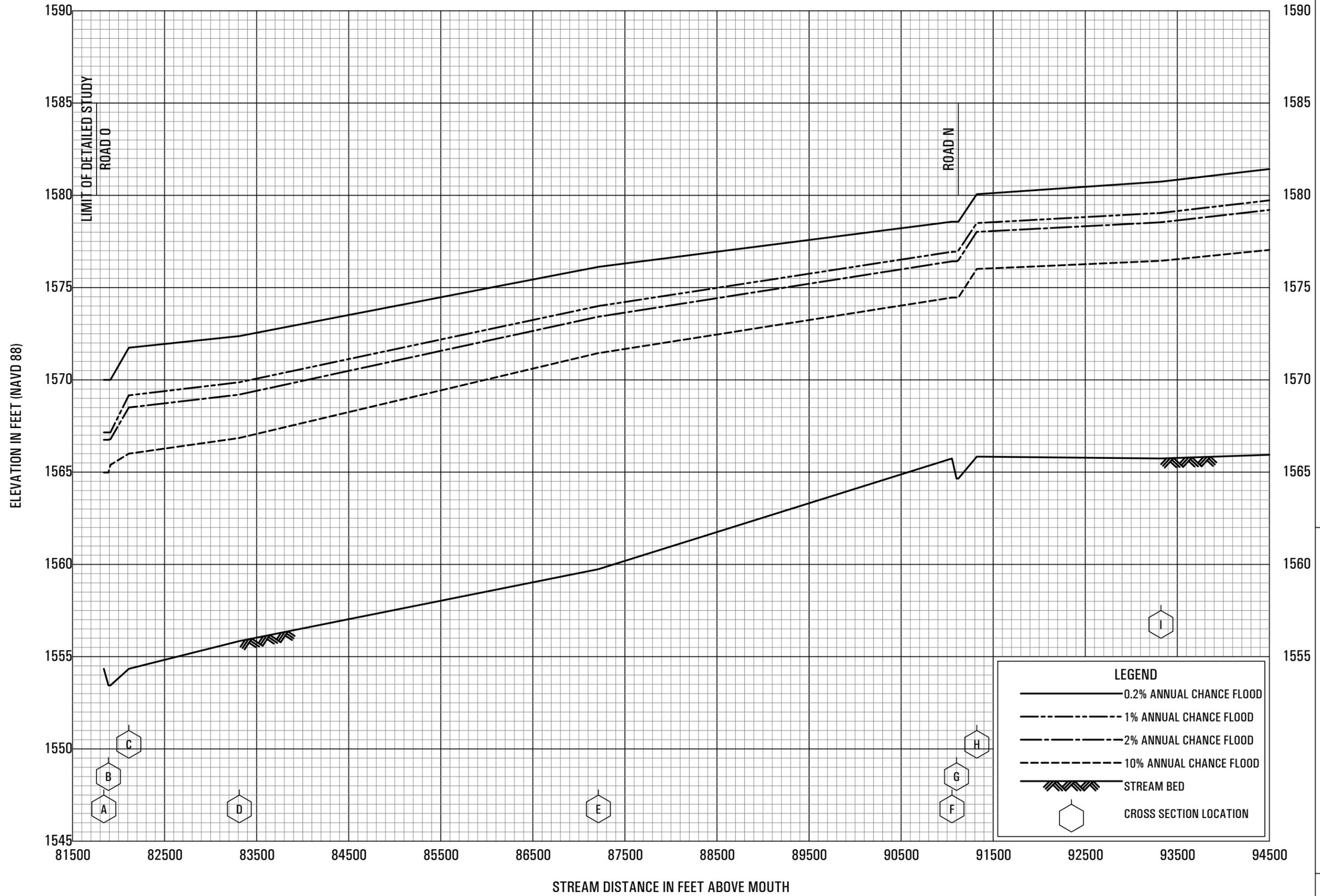
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**YORK COUNTY, NE
AND INCORPORATED AREAS**

FLOODWAY DATA

TRIBUTARY C

EXHIBIT 2 – FLOOD PROFILES

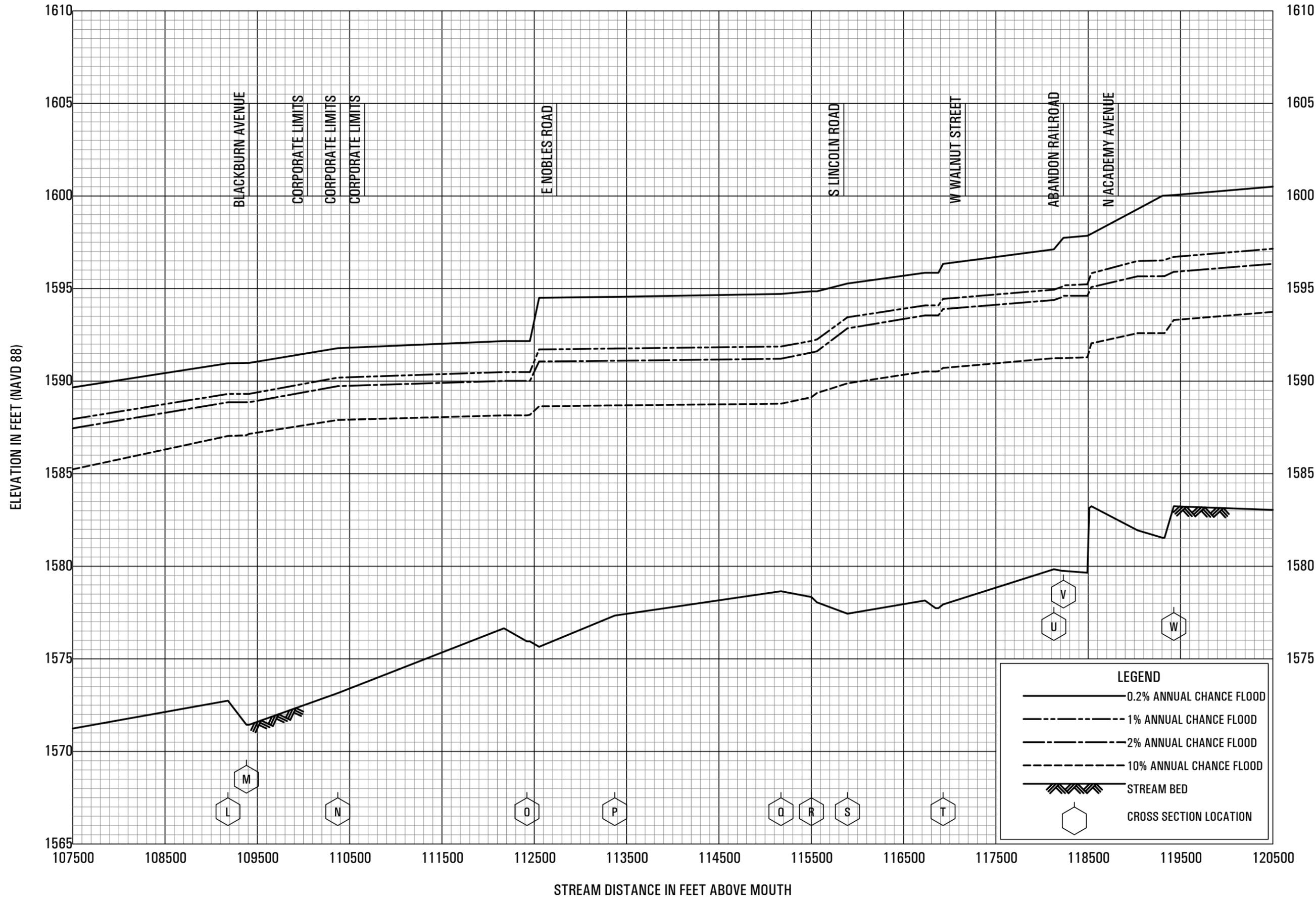


FLOOD PROFILES

BEAVER CREEK

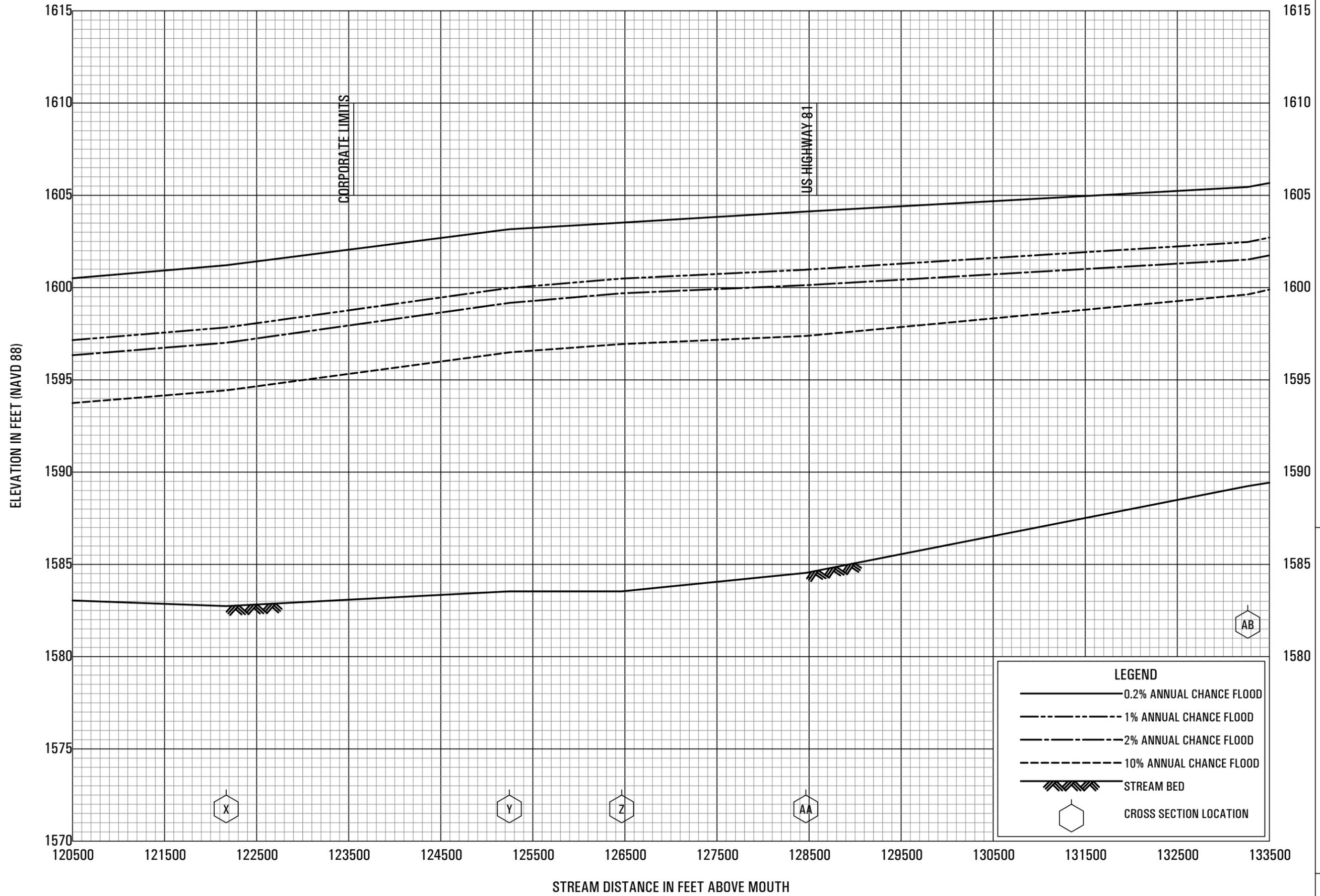
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YORK COUNTY, NE
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FLOOD PROFILES
BEAVER CREEK

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YORK COUNTY, NE
AND INCORPORATED AREAS

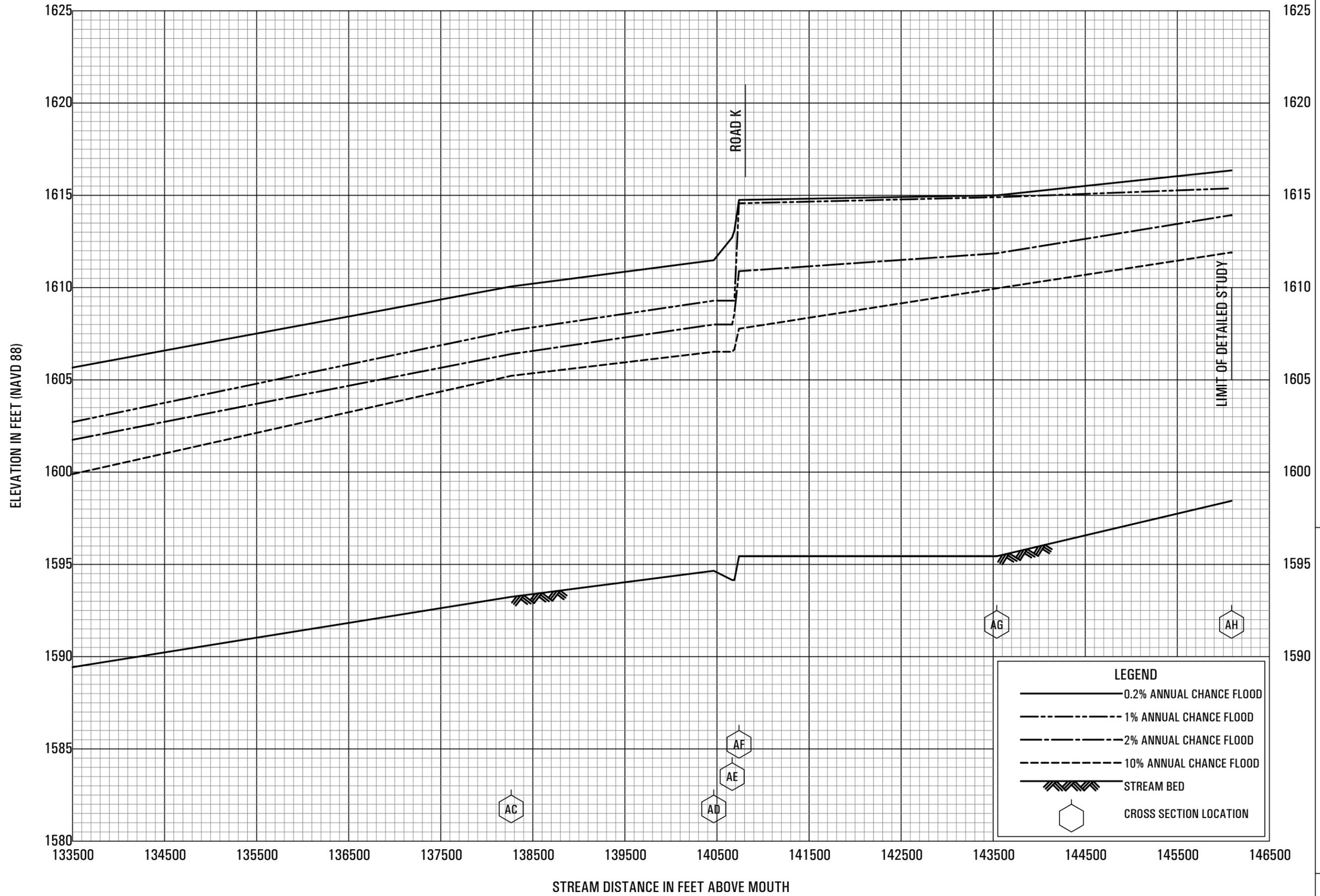


FLOOD PROFILES

BEAVER CREEK

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**YORK COUNTY, NE
AND INCORPORATED AREAS**

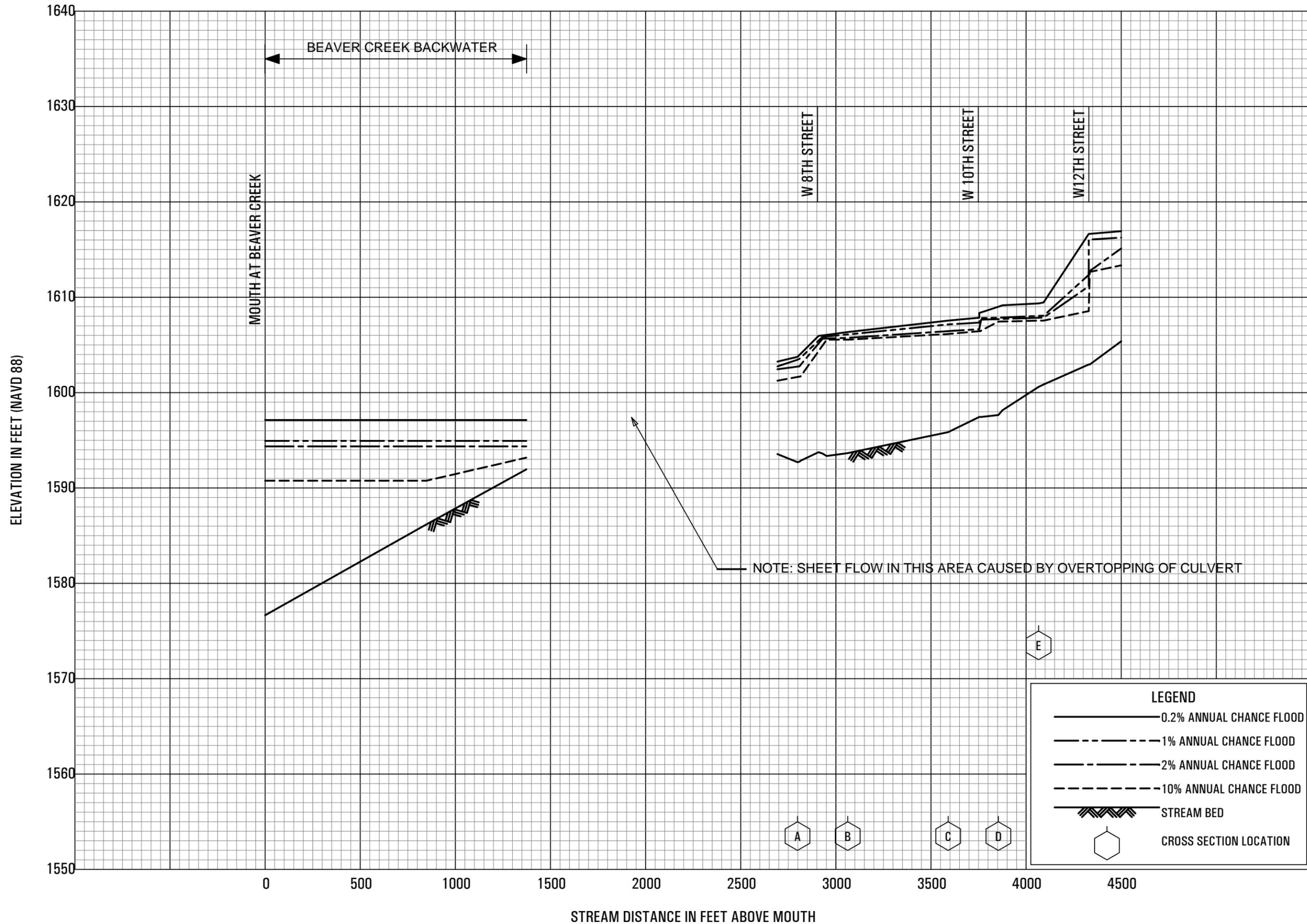


FLOOD PROFILES

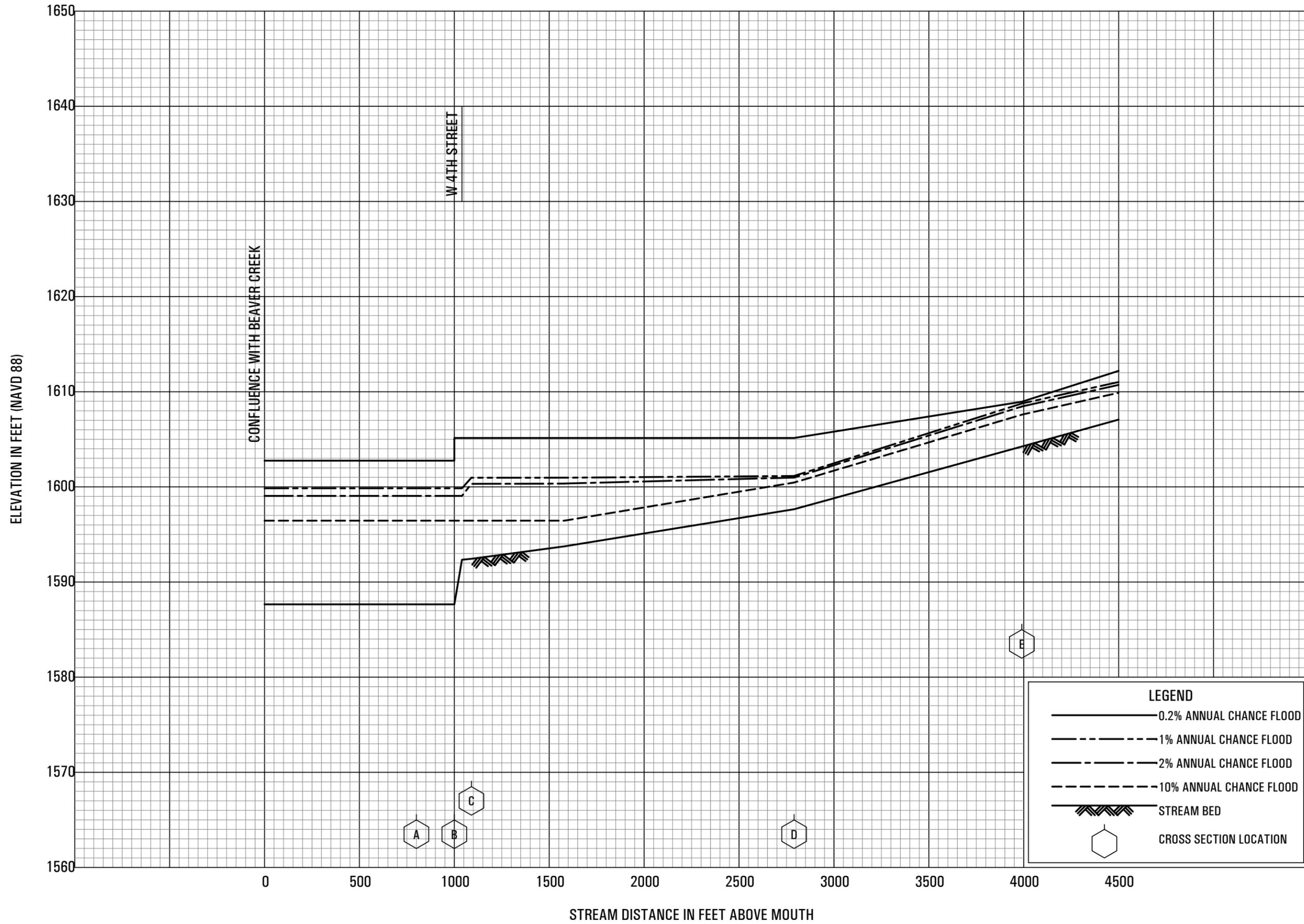
BEAVER CREEK

NEBRASKA DEPARTMENT OF NATURAL RESOURCES

YORK COUNTY, NE
AND INCORPORATED AREAS



FLOOD PROFILES
TRIBUTARY B
 NEBRASKA DEPARTMENT OF NATURAL RESOURCES
YORK COUNTY, NE
 AND INCORPORATED AREAS



FLOOD PROFILES
TRIBUTARY C

NEBRASKA DEPARTMENT OF NATURAL RESOURCES
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EXHIBIT 3 – WORK MAP INDEX