APPENDIX D - 6

Environmental Resources Memorandum

NORTH BRANCH FOREST RIVER DAM NO. 1 (BYLIN DAM)

Appendix D-6

Environmental Resources Memorandum

2022-05-10

Prepared on Behalf of:
Walsh County Water Resource District

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PURPOSE OF THIS MEMORANDUM

The purpose of this memorandum is to provide environmental data that is not already provided in the appendices of the environmental assessment document (see **EA Appendix D-7: Reservoir Sediments Characterization Memorandum**, **EA Appendix D-9: Aquatic Resources Report**, and **EA Appendix D-10: Biological Inventory Report**), to meet the requirements of the NRCS. The areas described in the memorandum include the three Areas of Interest (AOI, areas are shown in the memorandum exhibits) as follows:

1. the upstream subwatershed (Area 1),
2. the Upstream Assessment Area (U-AA) consisting of a stretch of river at the inlet of the reservoir, the reservoir and the dam, and a short stretch of the river at the outlet; and
3. the Downstream Assessment Area (D-AA) consisting of the subwatershed and the Forest River downstream of the dam to the confluence of the mainstem at Fordville, ND.

Text from the cooperative agreement detailing the environmental information to be reported for the environmental assessment:

> *Complete environmental evaluations as outlined in NWPM Parts 501.35 and 501.36, including (at a minimum); field determinations and mapping of onsite wetlands, establishing air and water quality conditions, identifying land use classifications, evaluation sediment delivery from cropland through the use of a Geographic Information System (GIS) based Revised Universal Soil Loss Equation (RUSLE) analysis, highly erodible cropland, characterization of fish and wildlife habitat/populations, identification of threatened and endangered species, and field characterization and evaluation of riparian areas and stream channel stability. Some of this information is/will be available as the results of the Forest River RCPP watershed planning effort.*
>
> *Complete laboratory analysis to evaluate reservoir contamination at a minimum of 2 locations in the reservoir…include arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPHs).*

GATHERED DATA

ECOREGION

The reservoir is located within the Drift Plains, a sub-region of the Northern Glaciated Plains while parts of the river downstream also pass through the Glacial Lake Agassiz Basin, a sub-region of the Lake Agassiz Plain (Bryce et al. 1998) (**Exhibit D-6-1: Ecoregions Map**).

The Northern Glaciated Plains ecoregion consists of transitional grasslands within a continental climate zone formed on recent glaciation. The landforms include drift plains, glacial lake basins, shallow river valleys, and deposits of rocks to sands. The drainage system is immature and supports numerous wetlands ranging from seasonal to permanent. Most of the land has been converted primarily to farmland, but historical vegetation ranged from tallgrass prairie to short grass prairie and wetland ecosystems. The Drift Plains sub-ecoregion was formed by retreating glaciers and the resulting undulating topography of thick glacial till. Prairie potholes located within the upstream watershed provide natural water management because of their ability to absorb rainfall and snow melt runoff.

The Lake Agassiz Glacial Plain is characterized by an extremely flat lake plain and gently rolling hills. The beach ridge is on the west and east sides of the lakebed. Historical vegetation included tallgrass prairie with many wetlands and shrubland and forests. The continental climate and the predominance of rich loamy soils supported tallgrass prairie until agriculture began to dominate from the mid-19th century. The Glacial Lake Agassiz Basin is characterized by the poorly defined floodplain of the Red River of the North. This ecoregion is extremely productive for agriculture, thus most of the wetlands and natural areas have been cultivated. Most of the region is covered by silt and clay deposits consistent with a lake bottom. Beach ridges scattered throughout the valley mark the former shoreline of the giant Lake Agassiz at various periods of time.

TOPOGRAPHY

Topography of the Forest River watershed is generally characterized by moderate slopes in the west (Nelson and western Walsh counties), which flatten in the east (Grand Forks and eastern Walsh counties). The valley rises 500 feet over a bedrock escarpment to mark the natural boundary of the Red River Valley (North Dakota Game and Fish Department 2016). Within the U-AA elevations range from 1,550 feet at the upstream end to 1,500 feet at the dam (NAVD 88) (**Exhibit D-6-2: LiDAR Derived Slope Map**). The D-AA consists of steep slopes along the North Branch Forest River until it intersects County Road 14 north of Lankin. From there, slopes gradually flatten to the east between Lankin and Fordville.

LAND USE

HEI scientists completed a field survey within the U-AA to describe the types and extent of human use of the land. **Figure D-6-1** shows the different categories of land use and the proportions of these uses**.** Of the total acres in the U-AA, 803 acres (84 %) are used for human activity (grassland, cropland, developed) and 8 % (excluding the open water of the reservoir) is relatively undisturbed. Keeping livestock is an important use of the land around the reservoir (**Exhibit D-6-3: Grazing Land Map**). There are two livestock operations around the reservoirs. One operation is located on the north and south sides of Bylin Reservoir (north 79.60 acres, south 85.06 acres, total approximately 164.7 acres). The other operation is located north along the length of Dougherty Reservoir and also on the eastern half of the south side (north 63.72 acres, south 65.92 acres, total approximately 129.6 acres). This area also includes a small portion of the southwestern side of Bylin Reservoir.

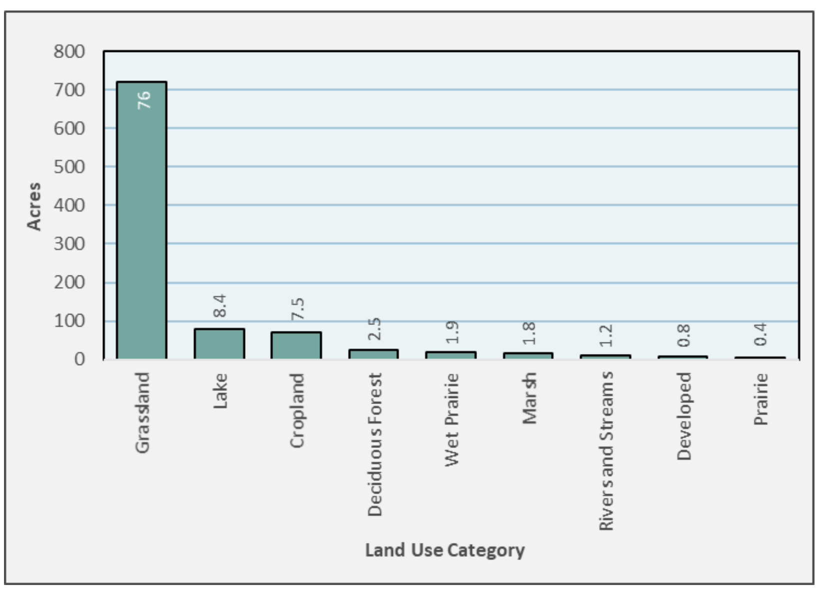


Figure D-6-1: Land use categories and proportions in the U-AA.

SURFACE GEOLOGY

The surface geology in the general area, being fine glacial sedimentary deposits, is moderately to highly erodible. This, in addition to the low-relief landscape, makes the area subject to meandering watercourses and substantial sediment movement to the Red River of the North. Several formations are present in the AOI; these consist of glacial till, clay, and shale sediments (Bryce et al. 1998) (**Exhibit D-6-4: Geologic Formations Map**). The Coleharbor formation, the most abundant in the AOI, is composed of lenses and beds of till, gravel, sand, silt, clay, and boulders and cobbles (Bluemle 1973). This formation has poorly integrated drainage, gentle slopes, potholes, and glacial outwash and lake plain areas. This formation makes up 78 % of the AOI. The U-AA is dominated by Pierre shale with lesser amounts of Coleharbor glacial till. The D-AA is composed of Pierre shale, Coleharbor glacial till, and Oahe clays.

The Pierre Formation is considered to be potentially fossiliferous in nearby areas (i.e., Cavalier County)(C. Boyd, North Dakota Geological Survey, pers. comm.). Mitigation for paleontological resources may include monitoring during construction in areas not already disturbed or that are consisting of vertical cuts of more than three feet.

SOIL RESOURCES

SOIL UNITS

Over the AOI there are a large variety of mapped units (US Department of Agriculture Natural Resources Conservation Service Soil Survey Staff 2020). They are predominantly loamy textured (**Exhibit D-6-5: Soil Texture Map**) and this reflects the underlying geologic units of glacial till (**Figure D-6-2**). Area 1 has a total of 32 different soil units, the most common of which are Barnes-Svea loams (30 %, 4,100 acres), Barnes-Buse loams (18 %, 2,400 acres), and Hamerly-Wyard loams (16 %, 2,100 acres). The U-AA is dominated by loamy soils and contains a total of 16 different soil units. The dominant soil unit, Kloten-Walsh-Edgeley loams consists of shallow, well-drained and moderately permeable soils on gently sloping to steep valley sides. The D-AA has a large variety of soil units (85 units), the most dominant being Barnes-Svea loams, deep, well-drained soils formed in loamy till on till plains and moraines.

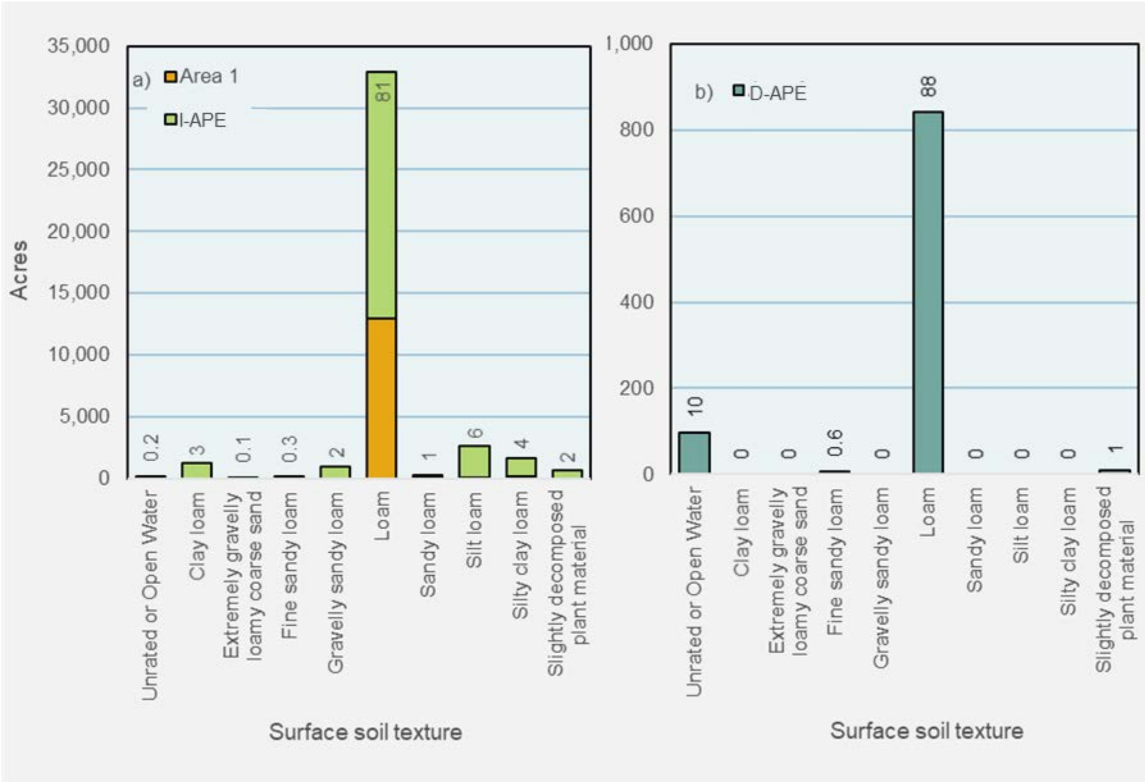


Figure D-6-2: Surface soil texture in Area 1, D-AA, and the U-AA. The values above the bars indicate the proportion of each increment out of the total area. Note different scale.

SOIL ERODIBILITY

The K-factor of a soil is an index of relative susceptibility to water erosion (US Department of Agriculture RUSLE Development Team 2001). The index values range between 0.02 to 0.64, with higher erosion potential at the higher values. High-clay soils and sandy soils tend to have low K-values, fine sandy loams typically have moderate values, and high-silt soils are the most erodible (US Department of Agriculture RUSLE Development Team 2001). The K-values for the AOI range from 0.1 to 0.37 (**Figure D-6-3**). Area 1 is dominated by soils with K-values between 0.1 and 0.3 (99 %, 13,000 acres). Area 2 is also dominated by soils with K-values between 0.1 and 0.3 (89 %, 24,300 acres), while 8 % of the land consists of soils with K-values between 0.3 and 0.4 (2,200 acres). These patterns reflect soil textures where the silty loam soils in the D-AA are more susceptible to erosion. The U-AA has predominantly soils that are moderately erodible, with 88 % of the soils having K-values of 0.2-0.3 (840 acres).

To estimate the potential for erosion of croplands in the region, we compared the available GIS data for tilled land in the Forest River watershed (US Department of Agriculture National Agricultural Statistics Service 2018) and the soil K-factor (the index of relative susceptibility to erosion (US Department of Agriculture RUSLE Development Team 2001). The index values in the AOI range between 0.02 and 0.37, but the majority of the area falls within the moderately-erodible category (93 %, 27,000 acres) (**Figure D-6-4**, **Exhibit D-6-6 – Soil Erodibility Map**). Within the U-AA, 99 % of the acres are moderately-erodible (0.2-0.3 K-factor). This means erosion and subsequent transport of soils into the Bylin reservoir are at a moderate level.

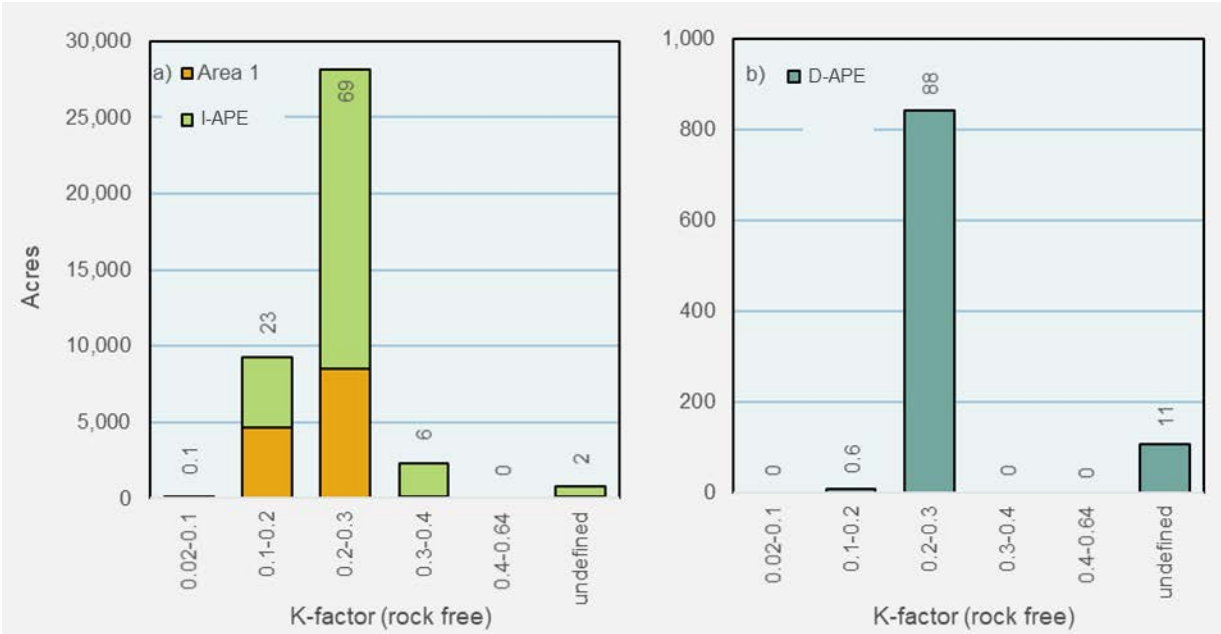


Figure D-6-3: Soil K-factor (rock free) in Area 1, D-AA, and U-AA. The values above the bars indicate the proportion of each increment out of the total area. Note different scale.

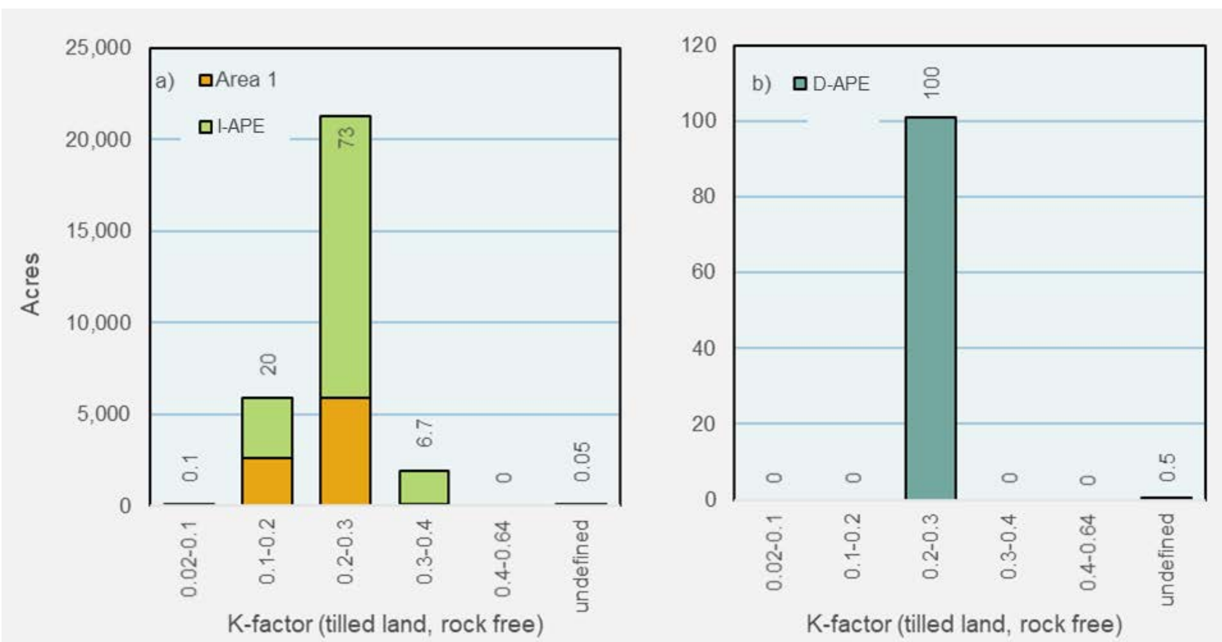


Figure D-6-4: Tilled cropland and relative susceptibility to erosion (K-factor) in Area 1, D-AA, and U-AA. The values above the bars indicate the proportion of each increment out of the total tilled area. Note different scale.

SOIL HYDRIC RATING

Hydric soils are saturated, flooded, or ponded long enough during a growing season to support the growth and regeneration of hydrophytic vegetation (US Army Corps of Engineers Environmental Laboratory 1987). The AOI is comprised of soils (includes open water) with both low and high hydric ratings (US Department of Agriculture Natural Resources Conservation Service Soil Survey Staff 2020) (**Exhibit D-6-7: Hydric Soils Map**)(**Figure D-6-5**). The soils in Area 1 are predominantly not hydric to slightly hydric, with 13 % cover in the higher hydric ratings reflecting the presence of wetlands on the landscape. The D-AA is covered with low-hydric rating soils, with only 3 % of the area covered by highly hydric soils. Most of the land in the U-AA (99 %, 750 acres), including open water, has soils with a low hydric rating of 0-32 %. The soils that are moderately hydric (range of 33-65 %) are listed as Hamerly-Tonka complex, 0-3 % slopes. These soils are located in a somewhat flatter area 2.5 miles upstream from Bylin Dam. The non-hydric soils are located along the North Branch Forest River where the topography is steep, resulting in well-drained soils.

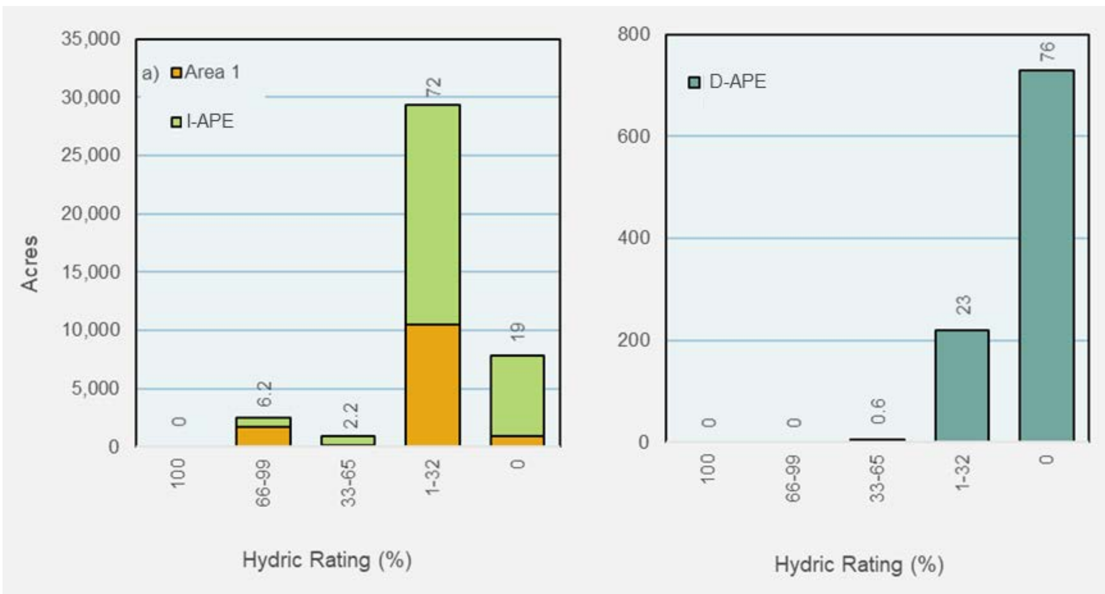


Figure D-6-5: Soil hydric rating in Area 1, D-AA, and U-AA. The values above the bars indicate the proportion of each increment out of the total area. Note different scale.

REGULATED AQUATIC RESOURCES

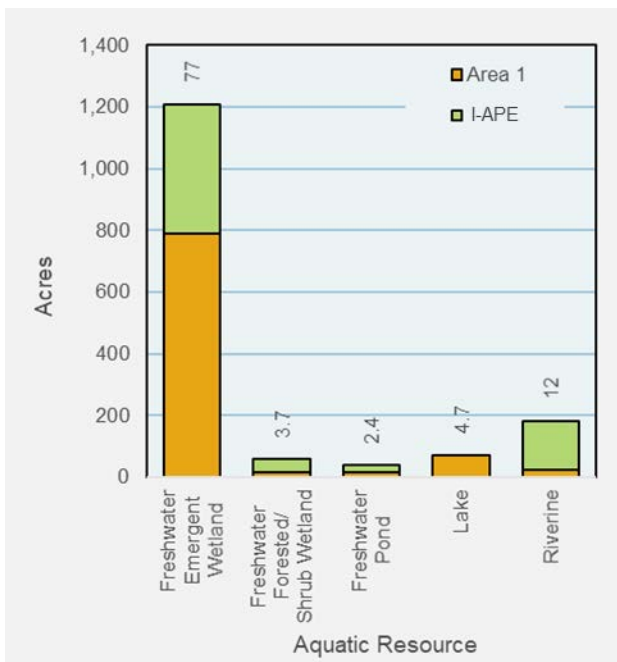
Aquatic resources in the area consist of wetlands, open water (lakes), and a network of rivers. Many of these are protected to varying degrees under the Clean Water Act and other legislation. When federal funding is used for construction and improvement projects, Executive Order 11990 requires federal agencies to preserve, enhance, or minimize degradation and losses to wetlands. NRCS policy for implementing the executive order can be found at 190-GM, Part 410, Subpart B, Section 410.26. The Clean Water Act Section 404 requires permitting from the US Army Corps of Engineers for activities that impact Waters of the US. The NRCS floodplain management policy reviews activities in wetlands that occur within the 50-year floodplain (190-GM Section 510.25). Rivers, in addition to regulation under the US Army Corps of Engineers, may fall under the National Wild and Scenic Rivers Act of 1968 (Public Law 90-542).

The region is covered by a network of streams and rivers all flowing from the higher elevations of the Drift Plains eventually to the Red River of the North (US Department of Interior 2019, North Dakota Information Technology Department 2020, US Fish and Wildlife Service 2020). The Red River of the North is a navigable river and, by definition is regulated under Section 10 of the CWA. The Forest River and tributaries would be considered Waters of the US and under the jurisdiction of Section 404 of the CWA. The US Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI) (US Fish and Wildlife Service 2019) maps the watercourses within AOI. Neither the Forest River nor its tributaries are included in the list of rivers designated as Wild and Scenic Rivers (US Fish and Wildlife Service 2020).

For Area 1 and the D-AA, the information presented here is sourced from aerial photography and GIS data. Information regarding the resources in the U-AA is detailed in the **EA Appendix D-9: Aquatic Resources Report.**

In Area 1 there are a total of 6.3 miles of the North Branch Forest River and approximately 13 miles of unnamed tributaries (**Exhibit D-6-8: National Wetlands Inventory Map**). The streams in this area are generally small and appear in aerial photographs to be classified as intermittent. The river here is listed by the NWI (using nomenclature from the "Cowardin" system (Federal Geographic Data Committee 2013) as riverine, intermittent, streambed, seasonally flooded (R4SBC) and palustrine, emergent, persistent, and seasonally flooded (PEM1C) linking many wetlands, and it is listed as excavated in some locations. The nine tributaries that contribute directly to the reservoir drain adjacent agricultural land. The NWI shows 820 acres of wetlands (freshwater emergent, forested, scrub-shrub, and ponds) (89 % of the aquatic resources, 6.1 % of the total land area) (**Figure D-6-6**). The D-AA, ending at the confluence of the mainstem Forest River near Fordville, consists of 31 miles of the North Branch Forest River and 69 miles of unnamed tributaries. There are 485 acres of wetlands (75 % of the aquatic resources, 1.8 % of the total land area) and no sites of open water.

Figure D-6-6: Aquatic Resources in Area 1 and the D-AA. The values above the bars indicate the proportion of each type out of the total area of aquatic resources. Note different scale.



WATER QUALITY

Section 303(d) of the Clean Water Act of 1972 (CWA) requires states to monitor and assess their waters to determine if they meet water quality standards supporting the beneficial uses they are intended to provide (33 U.S.C. 1313(d)). The North Dakota Department of Environmental Quality (NDDEQ), formerly named the North Dakota Department of Health (NDDH), published water quality data in its 2018 Water Quality Assessment Report (North Dakota Department of Health 2019). Of the 295 public lakes and reservoirs in the state, 200 are listed specifically in the state's water quality standards as "classified" lakes and therefore are noted as having beneficial uses. The remaining 95 lakes and reservoirs, while included in the state's estimate of total lake acres, are not considered classified waters and thus not assessed.

Waters that do not meet their designated uses due to water quality standard violations are listed as impaired. The 2018 Water Quality Assessment Report (North Dakota Department of Health 2019) lists waterbodies not meeting water quality standards and those requiring total maximum daily load (TMDL) studies.

NARRATIVE WATER QUALITY STANDARDS

The NDDEQ has set narrative water quality standards that apply to all surface waters in the state (NDCC 33-16-02.1-08). The narrative standards pertaining to nutrient impairments are listed below.

- "All waters of the state shall be free from substances attributable to municipal, industrial, or other discharges or agricultural practices in concentrations or combinations which are toxic or harmful to humans, animals, plants, or resident aquatic biota. (NDCC 33-16-02.1-08-1(a)(4))
- No discharge of pollutants, which alone or in combination with other substances shall:
    - Cause a public health hazard or injury to environmental resources;
    - Impair existing or reasonable beneficial uses of the receiving waters; or
    - Directly or indirectly cause concentrations of pollutants to exceed applicable standards of the receiving waters. (NDCC 33-16-02.1-08-1(e))."

In addition to the narrative standards, the NDDEQ has set a biological goal for all surface waters in the state. The goal states that "the biological condition of surface waters shall be similar to that of sites or waterbodies determined by the department to be regional reference sites (NDCC 33-16-02.1-08-2(a))."

NUMERIC WATER QUALITY STANDARDS

All lakes classified under the legislative rule in North Dakota are assigned aquatic life, recreation, irrigation, livestock watering, and wildlife beneficial uses (NDCC 33-16-02.1-09, 3.g.(1.) and 3.e.). North Dakota state water quality standards state that lakes listed by NDDEQ and all stream classes use the Class I stream numeric criteria unless adjusted depending upon the stream class or site-specific requirements. Class I criteria include standards for aluminum, ammonia (total as N), barium, boron, chloride (total), chlorine (residual), dissolved oxygen, nitrate as N^2, nitrite as N, *E. coli*, pH, phenols, sodium, sulfates (as total SO_4), temperature, radioactivity, and 142 other substances, including trace elements and organics. Wetlands and lakes that are not listed use criteria for Class III streams minus the requirements for dissolved oxygen and temperature.

The aquatic resources in the AOI that are monitored by NDDEQ include the North Branch Forest River and Bylin reservoir (North Dakota Department of Environmental Quality 2020). The mainstem Forest River is listed as a Class II stream, North Branch Forest River is listed as a Class III stream, and Bylin reservoir is listed as a Class III Lake. Selected standards for these are listed in **Table D-6-1.** Chlorophyll-a is used as an indicator of lake and reservoir water quality during the growing season. The standard for dissolved oxygen is listed as 5.0 mg L^{-1}. This concentration is based on the premise that DO is a measure of the amount of oxygen dissolved in an aqueous solution (water) and aquatic life requires oxygen to respirate and support life. The lower the available DO, the less oxygen available and the greater the stress on aquatic life. Prolonged exposure to low DO can cause fish kills and loss of aquatic life and thus persistent ecosystem degradation. State standards also stipulate this daily minimum does not apply to the hypolimnion of Class III and IV lakes and reservoirs during periods of thermal stratification. The standard for dissolved nitrate as N is 1.0 mg L^{-1}, where up to 10 % of samples may exceed the 1.0 mg L^{-1}. The pH standard stipulates up to 10 % of samples collected during a 3-year period may exceed the range as long as lethal conditions are not present. The sulfate standard is a maximum 450 mg L^{-1} for Forest River and 750 mg L^{-1} for the lakes. The maximum temperature of the water is set at 29.44 °C (85 °F) or if warmer cannot exceed 2.78 °C above background conditions.

Table D-6-1: Numeric standards (selected) applicable for aquatic resources monitored by NDDEQ in the AOI.

State Water Quality Standard	Forest River	North Branch Forest River	Bylin Reservoir	Lake Ardoch
Chlorophyll-a (guideline) April – November	n/a	n/a	20 µg L^{-1}	20 µg L^{-1}
Dissolved oxygen daily minimum	5.0 mg L^{-1}	5.0 mg L^{-1}	*5.0 mg L^{-1}	*5.0 mg L^{-1}
Nitrates (as N^2 or N) maximum	1.0 mg L^{-1}	1.0 mg L^{-1}	1.0 mg L^{-1}	1.0 mg L^{-1}
pH	6.0-9.0	6.0-9.0	7.0-9.0	6.0-9.0
Sulfate (SO_4) 30-day arithmetic average	450 mg L^{-1}	450 mg L^{-1}	250 mg L^{-1}	750 mg L^{-1}
Temperature	29.44 °C	29.44 °C	29.44 °C	n/a
* hypolimnion exempt during summer and winter				

IMPAIRED WATERS

According to the NDDEQ (2019), there is one stream segment of the North Branch Forest River listed as impaired downstream of Bylin Dam (**Table D-6-2, Exhibit D-6-9: Impaired Waters Map**) and requiring TMDL evaluation.

Table D-6-2: Impaired waters in the Area of Interest

Waterbody Name	Number	Size	Designated Use	Supports Designated Use	Impairment
North Branch Forest River from its confluence with tributary near Highway 32 (ND-09020308-033-S) downstream to its confluence with Middle Branch Forest River	ND-09020308-029-S_00	12.31 miles	Fish and Other Aquatic Biota	Fully supporting, but threatened	Combined biota/habitat bioassessments

WATER QUALITY DATA

The NDDH Water Quality Assessment Reports, years 2004 through 2018 (North Dakota Department of Health 2005, 2007, 2009, 2011, 2013, 2015, 2017, 2019), have not listed Bylin Dam as an impaired water, and no TMDL studies were required. The NDDH conducted a lake water quality assessment in 2015 (North Dakota Department of Environmental Quality 2019).

Bylin Dam regularly has a stratified water column during the summer months. Of the sampling that occurred from May through September of 2015, temperature and dissolved oxygen concentrations showed the reservoir was stratified during May and July **(Figure D-6-7**). Temperatures averaged 1.9 °C in May and 6.7 °C in September. Dissolved oxygen in May and July showed concentrations greater than 6.0 mg L^{-1} down to a depth of four meters. At six meters depth, the dissolved oxygen concentrations dropped below 2.0 mg L^{-1} in May and below 1.0 mg L^{-1} in July. At these depths the dissolved oxygen concentrations drop below the numerical water quality standard of 5.0 mg L^{-1}. Temperature and dissolved oxygen concentrations for September maintained consistency throughout the water column. This consistency in September is characteristic of a holomictic waterbody, which undergoes thermal mixing. Dissolved oxygen concentrations during this time ranged from 7.90 mg L^{-1} to 8.10 mg L^{-1}.

The trophic state was determined for Bylin Dam based on the Secchi disk transparency (as a measure of turbidity) and the total phosphorus and chlorophyll-a concentrations sampled during the summer of 2015 (North Dakota Department of Environmental Quality 2019). The results are summarized in **Figure D-6-8** and compare the results from 2015 to historical data (1988 through 1997) for Bylin Dam. Historically, Bylin Dam has shown water quality more characteristic of a hypereutrophic reservoir. The results from 2015 show turbidity conditions and chlorophyll-a have improved from the historical state. The reservoir is now determined to be more characteristic of a eutrophic reservoir. NDDEQ issued a harmful algal bloom (HAB) advisory in August 2021 (NDDEQ 2022), and climate change may exacerbate eutrophic conditions in the reservoir into the future (see Threats to Ecosystems section).

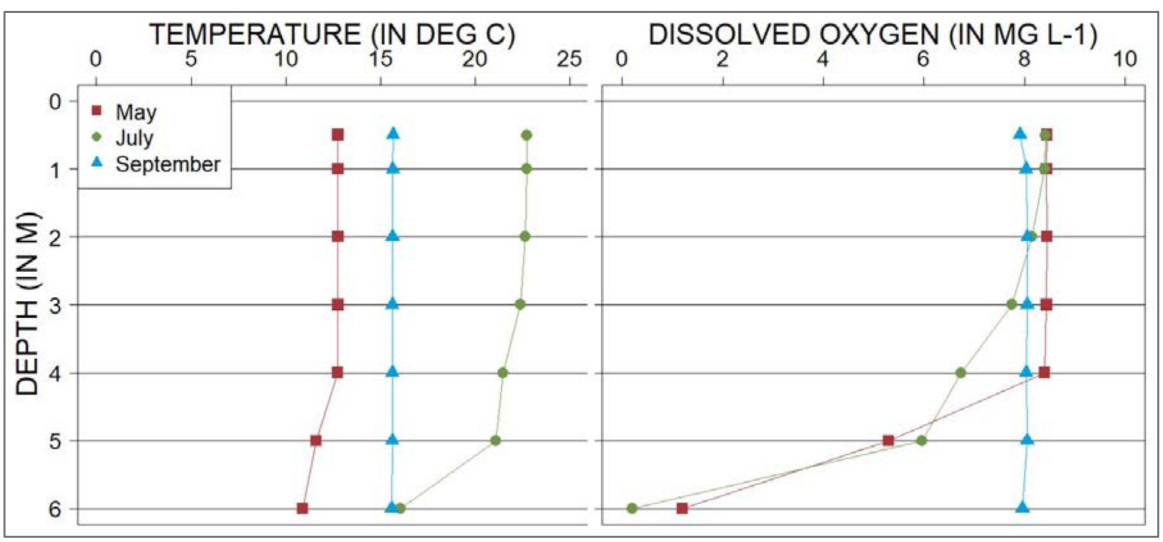


Figure D-6-7: Temperature and Dissolved oxygen profiles for Bylin Dam 2015 (from North Dakota Department of Environmental Quality 2019).

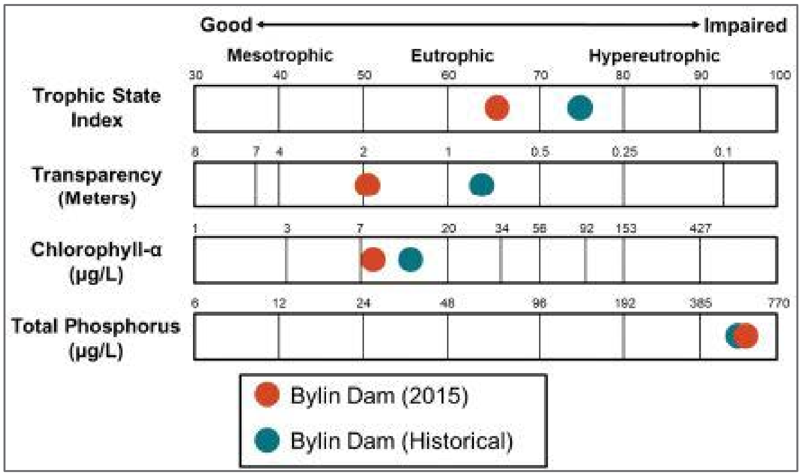


Figure D-6-8: Historic (1988-1997) and 2015 Trophic State Indices for Bylin Dam 2015 (from North Dakota Department of Environmental Quality 2019).

In addition to chlorophyll-a, turbidity, and dissolved oxygen, the NDDEQ has periodically collected nitrogen and phosphorus water quality samples from the Bylin Dam reservoir (deepest part) since 1988. **Table D-6-3** summarizes the most recent data collected between May and September of 2015. The purpose of NDDEQ data collection is to monitor and assess the water quality of the reservoir. The data are available on the Surface Water Quality Data For North Dakota website (North Dakota Department of Environmental Quality 2020) and summarized below. The concentrations of nitrate-nitrogen are meeting the numeric water quality standard (**Table D-6-1**) of 1.0 mg L^{-1}, dissolved oxygen concentrations are above the standard of 5.0 mg L^{-1}, and concentrations of chlorophyll-a are mostly below the standard of 20 µg/L^{-1}.

Table D-6-3: Summary of 2015 results (deepest part of the Bylin Dam reservoir) (from North Dakota Department of Environmental Quality 2019).

Results 2015	Unit	Depth (m)	May 06	July 20	Sept. 23
Temperature	°C	0-6	12.32	21.29	15.62
Dissolved oxygen	mg L^{-1}	0-3	8.45	8.18	8.01
		4-6	4.97	4.30	8.01
Chlorophyll-a	µg L^{-1}	0.92	<3.00	15.3	9.61
Nitrate-nitrite	mg L^{-1}	0.92	0.03	1.00	<0.03
Ammonia-nitrogen	mg L^{-1}	0.92	0.19	0.18	0.08
Phosphorus total	mg L^{-1}	0.92	0.44	0.56	0.78

The North Dakota Game and Fish Department (NDGFD) has been collecting winter and summer temperatures, conductivity (specific conductance), and dissolved oxygen data at the deepest part of the reservoir since 1999, with the most recent sampling date of August 19, 2019 (see Randy Hiltner, Fisheries Supervisor, NE District, NDGFD, for complete methods). Water samples are taken throughout the water column, generally one sample near the bottom, one sample near mid-water column, and one sample at 1 meter from the surface of the water column. The conductivity data show spikes of increased conductivity in the summer samples (**Figure D-6-9**). This likely indicates increasing contribution of dissolved solids into the reservoir and may indicate the presence of discharge or other pollutants.

Conductivity is also affected by the area's geology, as streams located within clay soils have an increased conductivity from easily ionized material within the soil (US Environmental Protection Agency 2012). The winter concentrations of dissolved oxygen have been variable over the last 20 years, and the mean concentration fell below the state water quality standard of 5.0 mg L^{-1} during six of the years with the values dropping below 3.0 mg L^{-1} in years 2008 and 2009 (**Figure D-6-10**). This indicates that the oxygen concentrations are usually adequate for sustaining fish populations through the winter months. There have been no winter fish kills reported at Bylin Dam (R. Hiltner, pers. comm.). The mean summer dissolved oxygen concentrations dropped below 5.0 mg L^{-1} in four out of the last 20 years.

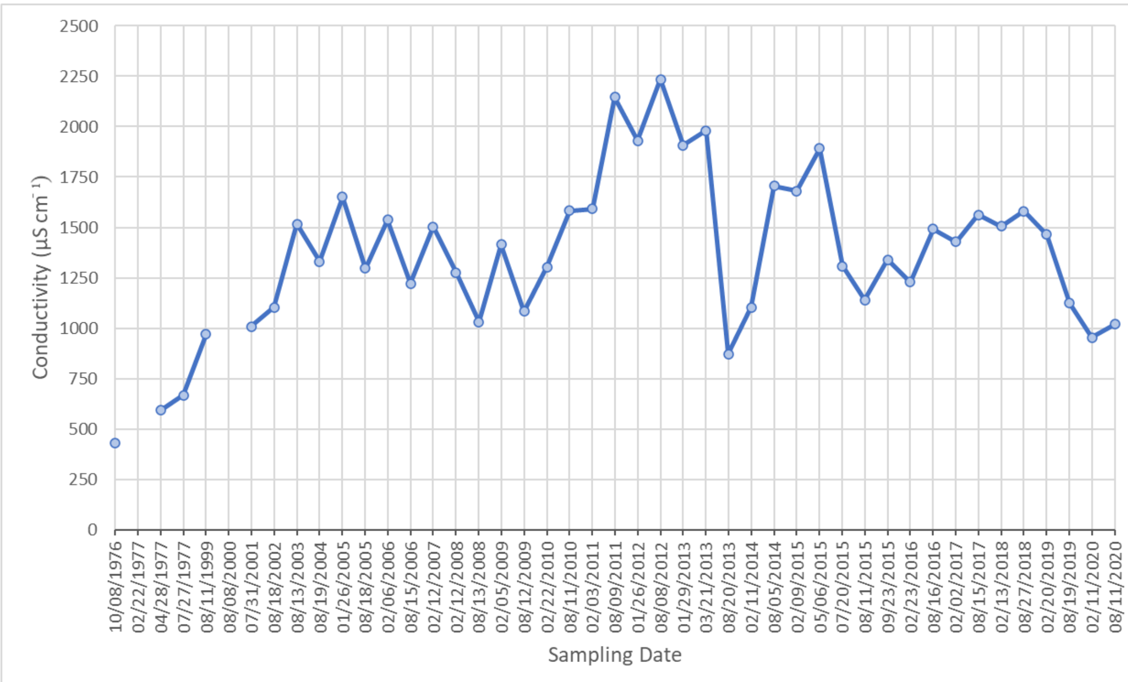


Figure D-6-9: Mean conductivity in the Bylin Dam reservoir over time (NDGFD data).

The North Dakota Game and Fish Department (NDGFD) sampled again on February 6th and August 5th, 2020 (R. Hiltner, Fisheries Supervisor, NE District, North Dakota Game and Fish Department for complete methods). During 2020, the typical depth of oxygenated water was limited to the top three meters during the summer and below this are approximately 4 m of anoxic water (summer and winter), indicating stratification of the lake (**Figure D-6-11**). This shows the summer and winter DO concentrations were falling below the 5.0 mg L^{-1} concentration below which aquatic life is affected. This is a different pattern than seen for the 2015 sampling, where the DO threshold was not met until approximately 5 m depth in the summer and deeper than 6 m in the winter (North Dakota Department of Environmental Quality 2020).

The conductivity data for 2020 show relatively low values compared to previous decades (**Figure D-6-9**), possibly indicating a reduced influx of sediments from the watershed. The winter concentrations of dissolved oxygen have been similar over the last 15 years, with a decline during the past three years. The mean concentration fell below the state water quality standard of 5.0 mg L^{-1} during seven of the 16 documented years but have not fallen below 3 mg L^{-1} since 1994 (**Figure D-6-10**). During the past two winters, the concentrations were 3.7 and 3.4 mg L^{-1}. This indicates the oxygen concentrations generally have been adequate for sustaining the fish populations through the winter months but could potentially become inadequate if the low concentrations are sustained. The mean summer DO concentrations dropped below 5 mg L^{-1} in four of the last 21 documented years (which were documented over a 29-year span), indicating potential for impaired conditions and oxygen deprivation. Data collected in 2020 show average DO declined from 2019 but remained at 5.2 mg L^{-1}, above the critical threshold. Both summer and winter DO concentrations of the water at the lowest depths (hypolimnion) fell below the NDDEQ standard of 5.0 mg L^{-1} concentration below which aquatic life is affected. Because Bylin Dam reservoir is stratified, the hypolimnion is exempt from the DO standard in summer and winter.

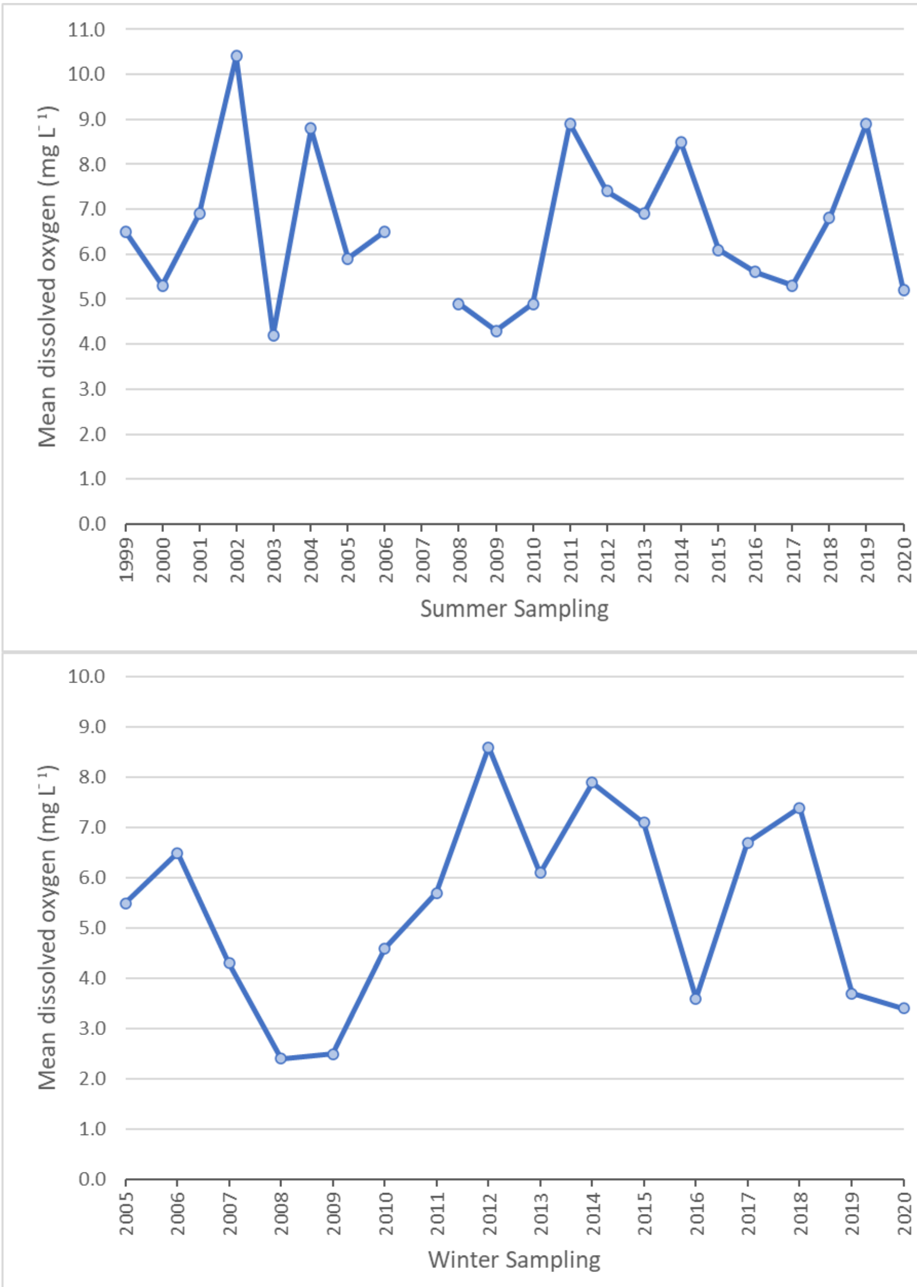


Figure D-6-10: Mean dissolved oxygen concentrations in the Bylin Dam reservoir over time during the a) winter and b) summer seasons (NDGFD data).

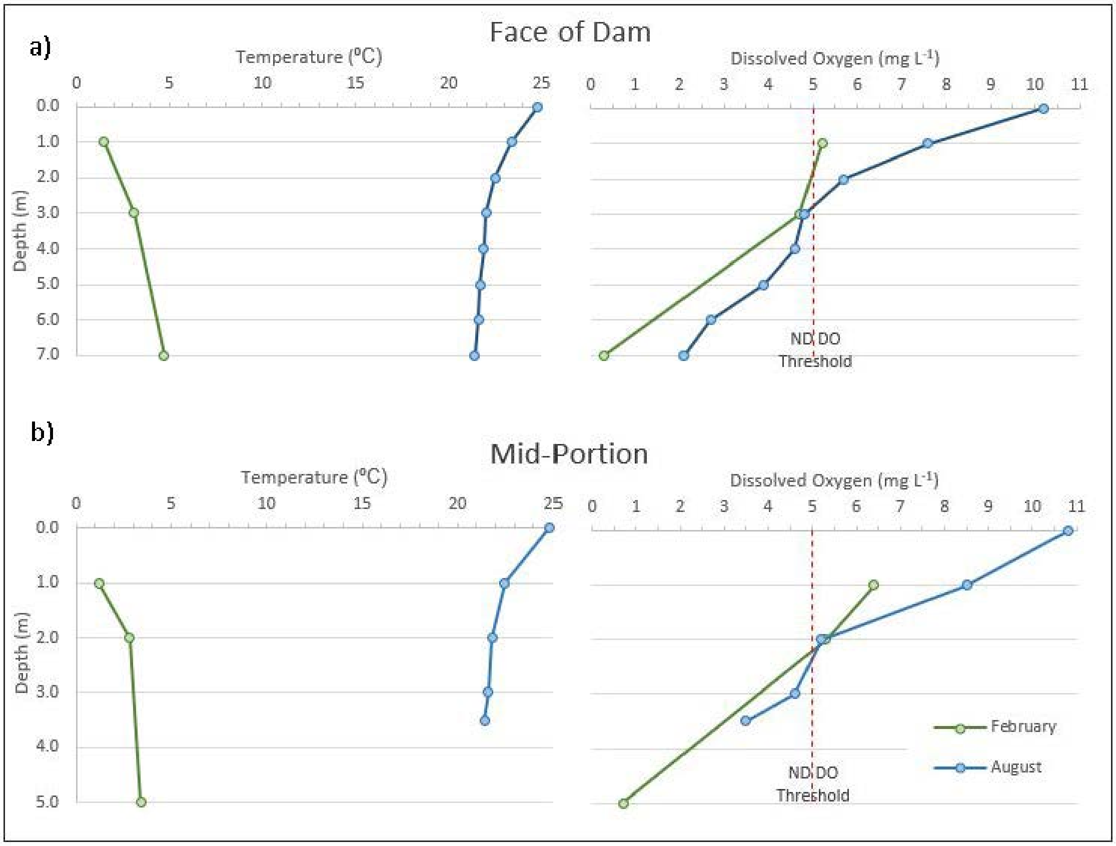


Figure D-6-11: Temperature and dissolved oxygen concentrations in 2020 at two NDGFD sampling locations in the Bylin Dam reservoir, a) face of dam (Site 381265) and b) mid-portion. Y-axes are different at each location as there were no data collected below 4.0 m at the mid-portion site. Dashed line indicates threshold for dissolved oxygen (NDDEQ).

AIR QUALITY

The NDDEQ Division of Air Quality has the responsibility to ensure the ambient air quality in North Dakota is maintained in accordance with the levels established by the state and federal Ambient Air Quality Standards (AAQS) and the Prevention of Significant Deterioration of Air Quality Rules. NDDEQ operates and maintains a network of ambient air quality monitoring sites throughout the state; the nearest air quality monitoring stations to the project are in Grand Forks (Grand Forks County) and Devils Lake (Ramsey County). According to the EPA Green Book, state and federal standards were not exceeded at the monitoring sites throughout the state (as of October 31, 2020, US Environmental Protection Agency 2020). According to the EPA air quality data, the project area is designated to be in attainment or unclassifiable (to be considered in attainment) for all AAQS.

WATER MANAGEMENT

Flows in the AOI are regulated by several small flood control dams scattered throughout the Forest River watersheds. Some of the flood control dams were constructed by the NRCS through Public Law 83-566. These dams are located primarily in the upper portions of the North Branch, Middle Branch, and South Branch Forest River of the watershed. Several dams are within a 35-mile radius of Bylin Dam (**Table D-6-4**,**Exhibit D-6-10: Dam Locations Map**). In addition to flood control dams, drainage improvements have been constructed both privately and publicly throughout the watershed to enhance agricultural production. Several miles downstream of Bylin Dam, near the North Branch Forest River crossing with North Dakota State Highway 32, the river follows a constructed drainage improvement ditch known as Walsh County Drain 97.

Table D-6-4: Dams located within the Forest River drainage area (35-mile radius of Bylin Dam).

Dam name	Primary Purpose	Year Built	Drainage Area (mi^2)	Maximum Volume (acre-feet)	Normal Pool Surface Area (acres)	Linear Distance from Bylin Dam (miles)
Kratochvil (NB FR Dam 3)	Flood control	1962	12.6	2,837	32	3.5
Soukup (NB FR Dam 5)	Flood control	1962	3.3	1,116	33	5
Chyle (NB FR Dam 6)	Flood control	1966	5.9	1,470	12	8
Matejcek Dam	Flood control, wildlife, recreation	1966	45.9	9,144	134	10.5
Whitman Dam (MSB FR Dam 6)	Flood control	1965	84.7	9,364	143	13
Sarnia Dam	Flood control	1936	26.6	1,610	no data	15
Fordville (MSB FR Dam 4)	Flood control, wildlife, recreation	1978	41.5	10,703	197	17.5
Lake Ardoch	Fish and wildlife	1934	793	13,630	996	34
Dougherty	Recreation	1935	-	213	24	1
Bylin (NB FR Dam 1)	Flood control, wildlife, recreation	1964	22.1	5,850	60	-
Homme Reservoir (Park River)	Flood control	1951	229	6,700	194	10
Niagara 1	Water supply	1905	2.9	170	17	26
Niagara 2	Recreation	1935	2.9	243	16	26
Kolding	Flood control	1972	11.2	1,983	9.8	30

HABITATS AND BIOTIC COMMUNITIES

Information regarding the resources in the U-AA is detailed in the **EA Appendix D-10: Biological Inventory Report**.

The D-AA has 485 acres of wetlands and has no sites of open water. The North Branch Forest River to the confluence of the mainstem Forest River consists of 31 miles or river and 69 miles of unnamed tributaries. A corridor of riparian woodland extends from Bylin Dam downstream to ND Highway 32 near Lankin. Between ND Highway 32 and Fordville, the river is channelized and supports sparse stands of riparian forest. Grassland and pastureland cover are the predominant natural habitats in the area. Upland deciduous forest covers some areas.

ECOSYSTEM SERVICES

Ecosystem services are defined as simply the benefits (goods and services) people obtain from ecosystems (Millennium Ecosystem Assessment 2005). The authors of the Millennium Ecosystem Assessment state that “humans depend on ecosystem properties and on the network of interactions among organisms and within and among ecosystems for sustenance, just like all other species.” With growing human populations, declining resources, and a changing climate, the pressure on ecosystems is increasing significantly. Using a framework of services from a human perspective enables scientists, planners, and resource managers to evaluate the costs and benefits of human impacts. Ecosystem services, either tangible or intangible, are the crucial link between ecological function and social well-being.

As a framework to understand and identify ecosystem services, they are categorized into four groups, each with subcategories of services:

- Provisioning services are tangible goods provided for direct human use and consumption, such as food, fiber, water, timber, or biomass.
- Regulating services maintain a world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe—examples include flood and disease control, water filtration, climate stabilization, and crop pollination.
- Supporting services refer to the underlying processes maintaining conditions for life on Earth, including nutrient cycling, soil formation, and primary production.
- Cultural services make the world a place in which people want to live—examples include recreational uses, spiritual uses, aesthetic viewsheds, and a role in tribal values.

NRCS requires ecosystem services for the area impacted to be documented and considered. Once this framework is in place, economic analysis can follow to assign these resources monetary value by incorporating ecological principles into the costs of the project. For example, pollinators are critical for ecosystem function, particularly pollinating insects, which are under pressure from negative anthropogenic impacts (Vanbergen 2013). The value of pollinators, both by wild and managed animals, was estimated to be $215 billion (2005 dollars), equivalent to 9.5 % of global food production value. Pollination of wild plants is also critical for functioning ecosystem services, including biodiversity maintenance and support services such as nutrient cycling and primary production.

All the main categories of ecosystem services are represented in the AOI (**Table D-6-5**). Riparian zones are known to be extremely productive ecosystems and have diverse habitat potential for a wide variety of plants and animals (US Department of Agriculture - Natural Resources Conservation Service 1996, Machtinger et al. 2007). The ecosystem services of riparian habitats include providing base flow (water storage, reduced evaporation due to shading by vegetation), nutrient cycling (plant uptake and recycling), energy transfer (organic matter distribution), reduced downstream flooding (vegetation dissipates energy of water, increases infiltration time), water quality benefits (decreased water velocity decreases sediment transport, enables nutrient uptake, and reduces nonpoint source pollution), support for aquatic life (phytostabilization of banks, vegetation is provides fish habitat and food for organisms), and support for terrestrial life (supply food, provide habitat corridors and connections with other habitats).

Table D-6-5: Major ecosystem services currently (✓) or potentially (+) utilized within the APEs.

Ecosystem Services	Soils	Water	Habitats / Communities	Plants	Animals
Provisioning Services					
Food (directly or indirectly)	✓		✓	✓	✓
Fresh water (directly or indirectly)		✓			
Fuel					
Fiber					
Biochemicals, natural medicines, pharmaceuticals	+			+	+
Ornamental resources					
Genetic resources	+			+	+
Clay, mineral, aggregate harvesting	✓				
Waste disposal locations					
Energy harvesting from natural air & water flows					
Regulating Services					
Air quality regulation	✓		✓	✓	
Local climate regulation, carbon storage			✓	✓	
Global climate regulation, carbon storage	✓		✓	✓	
Water regulation (flood damage control, recharging groundwater resources)			✓		
Flood hazard regulation			✓		
Storm hazard regulation			✓		
Pest regulation/biological control					✓
Disease regulation - human			✓		
Disease regulation - livestock			✓		
Erosion regulation			✓	✓	
Water quality – water purification			✓	✓	
Biodiversity – species resilience				✓	✓
Pollination					✓
Salinity regulation					
Fire regulation			✓		
Noise and visual buffering			✓	✓	
Cultural Services					
Cultural heritage		✓	✓	✓	✓
Recreation and ecotourism		✓	✓	✓	✓
Spiritual and religious value		+	+	+	+
Aesthetic		✓	✓	✓	
Inspiration value			+	+	+
Social relations		✓	✓		✓
Education and research			+	+	+
Sense of place			✓	+	✓
Species existence value				✓	✓
Supporting Services					
Soil formation and retention	✓				
Primary production			✓	✓	
Nutrient cycling	✓	✓	✓	✓	✓
Water recycling			✓	✓	
Production of atmospheric oxygen				✓	
Provisioning of habitat	✓	✓	✓	✓	

THREATS TO ECOSYSTEMS

Threats to ecosystems take many forms, but most result from direct and indirect anthropogenic sources. The main categories of threats are habitat destruction, pollution, eutrophication, non-native and invasive species, overharvesting, biodiversity loss, and climate change.

- Habitat degradation consists of anything that causes clearing of natural vegetation or fragmentation of ecosystems. These activities can include urban expansion and development (e.g., road construction and maintenance, residential and industrial development), gravel mining, logging, conversion of grassland to cropland, intensive grazing, erosion (wind and air), river and stream channelization, and energy development. Riparian areas, in particular, are attractive for cropland and grazing land because these areas can be especially fertile (Machtinger et al. 2007). For birds, development can cause problems from wind turbines, overhead powerlines, and communication transmission lines. Fragmentation of prairie habitat is a major threat to many species, including insects, amphibians, and plants such as orchids.
- Erosion can negatively affect soil resources, plant communities, and water bodies. Loss of topsoil, particularly on slopes, can degrade the habitat quality for plants and animals, and cause the decline in soil health with loss of microbial populations in the soils. If erosion is severe, plants that form soil-stabilizing root systems can be lost, thus exacerbating erosion into the future. Patches of bare ground become inhabited easily by opportunistic species (weeds) that can be prolific seed producers and controlling their spread can be very difficult to impossible. Once streams and rivers begin to experience erosion, incising of the channels begins and becomes worse over time. Eroded soils flow into water bodies and continue downstream, carrying sediment particles and associated nutrients and metals. Sediment accumulation in wetlands, streams, and lakes is a serious problem. Increased intensity of storm events, as predicted for the region as climate change continues, would result in increased erosion and sediment transport into water bodies.
- Pollution can result in reduced productivity for animals, plants, decomposers, and bacteria. Whether the pollution is located in the air or water, the negative impacts can include decreased soil health, declining populations, and/or changes in species equilibrium. Pollution can come from many sources, including industry waste (e.g., automobile exhaust, factory emissions, methane discharge), mining (e.g., metals, sulfides, acid mine drainage), groundwater pollution (e.g., hydraulic fracturing, sewage discharge), agriculture (e.g., herbicides, pesticides, overapplication of fertilizers), particulates from automobile tires, erosional sediment transport, and microplastics in the environment.
- Eutrophication results primarily from agricultural chemical pollution and sediment erosion. Eutrophication causes habitat degradation in waterbodies through changes in chemical balance (hypoxia negatively impacts fish) and species equilibrium (plant and fish populations change, which can affect the turbidity regime). Climate change predictions of 1) increased intensity of precipitation events would exacerbate erosion and sediment transport, thus also increasing phosphorus delivery and 2) a warmer climate would be expected to increase the size and frequency of phosphorus-stimulated algal blooms on water bodies (Moss et al. 2011).
- Non-native and invasive species typically alter equilibrium of species in ecosystems. Most non-native species were brought to North America by European settlers importing species they were familiar with as forage grasses. These species are widespread now and have become naturalized on the landscape. Most tame grasslands, those areas where cropland has been “restored” to

grasslands, show a legacy of non-native species, including recommended seed mixes for land that was put into the Conservation Reserve Program (CRP). Other grasslands areas, including vegetation cover over construction sites (e.g., dams, spillways, road verges), use non-native species in prescribed seed mixes that grow rapidly and form dense but shallow root systems. Many wetlands have been impacted by non-native species, including *Phalaris arundinacea*, a rapidly growing grass that can be used for increased grazing opportunities in wet prairies. Another wetland species that is considered non-native is the hybrid cattail *Typha x glauca*, which typically forms monocultures and outcompetes native plants (Bansal et al. 2019). *Euphorbia esula* can be detrimental to cattle. Many truly invasive species are not subject to natural historical population control mechanisms and tend to outcompete native species. This can result in severe habitat degradation.

- Emerging pathogens can be introduced to an ecosystem from elsewhere or can become more prevalent if conditions change (e.g., climate change, imbalance in species equilibrium). Dutch elm disease is an example of a pathogen. White-nose syndrome is another example of a pathogen, which is increasing in bat populations due to other factors in the environment.
- Overharvesting consists of a resource being collected faster than it can repopulate in an area. This includes clear-cutting forests, overfishing, and intensive plant collecting (e.g., ginseng).
- Loss of biodiversity is a consequence of habitat degradation. Decreased biodiversity can lead to changing species composition and ecosystem processes in an area, thus causing further habitat degradation.
- Climate change is an overriding threat to ecosystems globally. A warming climate can alter the balance between abiotic and biotic environments. Consequences of climate change include altered species distribution, population, and survival. For example, climate change can cause asynchronous life-cycle events (phenology), including insect emergence, flower blooming dates and pollinator resources, and migratory bird arrivals as well as changes in their feeding and breeding success. Warming temperatures can exacerbate both eutrophication and greenhouse gas (carbon dioxide, methane) release from lakes and reservoirs (Kosten et al. 2010, Moss et al. 2011). North Dakota is already experiencing some effects including lengthening growing seasons and intense rainfall events (EPA 2016).The climate is predicted to become warmer and wetter in winter and spring, with a predicted 10-20 % increase in average precipitation by the end of the 21st century)(IPCC 2014). Precipitation events are expected to be less frequent but more intense and there will be less snow cover. Warmer winters may result in thinner ice or alter the typical amount of snow cover, thus affecting the timing or thickness of sunlight-restricting snow. This could have direct implications on how the eutrophic waters mediate bacteria growth and oxygen depletion during the winter season. Intervals of drought between intense rainfall events can cause wetlands and lakes, which tend to sequester carbon in the soils, to become sources of carbon dioxide gas to the atmosphere from increased decomposition of organic matter (Marcé et al. 2019).

There are several currently occurring threats to ecosystems in the AOI and several more which have the potential to occur if conditions change with the dam (**Table D-6-6**). Raising the dam would cause temporary impacts to the wetlands upstream and would increase the habitat area for species requiring open water. The fish in the reservoir are not natural populations, but migratory birds and waterfowl may benefit from a larger reservoir surface area.

Table D-6-6: Current and potential threats to ecosystems in the U-AA and D-AA.

Ecosystem Threat Category	Current and Potential Threats
Habitat degradation	• Intensive agriculture occurring, including cultivation and grazing (continued degradation of grasslands, prairie, wetland drainage) • Overgrazing on slopes can alter the plant community composition and enable non-native species to become established (e.g., *Carduus nutans*) • Potential future expansion of campground, toilet facilities, roads, parking lots, downstream structures • Potential for riparian habitat loss if reservoir pool size is increased • Potential for woodland/prairie loss if the footprint of the dam increases
Erosion	• Grazing on slopes and in wetlands/shorelines (**Exhibit D-6-3: Grazing Land Map**) • Potential overgrazing reducing soil stabilization by plant roots • River channel incision downstream • Sediment accumulation in the reservoir • Wave action on steep shoreline and slope erosion
Pollution	• Few residences or industries in area, not likely a problem • Agrichemicals in contributing watershed (pesticides, herbicides, fertilizers, metals)
Eutrophication	• Small feedlot outside U-AA boundaries drains into reservoir tributary, likely no impact from the few residential septic tanks • Continuing nutrient and sediment contributions from agriculture in contributing area • Livestock grazing on the slopes and the shoreline results in erosion, sediment transport, and nutrient loading • Loss of vegetation buffer around water bodies reduces filtration of nutrients • Harmful algal blooms occurring
Non-native and invasive species	• Several plant species present in the AOI that are either listed as noxious weeds or are noted as troublesome including *Carduus nutans, Cirsium arvense, Euphorbia esula, Melilotus officinalis, Phalaris arundinacea, Poa pratensis, Rhamnus cathartica, Sonchus arvensis*, and *Typha x glauca.* • Increased human traffic brings in more non-native species that may become established
Emerging pathogens	• Dutch elm disease is widespread in North Dakota, white-nose syndrome may have potential to affect bats • Low potential for emerging pathogens
Overharvesting	• n/a – lumber industry not present, fish populations maintained artificially
Loss of biodiversity	• Documented extirpation of species, bumblebee declines, general pollinator declines, bird population and species decline • Presence of plant species that form monocultures and/or use other mechanisms (e.g., allelopathy) to alter communities: *Phalaris arundinacea, Rhamnus cathartica,* and *Typha x glauca*
Climate change	• Potential for changes in winter fish survival under eutrophic water conditions • Less frequent but more intense precipitation events will increase sediment transport to the reservoir causing increased sediment accumulation rate and eutrophication severity • Longer intervals between precipitation events could stimulate desire for crop irrigation from reservoir, also could result in increased wind erosion of soils and desertification • Phenological disruption, food-web alterations • Warming temperatures can stimulate release of carbon dioxide and methane from lake sediments • Air quality issues including increased methane and carbon dioxide release from the reservoir

SOCIAL ISSUES

Environmental justice is the principle that all human populations have the opportunity to comment on proposed federal actions and all populations share benefits from, are not excluded by, and are not disproportionately adversely affected by government programs affecting human health or the environment. Executive Order 12898 (February 11, 1994) requires federal agencies to make environmental justice part of the mission. To do this, the agencies must identify how their activities affect minority or low-income populations and Indian Tribes.

Data were obtained from the US Census Bureau and the Bureau of Labor Statistics to develop an understanding of the demography and economic status of the AOI. Demographic statistics for the project area were generated using county level data (**Table D-6-7)**. The population within the three counties is approximately 86,705 people, the majority of the population is white (<67 %), with the predominant minority being classified as “Native Hawaiian and Other Pacific Islander ” (<1 %). The poverty levels are 9.4% percent in Walsh County, 11.5 % in Nelson County, and 15.4% in Grand Forks County. Comparatively, the poverty level in the State of North Dakota is at 10.7%. The average per capita income is lowest for Grand Forks County and highest in Walsh County at $34,441.

Table D-6-7: Demographic Statistics within the Bylin AOI.

Location	Population (2020)[1]	Per-Capita Income (2020)[2]	People in poverty (%)[3]	Predominant Race (2020 est.)[1]	Predominant Minority (2020 est.)[1]
Grand Forks County	73,170	$32,251	15.4%	White, 67%	Two or more races, 6.4%; Native Hawaiian and Other Pacific Islander, <1%
Nelson	3,015	$34,189	11.5%	White, 79%	Two or more races, 2.8%; Native Hawaiian and Other Pacific Islander, <1%
Walsh County	10,520	$34,441	9.4%	White, 82%	Two or more races, 7.5%; Asian, <1%
North Dakota	779,094	$36,289	10.7%	White, 70%	Native Hawaiian and Other Pacific Islander, <1%

[1] US Census Bureau (2022a), [2] US Census Bureau (2022b), [3] US Census Bureau (2022c) American Community Survey

Analysis of the socioeconomic status within the AOI was reviewed for Walsh, Nelson, and Grand Forks counties. Employment within this tri-county region from 2000 to 2020 is shown in **Table D-6-8** (US Census Bureau 2022d). Service-related jobs represented 79 %, 63 %, and 62 % of the workforce in Grand Forks, Nelson, and Walsh Counties. Non-services related jobs accounted for the next highest percentage of the workforce and government jobs accounted for the lowest percentage of jobs. Jobs in Grand Forks and Walsh Counties increased, while jobs in Nelson County decreased. Between 2000 - 2020, unemployment rates have lowered in Grand Forks County, but have increased in both Nelson and Walsh Counties.

Table D-6-8: Walsh, Nelson, and Grand Forks counties employment by industry, 2000-2020 (percent of all jobs).

Employment Category	2000	2010	2020
Grand Forks County			
Total Employment	34,946	36,648	35,591
Unemployment %	3.6	4	2.2
Non-Services Related %	18	18	17
Services Related %	77	77	79
Government %	5	5	4
Nelson County			
Total Employment	1,753	1,627	1,340
Unemployment %	3.8	4.0	4.5
Non-Services Related %	31	32	30
Services Related %	65	64	63
Government %	4	5	7
Walsh County			
Total Employment	6,227	5,921	4,953
Unemployment %	3.6	5.0	4.5
Non-Services Related %	32	34	35
Services Related %	63	61	62
Government %	5	5	3
Non-Services Related includes: Agriculture, forestry, fishing and hunting, and mining; Construction; Manufacturing; and Information Services Related includes: Wholesale trade; Retail trade; Transportation and warehousing, and utilities; Finance and insurance, and real estate and rental and leasing; Other services, except public administration; Professional, scientific, and management, and administrative and waste management services; Arts, entertainment, and recreation, and accommodation and food services; Educational services, and health care and social assistance			

The US Department of Labor – Bureau of Labor Statistics (BLS) and the US Census Bureau collect information pertaining to the labor market activity, working conditions, and price changes in the economy. Because Walsh County contains most of the land of the AOI, the Walsh County statistical data were considered representative. The US Census Bureau's American Community Survey (ACS) reported the average earnings per job and the per capita income increased by 18.5 % and 12.6 % between 2017-2020 (**Table D-6-9**).

Table D-6-9: Walsh County income data. 2017-2020 (US Census Bureau 2022e).

Walsh County	2017	2020	Change 2017-2020	% Change 2017-2020
Average Earnings per Job (2020 $s)	$38,852	$46,032	$7,180	18.5
Per Capita Income (2020 $s)	$30,465	$34,441	$2,266	12.6

The BLS quarterly census of employment and wages data were utilized to characterize the public and private employment characteristics of the AOI. The data were reviewed for Walsh County. Private entities represent approximately 97 % of the commerce within Walsh County and the annual average employment for private entities decreased by 7.1 % (**Table D-6-10**). The annual wages for both private and federal government entities increased between 2017-2020.

Table D-6-10: Walsh County 2017-2020 annual average employment and wages (US BLS 2022).

Summary Change Table	Annual Establishments	Annual Average Employment	Total Annual Wages ($ US)	Annual Average Weekly Wage	Annual Wages per Employee ($ US)
Walsh County 2017-2020 Annual Averages – Private[1]					
2017 levels	473	3,885	$151 million	$747	$38,832
2020 levels	466	3,609	$168 million	$897	$46,639
Change from 2017 to 2020	-7	-276	$17 million	$150	+$7,807
Percent change from 2017 to 2020	-1.4	-7.1	+11.3	+20.1	+20.1
Walsh County 2017-2020 Annual Averages – Federal Government[2]					
2017 levels	14	51	$2.6 million	$965	$50,186
2020 levels	14	53	$2.7 million	$989	$51,429
Change from 2017 to 2020	0	+2	+$100,000	+$24	+$1,243
Percent change from 2017 to 2020	0	+3.9	+3.8	+2.5	+2.5

[1]Bureau of Labor Statistics (2022a), [2]Bureau of Labor Statistics (2022b)

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EXHIBITS

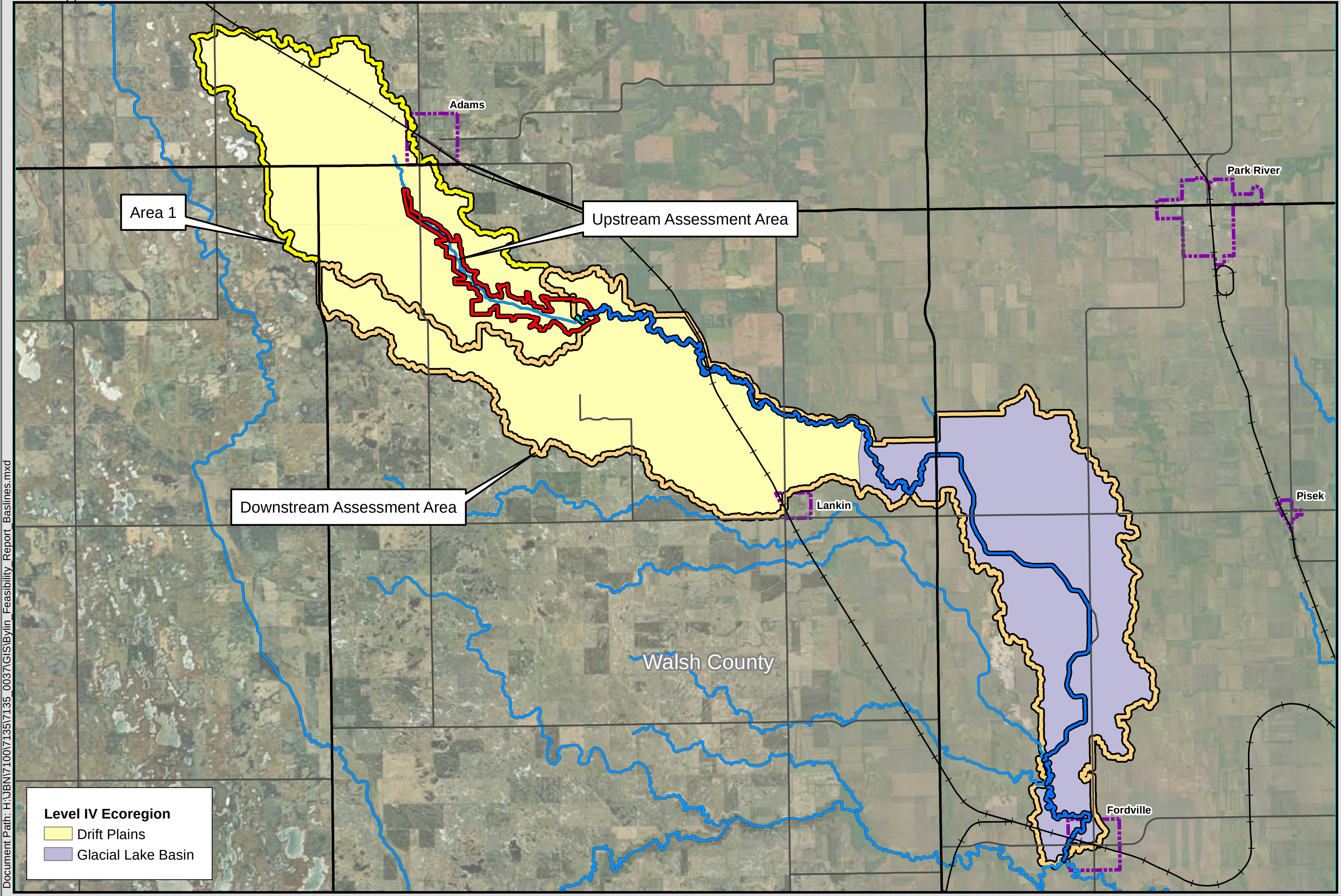

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Exhibit D-6-1: Ecoregions Map (Areas of Interest)

North Branch Forest River Dam No.1 (Bylin Dam)

1 inch = 2.5 miles

0 2.5 5 Miles

N S W E

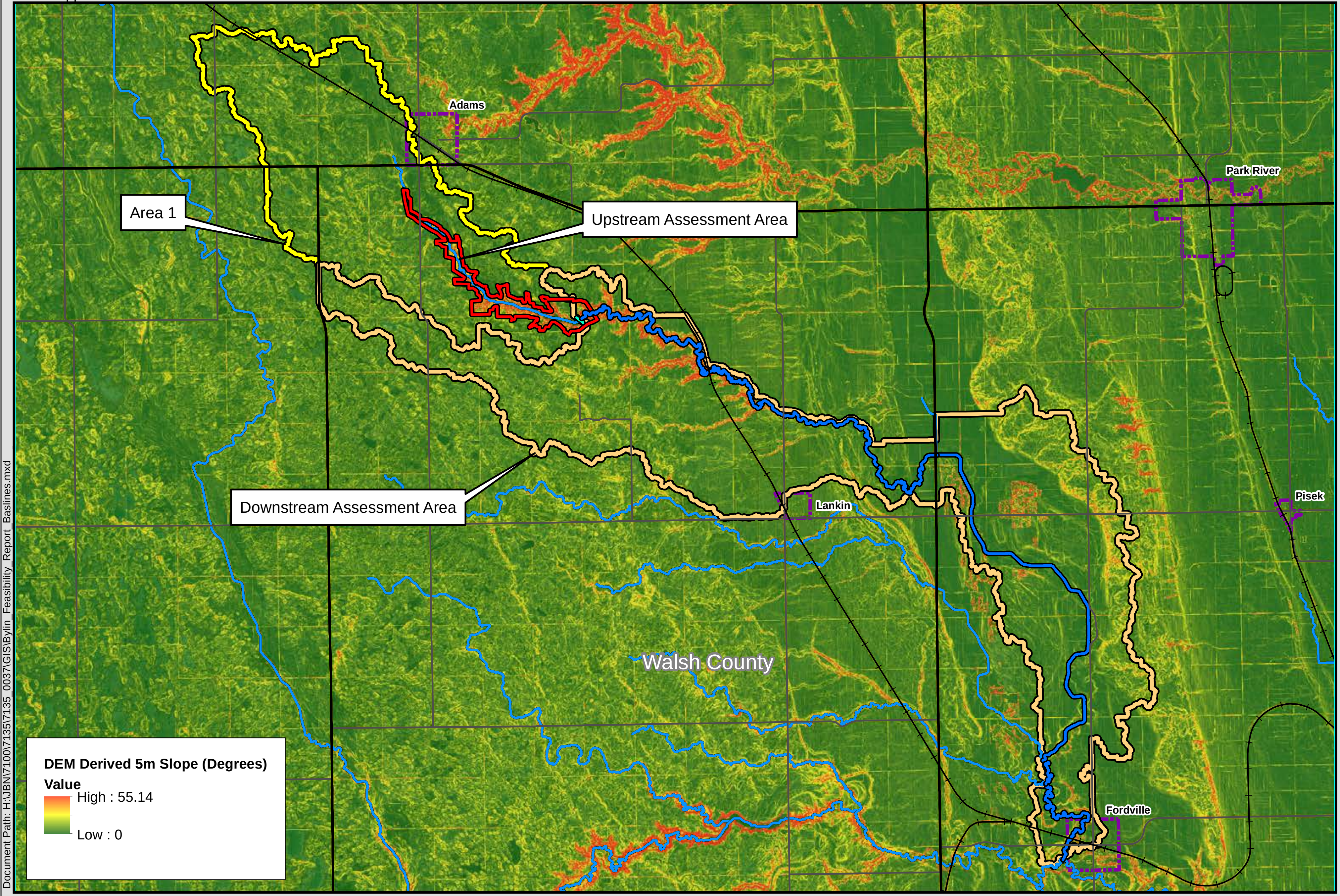

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Exhibit D-6-2: Lidar Derived Slope Map (Areas of Interest)

North Branch Forest River Dam No.1 (Bylin Dam)

1 inch = 2.5 miles

0 2.5 5 Miles

N W E S

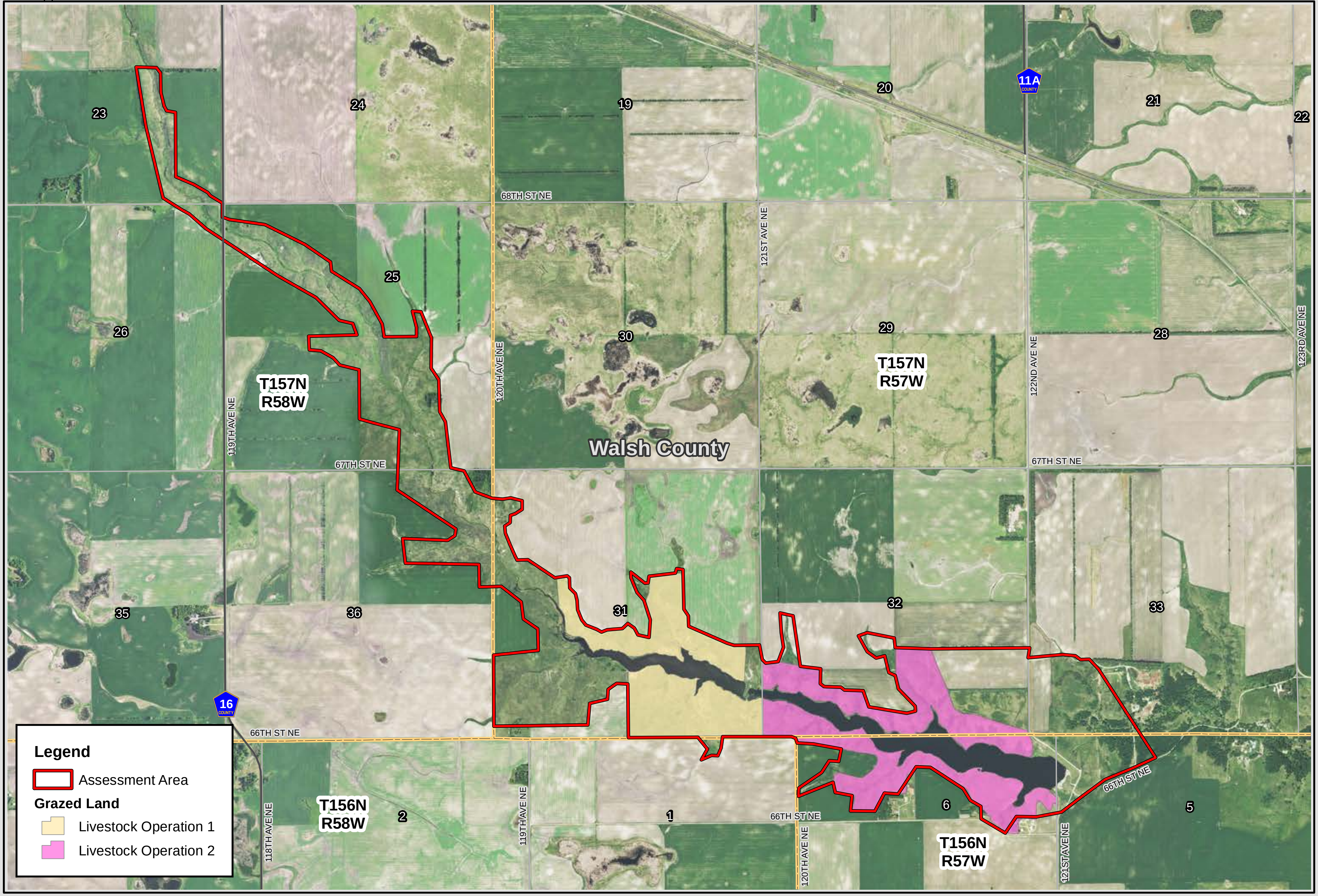

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Exhibit D-6-3: Grazing Land Map (U-AA)

North Branch Forest River Dam No. 1 (Bylin Dam)

0 1,250 2,500 5,000 Feet

1 inch = 2,500 feet

N W E S

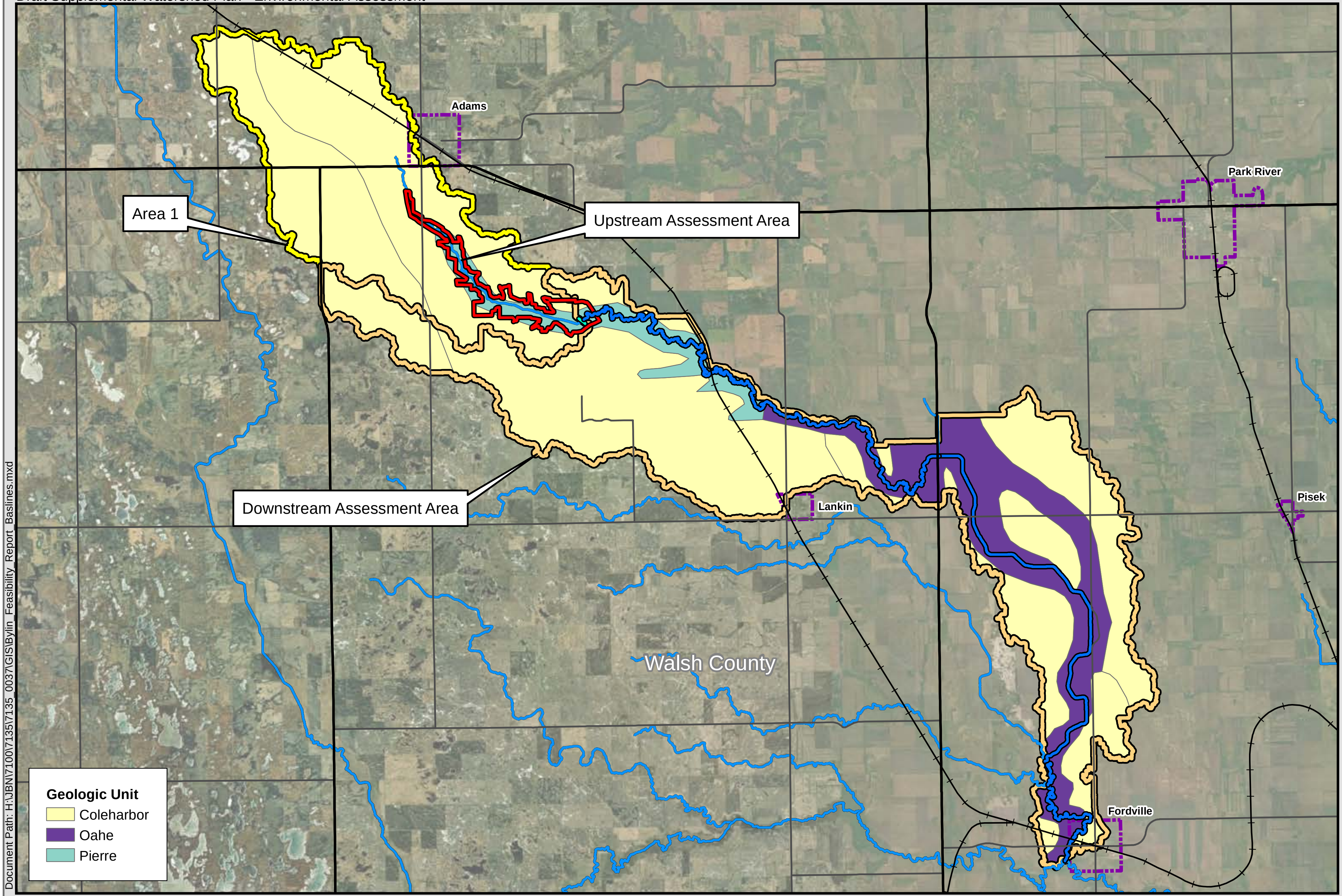

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Exhibit D-6-4: Geologic Formations Map (Areas of Interest)

North Branch Forest River Dam No.1 (Bylin Dam)

1 inch = 2.5 miles

0 2.5 5 Miles

N W E S

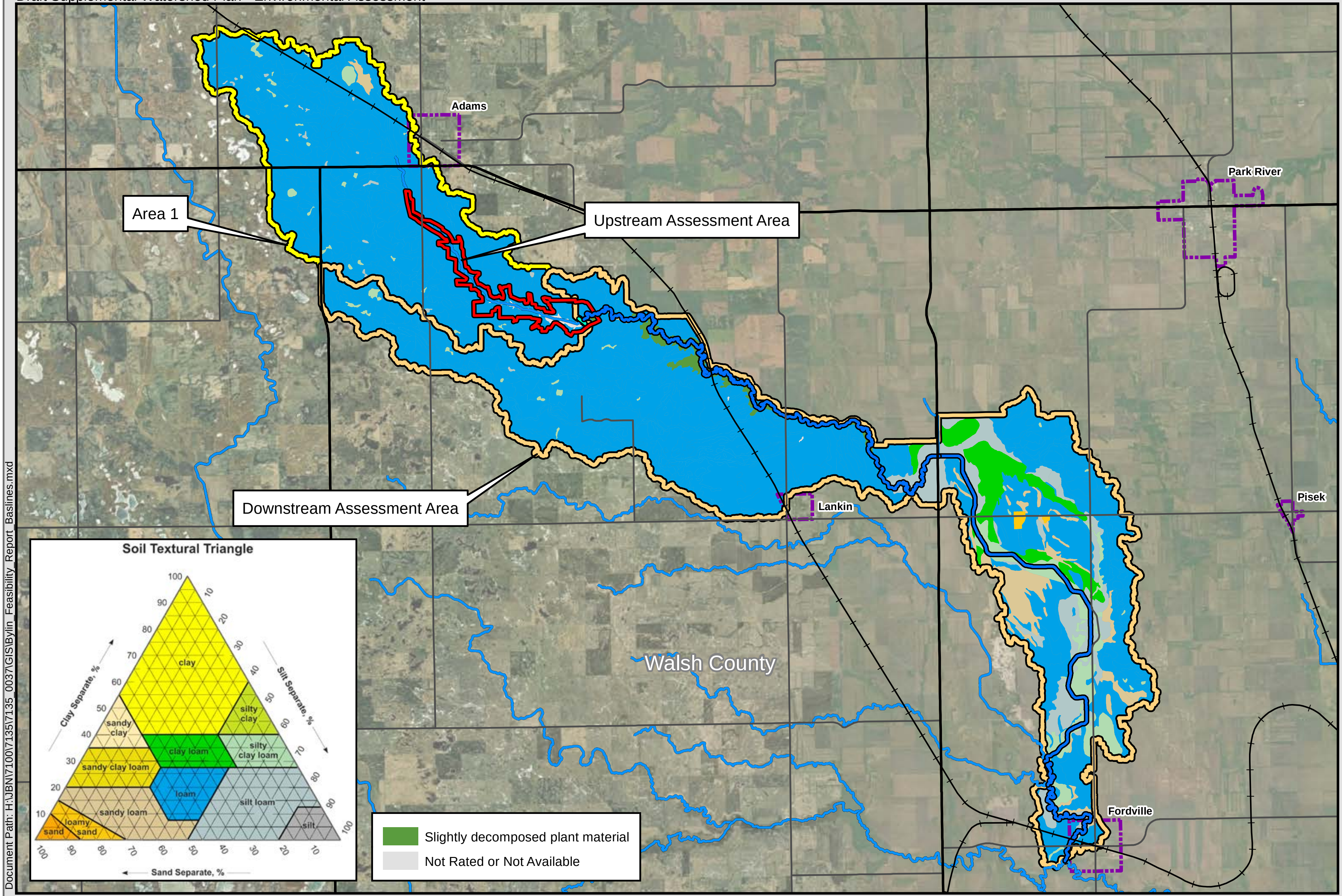

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Exhibit D-6-5: Soil Texture Map (Areas of Interest)

North Branch Forest River Dam No.1 (Bylin Dam)

1 inch = 2.5 miles

0 2.5 5 Miles

N W E S

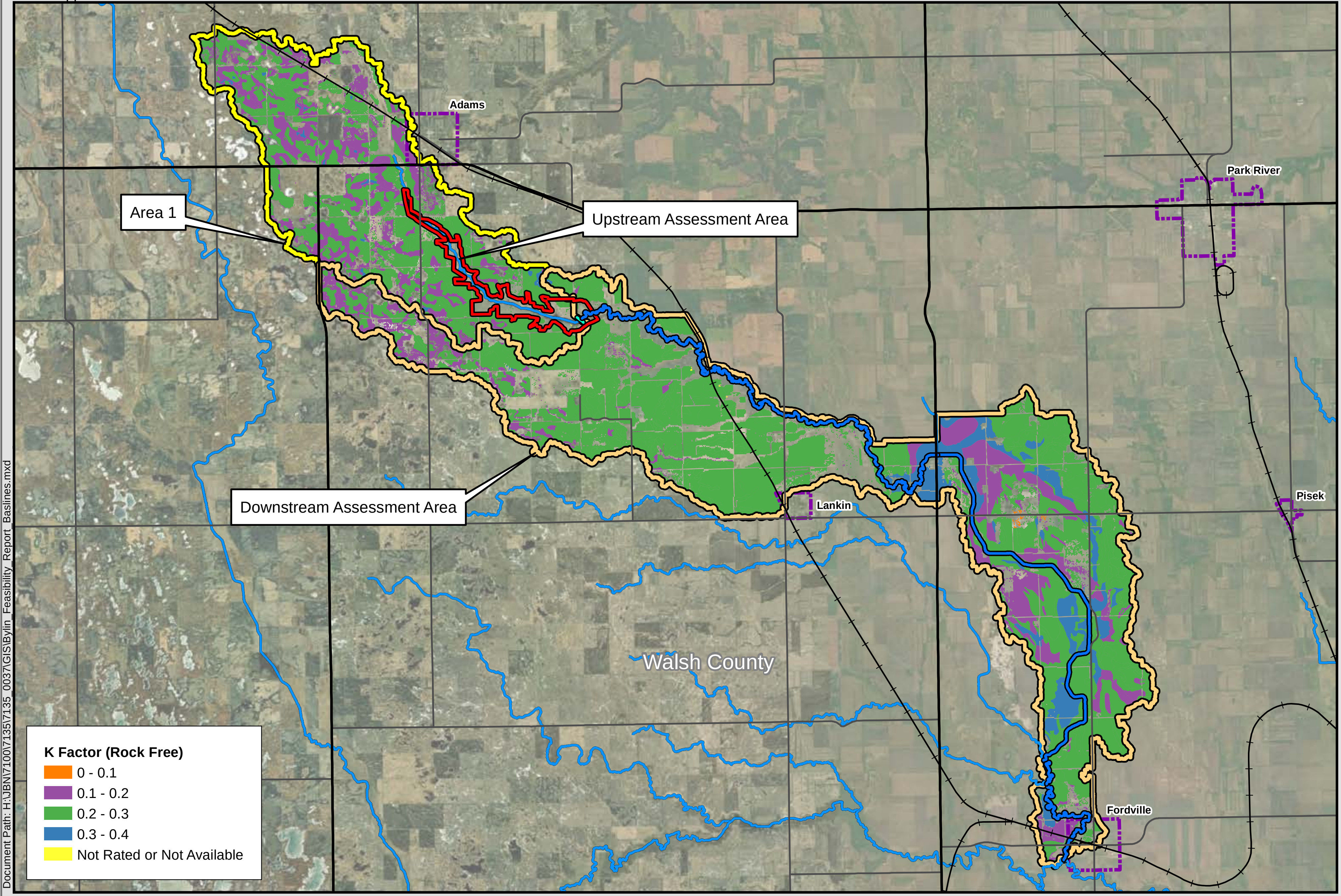

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Exhibit D-6-6: Soil Erodibility Map (Areas of Interest)

North Branch Forest River Dam No.1 (Bylin Dam)

1 inch = 2.5 miles

0 2.5 5 Miles

N W E S

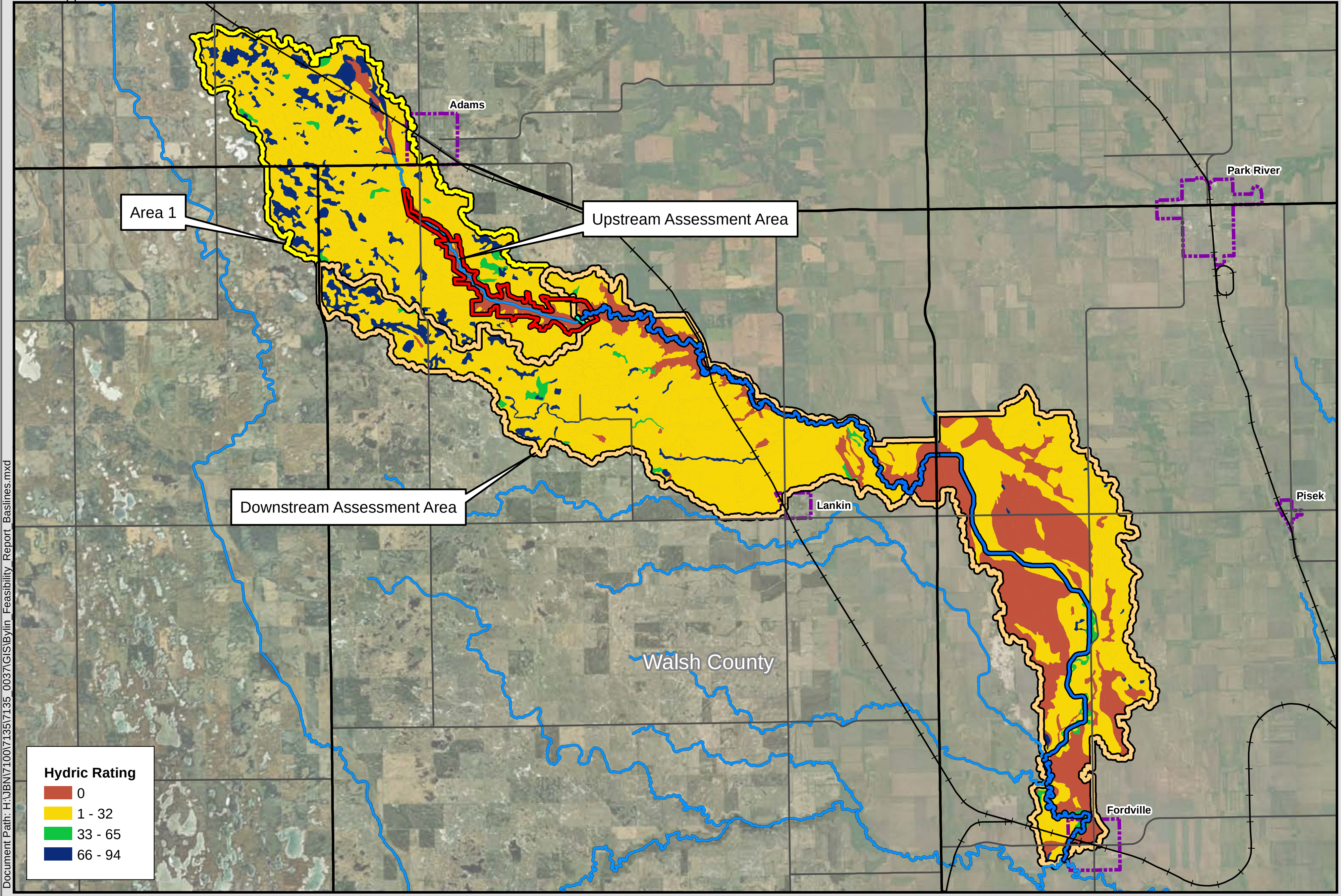

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Exhibit D-6-7: Soil Hydric Rating map of Area of Interest

North Branch Forest River Dam No.1 (Bylin Dam)

1 inch = 2.5 miles

0 2.5 5 Miles

N S W E

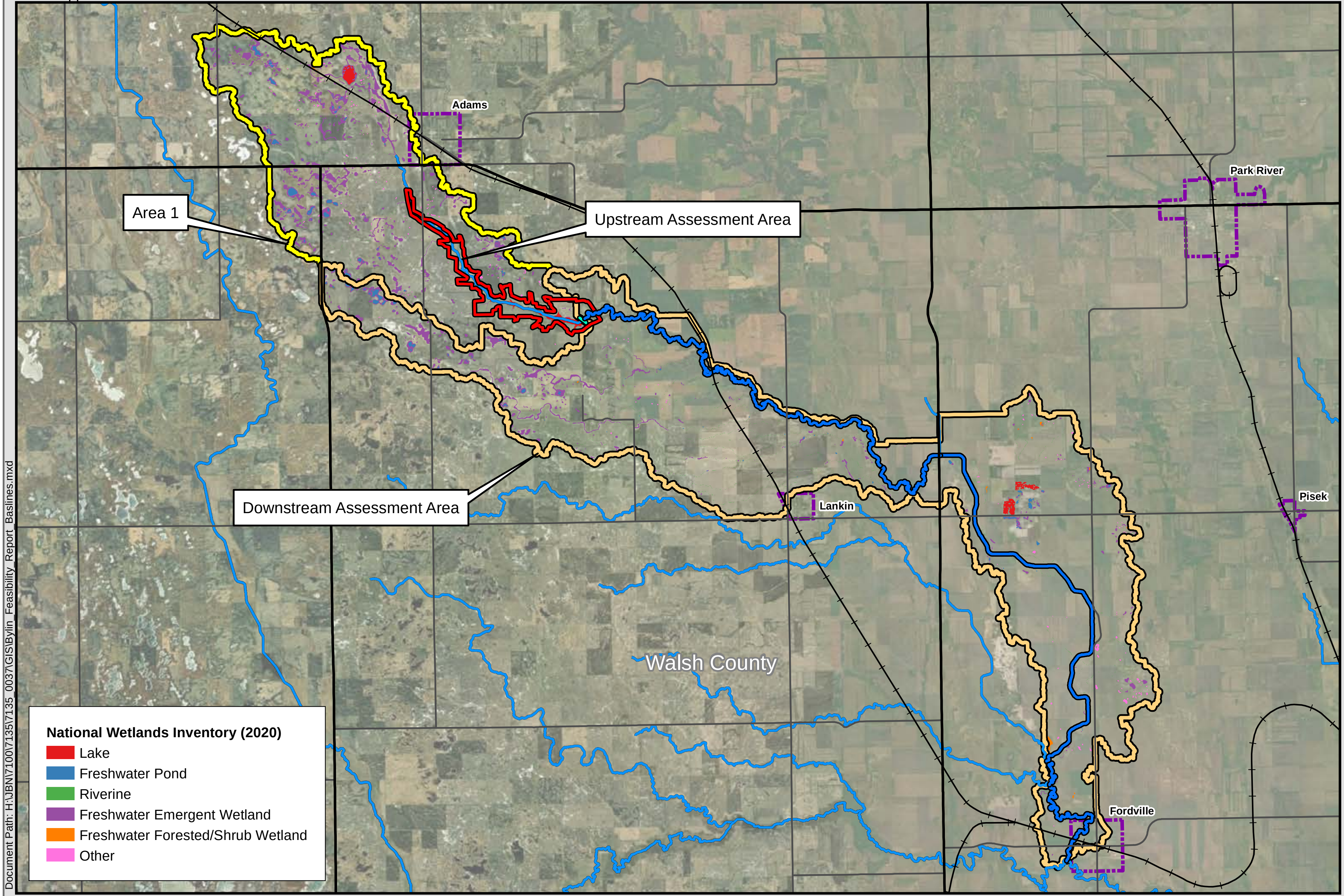

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Exhibit D-6-8: National Wetland Inventory and Rivers (Areas of Interest)

North Branch Forest River Dam No.1 (Bylin Dam)

1 inch = 2.5 miles

0 2.5 5 Miles

N W E S

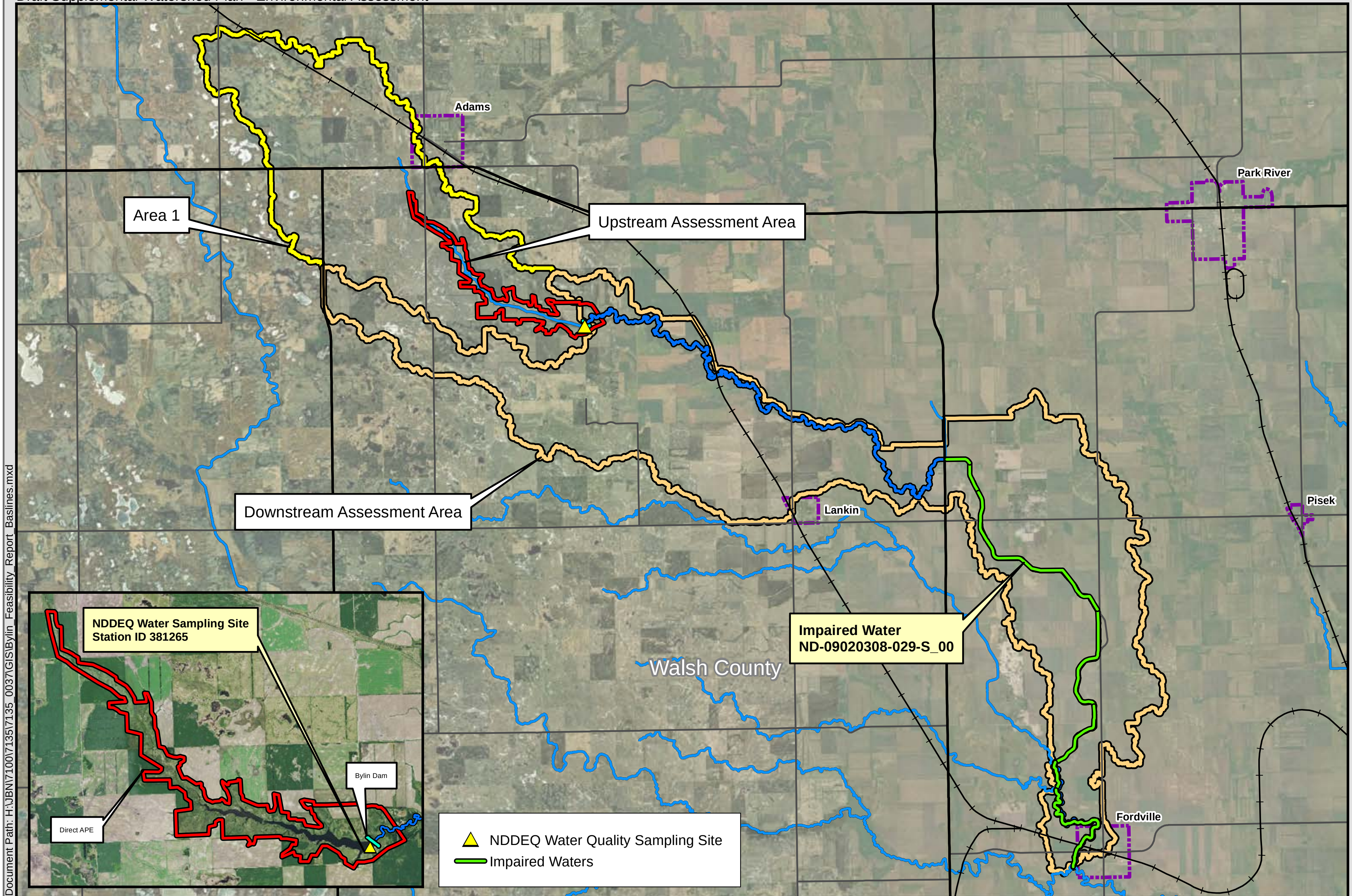

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Exhibit D-6-9: Impaired Waters of the US Map (Areas of Interest)

North Branch Forest River Dam No.1 (Bylin Dam)

1 inch = 2.5 miles

0 2.5 5 Miles

N W E S

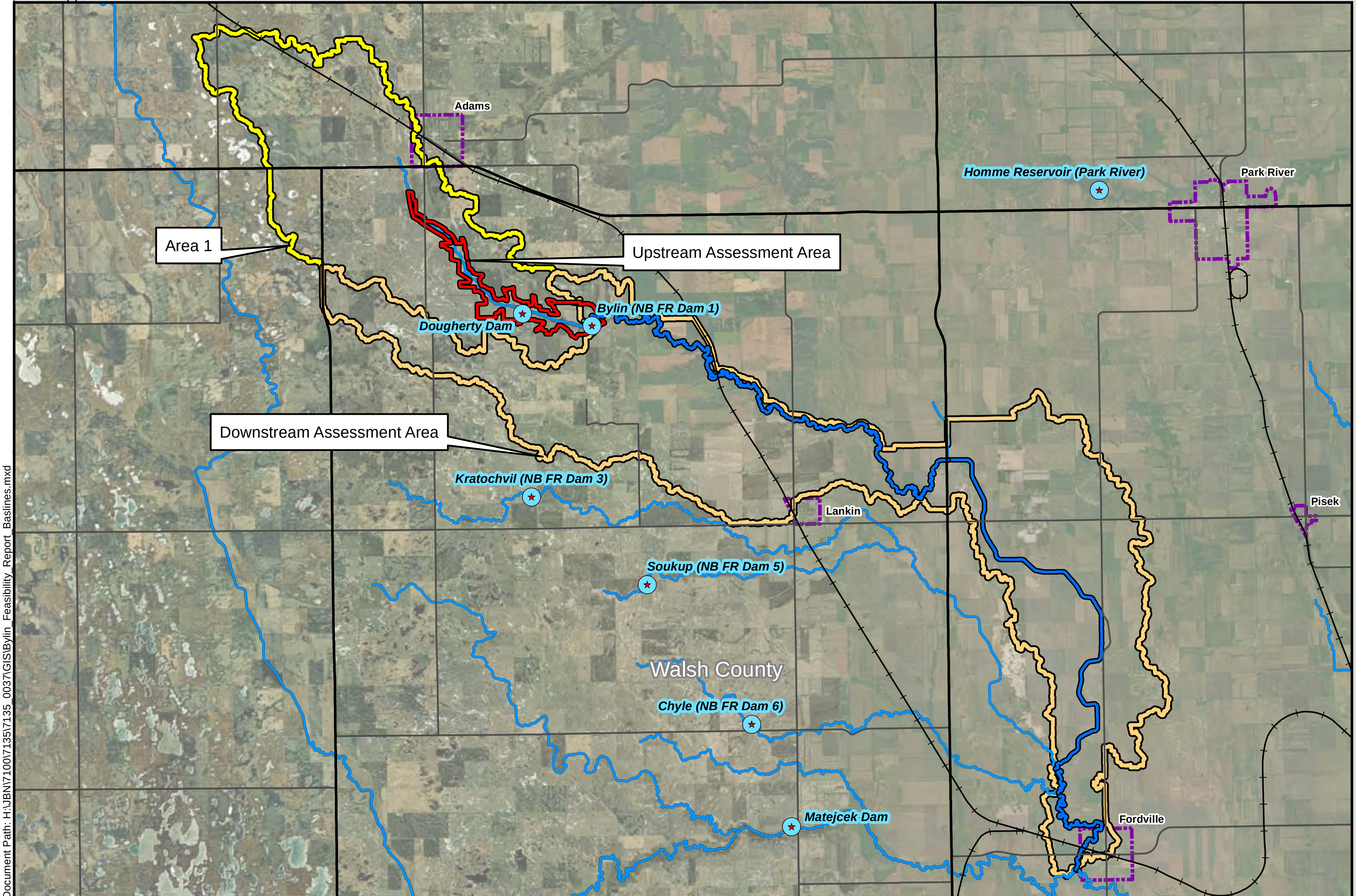

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Exhibit D-6-10:Dam Locations Map (35-mile radius of Bylin Dam)

North Branch Forest River Dam No.1 (Bylin Dam)

1 inch = 2.5 miles

0 2.5 5 Miles

N W E S