Moorhead South Growth Area
Alternative Urban Areawide Review (AUAR) Update

Prepared for: City of Moorhead, MN
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August 2024

Table of Contents

Tables

Figures

Appendices

Introduction

An Alternative Urban Areawide Review (AUAR) is authorized under Minnesota Rules Chapter 4410.3610 as an alternative form of environmental review for development projects. Generally, the AUAR consists of one or more development scenarios, an inventory of environmental and cultural resources, an assessment of the "cumulative" impacts that the development scenarios may have on these resources as well as public infrastructure services, and a set of mitigation measures that reduce or eliminate the potential impacts generated by the development. The AUAR is intended to address the "cumulative" impacts resulting from a sequence of related development projects as opposed to an Environmental Assessment Worksheet (EAW) or Environmental Impact Statement (EIS) which simply looks at a single project's impacts and does not attempt to outline mitigation initiatives.

An AUAR is used as a tool to help parties interested in development within the AUAR area understand the existing environmental and cultural resources present on a site prior to initiating detailed planning and design. It is also used to identify key initiatives that must or should be undertaken to minimize negative impacts generated by proposed development.

AUAR Process Summary

The City first completed an AUAR for the AUAR area in conjunction with a study of the South Moorhead Township growth area. The City of Moorhead expected that property owners and developers in the growth area would begin to explore development projects. Rather than evaluating projects individually, the City desired a comprehensive review of the potential impacts of full growth east of the city.

In accordance with Minnesota Rules 4410.3610 Subp. 7, for the AUAR to remain valid as the environmental review document for the area, the document needs to be updated every five years until all development in the study area has received final approval. Since undeveloped areas still remain in the study area and the AUAR will expire in 2023, the purpose of this document is to update the AUAR pursuant to Minnesota Rules.

A relatively small amount of development has occurred since 2018, and much of the analysis in the 2018 AUAR remains valid. The City adopted an update to the Comprehensive Plan in 2022, which is used as one of the development scenarios for this AUAR update. The land uses in the Comprehensive Plan update are nearly identical to the land uses in the 2018 AUAR Scenario 2: Maximum Development. Differences include simplified land uses (heavy industrial and light industrial became one industrial land use category) and the addition of mixed use in some formerly commercial-only areas. The EQB adopted a new Climate EAW form in December 2022, adding several new questions meant to evaluate the impacts of climate change on any potential development. This AUAR update uses the new Climate EAW form to evaluate potential expansion into the South Growth Area.

December 2022 version

Environmental Assessment Worksheet

This most recent Environmental Assessment Worksheet (EAW) form and guidance documents are available at the Environmental Quality Board's website at**:** https://www.eqb.state.mn.us/ The EAW form provides information about a project that may have the potential for significant environmental effects. Guidance documents provide additional detail and links to resources for completing the EAW form.

Cumulative potential effects can either be addressed under each applicable EAW Item or can be addressed collectively under EAW Item 21.

Note to reviewers: Comments must be submitted to the RGU during the 30-day comment period following notice of the EAW in the *EQB Monitor*. Comments should address the accuracy and completeness of information, potential impacts that warrant further investigation and the need for an EIS.

1. Project Title: Moorhead East Growth Area AUAR Update

2. Proposer

Proposer: City of Moorhead
Contact person: Robin Huston
Title: City Planner/Zoning Administrator
Address: 500 Center Ave
City, State, ZIP: Moorhead, MN 56561
Phone: 218-299-5374
Email: robin.huston@moorheadmn.gov

3. Responsible Governmental Unit (RGU)

RGU Agency: City of Moorhead
Contact person: Robin Huston
Title: City Planner/Zoning Administrator
Address: 500 Center Ave
City, State, ZIP: Moorhead, MN 56561
Phone: 218-299-5374
Email: robin.huston@moorheadmn.gov

4. Reason for EAW Preparation

Required:	Discretionary:
☐ EIS Scoping	☐ Citizen petition
☐ Mandatory EAW	X RGU discretion
	☐ Proposer initiated

If EAW or EIS is mandatory give EQB rule category subpart number(s) and name(s):

Over the past decade, the City of Moorhead has experienced an increase in development activity that has led to the need to plan for future growth. The City of Moorhead recognized the need for more detailed land use planning that would facilitate the development of multiple parcels in a cohesive manner and ensure that the

public infrastructure needed to support development is planned appropriately. This AUAR Update is being prepared to evaluate the potential future growth and its associated impacts on a cumulative basis rather than on a piecemeal basis as individual projects require or conduct environmental reviews. This is a discretionary AUAR completed by the City of Moorhead.

5. Project Location

County: Clay County

City/Township: Moorhead, MN

PLS Location (¼, ¼, Section, Township, Range): Sections 29-33, Township 139N, Range 48W; Section 36, Township 139N, Range 48W; Sections 5-6, Township 138N, Range 48W

Watershed (81 major watershed scale): County Ditch #47 Minor Watershed, the Red River Minor Watershed, and Upper Red River of the North (57)

GPS Coordinates: 46º49'45.1"N 96º 46'12.5W

Tax Parcel Number: N/A

At a minimum attach each of the following to the EAW:

- County map showing the general location of the project;
- U.S. Geological Survey 7.5 minute, 1:24,000 scale map indicating project boundaries (photocopy acceptable); and
- Site plans showing all significant project and natural features. Pre-construction site plan and post-construction site plan.
- List of data sources, models, and other resources (from the Item-by-Item Guidance: *Climate Adaptation and Resilience* or other) used for information about current Minnesota climate trends and how climate change is anticipated to affect the general location of the project during the life of the project (as detailed below in item 7. Climate Adaptation and Resilience).

Figure 5-1 through 5-3 show the AUAR location.

6. Project Description

a. Provide the brief project summary to be published in the EQB Monitor, (approximately 50 words).

The City of Moorhead is updating the South Growth Area AUAR for the second time since its adoption in 2009 and subsequent update in 2018. A relatively small amount of development has occurred since 2018. The AUAR Update includes assumptions in the adopted 2022 Comprehensive Plan Update and the AUAR update incorporates questions regarding climate change adopted by the EQB in December 2022.

b. Give a complete description of the proposed project and related new construction, including infrastructure needs. If the project is an expansion include a description of the existing facility. Emphasize: 1) construction, operation methods and features that will cause physical manipulation of the environment or will produce wastes, 2) modifications to existing equipment or industrial processes, 3) significant demolition, removal or remodeling of existing structures, and 4) timing and duration of construction activities

The AUAR area encompasses over 3,600 acres in south Moorhead Township. Total build out of the AUAR area is not anticipated for over 20 years. This AUAR evaluates the potential full build-out scenario, as per the Growth Area Plan (GAP) adopted in 2016 and any updated policies from the 2022 Comprehensive Plan.

The full build-out development scenario is evaluated in this AUAR. This scenario reflects the land use pattern described in the Moorhead Growth Area Plan (GAP). The GAP was developed to address the increase in development activity that has led to the need to plan for future growth. General directions for the GAP were established based on the City's 2009 Comprehensive Plan Update, stormwater plans, utility infrastructure plans, and regional transportation plan as provided by Fargo-Moorhead Metropolitan Council of Governments (Metro COG). The general public, city staff, affected property owners and the development community were integrally involved throughout any past planning processes, providing input before alternatives were conceived and reviewing proposed alternatives to help converge on a preferred plan.

The future land uses for the Growth Areas were reinforced and formally adopted in the City's 2022 Comprehensive Plan Update, fulfilling a mitigation step in the 2018 AUAR. Minor changes were made to planned land uses to consolidate the City's land uses and create more areas that allow for mixed use development. Except these minor changes, the future land uses in the Growth Areas remain the same as in the 2018 AUAR full-buildout scenario.

1) *Construction, operation methods and features that will cause physical manipulation of the environment or will produce wastes.*

   Development in the AUAR area is not anticipated to involve the physical or hydrologic alteration of any existing surface waters; however, development could impact the Red River and its tributary streams if storm water runoff is not managed adequately.

2) *Modifications to existing equipment or industrial processes*

   There will be no modifications to existing equipment or industrial processes. Any and all existing equipment will be removed from the site and disposed of according to all applicable city, state and federal regulations.

3) *Significant demolition, removal or remodeling of existing structures*

   At this time, the city does not have plans for significant demolition, removal, or remodeling of any existing structures. However, should demolition occur, all construction wastes will be removed and disposed of off-site according to all applicable city, state and federal regulations.

4) *Timing and duration of construction activities*

   The AUAR area will likely not be fully built out for 20+ years, depending upon market conditions.

c. **Project magnitude**

Total Project Acreage Approximately 3,696.41 acres.

This AUAR will evaluate two development scenarios with varying magnitudes. Table 1 summarizes the development magnitude data for each Scenario.

Scenario 1: No Further Build. This scenario assumes that development in the South AUAR area would halt at its current state. Therefore, acreage and development intensity figures used in this AUAR represent the current status (at time of writing) of development in the South AUAR area.

A relatively small amount of development has occurred in the growth area since the 2018 AUAR, which is reflected in the acreage assumptions for Scenario 1 – No Further Build in Table 1 below. Development or redevelopment since 2018 in the AUAR area includes about 30 acres of low density residential development, 1.7 acres of medium density residential, and about 62 acres of commercial development.

Scenario 2: Maximum Development. This scenario assumes that all land in the South AUAR area will develop to its maximum allowed intensity. The acreage figures for this scenario represent how the current AUAR area acreage is guided by the city. See Table 1 for guided acreages. The development intensity figures for Scenario 2 represent the maximum development that could occur in the South AUAR area based on the City's current land use and zoning controls.

The acreages in Scenario 2 - Maximum Development have shifted slightly since the 2018 AUAR Update based on the City's recently adopted 2022 Comprehensive Plan Update.

Table 1. Project Magnitude

Land Uses	Scenario 1: No Further Build (acres)	Scenario 2: Maximum Development (acres)*
Residential	95.9 (+31.69)	2,923.46 (+ 286.75)
Commercial	59.44 (+61.72)	84.62 (- 3.65)
Mixed Use	0	43.18 (+ 11.58)
Industrial	61.72	0
Public/Semi-Public, Institutional	101.72	180.95
Parks & Open Space	10.17	336.79 (- 42.02)
Agricultural	3,233.26 (-93.41)	0 (-185.39)
Right-of-Way	95.23	97.39 (- 23.15)
Open Water	38.96	30.02 (- 44.12)
Total	**3,696.41**	**3,696.41**

*Note: Maximum Development Acreage assumptions are based on the 2022 Comprehensive Plan Update. As development occurs, subdivision requirements will be applied including park dedication and right-of-way requirements which will increase the acreage in those two categories.

d. Explain the project purpose; if the project will be carried out by a governmental unit, explain the need for the project and identify its beneficiaries.

The City of Moorhead has experienced an increase in development activity that has led to the need to plan for future growth. The City of Moorhead recognized the need for more detailed land use planning that would facilitate smart growth and the development of multiple parcels in a cohesive manner and ensure that the public infrastructure needed to support development is planned appropriately. This is a discretionary AUAR and Update completed by the City of Moorhead.

The City is constrained by its flat ground and soils, which challenges the City's ability to extend sewer infrastructure to areas not currently served. Because of this, the growth areas are intended to be a long-term growth opportunity for the City. In the City's current 2022 Comprehensive Plan

Update most growth is focused on the City's mixed-use areas – downtown, along Highway 10 (EasTen) and around the I-94 intersection (Holiday).

The development within the AUAR area, while long-term, will increase housing options and availability and provide recreation opportunities, hospitality and commercial services to the area. The City and the region will be positively impacted by the increased revenue and property taxes generated by development within this area, as well as enhancements to services, jobs, and recreational opportunities in the region. The project will mostly be completed by private developers.

e. Are future stages of this development including development on any other property planned or likely to happen? ☐ **Yes** **X No**
If yes, briefly describe future stages, relationship to present project, timeline and plans for environmental review.

No. The AUAR evaluates the full build-out of proposed development within the AUAR area. The area is planned to be developed continuously over the next 20+ years in response to market demand.

f. Is this project a subsequent stage of an earlier project? **X Yes** ☐ **No**
If yes, briefly describe the past development, timeline and any past environmental review.

N/A

7. Climate Adaptation and Resilience

a. Describe the climate trends in the general location of the project (see guidance: Climate Adaptation and Resilience) and how climate change is anticipated to affect that location during the life of the project.

In general, Minnesota is anticipated to experience an increase in temperature, precipitation, and more frequent extreme precipitation events resulting from climate change. In Minnesota, annual average temperatures have risen two degrees over the past century and up to three degrees in the northern part of the state. The highest average temperature increases have occurred during the winter. Since 1895, temperatures during the winter have increased at a rate two to three times higher than during the summer. In particular, winter warming rates have risen more sharply in recent decades. [1] Current climate warming trends, most notably during the winter, are anticipated to continue.[2]

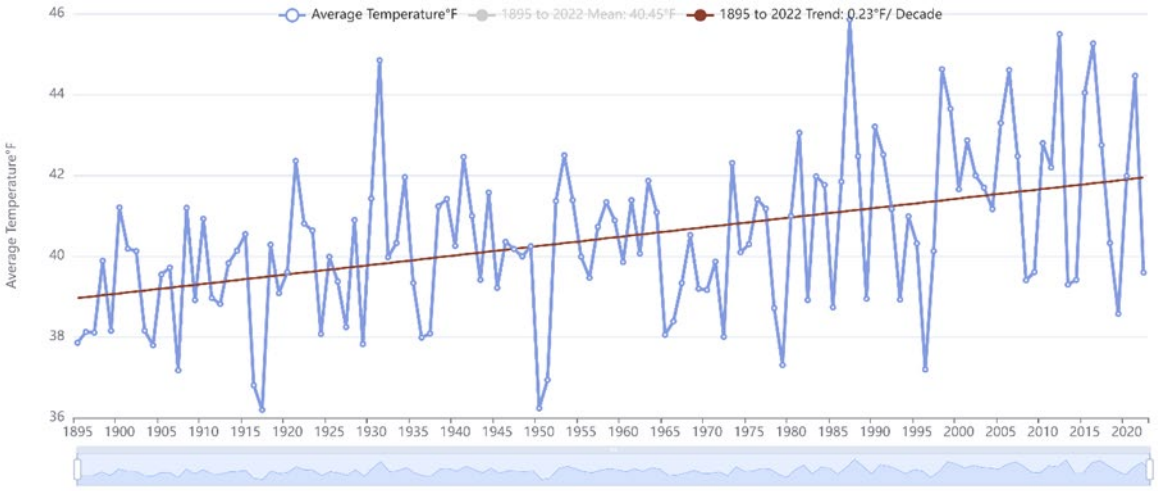
Heavy rain events have become more frequent in Minnesota and more intense. From 1973 to 2020, Minnesota experienced 17 mega-rain events[3] with a notable increase since 2000. Of these 17 events, three occurred in the 1970s, two in the 1980s, one in the 1990s, six mega-rain events occurred in the 2000s, four in the 2010s, and one in 2020. Thus, in the past 21 years (2000 to 2020), almost two times as many mega rain events occurred compared to the prior 27 years (1973 to 1999).[4]

Climate trends for Clay County parallel the overall statewide trends, indicating Minnesota's climate is

[1] DNR. 2021. Climate Trends. Available at: https://www.dnr.state.mn.us/climate/climate_change_info/climate-trends.html. Accessed May 2023.
[2] MnDOT. 2021. Minnesota Go Climate Change Report. Available at: https://www.minnesotago.org/trends/climate-change. Accessed May 2023.
[3] Mega-rain events are defined as events in which six inches of rain covers more than 1,000 square miles and the core of the event tops eight inches.
[4] DNR. 2022. Historic Mega-Rain Events in Minnesota. Available at: https://www.dnr.state.mn.us/climate/summaries_and_publications/mega_rain_events.html. Accessed May 2023.

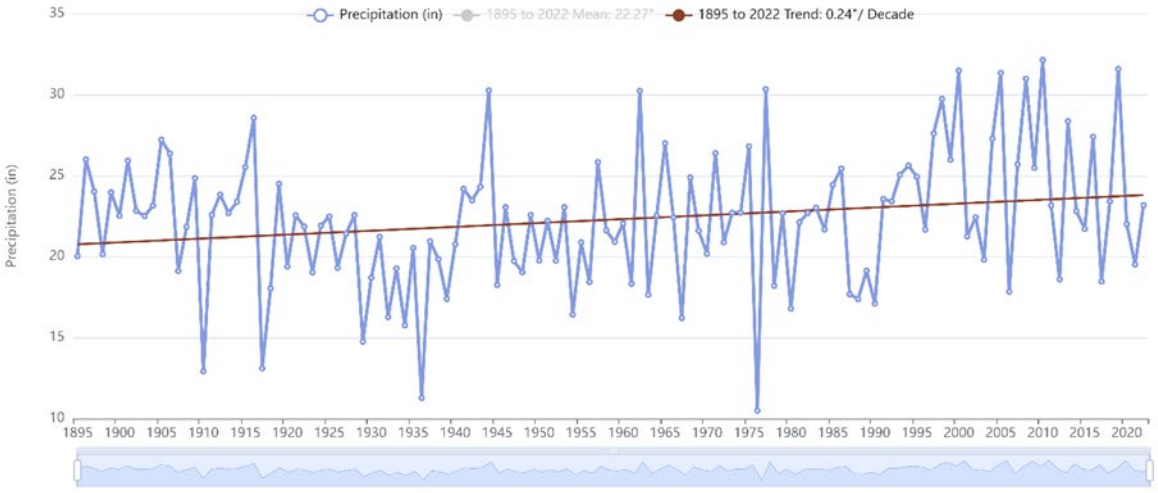
becoming warmer and wetter. Exhibits 1 and 2 illustrate historical average annual temperature and precipitation trends from 1895 to 2022. During this time period, the County experienced an average annual temperature increase of 0.23 degrees Fahrenheit (°F) per decade and annual precipitation increase of 0.24 inches per decade.

Exhibit 1. Historical Annual Average Temperature in Clay County (1895 – 2022)



Source: Minnesota Department of Natural Resources. https://arcgis.dnr.state.mn.us/ewr/climateexplorer/main/historical

Exhibit 2. Historical Annual Average Precipitation in Clay County (1895 – 2022)

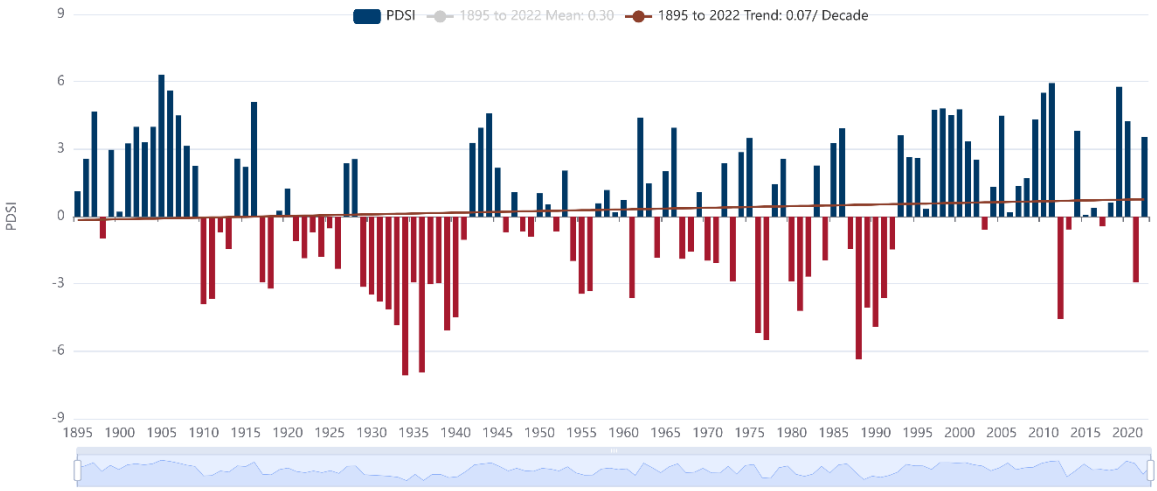


Source: Minnesota Department of Natural Resources. https://arcgis.dnr.state.mn.us/ewr/climateexplorer/main/historical

The Palmer Drought Severity Index (PDSI) utilizes temperature and precipitation data to estimate relative soil moisture conditions and serve as an indicator of long-term drought conditions. The index ranges from -5 to +5 indicating dry and wet conditions, respectively. PDSI values are reported on a monthly basis. Exhibit 3 shows historic PDSI values for the month of August from 1895 to 2022 for Clay County, which indicates an increase of 0.07 per decade. Generally, the PSDI

historical data indicates that the region is experiencing a wetter climate.

Exhibit 3. Historical PDSI Values for Clay County (1895-2022)



Source: Minnesota Department of Natural Resources. https://arcgis.dnr.state.mn.us/ewr/climateexplorer/main/historical

According to DNR climate trends data, the frequency of intense storms is increasing. The U.S. Environmental Protection Agency's (EPA) Climate Resilience Evaluation and Awareness Tool (CREAT) Climate Change Scenarios Projection Map[5] details the expected percent change in 100-year storm intensity for a select area. Two different scenarios of "stormy" and "not as stormy" are considered for the years of 2035 and 2060. Table 2 quantifies these changes for the area containing the AUAR area and shows that storm intensity in this area is expected to increase over time in either scenario.

Moorhead Public Service further clarified with their CREAT module from 2018/2019 that the increased frequency of intense storms is primarily in the form of snow during MN's dry season (winter). This increase in annual precipitation is lost during spring snowmelt and flood season, and statistically the summer months are receiving less frequent precipitation, but higher "mega rain events". This puts additional strain on water supply resources during the summer months, especially groundwater supplies.

Table 2. Percent Change in 100-Year Storm Intensity for the AUAR area

Year	Scenario	
	Stormy	Not as Stormy
2035	13.2	2.2
2060	25.8	4.3

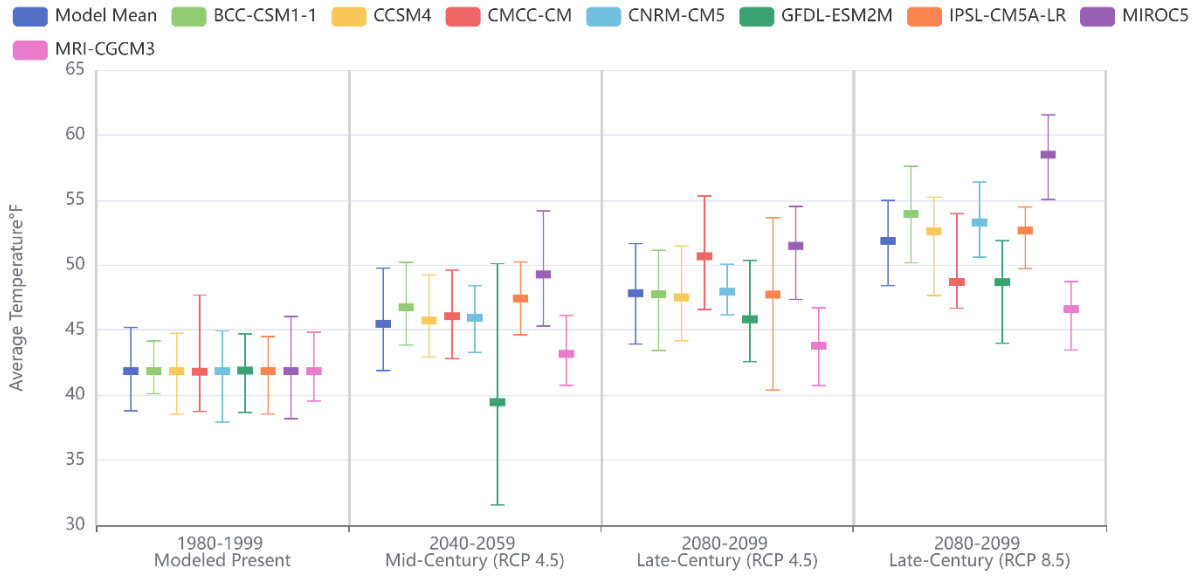
Projected climate trends indicate that temperatures within Clay County will continue to increase. Exhibit 4 illustrates projected temperatures for Clay County. Several climate models are shown in the projected temperature analysis. The model mean, shown in blue, illustrates the average of all models included in the analysis. Exhibit 4 shows the modeled present condition, mid-century (2040-2059) at Representative Concentration Pathway (RCP) 4.5, late-century (2080-2099) at RCP

[5] EPA. 2016. CREAT Climate Change Scenarios Projection Map. Available at: https://epa.maps.arcgis.com/apps/MapSeries/index.html?appid=3805293158d54846a29f750d63c6890e. Accessed May 2023.

4.5, and late-century (2080-2099) at RCP 8.5. RCP is a greenhouse gas concentration scenario used by the Intergovernmental Panel on Climate Change in the fifth assessment report. RCP 4.5 is an intermediate scenario in which emissions decline after peaking around 2040 and RCP 8.5 represents a worst-case scenario in which emissions continue rising through the 21st century.

Under the RCP 4.5 scenario, the annual temperature is anticipated to increase within the county from a modeled present mean of 41.9°F (1980-1999) to a mid-century (2040-2059) model mean of 45.5°F and a late-century (2080-2099) model mean of 47.9°F. Under the RCP 8.5 worst-case scenario, Clay County would experience a late-century (2080-2099) model mean temperature of 51.9°F.

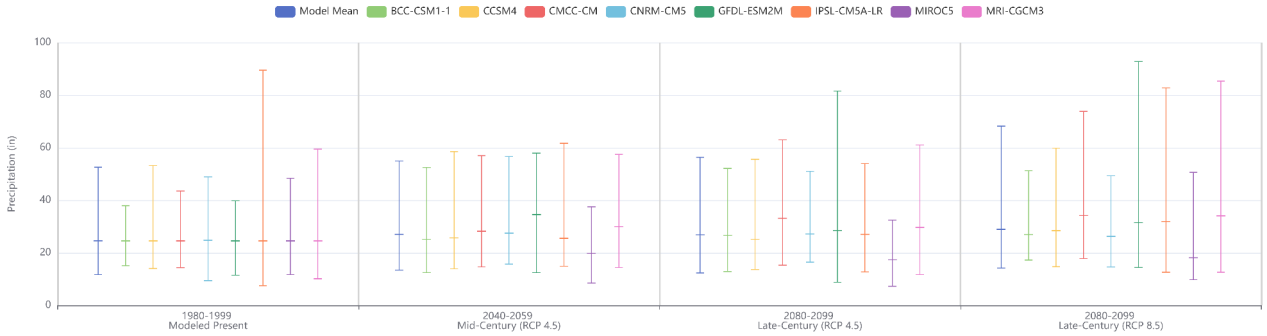
Exhibit 4. Projected Temperatures in Clay County



Source: Minnesota Department of Natural Resources. Minnesota Climate Explorer (state.mn.us). Definitions of the models included in this analysis can be found at Climate Explorer Metadata | Minnesota DNR (state.mn.us).

Exhibit 5 presents projected average annual precipitation for Clay County. Under the RCP 4.5 scenario, the annual precipitation is anticipated to increase within Clay County from a modeled present mean of 24.6 inches (1980-1999) to a mid-century (2040-2059) model mean of 27.0 inches and a late-century (2080-2099) model mean of 26.8 inches. Under the RCP 8.5 worst-case scenario, the county would experience a late-century (2080-2099) model mean precipitation of 28.9 inches. In comparison to the modeled present mean (1980-1999), the late-century (2080-2099) modeled mean annual precipitation would increase by approximately 8.9 percent under the RCP 4.5 scenario and increase by approximately 17.5 percent under the RCP 8.5 scenario.

Exhibit 5. Projected Precipitation in Clay County



Source: Minnesota Department of Natural Resources. Minnesota Climate Explorer (state.mn.us). Definitions of the models included in this analysis can be found at Climate Explorer Metadata | Minnesota DNR (state.mn.us).

b. For each Resource Category in the table below: Describe how the project's proposed activities and how the project's design will interact with those climate trends. Describe proposed adaptations to address the project effects identified.

Table 3 summarizes climate considerations related to the project and adaptation considerations.

Table 3. Climate Considerations and Adaptations

Resource Category	Climate Considerations	Project Information	Adaptations
Project Design	Increased heavy rainfall and flooding.	The Project would result in an increase in impervious surface under the maximum development scenario.	The Project would utilize infrastructure design standards appropriate for heavier rainfall and flooding and that are compliant with City of Moorhead requirements as well as the National Pollutant Discharge Elimination System (NPDES) stormwater management requirements.
Land Use	Heavier rainfall is expected to increase the risk of localized flooding.	The western portion of the AUAR area falls within a 100-year floodplain. The center of the AUAR area falls within the 500-year floodplain. The remaining sections of the AUAR area are located within an area of minimal flood risk.	The Project would utilize infrastructure design standards appropriate for heavier rainfall and flooding that are compliant with City of Moorhead requirements as well as the National Pollutant Discharge Elimination System (NPDES) stormwater management requirements. The City will continue to require reduced impervious surface for new development. Currently this is done on a case-by case basis through an overlay for new

			developments and reduced parking requirements, but a more permanent solution may be explored in the future.
Water Resources	Addressed in item 12		
Contamination/ Hazardous Materials/ Wastes	Protection of water resources from soil and water contamination.	The presence or absence of hazardous materials will be determined as the Project develops. If present within the AUAR area, hazardous materials would be stored properly using secondary containment and additional BMPs as necessary.	Stormwater management for impervious surfaces would be planned and consistent with NPDES requirements, including the use of permanent stormwater ponds.
Fish, wildlife, plant communities, andsensitive ecological resources (rare features)	Addressed in item 14.		

8. Cover Types

Table 4 provides a summary of land cover types currently in the AUAR area and estimated post-construction land cover as a result of planned development in Scenario 2 – Full Buildout. The current cover types have been updated to reflect development or redevelopment that has occurred since the 2018 AUAR. Existing cover types are shown in Figure 8-1. Estimated post-construction land cover types were calculated based on the Future Land Use data from the 2022 Comprehensive Plan.

Table 4. Cover Types

Cover Types	Before(acres)	After (acres)
Wetlands and shallow lakes (<2 meters deep)	80.8	66.21
Deep lakes (>2 meters deep)	--	--
Wooded/forest	1.72	0.07
Rivers/streams	--	--
Brush/grassland	--	--
Cropland	3,010.30 (-93.41)	226.39
Livestock rangeland/pastureland	--	--
Lawn/landscaping	--	--
Green infrastructure TOTAL (from table below*)	--	--
Impervious surface	578.43 (+93.41)*	3,329.60**
Stormwater Pond (wet sedimentation basin)	1.5***	74.14

Other (describe)	--	--
TOTAL	**3,696.41**	**3,696.41**

*Change in acreage of impervious surface is generalized based on permit data for development or redevelopment parcels. This does not account for required constructed stormwater infrastructure for these parcels, meaning actual impervious surface is less than the amount shown in the table.
**Note: After assumptions are based on the 2022 Comprehensive Plan Update. As development occurs, zoning and subdivision requirements will be applied including open space and park dedication, which will ultimately reduce the impervious surface category in this table.
***Note: The 1.5 acres of stormwater pond are included in the acreage for wetlands and shallow lakes and should not be counted towards total acreage.

While it is too early to identify specific green infrastructure elements to be included in new development, the City is committed to encouraging green infrastructure in new development, where feasible. The city recognizes that there may be limitations to green infrastructure given the flat topography and heavy clay soils that limit infiltration.

With its location along the Red River, the City of Moorhead regularly experiences heavy flooding. The City is committed to green infrastructure, where feasible, that reduces the frequency and impacts of flooding. The City has proactively acquired properties along the river and converted them to green space. The City has also been involved in the Fargo Moorhead Area Diversion Project, which has progressed significantly since the 2018 AUAR and will provide a permanent solution to protect the Fargo-Moorhead metro area by diverting excess water around the metro area during significant flood events. In its Comprehensive Plan, the City has committed to "develop policies that support individual and community projects such as native landscapes, rain gardens, local food production and pollinators," and will remain flexible to allowing other green infrastructure elements in new development.

Table 5. Green Infrastructure

Green Infrastructure*	**Before (acreage)**	**After (acreage)**
Constructed infiltration systems (infiltration basins/ infiltration trenches/ rainwater gardens/ bioretention areas without underdrains/swales with impermeable check dams)	N/A (see text below)	N/A
Constructed tree trenches and tree boxes	N/A	N/A
Constructed wetlands	N/A	N/A
Constructed green roofs	N/A	N/A
Constructed permeable pavements	N/A	N/A
Other (describe) Landfill-based geothermal system	N/A	N/A
TOTAL*	N/A	N/A

The City of Moorhead has been designated as a Tree City USA for the past 30 years. The City also achieved Step 5 in the Green Step City program in 2022. New development will be required to plant trees per the landscaping and tree standards in the zoning code, but it is too early to quantify tree removal or replacement for the AUAR area. Finally, the Comprehensive Plan has policies encouraging sustainability and tree planting. In recent years, the average number of trees planted by the city has increased from 400 to 700 annually.

Table 6. Tree Canopy

Trees	Percent	Number
Percent tree canopy removed or number of mature trees removed during development	NA	--
Number of new trees planted	NA	--

9. Permits and Approvals Required

List all known local, state and federal permits, approvals, certifications and financial assistance for the project. Include modifications of any existing permits, governmental review of plans and all direct and indirect forms of public financial assistance including bond guarantees, Tax Increment Financing and infrastructure. All of these final decisions are prohibited until all appropriate environmental review has been completed. See Minnesota Rules, Chapter 4410.3100.

Table 7 lists all permits that may be required for development in the AUAR area.

Table 7. Permits and Approvals

Unit of Government	Type of Application	Status
Federal		
US Army Corps of Engineers	Clean Water Act Section 401/10 Wetland Permits (Joint Application for Activities Affecting Water Resources in Minnesota)	Applicable to Future Development
Federal Aviation Administration	FAA 7460-1 Permit	
State		
Minnesota State Historic Preservation Office	Cultural Resource Coordination	Applicable to Future Development
Minnesota Department of Transportation	Utilities in Right-of-Way Permit	
	Right-of-way permit for work within or affecting MnDOT right-of-way	
	Limited Use Permit	
Minnesota Department of Health	Water Main Plan Review	
Minnesota Department of Natural Resources	Water Supply Appropriations Permit (if needed)	
Minnesota Pollution Control Agency	NPDES General Permit for Construction	
	Sanitary Sewer Extension Permit	
	Clean Water Act Section 401 Water Quality Certification required if a US Army Corps of Engineers Clean Water Action Section 404 Permit is required	
	Notification of Intent to Perform a Demolition	

	UST Notification of Installation or Change in Status Form	
Regional/Local		
City of Moorhead	Subdivision Approval	Applicable to Future Development
	Rezoning	
	Planned Unit Development Approval	
	Conditional Use Permit Approval	
	Grading/Erosion Control Permit	
	Site Plan Approval	
	Comprehensive Plan Amendment	
	Zoning Ordinance Amendments	
	Variance	
	Floodplain Development Permit	
Clay County	Roadway Access Permit	
	Utilities in Right-of-Way Permit	
Clay County Soil and Water Conservation District	Joint Application for Activities Affecting Water Resources in Minnesota	
Buffalo-Red River Watershed District	Watershed Permit	

Cumulative potential effects may be considered and addressed in response to individual EAW Item Nos.10-20, or the RGU can address all cumulative potential effects in response to EAW Item No.22. If addressing cumulative effect under individual items, make sure to include information requested in EAW Item No. 21.

10. Land use

a. Describe:

i. Existing land use of the site as well as areas adjacent to and near the site, including parks and open space, cemeteries, trails, prime or unique farmlands.

Land within the South Growth Area is almost entirely agricultural or vacant in use. There are some single-family residences along main roadways in the area, especially along Highway 75 and 46th Avenue South. There are three main commercial areas within the South Growth Area, two along Highway 75, directly south of the City (KVOX-FM Moorhead and Moorhead Marine) and one along the railroad at 50th Avenue South. There is one designated park and open space area, located along the Red River. The Bluestem Center for the Arts is the only existing institutional use in the South Growth Area, located along the Red River. Figure 10-1 shows existing land use.

Development or redevelopment since 2018 in the AUAR area includes about 30 acres of low density residential development, 1.7 acres of medium density residential, and about 62 acres of commercial development.

There are no parks within the South AUAR area, but there are open spaces along the Red River.

Additionally, there are a variety of shared use paths within the growth area. There are no cemeteries within the AUAR area. There is prime farmland within and surrounding the AUAR area.

ii. Plans. Describe planned land use as identified in comprehensive plan (if available) and any other applicable plan for land use, water, or resources management by a local, regional, state, or federal agency.

Moorhead completed an update to the Comprehensive Plan in 2022, entitled Onward Moorhead. Included in the Comprehensive Plan is a future land use map which shows the South Growth Area as a combination of residential, commercial, public uses and open space. The South Growth Area examined in this AUAR is comprised of three distinct areas: the Southeast Area, the South Central Area, and the South Area.

- Southeast Area: New residential neighborhood with a mix of low, medium, and high density housing options. There will be new parks and institutional uses to support these residences.
- South Central Area: New residential neighborhood with mainly low density housing and connecting parks and open spaces. Higher density housing and commercial uses are proposed for land along Highway 75.
- South Area: New residential neighborhood with mainly low density housing and connecting parks and open spaces. Land along the Red River is proposed to remain park and open space and connect with Bluestem. Some commercial and higher density housing uses are proposed for along Highway 75.

Figure 10-2 illustrates the planned future land use in the South Growth Area.

iii. Zoning, including special districts or overlays such as shoreland, floodplain, wild and scenicrivers, critical area, agricultural preserves, etc.

Zoning within the South Growth Area is complicated because of the many jurisdictions located within the area. For property within the City of Moorhead, land is generally zoned TZ Transitional and P Public Open Space. Some residential parcels have been platted and zoned as low density residential (RLD1, RLD2, and RLD3).

Most of the South Growth Area is outside the City of Moorhead and is under the jurisdictional authority of Clay County and Moorhead Township. Land within the South Growth Area is zoned AG General everywhere except for a collection of parcels at the intersection of 50th Avenue South and Highway 75.

The Red River of the North makes up the western boundary of the South Growth area, causing a portion of the South Growth Area to be located within a Federal Emergency Management Agency (FEMA) mapped floodplain. Since the 2018 AUAR Update, the City has acquired much of the land that had not been previously acquired by Clay County or the Buffalo Red River Watershed District along the Red River to preserve as open space. Within the floodplain areas, special regulations are in place to protect from flooding, and as per City code, improvements within the flood way are limited or are not permitted unless the improvement is independently evaluated through hydraulic modeling. A floodplain permit is required for lots within the 100-year floodplain. Additionally, the Fargo-Moorhead Diversion Project is underway to provide an outlet for flood waters and reduce flooding in the Fargo and Moorhead region.

iv. If any critical facilities (i.e. facilities necessary for public health and safety, those storing hazardous materials, or those with housing occupants who may be insufficiently mobile) are

proposed in floodplain areas and other areas identified as at risk for localized flooding,describe the risk potential considering changing precipitation and event intensity.

Areas within the AUAR area are located within the 100-year regulated floodplain and floodway. As mentioned above, the City has acquired much of this land that had not been previously acquired by Clay County or the Buffalo Red River Watershed District as a preventative measure to preserve as open space. Additionally, the Fargo-Moorhead Diversion project should help to alleviate flooding in the future in these areas. As described in Item 7, future climate conditions may result in increased localized flooding associated with increased high intensity rainfall events. No critical facilities such as public health or specialty housing facilities would be included under the proposed Development Scenarios.

b. Discuss the project's compatibility with nearby land uses, zoning, and plans listed in Item 9a above, concentrating on implications for environmental effects.

The anticipated land uses in each scenario are compatible with the adjacent land uses. The mixture of residential, commercial, public/institutional and park/open space will be an expansion of the urban land uses already north of the Growth Area.

The 2022 Comprehensive Plan shows the adopted future land use for the area and should be relied upon for determining the future of the area. The growth shown in the AUAR is compatible with the future land uses shown in the Comprehensive Plan.

c. Identify measures incorporated into the proposed project to mitigate any potential incompatibility as discussed in Item 10b above and any risk potential.

Required Changes to Zoning:
Given that the proposed future land use in the South Growth Area is not consistent with existing zoning of TZ Transitional, the City must update their zoning map to accurately implement this revised future land use plan.

As new land within the South Growth Area is annexed into the City of Moorhead, the City must update its zoning map to reflect the residential and mixed use nature of the proposed future land use (rather than agricultural).

11. Geology, Soils and Topography/Land Forms

a. Geology - Describe the geology underlying the AUAR area and identify and map any susceptible geologic features such as sinkholes, shallow limestone formations, unconfined/shallow aquifers, or karst conditions. Discuss any limitations of these features for the project and any effects the project could have on these features. Identify any project designs or mitigation measures to address effects to geologic features.

Geologic conditions and risk factors remain unchanged from the 2018 AUAR.

b. Soils and topography - Describe the soils on the site, giving NRCS (SCS) classifications and descriptions, including limitations of soils. Describe topography, any special site conditions relating to erosion potential, soil stability or other soils limitations, such as steep slopes, highlypermeable soils. Provide estimated volume and acreage of soil excavation and/or grading. Discuss impacts from project

activities (distinguish between construction and operational activities) related to soils and topography. Identify measures during and after project construction to address soil limitations including stabilization, soil corrections or other measures. Erosion/sedimentation control related to stormwater runoff should be addressed inresponse to Item 12.b.ii.

Soil conditions, risk factors, and mitigation strategies are unchanged from the 2018 AUAR. The USDA-NRCS Web Soil Survey mapping remains unchanged from 2018[6]. Figure 11-1 shows the basic soil survey map for the AUAR area.

12. Water Resources

a. Describe surface water and groundwater features on or near the site in a.i. and a.ii. below.

i. Surface water - lakes, streams, wetlands, intermittent channels, and county/judicial ditches. Include any special designations such as public waters, shoreland classification and floodway/floodplain, trout stream/lake, wildlife lakes, migratory waterfowl feeding/resting lake, and outstanding resource value water. Include the presence of aquatic invasive species and the water quality impairments or special designations listed on the current MPCA 303d Impaired Waters List that are within 1 mile of the project. Include DNR Public Waters Inventory number(s), if any.

Surface Waters

No lakes, streams, shorelands, trout streams/lakes, designated wildlife lakes, lakes of biological significance, or migratory waterfowl feeding/resting lakes are present within the AUAR area[7]. Clay County Ditch No. 42 extends east to west along the southern boundary of the AUAR area parallel with County State Aid Highway (CSAH) 12 (60th Avenue South), and Clay County Ditch No. 47 extends along the eastern boundary of AUAR area parallel with Highway 52. Figure 12-1 shows existing water resources in the AUAR area.

DNR Public Waters

One DNR Public Water Watercourse, the Red River (kittle number: H-026) extends north to south along the western boundary of the AUAR area. No other DNR Public Water Basins or Public Water Watercourses are present within one mile of the AUAR area. The South Branch of the Buffalo River (kittle number: H-026-056-009) is a DNR Public Watercourse located approximately 2.5 miles east of the AUAR area.

Wetland Resources

According to a review of the National Wetlands Inventory (NWI) in 2023[8], there are approximately 80.8 acres of wetlands within the AUAR area, which is an increase from the 29.3 acres identified in the 2018 review. This discrepancy is because the 2023 AUAR update utilized updated NWI data. Of the 80.8 acres identified, approximately 1.5 acres are associated with stormwater pond features in the northern portion of the AUAR area adjacent to residential

[6] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/ accessed [05/09/2023].
[7] DNR. undated(a). Minnesota Conservation Explorer. Available at: https://mce.dnr.state.mn.us/content/explore. Accessed August 2023.
[8] 2009-2014 National Wetland Inventory Update. Data analyzed in ArcGIS using spatial and tabular geodatabase data from Minnesota Geospatial Commons, downloaded in 2022.

developments. The remaining 79.3 acres are primarily associated with riverine and forested wetland features adjacent to the Red River.

MPCA 303d Impaired Waters List

The MPCA published a revised list of impaired waters in 2024. Based on the MPCA's 2024 303d impaired waters list, the Red River (assessment unit identifier [AUID]: 09020104-544) is impaired for aquatic consumption, aquatic life, and aquatic recreation as a result of *E. coli*, mercury in fish tissue, and turbidity, which extends along the western boundary of the AUAR area. In 2018, the Red River was delisted for polychlorinated biphenyls (PCBs) in fish tissues without the use of corrective actions[9]. Additionally, the South Branch of the Buffalo River (AUID: 09020106-503), located approximately 2.5 miles east of the AUAR area, is impaired for aquatic life and aquatic recreation as a result of *E. coli,* turbidity, and dissolved oxygen.

The MPCA approved a WRAPS report for the Upper Red River of the North watershed on December 22nd, 2017. The Watershed Restoration and Protection Strategy (WRAPS) process was developed by the MPCA to identify and address water quality threats in Minnesota's eighty major watersheds. The reports have two parts. The first is that impaired waters have restoration strategies, and the second is that non-impaired waters have protection strategies.

A full report for the Upper Red River of the North watershed can be found here: https://www.pca.state.mn.us/sites/default/files/wq-ws4-36a.pdf, and a summary of the report is also provided by the MPCA: https://www.pca.state.mn.us/sites/default/files/wq-ws4-36b.pdf. The WRAPS summary includes information on the WRAPS program, watershed characteristics, and strategies for protection, as well as other components of this process. Best management practices (BMPs) based on sediment, phosphorus and nitrogen delivery, as well as bacteria risks, in this area, are identified. Developers should reference this report, and incorporate BMPs where possible.

Floodway/Floodplain

According to the Federal Emergency Management Agency (FEMA) National Flood Hazard Layer (NFHL) viewer, small portions of the western portion of the AUAR area are within a 100-year regulated floodplain and floodway associated with the Red River (FEMA 2012)[10]. Additional areas are also within the 500-year floodplain or designated as Areas with Reduced Risk Due to Levee. A levee is present along portions of the western boundary of the AUAR area to reduce flood risk associated with the Red River. The majority of this area is no longer within the 100-year floodplain due to the levee project and subsequent FEMA Letter of Map Review (LOMR). At this time, there are no plans to construct additional in-town levees within the AUAR area. This has not changed since the 2018 review.

As discussed in Item 8, the proposed Fargo Moorhead Area Diversion Project has developed since 2018 and will provide permanent improvements to mitigate flood risk by diverting excess water around the metro area during significant flood events.

ii. Groundwater – aquifers, springs, seeps. Include: 1) depth to groundwater; 2) if project is

[9] MPCA. 2022. Minnesota's impaired waters list. Available at: https://www.pca.state.mn.us/air-water-land-climate/minnesotas-impaired-waters-list. Accessed May 2023.
[10] FEMA. 2012. National Flood Hazard Layer (NFHL) Viewer. Available at: https://www.fema.gov/flood-maps/national-flood-hazard-layer. Accessed May 2023.

within a MDH wellhead protection area; 3) identification of any onsite and/or nearby wells, including unique numbers and well logs if available. If there are no wells known on site or nearby, explain the methodology used to determine this.

Depth to Groundwater

The available Minnesota Well Index data on wells within the AUAR area are unchanged from the 2018 AUAR update[11]. Depth to groundwater within the AUAR area ranges from 12 feet to 180 feet in the wells observed within the area. Average groundwater depth is 55 feet. However, since low permeability soils and clay deposits exist in the area, there is a potential for perched groundwater to be present at or near the land surface over portions of the AUAR area. Figure 12-2 shows well locations.

MDH Wellhead Protection Area

As of the 2018 review, it was determined that the AUAR area does not overlap with Drinking Water Supply Management Areas (DWSMA). This remains true for the 2023 review. Two DWSMA are located outside of the AUAR area. The Buffalo Aquifer DWSMA and Wellhead Protection Area are located approximately 2.3 miles northeast of the AUAR area, which is classified as "highly vulnerable" to contamination from spills or leaks that occur at or near the land surface[12]. This is either due to the clay layers not being laterally extensive across the DWSMA to afford protection, or the presence of human-sourced contamination has been detected in the aquifer. In the area, best management practices should be undertaken to avoid spills or leaks infiltrating into soils. The Moorhead Public Service Wellhead Protection Plan and the Clay County Development Code should be used to reference protective measures to be undertaken in this area. Additionally, the Moorhead Aquifer DWSMA and Wellhead Protection Area is located approximately 2.4 miles north of the AUAR area and is ranked as low vulnerability for contamination from spills or leaks.

Onsite Wells

A total of 28 groundwater wells have been identified within the AUAR area using the County Well Index database. This number is unchanged from the 2018 AUAR and onsite wells are shown in Figure 12-2. The actual number of wells within the AUAR area is likely to be greater, since not all wells have been accounted for in the State's database, especially any wells drilled prior to 1975 before the State started collecting well records. Improperly constructed wells, or unused wells which haven't been sealed, can act as a pathway for contaminants to reach the aquifer. Therefore, Well Code requires that unused wells be sealed by a licensed well contractor. If any unused wells are encountered during construction activities, or if any wells are taken out of service during the course of construction, these wells must be sealed to meet the Well Code.

b. Describe effects from project activities on water resources and measures to minimize or mitigate the effects in Item b.i. through Item b.iv. below.

i. Wastewater - For each of the following, describe the sources, quantities and composition ofall sanitary, municipal/domestic and industrial wastewater produced or treated at the site.

1) If the wastewater discharge is to a publicly owned treatment facility, identify any pretreatment measures and the ability of the facility to handle the added water andwaste loadings, including

[11] Minnesota Geological Survey County Well Index data. February 2023. Provided by MGS annually to subscribers.
[12] MDH. 2012. Source Water Protection Web Map Viewer. Available at: https://www.health.state.mn.us/communities/environment/water/swp/mapviewer.html. Accessed May 2023.

any effects on, or required expansion of, municipal wastewater infrastructure.

The City of Moorhead completed a Sanitary/Storm Water Master Plan for this area in 2006. In 2007, the plan was updated to include the future sanitary sewer needs in some of the area covered in this AUAR. In 2015, an additional study was implemented to evaluate most of the area that is covered under this AUAR. That document is available for review through the City of Moorhead Engineering Department. The majority of the area in this AUAR is undeveloped, so construction of trunk sewer facilities in this area is readily achievable. Future growth in this area requires that sanitary sewer flows be conveyed to the City's Wastewater Treatment Facility (WWTF), which is located on 28th Street North, just north of 15th Avenue North.

Since this AUAR is located in the southern portion of the City, the conveyance facilities must go through the fully developed portion of the City of Moorhead. Using the existing facilities is more economically feasible than constructing new facilities, but in order to accomplish this in a cost-effective manner, the existing trunk facilities must be modified. There is insufficient capacity in the existing trunk sewer system to convey much of this wastewater through the developed portion of Moorhead using conventional strategies. Therefore, a combination of strategies is proposed. For the AUAR development west of 20th Street South, it is proposed to utilize an equalization tank to hold daytime flows and then release them to the WWTF at night when the other portions of the City are not fully using the existing trunk facilities. This layout is shown on Figure 12-3 and is labeled as the SW portion of the AUAR area. As shown on Figure 12- 3, a system of lift stations and forcemains, along with a short segment of trunk gravity sewer, will convey the local gravity flows to the equalization tank located north of I-94 on the west side of 28th Street South. For the portion of the AUAR area located east of 20th Street South, a new lift station and forcemain system will convey wastewater to the existing East Side Trunk Sewer System as shown on Figure 12-4. This Figure shows the southeast service expansion area combining with facilities planned for the East AUAR. The analysis behind the system layout was conducted using two phases. These two phases were established by considering anticipated construction based on an expected logical progression of growth. Average wastewater flows were allocated to each different land use proposed as shown in Table 8 below. The expected wastewater flows for each land use subarea are available in the current draft report available for review from the City of Moorhead Engineering Department.

Table 8. Average Wastewater Flows by Land Use

Land Use	Flow Allocation
Low Density Residential	300 gallons per unit per day
Medium and Mixed Density Residential	225 gallons per unit per day
High Density Resdiential	200 gallons per unit per day
Commercial	1500 gallons per acre per day
Industrial	2000 gallons per acre per day
Parks and Public Use	500 gallons per acre per day

With the strategies employed on Figures 12-3 and 12-4, the proposed sanitary sewer system is projected to be able to serve approximately 85% of the flow that is anticipated to be generated by this AUAR area. Specifically, the development south of 60th Ave South is not included within the flows shown on Figures 12-3 or 12-4. As outlined in the mitigation strategies, this number will be monitored over time to see if the projected flows are realized as development occurs.

All wastewater in the City of Moorhead is transported to the WWTF. The WWTF is currently operating under its wet weather design capacity of 9 million gallons per day (MGD). However, in order for this area to be completely developed, a major expansion to the WWTF will be needed. Based on the City's anticipated growth rate, expansion will not be needed for the next 10 years.

MITIGATION STRATEGIES

The City of Moorhead will monitor the wastewater system to determine when additional improvements are needed and will continue to update its capital budget to plan accordingly for these investments. Through the site development plan review process, the City of Moorhead will monitor and verify estimated wastewater flows for general conformance to current draft Sanitary/Storm South and East Area Master Plan. Each development will be responsible for; 1) Sanitary sewer connection fees related to their proposed development; 2) Proportional share of the costs of the Trunk Sanitary Sewer Components; 3) Construction of local sewer components to serve the development; and, 4) MPCA/NPDES sanitary sewer extension permits.

2) *If the wastewater discharge is to a subsurface sewage treatment systems (SSTS), describe the system used, the design flow, and suitability of site conditions for such a system. If septic systems are part of the project, describe the availability of septage disposal options within the region to handle the ongoing amounts generated as a result of the project. Consider the effects of current Minnesota climate trends and anticipated changes in rainfall frequency, intensity and amount with this discussion.*

   N/A

3) *If the wastewater discharge is to surface water, identify the wastewater treatment methods and identify discharge points and proposed effluent limitations to mitigate impacts. Discuss any effects to surface or groundwater from wastewater discharges, taking into consideration how current Minnesota climate trends and anticipated climate change in the general location of the project may influence the effects.*

   N/A

ii. Stormwater - Describe changes in surface hydrology resulting from change of land cover. Describe the routes and receiving water bodies for runoff from the project site (major downstream water bodies as well as the immediate receiving waters). Discuss environmental effects from stormwater discharges on receiving waters post construction including how the project will affect runoff volume, discharge rate and change in pollutants. Consider the effects of current Minnesota climate trends and anticipated changes in rainfall frequency, intensity and amount with this discussion. For projects requiring NPDES/SDS Construction Stormwater permit coverage, state the total number of acres that will be disturbed by the project and describe the stormwater pollution prevention plan (SWPPP), including specific best management practices to address soil erosion and sedimentation during and after project construction. Discuss permanent stormwater management plans, including methods of achieving volume reduction to restore or maintain the natural hydrology of the site using green infrastructure practices or other stormwater management practices. Identify any receiving waters that have construction-related water impairments or are classified as special as defined in the Construction Stormwater permit. Describe additional requirements for special and/or impaired waters.

Surface waters in the AUAR area are shown on Figure 12-1. Surface water generally flows north and west to the Red River via ditch systems. The study area contains County Ditch No. 9, and County Ditch No. 47 runs along the eastern border of the study area. Smaller roadway ditches also convey surface water, generally to the County ditches.

Existing conditions largely consist of agricultural land use, with little structural stormwater management. Development in the AUAR area is anticipated to increase stormwater runoff due to the increase in impervious surfaces associated with urban land uses. Under proposed conditions, a stormwater system will be implemented to address local, state, and federal requirements, as discussed below. This system will generally consist of stormwater ponds for rate control and water quality treatment; infiltration, filtration, or bioretention for volume control and water quality treatment where feasible in accordance with City code and MPCA permit requirements; and temporary erosion and sediment control features such as vegetative restoration, storm drain inlet protection, construction entrance protection, and silt fence.

Where possible, the City's Growth Area Plan (GAP) encourages stormwater to be kept on the surface and treated on-site to reduce expensive stormwater system costs, subject to site limitations. In some cases, regional stormwater treatment may be more effective. The GAP also encourages the stormwater system to be integrated with the open space system to create a valuable amenity for neighborhoods. The GAP illustrates how landscape corridors and parkways can meander through neighborhoods and contain stormwater systems.

Development within the AUAR area is subject to the regulations of Chapter 8 – Storm Water Management of Title 3 – Public Health and Sanitation of the City Code. The City Code incorporates the design standards in the Minnesota Stormwater Manual and NPDES Construction Site Permit by reference. The Code calls for treatment of the required water quality volume (subject to site-specific limitations and/or prohibitions), as well as no net increase from pre-development peak flows for the 2-, 10-, and 100-year storm events.

Additionally, stormwater will need to be managed in accordance with the City's NPDES MS4 Stormwater Permit and Stormwater Pollution Prevention Plan (SWPPP), Construction Site Stormwater Permit, and (for industrial sites) Industrial Stormwater Permit, as well as the requirements of the Buffalo-Red River Watershed Management District. These plans, codes, and permits provide requirements for rate control, water quality treatment, and volume control. They address both temporary and permanent stormwater management.

As discussed in Item 7, Minnesota is anticipated to see an increase in precipitation and an increase in the frequency of extreme precipitation events. As a result, stormwater BMPs proposed as part of future development should be designed to be able to handle this increase in volume, and the erosion control and sediment control devices used on site will need to be maintained regularly.

MITIGATION STRATEGIES

- Development within the AUAR will comply with relevant requirements for TPP and TS. Developments should seek to incorporate Low Impact Design (LID) practices; LID is a stormwater management approach that helps produce conditions similar to the site's natural hydrology. Examples of LID practices include vegetated filter strips at the edges of paved surfaces, trees or swales between rows of cars in a parking lot, rain gardens, porous pavers, and green roofs. Developers will refer to the online Minnesota Stormwater Manual for guidance.

- Development within the AUAR area is subject to the regulations of Chapter 8 – Storm Water Management of Title 3 – Public Health and Sanitation of the City Code. The City Code incorporates the design standards in the Minnesota Stormwater Manual and NPDES Construction Site Permit by reference. The Code calls for treatment of the required water quality volume (subject to site-specific limitations and/or prohibitions), as well as no net increase from pre-development peak flows for the 2-, 10-, and 100-year storm events.

- Most of the development in the AUAR area is outside of the 100-year floodplain. The western portion of the AUAR area, outside of LOMR areas, is within the 100-year floodplain. Development within this area is subject to the regulations of Chapter 7 - Subdividing in Flood Areas of Title 11 - Subdivisions of the Moorhead City Code. The GAP continues Moorhead's efforts to establish a greenway along the Red River. The Red River is not part of the Wild and Scenic Rivers program or the Critical Areas program.
- Better Site Design concepts found in the Minnesota Stormwater Manual will be utilized to maintain pre-development hydrology for the AUAR area by minimizing the amount of new impervious surfaces that will result in increased flows to the Red River.
- Infiltration areas will be utilized to the extent practicable to keep water onsite.
- A minimum 50-foot natural buffer will be maintained near surface waters during and after construction. When this buffer cannot be maintained, redundant downgradient sediment controls will be utilized, and the natural buffer restored with native vegetation upon completion of construction.
- Due to the impairment of the Red River, any soil that is disturbed as a result of development must be stabilized within seven days for any portion of the development where soil disturbance will temporarily or permanently cease for seven days or more.
- Stormwater runoff for proposed developments will be regulated by MPCA-issued NPDES permitting and local inspection. Stormwater management is discussed in detail in Section 12.b.ii below.

iii. Water appropriation - Describe if the project proposes to appropriate surface or groundwater (including dewatering). Describe the source, quantity, duration, use and purpose of the water use and if a DNR water appropriation permit is required. Describe anywell abandonment. If connecting to an existing municipal water supply, identify the wells tobe used as a water source and any effects on, or required expansion of, municipal water infrastructure. Discuss environmental effects from water appropriation, including an assessment of the water resources available for appropriation. Discuss how the proposed water use is resilient in the event of changes in total precipitation, large precipitation events, drought, increased temperatures, variable surface water flows and elevations, and longer growing seasons. Identify any measures to avoid, minimize, or mitigate environmental effects from the water appropriation. Describe contingency plans should the appropriation volume increase beyond infrastructure capacity or water supply for the project diminish in quantity or quality, such as reuse of water, connections with another water source, or emergency connections.

Moorhead Public Service (MPS), a municipally-owned entity, will be the source of water for the developed area. The current firm capacity of the MPS system is 11.0 MGD (million gallons per day), using three different water sources. These sources are the Red River, the Moorhead Aquifer, and the Buffalo Aquifer. The new Water Treatment Plant (WTP) is designed to treat up to one hundred

percent of its 10 MGD capacity using surface water from the Red River. The Red River Appropriations permit supplies up to the designated maximum of 10 MGD. Maximizing the surface water use depends on surface water quality, with groundwater held as drought backup supply. Ground water pumping capacity can supply up to 5.6 MGD during emergencies. Current water usage is approximately 4.5 MGD, with a peak demand of 9.0 MGD during summer months.

Development of the AUAR area is anticipated to increase water demand by 4.4 MGD for average daily demand, with an estimated additional peak demand of 11.5 MGD. Therefore, the system will ultimately need to provide for an ultimate demand of 20.5 MGD to satisfy peak demands, approximately 2 times the existing capacity of the current MPS water treatment plan. Development of other portions of the city may additionally increase daily demands on the system, requiring further appropriations of surface water and groundwater to meet these demands. Substantial infrastructure additions will be required to handle additional volume projections including other water supply sources.

The Moorhead Aquifer has historically provided groundwater to the community but is limited in its yield due to a low recharge rate. Water levels in the Moorhead Aquifer have dropped over the past century due to continued pumping, but have rebounded recently since the new surface water treatment plant was placed into service in 1994. Additional water supply needs will therefore be more dependent on the expansion of pumping from the Buffalo Aquifer and the Red River.

The Buffalo Aquifer receives a higher amount of recharge than the Moorhead Aquifer and is therefore a more sustainable source of groundwater for the coming decades, however there are still concerns related to limited yield capacities. MPS, with cooperation from the DNR, has developed the Buffalo Aquifer Management Plan to help guide usage of this aquifer for future needs, especially during drought periods where the aquifer will be heavily relied upon to meet most of Moorhead's water supply needs. The plan outlines a monitoring approach to identify drought stages and provides appropriate responses to address each stage of drought that include potential water demand reductions and demand reduction actions.

MPS is planning to secure Appropriations permits for an additional well field in the Buffalo Aquifer capable of producing an additional 2.0 MGD. Expansion of the Red River Appropriations permit and associated infrastructure buildout of the surface water treatment plant would be required for increasing water supply and treatment capacity.

Expanding the water supply system to further utilize the Buffalo Aquifer and the Red River will require an amended Water Appropriations Permit from the Minnesota DNR. As part of this permitting process, an investigation into any possible environmental impacts of the groundwater or surface water withdrawals will need to be undertaken. At present, there are no known negative impacts identified other than the reduction in water levels of the Moorhead and Buffalo Aquifers. However, supply projections above would likely push Buffalo and Moorhead Aquifer past their individual safe yield thresholds if full 1:1 redundancy is anticipated. Further study will be required to demonstrate that proposed future water withdrawals will be sustainable without negatively impacting natural resources or other well owners in the vicinity.

Expansion of the water supply system will also require an expansion of the water distribution system in order to pipe water to the AUAR area. Additional water storage may also be required in order meet peak demands.

If temporary dewatering of shallow groundwater is required as part of the project activities, and is expected to exceed 10,000 gallons per day or 1 million gallons per year, then a separate Minnesota

DNR Water Appropriations permit will be required before undertaking dewatering. Any temporary dewatering activities are not expected to have an impact on nearby groundwater wells (either private or municipal).

No specific wells have been identified for abandonment as part of the project activities. As existing properties are redeveloped, however, there is a likelihood that wells on these properties may be sealed as part of those redevelopment activities. Potential wells that could be impacted are identified in Figure 12-2. Other wells that are not identified in Figure 12-2 may also exist within the AUAR area if they are not accounted for in the State's database.

Climate change trends may affect surface water and groundwater interactions that may lead to long-term uncertainty regarding surface and groundwater levels, aquifer recharge, and groundwater flow, resulting in impacts to groundwater supply availability, quality, and quantity. Surface and groundwater quantity is driven by the balance of atmospheric input from precipitation (recharge) and losses due to evapotranspiration[13]. The DNR Water Appropriation Plan requires that all permittees adhere to the Statewide Drought Plan in accordance with M.S. 103G.293 and that all practical and feasible water conservation methods and practices are employed, including reuse and recycling of water.

MITIGATION STRATEGIES

Expansion of the MPS water supply system will be required to meet anticipated water demands for the built-out AUAR area. Expansion of the system will require appropriations of water from the Buffalo Aquifer and the Red River. The Buffalo Aquifer Management Plan will be used to guide future development of wells in the Buffalo Aquifer, along with management of pumping rates. A Minnesota DNR Water Appropriations permit will be required to utilize new (or expanded) sources of water. Depending on the actual number of wells that are required and the future water demands, the permitting process will identify any additional mitigation measures needed to protect natural resources or other water supply users. Additional mitigation strategies may include additional monitoring of aquifer levels, instituting more preventative water conservation measures, and working with the DNR to predict aquifer sustainability.

If current water resources are unable to meet anticipated water demands, more aggressive water conservation and reuse will need to be implemented, including (but not limited to) temporary water sprinkling bans during peak demand periods and the use of stormwater for irrigation to reduce demands on the aquifers.

If temporary dewatering of shallow groundwater is required as part of the project activities, and is expected to exceed 10,000 gallons per day or 1 million gallons per year, then a separate Minnesota DNR Water Appropriations permit will be required before undertaking dewatering. Any temporary dewatering activities are not expected to have an impact on nearby groundwater wells (either private or municipal).

The City of Moorhead Wellhead Protection Plan should be used to reference protective measures to be undertaken in this area. Any wells abandoned during Project development or redevelopment will need to be sealed according to Minnesota Well Code by a licensed well contractor.

[13] DNR. 2021. Climate's Impact on Water Availability. Available at: https://www.dnr.state.mn.us/climate/water_availability.html. Accessed May 2023.

iv. Surface Waters

a) Wetlands - Describe any anticipated physical effects or alterations to wetland features such as draining, filling, permanent inundation, dredging and vegetative removal. Discuss direct and indirect environmental effects from physical modification of wetlands, including the anticipated effects that any proposed wetland alterations may have to the host watershed, taking into consideration how current Minnesota climate trends and anticipated climate change in the general location of the project may influence the effects. Identify measures to avoid (e.g., available alternatives that were considered), minimize, or mitigate environmental effects to wetlands. Discuss whether any required compensatory wetland mitigation for unavoidable wetland impacts will occur in the same minor or major watershed and identify those probable locations.

Approximately 80.8 acres of NWI features were identified within the AUAR area, primarily near the Red River (Figure 12- 1). Any wetlands within the AUAR area are under the jurisdiction of the USACE and the Wetland Conservation Act (WCA). Additionally, the City of Moorhead may regulate any excavation, grading, or filling in a wetland, designated flood plain, or shoreland district. Further consultation with the City, County, and appropriate Watershed Management District should be conducted during the planning phase of any future development within the AUAR area with the potential to impact wetlands.

MITIGATION STRATEGIES

Mitigation strategy for potential wetland impacts is to follow the state and federal wetland permitting processes, and this is unchanged from the 2018 AUAR update.

Currently, no specific development to the AUAR area is planned; therefore, there are no anticipated impacts to wetlands. However, should wetland impacts become necessary with development within the AUAR area, on-site wetland mitigation will be considered if there are wetland restoration opportunities located within the AUAR area that would yield wetland mitigation credit. Wetland banking will be used if on-site locations are not available and/or if agencies recommend the use of a wetland bank.

Additional mitigation strategies that may be implemented to preserve and protect surface waters include vegetative buffers, construction erosion control, and coordination with Clay County and watershed district staff on watershed quality issues and land use activities. Wetlands will not be utilized for stormwater treatment unless they have been mitigated for.

b) Other surface waters- Describe any anticipated physical effects or alterations to surface water features (lakes, streams, ponds, intermittent channels, county/judicialditches) such as draining, filling, permanent inundation, dredging, diking, stream diversion, impoundment, aquatic plant removal and riparian alteration. Discuss direct and indirect environmental effects from physical modification of water features, taking into consideration how current Minnesota climate trends and anticipated climate change in the general location of the project may influence the effects. Identify measures to avoid, minimize, or mitigate environmental effects to surface water features, including in-water Best Management Practices that are proposed to avoid or minimize turbidity/ sedimentation while physically altering thewater features. Discuss how the project will change the number or type of watercraft on any water body, including current and projected watercraft usage.

Development in the AUAR area is not anticipated to involve the physical or hydrologic alteration of any existing surface waters. However, development could impact the Red River and its tributary streams if stormwater runoff is not managed adequately. The MPCA has already identified portions of the Red River in the Moorhead area as impaired. Additional drainage from urban development could increase sediment and pollutant loads into the Red River. Recognizing this issue, the City of Moorhead has developed a Stormwater Ordinance which addresses the treatment of stormwater runoff, including construction techniques to minimize erosion and stabilize soils. The City has also identified a greenway corridor along the Red River in the Growth Area Plan to help prevent and reduce sediments from entering the river.

The potential for erosion of soils exposed during development of the AUAR area will be minimized using Best Management Practices (BMPs) during and after construction. Specific erosion control practices will be identified in final grading and construction plans for each proposed development project. Developments will be required to meet as necessary the standards of the National Pollutant Discharge Elimination System (NPDES), the City of Moorhead, and the Buffalo-Red River Watershed Management District.

Due to the proximity of the Red and Buffalo rivers to the AUAR area, it is possible that the number of recreational watercraft on these rivers increases with the addition of residential developments. Industrial watercraft usage is not anticipated to increase at this time as no specific industrial development is proposed. An intensive study on current and projected watercraft usage was not conducted as part of this AUAR. It is anticipated that recreational watercraft usage could increase as residential development increases; however, impacts are expected to be minimal. Future watercraft usage will be studied, as necessary, as specific residential developments are proposed.

13. Contamination/Hazardous Materials/Wastes

a. Pre-project site conditions - Describe existing contamination or potential environmental hazardson or in close proximity to the project site such as soil or ground water contamination, abandoned dumps, closed landfills, existing or abandoned storage tanks, and hazardous liquid or gas pipelines. Discuss any potential environmental effects from pre-project site conditions that would be caused or exacerbated by project construction and operation. Identify measures to avoid, minimize or mitigate adverse effects from existing contamination or potential environmental hazards. Include development of a Contingency Plan or Response Action Plan.

The following databases were reviewed to evaluate on-site or nearby potential sources of contamination or environmental hazards: the MPCA "What's in My Neighborhood" (WIMN) online maps, the Minnesota Department of Agriculture (MDA) "County Spill Records," the MPCA Institutional Controls Interactive (IC) online maps, and the MPCA Petroleum Remediation Program (PRP) online maps. Table 9 summarized sites documented in MPCA's WIMN database within and in close proximity to the AUAR area. Figure 13-1 identifies MPCA WIMN sites within or in close proximity to the AUAR area.

Table 8. MPCA WIMN Database Inquiry Results

Site ID	Site Name	MPCA Program	Status
145699	River Haven Road Flood Mitigation Projec	• Stormwater	INACTIVE

130647	Prairie Meadows II Addition	• Stormwater	INACTIVE
232466	Village Green 6th (19-A6-05)	• Stormwater	ACTIVE
147705	Farmstead Care Phase I	• Stormwater	INACTIVE
6721	Kens Lawn Service	• Hazardous Waste	INACTIVE
149428	Prairie Meadows 5th (15-A2-3)	• Stormwater	ACTIVE
213258	Village Green 6th (16-A2-02)	• Stormwater	ACTIVE
231839	Southside Water Tower	• Stormwater	ACTIVE
135241	Pedestrian Underpass 20th St S & BNSF RR	• Stormwater	INACTIVE
126497	Shepherd Meadows Addition	• Stormwater	ACTIVE
221402	South Moorhead Self Storage Units	• Stormwater	ACTIVE
231410	Storemoor	• Stormwater	ACTIVE
143653	BRRWD Project No 71 - Flood Mit Project	• Stormwater	ACTIVE
16783	Simplot Grower Solutions - Moorhead	• Multiple Programs	ACTIVE
135658	Bluestem Levee (11-13-2)	• Stormwater	INACTIVE
214147	Prairie Meadows 6th (16-A6-04)	• Stormwater	ACTIVE
5178	G&M Enterprises/Red River Trails, Inc.	• Multiple Programs	ACTIVE
154433	Stonemill Estates 2nd Addition 15-A6-3	• Stormwater	ACTIVE
248294	Prairie Parkway Addition	• Stormwater	ACTIVE
197133	High Voltage Testing Lab	• Investigation and Cleanup	ACTIVE
188417	Johanson Residence	• Investigation and Cleanup	ACTIVE
252799	Hampton Place 4th (22-A6-02)	• Stormwater	ACTIVE
249152	Prairie Meadows 7th Addition (21-A6-04)	• Stormwater	ACTIVE
124415	Trollwood Performing Arts School	• Stormwater	INACTIVE
133489	Prairie Meadows 3rd Addition - Moorhead	• Stormwater	INACTIVE
224113	Hampton Place 3rd	• Stormwater	ACTIVE

b. Project related generation/storage of solid wastes - Describe solid wastes generated/stored during construction and/or operation of the project. Indicate method of disposal. Discuss potential environmental effects from solid waste handling, storage and disposal. Identify measures to avoid, minimize or mitigate adverse effects from the generation/storage of solidwaste including source reduction and recycling.

Construction

Future proposed developments may require demolition of certain existing structures in the AUAR area. Therefore, the proposed development will require pre-demolition regulated building materials surveys prior to demolition of any existing structures.

The historical land use of much of the AUAR area appears to have included agricultural use. It is common practice in rural areas to dispose of old structures by burning and/or burying demolition debris onsite. Therefore, shallow-buried farmstead debris may be encountered and require management for proper off-site disposal during development. In addition, old cisterns, septic tanks, and water wells are often associated with former farmsteads and will need to be managed in accordance with local and state regulations if these features are identified or encountered prior to or during construction.

The disposal of solid wastes generated by clearing the construction area is a common occurrence associated with construction projects. Additional items that may require removal and offsite recycling/disposal include existing vegetation (e.g., trees and crops), components associated with the irrigation system, fencing, and other agricultural items that may be present on the property.

Post-Construction
Future development within the AUAR area would generate solid waste during operation. Future proposed development will be required to undertake acceptable methods to minimize excess waste materials. When and where feasible, items will be evaluated for recycling or reuse prior to disposal at an offsite landfill. All solid waste minimization, avoidance, and disposal measures will be handled by the contractor under provisions outlined in their contract. Solid wastes generated during future operations would be subject to compliance with local, state, and federal regulations as well as the industrial developer's corporate policies on waste reduction and recycling.

c. Project related use/storage of hazardous materials - Describe chemicals/hazardous materials used/stored during construction and/or operation of the project including method of storage. Indicate the number, location and size of any new above or below ground tanks to store petroleum or other materials. Indicate the number, location, size and age of existing tanks on the property that the project will use. Discuss potential environmental effects from accidental spill or release of hazardous materials. Identify measures to avoid, minimize or mitigate adverse effects from the use/storage of chemicals/hazardous materials including source reduction and recycling. Include development of a spill prevention plan.

Not applicable to an AUAR

d. Project related generation/storage of hazardous wastes - Describe hazardous wastes generated/stored during construction and/or operation of the project. Indicate method of disposal. Discuss potential environmental effects from hazardous waste handling, storage, and disposal. Identify measures to avoid, minimize or mitigate adverse effects from the generation/storage of hazardous waste including source reduction and recycling

Small quantities of hazardous wastes in the form of used oils/lubricants, waste paints, or other materials may be generated during construction. Hazardous wastes may be generated postconstruction at future industrial facilities and operations developed in the AUAR area. Through the land development planning, assessment, and approval process, the City will require that MPCA and other regulatory requirements be met for the generation/storage of hazardous wastes.

MITIGATION STRATEGIES
Proposed development will be required to conduct pre-demolition regulated building materials surveys prior to demolition of any existing structures.

Any shallow-buried farmstead debris encountered during construction will be managed for proper off-site disposal during development. In addition, old cisterns, septic tanks, and water wells will

be managed in accordance with local and state regulations if these features are identified or encountered prior to or during construction.

Post Construction, when and where feasible, items will be evaluated for recycling or reuse prior to disposal at an offsite landfill. Additionally, the City will require that MPCA and other regulatory requirements be met for the generation/storage of hazardous wastes post construction.

14. Fish, Wildlife, Plant Communities, and Sensitive Ecological Resources (Rare Features)

a. Describe fish and wildlife resources as well as habitats and vegetation on or in near the site.

The AUAR area is located within an ecological area classified as the Prairie Parkland Province (251), Red River Valley Section (251A), and Red River Prairie Subsection (251Aa). The land is presently used primarily for agriculture within this Subsection and the Glacial Lake Agassiz lake plain has been ditched for this purpose. Native vegetation is present in fragments east of the beach ridges and in the interbeach zone. This native vegetation, which was more widespread pre-settlement, consisted of tallgrass prairie and wet prairie communities with bluestems (i.e., *Andropogon gerardii* and *Schizachyrium scoparium),* Indian grass (*Sorghastrum nutans*), bluejoint grass (*Calamagrostis canadensis*), cordgrass (*Spartina* spp.), cattails (*Typha* spp.), rushes (*Juncus* spp.), and sedges (*Carex* spp.). Forested floodplains, woodlands, and brushlands were also prevalent[14,15].

A detailed description of the land cover types within the AUAR area is available in Item 8 and Table 4. The AUAR area overlaps the southern boundary of the City of Moorhead and extends further south primarily over cropland. Additional land cover, according to Google Earth aerial imagery, includes developed areas consisting of rural residences as well as paved and gravel roadways, lawn/landscaping, fragmented woodlands, open water features, and wetlands. As the AUAR is primarily cropland and developed land (Table 4), limited habitat is available for wildlife; however, these areas may provide habitat for urban wildlife species, such as mice, rabbits, raccoons, squirrels, deer, coyotes, and foxes. Additionally, while limited, the woodlands may provide suitable nesting and migratory stopover sites for avian species, and the open water and wetland areas may provide suitable habitat for aquatic species, such as fish, frogs, and toads. The woodlands, open water, and wetlands located within and near the AUAR area may also contain suitable summer habitat and foraging habitat for bat species.

b. Describe rare features state-listed (endangered, threatened or special concern) species, native plant communities, Minnesota Biological Survey Sites of Biodiversity Significance, and other sensitive ecological resources on or within close proximity to the site. Provide the license agreement number (LA-) and/or correspondence number (MCE) from which the data were obtained and attach the Natural Heritage Review letter from the DNR. Indicate if any additional habitat or species survey work has been conducted within the site and describe the results.

Federally – Listed Species

The United States Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IpaC) tool[16] was reviewed to identify an updated list of federally listed species that have the potential to occur within the AUAR area. Two species were identified from this review: the northern long-eared bat (*Myotis septentrionalis*; endangered) and the monarch butterfly (*Danaus plexippus*; candidate). The northern long-

[14] DNR. 2000. Ecological Classification System. Available at: https://www.dnr.state.mn.us/ecs/index.html. Accessed May 2023.
[15] DNR. 1999. Minnesota Geospatial Commons – Ecological Sections of Minnesota. Available at: https://gisdata.mn.gov/dataset/geos-ecological-class-system. Accessed May 2023.
[16] USFWS. 2023a. Information for Planning and Consultation. Available at: https://ipac.ecosphere.fws.gov/. Accessed May 2023.

eared bat (NLEB) was identified in the 2018 review but has since been up-listed from threatened to endangered as of March 31, 2023[17]. Additionally, the monarch butterfly was not identified in the 2018 review, and the Dakota skipper (*Hesperia dacotae*; threatened) and rusty patched bumble bee (*Bombus affinis*) were identified in the 2018 review, but not identified in the 2023 review. Appendix B includes the IPaC results.

Northern long-eared bat

Suitable summer roosting, forage, and travel habitat for northern long-eared bat (NLEB) consists of a wide variety of contiguous forested and wooded habitats with varying tree density and amounts of canopy closure. While roosting, the NLEB is generally found in deep crevices in areas such as forests and woodlots (i.e., live trees and/or snags greater than or equal to three inches in diameter at breast height that have exfoliating bark, cracks, crevices, and/or cavities) as well as linear features such as fence rows, riparian forests, and other wooded corridors. NLEB roosts in both live trees and snags[18,19,20]. Additional summer habitat for the NLEB consists of areas adjacent to wooded areas, namely emergent wetlands and edges of agricultural fields, old fields, and pastures. The NLEB has also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses[21]. During winter months, NLEB hibernates in caves or abandoned mines[21].

Clay County is not listed as a county with documented white-nose syndrome (WNS)[22,23]. Since the 2018 review; however, the 4(d) Rule of the Endangered Species Act (ESA) no longer applies to the NLEB as a result of the up-listing from threatened to endangered. According to the Minnesota Department of Natural Resources (DNR) Natural Heritage Information System (NHIS) database under license agreement LA-2022-023, no known roost trees or hibernacula are in the AUAR area or within a one-mile radius of the AUAR area.

The AUAR area, as detailed in Item 8 and Table 4, is primarily cropland (approximately 3.010.3 acres; 81 percent) and impervious surface (approximately 578.4 acres; 16 percent). Approximately 1.7 acres of wooded habitat is present within the AUAR area. Sparse trees within the AUAR area may provide suitable roosting habitat for the NLEB, but this is unlikely due to their lack of connectivity to large, contiguous tracts of forest and their proximity to developed areas. Contiguous tracts of wooded areas primarily along the Red River may provide suitable roosting habitat for the NLEB. The open water features and wetlands located within and near the AUAR area may also provide drinking and foraging sources for NLEB utilizing habitat outside of the AUAR area.

Direct mortality from collision with construction equipment is unlikely given that construction activities would occur during daylight hours when bats would not be active. Up to two acres of tree clearing is anticipated to occur within the AUAR area as part of construction. This action may impact potentially

[17] USFWS. 2023b. Northern Long-eared Bat. Available at: https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis. Accessed May 2023.
[18] Sasse, D.B., and P.J. Pekins. 1996. Summer roosting ecology of northern long-eared bats (Myotis septentrionalis) in the White Mountain National Forest. Bats and forests symposium. British Columbia Ministry of Forests Working Paper 23:91-101.
[19] Foster, R.W. and A. Kurta. 1999. Roosting ecology of the northern bat. (Myotis septentrionalis) and comparisons with the endangered Indiana bat (Myotis sodalis). Journal of Mammalogy 80:659-672.
[20] Owen, S.F.; Menzel, M.A.; Ford, M.W.; Chapman, B.R,; Miller, K.V.; Edwards, J.W.; and Wood, P.B. 2003. Homerange size and habitat use by the northern Myotis (Myotis septentrionalis). American Midland Naturalist 150: 352-359.
[21] USFWS. 2022a. Rangewide-Wide Indiana Bat & Northern Long-Eared Bat Survey Guidelines. Available at: https://www.fws.gov/media/range-wide-indiana-bat-and-northern-long-eared-bat-survey-guidelines. Accessed March 2023.
[22] WNS Response Team. 2023. Where is WNS Now? Available at: https://www.whitenosesyndrome.org/where-is-wns. Accessed May 2023.
[23] DNR. 2020. White-nose Syndrome and Minnesota's Bats. Available at: https://www.dnr.state.mn.us/wns/index.html. Accessed May 2023.

suitable, undocumented NLEB roosting habitat within the AUAR area. Tree clearing is recommended to occur during the bat inactive period from November 15 to March 31.

Given the lack of documented NLEB roost trees and hibernacula as well as the lack of contiguous forest within the AUAR area, adverse impacts to the NLEB as a result of the Project are not anticipated.

Monarch butterfly

The monarch butterfly is a migratory butterfly that exists in two main populations within the United States divided by the Rocky Mountains: the eastern population that overwinters in the mountains of Mexico, and the western population that overwinters along the southern pacific coast of California[24]. This species generally occurs in areas with high densities of nectar sources, preferably native prairies with nectar species such as black-eyed Susan (*Rudbeckia hirta*), narrow-leaved coneflower (*Echinacea angustifolia*), and rough blazing star (*Liatris aspera*) utilized for feeding by adults[25]; however, the presence of milkweed (*Asclepias* spp.) is required for breeding habitat as it is the only genus on which the larvae can feed[26]. The monarch butterfly is a candidate for federal listing due to habitat loss, relating mainly to the loss of milkweeds and native prairies.

The monarch butterfly is a candidate for federal listing and is not regulated by the USFWS at this time. Neither suitable foraging habitat (native prairie) nor suitable breeding habitat (milkweeds) are present within the AUAR area in large enough densities to support this species given the large areas of cropland present. Additionally, no grasslands were identified within the AUAR area as shown in Table 4. As such, impacts to this species are not anticipated as a result of the Project. It is also recommended that impacts to this species be reassessed when a listing status is finalized.

Migratory birds

Construction activities and development within the AUAR area have the potential to impact birds protected under the Migratory Bird Treaty Act (MBTA). The MBTA makes it illegal for anyone to take (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct) any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations.

Under the MBTA, construction activities in grasslands, roadsides, wetlands, riparian (steams), shrublands, or wooded habitats that would otherwise result in the taking of migratory birds, eggs, young, and/or active nests should be avoided. Although the provisions of the MBTA are applicable throughout the entire year, most migratory bird nesting activity in Minnesota occurs approximately from mid-March to August 15[27]. According to the USFWS IPaC results, there are 12 migratory bird species listed as Birds of Conservation Concern (BCC). These species are detailed in Table 10.

Table 9. Birds of Conservation Concern with Potential to Occur Within the AUAR Area

[24] USDA Forest Service. undated(a). Migration and Overwintering. Available at: https://www.fs.fed.us/wildflowers/pollinators/Monarch_Butterfly/migration/. Accessed November 2021.
[25] DNR. 2022. Butterfly Gardens. Available at: https://www.dnr.state.mn.us/gardens/butterfly/index.html. Accessed March 2022.
[26] National Wildlife Federation. undated. Monarch Butterfly. Available at: https://www.nwf.org/Educational-Resources/Wildlife-Guide/Invertebrates/Monarch-Butterfly. Accessed December 2021.
[27] DNR. 2014. Best Practices for Meeting DNR GP 2004-0001 (version 4, October 2014). Available at: http://files.dnr.state.mn.us/waters/watermgmt_section/pwpermits/gp_2004_0001_chapter1.pdf. Accessed May 2023.

Common Name	Scientific Name	Habitat
American golden-plover	*Pluvialis dominica*	Forages in lagoons and estuaries, breeds in lowlands and mountains of the tundra, and uses grasslands and farmlands as stopover sites during migration
Black tern	*Chlidonias niger*	Variety of wetland habitats and tropical ocean waters
Black-billed cuckoo	*Coccyzus erythropthalmus*	Forests, woodlands, scrub, and thickets
Bobolink	*Dolichonyx oryzivorus*	Grasslands, tallgrass and mixed prairie, hayfields, marshes, and rice and sorghum fields
Chimney swift	*Chaetura pelagica*	Urban or suburban settings with chimneys, or rural areas with hollow trees, tree cavities, and caves
Franklin's gull	*Leucophaeus pipixcan*	Breed in freshwater marshes with emergent vegetation; forages in agricultural fields, pastures, and wetlands; and uses a wide variety of habitats during migration (opportunistic)
Golden-winged warbler	*Vermivora chrysoptera*	Open woodlands, wet thickets, tamarack bogs, aspen or willow stands, and wetlands
Hudsonian godwit	*Limosa haemastica*	Breeds in arctic bog habitats known as muskegs; forages along coastlines, mudflats, and marsh edges; and uses stopover sites at various wetland types during migration
Lesser yellowlegs	*Tringa flavipes*	Breeds in open or semi-open woodlands, wet meadows, marshes, bogs, and ponds; utilizes fresh and brackish wetland types during migration and overwintering
Long-eared Owl	*Asio otus*	Roost in dense foliage and forage over grasslands for small mammals
Marbled godwit	*Limosa fedoa*	Shorebird that breeds in northern prairies and spends the winters along the coasts
Red-headed woodpecker	*Melanerpes erythrocephalus*	Deciduous woodlands with oak, oak-hickory, maple, ash, and/or beech with dead or partially dead trees present
Short-billed dowitcher	*Limnodromus griseus*	Breeds in taiga habitat in wetlands often near edges of bogs (muskegs), winters in saltwater and brackish environments, and uses stopover sites in a variety of manmade environments during migration (impoundments, sewage ponds, flooded farm fields, etc.)
Willet	*Tringa semipalmata*	Open beaches, bayshores, marshes, mudflats, rocky coastal zones, wetlands, prairie pothole ponds, wet fields, saltmarshes, barrier islands, and barrier beaches

Source: USFWS IPaC and Cornell Lab of Ornithology

One additional species, the bald eagle (*Haliaeetus leucocephalus*), is not listed on the USFWS IPaC as a BCC species but warrants attention under the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d). This Act prohibits anyone from taking (i.e., "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb") bald eagles or golden eagles (*Aquila chrysaetos*), including their parts, nests, or eggs. Regulations further define "disturb" as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding,

or sheltering behavior"[28]. According to the USFWS IPaC results, the bald eagle has the potential to occur within the AUAR area. This species nests in forested areas adjacent to large bodies of water generally away form human activity. They prefer tall, mature coniferous or deciduous trees for perching and nesting, and will forage around dams, dumps, and fish processing plants as well as open water features[29]. The trees within the AUAR area are not ideal for nesting sites due to their smaller size and proximity to human developments; however, open water features within and nearby the AUAR area may provide foraging sites for this species. Wooded areas buffering the Red River may provide potential nesting sites, however, these areas are planned to remain undeveloped according to the maximum development scenario. Therefore, incidental take of the bald eagle is unlikely as a result of the Project.

State – Listed Species

Under Stantec's Limited License to Use Copyrighted Material (LA-2022-023) related to Rare Features Data, the DNR NHIS database was searched in May 2023 to identify species within the AUAR area and within a one-mile radius of the AUAR area. One record within the AUAR area was identified, the burrowing owl (*Athene cunicularia*; endangered). The 2018 NHIS review also identified two species of special concern within close proximity of the AUAR area, the lake sturgeon (*Acipenser fulvescens*) and the black sandshell mussel (*Ligumia recta*). Both of these species were documented within the Red River. Species of special concern are not regulated by the state; however, these species are considered extremely uncommon or have unique or highly specific habitat requirements and receive careful monitoring status. The lake sturgeon and black sandshell were not identified in the May 2023 NHIS review. A request for concurrence was submitted to the DNR through their Minnesota Conservation Explorer tool on June 2, 2023. NHIS Query is shown in Appendix B.

Burrowing Owl

The NHIS search indicated one record within the AUAR area, the burrowing owl (*Athene cunicularia*; endangered), which was also identified in the 2018 NHIS review. As described in the 2018 AUAR, this record is associated with an observation in 2007 in a fallow beet field. It was unknown whether the bird has nested at this site due to the observation time being late in the season (post-nesting). Habitat for the burrowing owl includes open, grazed pastures or native, mixed-grass prairies populated by burrowing mammals. Surveys for this species are recommended prior to impacting potential burrowing owl habitat in the AUAR area.

Native Plant Communities and Sites of Biodiversity and Ecological Significance

DNR NHIS data also provides information regarding the presence of DNR native plant communities, sites of biodiversity significance, and regionally significant ecological areas. According to a review of this database using Stantec's limited license (LA-2022-023), no such sites are located within the AUAR area; however, there is a stretch of the Ottertail Valley Railroad located along the eastern boundary of the AUAR area that contains a wetland prairie system and a site of moderate biodiversity significance. Given that this area is located along the boundary of the AUAR area, impacts to the wetland prairie system and the associated site of biodiversity significance are not anticipated.

c. Discuss how the identified fish, wildlife, plant communities, rare features and ecosystems may be affected by the project including how current Minnesota climate trends and anticipated climate change

[28] USFWS. undated. Bald and Golden Eagle Protection Act. Available at: https://www.fws.gov/law/bald-and-golden-eagle-protection-act. Accessed May 2023.
[29] Cornell Lab of Ornithology. 2023. All About Birds – Bald Eagle Life History. Available at: https://www.allaboutbirds.org/guide/Bald_Eagle/lifehistory#habitat. Accessed May 2023.

in the general location of the project may influence the effects. Include a discussion on introduction and spread of invasive species from the project construction and operation. Separately discuss effects to known threatened and endangered species.

Urban wildlife may be impacted with the removal of woodland within the AUAR area; however, these habitat generalist species are typically adaptive to development activities and would likely relocate to undeveloped areas in the vicinity or continue to live in the remaining undeveloped areas within the AUAR area.

Development of the South Growth Area is not anticipated to have significant adverse impacts on federally or state listed threatened or endangered species, state special concern species, or candidates for listing.

Federally-Listed Species

Northern long-eared bat

Although a limited area (1.72 acres; <0.1 percent) of the AUAR area may provide suitable roosting habitat for the NLEB and up to two acres of tree clearing are anticipated for the Project, adverse impacts to the NLEB are not anticipated due to the lack of documented roosts or hibernacula within and in the vicinity of the AUAR area, and the lack of contiguous forested habitat. Wooded areas along the Red River are planned to remain park/open space land and would not be developed based on the maximum development scenario. It is recommended that tree clearing occur during the bat inactive season of November 15 to March 31. While impacts are not anticipated from the Project, climate change is anticipated to impact this species. Based on the climate discussion in Item 7, the state of Minnesota is getting warmer and wetter. These changes in temperature and precipitation may influence the NLEB's available suitable roosting and foraging habitat, as well as prey availability (USFWS 2022b)[30]. Although a less significant stressor compared to white-nose syndrome, climate change variables may negatively affect the NLEB[31].

Monarch butterfly

The monarch butterfly is a candidate for federal listing and is not regulated by the USFWS at this time. The AUAR area is unlikely to support this species given that it is located within a primarily agricultural area that lacks high densities of nectar sources and milkweed. Therefore, impacts are not anticipated for this species. As discussed in Item 7, climate change is anticipated to result in increasing temperatures, which may increase the number of days and the area in which monarch butterfly populations would be exposed to unsuitably high temperatures. This can result in them using up fat stores too quickly at their overwintering sites and may result in them incorrectly judging when to enter and exit states of dormancy[32].

Migratory birds

Construction activities in grasslands, roadsides, shrublands, or woodland habitats within the AUAR area may result in the taking of migratory birds, eggs, young, and/or active nests, if present. Although the provisions of the MBTA are applicable throughout the entire year, most migratory bird nesting activity in

[30] USFWS. 2022b. Northern Long-Eared Bat Overview. Available at: fws.gov/species/northern-long-eared-bat-myotis-septentrionalis. Accessed September 2022

[31] USFWS. 2022c. Proposed Rule 87 FR 16442: Endangered and Threatened Wildlife and Plants; Endangered Species Status for Northern Long-Eared Bat. Available at: https://www.federalregister.gov/d/2022-06168. Accessed January 2023.

[32] Kobilinksy, D. 2019. Watch: Temperature drives internal clock for monarchs. The Wildlife Society. Available at: https://wildlife.org/watch-temperature-drives-internal-clock-for-monarchs/. Accessed September 2022.

Minnesota occurs approximately from mid-March to August 15. When possible, removal of vegetation is recommended to occur outside of this timeframe to minimize potential take of migratory birds. Beyond the Project, the threats to migratory birds are many, but climate change, according to the National Audubon Society, is the largest concern. It is estimated that 389 North American bird species are at increasing risk of extinction as a result of warming temperatures altering their range[33].

State-Listed Species

Burrowing Owl

Given that habitat for the burrowing owl includes open, grazed pastures or native, mixed-grass prairies populated by burrowing mammals, future development within the AUAR area may have the potential to impact suitable habitat for the burrowing owl. Climate change has the potential to negatively impact the burrowing owl due to increased potential for wildfires that may result in habitat loss and spring heat waves that may endanger young birds in the nest. Drought could also diminish water and food resources. An increase in 3°F, is projected shift the habitat range of the burrowing owl eastward, potential expanding its range in Minnesota during the summer.[34]

Native Plant Communities and Sites of Biodiversity and Ecological Significance

The railroad wetland prairie system and associated site of biodiversity significance located along the eastern boundary of the AUAR area are not anticipated to be impacted as a result of potential development; however, the projected Minnesota climate trends of warmer temperatures and increased precipitation may impact the species and thus the biodiversity of this site, depending on how vulnerable the present species are to climatic change.

Invasive Species

Noxious weeds and invasive species in Minnesota are managed through the Department of Agriculture (MDA) under Minnesota Statutes Section 18.78, the DNR, and local ordinances. BMPs during construction activities and operation within the AUAR area should be implemented to minimize the introduction or spread of noxious weeds and invasive species. These practices include cleaning vehicles and equipment of mud and dirt from other construction areas, removing seeds that attach to clothing or equipment, minimizing soil disturbance, not moving potentially contaminated materials between sites, and staying on designated roads/trails[35,36].

d. Identify measures that will be taken to avoid, minimize, or mitigate the adverse effects to fish,wildlife, plant communities, ecosystems, and sensitive ecological resources.

At the that a future project is proposed, potential impacts to burrowing owl habitat should be evaluated. If suitable habitat may be impacted, surveys for this species are recommended prior to impacting potential burrowing owl habitat in the AUAR area.

Sightings of any rare species during construction activities would be reported to the DNR Nongame

[33] National Audubon Society. undated(a). Survival by Degrees: 389 Bird Species on the Brink. Available at: https://www.audubon.org/climate/survivalbydegrees. Accessed May 2023.
[34] National Audubon Society. Burrowing Owl. undated(a). https://www.audubon.org/field-guide/bird/burrowing-owl. Access August 2023.
[35] USDA National Invasive Species Information Center. undated(b). Best Management Practices. Available at: https://www.invasivespeciesinfo.gov/subject/best-management-practices. Accessed January 2023.
[36] DNR. 2023c. Terrestrial invasive species. Available at: https://www.dnr.state.mn.us/invasives/terrestrial/index.html. Accessed January 2023.

Wildlife specialist. The City of Moorhead would follow the guidance that is received to avoid impacts.

It is recommended that tree clearing be conducted during the bat inactive season of November 15 to March 31 to avoid impacts to the NLEB.

It is recommended that vegetation removal be conducted outside of the migratory bird nesting timeframe of mid-March to August 15 to avoid take of migratory bird species.

MITIGATION STRATEGIES

As of 2023, the main update for mitigation strategies relates to the NLEB and the reclassification from threatened to endangered, and the nullification of the 4(d) Rule of the ESA, both of which took effect on March 31, 2023. Once available, new tools from the USFWS should be reviewed to provide guidance on this species and how to mitigate any impacts. Tree clearing is still recommended to occur between November 15 and March 31 to avoid the bat active season.

Mitigation strategies that remain valid from the 2018 review are as follows:

If tree clearing cannot be avoided during the peak breeding season for migratory birds (approximately mid-March to August 15), it is recommended that a qualified biologist conduct a pre-construction breeding bird survey within the AUAR area to determine the absence or presence of breeding birds and their nests. Pre-construction breeding bird surveys may include:

1) Pre-construction surveys that occur no more than two weeks before tree and shrub clearing activities commence. The area surveyed will include the areas where potential suitable habitat has been identified and tree or shrub clearing has not been completed.
2) If an occupied nest is observed during the survey, tree and shrub clearing activities will not be permitted within a 660 foot buffer of the nest site during the breeding season or until the fledglings have left the area. Consult with the USFWS to avoid take of migratory bird species.

Upon completion, the survey results would be submitted to the USFWS, as appropriate. If breeding birds are not present, construction can proceed with no restrictions. If breeding birds or active nests are present, additional consultation may be required.

The results of the DNR NHIS review are typically valid for one year. The NHIS database should be consulted prior to the commencement of construction activities within the AUAR area to identity any new records of rare or otherwise significant species, native plant communities, and other natural features within the AUAR area vicinity.

BMPs such as erosion and sediment control devices would be used during construction activities to prevent the flow of sediment into wetlands and open water features within or adjacent to the AUAR area and to avoid adverse effects to water quality and aquatic species, if present. Wildlife-friendly erosion control materials would be used whenever feasible.

15. Historic Properties

Describe any historic structures, archeological sites, and/or traditional cultural properties on or in close proximity to the site. Include: 1) historic designations, 2) known artifact areas, and 3) architectural features. Attach letter received from the State Historic Preservation Office (SHPO).

Discuss any anticipated effects to historic properties during project construction and operation. Identify measures that will be taken to avoid, minimize, or mitigate adverse effects to historic properties.

The Minnesota State Historic Preservation Office (SHPO) was contacted regarding the presence of architectural or archaeological resources. Three archaeological sites and no architectural resources are located within the AUAR area. An additional four archaeological sites and 14 architectural resources are located within a mile of the AUAR area. The archaeological sites within the AUAR area consists of the red river trail and two homesteads. The additional archaeological sites outside the AUAR area consists of a lithic scatter, artifact scatter, a single artifact spot and a town based on historic documentation no context is given for these sites and none of the sites have been determined eligible or have been listed on the National Register of Historic Places. The architectural resources within the vicinity represent bridges, ditches, farmsteads, the state highway and the railroad. One of these resources, the South Dam is considered eligible and the remaining resources have not been evaluated.

No archaeological surveys were conducted during the preparation of this AUAR as no specific development project is planned at this time. However, due to the nature and location of the South growth area, when development occurs, a Phase IA literature review and archaeological assessment should be completed per development project to assess the potential for intact archaeological sites in the development area. Based on the results of the Phase IA review and assessment, a Phase I archaeological survey may be required. Cultural and archaeological resource are not present within the proposed expansion site. Appendix C provides correspondence from SHPO.

If proposed development should be conducted within 150 feet of a previously recorded archaeological site a Phase II evaluation should be conducted to provide recommendations for eligibility of the site if it cannot be avoided.

16. Visual

Describe any scenic views or vistas on or near the project site. Describe any project related visual effects such as vapor plumes or glare from intense lights. Discuss the potential visual effects from the project. Identify any measures to avoid, minimize, or mitigate visual effects.

The AUAR anticipates a development pattern similar to those uses north of the area and does not anticipate adverse visual impacts as a result of the development scenario.

The west side of the AUAR area is located adjacent to the Red River. Scenic views or vistas could be affected by development of this area. As mentioned in the Land Use Item (8), the City has acquired much of the land that had not been previously acquired by Clay County or the Buffalo Red River Watershed District along the Red River to preserve as open space, which will help to keep scenic views to and from the Red River intact. Any future developer should also consider implementing measures to reduce the visual impact of their development such as screening and buffering.

17. Air

a. Stationary source emissions - Describe the type, sources, quantities and compositions of any emissions from stationary sources such as boilers or exhaust stacks. Include any hazardous air pollutants, criteria pollutants. Discuss effects to air quality including any sensitive receptors, human health or applicable regulatory criteria. Include a discussion of any methods used assess the project's effect on air quality and the results of that assessment. Identify pollution control

equipment and other measures that will be taken to avoid, minimize, or mitigate adverse effects from stationary source emissions.

Stationary source emissions will not be produced by future development. Furthermore, in accordance with the EQB's AUAR guidance document[37], this item is not applicable to an AUAR as any stationary air emission sources large enough to merit environmental review would require individual review.

b. Vehicle emissions - Describe the effect of the project's traffic generation on air emissions. Discuss the project's vehicle-related emissions effect on air quality. Identify measures (e.g. traffic operational improvements, diesel idling minimization plan) that will be taken to minimizeor mitigate vehicle-related emissions.

Motorized vehicles affect air quality by emitting air borne pollutants. The changes in traffic volumes, travel patterns, and roadway locations resulting from either development scenario could affect air quality by changing the number of vehicles and the congestion levels in the AUAR area. The criteria pollutants identified by the EPA are ozone, particulate matter, carbon monoxide, nitrogen dioxide, lead, and sulfur dioxide. Potential impacts resulting from these pollutants are assessed by comparing projected concentrations to National Ambient Air Quality Standards (NAAQS).

NAAQS – Criteria Pollutants

Section 109(b) of the Clean Air Act (CAA) requires that the EPA to establish NAAQS "requisite to protect" public health and public welfare (40 CFR Part 50). The CAA identifies two class types of NAAQS: primary standards and secondary standards. Primary standards are limits set to protect the public health of the most sensitive populations, such as asthmatics, children and the elderly. Secondary standards are limits set to protect public welfare, such as protection against visibility impairment or damage to vegetation, wildlife and structures. The CAA requires the EPA to periodically review and, if new data indicate, update the NAAQS.

The EPA has promulgated NAAQS for six criteria pollutants: ozone, particulate matter (PM), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and lead. Standards for PM are categorized on the size of the PM based on the aerodynamic diameter of the PM. PM_{10} represents particulate matter with an aerodynamic diameter of less than 10 microns and $PM_{2.5}$ is PM with a diameter of less than 2.5 microns.

In Minnesota, the MPCA monitors and regulates air pollution. MPCA is required to develop regulations, referred to as the State Implementation Plan (SIP) to outline how the areas under their jurisdiction will attain and maintain ambient air concentration levels in compliance with the NAAQS. Within their SIP, MPCA has developed state air quality regulations under Section 7009.0800 of the Minnesota Administrative Rules. In general, the state standards mirror the EPA NAAQS. The primary difference is the state has developed ambient air quality standards for hydrogen sulfide (H2S).

Minnesota had several areas designated as nonattainment for lead, PM10, and SO_2 during the 1980s and 1990s. These areas were primarily located in the seven-county Twin Cities Metropolitan Area. The majority of these areas were all redesignated to attainment by 2002 and considered maintenance areas, which require the state to regularly assess monitoring information, changes to emission patterns, and perform evaluation of the SIP requirements to assure that the areas continue to maintain their attainment

[37] EQB. Alternative Urban Areawide Review Documents: Recommended Content and Format. Updated September 2008. https://www.eqb.state.mn.us/sites/default/files/documents/AUAR%20guidance%20%28form%29%20-9-09.pdf

status. Since the 2018 AUAR Update, the Twin Cities the 20-year maintenance period for this area ended on November 29, 2019. No maintenance or nonattainment areas currently encompass the Moorhead area.

Carbon monoxide (CO) levels are elevated near roadway intersections due to the emission of this pollutant from the vehicles idling and passing by. The State of Minnesota has ambient CO standards that are designed to protect human health and the environment. The state standards are:

- 1-hour average: 35 parts per million (ppm); and
- 8-hour average: 9 ppm.

Concentrations near or above these levels are most likely to occur near intersections that are congested and have high traffic volumes. The Minnesota Department of Transportation (MnDOT) has developed a screening method designed to identify intersections that may cause a CO impact above the State standards. The EPA has approved a CO hot spot screening method designed to identify intersections that may result in CO emissions that exceed air quality standards. This screening method assumes that intersections with a total daily traffic volume exceeding 82,300 vehicles per day may result in potential CO impacts that exceed air quality standards. As described in further detail in Item 20 (Transportation), 2045 forecasted daily volumes would range from 700 vehicles per day (vpd) to 15,515 vpd, below the hot spot screening threshold.

Sulfur dioxide emissions are primarily associated with power plants and specific industrial activities. Automotive traffic is not a major source of sulfur dioxide emissions. Diesel engines were formerly a source of sulfur dioxide emissions, but recent federal air pollution regulations mandated that all on-road diesel fuel be converted to ultra-low sulfur diesel, which contains less than 15 parts per million sulfur. Therefore, truck traffic is no longer a significant source of sulfur dioxide emissions.

Like carbon monoxide, nitrogen dioxide emissions are elevated near roadway intersections due to the emission of this pollutant from the vehicles idling and passing by. MPCA has performed long time ambient air monitoring for this pollutant throughout the Twin Cities area at heavily trafficked intersections. No exceedances of the NAAQS for nitrogen dioxide have been monitored. Therefore, none of the intersections in the AUAR area under any of the traffic scenarios would result in a violation of the air quality standard for nitrogen dioxide.

Nitrogen dioxide and volatile organic compound emissions from vehicular traffic contribute to the formation of ozone. Ground-level ozone, also known as smog, is produced on hot, sunny days by a chemical reaction between VOCs and oxides of nitrogen (NOx). VOCs are released from activities such as the use of paints and solvents. NOx emissions are released from motor vehicles, power plants, and other activities that require fuel combustion. Levels of ozone are dependent on the amount of VOCs and NOx in the air as well as weather conditions including sunlight, temperature, and wind speed and direction. In Minnesota, the highest levels of ozone occur on hot and sunny summer days. Due to the conditions necessary to create ozone, ozone is considered a regional pollutant and is not associated with small, localized changes in traffic conditions. Since the development being analyzed within this AUAR will not result in any significant changes to the vehicular emissions within the Moorhead metropolitan area and the Moorhead area currently attains the ozone NAAQS, the nitrogen dioxide and volatile organic compound traffic emissions associated with this project would not result in a violation of the air quality standard for ozone.

Vehicular traffic is not a significant contributor to particulate or lead emissions. Lead was removed as an additive from gasoline in the 1970s. Federal regulations have been implemented over the past two decades that have substantially reduced particulate emissions from diesel truck engines. Continued turnover of current truck fleets in the coming years will result in reductions of diesel particulate impacts

from vehicular traffic throughout the nation and within the AUAR study area. Since the AUAR study area currently attains the lead and particulate matter NAAQS, this project will not result in a violation of the air quality standards.

Mobile Source Air Toxics

In addition to the criteria air pollutants, the EPA also regulates air toxics. The Federal Highway Administration (FHWA) provides guidance for the assessment of Mobile Source Air Toxic (MSAT) effects for transportation projects. A qualitative evaluation of MSATs has been performed for the AUAR, the scope and methods of which have been developed in collaboration with MnDOT, MPCA, and FHWA.

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA assessed this expansive list in its rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are part of EPA's Integrated Risk Information System (IRIS).[38] In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA).[39] These are *1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter.* While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules.

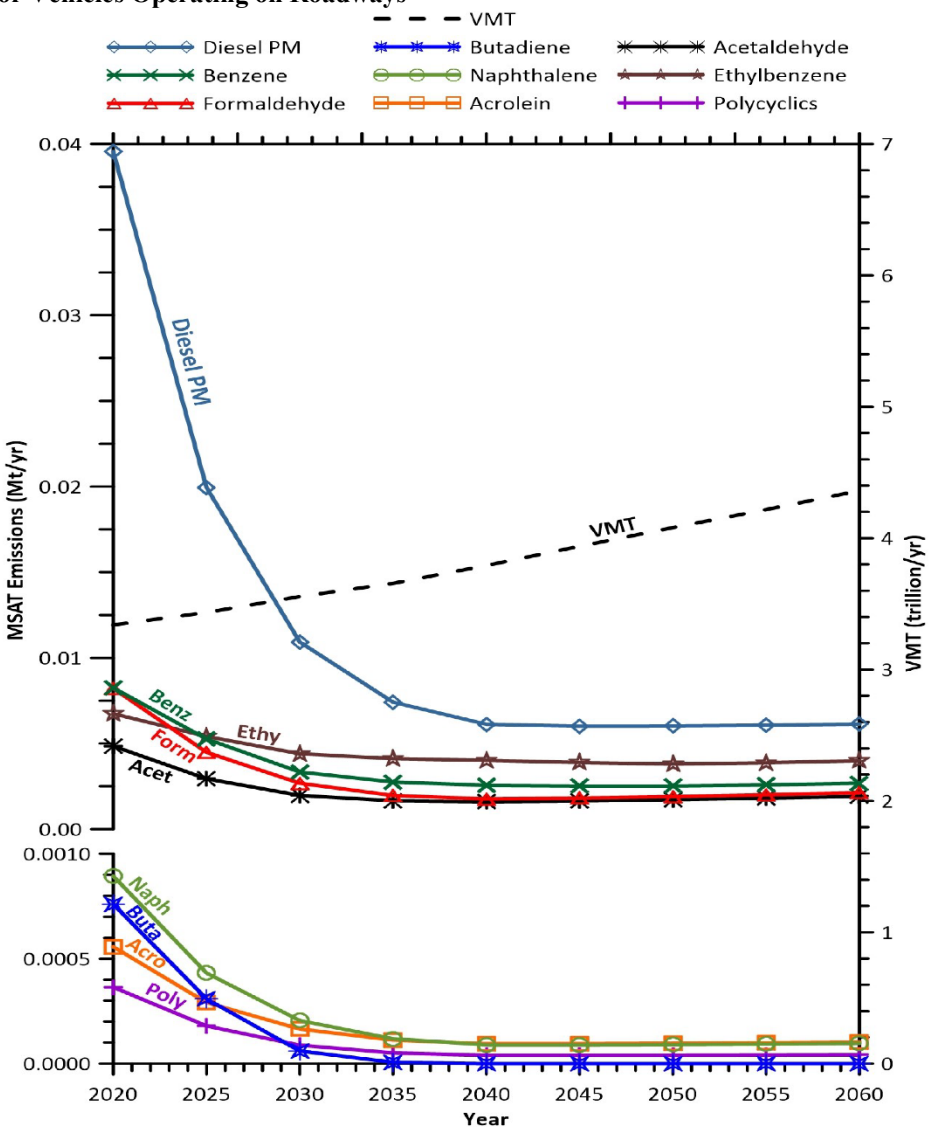
Motor Vehicle Emissions Simulator (MOVES)

According to EPA, MOVES3 is a major revision to MOVES2014 and improves upon it in many respects. MOVES3 includes new data, new emissions standards, and new functional improvements and features. It incorporates substantial new data for emissions, fleet, and activity developed since the release of MOVES2014. These new emissions data are for light- and heavy-duty vehicles, exhaust and evaporative emissions, and fuel effects. MOVES3 also adds updated vehicle sales, population, age distribution, and vehicle miles travelled (VMT) data. In the November 2020 EPA issued MOVES3 Mobile Source Emissions Model Questions and Answers[40] EPA states that for on-road emissions, MOVES3 updated heavy-duty (HD) diesel and compressed natural gas (CNG) emission running rates and updated HD gasoline emission rates. They updated light-duty (LD) emission rates for hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxide (NOx) and updated light-duty (LD) particulate matter rates, incorporating new data on Gasoline Direct Injection (GDI) vehicles.

Using EPA's MOVES3 model, as shown in Exhibit 6, FHWA estimates that even if VMT increases by 31 percent from 2020 to 2060 as forecast, a combined reduction of 76 percent in the total annual emissions for the priority MSAT is projected for the same time period.

[38] https://www.epa.gov/iris
[39] https://www.epa.gov/national-air-toxics-assessment
[40] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010M06.pdf

Exhibit 6. FHWA Projected National MSAT Emission Trends 2020 - 2060
For Vehicles Operating on Roadways



Note: Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.
Source: EPA MOVES3 model runs conducted by FHWA, March 2021.

Diesel PM is the dominant component of MSAT emissions, making up 36 to 56 percent of all priority MSAT pollutants by mass, depending on calendar year. Users of MOVES3 will notice some differences in emissions compared with MOVES2014. MOVES3 is based on updated data on some emissions and pollutant processes compared to MOVES2014, and also reflects the latest Federal emissions standards in place at the time of its release. In addition, MOVES3 emissions forecasts are based on slightly higher VMT projections than MOVES2014, consistent with nationwide VMT trends.

Qualitative MSAT Analysis

For either development scenario in this AUAR, the amount of MSAT emitted would be proportional to the VMT, assuming that other variables such as fleet mix are the same. The VMT estimated for either development scenario would be slightly higher than that for the No Build condition, because of the additional activity associated with the proposed development. This increase in VMT would lead to higher MSAT emissions in the vicinity of the AUAR area. The higher emissions could be offset somewhat by a decrease in regional traffic due to increased use of transit. The extent to which these emissions decreases will offset vehicle related emissions increases is not known. Also, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 76 percent from 2020 to 2060.[41] Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in virtually all locations.

c. Dust and odors - Describe sources, characteristics, duration, quantities, and intensity of dust and odors generated during project construction and operation. (Fugitive dust may be discussed under item 17a). Discuss the effect of dust and odors in the vicinity of the project including nearby sensitive receptors and quality of life. Identify measures that will be taken to minimize ormitigate the effects of dust and odors.

Per EQB Guidance, dust and odors need not be addressed in an AUAR (as no industrial uses are proposed) unless there is some unusual reason to do so. There is no unusual reason to do so with respect to the proposed development scenarios.

18. Greenhouse Gas (GHG) Emissions/Carbon Footprint

a. GHG Quantification: For all proposed projects, provide quantification and discussion of project GHG emissions. Include additional rows in the tables as necessary to provide project-specific emission sources. Describe the methods used to quantify emissions. If calculation methods are not readily available to quantify GHG emissions for a source, describe the process used to cometo that conclusion and any GHG emission sources not included in the total calculation.

The EQB's Revised EAW Guidance (January 2022) was used to develop the carbon footprint for this AUAR. At this point in the South Growth Area planning, approximate land use category changes have been determined, but specific development projects have not yet been identified. As such, only GHG emissions associated with the land use changes (changes in the amount of carbon sequestered by changing from agricultural land use to wetlands or developed areas, for example), are presented in this AUAR. The analysis conducted in this AUAR Update has been customized to be appropriate for an AUAR Update.

As prescribed by the EQB's Draft EAW Guidance, GHG emissions associated with changes in land use were quantified using the Chapter 6: Land Use, Land-Use Change and Forestry, of the EPA's Inventory of Sources and Sinks of Greenhouse Gases, which provides an assessment of greenhouse gas fluxes resulting from land use and land use change in the U.S. The term "flux" describes the exchange of carbon dioxide to and from the atmosphere. A negative flux is a removal of carbon dioxide from the atmosphere, or carbon sequestration.

[41] FHWA. Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. January 18, 2023. https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/fhwa_nepa_msat_memorandum_2023.pdf

For this AUAR study, GHG emissions were calculated based on the proposed land use changes for the AUAR area of 3,696.4 acres provided in Table 1 (see Item 6a. above). As prescribed in the EQB carbon footprint guidance, emission factors (tons of CO_2e per acre) for the entire U.S. were determined based on net CO_2 emissions flux (tons CO2e) and total land area land use change information from the most recent version of the U.S. EPA's Inventory of Sources and Sinks, 1990-2021[42]. Total emissions associated with the proposed East Growth Area land use changes would increase CO2e emissions by approximately 5,956 tons per year of CO2e. Detailed calculations are provided in Appendix D.

Additional GHG emissions associated with construction and operation of future developments in the East Growth Area depend on the type and size of the developments (residential, commercial, industrial). Since the planned developments are unknown at this time, GHG emission calculations cannot yet be performed.

b. GHG Assessment

i. Describe any mitigation considered to reduce the project's GHG emissions.

Mitigation options will be evaluated when specific development types are identified.

ii. Describe and quantify reductions from selected mitigation, if proposed to reduce theproject's GHG emissions. Explain why the selected mitigation was preferred.

N/A – mitigation options will be evaluated when specific development types are identified.

iii. Quantify the proposed projects predicted net lifetime GHG emissions (total tons/#of years) and how those predicted emissions may affect achievement of the Minnesota Next Generation Energy Act goals and/or other more stringent state or local GHG reduction goals.

Lifetime GHG emissions will be evaluated when specific developments are identified.

19. Noise

Describe sources, characteristics, duration, quantities, and intensity of noise generated during project construction and operation. Discuss the effect of noise in the vicinity of the project including 1) existing noise levels/sources in the area, 2) nearby sensitive receptors, 3) conformance to state noise standards, and 4) quality of life. Identify measures that will be taken to minimize or mitigate the effects of noise.

1) Existing noise levels/sources in the area

Existing noise sources include vehicle traffic along Highway 52, Highway 75, and other connecting local roadways. Other existing noise sources would include noise generated by operations and equipment associated with existing agricultural uses within the AUAR area and the Moorhead Municipal Airport located east of AUAR area.

2) Nearby sensitive receptors

The majority of the AUAR area consists of agricultural and undeveloped land. Nearby sensitive receptors would include rural residences present within and adjacent to the AUAR area. Additional sensitive receptors

[42] https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks

include residential neighborhoods and public/institutional uses, including parkland, schools, and religious institutions, located in close proximity to the northern boundary of the AUAR area.

3) Conformance to state noise standards

Minnesota Rules Chapter 7030 provides the Minnesota standards for noise. These standards describe the limiting levels of sound established on the basis of present knowledge for the preservation of health and welfare. These standards are designed to be consistent with sleep, speech, annoyance, and hearing conservation requirements for receivers within areas grouped according to land use activities. The Minnesota standards are as follows:

Table 110: Minnesota Pollution Control Agency State Noise Standards

Land Use	Code	Day (7:00 a.m. - 10:00 p.m.) dBA		Night (10:00 p.m. - 7:00 a.m.) dBA	
Residential	NAC-1	L10 of 65	L50 of 60	L10 of 55	L50 of 50
Commercial	NAC-2	L10 of 70	L50 of 65	L10 of 70	L50 of 65
Industrial	NAC-3	L10 of 80	L50 of 75	L10 of 80	L50 of 75

Notes:
1. NAC-1 includes household units, transient lodging and hotels, educational, religious, cultural entertainment, camping and picnicking land uses.
2. NAC-2 includes retail and restaurants, transportation terminals, professional offices, parks, recreational and amusement land uses.
3. NAC-3 includes industrial, manufacturing, transportation facilities (except terminals), and utilities land uses.
4. From Minnesota Pollution Control Agency, Minn. Rules sec. 7030.0040

L10 means the sound level which is exceeded for 10 percent of the time for a one-hour period. L50 means the sound level that is exceeded 50 percent of the time for a one-hour period. Sound levels are expressed in dBA. A dBA is a unit of sound level expressed in decibels and weighted for the purpose of approximating the human response to sound.

Minnesota Statutes, Section 116.07, Subd. 2a, exempt noise from local and county roads from the requirements of these noise rules unless full control of access to the road has been acquired. This statute exempts noise from all roadways in the AUAR area.

4) Quality of life

Scenario 2 (Maximum Development) includes residential, commercial, mixed use, public/institutional, and parkland uses. No industrial uses are included in the development scenarios. Future development would be required to comply with state noise standards and local noise regulations.

MITIGATION STRATEGIES

- The AUAR area would be developed, such that where feasible, setbacks would protect land use activities sensitive to noise from noise producing sources. Once future projects are further defined, setback distances and potential mitigation measures should be reviewed relative to the sensitive receptors described in the above section to determine the potential for the project to exceed state noise standards.
- Future proposers would be advised to coordinate with the MPCA and MnDOT during project development and planning, as needed, to review roadway noise levels and setbacks.

- If needed, a traffic noise analysis would be conducted to model the existing and build condition near the AUAR area. The traffic noise modeling will be completed using the FHWA Traffic Noise Model (TNM). Prior to beginning the noise analysis, future project proposers should meet with MnDOT staff to discuss the proposed traffic noise analysis methodology to ensure that State Standards will be met. Daytime noise monitoring will be conducted at predetermined locations on the project site. A build condition noise model will be developed for specified locations and be compared to State daytime and nighttime noise standards. If State Standards are exceeded, an analysis of potential noise barriers would be evaluated in accordance with MnDOT guidance.

20. Transportation

a. Describe traffic-related aspects of project construction and operation. Include: 1) existing and proposed additional parking spaces, 2) estimated total average daily traffic generated, 3) estimated maximum peak hour traffic generated and time of occurrence, 4) indicate source of trip generation rates used in the estimates, and 5) availability of transit and/or other alternative transportation modes.

The basis of this South AUAR is to assess impacts to Moorhead's transportation system because of revised growth assumptions, future land uses and proposed transportation improvements associated with the approved 2045 Fargo-Moorhead Metropolitan Transportation Plan. This AUAR considers the updated 2045 Fargo-Moorhead Metropolitan Transportation Plan which was developed, reviewed, and approved by the Fargo-Moorhead Metropolitan Council of Governments (Metro COG), Minnesota Department of Transportation (MnDOT), Federal Highway Administration (FHWA), Clay County, and the City of Moorhead. The 2045 Fargo-Moorhead Metropolitan Transportation Plan guides how the region grows and invests transportation dollars out to the year 2045.

For the purposes of transportation planning, this AUAR identified transportation system needs out to the year 2045. Since specific developments in the south growth area are not yet proposed, traffic-related specifics such as number of existing/proposed parking spaces could not be considered. As future development occurs in the south growth area, subsequent AUAR's would re-assess traffic related impacts to the transportation system through detailed traffic impact analyses.
The growth assumptions outlined in the 2045 Fargo-Moorhead Metropolitan Transportation Plan for population, households, and persons per household are shown in Table 12. Moorhead is projected to continue steady growth in population and households out to 2045.

Table 11: Household/Population Projections

Growth Category	2015	2045	% Change 2015-2045
Population	43840	58870	34.3%
Households	15920	22560	41.7%
Persons Per Household	2.75	2.61	-5.1%

Existing Metro COG travel demand model (TDM) results were used to reflect traffic conditions in the south growth area. 2045 model runs were utilized to document capacity issues, identify mitigation methods, and define network revisions.

Table 12: TDM Forecasted AADT

Link	Functional Classification	2021 Existing Daily Volumes	2045 Forecasted Daily Volumes on Fiscally Constrained Network
14th Street South	Local Collector	1915	3270
20th Street South	Minor Arterial	0	3115
28th Street South	Collector	1760	7060
40th Street South	Collector	1735	6215
TH 75 (8th Street South)	Minor Arterial	8215	15515
50th Avenue South	Collector	925	1940
60th Avenue South	Collector	2190	9190
80th Avenue South	Collector	35	700

The forecasted Annual Average Daily Traffic (AADT) volumes on links within the south growth area is shown in Table 13. The percentage of AADT occurring during the peak hour was estimated using MnDOT Automated Traffic Recorder (ATR) 43, which is in a similar area type along TH 10. Table 14 shows that peak hour traffic was determined to be 9.4 percent of AADT occurring on a weekday between 3-5PM.

Table 13: Percent of AADT in Peak Hour for south Growth Area

ATR #	2020	2021	2022	Average
043	9.4	9.4	9.4	9.4

The Metro COG TDM forecasts the magnitude of additional trips added to the network by applying trip production equations to demographic and socioeconomic data. The resulting trip production rates are balanced with attraction rates obtained from NCHRP 714 and the ITE trip generation manual. Forecasted trips are distributed and assigned to the network to generate future AADT. Forecasted AADT for a 2045 buildout is shown in Table 13.

Metro Area Transit Bus (MATBUS) is the public transportation system serving the communities of Fargo ND, West Fargo ND, Moorhead MN, and Dilworth MN. They currently provide 22 fixed routes linking riders to employment, education, healthcare, entertainment and more. Currently, no MATBUS routes operate within the south growth area.

Additional transit options include 24/7 taxi cab services, ride sharing services, and a variety of transport options for disabled or senior residents.

b. Discuss the effect on traffic congestion on affected roads and describe any traffic improvements necessary. The analysis must discuss the project's impact on the regional transportation system.If the peak hour traffic generated exceeds 250 vehicles or the total daily trips exceeds 2,500, a traffic impact study must be prepared as part of the EAW. Use the format and procedures described in the Minnesota Department of Transportation's Access Management Manual, Chapter 5 (available at: http://www.dot.state.mn.us/accessmanagement/resources.html) or a similar local guidance.

The impact to the regional transportation system was assessed using the Metro COG's TDM developed as part of the 2045 Fargo-Moorhead Metropolitan Transportation Plan. The model was updated considering committed improvements out to the year 2045. Forecasted traffic through 2045 utilizing did not suggest major impacts to the transportation system.

Fargo-Moorhead Metro COG's TDM assigns capacity based on the functional class, number of lanes, and intersection configuration. Base capacities for each functional class were modified according to the number of lanes. Link volume to capacity ratios for existing roadways within the south growth area are summarized in Table 15.

Table 14: Link Volume to Capacity Ratios 2045

Link	Functional Classification	2021 Existing Daily Volumes	2045 Forecasted Daily Volumes on Fiscally Constrained Network
14th Street South	Local Collector	0.2	0.34
20th Street South	Minor Arterial	0.00	0.22
28th Street South	Collector	0.18	0.74
40th Street South	Collector	0.18	0.65
TH 75 (8th Street South)	Minor Arterial	0.30	0.57
50th Avenue South	Collector	0.10	0.20
60th Avenue South	Collector	0.23	0.96
80th Avenue South	Collector	0.01	0.07

Table 15 shows that links within the south growth area would operate below capacity using projected traffic through 2045. A demand-to-capacity ratio less than 0.85 suggests that the links are operating below capacity with no excessive delay experienced. Poor operation is indicated by demand-to-capacity ratio between 0.95 and 1.0. Table 15 shows that all links within the south growth area would operate below capacity using projected traffic except 60th Avenue, which would be over capacity. In the 2045, additional improvements would be needed on 60th Avenue.

c. Identify measures that will be taken to minimize or mitigate project related transportation effects.

Proposed roadway improvements needed to accommodate full buildout of the South Growth Area beyond 2045 are summarized below:

- Construction of 28th Street South Collector between 40th Avenue South and 50th Avenue South
- Construction of 50th Avenue South collector between TH 75 and TH 52.
- Railroad crossing improvements at 50th Avenue South and 50th Street South.
- Construction of 14th Street South local collector between 46th Avenue South and 60th Avenue South
- Construction of 20th Street South minor arterial between 40th Avenue South and 60th Avenue South

The proposed 20th Street South minor arterial is intended to provide mobility through the growth area from north-south with speed limits in the 35-40 mph range. Its main function would be to connect collector roadways such as 50th Avenue South to I-94 or principal arterials north of I-94. The 14th Street South, 50th Avenue South collector roadways would provide access to adjacent land uses while

connecting to 20th Street South and MNTH 52 minor arterials.

21. Cumulative Potential Effects

(Preparers can leave this item blank if cumulative potential effects areaddressed under the applicable EAW Items)

a. Describe the geographic scales and timeframes of the project related environmental effects that could combine with other environmental effects resulting in cumulative potential effects.

Full build-out of the AUAR area is expected to occur over the next 20+ years, depending on market conditions. The geographic scale of potential effects is assumed to be a one-mile radius of the AUAR area. No significant developments have been identified within this area and there has been no new development since the 2018 AUAR. The capacity of the City's sanitary sewer system limits the growth potential in this area, and therefore new development has been limited to areas of the city with sufficient existing capacity.

Anticipated cumulative impacts are associated with normal growth and development as discussed in the 2022 Comprehensive Plan Update and the five-year updates of the AUAR.

b. Describe any reasonably foreseeable future projects (for which a basis of expectation has been laid) that may interact with environmental effects of the proposed project within the geographic scales and timeframes identified above.

All cumulative impacts associated with anticipated development within the AUAR area have been accounted for within the responses to AUAR questions. No reasonably foreseeable future projects have been identified at this time.

c. Discuss the nature of the cumulative potential effects and summarize any other available information relevant to determining whether there is potential for significant environmental effects due to these cumulative effects.

All cumulative impacts associated with known proposed development within the AUAR area have been accounted for within the responses to the questions contained in this AUAR.

22. Other Potential Environmental Effects

If the project may cause any additional environmental effects not addressed by items 1 to 19, describe the effects here, discuss the how the environmentwill be affected, and identify measures that will be taken to minimize and mitigate these effects.

No other potential environmental effects are anticipated that are not addressed by Items 1 through 21.

RGU CERTIFICATION
*(The Environmental Quality Board will only accept **SIGNED** EnvironmentalAssessment Worksheets for public notice in the EQB Monitor.)*

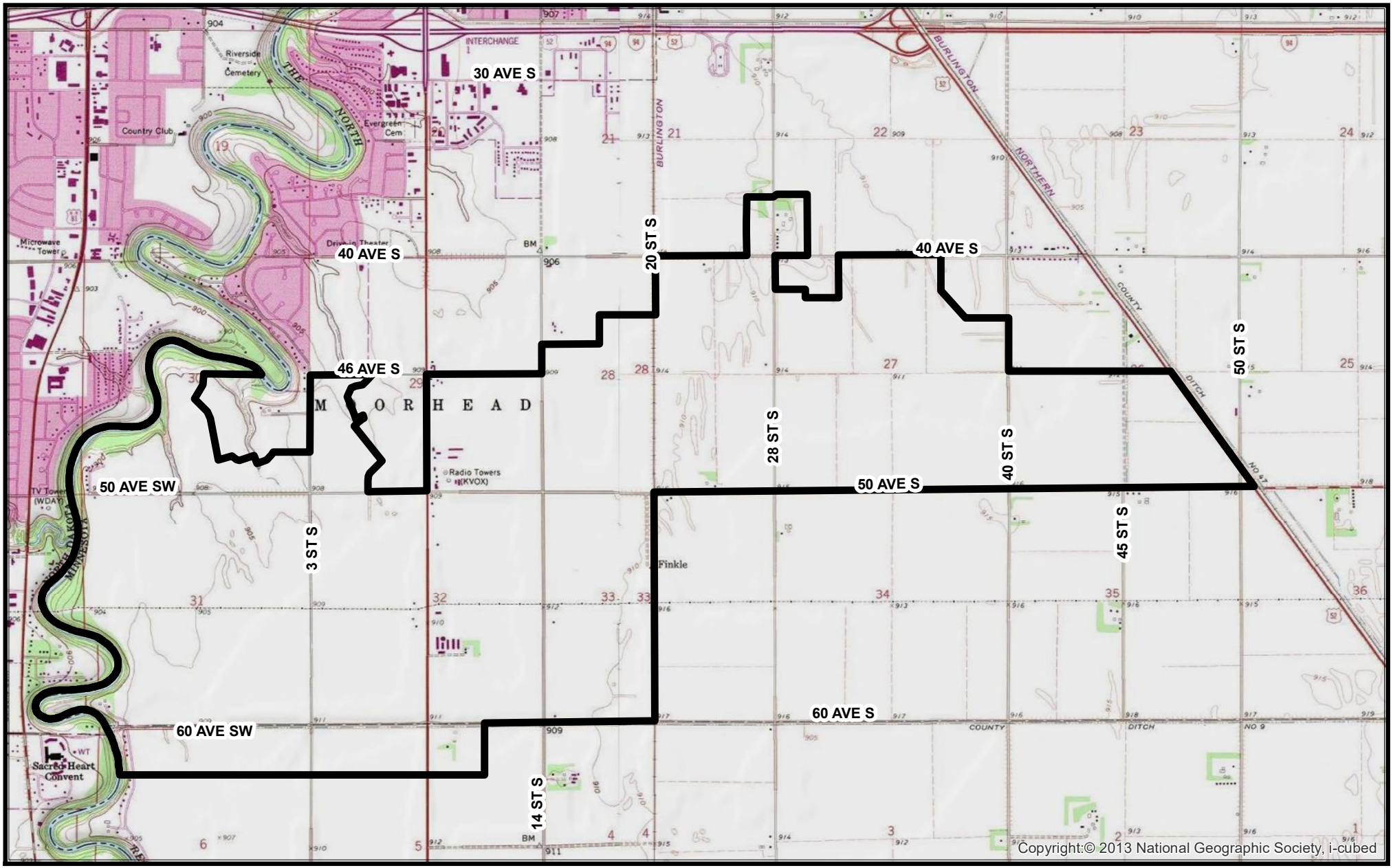
I hereby certify that:

- The information contained in this document is accurate and complete to the best of my knowledge.
- The EAW describes the complete project; there are no other projects, stages or components other than those described in this document, which are related to the project as connected actions or phased actions, as defined at Minnesota Rules, parts 4410.0200, subparts 9c and 60, respectively.
- Copies of this EAW are being sent to the entire EQB distribution list.

Signature_____ Date _____

Title _____

Appendix A- Figures



USGS Map

South Moorhead AUAR

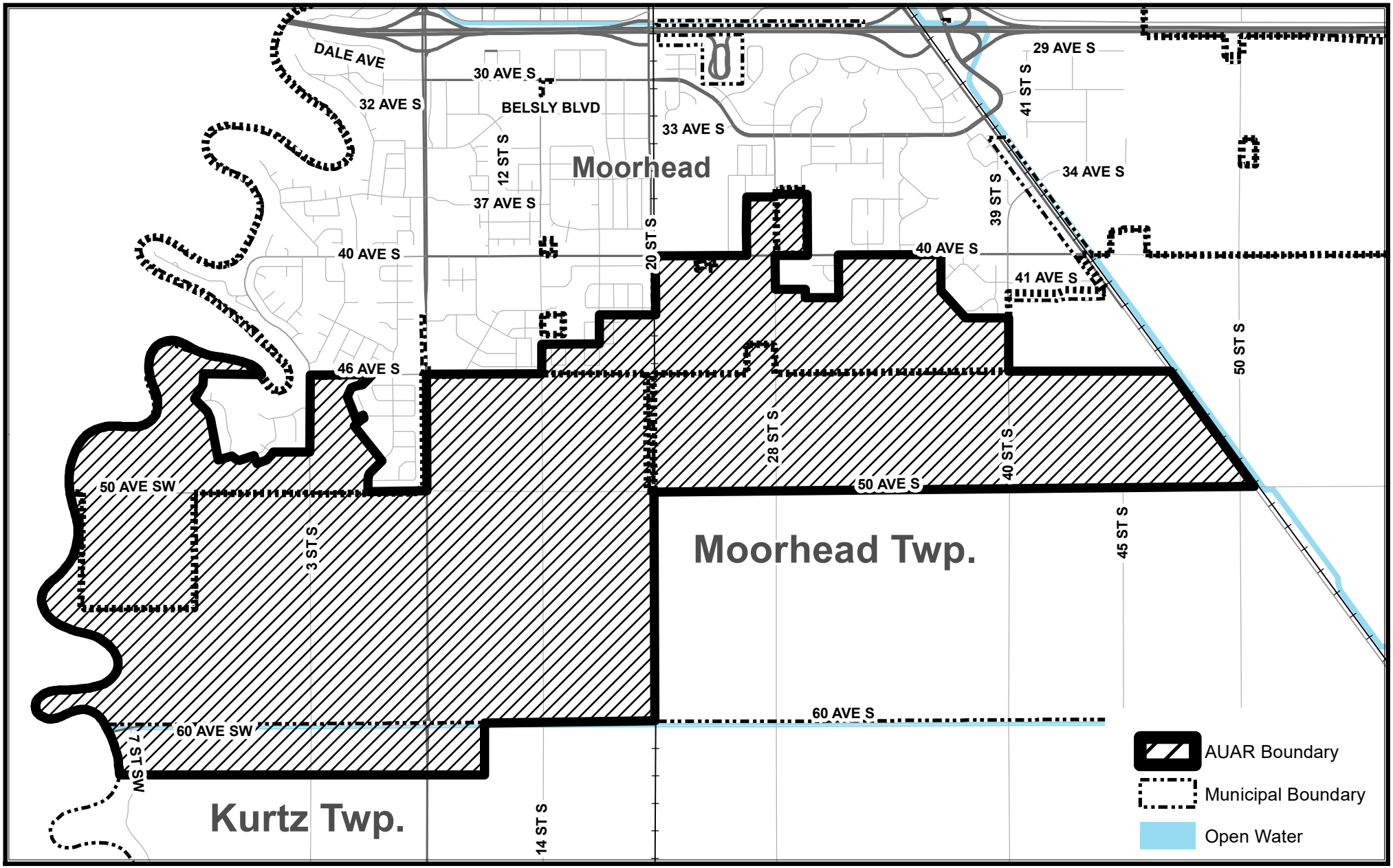
Figure 5-1

N

3,000 0 3,000 Feet

AUAR Boundary

Stantec



AUAR Boundary

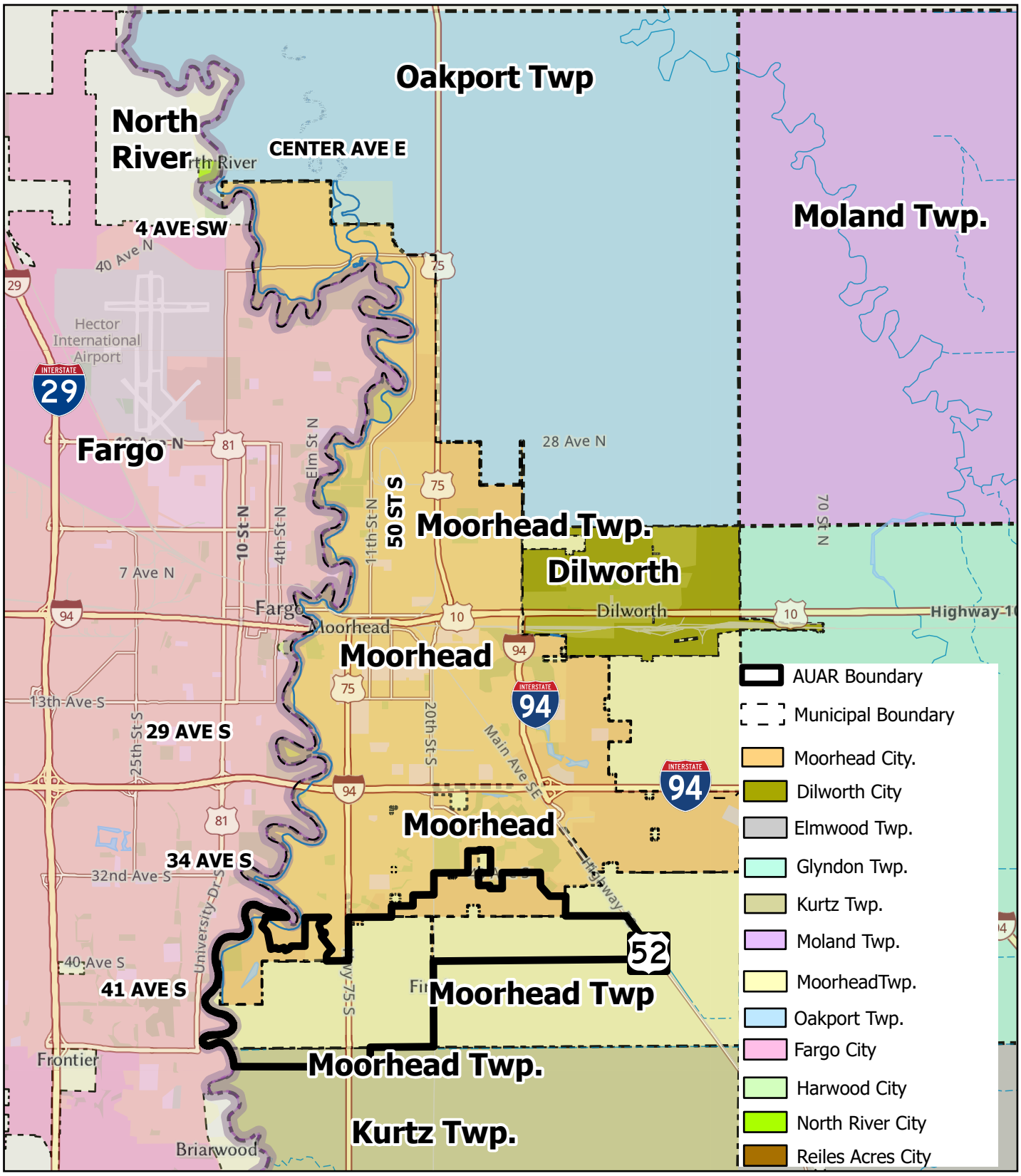
South Moorhead AUAR

Figure 5-2

N

3,000 0 3,000 Feet

Stantec



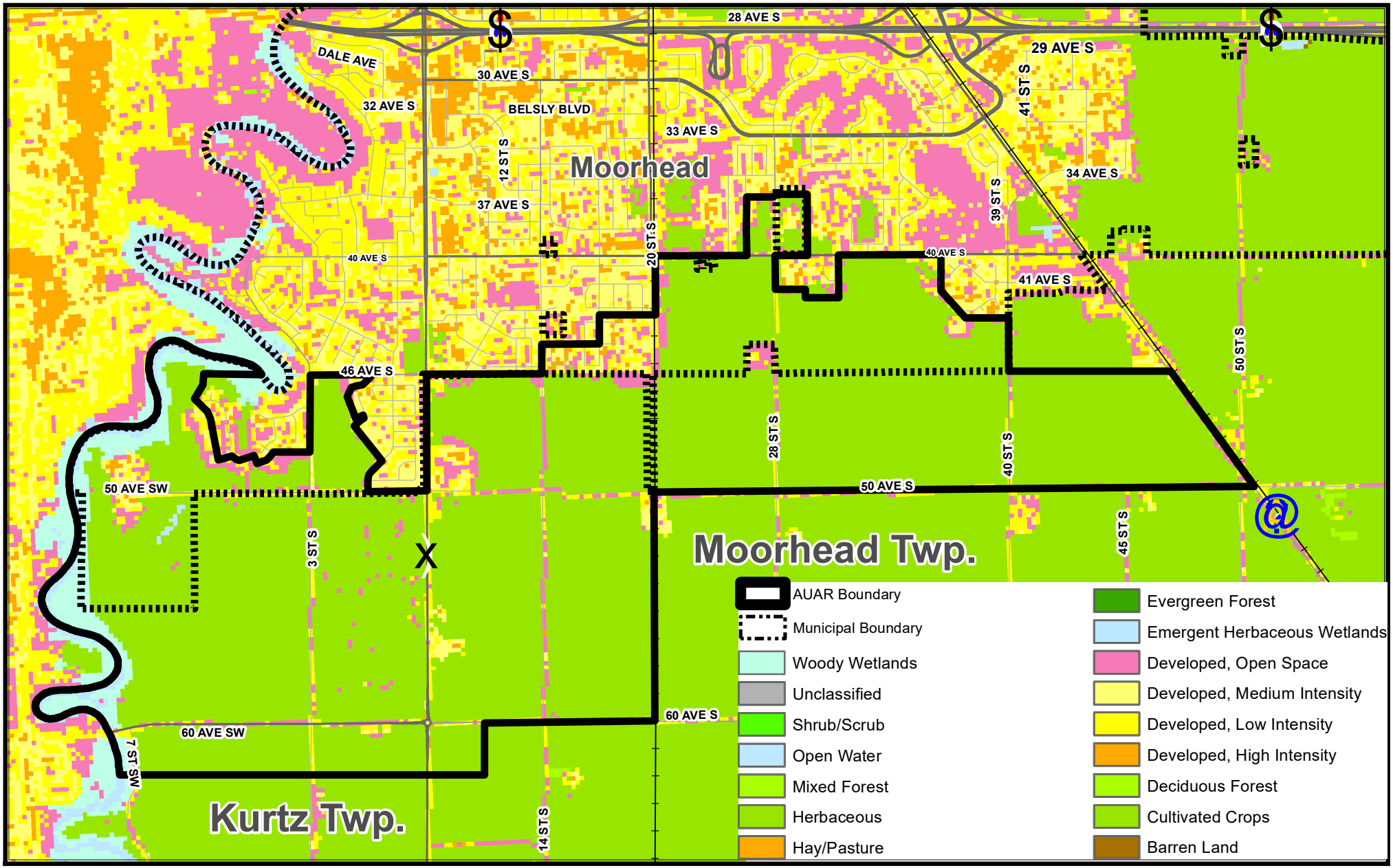
Project Location
South Moorhead AUAR

Figure 5-3

N

0 4,500 9,000 18,000
Feet

Stantec



Existing Land Cover

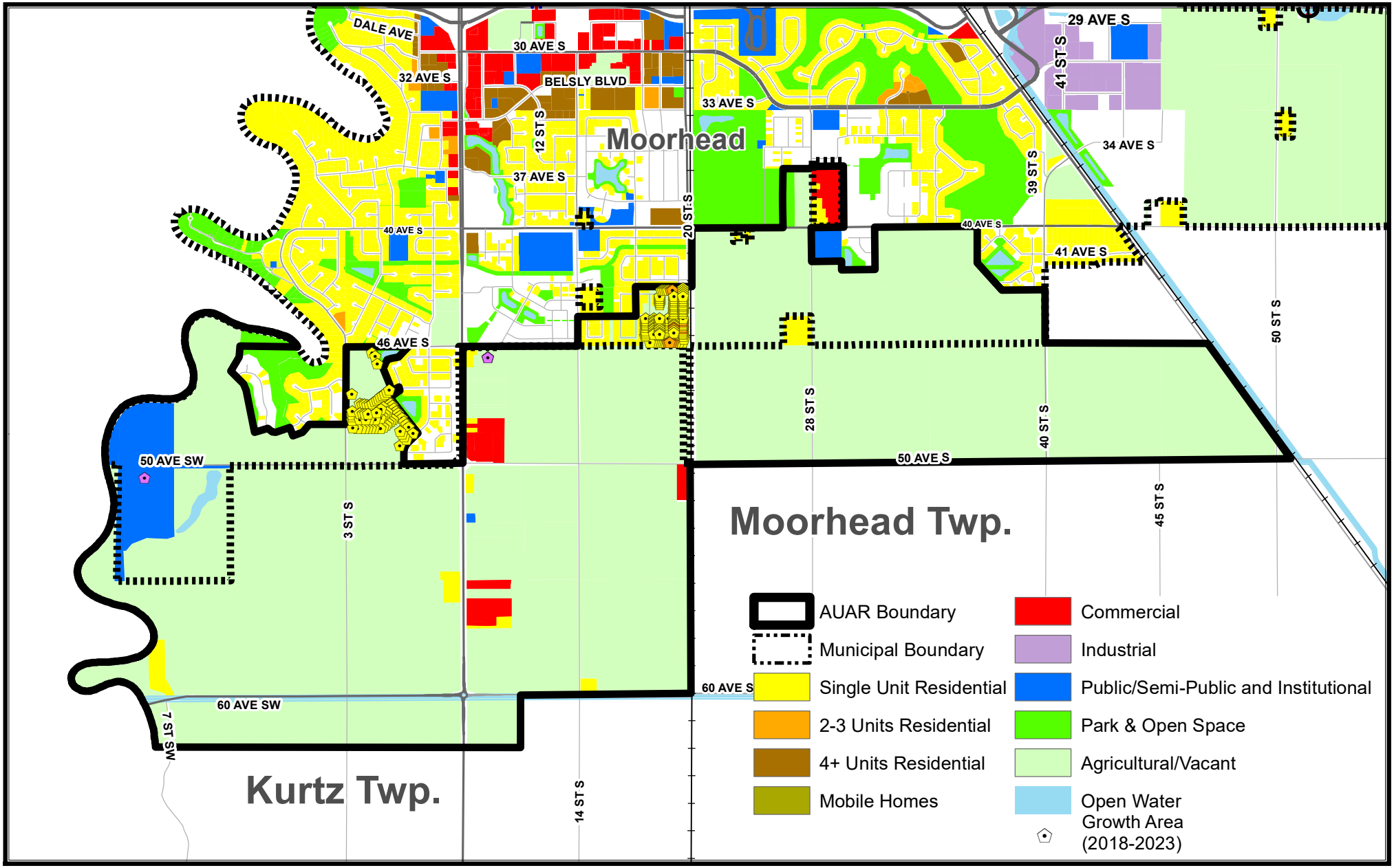
South Moorhead AUAR

Figure 8-1

N

3,000 0 3,000 Feet

Stantec



Existing Land Use

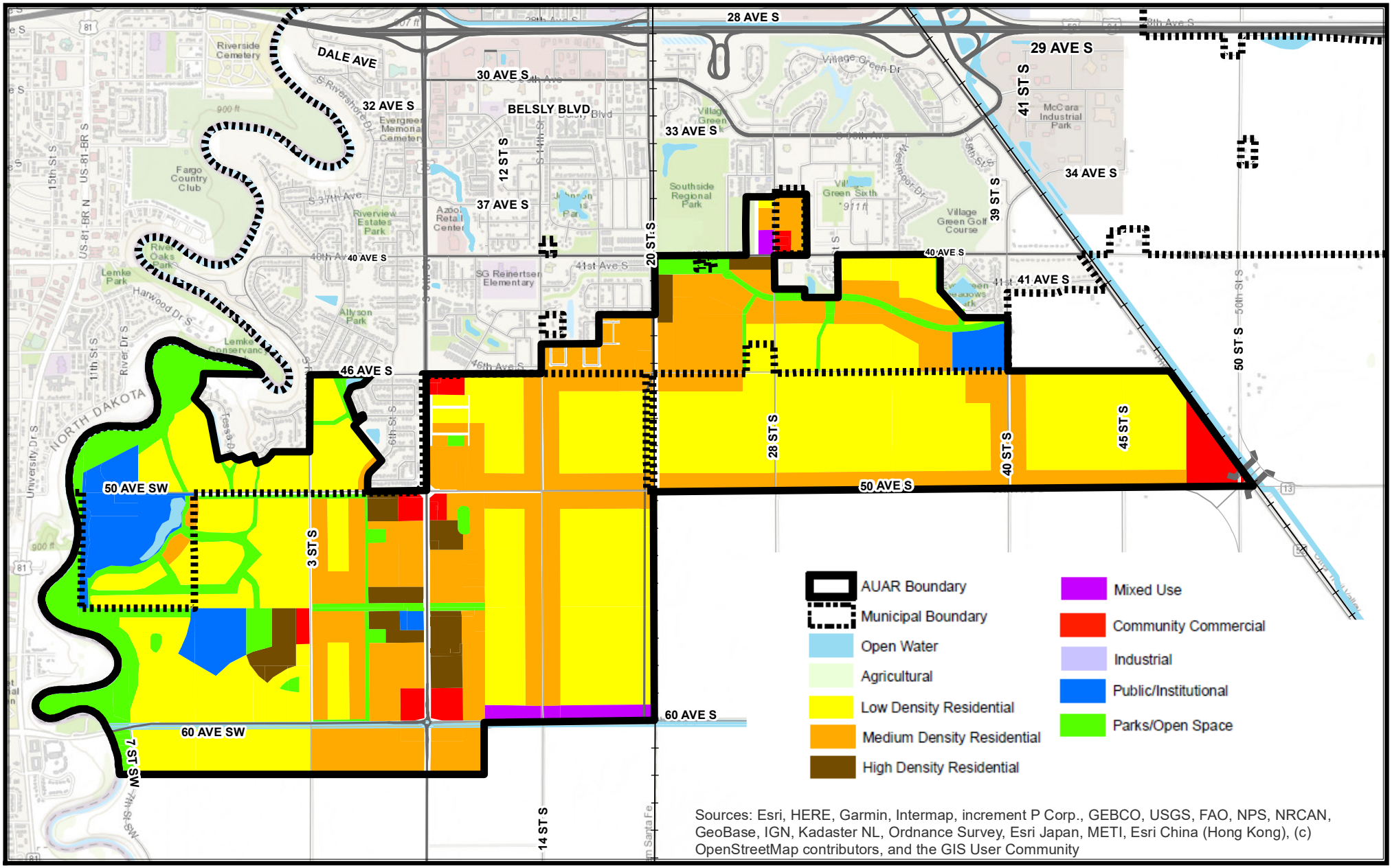
South Moorhead AUAR

Figure 10-1

N

3,000 0 3,000 Feet

Stantec



Planned Future Land Use

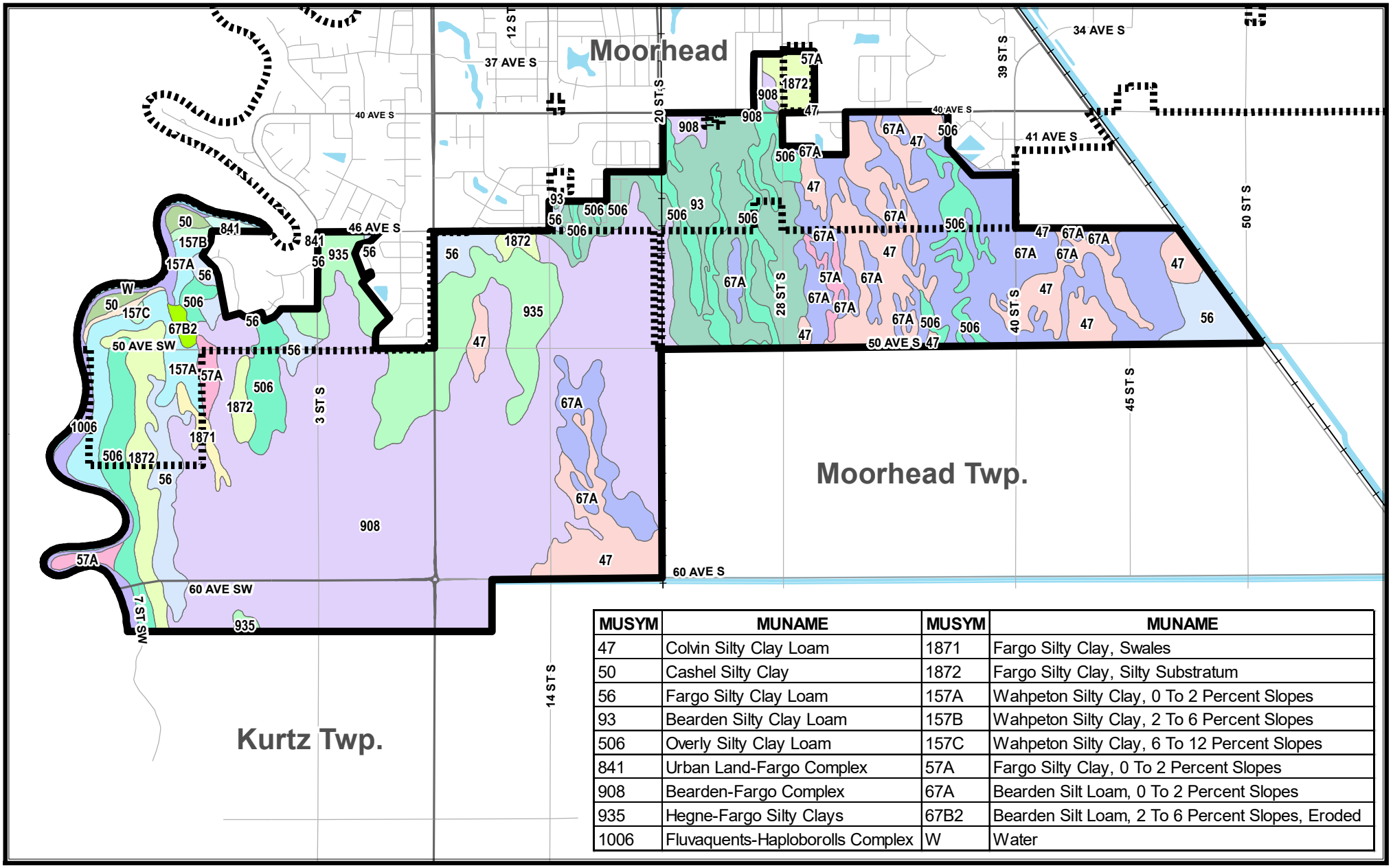
South Moorhead AUAR

Figure 10-2

N

3,000 0 3,000 Feet

Stantec



MUSYM	MUNAME	MUSYM	MUNAME
47	Colvin Silty Clay Loam	1871	Fargo Silty Clay, Swales
50	Cashel Silty Clay	1872	Fargo Silty Clay, Silty Substratum
56	Fargo Silty Clay Loam	157A	Wahpeton Silty Clay, 0 To 2 Percent Slopes
93	Bearden Silty Clay Loam	157B	Wahpeton Silty Clay, 2 To 6 Percent Slopes
506	Overly Silty Clay Loam	157C	Wahpeton Silty Clay, 6 To 12 Percent Slopes
841	Urban Land-Fargo Complex	57A	Fargo Silty Clay, 0 To 2 Percent Slopes
908	Bearden-Fargo Complex	67A	Bearden Silt Loam, 0 To 2 Percent Slopes
935	Hegne-Fargo Silty Clays	67B2	Bearden Silt Loam, 2 To 6 Percent Slopes, Eroded
1006	Fluvaquents-Haploborolls Complex	W	Water

Soils

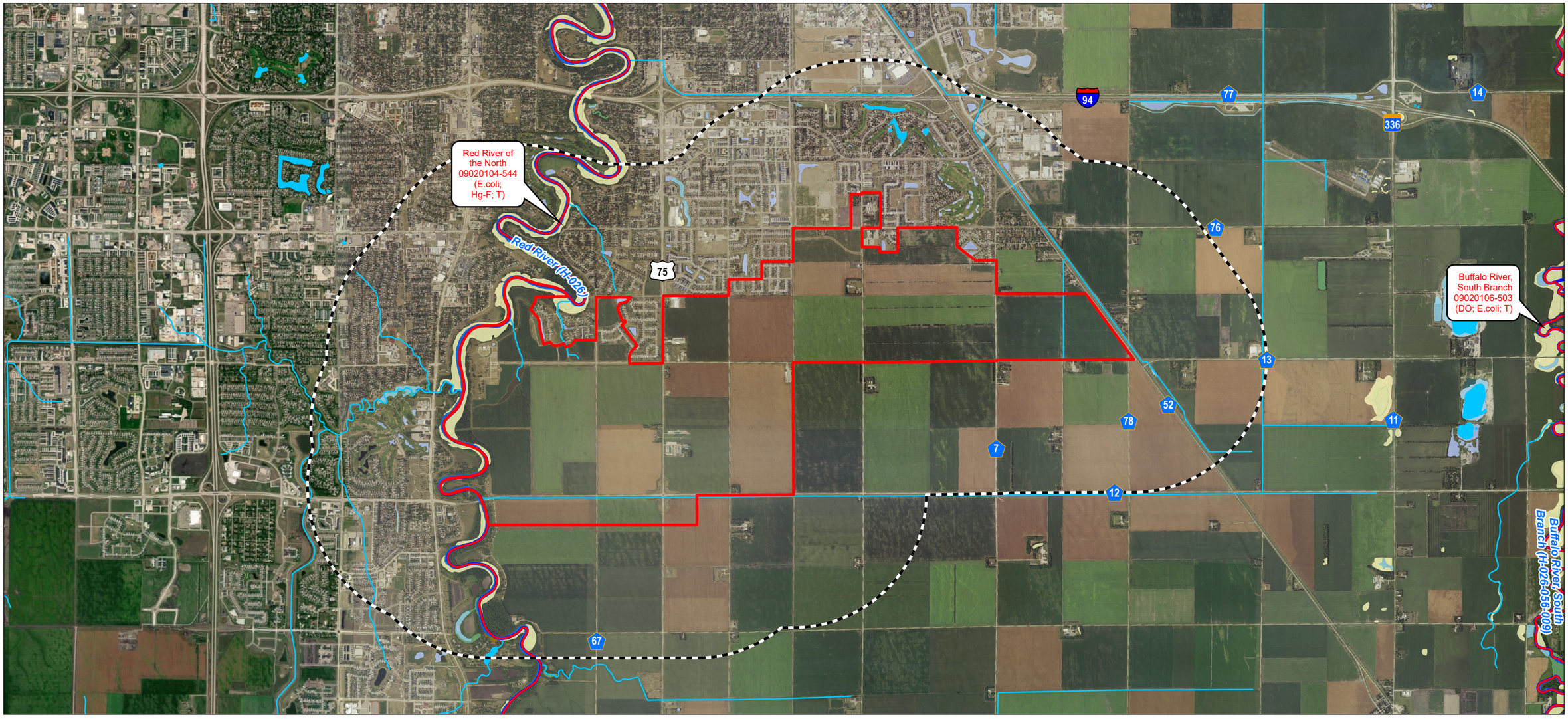
South Moorhead AUAR

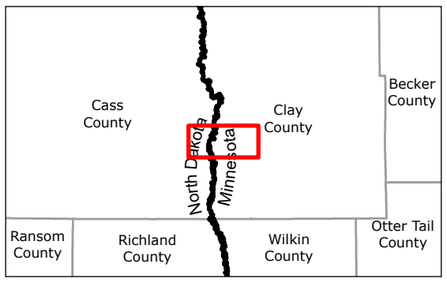
Figure 11-1

N

3,000 0 3,000 Feet

Stantec





Legend

- 1 Mile Radius
- AUAR Boundary
- 2022 MPCA Impaired Streams (Draft)

Minnesota Public Waters Delineations

- Public Water Watercourse

National Hydrography Dataset

- NHD - Flowline
- NHD - Waterbody

NWI Circular 39 Class

- 1 - Seasonally Flooded Basin or Flat
- 3 - Shallow Marsh
- 4 - Deep Marsh
- 5 - Shallow Open Water
- 6 - Shrub Swamp
- 7 - Wooded Swamp
- Riverine Systems

0 2,000 4,000 Feet

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1:48,000

N

Stantec

Project Location
Clay Co., MN

Prepared by KJM on 2023-06-22

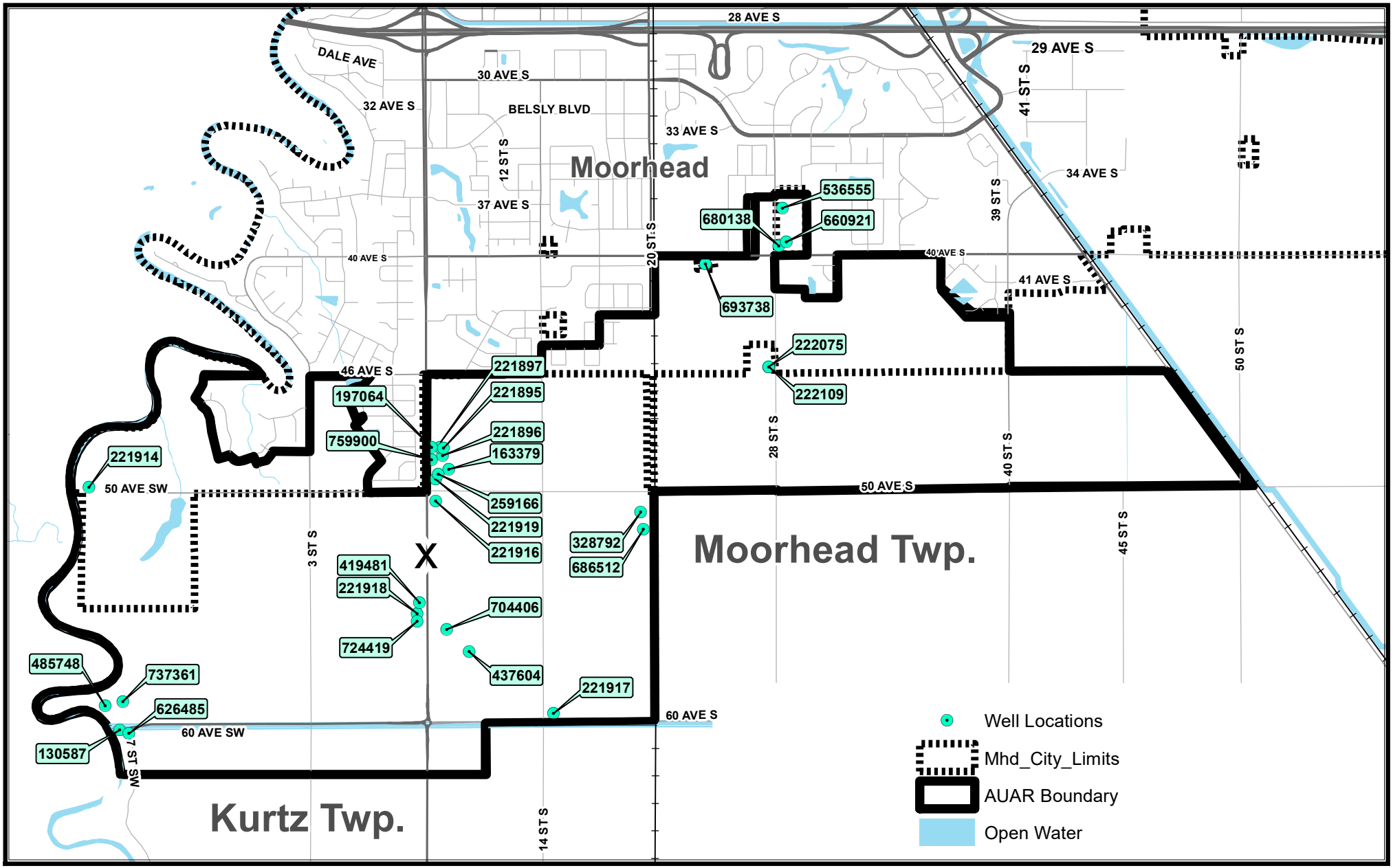
Client/Project
193806099
City of Moorhead, MN
Moorhead Growth Areas AUAR
South Project

Figure No.
12-1

Title
Water Resources Map

Notes
1. Coordinate System: NAD 1983 HARN Adj MN Clay Feet
2. Data Sources: City of Moorhead, MNDNR, MNDOT, MPCA, USGS
3. Background: Clay Co. 2021

V:\1938\Active\193806099\03_data\gis_cad\gis\pro\south_auar\south_auar.aprx Revised: 2023-06-22 By: kjmueller



Well Locations

12-2

South Moorhead AUAR

N

3,000 0 3,000 Feet

Stantec

LEGEND

EXISTING SANITARY SYSTEM

- LS — SANITARY LIFT STATION
- SANITARY FORCEMAIN

GRAVITY SEWER DIAMETER

- LESS THAN 10 INCH
- 10 INCH
- 12 INCH
- 15 INCH
- 18 INCH
- 21 INCH
- 24 INCH
- 27 INCH
- 30 INCH AND LARGER

- EXISTING SANITARY SEWER SERVICE AREA

SEWER EXPANSION AREA

- SOUTHWEST
- GROWTH BOUNDARY

TRUNK IMPROVEMENTS

- NEW GRAVITY SEWER
- NEW FORCE MAIN
- LS — NEW LIFT STATION
- LS — UPGRADE LIFT STATION
- NEW TANK

BASE MAPPING

- CITY PARCEL
- COUNTY ROADS

0 ¼ ½ ¾ MILES

N

TREATMENT FACILITY
WTF
LS39
LS15
15TH AVE N
NEW 30 INCH FM
LS14
HWY 10
LSE
LS40
LS31
LS38
LS10
LS5
LS3
LS8
LS32
LS36
LS13
16TH AVE S
LS4
20TH AVE S
LSA
LS11
3.0 MG TANK AND
7,000 GPM LIFT STATION
LS12
I-94
30TH AVE S
LS19
LS6
LS18
LS30
LS7
LS17
LS37
40TH AVE S
LS21
LS20
NEW 24 INCH FM
46TH AVE S
LS35
LS43
SW PHASE 2
NEW 15 INCH GRAVITY
NEW 4,700 GPM LIFT STATION
14TH ST S
28TH ST S
40TH ST S
LS41
NEW 24 INCH FM
3RD ST S
NEW 15 INCH GRAVITY
12 INCH FM
NEW 2,300 GPM LIFT STATION
NEW 16 INCH FM
NEW 1,400 GPM LIFT STATION
SOUTHWEST EXPANSION AREA
SW PHASE 2
60TH AVE S

Stantec

2335 Highway 36 West
Saint Paul, MN 55113
651.636.4600

FIGURE 12-3 - SOUTHWEST (PHASE 2) SERVICE EXPANSION AREA

CITY OF MOORHEAD SANITARY SEWER SYSTEM

MARCH 2017

V:\1938\active\193803033\GIS\Projects\Figure 4 - 2017 SW Expansion Phase 2.mxd

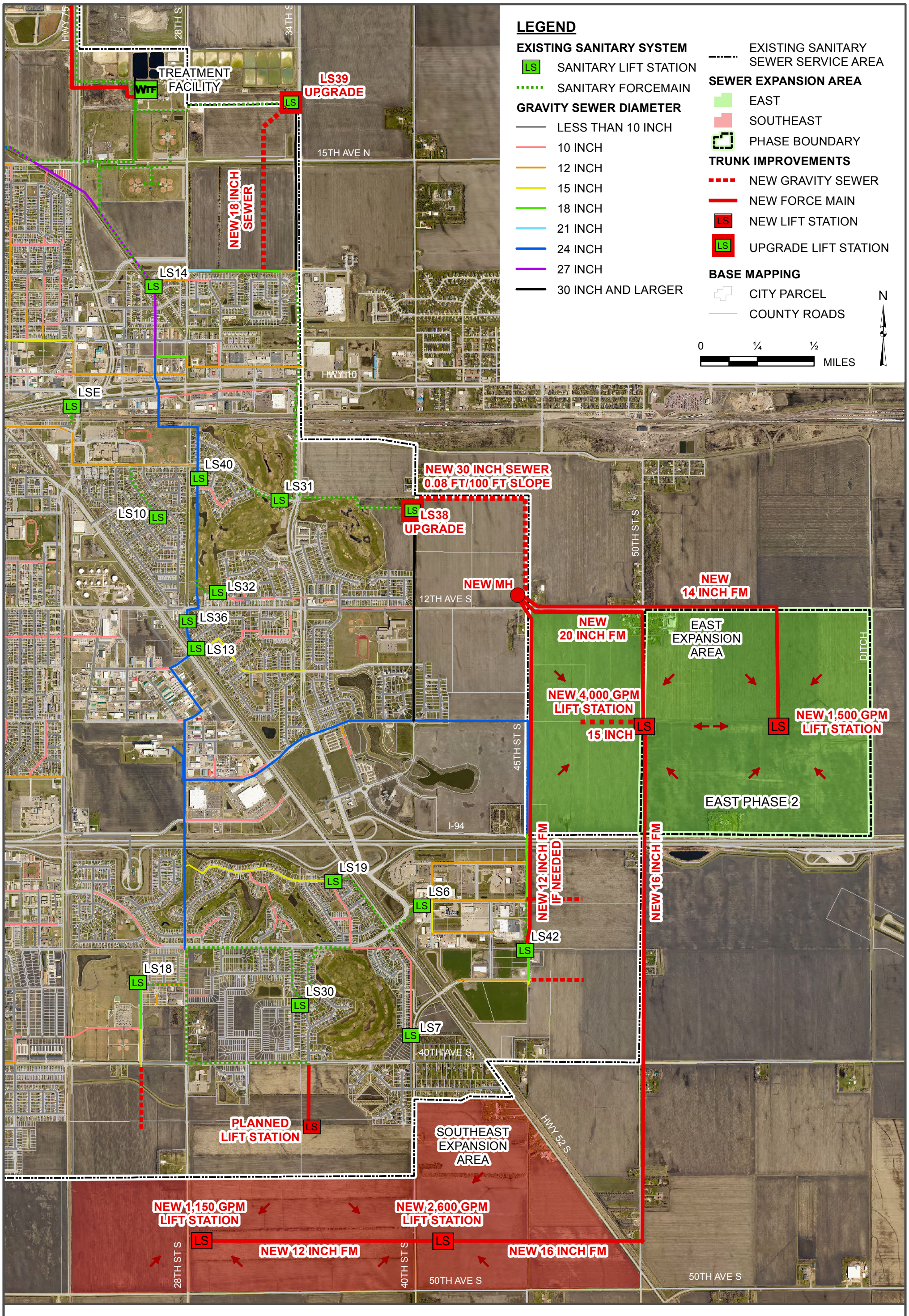
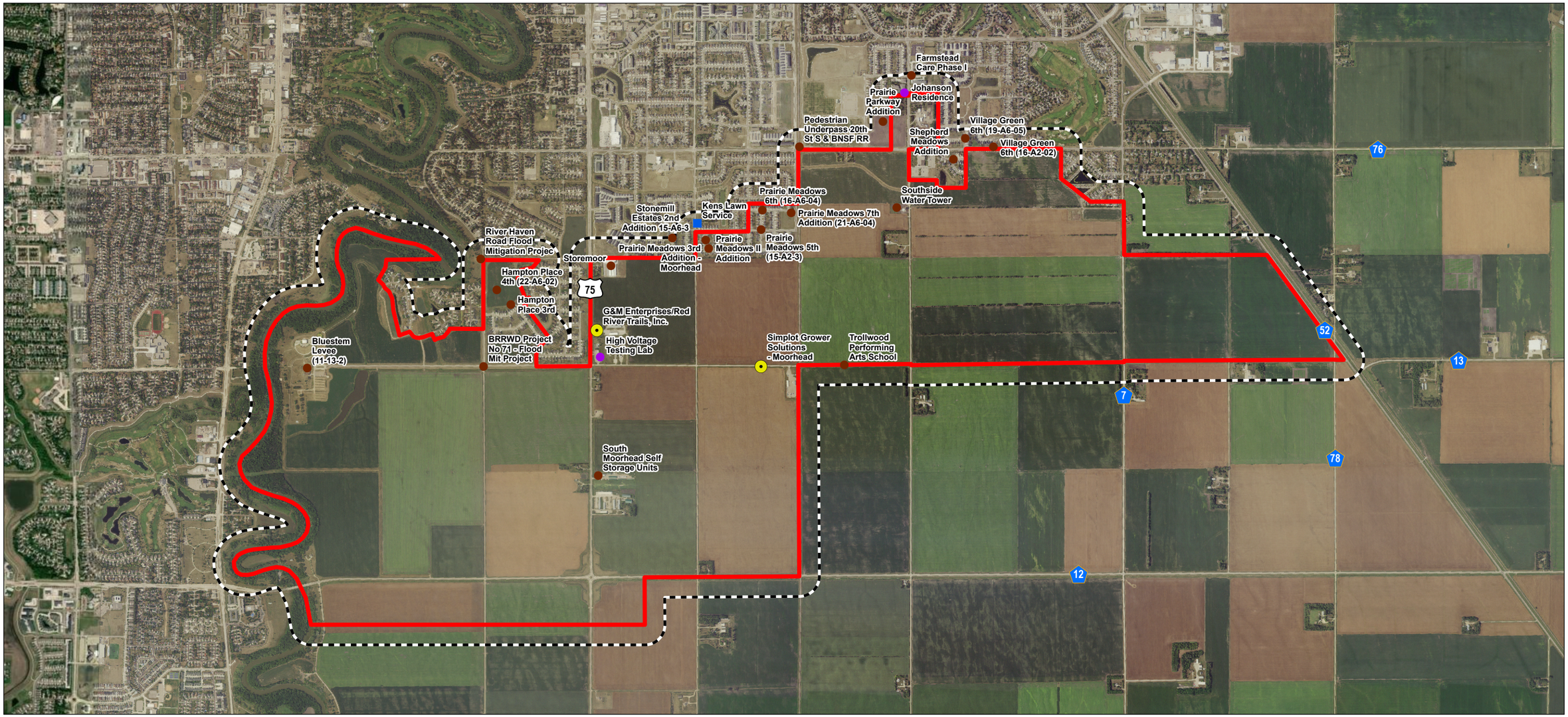


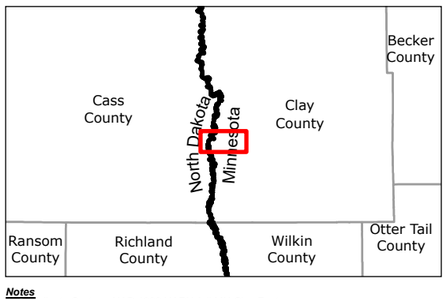
FIGURE 12-4 - EAST (PHASE 2) & SOUTHEAST SERVICE EXPANSION AREAS CITY OF MOORHEAD SANITARY SEWER SYSTEM

Stantec
2335 Highway 36 West
Saint Paul, MN 55113
651.636.4600

MARCH 2017

V:\1938\active\193803033\GIS\Projects\Figure 5 - 2017 East Phase 2 and SE Expansion.mxd





Legend

- AUAR Boundary
- 500 ft Buffer

MPCA Sites

Program Name

- Hazardous Waste
- Investigation and Cleanup
- Multiple Programs
- Stormwater

0 1,250 2,500 Feet

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1:30,000

N

Stantec

Project Location
Clay Co., MN

Prepared by KJM on 2023-06-22

Client/Project 193806099
City of Moorhead, MN
Moorhead Growth Areas AUAR
East Project

Figure No.
13-1

Title
MPCA WIMN Potentially Contaminated Sites

Notes
1. Coordinate System: NAD 1983 HARN Adj MN Clay Feet
2. Data Sources: City of Moorhead, MNDNR, MNDOT, MPCA, USGS
3. Background: Clay Co. 2021

V:\1938\Active\193806099\03_data\gis_cad\gis\pro\south_auar\south_auar.aprx Revised: 2023-06-22 By: KJmueller

Appendix B - NHIS

DEPARTMENT OF NATURAL RESOURCES

Minnesota Department of Natural Resources
Division of Ecological & Water Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025

November 7, 2023
Correspondence # MCE 2023-00470

Kevin Mueller
Stantec

RE: Natural Heritage Review of the proposed Moorhead South Growth Area AUAR Update,
T139N R49W Sects 25, 36, T139N R48W Sects 21, 22, 26-33, T138N R48W Sects 5, 6; Clay County

Dear Kevin Mueller,

As requested, the Minnesota Natural Heritage Information System has been reviewed to determine if the proposed project has the potential to impact any rare species or other significant natural features. Based on the project details provided with the request, the following rare features may be impacted by the proposed project:

Ecologically Significant Areas

- The Minnesota Biological Survey (MBS) has identified a Site of *Moderate* Biodiversity Significance on the eastern edge of the proposed project on the opposite side of Hwy 52. Sites of Biodiversity Significance have varying levels of native biodiversity and are ranked based on the relative significance of this biodiversity at a statewide level. Sites ranked as *Moderate* contain occurrences of rare species and/or moderately disturbed native plant communities, and/or landscapes that have a strong potential for recovery. This Site also has a mapped example of WPn53c – Wet Prairie (Northern), which has a state conservation rank of S3: Vulnerable to Extirpation. Development within the proposed project area is unlikely to directly affect this MBS Site and native plant community however indirect effects are still possible. More than 99% of the prairie that was present in the state before settlement has been destroyed, and more than one-third of Minnesota's endangered, threatened, and special concern species are now dependent on the remaining small fragments of Minnesota's prairie ecosystem. Therefore, we feel that all prairie remnants merit protection. We encourage you to consider project alternatives that would avoid or minimize disturbance to this ecologically significant area. Some possible actions to avoid or minimize potential impacts are

- Retain a buffer between proposed activities and the MBS Site;
- Use effective erosion prevention and sediment control measures;
- Inspect and clean all equipment prior to bringing it to the Site to prevent the introduction and spread of invasive species;
- Revegetate disturbed soil with native species suitable to the local habitat as soon after construction as possible; and
- Use only weed-free mulches, topsoils, and seed mixes. Of particular concern are birdsfoot trefoil (*Lotus corniculatus*) and crown vetch (*Coronilla varia*), two invasive species that are sold commercially and are problematic in prairies and disturbed open areas.

MBS Sites of Biodiversity Significance and DNR Native Plant Communities can be viewed using the Minnesota Conservation Explorer or their GIS shapefiles can be downloaded from the MN Geospatial Commons. Please contact the NH Review Team if you need assistance accessing the data. Reference the MBS Site Biodiversity Significance and Native Plant Community websites for information on interpreting the data.

State-listed Species

- Great Plains toad (*Anaxyrus cognatus*), a state-listed species of special concern, was documented in the vicinity of the proposed project. This species is found in remnant prairies and grasslands in Western Minnesota. They breed from May to July in highly ephemeral water-filled prairie depressions and have adapted to breed in flooded agricultural fields. Given the presence of these rare toads, the DNR recommends that the use of erosion control mesh, if any, be limited to wildlife-friendly materials.

- The Natural Heritage Information System (NHIS) tracks bat roost trees and hibernacula plus some acoustic data, but this information is not exhaustive. Even if there are no bat records listed nearby, all seven of Minnesota's bats, including the federally endangered northern long-eared bat (*Myotis septentrionalis*), can be found throughout Minnesota. During the active season (approximately April-November) bats roost underneath bark, in cavities, or in crevices of both live and dead trees. Tree removal can negatively impact bats by destroying roosting habitat, especially during the pup rearing season when females are forming maternity roosting colonies and the pups cannot yet fly. To minimize these impacts, the DNR recommends that tree removal be avoided from June 1 through August 15.

- Please visit the DNR Rare Species Guide for more information on the habitat use of these species and recommended measures to avoid or minimize impacts. For further assistance with these species, please contact the appropriate DNR Regional Nongame Specialist or Regional Ecologist.

Federally Protected Species

- To ensure compliance with federal law, conduct a federal regulatory review using the U.S. Fish and Wildlife Service's (USFWS) online Information for Planning and Consultation (IPaC) tool.

Environmental Review and Permitting

- Given the potential presence of state protected species, we encourage submission of Natural Heritage Review requests to ensure avoidance of take for these species and to determine survey needs as individual projects are planned.

- Please include a copy of this letter and the MCE-generated Final Project Report in any state or local license or permit application. Please note that measures to avoid or minimize disturbance to the above rare features may be included as restrictions or conditions in any required permits or licenses.

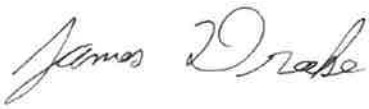
The Natural Heritage Information System (NHIS), a collection of databases that contains information about Minnesota's rare natural features, is maintained by the Division of Ecological and Water Resources, Department of Natural Resources. The NHIS is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. However, the NHIS is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. Therefore, ecologically significant features for which we have no records may exist within the project area. If additional information becomes available regarding rare features in the vicinity of the project, further review may be necessary.

For environmental review purposes, the results of this Natural Heritage Review are valid for one year; the results are only valid for the project location and project description provided with the request. If project details change or the project has not occurred within one year, please resubmit the project for review within one year of initiating project activities.

The Natural Heritage Review does not constitute project approval by the Department of Natural Resources. Instead, it identifies issues regarding known occurrences of rare features and potential impacts to these rare features. Visit the Natural Heritage Review website for additional information regarding this process, survey guidance, and other related information. For information on the environmental review process or other natural resource concerns, you may contact your DNR Regional Environmental Assessment Ecologist.

Thank you for consulting us on this matter and for your interest in preserving Minnesota's rare natural resources.

Sincerely,



James Drake
Natural Heritage Review Specialist
James.F.Drake@state.mn.us

Cc: Owen Baird

Formal Natural Heritage Review - Cover Page

See next page for results of review. A draft watermark means the project details have not been finalized and the results are not official.

Project Name: Moorhead South Growth Area AUAR Update

Project Proposer: City of Moorhead

Project Type: Development, Mixed Use

Project Type Activities: Tree Removal;Groundwater Impacts (e.g., contamination, dewatering, change in recharge);Wetland impacts (e.g., dewatering, discharge, excavation, fill, runoff, sedimentation)

TRS: T138 R48 S4, T138 R48 S5, T138 R48 S6, T139 R48 S21, T139 R48 S22, T139 R48 S25, T139 R48 S26, T139 R48 S27, T139 R48 S28, T139 R48 S29, T139 R48 S30, T139 R48 S31 +

County(s): Clay

DNR Admin Region(s): Northwest

Reason Requested: Other

Project Description: The City of Moorhead recognizes the need for more detailed land use planning that facilitates development in a cohesive manner and ensures that the public ...

Existing Land Uses: The majority of existing land use within the South Growth Area is agricultural or vacant land. Residential uses are present along the northern boundary of the South AUAR area.

Landcover / Habitat Impacted: The primary land cover anticipated to be impacted is cropland. Future development would increase impervious surfaces within the AUAR area. Tree removal ...

Waterbodies Affected: According to NWI, a few wetlands are present within the AUAR area. The Red River extends along the western boundary of the AUAR area, which is a DNR Public ...

Groundwater Resources Affected: Development of the AUAR area would increase water demand such that further appropriations of surface or groundwater may be required in the future.

Previous Natural Heritage Review: No

Previous Habitat Assessments / Surveys: No

SUMMARY OF AUTOMATED RESULTS

Category	Results	Response By Category
Project Details	No Comments	No Further Review Required
Ecologically Significant Area	Comments	Potential RNC - Will Require Consultation
State-Listed Endangered or Threatened Species	Needs Further Review	State-protected Species in Vicinity
State-Listed Species of Special Concern	No Comments	No Further Review Required
Federally Listed Species	No Records	Visit IPaC For Federal Review

DEPARTMENT OF NATURAL RESOURCES

June 20, 2023

Project Name: Moorhead South Growth Area AUAR Update
Project Proposer: City of Moorhead
Project Type: Development, Mixed Use
Project ID: MCE #2023-00470

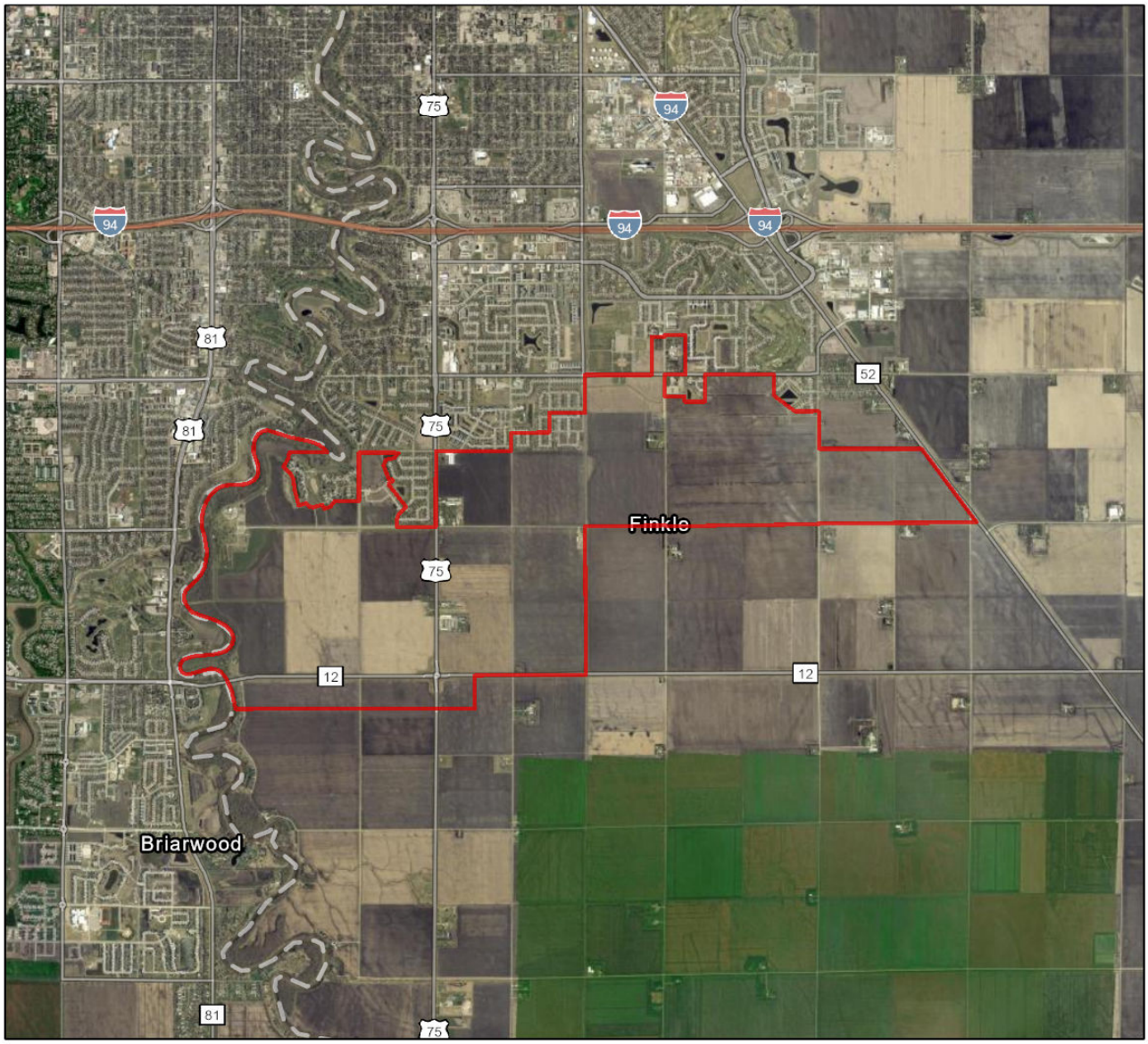
AUTOMATED RESULTS: FURTHER REVIEW IS NEEDED
As requested, the above project has undergone an automated review for potential impacts to rare features. Based on this review, one or more rare features may be impacted by the proposed project and further review by the Natural Heritage Review Team is needed. You will receive a separate notification email when the review process is complete and the Natural Heritage Review letter has been posted.

Please refer to the table on the cover page of this report for a summary of potential impacts to rare features. For additional information or planning purposes, use the Explore Page in Minnesota Conservation Explorer to view the potentially impacted rare features or to create a Conservation Planning Report for the proposed project.

If you have additional information to help resolve the potential impacts listed in the summary results, please attach related project documentation in the Edit Details tab of the Project page. Relevant information includes, but is not limited to, additional project details, completed habitat assessments, or survey results. This additional information will be considered during the project review.

Moorhead South Growth Area AUAR Update

Aerial Imagery With Locator Map



N
W E
S

0 0.42 0.85 1.7 2.55 3.4
Miles

Project Boundary

Project Type: Development, Mixed Use

Project Size (acres): 3,700.79

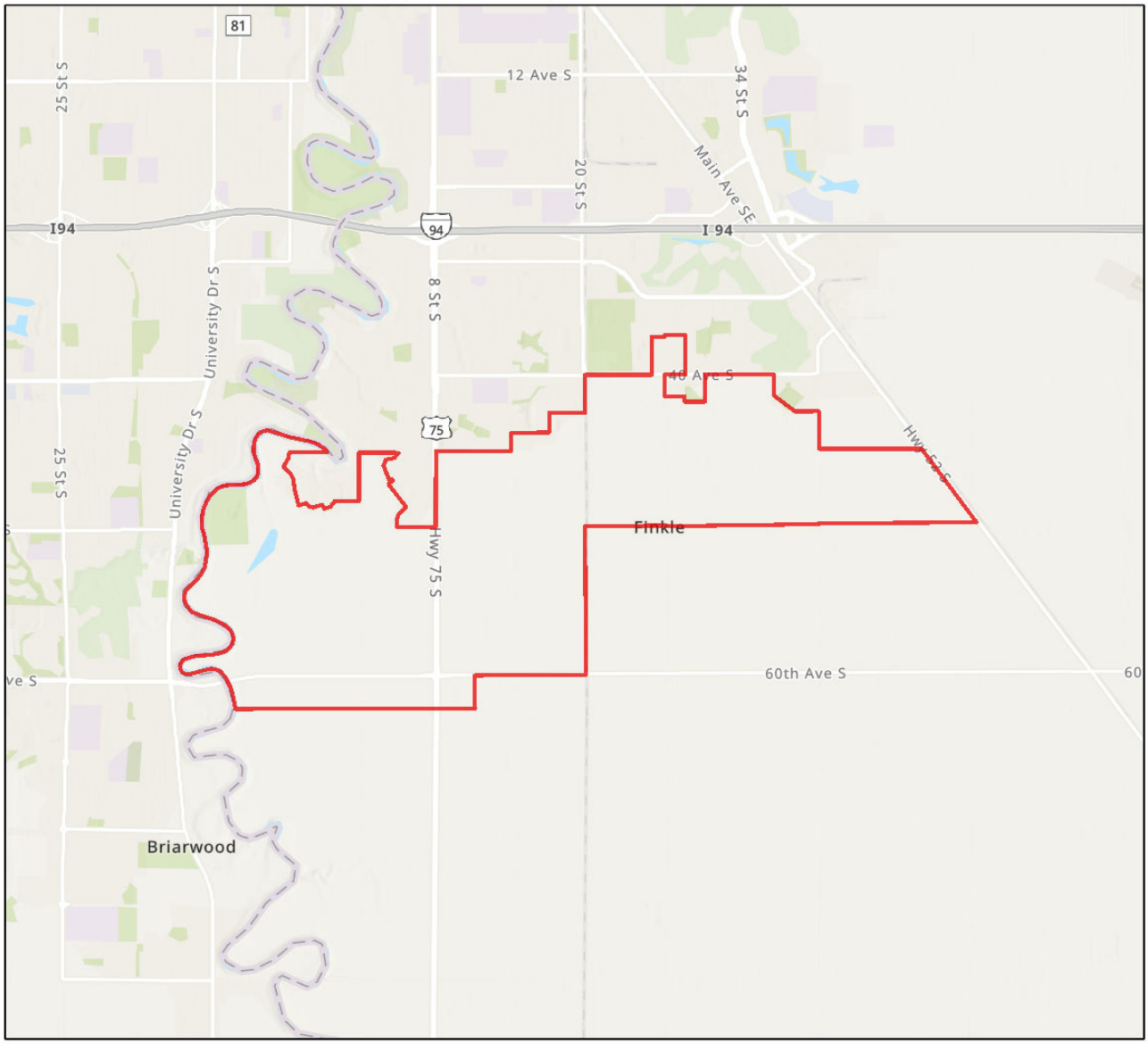
County(s): Clay

TRS: T138 R48 S4, T138 R48 S5, T138 R48 S6, T139 R48 S21, T139 R48 S22 +

Fargo, North Dakota, Earthstar Geographics
City of Moorhead, State of North Dakota, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

Moorhead South Growth Area AUAR Update

USA Topo Basemap With Locator Map



N
W E
S

0 0.42 0.85 1.7 2.55 3.4 Miles

Project Boundary

Project Type: Development, Mixed Use

Project Size (acres): 3,700.79

County(s): Clay

TRS: T138 R48 S4, T138 R48 S5, T138 R48 S6, T139 R48 S21, T139 R48 S22 +

Esri, NASA, NGA, USGS
City of Moorhead, State of North Dakota, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

Appendix C- SHPO Query

From: MN_MNIT_Data Request SHPO
To: Walburg, Lauren
Subject: RE: Moorhead South Growth Area - AUAR Update - SHPO Database Query Request
Date: Friday, May 12, 2023 2:53:55 PM
Attachments: ~WRD0003.jpg
image001.png
image002.png
image003.png
image004.png
Archaeology.xls
History.xls

Hello Lauren,

Please see attached.

Jim

SHPO Data Requests
Minnesota State Historic Preservation Office
50 Sherburne Avenue, Suite 203
Saint Paul, MN 55155
(651) 201-3299
datarequestshpo@state.mn.us

Notice: This email message simply reports the results of the cultural resources database search you requested. The database search is only for previously known archaeological sites and historic properties. **IN NO CASE DOES THIS DATABASE SEARCH OR EMAIL MESSAGE CONSTITUTE A PROJECT REVIEW UNDER STATE OR FEDERAL PRESERVATION LAWS –** please see our website at https://mn.gov/admin/shpo/protection/ for further information regarding our Environmental Review Process.
Because the majority of archaeological sites in the state and many historic/architectural properties have not been recorded, important sites or properties may exist within the search area and may be affected by development projects within that area. Additional research, including field surveys, may be necessary to adequately assess the area's potential to contain historic properties or archaeological sites.
Properties that are listed in the National Register of Historic Places (NRHP) or have been determined eligible for listing in the NRHP are indicated on the reports you have received, if any. The following codes may be on those reports:
NR – National Register listed. The properties may be individually listed or may be within the boundaries of a National Register District.
CEF – Considered Eligible Findings are made when a federal agency has recommended that a property is eligible for listing in the National Register and MN SHPO has accepted the recommendation for the purposes of the Environmental Review Process. These properties need to be further assessed before they are officially listed in the National Register.
SEF – Staff eligible Findings are those properties the MN SHPO staff considers eligible for listing in the National Register, in circumstances other than the Environmental Review Process.
DOE – Determination of Eligibility is made by the National Park Service and are those properties that are eligible for listing in the National Register, but have not been officially listed.
CNEF – Considered Not Eligible Findings are made during the course of the Environmental Review Process. For the purposes of the review a property is considered not eligible for listing in the National Register. These properties may

need to be reassessed for eligibility under additional or alternate contexts.
Properties without NR, CEF, SEF, DOE, or CNEF designations in the reports may not have been evaluated and therefore no assumption to their eligibility can be made. Integrity and contexts change over time, therefore any eligibility determination made ten (10) or more years from the date of the current survey are considered out of date and the property will need to be reassessed.
If you require a comprehensive assessment of a project's potential to impact archaeological sites or historic/architectural properties, you may need to hire a qualified archaeologist and/or historian. If you need assistance with a project review, please contact Kelly Gragg-Johnson, Environmental Review Specialist @ 651-201-3285 or by email at kelly.graggjohnson@state.mn.us.
The Minnesota SHPO Archaeology and Historic/Architectural Survey Manuals can be found at https://mn.gov/admin/shpo/identification-evaluation/.

Please subscribe to receive SHPO notices for the most current updates regarding office hours, accessing research files, or changes in submitting materials to the SHPO.

To access historic resource information please visit our webpage on Using SHPO's Files.

From: Walburg, Lauren <Lauren.Walburg@stantec.com>
Sent: Thursday, May 4, 2023 12:50 PM
To: MN_MNIT_Data Request SHPO <DataRequestSHPO@state.mn.us>
Subject: Moorhead South Growth Area - AUAR Update - SHPO Database Query Request

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Good afternoon,

On behalf of the City of Moorhead, Stantec is preparing an Alternative Urban Areawide Plan Update for the proposed Moorhead South Growth Area. The City of Moorhead is updating the South Growth Area AUAR for the first time since its adoption in 2018. No new development has occurred in the growth area since 2018. The 2023 Update includes assumptions in the adopted 2022 Comprehensive Plan Update and the AUAR update incorporates questions regarding climate change adopted by the EQB in December 2022.

This is a discretionary AUAR completed by the City of Moorhead.

The Project Area includes**: Sections 29-33, Township 139N, Range 48W; Section 36, Township 139N, Range 48W; Sections 5-6, Township 138N, Range 48W.** Attached, please also find project location figures for reference.

Could you please provide information regarding any known historic properties and/or other cultural resources on or near the site from the state database of cultural resources and historic properties?

Information received will be used in preparation of the AUAR update.

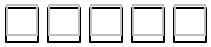
Please do not hesitate to contact me if you have any questions or require additional information to complete this database review request.

Thank you!

Lauren Walburg AICP
Urban Planner
Pronouns: she, her, hers

Direct: 612 712-2071
Lauren.Walburg@stantec.com

Stantec
733 Marquette Avenue Suite 1000
Minneapolis MN 55402-2309



We do what is right for our communities and our world. Learn more about our net-zero pledge and commitment to sustainability.

Appendix D- GHG Calculations

Moorhead AUAR Update
Greenhouse Gas Emissions Associated with Land Use Changes - South Development

			Land Use Emissions or Reductions					
Land Use Change[1]	**Description**	**Land Area (acres)**	**Net CO2 Emissions Flux (tons CO2e)[2]**	**Total Area Land Use Change (hectares)[3]**	**Emission Factor (tons CO2e/acre)**	**Emissions (tons CO2e, negative value represents sink/removal of carbon)**	**Project Lifetime Multiplier (assume 50+ years)**	**Emission Rate (ton/yr)**
Wetland Remaining Wetland (includes stormwater ponds)		30.02	45,400,000	38,613,000	0.48	14.3	1	14.3
Wetland to Settlement		8.94	300,000	14,000	8.67	77.5	1	77.5
Settlement Remaining Settlement		330.77	15,900,000	43,189,000	0.149	49.28	1	49
Cropland to Settlement	Settlement includes developed areas, including residential, industrial, commercial and institutional land.	3326.67	5,900,000	1,366,000	1.75	5,814.8	1	5815
Total		**3696.4**						**5956**

1. Stormwater ponds are not represented in the U.S. Greenhouse Gas Emissions Sources and Sinks: 1990-2020 document. Conservatively assume the stormwater ponds have the same carbon sequestration as wetlands. Settlements

2. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021. Net Flux from Soil, Dead Organic Matter and Biomass Carbon Stock Changes.
Wetlands Remaining Wetlands: Table 6-1.
Settlements Remaining Settlements: Table 6-112
Cropland Converted to Settlements: Table 6-129.
Wetland to Settlements: Table 6-129.

3. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020. Land Use and Land-Use Change for the U.S. Managed Land Base for All 50 States, Table 6-5.