Appendix I

Highlighted Revisions to Draft AUAR Text

Responding to the Draft AUAR comment letters warranted revisions or additions to the text and figures included in the Draft AUAR. The purpose of this appendix is to assist in the review of the Final AUAR by outlining the revisions and additions and where the revisions and additions are located in the Final AUAR document.

Additions to the AUAR document

Item 21. Traffic	Traffic Noise Analysis added to Item 21 and highlighted in Appendix I
Appendix A	Figure 21-13. Traffic Noise Analysis Results
Appendix E	2020 No-Build Traffic Analysis
Appendix F	2030 AM Peak Hour Traffic Analysis

Revisions to the AUAR document

Executive Summary	Text revisions highlighted in Appendix I
Item 17. Water Quality	Text revisions highlighted in Appendix I
Traffic Figures	21-1, 21-2, 21-3, 21-4, 21-8, 21-9, 21-10, 21-11, and 21-12 (included in Appendix A)
Item 21. Traffic	Text revisions highlighted in Appendix I
Appendix D	Hydrologic Analysis - text revisions highlighted in Appendix I

Executive Summary

The I-35E Corridor Final AUAR has been prepared for the City of Lino Lakes (city) in accordance with Minnesota Rules Chapter 4410. This AUAR process was prompted by the fact that large portions of the AUAR area are facing development pressure, that the city has a strong commitment to conserving natural resources and that the city wants to balance development with natural resource conservation. The city determined that undergoing the AUAR process would provide the city with an invaluable tool as they plan for and manage growth within the northeastern portion of the city (Figure 5-1). The AUAR follows the format of an Environmental Assessment Worksheet (EAW) and provides a level of analysis commensurate with an Environmental Impact Statement (EIS).

The large geographic scope of the AUAR area (over 4,500 acres) allows for a comprehensive analysis of the cumulative impacts of development within the AUAR area (Figure 5-2). Mn

Rules state that, "the Responsible Governmental Unit (RGU) may specify more than one scenario of anticipated development provided that at least one scenario is consistent with the adopted comprehensive plan. At least one scenario must be consistent with any known development plans of property owners within the area," (Mn Rules. Chapter 4410.3610 subp.3). This AUAR includes a review of three development scenarios.

1. 1. Scenario One is consistent with the adopted plans of the city and allows for an additional 2,237 housing units, 2,985,733 ft^2 of commercial uses, and 11,175,035 ft^2 of industrial uses (see Figure 6-2).
2. 2. Scenario Two is based on known development plans of property owners within the AUAR area and has a commercial and industrial emphasis (see Figure 6-3). Scenario Two allows for an additional 5,715 housing units, 5,617,890 ft^2 of commercial uses, and 9,570,045 ft^2 of industrial uses.
3. 3. Scenario Three has a residential emphasis and allows for an additional 8,659 housing units, 4,141,554 ft^2 of commercial uses, and 5,829,722 ft^2 of industrial uses (see Figure 6-4).

Distribution of the proposed Final AUAR does not constitute approval of any specific project pursuant to zoning, subdivision, or other official controls of the City of Lino Lakes. Rather, preparation and distribution of the proposed Final AUAR is mandated by the Environmental Review Program, Environmental Quality Board, Chapter 4410 Minnesota Rules. Any proposed specific project within the AUAR area remains subject to applicable local zoning, subdivision, or other official controls. Specific projects that are consistent with the assumptions of the adopted Final AUAR and which comply with the mitigation plan within the Final AUAR are exempt from further environmental review pursuant to Minnesota Rules Section 4410.3610 Subp. 5 E.

AUAR PROCESS SUMMARY

This AUAR process is unique in that it includes a strong public participation and an agency participation component throughout the process, rather than only involving the public and reviewing agencies after the Draft AUAR is completed, which is the standard process required by Minnesota Rules. To ensure very strong and timely communication and the participation of numerous key stakeholder groups throughout the planning process, an Advisory Panel was selected to serve as the primary working group during the course of the research, planning and environmental review process. The Advisory Panel includes property and business owners within the AUAR area as well as members of the city's Planning and Zoning Board, Environmental Board, and Economic Development Advisory Committee. All information, work products, findings and recommendations developed by the AUAR consultant team were presented to the Advisory Panel for its review and comment. Also, this information was made available to the general public on the city's website

Advisory Panel

A series of Advisory Panel workshops were held to present research related to the AUAR, to assist in the creation of the development scenarios that are reviewed in this AUAR document, and to review the Draft and Final AUAR documents. Several Advisory Panel workshops were held for the purposes of presenting the development scenarios, receiving comments on the scenarios, reviewing the revised development

scenarios. A list of workshops follows.

Topic	Date

Introduction to the AUAR Process	November 18, 2004
Municipal Services	December 2, 2004
Natural & Cultural Resources	December 16, 2004
Transportation	January 6, 2005
Demographics and Market Analysis	January 20, 2005
Development Scenarios I	February 3, 2005
Development Scenarios II	February 17, 2005
Development Scenarios III	March 3, 2005
Draft AUAR	June 9, 2005
Final AUAR	September 22, 2005

Environmental Board
Several members of the Lino Lakes Environmental Board are on the Advisory Panel. In addition to their participation on the Advisory Panel, the Environmental Board devoted its June 7, 2005 meeting to reviewing and discussing the Draft AUAR. The Environmental Board discussed and provided comments on each AUAR item. Several revisions to the Draft AUAR were made to address the comments of the Environmental Board prior to the City Council authorizing its distribution. The Environmental Board met jointly with the Advisory Panel on September 22, 2005 to review the Final AUAR. The focus of that meeting was reviewing the Mitigation Plan.

City Council
All of the information provided by the Advisory Panel and Environmental Board, including comments, suggestions, and concerns, was assembled and delivered to the Mayor and City Council prior to their review and consideration of the work completed. The City Council held three work sessions regarding the AUAR prior to ordering the preparation of the document at their April 11, 2005 City Council meeting. The purpose of the first work session, held January 19, 2005, was to introduce the City Council to the

AUAR process and review the relevant background research. The City Council held two work sessions to review the draft development scenarios on March 29 and April 6, 2005. The City Council held a work session on September 21, 2005 to review the Final AUAR and Mitigation Plan. The City Council authorized distribution of the Final AUAR and Mitigation Plan at its September 26, 2005 meeting.

Agencies
To engage reviewing agencies early in the AUAR process, a series of agency meetings were held to present background research, to solicit initial comments on the research, and to help the AUAR team scope out the level of detail needed in the AUAR analysis. Valuable information was gained from agency staff that was incorporated into the AUAR analysis. Staff from the following agencies attended some or all of the meetings: Department of Natural Resources, Department of Transportation, Metropolitan Council, Anoka County, Washington County, US Army Corps of Engineers, US Fish and Wildlife Service, Anoka
Conservation District, Rice Creek Watershed District, and Environmental Quality Board. A list of agency

meetings follows.

Topic	Date
Municipal Services & Tour of AUAR area	November 23, 2004
Natural & Cultural Resources	December 7, 2004
Transportation	December 28, 2004
Development Scenarios I	January 25, 2005
Development Scenarios II	February 22, 2005

The City received comment letters on the Draft AUAR from the following agencies: Department of Natural Resources, Department of Transportation, Metropolitan Council, Anoka County, Washington County, and Rice Creek Watershed District. City staff and members of the AUAR technical team met with agency staff to better understand the comments on the Draft AUAR and to further involve the agencies in the preparation of the Final AUAR and Mitigation Plan. City staff and members of the AUAR technical team met with the commenting agencies to discuss their comments, the city's approach to addressing the comments, and additional mitigation strategies. A meeting was held with Rice Creek Watershed District staff on August 23, 2005 to discuss stormwater management issues and a meeting was held on August 26, 2005 with staff from the Department of Transportation, Metropolitan Council, and Anoka County to discuss transportation issues.

Public Open House

In addition to the Advisory Panel, City Council, and agency workshops, a public open house was held on February 17, 2005. The purpose of the public open house was to give the general public the opportunity to review and submit comments on the background research and the draft development scenarios.

Public Comment Period

The Draft AUAR, including a draft Mitigation Plan Outline was prepared and distributed to the Environmental Quality Board (EQB) and persons and agencies on the official EQB mailing list in accordance with EQB rules. In addition, the Draft AUAR was transmitted to the Advisory Panel and surrounding communities. The 30-day comment period occurred from July 4 to August 3, 2005. Two state agencies, five local units of government, two business ventures, one citizen group and one citizen submitted comment letters on the I-35E Corridor Draft AUAR. The Draft AUAR comment letters are included in Appendix H.

MAJOR ISSUES AND PROPOSED MITIGATION SUMMARY

The potential impacts and major issues identified in the Draft AUAR and/or in the Draft AUAR comment letters are summarized in the following section. The major issues include traffic, ecologically sensitive resources, storm water management, regional sanitary sewer infrastructure capacity, and cultural resources. The discussion of each issue also includes a discussion of the proposed mitigation measures that address the identified impacts and issues. A comprehensive summary of potential impacts and the proposed mitigation strategies are included in the Mitigation Plan. The final Mitigation Plan will become a component of the action plan to ensure that the city avoid, minimize, or mitigate significant environmental impacts from the development of the AUAR area

Traffic
A detailed traffic impact analysis has been prepared to fully investigate the effects of the proposed land use scenarios on the local and regional roadway systems (see Item 21. Traffic). The traffic analysis focused on the operation of the primary roadways and their intersections during the p.m. peak period, which is Evaluating the development scenarios involved the complex process of developing and distributing background and development scenario related traffic through the areas roadway network. The network includes a system of frontage roadways that will assist in the circulation of traffic through the area. This roadway system, which was presented to the City and Anoka County early in the AUAR process, was used as a guideline in determining where to put the various developments.

typically the time when the most severe traffic congestion is incurred. The traffic analysis was expanded to include a noise impact analysis (see Item 21, Traffic), a 2020 no-build traffic analysis (see Appendix E), and a 2030 a.m. peak analysis (see Appendix F) to address comments received on the Draft AUAR.

The key guidelines included:
. • Limit access to CSAH 14 and 80th Street between CSAH 21 and Elmcrest Avenue North
. • Limit access and preserve mobility on CSAH 14, CSAH 21, and 80th Street (assuming future interchange)

. • Signalized (primary) intersections at ½ mile spacing
. • Collector (secondary) intersections at ¼ mile spacing
. • Enhance existing street network to serve local trips (e.g., upgrade Elmcrest Avenue North)
. • Develop frontage/backage road system to provide property access
. • Consolidate existing access as opportunities arise
. • Consider I-35E park and ride location
. • Provide bicycle/pedestrian trail connectivity

In general, the overall development scenarios resulted in significant increases in traffic to/from the AUAR area. The major problems with the intersection were southbound left-turns and westbound left-turns. The lane geometry that was assumed was single left-turns on all approaches. The results indicate that given the expected development in the AUAR area that several of the approaches would require dual left-turn lanes to adequately accommodate study area traffic. The redesigned interchange at CSAH 14 and I-35E overall functioned satisfactory during the p.m. peak hour for the 2030 land use scenarios. The northern section of the AUAR area, along 80th Street and the bypass, also showed high traffic volumes and intersections projected to operate over-capacity under the assumed lane geometry.

Table 21-5 displays the overall Level of Service (LOS) for all of the analyzed intersections for the development scenarios for 2030 build-out and post 2030 build-out conditions. Table 21-6 displays the LOS for each of the turning movements for the 2030 build-out conditions. The intersection traffic volumes for the full development of the scenarios (post 2030) resulted in severe congestion for virtually all turning movements and therefore are not shown in the table.

The proposed developments will increase traffic on roadways within, and adjacent to the AUAR area. Mitigation will include adding traffic signals and turn lanes and widening roads as necessary during the various stages of development (see Figures 25-8 through Figure 25-12). In general, Scenario One had the least impact on traffic congestion with two intersections performing at LOS F, without mitigation. Scenario Two had four intersections and Scenario Three had six intersections operating at LOS F, respectively. With reasonable mitigation measures all the intersections in Scenarios One and Two were able to operate at LOS E or better. Even with reasonable mitigation measures, Scenario Three, which has a residential emphasis, still had intersections performing at LOS F. These include the east ramps at the proposed Northerly Bypass/I-35W interchange, and the intersection of CSAH 14 and Otter Lake Road.

To mitigate the impact of the additional traffic on the regional system I-35W and I-35E would need to be reconstructed to provide a six-lane cross-section. It should be noted that it was determined that an expansion will be necessary even without the development scenarios used in this analysis. As the interstates serve a much larger area, the projected growth of the entire Twin Cities region should warrant expansion to the interstates by the year 2030.

As future growth occurs, alternative modes of transportation may be needed to maintain the area's mobility. These modes may include express bus service, buses operating on exclusive right-of-way (busways), or commuter rail. All three of these modes were looked at in the transit study conducted in 2001 by the Rush Line Corridor Task Forces. The general alignment proposed for the Rush Line is adjacent to TH 61 in Washington County, or within 2-miles AUAR area. Opportunities should be explored to provide a link to this system as it is being developed.

Pedestrian and bicycle paths are another way to improve mobility within and to the AUAR area. It is recommended that ***any*** roadway improvements being planned in the AUAR area should include provisions for the addition of pedestrian / bicycle facilities. These facilities should ideally be at least 10 feet wide and separated from the highway shoulder by a minimum of 20 feet.

Figures 21-8, 21-9, and 21-10 display the intersection LOS for each of the scenarios and also display the mitigation measures that were identified to address the deficiencies. These figures represent general/conceptual improvements that were shown to improve overall traffic operations for the respective development scenarios. The improvements are intended to represent the minimum level of infrastructure investment that would be needed to meet acceptable level of service standards. Additional roadway and non-motorized improvements, beyond the minimum level, may be identified to accommodate specific development needs that are identified within the AUAR area.

Draft AUAR comment letters suggested that the city establish a monitoring program in an effort to link permitted development to the capacity of the surrounding road network. The City will implement an on-going traffic management plan to monitor traffic volume growth and any operational issues that may develop in and around the AUAR area. This monitoring program is intended to give the City, County and other agencies the opportunity to evaluate future development projects within the AUAR area and their cumulative impacts on the transportation system. The results of the monitoring program will be shared with the various road authorities on a regular basis.

To implement the monitoring program, a traffic impact study will be required for all developments within the AUAR area and a consistent methodology will be followed. Each traffic impact study will identify the deficiencies and reasonable mitigation measures that are related to the development. Per the City of Lino Lakes subdivision and zoning ordinances, specific level of service guidelines must be followed to obtain an acceptable level of service. Section 1002-6 of the Lino Lakes Subdivision Ordinance states that if a proposed subdivision is not consistent with the Comprehensive Plan with respect to the Land Use Plan, or the Transportation Plan, specific guidelines to roads or highways to serve the development must be met. For reference, Section 1002 of the Subdivision Ordinance is included under the "General Implementation Tools" of the Mitigation Plan. If no reasonable mitigation measures are agreed upon or are unfeasible, the intensity or timing of the proposed development would be staged so as to not overly burden the transportation system.

Ecologically Sensitive Resources

The AUAR area contains a wealth of ecologically sensitive resources including high quality natural and semi-natural areas, wildlife corridors, two rare animals, the Peltier Lake Island Heron Rookery, two rare plant communities, and portions of the Rice Creek Chain of Lakes Regional Park. Mitigating impacts to ecologically sensitive resources is discussed throughout the Final AUAR.

The Conservation Design Framework (Figure 10-3 and described under Item 10) is designed to conserve wildlife habitat and natural plant communities, and will provide an invaluable tool for conservation of wildlife and rare features within the AUAR area. Most importantly, the Conservation Design Framework protects the existing significant fish, wildlife, and ecological sensitive resources in the northwest portion of the AUAR, and goes beyond to identify and protect the most significant outlier habitats, buffering them, and connecting them with greenway corridors. In brief, conservation design principles behind the Framework include:

- ③ protect streams, lakes, and groundwater by purifying, filtering, and infiltrating surface runoff to the maximum extent possible
- ③ preserve, restore, and enhance existing natural and semi-natural areas and wildlife habitat
- ③ create wildlife opportunities by restoring and managing wildlife habitat
- ③ establish wide buffers and connections around and between core and outlier habitats

The greenway corridors are designed to connect the larger and higher quality natural areas. These corridors will provide three main services: 1) stormwater collection and conveyance, 2) ecological corridors for wildlife movement and native plant dispersal, and 3) recreational trails for people. Certain greenway corridors may warrant design for specific wildlife species, may provide certain stormwater management opportunities, or may need to accommodate different types of trails or passive recreational uses. Design considerations may include corridor width, appropriate vegetation structure, human access and use, and whether or not it is appropriate for a corridor to cross a particular type of roadway.

New developments represent opportunities to plan and carry out ecological restoration and management. Ecological restoration, enhancement, and/or expansion will help mitigate potential impacts on wildlife and rare features, and if these activities are planned, scheduled, and carried out at the recommended broad scale, will likely result in a net increase in conservation and ecological benefits within the AUAR area compared with existing conditions.

Various tools exist or can be developed to ensure the protection and stewardship of the preserved, restored, and enhanced natural resources in the AUAR area. These tools can be used to establish a consistent set of standards for treating the open space across different areas as they are developed. For example, the buffers shown on the Conservation Design Framework (Figure 10-3) are conceptual and will allow the city the flexibility to consider several land protection and preservation tools in these areas. The variety of tools listed throughout this Final AUAR will enable public and private sectors to cooperate in creating this natural open space network over time in a realistic market and regulatory context.

Stormwater Management

Effective stormwater management and planning within the AUAR area is a challenging pursuit, but one that is critical to prudent and environmentally sound development. The AUAR process presents an opportunity for logical and innovative stormwater management that integrates traditional stormwater detention and water quality requirements with environmental restoration and conservation objectives. This ideal can be implemented on both a regional and site scale to minimize the impact of development on runoff rates and volumes, water quality, and the region's aquatic resources. The stormwater analysis is fully discussed under Item 17 and Appendix D contains the Hydrologic Analysis.

The majority of the AUAR area faces many obstacles to effective stormwater management. In many cases agricultural ditch and tile networks have significantly altered drainage basins and changed sub-watershed divides. The drainage capacity of these existing tile networks will be insufficient to convey stormwater runoff from further residential, commercial, or industrial development. The recommendations made within this AUAR document are intended to improve post-development runoff water quality; attenuate runoff release rates downstream and drainage infrastructure capacities for both frequent and occasional rainfall events; and enhance groundwater recharge as the AUAR area is developed.

Stormwater management areas (SMAs) will play a critical role in mitigating potential impacts from stormwater following development of the AUAR area. Appropriate design, construction, and maintenance of these areas will enable development to occur without compromising the integrity of the region's aquatic resources. The stormwater management approach outlined in this Final AUAR provides adequate detention of runoff for post-development conditions. It also provides a framework for water quality enhancement and increased groundwater recharge. The stormwater detention facility design will provide hydraulic properties appropriate for native plant species to thrive. All of these factors will help mitigate potential water quality problems associated with development in the AUAR area.

The most effective approach to addressing stormwater issues is by implementing an integrated system of stormwater management elements. The Conservation Design Framework provides an appropriate layout for the regional implementation of an integrated system (see Figure 10-3). Within the greenway corridors shown in the Framework, bio-swales, wet prairie, and wetlands can be oriented in series to effectively retard runoff rates, reduce stormwater volume, and enhance water quality. Runoff rates and volumes are decreased due to increased infiltration, evapotranspiration, and increased friction imparted on the flow. These decreased rates also reduce the ability of runoff to generate and carry sediment and associated pollutants.

The runoff volume into the receiving waters will likely increase with development due to the increased impervious area constructed in the AUAR area. However, with the stormwater management requirements outlined in this document, the peak runoff release rates will be decreased from storms of 1-, 10-, and 100year recurrence intervals and runoff volumes will be no less than 80% and no more than 150% of existing conditions. The recommended large area stormwater management elements will result in relatively small water level fluctuations, provide area to enhance the groundwater recharge necessary to provide base flow to the receiving streams, and provide the detention time necessary to cleanse the runoff of contaminants and meter the increased runoff volume in compliance with Rice Creek Watershed District (RCWD) Rules.

Regional Sanitary Sewer Infrastructure Capacity

The city has met with Metropolitan Council Environmental Services (MCES) staff on several occasions from 2003 through Spring 2005 to discuss existing and future MCES service to Lino Lakes. The MCES is in the process of updating their comprehensive planning for the "Northeast Region," which includes Lino Lakes, Centerville, North Oaks, Forest Lake, Hugo, White Bear Lake, and White Bear Township. They anticipate the need to provide additional capacity in the Forest Lake Interceptor and downstream facilities to serve the future needs of those communities. Currently, MCES is engaged in plans to construct additional capacity support for the Forest Lake Interceptor.

Following a series of meetings in early 2005, MCES agreed to construct an additional interceptor to serve the easterly portion of Lino Lakes. The MCES intends to construct this pipe in 2006, in conjunction with a proposed county highway improvement project. The new interceptor should be designed to convey the excess flow not accommodated by the existing Centerville Interceptor. Assuming the existing interceptor can handle 1.7 MGD, the new pipe should be designed to convey flows ranging from 1.3 MGD for Scenario One to 2.5 MGD for Scenario Three (see full discussion under Item 18).

Design of the new interceptor is now in progress. Lino Lakes provided flow estimates, based on the *Comprehensive Sanitary Sewer Plan Scenario*, to MCES in March 2005 (see Item 18 for additional information). MCES has directed the designers to provide capacity in the new interceptor for 2.0 MGD average daily flow. Discussions are currently underway between Lino Lakes and MCES regarding the capacity to be provided in the new interceptor. Assuming capacity remains at 2.0 MGD, the existing and new interceptors will have adequate capacity for projected development through at least 2030 under any of the three AUAR Scenarios. However, ultimate development as projected by Scenarios Two and Three could eventually exceed capacity. If the city chooses to amend its Comprehensive Plan to accommodate components of Scenarios Two or Three, then a subsequent revision to the Comprehensive Sanitary Sewer Plan will be required. The Comprehensive Planning process, including review by the Metropolitan Council, is the appropriate process to resolve any potential sewer capacity issues.

Cultural Resources

Ten precontact archaeological sites have been recorded in the north and western portions of the AUAR area, and numerous others have been documented in proximity to it (see Table 25-1). For the most part, sites are located in proximity to water: Centerville Lake, George Watch Lake, Peltier Lake, Rondeau Lake, Clearwater Creek, Hardwood Creek, and Rice Creek. The undisturbed landforms adjacent to these bodies of water have the greatest potential for containing intact archaeological sites. Several sites have been identified on slight rises within the wetlands surrounding Rice Creek; therefore, those wetlands, and the northern portion of Peltier Lake, have high potential to contain intact archaeological resources. Further, those undisturbed areas adjacent to known sites are also considered to have high archaeological potential.

Because of the high level of archaeological sites in the AUAR area, appropriate levels of historical and archaeological surveys in areas identified as having high potential for containing cultural resources will occur prior to future development. This is intended to mitigate any intentional or unintentional damage to, or destruction of, important archaeological sites and historic properties without due process and consideration.

The 106 Group created a map that shows areas with a high potential for archaeological sites. Given the sensitive nature of this information, this map cannot be included in the AUAR document, nor can it be made available to the public. The city will have this map on file and consult it when development applications are submitted for review. If a development application falls within an area that is considered to have a high potential for archaeological sites, the city will require that the following steps and procedures involved in the identification and analysis of any archaeological sites is followed prior to development:

- Conduct a Phase I archaeological survey within the area of potential effect (APE). The objective of the archaeological fieldwork is to determine if there are archaeological sites in the areas identified as having high potential for such, and define the extent of those sites that may be impacted by development plans.
- Conduct a Phase II archaeological survey. If archaeological resources are uncovered within the APE that may be eligible for listing on the National Register of Historic Places (NRHP) a Phase II survey should be conducted. The objective of the investigation is to determine whether archaeological resources are eligible for listing on the NRHP.
- Plan for avoidance or conduct Phase III data recovery. If a significant archaeological site is identified that will be impacted by development, avoidance is recommended. If this is not possible, then a data recovery of the site should occur.

MITIGATION PLAN

A comprehensive summary of potential impacts and the proposed Mitigation Plan are included in this Final AUAR. A draft mitigation plan outline was included in the Draft AUAR to assist in the public in understanding the City's initial approach to mitigating impacts. The potential impacts and mitigation strategies included in the Draft Mitigation Plan Outline in the Draft AUAR have been revised and expanded upon to address Draft AUAR comments. The final Mitigation Plan will become a component of the action plan to ensure that the city avoid, minimize, or mitigate significant environmental impacts from the development of the AUAR area.

17. Water Quality - Surface Water Runoff.
.a. Compare the quantity and quality of site runoff before and after the project. Describe permanent controls to manage or treat runoff. Describe any stormwater pollution prevention plans.
.b. Identify routes and receiving water bodies for runoff from the site; include major downstream water bodies as well as the immediate receiving waters. Estimate impact runoff on the quality of receiving waters.

AUAR Guidelines: For an AUAR the following additional guidance should be followed in addition to that in EAW Guidelines:

- *it is expected that an AUAR will have a detailed analysis of stormwater issues;*
- *a map of the proposed stormwater management system and of the water bodies that will receive stormwater should be provided;*
- *the description of the stormwater system should identify on-site and regional detention ponding and also indicate whether the various ponds will be new water bodies or converted existing ponds or wetlands. Where on-site ponds will be used but have not yet been designed, the discussion should indicate the design standards that will be followed.*

. a. Compare the quantity and quality of site runoff before and after the project. Describe permanent controls to manage or treat runoff. Describe any stormwater pollution prevention plans.

STORMWATER MANAGEMENT ISSUES

Effective stormwater management and planning within the AUAR area is a challenging pursuit, but one that is critical to prudent and environmentally sound development. The AUAR process presents an opportunity for logical and innovative stormwater management that integrates traditional stormwater detention and water quality requirements with environmental restoration and conservation objectives. This ideal should be implemented on both a regional and site scale to minimize the impact of development on runoff rates and volumes, water quality, and the region's aquatic resources.

Watershed divides as represented by site topographic features largely represent pre-settlement conditions. The gradual establishment of these features by physical and chemical processes created a natural, stable system that could respond to hydrologic fluctuations. The introduction of modern agriculture increased runoff by limiting the system's natural ability to detain runoff flow and reduce runoff volume. This was primarily done through replacement of prairies and wetlands with tile-drained agricultural crops, the dominant land use under pre-development conditions (Figure 10.1).

Much of the site contains agricultural drainage ditches designed to manage runoff and keep fields dry for more reliable crop production. In many cases ditch and tile networks have significantly altered drainage basins and changed sub-watershed divides. It is likely that runoff amounts entering ditches will significantly increase as areas tributary to them develop. The drainage capacity of existing tile networks will be insufficient to convey stormwater runoff from further residential, commercial, or industrial development. To minimize this effect, stormwater management should be dispersed throughout the site as much as possible. Stormwater management elements employed for this function should be designed to maximize infiltration and groundwater recharge potential. Site conditions may suggest that the potential for infiltration and recharge is minimal, but best management practices should be employed despite this. The cumulative impact of maximizing infiltration and recharge potential for all development will be to minimize ecological impacts and flooding threats throughout the AUAR project area.

Sound stormwater management philosophy encourages the utilization of the inherent ability of the site to handle runoff through re-establishment of pre-settlement watershed divides. Prior to settlement the landscape evolved through physical and chemical processes to maximize its ability to handle runoff. The stormwater management approach for the AUAR area should be to augment the inherent management potential of the site with stormwater management techniques that encourage infiltration and groundwater recharge.

In most cases maintaining or restoring pre-settlement watershed divides results in optimal conditions for the success of ecological resources. Typically the resources being protected and restored evolved in response to the presence of pre-settlement watershed divides. Restoring watershed divides will likely aid in producing hydrologic and hydraulic conditions optimal for resource protection, restoration, and creation.

There are significant logistical and legal challenges associated with the re-establishment of pre-settlement subwatershed divides. Any disconnecting of public drainage infrastructure, including tile lines, must be reviewed by the RCWD Engineer to ensure that the ditch capacity and landowner drainage rights are maintained. If such a disconnection is proposed, the proposed plan will need to be reviewed for compliance with Minnesota Statutes Section 103E.227 (impoundment & diversion proceedings) and/or Minnesota statute Section 103E.805 (abandonment proceedings) and a public hearing will be required. In the event that pre-settlement drainage divides are re-established, "benefited parties" will have opportunities to comment on, or object to, proposed changes. Mandated re-establishment of subwatershed divides is not included in the Mitigation Plan. Collection of 1-foot contour interval topographic data for new development sites are a requirement of the Mitigation Plan.

Maintaining or restoring pre-settlement subwatershed divides can be accomplished by disconnecting drainage infrastructure currently passing through watershed divides as suggested by existing site topographic mapping. Currently, for the majority of the AUAR area, this information is limited to 10-foot contour interval topographic mapping as provided by the United States Geological Survey (USGS). Development of high resolution contour interval mapping (2-foot or greater) is absolutely essential to any future development decision-making within the AUAR area.

A lack of high resolution topographic information is particularly important as new developments are designed to accommodate existing conditions, off-site sources of runoff. All new development must maintain existing conditions drainageways. Part of this accommodation is quantifying the amount of flow coming through the site. With the current level of topographic data resolution, it is unlikely that new development applicants will be able to accurately assess off-site runoff quantities. Flooding of properties may result from this condition.

Recommendations made within this AUAR document are intended to improve post-development runoff water quality; attenuate runoff release rates below stream and drainage infrastructure capacities for both frequent and occasional rainfall events; and enhance groundwater recharge as the AUAR area is developed. The AUAR area was sub-divided into 40 potential development zones (Figure 17-1). Generally, an area of prospective development is any area that is not within the FEMA 100-year floodplain and does not contain the most ecologically significant natural resources (as discussed under Item 10). Boundaries of potential development zones are largely defined by sub-watershed divides and existing roadways. Potential development zones are further sub-divided by whether or not an area has direct access to drainageways or it is drained by an agricultural tile system. Potential development zones with access to positive surface drainage outlets (to either natural or constructed surface drainageways) total 1,536 acres, while those lacking a surface drainage outlet and are dependent on an underground tile system for drainage total 974 acres. In either case, most of the AUAR area is directly tributary to aquatic resources classified as MNDNR Public Waters, including Rondeau Lake, Peltier Lake, and Hardwood Creek.

PRE-DEVELOPMENT CONDITIONS

The AUAR area contains portions of the Rice Creek, Hardwood Creek, and Clearwater Creek watersheds. Most of the developable area within the AUAR area is mapped as hydric soils (Figure 17-1) and is used primarily for agriculture. The probable low infiltration capacity of the hydric soils suggests the area produces considerable runoff. Item 12 of this document addresses runoff sensitivity issues within the AUAR area. The site also contains very little relief, which prevents effective drainage. Thus, drainage for a large proportion of the AUAR area depends on a system of tile networks. Because runoff largely originates from agricultural areas, it is likely infused with pesticides, herbicides and fertilizer residues.

Stormwater models were used to define the peak pre-development runoff release rates (based on Rice Creek Watershed District regulatory criteria) for each potential development zone (Figure 17

1). Hydrologic modeling for the existing conditions analysis was done using XP-SWMM Version 9 and TR-55 methodology (Appendix D.1). Composite runoff curve numbers have been generated for each potential development zone (Appendix D.1.2). Runoff curve numbers used throughout this study are not to be used as regulatory parameters. The RCWD has established runoff curve numbers recommended for individual site development, and they are the definitive land cover parameters for characterizing pre- and post-development stormwater runoff. Rainfall depths for the 1-, 10-, and 100-Year rainfall events are 2.35 inches, 4.15 inches, and 5.9 inches, respectively. The SCS Type II rainfall distribution was used to distribute this rainfall over a 24-hour design event duration.

Potential development zones have been sub-divided into areas draining adjacent to free outfalls and areas requiring tile drainage (Figure 17-2). The analysis assumes that tile systems were designed to drain 2 inches of runoff over a 24-hour period to prevent crop damage. The assumption results in a site release rate for subdivisions in tile drained areas of 0.084 cubic feet per second, per acre (cfs/ac). Table 17-1 presents the results of the pre-development conditions modeling.

Table 17-1. Pre-Development Conditions Runoff Release Rates

Potential Development Zone	Tributary Area (acres)	Runoff Release Rate (cfs)		
		Q_1	Q_{10}	Q_{100}
A-FR	6.62	3.0	12.0	23.0
C-FR	48.69	26.0	84.0	148.0
D-FR	36.98	18.0	61.0	110.0
E-FR	38.16	29.1	74.9	121.6
E-TD	53.50	4.5	4.5	4.5
F-FR	44.12	41.0	103.0	165.0
G-FR	46.04	16.0	63.0	118.0
H-FR	52.07	20.0	77.0	145.0
I-FR	64.10	45.1	116.3	190.7
I-TD	16.90	1.4	1.4	1.4
J-FR	16.17	15.0	40.0	67.0
K-FR	73.60	18.0	50.0	84.0
L-FR	63.87	15.5	44.1	75.0
L-TD	47.70	4.0	4.0	4.0
M-FR	162.49	25.0	94.2	176.8
M-TD	32.40	2.7	2.7	2.7
N-FR	8.55	4.0	16.0	29.0
O-FR	29.73	22.7	58.3	94.4
O-TD	21.30	1.8	1.8	1.8
Q-TD	276.53	23.2	23.2	23.2
R-FR	192.53	93.1	249.5	412.7
R-TD	32.80	2.8	2.8	2.8
S-TD	49.99	4.2	4.2	4.2
T-FR	71.97	45.0	120.0	198.0
U-FR	123.36	90.0	231.0	376.0
V-FR	190.14	45.9	119.5	196.6
V-TD	29.40	2.5	2.5	2.5
W-FR	13.32	7.2	19.5	32.8
W-TD	257.26	21.6	21.6	21.6
X-FR	39.28	27.0	64.0	103.0
Y-FR	59.40	22.6	60.4	100.2`
Y-TD	30.10	2.5	2.5	2.5
Z-FR	48.72	54.0	135.0	217.0
AA-FR	26.24	16.5	46.1	77.8
AA-TD	51.70	4.3	4.3	4.3
BB-FR	15.66	24.4	56.2	88.8
BB-TD	5.50	0.5	0.5	0.5
CC-FR	56.73	58.9	151.9	246.6
CC-TD	11.60	1.0	1.0	1.0
DD-FR	4.24	4.0	12.0	21.0

Notes: FR = free outfall TD = tile-drained Q_1 = 1-Year Event Q_{10} = 10-Year Event Q_{100} = 100-Year Event

POST-DEVELOPMENT CONDITIONS: SCENARIO TWO

As discussed under Item 7, three development scenarios were developed for the AUAR area. Based on qualitative analyses of spatial and statistical planned land uses, Scenario Two (Figure 6

3, Table 7-2) was chosen as the scenario that represents the most significant impact to property and receiving aquatic resources. This scenario was chosen to present a worst case scenario from a hydrologic and land use perspective. This document advocates, and the Mitigation Plan requires, implementation of regional and site-specific best management practices that will greatly reduce runoff rates and volume and enhance water quality. With the exception of the stormwater detention capacity of the designed conceptual stormwater management areas (SMAs), the beneficial impacts of these practices have not been included in the quantitative portion of this analysis.

Urbanization and development of the City of Lino Lakes as portrayed in Scenario Two will result in decreased amounts of agricultural chemicals and sediment transported into lakes and streams. The exception to this is when poorly designed or implemented erosion control plans fail during construction of development projects. Though agricultural pollutants may be decreased, an increase in constituents common to urban runoff is likely.

The design and implementation of both regional and local stormwater management plans will limit post-development runoff to pre-development rates, as required by *Rice Creek Watershed District Rules*. Total runoff volumes, however are likely to increase with increases in impervious surface due development. To minimize this impact, a runoff volume based regulatory criterion has been developed by the City. The criterion is designed to ensure that proposed conditions runoff volumes remain within a reasonable range to prevent personal property and sensitive ecological features from experiencing too much or too little flooding. This criterion is also important for increasing the stability of streams and ditches receiving runoff. Though regulatory criteria is provided to maintain proposed runoff rates below existing conditions runoff rates, failure to attenuate runoff volumes will result in the compromised stability of receiving water bodies such as Hardwood Creek, Clearwater Creek, and regional and local drainage ditches. Increased sediment flows resulting from this degradation would result in delta formation in Peltier Lake. Not only is sediment deposition enormously destructive to Peltier Lake, but it also increases difficulty of compliance with future TMDL standards. To that end, implementation of volume based stormwater release criteria is important in expediting responsible development of the AUAR area.

The volume based criterion states that proposed conditions runoff volumes must be no less than 80% and no greater than 150% of existing conditions runoff volumes for a given new development. The goal of all development within the AUAR area should be to maintain proposed conditions runoff volumes within 20% of existing conditions runoff volumes for each new development site. Dispersed stormwater management techniques that encourage runoff infiltration and groundwater recharge must be employed in addition to SMA recommendations made later in this document to achieve compliance with this criterion. Implementation of volume based runoff release rate regulatory criteria has well-established precedence throughout the United States, including in Washington County, Minnesota. The volume based release rate criterion is recommended after consultation with regulatory personnel and academics throughout the Midwest and the RCWD.

RUNOFF FLOW RATE

The hydrologic analysis of Scenario Two (Appendix D.2) showed that a majority of potential development zones would experience increases in runoff flow rate with unattenuated stormwater management (Table 17-2).

Table 17-2. Scenario Two: Unattenuated Runoff Release Rates

RUNOFF FLOW RATE

The hydrologic analysis of Scenario Two (Appendix D.2) showed that a majority of potential development zones would experience increases in runoff flow rate with unattenuated stormwater management (Table 17-2).

Potential Development Zone	Tributary Area (acres)	Runoff Release Rate (cfs)		
		Q_1	Q_{10}	Q_{100}
A-FR	6.62	4.8	15.9	28.3
C-FR	48.69	48.2	120.9	194.9
D-FR	36.98	35.9	94.6	155.5
E-FR	38.16	68.5	133.4	195.4

E-TD	53.50	95.2	199.3	299.9
F-FR	44.12	64.1	135.1	203.8
G-FR	46.04	36.9	100.2	167.8
H-FR	52.07	53.9	139.5	227.7
I-FR	64.10	48.4	123.6	201.0
I-TD	16.90	29.0	63.7	99.3
J-FR	16.17	7.4	28.5	53.0
K-FR	73.60	23.5	61.1	100.2
L-FR	63.87	66.1	171.1	279.3
L-TD	47.70	112.6	216.8	316.4

Potential Development Zone	**Tributary Area (acres)**	**Runoff Release Rate (cfs)**		
		Q_1	**Q_{10}**	**Q_{100}**
M-FR	162.49	247.8	508.6	759.9
M-TD	32.40	46.5	98.0	147.8
N-FR	8.55	10.5	25.4	41.0
O-FR	29.73	35.4	85.6	136.1
O-TD	21.30	55.0	112.2	167.3
Q-TD	276.53	224.7	527.4	830.0
R-FR	192.53	111.7	281.0	454.7
R-TD	32.80	45.5	98.4	149.9
S-TD	49.99	23.8	63.8	105.6
T-FR	71.97	88.1	186.0	280.8
U-FR	123.36	95.8	238.9	384.6
V-FR	190.14	86.1	183.1	277.7
V-TD	29.40	93.5	212.6	330.4
W-FR	13.32	17.9	37.9	57.3
W-TD	257.26	288.5	573.8	847.7
X-FR	39.28	51.7	103.6	153.5
Y-FR	59.40	122.6	252.6	377.8
Y-TD	30.10	67.6	132.2	194.2
Z-FR	48.72	59.6	144.9	231.1
AA-FR	26.24	54.0	111.3	166.5
AA-TD	51.70	81.6	170.6	256.5
BB-FR	15.66	31.0	64.5	97.4
BB-TD	5.50	10.9	22.6	34.1
CC-FR	56.73	83.4	181.1	276.4
CC-TD	11.60	20.8	46.2	71.0
DD-FR	4.24	7.9	16.8	25.6

Notes: FR = free outfall TD = tile-drained Q_1 = 1-Year Event Q_{10} = 10-Year Event Q_{100} = 100-Year Event

PERMANENT CONTROLS TO MANAGE OR TREAT RUNOFF

The stormwater management plan will improve stormwater quality, increase infiltration, maximize groundwater recharge, reduce peak stormwater discharge rates, and regulate runoff volume releases from the AUAR area through the use of dispersed stormwater management practices throughout the AUAR site and stormwater management areas (SMAs). Dispersed stormwater management will entail collection, conveyance, and management of stormwater runoff through the use of bio-swales, rain gardens, and infiltration areas. Conceptual SMAs have been designed and are discussed in detail later in this document. Any development within the Lino Lakes AUAR area must comply with all stormwater management criteria outlined in *Rice Creek Watershed District Rules*.

Vegetated /Bio-Swales

Vegetated swales, as defined by the MPCA in *Protecting Water Quality in Urban Areas - Best Management Practices for Dealing with Storm Water Runoff from Urban, Suburban, and Developing Areas of MN* (2000), are "…earthen conveyance systems in which pollutants are removed from urban storm water by filtration through the grass and infiltration through the soil. The primary purpose of these structures is often conveyance, but they differ from conveyance channels because water quality and quantity benefits are part of the design considerations. Enhanced vegetated swales, or biofilters, utilize check dams and wide depressions and off-channel retention areas to increase runoff storage and promote greater setting of pollutants." Appropriate design of vegetated swales and biofilters (e.g., gentle slopes, diverse native vegetation, etc.) can provide storm water management functions as well as wildlife habitat/corridors and attractive natural open space.

Mitigated Runoff Release Rates

The Mitigation Plan establishes sizing criteria for SMAs that are designed to support wetland complexes or large infiltrating surfaces with native plant populations. To create conditions appropriate for these two types of stormwater management features, SMAs were designed to experience maximum water surface fluctuations of less than 2.5 feet and contain basin side slopes less than or equal to 6:1, horizontal to vertical. Permanent open water cannot exceed 20%of the total surface area of a given SMA. Emergent wetland is considered to be open water, as this feature infiltrates negligible amounts of water. The remaining 80% of surface area should be populated with mesic prairie or wet prairie plant communities and not permanently inundated to maximize infiltration potential.

Computer models were created to simulate the hydraulics of conceptual SMAs. Outlets for each SMA were designed to maintain proposed conditions runoff release rates below existing conditions runoff release rates for rainfall events of 1-, 10-, and 100-Year recurrence intervals (Table 17-3). The regulatory maximum site release rates for proposed conditions are based on the lesser of the existing tile system capacity or the *Rice Creek Watershed District Rules*. Rating curves were input to simulate three-stage outlets for detention of these rainfall events. Outlets for the 1-, 10-, and 100-Year rainfall events had invert elevations at SMA depths of 0.75-, 1.25-, and 2.5-feet, respectively.

Table 17-3. Scenario Two: Attenuated Runoff Release Rates

Potential Development Zone	Tributary Area (acres)	Runoff Release Rate (cfs) Q_1	Q_{10}	Q_{100}
A-FR	6.62	2.9	12.5	19.0
C-FR	48.69	37.0	99.1	146.8

D-FR	36.98	18.8	70.5	105.8
E-FR	38.16	47.5	89.4	118.8
E-TD	53.50	1.4	2.9	4.4
F-FR	44.12	56.1	115.0	159.5
G-FR	46.04	20.8	75.2	115.2
H-FR	52.07	25.6	94.4	144.4
I-FR	64.10	45.9	119.3	191.0
I-TD	16.90	0.4	0.8	1.2
J-FR	16.17	6.9	24.1	44.9
K-FR	73.60	16.8	52.2	77.7
L-FR	63.87	13.9	52.0	75.0
L-TD	47.70	1.4	2.7	4.0
M-FR	162.49	41.3	120.1	173.9
M-TD	32.40	0.8	1.8	2.7
N-FR	8.55	3.5	16.2	22.8
O-FR	29.73	24.3	64.8	93.5
O-TD	21.30	0.5	1.0	1.5
Q-TD	276.53	5.8	13.4	21.1
R-FR	192.53	105.4	264.1	411.7
R-TD	32.80	0.7	1.6	2.4
S-TD	49.99	1.0	2.4	3.9

Potential Development Zone	Tributary Area (acres)	Runoff Release Rate (cfs) Q_1	Q_{10}	Q_{100}

T-FR U-FR V-FR V-TD W-FR W-TD X-FR Y-FR Y-TD Z-FR AA-FR AA-TD BB-FR BB-TD CC-FR CC-TD DD-FR

71.97 123.36 190.14
29.40
13.32 257.26
39.28
59.40
30.10
48.72
26.24
51.70
15.66

5.50
56.73
11.60
4.24 64.6
88.9
55.1
1.9
8.4
6.5
34.8
38.8
0.8
44.5
24.1

1.3
25.9
0.1
71.6
0.2
6.5 138.4 227.3 129.0 4.2 21.1 13.3 70.5 81.6 1.6 117.2 54.8 2.8 57.9 0.3 158.0 0.5 13.6 197.1 365.1 179.4
6.5 28.5 19.9 93.5 100.0 2.3 174.0 75.9 4.2 76.6 0.4 228.7 0.8 18.2

Notes: FR = free outfall TD = tile-drained Q_1 = 1-Year Event Q_{10} = 10-Year Event Q_{100} = 100-Year Event

RUNOFF VOLUME ANALYSIS (BOTH PRE-AND POST-DEVELOPMENT)

Runoff volumes for the 1-, 10-, and 100-year storm events were extracted from XP-SWMM modeling results (Table 17-4). These results suggest that the large proportions of impervious surface associated with commercial and industrial land uses can produce significant increases in runoff volume from pre- to post-development conditions.

Table 17-4. Runoff Volume Comparison

Potential Development Zone	Pre-Development Runoff Volume (ac-ft) 1-Yr	10-Yr	100-Yr	Scenario 2 Runoff Volume (ac-ft) 1-Yr	10-Yr	100-Yr
A-FR	0.3	0.9	1.7	0.4	1.1	1.9
C-FR	2.8	8.2	14.2	4.3	10.5	17.0
D-FR	1.9	5.8	10.2	3.0	7.8	12.8
E-FR	3.6	8.6	13.9	5.7	11.5	17.2
E-TD	4.1	10.6	17.5	6.6	14.1	21.6
F-FR	4.0	9.8	16.0	5.3	11.4	17.6
G-FR	2.0	6.4	11.6	3.4	9.0	15.0
H-FR	2.1	7.1	13.1	4.1	10.6	17.5
I-FR	5.0	12.8	21.0	5.4	13.4	21.9
I-TD	1.7	3.9	6.3	1.8	4.1	6.5
J-FR	1.1	3.1	5.2	0.7	2.4	4.4
K-FR	5.5	14.4	24.1	6.2	15.4	25.3
L-FR	3.2	9.8	17.4	5.1	13.0	21.5
L-TD	4.6	11.2	18.0	7.4	14.8	22.2
M-FR	7.2	23.3	42.3	20.7	43.3	65.9
M-TD	1.4	4.5	8.2	3.9	8.3	12.7
N-FR	0.4	1.3	2.4	0.8	1.9	3.1

Potential Development Zone	Pre-Development Runoff Volume (ac-ft) 1-Yr	10-Yr	100-Yr	Scenario 2 Runoff Volume (ac-ft) 1-Yr	10-Yr	100-Yr
O-FR	2.0	5.4	9.1	2.7	6.5	10.6
O-TD	2.3	5.3	8.4	3.0	6.4	9.7
Q-TD	21.9	56.0	92.5	28.1	65.8	104.6
R-FR	14.6	38.0	63.4	16.9	41.2	66.8
R-TD	3.3	7.6	12.2	3.8	8.3	12.8

S-TD	3.9	10.0	16.5	3.9	10.0	16.5
T-FR	5.8	15.0	24.8	8.6	18.5	28.4
U-FR	10.3	25.7	42.0	10.9	26.4	42.9
V-FR	16.0	39.2	63.8	22.5	48.3	74.1
V-TD	6.4	16.8	28.0	9.0	20.6	32.5
W-FR	1.0	2.6	4.3	1.6	3.4	5.3
W-TD	21.0	53.3	87.7	34.7	71.4	107.5
X-FR	4.0	9.6	15.4	5.9	12.2	18.4
Y-FR	4.5	11.7	19.5	7.8	16.7	25.7
Y-TD	2.5	6.3	10.1	4.4	8.9	13.3
Z-FR	7.1	19.0	31.9	9.5	22.6	36.3
AA-FR	1.9	5.1	8.6	3.4	7.4	11.3
AA-TD	3.6	9.6	16.2	6.4	13.8	21.2
BB-FR	1.5	3.6	5.8	2.0	4.2	6.5
BB-TD	0.5	1.3	2.0	0.7	1.5	2.3
CC-FR	4.5	11.5	11.7	6.3	14.1	22.1
CC-TD	0.9	2.4	2.5	1.3	3.0	4.7
DD-FR	0.3	0.8	1.3	0.5	1.1	1.7

Notes: FR = free outfall TD = tile-drained

Recommended Surface Area for Stormwater Management

SMA sizing criteria provided a basis for defining recommended surface area for stormwater management for each potential development zone (Table 17-5). Each SMA was assumed to be rectangular, and sized for a 100-year water surface fluctuation of 2.5 feet with 0.75 feet of freeboard. Side slopes were designed with a horizontal to vertical ratio of 6:1. Iterations were conducted to increase the 100-Year SMA depth to 2.5 feet to minimize the amount of SMA surface area needed for stormwater management. Potential infiltration in each SMA was not included in the optimization of SMA surface area, adding to the conservative nature of the surface areas recommended in Table 17-5 and appearing in Figure 17-3. The hydraulic characteristics of the SMAs will support native wetland vegetation. In general, tile-drained potential development zones with commercial and industrial land uses require the most surface area for stormwater management (Figure 17-3).

Table 17-5. Scenario Two: Recommended Surface Area for Stormwater Management

Potential Development Zone	100-Year Runoff Pre-Development Conditions (cfs)	Unattenuated (cfs)	Scenario 2 Recommended SMA Area (acres)
A-FR	23.0	28.3	0.13
C-FR	148.0	194.9	1.09
D-FR	110.0	155.5	1.09
E-FR	121.6	195.4	1.51
E-TD	4.5	299.9	10.29
F-FR	165.0	203.8	0.99
G-FR	118.0	167.8	1.20
H-FR	145.0	227.7	1.61
I-FR	190.7	201.0	0.00
I-TD	1.4	99.3	2.60

J-FR	67.0	53.0	0.00
K-FR	84.0	100.2	2.13
L-FR	75.0	279.3	3.37
L-TD	4.0	316.4	7.35
M-FR	176.8	759.9	12.32
M-TD	2.7	147.8	4.29
N-FR	29.0	41.0	0.57
O-FR	94.4	136.1	0.83
O-TD	1.8	167.3	4.19
Q-TD	23.2	830.0	35.54
R-FR	412.7	454.7	2.00
R-TD	2.8	149.9	4.90
S-TD	4.2	105.6	5.50
T-FR	198.0	280.8	1.75
U-FR	376.0	384.6	0.75
V-FR	196.6	277.7	36.80
V-TD	2.5	330.4	2.65
W-FR	32.8	57.3	8.26
W-TD	21.6	847.7	11.51
X-FR	103.0	153.5	1.72
Y-FR	100.2	377.8	3.37
Y-TD	2.5	194.2	5.00
Z-FR	217.0	231.1	2.65
AA-FR	77.8	166.5	1.35
AA-TD	4.3	256.5	7.14
BB-FR	88.8	97.4	0.46
BB-TD	0.5	34.1	1.09
CC-FR	246.6	276.4	0.30
CC-TD	1.0	71.0	2.13
DD-FR	21.0	25.6	0.19

Notes: FR = free outfall TD = tile-drained

63 The RCWD requirement of on-site infiltration best management practices can be satisfied with a regional infiltration system design, though this arrangement is not yet established. In the future, the RCWD may allow each stormwater applicant to receive infiltration credits based on their relative contribution to the regional infiltration feature and its overall infiltration capacity. For

Information presented in Table 17-5 and Figure 17-3 is to be used by planning personnel as a tool to ascertain how much area will likely be required for stormwater management in a given development zone. The amount of area allocated to stormwater management is not mandatory; however, most of the criteria used to approximate these numbers are either required by RCWD or the Mitigation Plan. The results do not represent stormwater criteria that in any way change development permits required by RCWD or any other agency. Additionally, surface areas estimates were conservative, as basins were assumed to be rectangular in shape; a highly inefficient use of space.

Infiltration

The mitigation of stormwater runoff volume via enhanced infiltration and groundwater recharge is critical to the health of ecological resources fed by groundwater and the stability of streams and water bodies receiving runoff. Implementation of all appropriate runoff infiltration and groundwater recharge enhancement techniques are encouraged for development within the AUAR area. An action that is consistent with this approach is to limit permanent open water or emergent wetland in SMAs to 20% of their total surface area. The remaining portion of the SMA should be populated with mesic prairie or wet prairie plant communities and not permanently inundated. Reports of high groundwater tables and shallow clay layers create challenges for enhancement of infiltration and groundwater recharge, but creating SMAs with these characteristics will maximize infiltration potential.

The role of native prairie plant species is critical in areas that were previously under agricultural land uses, because deep-rooted native plants create preferential infiltration and groundwater recharge pathways through hardpan layers. Hardpan layers are common areas previously under row crop land uses due to repeated tillage of soil at the same depth.

Rice Creek Watershed District (RCWD) criteria require that all developments infiltrate runoff volumes generated from the mean rainfall event (0.34 inches) within a 72-hour period. The Minnesota Pollution Control Agency (MPCA) has NPDES requirements that mandate the infiltration of the runoff from this storm in 48 hours. Because this criterion is more restrictive, it should be used whenever possible. The MPCA also requires 3 feet of separation between infiltration facilities and groundwater when feasible.

Computer Modeling results suggest SMAs having the geometry outlined in the Mitigation Plan and containing plant and open water characteristics outlined previously will meet infiltration criteria required by *Rice Creek Watershed District Rules*. Modeling results are primarily due to the large infiltrating surface area of the assumed SMA geometry, and don't consider the role of native plant species. The infiltration rate in non-open water portions of SMAs was assumed to be 0.03 in/hr, which is the RCWD recommended infiltration rate for Type D soils (SCS Hydrologic Soil Group). Portions of SMAs with open water or emergent wetland were considered to have a negligible infiltration rate.

If insufficient infiltration is provided by SMAs, infiltration facilities meeting RCWD and MPCA criteria must be provided by the developer. Additional infiltration will be provided within dispersed stormwater management systems within each development that collect and infiltrate runoff through the use of bio-swales, rain gardens, and infiltration areas.

64 example, if a developer owns 3% of an area tributary to a regional infiltration feature, that entity could utilize 3% of the infiltration

capacity of the feature for that entity's infiltration requirement. Any infiltration features within the AUAR area should be designed to utilize the water consumption characteristics of native plant species. Infiltration in these facilities should be augmented with large herbaceous and woody plant species (e.g., aspen and cottonwood), as they remove significant quantities of water through transpiration. This evapotranspiration enhancement technique is particularly critical in the AUAR area because the MPCA 3-foot facility separation from groundwater will be very difficult to achieve in many areas.

MITIGATION SUMMARY

Stormwater Management Areas

Stormwater management areas (SMAs) will play a critical role in mitigating potential impacts from stormwater following development of the AUAR area. Appropriate design, construction, and maintenance of these areas will enable development to occur without compromising the integrity of the region's aquatic resources.

Conservation Design Framework (CDF)

The stormwater management approach outlined in this document provides adequate detention of runoff for post-development conditions. It also provides a framework for water quality enhancement and increased groundwater recharge. The stormwater detention facility design will provide hydraulic properties appropriate for native plant species to thrive. All of these factors will help mitigate potential water quality problems associated with development in the AUAR area.

This approach, however, in many cases requires the allocation of large portions of potential development zones for stormwater management. The potential development zones requiring the greatest surface area for stormwater management are those considered to be drained by tile networks. Providing regional surface drainage infrastructure with greater drainage capacities will decrease the amount of surface area required for stormwater management. This regional drainage infrastructure must also address water quality concerns as they will be directly tributary to Clearwater Creek, Hardwood Creek, and the Rice Creek Chain of Lakes.

The most effective approach to addressing these issues simultaneously uses an integrated system of stormwater management elements, and the Conservation Design Framework (CDF) provides an appropriate layout for its regional implementation (Figure 10-3). Within the greenway corridors shown in the CDF, bio-swales, wet prairie, and wetlands can be oriented in series to effectively retard runoff rates, reduce stormwater volume, and enhance water quality. Runoff rates and volumes are decreased due to increased infiltration, evapotranspiration, and increased friction imparted on the flow. These decreased rates also reduce the ability of runoff to generate and carry sediment and associated pollutants.

The hydric soils throughout the AUAR area will pose problems for achieving infiltration criteria as outlined in the *Rice Creek Watershed Rules*. Native wetland and prairie plants are particularly useful for achieving infiltration requirements under these conditions, because they use large amounts of water and create preferential infiltration pathways. The greenway corridors established in the CDF provide appropriate locations for these types of infiltration facilities. The location and expansiveness of these corridors could provide the necessary surface area for the shared infiltration facilities discussed previously in this document.

Additional Stormwater Management Techniques

The City and RCWD will consider the use of additional stormwater management techniques when specific development proposals are submitted for review in the future. The appropriateness of such techniques will be evaluated by the City and RCWD based on soil suitability and compatibility with future development proposals. The following is a list of additional stormwater management recommendations:

- Adhere to surface area recommendations for stormwater management (Figure 17-3).

  The rear lot areas would be designed for infiltration, and side lot areas would be designed for effective drainage and conveyance of water from around foundations to ensure no standing water remains adjacent to the houses.
- Route driveway, sidewalk and gutter downspout waters into rain gardens and infiltration areas. This can be accomplished without compromising safe and effective drainage and dewatering needs around foundations and road subgrades.
- Route road runoff into parkway and road ROW swales, rain gardens, and infiltration areas.
- During site design, follow low impact development practices, such as increased open space, disconnected and minimized impervious surfaces, capitalizing on high infiltration capacity soils, and dispersed stormwater management.
- In residential development areas, use of a combination of side and rear lot drainage easements that are no-mow zones planted with formal or informal native landscaping.
- Route parking lot runoff into bio-swales, parking lot islands, and other suitable locations that support infiltration.

b. Identify routes and receiving water bodies for runoff from the site; include major downstream water bodies as well as the immediate receiving waters. Estimate impact runoff on the quality of receiving waters.

- *AUAR Guidelines: if present in or adjoining the AUAR area, the following types of water bodies must be given special analyses:*

a. o *lakes: within the Twin Cities metro area a nutrient budget analysis must be prepared for any "priority lake" identified by the Metropolitan Council (see Appendix E of EAW Guidelines (1990) or contact the Council staff. Outside of the metro area, lakes needing a nutrient budget analysis must be determined by consultation with the MPCA and DNR staffs;*

b. o *trout streams: if stormwater discharges will enter or affect a trout stream an evaluation of the impacts on the chemical composition and temperature regime of the stream and the consequent impacts on the trout population (and other species of concern) must be included;*

RECEIVING WATER BODIES DISCUSSION

Implementing a management scheme that focuses on regional stormwater management involves taking a holistic view of the AUAR area and its associated watersheds. Understanding existing hydrologic regimes is critical in establishing a regulatory framework that ensures the safety of people, property, and natural resources. Prior to European settlement, precipitation was distributed between the watersheds of Clearwater Creek, Hardwood Creek, and the Rice Creek Chain of Lakes (Figure 17-4). This continues to be the case today, but the distribution of water between each of these receiving features has changed due to agricultural and residential development, as has the quality of the runoff.

The runoff volume into the receiving waters will likely increase with development due to the increased impervious area constructed in the AUAR area. However, with the stormwater management requirements and recommendations outlined in this document, peak runoff release rates will be decreased from storms of 1-, 10-, and 100-year recurrence intervals. The recommended large area stormwater management elements will result in relatively small water level fluctuations, provide area to enhance the groundwater recharge necessary to provide base flow to the receiving streams, and provide the detention time necessary to cleanse the runoff of contaminants and meter the increased runoff volume to an amount within the receiving streams ecological carrying capacity.

NUTRIENT BUDGET ANALYSIS

A nutrient budget analysis is required if activities from a project may affect lakes identified as a "priority lake" in the EAW Guidelines (Environmental Quality Board, 2000). The proposed development will cause an increase in stormwater volume entering Peltier Lake and Rondeau Lake, of which Peltier Lake is identified as a priority lake by the Metropolitan Council.

Sound watershed management requires an understanding of chemical components within stormwater runoff. One of the groups of constituents having the most detrimental effects on lakes, rivers, and streams is nutrients. At high concentrations they can be toxic to fish and plant species, but even in relatively small concentrations they can have profound effects on natural systems. Often times the nutrients that are most damaging are the phosphorus and nitrate species. These two subsets of the nutrient family expedite the process of eutrophication in lakes, which can destroy native ecosystems and make the system undesirable for recreation and water supply. Any development in the AUAR area should have a "no net release" total phosphorus policy to prevent further eutrophication of downstream water bodies. This premise is particularly applicable to Peltier Lake, one of the Twin Cities most eutrophied lakes according to MPCA staff.

The Minnesota Pollution Control Agency (MPCA) has established a list of impaired waters, which includes several of the systems within, or downstream of, the AUAR area. These systems include Peltier Lake, Rondeau Lake, and Hardwood Creek. Nutrient budget analyses are required for priority lakes within the AUAR area. These analyses focused on phosphorus, because it is one of the major contributors to water quality problems associated with development. It is also a nutrient that can be mitigated quite well if the problem is understood. Effective mitigation of total phosphorus can be achieved through responsible land use practices and stormwater design. Two models were used in for these analyses: the Minnesota Lake Eutrophication Analysis Procedure (MINLEAP) Model[1] and the Reckhow and Simpson Model[2]. The MINLEAP model was chosen to approximate total phosphorus loading within each watershed on an annual basis. The Reckhow and Simpson Model was used to compare pre- and post-development total phosphorus loading originating from potential development zones in the AUAR area.

Watershed Analysis

The MINLEAP model was chosen to analyze total phosphorus loading in each priority lake watershed, because it can provide meaningful results despite a lack of high resolution site data. The model was designed as a screening tool for identifying problem waters. It utilizes water and phosphorus balances and a network of empirical models to predict total phosphorus, chlorophyll-a, and transparency values. Input parameters were taken from the Rice Creek Watershed District

1 Wilson, C.B. and W.W. Walker. 1989. Development of lake assessment methods based upon the aquatic ecoregion concept. Lake and Reservoir Management. 5(2): 11-22. 2 Reckhow, K.H. and J.T. Simpson. 1980 as designed by Wilson, B. (1994). A Procedure Using Modeling and Error Analysis for the Prediction of the Lake Phosphorus Concentration from Land Information. Canadian Journal of Fishery Aquatic Sciences. 37:1439-1448

(Table 17-6). Ecoregion mapping was obtained from the United States Environmental Protection Agency (USEPA) (Omerink and Gallant, 1988)[3] Results from the analysis (Table 17-7) are regional in nature and should be calibrated with field data.

Table 17-6: Input parameters for MINLEAP analysis for Peltier Lake and Rondeau Lake

Parameter	Peltier Lake	Rondeau Lake
Watershed Area (ac)	65,989	3,448
Lake Area (ac)	483	275
Mean Lake Depth (ft)	7	3
Observed Summer-Mean Total P (ppb)	150	44
In-Lake Chlorophyll Concentration (ppb)	75	5
Mean Secchi Disk Depth (ft)	1.1	0.75
Ecoregion	CHF	CHF

Table 17-7: Results from MINLEAP analysis for Peltier Lake and Rondeau Lake Results Peltier Lake Rondeau

Lake		
Predicted Summer-Mean Total P (ppb)	99	74
Average Total P Inflow (ppb)	149	162
Total P Load (lbs/yr)	11,457	665
P Retention Coefficient	0.34	0.55
Lake Outflow (cfs)	38.96	2.08
Residence Time (yr)	0.1	0.5

Site Analysis

An analysis was completed to evaluate the amount of pre- and post-development non-point source phosphorus pollution generated from potential development zones in the AUAR area. This analysis does not include areas outside of the potential development zones established previously. Additionally, Peltier Lake was the only lake analyzed, because none of the potential development zones are tributary to Rondeau Lake.

The Reckhow and Simpson method utilizes land use information and empirically based export coefficients to approximate total phosphorus loading to lakes. The potential development zones were categorized by five different land use types: urban, agricultural, forest, wetlands, and open space. The surface areas associated with these land uses were then combined with empirical coefficients resulting in approximations of annual amounts of total phosphorus deposition in Peltier Lake. Results from the analysis (Table 17-8) suggest an increase from pre- to post-development conditions in total phosphorus deposition in Peltier Lake of 130% for small export coefficients and 65% for large export coefficients, if water quality treatment (as proposed through the use of SMAs) is not taken into account.

3 Omernik, J and A. Gallant. 1988. Ecoregions of the Upper Midwest States. EPA/600/3-88-037. U.S. Environmental Protection Agency, Washington D.C.

Table 17-8. Peltier Lake Total Phosphorus Loading Results

Pre-Development	Urban	Agricultural	Forest	Wetlands	Open Space	***Total***
Area (ac)	403	1784	40	104	119	**2450**
Phosphorus Export Coefficient (kg/acre-yr)	0.75-1.25	0.20-0.60	0.10-0.15	0.10	0.20-0.40	**NA**
Phosphorus Loading (kg/yr)	122-204	144-433	2	4	10-19	**282-662**

Post-Development	Urban	Agricultural	Forest	Wetlands	Open Space	***Total***
Area (ac)	2034	104	0	89	223	**2450**

Phosphorus Export Coefficient (kg/acre-yr)	0.75-1.25	0.20-0.60	0.10-0.15	0.10	0.20-0.40	**NA**
Phosphorus Loading (kg/yr)	617-1029	8-25	0	4	18-36	**647-1094**

MITIGATION SUMMARY

Results of the nutrient budget analysis suggest that mitigation will be required to prevent non-point source pollution in the form of total phosphorus from being deposited in Peltier Lake. Any development within the AUAR area should provide runoff treatment facilities and land uses that result in no increases in total phosphorus leaving the site. Facilities to achieve this objective were not designed as part of this analysis, however the stormwater management system discussed previously can provide an optimal design framework for nutrient removal. Dispersed stormwater management emphasizing infiltration as the treatment mechanism will optimize phosphorus removal. The use of constructed treatment wetlands for stormwater detention will enhance sediment removal, greatly decreasing quantities of non-soluble phosphorus reaching Peltier Lake, Hardwood Creek, and Clearwater Creek. The goal of the implementation of best management practices such as rain gardens, infiltration galleries, buffer strips, designed wetlands, bio-swales, and sedimentation basins should be no net increases in total phosphorus leaving a given development site.

21. Traffic. Parking spaces added NA. Existing spaces (if project involves expansion) **N.A.** . Estimated total average daily traffic generated . Estimated maximum peak hour trafficgenerated (if known) and time of occurrence . Provide an estimate of the impact on trafficcongestion on affected roads and describe any traffic improvements necessary. If the project is within the Twin Cities metropolitan area, discuss its impact on the regional transportation system.

For each affected road indicate the ADT and the directional distribution of traffic with and without the project. Provide an estimate of the impact on traffic congestion on the affected roads and describe any traffic improvements which will be necessary.

AUAR Guidelines: For most AUAR reviews a relatively detailed traffic analysis will be needed, especially if there is to be much commercial development in the AUAR area or if there are major congested roadways in the vicinity. The results of the traffic analysis must be used in the responses to item 22 and to the noise aspect of item 24.

Instead of responding to the information called for in item 21, the following information should be provided:

21a. a description and map of the existing and proposed roadway system, including state, regional, and local roads to be affected by the development of the AUAR area. This information should include existing and proposed roadway capacities and existing and projected background (i.e., without the AUAR development) traffic volumes

21b. trip generation data -- trip generation rates and trip totals -- for each major development scenario broken down by land use zones and/or other relevant subdivisions of the area. The projected distributions onto the roadway system *must be included;*

21c. *analysis of impacts of the traffic generated by the AUAR area on the roadway system, including: comparison of peak period total flows to capacities and analysis of Levels of Service and delay times at critical points (if any);*

21d. *a discussion of structural and non-structural improvements and traffic management measures that are proposed to mitigate problems;*

Note: in the above analyses the geographical scope must extend outward as far as the traffic to be generated would have a significant effect on the roadway system and traffic measurements and projections should include peak days and peak hours, or other appropriate measures related to identifying congestion problems, as well as ADTs.

EXISTING ROADWAY SYSTEM

Two existing principal arterial roadways serve the AUAR area:

- I-35W, to the west and northwest of the AUAR area, is a four-lane interstate freeway with an interchange located at CSAH 23 (Lake Drive), which is a considerable distance from the AUAR area. Current average daily traffic (ADT) in the vicinity of the AUAR area is 35,000 – 40,000.
- I-35E, which bisects the AUAR area, is a four-lane interstate freeway with an interchange located at CSAH 14. Current ADT in the vicinity of the AUAR area is 39,000 – 47,000. 82

The AUAR area is served by three minor arterials:

- CSAH 21 (20th Avenue North, north of Main Street) is a two-lane north-south arterial that bisects the AUAR area. CSAH 21, which had been a Major Collector roadway, was recently re-classified as an “A” Minor Arterial. Approximate ADT in the AUAR area ranges from 1,000 to 4,000.
- CR 54 (20th Avenue North, south of Main Street) is a two-lane north-south arterial that joins CSAH 21 at CSAH 14 (Main Street). Like CSAH 21, CR 54 had been a Major Collector roadway but was recently re-classified as an “A” Minor Arterial. Approximate ADT in the AUAR area ranges from 4,000 to 5,000.
- CSAH 14 (Main Street) is a two-lane “A” Minor Reliever and as an “A” Minor Expander that connects I-35E with Lino Lakes, Centerville and areas to the west of I-35W with I-35E via its interchange. Approximate ADT in the AUAR area ranges from 5,700 to 15,000.

PROPOSED, PLANNED AND/OR PROGRAMMED ROADWAY IMPROVEMENTS

Information provided by the City of Lino Lakes, Anoka County, as well as the Technical Advisory Committee identified the following improvements to include in the analysis of future traffic conditions.

- Expansion of I-694 from TH 36 to I-35W
- Expansion of I-35E from I-694 to I-94

. • A new interchange would be constructed at 80th Street and I-35E
. • The "Northerly Bypass" would be constructed to link I-35W and I-35E, and
. • A new interchange would be constructed on I-35W to serve the Northerly Bypass.
. • A reconstructed interchange at I-35E and CSAH 14.
. • A north-south frontage/backage road west of I-35E, which would parallel CSAH 21 (20th Avenue north) and extend northward from CSAH 14. This roadway would extend approximately 1.75 miles to the north, but would not intersect with CR 140 (80th Street East)
. • A north-south frontage/backage road south of CSAH 14, which would parallel CR 54 west of I-35E.

Figure 21-1 displays the existing/proposed transportation network along with current daily traffic counts and functional classification. In addition, the proposed or un-built transportation system is shown on the map. Note that all proposed or un-built alignments are purely conceptual.

EXISTING OR PROPOSED TRANSIT SERVICES TRANSPORTATION STUDY

Express Route 275 provides weekday rush hour express service from Lake Drive and Lino Park to downtown Saint Paul. This route serves park and ride lots at Lake Drive and Lois Lane, Lino Lakes City Hall at Main Street and Rondeau Drive and Centerville Road and Main (CSAH 21 and CSAH 14). Express Route 250 also provides weekday rush hour service from St. Joseph's Church in Lino Lakes as well as the high frequency weekday rush hour Express Route 250 service from 95th and I-35W Park and Ride in Blaine.

In general, the Anoka County Transit System Plan, completed in October 2004, identified additional Anoka County transit services. The following was identified in the transit system plan:

"It is expected that Anoka County will also stay involved with a number of other transit activities and will expand its role in some new areas. The County should maintain its involvement with the Northstar Commuter Coach service operated along TH 10 between Elk River and Downtown Minneapolis with an intermediary stop at Coon Rapids/Riverdale. This service is currently operated by the Northstar Corridor Development Authority (NCDA). In the event the Northstar Commuter Rail Project begins service, the County will need to look at how feeder service is operated to the rail stations. At that time, the Northstar Commuter Coach service could be redeployed to another corridor such as TH 65. Other activities in this timeframe include expanded Transportation Management Organization (TMO) activities focusing on meeting business needs, promoting the benefits of transit, and assisting in planning and other Transportation Demand Management (TDM) activities."

The Met Council's Park and Ride Facility Site Location Plan also includes a proposed new facility at/near 35E and Co Rd 140 (80th St E). Projections made in the plan indicate that there will be demand for a 600-space lot by 2030.

Between 2006 and 2010 the AUAR study area falls under the limited fixed route service area (see figure 28 of the Anoka County Transit System Plan). Commuter coach service and transit oriented corridors are identified as improvements between 2011 and 2015 (see figure 29 of the Anoka County Transit System Plan) that would approach the west boundary of the AUAR study area. Specifically, commuter coach service is identified as along I-35W while CSAH 14 is identified as transit oriented corridor extending west from I-35W.

A detailed traffic impact analysis has been prepared to fully investigate the effects of the proposed land use scenarios on the local and regions roadway systems. Traffic information and forecasts were based on traffic counts conducted from July 2003, to May 2004 as part of the County State Aid Highway 14 Alternatives Analysis Report completed in July 2004.[4] Presently only one intersection, CSAH 14/I-35E (east ramp), in the AUAR study area experiences significant peak period delays (For additional detail on existing conditions, see Appendix E.

Traffic generation was prepared using the Institute of Transportation Engineers "*Trip Generation* (7th Edition)." Traffic generation and distribution was also prepared with the assistance of the Anoka County Version of the Metropolitan Council's Travel Demand Forecasting Model. Several development and land use scenarios were evaluated as part of the AUAR. These scenarios reflected varying degrees of development intensity and development location. The development intensity for most scenarios exceeded the Met Council's 2030 development totals for the AUAR study area. A separate development scenario, consistent with the Met Council's development total, was also analyzed. This scenario, as with all the scenarios, uses the Met Council Travel Demand Model to take into account the impact of known large scale developments in the surrounding area. Although the timing of the development is uncertain, we assumed a timeline of 2030 and post-2030 for the scenarios. The scenarios include:

- Scenario 1: 2030 Build-out of Lino Lakes Comprehensive Plan; Parks, Open Space, and Trails Plan; and the Anoka County C.S.A.H. 14 Plan
- Scenario 2: 2030 Build-out of Known Plans – Commercial and Industrial Emphasis.
- Scenario 3: 2030 Build-out of Known Plans – Residential Emphasis.
- Scenario 1A: POST 2030 Build-out of Lino Lakes Comprehensive Plan; Parks, Open Space, and Trails Plan; and the Anoka County C.S.A.H. 14 Plan)
- Scenario 2A: POST 2030 Build-out of Known Plans – Commercial and Industrial Emphasis.
- Scenario 3A: POST 2030 Build-out of Known Plans – Residential Emphasis.

[4] Alternative Analysis Report – CSAH 14: I-35W to I-35E Study, *SRF Consulting Group, July 2004.*

The regional transportation planning modeling (developed and maintained by Met Council) was used to evaluate the development and land use impacts related to the various AUAR scenarios. Each transportation and land use scenario were run in the Met Council model to obtain future year daily traffic volumes for the roadways being analyzed. The future year daily traffic volumes from the model were then used to assist in determining the distribution of trips through the roadway network. The detailed traffic "operations" analysis for the respective AUAR scenarios was completed using Synchro/SimTraffic.

The Traffic analysis focused on the operation of the primary roadways and their intersections during the peak travel periods (a.m. and p.m. peak hours), which is typically the time when the most severe traffic congestion is incurred.

Existing Roadways

- I-35W
- I-35E
- CSAH 21 (20th Avenue North – north of CSAH 14, and Centerville Road south of CSAH 14))
- CR 54 (20th Avenue North – south of CSAH 14)

- CSAH 14 (Main Street)
- CR 140 (80th Street East)
- Elmcrest Avenue North
- Otter Lake Road
- Center Street
- Cedar Street
- Birch Street

New Roadways/Interchanges

Although the majority of projects are not slated for funding, it is assumed that at some point prior to 2030 each would occur in some capacity. A No-Build analysis, which used the Met Council 2030 development projection (representing only about 20-25 percent of the development of the AUAR Scenarios) showed that the existing transportation system would be insufficient. S Based on this analysis and on the fact that each of these improvements have been studied and are generally considered to reasonable improvements by 2030, they were assumed in the AUAR analysis. New interchanges will require an Interstate Access Request (IAR) that needs final approval by FHWA. The IAR should demonstrate:

1) Why the existing interchanges or local roads can not accommodate the design year traffic, and that all reasonable design options have been adequately assessed.

2) That the proposed Interstate access point mush not have a significant adverse impact on the safety and operation of the Interstate facility (an operation analysis would be needed to support this).

3) That the Interstate access would not be put into the context of area development.

4) That any request for new or revised access to the Interstate should be in the context of a long-term plan derived from an Interstate network study.

Projects include:[5]

- Northerly Bypass
- Northerly Bypass interchange with I-35W
- CR 140 (80th Street East) interchange with I-35E
- Reconstructed CSAH 14 interchange with I-35E (Diamond plus Northwest Loop)[6]
- Otter Lake Road Extension
- Center Street Extension
- 21st Avenue North Extension
- Frontage/Backage Road System

Existing Intersections

- CSAH 14/CSAH 21 (Centerville Road)
- CSAH 14/CSAH 21 (20th Avenue North)
- CSAH 14/I-35E West Ramp
- CSAH 14/I-35E East Ramp
- CR 54/Center Street
- CR 54/Cedar Street

New Intersections

- CR 140 (80th Street East) at: -I-35W (west ramps) -I-35W (east ramps) -CSAH 21 -I-35E (west ramps) -I-35E (east ramps) -Elmcrest Avenue
- CSAH 14 at: -CSAH 21 (Centerville Rd.) -CSAH 21(20th Avenue North) -21st Avenue North (West Frontage Road) -I-35E (west ramps) and new city street per new interchange design[7] -I-35E (east ramps) -Otter Lake Road
- CSAH 21 at:

[5] It must be noted that none of the first four projects listed are currently funded for implementation, however, it is expected that each would have to occur prior to 2030 to realize full build-out of the three land use scenarios. The four projects are: Northerly Bypass, Northerly Bypass with interchange with I-35W, CR 140 interchange with I-35E, and the reconstructed CSAH 14 interchange with I-35E. It should be noted that the assumption of a 6-lane cross section of I-35W and I-35E, up to CSAH 14, does not have funding identified and is not included in MnDOT's 20-year TSP. Prior to the construction of these proposed interchanges, FHWA would require that the supporting roadway network (county and city system) be constructed.

[6] Additional interchange analysis and design is needed to determine the ultimate interchange configuration. At the time of this study, the Diamond Plus Northwest Loop design was the design with the most support and was the alternative identified (in the Memorandum entitled: I-35E/CSAH 14 Interchange Alternatives Evaluation, conducted for Anoka County, by SRF Consulting Group, Inc. May 19, 2005.) as the most appropriate for evaluation as part of the AUAR.

[7] I-35E/SCSAH 14 Interchange Alternative Evaluation, SRF Consulting Group, Inc. May, 2005

  - North Crossroad to Frontage Road
  - Middle Crossroad to Frontage Road
- South Crossroad to Frontage Road

- CR 54 at: -South Crossroad to Frontage Road -Birch Street

Trip Generation

In determining the amount of traffic for the scenarios, it was necessary to designate the land-uses using ITE's Trip Generation handbook. The categories and assumptions for the three land uses are shown in Table 21-1. In determining the impact of the traffic generated by the land use scenarios, a process was followed to replace the trips generated by Met Council 2030 land use scenario. This is a necessary step in the analysis to avoid "double counting" the impact of new trips. This was accomplished by converting the trip values used in the Met Council Travel Demand Model to ITE Trip Generation values and then subtracting them out from the AUAR Land Use Scenario trip totals.

Tables 21-2, and 21-3 display the trip generation characteristics for the 2030 Base Timeframe, and the Post 2030 timeframe.[8]

Table 21-4 displays the increase in trips for the two timeframes. A trip is one movement to or from a location. For example, a resident leaving home in the morning to drive to work produces one morning trip *out of* the house, and one trip *in to* the workplace. Also included in the tables is the intensity of each development type for each scenario.

[8] In addition to these development scenarios, an analysis was conducted to determine the needs based on the 2030 land use scenario developed by the Twin Cities Metropolitan Council (Met Council). The transportation network used in this analysis reflected a no-build infrastructure system and contained only those transportation improvements either funded or planned for implementation. This transportation/land use scenario was analyzed to determine a purpose and need for improvements. A memorandum is contained in Appendix F of this report.

Table 21-1.Land Use Breakdown and Description

USE	SUB-USE	ITE	% of USE	DESCRIPTION
Rural Low Density Sewered Residential High Density Residential Industrial Low-Med Density Residential Med-high Density Residential Med Density Residential Commercial	Single-Family Detached	210	100%	Single-family detached homes on individual lots. Typically a suburban subdivision.
	Single-Family Detached	210	100%	Single-family detached homes on individual lots. Typically a suburban subdivision.
	Single-Family Detached	210	50%	Single-family detached homes on individual lots. Typically a suburban subdivision.
	Townhouse	230	50%	Ownership units that have at least one other owned unit within the same building structure. Both townhomes and condominiums are included in this land use
	Townhouse	230	80%	Ownership units that have at least one other owned unit within the same building structure. Both townhomes and condominiums are included in this land use
	Senior Adult Housing Attached	252	20%	Independent living developments for seniors, containing apartment-like residential units. May include limited social or recreational services. Residents may or may not be retired people
	Townhouse	230	40%	Ownership units that have at least one other owned unit within the same building structure. Both townhomes and condominiums are included in this land use
	Senior Adult Housing Attached	252	10%	Independent living developments for seniors, containing apartment-like residential units. May include limited social or recreational services. Residents may or may not be retired people
	Apartments	220	50%	Rental dwelling units located within the same building with at least three other dwelling units.
	Apartments	220	100%	Rental dwelling units located within the same building with at least three other dwelling units.
	Office Park	750	30%	Suburban subdivisions or PUDs containing general office buildings and support services, including banks, restaurants and service stations in a campus-like atmosphere.
	Business Park	770	60%	A group of one or two story buildings served by a common roadway system. May include offices, retail and wholesale stores, restaurants, recreational areas, and warehousing/industrial uses.
	Shopping Center	820	10%	An integratedgroup of commercial establishments, planned, owned and managed as a unit.Provides on site parking and may include outparcels located on the perimeter of the site.
	Light Industrial	110	30%	These facilities have an emphasis on activities other than manufacturing and typically have minimal office space.
	Industrial Park	130	30%	This land use is characterized by a mix of manufacturing, service and warehouse facilities. Some house a large number of small businesses, while others have one or two dominant industries.
	Warehousing	150	40%	This use is primarily devoted to the storage of materials, but also may include office and maintenance areas.

R:\31809732\Traffic Data - Analysis-data\[ITE TRIP GEN.xls]Land Use Breakdown

* Source: ITE *Trip Generation, Seventh Edition* , 2003.

Table 21-2. Base 2030 Trip Generation Summary[9]

Traffic Generation - 2030 Horizon Year (BASE)												
	Land Use	Intensity	A.M. Peak Hour			P.M. Peak Hour			Daily Total		
			In	Out	Total	In	Out	Total	In	Out	Total
SCENARIO 1 City Comprehensive Plan	Rural Land Use (du)	125	23	70	93	80	47	127	598	598	1,196
	Low Density (du)	510	96	287	383	325	191	516	2,440	2,440	4,880
	Medium Density (du)	1,129	76	340	416	330	165	495	3,039	3,039	6,078
	High Density (du)	473	48	193	241	191	103	294	1,589	1,589	3,178
	Commercial (1ksf)	2,500	3,459	804	4,263	1,935	3,738	5,673	26,633	26,633	53,266
	Industrial (1ksf)	3,750	2,239	416	2,655	512	2,263	2,775	11,556	11,556	23,112
	TOTAL		5,941	2,110	8,051	3,373	6,507	9,880	45,855	45,855	91,710

SCENARIO 2 — Commerical/Industrial Emphasis

Land Use	Intensity	A.M. Peak Hour In	A.M. Peak Hour Out	A.M. Peak Hour Total	P.M. Peak Hour In	P.M. Peak Hour Out	P.M. Peak Hour Total	Daily Total In	Daily Total Out	Daily Total Total
Rural Land Use (du)	44	8	25	33	28	16	44	211	211	422
Low Density (du)	118	22	66	88	75	44	119	565	565	1,130
Low/med Density (du)	2,419	317	1,122	1,439	707	353	1,060	9,331	9,331	18,662
Med/high Density (du)	2,173	184	770	954	755	394	1,149	6,575	6,575	13,150
High Density (du)	961	98	392	490	387	209	596	3,229	3,229	6,458
Commercial (1ksf)	2,500	3,459	804	4,263	1,935	3,738	5,673	26,633	26,633	53,266
Industrial (1ksf)	3,750	2,239	416	2,655	512	2,263	2,775	11,556	11,556	23,112
TOTAL		**6,327**	**3,595**	**9,922**	**4,399**	**7,017**	**11,416**	**58,100**	**58,100**	**116,200**

SCENARIO 3 — Residential Emphasis

Land Use	Intensity	A.M. Peak Hour In	A.M. Peak Hour Out	A.M. Peak Hour Total	P.M. Peak Hour In	P.M. Peak Hour Out	P.M. Peak Hour Total	Daily Total In	Daily Total Out	Daily Total Total
Rural Land Use (du)	43	8	24	32	27	16	43	206	206	412
Low Density (du)	118	22	66	88	75	44	119	565	565	1,130
Low/med Density (du)	3,685	483	1,709	2,192	1,077	537	1,614	14,215	14,215	28,430
Med/high Density (du)	3,247	274	1,151	1,425	1,129	589	1,718	9,825	9,825	19,650
High Density (du)	1,566	160	639	799	631	340	971	5,262	5,262	10,524
Commercial (1ksf)	2,500	3,459	804	4,263	1,935	3,738	5,673	26,633	26,633	53,266
Industrial (1ksf)	3,750	2,239	416	2,655	512	2,263	2,775	11,556	11,556	23,112
TOTAL		**6,645**	**4,809**	**11,454**	**5,386**	**7,527**	**12,913**	**68,262**	**68,262**	**136,524**

SOURCE: ITE Trip Generation, *7th Edition.*
R:\31809732\Synchro\AUAR Analysis\Excel\Unsignal 21\[Scenario 1 Traffic Analysis -w20 no signal Monday.xls]Trip Generation Summary

[9] The trips indicated in the table reflect absolute values for the land use scenario. These values were substituted for the values projected by the Met Council for the Study Area for use in the Travel Demand Model, which was used to determine background traffic and trip distribution into the AUAR area.

Table 21-3. Post 2030 Trip Generation Summary

Traffic Generation - POST 2030 Horizon Year

SCENARIO 1 — City Comprehensive Plan

Land Use	Intensity	A.M. Peak Hour			P.M. Peak Hour			Daily Total		
		In	Out	Total	In	Out	Total	In	Out	Total
Rural Land Use (du)	125	23	70	93	80	47	127	598	598	1,196
Low Density (du)	510	96	287	383	325	191	516	2,440	2,440	4,880
Medium Density (du)	1,129	76	340	416	330	165	495	3,039	3,039	6,078
High Density (du)	473	48	193	241	191	103	294	1,589	1,589	3,178
Commercial (1ksf)	2,985	4,130	960	5,090	2,310	4,463	6,773	31,799	31,799	63,598
Industrial (1ksf)	11,175	6,673	1,239	7,912	1,525	6,745	8,270	34,436	34,436	68,872
TOTAL		**11,046**	**3,089**	**14,135**	**4,761**	**11,714**	**16,475**	**73,901**	**73,901**	**147,802**

SCENARIO 2 — Commerical/Industrial Emphasis

Land Use	Intensity	A.M. Peak Hour			P.M. Peak Hour			Daily Total		
		In	Out	Total	In	Out	Total	In	Out	Total
Rural Land Use (du)	44	8	25	33	28	16	44	211	211	422
Low Density (du)	118	22	66	88	75	44	119	565	565	1,130
Low/med Density (du)	2,419	317	1,122	1,439	707	353	1,060	9,331	9,331	18,662
Med/high Density (du)	2,173	184	770	954	755	394	1,149	6,575	6,575	13,150
High Density (du)	961	98	392	490	387	209	596	3,229	3,229	6,458
Commercial (1ksf)	5,617	7,771	1,806	9,577	4,347	8,398	12,745	59,838	59,838	119,676
Industrial (1ksf)	9,570	5,714	1,061	6,775	1,306	5,776	7,082	29,490	29,490	58,980
TOTAL		**14,114**	**5,242**	**19,356**	**7,605**	**15,190**	**22,795**	**109,239**	**109,239**	**218,478**

SCENARIO 3 — Residential Emphasis

Land Use	Intensity	A.M. Peak Hour			P.M. Peak Hour			Daily Total		
		In	Out	Total	In	Out	Total	In	Out	Total
Rural Land Use (du)	43	8	24	32	27	16	43	206	206	412
Low Density (du)	118	22	66	88	75	44	119	565	565	1,130
Low/med Density (du)	3,685	483	1,709	2,192	1,077	537	1,614	14,215	14,215	28,430
Med/high Density (du)	3,247	274	1,151	1,425	1,129	589	1,718	9,825	9,825	19,650
High Density (du)	1,566	160	639	799	631	340	971	5,262	5,262	10,524
Commercial (1ksf)	4,141	5,729	1,331	7,060	3,205	6,191	9,396	44,114	44,114	88,228
Industrial (1ksf)	5,829	3,481	646	4,127	795	3,518	4,313	17,962	17,962	35,924
TOTAL		**10,157**	**5,566**	**15,723**	**6,939**	**11,235**	**18,174**	**92,149**	**92,149**	**184,298**

SOURCE: ITE Trip Generation, *7th Edition.*

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Table 21-4. Increase over Base 2030 (Post 2030 – Base 2030)

Increase over Base 2030 (Post 2030 - Base 2030)

Scenario	Land Use	Intensity	A.M. Peak Hour In	A.M. Peak Hour Out	A.M. Peak Hour Total	P.M. Peak Hour In	P.M. Peak Hour Out	P.M. Peak Hour Total	Daily Total In	Daily Total Out	Daily Total Total
SCENARIO 1 City Comprehensive Plan	Rural Land Use (du)	-	-	-	-	-	-	-	-	-	-
	Low Density (du)	-	-	-	-	-	-	-	-	-	-
	Medium Density (du)	-	-	-	-	-	-	-	-	-	-
	High Density (du)	-	-	-	-	-	-	-	-	-	-
	Commercial (1ksf)	485	671	156	827	375	725	1,100	5,167	5,167	10,334
	Industrial (1ksf)	7,425	4,434	823	5,257	1,013	4,481	5,494	22,880	22,880	45,760
	TOTAL		**5,105**	**979**	**6,084**	**1,388**	**5,206**	**6,594**	**28,047**	**28,047**	**56,094**

Scenario	Land Use	Intensity	A.M. Peak Hour In	A.M. Peak Hour Out	A.M. Peak Hour Total	P.M. Peak Hour In	P.M. Peak Hour Out	P.M. Peak Hour Total	Daily Total In	Daily Total Out	Daily Total Total
SCENARIO 2 Commerical/Industrial Emphasis	Rural Land Use (du)	-	-	-	-	-	-	-	-	-	-
	Low Density (du)	-	-	-	-	-	-	-	-	-	-
	Low/med Density (du)	-	-	-	-	-	-	-	-	-	-
	Med/high Density (du)	-	-	-	-	-	-	-	-	-	-
	High Density (du)	-	-	-	-	-	-	-	-	-	-
	Commercial (1ksf)	3,117	584	1,753	2,337	1,983	1,165	3,148	14,915	14,915	29,830
	Industrial (1ksf)	5,820	1,091	3,274	4,365	3,703	2,175	5,878	27,849	27,849	55,698
	TOTAL		**1,675**	**5,027**	**6,702**	**5,686**	**3,340**	**9,026**	**42,764**	**42,764**	**85,528**

Scenario	Land Use	Intensity	A.M. Peak Hour In	A.M. Peak Hour Out	A.M. Peak Hour Total	P.M. Peak Hour In	P.M. Peak Hour Out	P.M. Peak Hour Total	Daily Total In	Daily Total Out	Daily Total Total
SCENARIO 3 Residential Emphasis	Rural Land Use (du)	-	-	-	-	-	-	-	-	-	-
	Low Density (du)	-	-	-	-	-	-	-	-	-	-
	Low/med Density (du)	-	-	-	-	-	-	-	-	-	-
	Med/high Density (du)	-	-	-	-	-	-	-	-	-	-
	High Density (du)	-	-	-	-	-	-	-	-	-	-
	Commercial (1ksf)	1,641	308	923	1,231	1,044	613	1,657	7,852	7,852	15,704
	Industrial (1ksf)	2,079	390	1,169	1,559	1,323	777	2,100	9,948	9,948	19,896
	TOTAL		**698**	**2,092**	**2,790**	**2,367**	**1,390**	**3,757**	**17,800**	**17,800**	**35,600**

SOURCE: ITE Trip Generation, *7th Edition.*

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Traffic Impact

The process of evaluating the proposed land use involved the complex process of developing and distributing background and development related traffic through the areas roadway network. The network includes a system of frontage roadways that will assist in the circulation of traffic through the area. This roadway system, which was presented to the city and Anoka County early in the AUAR process, was used as a guideline in determining where to put the various developments.

The key guidelines included:

- Limit access to CSAH 14 and 80th Street between CSAH 21 and Elmcrest Avenue North
- Limit access and preserve mobility on CSAH 14, CSAH 21, and 80th Street (assuming future interchange)
- Signalized (primary) intersections at ½ mile spacing
- Collector (secondary) intersections at ¼ mile spacing
- Enhance existing street network to serve local trips (e.g., upgrade Elmcrest Avenue North)
- Develop frontage/backage road system to provide property access
- Consolidate existing access as opportunities arise
- Consider I-35E park and ride location
- Provide bicycle/pedestrian trail connectivity

The approach in determining the traffic impacts was to develop a traffic simulation model using Synchro/SimTraffic. This software package allows a technically sound and visually attractive method to present results to the public.

To provide a baseline from which to compare the impact of both the land use scenarios and the potential roadway improvements, it is first necessary to analyze a "No-Build" Scenario. The No-Build Scenario assumed only those projects approved for funding for the transportation system. The land use scenario used the 2030 forecasts developed by the Metropolitan Council. The analysis showed that even with a much lower development scenario, the transportation system was inadequate to effectively accommodate the projected travel demand. Detailed results of this analysis are provided in Appendix E.

The first step in analyzing the impact of the proposed land use scenarios with the potential 2030 transportation network, was to identify specific areas of proposed development and distribute the traffic across the network[10]. The traffic was then assigned to specific turn movements at the intersection level for the p.m. peak hour.[11] In addition to the turning movements, daily traffic forecasts were developed for the primary roadways within or adjacent to the AUAR area. Figures 21-2 21-3 and 21-4 display the projected trip distribution and assignment of 2030 traffic volumes for each of the three respective land use scenarios. Figures 21-5, 21-6, and 21-7 display the resulting level of service (LOS) as displayed in the SimTraffic network for each of these scenarios.

[10] It should also be noted that other proposed developments, not related to the three AUAR Scenarios were incorporated into the analysis. One such development is the Eagle Brook Church located west of CSAH 21, 1 ¼ miles north of CSAH 14. A full traffic analysis of this development was prepared by SRF Consulting Group for the

Eagle Brook Church Environmental Assessment Worksheet (EAW), October, 2002.

[11] An additional a.m. peak hour analysis was completed for development scenario 2 with the results included in Appendix F. No significant overall differences in traffic operations were observed from the p.m. peak hour analysis. For all transportation scenarios evaluated, the p.m. peak hour conditions represented the worse case scenario.

In general, the overall land use/development scenarios resulted in significant increases in traffic to/from the AUAR area. Roadways that are projected to see large increases include CSAH 14, CSAH 21, and CR 144 (80th Street E.) Roadways beyond the defined AUAR area may also require upgrades or improvements to add capacity to accommodate increased traffic levels. One such example is TH 61 which is projected to more than double in traffic by 2030 regardless of the projected development scenario within the AUAR area. The major problems with the intersection were southbound left-turns and westbound left-turns. The lane geometry that was assumed was single left-turns on all approaches. The results indicate that given the expected development in the AUAR area that several of the approaches would require dual left-turn lanes to adequately accommodate AUAR area traffic.

The redesigned interchange at CSAH 14 and I-35E overall functioned satisfactory during the p.m. peak hour for 2030 land use Scenarios One – Comprehensive Plan, and Two Commercial and Industrial Emphasis. For Scenario Three – Residential Emphasis, the interchange system performed at unacceptable levels (LOS E). However, with reasonable mitigation measures it performed at LOS C.[12] The northern section of the AUAR area, along 80th Street and the bypass, also showed high traffic volumes and intersections projected to operate over-capacity under the assumed lane geometry.

Table 21-5 displays the overall Level of Service for all of the analyzed intersections for the three land use scenarios for 2030 build-out and post 2030 build-out conditions. Table 21-6 displays the LOS for each of the turning movements for the 2030 build-out conditions. The intersection traffic volumes for the full development of the scenarios (post 2030) resulted in severe congestion for virtually all turning movements and therefore is not shown in the table.

[12] In Development Scenario 3 – Residential Emphasis, the intersections of the I-35E ramps with CSAH 14 each operated at LOS E during the PM Peak hour of traffic. The mitigation measures enabled the movement, and the overall intersection of the west juncture of I-35E/CSAH 14 to operate at LOS D. The mitigation measures include the provision of an additional through lane for each direction of travel (6-lane cross-section), and an additional westbound left-turn lane (dual lefts). At the east juncture of the I-35E/CSAH 14 intersection, additional through lanes allowed for the through travel movement to operate at LOS D, and the entire intersection, a LOS C.

Intersection	Land Use #1	Land Use #2 2030 Scenarios	Land Use #3	Land Use #1 Land Use #2 Land Use #3 Post 2030 Full-Build Scenarios
CR 140 (80th Street East)				
80th Street at I-35W (west ramps)	B	C	D	E **F** **F**
80th Street at I-35W (east ramps)	**F**	**F**	**F**	**F F F**
80th Street at CSAH 21	E	**F**	**F**	**F F F**
80th Street at I-35E (west ramps)	B	D	E	E **F F**
80th Street at I-35E (east ramps)	E	D	D	**F F F**
80th Street at Elmcrest Avenue	B	**F**	**F**	E **F F**
CSAH 14 (Main Street)				
CSAH 14 at CSAH 21 (Centerville Rd.)	B	B	B	E E E
CSAH 14 at CSAH 21	C	D	E	**F F F**
CSAH 14 at 21st Ave. N.	B	B	B	E E E
CSAH 14 at I-35E (west ramps)	C	C	E	**F F F**
CSAH 14 at I-35E (east ramps)	D	D	E	E E **F**
CSAH 14 at Otter Lake Road	**F**	**F**	**F**	**F F F**
CSAH 21 (20th Avenue North)				
CSAH 21 at North Crossroad	D	E	E	**F F F**
CSAH 21 at Middle Crossroad	B	C	D	E **F F**
CSAH 21 at South Crossroad	B	B	C	E E **F**
CR 54 South of CSAH 14				
CR 54 at Center Street	B	B	B	E E E
CR 54 at Ceder Street	B	B	B	E E E
CR 54 at South Crossroad	B	B	B	E E E
CR 54 at Birch Street	B	B	B	E E E

SOURCE: URS Corporation. R:\31809732\Synchro\AUAR Analysis\Excel\[LOS Summary.xls]Overall LOS

Table 21-6. Intersection Turning Movement LOS For 2030 Build Scenarios

	Land Use	EASTBOUND			WESTBOUND			NORTHBOUND			SOUTHBOUND		
Intersection	Scenario	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
80th Street E. (CR 140)													
80th Street at I-35W (west ramps)	1		E	C	A	A					E		A
	2		F	C	B	A					D		A
	3		F	C	B	A					F		A
80th Street at I-35W (east ramps)	1	F	A			F	B	D		F			
	2	F	A			F	B	C		F			
	3	F	A			F	A	C		F			
80th Street at CSAH 21	1	E	C	F	F	D	B	F	C	A	E	E	C
	2	F	F	F	F	F	C	F	D	D	F	E	A
	3	E	D	F	F	C	A	F	E	D	F	E	A
80th Street at I-35E (west ramps)	1		B	A	C	B					B		C
	2		E	B	D	A					C		F
	3		E	A	F	D					D		F
80th Street at I-35E (east ramps)	1	F	A			E	A	D		F			
	2	D	A			D	A	E		D			
	3	F	A			E	A	F		E			
80th Street at Elmcrest Avenue	1		B	A	E	B		B		D			
	2	F	B	A	F	C	A	F	C	F	E	C	F
	3	F	A	A	F	C	A	F	E	F	F	E	F
CSAH 14 (Main Street)													
CSAH 14 at CR 21 (Centerville Rd.)	1		C	A	C	A		C		A			
	2		C	A	C	A		B		A			
	3		C	A	C	A		B		A			
CSAH 14 at CSAH 21	1	F	E	C	C	D	D	E	E	A	E	E	B
	2	F	D	B	D	C	D	D	E	B	E	D	A
	3	F	E	B	D	C	F	E	F	C	F	D	A
CSAH 14 at 21st Avenue North	1	B	A	B		A	A			B		A	B
	2	B	A	B		A	A			B		A	B
	3	B	A	B		A	A			B		A	B
CSAH 14 at I-35E (west ramps)	1		A	A	E	B		D		E	D	D	D
	2		A	A	E	B		D		E	D	D	D
	3		A	A	E	D		D		F	D	D	F
CSAH 14 at I-35E (east ramps)	1	E	B			B	C	E		C			
	2	E	B			B	C	E		C			
	3	E	C			C	C	E		D			
CSAH 14 at Otter Lake Road	1	F	A	A	E	C	A	F	B	A	D	C	F
	2	F	B	A	E	E	A	F	B	A	D	B	F
	3	F	B	A	E	F	A	F	B	A	D	B	F
CSAH 21 (20th Avenue North)													
CSAH 21 at North Crossroad	1	A	A	A	B	B	F	A	B	A	F	B	A
	2	A	A	A	B	B	D	A	C	A	F	A	A
	3	A	A	A	E	E	D	A	A	A	F	A	A
CSAH 21 at Middle Crossroad	1	C	B	B	C	D	C	A	A	A	D	A	A
	2	C	B	B	C	C	D	A	A	A	F	D	A
	3	E	D	C	D	D	D	A	A	A	F	A	A
CSAH 21 at South Crossroad	1	C		A	C	C	C	A	A	A	D	A	A
	2	B	B	A	B	B	B	A	A	A	B	A	A
	3	E	E	B	E	E	E	A	A	A	F	A	A
CR 54 South of CSAH 14													
CR 54 at Center Street	1	A	A	A	A	A	A	A	A	A	A	A	A
	2	A	B	A	B	B	A	A	A	A	A	A	A
	3	A	A	A	A	B	A	A	A	A	A	A	A
CR 54 at Cedar Street	1	A	A	A	A	A	A	A	A	A	A	A	A
	2	A	B	A	B	B	A	A	A	A	A	A	A
	3	A	A	A	A	B	A	A	A	A	A	A	A
CR 54 at South Crossroad	1	A	A	A	A	A	A	A	A	A	A	A	A
	2	A	B	A	B	B	A	A	A	A	A	A	A
	3	A	A	A	A	B	A	A	A	A	A	A	A
CR 54 at Birch Street	1	A	A	A	A	A	A	A	A	A	A	A	A
	2	A	B	A	B	B	A	A	A	A	A	A	A
	3	A	A	A	A	B	A	A	A	A	A	A	A

SOURCE: URS Corporation.

Regional System Impacts

I-35E and I-35W, the principal arterials serving the site currently operate at a LOS of C.[13] Without any expansion of the freeways, which are currently 4-lanes, the LOS is projected to drop to "E" or worse at every location. Table 21-7 displays the future LOS for each of the three 2030 scenarios.

Table 21-7. Level of Service for Regional Roadways

Roadway/Location	2003 Conditions ADT	2003 Conditions LOS	2030 Scenario 1 Daily Traffic	2030 Scenario 1 LOS	2030 Scenario 2 Daily Traffic	2030 Scenario 2 LOS	2030 Scenario 3 Daily Traffic	2030 Scenario 3 LOS
I-35W								
North of Bypass	35,500	C	68,600	E	76,600	E	78,500	F
South of Bypass	35,500	C	84,500	F	94,400	F	96,800	F
I-35E								
North of CR 140 (80th Street East)	39,500	C	95,600	F	106,600	F	109,200	F
Between CR 140 and CSAH 14	39,500	C	107,300	F	120,200	F	123,300	F
South of CSAH 14	46,500	C	108,300	F	121,000	F	124,000	F

R:\31809732\Synchro\AUAR Analysis\Excel\[LOS Summary.xls]Regional LOS

Source: URS Corporation.

Seasonal Traffic Impacts

As I-35E is a gateway to many popular recreational destinations north of the Twin Cities, there is a marked increase in traffic during the summer months. Recreational peak periods occur particularly on Fridays and Sundays and can result in significant traffic increases during these travel periods. While widening the Interstate and the CSAH 14 interchange could likely address this in traffic, it would likely not be very cost-effective as the system would operate well below capacity for the majority of the year.

MITIGATION SUMMARY

The proposed developments will increase traffic on roadways within, and adjacent to the AUAR area. Mitigation will include adding traffic signals and turn lanes and widening roads as necessary during the various stages of development. In general, Scenario One had the least impact on traffic congestion with two intersections performing at LOS F, without mitigation. Scenario Two had four intersections and Scenario Three had six intersections operating at LOS F, respectively. With reasonable mitigation measures all the intersections in Scenarios One and Two were able to operate at LOS E or better.[14] Even with reasonable mitigation measures, Scenario Three, which has a residential emphasis, still had intersections performing at LOS F. These include the east ramps at the proposed Northerly Bypass/I-35W interchange, and the intersection of CSAH 14 and Otter Lake Road.

To mitigate the impact of the additional traffic on the on the regional system, specifically Interstates 35W and 35E, each would need to be reconstructed to provide a six-lane cross-section.

It should be noted that it was determined that an expansion will be necessary even without the land use scenarios used in this analysis. As the interstates serve a much larger area, the projected growth of the entire Twin Cities region should warrant expansion by the year 2030. Right of way

[13] The generalized daily traffic capacity threshold for a 4-lane freeway is A: <15,800, B: < 33,600, C: 50,400 D:
64,400, and E: 78,100. Source: I-94 IRC Study, May 2002 URS Corporation.
[14] Reasonable mitigation measures are of the types that have been implemented elsewhere in the region. Examples
include dual right-turn and left-turn lanes. Triple turn lanes were not deemed to be reasonable and therefore were
not employed.

should be preserved within the AUAR study area, especially along I-35E, to accommodate future expansion projects that would help mitigate projected future year traffic levels.

As future growth occurs, alternative modes of transportation may be needed to maintain the area's mobility. These modes may include express bus service, buses operating on exclusive right-of-way (busways), or commuter rail. All three of these modes were looked at in the transit study conducted in 2001 by the Rush Line Corridor Task Forces. The general alignment proposed for the Rush Line is adjacent to TH 61 in Washington County, or within 2-miles AUAR Study Area. Opportunities should be explored to provide a link to this system as it is being developed.

Pedestrian and bicycle paths are another way to improve mobility within and to the study area. It is recommended ***any*** roadway improvements in the AUAR area that are being planned should include provisions for the addition of pedestrian / bicycle facilities. These facilities should ideally be at least 10 feet wide and separated from the highway shoulder by a minimum of 20 feet.

Figures 21-8, 21-9, and 21-10 display the intersection LOS for each of the scenarios and also display the mitigation measures that were identified to address the deficiencies.

Traffic Impacts without the Northerly Bypass

An analysis was conducted to determine the impact on traffic without the Northerly Bypass and interchange at I-35W on the operation of traffic. Using the Anoka County Version of the Metropolitan Council Travel Demand Model, the traffic generated by Scenario One – Comprehensive Plan, was distributed to the roadway network, excluding the proposed Northerly Bypass. In general, the traffic decreased on the interstates, and increased substantially on the arterial and collectors. Traffic on CSAH 14 (Main Street) east of Centerville Road increased by nearly 16,000, while large increases were also recorded along many other roadways. Figure 2111 presents the distribution and assignment of traffic onto the transportation system without the Northerly Bypass. With the increase in traffic, intersections, which were operating at acceptable Levels of Service, are now projected to need mitigation measures. One such intersection is CSAH 14 at CSAH 21 (Centerville Road). In general, the lack of the Bypass puts considerable strain on CSAH 14 and its intersections with the west leg of CSAH 21 (Centerville Road) and at the east leg (20th Avenue North). Figure 21-12 presents the LOS and mitigation measures recommended for the Scenario One, without the Northerly Bypass.

Traffic Noise

City and county roads outside of Minneapolis and St. Paul are exempt from the State Noise Standards. CSAH 21 and 80TH Street are exempt from the State Noise Standards, but I-35E is not
exempt from the State Noise Standards. However, this rule is generally applied to roadway projects, and relates to the fact that is virtually impossible to provide noise mitigation to roadways that have occasional access points that would prohibit the effectiveness of noise barriers.

Minnesota Rule, 7030.0030 NOISE CONTROL REQUIREMENT, states in part that:

> *Any municipality having authority to regulate land use shall take all reasonable measures within its jurisdiction to prevent the establishment of land use activities listed in noise area classification (NAC) 1, 2, or 3 in any location where the standards established in part 7030.0040 will be violated immediately upon establishment of the land use.*

This is accounted for with mitigation for this noise analysis, presented toward the end of this noise section of the AUAR.

Noise Description

Noise is defined as any unwanted sound. Sound travels in a wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels. Decibels (dB) represent the logarithmic increase in sound energy relative to a reference energy level. A sound increase of 3 dB is barely perceptible to the human ear, a 5 dB increase is clearly noticeable, and a 10 dB increase is heard twice as loud. For example, if the sound energy is doubled (e.g. the amount of traffic doubles), there is a 3 dB increase in noise, which is just barely noticeable to most people. On the other hand, if traffic increases to where there is 10 times the sound energy level over a reference level, then there is a 10 dB increase and it is heard twice as loud.

For highway traffic noise, an adjustment, or weighting, of the high- and low-pitched sounds is made to approximate the way that an average person hears sounds. The adjusted sound levels are stated in units of " A-weighted decibels" (dBA). In Minnesota, traffic noise impacts are evaluated by measuring and/or modeling the traffic noise levels that are exceeded 10 % and 50% of the time during the hour of the day and/or night that has the heaviest traffic. These numbers are identified as the L_{10} and L_{50} levels. The L_{10} value is compared to FHWA noise abatement criteria.

The following chart provides a rough comparison of the noise levels of some common noise sources. (Source: "A Guide to Noise Control in Minnesota," Minnesota Pollution Control Agency, http://www.pca.state.mn.us/programs/pubs/noise.pdf and "Highway Traffic Noise," FHWA, http://www.fhwa.dot.gov/environment/htnoise.htm)

<u>**Sound Pressure Level (dBA)**</u> <u>**Noise Source**</u>

140 ----------------------------- Jet Engine (at 25 meters)

130 ----------------------------- Jet Aircraft (at 100 meters)

120 ----------------------------- Rock and Roll Concert

110 ----------------------------- Pneumatic Chipper

100 ----------------------------- Jointer/Planer

90 ----------------------------- Chainsaw

80 ----------------------------- Heavy Truck Traffic

70 ----------------------------- Business Office

60 ----------------------------- Conversational Speech

50 ----------------------------- Library

40 ----------------------------- Bedroom

30 ----------------------------- Secluded Woods

20 ----------------------------- Whisper

AUAR Traffic Noise Analysis

Sensitive Noise Receptors

The analysis was conducted using three (3) receptor sites located in the study area. The general geographic location of the three sites, shown on Figure 21-13, are:

- Site 1 – West of CSAH 21, midway between 80th Street E and CSAH 14
- Site 2 – Southwest Quadrant of I-35E/80th Street E.
- Site 3 - Northeast Quadrant of I-35E/80th Street E.

Receptor locations have been placed 200 feet from the centerline of each of these nearest roadways for purposes of this noise analysis. Note that each of the sensitive noise receivers are included as a part of this study, and can be properly designed to accommodate noise impacts as the development is defined in more detail.

Methodology and Assumptions

Existing (2004) and future (2030) noise levels were projected using the FHWA noise prediction model STAMINA 2.0, as modified for use by Mn/DOT and the MPCA. Noise projections were based on 2004 traffic counts, and anticipated 2030 forecast peak-hour daily traffic volumes, vehicle speeds, mix of vehicles, roadway grades, and the distance from the roadway centerline to the receptor. Existing and anticipated future Average Daily Traffic (ADT) is provided in the traffic impact section of this report. The specific modeling locations are summarized in Table 21-8.

Table 21-8. Existing(2004) and Future (2030) Daily Traffic by Receptor Location

Scenario	Average Daily Traffic by Receptor Location: Adjacent to CSAH 21, at Receptor 1	Adjacent to I-35E, near Receptor 2	Adjacent to CSAH 21, at Receptor 3
Existing	1,500	39,500	1,100
2030 No-Build	7,900	91,700	7,200
2030 Build (Scenario 3)	35,200	123,300	47,100

The following assumptions were used in modeling the project noise levels:

Vehicle Speeds CSAH 21: 45 mph (near receptor 1)
I-35E: 65 mph (near receptor 2)
CR 140: 45 mph (near receptor 3)

Vehicle Mix 95% automobiles and light trucks
3% medium trucks
2% heavy trucks

Ground Cover soft ground *Time Period* Daytime peak hour: 10% of ADT

The analysis found that there will be considerable increase in noise levels at the three locations over current levels. Table 21-9 presents these increases by location, and by Scenario including the base year (2004), the 2030 No-Build Scenario using Met Council's Land Use Scenario, and 2030 AUAR Scenario 3. All of the receptors analyzed exceed the State Noise Standards the Year

2030 for the Build Scenario. It is not uncommon for noise levels to exceed the State Noise Standards at sensitive noise receivers adjacent to major roadways similar to those in the project area. Therefore, noise abatement measures should be considered for all of the receptors.

Table 21-9. Existing and Predicted Daytime Noise Levels (dBA)

Daytime Noise Levels (7:00 a.m. - 10:00 p.m.)

	Existing		No Build		Build		Increase (No Build - Build)	
Receptor	L10	L50	L10	L50	L10	L50	L10	L50
1	54	45	62	55	67	63	6	8
2	72	68	75	72	76	73	1	2
3	53	43	61	55	68	65	7	10
State Standards	65	60	65	60	65	60	65	60

SOURCE: URS Corporation.

Since the noise levels exceed the State Noise Standards, noise mitigation has been considered as described below.

MITIGATION SUMMARY

Site plans for future developments should include measures such as appropriate setback distances, earthen berms, noise walls, and appropriate site design (such as outdoor activity areas being developed away from major noise sources). Each of these items should be considered on a case-by-case basis.

APPENDIX D.1: PRE-DEVELOPMENT HYDROLOGIC ANALYSIS

The stormwater analysis of the AUAR area for pre-development conditions (AUAR Figure 10-1) began by establishing 30 potential development zones (Figure D.1-1). These zones are in areas that are not within the FEMA 100-year floodplain boundary or do not contain high priority natural resources. Hydrologic modeling was done using XP-SWMM Version 9 and TR-55 methodology (Table D.1-1).

Runoff Curve Numbers (CNs) used in hydrologic analyses in support of the AUAR were chosen based on the following assumptions and rationale:

- Models were designed to simulate wet periods, such as early to mid-spring when flooding problems tend to be more severe;
- Concern was taken to not under-estimate CNs to prevent their use by development applicants to under-represent proposed runoff flow rates and volumes in on-site areas. This is particularly significant in regards to wetland and wet prairie curve numbers, as in some cases a large portion of a given development zone is recommended to be allocated to SMAs;
- Concern was taken to not under-estimate CNs to prevent their use by development applicants to under-represent off-site runoff flow rates and volumes being conveyed in drainageways within the applicant's site. This is particularly true of estimates of agricultural CNs, as off-site areas will likely be under agricultural land uses during development;
- AES conducted multiple field reviews to substantiate chosen CNs;

Runoff curve numbers used throughout this study are not to be used as regulatory parameters. *Rice Creek Watershed District Rules* has established runoff curve numbers recommended for individual site development, and they are the definitive land cover parameters for characterizing pre- and post-development stormwater runoff.

Table D.1-1. Pre-Development Curve Number Key: Hydrologic Soil Group C Land Use Curve Number

Saturated Soil 100 Agriculture: Row Crops 85 Agriculture: Hay/Alfalfa 71 Upland Grasslands 71 Wet Prairie 86 Forest 73 Developed: 0-25% Impervious 77 Developed: 25-50% Impervious 83 Developed: 50-75% Impervious 90 Developed: 75-100% Impervious 94

Composite curve numbers were generated for each potential development zone (Table D.1-2).

Table D.1-2. Pre-Development Composite Curve Numbers Potential Tributary Area Runoff Release Rate (cfs) Development Zone (acres) Q_1 Q_{10} Q_{100}

Potential Development Zone	Tributary Area (acres)	Composite Curve Number
A	6.62	73
C	48.69	78

Q-TD	276.53	224.7	527.4	830.0
R-FR	192.53	111.7	281.0	454.7
R-TD	32.80	45.5	98.4	149.9
S-TD	49.99	23.8	63.8	105.6
T-FR	71.97	88.1	186.0	280.8
U-FR	123.36	95.8	238.9	384.6
V-FR	190.14	86.1	183.1	277.7
V-TD	29.40	93.5	212.6	330.4
W-FR	13.32	17.9	37.9	57.3
W-TD	257.26	288.5	573.8	847.7
X-FR	39.28	51.7	103.6	153.5
Y-FR	59.40	122.6	252.6	377.8
Y-TD	30.10	67.6	132.2	194.2
Z-FR	48.72	59.6	144.9	231.1
AA-FR	26.24	54.0	111.3	166.5
AA-TD	51.70	81.6	170.6	256.5
BB-FR	15.66	31.0	64.5	97.4

BB-TD	5.50	10.9	22.6	34.1
CC-FR	56.73	83.4	181.1	276.4
CC-TD	11.60	20.8	46.2	71.0
DD-FR	4.24	7.9	16.8	25.6

Notes: FR = free outfall

TD = tile-drained

Q_1 = 1-Year Event

Q_{10} = 10-Year Event

Q_{100} = 100-Year Event

Computer models were created to simulate the hydraulics of conceptual SMAs. Outlets for each SMA were designed to maintain proposed conditions runoff release rates below existing conditions runoff release rates for rainfall events of 1-, 10-, and 100-Year recurrence intervals (Table D.2-4). The regulatory maximum site release rates for proposed conditions are based on the lesser of the existing tile system capacity or the *Rice Creek Watershed District Rules*. Rating curves were input to simulate three-stage outlets for detention of these rainfall events. Outlets for the 1-, 10-, and 100-Year rainfall events had invert elevations at SMA depths of 0.75-, 1.25-, and 2.5-feet, respectively.

Table D.2-4. Scenario 2: Attenuated Runoff Release Rates

Potential Tributary Area Runoff Release Rate (cfs) Development Zone (acres) Q_1 Q_{10} Q_{100}

A-FR	6.62	2.9	12.5	19.0
C-FR	48.69	37.0	99.1	146.8
D-FR	36.98	18.8	70.5	105.8
E-FR	38.16	47.5	89.4	118.8
E-TD	53.50	1.4	2.9	4.4
F-FR	44.12	56.1	115.0	159.5
G-FR	46.04	20.8	75.2	115.2
H-FR	52.07	25.6	94.4	144.4
I-FR	64.10	45.9	119.3	191.0
I-TD	16.90	0.4	0.8	1.2
J-FR	16.17	6.9	24.1	44.9
K-FR	73.60	16.8	52.2	77.7
L-FR	63.87	13.9	52.0	75.0

STORMWATER MANAGEMENT AREA SIZE REQUIREMENTS

SMA sizing criteria provided a basis for defining recommended surface area for stormwater management for each potential development zone (Table D.2-6). Each SMA was assumed to be rectangular, and sized for a 100-year water surface fluctuation of 2.5 feet with 0.75 feet of freeboard. Side slopes were designed with a horizontal to vertical ratio of 6:1. Iterations were conducted to increase the 100-Year SMA depth to 2.5 feet to minimize the amount of SMA surface area needed for stormwater management. Potential infiltration in each SMA was not included in the optimization of SMA surface area, adding to the conservative nature of the surface areas recommended in Figure 17-3. The hydraulic characteristics of the SMAs will support native wetland vegetation. In general, tile-drained potential development zones with commercial and industrial land uses require the most surface area for stormwater management (Figure 17-3).

Table D.2-6. Scenario 2: Recommended Surface Area for Stormwater Management

100-Year Runoff

Potential Development Zone	Pre-Development Conditions (cfs)	Unattenuated Scenario 2 (cfs)	Recommended SMA Area (acres)
A-FR	23.0	28.3	0.13
C-FR	148.0	194.9	1.09
D-FR	110.0	155.5	1.09
E-FR	121.6	195.4	1.51
E-TD	4.5	299.9	10.29
F-FR	165.0	203.8	0.99
G-FR	118.0	167.8	1.20
H-FR	145.0	227.7	1.61
I-FR	190.7	201.0	0.00
I-TD	1.4	99.3	2.60
J-FR	67.0	53.0	0.00
K-FR	84.0	100.2	2.13
L-FR	75.0	279.3	3.37
L-TD	4.0	316.4	7.35
M-FR	176.8	759.9	12.32
M-TD	2.7	147.8	4.29
N-FR	29.0	41.0	0.57
O-FR	94.4	136.1	0.83
O-TD	1.8	167.3	4.19
Q-TD	23.2	830.0	35.54
R-FR	412.7	454.7	2.00
R-TD	2.8	149.9	4.90
S-TD	4.2	105.6	5.50
T-FR	198.0	280.8	1.75
U-FR	376.0	384.6	0.75
V-FR	196.6	277.7	36.80
V-TD	2.5	330.4	2.65
W-FR	32.8	57.3	8.26
W-TD	21.6	847.7	11.51
X-FR	103.0	153.5	1.72