DPSA 8-12 / SNOWFLAKE SITE ADDITIONAL INFORMATION REQUESTED BY THE TEP 5-2-16

Why don't on-site concepts show more development deeper into the site? You have 140 acres to work with.

There are several reasons for this:

1. Currently, the purchaser of land, dba Pacific Education Partners, is obligated to preserve as much of the current Snowflake Nordic operations as possible for a period of up to five years. Pushing the development into the core of the 140 acres and away from Rice Lake Road will impact more important ski trails than if the development is constructed closer to Rice Lake Road, as currently proposed. I initially had the perception that a ski trail was a ski trail. I was later informed by the leadership at Snowflake Nordic that each trail has a specific purpose and there are topographic and distance characteristics that make each trail unique. Without these unique characteristics, they will be less attractive as a ski center and they fear losing the funding that comes from different schools to use their site. In other words, if too many trails at Snowflake are destroyed, members and other schools will no longer use the facility.
2. The topography steepens dramatically as you move into the site. There is more exposed bedrock and more scattered high quality wetlands. While we have not determined exactly how many wetlands would be impacted if we moved the development deeper into the site, we know it would possible meet or exceed the current proposed impacts. In addition, the wetlands deeper into the site are the wetlands of higher quality compared to the wetlands proposed to be impacted as part of the existing proposal.
3. Habitat fragmentation would be exacerbated if we pushed the development further into the site. Roads would have to be lengthened to reach the development site, and there would be a forested edge on four sides of the development versus just three sides (Rice Lake Road is not a forested edge in terms of habitat). The more exposed forest edge, the more chance of non-native plant and animal intrusion. Such is the case with nest raiding cowbirds, which interfere with neotropical migrant hatchlings on disturbed forest edges.

Why not construct a parking ramp?

1. Charter schools receive per pupil financing from the Minnesota Department of Education. That funding amounts to about $0.35 on the dollar to what levied schools receive. The projected number of students frames the amount of income, and therefore the bond amount that can be attained. The bond amount dictates the construction budget. Parking ramps are extremely expensive. Where a surface parking lot might cost $700 per stall, a parking ramp can cost $3000 per stall.
2. Even with a parking ramp, the space currently proposed for surface parking would have to be occupied by the ramp. After the first level of parking and part of the second level, the relative loss of the surface parking proposal would be equalized, then additional levels would be required to accommodate the remainder of the parking. The current zoning has a height

limitation of only 30', so the benefit to a parking ramp by attaining efficiency with greater height, cannot be realized.

Why not construct the school next to the jail?

1. The attached letter from the DPSA Head of Schools Bonnie Jorgenson notes the reason for not selecting a school site next to a jail.
2. None of the consulting team was willing to advocate for a school site next to a jail. Even though the chance of an issue between inmates and students is probably small, if there was an issue, it would be a monumental disaster. As a matter of self preservation and/or common sense, nobody with DPSA or the design team was willing to take any unnecessary chance with a child's well being, no matter how small the chance.

How is storm water going to be treated?

Attached is the most recent storm water plan with associated grading. All of the storm water will be treated below ground. An underground corrugated metal pipe storage system is proposed; although a tire derived aggregate system is being evaluated pursuant to MPCA input. In either case, the systems work in similar ways, storing volumes of storm water underground and releasing that water slowly.

How are you dealing with freshwater seeps from the hillside?

All subsurface and surface water that runs down the hill toward the track and field will be collected with subdrains that bi-pass storm water treatment and go directly back into the wetlands along Rice Lake Road. The rate of this discharge will be controlled by a bed of rock beneath the track and careful sizing of the subdrain outlet.

Storm water that runs into the proposed County backage road will be treated in much the same way, whether the County constructs the road or it remains a private enterprise. That has yet to be determined

Why is the County backage road located where it is and not closer to Rice Lake Road?

1. The County has directed the position of the road. The curve speeds and stacking distance against Rice Lake Road are two major considerations in the alignment of the road. If the road were located on the south side of the school, there would not be enough vehicle stacking ahead of Rice Lake Road. The current design runs that stacking up gradient to the north and perpendicular to Rice Lake Road.
2. A 30 mph curve, which is the County minimum for this application, is too large of a radius of curvature to come off of Rice Lake Road and arc east toward the school. There is also the complication of the existing driveway that leads to Arrowhead tennis.
3. Having a 30mph 36' wide public road run past the front of a new high school is not an ideal situation when busses are pulled of to the side loading children.

Where is the traffic study?

It is attached.

Why did you show the old Duluth Armory as a potential off site candidate if it is not a viable option?

We feel that it is important to frame the conversation about wetland impact. The subject of adaptive reuse comes from not only City planning but from citizens concerned about the impacts to wetlands and forest. The Duluth Armory is one of the first available sites re-evaluated as part of this process, even though it was quickly dismissed due to a lack of available programmable green space, lack of parking and potential for environmental remediation issues.

Duluth Edison Charter Schools
Your K-8 Schools of Choice

NORTH STAR ACADEMY: K-8
3301 Technology Drive
Duluth, MN 55811
Ph: (218) 728-9556
Fax: (218) 728-2075

RALEIGH ACADEMY: K-5
5905 Raleigh Street
Duluth, MN 55807
Ph: (218) 628-0697
Fax: (218) 628-2264

May 5, 2016

To Whom It May Concern:

It is the practice of the Duluth Public Schools Acdemy, Tischer Creek Duluth Building Company and school administration to put safety of students at the forefront of our decision making. We strive for academic excellence and the safety of our students.

Part of creating a safe learning environment is to seek out sites for our facilities that will have adjacent land uses that are compatible with school operations. Our administration has informed our site selection contractors, and also our participating design team, that locating a school next to a County Jail or other penal / correctional facilities is not a compatible land use with a high school or any of our educational facilities.

It is for this reason that we were not able to utilize the land that was available on the northeast corner of Haines Road and Arrowhead road in Duluth, MN. This land was shown as an off-site option on the wetland permit application because it was one of the sites we evaluated and members of the public must be informed of this process."

Sincerely,

Bonnie Jorgenson, Head of School
Crystal Palmer, School Board President
Paul Goossens, President, Tischer Creek Duluth Building Company

Northland
Consulting Engineers L.L.P.
Structural, Civil and Forensic Engineering
102 South 21st Ave. West, Duluth, MN 55806
(V)218-727-5995, (F)218-727-7779

Preliminary Drainage Report Summary – Duluth Public Schools Academy (DPSA) 8-12

Amended (5/5/16)

DPSA is in the process of completing a design for a new high school on newly acquired property along Rice Lake Road. The existing property was home to Snowflake Nordic Ski Center with an extensive trail system, a chalet and a few storage buildings. Almost the entire site is wooded minus the areas used for skiing. The proposed location of the high school will be in the south west corner of the property east of the Arrowhead Tennis Center.

Existing Site Drainage Conditions

The proposed site layout sits on multiple lots. The future property line to accommodate the new school will be approximately 16.92 acres. This will act as our project area when comparing existing to proposed. On the existing site there is only 26,455 SF of impervious or 0.61 acres. As stated above, a vast majority of the site is wooded aside from the areas that have been cleared of trees for the cross country ski activities. All runoff from the site flows south towards Rice Lake Road. Topography across the site varies from steep hillsides to flat areas including wetlands. On the site there are multiple wetlands that collect runoff and allow storage. All flow from the wetlands continues south to the ditch along Rice Lake Road. Once it crosses Rice Lake road through various culverts, it reaches a tributary of Chester Creek and is carried to Lake Superior.

Post-Construction Site Drainage Conditions

The post-construction site will consist of new school building, various parking lots, track/field surface and (2) smaller structures to service the field venue. The topography of the site will change leaving the parking and building on a level area constructed into the hillside. The post construction site will have approximately 8.19 acres of impervious, which adds 7.58 acres of impervious area. It should be noted that the runoff from the county road surrounding the site has not be accounted for in this design. It is the responsibility of the county to design the storm water collection and treatment system.

Site Area Breakdown

	Pre-Development		Post-Development	
	Area (SF)	% of Total Site	Area (SF)	% of Total Site
Total Site Area	736,941	100%	736,941	100%
Impervious Area	26,445	4%	356,769	48%
-Bit./Conc.	5,000	1%	222,143	30%
-Gravel	17,515	2%	0	0%
-Roof	3,930	1%	69,260	9%
-Track Surface	0	0%	65,366	9%

Pervious Area	710,496	96%	380,172	52%
-Grass	0	0%	293,309	40%
-Athletic Turf	0	0%	86,863	12%
-Woods	710,496	96%	0	0%
Disturbed Area	0	0%	736,941	100%

The site and storm water design has been designed to meet the requirements of the City of Duluth UDC and Engineering Guidelines. Prior to the issuance if building permits, an MS4 Statement of Compliance will be issued when the storm water management plan is approved. The system will include discharge, sediment reduction, temperature and volume controls. The storm water conveyance and treatment system will be owned and operated privately. The Certificate of Occupancy will be issued after the record drawings for the storm water management BMPs has been delivered to the City. The owner will be required to inspect and maintain the system to ensure it is functioning properly and correct all deficiencies should there be any. A storm water BMP operations and maintenance manual will be included in the final storm water report. This will direct the owner of the property on how and when to inspect and clean the systems on site.

The site runoff will need to be attenuated and treated extensively, because of the nature of the existing site. With much of the existing site being wooded and wetlands, the addition of 7.5+ impervious acres will produce a significant increase on the amount of site runoff. The UDC states that for sites above the "Bluff Line" that post-construction flows are reduced to 90% of the existing flow for the 2 year storm and 75% of the existing flows for the 10 and 100 year storms. Substantial reductions in the time of concentrations are anticipated and will be accounted for in the design. The site runoff, especially from the parking lots and buildings, will be collected by various inlets across the site and piped to underground storage systems. Any runoff that flows toward the track will be collected in a perimeter drain. Rainfall directly on the track and field surface will be collected and attenuated in a sand/underdrain section beneath the turf surface. All the underdrains will then flow to a header pipe and be discharged into the hillside.

Preliminary Site Discharge Peak Flow Rates

Storm Event	Existing Runoff Rate (cfs)	Proposed Runoff Rate (cfs)	Reduction in Runoff Rate (cfs)	Reduction in Runoff Rate (%)
WQ Storm	0.02	0.98	+0.96	-
2-yr	5.63	5.07	0.56	10%
10-yr	15.12	10.75	4.37	29%
100-yr	42.70	27.58	15.12	35%

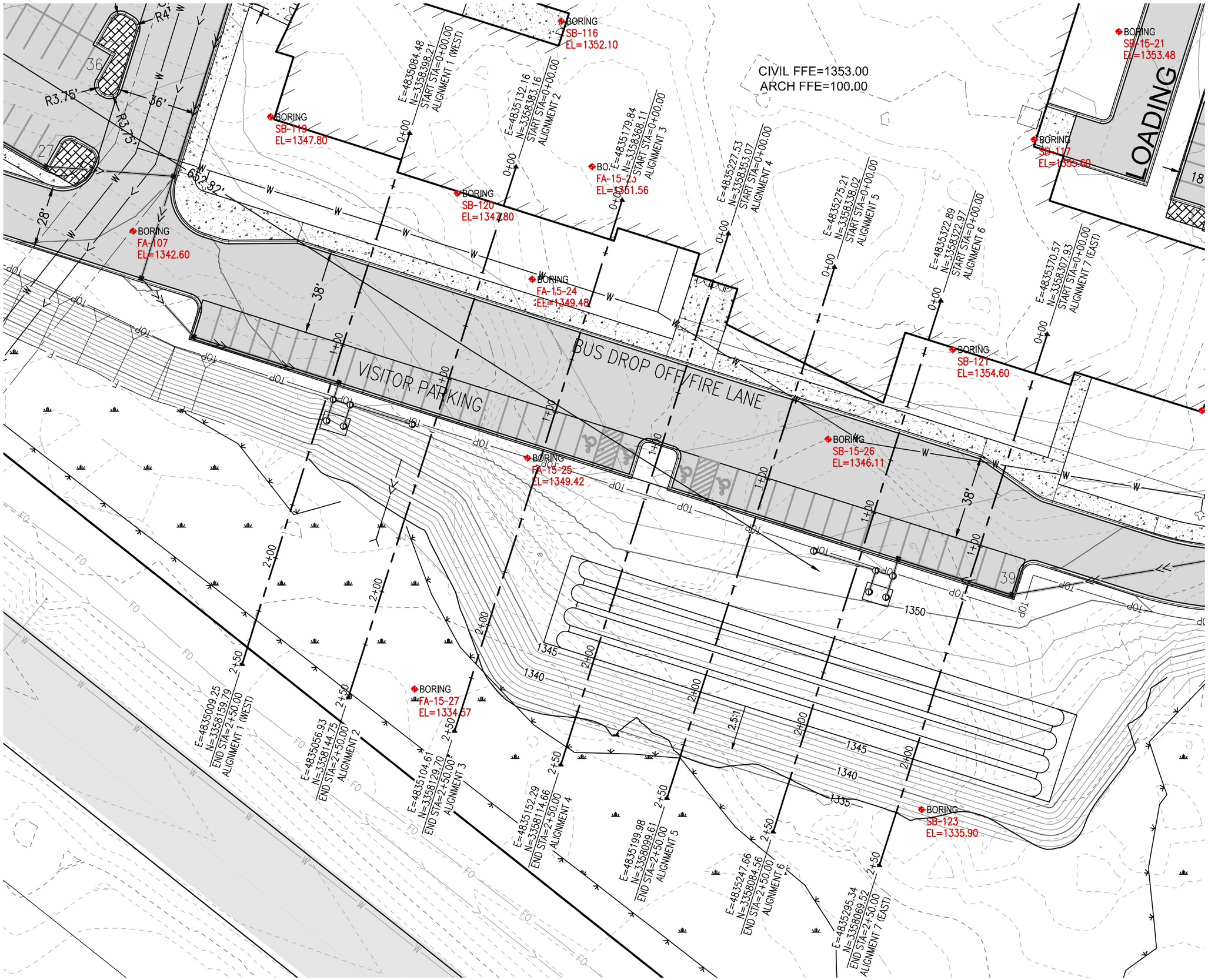
As shown on the attached exhibits, there will be two main treatment areas based on the grading of the site. The systems will be comprised of large diameter perforated CMP pipes with storage capacity on the porous bedding. The preliminary design has the south storage system designed with 96" diameter pipe

and the north system designed with 48" diameter pipe. All of the bituminous runoff will be conveyed through sediment treatment chambers to remove Total Suspended Solids (TSS) before entering the underground storage. The underground storage will allow the storm water to be attenuated and released at the reduced rates required by the City of Duluth's UDC.

The developer reserves the right to explore other possible treatment and storage solutions that meet the requirements of the City of Duluth, MPCA, and the MNDNR.

Discharging to wetlands and sensitive trout stream environments, such as tributaries of Chester Creek, require additional consideration for temperature controls. By treating and attenuating the site runoff underground, it will have a chance to cool before being released downstream.

All runoff from the post construction site will continue to flow into the same Chester Creek tributary on the south side of Rice Lake Rd. The runoff rates will be reduced and the sediment will be removed to the levels required within the UDC. Once in Chester Creek it will flow downstream and discharge into Lake Superior.



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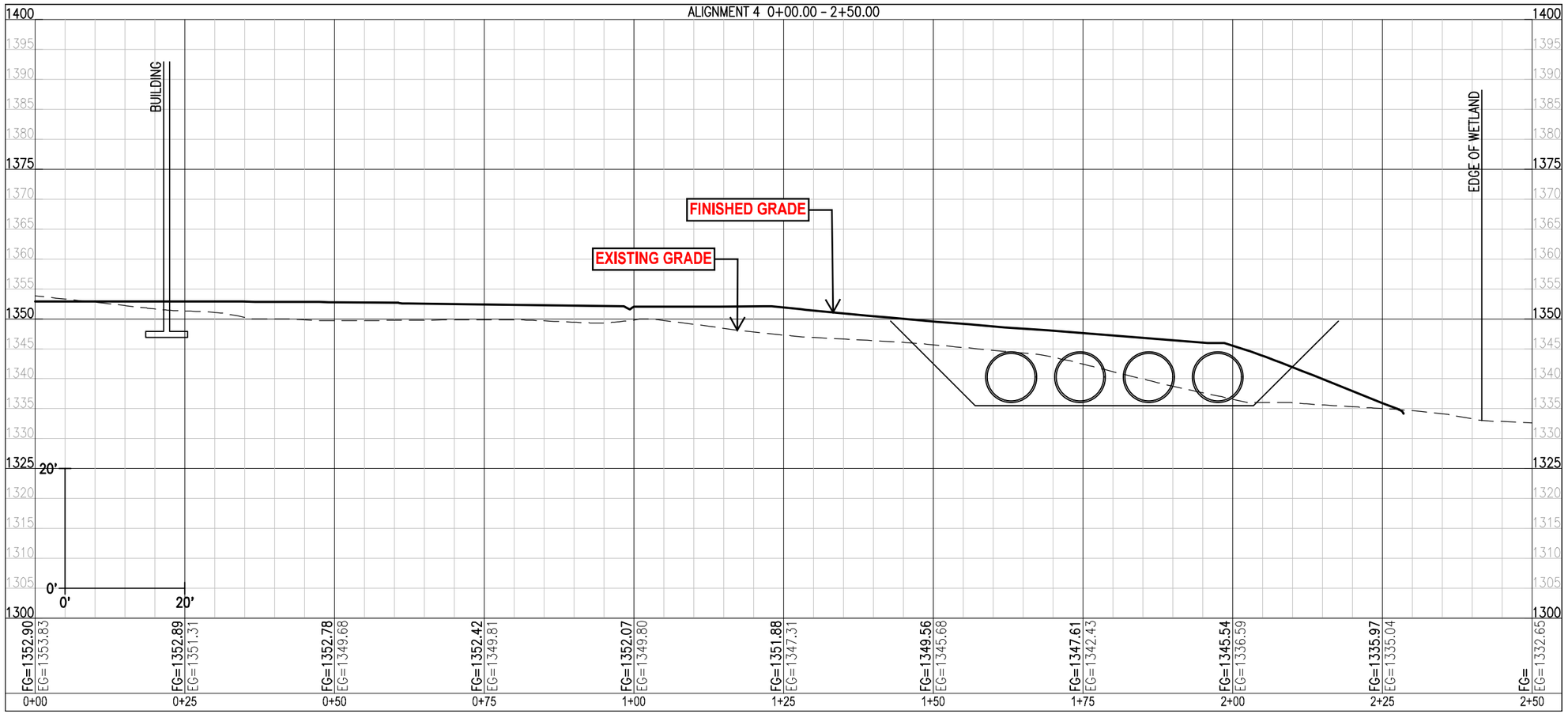
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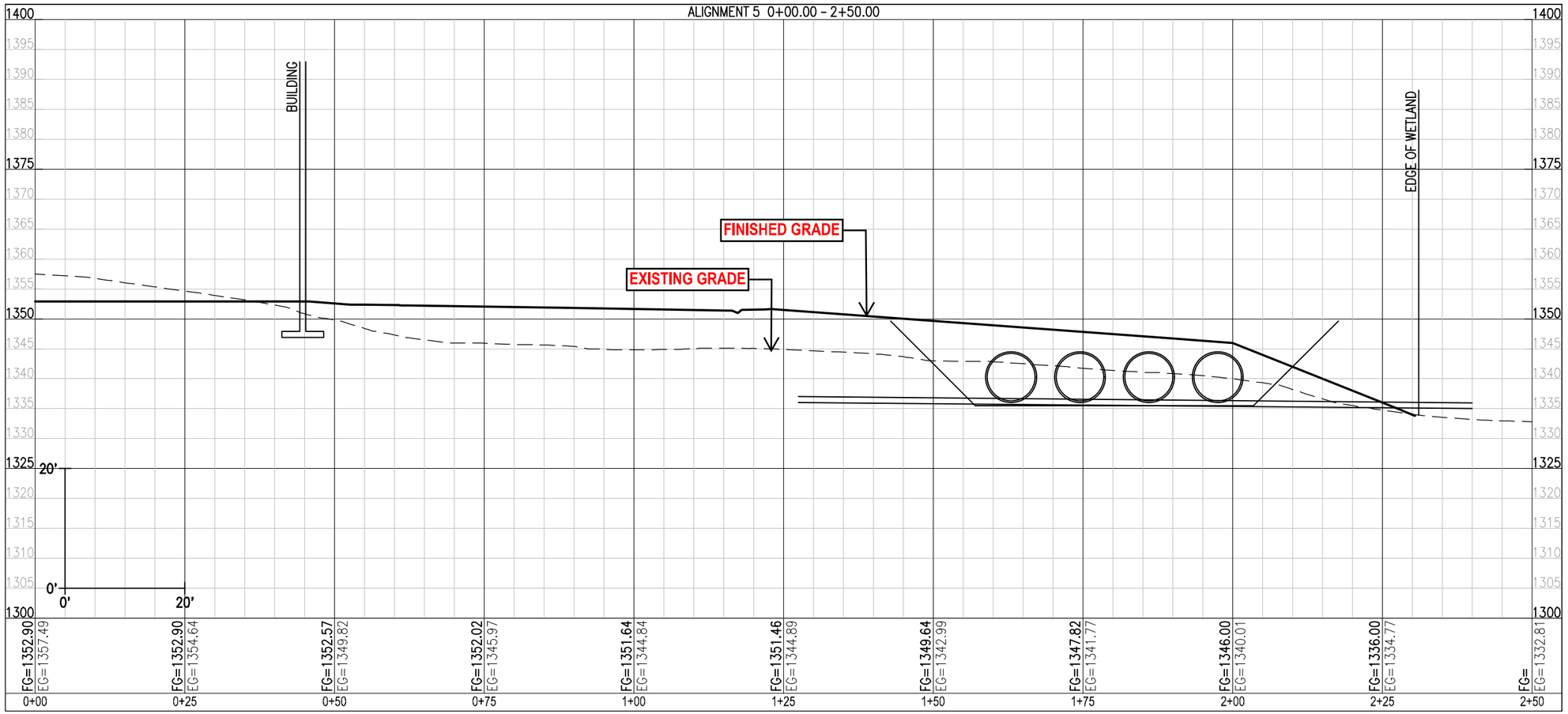
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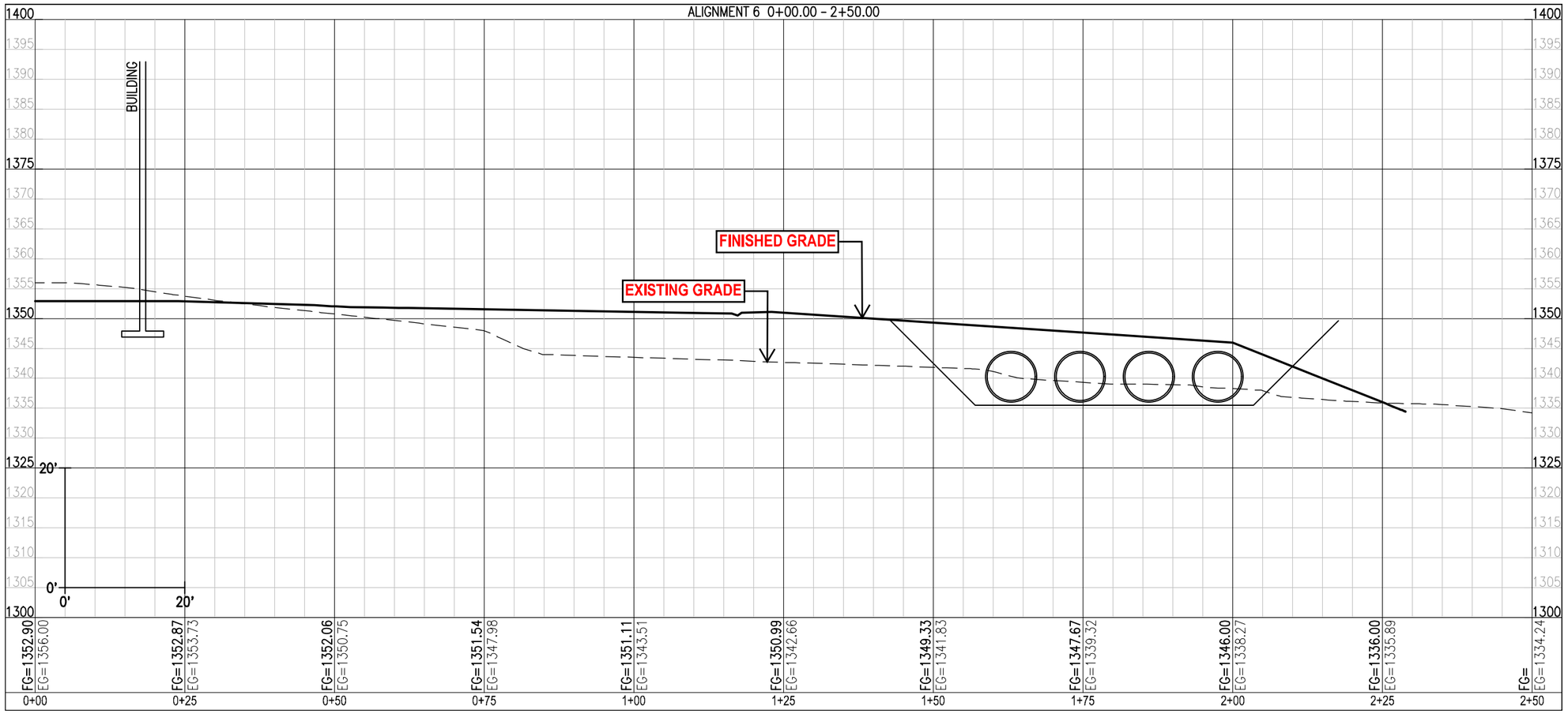
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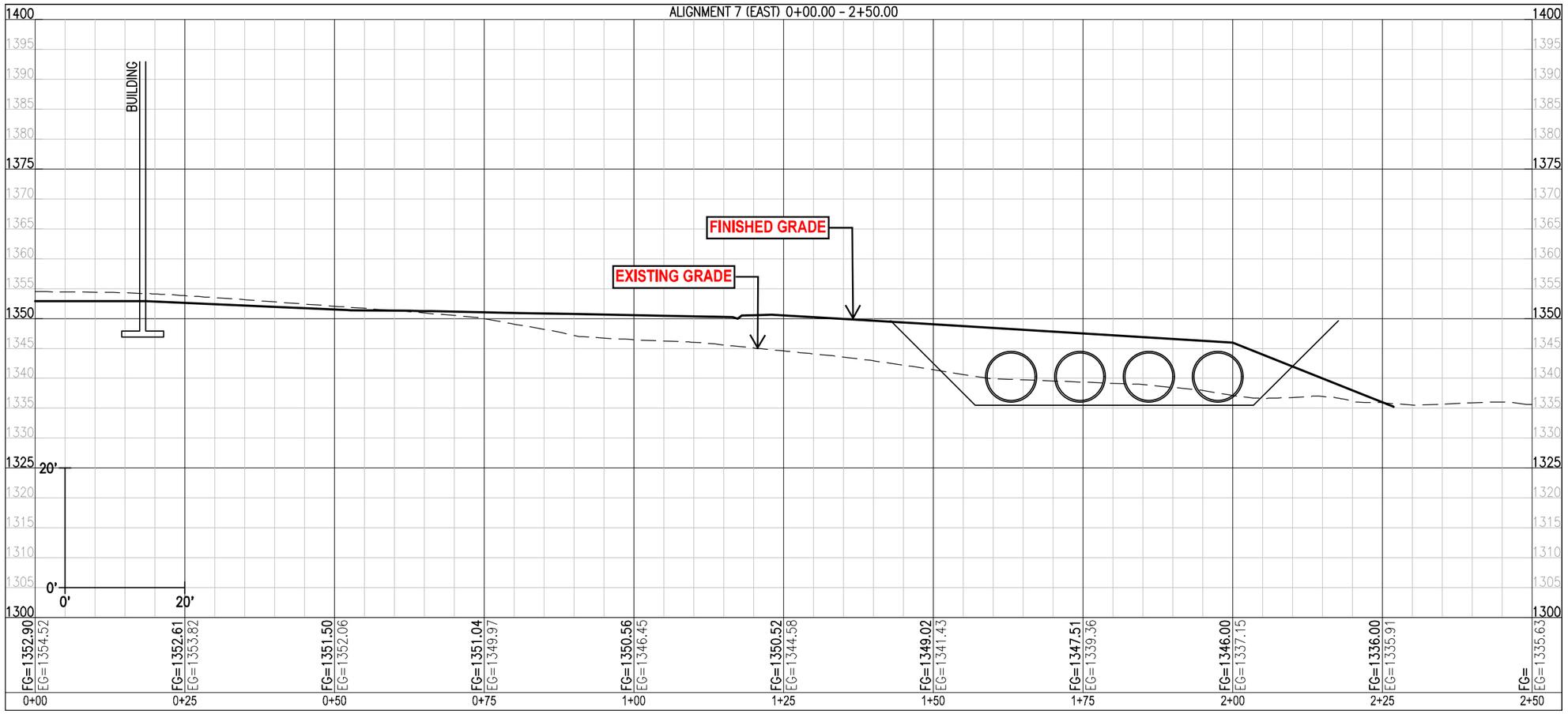
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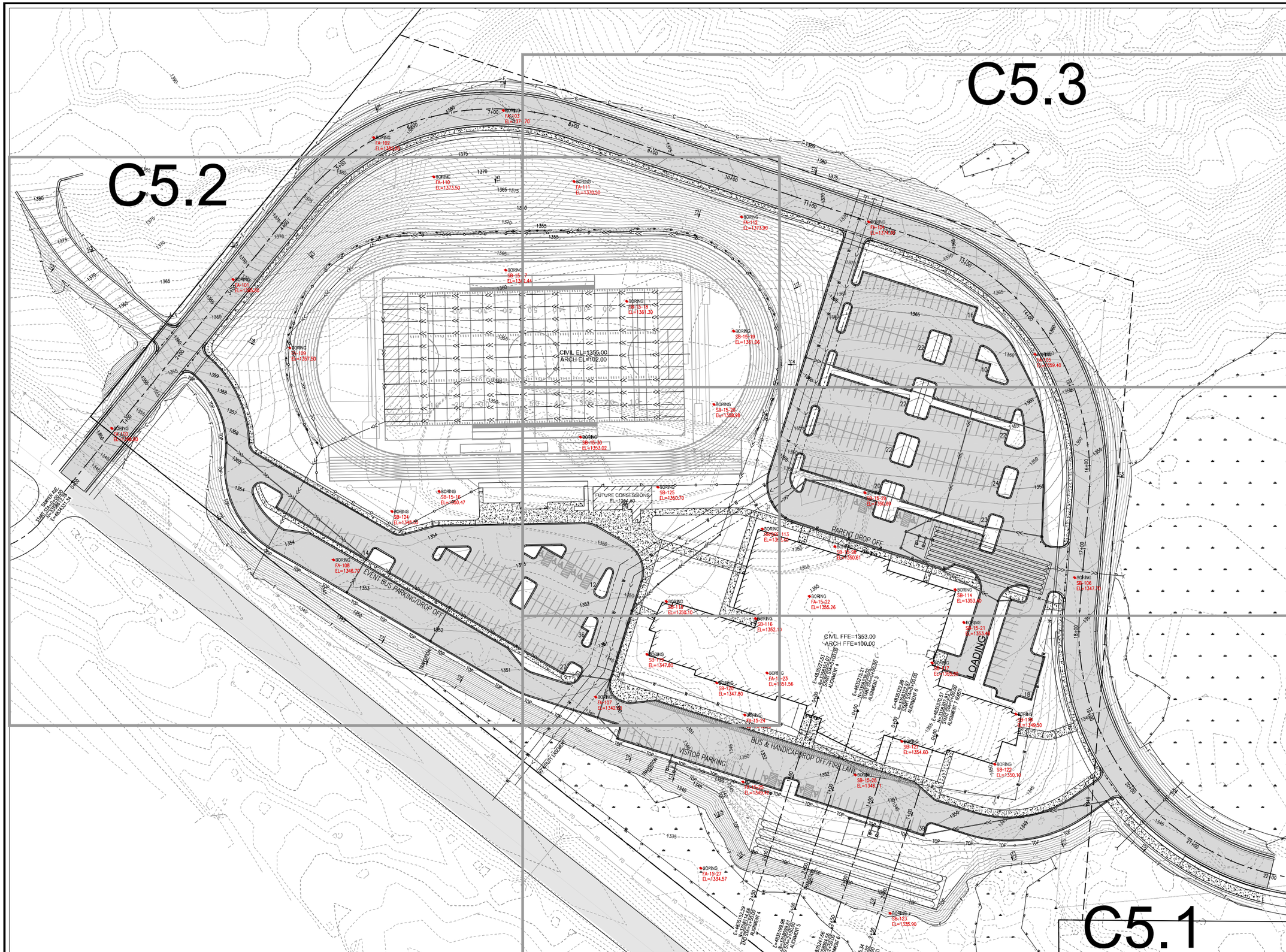

FOUNDATIONS ARCHITECTURE
GREG STROM, ARCHITECT
2150 CULAS ROAD
DULUTH, MN 55804
PH: 218.525.4326
CELL: 218.391.7334

CONSULTANTS

AROLA ARCHITECTURE STUDIO, LLC
205 WEST FIRST STREET • DULUTH, MN • 218.310.3959

EAPC ARCHITECTS ENGINEERS
TELE 701.461.7222 FAX 701.461.7223
112 No. Roberts Street, Suite 300, Fargo ND 58102

JILL ISOLA JOHNSON
CERTIFIED INTERIOR DESIGNER
PHONE: 218.349.0655

WIRTH BUILDING
13 WEST SUPERIOR ST. #201
DULUTH, MN 55802

Northland Consulting Engineers L.L.P.
Structural, Civil and Forensic Engineering
102 South 21st Ave. West, Duluth, MN 55806
(V)218-727-5995, (F)218-727-7779

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PRELIMINARY
NOT FOR CONSTRUCTION

SIGNATURE _____
DAVID BOLF, PE

DATE XX/XX/XX LICENSE No. 40926

PROPOSED BUILDING FOR:
DECS 8-12 SCHOOL
43xx RICE LAKE ROAD
DULUTH, MINNESOTA 55811

OWNER:
PROJECT OWNER

REVISIONS

ISSUED DATE
05/06/2016

PROJECT NO.	15-504-C
DRAWN BY	JDO
APPROVED BY	ARZ

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SCALE = 2" AT FULL SCALE

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OVERALL GRADING PLAN

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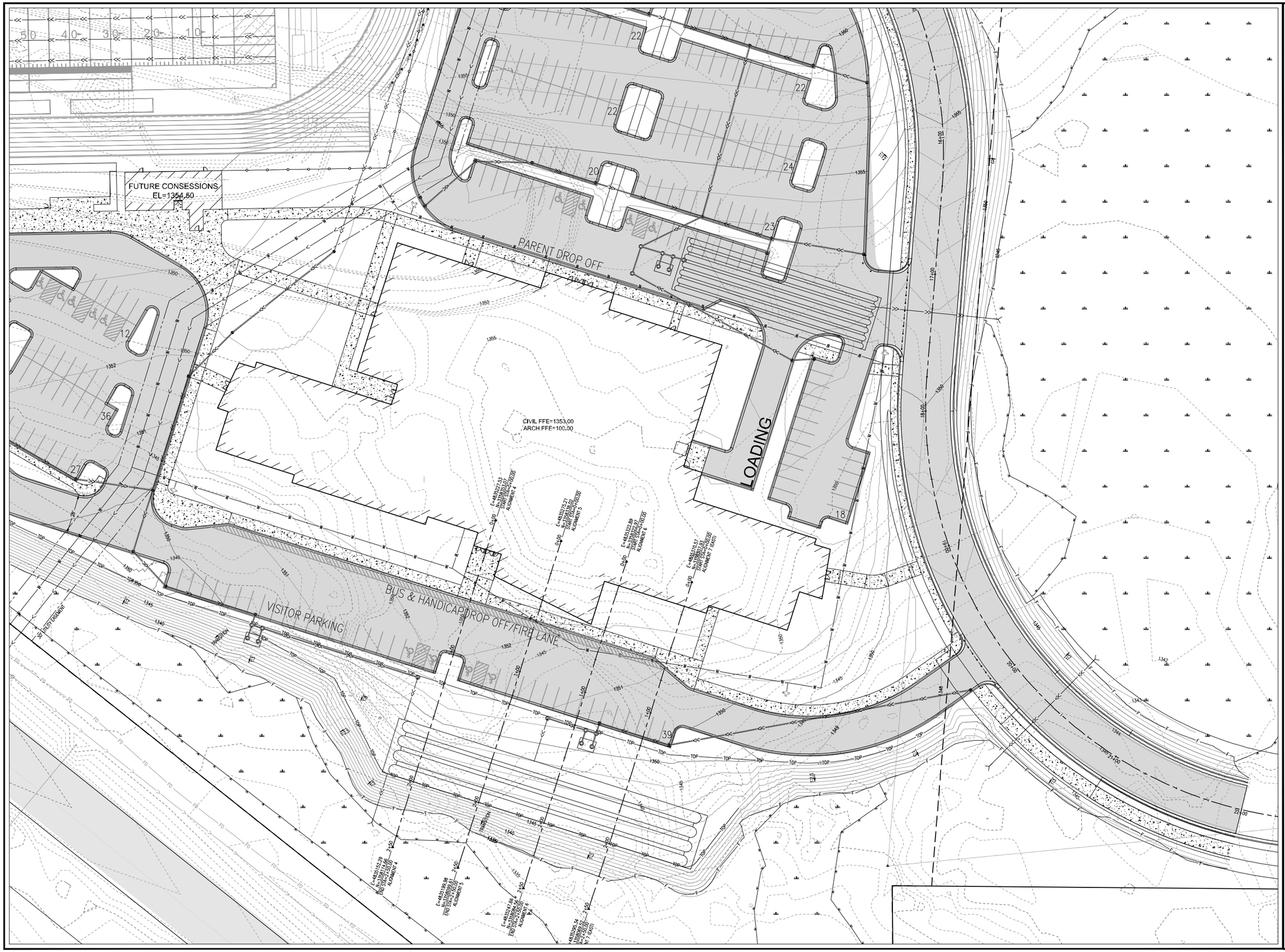
C5.0



FOUNDATIONS ARCHITECTURE
GREG STROM, ARCHITECT
2150 CULAS ROAD
DULUTH, MN 55804
PH.: 218.525.4326
CELL: 218.391.2334

CONSULTANTS

AROLA ARCHITECTURE STUDIO, LLC
205 WEST FIRST STREET • DULUTH, MN • 218.310.3959

EAPC ARCHITECTS ENGINEERS
TELE 701.461.7222 FAX 701.461.7223
112 No. Roberts Street, Suite 300, Fargo ND 58102

JILL ISOLA JOHNSON
CERTIFIED INTERIOR DESIGNER
PHONE- 218.349.0655
WRTH BUILDING
13 WEST SUPERIOR ST. #201
DULUTH, MN 55802

Northland Consulting Engineers L.L.P.
Structural, Civil and Forensic Engineering
102 South 21st Ave. West, Duluth, MN 55806
(V)218-727-5995, (F)218-727-7779

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SCALE = 2" AT FULL SCALE

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GRADING PLAN

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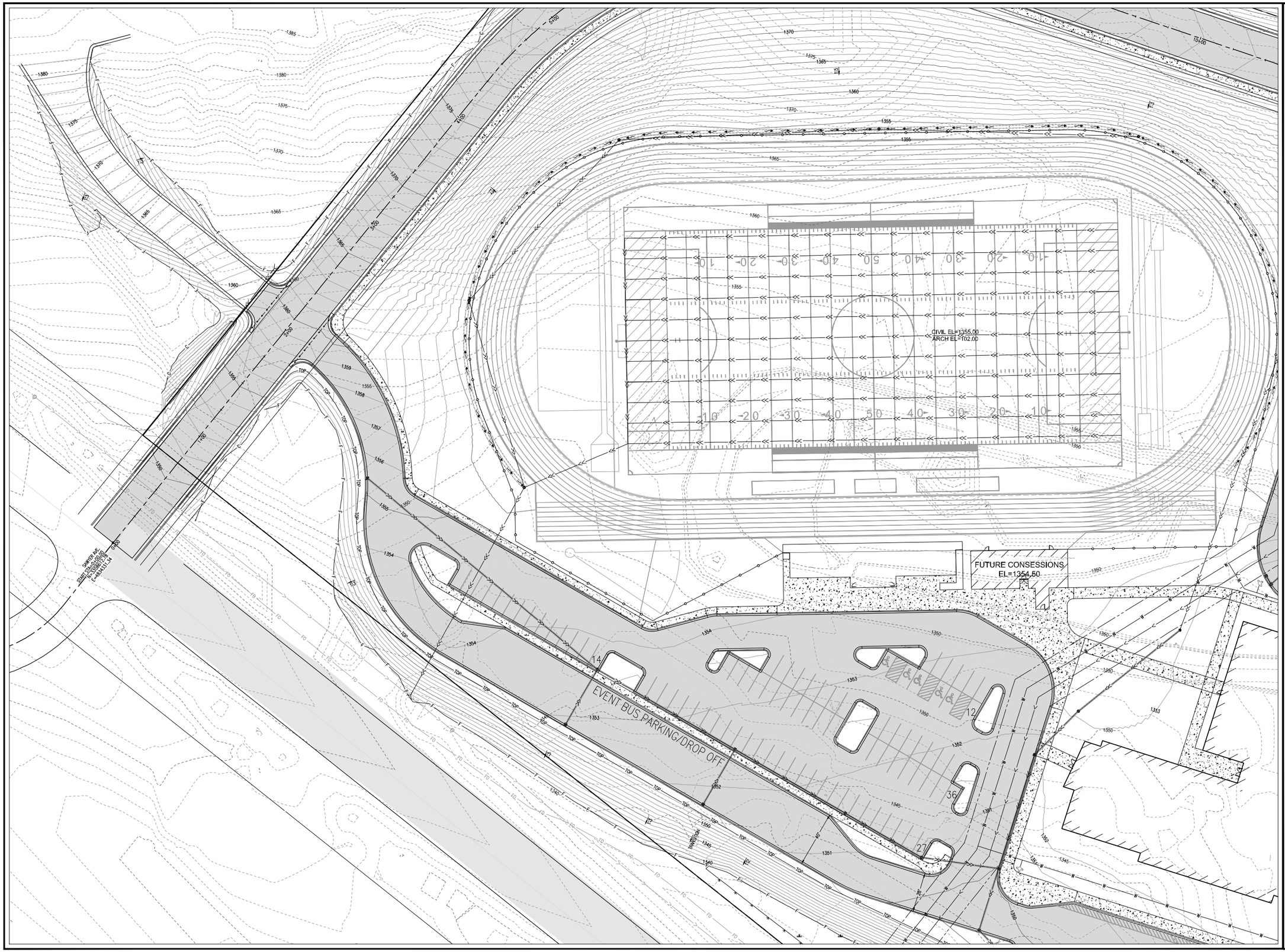

FOUNDATIONS ARCHITECTURE
GREG STROM, ARCHITECT
21550 CULAS ROAD
DULUTH, MN 55804
PH.: 218 525-1356
CELL: 218 391-2334

CONSULTANTS

AROLA ARCHITECTURE STUDIO, LLC
205 WEST FIRST STREET • DULUTH, MN • 218.310.3959

EAPC ARCHITECTS ENGINEERS
TELE 701.461.7222 FAX 701.461.7223
112 No. Roberts Street, Suite 300, Fargo ND 58102

JILL ISOLA JOHNSON
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PHONE- 218.349.0655
WIRTH BUILDING
13 WEST SUPERIOR ST. #201
DULUTH, MN 55802

Northland Consulting Engineers L.L.P.
Structural, Civil and Forensic Engineering
102 South 21st Ave. West, Duluth, MN 55806
(V)218-727-5595, (F)218-727-7779

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DRAWN BY	JDO
APPROVED BY	ARZ

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SCALE = 2" AT FULL SCALE

KEY
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GRADING PLAN

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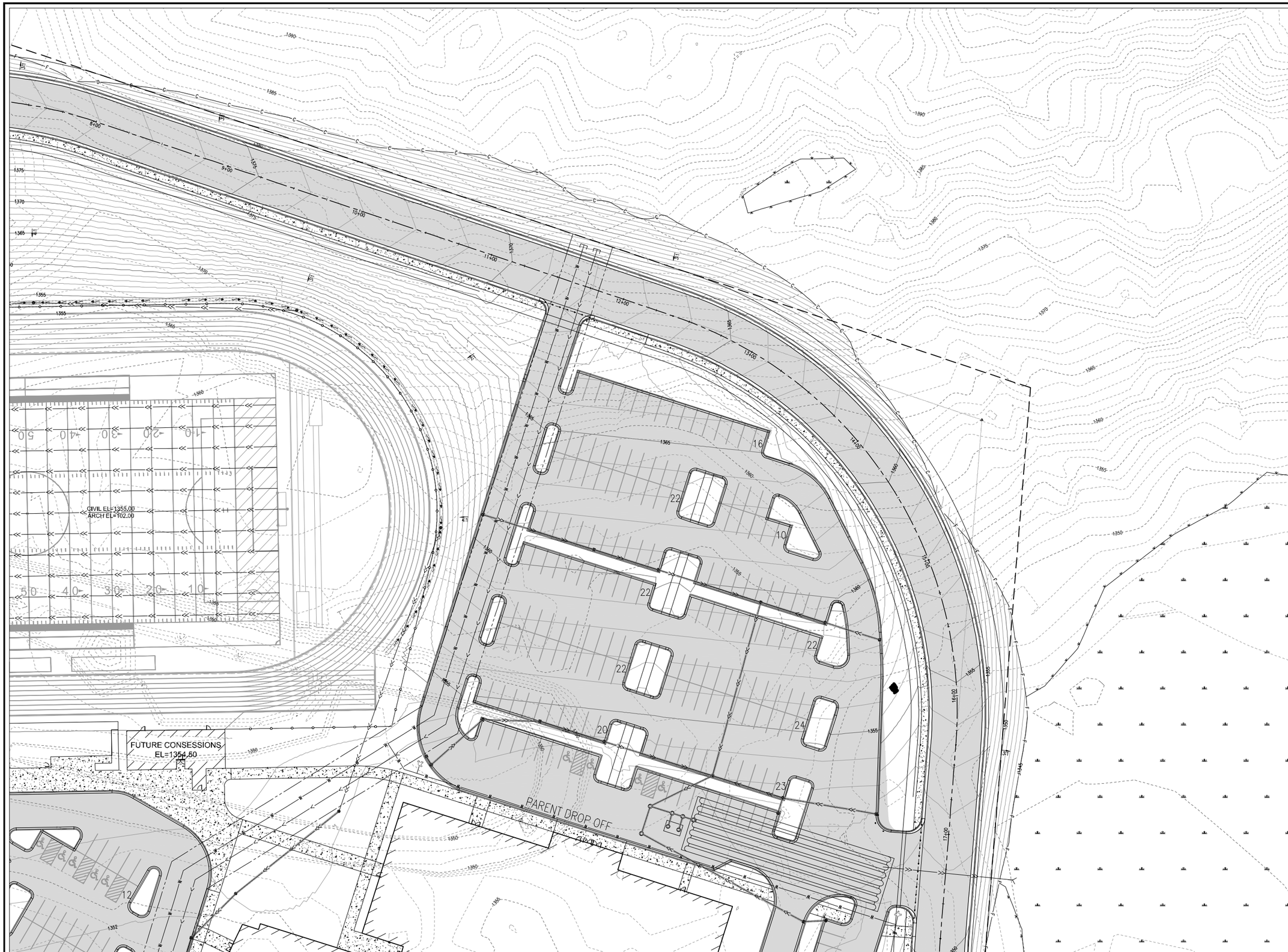

FOUNDATIONS ARCHITECTURE
GREG STROM, ARCHITECT
21550 CULAS ROAD
DULUTH, MN 55804
PH.: 218.525.4356
CELL: 218.391.2334

CONSULTANTS

AROLA ARCHITECTURE STUDIO, LLC
205 WEST FIRST STREET • DULUTH, MN • 218.310.3959

EAPC ARCHITECTS ENGINEERS
TELE 701.461.7222 FAX 701.461.7223
112 No. Roberts Street, Suite 300, Fargo ND 58102

JILL ISOLA JOHNSON
CERTIFIED INTERIOR DESIGNER
PHONE- 218.349.0655

WIRTH BUILDING
13 WEST SUPERIOR ST. #201
DULUTH, MN 55802

Northland Consulting Engineers L.L.P.
Structural, Civil and Forensic Engineering
102 South 21st Ave. West, Duluth, MN 55806
(V)218-727-5995, (F)218-727-7779

I HERE BY CERTIFY THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM DULY LICENSED ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRELIMINARY
NOT FOR CONSTRUCTION

SIGNATURE _____
DAVID BOLF, PE

DATE XX/XX/XX LICENSE No. 40926

PROPOSED BUILDING FOR:
DECS 8-12 SCHOOL
43xx RICE LAKE ROAD
DULUTH, MINNESOTA 55811

OWNER:
PROJECT OWNER

REVISIONS

ISSUED DATE
05/06/2016

PROJECT NO.	15-504-C
DRAWN BY	JDO
APPROVED BY	ARZ

0 2
SCALE = 2" AT FULL SCALE

KEY
N W E S
0' 15' 30' 60'

GRADING PLAN

SHEET NO.
C5.3

SRF Consulting Group, Inc. | Engineers Planners Designers

Memorandum

SRF No. 0159014

To: David Bolf, PE
Northland Consulting Engineers

From: Matt Pacyna, PE, Senior Associate
Tom Sachi, EIT, Engineer

Date: February 10, 2016

Subject: Duluth Edison High School Traffic Study

Introduction

SRF has completed a traffic study for the proposed Duluth Edison Charter High School and apartment complex located north of Rice Lake Road (CSAH 4) between Technology Drive and Krueger Road in the City of Duluth (see Figure 1: Project Location). The proposed high school will be located to the west of the existing Northstar Academy Charter School. The main objectives of this study are to review existing operations within the study area, evaluate traffic impacts to the adjacent roadway network, and recommend any necessary improvements to accommodate the proposed developments. The following sections provide the assumptions, analysis, and study conclusions/ recommendations offered for consideration.

Existing Conditions

The existing conditions were reviewed to establish a baseline in order to identify any future impacts associated with the proposed development. The evaluation of existing conditions includes peak period intersection turning movement counts, field observations, and an intersection capacity analysis.

Data Collection

Peak period turning movement and pedestrian counts were collected by SRF during the week of October 5, 2015 at the following study intersections:

- CSAH 4 and Airport Road
- CSAH 4 and Airpark Boulevard
- CSAH 4 and Krueger Road
- CSAH 4 and Technology Drive
- CSAH 4 and Arlington Avenue/Arrowhead Road
- CSAH 4 and Sawyer Avenue/Arrowhead Road

In addition to the intersection turning movement counts, short-term pulse (i.e. 15-minute) counts were collected at driveways within the study area and at Persons Street in order to establish travel patterns. The traffic data focused on the a.m. (7:30 a.m. to 8:30 a.m.) and school afternoon/p.m. (4:00 p.m. to 5:00 p.m.) peak hours. It should be noted that the afternoon school and p.m. peak hour occurred at the same time, due to the current Northstar Academy Chart School hours (8:30 a.m. to 4:00 p.m.). Historical annual average daily traffic (AADT) volumes within the study area, provided by the Minnesota Department of Transportation (MnDOT), were also reviewed.

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Project Location

Duluth Edison Charter School Expansion Traffic Study
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Figure 1

In addition to the intersection turning movement counts, observations were completed to identify roadway characteristics within the study area (i.e. roadway geometry, posted speed limits, and traffic controls). Currently, CSAH 4 is a two-lane roadway with a posted speed limit of 55 miles per hour (mph) north of Arrowhead Road and 45 mph south of Arrowhead Road. Arrowhead Road is a four-lane roadway with a posted speed limit of 40 mph. Arlington Avenue is a two-lane roadway with a posted speed limit of 40 mph.

The CSAH 4 intersections with Technology Drive, Arlington Avenue, and Sawyer Avenue are currently controlled by traffic signals. All remaining intersections within the study area are side-street stop controlled. It should be noted that the CSAH 4/Airport Road intersection has been identified as an intersection that will be upgraded to a traffic signal in the near future. CSAH 4, Arrowhead Road, and Arlington Avenue are functionally classified as minor arterial facilities, while all other study roadways are functionally classified as local streets. Existing geometrics, traffic controls, and volumes within the study area are shown in Figure 2.

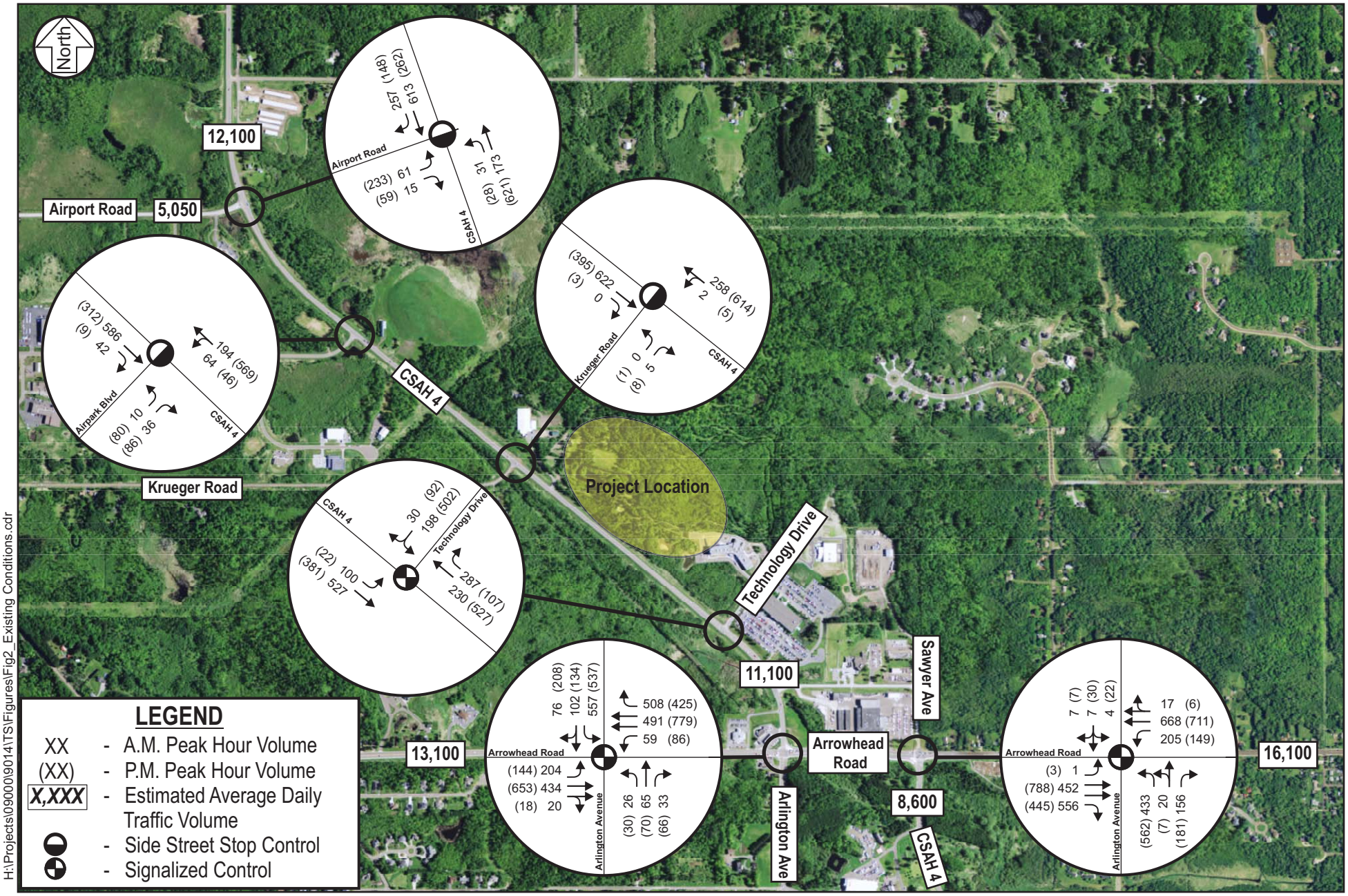
Existing Intersection Capacity Analysis

An existing intersection capacity analysis was completed using Synchro/SimTraffic software (V8.0) to establish a baseline condition to which future traffic operations could be compared. Capacity analysis results identify a Level of Service (LOS) which indicates how well an intersection is operating. Intersections are ranked from LOS A through LOS F. The LOS results are based on average delay per vehicle, which correspond to the delay threshold values shown in Table 1. LOS A indicates the best traffic operation, while LOS F indicates an intersection where demand exceeds capacity. Overall intersection LOS A though LOS C is generally considered acceptable in the Duluth area.

Table 1. Level of Service Criteria for Signalized and Unsignalized Intersections

LOS Designation	Signalized Intersection Average Delay/Vehicle (seconds)	Unsignalized Intersection Average Delay/Vehicle (seconds)
A	≤ 10	≤ 10
B	> 10 - 20	> 10 - 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50
F	> 80	> 50

For side-street stop/yield controlled intersections, special emphasis is given to providing an estimate for the level of service of the side-street approach. Traffic operations at an unsignalized intersection with side-street stop/yield control can be described in two ways. First, consideration is given to the overall intersection level of service. This takes into account the total number of vehicles entering the intersection and the capability of the intersection to support these volumes.



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Existing Conditions

Duluth Edison Charter School Expansion Traffic Study

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Figure 2

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Second, it is important to consider the delay on the minor approach. Since the mainline does not have to stop, the majority of delay is attributed to the side-street approaches. It is typical of intersections with higher mainline traffic volumes to experience high levels of delay (i.e. poor levels of service) on the side-street approaches, but an acceptable overall intersection level of service during peak hour conditions.

Due to the presence of the Northstar Academy Charter School, a separate analysis was completed for both the peak 15-minute interval as well as a full 60-minute interval (i.e. the peak hour). Since schools generally peak for shorter times (i.e. 15-minute intervals), the extra analysis was considered to ensure any improvements were not based solely on a 15-minute or 60-minute period of traffic.

Results of the existing intersection capacity analysis for the peak 15-minute interval shown in Table 2 indicates that the CSAH 4/Airport Road intersection operates at LOS D during the p.m. peak 15-minute period. Side-street left-turns were observed to be difficult from both Airport Road and Airpark Boulevard onto CSAH 4 during the p.m. peak 15-minute period. Additionally, southbound left-turns at the CSAH 4 and Arlington Avenue/Arrowhead Road intersection are difficult during both the a.m. and p.m. peak hours. During the a.m. peak hour, this queue was observed often extending beyond Persons Street and the right-in only turn lane into the Optum/United Health Group driveway.

Table 2. Existing Intersection Capacity Analysis – 15 Minute Interval

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
CSAH 4 and Airport Road(1)	A/C	23 sec.	D/F	137 sec.
CSAH 4 and Airpark Boulevard(1)	A/C	19 sec.	A/E	45 sec.
CSAH 4 and Krueger Road(1)	A/B	14 sec.	A/B	14 sec.
CSAH 4 and Technology Drive	B	12 sec.	C	27 sec.
CSAH 4 and Arlington Avenue/Arrowhead Road	C	33 sec.	C	28 sec.
CSAH 4 and Sawyer Avenue/Arrowhead Road	C	20 sec.	C	26 sec.

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst approach LOS. The delay shown represents the worst side-street approach delay.

Additionally, internal queuing was present for the Northstar Academy Charter School and Optum/United Health Group driveways along Technology Drive during the school start and end times. This queuing and delay is a result of the operations at the CSAH 4/Technology Drive intersection, and the driveway density and configuration along Technology Drive. The queuing and delay observed at these intersections occur primarily only in the peak 15-minute period immediately before and after school.

Based on observations, traffic volumes in the study area remain steady over the course of the peak hour at several study intersections. Therefore, a full 60-minute (i.e. peak hour) analysis was completed to confirm the observations and quantify area traffic operations.

Results of the existing intersection capacity analysis for the 60-minute peak period shown in Table 3 indicates that all study intersections currently operate at an acceptable overall LOS C or better during the a.m. and p.m. peak hours. However, the significant side-street left-turning delay for motorists on Airport Road turning left onto CSAH 4 continues throughout the entire peak hour. It should be noted that a traffic signal is planned to be installed at this intersection, which is expected to alleviate the side-street delay and queuing noted. This signal was assumed to be constructed for the future intersection capacity analysis.

Table 3. Existing Intersection Capacity Analysis – 60 Minute Interval

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
CSAH 4 and Airport Road(1)	A/C	17 sec.	B/F	55 sec.
CSAH 4 and Airpark Boulevard(1)	A/C	14 sec.	A/C	20 sec.
CSAH 4 and Krueger Road(1)	A/B	13 sec.	A/B	12 sec.
CSAH 4 and Technology Drive	B	11 sec.	C	26 sec.
CSAH 4 and Arlington Avenue/Arrowhead Road	C	29 sec.	C	28 sec.
CSAH 4 and Sawyer Avenue/Arrowhead Road	C	17 sec.	C	26 sec.

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst approach LOS. The delay shown represents the worst side-street approach delay.

Year 2020 No Build Conditions

Preliminary discussions with project stakeholders indicate several projects that are planned for the area. The majority of these are aimed at improving intersection operations, while the need for one is tied to the proposed development. The following improvements are planned to be constructed by the year 2020.

1) New traffic signal at CSAH 4 and Airport Road
2) Extension of Sawyer Avenue to Technology Drive
   a. Includes modification of the north approach of the CSAH 4 and Sawyer Avenue/Arrowhead Road intersection to have a southbound left-turn lane and a shared thru/right-turn lane.
3) Realignment of Krueger Road to the south to align with the proposed development access.
   a. Note this realignment is only needed if the proposed development is constructed.

To determine how these planned improvements would impact area operations, a detailed intersection capacity analysis was completed. To account for area travel pattern changes due to the extension of Sawyer Avenue, existing traffic volumes were modified to reflect future no build conditions based on estimated travel times and a route diversion analysis. These volumes were then grown at an annual growth rate of one percent to reflect year 2020 conditions, which is consistent with the *Duluth-Superior Transportation Plan*.

With the extension of Sawyer Avenue, approximately 3,500 additional vehicles per day will use the north approach of Sawyer Avenue at CSAH 4. These vehicles, originally traveling along CSAH 4 north of Arrowhead Road, are expected to divert from Arrowhead Road to Sawyer Avenue to reach their respective destinations. It should be noted that no high school volumes were included as part of the no build analysis. The year 2020 no build conditions are shown in Figure 3.

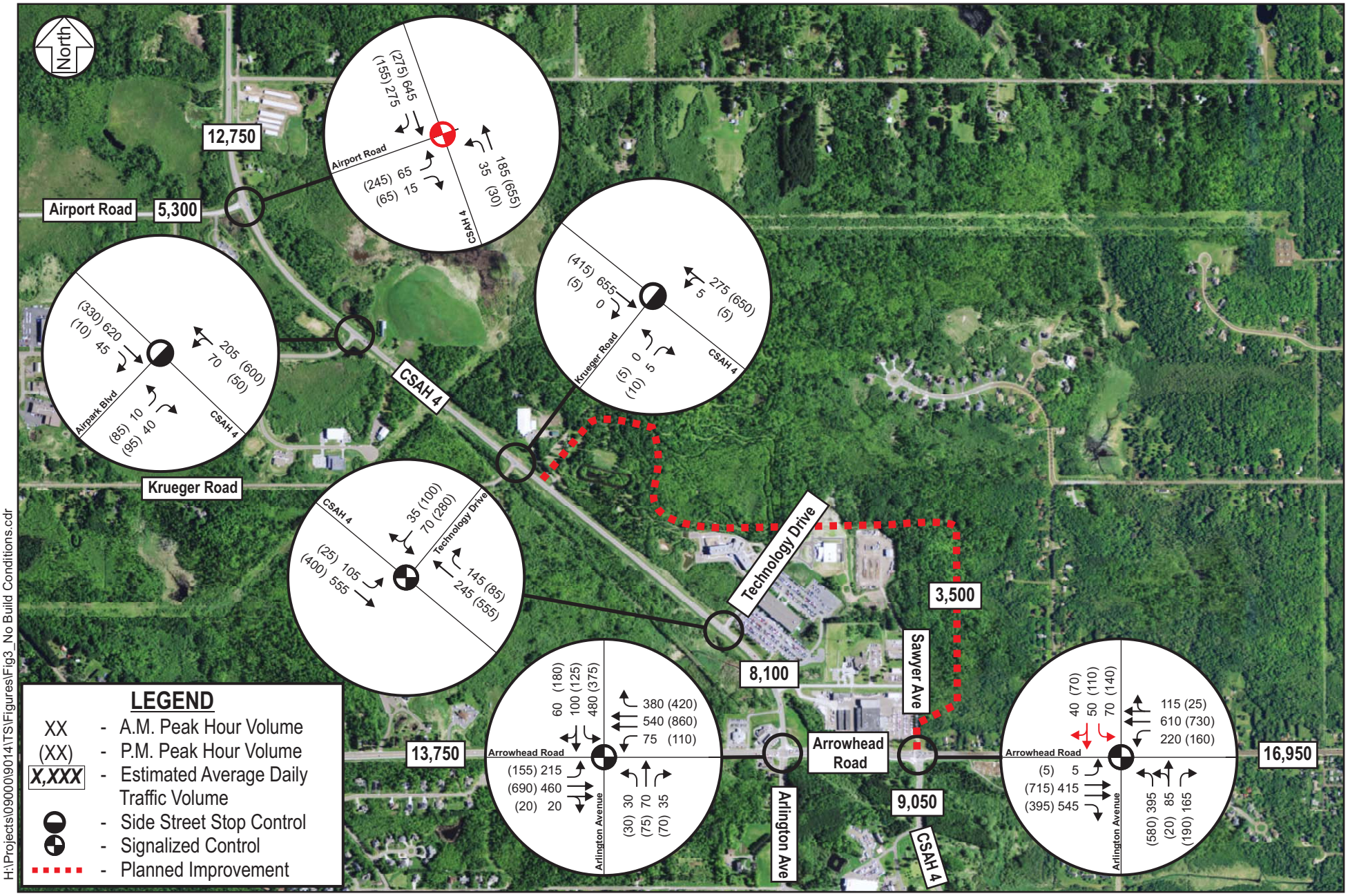
Results of the year 2020 no build intersection capacity analysis for the peak 15-minute interval shown in Table 4, indicates that all intersections are expected to operate at an acceptable overall LOS C or better during the a.m. and p.m. peak 15-minute periods. The side-street delay of the Airpark Boulevard is expected to be approximately 55 seconds (LOS F) during the p.m. peak 15-minute period. The queuing issues along Technology Drive and CSAH 4 are expected to improve due to the extension of Sawyer Avenue as motorists will have an alternative route to consider.

Table 4. Year 2020 No Build Intersection Capacity Analysis – 15 Minute Interval

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
CSAH 4 and Airport Road	A	8 sec.	B	12 sec.
CSAH 4 and Airpark Boulevard(1)	A/C	21 sec.	B/**F**	**55 sec.**
CSAH 4 and Krueger Road(1)	A/C	15 sec.	A/B	14 sec.
CSAH 4 and Technology Drive	A	8 sec.	B	16 sec.
CSAH 4 and Arlington Avenue/Arrowhead Road	C	30 sec.	C	25 sec.
CSAH 4 and Sawyer Avenue/Arrowhead Road	C	25 sec.	C	35 sec.

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst approach LOS. The delay shown represents the worst side-street approach delay.

An additional intersection capacity analysis was completed to determine the impacts of the planned improvements over the course of the full 60-minute peak hour. Results of the year 2020 no build intersection capacity analysis for the 60-minute peak period shown in Table 5 indicates that all study intersections currently operate at an acceptable overall LOS C or better during the a.m. and p.m. peak hours. It should be noted that this includes the current north/south split phasing at the CSAH 4 and Sawyer Avenue/Arrowhead Road intersection.



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Year 2020 No Build Conditions

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Figure 3

Table 5. No Build Intersection Capacity Analysis – 60 Minute Interval

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
CSAH 4 and Airport Road	A	7 sec.	B	11 sec.
CSAH 4 and Airpark Boulevard(1)	A/C	15 sec.	A/C	23 sec.
CSAH 4 and Krueger Road(1)	A/B	13 sec.	A/B	12 sec.
CSAH 4 and Technology Drive	A	7 sec.	B	17 sec.
CSAH 4 and Arlington Avenue/Arrowhead Road	C	27 sec.	C	26 sec.
CSAH 4 and Sawyer Avenue/Arrowhead Road	C	25 sec.	C	34 sec.

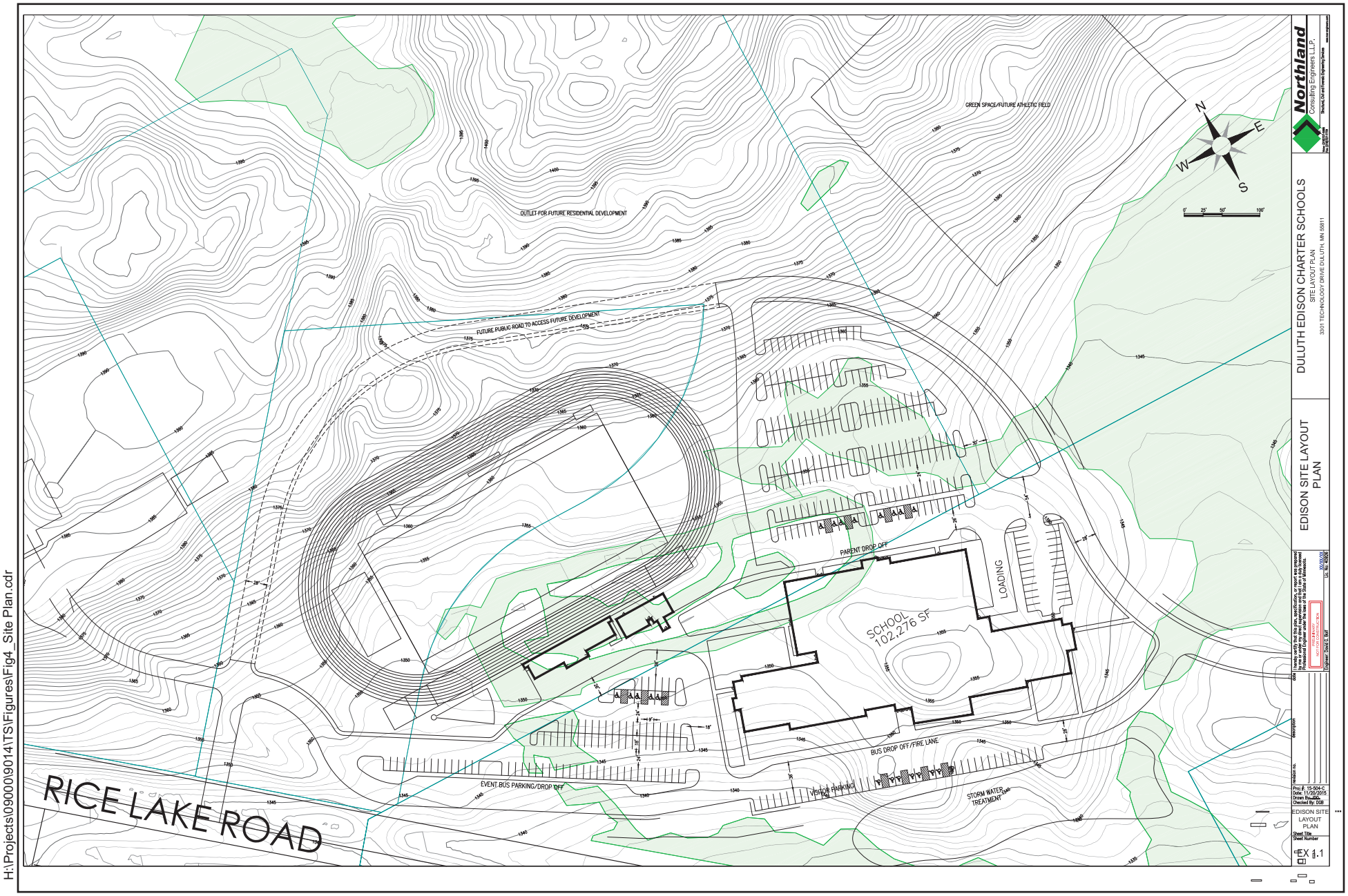
(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst approach LOS. The delay shown represents the worst side-street approach delay.

With the addition of the north leg of Sawyer Avenue at CSAH 4 and the need to modify the north approach to accommodate the additional traffic volumes, there is the opportunity to remove the north/south split phasing. This would provide some signal timing flexibility for the CSAH 4 and Sawyer Avenue/Arrowhead Road intersection. Therefore, a sensitivity test was completed to determine how the traffic signal at the CSAH 4 and Sawyer Avenue/Arrowhead Road intersection would operate without split phasing on the north and south approaches. To remove the split phasing, a restriping of the south approach to include dual left-turn lanes and a shared thru/right-turn lane would be needed. Results indicate that during the p.m. peak hour, removing the split phasing improves overall intersection operations, while similar operations are maintained during the a.m. peak hour.

Proposed Development

The proposed Edison Charter High School and apartment complex development is located along CSAH 4, west of the existing Northstar Academy Charter School (see Figure 4 – Site Plan) in the City of Duluth. Once fully completed, the proposed development is expected to consist of an 800 student charter high school and 400 apartment units. It should be noted that upon initial construction, opening is planned for the year 2017. However, full occupancy of the high school is not planned until year 2020.

Access to the proposed development is planned along CSAH 4 approximately 250 feet south of Krueger Road. However, if the proposed development is approved, Krueger Road would be realigned opposite of the development access, creating a four-legged intersection. Access to the site is also planned via the new Sawyer Avenue extension from Arrowhead Road to Krueger Road.



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Site Plan

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Figure 4

Year 2020 Build Conditions

To help determine impacts associated with the proposed development, traffic forecasts were developed for year 2020 build conditions. Year 2020 build conditions take into account the year 2020 no build condition and traffic generated by the proposed development. The evaluation of year 2020 build conditions includes a trip generation estimate for the proposed development and an intersection capacity analysis.

Trip Generation

To account for traffic impacts associated with the proposed development, a trip generation estimate for the proposed land use was developed for the a.m. and p.m. peak hours as well as a daily basis. These estimates, shown in Table 6, were developed using the *ITE Trip Generation Manual, Ninth Edition*.

Table 6. Trip Generation Estimates

Land Use Type *(ITE Code)*	Size	A.M. Peak Hour Trips		P.M. Peak Hour Trips		Daily Trips
		In	Out	In	Out	
Proposed Land Use						
Apartments *(220)*	400 Dwelling Units	41	163	161	87	2,660
High School *(530)*	800 Students	234	110	77	155	1,368
	New System Trips	275	273	238	242	4,028

The proposed development is expected to generate approximately 548 a.m. peak hour, 480 p.m. peak hour and 4,028 daily trips. These trips were distributed throughout the area based on the directional distribution shown in Figure 5, which was developed based on existing area travel patterns and engineering judgment. It should be noted that an internal multi-use reduction was not applied for trips between the proposed apartments and high school. Since the proposed high school is expected to be a charter school, students living in the apartments are not likely to be destined to attend the school unless families enroll accordingly. Therefore to provide a conservative analysis, no multi-use internal reductions were applied. The resultant year 2020 conditions are shown in Figure 6.

Intersection Capacity Analysis

To determine how the planned roadway network will accommodate year 2020 build conditions, an intersection capacity analysis was completed using Synchro/SimTraffic software. In addition to the existing intersections, the proposed development driveway was reviewed to determine if any queuing or delay issues are expected under year 2020 build conditions. Once again, the analysis was completed for both the 15- and 60-minute time periods. The CSAH 4 and Sawyer Avenue/Arrowhead Road intersection was assumed to continue to have split phasing for the north/south approaches.

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Directional Distribution

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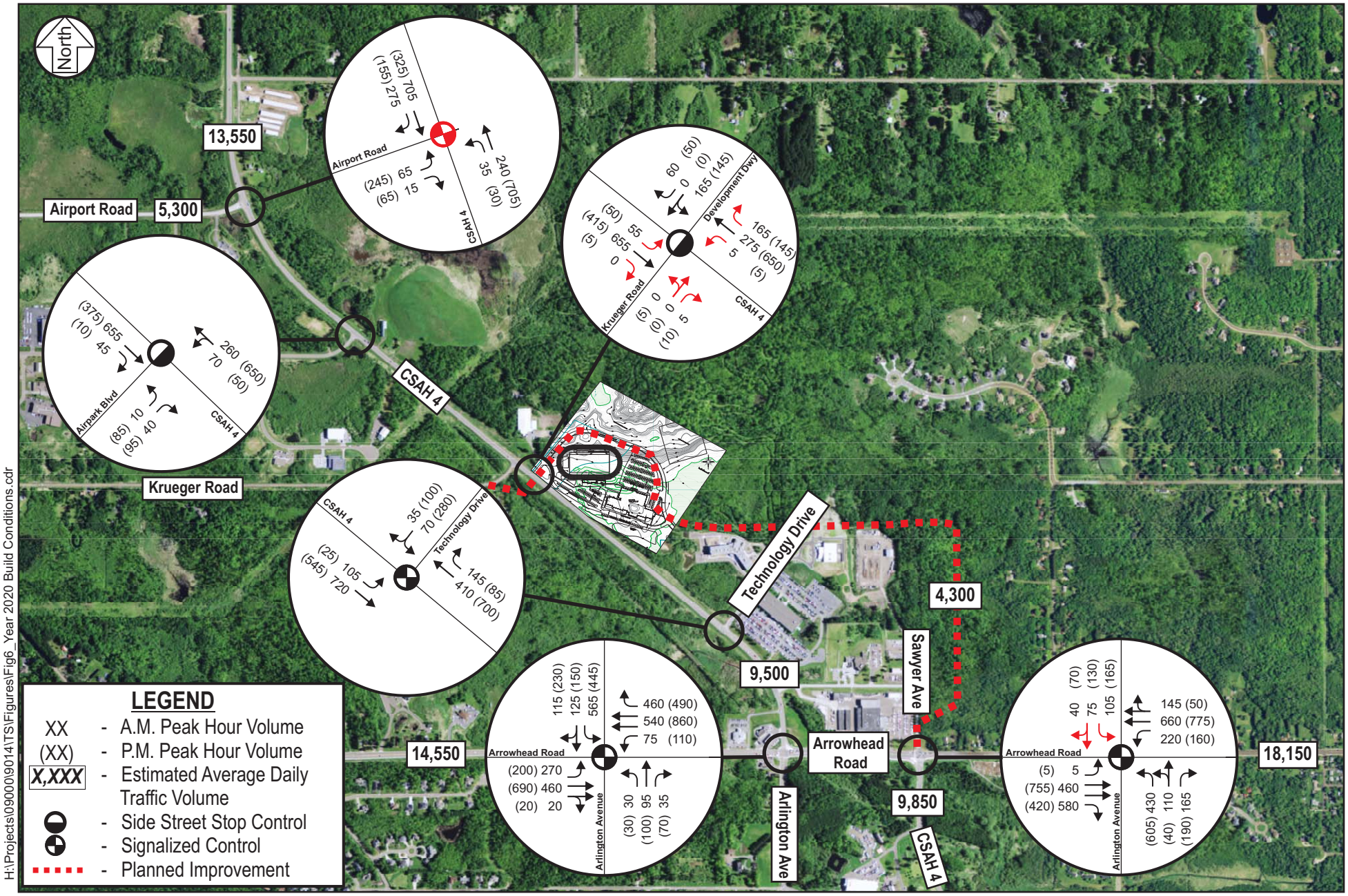
Figure 5



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Year 2020 Build Conditions

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Figure 6

Results of the year 2020 build intersection capacity analysis shown in Table 7 indicate that the CSAH 4 and Krueger Road/High School Access intersection is expected to operate at an overall LOS D during the p.m. peak 15-minute periods. During the p.m. peak 15-minute period, significant queuing and delays at the development access are expected. Side-street/driveway access is also expected to continue to be difficult at the CSAH 4/Airpark Boulevard intersection during the p.m. peak 15-minute period. Additionally, the CSAH 4 and Arlington Avenue/Arrowhead Road intersection is expected to operate at a LOS D during the a.m. peak hour.

Table 7. Year 2020 Build Intersection Capacity Analysis – 15 Minute Interval

Intersection	A.M. Peak Hour		P.M. Peak Hour	
	LOS	Delay	LOS	Delay
CSAH 4 and Airport Road	A	8 sec.	B	12 sec.
CSAH 4 and Airpark Boulevard(1)	A/C	22 sec.	B/**F**	**76 sec.**
CSAH 4 and Krueger Road/High School Access(1)	A/D	**30 sec.**	D/F	150 sec.
CSAH 4 and Technology Drive	B	10 sec.	C	18 sec.
CSAH 4 and Arlington Avenue/Arrowhead Road	**D**	**38 sec.**	C	31 sec.
CSAH 4 and Sawyer Avenue/Arrowhead Road	C	25 sec.	C	34 sec.

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst approach LOS. The delay shown represents the worst side-street approach delay.

Once again, a full peak hour intersection capacity analysis was completed to determine the impacts of the proposed development over the course of the full 60-minute peak hour. Results of the year 2020 build condition intersection capacity analysis for the 60-minute peak period shown in Table 8 indicate that all study intersections currently operate at an acceptable overall LOS C or better during the a.m. and p.m. peak hours. The significant side-street delay at the CSAH 4/Airpark Boulevard intersection is not expected to remain over the course of the full peak hour. However, the average side-street delay at the proposed development driveway is expected to extend over 30 seconds during the p.m. peak hour. Delays, queues, and safety at this location should be monitored to determine if signalization is warranted. Further discussion regarding potential mitigation is provided later in this memorandum.

Table 8. Year 2020 Build Intersection Capacity Analysis – 60 Minute Interval

Intersection	A.M. Peak		P.M. Peak	
	LOS	Delay	LOS	Delay
CSAH 4 and Airport Road	A	8 sec.	B	12 sec.
CSAH 4 and Airpark Boulevard(1)	A/C	16 sec.	A/D	27 sec.
CSAH 4 and Krueger Road/High School Access(1)	A/C	21 sec.	B/D	33 sec.
CSAH 4 and Technology Drive	A	8 sec.	B	17 sec.
CSAH 4 and Arlington Avenue/Arrowhead Road	C	31 sec.	C	31 sec.
CSAH 4 and Sawyer Avenue/Arrowhead Road	C	24 sec.	C	32 sec.

(1) Indicates an unsignalized intersection with side-street stop control, where the overall LOS is shown followed by the worst approach LOS. The delay shown represents the worst side-street approach delay.

Recommended Improvements

To address the operational issues identified, the following improvements are offered for consideration.

CSAH 4 and Krueger Road/High School Access

1) Add southbound and northbound left- and right-turn lanes on CSAH 4
2) Widen the Krueger Road and High School Driveway access to include right- and shared thru/left-turn lanes.
3) Monitor the intersection to determine if/when a traffic signal may be warranted and installed.
   a. A traffic signal would provide acceptable overall operations (LOS B or better) during the a.m. and p.m. peak hours and improved access to CSAH 4.
   b. Based on the traffic forecasts within this study, warrant three (Peak Hour Warrant) is expected to be met for the future build traffic volumes at this intersection.
      i. This assumes full-enrollment capacity is reached by the year 2020, as well as the assumed apartment development being constructed and fully occupied.
      ii. Based on discussions with Edison representatives, full-enrollment capacity is not likely expected until after year 2020.
      iii. Given that there are some unknowns with respect to the development and enrollment timeframes, as well as how area travel patterns will ultimately change given the future extension of Sawyer Avenue, the traffic signal should not be installed until a signal warrant is met and travel patterns have normalized.
   c. Based on traffic signal spacing guidelines from MnDOT, a one-quarter mile traffic signal spacing is recommended along minor arterial corridors. There is at least one-quarter mile distance between the proposed development access and both the signalized intersections along CSAH 4 at Technology Drive and Airport Road.

CSAH 4 and Arlington Avenue/Arrowhead Road

4) *Optional:* Restripe for an additional southbound left-turn.
   a. This would reduce southbound queuing and delay at the study intersection and improve overall intersection operations to a LOS C during the peak 15-minute periods.

CSAH 4 and Sawyer Avenue/Arrowhead Road

5) Construct a southbound left-turn lane.
   a) This is expected to improve intersection operations to an acceptable overall LOS C.
6) *Optional:* Remove the split timing at the north and south approaches of the intersection and replace with protected-only or flashing yellow arrow left-turn phasing.
   a) Requires the restriping of the south approach to include dual left-turn lanes and a shared thru/right-turn lane.
7) *Optional:* Construct a westbound right-turn lane to reduce conflicts between through and turning vehicles.

Note: The need for the improvements at the CSAH 4 and Sawyer Avenue/Arrowhead Road intersection are the result of the extension of Sawyer Avenue rather than the proposed development.

Site Plan/Access Review

A review of the proposed site plans was completed to identify any issues and recommend potential improvements with regard to site access, traffic control, and circulation. Based on this review, the following issues were identified that should be discussed further and/or incorporated:

1) Internal traffic controls were not identified. However, traffic controls, signing, and striping should be incorporated based on the Manual on Uniform Traffic Control Devices (MUTCD). In particular, it is important to identify traffic controls at intersections between internal roadways/driveways to minimize vehicular conflicts and driver confusion.

It should be noted that several site plan improvements were already incorporated into the site plan as part of the development process.

Summary and Conclusions

The following study conclusions and recommendations are offered for your consideration:

1. Results of the existing intersection capacity analysis for the peak 15-minute interval indicates that the CSAH 4/Airport Road intersection operates at LOS D during the p.m. peak 15-minute period.
   a) Side-street left-turns were observed to be difficult from both Airport Road and Airpark Boulevard onto CSAH 4 during the p.m. peak 15-minute period. Southbound left-turns at the CSAH 4 and Arlington Avenue/Arrowhead Road intersection are difficult during both the a.m. and p.m. peak hours.
   b) Internal queuing was present for the Northstar Academy Charter School and Optum/United Health Group driveways along Technology Drive during the school start and end times. These operations occur primarily during the peak 15-minute period before and after school.
2. Results of the existing intersection capacity analysis for the 60-minute peak period indicates that all study intersections currently operate at an acceptable overall LOS C or better during the a.m. and p.m. peak hours.
   a) The significant side-street left-turning delay for motorists on Airport Road turning left onto CSAH 4 continues throughout the entire peak hour. A traffic signal is planned to be installed at this intersection to address this issue.
3. The following improvements are planned to be constructed by the year 2020.
   a) New traffic signal at CSAH 4 and Airport Road
   b) Extension of Sawyer Avenue to Krueger Road
   c) Realignment of Krueger Road to the south to align with the proposed development access.
      - Contingent upon construction of the proposed development.
4. Existing traffic volumes were modified to reflect year 2020 no build conditions, including an annual growth rate of one percent, which is consistent with area planning documents.
5. Approximately 3,500 vehicles per day are expected to utilize the extension of Sawyer Avenue under year 2020 no build conditions.
6. Results of the year 2020 no build intersection capacity analysis for the peak 15-minute interval indicates that all intersections are expected to operate at an acceptable overall LOS C or better during the a.m. and p.m. peak 15-minute periods.
   a) Side-street delay at Airpark Boulevard is expected to be approximately 55 seconds (LOS F) during the p.m. peak 15-minute period.
   b) The queuing issues along Technology Drive and CSAH 4 are expected to improve due to the extension of Sawyer Avenue as motorists will have an alternative route to consider.
7. Results of the year 2020 no build intersection capacity analysis for the 60-minute peak period indicates that all study intersections currently operate at an acceptable overall LOS C or better during the a.m. and p.m. peak hours. This includes the current north/south split phasing at the CSAH 4 and Sawyer Avenue/Arrowhead Road intersection.

a) If split phasing were to be removed, the overall operations are improved in the p.m. peak hour and maintained during the a.m. peak hour. However, the south approach would need to be re-striped to include dual left-turn lanes and share thru/right-turn lane.

8. The proposed development is expected to consist of an 800 student charter high school and 400 apartment units. This will generate approximately 548 a.m. peak hour, 480 p.m. peak hour and 4,028 daily trips.
9. Results of the year 2020 build intersection capacity analysis indicate that the CSAH 4 and Krueger Road/High School Access intersection is expected to operate at an overall LOS D during the p.m. peak 15-minute period.
   a) Significant side-street queuing and delays over two and a half minutes are expected at the Krueger Road/High School Access.
10. Results of the year 2020 build condition intersection capacity analysis for the 60-minute peak period indicate that all study intersections currently operate at an acceptable overall LOS C or better during the a.m. and p.m. peak hours.
    a) The average side-street delay at the proposed development driveway is expected to extend over 30 seconds during the p.m. peak hour.
11. To address the operational issues identified, the following improvements are offered for consideration.
    a) CSAH 4 and Krueger Road/High School Access
       - Add southbound and northbound left- and right- turn lanes on CSAH 4.
       - Widen the Krueger Road/High School Driveway access to include a right- and shared thru/left-turn lanes.
       - Monitor the intersection to determine if/when a traffic signal may be warranted and installed (expected to be after year 2020).
    b) CSAH 4 and Arlington Avenue/Arrowhead Road
       - *Optional* - Restripe to include an additional southbound left-turn.
    c) CSAH 4 and Sawyer Avenue/Arrowhead Road
       - Construct a southbound left-turn lane.
       - *Optional* - Remove the split timing at the north and south approaches of the intersection and replace with protected-only or flashing yellow arrow left-turn phasing.
         - Requires the restriping of the south approach to include dual left-turn lanes and a shared thru/right-turn lane.
       - *Optional* - Construct a westbound right-turn lane.
    d) Incorporate traffic controls, signing, and striping based on the Manual on Uniform Traffic Control Devices (MUTCD).

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Addendum

SRF No. 0159014

To: David Bolf, PE
Northland Consulting Engineers

From: Matt Pacyna, PE, Senior Associate
Tom Sachi, EIT, Engineer

Date: May 6, 2016

Subject: Addendum to the Duluth Edison High School Traffic Study

Introduction

Since completion of the *Duluth Edison High School Traffic Study* dated April 6, 2016, discussions with the project team indicate a desire to reduce the number of proposed apartment units. This stems from a combination of factors, including financial considerations, preserving ski trails, and other environmental considerations within the project area. Therefore, this addendum was developed to determine how the change in land use impacts the previous traffic study recommendations. The following sections provide the assumptions, analysis, and addendum conclusions.

Proposed Development Changes

The number of proposed apartment units is expected to decrease from 400 (previously assumed) to 100 apartment units. The high school enrollment, construction timeframe, and site access assumptions continue to be consistent with the previous traffic study. Other study changes include:

Trip Generation

To account for traffic impacts associated with the proposed development change, a trip generation estimate was developed for the a.m. and p.m. peak hours, as well as a daily basis. These estimates, shown in Table 1, were developed using the *ITE Trip Generation Manual, Ninth Edition*.

Table 1. Trip Generation Estimates

Land Use Type *(ITE Code)*	Size	A.M. Peak Hour Trips		P.M. Peak Hour Trips		Daily Trips
		In	Out	In	Out	
Proposed Land Use						
Apartments *(220)*	100 Dwelling Units	10	41	40	22	665
High School *(530)*	800 Students	234	110	77	155	1,368
	New System Trips	244	151	117	177	2,033

The change from 400 to 100 apartment units represents a decrease of 153 a.m. peak hour, 186 p.m. peak hour, and 1,995 daily trips from the previously proposed development. The total site (high school and 100 apartments) is expected to generate 395 a.m. peak hour, 294 p.m. peak hour, and 2,033 daily trips once fully occupied.

Intersection Capacity Analysis

Given the expected decrease in the proposed development trip generation from the previous traffic study, the study area intersections are expected to operate at the same level of service or better under year 2020 peak hour conditions when compared to the previous traffic study. However, the reduction in the proposed development trip generation does not change the previously identified geometric and traffic control recommendations.

Signal Warrant Analysis

A review of the previous traffic signal warrant analysis indicates that even with the reduction in the number of apartment units (400 to 100), a traffic signal would still be warranted at the CSAH 4 and Krueger Road/High School Access intersection between year 2019 and year 2020. This timeframe assumes 100 apartment units are occupied and high school enrollment between 600 and 800 students.

Conclusions

Although the change from 400 to 100 apartment units is expected to reduce the overall trip generation for the proposed development, the previously recommended geometric and traffic control improvements remain valid.