

Environmental Assessment for Construction and Operations of Neutrinos at the Main Injector (NuMI) Off-Axis Electron Neutrino (ν_e) Appearance Experiment (NO ν A) at the Fermi National Accelerator Laboratory, Batavia IL, and near the Ash River, St. Louis County, MN

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Appendix A

Minnesota Environmental Assessment Worksheet

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ENVIRONMENTAL ASSESSMENT WORKSHEET

Note to preparers: This form and EAW Guidelines are available at <http://www.eqb.state.mn.us>. The Environmental Assessment Worksheet provides information about a project that may have the potential for significant environmental effects. The EAW is prepared by the Responsible Governmental Unit or its agents to determine whether an Environmental Impact Statement should be prepared. The project proposer must supply any reasonably accessible data for — but should not complete — the final worksheet. If a complete answer does not fit in the space allotted, attach additional sheets as necessary. The complete question as well as the answer must be included if the EAW is prepared electronically.

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

1. **Project title** NOvA Off Axis Detector Facility at Ash River Site

2. **Proposer** Regents of the University of Minnesota

Contact person Kathleen O'Brien
Title Vice President for University Services
Address 317 Morrill Hall,
100 Church Street SE
City, state, ZIP Minneapolis, MN 55455
Phone 612.624.3557
Fax 612.626.2278
E-mail kobrien@umn.edu

3. **RGU** Regents of the University of Minnesota

Contact person Kathleen O'Brien
Title Vice President for University Services
Address 317 Morrill Hall,
100 Church Street SE
City, state, ZIP Minneapolis, MN 55455
Phone 612.624.3557
Fax 612.626.2278
E-mail kobrien@umn.edu

4. **Reason for EAW preparation** (check one)

EIS scoping Mandatory EAW Citizen petition RGU discretion Proposer volunteered

If EAW or EIS is mandatory give EQB rule category subpart number:

5. **Project location**

County – St. Louis County

City/Township – Project site is located approximately 38 miles southeast of International Falls, Minnesota and 1-1/4 miles southwest of the Settlement of Ash River, off the Ash River Trail (St. Louis County Highway 129).

Section – 13, 14, 15
Section – 18

Township - 68N Range - 20W and
Township - 68N Range - 19W

Attach each of the following to the EAW:

- County map showing the general location of the project (See **Figure 1**);
- U.S. Geological Survey 7.5 minute, 1:24,000 scale map indicating project boundaries (photocopy acceptable) (See **Figure 2**);
- Site plan showing all significant project and natural features (See **Figure 3**).

6. **Description**

- a. Provide a project summary of 50 words or less to be published in the *EQB Monitor*.

The University of Minnesota is proposing to construct an electron neutrino detector for research on sub-atomic particles. The facility will be about 30 miles southeast of International Falls, Minnesota and will include a 38,028 square foot detector assembly and service building, and a 3 mile access road.

- b. Give a complete description of the proposed project and related new construction. Attach additional sheets as necessary. Emphasize construction, operation methods and features that will cause physical manipulation of the environment or will produce wastes. Include modifications to existing equipment or industrial processes and significant demolition, removal or remodeling of existing structures. Indicate the timing and duration of construction activities.

The University of Minnesota proposes to construct a physics laboratory on a currently undeveloped site about 1-1/4 miles southwest of the unincorporated settlement of Ash River, MN, The site is about one mile south of St. Louis County Highway 129 (Ash River Trail), about 8 miles east of the intersection of the Ash River Trail and U.S. Highway 53, about 21 miles (straight-line) and about 34 miles by road northeast of Orr, MN and about 38 miles by road southeast of International Falls, MN. The closest straight-line distance to Voyageurs' National Park is 1 mile. The site is accessible from the Ash River Trail via an existing, approximately 3.5 mile long logging road. Upgrading the existing roadway is part of this project.

Project Rationale: The purpose of the proposed physics laboratory known as the Ash River Laboratory and Detector is to house a neutrino detector, which will be constructed by an international group of scientists known as the NOvA Collaboration. Neutrinos are elementary particles, which exist in three different types or flavors. They are uncharged, non-ionizing and only rarely interact with ordinary matter. Neutrinos are useful probes of the weak interaction, one of the four fundamental forces in the Universe. The study of the spontaneous transition of neutrinos from one type to another is considered a good way to study important physics questions, such as the properties of the weak interaction, neutrino mass, the contribution of neutrinos to the dark matter in the universe and the relationship between matter and antimatter. The Office of Science of the U.S. Department of Energy has previously constructed a neutrino laboratory and detector at Soudan, MN and a neutrino beam from Fermi National Accelerator Laboratory (Fermilab), near Batavia IL, to the Soudan laboratory and beyond. The proposed Ash River Laboratory and Detector will use the same Fermilab-to-Soudan neutrino beam. In contrast to the Soudan neutrino detector, which measures the parameters of a neutrino flavor transition that is known to occur, the Ash River site neutrino detector will search for a different, previously unobserved transition. A complementary experiment with a shorter neutrino beam is under construction in Japan.

Site Selection Rationale: The mean energy of a neutrino in a neutrino beam varies depending on the distance of the particular neutrino from the beam centerline. The NOvA Collaboration has determined that the optimal neutrino detector location is 12 km (7.5 miles) from the neutrino beam centerline. This requirement was the primary criterion for site selection. Other site selection criteria were as follows:

- (a) The location should be as far as possible from Fermilab to optimize the sensitivity of the experiment.
- (b) The site should be accessible to a highway and have reasonable access to electrical power and telecommunications to reduce construction costs and provide long term accessibility.
- (c) A location in the United States enhances the project organization.
- (d) The location should be elevated, to reduce wetland impacts, and not directly visible from existing parks and other recreational facilities. These factors were considered to reduce the environmental impacts.

Personnel from the Minnesota Department of Natural Resources, the National Park Service and Fermilab participated in preliminary site surveys, although the actual site selection was the responsibility of the University. The selected site is optimal based on the stated criteria.

Site and Laboratory Overview: The proposed physics laboratory site consists of approximately 90 acres of land, much of which has been clear-cut by current or previous owners over the last few years. The main building will have a detector enclosure 295 feet long by 67 feet wide and an assembly area of the same width

and an additional 65 feet in length. The floor of this entire area will be located approximately 40 feet below grade. The entire detector will be surrounded and covered by concrete and aggregate to reduce the effects of cosmic rays coming down naturally from the sky on the detector. Some of the aggregate will consist of a mined mineral known as barite (primarily barium sulfate), which is particularly effective at stopping cosmic rays. Additional features of the physics laboratory include a service building 130 feet long by 67 feet wide built at grade. The Service Building will have one at-grade loading dock and two recessed loading docks. An overhead crane will be used for unloading. Additional site features include the eastern end of the access road and a parking area for 25 vehicles.

Neutrino Detector: The neutrino detector will have a total mass of up to 20,000 metric tons. Approximately 70 percent of the mass will consist of mineral oil with the addition of up to 10 percent by mass of pseudocumene and other organic compounds known as wavelength-shifters. These compounds have the ability to absorb light at one wavelength and re-emit the light at another, longer wavelength, so that light can be more efficiently transmitted and collected. The remaining 30 percent of the mass will consist primarily of polyvinyl chloride (PVC) extrusions, which will house the mineral oil in channels approximately 2.5 inches in width and 52 feet in length. In addition to this primary containment, the neutrino detector enclosure will provide sufficient below-grade, secondary containment for the entire mineral oil inventory plus the entire contents of the water-based fire suppression system.

Roadway, Site and Laboratory Construction: The initial planned onsite activities are the construction of the road, the leveling of the building site and the construction of the physics laboratory. The road will follow the existing logging road, except that some curves will be straightened and some grades will be reduced. The road is designed to be as “fill neutral” as possible, that is, soil and rock removed from the building site will be used for widening the logging road. The current plan is that the finished road will appear similar to the Ash River Trail with two paved traffic lanes, shoulders and open ditches for drainage. Utilities will be buried on either side of the road.

Much of the western third of the road traverses a wetland on an old railroad embankment. Care will be taken to minimize impacts on the wetland and wetland credits will be purchased as a permanent mitigation. Although this road section impacts a wetland, its environmental impact is less than any alternative new right-of-way. Alternative routes would likely affect mature, not recently logged forest areas and would certainly establish new migration routes for wildlife.

Soil and rock borings have established that the Physics Laboratory site is primarily granite with minimal soil cover. Leveling the site and excavating for the building will require both bulldozing of the soil cover and blasting of the rock. We anticipate onsite crushing of excavated rock to provide fill material for the road and aggregate for the concrete required for the Physics Laboratory.

Schedule and Decommissioning: The University expects to commence construction in late Fall 2007 or early Spring 2008, depending on the availability of funds and the weather. Site and building construction is expected to last through 2010. Detector installation is expected to occur between 2010 and 2013. During installation, 30 to 50 people are expected to work at the site, either as employees or visitors. Detector operation is expected through 2025. Average staff and scientific visitor count during operations is expected to be fewer than 10 people. A visitor program for school groups and the general public might include 2,000 to 3,000 people per year.

The University will own the site and buildings, but the neutrino detector and other equipment will be the property of the United States. At the conclusion of the physics research, the University will require the United States to remove all of its equipment and to remediate any issues resulting from its equipment. The University will then determine future use of the building and site in the best interests of the University and the people of Minnesota.

Environmental Issues: Because the site is currently undeveloped, the proposed project will change the appearance and current use of the site. At closest approach, the physics laboratory is just over 1,000 feet from the nearest point of the Ash River, which discharges in Lake Kabetogama. The University and its contractors expect to minimize environmental impacts by (1) depressing the detector into the ground to provide secondary

containment and minimize visual impacts; (2) implementing a Storm Water Pollution Prevention Plan as well as erosion and sedimentation controls to minimize impacts on the Ash River and adjacent waters; (3) using the existing access right-of-way to minimize impacts on wildlife; and (4) purchasing wetland credits to provide no net loss of wetlands in the region.

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

The NOvA project is considered basic research to advance human understanding of the physics of the neutrino particle. The project is being constructed in large part due to its location as the most optimal distance from the other laboratories that will jointly conduct the research. Other locations outside of the northern St. Louis County area are not suitable for the technology. The University of Minnesota conducted open houses to identify stakeholders and generate feedback and consensus to select a site that most suitably minimizes environmental effects and community concerns. The National Park Service emerged as a key stakeholder and provided input and consensus to select a site that minimizes potential environmental effects related to Voyageurs National Park. The lead government agency for the project will be the University of Minnesota.

- d. Are future stages of this development including development on any outlots planned or likely to happen?
 Yes No

The current design does not include plans for further development.

- e. Is this project a subsequent stage of an earlier project? Yes No

This project is not a subsequent stage of an earlier project.

7. **Project magnitude data**

Total project acreage: The project site is defined as that area in the immediate vicinity of the proposed facility structure and the area within 25 feet of the centerline of the proposed access road. The project site consists of both the 89.63 acres of property referred to as the facility site where the Ash River Laboratory and Detector will be constructed, and the 18.90 acres along the approximately 3-mile access road. The limits of the facility site and the proposed access road corridor are identified on **Figure 2**.

With in the facility site the detector structure will occupy approximately 1.0 acre. The Assembly Space and Service Building will occupy approximately 0.66 acres in area and will be visible above the ground surface. The associated parking area will be 0.92 acres in area.

Number of residential units: unattached - NA attached – NA **maximum units per building** - NA
 Commercial, industrial or institutional building area (gross floor space): total square feet: Approx. 38,038 sq. ft.

Indicate areas of specific uses (in square feet):

Office	1,000 sq. ft. (Includes kitchenette (200 sq. ft.) and conference room (250 sq. ft.).	Manufacturing	NA
Retail	NA	Other industrial	NA
Warehouse	NA	Institutional	37,038 sq. ft.
Light industrial	NA	Agricultural	NA
Other commercial (specify)	NA		

Building height. If over 2 stories, compare to heights of nearby buildings

The building is 22-meters high (72-feet), with the majority of the facilities occurring below ground. Approximately 37.6 feet will be exposed above ground. There are no existing buildings located on or in the vicinity of the project site.

8. **Permits and approvals required.** List all known local, state and federal permits, approvals and financial assistance for the project. Include modifications of any existing permits, governmental review of plans and all direct and indirect forms of public financial assistance including bond guarantees, Tax Increment Financing and infrastructure.

Unit of Government	Types of Applications	Status
FEDERAL:		
U.S. Army Corps of Engineers	Section 404 Permit	To be applied for
Department of Energy	Project funding	Currently in negotiation
STATE:		
Minnesota Pollution Control Agency	National Pollutant Discharge Elimination System NPDES Construction Permit	To be applied for
Minnesota Pollution Control Agency	Section 401 Certification of U.S. Army Corps of Engineers Section 404 permit	To be applied for
Minnesota Department of Health	Domestic Well Permit	To be applied for
Minnesota Pollution Control Agency Minnesota Department of Natural Resources Minnesota Department of Health	Dewatering Permits: <ul style="list-style-type: none"> ▪ NPDES ▪ Temp. Dewatering Permit (Construction only) ▪ Water Appropriations Permit ▪ Dewatering Well Construction 	To be applied for if necessary
Minnesota Department of Natural Resources	Construction Dewatering Permit	To be applied for, if necessary
University of Minnesota	Building Permit	To be applied for
LOCAL:		
St. Louis County	Wetland Conservation Act Permit	To be applied for
St. Louis County Planning Commission	Land Alteration Permit	To be applied for

9. **Land use.** Describe current and recent past land use and development on the site and on adjacent lands. Discuss project compatibility with adjacent and nearby land uses. Indicate whether any potential conflicts involve environmental matters. Identify any potential environmental hazards due to past site uses, such as soil contamination or abandoned storage tanks, or proximity to nearby hazardous liquid or gas pipelines.

The site is currently undeveloped. The facility site consists of three land parcels that total 56 acres. Two (2) of the parcels are currently owned by the Minnesota Department of Natural Resources (MNDNR). The third section is currently owned by the Forest Capital Partners (formerly Boise Cascade). Access to the facility site is via an old clay base logging road which crosses land owned by Forest Capital Partners and the MNDNR. The properties have been primarily utilized for timber cutting operations in the past. The MNDNR Division of Forestry is responsible for management of the site and these timber production areas are parcels within the Kabetogoma State Forest. The proposed facility site contains several logging roads and trails providing access throughout the site. No old growth forest exists on the site. The upland forest cover consists of young stands of trees in areas recently harvested, to middle aged trees in older cut areas. Approximately 80% of the existing tree cover consists of quaking aspen (*Populus tremuloides*). The majority of the facility site has been recently clear-cut and is devoid of tree cover.

The proposed access road alignment crosses both wetland and upland land uses that are similar to those found on the facility site. The road also transects through MNDNR-owned timber parcels and private parcels. There are no residential or developed parcels along the proposed access road alignment. Similar to the facility site, there are numerous clearcuts and other recent impacts from timber production in the vicinity of the access road alignment.

Neither the proposed facility site nor access road alignment show evidence of potential pollution concerns or potential environmental hazards due to past site uses.

10. **Cover types.** Estimate the acreage of the site with each of the following cover types before and after development:

If **Before** and **After** totals are not equal, explain why.

Cover Type	Before		After	
	Facility Site	Access Road	Facility Site	Access Road
Types 1-8 Wetlands	4.13 acres	2.55 acres	4.13 acres	0 acres
Wooded/Forest	84.20 acres	4.35 acres	78.79 acres	0 acres
Brush/Grassland	0 acres	8.9 acres	0 acres	7.6 acres
Cropland	0 acres	0 acres	0 acres	0 acres
Lawn/Landscaping	0 acres	0 acres	3.39 acres	0 acres
Impervious Surfaces	1.30 acres	3.1 acres	3.32 acres	11.3 acres
Other	0 acres	0 acres	0 acres	0 acres
Totals	89.63 acres	18.90 acres	89.63 acres	18.90 acres

The table above shows that the existing 89.63 acre facility site area is wooded, with parts having been logged within the last five years. The existing impervious surfaces are associated with natural surface bedrock exposures and logging roads located within the facility site. Construction on the facility site will result in creation of new impervious surfaces. The area of proposed new impervious surfaces includes the laboratory and detector building, service and assembly structure, and the parking area. The area immediately around the structures will be restored after construction as lawn and landscaping.

Cover types were estimated within a 66-foot corridor for the proposed access road. The existing gravel roadway along the corridor is considered impervious surface. The calculations assume the new road will be a 30-foot paved roadway with 10-feet of clear zone on either side. Areas within the 30-foot roadway will be converted to impervious surface, either from the existing gravel road (also considered impervious), wetland, or forest. The 10-foot clear area along either side of the completed roadway is assumed to be converted to brush/grassland after restoration following construction. It is assumed that these areas will be maintained annually to keep brush and trees back from the roadway to maintain the clear zone.

Two wetlands were delineated within the 89.63 facility site boundary, but none of these wetlands will be impacted by the facility or related construction. Four wetlands were delineated along the proposed road alignment. The 0 acres value in the “After” column for the access road is based on the preliminary estimate that there will be 2.52 acres of wetlands impacted by the road. Road related wetland impacts are expected to be refined when detail design plans are developed, but the final wetland impact acreage should be similar. The difference in forest cover acreages for the access road is represented in the after amounts of impervious surface (road surface) and the grassland that will be maintained in the adjacent right-of-way of the access road. Eight (8) acres of temporary stockpiles will be placed within the facility site during construction entirely within the recently clear cut wooded forest cover type. Upon completion of construction, temporary stockpiles will be removed and those areas restored; the 8 acres of restored stockpile areas are included in the 78.79 acres of wooded/forest cover in the “After” column.

11. Fish, wildlife and ecologically sensitive resources

a. Identify fish and wildlife resources and habitats on or near the site and describe how they would be affected by the project. Describe any measures to be taken to minimize or avoid impacts.

Facility Site: The habitats within the site boundary are entirely comprised of forested uplands that have been subjected to recent clearcutting activities. There are no fluvial, or lacustrine habitats affected by the project. Patches of un-cut timber are present amid the recently clearcut areas within the facility site boundary. Quaking aspen (*Populus tremuloides*) are the dominant canopy trees with a subcanopy of paper birch (*Betula papyrifera*), balsam fir (*Abies balsamea*) and white spruce (*Picea glauca*). The shrub layer has scattered beaked hazel (*Corylus cornuta*) and the ground cover is dominated with bracken fern (*Pteridium aquilinum*) and bigleaf aster (*Aster macrophyllum*). There is no old growth forest within or immediately adjacent to the project site boundary, including red pine (*Pinus*

resinosa) or white pine (*P. strobius*). Soils are thin or comprised of exposed Precambrian bedrock outcrops within a relatively rugged topography. These habitats represent the common types of upland habitats found in the surrounding area.

Permanent impacts to this upland habitat will total 2.11 acres and will be restricted to areas that are graded, impervious surfaces (parking and buildings), and the area that is converted to landscaping/turf that will surround the underground facility. A breakdown of this impact area is as follows:

- Detector Facility = 0.67 acres
- Parking area comprised of impervious surfaces = 0.93 acres
- Lawn and landscaping adjacent to building and parking lot = 3.39 acres

The remaining area within the 89.63 facility site boundary will remain as undisturbed upland habitat. Before and after cover types are also summarized in question 10 of this EAW.

No raptor nests or suitable nest trees were observed within the footprint of these facilities due to recent clearcutting. No deer wintering yards, or other unique habitat feature was identified within or immediately adjacent to the site boundary. Direct impacts to wildlife habitat are anticipated to be relatively minimal and restricted to the areas within the site boundary that are permanently converted to another land use. No direct impacts to fish habitats will occur. Indirect impacts to fish habitats (Ash River) will be minimized through the implementation of required National Pollution Discharge Elimination System (NPDES) permit standards during and after construction.

Surrounding habitats that are outside of the site boundary include Type 3 semi-permanently flooded marshes, Type 6 scrub shrub swamps, and Type 7 black spruce (*Picea mariana*) swamps. Surrounding uplands are similar to the forest communities found within the site boundary and described above, much of which has also been subjected to timber harvesting activities including clearcutting.

Ash River: The Ash River channel and associated floodplain is located 1,160 feet to the south of the facility footprint or the area of the project that will be subject to construction activities. The closest portion of facility footprint (parking lot) is 1,186 from the Ash River channel. During the preliminary planning for this project, the location of the facility was moved further away from the Ash River channel to minimize the potential for disturbance along the shoreline and floodplain. The Ash River is a MNDNR Designated Trout Stream subject to Minnesota Statutes and MNDNR policy. Projects that are within 1,000 feet of a Designated Trout Stream are subject to special conditions set forth in the Statutes and MNDNR policies related to the MNDNR Protected Waters statutes. Although there is no specific statute language on the implementation of Designated Trout Waters best management practices (BMPs), the MNDNR is expected to provide comments and direction on specific measures to reduce the potential for impacts to these waters. Trout stream BMPs often include provisions to reduce tree cover (shading) removal, sediment control, and in-stream habitat loss.

In addition to the potential project implications on the Ash River, other indirect impacts to fish and wildlife habitats are expected to be minimal. Most or all of these surrounding habitats are expected to remain in their current state as natural cover or timber harvesting. No disruptions of wildlife migration, movement, or genetic exchange are anticipated. Habitat fragmentation effects are anticipated to be minimal due to the relatively small size of the project impact area and the anticipated static state of the surrounding habitats. Relatively speaking, large amounts of forest cover in the area have already been subjected to temporary habitat fragmentation as a result of timber harvesting. Minimization of indirect temporary impacts resulting from construction will be implemented through the NPDES permit and erosion control requirements that will be applied.

Access Road: Anticipated impacts to fish and wildlife habitats from the proposed access road include forested upland habitats similar to the conditions described within the site boundary and to Type 6 scrub shrub, Type 7 mixed forest, and Type 8 black spruce and tamarack (*Larix laricina*) bog wetland habitats. Road impacts will be minimized to the greatest extent practicable by using the footprint of the existing roads and avoiding and minimizing wetland impacts. Unavoidable wetland impacts will be mitigated for through the wetland permitting process described in more detail in EAW question 12.

There are no known concentrations of migratory birds protected under the Federal Migratory Bird Treaty Act within the project boundary, and no project effects on such concentrations are anticipated. To comply with and minimize effects on nesting songbirds protected under the Act, tree clearing activities will occur outside of the bird nesting season from April 1 to August 15. This will apply in areas that were not previously clearcut for timber harvesting.

b. Are any state-listed (endangered, threatened or special concern) species, rare plant communities or other sensitive ecological resources such as native prairie habitat, colonial waterbird nesting colonies or regionally rare plant communities on or near the site? X Yes No

If yes, describe the resource and how it would be affected by the project. Indicate if a site survey of the resources has been conducted and describe the results. If the DNR Natural Heritage and Nongame Research program has been contacted give the correspondence reference number: SEH/MNDNR NHIP License Agreement. Describe measures to minimize or avoid adverse impacts.

The MNDNR Natural Heritage Information Program (NHIP) was contacted to identify potential state and federally listed Threatened, Endangered, Special Concern species, and sensitive resources in the project area (MNDNR correspondence reference # SEH/MNDNR NHIP License Agreement). The NHIP identified 5 occurrences within a 1.5-mile radius of the project site and is the basis for the following discussion. No occurrences are found within the facility site boundary or footprint of the proposed access road.

Federally Listed Threatened and Endangered Species

The project county is within the breeding range of the bald eagle (*Haliaeetus leucocaphalus* – federal status, Threatened – proposed for delisting), the distributional range of the grey wolf (*Canis lupus* – federal status, Threatened), and the distributional range of the Canada lynx (*Lynx canadensis* – federal status, Threatened). No bald eagle nesting areas are identified within or within a one-mile radius of the site boundary and none were observed during a site reconnaissance. Suitable nest trees for eagle nests were lacking and there were no lakes that serve as foraging habitats for bald eagles in the vicinity of the site boundary.

Canada lynx habitat is marginal to poor within the site boundary, due to extensive clearcutting. MNDNR data (MNDNR, 2005) show one un-verified occurrence of the Canada lynx in an area several miles to the south of the project. The majority of the verified occurrences in St. Louis County, including breeding occurrences and radio collared cats occur approximately 50 or more miles to the east of the project area in the eastern part of the Superior National Forest. Despite the poor habitat conditions and lack of verified occurrences, Canada lynx are wide ranging animals that could potentially utilize and establish in the project area in the future. Ongoing MNDNR, U.S Forest Service (USFS), and U.S. Fish and Wildlife Service (USFWS) efforts to monitor this recently listed species are expected to continue.

Grey wolves are known to occur throughout the project area, an area where wolves have long been established prior to and since they were federally listed. Two observations of wolf scat were documented within the project boundary during a 2005 field reconnaissance. The nature of the project and the surrounding habitats and land uses are such that no measurable effects to grey wolves or their habitats are anticipated. Measurable effects could be possible if the project were to cumulatively result in impacts with other reasonable and foreseeable projects in the area. To date there are no other reasonable and foreseeable projects proposed in addition to this project.

State Threatened, Endangered and Special Concern Species and NHIP Occurrences

The NHIP identified no occurrences within the site boundary and five (5) occurrences within a 1.5 mile radius of the site boundary. One occurrence is recorded near the existing access road, approximately 800 feet southeast of the intersection with the Ash River Trail. The following paragraphs provide a general description of the location and characteristics of the occurrences. However, the precise location and details about the species occurrences are not provided, nor published on the figures in this document in order to protect the rare features from exploitation or destruction.

Four of the five noted occurrences were of tiger beetles (*Cicindela denikei* – state status, Threatened). Two of the tiger beetle occurrences were recorded in 2001 and 2004 approximately 1.5 to 2 miles south of the facility site, upgradient of a tributary to the Ash River. Because of the distance of the separation and the fact that they are upgradient from the project site, these occurrences are outside the influence of the proposed project. Habitats for the tiger beetle are microhabitats several square feet in size, ephemeral, and restricted to bare patches of disturbed soil.

Most occurrences of this rare insect are chance sightings or the results of research by the scientific community. Survey, detection and mitigation or habitat management for this species does not exist due to the species biology. Tiger beetle occurrences in the NHIS are primarily included for tracking and monitoring purposes.

The other three noted occurrences are east of the project site along the existing access road and Ash River Trail. One tiger beetle occurrence and one location of a population of Lapland buttercup (*Ranunculus lapponicus* – state status, Special Concern) are identified along the Ash River Trail west of the intersection of the site access road. These locations are outside of the influence of the proposed project. The only noted occurrence within close proximity the project area is a single occurrence of a tiger beetle recorded in 2001 approximately 50 feet off the existing site access road.

12. **Physical impacts on water resources.** Will the project involve the physical or hydrologic alteration — dredging, filling, stream diversion, outfall structure, diking, and impoundment — of any surface waters such as a lake, pond, wetland, stream or drainage ditch? Yes No

If yes, identify water resource affected and give the DNR Protected Waters Inventory number(s) if the water resources affected are on the PWI: Ash River. Describe alternatives considered and proposed mitigation measures to minimize impacts.

The Ash River and associated floodplain wetlands exist south and east of the project as shown on **Figure 6**. The Ash River is a Protected Water on the Minnesota Department of Natural Resources (MNDNR) Protected Waters Inventory (PWI) Maps (See Figure 7).. The stream segment that flows to the south of the project site is a MNDNR Designated Trout Stream. The National Wetlands Inventory (NWI) shows additional wetland habitat in areas around the proposed project site, including forested bog habitat along the existing access road. A wetland delineation was completed for the project following the U.S Army Corps of Engineers (USACE) wetland delineation manual. Two wetlands were delineated within the facility site boundary and several wetlands are crossed by the proposed access road. The delineated wetlands are shown in **Figure 6**.

There are two wetlands and no streams located within the 89.63 acre facility boundary, but none of the wetlands will be impacted as they are located outside of the facility impact footprint. Therefore, construction of the detector enclosure and the associated parking facilities will not result in dredge and fill impacts to wetland habitat. The Ash River is located approximately 1,186 feet south of the facility parking area. No direct impacts to the Ash River or the associated floodplain wetlands will occur from construction of the proposed project.

Wetland sequencing requirements under the guidance of both the Minnesota Wetland Conservation Act (WCA) and the Section 404 requirements of the USACE were implemented from the on-set of the project and will be implemented through construction. New road alignment alternatives were compared to the wetland impacts associated with improvement of the existing timber access road. All of the new road alignments that were evaluated would result in 20 acres or more of wetland impact. In comparison, improvement of the existing timber access road for the project will impact approximately 2.52 acres of wetlands with dredge and fill impacts. Improvement of the timber access road will result in reconstruction of approximately 4,205 feet of existing road. Improvement of the existing roadway from a 15-foot unpaved section to a 30-foot paved section will result in filling approximately 2.52 acres of wetland along the existing roadway as shown on **Figure 5**. The existing timber road alignment was selected as the preferred alternative for the access road specifically to minimize wetland impacts. Wetland sequencing will be implemented through the final design and permitting for the access road and will consider measures to minimize the impact footprint within each wetland.

Impacts of this magnitude will require permits from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and from St. Louis County under the requirements of the Minnesota Wetland Conservation Act of 1991 (WCA). None of the potentially impacted wetland habitat is designated as a Protected Water or wetland under jurisdiction of the Minnesota Department of Natural Resources.

Both the federal and state wetland regulations require consideration of measures to avoid and minimize impacts to wetlands and will require mitigation of unavoidable impacts by replacement at a minimum ratio of one acre for each acre filled. Sequencing (avoidance and minimization) and mitigation opportunities will be evaluated during project design and discussed with regulatory staff during project permitting. Wetland mitigation will come from within the required USACE Wetland Bank Service Area, from an existing wetland bank located in Beltrami County (BWSR

Account #1266) which provides both WCA and Section 404 wetland credit. The Combined Wetland Permit Application and Replacement Plan will be submitted to the respective review agencies after the completion of the EAW process. Wetland mitigation for the project will be addressed within the Replacement Plan and will follow the required in-kind, in-place sequence for implementing mitigation.

Design details on culvert crossings and hydrologic modeling, and potential for flooding or overtopping of the proposed access road will be evaluated during the final design phase in the future.

13. **Water use.** Will the project involve installation or abandonment of any water wells, connection to or changes in any public water supply or appropriation of any ground or surface water (including dewatering)? Yes No
If yes, as applicable, give location and purpose of any new wells; public supply affected, changes to be made, and water quantities to be used; the source, duration, quantity and purpose of any appropriations; and unique well numbers and DNR appropriation permit numbers, if known. Identify any existing and new wells on the site map. If there are no wells known on site, explain methodology used to determine.

The Minnesota Department of Health//Minnesota Geological Survey, County Well Index (CWI) statewide well database was searched to identify wells within the project area. No well records were identified in that search (*County Well Index, Minnesota, January 12, 2005, Minnesota Geological Survey and Minnesota Department of Health*).

Geotechnical borings were drilled at the project site in the fall of 2005 by American Engineering Testing (AET) of St. Paul, Minnesota. Two borings were drilled in the vicinity of the proposed facility structure. A piezometer was constructed at one of the borings after the completion of drilling (as shown on **Figure 4**) and was used to monitor groundwater levels at the site. The piezometer was constructed by driving a 4 inch diameter steel casing to the top of bedrock. The open borehole created by the rock coring was used for the lower portion of the piezometer. A protective steel casing was placed around upper portion of the piezometer. This piezometer is no longer actively monitored and will be abandoned and sealed in accordance with Minnesota Rules, Chapter 4725.

The proposed project will require one or more water wells for domestic water purposes and to fill storage tanks for fire protection. The wells will be sited near the Detector Enclosure in order to serve that facility. The well will be used for potable water for the normal operating occupancy of 8 – 10 people. The well will also be used to charge the Fire Protection system (60,000 gallons of storage). The well will not be used to actively fight fire, but will only be used to charge the storage system. This will limit the capacity need of the facility and the demand on the well. The approximate location of the new well is shown on **Figure 3**.

At a minimum, dewatering of perched groundwater will be required during construction. During construction a temporary dewatering permit will be obtained from the MNDNR. If groundwater is determined to exist within the bedrock, permanent dewatering may be needed to protect the structure. Permanent dewatering will likely consist of a series of perimeter drains that discharge to a gravity outlet or to a sump where the discharge will be pumped out to a temporary or permanent sedimentation basin. Further evaluation will be needed to determine the pumping rate for dewatering; however, it is likely a water appropriations permit will be required.

14. **Water-related land use management district.** Does any part of the project involve a shoreland zoning district, a delineated 100-year flood plain, or a state or federally designated wild or scenic river land use district?
 Yes No
If yes, identify the district and discuss project compatibility with district land use restrictions.

There is a 100-year floodplain along the Ash River identified on the National Flood Insurance Program Flood Insurance Rate Map (FIRM) (See Figures 4 and 5). In addition, the Ash River is a Protected Water and has a designated shoreland area within 300 feet of its bank (Figure 7).. The shoreland zone also includes the area of the floodplain where it extends beyond the 300-foot defined shoreland area. None of the proposed facility impact footprint is within either the shoreland area or the floodplain of the Ash River.

15. **Water surface use.** Will the project change the number or type of watercraft on any water body? Yes No
If yes, indicate the current and projected watercraft usage and discuss any potential overcrowding or conflicts with other uses.

16. **Erosion and sedimentation.** Give the acreage to be graded or excavated and the cubic yards of soil to be moved: Acres: 33 acres (approximately 6 acres for the facility structure, 8 acres for temporary construction stockpiles within the project site, and 19 acres along the access road) ; Cubic Yards: Soil/Clay Stockpile - approximately 84,000 cu. yds.; Rock Stockpile - approximately 74,000 cu. yds.

Construction of the Detector Enclosure will require excavation of 40 feet overburden and bedrock in the southernmost portion of the structure. The northernmost portion of the structure, where trucks will dock to unload materials, will be constructed approximately 10 feet below existing grade. The grade of the structure has been set to have as much of the facility underground as possible to shield it from cosmic rays, to balance materials on the site, and to have sufficient materials available to backfill around the facility structure. As currently proposed, the Detector Enclosure will have a clear height of 65 feet, measured from the depressed floor of the Detector Enclosure. The roof of the Detector Enclosure will include a cast-in-place concrete overburden to shield the detector from cosmic rays. Topsoil and rock excavated for facility construction will be stockpiled for use in backfilling the facility and for restoration of other disturbed areas of the site.

Construction of the facility will result in disturbance of approximately 14 acres of the 89.93 acre project site, and reconstruction of the access road will result in the disturbance of approximately 19 acres. Because development of the proposed project will include clearing, grading, and excavation disturbing greater than one acre, it will be required to comply with the General Permit to discharge storm water associated with construction activity under the NPDES as implemented by the Minnesota Pollution Control Agency (MPCA). Coverage under the General Permit will be applied for and a Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to the beginning of construction. Runoff from the site will flow to a special water (the Ash River) and ultimately to an impaired water (Lake Kabetogama), so the SWPPP will comply with the more rigorous requirements of the NPDES General Permit. The impairment category for Lake Kabetogama is listed as “mercury” in the Impaired Waters list. No project effects are anticipated on the impairment as no significant mercury based emissions will occur.

The SWPPP will include a combination of narrative, plan sheets and standard detail sheets that address the foreseeable conditions, at any stage in the construction or post-construction activities. It will include a description of the nature of the construction activity and address the potential for discharge of sediment and/or other potential pollutants from the site.

The SWPPP will address both temporary and permanent storm water treatment and control at the project site. Temporary sediment basins will be provided to treat runoff prior to discharge from the construction site. The basins will provide storage to contain a two-year, 24-hour storm from each acre contributing to the basin or at least 1,800 cubic feet, whichever is greater. The basin(s) will be designed with the ability to allow complete basin drawdown for maintenance and provide a stabilized emergency overflow to prevent failure of pond integrity and energy dissipation will be provided for the basin outlet. The temporary basins will be constructed and made operational concurrent with the start of soil disturbance. Where temporary sediment basins are not attainable due to site limitations (shallow depth to bedrock), equivalent sediment controls, such as smaller sediment basins, and/or sediment traps, silt fences, vegetative buffer strips or any appropriate combination of measures will be provided for all down slope boundaries of the construction area.

Permanent storm water management facilities will be designed with a volume equivalent to at least one inch of runoff from the new impervious surfaces, in accordance with the requirements for projects discharging to special waters. Permanent treatment facilities will include wet sedimentation, infiltration/filtration, regional ponds or a combination of acceptable practices to provide treatment to a level approved by the MPCA. Where the proximity to bedrock precludes the installation of typical permanent storm water management practices, other treatment, such as grassed swales, smaller ponds, or grit chambers will be provided prior to discharge to surface waters.

Sediment control practices will also be utilized to minimize sediment from entering the treatment facilities and ultimately downstream surface waters. Temporary stockpiles on the site will be protected by silt fence or other effective sediment controls until final stabilization is established on the site. Any site dewatering during construction will be discharged to a temporary or permanent sedimentation basin or otherwise treated such that the receiving water or downstream waters are not adversely affected. Regular inspection of the construction site will be made to ensure erosion and sedimentation controls and treatment facilities are functioning.

The SWPPP for the project site will meet necessary special requirements for discharges to Special Waters because the Ash River is a trout stream and because the Ash River discharges to Lake Kabetogama, an impaired water. The special provisions require protections to higher standards than the general permit requirements. The additional requirements include temporary erosion protection or permanent cover within shorter timeframes; temporary sediment basins for smaller contributing areas; permanent storm water management systems with additional storage volume; a 100-foot, undisturbed buffer zone maintained from the special water; runoff rates maintained at pre-construction rates for both the 1- and 2-year, 24-hour precipitation events; and storm water management system designed to minimize any increase in the temperature of trout stream receiving waters from the 1- and 2-year, 24-hour precipitation events. Because the project will discharge to a trout stream, the site design will also minimize impacts by minimizing impervious surfaces, using vegetated swales between impervious areas, use of infiltration or evapotranspiration of runoff and shading of treatment facilities.

Disturbed areas not occupied by the Detector Enclosure or other facility elements, including stockpile areas, will be restored by replacing topsoil and seeding. Trees may be planted to provide additional visual screening of the facility. Final stabilization of the site will be accomplished in accordance with the SWPPP and the requirements of the NPDES permit.

Describe any steep slopes or highly erodible soils and identify them on the site map. Describe any erosion and sedimentation control measures to be used during and after project construction.

The preliminary results of the National Resource Conservation Service (NRCS) St. Louis County Soil Survey (draft in progress) were reviewed to identify soil map units within the facility site and along the access road. The countywide soil survey is currently incomplete and the erodible soil classifications have not been revised to reflect the draft results of the field mapping, so the old Erodible Soils list was referenced and interpolated when possible. The following soils were found mapped within the facility boundary, all of which are classified as “Not Highly Erodible” under the old Erodible Soils classification system.

- Ashlake-Effie Complex, 1 to 8 percent slopes
- Baudette-Littleswan complex, 1 to 4 percent slopes
- Cutaway-Bionditch-Biwabik complex, 1 to 8 percent slopes

Only a portion of the area surrounding the access road alignment has been surveyed and mapped to date (the western third). In addition to the three map units found within the facility boundary, the following soil map units that have been surveyed were present along the proposed access road alignment. Both of these map units were classified as “Not Highly Erodible” under the old Erodible Soils classification system.

- Suomi-Ashlake complex, 1 to 8 percent slopes
- Spooner-Endoquolls, depressional complex, 0 to 1 percent slopes

There are no steep slopes (i.e. >12%) within the facility site boundary or affected by the access road alignment.

Erosion and sedimentation control measures to be used during and after project construction will be defined during project design. The measures will be designed and implemented in accordance with the NPDES requirements and will be submitted to the MPCA for review and approval prior to the start of construction as described above.

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.

The proposed development will require a NPDES permit from the MPCA and preparation and implementation of a SWPPP as described above. Construction storm water runoff will be treated and managed in accordance with the requirements of the NPDES permit. The controls to be used to manage surface water runoff and to protect downstream water resources will be designed during final design of the proposed project. The SWPPP will be submitted to the MPCA along with the application for the NPDES as required and described above. Post

construction run-off will be treated in accordance with the requirements in the MPCA. Details on appropriate post construction storm water treatment methods will be developed during the final design phases for the access road and the facility site parking lot and for the purposes of the Land Alteration Permit that will be requested from St. Louis County. An industrial storm water permit will not be required. The SWPPP will be prepared and kept at the site during construction by the Permittee who has control of the site, as required by the General Permit.

Containment within the facility will be provided both for the scintillator oil in the detector and for the foam fire suppression system in the building. The facility design will include sufficient storage to contain 100% of the scintillator oil from the detector within the Detector Enclosure. Any scintillator fluid escaping the detector will be collected in a sump, removed, treated and disposed of properly. Similarly, the structure will accommodate containment of the foam fire suppression materials to avoid contact with outside elements or discharge from the site.

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.

Topography on the site results in surface water flow to the south and to the Ash River. The Ash River flows generally east/northeast where it is joined by the Camp Ninety Creek and Gannon Creek before turning north and flowing to Kabetogama Lake. Runoff to the Ash River will be treated in accordance with the approved SWPPP prior to discharge from the site in order to protect the quality of downstream water resources.

18. Water quality: wastewaters

a. Describe sources, composition and quantities of all sanitary, municipal and industrial wastewater produced or treated at the site.

No municipal or industrial wastewater will be generated at the facility during construction or operation. Only normal, domestic sanitary wastewater will be discharged from the facility. The average domestic wastewater output for a workplace setting is 16 gallons per person per day. Assuming that 8 to 12 staff will use the facility during operation, daily total output is expected to be 128 to 192 gallons per day respectively. Domestic wastewater generated during construction and detector assembly will be supplemented with portable facilities and construction crews will not use the indoor facilities during construction.

b. Describe waste treatment methods or pollution prevention efforts and give estimates of composition after treatment. Identify receiving waters, including major downstream water bodies, and estimate the discharge impact on the quality of receiving waters. If the project involves on-site sewage systems, discuss the suitability of site conditions for such systems.

A holding tank will be installed to hold domestic waste output and the tank will be emptied regularly or as needed depending on the phase the project. The holding tank contents will be emptied and hauled by truck to Koochiching County Sanitary Sewer District treatment plant located in International Falls. The Sanitary Sewer District was contacted and confirmed that they can capably accept domestic waste from the facility. Sanitary material trucking services can be provided by a local source through private contracting.

c. If wastes will be discharged into a publicly owned treatment facility, identify the facility, describe any pretreatment provisions and discuss the facility's ability to handle the volume and composition of wastes, identifying any improvements necessary.

Wastewater from the holding tank will be trucked and discharged to the wastewater treatment plant in International Falls which is part of the East Koochiching Sanitary Sewer District. The holding tank contents will be emptied and hauled by truck to Koochiching County Sanitary District treatment plant located in International Falls. The Sanitary Sewer District was contacted and confirmed that they can capably accept domestic waste from the facility. Sanitary material trucking services can be provided by a local source through private contracting.

d. If the project requires disposal of liquid animal manure, describe disposal technique and location and discuss capacity to handle the volume and composition of manure. Identify any improvements necessary. Describe any required setbacks for land disposal systems.

Not applicable, no animal waste will be generated from this facility.

19. Geologic hazards and soil conditions

a. Approximate depth (in feet) to ground water: 2.5 feet; to bedrock: 4 to 17.8 feet.

American Engineering Testing, Inc. (AET) performed drilling at the project site. Two borings were drilled on the site in September 2005 at the locations AR-1 and AR-2 shown on **Figure 4**. The estimated surface elevations for AR-1 and AR-2 are 1,238 and 1,217 feet above mean sea level (msl) respectively. Borings AR-1 and AR-2 were completed in the vicinity of the building footprint. Rock coring was performed in both borings to depths of 60.2 feet and 57.8 feet, respectively.

Surficial soil deposits above bedrock in the area of the borings vary in thickness from 4 to 17.8 feet. The near surface, unconsolidated material is clayey in nature ranging from lean to fat clay to clayey sand. Underlying the clayey surface layer, is silty sand extending to the surface of the bedrock. Possible cobbles were noted during drilling and mottling of the soils was also indicated. Twenty-seven additional borings were completed on site by AET in October, 2006. These borings locations are also included on Figure 4. Unconsolidated deposits in these borings are also consistent with the glacial till and have sandy and gravelly deposits overlying bedrock at the proposed detector facility. Several borings taken along the proposed access road encountered peat deposits up to a depth of 11 feet over a centerline distance of 3,000 feet. Other borings drilled along the access road encountered clayey glacial till deposits near the ground surface.

Depth to bedrock was found to range from approximately four to eighteen feet below ground surface. Bedrock at the site consists of Vermillion granite massif. Joints were observed in the rock at various depths. Coloration of the rock varies with depth at each boring but generally includes pink and black with gray speckling. Four main lithologies were observed in rock cores from the site. granite, granodiorite, diorite and migmatite.

Groundwater elevations monitored at boring AR-1 were found to be approximately 2.5 feet below the surface. Groundwater elevation was measured at only at AR-1 and represents groundwater elevation only in that location. A perched groundwater interval has been documented at the overburden/bedrock interface at several site locations. This perched water unit, where it occurs, is generally less than 1 foot thick and is likely caused by seasonal runoff and rainfall events. The direction of groundwater movement likely follows the slope of the bedrock at the site from northeast to southwest.

Further investigation was completed on the groundwater condition at the site from January 2007 through May 2007. Results of the monitoring and testing indicate the distribution of water is highly variable across the detector site. The occurrence of dry wells and low quantities of water, in wells that exhibit water, suggest that a water table aquifer is not present at the site to the depths investigated, as low as elevation 1181 feet.

Packer tests were run in the field to gain an indication of the number of fractures in the rock and potential groundwater flow characteristics. The packer tests involved sealing and pressurizing a portion of the cored borehole under 30 psi of pressure. The lack of pressure drop and flow in all tests indicates the rock is not very fractured within the tested zones.

Describe any of the following geologic site hazards to ground water and also identify them on the site map: sinkholes, shallow limestone formations or karst conditions. Describe measures to avoid or minimize environmental problems due to any of these hazards.

None of these geologic site hazards to ground water are known to exist at the site.

b. Describe the soils on the site, giving NRCS (SCS) classifications, if known. Discuss soil granularity and potential for groundwater contamination from wastes or chemicals spread or spilled onto the soils. Discuss any mitigation measures to prevent such contamination.

The NRCS has not yet published a soil survey for St. Louis County. The soil characteristics identified from the site borings show that the site is covered with 6.5 to 7.5 feet of clayey soils. These soils limit the permeability at the site

and minimize potential for groundwater contamination. Further, the results of the packer tests show little fracture of the bedrock, further limiting the potential of surface water into the groundwater table. These same characteristics will also limit infiltration of surface water runoff at the site.

20. Solid wastes, hazardous wastes, storage tanks

a. Describe types, amounts and compositions of solid or hazardous wastes, including solid animal manure, sludge and ash, produced during construction and operation. Identify method and location of disposal. For projects generating municipal solid waste, indicate if there is a source separation plan; describe how the project will be modified for recycling. If hazardous waste is generated, indicate if there is a hazardous waste minimization plan and routine hazardous waste reduction assessments.

The proposed NOvA liquid scintillator is a generic equivalent to the commercial product sold by Bicon as BC-517P. The primary ingredient is mineral oil, a petroleum derivative, that is commercially sold as baby oil, as a food additive and as a laxative. It is chosen for its availability in large volumes, relatively low cost, optical transparency and high flash point. The second most common ingredient by weight (about 5%) is Pseudocumene [1,2,4-Trimethylbenzene], a benzene derivative. The remaining ingredients are small amounts of organic ultraviolet wavelength shifters and anti-oxidants. The liquid scintillator is not considered a hazardous material by the Minnesota Pollution Control Agency (MPCA).

A spill containment system has been designed for the tanker trailers carrying liquid scintillator. The system includes a concrete basin sized to contain the full volume from one tanker trailer and has been designed similar to the standards and techniques used in the gasoline industry. This containment system extends to include the scintillator conditioning equipment and piping.

Assuming 8 to 10 employees using the site during working hours of operation, solid waste generated during operation is anticipated to range from 2.7 to 3.5 pounds per person or 25 to 35 pounds per day for the facility (source, U.S. Environmental Protection Agency).

Any solid waste generated during construction, including collected sediment, asphalt and concrete millings, floating debris, paper, plastic, fabric, construction and demolition debris and other wastes will be collected and disposed of properly in accordance with the SWPPP and the NPDES permit. Any hazardous materials used during construction, including oil, gasoline, and paint, will be properly stored, including secondary containment, to prevent spills or leaks.

No hazardous wastes will be created during operation of the facility. Any fuel or other materials maintained at the site for backup power generation or other uses will be stored within the facility structure with proper spill containment features. Solid wastes generated at the facility will be assembled for collection by a licensed waste hauler for disposal at a licensed disposal facility. Solid wastes generated during facility operation will be limited to that typical of office waste.

At the completion of the NOvA Project, the detector and associated support systems will be removed, and the building will be returned to an empty state. The liquid scintillator will be removed by emptying the horizontal and vertical extrusion modules. The vertical extrusion modules will be emptied with an interior pump that operates like a pump at the bottom of a deep water well, and the horizontal extrusion modules will be emptied by gravity flow. Used oil will be recycled. Once drained of scintillator, the PVC components of the detector can be broken down into manageable sections.

b. Identify any toxic or hazardous materials to be used or present at the site and identify measures to be used to prevent them from contaminating groundwater. If the use of toxic or hazardous materials will lead to a regulated waste, discharge or emission, discuss any alternatives considered to minimize or eliminate the waste, discharge or emission.

Epoxy will be used during detector assembly to combine the PVC extrusions into moveable blocks. The type of epoxy will be Devcon Plastic Welder 60. It will be used and maintained, and wastes will be disposed of in accordance with manufacturer recommendations and requirements. Any other hazardous materials used during

construction, including oil, gasoline, and paint, will be properly stored, including secondary containment, to prevent spills or leaks.

Upon completion of assembly, the scintillator liquid will be pumped from the loading dock to the detector. Although not a hazardous material, the transfer of the scintillator liquid will be monitored to avoid leaks and spills. Spill containment systems will be installed beneath the tanker unloading areas. Any fuel or other materials maintained at the site for backup power generation or other uses will be stored within the facility structure with proper spill containment features.

c. Indicate the number, location, size and use of any above or below ground tanks to store petroleum products or other materials, except water. Describe any emergency response containment plans.

The facility will include six (6) 1,000 gallon propane tanks for emergency electrical generation and four (4) 1,000 gallon propane tanks for building heating. These tanks may be above or below ground, but will be constructed in accordance with applicable regulations and protections.

The current design includes extensive pressure and leak testing of the detector components during the manufacturing process. The primary containment for the scintillator is the PVC cells of the detector. The walls and floor of the Detector Enclosure and Assembly Area will provide the secondary containment. These surfaces have been designed to contain 100% of the liquid scintillator as well as the fire protection foam that would be used in the event that a full release of water occurred during a complete release of the scintillator. The surfaces will be coated with a sealant to provide a non-porous surface.

21. Traffic.

Parking spaces added: Parking lot is sized for 25 vehicles.

Existing spaces (if project involves expansion): None.

Estimated total average daily traffic generated: 16 – 20 trips per day during operation; up to 90 trips per day during construction.

Estimated maximum peak hour traffic generated (if known) and time of occurrence: Not Available

Provide an estimate of the impact on traffic congestion 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.

Access to the project site will be via Ash River Trail (County Road 129). Ash River Trail is a two-lane, paved roadway with a weight capacity of nine (9) tons (*Source: St. Louis County Road Restrictions Map, 2005*). The most recent available daily traffic volume on County Road 129 indicates an average daily traffic volume of 310 vehicles per day (VPD) (*Source: Mn/DOT Traffic Volumes and General Highway Map, 2003*).

Construction of the proposed detector enclosure and assembly building is anticipated to begin in the middle of 2008 and be completed in 2011. During construction of the proposed detector enclosure and assembly building, a maximum of 35 workers are expected to be on site each day. It is estimated that this will result in approximately 20 to 35 cars accessing the site each day, generating 40 to 70 trips per day on Ash River Trail for approximately 20 months. Assuming construction begins in June 2008, construction of the facility structure is anticipated to be complete in February 2011.

It is expected that the detector enclosure and assembly building structures will be complete within 36 months from start of construction and that assembly of the physics detector will begin at that time. Assembly of the physics detector is anticipated to take approximately 48 months and will require up to 20 people on the site each day. It is estimated that this will result in a total of 20 to 30 vehicles accessing the site each day, generating 40 to 60 trips per day on Ash River Trail. Truck traffic delivering materials for the physics detector will include approximately 450 trucks with PVC extrusion over 18 months beginning approximately June 2010 and 750 tanker trucks with

scintillator liquid over 18 months beginning approximately August 2010. This will add one to two trucks at the site each day during detector assembly and will add two to four trips on Ash River Trail each day. Detector assembly is expected to be complete by the end of December 2013.

During normal operation of the facility 8 to 10 people will be on site on a daily basis. This will generate 16 to 20 trips per day over the ten (10) year operating period. Operation of the facility is expected to begin in 2013.

According to this construction and assembly schedule and the necessary number of vehicles and trucks at the site, there will be a maximum of 40 staff and five trucks accessing the site on a daily basis. This will add a maximum of 90 trips to Ash River Trail each day during the peak of the detector assembly.

The functional average daily traffic capacity for a rural two-lane county roadway like Ash River Trail is in the range of 8,000 to 10,000 vehicles per day. It currently serves approximately 310 VPD, leaving ample capacity of utility for the additional construction and operation traffic. The project proposers plan to enhance the site access to Ash River Trail at the site entrance to further facilitate site access and to minimize conflicts with vehicle and trucks turning onto the site access road.

22. **Vehicle-related air emissions.** Estimate the effect of the project's traffic generation on air quality, including carbon monoxide levels. Discuss the effect of traffic improvements or other mitigation measures on air quality impacts. Note: If the project involves 500 or more parking spaces, consult *EAW Guidelines* about whether a detailed air quality analysis is needed.

No traffic congestion is anticipated as a result of the additional construction or operation traffic from the proposed facility. Therefore, no decrease in air quality from vehicle-related air emissions is expected. The functional average daily traffic capacity for a rural two-lane county roadway like Ash River Trail is in the range of 8,000 to 10,000 vehicles per day (VPD). It currently serves approximately 310 VPD, leaving ample capacity of road for the additional construction and operation traffic. The additional traffic generated during construction will not significantly increase the VPD or result in congestion in this rural area.

23. **Stationary source air emissions.** Describe the type, sources, quantities and compositions of any emissions from stationary sources of air emissions such as boilers, exhaust stacks or fugitive dust sources. Include any hazardous air pollutants (consult *EAW Guidelines* for a listing) and any greenhouse gases (such as carbon dioxide, methane, nitrous oxide) and ozone-depleting chemicals (chloro-fluorocarbons, hydrofluorocarbons, perfluorocarbons or sulfur hexafluoride). Also describe any proposed pollution prevention techniques and proposed air pollution control devices. Describe the impacts on air quality.

The assembly adhesive that will be used to assemble the modules is Devcon-60. The adhesive contains methyl methacrylate (MMA), which is a volatile organic compound (VOC) and a federal hazardous air pollutant (HAP). MMA evaporates and is emitted during adhesive application. According to the adhesive manufacturer, MMA comprises approximately 2.7% (by mass) of the product.

The Devcon-60 adhesive will be used to assemble the individual PVC extrusion modules for the detector. A maximum of 15,624 modules can physically fit within the building. Approximate 21.5 pounds of adhesive is required for each module. Thus, the project is expected to use a maximum of 168 tons of Devcon-60. Conservatively assuming the module assembly process is completed within one year, the maximum amount of MMA vapor emitted is 4.5 tons. Minnesota requires an air permit if potential VOC emissions exceed 100 tons per year or if potential emissions of an individual HAP exceed 10 tons per year. Since MMA potential emissions will not exceed 10 tons per year, an air permit will not be required.

Further, since the project's federal HAP emissions do not exceed 10 tons per year, the National Emission Standards for Hazardous Air Pollutant (NESHAP) for miscellaneous plastic parts coating facilities (40 CFR Part 63, Subpart PPPP) will not apply.

Minnesota regulates air toxic emissions through its Air Emission Risk Analysis (AERA) program. Due to the relatively low emission rates and restricted timeframe of this project an AERA will likely not be required.

24. **Odors, noise and dust.** Will the project generate odors, noise or dust during construction or during operation?

Yes No

If yes, describe sources, characteristics, duration, quantities or intensity and any proposed measures to mitigate adverse impacts. Also identify locations of nearby sensitive receptors and estimate impacts on them. Discuss potential impacts on human health or quality of life. (Note: fugitive dust generated by operations may be discussed at item 23 instead of here.)

The proposed facility will not generate odors, noise or dust during operation. Normal construction activities (grading, paving, etc.) will result in dust and noise during construction activities, along with the potential for minor increases of odor. This will be limited to the construction of the Detector Enclosure and Service Building during the first 24 months of construction. All of the impervious surfaces will be non-graveled surfaces reducing the potential for dust. Assembly of the physics detector will be performed within the enclosure and will not result in odors or dust. Some noise will result from operation of equipment used for the detector assembly.

The proposed facility structure is to be founded at an approximate elevation of 1,183 feet. This will require removal of 25 to 40 feet of granitic bedrock by blasting with explosives. Noise and vibration will occur as a result of blasting. The amount of vibration and noise resulting from blasting operations is dependent on the amount of explosive charge and the sequence of the blasting. The project site is relatively remote, greater than one mile from any inhabited dwellings or structures, so the effect to people is not expected to be significant. No structures, other than a few small hunting cabins, exist within one mile of the site, so damage to existing structures is not likely.

Noise will also result from drilling holes in the bedrock for the placement of explosive charges. An air rotary drill will likely perform this work. Both drilling and blasting are temporary effects that will occur only during construction of the facility. Drilling and blasting will likely occur over a two- to four-month period.

Blasting of bedrock will occur during weekdays at the beginning of construction to allow the facility to reside below the existing surface (approximately 25 – 65 feet depending on the terrain). Dust is anticipated with blasting, but there are no sensitive receptors in the surrounding area. Noise and vibrations will occur due to the blasting and from drilling holes in the bedrock for the placement of explosive charges. Both drilling and blasting are temporary effects that will occur only during an approximately two- to four-month period during construction of the facility. Since the proposed site is considered remote, greater than one-mile from any inhabited dwellings or structures, other than a few small hunting cabins, the effect to people or structures is not likely.

Adjacent properties are not expected to be impacted by noise, dust or odors during the construction phase of the project. Dust generated by construction equipment will be mitigated by spray watering areas that are dry and contributing to dust. Dust will also be mitigated by minimizing the area of active disturbance and by restoring disturbed areas as soon as possible after completion of construction. Noise impacts will be mitigated by limiting the time of construction activities between 7:00am to 7:00pm. All impacts to noise, dust and odors will be temporary in nature. Levels will return to existing levels upon completion of project construction.

25. **Nearby resources.** Are any of the following resources on or in proximity to the site?

Archaeological, historical or architectural resources? Yes No

Prime or unique farmlands or land within an agricultural preserve? Yes No

Designated parks, recreation areas or trails? Yes No

Scenic views and vistas? Yes No

Other unique resources? Yes No

If yes, describe the resource and identify any project-related impacts on the resource. Describe any measures to minimize or avoid adverse impacts.

Archaeological, Historical and Architectural Resources: The 106 Group Ltd. conducted a Cultural Resources Assessment in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended. The assessment found that no architectural history surveys have been conducted and no properties have been inventoried within the project area. It also shows that no archaeological sites have been recorded or reported within the Project Area, but one site has been recorded (confirmed) and three sites have been reported (not field checked) within one mile of the Project Area. These four sites include three logging camps and a railroad trestle.

No previously recorded precontact archaeological sites are located within a one-mile radius of the study area. The project site is considered to have a low potential for containing contact period sites and post-contact archaeological sites, due to areas of topographic depression and the presence of exposed bedrock. The only area within the site that possesses a high archaeological potential is the southern portion of the site within 150 meters of the Ash River, due to elevated terraces overlooking the river.

The project area and the surrounding region have been used for commercial logging for over 100 years and stands of forest continue to be harvested. The study identified an abandoned railroad grade that may retain sufficient integrity to convey potential significance as an early logging road. This section of railroad passing through the western portion of the project area is identified as a “Winter Road” and is shown on Figure 2. The road extends south until it reaches the Ash River. The western portion of the existing access road to the project site originated as this “Winter Road”, which was later used as the basis for the rail line that was likely a spur extending from the VRL Railway which had a network of rail lines in northern St. Louis and Koochiching counties.

This railroad grade would likely be considered for eligibility for the National Register for Historic Places (NRHP), either under Criterion A, for the broad patterns of history related to timber procurement, or under Criterion C, if the grade represents a significant designed system or if the surviving features demonstrate design attributes that help explain how the various components work. Portions of the rail grade have been converted to a lightly traveled gravel road, which has been widened to accommodate local traffic. The road still conveys a strong sense of the direction within an appropriate setting. That portion of the rail grade extending southerly from the road, leading outside of the project area, also has a strong sense of place and direction, while the remnants of the trestle (also outside the project area) further contribute to the material integrity of the line.

The facility footprint is approximately 1,180 feet from the Ash River, well beyond the maximum threshold distance (492 feet or 150 meters) of the river corridor where there is a high potential for containing pre-contact sites. Since the facility is beyond this threshold distance, no additional archaeological testing is necessary and no impacts to significant archaeological sites are anticipated. No project effects to areas of “High Archaeological Potential” are anticipated to occur.

Prime or Unique Farmlands: The Natural Resources Conservation Service (NRCS) was contacted to request preliminary soil survey data that is currently being assembled for St. Louis County. The NRCS web site was then referenced to see if any of the draft soil map units meet the criteria for Prime or Unique as listed on the digitally available Prime or other Unique Farmlands List for St. Louis County (2005). None of the following soil map units that occur within the facility site boundary are classified as Prime, Unique or Soils of Statewide Importance according to the draft survey data and Farmlands List:

- Ashlake-Effie Complex, 1 to 8 percent slopes
- Baudette-Littleswan complex, 1 to 4 percent slopes
- Cutaway-Bionditch-Biwabik complex, 1 to 8 percent slopes

In addition to the three soil map units found within the facility site boundary, the following soil map units that have been mapped to date are within the proposed access road alignment.

- Suomi-Ashlake complex, 1 to 8 percent slopes
- Spooner-Endoaquolls, depressional complex, 0 to 1 percent slopes

The Suomi-Ashlake complex, 1 to 8 percent slopes is recognized as a “Farmland of Statewide Importance” which the NRCS defines as land that does not fully meet the Prime or Unique criteria, but could be economically viable farmland if managed and treated under acceptable farming standards. No Prime or Unique farmland soils are shown within or adjacent to the access road alignment.

Designated Parks, Recreation Areas or Trails: The project site is approximately one mile southeast of the nearest boundary of Voyageurs National Park. This boundary is located on the north side of County Road (CR) 129 approximately one mile northwest of the proposed project access road intersection with CR 129.

The proposed project site is within a parcel of the MNDNR owned and managed Kabetogoma State Forest. These parcels are managed for timber production and are leased for timber removal. They are also open for public use including hunting and recreation. The State Forest parcels are scattered across a wide area of St Louis and Itasca Counties and occupy approximately half of the land ownership in this region. The University of Minnesota and MNDNR are negotiating a land transfer to accommodate development of the facility and access road.

Within State Forest parcels, the Ash River Falls Ski Trails have been developed through a cooperative agreement with the National Park Service and MNDNR. This network of ski trails occurs near where CR 129 intersects with the proposed access road. The existing access road crosses once through a segment of the trail where the proposed access road will follow this segment of the existing access road and cross the trail at the same location. Minimal to no impact to this ski trail network is anticipated as a result of the access road construction and full use of the trail network is expected to continue uninterrupted.

26. **Visual impacts.** Will the project create adverse visual impacts during construction or operation? Such as glare from intense lights, lights visible in wilderness areas and large visible plumes from cooling towers or exhaust stacks?
 Yes No

Through the public involvement process, the University of Minnesota worked closely with the National Park Service (NPS) to minimize visual and light pollution impacts. The NPS advised on the site selection, preliminary design and provided best management practices to minimize effects. The selection of the Ash River site as a preferred alternative was strongly based on the outcomes of the NPS input and participation.

The project is not expected to create adverse visual impacts during construction or upon completion of the project. There will be no glare from intense lights. The only external lighting at the facility will be at access doors and in parking areas for safety and security. These lights will be directed downward and will be limited in number.

The detector facility will be constructed into an existing hill on the site. The elevation of the existing hill into which the structure will be constructed is approximately 1,240 feet. The proposed structure will be constructed approximately 64 feet within the hill (to elevation 1,176) leaving approximately 31 feet clear at the northern end of the structure. The topography of the hill falls to the south which will result in more of the structure above the existing surface toward the southern end of the structure. The two-story loading dock at the northern end of the facility will be above ground and visible.

Although the structure will extend above the existing grade, the earthen backfill will help it blend into the surrounding area. The undulating topography and the prominent siting of the facility on the hill both extend and limit the visibility of the development. When viewed from the opposite hillside to the south, the facility location on the hillside and the location of the Detector Enclosure make it visible. Views from the north, east, and west, including views from Voyageur's National Park, are not impacted because of the rolling topography and the wooded vegetation.

27. **Compatibility with plans and land use regulations.** Is the project subject to an adopted local comprehensive plan, land use plan or regulation, or other applicable land use, water, or resource management plan of a local, regional, state or federal agency?
 Yes No. If yes, describe the plan, discuss its compatibility with the project and explain how any conflicts will be resolved. If no, explain.

Under the provisions of Title 16, United States Code (USC), Section 3 and Title 36, Code of Federal Regulations (CFR), Chapter 1, Parts 1 – 7, Superintendent's Orders were developed to implement land use and planning policies for the Voyageurs National Park of the National Park Service, U.S. Department of Interior. These policies are such that they only apply to land uses and acreage located within the Park boundaries and do not have implications on the project site.

The MNDNR Division of Forestry is currently converting its regional based forest resource management plans to plans that are based and defined by Ecological Subsections in the MNDNR Ecological Classification System. These Plans address forest management and timber production objectives for lands within state forest lands. The nature and scope of the Plans are such that they are anticipated to be compatible with the project. Upon completion of the

MNDNR transfer of the project parcel to the University of Minnesota, the project area will no longer be a state forest land holding, will be removed from timber production and no longer subject to the Plan.

Under the St. Louis County Comprehensive Plan, a Voyageur Planning Area (VPA) sub-plan was adopted in 1982 with subsequently adopted amendments. The VPA plan provisions that have relevant implications on the project include the following:

- Goals that encourage the development and expansion of major industry while maintaining the rural character and property rights of individuals, while not having major adverse impacts on the environment.
- Policies that encourage development designs that minimize environmental impacts and effects on floodways, soil and rock formations, wetlands, erosion, slopes, and water supply and sanitary system capabilities.
- Developments that can adequately handle anticipated traffic needs, sanitary waste disposal, and minimize noise, odor, dust, and light pollution.
- The establishment of local planning committees in Unorganized Towns are encouraged to review plans and applications.

Concept 8 in the VPA addresses industrial uses and best fits this project, compared to Concept 7 on commercial uses. Concept 8 defines and separates heavy industries that require an industrial zone district from light industries not needing such classification. The unique character of this project and low amount of environmental and social effects anticipated are such that this project meets the light industry criteria. Heavy industries in the traditional sense likely include pulp and paper mills, refineries, and industries that have the potential to discharge waste.

The majority of the VPA addresses natural resources, residential lot and density criteria, shoreland management, and timber production, all common land uses in this region of St. Louis County. A relatively limited number of the provisions in the VPA are relevant and applicable to this project and most of these provisions are general. To date, a planning committee has not been established to review the plans and applications for the project, and it is not known if one will be. This may not be practicable due to the rural, low population density and character of the project area and the proximity to the National Park. The project is such that it is anticipated to be compatible with the goals and policies in the Voyageurs Planning Area sub-plan of the Comprehensive Plan for St. Louis County.

In summary the following plans were identified in the project area:

- The Superintendents Orders for the Voyageurs National Park – U.S. Department of Interior
- The Minnesota Department of Natural Resources Forestry Division Forest Resource Management Plan (currently under revision)
- The Voyageurs Planning Area sub-plan of the Comprehensive Plan for St. Louis County

Of these three plans, the project is only subject to the Voyageurs Planning Area sub-plan of the Comprehensive Plan for St. Louis County.

28. **Impact on infrastructure and public services.** Will new or expanded utilities, roads, other infrastructure or public services be required to serve the project? Yes No. If yes, describe the new or additional infrastructure or services needed. (Note: any infrastructure that is a connected action with respect to the project must be assessed in the EAW; see *EAW Guidelines* for details.)

Power and fiber optic service for the facility will be provided from existing services along Ash River Trail. These utilities will be extended to the facility site by buried service installed during construction of the access road. No improvements to the existing fiber optic service are anticipated. Improvements to the existing power transmission service serving the site will be required. The existing electrical service will be upgraded to accommodate the facility. This will include replacement of the transformer at the Kabetogama substation as well as related service upgrades along the existing line. No new or additional transmission lines will be constructed. The proposed upgrades will all be accommodated on existing transmission facilities. As the service reaches the west end of the site access road, it will be routed as an underground line along the access road alignment for the remaining distance to the project site.

Access to the facility site will be provided by a new access road constructed by the developers. No improvements to public roads are required. An enhanced entrance from eastbound Ash River Trail into the project site will be constructed by the developer to most safely and effectively accommodate traffic turning into the project site.

29. **Cumulative impacts.** Minnesota Rule part 4410.1700, subpart 7, item B requires that the RGU consider the "cumulative potential effects of related or anticipated future projects" when determining the need for an environmental impact statement. Identify any past, present or reasonably foreseeable future projects that may interact with the project described in this EAW in such a way as to cause cumulative impacts. Describe the nature of the cumulative impacts and summarize any other available information relevant to determining whether there is potential for significant environmental effects due to cumulative impacts (*or discuss each cumulative impact under appropriate item(s) elsewhere on this form*).

The proposer anticipates no future phases of development nor is any other developments proposed by others foreseeable in the area of the proposed project; therefore no long term cumulative impacts are anticipated. If new actions are proposed in the area after construction of the project, those actions can include this project in their cumulative effects analysis. To date, this project is the only reasonable and foreseeable action (funded and implemented project, not speculative or unfunded) in the surrounding area. Logging is not considered as a reasonable and foreseeable action as it has been occurring in the area for over a hundred years and will continue indefinitely and is a renewable, managed resource verses a permanent conversion to another land use.

30. **Other potential environmental impacts.** If the project may cause any adverse environmental impacts not addressed by items 1 to 28, identify and discuss them here, along with any proposed mitigation.

No other adverse environmental impacts are anticipated as a result of the proposed project.

31. **Summary of issues.** *Do not complete this section if the EAW is being done for EIS scoping; instead, address relevant issues in the draft Scoping Decision document, which must accompany the EAW.* List any impacts and issues identified above that may require further investigation before the project is begun. Discuss any alternatives or mitigative measures that have been or may be considered for these impacts and issues, including those that have been or may be ordered as permit conditions.

Storm water treatment and management: The proposed project will create new impervious surface by improvement and paving of the site access road and by construction of the proposed facility and parking area. Storm water runoff will be treated and managed in accordance with the requirements of the NPDES permit and the Storm Water Pollution Prevention Plan (SWPPP).

Erosion and sedimentation protection: Construction of the facility will result in disturbance of approximately 33 acres of the site, including the facility structure, site stockpiles and the access road improvements. Because development of the proposed project will include clearing, grading and excavation disturbing greater than five acres, it will comply with the General Permit to discharge storm water associated with construction activity under National Pollutant Discharge Elimination System (NPDES) as implemented by the Minnesota Pollution Control Agency (MPCA). An NPDES permit will be applied for, and will include development and a plan for implementation of a Storm Water Pollution Prevention Plan (SWPPP) prior to beginning construction. Runoff from the site will flow to a special water (the Ash River) and ultimately to an impaired water (Lake Kabetogama), so the SWPPP will be submitted to the MPCA for review and approval at least 30 days before the start of construction.

The SWPPP will address both temporary and permanent storm water treatment and control at the project site. Erosion and sediment control at the site will include both temporary and permanent sediment basins to treat runoff prior to discharge from the site. Where the proximity to bedrock precludes the installation of typical permanent storm water management practices, other treatment, such as grassed swales, smaller ponds, or grit chambers will be provided prior to discharge to surface waters.

Disturbed areas not occupied by the Detector Enclosure or other facility elements, including stockpile areas, will be restored by replacing topsoil and seeding. Trees may be planted to provide additional visual screening of the facility. Final stabilization of the site will be accomplished in accordance with the SWPPP and the requirements of the NPDES permit.

Wetlands impacts and mitigation: There are no wetlands or streams located within the impact or construction footprint of the facility site and construction of the Detector Enclosure, and the associated parking facilities will not result in direct impacts to wetland habitat. Construction of the access road will result in filling of wetlands along the western segment of the roadway where the existing logging road bisects existing wetlands. Improvement of the roadway will result in filling approximately two and half (2.5) acres of wetland. The wetland impacts will require permits from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and from St. Louis County under the requirements of the Wetland Conservation Act of Minnesota. Both the federal and state wetland regulations require consideration of measures to avoid and minimize impacts to wetlands and will require mitigation of unavoidable impacts by replacement at a minimum ratio of one acre for each acre filled. Sequencing (avoidance and minimization) and mitigation opportunities will be evaluated during project design and discussed with regulatory staff during project permitting.

Dewatering: At a minimum, dewatering of perched groundwater will be required during construction. If groundwater is determined to exist within the bedrock, permanent dewatering will be needed for the structure. Any site dewatering during construction will require a permit. The dewatering will be discharged to a temporary or permanent sedimentation basin or otherwise treated such that the receiving water or downstream waters are not adversely affected.

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

I hereby certify that:

The information contained in this document is accurate and complete to the best of my knowledge.

The EAW describes the complete project; there are no other projects, stages or components other than those described in this document, which are related to the project as connected actions or phased actions, as defined at Minnesota Rules, parts 4410.0200, subparts 9b and 60, respectively.

Copies of this EAW are being sent to the entire EQB distribution list.

Signature  Date 8/28/07
Title Vice President, University Services

Environmental Assessment Worksheet was prepared by the staff of the Environmental Quality Board at the Administration Department. For additional information, worksheets or for *EAW Guidelines*, contact: Environmental Quality Board, 658 Cedar St., St. Paul, MN 55155, 651-296-8253, or <http://www.eqb.state.mn.us>

Figures

Figure 1 - Location Map

Figure 2 – Project Site 7.5` Topographic Map

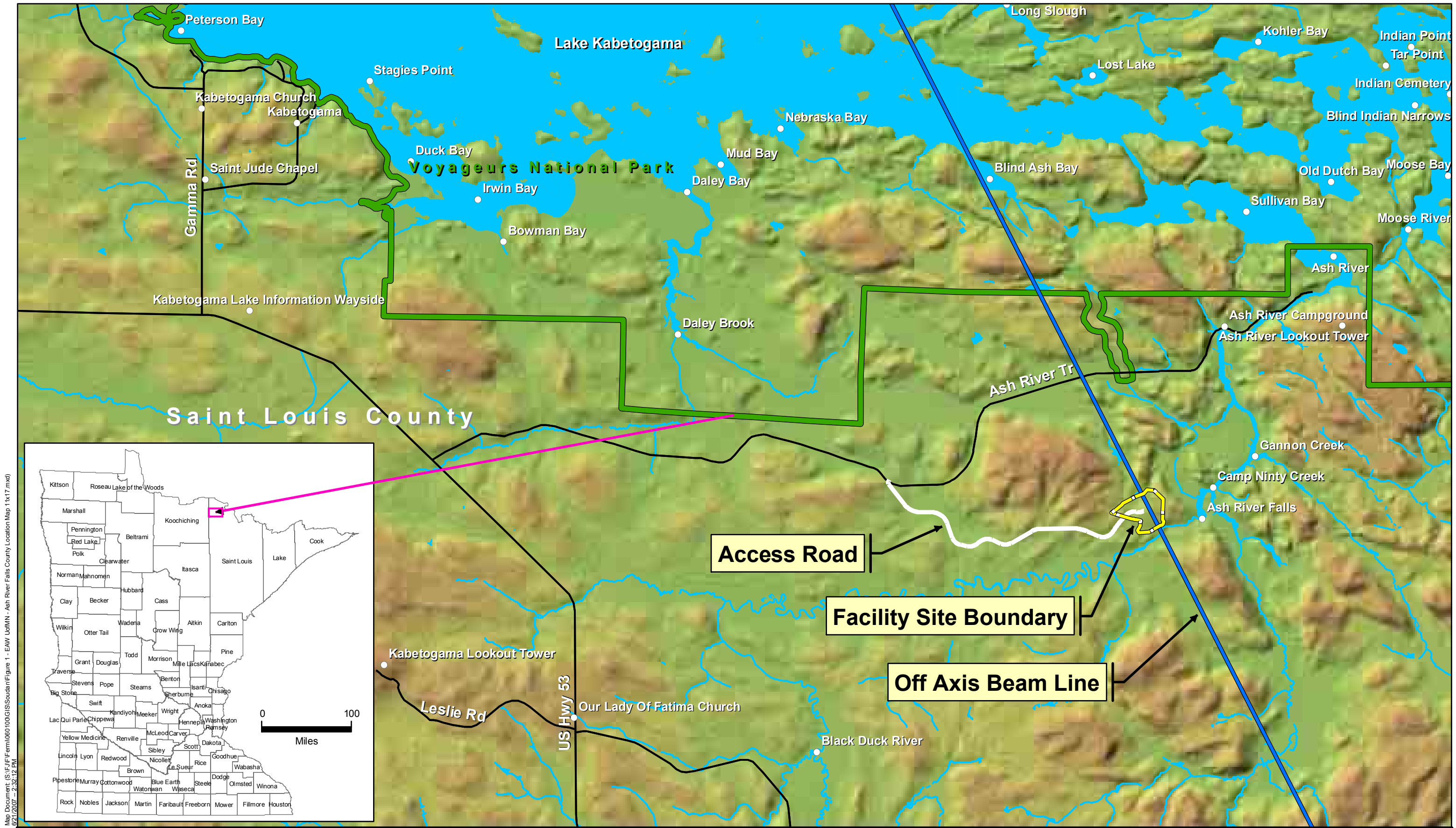
Figure 3 – Facility Site Plan

Figure 4 – Site Facility Boring Locations

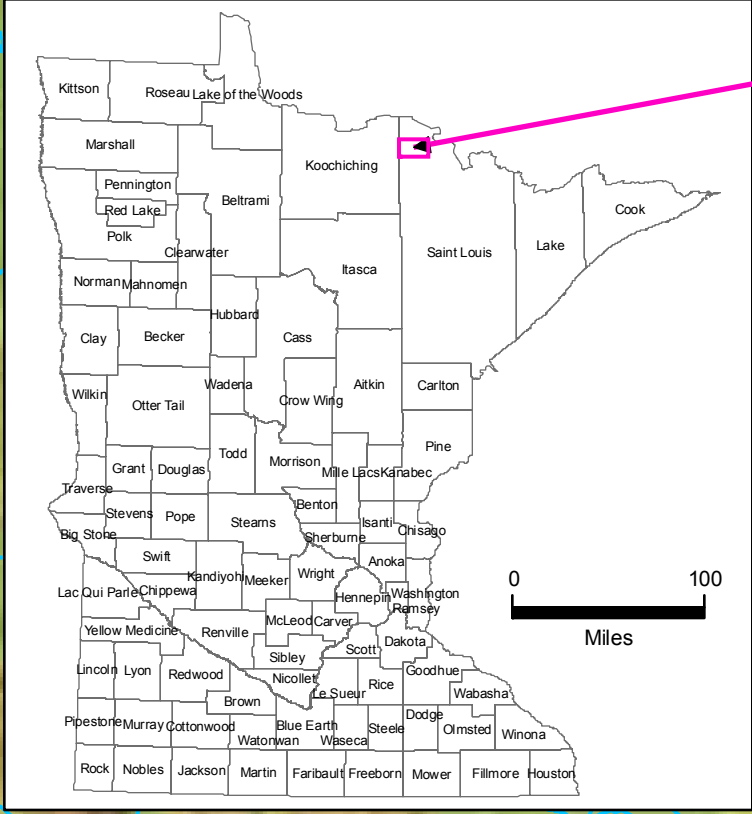
Figure 5 – Access Road Boring Locations

Figure 6 – Wetland Delineation Results

Figure 7 – Protected Water Inventory Map



Map Document: (S:\F\Fermi\060100\GIS\Soudan\Figure 1 - EAW UofMN - Ash River Falls County Location Map 11x17.mxd) 6/21/2007 2:32:12 PM




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ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
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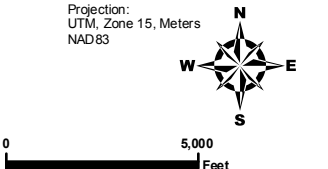
Legend

Facility Site Boundary	Off Axis Beam Line	Geographic Names	Hydrography
Proposed Bright Star Road (Along Existing Logging Road)	Existing Roads	National Park Boundary	Lakes
County Boundaries			

Fermilab
Off-Axis Detector
Ash River Falls

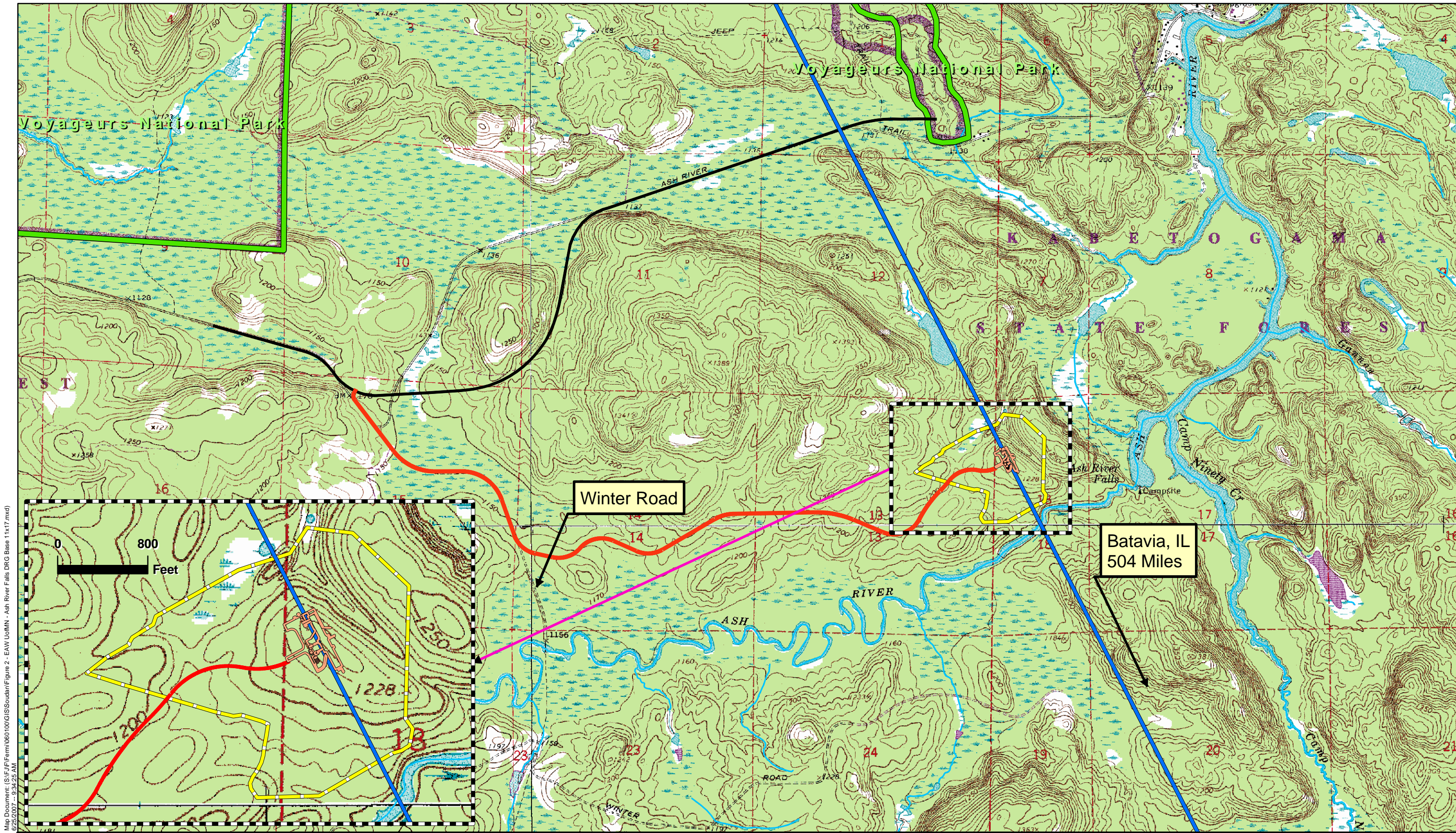
Figure 1
Location Map

Projection:
UTM, Zone 15, Meters
NAD83



0 5,000 Feet

Source: USGS, MnDOT, MNDNR, UofMN, Fermilab, and SEH.
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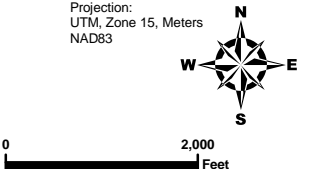
- Facility Site Boundary
- Facility Layout 06-2007
- Proposed Bright Star Road (Along Existing Logging Road)
- Off Axis Beam Line
- Ash River Trail
- National Park Boundary
- Hydrography

Source: USGS, MNDNR, UoMN, Fermilab, and SEH.
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Ash River Falls

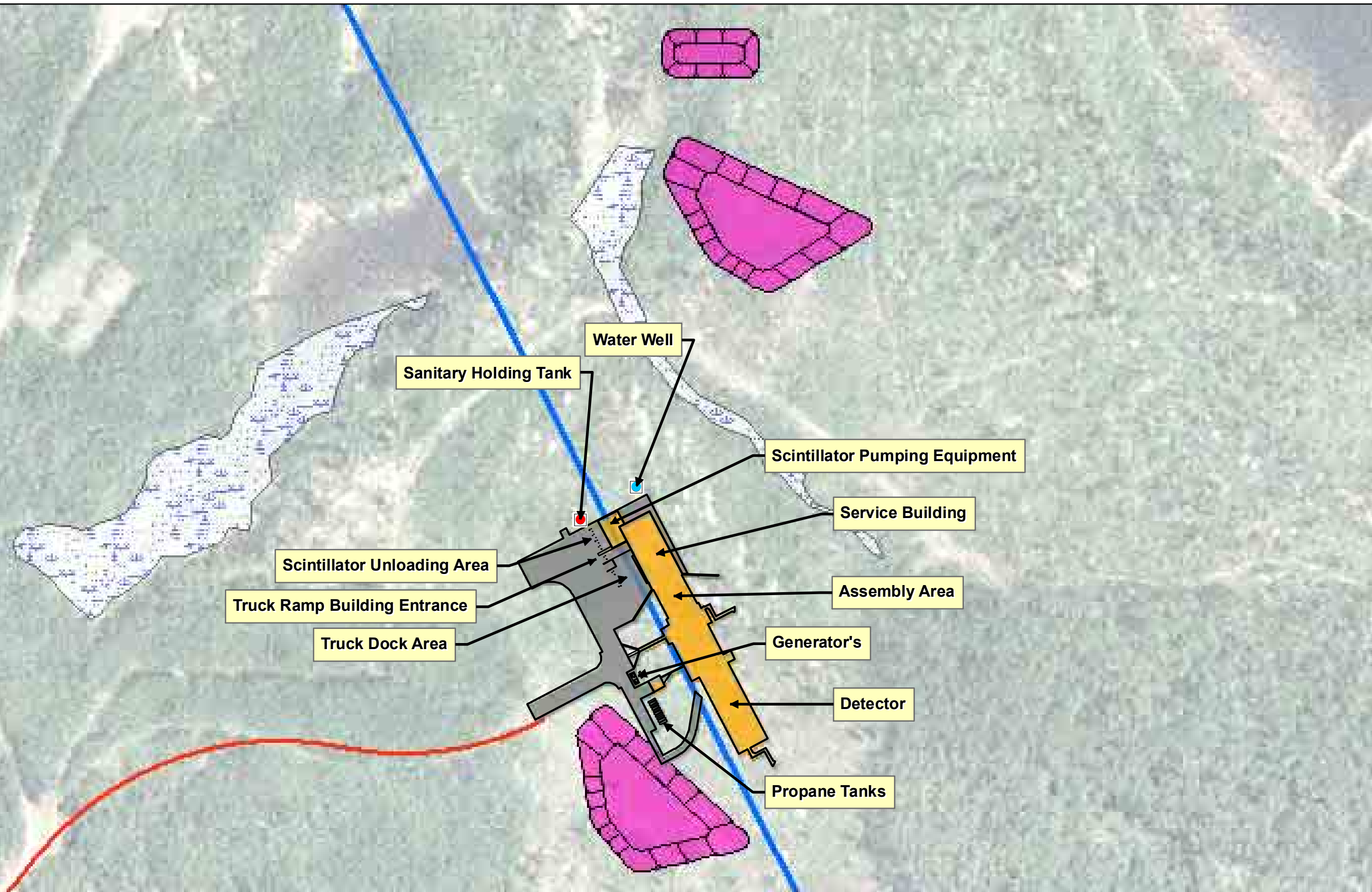
Figure 2
Project Site
7.5 Minute Topo

Projection:
UTM, Zone 15, Meters
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Map Document: (S:\F\Fermi060100\GIS\Soudan\Figure 3 - EAW UdrMN - Site Plan Ash River Falls 11x17.mxd)
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Facility Features 06-2007

Building

Parking Lot

Miscellaneous

Temporary Stockpiles

Water Well

Sanitary Holding Tank

Proposed Bright Star Road
(Along Existing Logging Road)

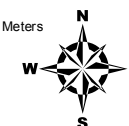
Off Axis Beam Line

Wetlands-Surveyed

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Ash River Falls

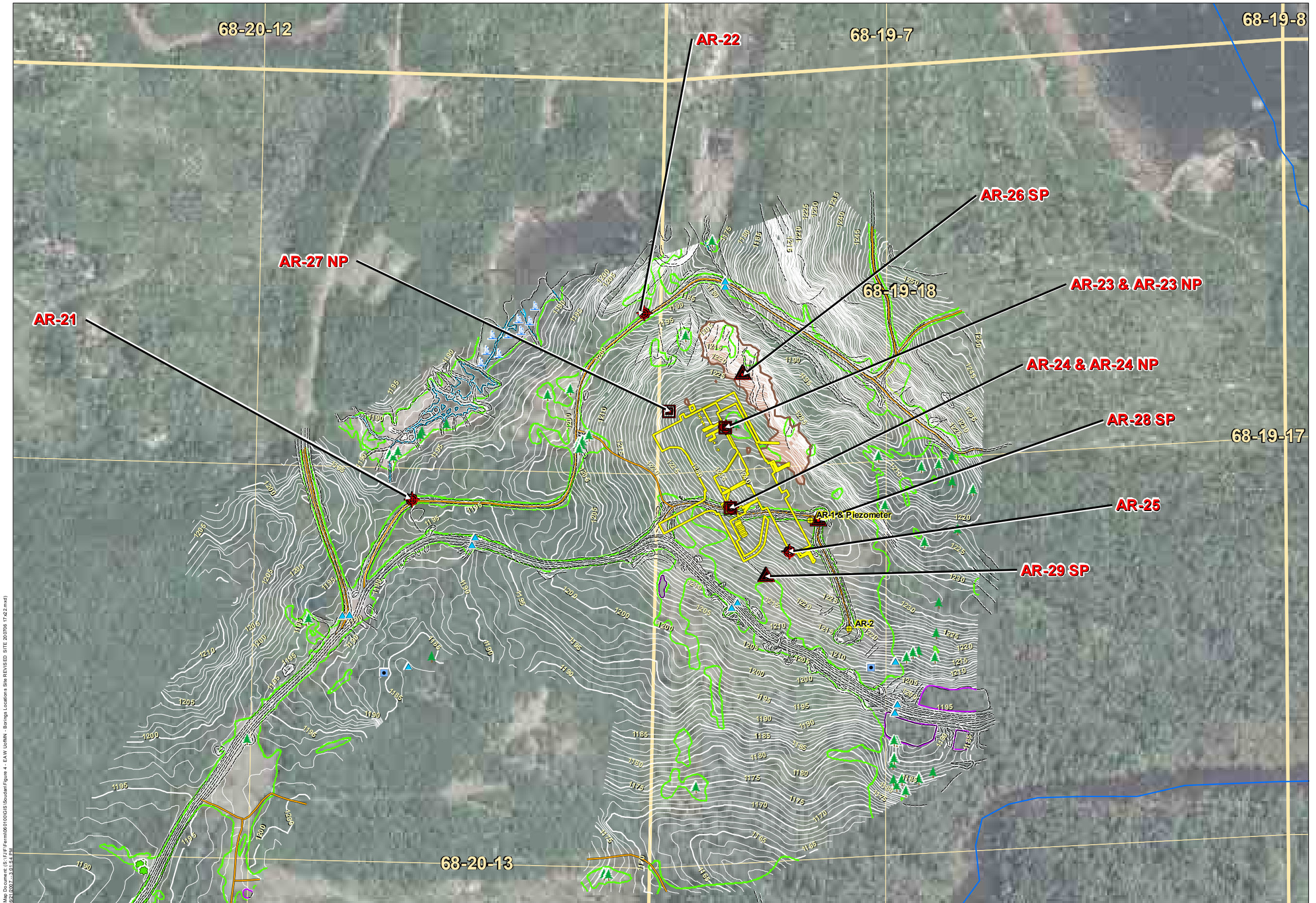
Figure 3
Facility Site Plan

Projection:
UTM, Zone 15, Meters
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Feet

Source: USDA-FSA 2003 DOQs, Fermilab, and SEH.
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Map Document: G:\15\Fermlab\060400\GIS\Source\Figure 4 - EAW\JOMM - Borings Locations Site REVISED SITE 200706 17x22.mxd
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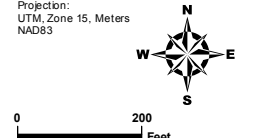
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Source: USDA-FSA 2003 DOQs, MNDNR, MnDOT, Fermlab, AET, U of MN, and SEH.
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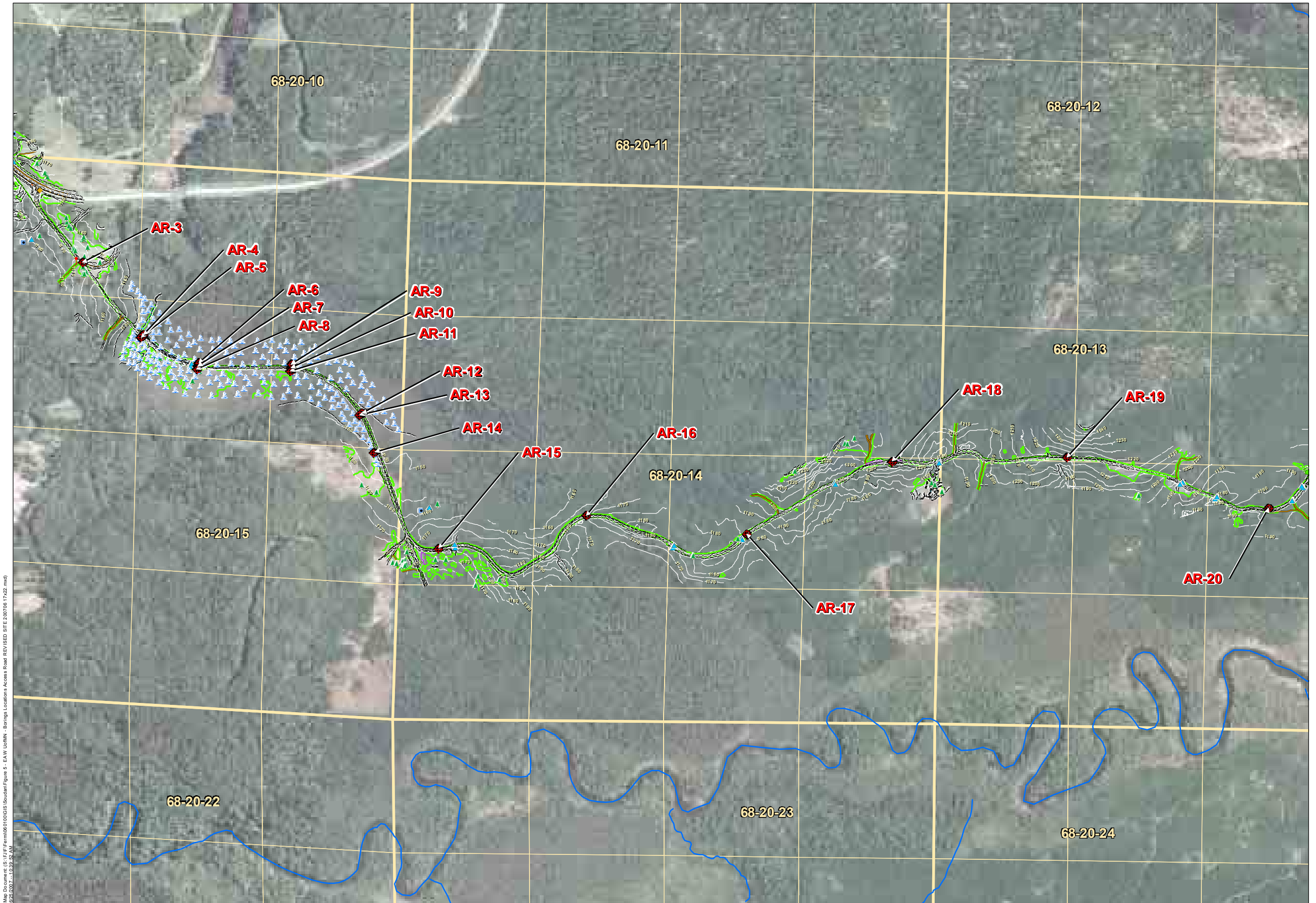
Fermlab - Project NOVA
Off-Axis Detector
Ash River Trail

FIGURE 4
Site Facility
Boring Locations

Projection:
UTM, Zone 15, Meters
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Map Document: G:\Projects\68-20\68-20\GIS\Source\Figure 5 - EAV UoMNI - Borings Locations Access Road REVISED SITE 20070617.rxd.mxd
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ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
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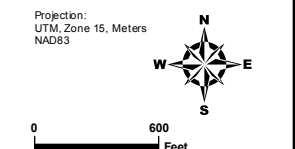
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Boring ID (2005)	CULV	SIGN	FLOWLINE-44	ROAD2-36	PLS 40's
Boring ID (2006)	POST	SWAMP	FLOWLINE2-46	ROAD3-26	PLS Sections
Nested Piezometers (2006)		TREE	PILE-31	ROAD4-61	
Shallow Piezometers (2006)			SIGN-18	TREES-40	
			C-BREAKLINES-38		

Source: USDA-FSA 2003 D OQGs, MNDNR, MnDOT, Fermilab, AET, UoMNI, and SEH.
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Fermilab - Project NOVA
Off-Axis Detector
Ash River Trail

FIGURE 5
Access Road
Boring Locations

Projection:
UTM, Zone 15, Meters
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Map Document: (S:\F\Fermi060100GIS\Soudan\Figure 6 - EAW UoMNM - Figure 5 - Wetland Permit - Ash River Falls Surveyed Wetlands 11x17.mxd)
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FAX: (651) 490-2150
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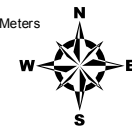
Facility Layout 06-2007	Ash River Trail	Surveyed Wetlands along Proposed Road	Hydrography
Off Axis Beam Line	National Park Boundary	Surveyed Wetlands within Site Boundary	
Proposed Bright Star Road (Along Existing Logging Road)			
Facility Site Boundary			

Source: USDA-FSA 2003 DOQQs, USGS, MNDNR, Mn/DOT, Fermilab, and SEH.
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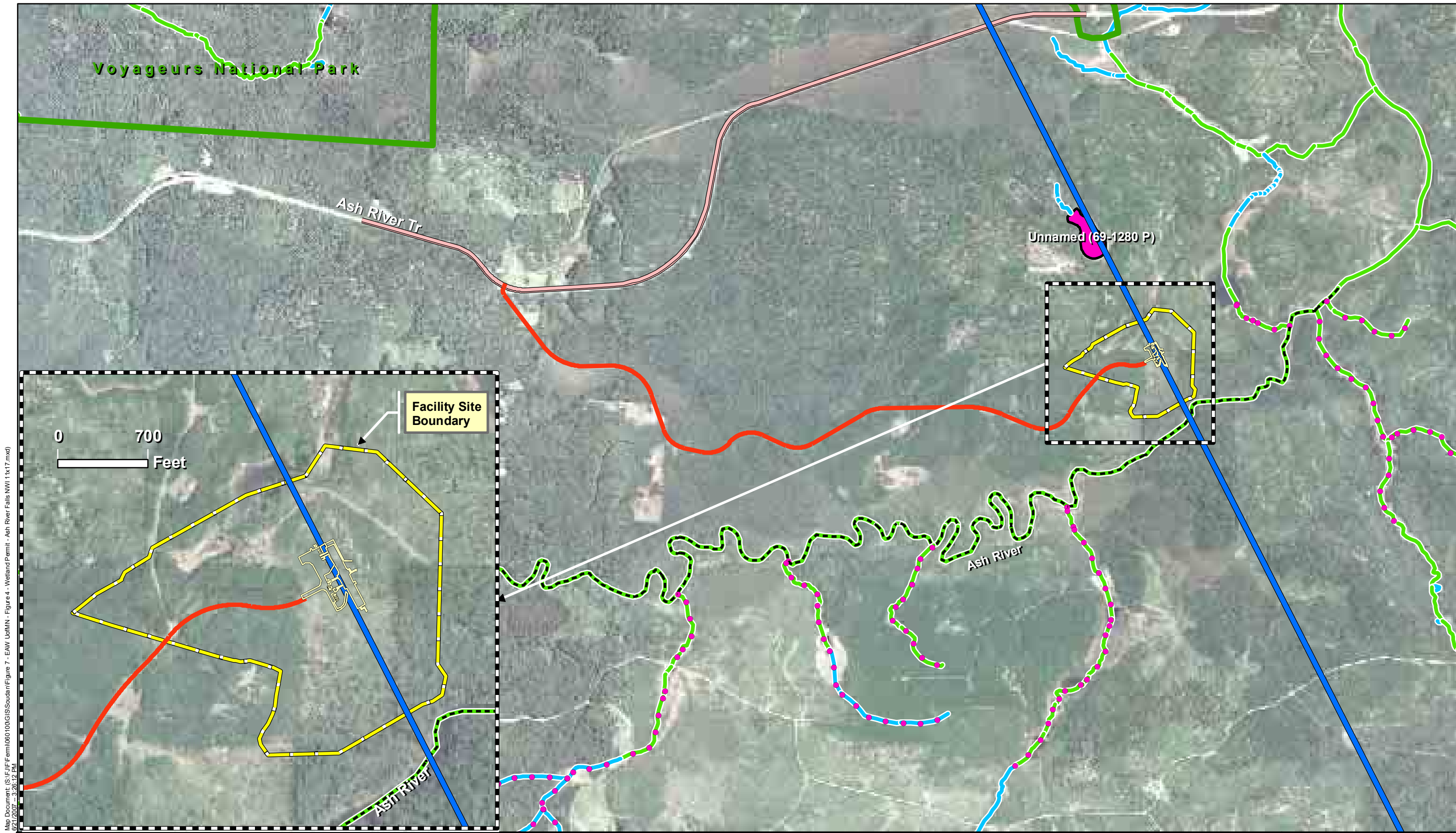
Fermilab
Off-Axis Detector
Ash River Falls

Figure 6
Wetland Delineation Results

Projection:
UTM, Zone 15, Meters
NAD83



0 1,000
Feet











Map Document: (S:\F\Fermi060100GIS\Soudan\Figure 7 - EAW UoMNM - Figure 4 - Wetland Permit - Ash River Falls NWI 11x17.mxd) 6/21/2007 -- 3:26:12 PM








3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

Project Number
AFERMI0601.00

June 2007

- Legend**
-  Facility Layout 06-2007
 -  Off Axis Beam Line
 -  Proposed Bright Star Road (Along Existing Logging Road)
 -  Facility Site Boundary
 -  Ash River Trail
 -  National Park Boundary
 - Public Waters Inventory (PWI)**
 -  PWI Lake
 -  PWI Wetland


- Trout stream or tributary according to Minnesota Rules 6264. Designation is defined on the basis of PLS sections.**
-  Designated trout stream
 -  Designated trout stream tributary

- Streams - Protected Waters Inventory (PWI)**
-  Watercourse not indicated on PWI Maps
 -  Protected watercourse on PWI; indicated on PWI Maps
 -  Protected Public Ditch; indicated on PWI Maps

Fermilab
Off-Axis Detector
Ash River Falls

Figure 7
PWI Map

Projection:
UTM, Zone 15, Meters
NAD83

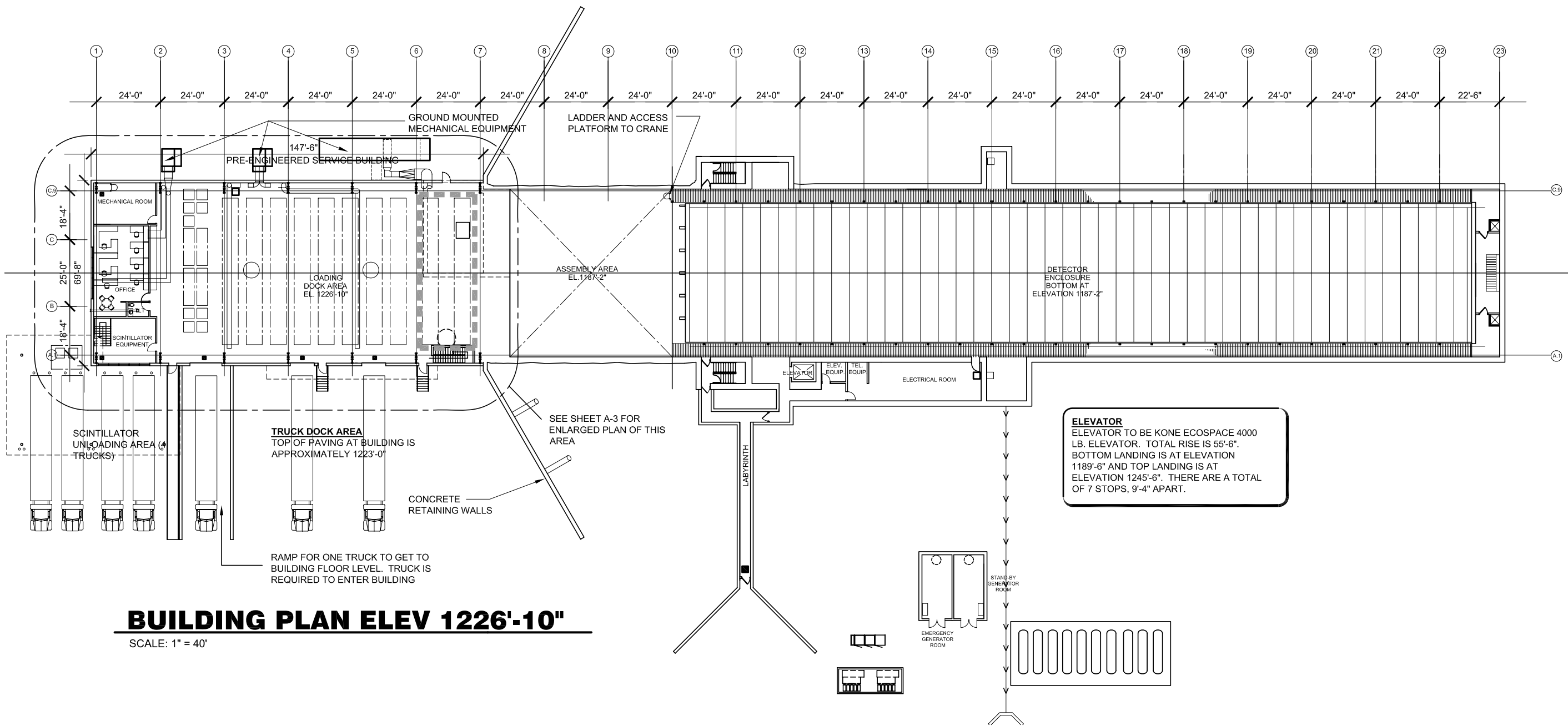


0 2,000 Feet

Source: USDA-FSA 2003 DOQQs, USGS, MNDNR, Mn/DOT, Fermilab, and SEH.
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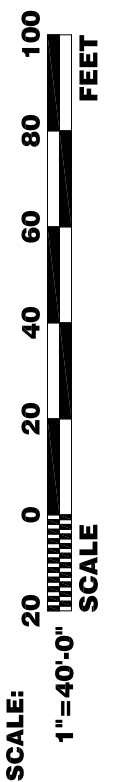
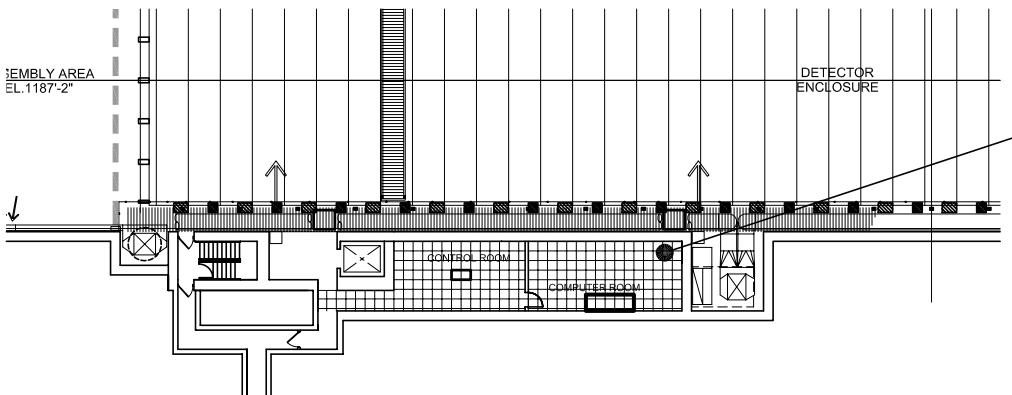
Appendix A

Project Drawings



ELEVATOR
 ELEVATOR TO BE KONE ECOSPACE 4000 LB. ELEVATOR. TOTAL RISE IS 55'-6". BOTTOM LANDING IS AT ELEVATION 1189'-6" AND TOP LANDING IS AT ELEVATION 1245'-6". THERE ARE A TOTAL OF 7 STOPS, 9'-4" APART.

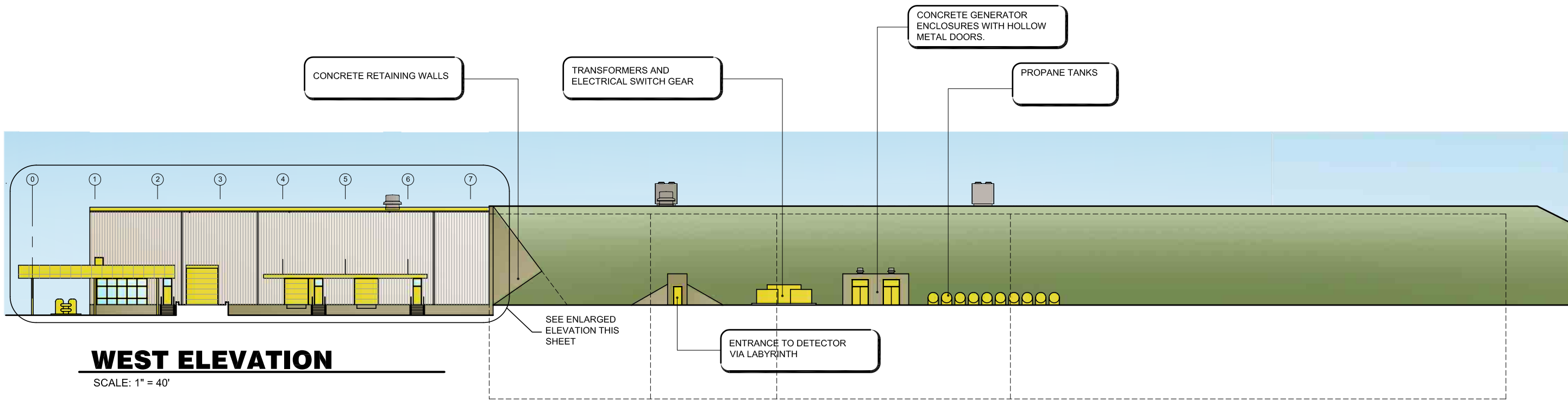
COMPUTER ROOM AND CONTROL ROOM
 RAISED COMPUTER FLOOR SYSTEM THROUGHOUT. 2'-0" UNDER FLOOR SPACE BELOW. TOP OF COMPUTER FLOOR IS AT ELEVATION 1245'-6" AND TOP OF STRUCTURAL SLAB IS 1243'-6"



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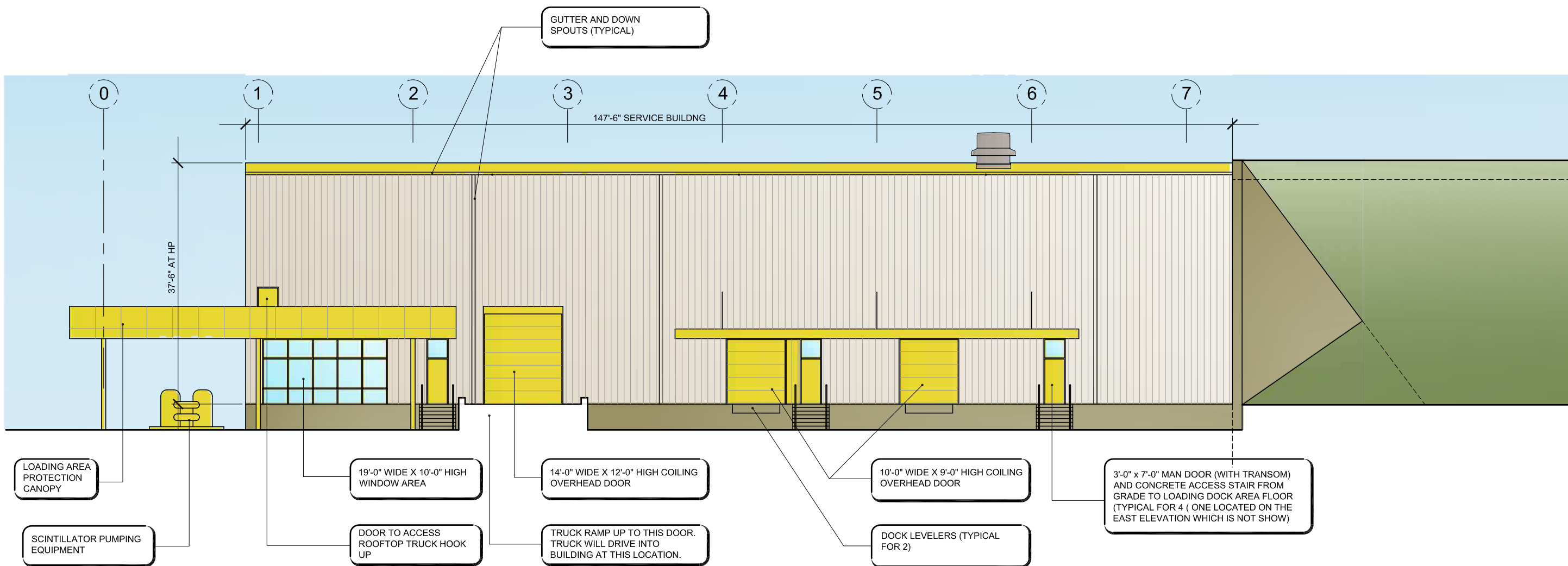
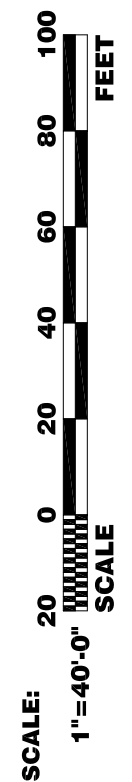


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18 APR. 2007
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15-1-3
 DRAWING NO.
A1



WEST ELEVATION

SCALE: 1" = 40'



ENLARGED WEST ELEVATION - SERVICE BUILDING

SCALE: 1" = 40'

EAST ELEVATION SIMILAR

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EXTERIOR ELEVATIONS

TITLE - I

DATED:
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15-1-3

DRAWING NO.
A-2

MECHANICAL ROOM
(AREA 350SF)
- 8" PAINTED CONCRETE BLOCK WALLS
- 2'-0" x 4'-0" LAY IN ACOUSTICAL CEILING (10-6" AFF WITH LAY-IN FLUORESCENT FIXTURES
- SEALED CONCRETE FLOOR

NOTE:
ACOUSTICAL CEILING IS SUSPENDED FROM HEAVY GAUGE STEEL STUDS SPANNING BETWEEN THE CONCRETE BLOCK WALLS AND THE EXTERIOR WALL OF THE BUILDING.

OFFICE (AREA 650SF)
- 8" PAINTED CONCRETE BLOCK WALLS
- 2'-0" x 4'-0" LAY IN ACOUSTICAL CEILING (9" AFF) WITH LAY-IN FLUORESCENT FIXTURES
- CARPET FLOOR

SCINTILLATOR EQUIPMENT ROOM (AREA 390 SF)
- 8" PAINTED CONCRETE BLOCK WALLS
- 2'-0" x 4'-0" LAY IN ACOUSTICAL CEILING (9" AFF) WITH LAY-IN FLUORESCENT FIXTURES
- SEALED CONCRETE FLOOR

LADDER AND ACCESS PLATFORM TO CRANE

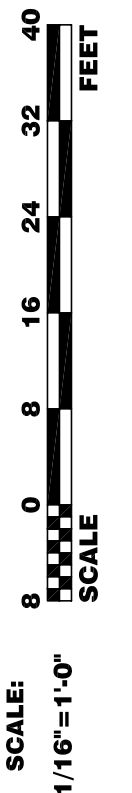
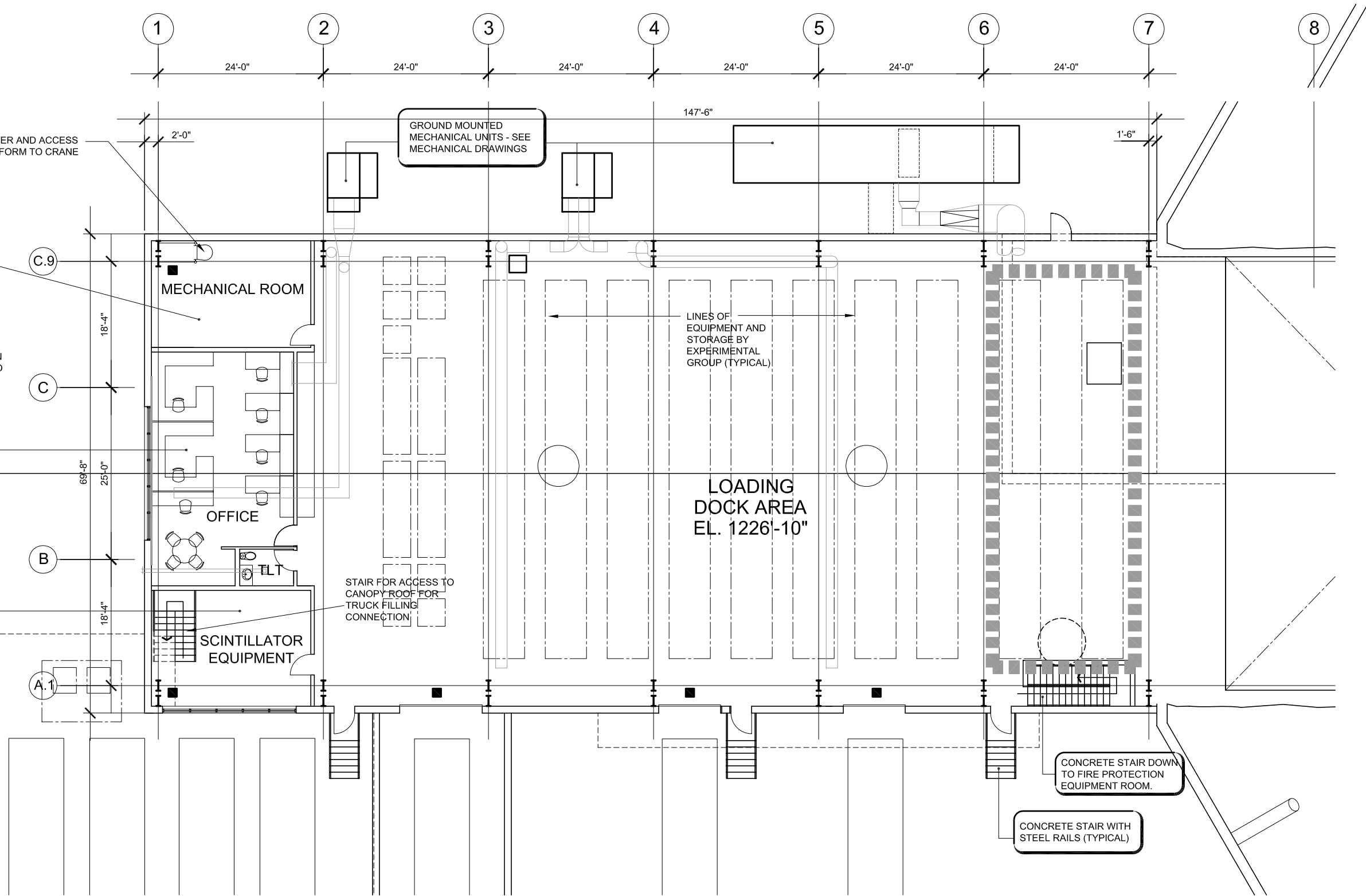
GROUND MOUNTED MECHANICAL UNITS - SEE MECHANICAL DRAWINGS

LINES OF EQUIPMENT AND STORAGE BY EXPERIMENTAL GROUP (TYPICAL)

STAIR FOR ACCESS TO CANOPY ROOF FOR TRUCK FILLING CONNECTION

CONCRETE STAIR DOWN TO FIRE PROTECTION EQUIPMENT ROOM.

CONCRETE STAIR WITH STEEL RAILS (TYPICAL)



ENLARGED PLAN OF SERVICE BUILDING -ELEV 1226'-10"

SCALE: 1/16" = 1'-0"

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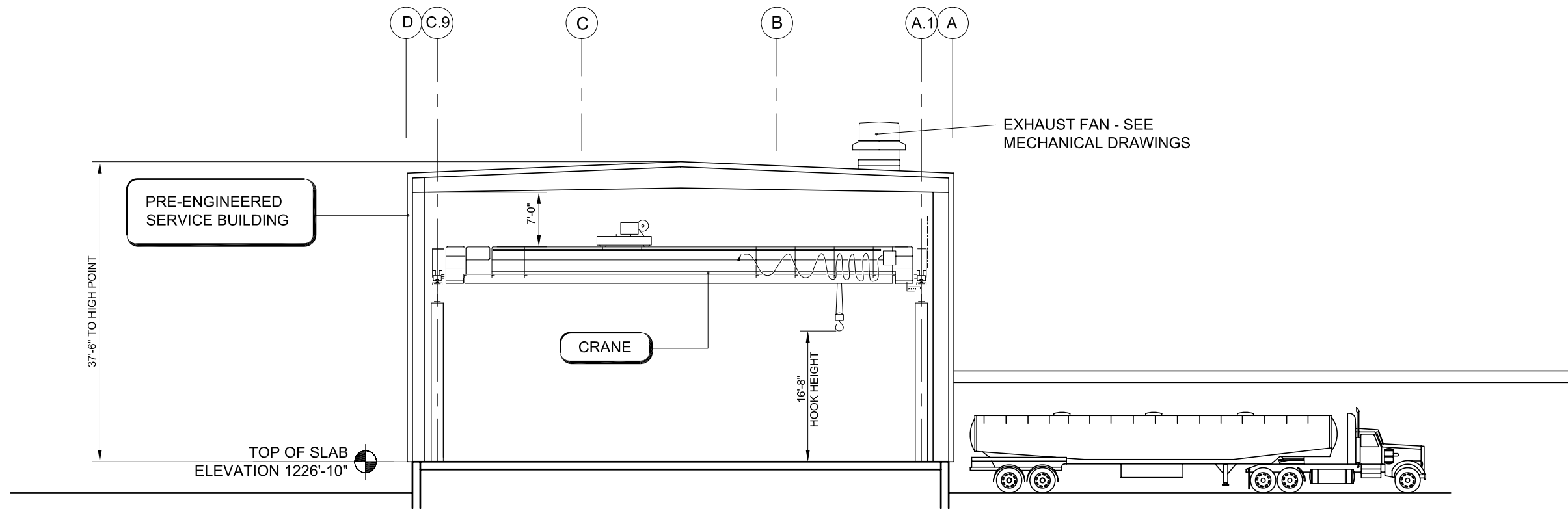


ENLARGED ARCHITECTURAL PLAN AT ELEV. 1226'-10"

TITLE - I
DATED:
18 APR. 2007

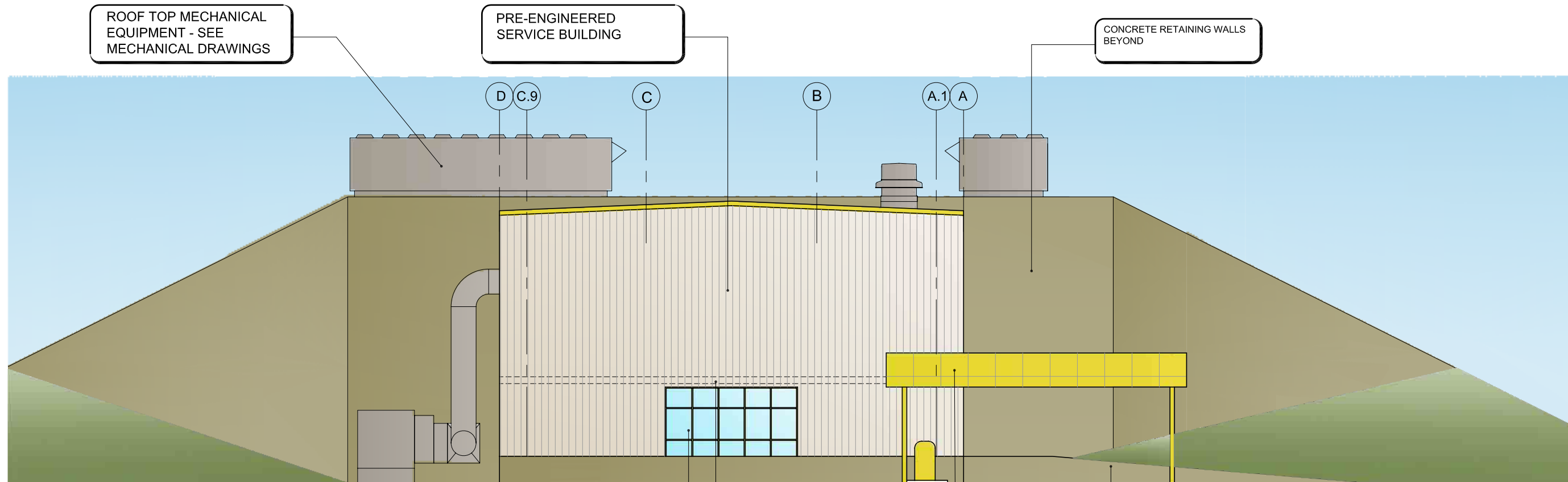
PROJECT NO.
15-1-3

DRAWING NO.
A-3



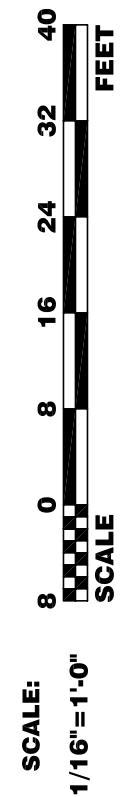
SECTION THROUGH SERVICE BUILDING

SCALE: 1/16" = 1'-0"



NORTH ELEVATION - SERVICE BUILDING

SCALE: 1/16" = 1'-0"



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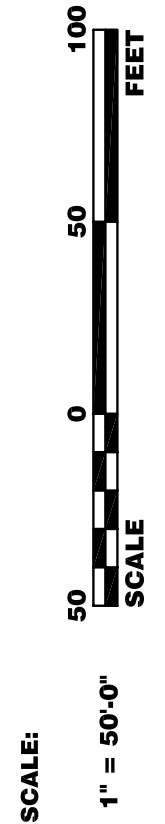
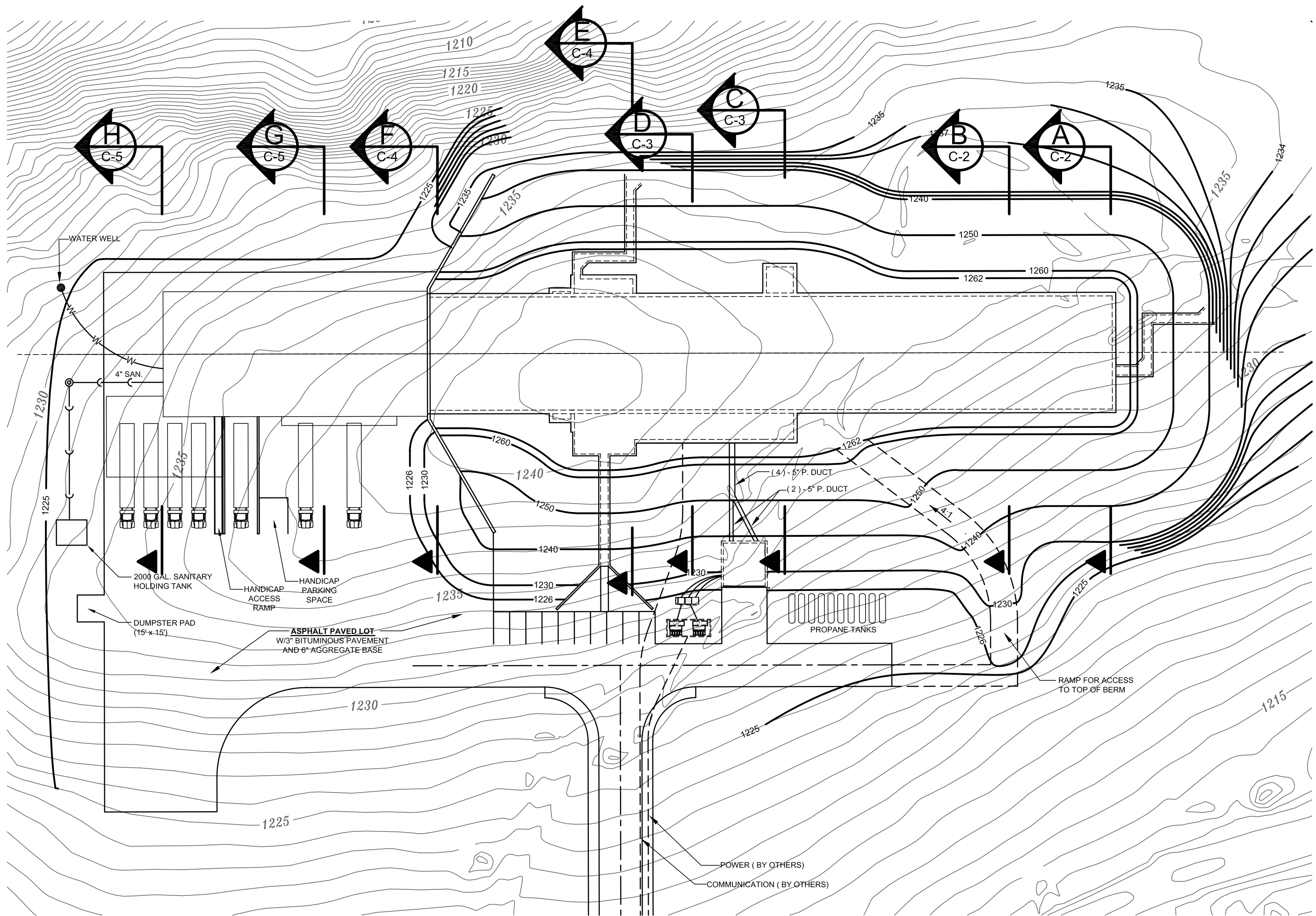
SERVICE BUILDING SECTION AND ELEVATION

TITLE - I

DATED:
18 APR. 2007

PROJECT NO.
15-1-3

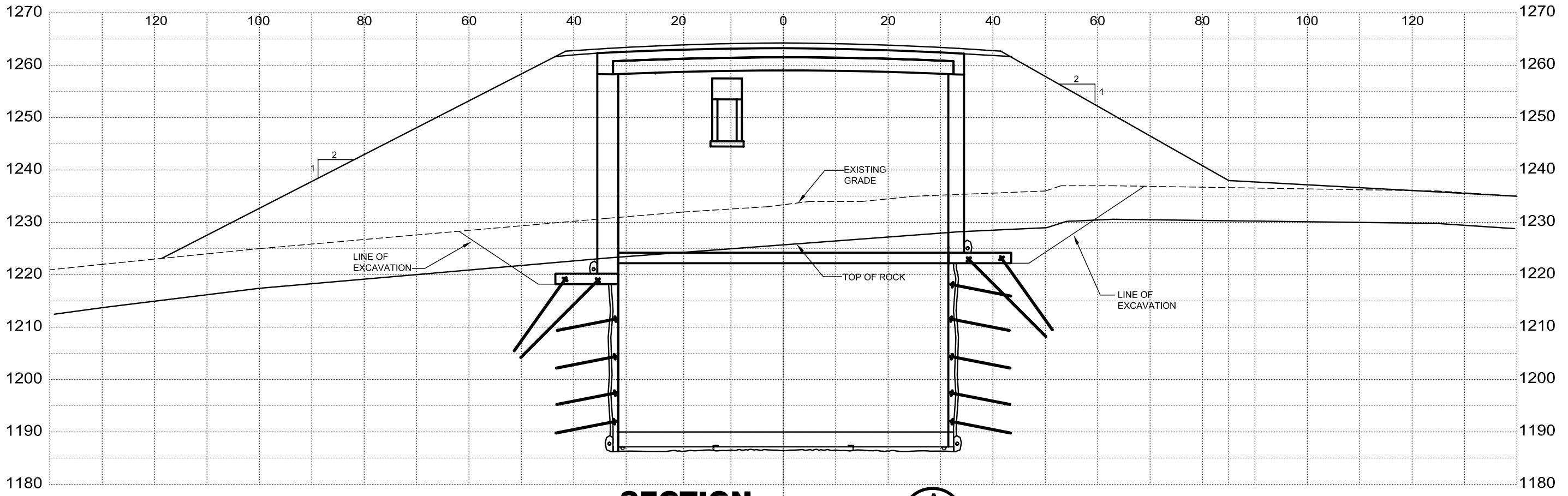
DRAWING NO.
A-4



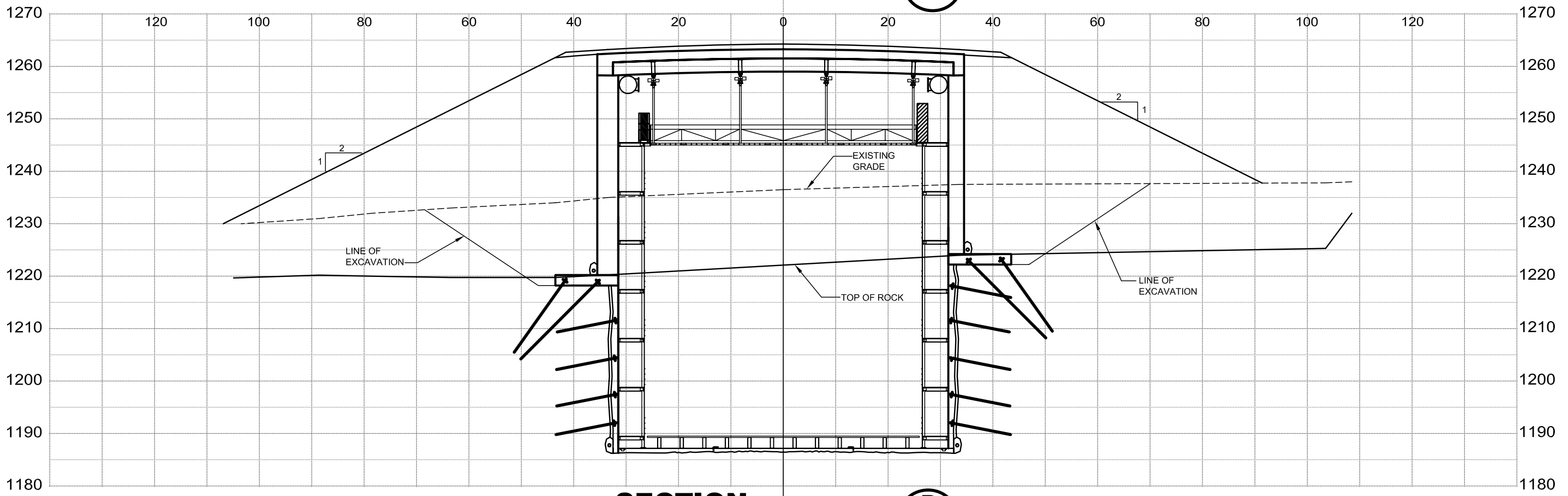
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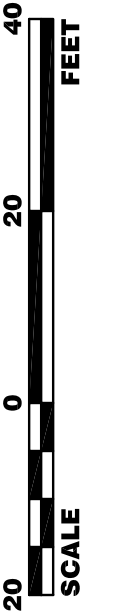
TITLE - I
 DATED:
18 APR. 2007
 PROJECT NO.
15-1-3
 DRAWING NO.
C-1



SECTION
SCALE 1" = 20'
A
C-1



SECTION
SCALE 1" = 20'
B
C-1



SCALE:
1" = 20'-0"

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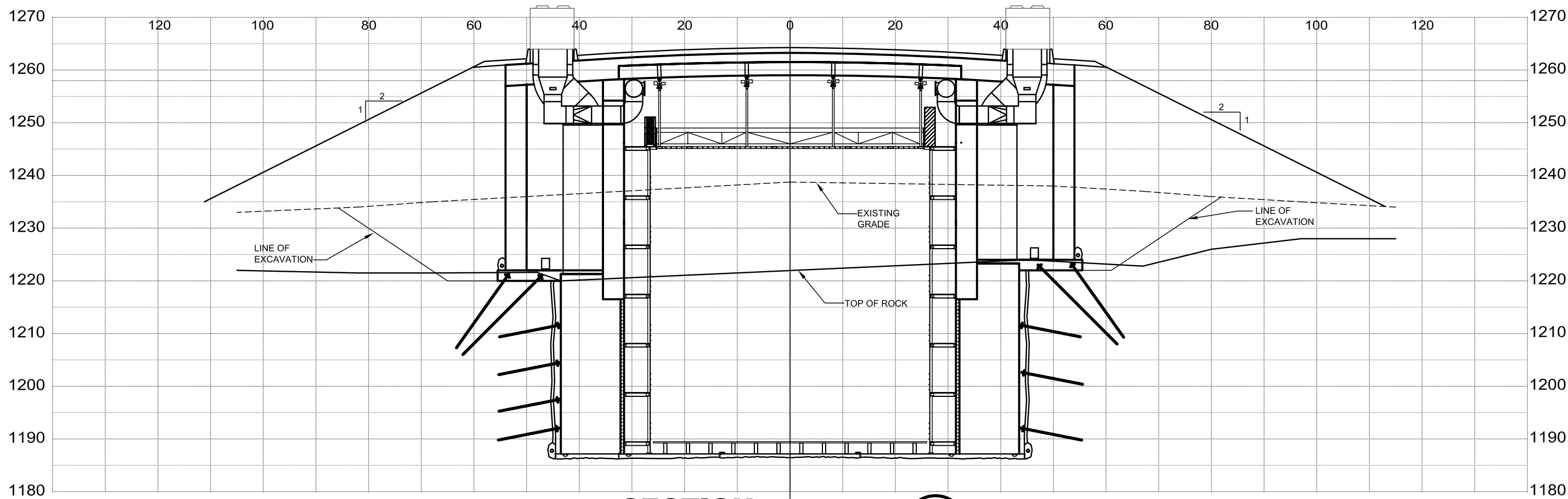
CIVIL CROSS-SECTIONS

TITLE - I

DATED:
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15-1-3

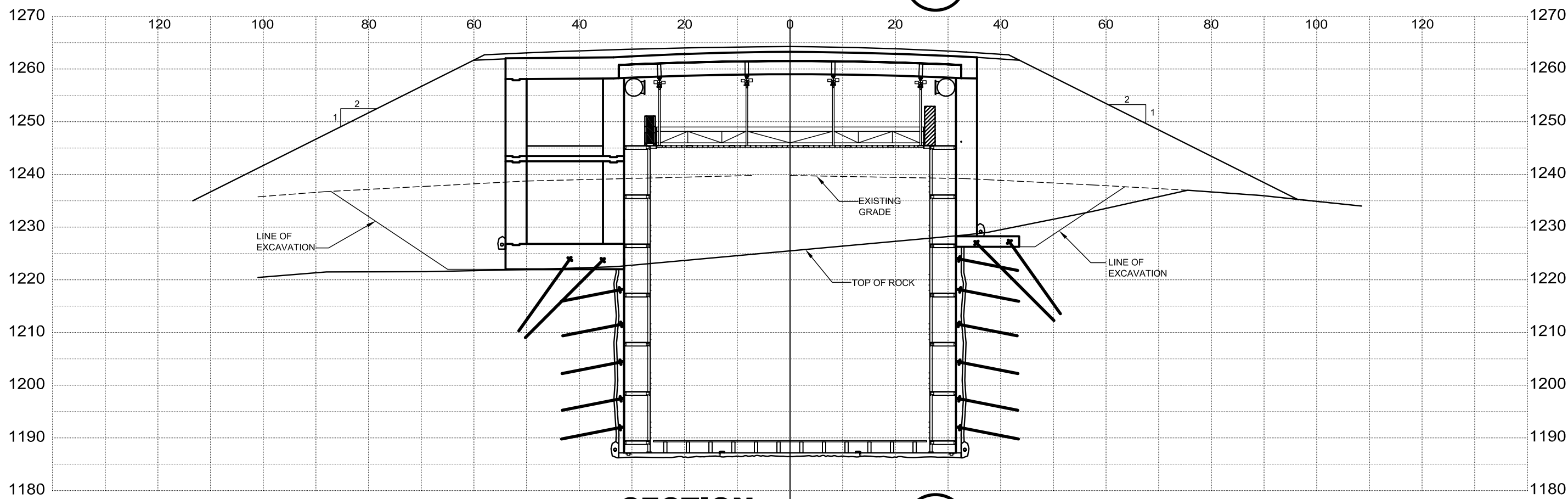
DRAWING NO.
C-2



SECTION

SCALE 1" = 20'

C
C-1



SECTION

SCALE 1" = 20'

D
D-1

SCALE:
1" = 20'-0"
SCALE
FEET
40
20
0

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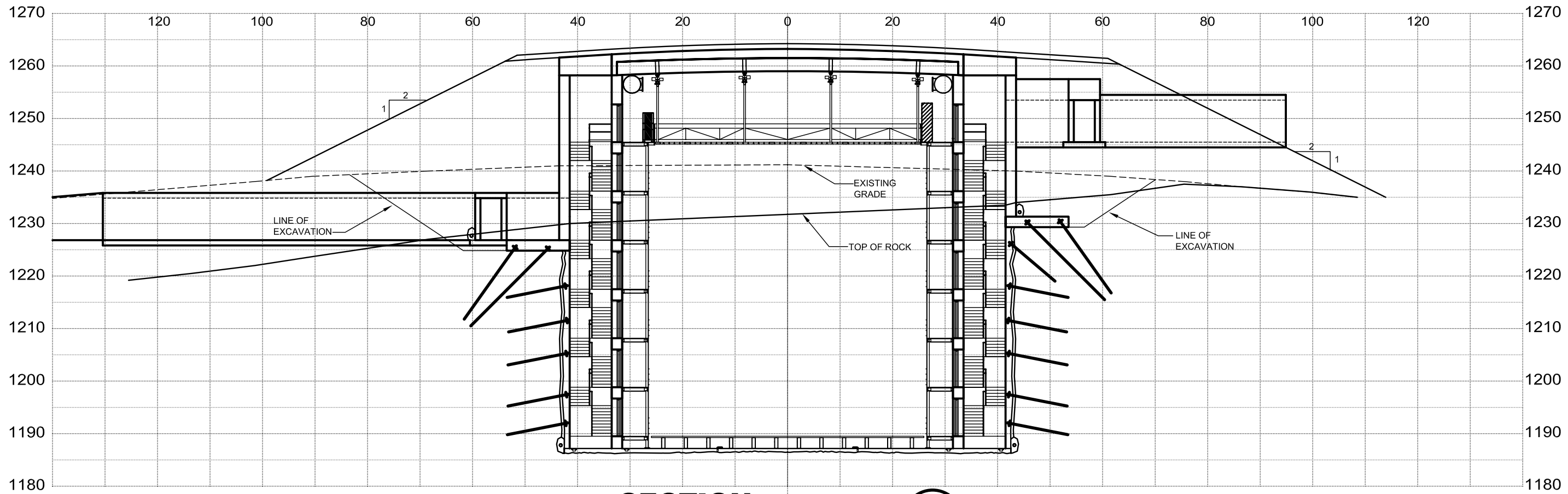
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TITLE - I

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18 APR. 2007

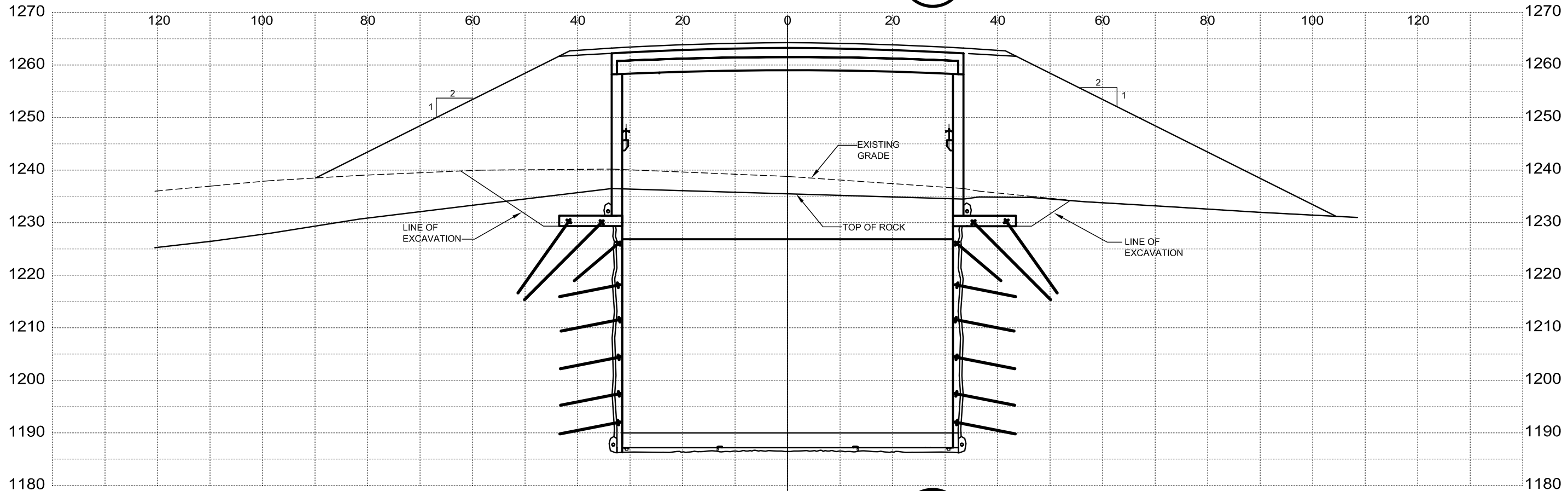
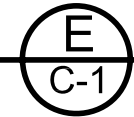
PROJECT NO.
15-1-3

DRAWING NO.
C-3



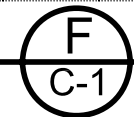
SECTION

SCALE 1"= 20'

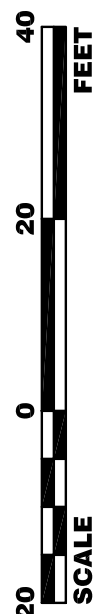


SECTION

SCALE 1"= 20'



SCALE:



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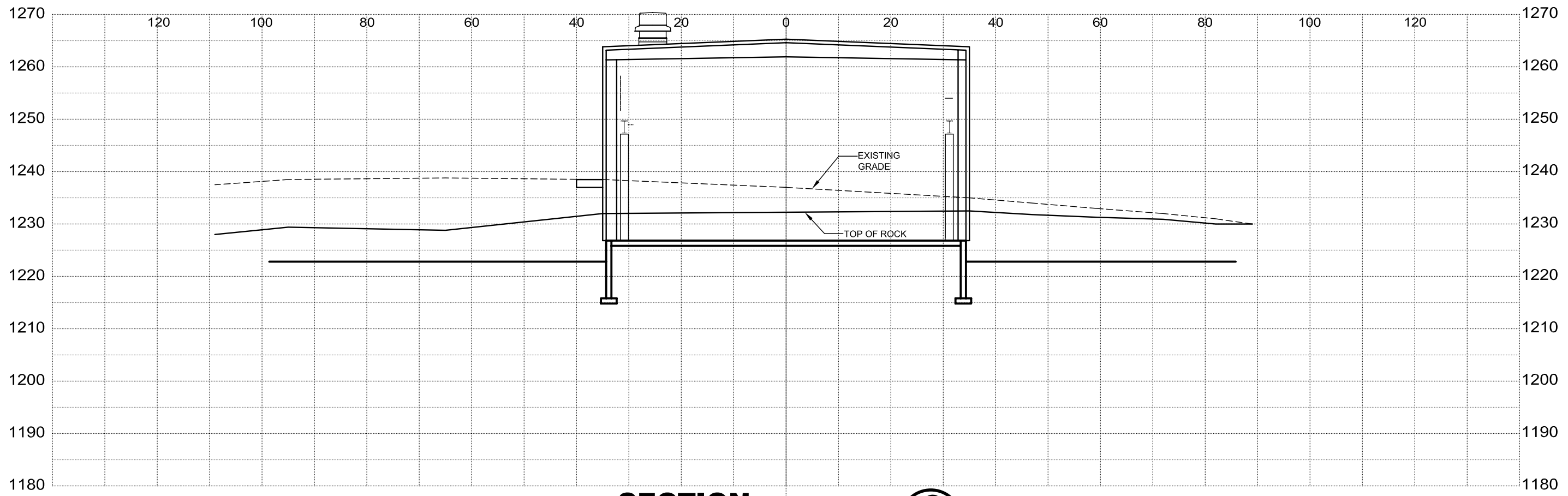
CIVIL CROSS-SECTIONS

TITLE - I

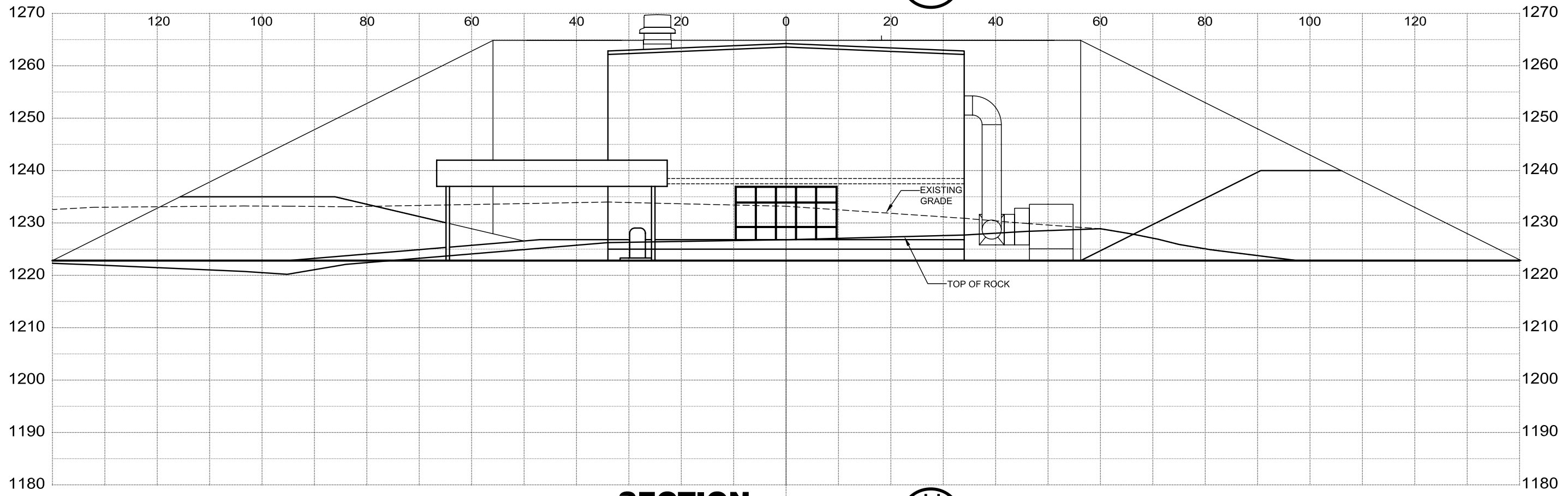
DATED:
18 APR. 2007

PROJECT NO.
15-1-3

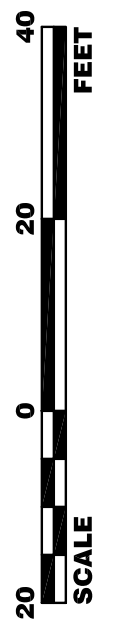
DRAWING NO.
C-4



SECTION
SCALE 1" = 20'
G
C-1



SECTION
SCALE 1" = 20'
H
C-1



SCALE:

1" = 20'-0"

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CIVIL CROSS-SECTIONS

TITLE - I

DATED:
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15-1-3

DRAWING NO.
C-5

ASSEMBLY HALL

CRITERIA
 TYPE: HVAC
 SUMMER: 70°F ± 5°, 50%RH MAX.
 WINTER: 70°F ± 5°, MIN 15%RH
 VENTILATION: 20,000 CFM 100% OUTSIDE AIR FOR GLUE EXHAUST SYSTEM (DURING APPROX 2YRS OF BLOCK ASSEMBLY)

CONCEPT:
 20,000 CFM 100% OUTSIDE AIR HVAC UNIT WITH DX COOLING (~115 TON), AND WITH SERIES DESSICANT WHEEL, UPSTREAM AND DOWNSTREAM OF COIL, (AAON RL 095 WITH D PAC-PRECISION AIR CONTROL) WITH PROPANE FIRED GAS HEATING SECTION AND STEAM HUMIDIFIER (200 MBTU/H, 188 LB/HR) INTEGRAL TO THE UNIT, DUCTED TO THE SPACE FOR CONTINUATION BY OTHERS.
 20,000 CFM EXHAUST FAN, AND EXHAUST DUCT, INTERLOCK WITH SUPPLY HVAC UNIT.

GENERATOR ROOM

CRITERIA
 TYPE: HEATING / VENTILATION
 SUMMER: AMBIENT
 WINTER: 65°F MIN.
 VENTILATION PER CODE

CONCEPT:
 PROPANE GAS-FIRED UNIT HEATER AND MOTORIZED LOUVER FOR SPACE. DUCTED INTAKE AND EXHAUST VENTILATION FOR GENERATOR RADIATOR, AND ENGINE AIR INTAKE.

CONTROL ROOM

CRITERIA
 TYPE: HVAC
 (ASSUME SAME AS COMPUTER ROOM).

CONCEPT:
 3-Ton (placeholder) INDOOR UNIT SPLIT SYSTEM (MINIMATE) WITH AIRCOOLED CONDENSER, WITH MINIMUM OA OPTION

COMPUTER ROOM

CRITERIA
 TYPE: HVAC
 72°F, 50%RH MAX, 30%RH MIN.
 MAJOR LOADS ARE (6)-8.32KW RACKS AND (2)-5.5 KW RACKS

CONCEPT:
 ONE 30-TON OR 85KW CRAC UNIT (LIEBERT DS105) DOWNFLOW FOR UNDERFLOOR AIR DISTRIBUTION, HOT AISLE/COLD AISLE CONCEPT, WITH INFRARED HUMIDIFIER AND ELECTRIC REHEAT WITH R407C AIR COOLED CONDENSER. NO REDUNDANCY

DETECTOR ENCLOSURE

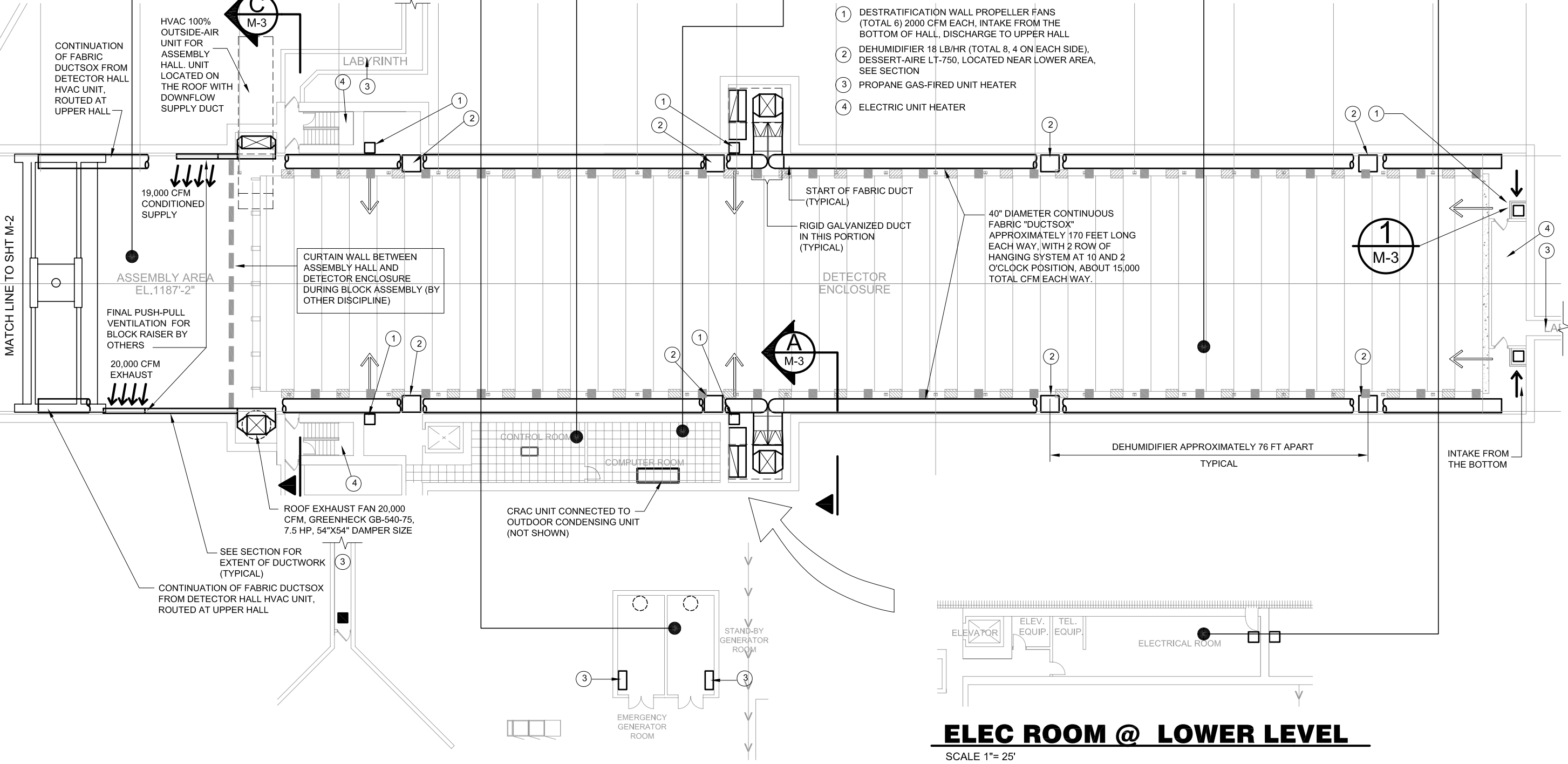
CRITERIA
 TYPE: HVAC
 SUMMER: 72°F ± 5°, 50°DEWPT MAX.
 WINTER: 72°F DB, MIN 15%RH
 VENTILATION: MINIMAL, FOR PEOPLE & PRESSURIZATION ONLY

CONCEPT:
 TWO 50-TON HVAC UNIT 30,000 CFM WITH 1000 CFM EACH OF OUTSIDE AIR (FOR PEOPLE AND PRESSURIZATION), WITH DEWPOINT CONTROL ECONOMIZER, PROPANE FIRED GAS HEATING SECTION, (AAON RN 050 WITH D-PAC (DIGITAL PRECISION AIR) CONTROL REMOTE ALARM/CONTROL LOCATED IN THE CONTROL ROOM, DUCTED TO THE SPACE, USING COMBINATION OF RIGID GALVANIZED DUCTWORK FROM UNIT THE BRANCH, AND 40" DIAMETER DUCTSOX FABRIC DUCT IN THE DETECTOR HALL. EACH SYSTEM WILL HAVE AN ELECTRIC STEAM HUMIDIFIER (~30 LB/HR, ARMSTRONG SERIES EHU-700-CM14, 480V 14A BASIS) WITH DUCT DISPERSION. A NUMBER OF SELF CONTAINED DX DEHUMIDIFIERS (DESSERT-AIRE LT 750) ARE LOCATED ALONG EACH SIDE FO THE HALL TO HELP MAINTAIN 50F SPACE DEWPOINT. SIX 2,000 CFM WALL FAN WILL DESTRATIFY THE SPACE AIR BRINGING THE LOWER COOLER SPACE AIR TO THE UPPER HALL. THE DETECTOR ENCLOSURE SHALL BE POSITIVE WITH RESPECT TO THE ADJACENT ASSEMBLY HALL AND LOADING DOCK.

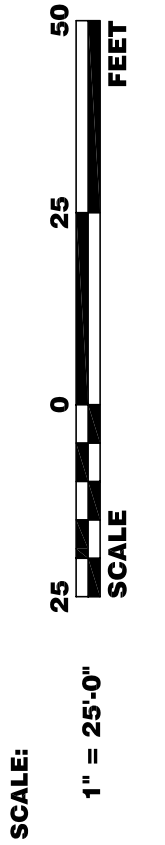
ELECTRICAL / TELE ROOM

CRITERIA
 TYPE: HEATING / VENTILATING
 SUMMER: AMBIENT
 WINTER: 65°F MIN, NO MIN RH

CONCEPT:
 ELECTRICAL HEATER



- ① DESTRATIFICATION WALL PROPELLER FANS (TOTAL 6) 2000 CFM EACH, INTAKE FROM THE BOTTOM OF HALL, DISCHARGE TO UPPER HALL
- ② DEHUMIDIFIER 18 LB/HR (TOTAL 8, 4 ON EACH SIDE), DESSERT-AIRE LT-750, LOCATED NEAR LOWER AREA, SEE SECTION
- ③ PROPANE GAS-FIRED UNIT HEATER
- ④ ELECTRIC UNIT HEATER



AREA CRITERIA PLAN
 SCALE 1" = 25'

ELEC ROOM @ LOWER LEVEL
 SCALE 1" = 25'

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CRITERIA AND CONCEPT - 1

TITLE - I
 DATED:
 18 APR. 2007
 PROJECT NO.
 15-1-3
 DRAWING NO.
 M-1

SCINTILLATOR ROOM

CRITERIA
 TYPE: HEATING
 MIN 68F
 VENTILATION: TBD

CONCEPT:
 PROPANE GAS-FIRED
 UNIT HEATER

TOILET

CRITERIA
 TYPE: HV
 78°F MAX, 70°F MIN
 VENTILATION &
 PLUMBING PER CODE

OFFICE

CRITERIA
 TYPE: HVAC
 SUMMER: 75°F ± 5°, 55%RH MAX.
 WINTER : 68°F ± 5°, NO MIN RH
 VENTILATION: ASHRAE 62

CONCEPT:
 ONE 5-TON HVAC DX UNIT WITH
 ECONOMIZER, PROPANE FIRED GAS
 HEATING SECTION, HORIZONTAL
 AIRFLOW CURB, DUCTED THROUGH
 THE LOADING DOCK WALL TO THE
 SPACE USING RIGID GALVANIZED
 DUCTWORK

MECHANICAL ROOM

CRITERIA
 TYPE: HEATING / VENTILATION
 SUMMER: (AMBIENT)
 WINTER : 68°F ± 5°, NO MIN RH
 VENTILATION: PER CODE

CONCEPT:
 PROPANE GAS-FIRED UNIT HEATER
 AND VENTILATION
 LOUVER/DAMPER

LOADING DOCK

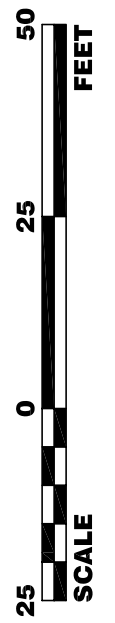
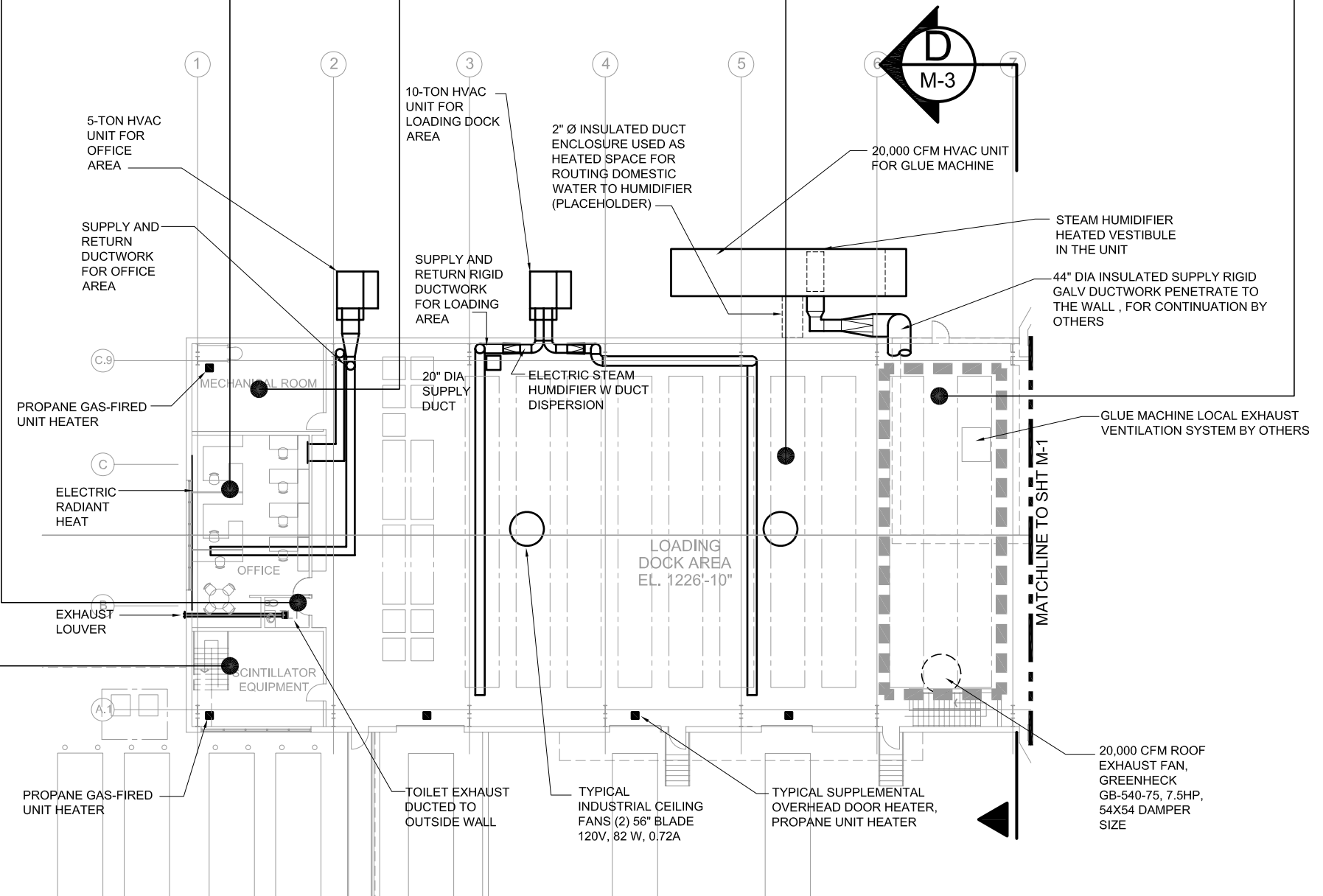
CRITERIA
 TYPE: HVAC
 SUMMER: 70°F ± 5°, 50%RH MAX.
 WINTER : 70°F ± 5°, MIN 15%RH
 VENTILATION: NONE

CONCEPT:
 ONE 10-TON HVAC DX UNIT WITH
 ECONOMIZER, PROPANE FIRED GAS
 HEATING SECTION, HORIZONTAL AIRFLOW
 CURB, DUCTED TO THE SPACE USING
 RIGID GALVANIZED DUCTWORK, WITH
 ELECTRIC STEAM HUMIDIFIER,
 DOWNSTREAM OF THE UNIT

GLUE MACHINE AREA

CRITERIA
 TYPE: HVAC
 SUMMER: 70°F ± 5°, 50%RH MAX.
 WINTER : 70°F ± 5°, MIN 15%RH
 VENTILATION: 20,000 CFM 100% OUTSIDE AIR FOR GLUE LOCAL EXHAUST SYSTEM

CONCEPT:
 20,000 CFM 100% OUTSIDE AIR HVAC UNIT WITH DX COOLING (~115 TON), AND WITH
 SERIES DESSICANT WHEEL, UPSTREAM AND DOWNSTREAM OF COIL, AAON RL 095
 WITH PAC-PRECISION AIR CONTROL, WITH PROPANE FIRED GAS HEATING SECTION
 AND STEAM HUMIDIFIER (200 MBTU/H, 188 LB/HR) INTEGRAL TO THE UNIT, DUCTED
 TO THE SPACE FOR CONTINUATION BY OTHERS.
 20,000 CFM EXHAUST FAN, AND EXHAUST DUCT, INTERLOCK WITH SUPPLY HVAC
 UNIT.



SCALE:

1" = 25'-0"

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CRITERIA AND CONCEPT - 2

AREA CRITERIA PLAN

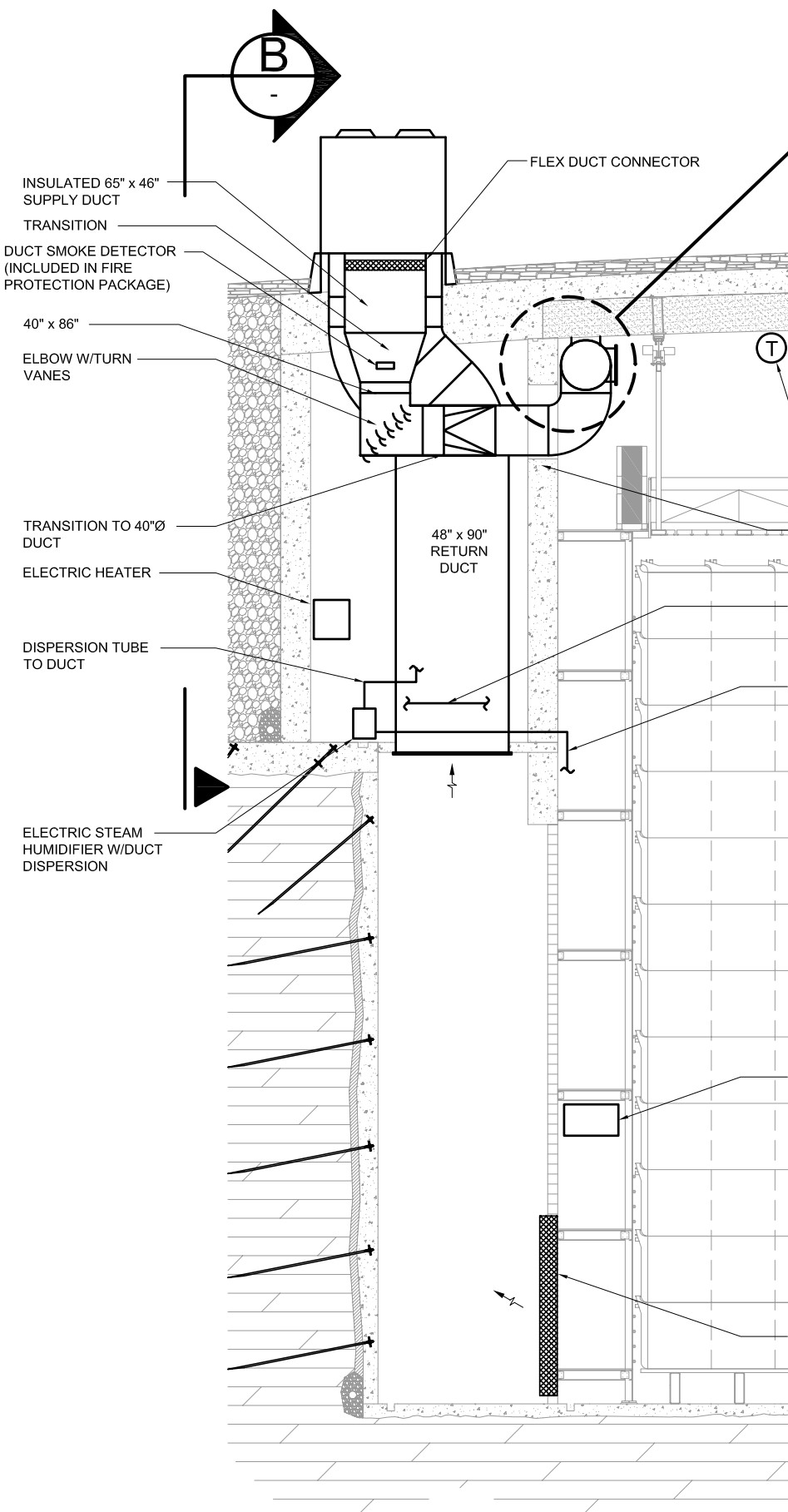
SCALE 1"= 25'

TITLE - I

DATED:
 18 APR. 2007

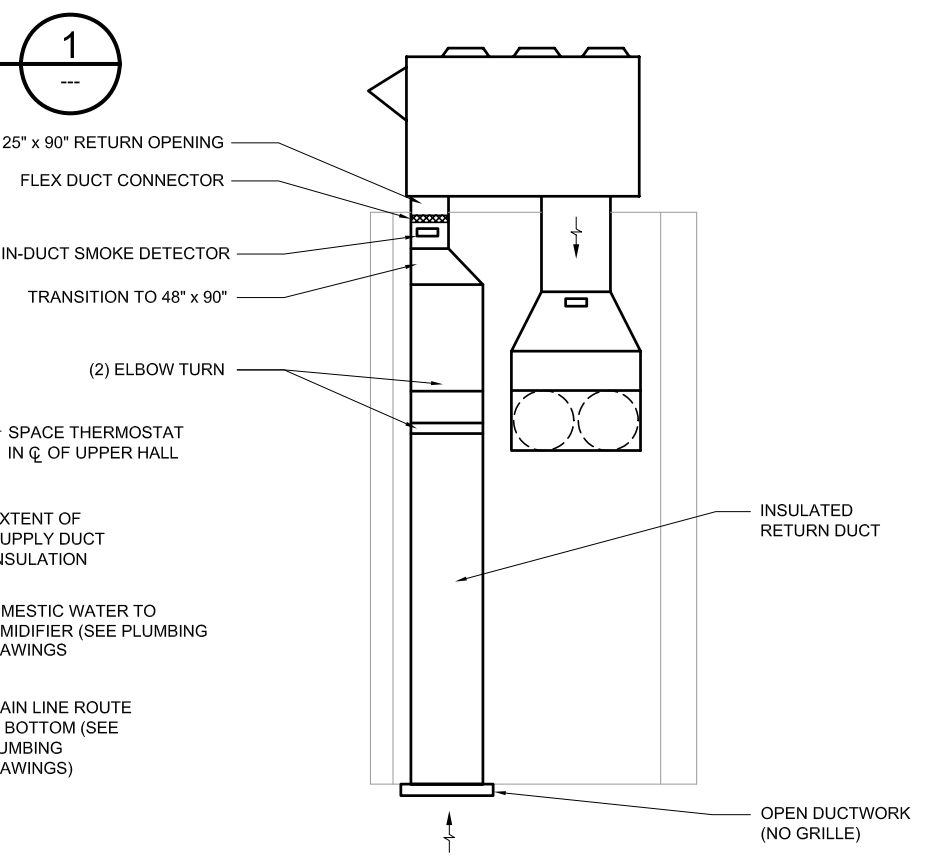
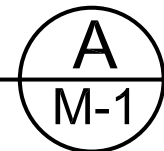
PROJECT NO.
 15-1-3

DRAWING NO.
 M-2



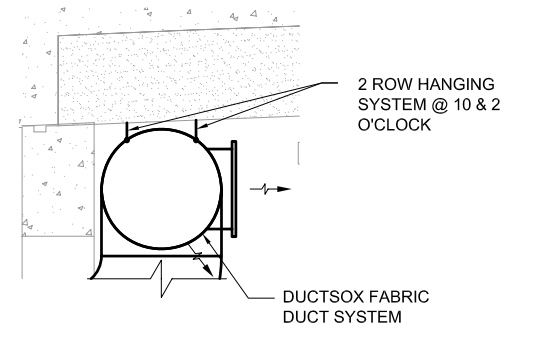
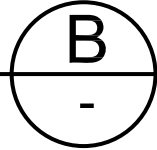
SECTION

SCALE 3/32"=1'-0"



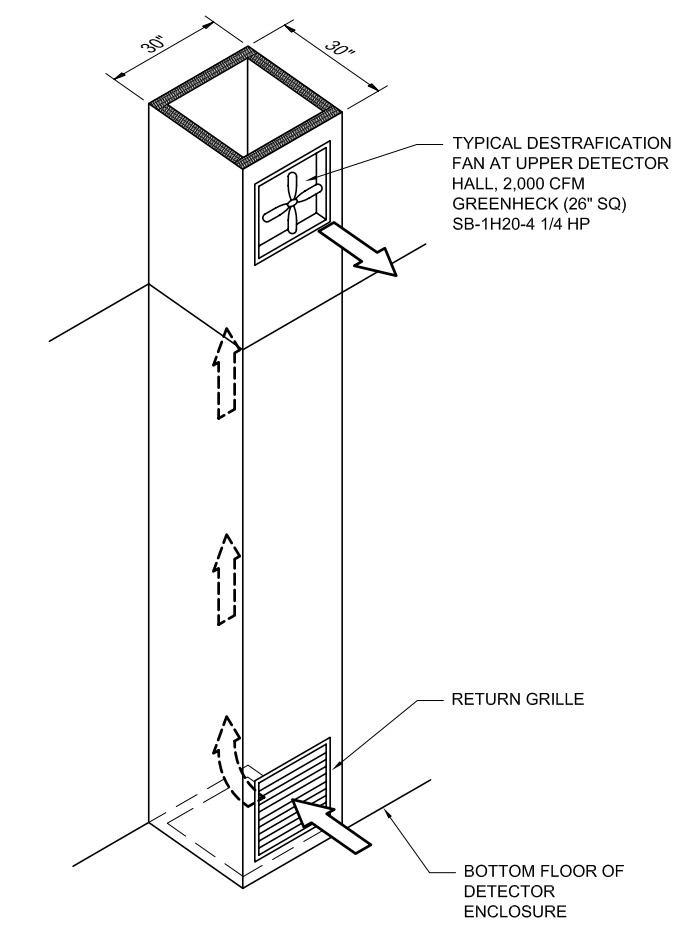
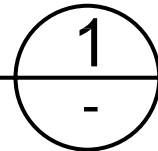
SECTION

SCALE 3/32"=1'-0"



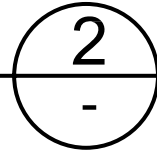
DETAIL

SCALE 3/16"=1'-0"



DETAIL

SCALE NONE



SCALE:

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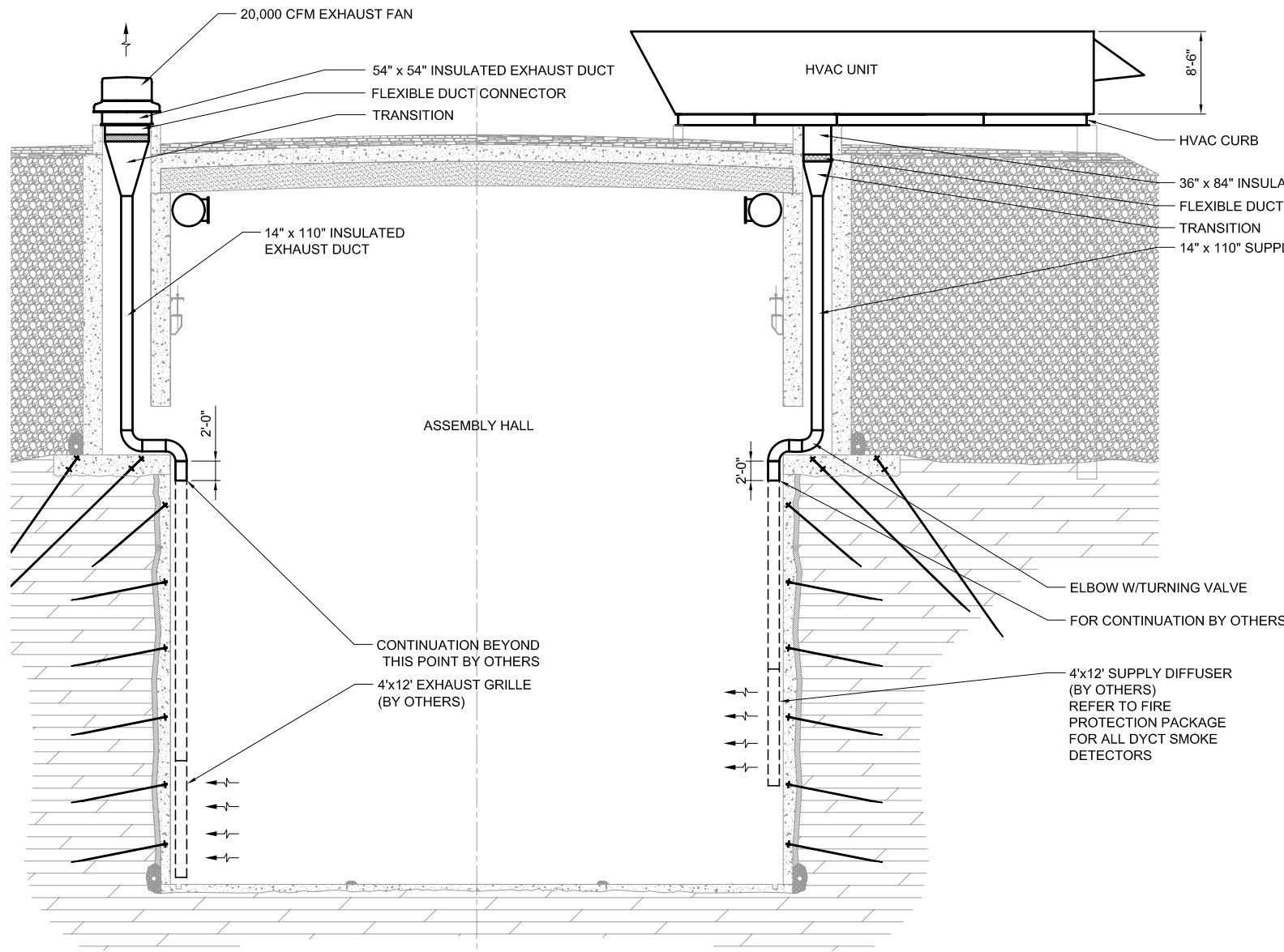
SECTION SHEET - 1

TITLE - I

DATED:
18 APR. 2007

PROJECT NO.
15-1-3

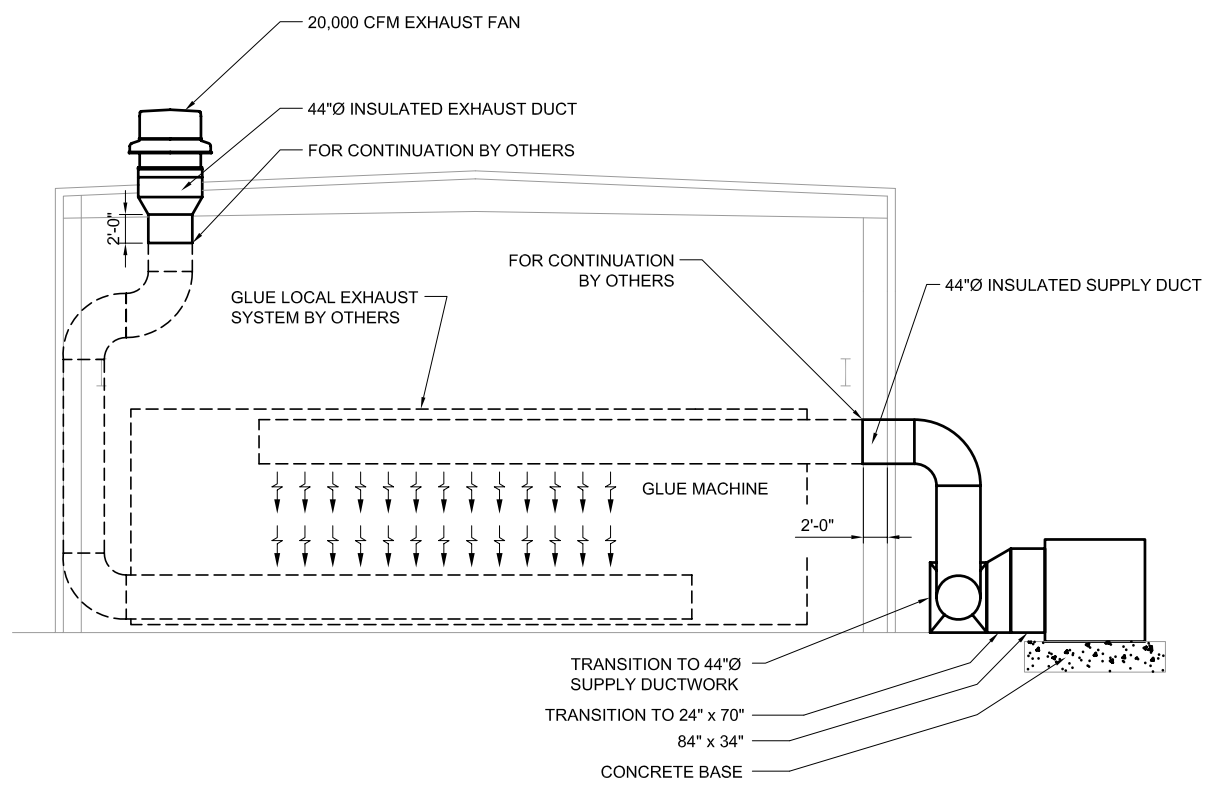
DRAWING NO.
M-3



SECTION

SCALE 1/16"=1'-0"

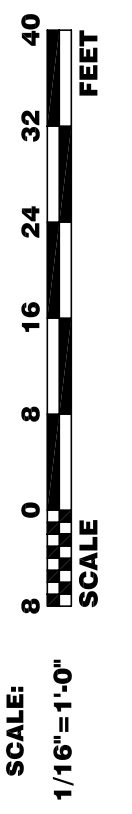
C
M-1



SECTION

SCALE 1/16"=1'-0"

D
M-1



FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY



SECTION SHEET - 2

TITLE - I

DATED:
11 APR 2007

PROJECT NO.
15-1-3

DRAWING NO.
M-4

(DOE/EA-1570)

**Environmental Assessment Worksheet
Transmittal Memo**



MEMORANDUM

TO: Minnesota Environmental Quality Board EAW Distribution List (attached)

DATE: August 28, 2007

RE: Environmental Assessment Worksheet (EAW) prepared for the NOvA Off Axis Detector Facility in Saint Louis County, Minnesota

Enclosed please find a copy of the Environmental Assessment Worksheet (EAW) prepared for the proposed NOvA Off Axis Detector Facility in Saint Louis County, Minnesota. The EAW was prepared on behalf of the Board of Regents of the University of Minnesota, who are the designated Responsible Governmental Unit (RGU) for the proposed project. The EAW was prepared in accordance with the rules and policies of the Minnesota Environmental Quality Board pursuant to Minnesota Statutes, section 116D.04 and 116D.045.

The EAW was prepared as a discretionary EAW since the mandatory EAW threshold criteria in the MEQB rules were not exceeded. In addition, a federal Environmental Assessment (EA) is being prepared for the project by the U.S. Department of Energy since federal funding is involved. The EAW and EA are separate documents and processes for the project and the EA schedule will continue and be completed after the EAW process is complete. The EAW will be an appendix in the EA document ultimately, and a separate public comment period will occur for the EA at a later date.

The enclosed EAW identifies potential project effects, environmental conditions, and permits and approvals anticipated for the project. A public meeting will be held at the VFW Hall, Highway 53 in Orr, MN on Wednesday, September 26 at 7:00 p.m. The 30 day public comment period begins on September 10, 2007. Your comments on the EAW are requested and will be accepted until October 10, 2007 when the public comment period ends.

Written comments and requests for printed copies may be directed to:

Brad Kovach, Project Manager
3535 Vadnais Center Drive
St. Paul, MN 55110-5196
bkovach@sehinc.com

BK
Enclosure

FERMILAB EAW DISTRIBUTION LIST

JON LARSEN
ENVIRONMENTAL QUALITY BOARD
ENVIRONMENTAL REVIEW PROGRAM
ROOM 300
658 CEDAR STREET
ST PAUL MN 55155

JIM HAERTEL
BOARD OF WATER & SOIL RESOURCES
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ST PAUL MN 55155

MINNESOTA DEPARTMENT OF HEALTH
ENVIRONMENTAL HEALTH DIVISION
625 NORTH ROBERT STREET
ST PAUL MN 55155

GERRY LARSON
MN/DOT
OFFICE OF ENVIRONMENTAL SERVICES
MS 620
395 JOHN IRELAND BOULEVARD
ST PAUL MN 55155

SUSAN MEDHAUG
MN DEPARTMENT OF COMMERCE
POLICY/PLANNING & ANALYSIS UNIT
85 SEVENTH PLACE E
ST PAUL MN 55101

STEVE COLVIN
MN DEPT OF NATURAL RESOURCES
ENVIRONMENTAL REVIEW UNIT
500 LAFAYETTE ROAD
ST PAUL MN 55155

STATE HISTORIC PRESERVATION OFFICE
LEVEL A
345 KELLOGG BLVD W
ST PAUL MN 55102

MINNESOTA HISTORICAL SOCIETY
345 KELLOGG BLVD
ST PAUL MN 55102

RICK NEWQUIST
MN POLLUTION CONTROL AGENCY
ENVIRONMENTAL REVIEW UNIT/MAJORS/REM
DIVISION
520 LAFAYETTE RD
ST PAUL MN 55155

TAMARA CAMERON
US ARMY CORPS OF ENGINEERS
REGULATORY FUNCTIONS BRANCH
190 FIFTH ST E
ST PAUL MN 55101

VOYAGEURS NATIONAL PARK
ATTN: SUPERINTENDENT
3131 HIGHWAY 52 SOUTH
INTERNATIONAL FALLS MN 56649-8904

KENNETH WESTLAKE
EPA
ENVIRONMENTAL PLANNING AND EVALUATION UNIT
77 W JACKSON BLVD
CHICAGO IL 60604-3590

US FISH AND WILDLIFE SERVICE
TWIN CITIES FIELD OFFICE E S
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JOHN COOPER
FERMI NATIONAL ACCELERATOR LABORATORY
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BATAVIA, IL 60510-5011

Appendix B

Description of NOvA Detectors

Description of NOvA Detectors..... B-1

APPENDIX B

DESCRIPTION OF THE NO ν A DETECTORS

B.1 The Basic NO ν A Detector Element

The basic unit of the NO ν A Detector is a simple rectangular rigid polyvinyl chloride (PVC) plastic cell containing liquid scintillator and a wavelength-shifting fiber (see Figure B.1). Charged particles traverse the cell primarily along its depth (D) and scintillator light is produced in the liquid. The light bounces around in the rectangular cell of width W , depth D , and length L until it is captured by a doubled length of wavelength-shifting fiber or absorbed by PVC or scintillator. At the top of the cell both ends of the looped fiber are directed to one pixel on an Avalanche Photodiode (APD) light detector array, and the light is converted to an electronic signal.

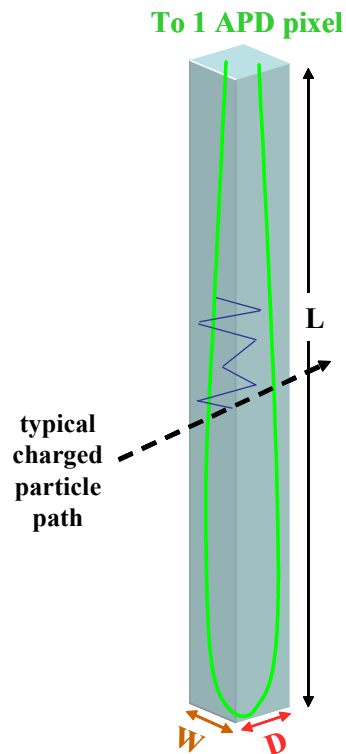


Figure B.1: A PVC cell of dimensions (W , D , L) containing liquid scintillator and a wavelength-shifting fiber (green). A charged particle incident on the front face produces light (blue line) that bounces off the cell walls until absorbed by the fiber. The fiber routes the light to an APD.

The NO ν A cell is made of a highly reflective titanium dioxide loaded rigid PVC cell. The cell width and depth satisfy the scientific requirements and the cell length is sized to fit on a standard domestic semi trailer truck 53 ft in length. To achieve the 20 kiloton mass for the Far Detector, the cell structure is repeated 500,000 times.

B.2 Liquid Scintillator

Sixty-nine percent (~ 13.8 kilotons) of the NOvA Far Detector mass is the liquid scintillator held inside the NOvA cells. The approximately 4.3 million gallons (gal) of liquid scintillator are composed primarily of mineral oil with 5.5% pseudocumene (1,2,4-Trimethylbenzene) as the scintillant. The liquid also contains chemical additives to shift the light wavelength. These additives are PPO (2,5-diphenyloxazole) and bis-MSB [1,4-di(methylstyryl)benzene]. An anti-static agent is added to the liquid at the level of 3 parts per million (ppm) to prevent charge build-up during distribution to the cells. Blending of the scintillator components would take place at Fermilab or at a toll blender in the Chicago area as discussed in Chapter 3 of the NOvA *Environmental Assessment*.

B.3 Rigid PVC Extrusions

The mass of the rigid PVC extrusions is ~ 6.2 kilotons or about 31 % of the mass of NOvA Far Detector. Assembling 500,000 objects is achieved by using larger rigid PVC extrusions with 16 cells extruded together in a unit as shown in Figure B.2. About 31,000 of the 16-cell extrusions are needed for the full Far Detector.

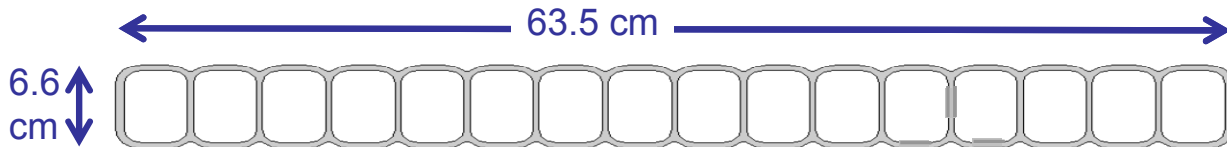


Figure B.2: Drawing of the End View of the NOvA rigid PVC extrusion.

B.4 Extrusion Modules Assembly

Raw extrusions from the commercial supplier are inspected for structural integrity at the vendor's site. The extrusions are sorted to remove any variations in thickness which may arise during the extrusion process and additional sorting may take place to remove extrusions with excess "banana" or curvature along the length.

Next, leak-tight NOvA extrusion modules are constructed from the PVC and fiber at the University of Minnesota, a NOvA Experiment Collaborator. Two sorted 16-cell objects are attached with methyl methacrylate adhesive, and the 32-cell extrusion module is cut to an exact length. The extrusions are threaded with wavelength shifting fiber loops as in Figure B.1, and each fiber is tested for continuity after installation. The extrusion modules are capped at one end by a simple PVC end plate to contain the liquid scintillator and are capped at the other end by a more complicated fiber manifold which holds the liquid and routes the 64 fiber ends to 32 APD pixels (Figure B.3).

The assembled extrusion modules with fiber manifolds and end caps are 51.5 ft long, sized to fit inside a standard domestic 53-ft semi trailer truck. The end plates and fiber manifolds link the 32 cells into a common liquid volume. Thus the 4.25 ft by 51.5 ft extrusion module forms the primary containment vessel for the liquid scintillator. Each extrusion module holds about 250 - 275 gal of scintillator. As part of the construction process, each completed extrusion module is tested for leaks before being shipped empty to the detector assembly site.

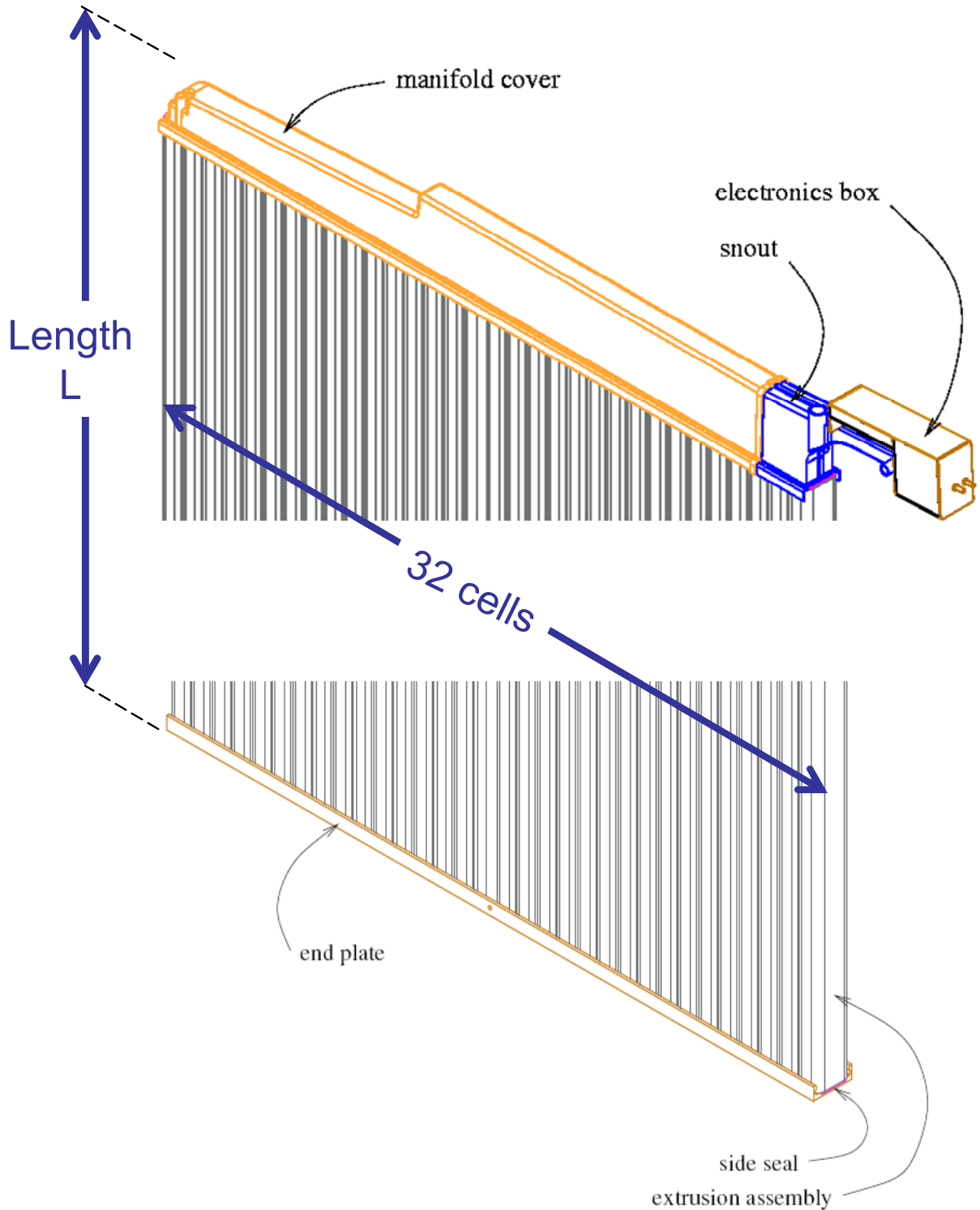


Figure B.3: A NOvA extrusion module constructed from two side by side 16 cell PVC extrusions and capped at both ends to contain the liquid scintillator. The manifold end also routes the 64 fiber ends to the avalanche photodiode array and associated electronics.

B.5 Light Detector, Electronics and Data Acquisition System

The NOvA light detector is an Avalanche Photodiode (APD). The thermal electronic noise generated in the APD is reduced by cooling the devices to -15°C (5°F) using thermo-electric (TE) coolers. Heat from the hot side of the TE coolers is removed by a water cooling system in the Far Detector Support Building. There are about 15,000 APDs on front-end boards in the Far Detector, one per extrusion module, which then interface to a standard Ethernet network for off-site data processing and analysis.

B.6 Final Detector Description

There are three NOvA detectors in the NOvA project: the Far Detector at Ash River, the Near Detector at Fermilab, and an Integration Prototype Near Detector (IPND) at Fermilab. The relative sizes of these detectors are illustrated in Figure B.4. All three detectors have an identical structure and are assembled in alternating layers of vertical and horizontal extrusions as shown in the inset to Figure B.4. This layering organizes the detector into planes with 90° stereo for tracking of particles produced in neutrino interactions originating in the PVC and scintillator mass. Table B.1 lists relevant parameters of the three detectors.

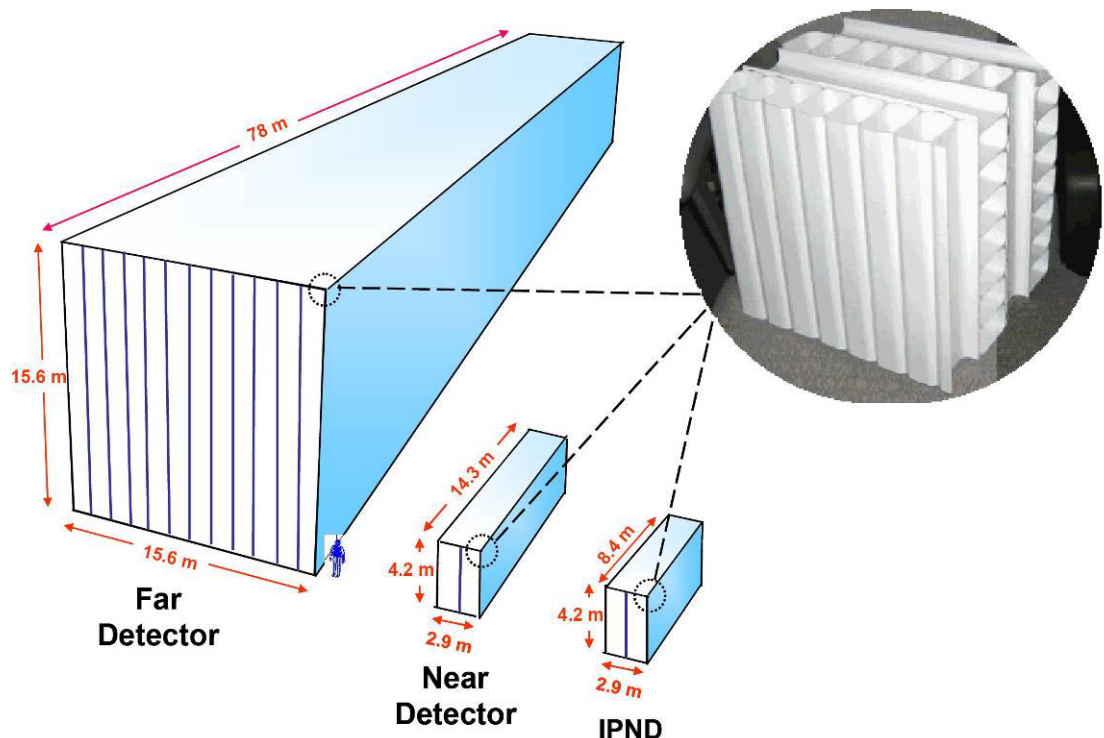


Figure B.4: The three NOvA detectors. The inset figure shows that each detector has an identical alternating plane structure composed of vertical and horizontal cells like those shown in Figure B.2.

	Integration Prototype Near Detector (IPND)	Near Detector	Far Detector
Mass (metric tons)	90 tons	222 tons	20,000 tons
Active Detector Size (width, height, length) in feet	(9.5, 13.8, 27)	(9.5, 13.8, 47)	(51, 51, 282)
Liquid scintillator required (gallons)	19,920	29,600	4,333,000
Wavelength Shifting fiber required (kilometers)	38.6	113	16,750
Number of 32 cell extrusion modules required	335	496 (335 get re-used from the IPND)	15,624
Number of detector channels (cells)	10,720	15,872	499,968

Table B.1: Parameters of the three NOvA detectors. The Far Detector is about 92 times the size of the Near Detector.

Appendix C

Material Safety Data Sheets for Chemicals

1,2,4-trimethylbenzene	Pseudocumene	C-1	
Plastic welder Adhesive	Devcon-60.....	C-3	
Methyl Methacrylate, 99%.....	MMA	C-18	
2,5-diphenyloxazole.....	PPO	wave shifter #1	C-22
1,4-di-(2-methylstyryl)-benzene.....	Bis-MSB	wave shifter #2	C-29

MSDS for
1,2,4-trimethylbenzene
Pseudocumene

Safety (MSDS) data for 1,2,4-trimethylbenzene
Safety (MSDS) data for 1,2,4-trimethylbenzene
Safety (MSDS) data for 1,2,4-trimethylbenzene

General

Synonyms: pseudocumene
Molecular formula: C₉H₁₂
CAS No: 95-63-6
EINECS No: 202-436-9

Physical data

Appearance: colourless liquid
Melting point: -43.8 C
Boiling point: 169 C
Vapour density:
Vapour pressure:
Density (g cm⁻³): 0.876
Flash point: 48 C
Explosion limits:
Autoignition temperature:
Water solubility: slightly soluble

Stability

Stable. Incompatible with strong oxidizing agents. Flammable. May form explosive mixtures with air.

Toxicology

Typical STEL 35 ppm. Typical TWA 25 ppm. May be harmful by ingestion, inhalation or through skin contact. Skin, eye and respiratory irritant.

Toxicity data

(The meaning of any toxicological abbreviations which appear in this section is given here.)

ORL-RAT LD50 5000 mg kg⁻¹

IPN-RAT LDLO 2000 mg kg⁻¹

IHL-MUS 8147 ppm acute

IPN-GPG LDLO 1566 mg kg⁻¹

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)

R36 R37 R38.

Transport information

Personal protection

Safety glasses, adequate ventilation.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on September 5, 2005. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

(DOE/EA-1570)

MSDS for
Plastic welder Adhesive
Devcon-60

PLASTIC WELDER II ACTIVATOR

This product appears in the following stock number(s):

14335 14340 14390 DA320

Last revised: 03/05/04

Printed: 3/25/2004

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**Tradename:** PLASTIC WELDER II ACTIVATOR**General use:** Adhesive**Chemical family:** Acrylate**MANUFACTURER**ITW Devcon
30 Endicott St.
Danvers, MA 01923**EMERGENCY INFORMATION****Emergency telephone number**
(CHEMTREC): (800) 424-9300
Other Calls: (978) 777-1100**2. COMPOSITION/INFORMATION ON INGREDIENTS****HAZARDOUS CONSTITUENTS****Exposure limits**

Constituent	Abbr.	CAS No.	Weight percent	ACGIH TLV	OSHA PEL	Other Limits
3,5-Diethyl-1,2-dihydro-1-phenyl-2-propylpyridine		34562317	1-10	n/e	n/e	n/e
Methyl Methacrylate Monomer	MMA	80626	60 - 100	50 ppm	100 ppm	100 ppm (Canada)

"TLV" means the Threshold Limit Value exposure (eight-hour, time-weighted average, unless otherwise noted) established by the American Conference of Governmental Industrial Hygienists. "STEL" indicates a short-term exposure limit. "PEL" indicates the OSHA Permissible Exposure Limit. "n/e" indicates that no exposure limit has been established. An asterisk (*) indicates a substance whose identity is a trade secret of our supplier and unknown to us.

3. HAZARDS IDENTIFICATION**Emergency Overview**

Appearance, form, odor: Paste with varied fragrant odor.

WARNING! Flammable. Eye, skin and respiratory irritant. Skin sensitizer. Harmful if inhaled or absorbed through skin. Chronic overexposure may cause liver and kidney effects.

Potential health effects

Primary routes of exposure: Skin contact Skin absorption Eye contact Inhalation Ingestion

Symptoms of acute overexposure:**Skin:** May cause irritation and sensitization. MMA may be absorbed through the skin.**Eyes:** Liquid and vapors causes moderate irritation (burning sensation, tearing, redness, swelling). May cause corneal damage.

Inhalation:

High concentration is irritant to respiratory tract and may cause dizziness, headache, and anaesthetic effects.

Ingestion:

Causes irritation, a burning sensation of the mouth, throat and gastrointestinal tract and abdominal pain.

Effects of chronic overexposure:

Prolonged exposure may lead to kidney, lung, heart and liver damage.

Carcinogenicity -- OSHA regulated: No

ACGIH: No

National Toxicology Program: No

International Agency for Research on Cancer: No

Medical conditions which may be aggravated by exposure:

Preexisting eye and skin disorders and diseases of the lung.

Other effects:

MMA: Developmental toxicity observed in animal tests, but only at levels toxic to the mother. MMA is reported to impair human olfactory function. Overexposure to pyridine and some of its derivatives may include weakness, dizziness, nausea, loss of consciousness, loss of appetite, and sleep disturbances.

4. FIRST AID MEASURES**First aid for eyes:**

Flush eye with clean water for at least 15 minutes while gently holding eyelids open. Get immediate medical attention.

First aid for skin:

Immediately remove contaminated clothing and excess contaminant. Flush skin with water. Wash thoroughly with warm soap and water. Consult a physician if irritation develops.

First aid for inhalation:

Remove patient to fresh air. Administer oxygen if breathing is difficult. Get medical attention if symptoms persist.

First aid for ingestion:

Do NOT induce vomiting. Give two glasses of water to dilute if patient is conscious. Get medical attention.

5. FIRE FIGHTING MEASURES**General fire and explosion characteristics:**

Vapor forms explosive mixture with air.

Extinguishing media:

Water

Carbon dioxide

Dry chemical

Foam

Alcohol foam

Flash Point (°F): 50

Method: TCC

Explosive limits in air (percent) -- Lower: 2.1

Upper: 12.5

Special firefighting procedures:

Keep personnel removed and upwind from fire. Wear self contained breathing apparatus and full protective equipment. Cool tank with water spray. Fight fire from a distance as the heat may rupture the tanks.

Unusual fire and explosion hazards:

Sealed containers at elevated temperatures may rupture due to polymerization. Vapors are heavier than air and may travel to ignition sources and flash back.

Hazardous products of combustion:

Toxic vapors may be released upon thermal decomposition (cyanide, nitrogen oxides).

6. ACCIDENTAL RELEASE MEASURES

Spill control:

Avoid personal contact. Eliminate ignition sources. Ventilate area.

Containment:

Dike, contain and absorb with clay, sand or other suitable non-combustible material.

Cleanup:

For large spills, pump to storage/salvage vessels. Soak up residue with an absorbent such as clay, sand, or other suitable material and dispose of properly (RCRA hazardous waste). Add inhibitor to prevent polymerization.

Special procedures:

Prevent spill from entering drainage/sewer systems, waterways, and surface waters. Use non-sparking tools

7. HANDLING AND STORAGE

Handling precautions:

Do not breathe vapor or mist. Do not get in eyes, on skin or clothing. Wash thoroughly after handling. Close container after each use. Ground container when pouring. Keep away from heat, flame or sparks. Use non-sparking tools.

Storage:

Keep in a cool place, without direct exposure to sunlight. Keep container tightly closed and otherwise in accordance with NFPA regulations. Maintain air space in storage containers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering controls

Ventilation :

Use ventilation that is adequate to keep employee exposure to airborne concentrations below exposure limits.

Other engineering controls :

Keep container tightly closed. Observe label precautions. Have emergency eye wash and safety shower present.

Personal protective equipment

Eye and face protection:

Wear safety glasses. Wear coverall chemical splash goggles and face shield when eye and face contact is possible.

Skin protection:

Wear impervious butyl rubber clothing as appropriate to prevent contact.

Respiratory protection:

A NIOSH/MSHA air purifying respirator with an organic vapor cartridge may be permissible, however use a positive pressure air supplied respirator if there is any potential for uncontrolled release, or unknown exposure levels.

9. PHYSICAL AND CHEMICAL PROPERTIES

Specific gravity:	0.96	Boiling point (°F):	213
Melting point (°F):	n/d	Vapor density (air = 1):	3.5
Vapor pressure (mmHg):	28 mm Hg at 68 °F	Evaporation rate (butyl acetate = 1):	3
VOC (grams/liter):	< 50 mixed	Solubility in water:	n/d
Percent volatile by volume:	n/d	pH (5% solution or slurry in water):	4.5-5.5
Percent solids by weight:	n/d		

10. STABILITY AND REACTIVITY

This material is chemically stable. Hazardous polymerization may occur.

Conditions to avoid :

Unstable with heat, direct sunlight, inert gas blanketing, ultraviolet radiation.

Incompatible materials:

Incompatible with strong oxidizing agents and reducing agents, acids and bases. Material is a strong solvent and can soften paint and rubber.

Hazardous products of decomposition:

Carbon monoxide, carbon dioxide, nitrogen oxides, cyanide and smoke.

Conditions under which hazardous polymerization may occur:

Excessive heat, storage in the absence of inhibitor and inadvertant addition of catalyst.

11. TOXICOLOGICAL INFORMATION

Acute oral effects: LD50 (rat): Not available.

Toxicity of MMA exposed near LD50 include blood in the urine and liver changes.

Acute dermal effects: LD50 (rabbit): Not available.

Dermatitis.

Acute inhalation effects: LC50 (rat): Not available.

Exposure: 4 hours.

Toxicity of MMA at 8-100 times TLV from respiratory and gastrointestinal irritation, lung damage, nervous system effects and blood in urine.

Eye irritation:

Not available.

Subchronic effects:

Inhalation: Repeated exposure of MMA at 5-100 times the TLV include lung damage, pulmonary irritation, liver changes, eye irritation, nasal tissue changes, incoordination and upper respiratory irritation. Ingestion: Liver and kidney affects with altered function in both organs. Skin permeation may occur.

Carcinogenicity, teratogenicity, and mutagenicity:

Possible reproductive hazard based on animal data.

Other chronic effects:

Inhalation: long term exposure of MMA caused inflammation of the nasal cavity, changes in nasal sensory cells and decreased body weight. Ingestion: Can cause decreased body weight, and increased kidney weight

Toxicological information on hazardous chemical constituents of this product:

Constituent	Oral LD50 (rat)	Dermal LD50 (rabbit)	Inhalation LC50 4hr, (rat)
3,5-Diethyl-1,2-dihydro-1-phenyl-2-propylpyridine	> 500 mg/kg	> 1000 mg/kg	n/d
Methyl Methacrylate Monomer	7872 mg/kg	> 5,000 mg/kg	7093 ppm

'n/d' = 'not determined'

12 ECOLOGICAL INFORMATION**Ecotoxicity:**

MMA has: estimate of 96 hour median threshold limit: 100-1,000 ppm; 96 hour LC50, fathead minnow: 150 ppm; 96 hour LC50, bluegill sunfish: 232 ppm

Mobility and persistence:

MMA is partially biodegradable in water. BOD-5 day: 0.14 g/g - 0.90 g/g; THOD : 1.92 g/g

Environmental fate:

MMA produces high tonnage material in wholly contained systems. Liquid with moderate mobility. Sparingly soluble in water. High potential for bioaccumulation. Low mobility in soil.

13. DISPOSAL CONSIDERATIONS

Please see also Section 15, Regulatory Information.

Waste management recommendations:

Do not dispose of in a landfill. Incineration is the preferred method of disposal.

14. TRANSPORT INFORMATION

Proper shipping name: Adhesives *

Technical name : N/A

Hazard class : 3

UN number: 1133

Packing group: II

Emergency Response Guide no.: 128

IMDG page number: N/A

Other: Containers < 30 liters are PG III

*Depending upon the size and type of container, this material may be reclassified as "Consumer Commodity, ORM-D" for shipments within the United States, or "Limited Quantity" elsewhere. Refer to the appropriate regulation.

15. REGULATORY INFORMATION**U.S. Federal Regulations****TSCA**

All ingredients of this product are listed, or are exempt from listing, on the TSCA inventory.

The following RCRA code(s) applies to this material if it becomes waste:

D001

Regulatory status of hazardous chemical constituents of this product:

Constituent	Extremely Hazardous*	Toxic Chemical**	CERCLA RQ (lbs)	TSCA 12B Export Notification
3,5-Diethyl-1,2-dihydro-1-phenyl-2-propylpyridine	No	No	0.0	Not required
Methyl Methacrylate Monomer	No	Yes	1000.0	Required

*Consult the appropriate regulations for emergency planning and release reporting requirements for substances on the SARA Section 301 Extremely Hazardous Substance list.

**Substances for which the "Toxic Chemical" column is marked "Yes" are on the SARA Section 313 list of Toxic Chemicals, for which release reporting may be required. For specific requirements, consult the appropriate regulations.

For purposes of SARA Section 312 hazardous materials inventory reporting, the following hazard classes apply to this material: - Immediate health hazard -- Delayed health hazard -- Fire hazard -- Reactivity hazard -

Canadian regulations

WHMIS hazard class(es) : B2; D2B

All components of this product are on the Domestic Substances List.

Regulatory notes:

In normal use, the methyl methacrylate in this product is polymerized during cure. For purposes of air quality regulations, the maximum amount of VOC (i.e. MMA) emitted is negligible (less than 5 %). Actual emissions are a function of substrate and process and should be considered on an individual basis.

16. OTHER INFORMATION

Hazardous Materials Identification System (HMIS) ratings:	Health	Flammability	Reactivity
	2*	3	2

The information and recommendations in this document are based on the best information available to us at the time of preparation, but we make no other warranty, express or implied, as to its correctness or completeness, or as to the results of reliance on this document.

PLASTIC WELDER II ADHESIVE

This product appears in the following stock number(s):

14335 14340 14390 DA305 DA320

Last revised: 03/08/04

Printed: 3/25/2004

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**Tradename:** PLASTIC WELDER II ADHESIVE**General use:** Adhesive**Chemical family:** Acrylate**MANUFACTURER**ITW Devcon
30 Endicott St.
Danvers, MA 01923**EMERGENCY INFORMATION****Emergency telephone number**
(CHEMTREC): (800) 424-9300
Other Calls: (978) 777-1100**2. COMPOSITION/INFORMATION ON INGREDIENTS****HAZARDOUS CONSTITUENTS****Exposure limits**

Constituent	Abbr.	CAS No.	Weight percent	ACGIH TLV	OSHA PEL	Other Limits
Maleic acid		110167	1 - 10	n/e	n/e	n/e
2,6-Di-tertiary-butyl-para-cresol	BHT	128370	< 5	2 mg/m3	10mg/m3	n/e
p(BD/MMA/STY)		25053092	1 - 10	n/e	n/e	n/e
Carbon tetrachloride		56235	< 1	5 ppm	10 ppm	2 ppm (Canada)
Chlorosulfonated polyethylene		68037398	20 - 30	n/e	n/e	n/e
Methyl Methacrylate Monomer	MMA	80626	50 - 60	50 ppm	100 ppm	100 ppm (Canada)

"TLV" means the Threshold Limit Value exposure (eight-hour, time-weighted average, unless otherwise noted) established by the American Conference of Governmental Industrial Hygienists. "STEL" indicates a short-term exposure limit. "PEL" indicates the OSHA Permissible Exposure Limit. "n/e" indicates that no exposure limit has been established. An asterisk (*) indicates a substance whose identity is a trade secret of our supplier and unknown to us.

3. HAZARDS IDENTIFICATION**Emergency Overview**

Appearance, form, odor: Off-white paste with varied fragrant odor.

WARNING! Flammable. Eye, skin and respiratory irritant. Skin sensitizer. Harmful if inhaled or absorbed through skin. Chronic overexposure may cause liver and kidney effects.

Potential health effects

Primary routes of exposure: Skin contact Skin absorption Eye contact Inhalation Ingestion

Symptoms of acute overexposure:

Skin: May cause irritation and sensitization. MMA and maleic acid may pass through intact skin.

Eyes: Liquid and vapors causes moderate irritation (burning sensation, tearing, redness, swelling). May cause conjunctivitis and corneal damage.

Inhalation:

High concentration is irritant to respiratory tract and may cause dizziness, headache, and anaesthetic effects.

Ingestion:

Causes irritation, a burning sensation of the mouth, throat and gastrointestinal tract and abdominal pain. May cause vomiting.

Effects of chronic overexposure:

Prolonged exposure may lead to kidney, lung, heart and liver damage.

Carcinogenicity -- OSHA regulated: No

ACGIH: No

National Toxicology Program: No

International Agency for Research on Cancer: No

Medical conditions which may be aggravated by exposure:

Preexisting eye and skin disorders and diseases of the lung.

Other effects:

Developmental toxicity observed in animal tests with MMA at levels toxic to the mother. MMA is reported to impair human olfactory function.

4. FIRST AID MEASURES**First aid for eyes:**

Flush eye with clean water for at least 15 minutes while gently holding eyelids open. Get immediate medical attention.

First aid for skin:

Immediately remove contaminated clothing and excess contaminant. Flush skin with water. Wash thoroughly with warm soap and water. Consult a physician if irritation develops.

First aid for inhalation:

Remove patient to fresh air. Administer oxygen if breathing is difficult. Get medical attention if symptoms persist.

First aid for ingestion:

Do NOT induce vomiting. Give two glasses of water to dilute if patient is conscious. Get medical attention.

5. FIRE FIGHTING MEASURES**General fire and explosion characteristics:**

Vapor forms explosive mixture with air.

Extinguishing media:

Water

Carbon dioxide

Dry chemical

Foam

Alcohol foam

Flash Point (°F): 50

Method: TCC

Explosive limits in air (percent) -- Lower: 2.1

Upper: 12.5

Special firefighting procedures:

Keep personnel removed and upwind from fire. Wear self contained breathing apparatus and full protective equipment. Cool tank with water spray. Fight fire from a distance as the heat may rupture the tanks.

Unusual fire and explosion hazards:

Sealed containers at elevated temperatures may rupture due to polymerization. Vapors are heavier than air and may travel to ignition sources and flash back.

Hazardous products of combustion:

Carbon monoxide, carbon dioxide, fumaric acid, maleic anhydride fumes, and smoke.

6. ACCIDENTAL RELEASE MEASURES**Spill control:**

Avoid personal contact. Eliminate ignition sources. Ventilate area.

Containment:

Dike, contain and absorb with clay, sand or other suitable non-combustible material.

Cleanup:

For large spills, pump to storage/salvage vessels. Soak up residue with an absorbent such as clay, sand, or other suitable material and dispose of properly (RCRA hazardous waste). Add inhibitor to prevent polymerization.

Special procedures:

Prevent spill from entering drainage/sewer systems, waterways, and surface waters. Use non-sparking tools

7. HANDLING AND STORAGE**Handling precautions:**

Do not breathe vapor or mist. Do not get in eyes, on skin or clothing. Wash thoroughly after handling. Close container after each use. Ground container when pouring. Keep away from heat, flame or sparks. Use non-sparking tools.

Storage:

Keep in a cool place, without direct exposure to sunlight. Keep container tightly closed and otherwise in accordance with NFPA regulations. Maintain air space in storage containers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Engineering controls****Ventilation :**

Use ventilation that is adequate to keep employee exposure to airborne concentrations below exposure limits.

Other engineering controls :

Keep container tightly closed. Observe label precautions. Have emergency eye wash and safety shower present.

Personal protective equipment**Eye and face protection:**

Wear safety glasses. Wear coverall chemical splash goggles and face shield when eye and face contact is possible.

Skin protection:

Wear impervious butyl rubber clothing as appropriate to prevent contact.

Respiratory protection:

A NIOSH/MSHA air purifying respirator with an organic vapor cartridge may be permissible, however use a positive pressure air supplied respirator if there is any potential for uncontrolled release, or unknown exposure levels.

9. PHYSICAL AND CHEMICAL PROPERTIES

Specific gravity:	0.93-1.05	Boiling point (°F):	213
Melting point (°F):	-54	Vapor density (air = 1):	3.5
Vapor pressure (mmHg):	28 mm Hg at 68 °F	Evaporation rate (butyl acetate = 1):	3
VOC (grams/liter):	< 50 mixed	Solubility in water:	n/d
Percent volatile by volume:	n/d	pH (5% solution or slurry in water):	
Percent solids by weight:	n/d		

10. STABILITY AND REACTIVITY

This material is chemically stable. Hazardous polymerization may occur.

Conditions to avoid :

Unstable with heat, direct sunlight, inert gas blanketing, ultraviolet radiation.

Incompatible materials:

Incompatible with strong oxidizing agents and reducing agents, metals, amines. Material is a strong solvent and can soften paint and rubber

Hazardous products of decomposition:

Carbon monoxide, carbon dioxide, fumaric acid, maleic anhydride fumes, and smoke.

Conditions under which hazardous polymerization may occur:

Excessive heat, storage in the absence of inhibitor and inadvertant addition of catalyst.

11. TOXICOLOGICAL INFORMATION

Acute oral effects: LD50 (rat): > 2000 mg/kg (estimate)

Toxicity of MMA exposed near LD50 include blood in the urine and liver changes.

Acute dermal effects: LD50 (rabbit): > 3000 mg/kg (estimate)

Dermatitis. Maleic acid is a skin and mucous membrane irritant.

Acute inhalation effects: LC50 (rat): Not available.

Exposure: 4 hours.

Toxicity of MMA at 8-100 times TLV from respiratory and gastrointestinal irritation, lung damage, nervous system effects and blood in urine.

Eye irritation:

Maleic acid is a severe eye irritant.

Subchronic effects:

Inhalation: Repeated exposure of MMA at 5-100 times the TLV include lung damage, pulmonary irritation, liver changes, eye irritation, nasal tissue changes, incoordination and upper respiratory irritation. Ingestion: Liver and kidney affects with altered function in both organs. Skin permeation may occur.

Carcinogenicity, teratogenicity, and mutagenicity:

Possible reproductive hazard based on animal data.

Other chronic effects:

Inhalation: long term exposure of MMA caused inflammation of the nasal cavity, changes in nasal sensory cells and decreased body weight. Ingestion: Can cause decreased body weight, and increased kidney weight

Toxicological information on hazardous chemical constituents of this product:

Constituent	Oral LD50 (rat)	Dermal LD50 (rabbit)	Inhalation LC50 4hr, (rat)
Maleic acid	708 mg/kg	1560 mg/kg	n/d
2,6-Di-tertiary-butyl-para-cresol	890 mg/kg	n/d	n/d
p(BD/MMA/STY)	n/d	n/d	n/d
Carbon tetrachloride	2350 mg/kg	>20gm/kg	8000ppm
Chlorosulfonated polyethylene	n/d	n/d	n/d
Methyl Methacrylate Monomer	7872 mg/kg	> 5,000 mg/kg	7093 ppm

n/d' = 'not determined'

12 ECOLOGICAL INFORMATION**Ecotoxicity:**

MMA has: estimate of 96 hour median threshold limit: 100-1,000 ppm; 96 hour LC50, fathead minnow: 150 ppm; 96 hour LC50, bluegill sunfish: 232 ppm

Mobility and persistence:

MMA is partially biodegradable in water. BOD-5 day: 0.14 g/g - 0.90 g/g; THOD : 1.92 g/g

Environmental fate:

MMA produces high tonnage material in wholly contained systems. Liquid with moderate mobility. Sparingly soluble in water. High potential for bioaccumulation. Low mobility in soil.

13. DISPOSAL CONSIDERATIONS

Please see also Section 15, Regulatory Information.

Waste management recommendations:

Do not dispose of in a landfill. Incineration is the preferred method of disposal.

14. TRANSPORT INFORMATION

Proper shipping name: Adhesives *

Technical name : N/A

Hazard class : 3

UN number: 1133

Packing group: II

Emergency Response Guide no.: 128

IMDG page number: N/A

Other: Containers < 30 liters are PG III

*Depending upon the size and type of container, this material may be reclassified as "Consumer Commodity, ORM-D" for shipments within the United States, or "Limited Quantity" elsewhere. Refer to the appropriate regulation.

15. REGULATORY INFORMATION**U.S. Federal Regulations****TSCA**

All ingredients of this product are listed, or are exempt from listing, on the TSCA inventory.

The following RCRA code(s) applies to this material if it becomes waste:

D001, D019

Regulatory status of hazardous chemical constituents of this product:

Constituent	Extremely Hazardous*	Toxic Chemical**	CERCLA RQ (lbs)	TSCA 12B Export Notification
Maleic acid	No	No	5000.0	Not required
2,6-Di-tertiary-butyl-para-cresol	No	No	0.0	Not required
p(BD/MMA/STY)	No	No	0.0	Not required
Carbon tetrachloride	No	Yes	10.0	Not required
Chlorosulfonated polyethylene	No	No	0.0	Not required
Methyl Methacrylate Monomer	No	Yes	1000.0	Required

*Consult the appropriate regulations for emergency planning and release reporting requirements for substances on the SARA Section 301 Extremely Hazardous Substance list.

**Substances for which the "Toxic Chemical" column is marked "Yes" are on the SARA Section 313 list of Toxic Chemicals, for which release reporting may be required. For specific requirements, consult the appropriate regulations.

For purposes of SARA Section 312 hazardous materials inventory reporting, the following hazard classes apply to this material: - Immediate health hazard -- Delayed health hazard -- Fire hazard -- Reactivity hazard -

Canadian regulations

WHMIS hazard class(es) : B2; D2B

All components of this product are on the Domestic Substances List.

Regulatory notes:

In normal use, the methyl methacrylate in this product is polymerized during cure. For purposes of air quality regulations, the maximum amount of VOC (i.e. MMA) emitted is negligible (less than 5 %). Actual emissions are a function of substrate and process and should be considered on an individual basis.

16. OTHER INFORMATION

Hazardous Materials Identification System (HMIS) ratings:	Health	Flammability	Reactivity
	2*	3	2

The information and recommendations in this document are based on the best information available to us at the time of preparation, but we make no other warranty, express or implied, as to its correctness or completeness, or as to the results of reliance on this document.

Plastic Welder™ 60

Description: Toughened structural adhesive, after curing, produces superior strength to load-bearing bonds to engineered plastics. (ZH5-72-4)

Intended Use: Bond: PVC, Fiberglass, ABS, FRP, PBT, PPO, PCBB, Metton®, Lomod®, Valox®, Noryl® GTX, Minlon®, epoxy, RIM urethane, wood, poorly prepared surfaces, and where outdoor weathering or solvent exposure is anticipated.

Product features:
 1:1 mix ratio
 Minimal surface preparation
 Non-sagging formula
 Room temperature cure
 Long open time
 Low VOC

Limitations:

Typical Physical Properties: *Technical data should be considered representative or typical only and should not be used for specification purposes.*

Cured 7 days @ 75° F

Shore Hardness	78 Shore D
Gap-Fill	0.125 in.
% Solids by Volume	100
Adhesive Tensile Lap Shear (PVC)	1.324 psi
Specific Volume	28.1 in.(3)/lb.

TESTS CONDUCTED

Adhesive Tensile Shear ASTM D 1002
 Cured Hardness Shore D ASTM D 2240
 Impact Resistance ASTM D 950

Uncured

Color	Straw
Viscosity	Adhesive: 51,000 cps; Acvigator: 60,000 cps
Weight	Adhesive: 8.4 lbs./gal.; Activator: 8.00 lbs./gal
Mixed Viscosity	55,000 cps
Mix Ratio by Volume	1:1
Mix Ratio by Weight	1:1
Mixed Density	8.20 lbs./gal./ .98gm/cc
Flashpoint	51 °F
Working Time	20-30 min. @ 72 °F
Fixture Time	45-60 min.@72 °F, 22 °C
Functional Cure	2 hrs.
Full Cure	24 hrs.
Service Temperature	-67 °F to 250 °F

Surface Preparation: Clean surface by solvent-wiping any deposits of heavy grease, oil, dirt, or other contaminants. Surface can also be cleaned with industrial cleaning equipment such as vapor phase degreasers or hot aqueous baths. If working with metal, abrade or roughen the surface to significantly increase the microscopic bond area and optimize the bond strength.

Mixing Instructions: ---- Proper homogenous mixing of resin and hardener is essential for the curing and development of stated strengths. ----

25 ML DEV-TUBE

1. Squeeze material into a small container the size of an ashtray.
2. Using mixing stick included on Dev-tube handle, vigorously mix components for one (1) minute.
3. Immediately apply to substrate.

35ML/50 ML/250 ML/380 ML/400 ML CARTRIDGES

1. Attach cartridge to Mark V™ [50ml], 380ml, 250ml [15:1 caulk gun], or 400ml dispensing systems [manual or pneumatic].
2. Open tip.
3. Burp cartridge by squeezing out some material until both sides are uniform (ensures no air bubbles are present during mixing).
4. Attach mix nozzle to end of cartridge.
5. Apply to substrate.

Application Instructions:

1. Apply mixed product directly to one surface in an even film or as a bead.
2. Assemble with mating part within recommended working time.
3. Apply firm pressure between mating parts to minimize any gap and ensure good contact (a small fillet of product should flow out the edges to display adequate gap fill).
4. Bond line thickness of mixed adhesive should be @ .010"-.030" for optimum adhesion.

For very large gaps:

1. Apply product to both surfaces.
2. Spread to cover entire area OR make a bead pattern to allow flow throughout the joint.

Let bonded assemblies stand for recommended functional cure time prior to handling.

ADDITIONAL PRODUCT INFORMATION:

- Can withstand processing forces
- Do not drop, shock load, or heavily load
- Intermittent exposure to temperatures above 250°F do not reduce performance characteristics

STAINLESS STEEL AND ALUMINUM APPLICATIONS:

Apply Devcon Metal Prep 90 to prime and condition aluminum and stainless steel surfaces prior to using Plastic Welder. Metal Prep 90 is fast-drying at ambient temperatures. Plastic Welder can be applied within minutes of its use. Overlap shear strength will improve 30-40% if Metal Prep 90 is used.

Storage:

Store between 55°F and 75°F. Continuous storage above 75°F reduces the shelf life of the materials. Prolonged exposure above 100°F quickly diminishes the product's reactivity, and should be avoided. Shelf life can be extended by refrigeration between 45°F and 55°F. DO NOT FREEZE.

Compliances:

None

Chemical Resistance:

Chemical resistance is calculated with a 7 day, room temp. cure (30 days immersion) @ 75°F)

Acetic (Dilute) 10%	Excellent
Ammonia	Very good
Cutting Oil	Excellent
Glycols/Antifreeze	Excellent
Hydrochloric 10%	Fair
Mineral Spirits	Excellent
Motor Oil	Excellent
Sodium Hydroxide 10%	Very good

Precautions:

Please refer to the appropriate material safety data sheet (MSDS) prior to using this product.

For technical assistance, please call 1-800-933-8266

FOR INDUSTRIAL USE ONLY

Warranty:

Devcon will replace any material found to be defective. Because the storage, handling and application of this material is beyond our control, we can accept no liability for the results obtained.

Disclaimer:

All information on this data sheet is based on laboratory testing and is not intended for design purposes. ITW Devcon makes no representations or warranties of any kind concerning this data.

Order Information:

(DOE/EA-1570)

MSDS for
Methyl Methacrylate, 99%
MMA



chemists helping chemists in research & indu

aldrich chemical c

METHYL METHACRYLATE
6172

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M A T E R I A L S A F E T Y D A T A S H E E T

PAGE: 2

CATALOG # M5590-9

NAME: METHYL METHACRYLATE, 99%

CLOTHING AND SHOES.
ASSURE ADEQUATE FLUSHING OF THE EYES BY SEPARATING THE EYELIDS WITH FINGERS.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
CALL A PHYSICIAN.
REMOVE AND WASH CONTAMINATED CLOTHING PROMPTLY.
DISCARD CONTAMINATED SHOES.

-----PHYSICAL DATA -----

MELTING POINT: -48 C
BOILING POINT: 100 C
SPECIFIC GRAVITY: 0.936
VAPOR DENSITY: 3.5
VAPOR PRESSURE: 29.0 MM @ 20 C

----- FIRE AND EXPLOSION HAZARD DATA -----

AUTO IGNITION TEMP.: 435 F
LOWER EXPLOSION LEVEL: 2.12%
UPPER EXPLOSION LEVEL: 12.5%
FLASH POINT: 50 F
EXTINGUISHING MEDIA
CARBON DIOXIDE, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.
SPECIAL FIRE FIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.
USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS.
FLAMMABLE LIQUID.
UNUSUAL FIRE AND EXPLOSION HAZARDS
VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASH BACK.
MAY UNDERGO AUTOPOLYMERIZATION.
CONTAINER EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.

----- REACTIVITY DATA -----

INCOMPATIBILITIES
OXIDIZING AGENTS
PEROXIDES
BASES
ACIDS
REDUCING AGENTS
AMINES
HALOGENS
HEAT
MAY POLYMERIZE ON EXPOSURE TO LIGHT.
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE

----- SPILL OR LEAK PROCEDURES -----

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
SHUT OFF ALL SOURCES OF IGNITION.
EVACUATE AREA.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH AN ACTIVATED CARBON ADSORBENT, TAKE UP AND PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

USA
Aldrich Chemical Co., Inc.
940 West Saint Paul Avenue
Milwaukee, Wisconsin 53233
Telephone: (414) 273-3850
TWX: (910) 262-3052 Aldrichem MI
Telex: 26 843 Aldrich MI
FAX: (414) 273-4979

Belgium
Aldrich-Chemie N.V./S.A.
6 Rue Caporal Claes
B-1030 Brussels
Telephone: (02) 2428750
Telex: 62202 Alchem B

France
Aldrich-Chemie S.a.r.l
27, Fosse des Treize
F-67000 Strasbourg
Telephone: (88) 327010
Telex: 890076 Aldrich F
FAX: (88) 75 12 83

Japan
Aldrich Japan
Kyodo Bldg. Shinkanda
10 Kanda-Mikuracho
Chiyoda Ku, Tokyo
Telephone: (03) 258-0155
FAX: (03) 258-0157

United Kingdom
Aldrich Chemical Co., Ltd
The Old Brickyard, New Road
Gillingham, Dorset SP8 4JL
Telephone: (07476) 2211
Telex: 417238 Aldrich G
FAX: (07476) 3779

West Germany
Aldrich-Chemie GmbH & Co. KG
D-7924 Steinheim
Telephone: (07329) 87-0
Telex: 714838 Aldri D
FAX: (07329) 87-39



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BATAVIA
S WILSON

IL 60510

DATE: 06/22/87
CUST # 210714 P.O. #

M A T E R I A L S A F E T Y D A T A S H E E T PAGE: 1

----- IDENTIFICATION -----

PRODUCT # M5590-9 NAME: METHYL METHACRYLATE, 99%
CAS # 80-62-6

----- TOXICITY HAZARDS -----

RTECS # QZ5075000
METHACRYLIC ACID, METHYL ESTER

IRRITATION DATA

SKN-RBT 10 GM/KG OPEN
EYE-RBT 150 MG

JIHTAB 23,343,41
INMEAF 14,292,45

TOXICITY DATA

ORL-RAT LD50:7872 MG/KG
IHL-RAT LC50:3750 PPM
IPR-RAT LD50:1328 MG/KG
SCU-RAT LD50:7500 MG/KG
ORL-MUS LD50:5204 MG/KG
IPR-MUS LD50:1000 MG/KG
SCU-MUS LD50:6300 MG/KG
SCU-DOG LD50:4500 MG/KG
ORL-GPG LD50:6300 MG/KG
IPR-GPG LD50:2000 MG/KG
SCU-GPG LD50:6300 MG/KG

JIHTAB 23,343,41
14CYAT 2,1880,63
JOREAF 51,1632,72
INMEAF 14,292,45
TOLED5 11,125,82
INMEAF 14,292,45
INMEAF 14,292,45
INMEAF 14,292,45
INMEAF 14,292,45
INMEAF 14,292,45
INMEAF 14,292,45
INMEAF 14,292,45

REVIEWS, STANDARDS, AND REGULATIONS

CARCINOGENIC REVIEW: ANIMAL INDEFINITE IMEMDT 19,187,79
CARCINOGENIC REVIEW: HUMAN INDEFINITE IMEMDT 19,187,79
ACGIH TLV-TWA 100 PPM 85INAB 5,406,86
MSHA STANDARD-AIR: TWA 100 PPM (410 MG/M3) DTLVS* 3,168,71
OSHA STANDARD-AIR: TWA 100 PPM FEREAC 39,23540,74
EPA TSCA CHEMICAL INVENTORY, 1986
EPA TSCA 8(A) PRELIMINARY ASSESSMENT INFORMATION, FINAL RULE FEREAC 47,26992,82
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, DECEMBER 1986
NTP CARCINOGENESIS STUDIES (INHALATION); NO EVIDENCE: MOUSE, RAT NTPTR* NTP-TR-314, 86
NTP CARCINOGENESIS STUDIES; TEST COMPLETED (CAMERA COPY IN PROGRESS), SEPTEMBER 1986
MEETS CRITERIA FOR PROPOSED OSHA MEDICAL RECORDS RULE FEREAC 47,30420, 82

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

----- HEALTH HAZARD DATA -----

ACUTE EFFECTS

HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.
VAPOR OR MIST IS IRRITATING TO THE EYES, MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
CAUSES SKIN IRRITATION.
SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND VOMITING.
MAY CAUSE ALLERGIC RESPIRATORY AND SKIN REACTIONS.
PROLONGED EXPOSURE CAN CAUSE:
NARCOTIC EFFECT.

FIRST AID

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED

USA
Aldrich Chemical Co., Inc.
940 West Saint Paul Avenue
Milwaukee, Wisconsin 53233
Telephone: (414) 273-3850
TWX: (910) 262-3052 Aldrichem MI
Telex: 26 843 Aldrich MI
FAX: (414) 273-4979

Belgium
Aldrich Chemie N.V./S.A.
6 Rue Caporal Clévis
B-1030 Brussels
Telephone: (02) 2428750
Telex: 82302 Alchem B

France
Aldrich-Chimie S.a.r.l.
27, Fosse des Treize
F-67000 Strasbourg
Telephone: (88) 327010
Telex: 890076 Aldrich F
FAX: (88) 75 12 83

Japan
Aldrich Japan
Kyodo Bldg, Shinjuku
10 Kanda-Mikuracho
Chiyoda-Ku, Tokyo
Telephone: (03) 258-0155
FAX: (03) 258-0157

United Kingdom
Aldrich Chemical Co., Ltd
The Old Brickyard, New Road
Gillingham, Dorset SP8 4JT
Telephone: (07476) 2211
Telex: 417238 Aldrich G
FAX: (07476) 3179

West Germany
Aldrich-Chemie GmbH & Co. KG
D-7924 Steinheim
Telephone: (07329) 87-0
Telex: 714838 Aldri D
FAX: (07329) 87-39



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M A T E R I A L S A F E T Y D A T A S H E E T

PAGE: 3

CATALOG # M5590-9

NAME: METHYL METHACRYLATE, 99%

WASTE DISPOSAL METHOD

BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE.

OBSERVE ALL FEDERAL, STATE & LOCAL LAWS.

--- PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE ---

CHEMICAL SAFETY GOGGLES.
WEAR HEAVY RUBBER GLOVES.
SAFETY SHOWER AND EYE BATH.
FACESHIELD (8-INCH MINIMUM).
USE ONLY IN A CHEMICAL FUME HOOD.
NIOSH/MSHA-APPROVED RESPIRATOR.
DO NOT BREATHE VAPOR.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
WASH THOROUGHLY AFTER HANDLING.
CORROSIVE.
LACHRYMATOR.
POSSIBLE SENSITIZER.
KEEP TIGHTLY CLOSED.
KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME.
REFRIGERATE.

----- ADDITIONAL PRECAUTIONS AND COMMENTS -----

ADDITIONAL INFORMATION

METHYL METHACRYLATE IS INHIBITED WITH 10 PPM HYDROQUINONE MONOMETHYL ETHER. DO NOT STORE UNDER INERT ATMOSPHERE. IT IS ACVISABLE TO USE MATERIAL WITHIN 6 MONTHS.

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. ALDRICH SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

Received 6/26/87

USA
Aldrich Chemical Co., Inc.
940 West Saint Paul Avenue
Milwaukee, Wisconsin 53233
Telephone: (414) 273-3850
TWX: (910) 262-3052 Aldrichem MI
Telex: 26 843 Aldrich MI
FAX: (414) 273-4979

Belgium
Aldrich Chemie N.V./S.A.
6 Rue Caporal Claes
B-1030 Brussels
Telephone: (02) 2428750
Telex: 62302 Alchem B

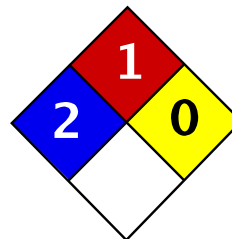
France
Aldrich-Chimie S.a.r.l.
27, Fossé des Treize
F-67000 Strasbourg
Telephone: (88) 327010
Telex: 890076 Aldrich F
FAX: (88) 75 12 83

Japan
Aldrich Japan
Kyodo Bldg, Shinkanda
10 Kanda-Mikuracho
Chiyoda-Ku, Tokyo
Telephone: (03) 258-0155
FAX: (03) 258-0157

United Kingdom
Aldrich Chemical Co., Ltd.
The Old Brickyard, New Road
Gillingham, Dorset SP8 4JL
Telephone: (07476) 2211
Telex: 417238 Aldrich G
FAX: (07476) 3779

West Germany
Aldrich Chemie GmbH & Co. KG
D-7924 Stenheim
Telephone: (07329) 87 0
Telex: 714638 Aldri D
FAX: (07329) 87 39

MSDS for
2,5-diphenyloxazole
PPO wave shifter #1



Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet PPO MSDS

Section 1: Chemical Product and Company Identification

<p>Product Name: PPO</p> <p>Catalog Codes: SLP1039</p> <p>CAS#: 92-71-7</p> <p>RTECS: RP6825000</p> <p>TSCA: TSCA 8(b) inventory: PPO</p> <p>CI#: Not available.</p> <p>Synonym: 2,5-Diphenyloxazole</p> <p>Chemical Formula: C15H11NO</p>	<p>Contact Information:</p> <p>Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396</p> <p>US Sales: 1-800-901-7247 International Sales: 1-281-441-4400</p> <p>Order Online: ScienceLab.com</p> <p>CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300</p> <p>International CHEMTREC, call: 1-703-527-3887</p> <p>For non-emergency assistance, call: 1-281-441-4400</p>
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Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
PPO	92-71-7	100

Toxicological Data on Ingredients: PPO LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin

with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: These products are carbon oxides (CO, CO₂), nitrogen oxides (NO, NO₂...).

Fire Hazards in Presence of Various Substances:

Flammable in presence of open flames and sparks.
Slightly flammable to flammable in presence of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 221.25 g/mole

Color: Not available.

pH (1% soln/water): Not applicable.

Boiling Point: 360°C (680°F)

Melting Point: 71°C (159.8°F)

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: PPO

Other Regulations: Not available..

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC): R36/38- Irritating to eyes and skin.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent.

Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 12:23 PM

Last Updated: 10/11/2005 12:23 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

MSDS for
1,4-di-(2-methylstyryl)-benzene
Bis-MSB wave shifter #2

Material Safety Data Sheet

Date Printed: 06/FEB/2005

Date Updated: 13/MAR/2004

Version 1.1

According to 91/155/EEC

1 - Product and Company Information

Product Name 1,4-BIS(2-METHYLSTYRYL)BENZENE, 99%
Product Number 222445

Company Sigma-Aldrich Pty, Ltd
Unit 2, 14 Anella Avenue
Castle Hill NSW 1765
Australia

Technical Phone # +61 2 9841 0555

Fax +61 2 9841 0500

Emergency Phone # +61 2 9841 0566

2 - Composition/Information on Ingredients

Product Name	CAS #	EC no	Annex I Index Number
1,4-BIS(2-METHYLSTYRYL)BENZENE	13280-61-0	236-285-5	None

Formula C₂₄H₂₂
Molecular Weight 310.44 AMU

3 - Hazards Identification

4 - First Aid Measures

AFTER INHALATION

If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

AFTER SKIN CONTACT

In case of contact, immediately wash skin with soap and copious amounts of water.

AFTER EYE CONTACT

In case of contact, immediately flush eyes with copious amounts of water for at least 15 minutes.

AFTER INGESTION

If swallowed, wash out mouth with water provided person is conscious. Call a physician.

5 - Fire Fighting Measures

EXTINGUISHING MEDIA

Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

SPECIAL RISKS

Specific Hazard(s): Emits toxic fumes under fire conditions.

SPECIAL PROTECTIVE EQUIPMENT FOR FIREFIGHTERS

Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.

6 - Accidental Release Measures

PROCEDURE(S) OF PERSONAL PRECAUTION(S)

Wear respirator, chemical safety goggles, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP

Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

7 - Handling and Storage

HANDLING

Directions for Safe Handling: Do not breathe dust. Avoid contact with eyes, skin, and clothing.

STORAGE

Conditions of Storage: Keep tightly closed. Store in a cool dry place.

SPECIAL REQUIREMENTS: Light sensitive.

8 - Exposure Controls / Personal Protection

ENGINEERING CONTROLS

Safety shower and eye bath. Mechanical exhaust required.

GENERAL HYGIENE MEASURES

Wash thoroughly after handling. Wash contaminated clothing before reuse.

PERSONAL PROTECTIVE EQUIPMENT

Respiratory Protection: Government approved respirator.

Hand Protection: Compatible chemical-resistant gloves.

Eye Protection: Chemical safety goggles.

9 - Physical and Chemical Properties

Appearance	Color: Light yellow	
	Form: Fine crystals	
Property	Value	At Temperature or Pressure
pH	N/A	
BP/BP Range	N/A	
MP/MP Range	180 °C	
Flash Point	N/A	
Flammability	N/A	
Autoignition Temp	N/A	
Oxidizing Properties	N/A	
Explosive Properties	N/A	
Explosion Limits	N/A	
Vapor Pressure	N/A	
SG/Density	N/A	
Partition Coefficient	N/A	
Viscosity	N/A	

Vapor Density	N/A
Saturated Vapor Conc.	N/A
Evaporation Rate	N/A
Bulk Density	N/A
Decomposition Temp.	N/A
Solvent Content	N/A
Water Content	N/A
Surface Tension	N/A
Conductivity	N/A
Miscellaneous Data	N/A
Solubility	N/A

10 - Stability and Reactivity

STABILITY

Materials to Avoid: Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

11 - Toxicological Information

SIGNS AND SYMPTOMS OF EXPOSURE

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

ROUTE OF EXPOSURE

Inhalation: Material is irritating to mucous membranes and upper respiratory tract.

Multiple Routes: May be harmful by inhalation, ingestion, or skin absorption. Causes eye and skin irritation.

12 - Ecological Information

No data available.

13 - Disposal Considerations

SUBSTANCE DISPOSAL

Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

14 - Transport Information

RID/ADR

Non-hazardous for road transport.

IMDG

Non-hazardous for sea transport.

IATA

Non-hazardous for air transport.

15 - Regulatory Information

CLASSIFICATION AND LABELING ACCORDING TO EU DIRECTIVES

S-PHRASES: 22 24/25

Do not breathe dust. Avoid contact with skin and eyes.

16 - Other Information

WARRANTY

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2005 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.

DISCLAIMER

For R&D use only. Not for drug, household or other uses.

Appendix D

Biological Resource Review Correspondence

EcoCAT Report, Illinois Department of Natural Resources, September 27, 2007 D-1

Letter, US Fish and Wildlife Service, Barrington, IL, October 22, 2007 D-3

Letter, US Fish and Wildlife Service, Bloomington, MN, Mar 18, 2008 D-5

Applicant: U.S. Department of Energy/Fermi National Accelerator Laboratory
Contact: Sally Arnold
Address: Fermi Site Office, P.O. Box 2000
 Batavia, IL 60510

IDNR Project #: 0803332
Date: 09/27/2007

Project: NuMI OFF-AXIS ve APPEARANCE EXPERIMENT (NOvA)
Address: Fermi National Accelerator Laboratory, Kirk Rd. & Pine St., Batavia

Description: Fermilab is planning to expand an existing underground tunnel, known as the Neutrinos at the Main Injector (NuMI) beamline facility, to accommodate a new experiment that will utilize an upgraded NuMI neutrino beam along a new trajectory toward a detector in Minnesota. This new project is called NOvA. The expansion of the underground tunnel will angle slightly off axis from the NuMI beamline and require excavation about 105 meters underneath the Fermilab site for an estimated length of about 18 meters. The tunnel will be about 3-4 meters in diameter. Although the original NuMI beamline required the construction of surface facilities, no additional surface facilities are planned for the NOvA tunneling project. We do not foresee the modification of any ecological habitat.

Natural Resource Review Results

This project was submitted for information only. It is not a consultation under Part 1075.

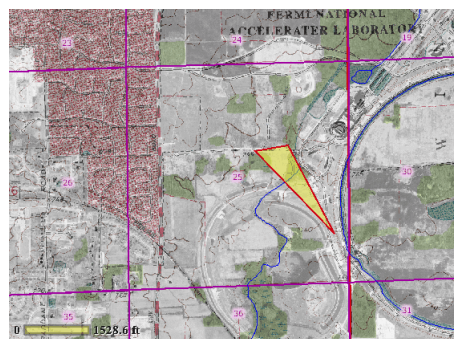
The Illinois Natural Heritage Database shows the following protected resources may be in the vicinity of the project location:

- Fermilab INAI Site
- Black-Crowned Night Heron (*Nycticorax nycticorax*)
- Blanding'S Turtle (*Emydoidea blandingii*)
- Upland Sandpiper (*Bartramia longicauda*)

Location

The applicant is responsible for the accuracy of the location submitted for the project.

County: Kane
Township, Range, Section:
 39N, 8E, 25



IL Department of Natural Resources Contact
 Impact Assessment Section
 217-785-5500
 Division of Ecosystems & Environment

Local or State Government Jurisdiction
 Other
 , Illinois

Disclaimer

The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, compliance with applicable statutes and regulations is required.

Terms of Use

By using this website, you acknowledge that you have read and agree to these terms. These terms may be revised by IDNR as necessary. If you continue to use the EcoCAT application after we post changes to these terms, it will mean that you accept such changes. If at any time you do not accept the Terms of Use, you may not continue to use the website.

1. The IDNR EcoCAT website was developed so that units of local government, state agencies and the public could request information or begin natural resource consultations on-line for the Illinois Endangered Species Protection Act, Illinois Natural Areas Preservation Act, and Illinois Interagency Wetland Policy Act. EcoCAT uses databases, Geographic Information System mapping, and a set of programmed decision rules to determine if proposed actions are in the vicinity of protected natural resources. By indicating your agreement to the Terms of Use for this application, you warrant that you will not use this web site for any other purpose.
2. Unauthorized attempts to upload, download, or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act.
3. IDNR reserves the right to enhance, modify, alter, or suspend the website at any time without notice, or to terminate or restrict access.

Security

EcoCAT operates on a state of Illinois computer system. We may use software to monitor traffic and to identify unauthorized attempts to upload, download, or change information, to cause harm or otherwise to damage this site. Unauthorized attempts to upload, download, or change information on this server is strictly prohibited by law. Unauthorized use, tampering with or modification of this system, including supporting hardware or software, may subject the violator to criminal and civil penalties. In the event of unauthorized intrusion, all relevant information regarding possible violation of law may be provided to law enforcement officials.

Privacy

EcoCAT generates a public record subject to disclosure under the Freedom of Information Act. Otherwise, IDNR uses the information submitted to EcoCAT solely for internal tracking purposes.



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chicago Ecological Services Field Office
1250 South Grove Avenue, Suite 103
Barrington, Illinois 60010
Phone: (847) 381-2253 Fax: (847) 381-2285

IN REPLY REFER TO:
FWS/AES-CIFO/8-FA-0053 / SL-0054

October 22, 2007

Ms. Sally C. Arnold
Department of Energy
Fermi Site Office
Post Office Box 2000
Batavia, Illinois 60510

Dear Ms. Arnold:

This responds to your letter dated October 1 2007 requesting information on endangered or threatened species for the proposed expansion of an existing underground tunnel. The expansion of the underground tunnel will angle slightly off axis from the existing beamline and require excavation approximately 105 meters underneath the Fermilab site for an estimated length of 18 meters. This tunnel would be approximately 3-4 meters in diameter. No surface facilities are planned nor do you foresee the modification of any ecological habitat. This proposed project is located at T39N, R8E, Section 25 in Kane County, Illinois as depicted on the map you enclosed.

The proposed project site is directly adjacent to Kane County Advanced Identification (ADID) site #s 2851, 2871, and 2860. ADID studies are conducted under the auspices of the U.S. Environmental Protection Agency to identify in advance of specific projects, those wetlands that are of the highest function and value. The results of ADID studies provide landowners and planners with information about the most important aquatic resources in a given area so that advance planning can take them into account.

ADID site #s 2851 and 2871 are determined to have high habitat value. High habitat value wetlands are characterized by having "high quality wildlife habitat, high floristic quality, or high quality aquatic habitat." High value habitat sites are considered "irreplaceable" and unmitigatable based on the fact that the complex biological systems and functions that these sites support cannot be successfully recreated within a reasonable time frame using existing mitigation methods. Both of these ADID sites support northern flatwood communities with ADID site # 2871 also supporting a sedge meadow community.

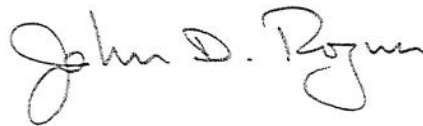
ADID site # 2860 is determined to be a high functional wetland site. High functional wetlands are considered to provide "exceptionally important benefits or functions worthy of extraordinary protection and management considerations." We caution you to avoid impacts, whether direct or indirect, to all three of these ADID sites.

Based on the information provided in your submittal and a review of our records, we do not believe that any federally endangered or threatened species occur in the vicinity of the site. This conclusion is based on the best available information, including information in your submittal, the scientific and technical literature, and our own files. Newer information based on updated surveys, changes in the abundance and distribution of listed species, changed habitat conditions, or other factors could change the conclusion. This could become more likely if projects experience significant delays in implementation. Feel free to contact us if you need more current information or assistance regarding the potential presence of federally listed species.

These comments only address federally listed species. Please contact the Illinois Department of Natural Resources for information on State-listed species. Also, we may have the opportunity to review the project for a broader range of fish and wildlife impacts if it requires a Section 404 permit. We are willing to work with you in advance of formal submittal if it would help streamline the approval process.

If you have any questions, please contact Ms. Cathy Pollack at 847/381-2253 ext. 20, or Ms. Karla Kramer at 847/381-2253 ext. 12.

Sincerely,

A handwritten signature in cursive script that reads "John D. Rogner". The signature is written in dark ink and is positioned above the typed name and title.

John D. Rogner
Field Supervisor



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Twin Cities Field Office
4101 American Blvd E.
Bloomington, Minnesota 55425-1665

MAR 18 2008

Ms. Sally C. Arnold
Document Manager for the NOvA Project
Department of Energy
P.O. Box 2000
Batavia, Illinois 60510

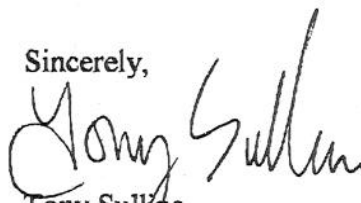
Dear Ms. Arnold:

This responds to your February 4, 2008, letter, requesting information on the potential for encountering threatened or endangered species within a proposed project corridor for the NOvA experiment in northern Minnesota. The proposed project would construct a new Far Detector facility, occupying part of a 90-acre plot near the Ash River in Section 18, T68N, R19W, of St. Louis County. The University of Minnesota, a research partner, would acquire an easement for a 20-acre road corridor for a distance of 3.6 miles. An all-weather road would be constructed over an existing logging road. Wetland impacts would be expected and a Corps of Engineers permit would be required to avoid, minimize, and mitigate all wetland impacts.

Canada lynx (*Lynx canadensis*) may be present in the action area. Canada lynx inhabit conifer forest that contain patches of high quality habitat for snowshoe hare (*Lepus americanus*), their primary prey. Canada lynx have been detected in the general vicinity of the proposed action (e.g., in Voyageurs National Park) and, thus, may be present in the area to be affected by the proposed action. For additional information regarding Canada lynx, contact our office or see our Internet site at <http://www.fws.gov/midwest/Endangered/mammals/lynx/index.html>. Section 7 of the Endangered Species Act of 1973, as amended, requires each federal agency to review any action that it funds, authorized or carries out to determine whether it may affect threatened, endangered, proposed or listed critical habitat. Federal agencies (or their designated representatives) must consult with the Fish and Wildlife Service (Service) if any such effects may occur as a result of their actions. Consultation with the Service is not necessary if the proposed action will not directly or indirectly affect listed species or critical habitat. If a federal agency finds that an action will have no effect on listed species or critical habitat, it should maintain a written record of that finding that includes the supporting rationale. Please note that your action area lies within the boundary of proposed critical habitat for Canada lynx. Federal action agencies must avoid actions which are likely to destroy or modify proposed critical habitat. We are available to confer with you further on this matter at your convenience.

If you have any questions, please call Mr. Nick Rowse, of my staff, at 612-725-3548 x210.

Sincerely,

A handwritten signature in black ink that reads "Tony Sullins". The signature is written in a cursive style with a large, looped "T" and "S".

Tony Sullins
Field Supervisor

Cc: Superintendent, Voyageurs National Park, International Falls, MN

Appendix E

Cultural and Historic Resources Documentation

Letter to Illinois Historic Preservation Agency, Dec. 18, 2007.....E-1

Letter from Advisory Council on Historic Preservation, Oct. 12, 2007.....E-3

Letter to Minnesota Historical Society, Apr. 14, 2008.....E-5

Programmatic Agreement, May 23, 2008E-6



Department of Energy

Fermi Site Office
Post Office Box 2000
Batavia, Illinois 60510

December 18, 2007

Ms. Anne E. Haaker, Deputy State Historic Preservation Officer
Illinois Historic Preservation Agency
Old State Capitol
Springfield, Illinois 62701

Dear Ms. Haaker:

SUBJECT: NATIONAL HISTORIC PRESERVATION ACT DETERMINATION –
FERMI NATIONAL ACCELERATOR LABORATORY (FERMILAB)
NEUTRINO DETECTOR, BATAVIA, ILLINOIS

The purpose of this letter is to initiate consultation with your office in order to satisfy Section 106 of the National Historic Preservation Act (Public Law 102-575).

The research program is called NOvA (NuMI Off-Axis Electron Neutrino (ν_e) Appearance Experiment). NuMI is an acronym for Neutrinos at the Main Injector. The Main Injector is a proton accelerator at the Department of Energy's (DOE's) Fermilab near Batavia, Illinois. The research program will require two neutrino detectors, one in Minnesota and one on the Fermilab site. We are currently in consultation with the Minnesota State Historic Preservation Officer on the Minnesota detector. The Fermilab detector would be located in a cavern 105 meters (345 feet) below grade and require the excavation of approximately 770 cubic meters (1,000 cubic yards) of rock. Existing shafts and access tunnels would be used. Excavated rock would be placed in surface stock piles.

Both the detector and associated stock pile(s) would be located in areas previously surveyed for historical properties, but where none have been identified. See enclosed Fermi National Accelerator Laboratory Cultural Resources Management Plan dated September 13, 2002. Based on this Plan, DOE has determined, pursuant to 36 Code of Federal Regulations Section 800.4(d)(1), that "no historic properties will be affected" by the Fermilab NOvA detector.

Ms. Anne E. Haaker

-2-

December 18, 2007

If you have questions, please feel free to contact me via telephone at 630-252-2007 or by e-mail at peter.siebach@ch.doe.gov. Alternatively, you can contact our project manager, Mr. Pepin Carolan, via telephone at 630-840-2227 or via e-mail at pepin.carolan@ch.doe.gov.

Sincerely,

/s/ 12/18/2007

Peter R. Siebach, Lead Agency Official
for National Historic Preservation Act
Compliance
NOvA Project

Enclosure:
As Stated

October 12, 2007

Mr. Dennis Gimmestad
Review and Compliance
Minnesota Historical Society
345 Kellogg Blvd. W.
St. Paul, MN 55102-1903

Dear Mr. Gimmestad:

SUBJECT: NATIONAL HISTORIC PRESERVATION ACT CONSULTATION –
NEUTRINO DETECTOR NEAR ASH RIVER, MN

The purpose of this letter is to initiate consultation under Section 106 of the National Historic Preservation Act (16 U.S.C. 470s, as amended) regarding the U.S. Department of Energy's (DOE's) proposal to conduct a new experimental research program in neutrino physics.

The research program is called NOvA [NuMI Off-Axis Electron Neutrino (ν_e) Appearance Experiment]. NuMI is an acronym for Neutrinos at the Main Injector. The Main Injector is a proton accelerator at DOE's Fermi National Accelerator Laboratory (Fermilab) near Batavia, Illinois. The NuMI beamline is currently aimed at an existing detector in the Soudan Mine located in Soudan, Minnesota. The NOvA research program would require the construction of an additional detector, the NOvA Far Detector, in the area of Ash River, MN, approximately 15 kilometers (9.3 miles) east of U.S. Highway 53 along the Ash River Trail Road (St. Louis County 129), about 40 kilometers (25 miles) southeast of International Falls. The structure housing the detector would be approximately 20.4 meters wide and 114 meters long (67 feet by 375 feet) and excavated 12 meters (40 feet) below the existing grade into granite rock at the site.

The purpose of the NOvA research program would be to advance human understanding of the physics of the neutrino particle, which is similar to an electron, but with an extremely small (almost zero) mass and without the charge. The neutrino flux from the existing NuMI neutrino beamline would be detected and measured using this new detector at the Ash River location, a location specially selected to achieve the physics measurements required for the experiment. Although scientists have much to learn about neutrinos, they know that neutrinos cannot harm the health or safety of people, animals or

other living things. Neutrinos cannot harm the water, the air, or the earth they pass through. The reason they are harmless is that they interact so rarely with other particles of matter. They pass through matter, including the earth, with no effect, as if it were not there. Scientists know that neutrinos are not harmful because of the many neutrino experiments and observations of naturally-occurring neutrinos that have been carried out all over the world since the discovery of neutrinos in 1956. Environmental protection and safety are topics which will be fully addressed in the environmental assessment being prepared for this project, which we intend to send to you in draft.

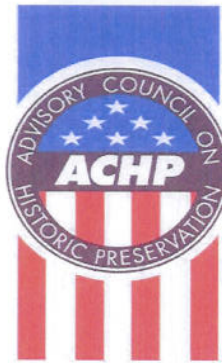
The University of Minnesota would be DOE's partner on the NOvA research program. DOE proposes to enter into a cooperative agreement with the University of Minnesota, that would provide \$45,600,000 to cover construction of the facility to house the NOvA Far Detector. As part of the cooperative agreement, the scientists from the University will participate in the research. Because of the Federal funding, it qualifies as a "Federal undertaking" under the National Historic Preservation Act (NHPA) and is therefore subject to the requirements of the Advisory Counsel on Historic Preservation (AHP) regulations for Protection of Historic Properties (36 CFR Part 800.16(y)).

Information concerning historic and/or cultural resources that could be located in the vicinity of the proposed site of the NOvA Far Detector is very important to us. If you are aware of such resources, or require additional information, please contact me. I can be reached via telephone at 630-252-2007, or by e-mail at peter.siebach@ch.doe.gov. Alternatively, you can contact our project manager, Mr. Pepin Carolan, via telephone at 630-840-2227 or via e-mail at pepin.carolan@ch.doe.gov. A response by November 9, 2007, would be appreciated.

Sincerely,

Peter R. Siebach
NEPA Compliance Officer

cc: Jim Jones, Minnesota Indian Affairs Council
David Woodward, 1854 Treaty Authority
Kathleen O'Brien, University of Minnesota
Marvin Marshak, University of Minnesota
William Miller, University of Minnesota



Preserving America's Heritage

April 14, 2008

Mr. Peter R. Siebach
Department of Energy
Chicago Operations Office
9800 South Cass Avenue
Argonne, IL 60439

**Ref: Proposed NOvA Far Detector Facility Project
Ash River, St. Louis County, Minnesota**

Dear Mr. Siebach:

On April 2, 2008, the Advisory Council on Historic Preservation (ACHP) received your notification and supporting documentation regarding the adverse effects of the referenced undertaking on properties listed and eligible for listing on the National Register of Historic Places. Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR § 800) does not apply to this undertaking. Accordingly, we do not believe that our participation in the consultation to resolve adverse effects is needed. However, if we receive a request for participation from the State Historic Preservation Officer, Tribal Historic Preservation Officer, affected Indian tribe, a consulting party, or other party, we may reconsider this decision. Additionally, should circumstances change and you determine that our participation is required, please notify us.

Pursuant to 36 CFR § 800.6(b)(1)(iv), you will need to file the final Memorandum of Agreement (MOA), developed in consultation with the Minnesota State Historic Preservation Officer and any other consulting parties, and related documentation with the ACHP at the conclusion of the consultation process. The filing of the MOA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the National Historic Preservation Act.

Thank you for providing us with your notification of adverse effect. If you have any questions or require further assistance, please contact Tom McCulloch at 202-606-8554, or via email at tmculloch@achp.gov.

Sincerely,

Raymond V. Wallace
Historic Preservation Technician
Federal Property Management Section
Office of Federal Agency Programs

ADVISORY COUNCIL ON HISTORIC PRESERVATION

1100 Pennsylvania Avenue NW, Suite 809 • Washington, DC 20004
Phone: 202-606-8503 • Fax: 202-606-8647 • achp@achp.gov • www.achp.gov

PROGRAMMATIC AGREEMENT

BETWEEN THE

UNITED STATES DEPARTMENT OF ENERGY

AND THE

**MINNESOTA STATE HISTORIC PRESERVATION OFFICE,
BOIS FORTE BAND OF MINNESOTA CHIPPEWA, AND THE
WHITE EARTH BAND OF MINNESOTA CHIPPEWA**

**REGARDING CONSTRUCTION AND OPERATION OF THE FAR DETECTOR FOR
THE NEUTRINOS AT THE MAIN INJECTOR OFF-AXIS NEUTRINO APPEARANCE
EXPERIMENT**

WHEREAS, the United States Department of Energy (DOE) and the University of Minnesota (U of MN) have entered into a cooperative agreement under which DOE will partially fund the proposed construction and operation by the U of MN of a Far Detector Facility (the Project), for the Neutrinos at the Main Injector (NuMI) Off-Axis Neutrino (ν) Appearance Experiment (NOvA)¹; and

WHEREAS, the Federal funding qualifies the Project as a Federal Undertaking; and

WHEREAS Federal Undertakings are subject to review under the National Historic Preservation Act (NHPA), 16 U.S.C. § 470, Section 106 and the implementing regulations of the Advisory Council for Historic Preservation (ACHP), at 36 C.F.R. Part 800, Subpart B; and

WHEREAS, the proposed site for the Project is in the area of Ash River, Minnesota, approximately 15 kilometers (9.3 miles) east of U.S. Highway 53 along the Ash River Trail Road (St. Louis County 129), about 40 kilometers (25 miles) southeast of International Falls; and

WHEREAS, a cultural resources assessment² was completed in December 2005 for the Ash River Site, which indicated low potential for pre-contact archaeological sites to exist within the facility footprint due to the presence of exposed bedrock and shallow soils; and

1 The purpose of the NOvA experiment is advance the understanding of the neutrino particle. Neutrinos originating at a proton accelerator at the DOE Fermi National Accelerator Laboratory (Fermilab) near Batavia, Illinois, would be detected at the Far Detector Facility.

2 *Cultural Resources Assessment for the Fermilab NOvA Project – Ash River Falls Site, St. Louis County, Minnesota*, December 2005

WHEREAS, higher potential for pre-contact archaeological sites exists along the proposed access road corridor; and

WHEREAS, the cultural resources assessment recommended “testing to determine if any intact archaeological deposits are present” in higher potential areas; and

WHEREAS, the DOE has defined the Project’s area of potential effect (APE) on archaeological resources to include the entire project area, which includes the locations of a detector enclosure and an assembly area 360 feet long by 67 feet wide, and a 130 foot long service building of the same width, as well as an access road and a parking area for 25 vehicles, and all areas of ground disturbance including temporary workspace, areas where construction vehicles may operate, and storage areas, for a total of approximately 121 acres³; and

WHEREAS, the APE for architectural history resources was determined by the DOE in consultation with the SHPO to be 1,110 acres and is composed of one known historical resource, a historic railroad grade for the Virginia and Rainy Lake (V&RL) logging railroad, originally identified during the 2005 cultural resources assessment⁴; and

WHEREAS, the entire V&RL logging railroad, including the main line and spurs, is presumed to be eligible for listing on the NRHP⁵; and

WHEREAS, the cultural resources assessment stated: “further research is recommended on this railroad segment”; and

3 This includes 4.99 acres for the facility footprint, 84.63 to 97.09 acres of buffer which could possibly be disturbed during construction, and 18.90 acres for the access road (66 foot wide corridor including the road and associated buffer area).

4 The Railroad grade is presumed to be eligible for listing in the National Register of Historic Places because it meets several criteria listed in the Multiple Property Documentation Form for Commercial Logging in Minnesota (1837-1940s). The railroad has potential significance under Criterion A, within the context of Northern Minnesota Lumbering, for contributing the broad patterns of history as the embodiment of employment creation, capital investment, and settlement, by creating transportation systems and supply routes in the formerly isolated northern St. Louis and Koochiching counties. The railroad, including the mainline that extended to dozens of logging camps and the countless logging spurs that allowed the forest to be clear cut, has potential significance under Criterion C as a distinctive, designed system that allowed the vast forests of Northern Minnesota to be economically harvested and shipped to far away mills for processing into milled lumber that was vital to the construction industry in the Midwest and Great Plains in the late nineteenth and the first part of the twentieth century (Douglas A. Birk 1998 Commercial Logging in Minnesota (1837-1940s) National Register of Historic Places Multiple Property Documentation Form, NPS)

5 The railroad line retains sufficient integrity of design, setting, materials, workmanship, feeling, and association. The line is clearly visible, the alignment, scale, and basic orientations of the bed are retained, the character and setting of the line are not marred by modern developments, the line is of adequate length to convey a sense of purpose or destination (Douglas A. Birk 1998 Commercial Logging in Minnesota (1837-1940s) National Register of Historic Places Multiple Property Documentation Form, NPS).

WHEREAS, an analysis of potential effects of the Project⁶ was completed in February 2008 for the Ash River Site, which indicated that a no adverse effect determination would be contingent upon certain design recommendations being implemented; and

WHEREAS, snow and ice within the APE have precluded field verification of the conclusions contained in the analysis of effects report; and

WHEREAS, the DOE has determined that potential remains for adverse effect on both pre-contact archaeological sites and the railroad grade; and

WHEREAS, the Minnesota State Historic Preservation Office (MN SHPO) has requested a Phase I archaeological survey within the project APE and DOE has concurred that this will occur prior to any construction activities; and

WHEREAS, the DOE initiated consultation with the Bois Forte Band of Minnesota Chippewa Tribal Historic Preservation Officer (THPO), the White Earth Band of Minnesota Chippewa THPO, the Leech Lake Band of Ojibwe THPO, the Grand Portage Band of Chippewa THPO, and the Fond du Lac Band of Lake Superior Chippewa Reservation Cultural Resources Specialist; and

WHEREAS, the Bois Forte Band of Minnesota Chippewa Tribal Historic Preservation Officer (THPO) and the White Earth Band of Minnesota Chippewa THPO responded, indicating that they are not aware of any occurrences of cultural resources, although not precluding their presence; and

WHEREAS, the Bois Forte Band of Minnesota Chippewa THPO and the White Earth Band of Minnesota Chippewa THPO have indicated a desire to participate as required signatories to this Agreement; and

WHEREAS, in accordance with 36 C.F.R. § 800.6(a)(1)(i)(C), DOE has notified the Advisory Council on Historic Preservation (ACHP) of the Programmatic Agreement with specified documentation and the ACHP has chosen not to participate in the consultation pursuant to 36 CFR § 800.6(a)(1)(iii); and

WHEREAS, the project will require a Department of the Army permit from the U.S. Army Corps of Engineers, St. Paul District pursuant to its regulatory authority under Section 404 of the Clean Water Act (33 U.S.C. 1344); and

WHEREAS, the United States Army Corp of Engineers may have jurisdiction over a wetland in the Project APE and has been consulted concerning this Agreement; and

⁶ *Fermilab NOvA Project Ash River Falls Site Analysis of Effects Study, St. Louis County, Minnesota, February 2008.*

WHEREAS, DOE is the lead agency for compliance with the National Historic Preservation Act; and

WHEREAS, satisfaction of this Agreement evidences that the DOE has considered effects on historic properties and has afforded the Advisory Council, the SHPO, the Bois Forte Band of Minnesota Chippewa, and the White Earth Band of Minnesota Chippewa an opportunity to comment, satisfying their responsibilities under Section 106 of the NHPA.

NOW, THEREFORE, the DOE, the MN SHPO, the Bois Forte Band of Minnesota Chippewa THPO, and the White Earth Band of Minnesota Chippewa THPO agree that the Undertaking shall be implemented in accordance with the following stipulations to take into account the effect of the undertakings on historic properties.

STIPULATIONS

The Parties agree as follows:

I. ARCHAEOLOGICAL SURVEY

1. DOE will ensure the completion of a Phase I archaeological survey in Spring, 2008, as weather conditions permit.
2. DOE will ensure that the results of the Phase I archaeological survey are documented in a technical report that satisfies the requirements of *The Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation* [Federal Register, Vol. 48, No. 190, pp. 44716-44740, September 29, 1983] (National Park Service [NPS] 1983).
3. If no archaeological resources are discovered, the project can proceed, subject to the stipulations in parts II-IV.

II. ARCHAEOLOGICAL FINDINGS

If archaeological resources are uncovered at any time (during the survey, or during excavation, construction, or operation of the Far Detector facility), DOE will schedule a meeting among representatives of DOE, the MN SHPO, the U of MN, the Bois Forte Band of Minnesota Chippewa THPO, and the White Earth Band of Minnesota Chippewa THPO. The meeting will be scheduled as soon as possible following discovery of the archaeological resource. Signatories agree to meeting and seeking resolution within 15 days or waive their right to participate.

If all parties concur that the findings are not eligible for listing on the National Register of Historic Places, then work in the area of the discovery can proceed, subject to the stipulations in parts III-IV.

If the findings have potential to be eligible for listing on the National Register of Historic Places then the representatives of the organizations above will develop procedures at the meeting to determine the necessary subsequent level of investigation or mitigation strategy.

A Treatment Plan will be developed and implemented for any archeological site discovered that is eligible for listing on the National Register of Historic Places and that cannot be avoided. The Treatment plan(s) will be prepared in consultation with the SHPO, THPOs, and other consulting parties. Consultation will mean, at a minimum, a seven day review and comment period on the draft plan(s). Failure of the SHPO, a THPO, or other consulting party to comment with that period will be deemed to be concurrence.

III. HISTORIC RAILROAD GRADE

In the January 2008 Analysis of Effects study for this historic railroad grade, recommendations were made that would result in the avoidance of adverse effect to this property. DOE will brief the SHPO on its final design concerning consistency with the Analysis of Effects study recommendations.

If an adverse effect is unavoidable, the DOE will consult with the SHPO and other consulting parties to develop and implement a mitigation plan. If a mitigation plan is required, SHPO review and approval of the plan is required before work can begin.

The SHPO agrees to comment on the mitigation plan within 30 days from the date of receipt. Failure to comment within 30 days shall be deemed as approval, and implementation of the mitigation plan may proceed.

IV. DISCOVERY OF CULTURAL ITEMS OR HUMAN REMAINS

A. DOE and/or the U of MN will assure that survey and excavation/construction procedures address the discovery of any cultural artifacts, as follows:

1. Work will immediately be halted within the area of the discovery;
2. A construction or environmental inspector and the DOE Fermi Site Office (FSO) Manager will be promptly notified of the discovery.
3. The inspector will immediately (including nights, holidays, and weekends) notify the Bois Forte Band of Minnesota Chippewa THPO and/or the White Earth Band of Minnesota Chippewa THPO and invite their cultural resource specialist to assess the discovery.
4. The inspector will also secure the area of discovery to ensure no further disturbance, collection, or removal of those materials occurs.

5. The inspector will establish a buffer to restrict foot access within the immediate area of the discovery.
6. The inspector will also ensure that vehicular traffic across the area is restricted to a location removed from the discovery.

After arrival at the site, the cultural resource specialist will evaluate the discovery and discuss options for addressing the discovery and for work resumption with the inspector. Under the guidance of the DOE-FSO, specific project elements will be redesigned to avoid burial sites (including human remains and associated funerary items) or cultural items unless the costs, loss of time, and impact on the project make such redesign unreasonable after giving great weight to the cultural importance. If the discovery does in fact consist of human remains, the inspector will immediately follow the procedures outlined in Stipulation B, C, or D, as appropriate.

- B. If human remains, or cultural items (including burial sites and funerary items indicative of the presence of human remains), as defined by the Native American Graves Protection and Repatriation Act (NAGPRA), are encountered during inventory, testing, mitigation or any construction-related activities, work within a minimum of 50 feet up to 200 feet as possible of the discovery will cease, although travel at any distance from the discovery through the area on existing travel corridors may continue. DOE will immediately (including nights, holidays, and weekends) notify the Signatories of the discovery first via telephone, then followed up by email and/or letter and implement internal procedures for complying with NAGPRA.
- C. In accordance with the provisions of Minnesota law (Minn. Stat. § 307.08), the discovery of human remains on state or private lands would be reported promptly to the local sheriff and the Minnesota State Archaeologist. The remains would not be disturbed or removed until authenticated by the State Archaeologist and the Bois Forte Band of Minnesota Chippewa and/or the White Earth Band of Minnesota Chippewa. A best effort will be made to do this within 7-days. Responsibility for further consultation would be at their joint discretion. Recent (i.e., not of cultural significance) human remains would be dispositioned by the local sheriff.
- D. Burial sites, human remains, and associated artifacts will be handled with respect from the time they are discovered until the applicable Treatment Plan has been fully implemented. Furthermore, any Treatment Plan for the treatment of human remains will conform to the following:
 - i. NAGPRA, if and to the extent it may be applicable, regardless of anything in this Agreement that may be contrary to such law.
 - ii. Excavation of human remains and associated objects will be carried out under the auspices of the Minnesota State Archaeologist, the Bois Forte Band of Minnesota

Chippewa THPO and/or the White Earth Band of Minnesota Chippewa THPO and in accordance with the greatest possible care and precision, ensuring that the physical integrity and orientation of the grave and its contents are respected.

iii. To the maximum extent practicable, the general public will be excluded from viewing any Native American burial site, human remains, or funerary items associated with such remains. No photographs will be taken of such sites or items.

iv. Native American human skeletal remains and associated artifacts will be reinterred in the manner and at the location agreed upon by the Minnesota State Archaeologist, the Bois Forte Band of Minnesota Chippewa THPO and/or the White Earth Band of Minnesota Chippewa THPO.

V. DISPUTE RESOLUTION

Should any signatory to this Agreement object at any time to any actions proposed or the manner in which the terms of this Agreement are implemented, DOE will consult with such party to resolve the objection. If DOE determines that such objection cannot be resolved, DOE will:

A. Forward all documentation relevant to the dispute, including DOE's proposed resolution, to the ACHP. The ACHP, at its discretion, will provide DOE with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, DOE will prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories and concurring parties, and provide them with a copy of this written response. DOE will then proceed according to its final decision.

B. If the ACHP does not provide its input regarding the dispute within the thirty (30) day time period, DOE may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, DOE will prepare a written response that takes into account any timely comments regarding the dispute from the signatories and concurring parties to the Agreement, and provide them and the ACHP with a copy of such written response.

C. DOE's responsibility to carry out all other actions subject to the terms of this Agreement that are not the subject of the dispute remain unchanged.

VI. EFFECTIVE DATE

The terms of this Agreement will become effective upon the date of the last signature by the Parties.

VII. AMENDMENTS

This Agreement may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with the ACHP.

VIII. TERMINATION

If any signatory to this Agreement determines that its terms will not or cannot be carried out, that party will immediately consult with the other parties to attempt to develop an amendment. If within thirty (30) days (or another time period agreed to by all signatories) an amendment cannot be reached, any signatory may terminate the Agreement upon written notification to the other signatories.

Once the Agreement is terminated, and prior to work continuing on the Project, DOE will either (a) execute another agreement pursuant to 36 CFR § 800.6, or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR § 800.7. DOE will notify the signatories as to the course of action it will pursue.

IX. ANTIDEFICIENCY ACT

Nothing herein will be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act, 31 U.S.C. Sec. 1341. This agreement is neither a fiscal nor a funds obligation document. Nothing in this agreement authorizes or obligates DOE to expend, exchange, or reimburse funds, services or supplies, or to transfer or receive anything of value.

X. AUTHORITY

DOE enters into this Agreement under the authority of section 646 of the Department of Energy Organization Act (Pub. L. 95-91, as amended; 42 U.S.C. sec. 7256).

XI. NO RESTRICTION

This agreement in no way restricts the parties from participating in any activity with other public or private agencies, organizations or individuals.

XII. REQUIRED SIGNATORIES

U.S. DEPARTMENT OF ENERGY

Eric M. Simpson Date: 5/5/08
Eric M. Simpson, Contracting Officer, Chicago Office

Joanna M. Livengood Date: 5/7/08
Joanna M. Livengood, Fermi Site Office Manager

MINNESOTA STATE HISTORIC PRESERVATION OFFICER

Nina Archabal Date: 5/23/08
Nina Archabal

BOIS FORTE BAND OF MINNESOTA CHIPPEWA TRIBAL HISTORIC PRESERVATION OFFICER


Rosemary Berens Date: 5-6-08
Rosemary Berens, Tribal Historic Preservation Officer

WHITE EARTH BAND OF MINNESOTA CHIPPEWA TRIBAL HISTORIC PRESERVATION OFFICER

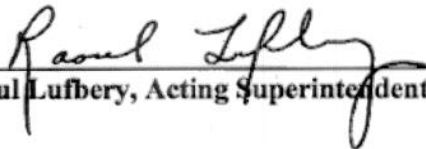
Thomas McCauley Date: 5/9/08
Thomas McCauley, Tribal Historic Preservation Officer

INVITED SIGNATORIES

UNIVERSITY OF MINNESOTA

 Date: 5/10/2008
Marvin L. Marshak, Principal Investigator, NOVA Project, University of Minnesota,
Morse-Alumni Professor

U.S. DEPARTMENT OF INTERIOR, PARK SERVICE, VOYAGEURS NATIONAL
PARK

 Date: 5-6-08
Raoul Lufbery, Acting Superintendent

(DOE/EA-1570)

Appendix F

**Correspondence from
U.S. Army Corps of Engineers
Regarding Wetland Determination**



DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
SIBLEY SQUARE AT MEARS PARK
190 FIFTH STREET EAST, SUITE 401
ST. PAUL MINNESOTA 55101-1638

January 25, 2008

REPLY TO
ATTENTION OF
Operations
Regulatory (2007-4858-TWP)

Peter Siebach
NEPA Compliance Officer, NOvA Project
U.S. Department of Energy
9800 South Cass Avenue
Argonne, IL 60564

Sally Arnold
NEPA Document Manager, NOvA Project
U.S. Department of Energy
Fermi Site Office
P.O. Box 2000
Batavia, IL 60510

Dear Mr. Siebach and Ms. Arnold:

This acknowledges receipt of an application for a Department of the Army permit for a project to construct an access road for entry to a proposed electron neutrino detector facility. The project site is in Sections 13, 14, 15, T. 68N., R. 20W., and Sec. 18, T. 68N., R. 19W, St. Louis County, Minnesota.

In a recent decision on the consolidated cases *Rapanos v. United States* and *Carabell v. United States* (Rapanos), the Supreme Court addressed where the Federal government can apply the Clean Water Act (CWA), specifically by determining whether a wetland or tributary is a water of the U.S. On June 5, 2007, the U.S. Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (Corps) issued joint guidance to implement the Rapanos decision. The joint guidance will be used by EPA regions and Corps districts to determine whether aquatic resources such as lakes, streams, and wetlands are waters of the U.S., subject to regulation under the CWA. The joint guidance and other information can be obtained from the internet at <http://www.mvp.usace.army.mil/regulatory/>

For most projects, including yours, this new guidance will require more site specific documentation than required in the past, and a detailed analysis. A site visit to the property during the growing season will also likely be required. In many cases our evaluations will require coordination with the U.S. Army Corps of Engineers Headquarters and/or the U.S. Environmental Protection Agency (EPA).

Therefore, please be advised that there may be a substantial increase in the amount of time it will take to process your permit application.

We have **preliminarily** determined that your project is subject to Section 404 of the Clean Water Act (33 U.S.C. 1344). Based on our initial review, we believe an individual Department of the Army permit will be required. Our review will include issuance of a public notice and preparation/review of an environmental assessment. State Historical/Archaeological surveys and US Fish and Wildlife studies are also required. It is possible, though unlikely, that a public hearing will be required.

As discussed with you on January 25, 2008, the St. Paul District, Corps of Engineers would like to be a cooperating agency in the preparation of the Environmental Assessment, pursuant to National Environmental Policy Act requirements. Mr. Joe Shoemaker from our Two Harbors office has been assigned as the Corps project manager. Please advise with your acceptance or denial of this request.

If you have any questions, contact Joe Shoemaker in our Two Harbors office at (218) 834-6630. In any correspondence or inquiries, please refer to the Regulatory number shown above.

Sincerely,



FOR Robert J. Whiting
Chief, Regulatory Branch

Enclosures

Copy furnished:

Brad Kovach, SEH

Appendix G

Responses to Comments on the Draft Environmental Assessment

Keweenaw Bay Indian Community.....G-1
Illinois Environmental Protection Agency.....G-2

**University of Minnesota Responses to Comments on the Minnesota
Environmental Assessment Worksheet**

**University of Minnesota Public Comment Letter
Marvin Marshak, June 24, 2008.....G-3**
**United States Department of the Interior, National Park Service, Voyageurs
National ParkG-4**
Minnesota Department of Natural Resources.....G-8
Minnesota Historical Society, State Historic Preservation Office.....G-9
Minnesota Department of Health.....G-9
Julian Brzoznowski, Orr, MN..... G-10
J. Dale Long, Orr, MN..... G-10
Len and Evie Mankus, Orr, MN.....G-10

Comments on the Draft EA and DOE responses

Summer Sky Cohen and Joseph Jacker, Keweenaw Bay Indian Community, Baraga, Michigan

Comment:

The Keweenaw Bay Indian Community Tribal Historic Preservation Office has no interests regarding religious or cultural sites documented at this time in the proposed project areas.

Response:

Thank you for notifying us.

Comment:

The Keweenaw Bay Indian Community urges you to consult other Indian Tribes in your immediate area that may have documented interests in your project site, if you have not already done so.

Response:

DOE notified local Indian Tribes concerning the NOvA project including: the Bois Forte Band of Minnesota Chippewa Tribal Historic Preservation Officer (THPO), the White Earth Band of Minnesota Chippewa THPO, the Leech Lake Band of Ojibwe THPO, the Grand Portage Band of Chippewa THPO, and the Fond du Lac Band of Lake Superior Chippewa Reservation Cultural Resources Specialist. The Bois Forte Band of Minnesota Chippewa and the White Earth Band of Minnesota Chippewa notified DOE of their desire to consult with us pursuant to Section 106 of the National Historic Preservation Act. The consultation commenced in October 2007 and resulted in a Programmatic Agreement, which was executed May 23, 2008. The Programmatic Agreement is appended to this EA.

Comment:

If artifacts or human remain are discovered, please notify the Keweenaw Bay Indian Community THPO immediately so we can assist in making an appropriate determination.

Response:

The Programmatic Agreement contains a “discovery plan” which requires DOE to immediately notify the Bois Forte Band of Minnesota Chippewa, the White Earth Band of Minnesota Chippewa, and the State Archaeologist should artifacts or human remains be discovered, take certain steps to protect them, and commence consultation concerning disposition. The Programmatic Agreement is included as an Appendix to this EA. We will also notify the Keweenaw Bay Indian Community THPO.

**Lisa Bonnett, Acting Deputy Director, Illinois Environmental Protection Agency,
Springfield, IL**

Comment:

The Agency has no objections to the project.

Response:

Thank you for notifying us.

Comment:

A construction site activity stormwater NPDES permit will be required from the Division of Water Pollution Control if more than one acre is disturbed during construction.

Response:

Thank you for the information. At present, the NOvA Project does not anticipate disturbing more than one acre during construction. However, should we find that disturbing more than one acre is necessary, the Department of Energy and/or Fermilab will apply to the Division of Water Pollution Control for a construction site activity stormwater NPDES permit.

UNIVERSITY OF MINNESOTA

*School of Physics and
Astronomy*

*318 Tate Laboratory of
Physics
116 Church Street S.E.
Minneapolis MN 55455*

*612-624-1312
Fax: 612-624-4578
marshak@umn.edu*

June 24, 2008

Ms. Sally Arnold
U.S. Department of Energy
c/o Fermilab
P.O. Box 500
Batavia IL 60510

Dear Sally:

I am writing to respond to the questions in your email of June 18, regarding the Environmental Assessment Worksheet for the NOvA Far Detector Building and Site.

The Regents of the University of Minnesota are a constitutional entity of the State of Minnesota, as initially chartered by the Territorial Laws of 1851 and by the State Constitution of 1858. The public is officially notified of the actions of the Regents by the publication of a "Regents' Docket," prior to each meeting, and by "Regents' Minutes," subsequent to each meeting. These documents are open to public inspection during business hours at the offices of the Regents. During recent years, these documents have also been published on the University's website.

The Regents' actions with respect to the NOvA EAW are documented in the Regents' Docket (Facilities Committee section) for November 2007 and in the Regents' Minutes (Facilities Committee section and Board of Regents' section) for November 2007. The Regents' unanimously approved the EAW as documented in the Minutes. A notice of this decision was published in the EQB Monitor on November 19, 2007. Minnesota law allows filing a petition for judicial review for 30 days following the EQB Monitor publication. No such petition was filed. There is no further "approval" process.

With regard to the public and agency comments received regarding the EAW, an individual response was made to each comment. In addition, all of the comments and all of the responses were published in the Regents' Docket (Facilities Committee section), November 2007.

I hope this information answers your questions.

Sincerely,



Marvin L. Marshak
Institute of Technology Professor
Morse-Alumni Professor of Physics

Response to Comments on the NOvA Off Axis Detector Facility at Ash River Environmental Assessment Worksheet (EAW)

The following agencies and individuals submitted comments on the NOvA Off Axis Detector Facility at Ash River Environmental Assessment Worksheet (EAW) during the public comment period from September 10, 2007, to October 10, 2007:

- United States Department of the Interior, National Park Service, Voyageurs National Park
- Minnesota Department of Natural Resources
- Minnesota Historical Society, State Historic Preservation Office
- Minnesota Department of Health
- Julian Brzoznowski – Citizen
- J. Dale Long – Citizen
- Len and Evie Mankus – Citizens

The comments in each letter are summarized, with corresponding responses provided below.

Comments of the United States Department of the Interior, National Park Service, Voyageurs National Park

Comment 1: The construction schedule on pages three and sixteen of the EAW do not appear to agree. In addition, during project construction the National Park Service estimates as many as ninety trips per day will occur between June 2008 and February 2011, and as many as 450 truckloads of PVC will be delivered to the site between June 2008 and December 2012. More than 750 trips with trucks containing scintillator oil will occur between August 2010 and the end of 2013. Please consider additional measures to limit the impact on visitor traffic entering Voyageurs National Park on park route #1, the road to the Ash River Visitor Center, and on the Ash River Trail.

Response: The construction schedule for the NOvA Project is subject to change as a result of policy and funding considerations by the United States Department of Energy's Office of Science. The University's current expectation is that site construction and road work will begin in spring 2008 and that construction of the Far Detector building will begin in fall 2008. Overall, building construction is expected to last through spring 2010, followed by two years of detector installation.

As indicated in the United States Department of the Interior's comment, the increase in vehicle traffic on U.S. Highway 53 and St. Louis County Highway 129 (Ash River Trail) during all phases of the project is "within customary limits," given the capacity of these roadways and current traffic levels. Based on the forecasted traffic levels for the St. Louis County Highway 129, the anticipated number of truck trips during the construction period will average between six and seven per day. At some phases of construction, there may be more truck trips than the

average of six to seven per day, and at other phases of construction there may be fewer truck trips than the average of six to seven per day. After building construction is complete in mid-2010, the number of truck trips per day will be one or two on average for approximately forty-eight months. U.S. Highway 53 and St. Louis County Highway 129, the roads in the vicinity of the project area, are reasonably straight and level, and provide multiple opportunities for passing safely. The University will cooperate with the St. Louis County Highway Department to optimize the design of the intersection between St. Louis County Highway 129 and the University's new access road to the proposed facility. Expected roadway and intersection design features include separate turning lanes, and warning and directional signs. The University expects very little increased traffic in the vicinity of the intersection of St. Louis County Highway 129 and National Parks Service Highway #1.

Comment 2: Blasting will be audible inside Voyageurs National Park. Please consider loading smaller shots to limit the distance that blasting noise will travel.

Response: The University will consider and implement all reasonable efforts to reduce the effects of blasting noise in Voyageurs National Park and the surrounding area. These efforts will include the use of smaller blasting charges, when possible, to minimize the noise. Blasting will only occur for approximately two to three months. As the EAW notes, the University will limit construction activities, including blasting, to the hours between 7:00 a.m. and 7:00 p.m. on weekdays and will not undertake construction activities on weekends.

The University provides the following additional analysis regarding the anticipated noise from blasting. The shortest distance between the park boundary and the area where blasting will occur is approximately 7,000 feet, or approximately 2,100 meters. The University estimates that the loudest blast associated with construction will be approximately 140 decibels at the blast site. The sound level from such a blast at the entrance to the park on NPS Highway #1 with no attenuation from vegetation and the rolling topography would be 65 decibels. This decibel level is equivalent to normal conversation. Considering natural attenuation from shrubs and trees in the area, the sound level at the entrance to the park drops to a range of 20 to 30 decibels. This decibel level is equivalent to a whisper or to the noise level found in a rural area. The rolling terrain in the area will provide further noise attenuation. Given the noise level associated with blasting, the distance of the park from the blasting area, and the natural noise attenuation as a result of the area's terrain, it is unlikely that park visitors will be aware of the blasting noise when inside the park boundaries.

Comment 3: The facility may be visible from locations inside Voyageurs National Park or along Ash River Trail, and the view of a large industrial facility from locations within the park could adversely affect a visitor's experience of the park.

Response: The NOvA Laboratory building is located on rolling terrain with mixed elevations at ground level ranging from 1,120 to 1,393 feet above mean sea level. Many of the higher elevations are forested with treetops as high as approximately 1,450 feet above mean sea level. The highest point of any building on the site will be approximately 1,271.5 feet above mean sea

level. Thus, although portions of the site buildings may be visible from some upland areas of the Voyageurs National Park at a distance of more than two miles, the buildings will be a low feature in contrast to nearby wooded outcrops.

The University will use design criteria to minimize the visual impact of any portion of the Far Detector building that might be visible from Voyageurs' National Park. The Far Detector building, which will have an above-ground height of approximately thirty-seven feet or approximately two stories, will not include any windows facing north to minimize reflected sunlight. An earthen berm with native grasses will surround much of the Far Detector building up to the roof line. Exterior colors for all buildings will be muted grays and browns. All north facing building walls will be in neutral colors to decrease contrast and visibility. The University will use native plants and trees to soften the outlines of all buildings. In addition, the University will work with the National Park Service to design additional measures to screen or soften the appearance of the site buildings, and will provide the National Park Service with view shed maps upon request.

Comment 4: Construction vehicle traffic will transport exotic plant seeds and plant parts to the facility. These seeds and plant parts, once established, may migrate into Voyageurs National Park.

Response: Because the project is receiving federal funding, the United States Department of Energy must comply with Executive Order 13112 on Invasive Species. The Department of Energy is preparing an Invasive Species Management/Control Plan to be implemented during and after construction of the facility to prevent or minimize the spread of noxious weeds and other invasive species. The University understands that the Department of Energy will seek input from the Department of the Interior before implementing the Invasive Species Management/Control Plan. The University also understands that the Department of Energy's Invasive Species Management/Control Plan will address methods and conditions to reduce the potential for invasive species infestations, including measures to provide clean fill materials free from noxious weeds and other measures to reduce incidental transport of noxious weed species by trucks and equipment.

Comment 5: Given that the facility may be visible from locations within Voyageurs National Park, please ensure that the facility meets site selection rationale (d) in the EAW, which states that the facility location should be elevated to reduce wetland impacts and to address the concern that the facility not be directly visible from existing parks and other recreational facilities.

Response: Please refer to Response to Comment 3 above. The Ash River site is nested among higher hills which screen the site from Voyageur's National Park, and is at least two miles from upland areas of the park from which site buildings may be visible, with the possible exception of the vehicular corridor along St. Louis County Highway 129. Moving the facility further south might decrease its possible visibility from the park, but would increase its visibility from the Ash River and could result in other adverse impacts on the Ash River. The site optimizes site

selection criterion (d) in the EAW by minimizing wetlands impacts and by limiting visibility from possible recreational areas to the north, east, and south.

Comment 6: The EAW does not discuss an alternative location for the facility, near the town of Buyck, which National Park Service staff at Voyageurs National Park considers the optimal location.

Response: An EAW under the Minnesota Environmental Policy Act need not consider alternatives to a proposed project. Nevertheless, the University notes that the Orr-Buyck Road location, which the comment references, was dropped from further consideration because studies by the United States Department of Energy determined that the Ash River location was more suitable for research on sub-atomic particles. In addition, the Department of Energy determined that the potential for environmental impacts was greater at the Orr-Buyck site. The University understands that the Department of Energy determined the Orr-Buyck location would have involved disruption of more wetlands than the Ash River site. In addition, unlike the Ash River site, construction of the facility at the Orr-Buyck site would have adversely affected stands of old-growth forest and high-quality wildlife habitat. In short, the Ash River site better meets all four site selection rationales summarized in the EAW, because: (1) it is located farther from Fermilab than the Orr-Buyck site, meeting EAW site selection criterion (a); it is near St. Louis County Highway 129, the only paved road in the area, meeting EAW site selection criterion (b); (3) it is in the United States, meeting EAW site selection criterion (c); and (4) it is elevated to reduce wetland impacts and is not directly visible from existing parks and other recreational facilities, meeting EAW site selection criterion (d).

The University also believes that the Ash River site provides the University an opportunity to coordinate with the National Park Service at Voyageurs National Park on educational and recreational opportunities, similar to the coordination between the Soudan Laboratory and nearby natural resources exhibits. About 5,000 students and members of the general public take science tours each year at the Soudan Laboratory in Soudan, Minnesota. Many of these visitors also tour natural resource exhibits near Soudan, such as the Ely Wolf Center. The University hopes to cooperate with the National Park Service to create summer research programs for school teachers and undergraduates that would take advantage of both the NOvA laboratory and nearby Voyageurs National Park.

Comment 7: The Far Detector (Assembly Space and Service) building will be seventy-two feet high, with thirty-seven feet protruding above the landscape. The “consensus” reached with the National Park Service regarding site selection and visibility of the building assumed a site with a one-story building in fifty-foot tall trees.

Response: See Responses to Comments 3 and 5.

Comment 8: Please consider restoring the area immediately surrounding the facility and those areas impacted by construction to a natural landscape using native vegetation. Typical lawn and

landscaping plans are exotic to this area and may result in further infestations of exotic plants in the park. The application of native plants may also soften the visual impact of the facility.

Response: In keeping with the intent of Executive Order 13112 on Invasive Species, the facility will be landscaped with native species from the surrounding region. No exotic or non-native species will be used for landscaping. Native trees may also be planted to provide additional screening benefits.

Comment 9: The access road to the facility will overwhelm the parking area for the Ash River Falls Trail and no accommodation for the parking area has been made.

Response: Thank you for your clarification regarding administration of the Ash River Falls Trail. The Department of Energy and the University of Minnesota will work with the Minnesota Department of Natural Resources to preserve access to these ski trails. If construction of an access road to the facility adversely affects the Ash River Falls Ski Trail parking area, the University will provide alternate parking during construction and at the close of construction will return the Ash River Falls Ski Trail parking area to a condition that meets or exceeds its current condition. Access road construction will not have any significant effects on the ski trail network, including the area where St. Louis County Highway 129 intersects with the proposed access road.

Comment 10: The facility may be visible from locations within Voyageurs National Park.

Response: See Response to Comment 5.

Comment 11: Although the Voyageurs National Park Superintendent's authority is not applicable to areas outside the park, the Superintendent has the responsibility to protect park resources and visitor experience of those resources from adversity or impairment, even if that impact originates outside the park.

Response: Comment noted. The only applicable adopted local comprehensive plan, land use plan or regulation, or other land use plan of any governmental agency is the Voyageurs Planning Area sub-plan of the Comprehensive Plan for St. Louis County. As the EAW notes, the project is compatible with the goals and policies of this comprehensive plan.

Comments of the Minnesota Department of Natural Resources

Comment: The University's request for a 200-foot right of way easement from DNR (a sixty-six foot permanent right-of-way, plus a temporary easement of sixty-seven additional feet on each site for construction) could have adverse resource impacts.

Response: The University will limit permanent impact from the road footprint to a sixty-six foot permanent right-of-way. Construction impact in the temporary right-of-way will not be extensive and little impact from construction is expected within the temporary right of way. Construction will be limited in the temporary right-of-way by virtue of use of the existing road alignment. Impacts will be minimized by using the existing road, rather than building a new road alignment through previously undeveloped areas. In addition, as discussed in the EAW, the University will minimize road construction impact to the greatest extent possible by undertaking erosion control measures and by minimizing or avoiding effects on wetlands. The University will mitigate unavoidable wetland impacts through the wetland permitting process, as discussed in the EAW.

Comments of the Minnesota Historical Society, State Historic Preservation Office

Comment 1: The Minnesota Historical Society will need to review a copy of the Cultural Resources Assessment before completing a review of the project.

Response: The United States Department of Energy provided a copy of the Cultural Resources Assessment to the State Historic Preservation Office.

Comment 2: The United States Department of Energy and the United States Army Corps of Engineers must initiate their own cultural resources assessments as soon as possible, to avoid later delays in project implementation.

Response: The United States Department of Energy has received copies of the Cultural Resources Assessment and is evaluating the assessment as it prepares an Environmental Assessment for the project under the National Environmental Policy Act. The United States Army Corps of Engineers will initiate its Section 106 coordination when it receives the Combined Wetland Permit Application requesting a Section 404 permit for the project under the Clean Water Act. The University is currently reviewing the Combined Wetland Permit Application.

Comments of the Minnesota Department of Health

Comment: Reciting the minimum requirements for the construction, repair, and sealing of wells and borings under Minn. R. Ch. 4725.

Response: The University is aware of Minn. R. Ch. 4725, which establishes the minimum distances from sources of contamination for construction of water supply wells. As shown on Figure 3 in the EAW, the University is likely to place the water supply well and the sanitary holding tank at least 125 feet apart. Actual location of the water supply well and the sanitary

holding tank, however, will depend upon the location of groundwater at the site. When construction of the project begins, the University will install the water supply well at least 50 feet from the building where the scintillator oil will be handled and stored, as Minn. R. Ch. 4725 requires. Following installation of the well, the University will place the sanitary holding tank more than 50 feet from the water supply well and in a side gradient or downgradient location, as Minn. R. Ch. 4725 requires.

Comments of Julian Brzoznowski – Orr, Minnesota

Comment: “I feel that it would be a boost to the area and many things could be learned from this project. OK.”

Response: Comment noted.

Comments of J. Dale Long – Orr, Minnesota

Comment: “Very good update on the plans and needs for the site. The City of Orr welcomes the project with open arms. With a little imagination who wouldn’t want to be part of the possible findings resulting from the research done on this site. The City of Orr would welcome the chance to supply housing needs, airport and recreation for the scientists and employees that will run this program.”

Response: Comment noted. The University will continue to work with the City of Orr and surrounding communities to provide support services for the employees and visitors planned for the facility.

Comments of Len and Evie Mankus – Orr, Minnesota

Comment: “We are very fortunate that you are coming to our area for this important endeavor. We hope that Orr can be a service to you.”

Response: Comment noted. The University is looking forward to continuing to work with the City of Orr.

Appendix H

DOE Approval of the Environmental Assessment.....H-1

Finding of No Significant Impact.....H-3



Department of Energy

Office of Science
Chicago Office
9800 South Cass Avenue
Argonne, Illinois 60439

June 11, 2008

Joanna M. Livengood, Manager
Fermi Site Office

SUBJECT: APPROVAL OF ENVIRONMENTAL ASSESSMENT (EA) FOR CONSTRUCTION AND OPERATION OF NEUTRINOS AT THE MAIN INJECTOR (NUMI) OFF-AXIS ELECTRON NEUTRINO (ν_E) APPEARANCE EXPERIMENT (NO ν A) AT THE FERMI NATIONAL ACCELERATOR LABORATORY (FERMILAB), BATAVIA, ILLINOIS, AND ST. LOUIS COUNTY, MINNESOTA (DOE-EA-1570)

On February 14, 2006, you named me the National Environmental Policy Act (NEPA) Compliance Officer (NCO) on the NO ν A EA. This memorandum fulfills my responsibility under Department of Energy (DOE) Order 451.1B, Section 5d(8), to advise you on the adequacy of the NO ν A EA. Sally Arnold was the Document Manager and Vicki Prouty provided legal counsel. Ms. Arnold involved both Counsel and me in all aspects of EA planning, preparation (including issues resolution), and review.

The NO ν A experiment entails constructing and operating facilities for a new neutrino physics research program. DOE's Fermilab is the lead DOE Laboratory on the project and the University of Minnesota is the lead collaborating university through a Cooperative Agreement with DOE. The program is designed to generate neutrinos at Fermilab in Batavia, Illinois, for analysis in proposed detectors at Fermilab and near the Ash River in St. Louis County, Minnesota.

Construction of the access road to the Ash River Site would impact a wetland, requiring a permit from the U.S. Army Corps of Engineers (USACE). Consequently, the EA incorporates a wetlands assessment and the USACE is a cooperating agency on the EA.



Based on the analysis in the EA, I recommend that you determine that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA. The enclosed Finding of No Significant Impact (FONSI) summarizes my rationale. Per DOE Order 451.1B, Section 5a(9), your signature below will approve the EA, and your signature on the enclosed FONSI will constitute DOE's NEPA clearance.

Despite the completion of DOE's NEPA process, there are two related items which will need to be resolved before construction of the NOvA Far Detector Facility can proceed:

1. The National Historic Preservation Act Programmatic Agreement that DOE entered into with the State of Minnesota, the Bois Forte Band of Minnesota Chippewa, and the White Earth Band of Minnesota Chippewa requires that DOE perform a Phase 1 archaeological survey and also brief the Minnesota State Historic Preservation Office concerning the final design of the access road to the Ash River Site. These actions are intended to ensure that archaeological/historical resources will not be compromised.
2. A wetlands permit from the USACE pursuant to Section 404 of the Clean Water Act is required and must be obtained before DOE undertakes actions which would impact wetlands in the vicinity of the NOvA Far Detector Facility.



Peter R. Siebach
NEPA Compliance Officer
NOvA Project

Enclosures:

1. Preliminary Final NOvA EA
2. Finding of No Significant Impact

Approved:



Joanna M. Livengood, Manager

Fermi Site Office

Date

6/11/08

- cc: S. Goel, SC-31.1, GTN, w/o encls.
M. Marshak, University of Minnesota, w/o encls.
J. Cooper, Fermilab, w/o encls.
R. Whiting, Army Corps of Engineers, w/o encls.

U.S. Department of Energy
Finding of No Significant Impact

Construction and Operation of Neutrinos at the Main Injector (NuMI) Off-Axis Electron
Neutrino (ν_e) Appearance Experiment (NOvA) at the Fermi National Accelerator
Laboratory, Batavia, Illinois, and St. Louis County, Minnesota
(DOE-EA-1570)

AGENCY: U.S. Department of Energy

ACTION: Finding of No Significant Impact

SUMMARY:

The proposed action involves constructing and operating facilities for a new neutrino physics research program. The Department of Energy's (DOE) Fermi National Accelerator Laboratory (Fermilab) is the lead laboratory, and the University of Minnesota is the lead collaborating university through a Cooperative Agreement with the DOE. The program would generate neutrinos at Fermilab in Batavia, Illinois, for analysis in proposed detectors at Fermilab and near the Ash River, in St. Louis County, Minnesota.

Proposed activities at the Ash River site include a wetlands action that requires a permit from the U.S. Army Corps of Engineers (USACE). Consequently, the EA incorporates a wetlands assessment, and the USACE is a Cooperating Agency in the EA. This Finding of No Significant Impact (FONSI) incorporates DOE's wetlands finding, pursuant to Title 10, *Code of Federal Regulations*, Part 1022 (10 *CFR* Part 1022), "Compliance with Floodplain/Wetlands Environmental Review Requirements".

Based on the analysis in the Environmental Assessment (EA), DOE has determined that the proposed action does not constitute a major federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act (NEPA).

DESCRIPTION OF THE PROPOSED ACTION:

Proposed Action: The proposed action would take place at both the Fermilab site and in St. Louis County, MN, near the U.S. – Canadian border. The region between the two sites would not be affected by construction, operation, or decommissioning of the proposed action. The proposed action consists of four main phases: (1) excavation and construction; (2) scintillator blending, detector assembly and testing; (3) performance of the NOvA experiment, and (4) decommissioning.

The construction phase at Fermilab would include an upgrade of the existing Fermilab accelerator complex with an increase of beam power in the Main Injector. A new underground cavern would be excavated at approximately 345 feet below grade adjacent to an existing tunnel. This excavation would remove about 1,000 cubic yards of rock

using conventional civil construction and mining techniques. The cavern would hold a new 222-ton “Near Detector” to monitor the neutrino beam as it leaves the Fermilab vicinity. Above-ground, a 90-ton prototype detector would be assembled in an existing Fermilab facility to provide development and optimization for the neutrino detector. In addition, to support the blending of approximately 4.2 million gallons of scintillation detector fluid, either a blending facility would be constructed at Fermilab or the services of a commercial blender near Chicago would be engaged. A constituent in the blending operation would be pseudocumene, a toxic organic liquid, at approximately 5% of the total volume. Blended scintillation fluid would be transported by tanker truck from the blending facility to the Ash River site.

A proposed new “Far Detector” Facility would be constructed at the Ash River site. The new building would be 67 feet wide by 375 feet long and would be sunk 40 feet below the existing grade into granite rock at the site. Site preparation would include improvement to an existing logging road to facilitate all-weather access. A proposed 20,000-ton Far Detector would be constructed with components identical to the ones used in the Near Detector, but with dimensions, number and total volume scaled to the larger size.

The schedule for the proposed action has construction/excavation and assembly starting in 2008. Construction and assembly would continue through 2013. Experiment performance would begin on parts of the devices during the construction period, but sustained operations would begin in 2013 and continue through at least 2019. Following achievement of experiment objectives, decommissioning would occur over a several-year period.

Purpose and Need: Neutrinos are uncharged, non-ionizing elementary particles that only rarely interact with ordinary matter. The study of the oscillation of neutrinos from one type to another is considered a good way to study important physics questions, such as the properties of the weak interaction, neutrino mass, the contribution of neutrinos to the Dark Matter in the Universe, and the relationship between matter and antimatter. Understanding these particles is an important goal of the worldwide physics community and the DOE Office of Science, and operation of the NO ν A facility would advance that goal.

Alternatives: NEPA requires evaluation of the impacts of “reasonable alternatives.” “Reasonable Alternatives” are those that satisfy the purpose and need of the proposed action.

The presence of existing NuMI beamline infrastructure at Fermilab fixed the location for the origin of the neutrinos. During conceptual design for the project, several site alternatives for the location of the Far Detector Facility were contemplated for beamline termination. Screening criteria included:

- The ability to have the detector as far away from Fermilab as possible;
- The ability to have a detector ~ 12 km off-axis from the central NuMI neutrino beam;

- Access to the site by existing roads;
- The ability to do construction in all seasons on the experimental hall and on the detector;
- Access to power, telephone lines, and fiber optic data connections;
- The availability of a relatively flat area for construction;
- The availability of high ground, well above the water table with no wetlands;
- The absence of features likely to provoke controversy or litigation; and
- A location in the United States [A location in Canada would require participation by a Canadian institutional collaborator].

Only one site alternative, the proposed site, met the screening criteria for a more thorough evaluation in the EA:

Four non-site alternatives were considered. Three were not analyzed:

- Alternative access roads to the proposed Ash River site that avoid wetlands were considered, but were determined not to be feasible because they did not meet several of the screening criteria, above. For example, a more direct route from the north across St. Louis County 129 would be shorter and cheaper, but would be controversial because of visibility from Voyageurs National Park, and impact old growth forest and protected wildlife.
- Alternative building designs for the Far Detector Facility were considered but did not address the need to maximize shielding of the detector from background radiation. The proposed design makes the best use of the excavated granite as a cosmic ray shield for the detector.
- Alternative detector technologies were considered for the Far Detector. Most were scientifically inferior, while one alternate required too many years of R&D to be considered viable.

One non-site alternative was considered reasonable for analysis.

- The NOvA EA analyzes two options for mechanically blending the scintillator materials. The first option was to use a local commercial toll blender in the Chicago area and transport blended materials from that location to Fermilab and Minnesota. The second option was to construct and operate a blending facility at an existing Fermilab site.

Additionally, the No Action alternative was analyzed. Under the No Action Alternative, the experiment would not be conducted and the scientific goals for the studies of neutrino oscillations would not be achieved in the U.S. in the near future. The No Action Alternative would avoid the potential environmental impacts of the Proposed Action, discussed below.

ENVIRONMENTAL IMPACTS:

The proposed construction site at Fermilab is limited to an underground excavation and a small surface stockpile for excavated rock. These areas are not known to contain historical resources or sensitive biological resources or habitats that would be affected by construction. Rock spoils generated during excavation would constitute a less than 2% increase in existing spoils piles at Fermilab. Labor staffing during construction would be a small fraction of the worker population currently accessing Fermilab. On-site impacts from traffic, air emissions, vibrations, and noise would be small. The EA projects that up to three cases of injury/illness can be expected, two during the excavation phase of construction. It also projects that five traffic accidents during worker commutes would occur, but that no traffic injuries or fatalities would result. Other off-site impacts from the proposed action would be extremely small and largely limited to air and noise impacts, but no noise or air quality standards are expected to be exceeded.

Changes in work activities at Fermilab related to the operational phase of the proposed project are few. Increasing the Main Injector beam power to 700 kW would increase estimated radionuclide emissions and tritium in ground water. Increased beam power would also lead to increased activation of accelerator and beamline components. Such increases could be expected to proportionally increase the potential estimated dose rate to workers. However, increased dose "rates" only refers to the potential for dose – DOE does not contemplate an actual increased dose to workers (or the public), since engineered and administrative barriers will be put into place to limit dose to current limits. The Fermilab radiation exposure control program has been effective in limiting exposure to workers, and doses will remain considerably below the DOE 10 *CFR* Part 835.202 total effective dose limit of 5 rem (5,000 mrem) and the Fermilab administrative dose goal of 1,500 mrem annually. The estimated maximum annual radiation dose at the site boundary that would result from airborne releases is 0.04 mrem. This hypothetical dose is far below the regulatory limit of 10 mrem in a year. Based on established conversion rates, radiation from the experiment would be responsible for no latent cancer fatalities to either workers or the public.

The Far Detector site in Minnesota is currently undeveloped, so the proposed project would change the appearance and current use of the site. The proposed project would include clearing, grading and excavation disturbing greater than 5 acres, and therefore would require a permit issued for the discharge of storm water associated with construction activity under National Pollutant Discharge Elimination System as implemented by the Minnesota Pollution Control Agency. The erosion controls required by the permit, as well as the site location and Facility design, would minimize potential impacts to surface water. During construction there would be short-term, localized impacts on air quality from vehicular traffic exhausts and earth-moving operations, similar to construction of any commercial facility of comparable size.

Construction of the access road would result in filling approximately 3.5 acres of wetlands, requiring a permit from the USACE under Section 404 of the Clean Water Act and conformance with the requirements of the Wetland Conservation Act of Minnesota. Approximately 5.2 acres of banked wetlands would be purchased to mitigate impacts to existing wetlands due to excavation and construction at the Ash River site. Under

Executive Order 11988, *Floodplain Management*, and Executive Order 11990, *Protection of Wetlands*, Federal agencies are required to consider the impact of proposed actions on wetlands and floodplains. The DOE requirements for compliance with Executive Orders 11988 and 11990 are found in 10 *CFR* Part 1022. A wetland assessment was included in the EA, and satisfies all the requirements of 10 *CFR* 1022. The wetlands permitting process has not been completed due to a USACE requirement to first have NEPA documentation in place.

Concerns over the potential for archeological resources to be affected in the project area at the Ash River site have been resolved through the negotiation of a Programmatic Agreement under Section 106 of the National Historic Preservation Act. Signatories include DOE, the Minnesota State Historic Preservation Office, the Bois Forte Band of Minnesota Chippewa, and the White Earth Band of Minnesota Chippewa. The programmatic agreement includes a stipulation that DOE perform an archeological survey of the project area in the spring of 2008, prior to construction. The survey would include further investigation of historical resources, including both architectural (i.e., to address potential impacts to a historic logging railroad grade) and cultural.

To address concerns of the National Park Service, the Far Detector Facility will be designed to minimize its visual impact on Voyageurs National Park. For example, the tallest section of the building (which would have an above-ground height of approximately thirty-seven feet or approximately two stories), will not have any windows facing north (i.e., toward Voyageurs) to minimize reflected sunlight. In addition, an earthen berm with native grasses would surround much of the Far Detector Facility up to the roof line. Exterior colors for all buildings would be muted grays and browns. All north facing building walls would be in neutral colors to decrease contrast and visibility. Native plants and trees would be planted to soften the outlines of all buildings. In addition, the NOvA Project would work with the National Park Service to design additional measures to screen or soften the appearance of the site buildings if needed

100% secondary containment of liquid scintillator and other liquids at every stage of the assembly and installation process, is designed to prevent any release to ground water during assembly, installation and operation. The adhesive that would be used to assemble the detector modules contains methyl methacrylate (MMA), a volatile organic compound and a federal hazardous air pollutant. The health and safety plan developed for the project would detail the proposed ventilation controls intended to comply with occupational and environmental concentration standards. Site workers and contractors would conduct work under a University of Minnesota site health and safety plan and procedures for installation and assembly operations.

Some impacts to employees would be expected from the NOvA experiment. The multiple shipments of materials via truck, tanker or rail car on and between the project sites are subject to routine traffic accidents. Based on traffic accident statistics, one accident and one injury can be expected during transportation of materials (during all phases of the project) and nine accidents and two injuries can be expected during worker commutes (during all phases of the project). No transportation fatalities are expected.

OSHA reportable cases would be approximately 19, or about 1~2 per year of the project schedule.

The spill of MMA or pseudocumene (a hazardous component of the largely mineral oil scintillation fluid) in an accident during delivery from the distributor to the NOvA Project in a wetland or other sensitive area could impact exposed sensitive species. Although an accident during transport has a calculable probability of *occasional* (approximately 0.03~0.04), the probability that an accident would occur that also causes a spill at an environmentally sensitive area would be several orders of magnitude less (1E-04).

Cumulative: Radiological impacts of the NOvA experiment result from increasing the beam power from 400 kW to 700 kW in the NuMI accelerator. As discussed in the EA, the NOvA proposed action would be an incremental change to the existing Fermilab operational base and would be offset by decreases due to completion of the Tevatron Collider research program. Increases in beam power would primarily affect radiological conditions. There are no other current or reasonably foreseeable future projects at Fermilab that may interact with the project described in the EA in such a way as to cause cumulative impacts.

There are no current activities or future phases of development planned for the Ash River site, nor are there any other activities or developments proposed by others that are reasonably foreseeable in the area of the proposed project. Therefore no cumulative impacts are anticipated with respect the project in the Ash River area. Future logging efforts are not considered "reasonable and foreseeable actions" in terms of evaluating cumulative impacts, as logging has been occurring in the area for over a hundred years and would continue indefinitely in the region as a renewable and managed resource.

DETERMINATION:

Based on the analysis in the final EA and consideration of public comments received on the draft EA, DOE has determined that the proposed construction and operation of NOvA at Fermilab and near Ash River, and the use of either a toll blender in the Chicago area or construction of a support facility at the Fermilab to mechanically blend scintillator materials would not individually or cumulatively have a significant affect on the quality of the human environment within the meaning of NEPA. Therefore, the proposed action does not constitute a major federal action within the meaning of NEPA, and an environmental impact statement is not required. With this determination, DOE can proceed with the NOvA project. However, since a permit from the USACE under Section 404 of the Clean Water Act is still required (and per USACE procedures, can not be issued until the NEPA process is complete), any activity involving wetlands will be contingent upon receipt of that permit. Likewise, the terms of the Programmatic Agreement under Section 106 of the National Historic Preservation Act will need to be met before any activities with the potential to effect historic properties are undertaken.

PUBLIC AVAILABILITY:

Copies of the EA are available by contacting:

Sally C. Arnold
Document Manager
U.S. Department of Energy
P.O. Box 500
Kirk Road and Pine Street
Batavia, IL 60510-0500
Telephone: 630/840-2239
E-Mail: sally.arnold@ch.doe.gov

Copies of the EA are also available for review at the following locations:

Batavia Public Library
10 S. Batavia Avenue
Batavia, IL

Warrenville Public Library District
28W751 Stafford Place
Warrenville, Illinois

University Librarian's Office
499 Wilson Library
309 19th Avenue South
Minneapolis, Minnesota

Municipal Building
600 4th Street
International Falls, Minnesota

Fermi National Accelerator Laboratory
Library
Wilson Hall, 3rd Floor
Kirk Road and Pine Street
Batavia, Illinois

The EA may be viewed on-line at: <http://www.fnal.gov/pub/neighbors/nova/NOvA-final-EA.pdf>

For further information regarding the DOE NEPA process, contact:

Peter R. Siebach
NEPA Compliance Officer
U.S. Department of Energy
Chicago Office (STS)
9800 S. Cass Avenue

Argonne, IL 60439
Telephone: 630/252-2007
E-Mail: peter.siebach@ch.doe.gov

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Joanna M. Livengood, Manager
Fermi Site Office