

# ENVIRONMENTAL ASSESSMENT WORKSHEET

This Environmental Assessment Worksheet (EAW) form and EAW Guidelines are available at the Environmental Quality Board's website at: <http://www.eqb.state.mn.us/EnvRevGuidanceDocuments.htm>. The EAW form provides information about a project that may have the potential for significant environmental effects. The EAW Guidelines provide additional detail and resources for completing the EAW form.

**Cumulative potential effects** can either be addressed under each applicable EAW Item, or can be addresses collectively under EAW Item 19.

**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: **Keene Creek Restoration Project**

### 2. Proposer: South St. Louis Soil & Water Conservation District

Contact person: Ann Thompson

Title: Conservation Specialist

Address: 215 N 1<sup>st</sup> Ave E. Rm. 301

City, State, ZIP: Duluth, MN 55803

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### 3. RGU: South St. Louis Soil & Water Conservation District

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### 4. Reason for EAW Preparation: (check one)

#### Required:

☐ EIS Scoping

☒ Mandatory EAW

#### Discretionary:

☐ Citizen petition

☐ RGU discretion

☐ Proposer initiated

If EAW or EIS is mandatory give EQB rule category subpart number(s) and name(s): The proposed project will re-align approximately 1,500 feet of a designated trout stream so the EAW is mandatory under the following rule category: Subp. 26. **Stream diversion**. For a diversion, re-alignment, or channelization of any designated trout stream, or affecting greater than 500 feet of natural watercourse with a total drainage area of ten or more square miles unless exempted by part 4410.4600, subpart 14, item E, or 17, the local government unit shall be the RGU. The South St. Louis Soil & Water Conservation District is the Local Government Unit and will serve as the RGU.

### 5. Project Location:

County: St. Louis

City/Township: Hermantown

PLS Location (1/4, 1/4, Section, Township, Range): T50 R15 Sec. 36

Watershed (81 major watershed scale): St. Louis River

GPS coordinates (decimal degrees): 46.771243°, -92.186062°

Tax Parcel Number: City of Hermantown property, Parcel ID numbers: 395-0014-00700, 395-0014-00980

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

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

*Additional Attachments:*

- *Attachment 4: Custom Soil Resource Report – Natural Resources Conservation Service*
- *Attachment 5: Wetlands Information – National Wetlands Inventory*
- *Attachment 6: Natural Heritage Review – Minnesota Department of Natural Resources*

## 6. Project Description:

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

The Keene Creek Restoration project will stabilize 1,500 linear feet of stream in Keene Creek Park in Hermantown, MN. This reach was manipulated in the past when gravel was mined and utilities were installed and was negatively impacted by the flood of 2012. After the 2012 flood, the stream ran against valley walls where erosion is occurring and many pools were filled. This project includes the remeandering of the stream in some areas, connecting the stream to the floodplain, and the installation of wood and boulders to provide habitat. Channel form will be restored, pool and riffle habitat will be created, the creek will be re-connected to the floodplain and native vegetation will be re-established in the riparian corridor. Restoring Keene Creek will have lasting beneficial effects on the health of this stream and on the greater watershed. Trails and bridges will remain in place.

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

The proposed project is a stream restoration and habitat enhancement project on Keene Creek, a designated trout stream that runs through the Cities of Hermantown and Duluth, MN. The project is located in the upper portion of the watershed on public property.

This restoration project is designed to improve the ecological/hydrological function of the stream channel and adjacent floodplain by creating a sinuous channel that is connected to the floodplain and has diverse in-stream habitat for trout and other cold-water species.

Construction of 1,500 feet of stream channel will include grading and stabilizing new stream banks, installing in-stream structures for grade control and fish habitat, and stabilizing and vegetating disturbed areas.

The new stream channel will be excavated at the calculated bankfull width of 18 feet. Natural Channel Design methodology requires that a reference reach be used to inform the design of the new channel. Data from McCarthy Creek off of the Lane Road is being used as the reference reach for this restoration project. The channel will have a slope of approximately 2% and will have a sinuosity of >1.2 (a Rosgen "C" channel type). "C" channels have a riffle-pool sequence. Pools will provide thermal refuge, cover, feeding and resting areas for aquatic organisms. Riffles will provide oxygen to the water column and the gravel within the riffles will provide spawning areas. Root wads will be installed to provide woody cover and habitat and to stabilize the stream banks.

A bulldozer, excavator and dump truck will be used to dig and shape the new channel. An excavator with a hydraulic thumb will be used to install the in-stream structures including toewood, boulders, logs and rocks.

The riparian areas will be planted with native vegetation. The riparian area will be stabilized with erosion control mats and blankets to allow vegetation to become established. Plantings will include native flower and grass seed, shrubs and trees.

The stream will be temporarily diverted around the active construction areas using an engineer-approved stream diversion plan. Any stockpiles will have erosion and perimeter control and other best management practices implemented according to the Storm Water Pollution Prevention Plan to ensure that sediment does not enter the stream during construction. A balance of fill and cut will occur so that excess material will not be hauled on or off site.

Timing: The proposed timing of the project is as follows:

**Construction:**

September 2020 and/or May – June 2021 (Construction will take approximately four weeks):

- Construction of the re-meandered channel, including grading and excavating.
- Placement of all stream structures and habitat features, including toe wood, stream vanes and j-hooks
- Stabilization of all disturbed areas (erosion control blanket in new channel).
- Construction and stabilization of the small tributary

**May – June 2021:**

- Planting of all disturbed areas with native forbs and grasses, shrubs and trees.
- Installation of erosion control matting to protect the newly seeded area.
- Restoration of any access trails and/or staging areas.

Construction limits, site access, the stream channel alignment and stockpile locations will be staked out prior to the start of the project. See Attachment 3 for design plans.

c. Project magnitude:

Total Project Acreage	0.98 ac.
Linear project length	1500 feet
Number and type of residential units	0
Commercial building area (in square feet)	0
Industrial building area (in square feet)	0
Institutional building area (in square feet)	0
Other uses – specify (in square feet)	0
Structure height(s)	N/A

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

The project has three purposes:

1. Create fish habitat
2. Enhance floodplain connectivity and stream stability by restoring the channel to the correct form
3. Decrease water temperatures through the establishment of native vegetation

The purpose of the project is to restore the physical and ecological function of Keene Creek. Each of the five components of stream health will be addressed (geomorphology, hydrology, connectivity, water quality, and biology). This includes creating diverse fish habitat; decreasing sediment input by moving the stream away from eroding banks; and re-meandering the creek to a natural, stable pattern. Using Natural Channel Design methodology will allow us to meet our goals.

The project is being carried out by the South St. Louis Soil & Water Conservation District in partnership with Minnesota Trout Unlimited. The beneficiaries for the project are aquatic species living in the creek, the residents of the Hermantown, and the citizens of the Hermantown/Duluth community as healthy creeks and watersheds are a goal for the City and its residents (City of Duluth Comprehensive Plan, 2006). Visitors and residents in the watershed will also receive an improved area for recreation and will benefit from a decrease in sediment moving downstream.

e. Are future stages of this development including development on any other property planned or likely to happen?

☒ Yes ☐ No

If yes, briefly describe future stages, relationship to present project, timeline and plans for environmental review.



It is likely that future restoration work in Keene Creek will occur adjacent to the 2020/2021 project site. The section of stream between sections being planned for restoration in 2020 and the section of stream surrounding the Okerstrom Road crossing in Keene Creek Park will likely be the sites of future stream restoration and habitat enhancement work. Any future restoration work will have the same goals of restoring channel form, connecting the stream to the floodplain, and creating diverse habitat for trout and aquatic organisms. Future restoration work is not specifically planned nor is it funded. Work is likely a few years away at the earliest.

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

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

	Before	After		Before	After
Wetlands	0	0	Lawn/landscaping	0	0
Deep water/streams	0.76	0.76	Impervious surface	0	0
Wooded/forest	0	0	Stormwater Pond	0	0
Brush/Grassland	0.22	0.22	Other	0	0
Cropland	0	0			
			<b>TOTAL</b>	<b>0.98</b>	<b>0.98</b>

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

<u>Unit of government</u>	<u>Type of application</u>	<u>Status</u>
MN DNR	Public Waters Permit	Submitted
MN DNR	Natural Heritage Information System	Complete/attachment 7
Army Corps of Engineers	CWA Section 404/401	Submitted
City of Hermantown	Land Alteration Permit	To be submitted
City of Hermantown	License Agreement	Complete

**Cumulative potential effects may be considered and addressed in response to individual EAW Item Nos. 9-18, or the RGU can address all cumulative potential effects in response to EAW Item No. 19. If addressing cumulative effect under individual items, make sure to include information requested in EAW Item No. 19**

**9. Land use:**

- a. Describe:
- Existing land use of the site as well as areas adjacent to and near the site, including parks, trails, prime or unique farmlands.

The project is located on City of Hermantown property. This site is currently forested on the riparian edges and is downstream of the baseball field. The area is used for recreation including hiking and dog walking.

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

The City of Hermantown's Comprehensive Plan (2001) identifies the project site as "Parks & Cemeteries." The project site is located within section #1 of the Comprehensive Plan. This area's goals are described as "Maintain suburban character, preserve critical natural features, phase residential development, develop existing and new park areas".

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

This area is designated as Public property with a shoreland zone of Natural Environment.

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

The restoration project at Keene Creek complies with the land uses and zoning areas described in the City of Hermantown Comprehensive Plan. Restoration of the stream will not change the land use currently in place and will continue to allow park and recreation space.

- c. Identify measures incorporated into the proposed project to mitigate any potential incompatibility as discussed in Item 9b above.

The design will be reviewed by the City of Hermantown to ensure that current and future recreation opportunities will continue.

## 10. Geology, soils and topography/land forms:

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

We have not identified any sinkholes, shallow limestone, shallow aquifers or karst conditions. Due to the absence of any known special features, we have not provided for any mitigation measures in our design. Bedrock is present on site at varying depths.

Soils and topography - Describe the soils on the site, giving NRCS (SCS) classifications and descriptions, including limitations of soils. Describe topography, any special site conditions relating to erosion potential, soil stability or other soils limitations, such as steep slopes, highly permeable soils. Provide estimated volume and acreage of soil excavation and/or grading. Discuss impacts from project activities (distinguish between construction and operational activities) related to soils and topography. Identify measures during and after project construction to address soil limitations including stabilization, soil corrections or other measures. Erosion/sedimentation control related to stormwater runoff should be addressed in response to Item 11.b.ii.

The Custom Soil Resource Report provided by the NRCS (attachment 4) identifies the soils in the project area as the following:

E12A Udifluvents Complex  
0 to 3 percent slopes,  
Flooded, 30.2%

F141D Ahmeek-Normanna-Cathro  
0 to 25 percent slopes,  
Depressional, complex, pitted, 60.2%

F142A Canosia loam  
0 to 2 percent slopes,  
3.0%

F148F Ahmeek-Rock  
0 to 50 percent slopes  
Outcrop-Fluvaquents, frequently flooded, complex, 1.7%

The National Wetland Inventory shows a wetland at the edge of the project margin. This wetland is a freshwater forested/shrub wetland.

The nature of the project involves impacts to the topography and soils, however, since this is a stream restoration project, we expect that those impacts will be positive, not negative. Excavated soils will serve as needed fill for the project. The project will not alter the topography of the site. Wetlands will not be impacted.

## 11. Water resources:

- a. Describe surface water and groundwater features on or near the site in a.i. and a.ii. below.
  - i. Surface water - lakes, streams, wetlands, intermittent channels, and county/judicial ditches. Include any special designations such as public waters, trout stream/lake, wildlife lakes, migratory waterfowl feeding/resting lake, and outstanding resource value water. Include water quality impairments or special designations listed on the current MPCA 303d Impaired Waters List that are within 1 mile of the project. Include DNR Public Waters Inventory number(s), if any.

The MN DNR Public Waters Inventory lists Keene Creek (S-002-002). Keene Creek is a designated trout stream.

- ii. Groundwater – aquifers, springs, seeps. Include: 1) depth to groundwater; 2) if project is within a MDH wellhead protection area; 3) identification of any onsite and/or nearby wells, including unique numbers and well logs if available. If there are no wells known on site or nearby, explain the methodology used to determine this.

A search of the Minnesota Department of Health's County Well Index online did not show any wells in or near the project area. See attachment 4.

The project site is not in an MDH wellhead protection area.

- b. Describe effects from project activities on water resources and measures to minimize or mitigate the effects in Item b.i. through Item b.iv. below.
  - i. Wastewater - For each of the following, describe the sources, quantities and composition of all sanitary, municipal/domestic and industrial wastewater produced or treated at the site.
    - 1) If the wastewater discharge is to a publicly owned treatment facility, identify any pretreatment measures and the ability of the facility to handle the added water and waste loadings, including any effects on, or required expansion of, municipal wastewater infrastructure.
    - 2) If the wastewater discharge is to a subsurface sewage treatment systems (SSTS), describe the system used, the design flow, and suitability of site conditions for such a system.
    - 3) If the wastewater discharge is to surface water, identify the wastewater treatment methods and identify discharge points and proposed effluent limitations to mitigate impacts. Discuss any effects to surface or groundwater from wastewater discharges.

No wastewater will be produced, treated or discharged during the project.

- ii. Stormwater - Describe the quantity and quality of stormwater runoff at the site prior to and post construction. Include the routes and receiving water bodies for runoff from the site (major downstream water bodies as well as the immediate receiving waters). Discuss any environmental effects from stormwater discharges. Describe stormwater pollution prevention plans including temporary and permanent runoff controls and potential BMP site locations to manage or treat stormwater runoff. Identify specific erosion control, sedimentation control or stabilization measures to address soil limitations during and after project construction.

This project will be completed under dry channel conditions. The quality and quantity of pre- and post-project stormwater runoff will be the same. The proposed project is not a development project and will not be creating any additional impervious areas. Short-term stormwater runoff may occur during the construction of this project. No soil limitations occur at the site of the project that would increase sedimentation from stormwater runoff. Post-construction stormwater runoff should be similar to pre-construction conditions as no impervious surfaces will be constructed. Best management practices will be used during construction to minimize soil erosion, including stabilization of constructed channels prior to the introduction of stream flow, use of erosion control blanket and mulch, rapid re-vegetation of disturbed areas. Disturbed soils will be seeded with native vegetation and covered with erosion control fabric adjacent to the stream. Mulch will be placed in the upland areas to encourage quick re-vegetation and reduce erosion from disturbed areas. The project will reduce long-term erosion by redirecting the stream flow away from steep, eroding banks.

- iii. Water appropriation - Describe if the project proposes to appropriate surface or groundwater (including dewatering). Describe the source, quantity, duration, use and purpose of the water use and if a DNR water appropriation permit is required. Describe any well abandonment. If connecting to an existing municipal water supply, identify the wells to be used as a water source and any effects on, or required expansion of, municipal water infrastructure. Discuss environmental effects from water appropriation, including an assessment of the water resources available for appropriation. Identify any measures to avoid, minimize, or mitigate environmental effects from the water appropriation.

This project will not result in any water appropriation from Keene Creek, during construction or permanently.

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

The National Wetland Inventory shows a wetland at the edge of the project margin. This wetland is a freshwater forested/shrub wetland. There will be no impacts to this wetland as a result of restoration activities.

- b) Other surface waters- Describe any anticipated physical effects or alterations to surface water features (lakes, streams, ponds, intermittent channels, county/judicial ditches) such as draining, filling, permanent inundation, dredging, diking, stream diversion, impoundment, aquatic plant removal and riparian alteration. Discuss direct and indirect environmental effects from physical modification of water features.

The nature of the project is to alter a surface water, however, the purpose of the alteration is environmentally positive. The project will re-establish a stable stream channel throughout the reach using Natural Channel Design methodology and will restore the dimension, pattern and profile of Keene Creek. Construction will occur between July and September.

Vegetation will be re-established at the project site. Only native plants will be planted in the riparian area and species will be identified in the restoration design plans. The South St. Louis Soil and Water Conservation District has extensive experience with stream restoration projects such as the proposed, and are familiar with riparian species that will not only thrive in NE Minnesota's environment, but also help ensure the integrity of the restored stream channel.

The environmental effects from altering (restoring) the creek will be wholly beneficial. Minimal, temporary turbidity may occur during construction, but it is expected to be less than the natural turbidity generated during spring runoff.

All direct and indirect environmental effects of restoring the creek are expected to be positive.

Keene Creek is not big enough to be used for watercraft.

Identify measures to avoid, minimize, or mitigate environmental effects to surface water features, including in-water Best Management Practices that are proposed to avoid or minimize turbidity/sedimentation while physically altering the water features.

The Soil and Water Conservation District will work with the contractor to ensure that all appropriate measures are taken to minimize environmental impacts including turbidity and sedimentation.

Soil stockpiles will be stabilized with straw mulch and silt fencing or a similar best management practice to ensure that no soils migrate into the creek.

The primary way that impacts to the creek will be mitigated is by conducting the project during low-flow periods (summer). In addition, the work will be phased so that only short sections of the stream will be under construction. As each section is completed, it will be planted and stabilized. Finally, impacts will be mitigated by diverting water around the active construction area according to an engineer-approved stream diversion plan.

Discuss how the project will change the number or type of watercraft on any water body, including current and projected watercraft usage.

There is currently no watercraft usage in the existing stream channel and there will be none in the future.

## 12. Contamination/Hazardous Materials/Wastes:

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

No hazardous contamination conditions are known to exist within the project area.  
No utilities run near the project site.

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

No solid wastes will be generated or stored during this project.

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

During project construction and installation, activities fuels, oils, lubricants and other hazardous materials will be used during equipment operations. An accidental release or spill of any of these substances could occur. A spill could result in potentially adverse effects to on-site soils. However, the amounts of fuel and other lubricants and oils will be limited and the equipment needed to quickly limit any contamination will be located on site. To minimize the likelihood of potential spills and leaks of petroleum and hydraulic fluids during project construction, equipment will be inspected daily for leaks and petroleum contamination. Additionally, a spill prevention control and containment plan designed to reduce effects from spills (fuel, hydraulic fluid, etc.) will be prepared and implemented prior to the start of construction.

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

No hazardous wastes will be generated or stored during this project.

### 13. Fish, wildlife, plant communities, and sensitive ecological resources (rare features):

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

The site is undeveloped forestland, with the exception of a mowed trail running on top of a sewer utility line.

Fish species include a limited number of game and non-game species. These include dace, chubs, and brook trout. Fish habitat is limited due to filled in pools and limited vegetative cover. Water temperatures in this reach are in the healthy range for trout. Fish habitat was affected by the June 2012 flood and previously by rerouting of the stream for gravel mining and utility installation. Keene Creek has not fully recovered.

- b. Describe rare features such as state-listed (endangered, threatened or special concern) species, native plant communities, Minnesota County Biological Survey Sites of Biodiversity Significance, and other sensitive ecological resources on or within close proximity to the site. Provide the license agreement number (LA-\_\_\_\_) and/or correspondence number (ERDB 20180101) from which the data were obtained and attach the Natural Heritage letter from the DNR. Indicate if any additional habitat or species survey work has been conducted within the site and describe the results.

The Natural Heritage Information System database was consulted in July 2020 to determine if any rare plant or animal species are present within the project site (attachment 6). It is not believed that "the proposed project will negatively affect any known occurrences of rare features".

- c. Discuss how the identified fish, wildlife, plant communities, rare features and ecosystems may be affected by the project. Include a discussion on introduction and spread of invasive species from the project construction and operation. Separately discuss effects to known threatened and endangered species.

The proposed project will have some temporary, negative impacts on the local wildlife and ecological communities, during the construction period. However these impacts will last no longer than 60 days and the site will be greatly enhanced for wildlife once the project is complete. Access trails and staging areas will be restored to a condition that is equal to or better than the existing conditions.

Due to the nature of the project, there is always the possibility that some sediment will move off site, especially as the temporary stream diversion system is being installed.

The proposed project will also impact local communities and wildlife positively as the purpose of the project is to improve both aquatic and terrestrial habitat and reduce sediment impacts to the creek and downstream neighborhood. This will be accomplished by constructing a stable stream channel that can effectively carry sediment and flows without aggrading or degrading. Also, we are moving the creek away from existing eroding banks, which will reduce the amount of sediment sloughing off of these banks during high flows. Additionally, habitat creation and enhancement is an integral part of the project design - pools will provide thermal refuge, cover, feeding and resting and nursery areas for fish; riffles will provide oxygen to the water column and provide spawning areas; and root wads will provide woody cover and habitat and stabilize the stream banks.

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

The purpose of the proposed project is to restore the aquatic ecology and terrestrial environment within the project area to a condition better than it was before the project.

Stream restoration will cause some temporary adverse impacts to fish, wildlife and plant communities. We are taking all reasonable measures to avoid impacts to the existing wildlife and ecology including the following:

1. Construction is being conducted during non-spawning periods of trout.
2. The channel restoration work will be completed in phases instead of disturbing the entire area at once.
3. If recommended by the MN DNR, we will work with the local fisheries office to move fish out of the active construction area prior to diverting water.
4. Access to the site will be limited and occur on the existing trail.
5. Staging areas will be limited in size and will have perimeter control to reduce sediment runoff.
6. Construction will be suspended during rain events at the discretion of the Engineer to limit rutting and excess erosion from the construction equipment.



7. The construction timeline will be kept tight, and the contractor will be expected to be dedicated to the project in order to minimize the amount of time that areas are disturbed. Contract timelines will be enforced.
8. Only native species that are appropriate to the existing terrestrial ecology will be used to restore the disturbed areas. In addition, we plan to have a three-year maintenance plan included in the contract in order to ensure the success of all seeding, trees, and shrubs.
9. Erosion control blanket is specified to be natural netting only to ensure disintegration. No plastic netting will be allowed on site.

**14. Historic properties:**

Describe any historic structures, archeological sites, and/or traditional cultural properties on or in close proximity to the site. Include: 1) historic designations, 2) known artifact areas, and 3) architectural features. Attach letter received from the State Historic Preservation Office (SHPO). Discuss any anticipated effects to historic properties during project construction and operation. Identify measures that will be taken to avoid, minimize, or mitigate adverse effects to historic properties.

The SHPO data base was referenced in July of 2020 and showed no known archeological sites.  
The SWCD is currently working with SPHO to determine if a Phase 1 archeology survey of the site is needed.

**15. Visual:**

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

No views and/or vistas will be impacted by this project. No vapor plumes or glare from lights will be present at the restoration site.

**16. Air:**

- a. Stationary source emission - Describe the type, sources, quantities and compositions of any emission from stationary sources such as boilers or exhaust stacks. Include any hazardous air pollutants, criteria pollutants, and any greenhouse gases. Discuss effects to air quality including any sensitive receptors, human health or applicable regulatory criteria. Include a discussion of any methods used assess the project's effect on air quality and the results of that assessment. Identify pollution control equipment and other measures that will be taken to avoid, minimize, or mitigate adverse effects from stationary source emission.

No stationary source emissions will be created from this project.

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

The construction equipment used for this project, possibly including an excavator, skid-steer, bulldozer and dump truck, would have localized, minimal effects on air quality. The overall impact on air quality is expected to be negligible and temporary in nature.

- c. Dust and odors - Describe sources, characteristics, duration, quantities, and intensity of dust and odors generated during project construction and operation. (Fugitive dust may be discussed under item 16a). Discuss the effect of dust and odors in the vicinity of the project including nearby sensitive receptors and quality of life. Identify measures that will be taken to minimize or mitigate the effects of dust and odors.

This stream restoration project will require the use of construction equipment such as an excavator, skid-steer and dump truck. Construction will involve the movement and grading of soils and rock materials in dry and wet soil conditions. Most materials handled are stone and wood and do not cause fugitive dust generation or offensive odors.



## 17. Noise

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

Noise generated from the project will be temporary and will only occur during construction hours. Earth-moving equipment will generate noise such as engine noise, rock on metal and backup safety alarms. This equipment will generate noise during workday daytime hours and will occur for a time between July 1<sup>st</sup> and September 15<sup>th</sup>.

The project site is located on City of Hermantown parkland.

## 18. Transportation

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

Limited hauling of construction materials (boulders and woody material) will occur. Hauling will only occur on weekdays, during daytime hours. Trucks will access the site at the end of Okerstrom Road.

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

No project-related traffic congestion is expected.

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

There are no anticipated project-related transportation effects.

## 19. Cumulative potential effects: (Preparers can leave this item blank if cumulative potential effects are addressed under the applicable EAW Items)

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

The proposed project is 0.98 acres. Construction will occur over approximately four weeks. Construction will not extend in the fall past September 15<sup>th</sup>.

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

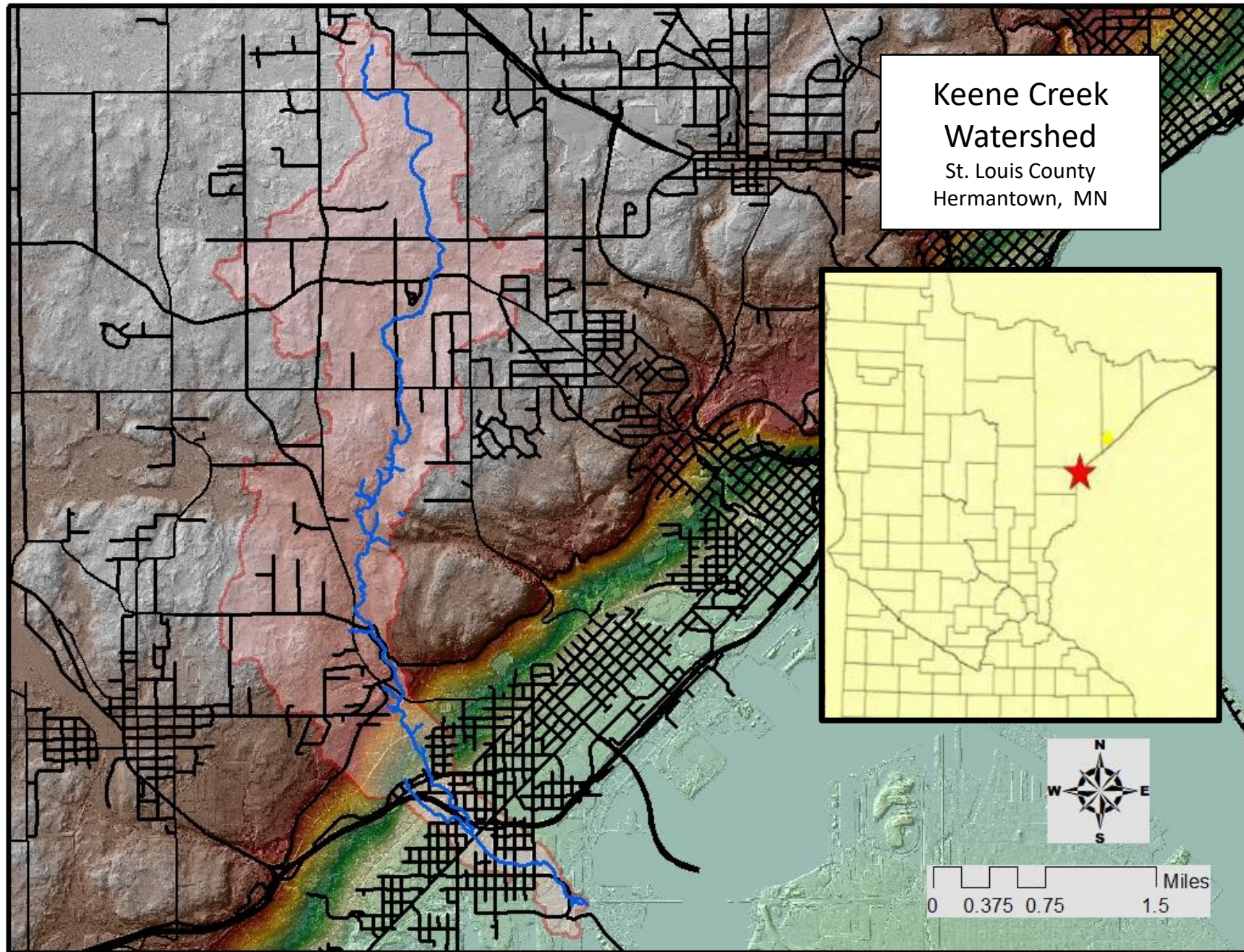
There are no projects known to any of the project partners within the same geographic area or timeframe that would interact with the proposed project in such a way as to cause cumulative effects.

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

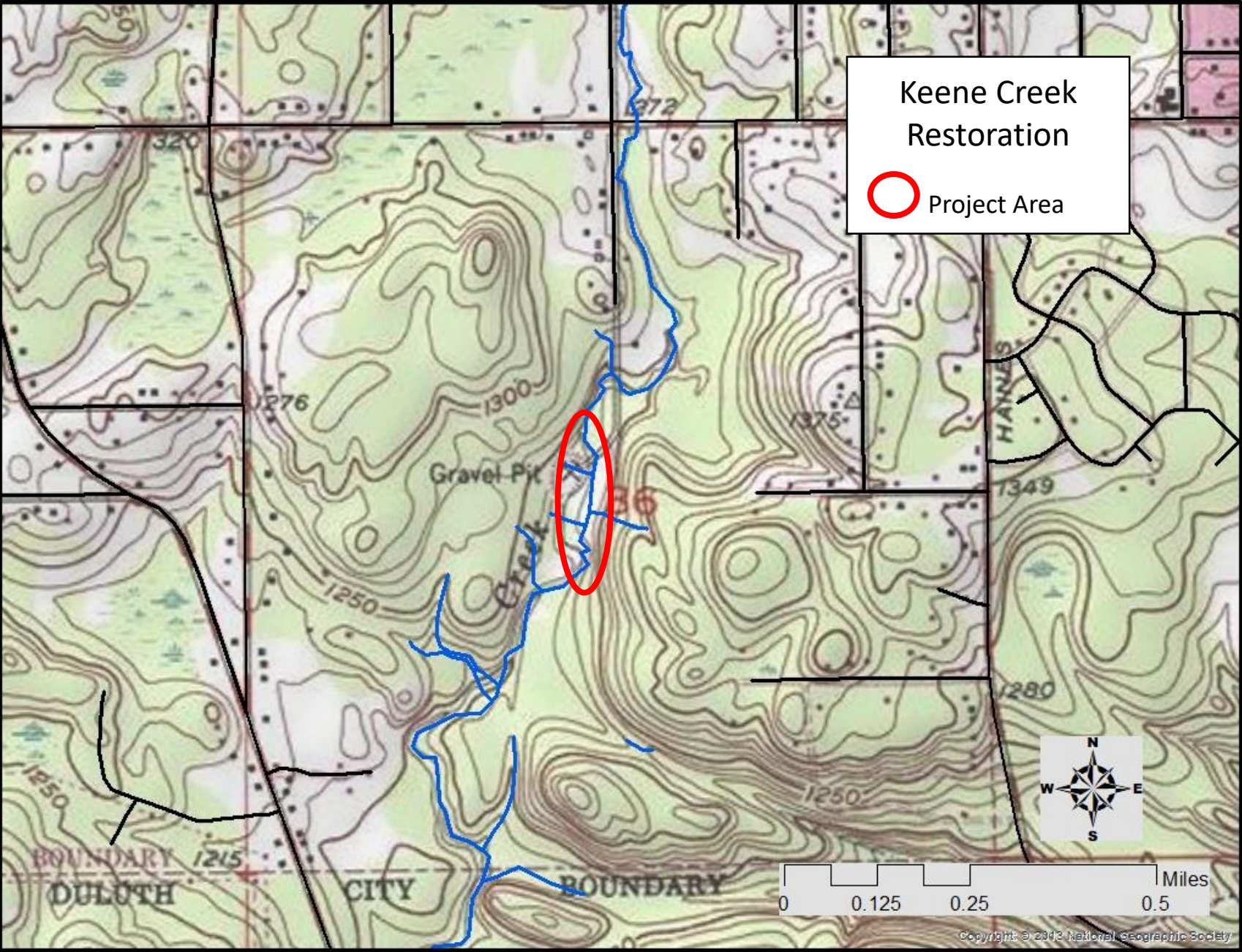
Increased turbidity or sedimentation from this project would be short-term and have no long-term consequences. A slight increase in downstream sedimentation due to in-channel construction should be expected. The expected increase in sedimentation is small and would not affect spawning areas for trout or aquatic invertebrates.

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

All potential environmental effects have been addressed.







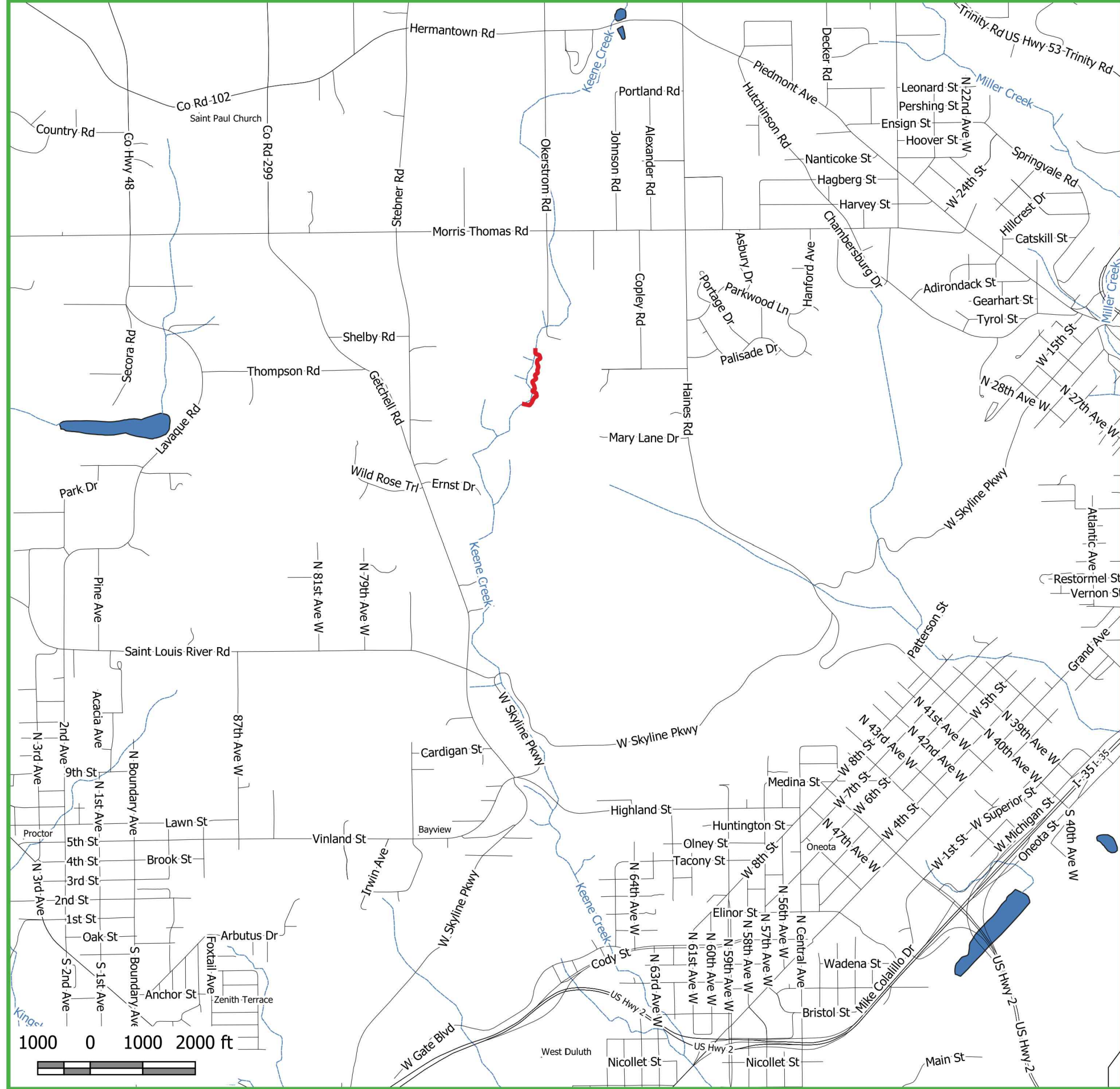
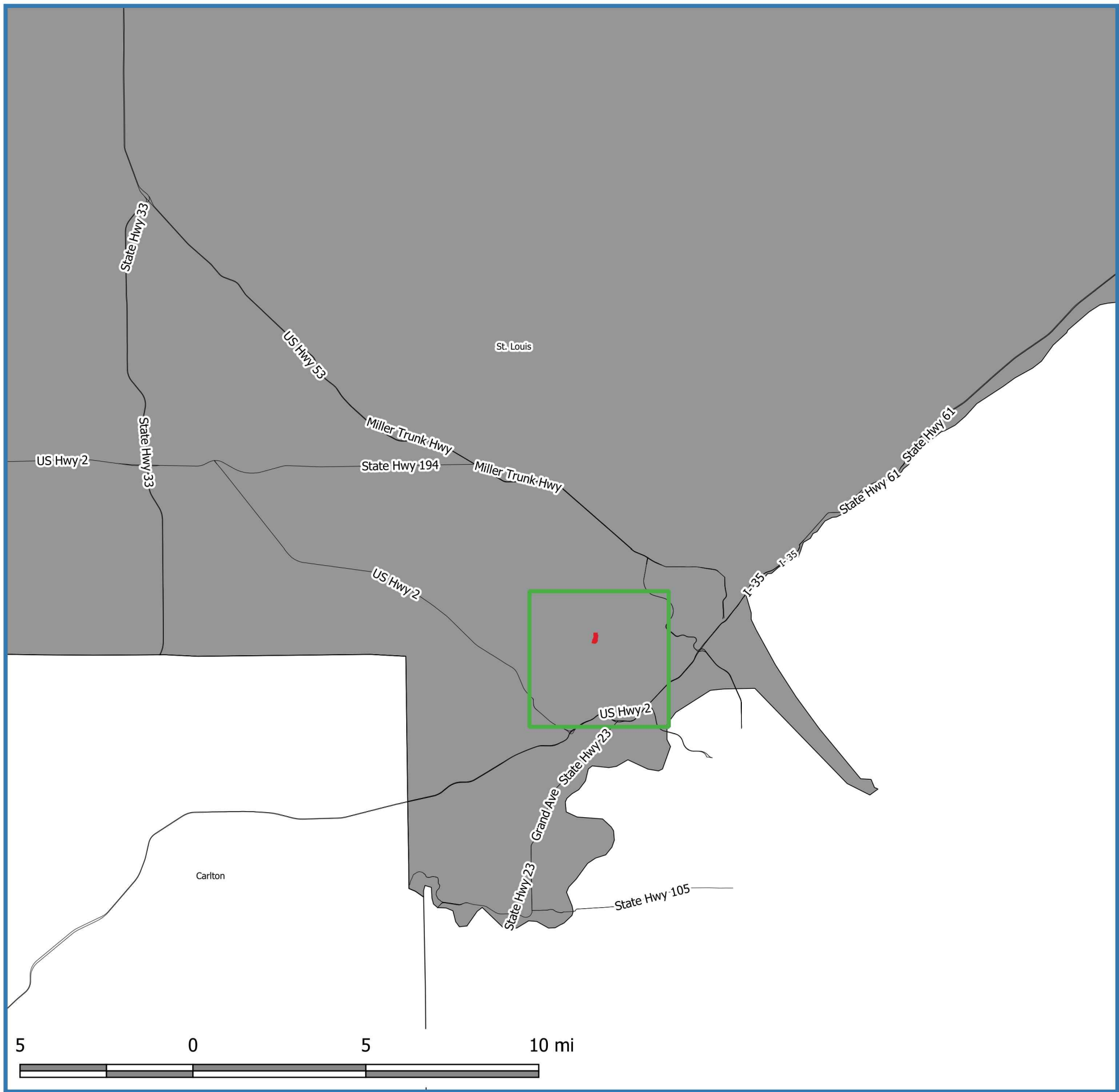
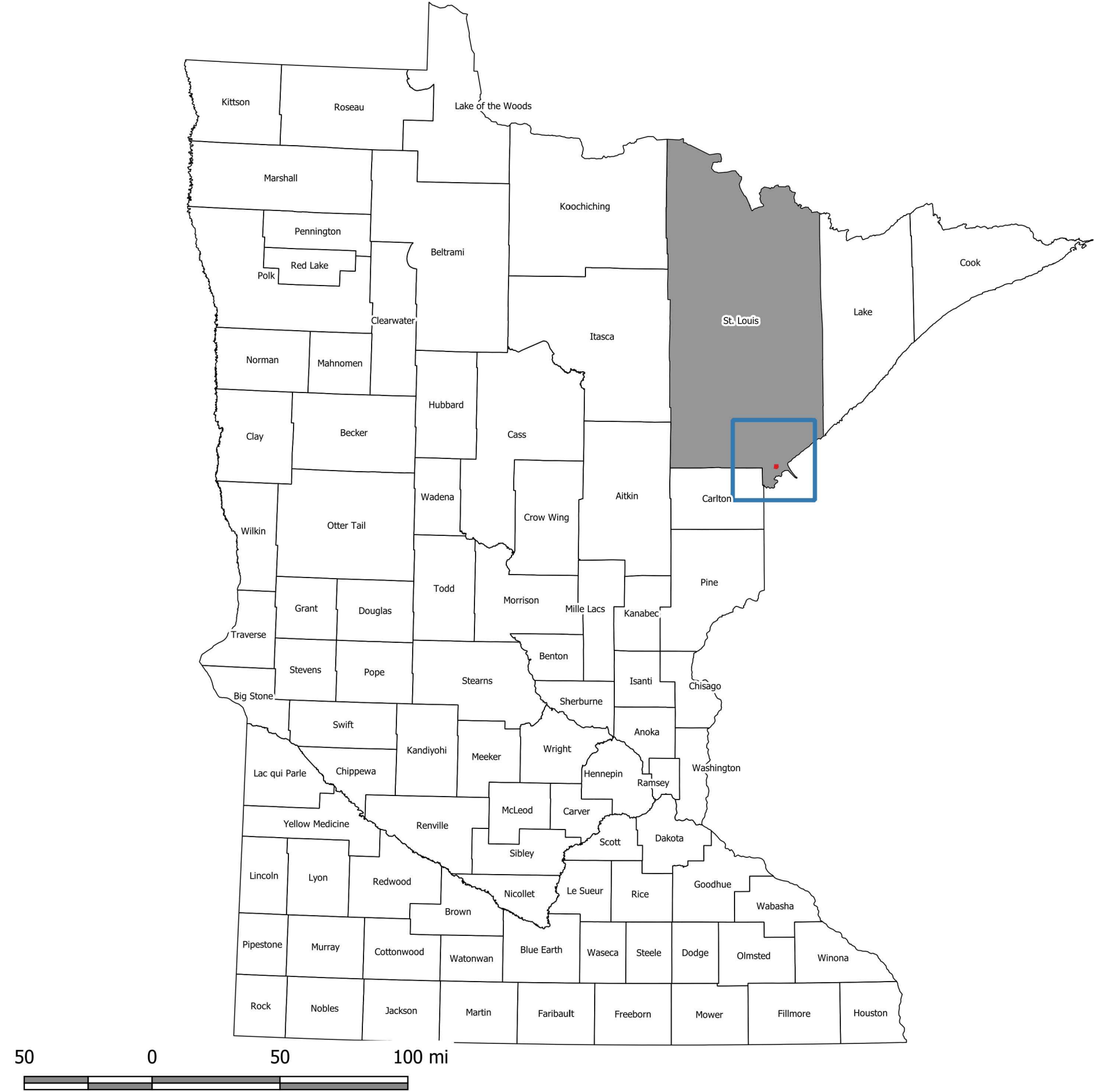


# DRAFT 60% - NOT FOR CONSTRUCTION

## KEENE CREEK PARK

## STREAM RESTORATION

CITY OF HERMANTOWN  
ST. LOUIS COUNTY, MN  
7/27/2020



Sheet List Table			
SHEET #	SHEET TITLE	DRAWING TITLE	REVISION DATE
1	COVER	keene_cover.dwg	Monday, July 27, 2020 3:13:28 PM
2	NOTES	keene_cover.dwg	Monday, July 27, 2020 3:13:28 PM
3	OVERVIEW	keene_pp.dwg	Monday, July 27, 2020 2:07:32 PM
4	UPPER KEENE CR PP - (1)	keene_pp.dwg	Monday, July 27, 2020 2:07:32 PM
5	UPPER KEENE CR PP - (2)	keene_pp.dwg	Monday, July 27, 2020 2:07:32 PM
6	UPPER KEENE CR PP - (3)	keene_pp.dwg	Monday, July 27, 2020 2:07:32 PM
7	UPPER KEENE CR SECTION - (1)	keene_xs.dwg	Monday, July 27, 2020 12:13:19 PM
8	VEG - PLAN	keene_vegetation.dwg	Monday, July 27, 2020 2:32:18 PM
9	DTL - CHANNEL DIMENSIONS	keene_masterDetail.dwg	Monday, July 27, 2020 2:33:38 PM
10	DTL - HABITAT LOGS	keene_masterDetail.dwg	Monday, July 27, 2020 2:33:38 PM
11	DTL - LOG CONSTRUCTED RIFFLE	keene_masterDetail.dwg	Monday, July 27, 2020 2:33:38 PM
12	DTL - TOE WOOD	keene_masterDetail.dwg	Monday, July 27, 2020 2:33:38 PM
13	DTL - LOG J-HOOK	keene_masterDetail.dwg	Monday, July 27, 2020 2:33:38 PM
14	DTL - GRAVEL RIFFLE	keene_masterDetail.dwg	Monday, July 27, 2020 2:33:38 PM
15	DTL - ROCK GLIDE RIFFLE	keene_masterDetail.dwg	Monday, July 27, 2020 2:33:38 PM
16	DTL - PLANTING	keene_masterDetail.dwg	Monday, July 27, 2020 2:33:38 PM



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NOTES:

GENERAL CONSTRUCTION NOTES:

1. THE WORK ON THIS PROJECT SHALL ADHERE TO THE FOLLOWING SPECIFICATIONS, STANDARDS AND/OR REGULATIONS: MN DOT STANDARD SPECIFICATIONS FOR CONSTRUCTION, 2016 EDITION, THE FOLLOWING SPECIFICATIONS EITHER MODIFY OR REPLACE APPROPRIATE MN DOT SPECIFICATIONS.
2. INSTREAM STRUCTURES SHALL BE INSTALLED AS THE CHANNEL IS BEING CONSTRUCTED AND NOT POST CONSTRUCTION. FILTER FABRIC INSTALLED AS PART OF THE INSTREAM STRUCTURE SHALL BE MIRAFI 170N SERIES NONWOVEN GEOTEXTILE, OR ENGINEER'S APPROVED ALTERNATIVE, UNLESS OTHERWISE SPECIFIED IN STRUCTURE DETAILS OR SPECIFICATIONS.
3. WHERE PRACTICABLE, EXISTING TREES AND VEGETATION SHOULD BE LEFT IN PLACE TO FACILITATE NATURAL REGENERATION AND SOIL STABILIZATION.
4. DEFINITIONS:

A. BANKFULL ELEVATION IS THE POINT OF INCIPIENT FLOODING IN AN ALLUVIAL CHANNEL. THIS ELEVATION IS THE REFERENCE FOR DEPTHS ON OR ALONG THE CHANNEL PROFILE AND STRUCTURES DESCRIBED IN THESE SHEETS.

B. THE BANKFULL BENCH IS A CONSTRUCTED FLOODPLAIN ADJACENT TO THE CHANNEL. THE BANKFULL BENCH IS CONSTRUCTED AT THE BANKFULL ELEVATION.

C. THE THALWEG IS THE LOWEST PORTION OF THE CHANNEL.

D. THE VANE LENGTH IS THE STRAIGHT LINE DISTANCE BETWEEN THE VANE ARM AND A LINE TANGENT TO THE STREAMBANK AT THE POINT WHERE THE VANE ARM INTERSECTS THE STREAMBANK.

E. THE VANE ANGLE IS THE ANGLE BETWEEN THE VANE ARM AND A LINE TANGENT TO THE STREAMBANK AT THE POINT WHERE THE VANE ARM INTERSECTS THE STREAMBANK.

F. SOD MATS ARE GRASS AND WILLOW TRANSPLANTS THAT STILL CONTAIN ROOTING DEPTH. APPROXIMATELY 9-12IN OF DEPTH WILL BE NEEDED WHEN HARVESTING THE SOD MATS.
6. THE ENGINEER WILL STAKE OUT THE CENTERLINE OF THE CHANNEL AND BE ON SITE FOR IMPLEMENT CONSTRUCTION OF STRUCTURE AND TO CONFIRM ELEVATIONS. THE CONTRACTOR SHALL HAVE SURVEY LEVEL EQUIPMENT ON SITE TO SET STRUCTURES AND BE RESPONSIBLE FOR ANY AND ALL ELEVATIONS. ANY COST ASSOCIATED WITH CHANGING STRUCTURE LOCATIONS OR ALIGNMENT SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION. STAKING MAY BE OMITTED FOR PORTIONS OF THE STREAM WHEN SURVEY-GRADE GPS IS USED TO CONSTRUCT THE CHANNEL. IF GPS IS USED IN LIEU OF STAKING THE CHANNEL IN THE FIELD, THE CONTRACTOR ASSUMES ALL RESPONSIBILITY FOR THE STREAM BEING CONSTRUCTED AS DESIGNED, INCLUDING ANY ISSUES RELATED TO PROJECTIONS, BASE POINTS OR CONVERSION OF DIGITAL TERRAIN MODELS.
7. PRIOR TO CLEARING AND GRUBBING, THE ENGINEER WILL MARK THE LIMITS OF CLEARING NEAR TREES. SOME MINOR ADJUSTMENT OF CHANNEL ALIGNMENT MAY BE REQUIRED TO PRESERVE TREES OR MINIMIZE IMPACT TO TREES.
8. ANY HARVESTING OF WILLOWS AND SOD FROM ONSITE MUST BE APPROVED BY THE ENGINEER.
9. CONTRACTOR SHALL MINIMIZE, TO THE MAXIMUM EXTENT POSSIBLE, IMPACTS TO THE ADJACENT TREES. CONSTRUCTION EQUIPMENT TRACKS AND PATHWAYS SHALL BE GRADED AND RECONTOURED AFTER CONSTRUCTION TO PREVENT RILL AND GULLY EROSION.
10. THE PROPOSED GRADING IS SHOWN ON THESE PLAN SHEETS. THE CONTRACTOR MAY EXTEND THE LIMITS OF DISTURBANCE ONLY WITH THE APPROVAL OF THE ENGINEER.
11. CONTRACTOR SHALL USE AN EXCAVATOR WITH A HYDRAULIC THUMB TO INSTALL INSTREAM STRUCTURES.
12. CHANNEL RELOCATION WORK SHALL BE COMPLETED AND STABILIZED PRIOR TO ALLOWING FLOW TO ENTER INTO THE NEWLY CONSTRUCTED STREAM CHANNEL. THE CONTRACTOR SHALL NOT OPEN UP MORE THAN 200 FEET OF CHANNEL WITHOUT EROSION CONTROL BLANKET IN PLACE OR BY APPROVAL OF THE ENGINEER.
13. IF THE EXISTING GROUND IS LESS THAN 0.2 FEET HIGHER THAN THE PROPOSED BANKFULL ELEVATION, IT IS NOT NECESSARY TO EXCAVATE MATERIAL TO THE PROPOSED ELEVATION SHOWN ON THE PROFILE.
14. THE SURFACE OF ALL INSTREAM STRUCTURES SHALL BE FINISHED TO A SMOOTH LINE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR THE VANE SLOPES AND INVERT ELEVATIONS SHALL BE WITHIN 0.1 VERTICAL FEET OF THE GRADES AND ELEVATIONS INDICATED. ALL GAPS OR VOIDS BETWEEN THE ROCKS SHALL BE PLUGGED WITH SMALL GRAVEL TO FORM A TIGHT-FITTING SEAL.
15. CONSTRUCTION SPECIFICATIONS FOR BANKFULL CHANNEL DIMENSIONS OR CROSS SECTIONS WILL BE HELD TO THE DIMENSIONS SHOWN ON THE TYPICAL CROSS SECTIONS. ELEVATIONS SHALL BE CONSTRUCTED WITHIN 0.1 VERTICAL FEET; WIDTHS AND MEAN DEPTHS MUST FALL WITHIN THE RANGES SHOWN IN THE DRAWINGS.
16. THE IN-STRUCTURE BID ITEMS SHALL INCLUDE ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT THE STRUCTURE. AFTER THE STRUCTURE IS COMPLETE AND FLOW IS RESTORED TO THE CHANNEL, SOME ADJUSTMENT TO THE STRUCTURE OR ADDITIONAL STABILIZATION MEASURES MAY BE NECESSARY TO ACHIEVE DESIRED EFFECT. ANY COSTS ASSOCIATED WITH THESE ADJUSTMENTS SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
17. THE EROSION CONTROL BLANKET. THE BLANKET SHALL BE ROLLED OUT IN THE DIRECTION OF THE ANTICIPATED RUN-OFF FLOW. INSTALL BLANKET IN ACCORDANCE WITH DETAIL SHOWN HEREIN. REWORKING OF AREAS THAT DO NOT ESTABLISH VEGETATION OR BECOME UNSTABLE SHALL BE NECESSARY IF THE EROSION CONTROL BLANKET SEPARATES FROM THE SOIL. SEE SEEDING AND PLANTING DETAIL FOR BLANKET SPECIFIATIONS. SEEDING OF THE BANKFULL BENCH SHALL BE IN ACCORDANCE WITH THE PLANTING TABLE. REFER TO CONTROL BLANKET DETAIL IF

THE TIMING OF PROJECT IS SUCH THAT RIPARIAN SEED MIX CANNOT BE PLACED IN THE FALL, THEN THE CONTRACTOR SHALL SEED WITH TEMPORARY COVER ACCORDING TO THE EROSION AND SEDIMENT PLAN OR APPROVED BY THE ENGINEER UNTIL RIPARIAN MIX CAN BE SEEDED IN THE SPRING.

18. EXCESS SPOIL MATERIAL MAY BE SPREAD AND GRADED ONSITE OR IN THE ONSITE PIT AS APPROVED BY THE ENGINEER. PLACEMENT OF ANY ON-SITE OR OFF-SITE SPOIL MATERIAL SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
19. SPOIL AREAS SHALL BE SEEDED WITH TEMPORARY VEGETATION WITHIN 7 DAYS FOLLOWING GRADING.
20. CONTRACTOR SHALL CALL GOPHER STATE ONE CALL FOR UTILITY MARKING AT LEAST 48 HOURS PRIOR TO START OF CONSTRUCTION. THE LOCATIONS OF THE UTILITIES SHOWN ON THESE DRAWINGS ARE APPROXIMATE ONLY (UTILITY QUALITY LEVEL D) AND MAY NOT BE ACCURATE. LOCATING UTILITIES IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE ENGINEER AND PROJECT OWNER WILL NOT BE RESPONSIBLE FOR ANY DAMAGES TO UTILITIES.
21. CONTRACTOR SHALL UTILIZE NATIVE MATERIAL FROM THE SITE WHERE AVAILABLE AND ALLOWED BY THE ENGINEER. NATIVE MATERIAL THAT CAN BE FOUND ON SITE INCLUDE TREES THAT CAN PROVIDE LIVE STAKES AND TREES THAT CAN BE USED FOR LOG STRUCTURES AND WOOD DEBRIS.
22. AFTER CONSTRUCTION, THE ACCESS ROADS LEADING TO THE PROJECT SITE SHALL BE RESTORED TO AS GOOD OR BETTER CONDITION THAN BEFORE CONSTRUCTION AT THE ENGINEER'S DISCRETION.
23. FOOTER DEPTH ON ALL STRUCTURES REQUIRING FOOTERS SHALL BE AT LEAST 6 TIMES GREATER THAN THE DROP BETWEEN THE STRUCTURE AND THE FOOTERED STRUCTURE DIRECTLY UPSTREAM OR APPROVED BY THE ONSITE ENGINEER.

EROSION/SEDIMENTATION CONTROL NOTES:

1. ALL CONTROL MEASURES SHALL BE CHECKED, AND REPAIRED AS NECESSARY, MONTHLY IN DRY PERIODS, AND WITHIN 24 HOURS AFTER ANY RAINFALL AT THE SITE OF .75 INCHES OR GREATER WITHIN A 24 HOUR PERIOD. DAILY CHECKING AND, IF NECESSARY, REPAIRING SHALL BE DONE DURING PROLONGED RAINFALLS. THE PERMITTEE SHALL MAINTAIN WRITTEN RECORDS OF SUCH CHECKS AND REPAIRS ON-SITE AT ALL TIMES, AND RECORDS SHALL BE SUBJECT TO INSPECTION AT ANY REASONABLE TIME.
2. THE CONSTRUCTION ACCESS POINTS SHALL BE MAINTAINED AS REQUIRED TO PREVENT SILT/SEDIMENT FROM LEAVING THE SITE. THIS INCLUDES BUT IS NOT LIMITED TO WASH DOWN OF THE CONSTRUCTION ACCESS POINTS, INSTALLING AND UTILIZING A VEHICLE WASH DOWN AREA, INSTALLING ADDITIONAL STONE, ETC.
3. TEMPORARY DIVERSION OF RUNOFF/RUNON WATER SHALL BE INSTALLED AS NEEDED TO FACILITATE CONSTRUCTION OR AS DIRECTED ON-SITE BY THE ENGINEER.
4. ALL DISTURBED AREAS SHALL BE PERMANENTLY STABILIZED IMMEDIATELY AFTER THE COMPLETION OF THE GRADING OPERATION. AREAS REQUIRING COCONUT COIR MATTING SHALL BE SEEDED AND MULCHED FOR STABILIZATION PRIOR TO THE INSTALLATION OF THE MATTING.
5. TEMPORARY STABILIZATION OF DISTURBED AREAS MUST BE INITIATED IMMEDIATELY WHENEVER WORK TOWARD PROJECT COMPLETION AND FINAL STABILIZATION OF ANY PORTION OF THE SITE HAS TEMPORARILY CEASED AND WILL NOT RESUME FOR A PERIOD EXCEEDING THIRTEEN (7) CALENDAR DAYS. THOSE AREAS SHALL BE SEEDED AND MULCHED IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS.
6. NECESSARY MEASURES SHALL BE TAKEN TO PRODUCE AND MAINTAIN AN ACCEPTABLE STAND OF GRASS. SAID MEASURES TO INCLUDE (BUT NOT LIMITED TO) WATERING, RE-SEEDING, REGRADING ERODED AREAS, RE-FERTILIZING, ETC.
7. CONTRACTOR IS RESPONSIBLE FOR KEEPING MUD AND DEBRIS OFF CITY/STATE STREETS AND ROW. CLEANUP IS REQUIRED DAILY.
8. ALL HAZARDOUS SUBSTANCES USED FOR THIS PROJECT (PAINT, OIL, GREASE, AND OTHER PETROLEUM PRODUCTS) SHALL BE STORED IN ACCORDANCE WITH SPCC REGULATIONS. THESE SUBSTANCES SHALL BE STORED AWAY FROM DRAINS AND DITCHES IN WATERTIGHT CONTAINERS. DISPOSAL OF THESE SUBSTANCES SHALL BE IN ACCORDANCE WITH ADEM REGULATIONS. DAILY INSPECTIONS SHALL BE PERFORMED FOR LEAK DETECTION. IF LEAKS OCCUR, APPROPRIATE ACTION SHALL BE TAKEN TO CONTAIN AND REMEDIATE THE SPILL. ADEQUATE TRASH CONTAINERS SHALL BE KEPT ON SITE FOR THE DISPOSAL OF CONSTRUCTION MATERIALS WASTE. NECESSARY MEASURES SHALL BE TAKEN TO PREVENT ANY TRASH OR OTHER POLLUTANTS FROM ENTERING "WATERS OF THE UNITED STATES."
9. ALL TEMPORARY MEASURES SHALL BE REMOVED ONCE ACCEPTABLE PERMANENT STABILIZATION IS ACHIEVED. THE ENGINEER SHALL DETERMINE IF THE PERMANENT STABILIZATION IS ACCEPTABLE.

SPECIAL NOTES:

THE ELEVATIONS SHOWN HEREIN ARE BASED ON DATA SURVEY THAT ENCOMPASSES THE EXISTING GROUND SURFACE FROM WHICH ALL COMPUTATIONS FOR CUT/FILL ARE BASED. SLIGHT DISCREPANCIES BETWEEN THE EXISTING GROUND DIGITAL SURFACE AND FIELD CONDITIONS CAN RESULT IN SIGNIFICANT VARIATIONS IN TOTAL EXCAVATED QUANTITIES. THUS, THE CONTRACTOR SHALL COMPARE QUANTITIES OF MATERIAL EXCAVATED TO THOSE SHOWN ON THE DRAWINGS TO MANAGE THE MOVEMENT OF MATERIAL ACROSS THE SITE.

TOPOGRAPHIC INFORMATION:

EXISTING GROUND SURFACES ARE BASED ON A SURVEY COMPLETED IN MAY 2020 BLENDED WITH STATE OF MN LIDAR. BENCHMARKS WERE SET THROUGHOUT THE SITE AND CAN BE PROVIDED AT ANY TIME. CHANGES IN EXISTING SURFACES SHALL BE INCIDENTAL TO CONSTRUCTION.

KEENE CREEK PARK STREAM RESTORATION CITY OF HERMANTOWN ST. LOUIS COUNTY, MN					
APPROVED BY: XX	REV	DESCRIPTION	CHECKED BY: XX	DRAWN BY: GET	APPRV
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DRAFT 60% - NOT FOR CONSTRUCTION					
NOTES					



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DULUTH, MN 55803

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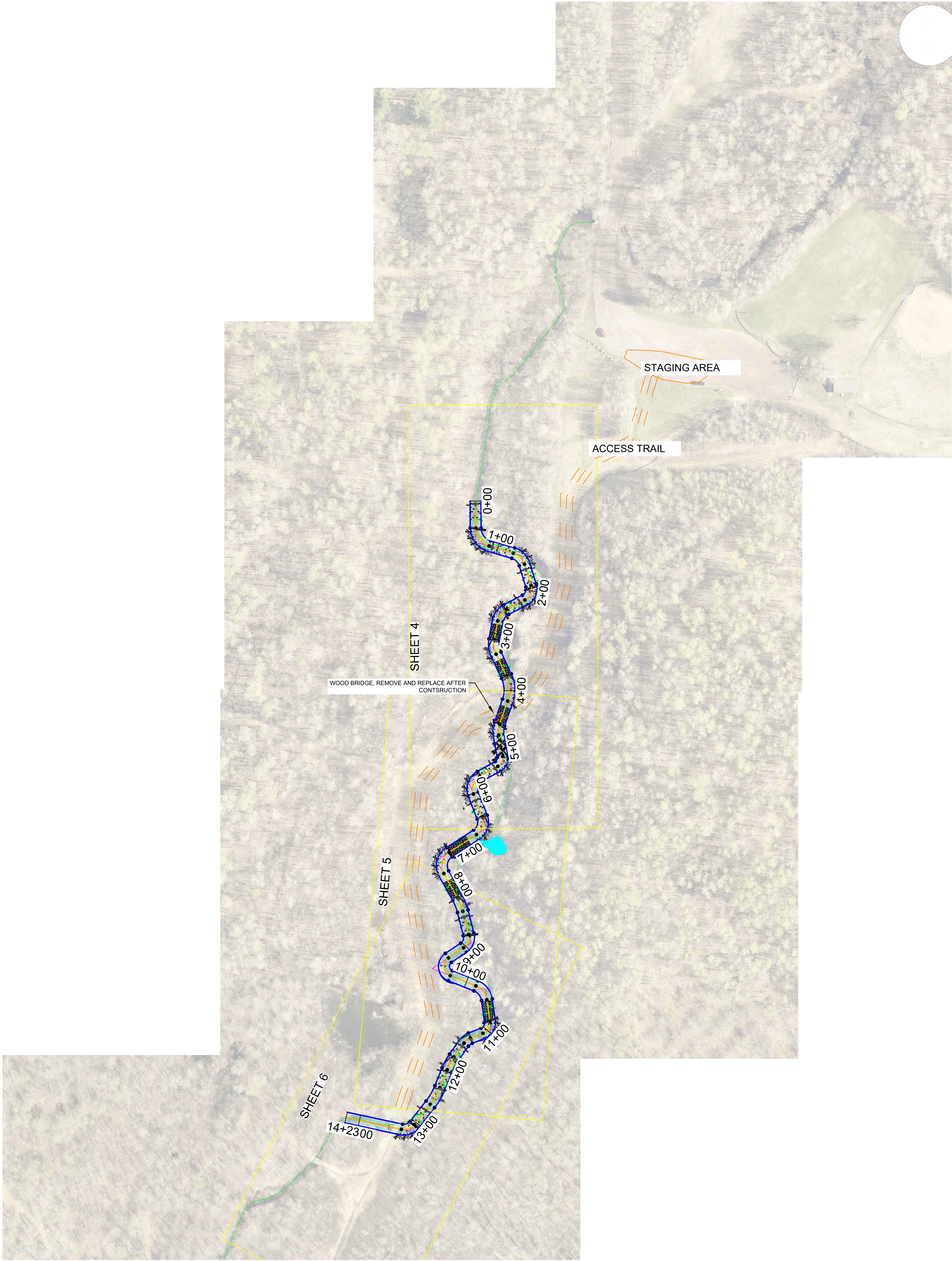
DATE: 7/27/2020

SHEET NUMBER  
2 OF 16



STATEMENT OF ESTIMATED QUANTITIES					
NOTE	NO.	ITEM	SPEC.	QUANTITY	UNIT
	1	MOBILIZATION	2021.501	1	LS
	2	ACCESS TRAIL, INSTALLATION/DECOMMISSION	2021.600	1	LS
	3	CUT COMMON CHANNEL EXCAVATION	2105.511	1200	CU YD
	4	FILL COMMON CHANNEL EXCAVATION	2105.511	800	CU YD
1	5	STREAM DIVERSION SYSTEM	PLANS	1	LS
	6	J-HOOK	PLANS	8	EACH
2	7	ROCK GLIDE RIFFLE	PLANS	10	EACH
2	8	GRAVEL RIFFLE	PLANS	6	EACH
3	9	CLASS II RIP RAP FOR RIFFLE AMENDMENT	PLANS	139	CY
	10	LOG CONSTRUCTED RIFFLE	PLANS	1	EACH
4	11	TOE WOOD, COMPLETE	2577.610	540	LIN FT
5	12	RIFFLE LOGS	PLANS	20	EACH
5	13	POINT BAR LOGS	PLANS	14	EACH
5	14	RUN LOGS	PLANS	8	EACH
5	15	RIFFLE HABITAT ROCKS	PLANS	200	EACH
5	16	POOL HABITAT ROCKS	PLANS	21	EACH
	17	MULCH MATERIAL TYPE 1	2575.511	2.0	TON
	18	TREE, 2.0' HEIGHT, 1 GALLON POT, COMPLETE WITH DEER PROTECTION WHERE NOTED	2571.501	626	EACH
	19	DECIDUOUS SHRUB, 1.5" HT CONTAINERIZED	2571.505	347	EACH
	20	SEED MIXTURE FLOODPLAIN, 34-361	2575.502	25	LBS
	21	SEED MIXTURE SIDE SLOPES, 36-311	2575.502	36	LBS
	22	SEEDING		0.97	ACRES
	23	CLEAR FOREST RESTORATION AREAS	PLANS	0.23	ACRES
	24	EROSION CONTROL BLANKETS CATEGORY 3N2S	2575.523	1373	SQ YD
6	25	EROSION CONTROL BLANKET- 700 GRAM COCUNUT FIBER WITH CAT. 3N BLANKET	2575.601	1024	SQ YD

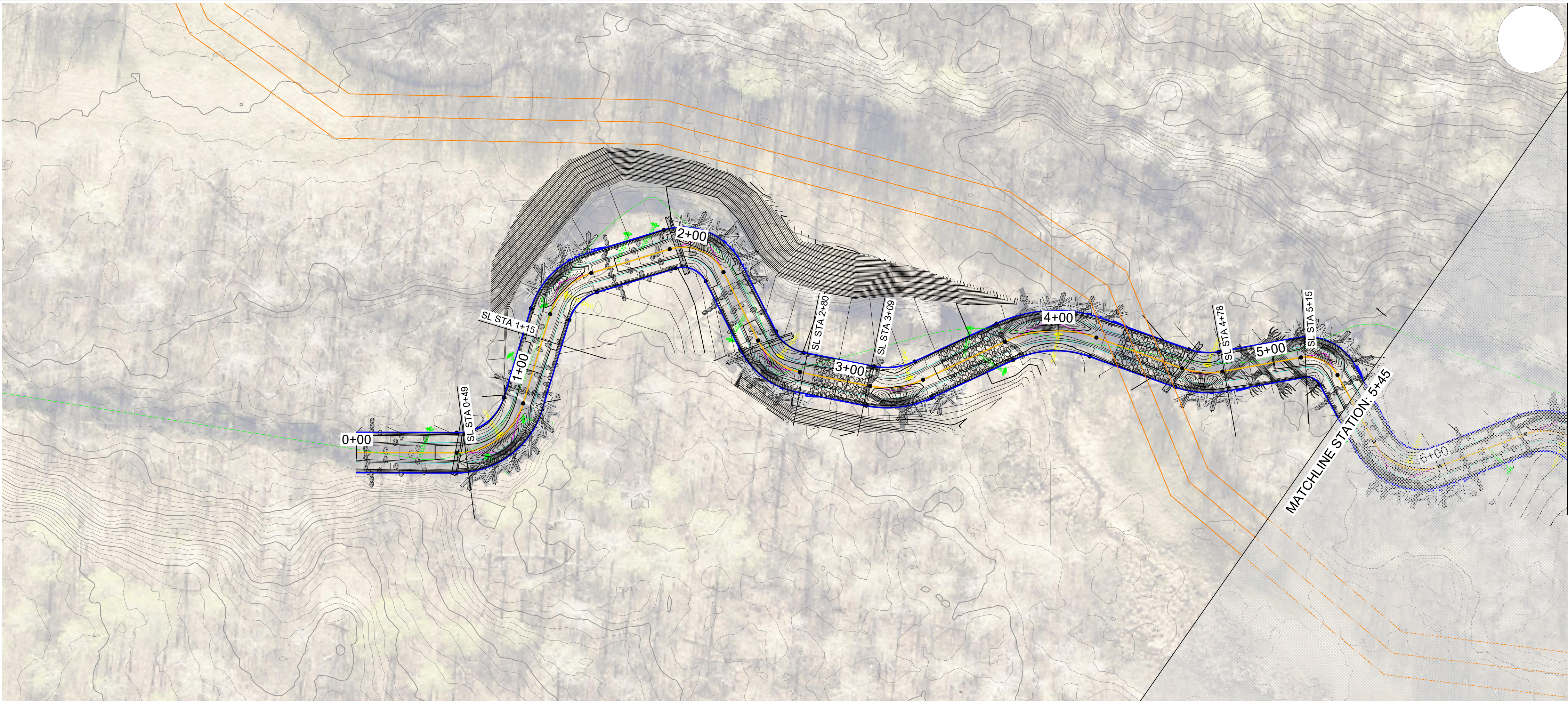
- QUANTITY NOTES:
- THIS ITEM CONSISTS OF DIVERSION OF THE STREAM DURING LOW FLOW PERIODS DURING CONSTRUCTION. THE ESTIMATED LOW FLOW IS 1 CFS. THE DIVERSION CAN EITHER BE THROUGH PUMPING OR CHANNEL DIVERSION. DIVERSION PLAN MUST BE SUBMITTED TO THE ENGINEER PRIOR TO PERFORMING WORK ON THE STREAM
  - THESE ITEMS INCLUDE ALL NECESSARY WORK TO CONSTRUCT THE RIFFLES AS SHOWN IN THE PLANS. NOT INCLUDED IS THE ADDITION OF HABITAT WOOD, HABITAT ROCKS, OR IMPORT OF RIP RAP MATERIAL.
  - THIS ITEM IS INTENDED FOR THE INCORPORATION INTO THE RIFFLE SUBSTRATE.
  - THIS ITEM INCLUDES ALL NECESSARY WORK TO COMPLETE THE TOEWOOD INSTALLATION INCLUDING THE COIR WRAPS AND ALL WOOD IMPORT.
  - THESE ITEMS INCLUDES ALL MATERIALS AND REQUIRED FOR THE INSTALLATION OF WOOD AND ROCKS IN THE RIFFLES AND POOLS AS NOTED ON THE DETAILS AND LOCATIONS ON THE PLAN VIEWS.
  - THIS ITEM IS DOES NOT INCLUDE THE COIR NEEDED FOR THE COIR WRAPS REQUIRED FOR THE TOEWOOD INSTALLATION.



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KEENE CREEK PARK STREAM RESTORATION CITY OF HERMANTOWN ST. LOUIS COUNTY, MN												
DRAFT 60% - NOT FOR CONSTRUCTION ----- ----- OVERVIEW												
 MINNESOTA TROUT UNLIMITED P.O. BOX 845 CHANHASSEN, MN 55317 -----  BEAVER RIVER CONSULTING, LLC. 5752 EALGE VIEW DRIVE DULUTH, MN 55803 -----												
FOR REVIEW NOT FOR CONSTRUCTION												
DATE: 7/27/2020 SCALE (34"x22"): 1" = 100' SCALE (17"x11"): 1" = 200'												
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SHEET NUMBER 3 OF 16												



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**PLAN LEGEND**

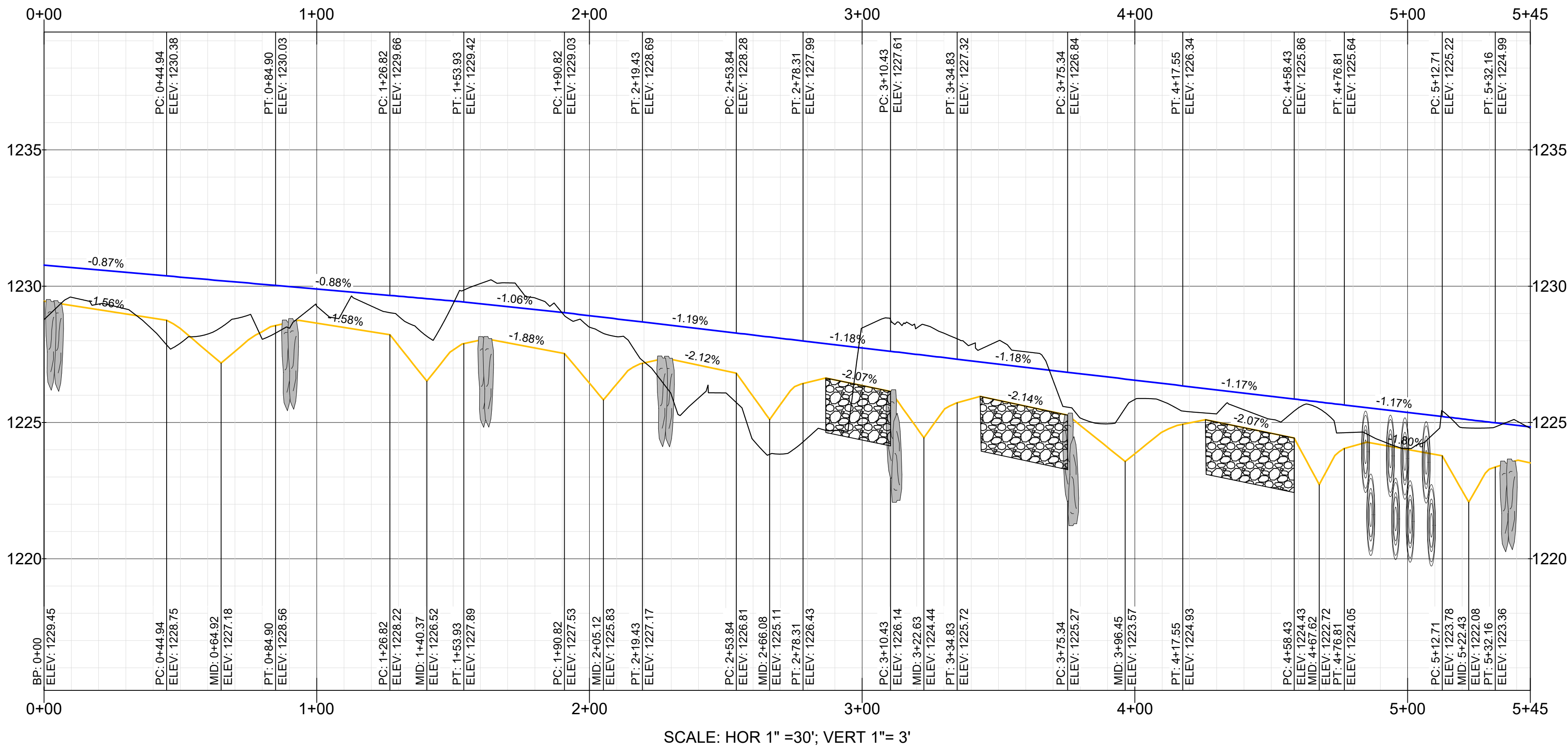
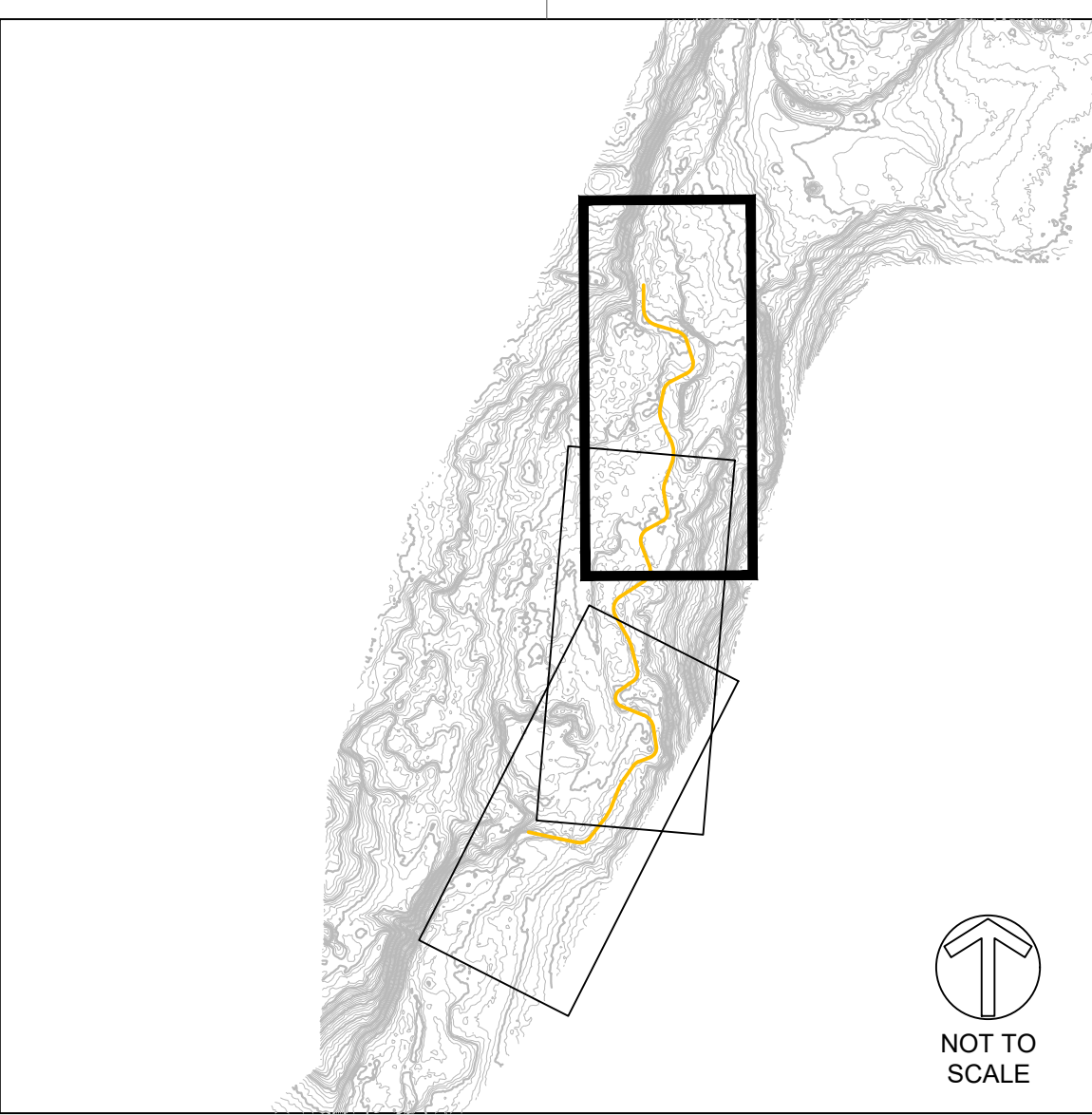
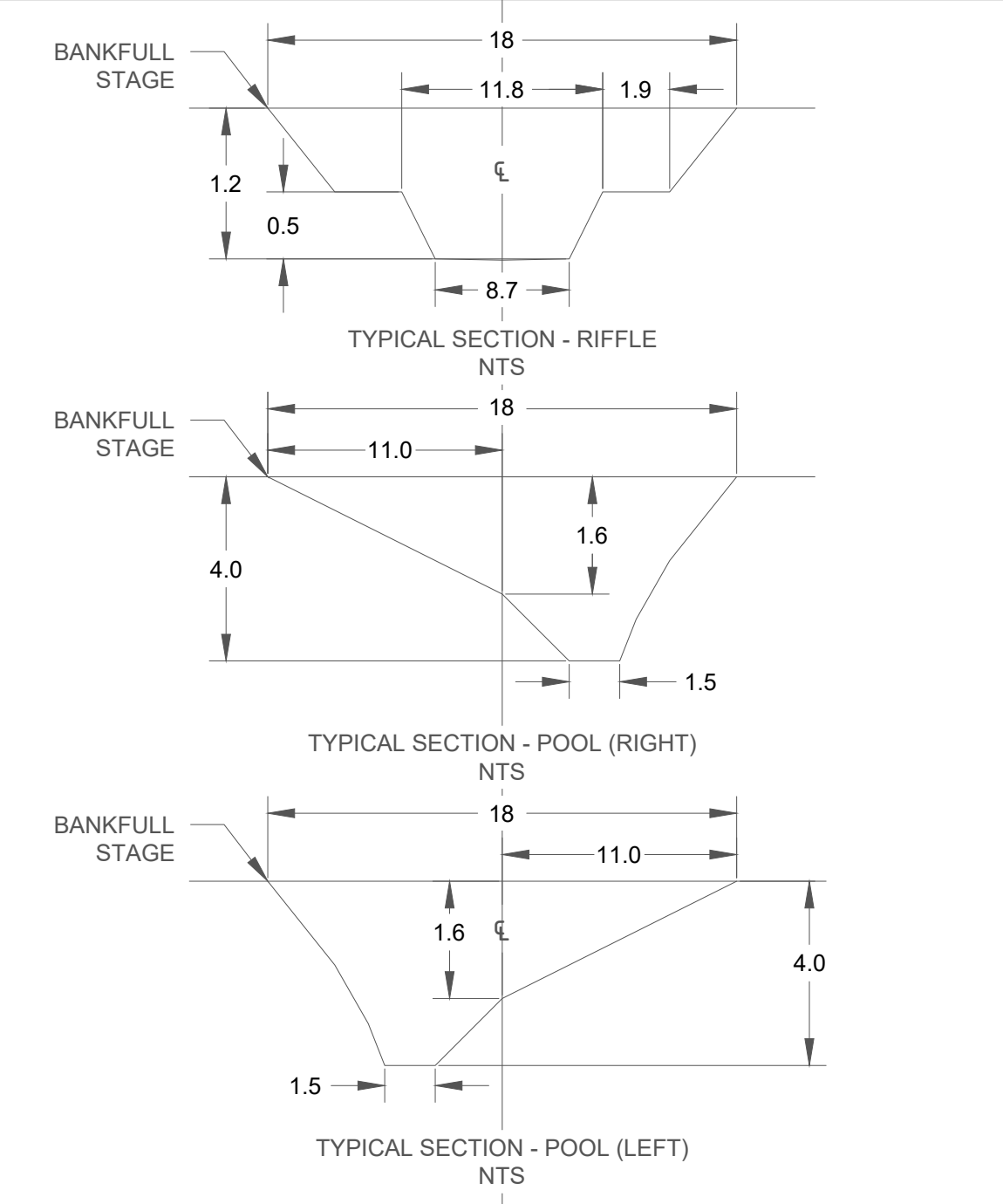
- PROPOSED STREAM CENTER LINE
- PROPOSED INNER BERM
- PROPOSED GEOMORPHIC CHANNEL TOB
- EXISTING THALWEG
- LIMITS OF DISTURBANCE
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR

**PROFILE LEGEND**

- PROPOSED STREAM CENTER LINE
- PROPOSED BANKFULL TOB
- EXISTING GROUND

**STRUCTURE**

- BOULDER
- HEADER AND FOOTER BOULDER
- LOG
- AUGMENTED RIFFLE



**APPROVED BY: XX** **CHECKED BY: XX** **DRAWN BY: GET**

REV	DESCRIPTION	APPROVED
1	DRAFT 30%	XX
XX	DRAFT 60%	XX
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**KEENE CREEK PARK  
STREAM RESTORATION  
CITY OF HERMANTOWN  
ST. LOUIS COUNTY, MN**

**DRAFT 60% - NOT FOR CONSTRUCTION  
UPPER KEENE CREEK  
PLAN AND PROFILE - (1)  
STA 0+00 TO 5+45**

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CHANHASSEN, MN 55317

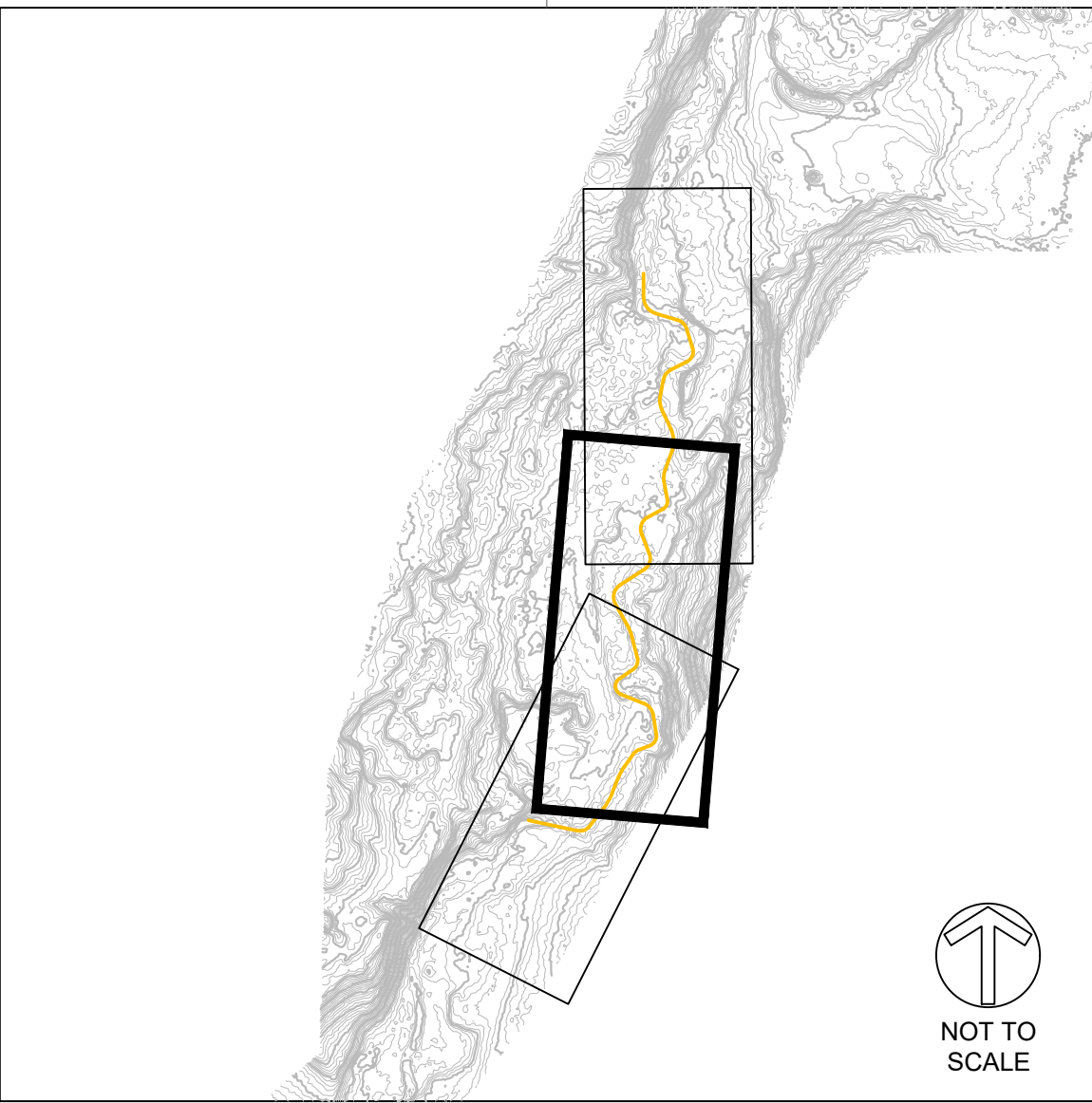
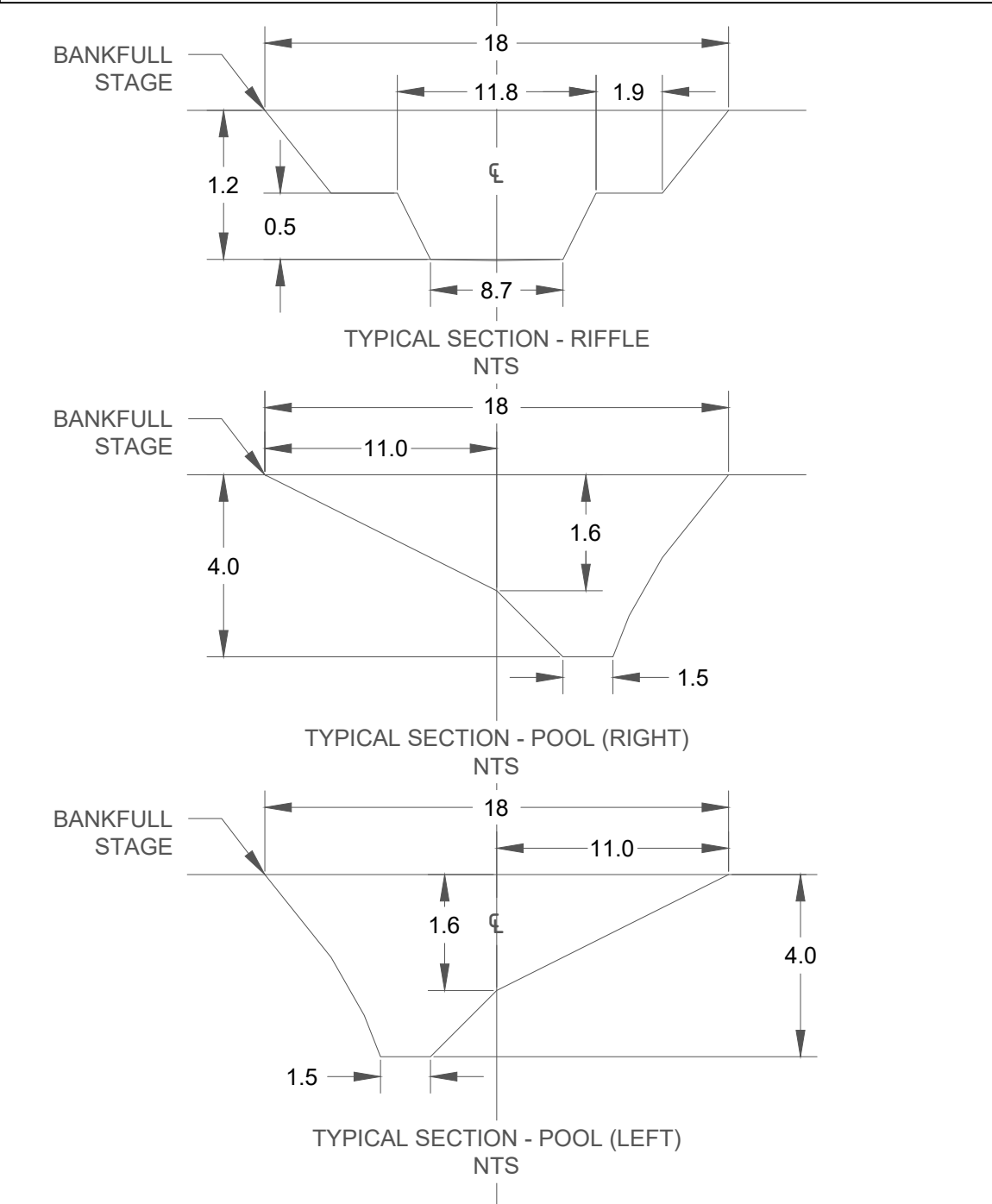
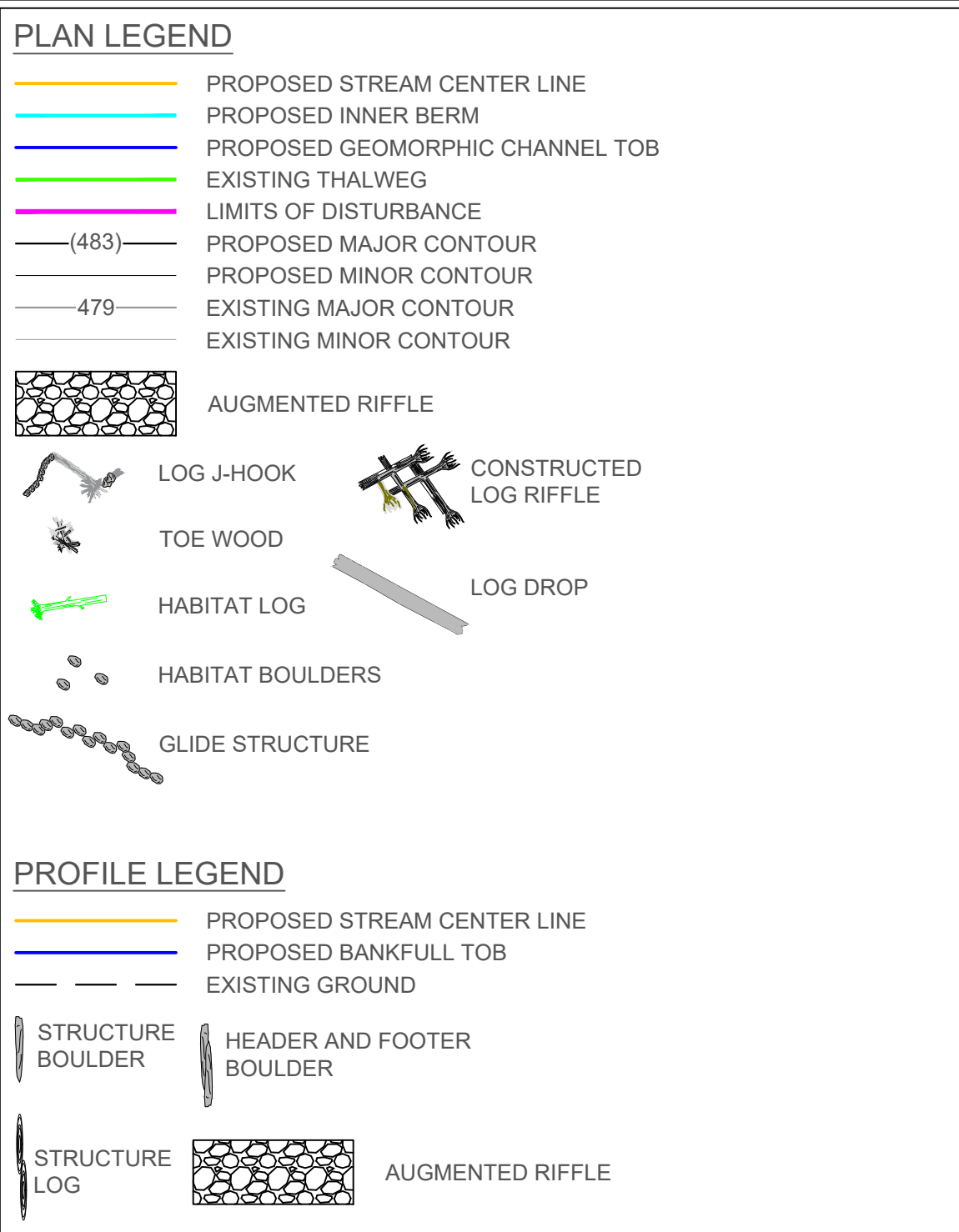
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DATE: 7/27/2020  
SCALE (34"x22"): 1" = 30'  
SCALE (17"x11"): 1" = 60'

**SHEET NUMBER**  
4 OF 16





APPROVED BY: XX	CHECKED BY: XX	DRAWN BY: GET	APPRV
REV	DESCRIPTION		
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XX	DRAFT 60%		XX
XX	XX		XX
XX	XX		XX
XX	XX		XX
XX	XX		XX
XX	XX		XX
XX	XX		XX

KEENE CREEK PARK  
STREAM RESTORATION  
CITY OF HERMANTOWN  
ST. LOUIS COUNTY, MN

DRAFT 60% - NOT FOR CONSTRUCTION  
UPPER KEENE CREEK  
PLAN AND PROFILE - (2)  
STA 5+45 TO 11+45



MINNESOTA TROUT UNLIMITED  
P.O. BOX 845  
CHANHASSEN, MN 55317

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BEAVER RIVER CONSULTING, LLC.  
5752 EALGE VIEW DRIVE  
DULUTH, MN 55803

----

FOR REVIEW  
NOT FOR  
CONSTRUCTION

DATE: 7/27/2020

SCALE (34"x22"): 1" = 30'

SCALE (17"x11"): 1" = 60'



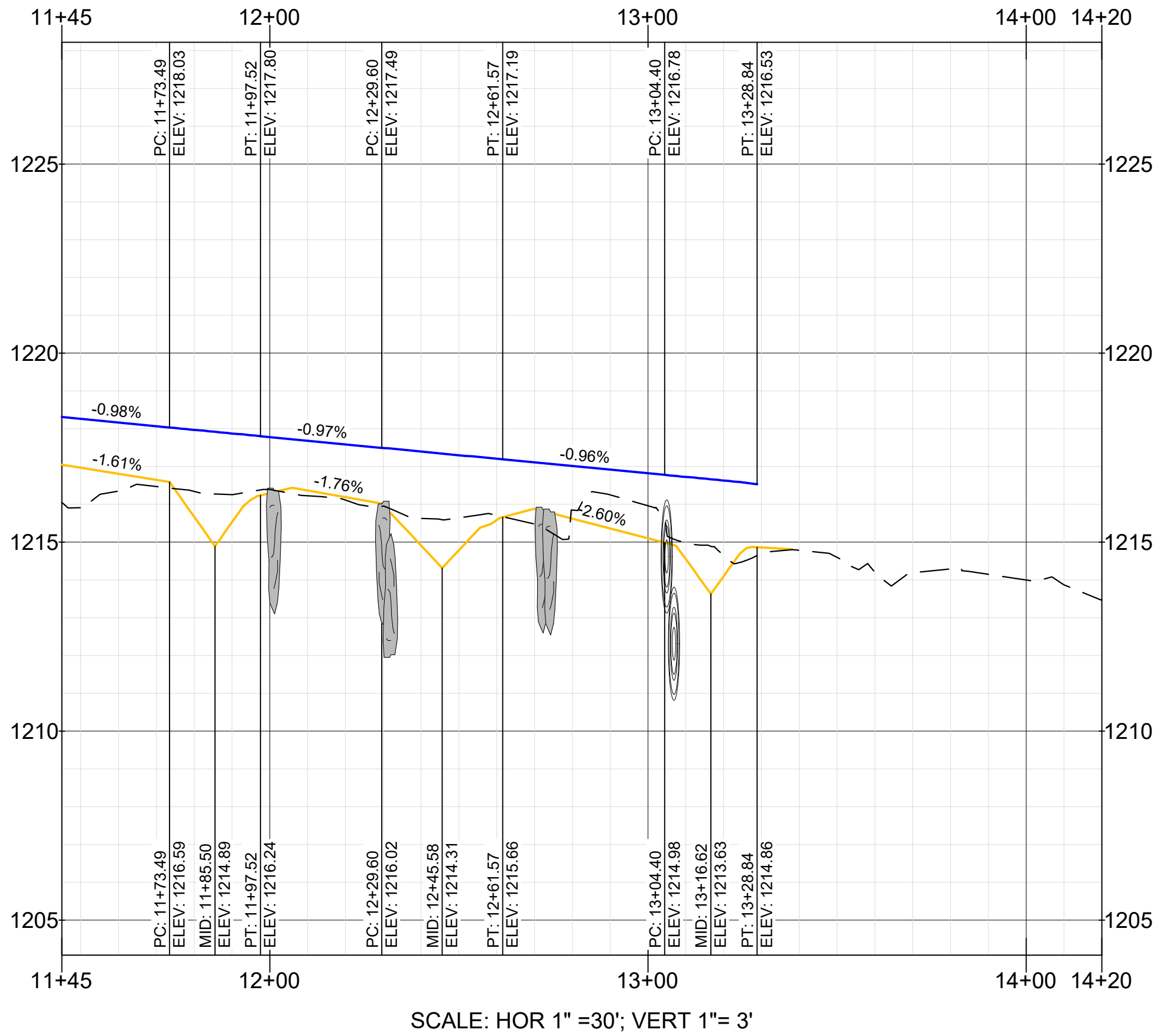
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SCALE IN FEET

SHEET NUMBER

5 OF 16



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PLAN LEGEND

PROPOSED STREAM CENTER LINE

PROPOSED INNER BERM

PROPOSED GEOMORPHIC CHANNEL TOB

EXISTING THALWEG

LIMITS OF DISTURBANCE

PROPOSED MAJOR CONTOUR

PROPOSED MINOR CONTOUR

EXISTING MAJOR CONTOUR

EXISTING MINOR CONTOUR

AUGMENTED RIFFLE

LOG J-HOOK

TOE WOOD

HABITAT LOG

HABITAT BOULDERS

GLIDE STRUCTURE

CONSTRUCTED LOG RIFFLE

LOG DROP

PROFILE LEGEND

PROPOSED STREAM CENTER LINE

PROPOSED BANKFULL TOB

EXISTING GROUND

STRUCTURE BOULDER

STRUCTURE LOG

HEADER AND FOOTER BOULDER

AUGMENTED RIFFLE

0

30

60

SCALE IN FEET

FOR REVIEW  
NOT FOR  
CONSTRUCTION

DATE: 7/27/2020

SCALE (34"x22"): 1" = 30'

SCALE (17"x11"): 1" = 60'

NOT TO SCALE

APPROVED BY: XX

CHECKED BY: XX

DRAWN BY: GET

REV

1

XX

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XX

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DESCRIPTION

DRAFT 30%

DRAFT 60%

XX

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APPRV

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KEENE CREEK PARK  
STREAM RESTORATION  
CITY OF HERMANTOWN  
ST. LOUIS COUNTY, MN

DRAFT 60% - NOT FOR CONSTRUCTION  
KEENE CREEK PARK  
PLAN AND PROFILE - (3)  
STA 11+45 TO 14+07

MINNESOTA TROUT UNLIMITED

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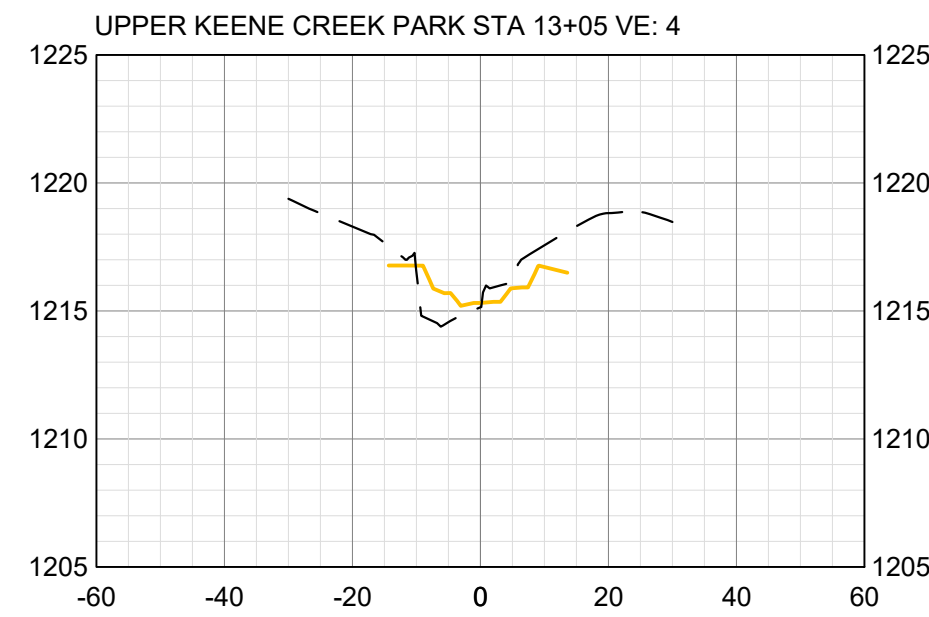
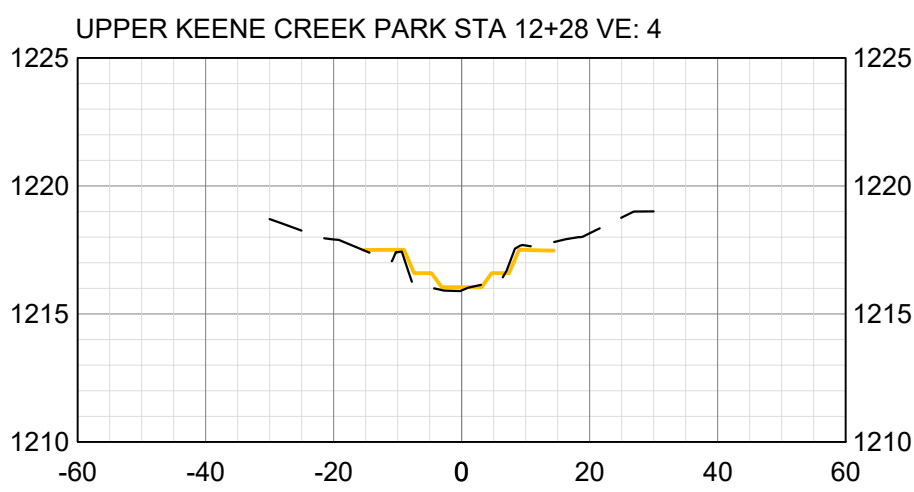
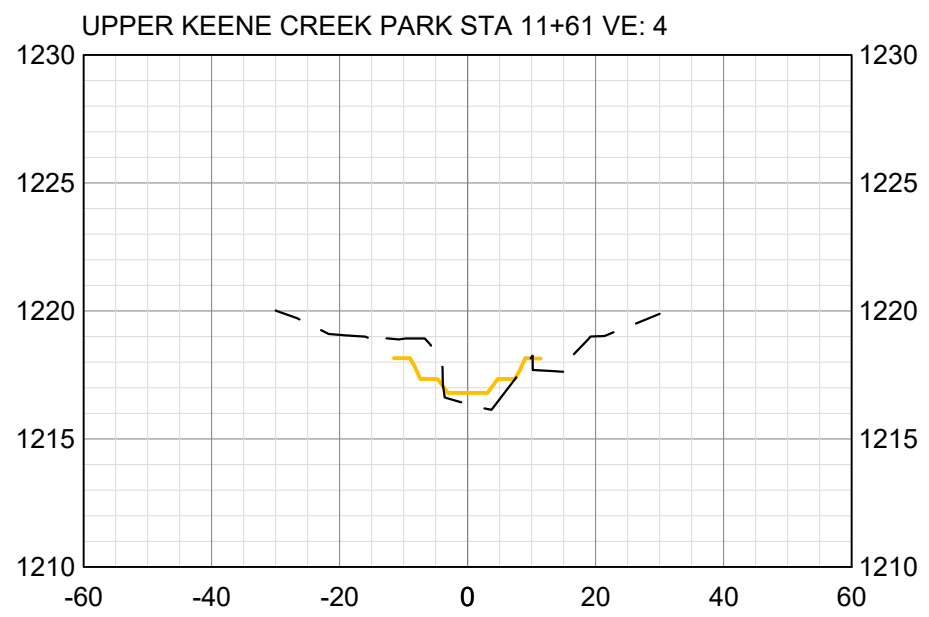
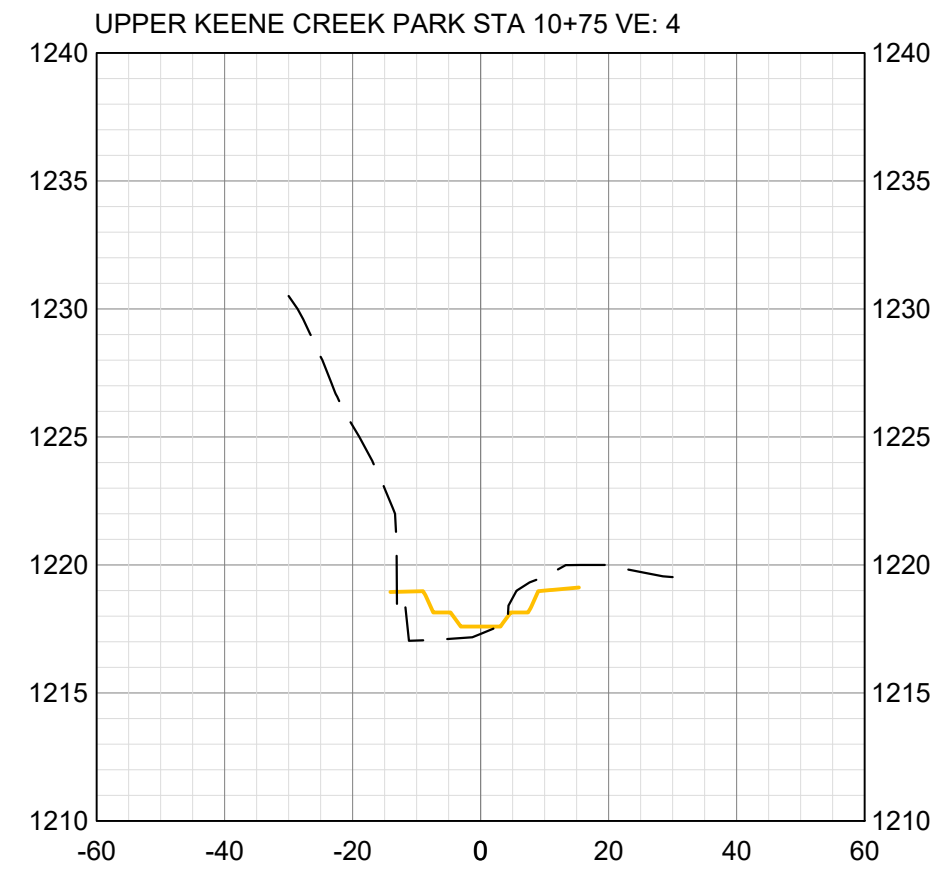
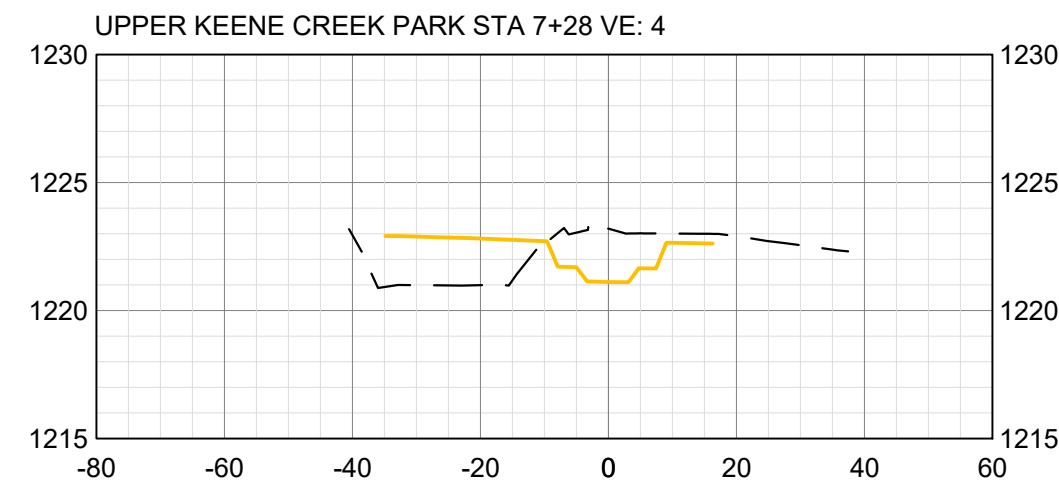
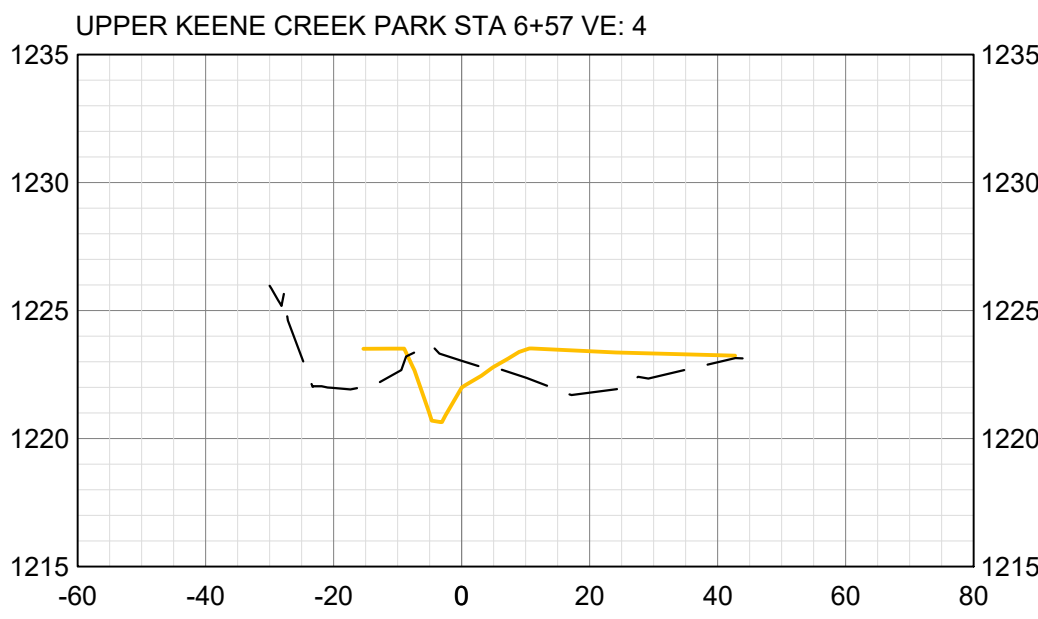
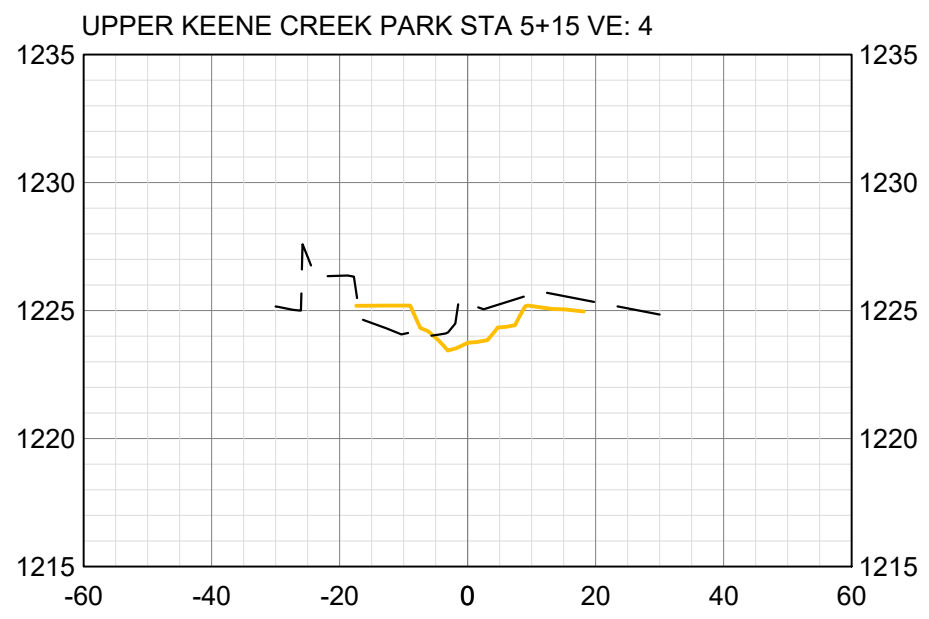
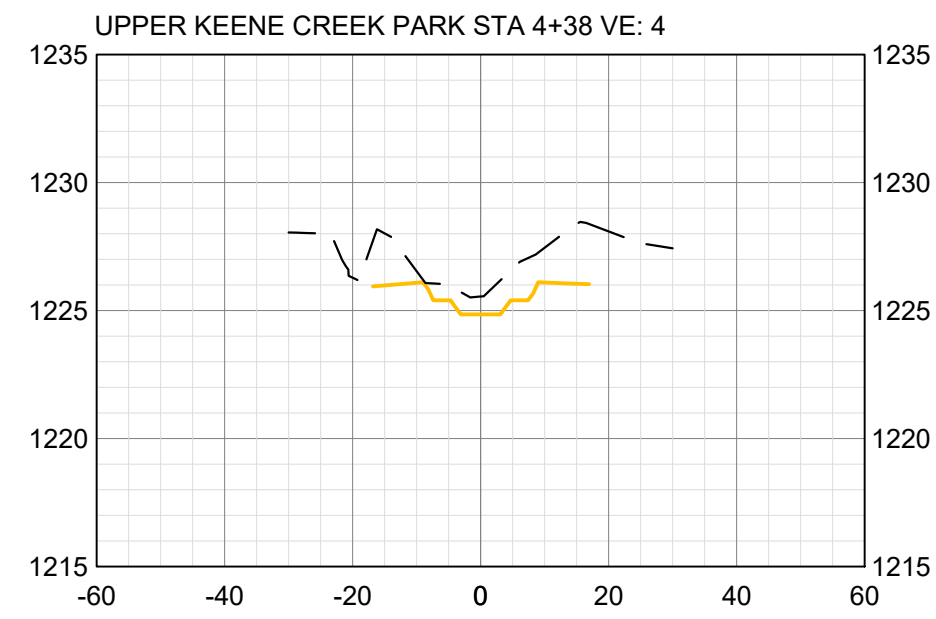
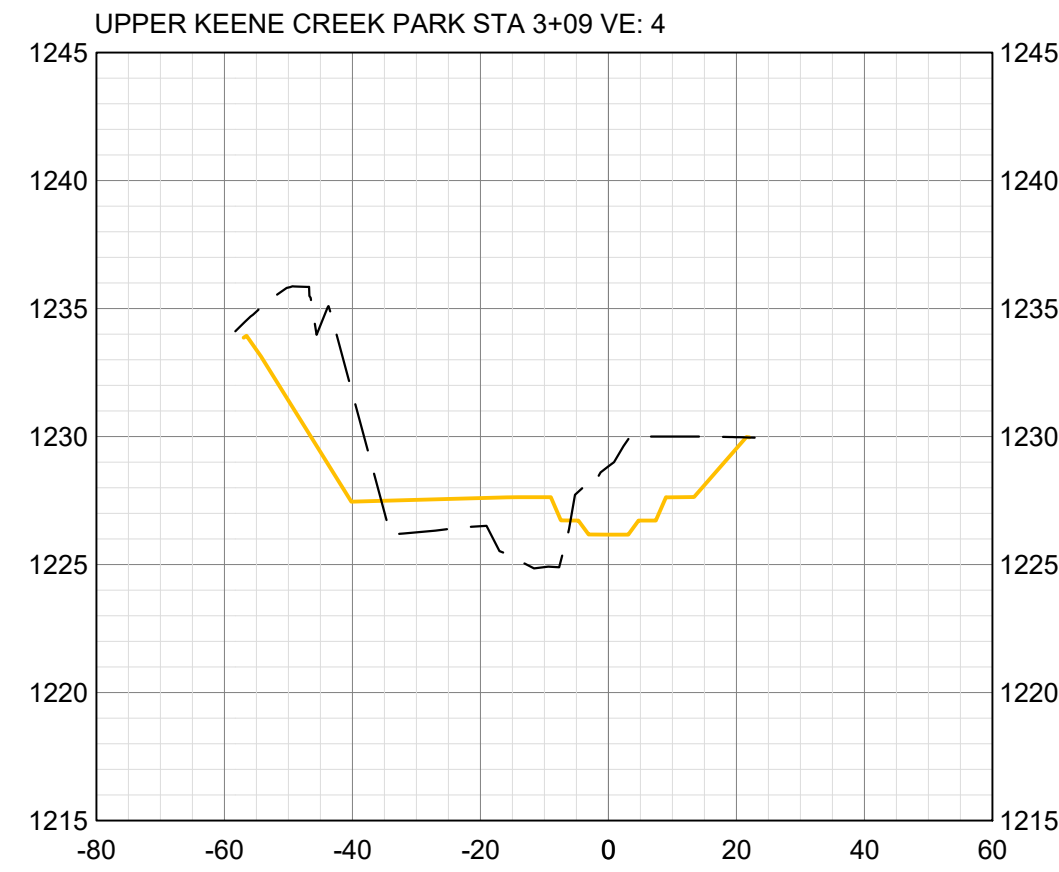
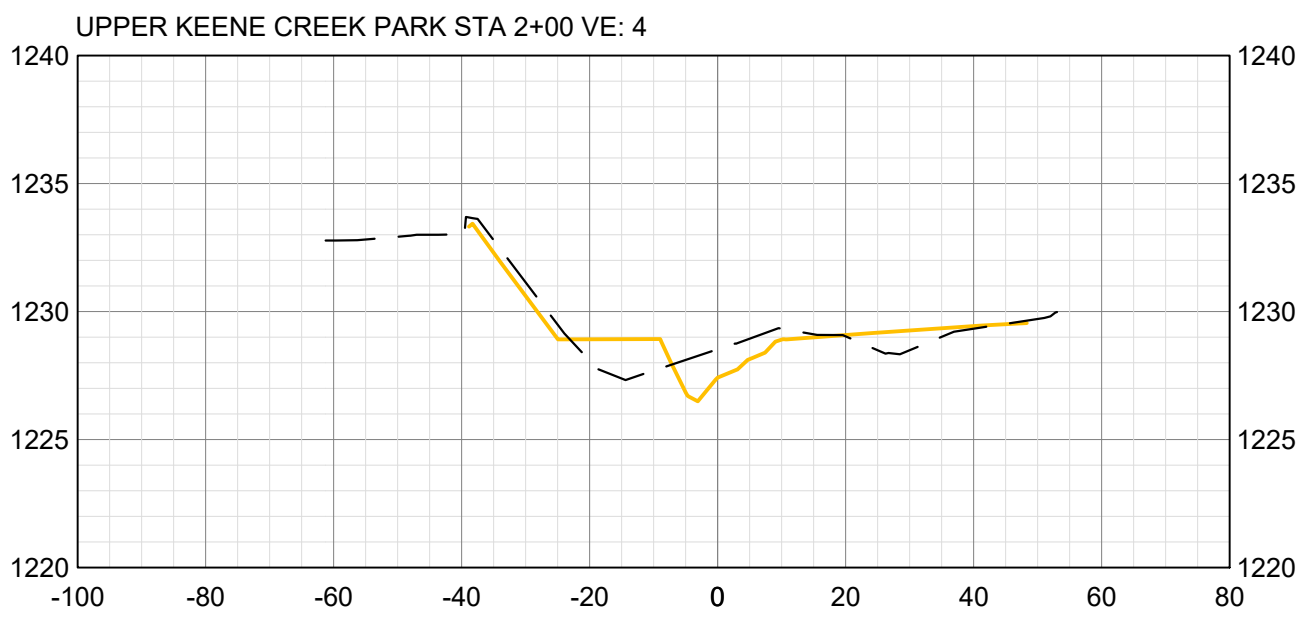
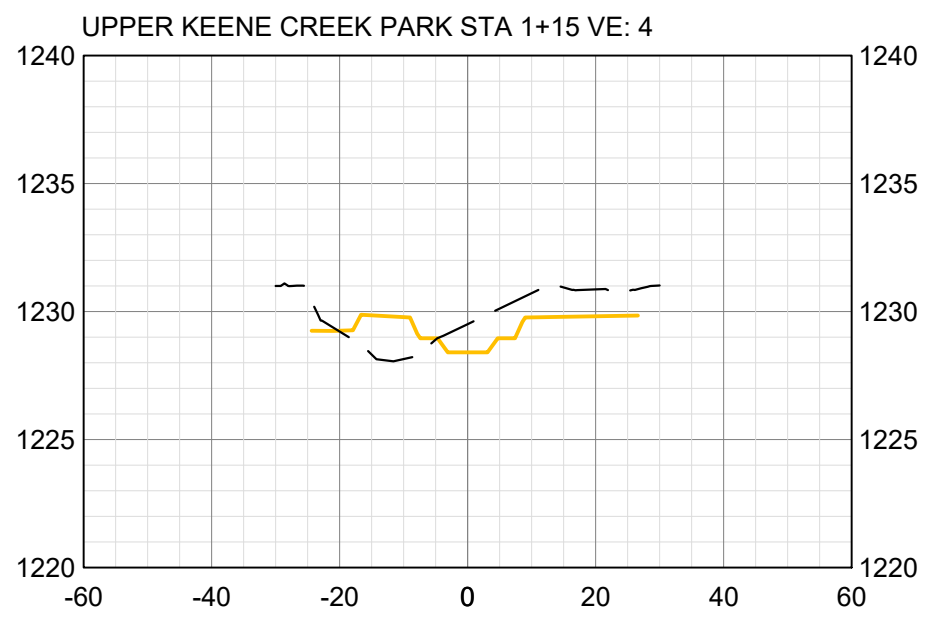
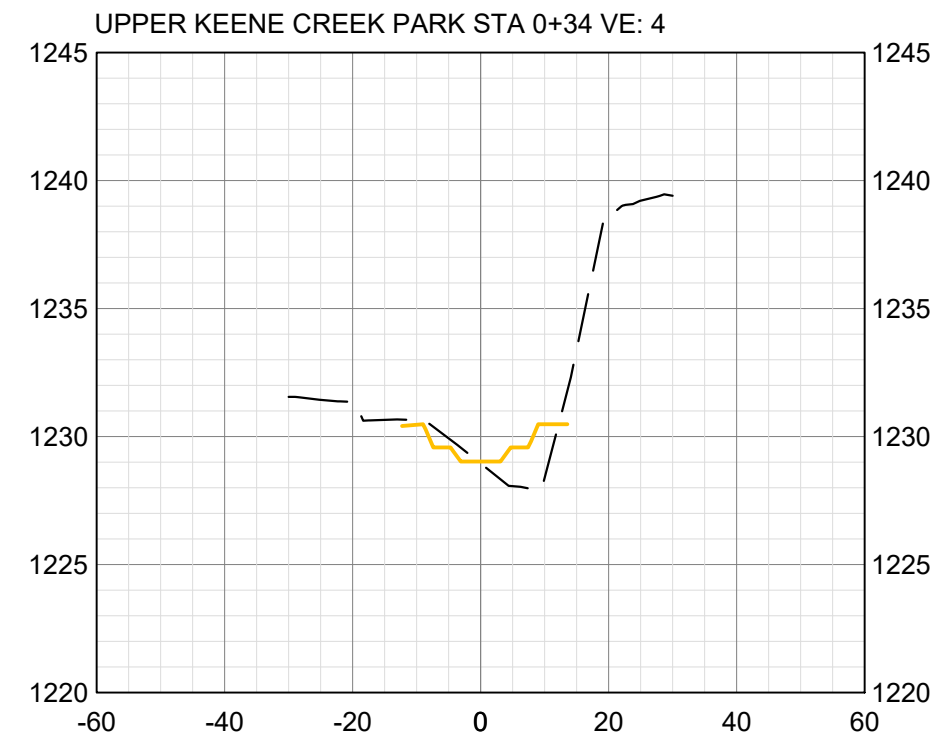
CHANHASSEN, MN 55317

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DULUTH, MN 55803





## SECTION LEGEND

DESIGN SURFACE  
EXISTING GROUND

APPROVED BY: XX	CHECKED BY: XX	DRAWN BY: GET	APPRV
REV	DESCRIPTION		
1	DRAFT 30%		XX
XX	DRAFT 60%		XX
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XX	XX		XX
XX	XX		XX
XX	XX		XX
XX	XX		XX

KEENE CREEK PARK  
 STREAM RESTORATION  
 CITY OF HERMANTOWN  
 ST. LOUIS COUNTY, MN

DRAFT 60% - NOT FOR CONSTRUCTION  
 UPPER KEENE CREEK  
 SECTIONS - (1)  
 STA 0+49 TO 13+05



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FOR REVIEW  
 NOT FOR  
 CONSTRUCTION

DATE: 7/27/2020

SCALE (34"X22"): 1" = 30'

SCALE (17"X11"): 1" = 60'



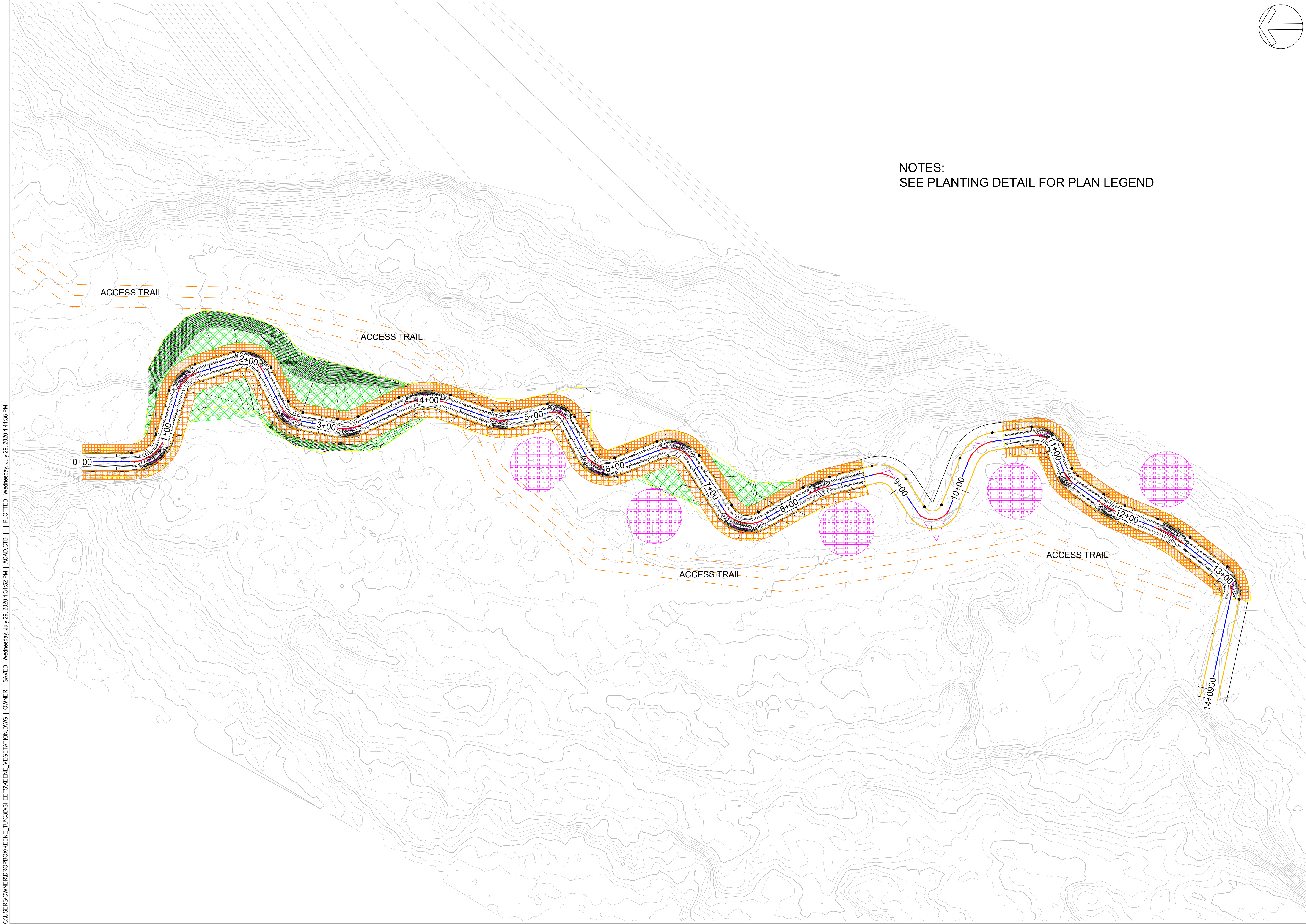
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SHEET NUMBER

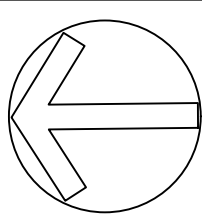
7 OF 16



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NOTES:  
SEE PLANTING DETAIL FOR PLAN LEGEND



KEENE CREEK PARK STREAM RESTORATION CITY OF HERMANTOWN ST. LOUIS COUNTY, MN		APPROVED BY: XX	CHECKED BY: XX	DRAWN BY: GET
		REV	DESCRIPTION	APPRV
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XX	DRAFT 60%	XX	XX	XX
XX	XX	XX	XX	XX
XX	XX	XX	XX	XX
XX	XX	XX	XX	XX
XX	XX	XX	XX	XX
XX	XX	XX	XX	XX
XX	XX	XX	XX	XX

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P.O. BOX 845  
CHANHASSEN, MN 55317

BEAVER RIVER CONSULTING  
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5752 EALGE VIEW DRIVE  
DULUTH, MN 55803

FOR REVIEW  
NOT FOR  
CONSTRUCTION

DATE: 7/27/2020  
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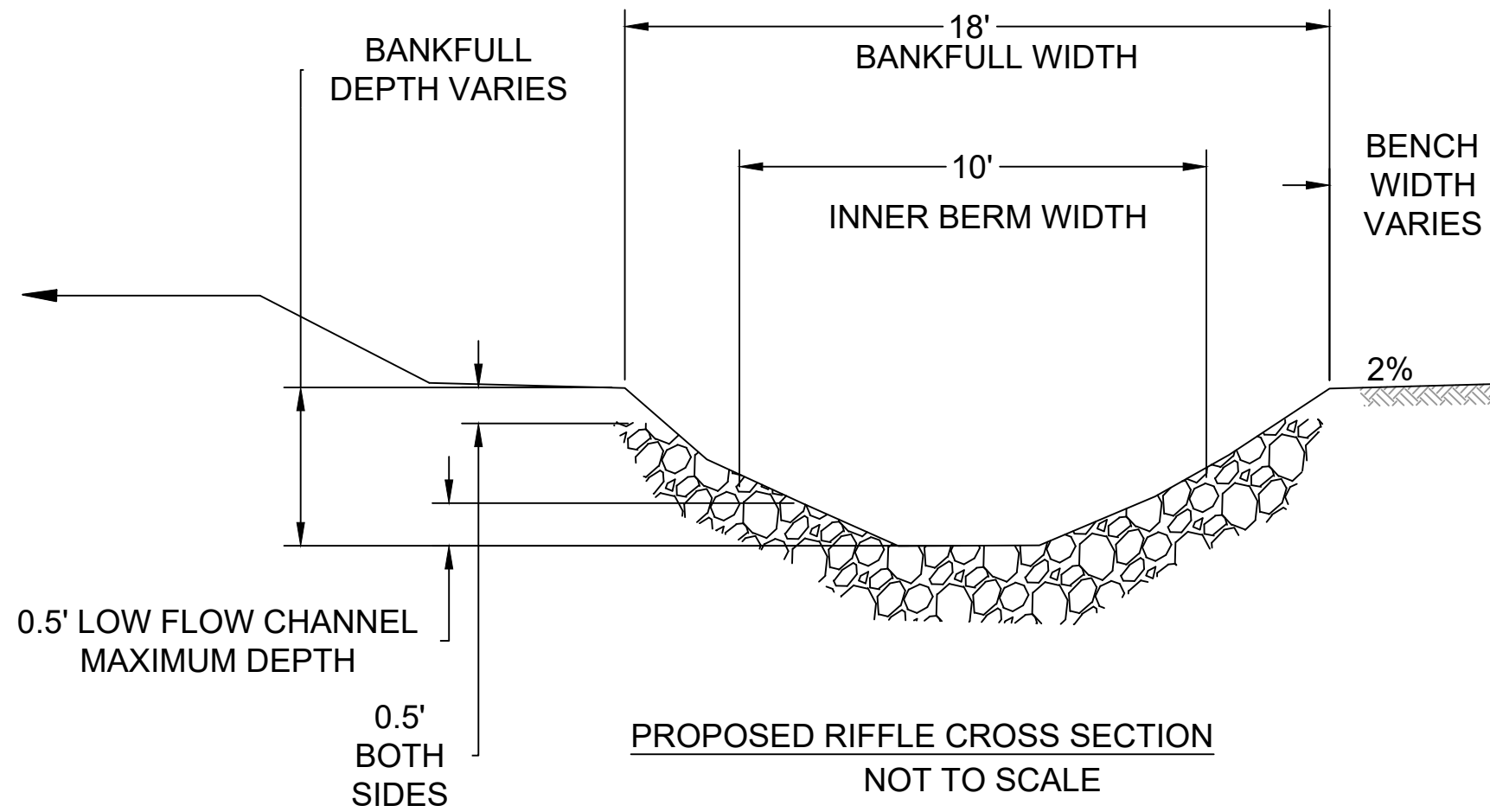
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SCALE IN FEET

SHEET NUMBER  
8 OF 16

DRAFT 60% - NOT FOR CONSTRUCTION  
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OVERVIEW - VEGETATION



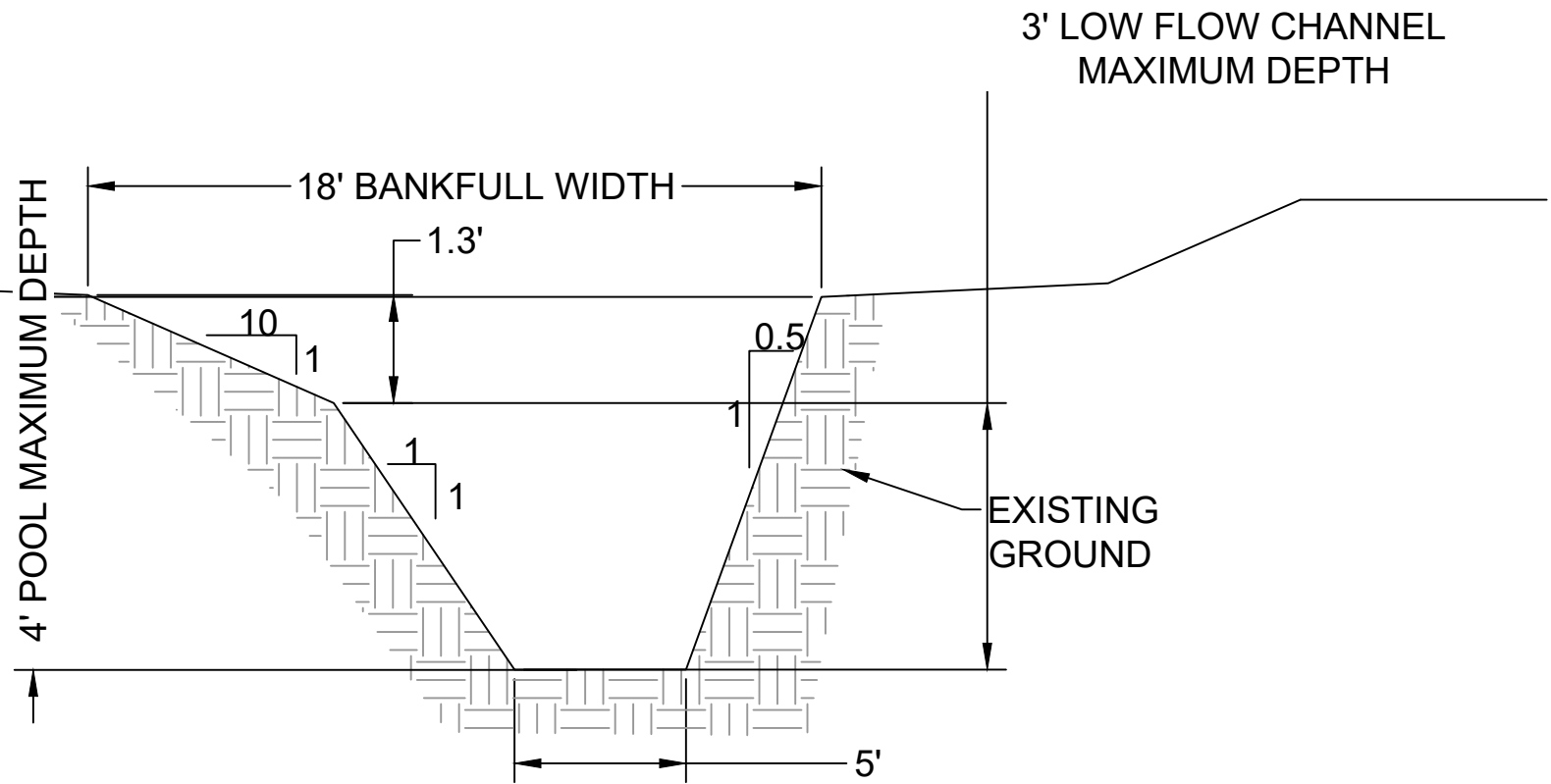


PROPOSED RIFFLE CROSS SECTION  
NOT TO SCALE

DESIGN CHANNEL DETAILS:  
CHANNEL TYPE: C4  
WATERSHED AREA: 3.0 MILE<sup>2</sup>

- RIFFLE DIMENSIONS:
- WIDTH- 18'
  - MAX DEPTH- 1.2'
  - CROSS SECTIONAL AREA- 17 SF
- WIDTH/DEPTH RATIO- 20
- POOL DIMENSIONS:
- WIDTH- 18'
  - MAX DEPTH- 4.0'
  - CROSS SECTIONAL AREA- 25-30 SF

- GLIDE DIMENSIONS
- WIDTH- 20'
  - MAX DEPTH- 0.7'
  - CROSS SECTIONAL AREA- 12 SF



PROPOSED POOL CROSS SECTION  
NOT TO SCALE

GRAVEL RIFFLE				
#	START STATION	END STATION	START ELEVATION	END ELEVATION
1	287	310	1226.6	1226.14
2	343	375	1226	1225.27
3	426	458	1225.1	1224.43
4	683	729	1222	1221.09
5	777	815	1220.9	1220.17
6	1056	1084	1218.03	1217.45

J-Hook TABLE			
#	START (PC)	ELEVATION (TW)	HEADER BOULDER ELEVATION
1	310.43	1226.14	1226.34
2	375.34	1225.27	1225.47
3	566.42	1223.05	1223.25
4	641.86	1222.16	1222.36
5	815.39	1220.17	1220.37
6	1131.35	1217.05	1217.25
7	1173.49	1216.59	1216.79
8	1229.6	1216.02	1216.22

ROCK GLIDE RIFFLE				
#	START STATION	END STATION	START ELEVATION	END ELEVATION
1	13	45	1229.24	1228.75
2	93	127	1228.7	1228.22
3	162	191	1228.1	1227.53
4	228	254	1227.4	1226.81
5	540	566	1223.6	1223.05
6	609	642	1222.9	1222.16
7	847	879	1220	1219.42
8	1153	1173	1216.96	1216.59
9	1206	1230	1216.4	1216.02
10	1270	1304	1215.9	1214.98

Toe Wood TABLE					
#	LENGTH	START STATION	END STATION	D.S. GLIDE ELEVATION	TOE WOOD, LOW WATER ELEVATION
1	57	45	93	1228.7	1229.2
2	44	127	162	1228.1	1228.6
3	47	190	228	1227.4	1227.9
4	41	253	287	1226.6	1227.1
5	25	325	343	1226	1226.5
6	42	390	426	1225.1	1225.6
7	32	458	485	1224.3	1224.8
8	38	513	540	1223.6	1224.1
9	37	581	609	1222.9	1223.4
10	36	657	683	1222	1222.5
11	57	729	777	1220.9	1221.4
12	43	1084	1117	1217.3	1217.8
13	42	1304	1337	1214.5	1215

RUN LOGS			
#	STATION	TW ELEVATION	LOG TW ELEVATION
1	45	1228.75	1228.95
2	191	1227.53	1227.73
3	254	1226.81	1227.01
4	458	1224.43	1224.63
5	729	1221.09	1221.29
6	879	1219.42	1219.62
7	1084	1217.45	1217.65
8	1304	1214.98	1215.18

APPROVED BY: XX

CHECKED BY: XX

DRAWN BY: GET

REV

DESCRIPTION

APPRV

1	DRAFT 30%	XX
XX	DRAFT 60%	XX
XX	XX	XX
XX	XX	XX
XX	XX	XX
XX	XX	XX
XX	XX	XX
XX	XX	XX
XX	XX	XX

KEENE CREEK PARK  
STREAM RESTORATION  
CITY OF HERMANTOWN  
ST. LOUIS COUNTY, MN

DRAFT 60% - NOT FOR CONSTRUCTION  
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-----  
DETAIL -CHANNEL DIM./STRUCTURE TABLES

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DULUTH, MN 55803  
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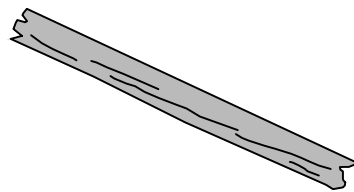
FOR REVIEW  
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DATE: 7/27/2020

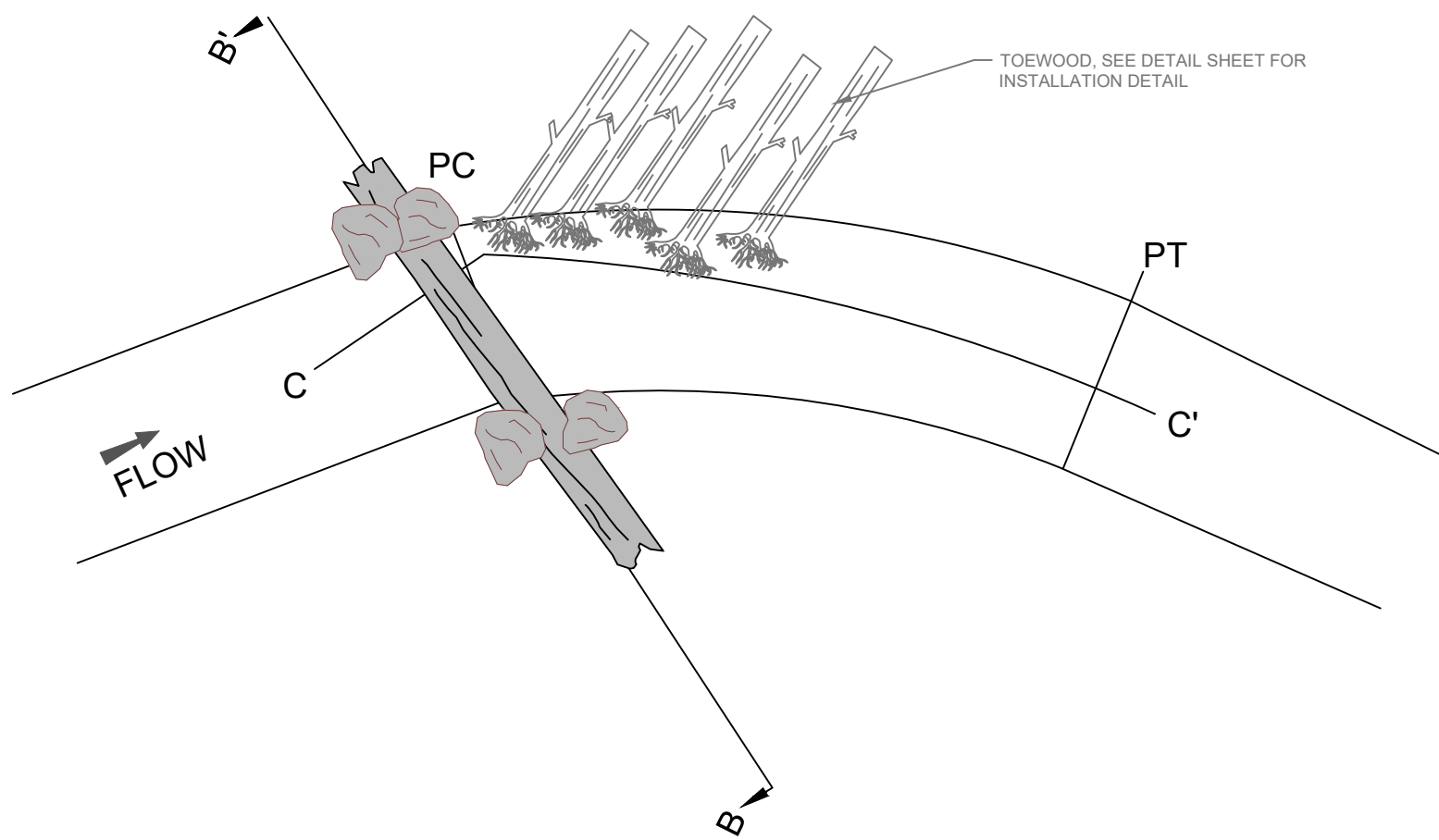
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SHEET NUMBER  
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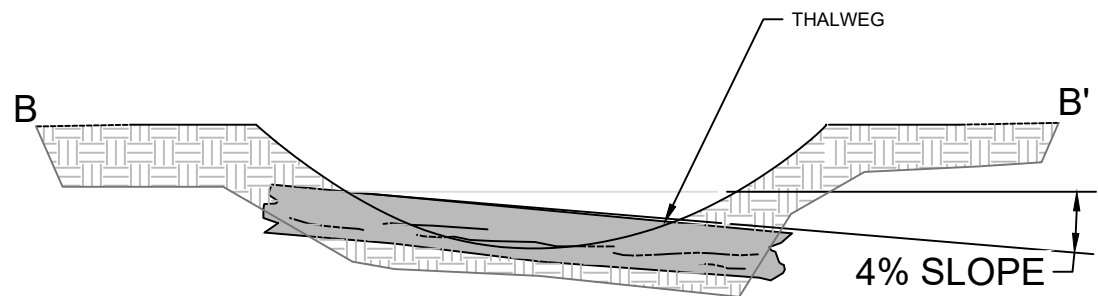
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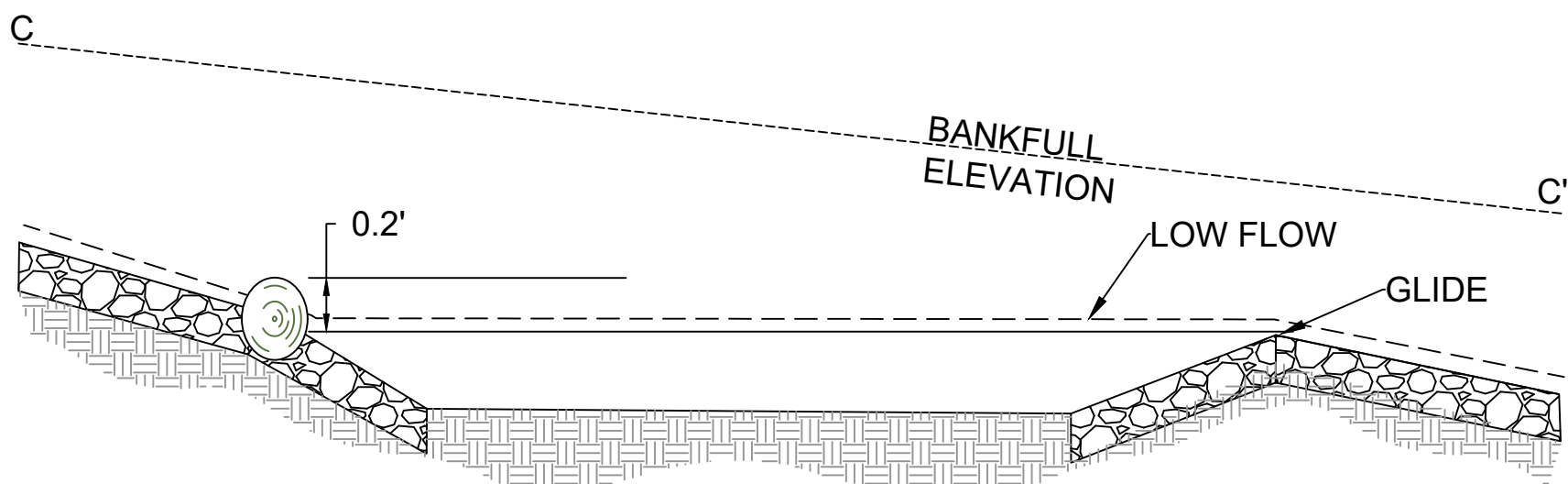
PLAN-SYMBOL



RUN LOG PLAN VIEW  
NOT TO SCALE



RUN LOG CROSS SECTION B-B'  
NOT TO SCALE

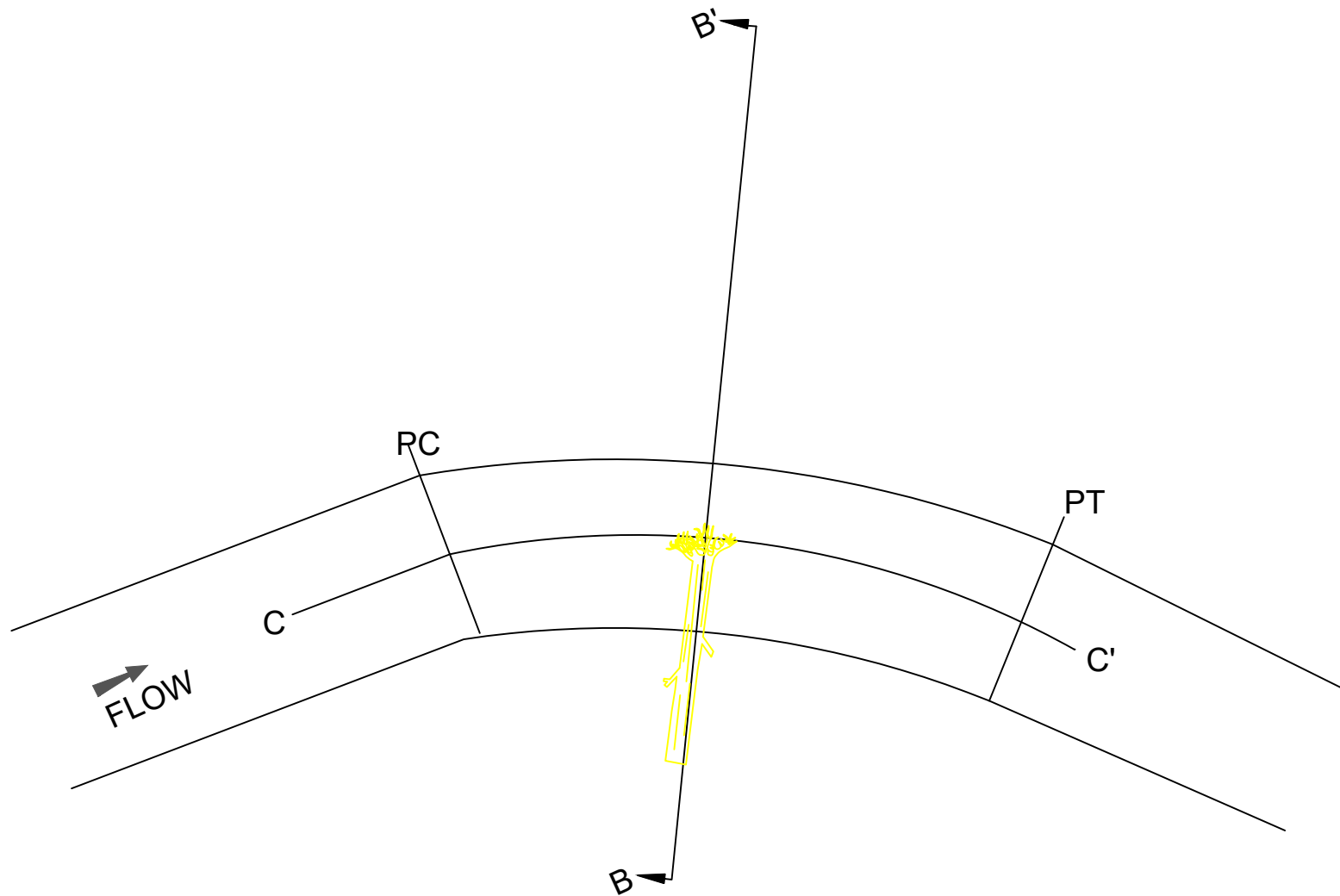


RUN LOG PROFILE C-C'  
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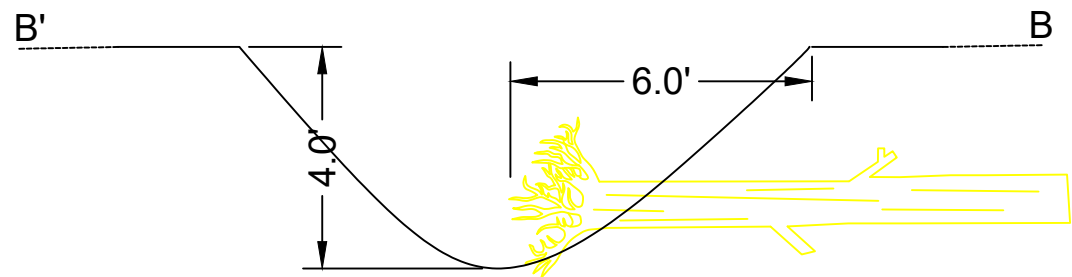
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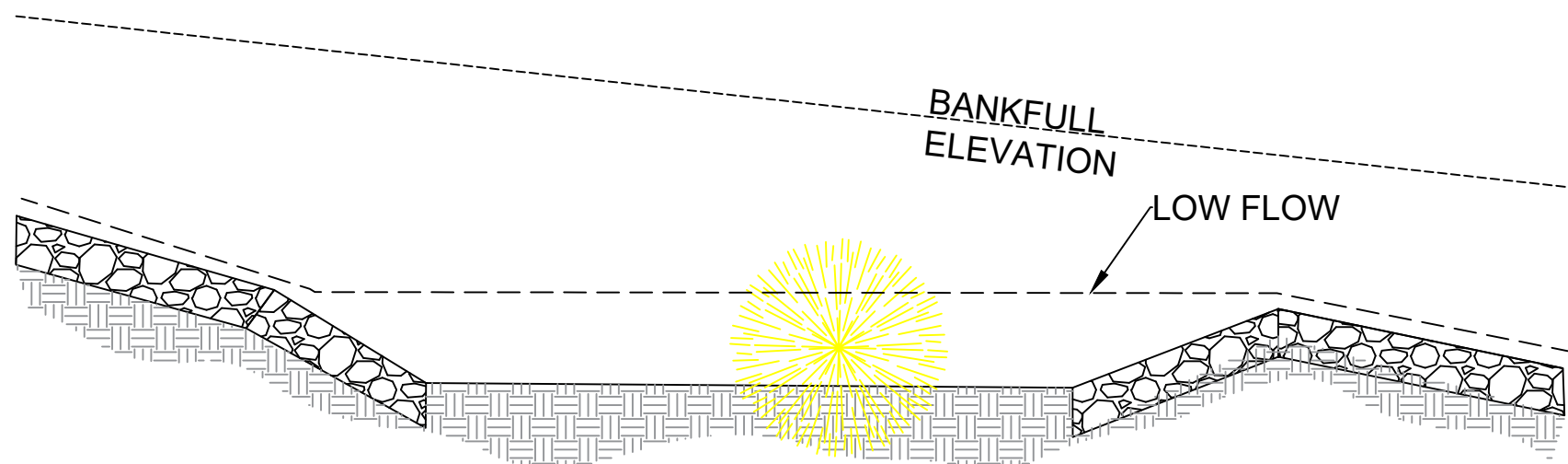
PLAN-SYMBOL



POINT BAR LOG PLAN VIEW  
NOT TO SCALE



POINT BAR LOG CROSS SECTION B-B'

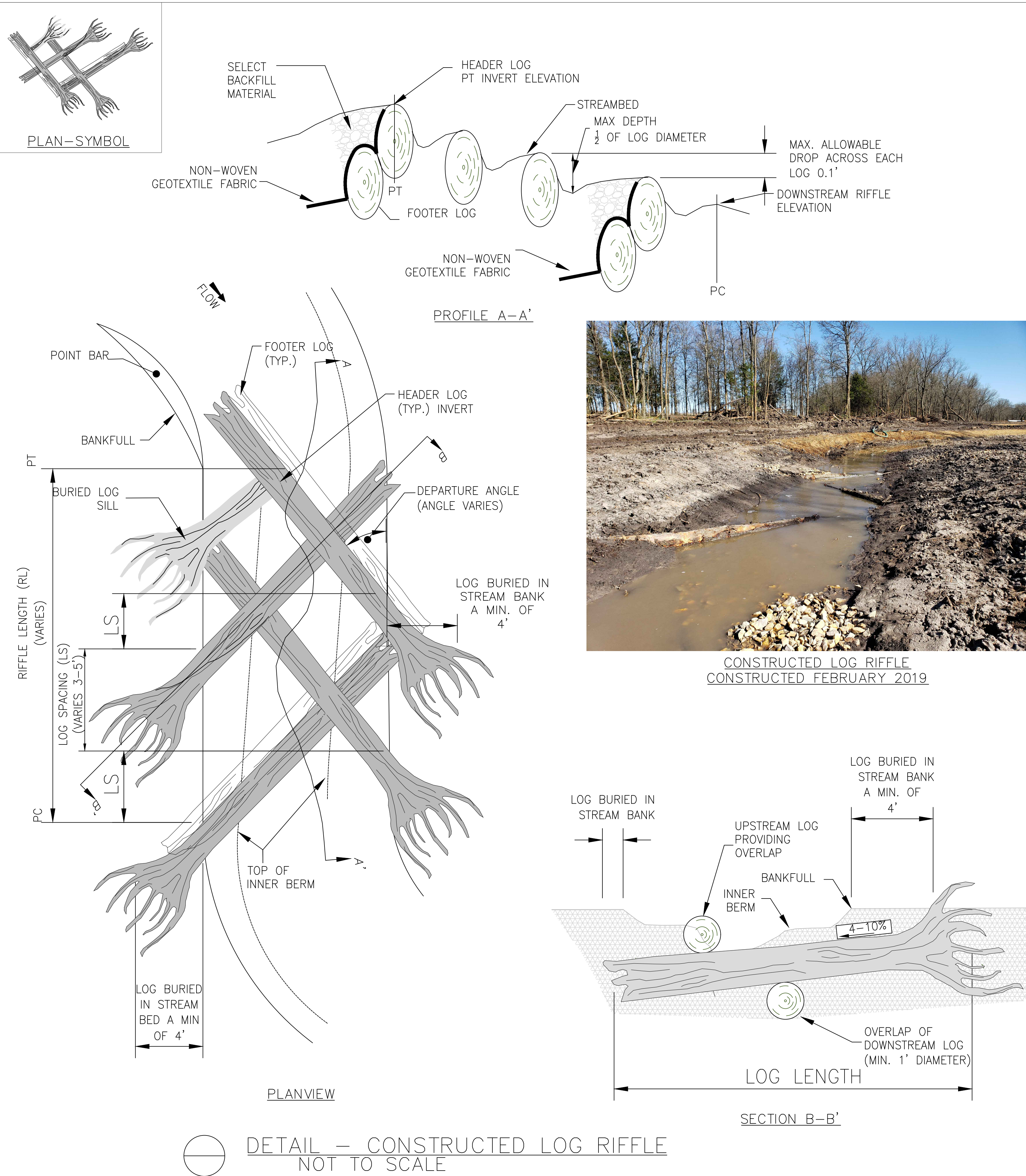


POINT BAR LOGS PROFILE C-C'

POINT BAR LOG DETAIL

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XX				XX		XX
KEENE CREEK PARK STREAM RESTORATION CITY OF HERMANTOWN ST. LOUIS COUNTY, MN						
DRAFT 60% - NOT FOR CONSTRUCTION ----- ----- DETAILS - HABITAT LOGS						
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FOR REVIEW NOT FOR CONSTRUCTION						
DATE: 7/27/2020						
NTS						
SHEET NUMBER 10 OF 16						





- NOTES:
1. THIS STRUCTURE HELPS MAINTAIN GRADE WITHIN A NEWLY CONSTRUCTED STREAM CHANNEL. IN GENERAL, IT IS USED IN LOCATIONS WHERE COARSE SUBSTRATE USED TO CONSTRUCT OTHER GRADE CONTROL STRUCTURES (E.G., AUGMENTED RIFFLE) IS NOT AVAILABLE. IF SUITABLE COARSE SUBSTRATE IS DISCOVERED ON SITE, THE CONTRACTOR MAY INSTALL A DIFFERENT GRADE CONTROL STRUCTURE WITH THE ENGINEER'S APPROVAL.
  2. THE CONSTRUCTED LOG RIFFLE SHALL BE INSTALLED ON PERENNIAL REACHES THAT ARE REMOTE. BANKFULL WIDTHS OF THESE REACHES WILL BE BETWEEN 8-11', WITH SLOPES THAT RANGE FROM 1.5-2.5%. THE CONSTRUCTED LOG RIFFLE STRUCTURES ARE INTENDED FOR REACHES WITH LIMITED ACCESS AND WITH TREES AVAILABLE ONSITE.
  3. LOGS SHALL HAVE MIN. DIAMETER OF 12". LOGS SHALL HAVE A MINIMUM LENGTH OF 10-50' DEPENDING ON THE REACH.
  4. ALL LOGS SHALL BE RELATIVELY STRAIGHT AND LIMBS SHALL BE TRIMMED FLUSH.
  5. THE LOGS AT THE UPSTREAM AND DOWNSTREAM END OF THE STRUCTURE WILL BE UNDERLAIN BY A FOOTER LOG (SOMETIMES CALLED A BACKER LOG) UNLESS OTHERWISE DIRECTED BY ENGINEER. THE HEADER LOG IS THE TOP LOG USED IN EACH PAIR. WHEN FINISHED, THE HEADER LOG IS VISIBLE ONLY BETWEEN THE INNER BERMS. THE HEADER LOG SHALL BE INSTALLED BEFORE THE FOOTER LOG. THE HEADER LOG DOES NOT REST ON THE TOP OF THE FOOTER LOG. THE FOOTER LOG IS INSTALLED FROM THE UPSTREAM SIDE AND INSTALLED AGAINST THE LOWER HALF OF THE HEADER LOG RESULTING IN A STAGGER WITH THE HEADER LOG BEING SLIGHTLY MORE DOWNSTREAM THAN THE FOOTER LOG.
  6. THE OTHER LOGS IN THE STRUCTURE ARE SINGLE LOGS WITH NO FOOTER LOG.
  7. SET INVERTS AT ELEVATIONS SHOWN ON THE PLAN AND PROFILE SHEETS. PLAN AND PROFILE SHEETS WILL BE PROVIDED TO THE CONTRACTOR AS A DWG FILE AND LN3 FILE. THE ELEVATIONS OF THE LOGS COMPRISING THE LOG CONSTRUCTED RIFFLE SHALL NOT VARY FROM THE PLAN UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
  8. THE MOST UPSTREAM LOG SHALL BE PLACED SUCH THAT THE BANK TIE-IN IS ON THE SAME SIDE AS THE NEXT UPSTREAM OUTSIDE BEND IN ORDER TO SERVE AS A VANE AND HELP DIRECT STREAM FLOW AWAY FROM THE PREVIOUS OUTSIDE BEND. LOCATION OF ALL RIFFLE LOG ARMS ARE SHOWN ON THE PLAN AND PROFILE SHEETS AND WILL BE PROVIDED TO THE CONTRACTOR AS A DWG FILE AND LN3 FILE. NO ELEVATIONS OF THE CONSTRUCTED RIFFLE ARMS MAY VARY FROM THE PLAN LOCATIONS WITHOUT DIRECTION FROM ENGINEER.
  9. THE MOST DOWNSTREAM LOG SHALL BE PLACED SUCH THAT THE HIGH POINT IS ON THE SAME SIDE AS THE NEXT DOWNSTREAM OUTSIDE BEND IN ORDER TO HELP DIRECT STREAM FLOW AWAY FROM THE NEXT OUTSIDE BEND.
  10. ALL LOGS ARE PLACED SUCH THAT THEY OVERLAP THE NEXT DOWNSTREAM LOG. THEREFORE, IT IS RECOMMENDED THAT THIS STRUCTURE BE CONSTRUCTED FROM DOWNSTREAM TO UPSTREAM.
  11. THE VERTICAL SLOPE OF EACH LOG SHALL NOT EXCEED 10% WITH THE SPECIFIC VERTICAL SLOPE OF EACH LOG DETERMINED BY THE ENGINEER.
  12. IT IS LIKELY THAT THE LOGS WILL REQUIRE NOTCHING WHERE THEY OVERLAP IN ORDER TO NOT EXCEED THE MAXIMUM VERTICAL SLOPE SPECIFICATION. THE CONTRACTOR SHOULD CHOOSE LOGS THAT CAN MEET THE SPECIFICATIONS OF THIS DETAIL.
  13. THE NOTCH DEPTH FOR ANY LOG SHALL NOT EXCEED HALF THE DIAMETER OF THE LOG UNLESS OTHERWISE DIRECTED BY THE ENGINEER. ANY NOTCHED LOGS SHALL BE APPROVED BY THE ENGINEER BEFORE THE LOGS ARE BACKFILLED.
  14. ALL GAPS/VOIDS LARGER THAN 1" BETWEEN THE HEADER AND FOOTER LOGS SHALL BE CHINKED WITH LIMBS AND/OR BRUSH ON THE UPSTREAM SIDE PRIOR TO PLACEMENT OF THE GEOTEXTILE.
  15. ON THE UPSTREAM SIDE OF THE LOGS A LAYER OF NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED AS SHOWN IN THE DETAIL THE ENTIRE LENGTH OF THE LOG. SECURE THE GEOTEXTILE FABRIC TO THE UPSTREAM SIDE OF THE HEADER LOG USING 3" 10D GALVANIZED COMMON NAIL ON 12" SPACING.
  16. SELECT BACKFILL MATERIAL SHALL BE PLACED UPSTREAM OF EACH LOG SUCH THAT FUTURE SETTLEMENT OF THE MATERIAL WILL BE MINIMAL. SELECT BACKFILL MATERIAL SHALL BE HAVE A MINIMUM D50 OF 60 MM. ANY DEVIATIONS IN THE GRADATION MUST BE APPROVED BY THE ENGINEER.
  17. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.1' OF THE GRADES AND ELEVATIONS INDICATED, PROVIDED ANY HEIGHT DOES NOT EXCEED MAX. ALLOWABLE DROP OF 0.1' OVER ANY ONE LOG AND 0.5' FOR THE ENTIRE STRUCTURE.
  18. DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES.
  19. THE DEPARTURE ANGLE SHOWN IN THE PLAN VIEW DRAWING IS DEPICTED IN SUCH A WAY TO EMPHASIZE DETAIL. ACTUAL DEPARTURE ANGLE SHALL BE AS SHOWN ON THE PLAN AND PROFILE SHEETS AND WILL BE PROVIDED TO THE CONTRACTOR AS A DWG FILE AND LN3 FILE.

APPROVED BY: XX	CHECKED BY: XX	DRAWN BY: GET
REV	DESCRIPTION	APPRV
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XX	DRAFT 60%	XX
XX	XX	XX
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XX	XX	XX
XX	XX	XX
XX	XX	XX
XX	XX	XX


KEENE CREEK PARK  
STREAM RESTORATION  
CITY OF HERMANTOWN  
ST. LOUIS COUNTY, MN

DRAFT 60% - NOT FOR CONSTRUCTION

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DETAIL - LOG CONSTRUCTED RIFFLE



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DULUTH, MN 55803

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FOR REVIEW  
NOT FOR  
CONSTRUCTION

DATE: 7/27/2020

NTS

SHEET NUMBER

11 OF 16

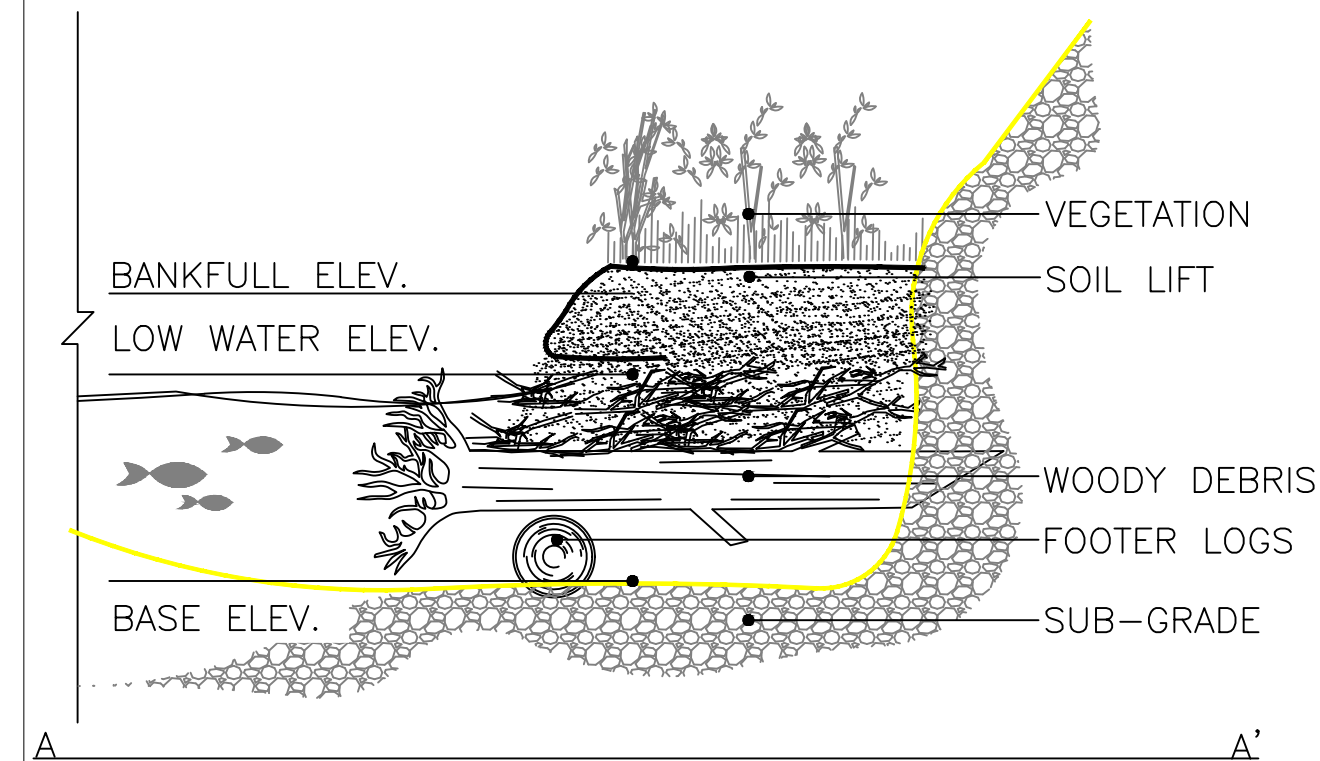


## 1. INSTALLATION SUMMARY

TOEWOOD BENCH CONSTRUCTION WILL BE DONE IN DRY WEATHER  
CONDITIONS AFTER STREAM HAS BEEN DIVERTED AND SITE DEWATERED.

ENGINEER OR SWCD REPRESENTATIVE MUST BE PRESENT FOR INSTALLATION  
OF TOEWOOD BENCH.

THE DRAWINGS ON THIS PAGE ARE NOT TO SCALE.



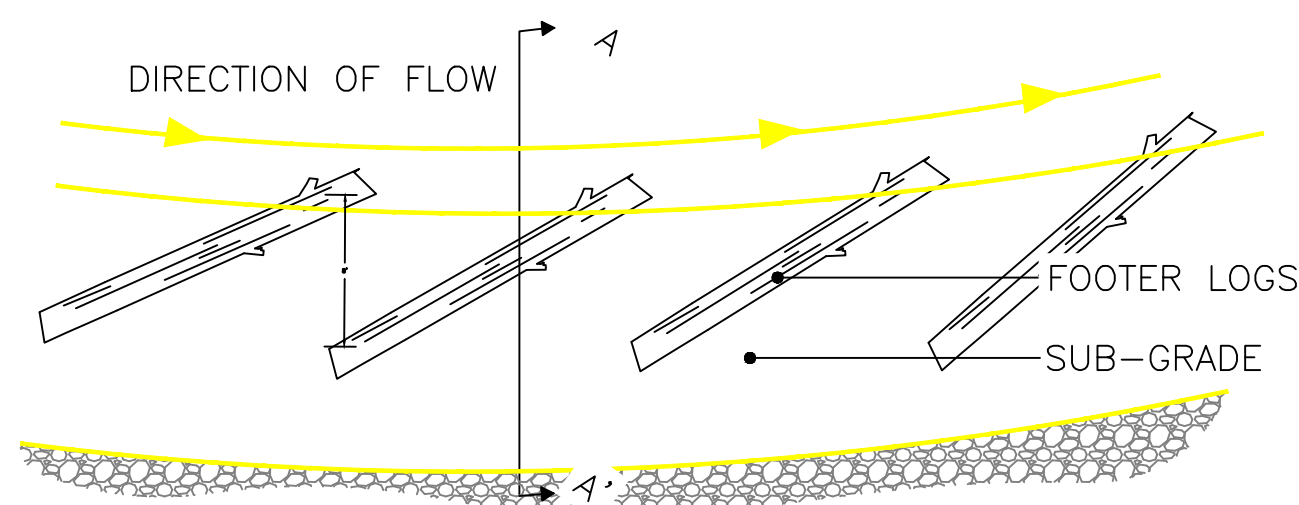
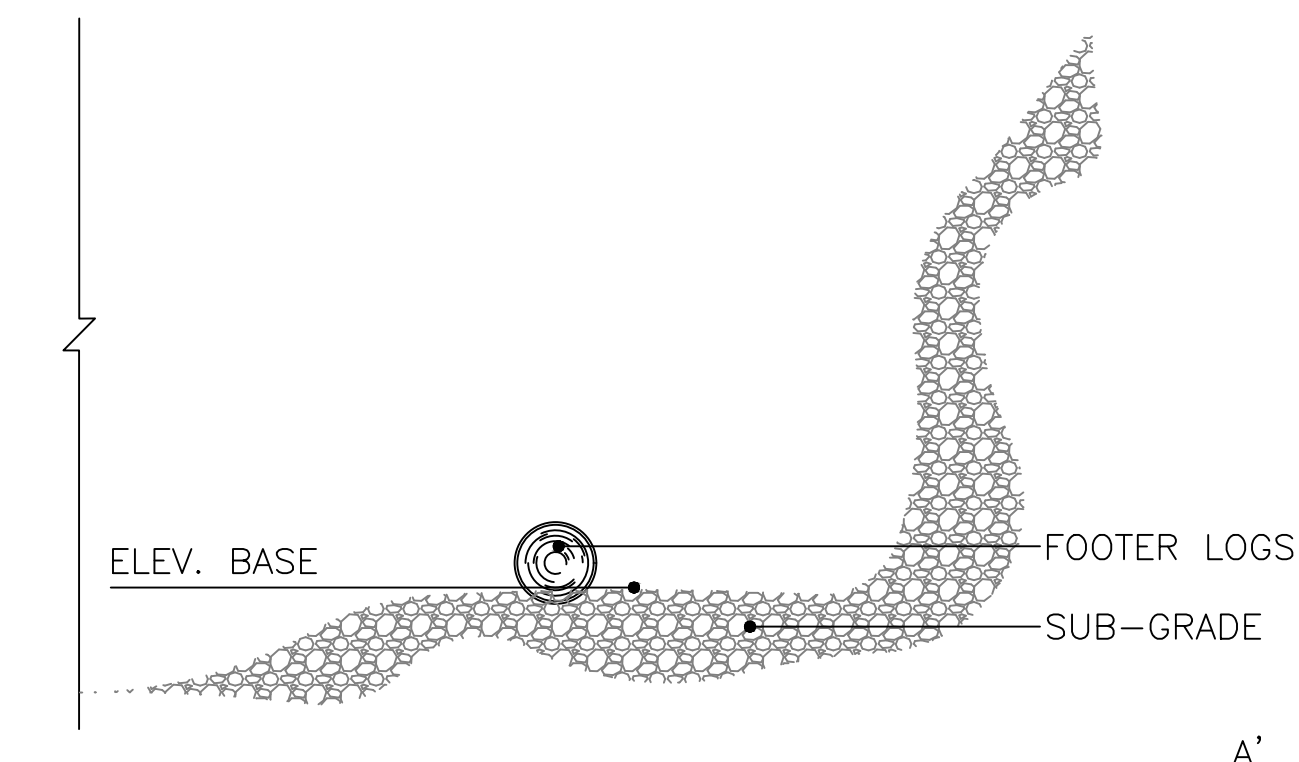
## 2. SUBGRADE AND FOOTER LOGS

SPECIFICATION:

- 10" MIN. DIAMETER
- LIMBS REMOVED
- 10' MIN. LENGTH

PLACEMENT:

- EXCAVATE TO BASE ELEVATION
- CONTRACTOR SHALL MAKE EFFORT TO SEPARATE GRANULAR AND FINE FILL NATIVE MATERIAL FOR USE IN STEPS 4 AND 5.
- SPACE FOOTER LOGS ENDS 8' APART, PERPENDICULAR TO STREAM
- KEY FOOTER LOGS 8' INTO BANK, 2' PROTRUDING INTO STREAM.



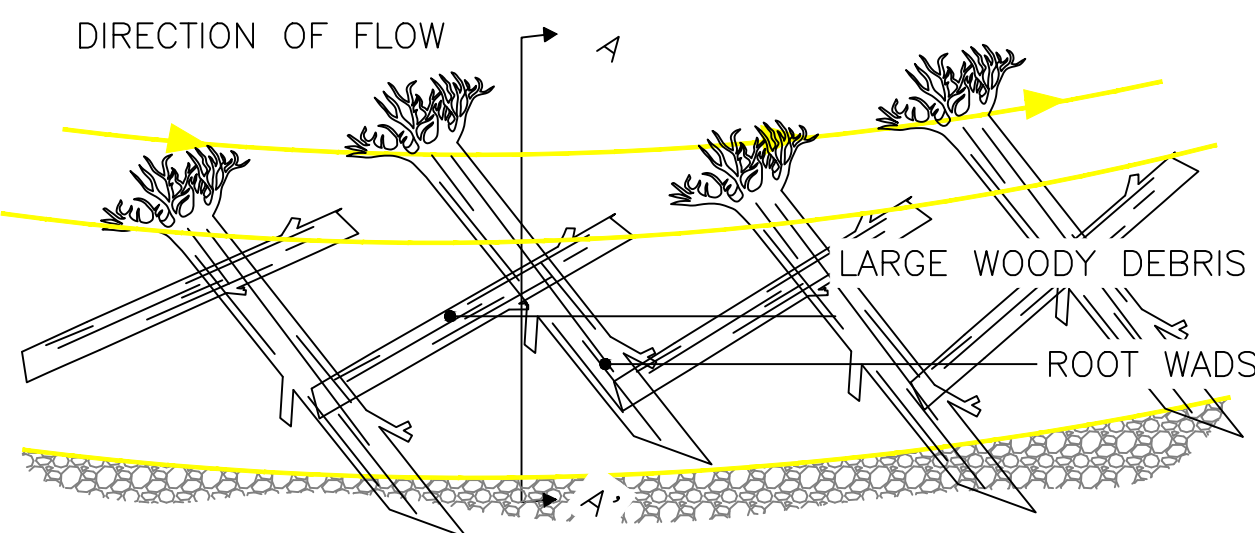
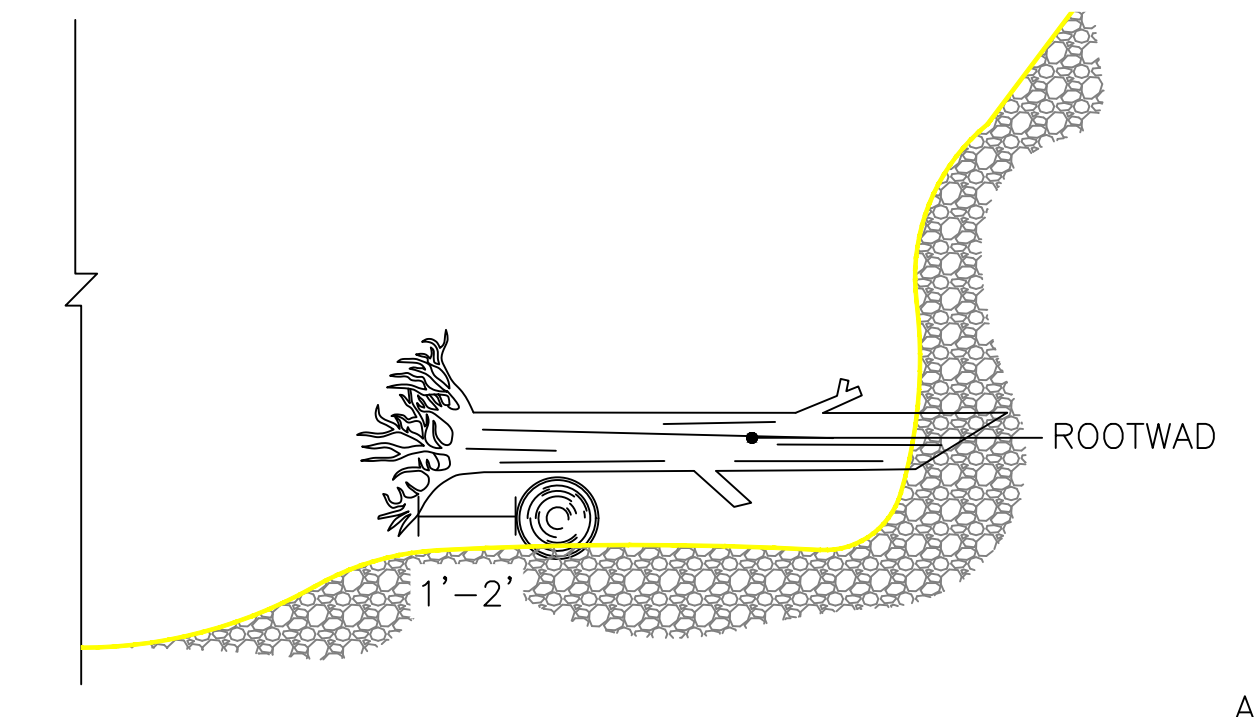
### 3. ROOTWAD PLACEMENT

ROOTWAD SPECIFICATION:

- 10" MIN DIAMETER
- LOG LENGTH OF 10' MIN.
- LIMBS SHALL BE REMOVED
- ROOT WADS SHALL BE LEFT INTACT

PLACEMENT:

- PLACE ROOTWADS ON TOP OF FOOTER LOGS AS SHOWN, OVERHANG ROOT WAD LOGS 1-2', VARY AND SHOWN SUCH THAT EVERY OTHER ROOT WAD IS PROTRUDING INTO STREAM 2 FEET
- ANGLE ROOTWADS UPSTREAM AS DIRECTED IN FIELD
- PLACE 1 ROOT WAD PER FOOTER LOG



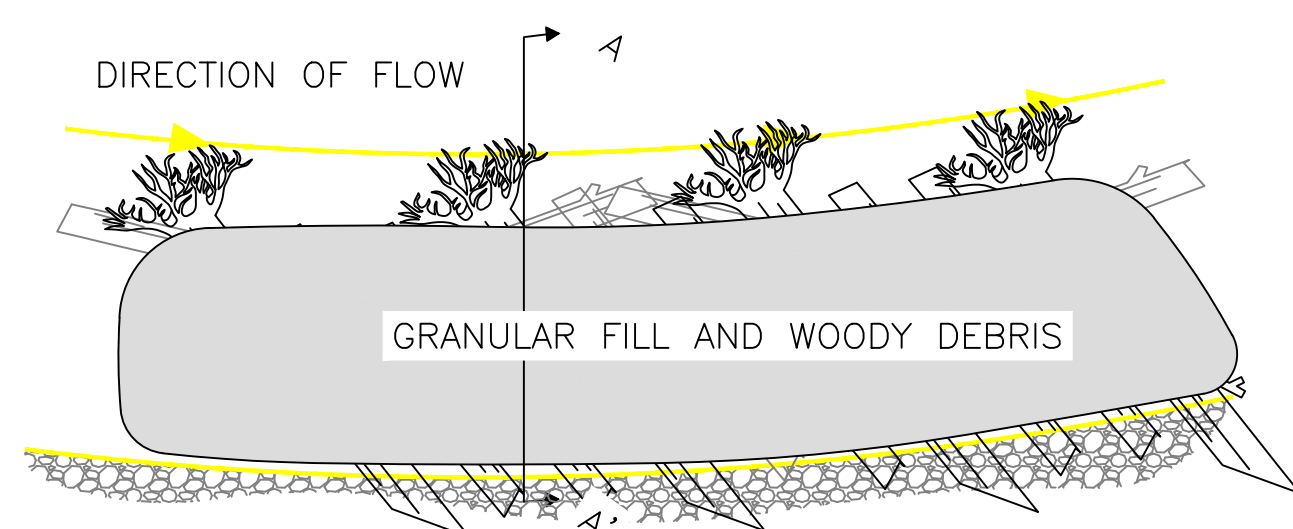
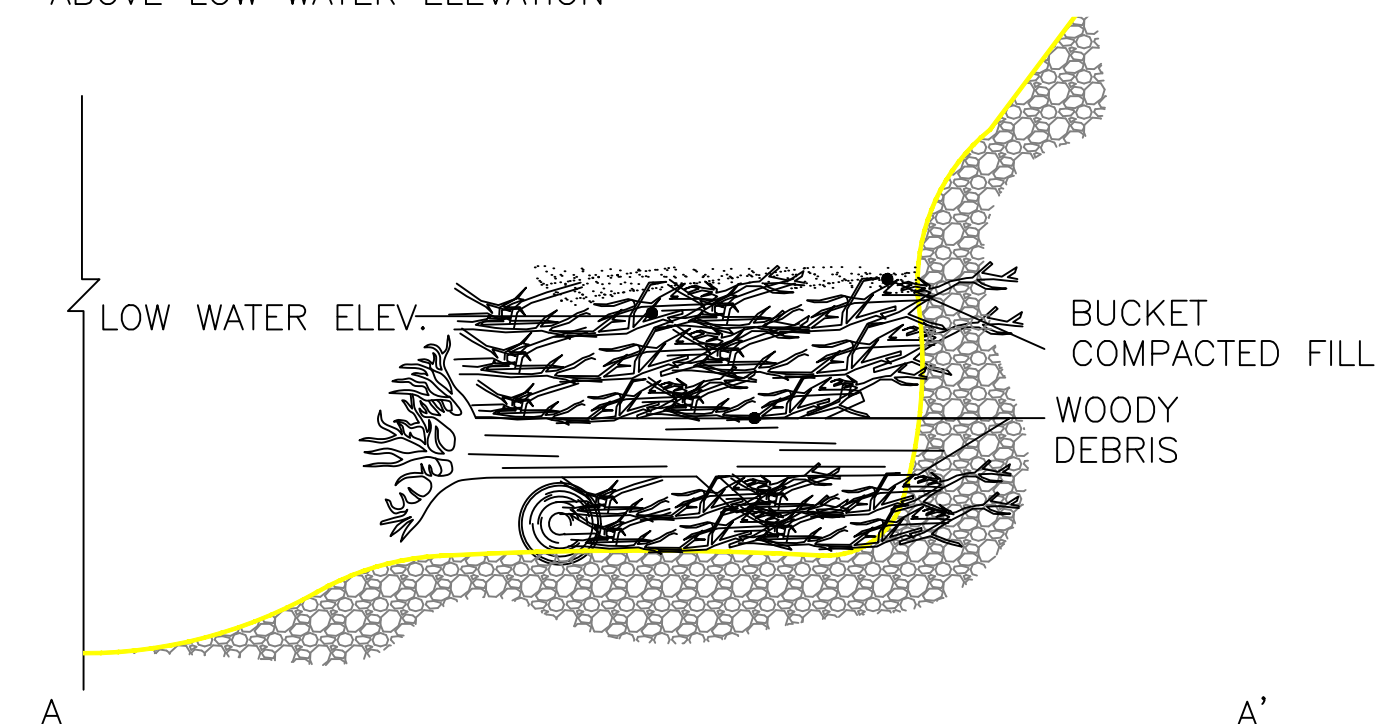
#### 4. WOODY DEBRIS PLACEMENT

WOODY MATERIAL SPECIFICATION:

- WOODY MATERIAL (COMPOSED OF 75 % SMALL LIMBS AND BRANCHES, 25% MEDIUM SIZED MATERIAL (3-6" LIMBS), AND LOGS UP TO 10" IN DIAMETER (ONE PER FIVE FEET),
- ALL MATERIAL SHALL BE FRESHLY CUT (NO ROTTEN LOGS OR LIMBS)

PLACEMENT:

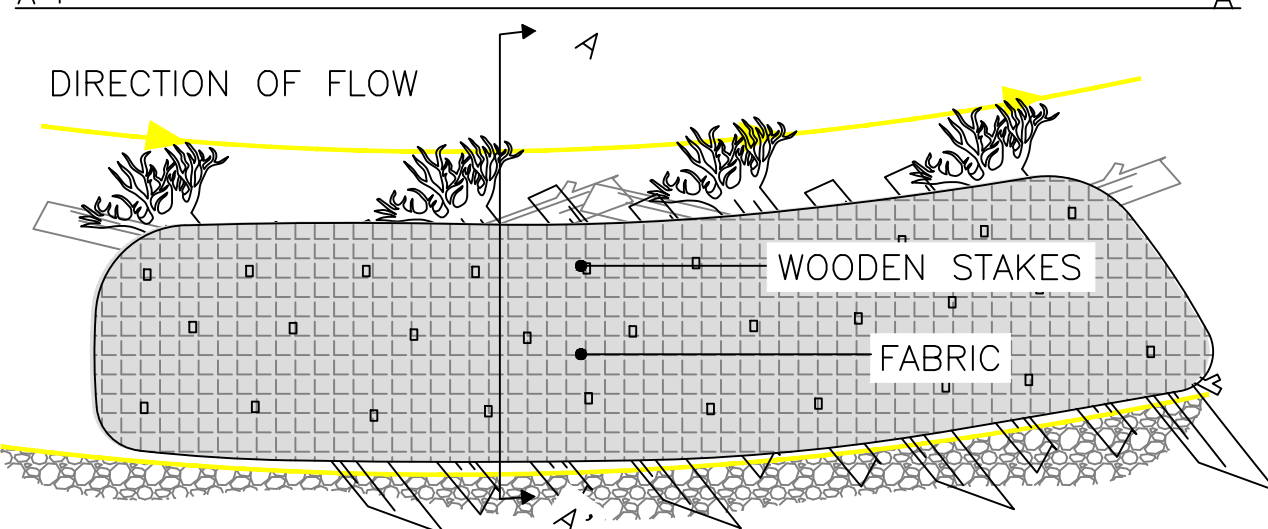
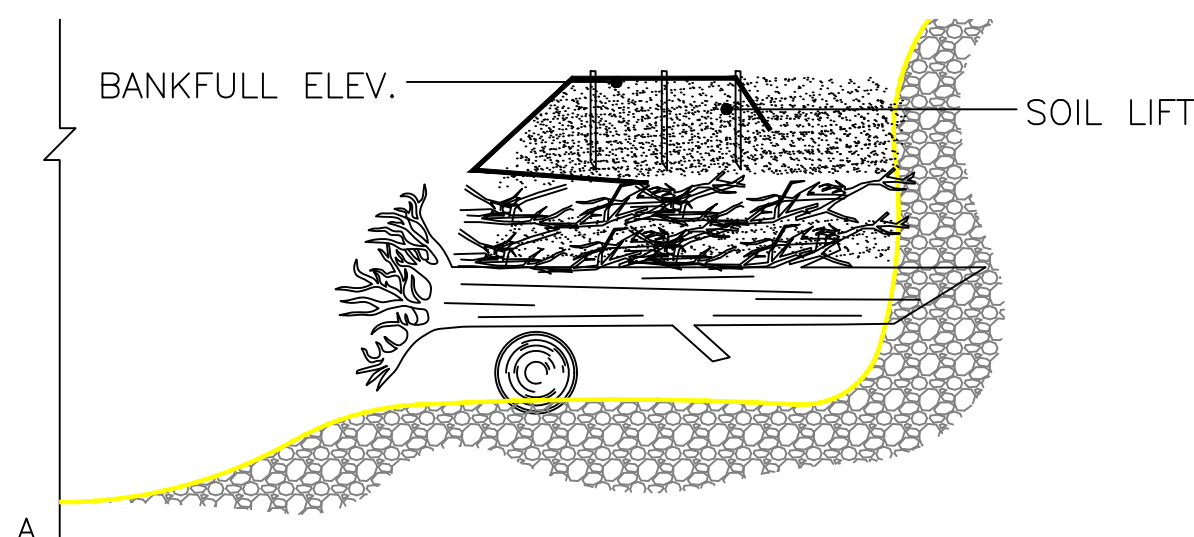
- FILL BETWEEN FOOTER LOGS AND ROOTWADS WITH WOODY MATERIAL
- PLACE WOODY MATERIAL TO 0.5' ABOVE LOW WATER ELEVATION
- LAYER GRANULAR FILL ON TOP OF WOODY DEBRIS
- COMPACTED FILL SHALL BE PLACED SUCH THAT THE TOP IS 0.8' ABOVE LOW WATER ELEVATION



## 5. SOIL LIFT

MATERIAL AND PLACEMENT SPECIFICATION:

- BLANKET SHALL BE: MIN 9.8' WIDE ROLANKA BIOD-MAT 70, GEOCOIR 700, OR EQUAL BACKED WITH MNDOT CAT 3N EROSION CONTROL BLANKET WITH NATURAL NETTING
- WOODEN STAKES: 18" WOODEN STAKES (2X4 CUT AT ANGLE OR EQUAL), PLACED AT MANUFACTURERS RECOMMENDED SPACING (3' MIN. TYP.) ALONG BLANKET.
- LAY BLANKET ON TOP OF SOIL A MINIMUM OF 3 FEET BACK FROM FACE OF WOOD, ON TOP OF BENCH ENSURE THAT COIR BLANKET IS A MINIMUM OF 3 FEET BACK FROM TOP OF BENCH
- PLACE FILL ON TOP OF BLANKET SLOPE AT 2:1 (H:V).
- BEFORE WRAPPING UP BLANKET, SEED ALL AREAS ABOVE LOW FLOW ELEVATION WITH MNDOT SEED MIX 34-361 RIPARIAN NORTHEAST @ 60 LBS/ACRE.
- BUCKET COMPACT UNTIL BANKFULL ELEVATION IS MET, GRADE TOP OF BENCH 2% TO EXISTING GROUND
- TRENCH COCONUT BLANKET INTO GROUND 1.0' ALONG OUTSIDE OF BEND.




APPROVED BY: XX	CHECKED BY: XX	DRAWN BY: GET
REV	DESCRIPTION	APPROV
1	DRAFT 30%	XX
XX	DRAFT 60%	XX
XX	XX	XX
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XX	XX	XX
XX	XX	XX
XX	XX	XX
XX	XX	XX

KEENE CREEK PARK  
STREAM RESTORATION  
CITY OF HERMANTOWN  
ST. LOUIS COUNTY, MN

DRAFT 60% - NOT FOR CONSTRUCTION


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DETAIL - TOE WOOD WITH SOD MAT



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CONSTRUCTION

DATE: 7/27/2020

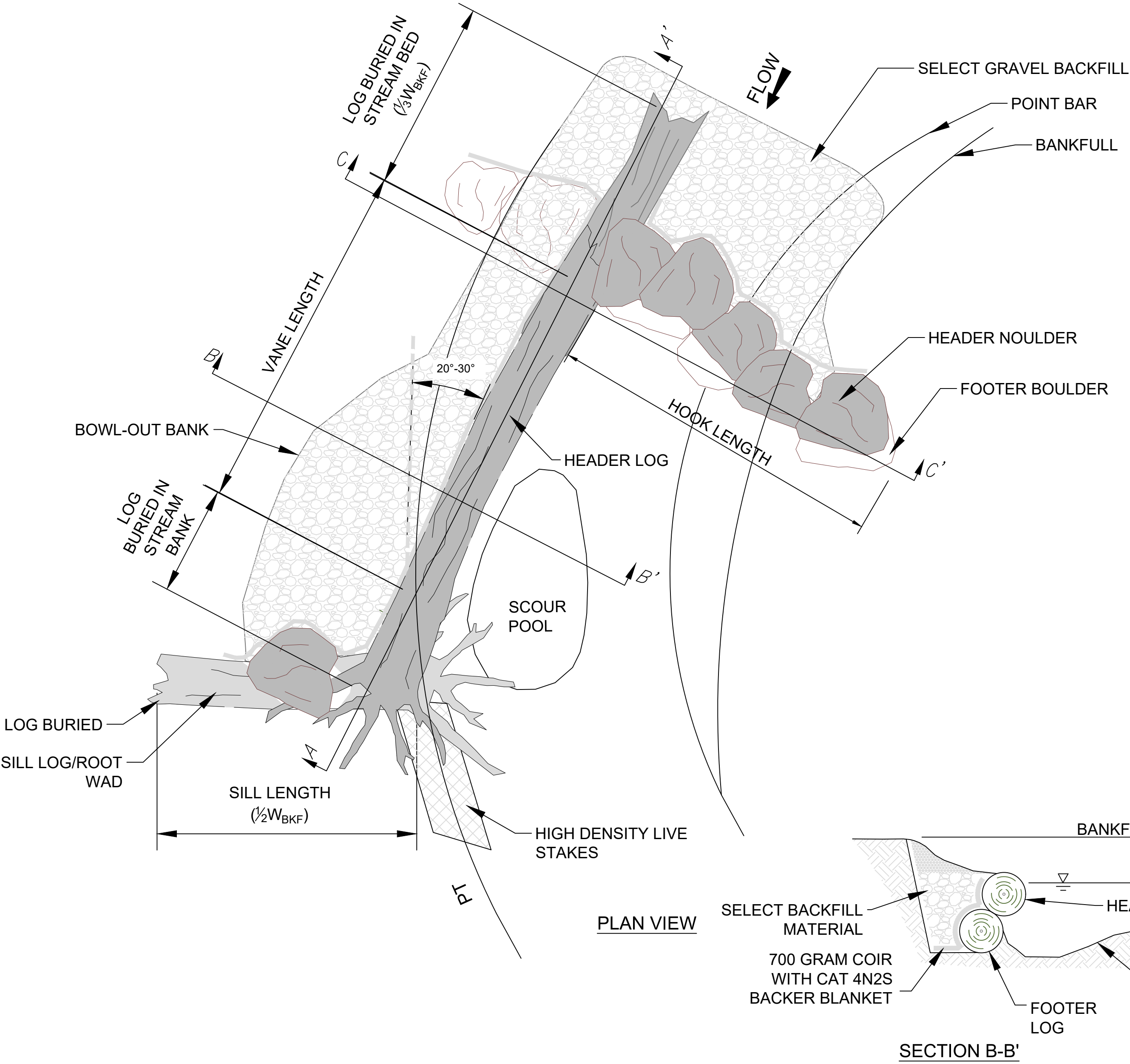
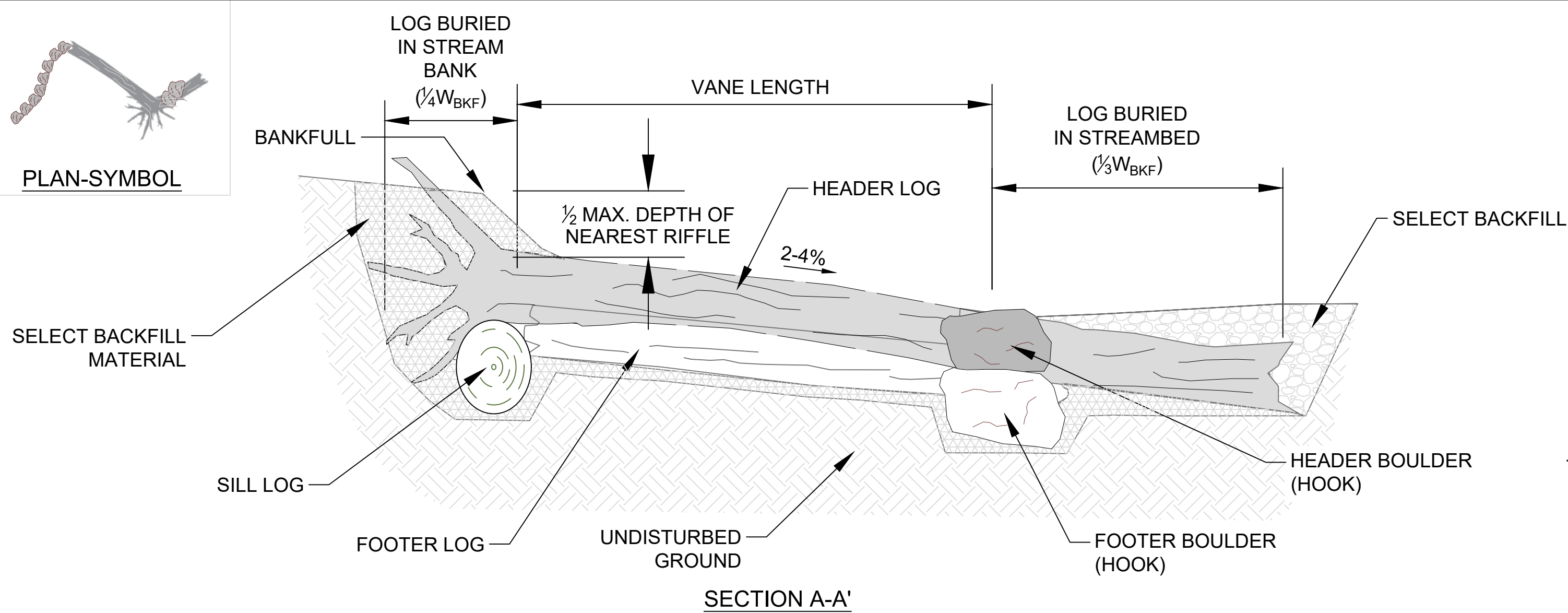
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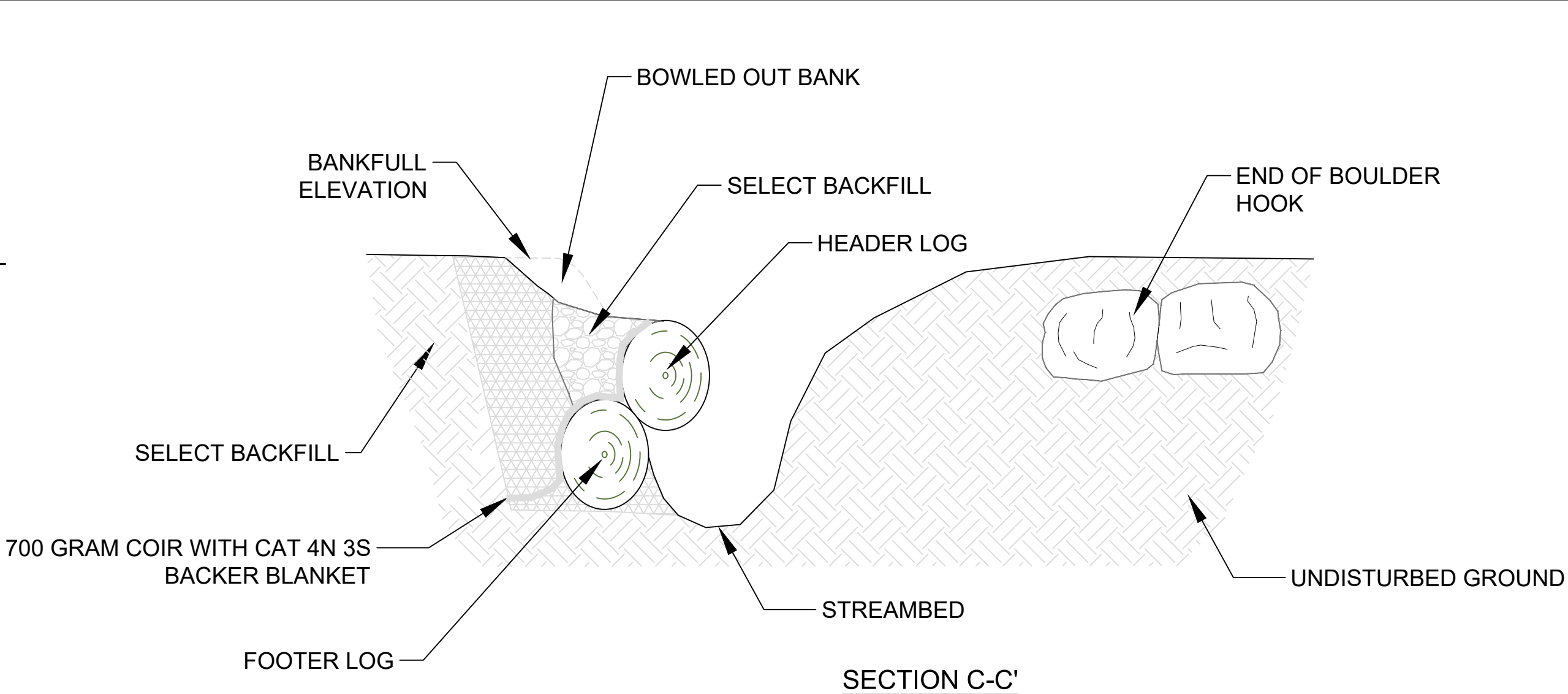
12 OF 16



C:\USERS\OWNER\PROBOX\KEENE\_TUC\DS\SHEETS\KEENE\_MASTER\DETAIL.DWG | OWNER: | SAVED: Wednesday, July 29, 2020 9:12:39 AM | ACAD.CTB | | PLOTTED: Wednesday, July 29, 2020 4:45:02 PM



DETAIL - LOG J-HOOK WITH ROOTWAD  
NOT TO SCALE



NOTES:

1. THE LOG J-HOOK WITH ROOT WAD IS USED TO STABILIZE THE OUTSIDE BANK OF A STREAM CHANNEL IN A BEND BY PHYSICALLY PROTECTING THE BANK AND HELPING TURN THE WATER TOWARD THE CENTER OF THE CHANNEL. THE LOG J-HOOK WITH ROOT WAD CAN BE USED TO HELP STABILIZE AN EXISTING CHANNEL OR TO PROTECT THE BANK OF A NEWLY CONSTRUCTED CHANNEL.
2. THE STRUCTURE IS COMPRISED OF BOTH LOGS AND BOULDERS. LOGS SHALL HAVE A MINIMUM DIAMETER OF 18". THE LENGTH OF THE LOGS WILL BE DETRMINED BY THE SIZE AND SHAPE OF THE CHANNEL. ALL LOGS SHALL BE RELATIVELY STRAIGHT AND LIMBS SHALL BE TRIMMED FLUSH. THE SIZE OF THE BOULDERS VARIES WITH THE SIZE OF THE CHANNEL.
3. HEADER LOGS/BOULDERS SHALL BE UNDERLAIN BY FOOTER LOGS/BOULDERS UNLESS OTHERWISE DIRECTED BY THE ENGINEER. FOOTER LOGS PROVIDE SCOUR PROTECTION FOR HEADER LOGS. FOOTER BOULDERS PROVIDE SCOUR PROTECTION AND A FOUNDATION FOR THE HEADER BOULDERS.
4. THE SILL LOG WITH ROOT WAD IS GENERALLY INSTALLED FIRST. THE CONTRACTOR SHALL DIG A TRENCH PERPENDICULAR TO THE BANKFULL FLOW DIRECTION AND INSTALL THE SILL LOG. IT MAY BE NECESSARY TO CUT THE SILL LOG ROOTWAD TO PREVENT THE ROOTWAD FROM PROTRUDING ABOVE THE BANKFULL ELEVATION. A BOULDER OR HEADER SILL LOG SHALL BE PLACED ON THE SILL LOG TO EFFECTIVELY EXTEND THE SILL FURTHER INTO THE BANK.
5. THE HEADER LOG OF THE VANE ARM IS GENERALLY INSTALLED NEXT. THE CONTRACTOR SHALL DIG A TRENCH TO FACILIATE THE INSTALLATION OF THE VANE ARM. THE HEADER LOG SHALL TIE INTO THE STREAM BANK AT A MINIMUM ELEVATION OF 1/4 DMAX (MEASURED AT THE NEXT DOWNSTREAM RIFFLE) BELOW BANKFULL ELEVATION AND A MINIMUM ELEVATION OF 1/2 DMAX (MEASURED AT THE NEXT DOWNSTREAM RIFFLE) BELOW BANKFULL ELEVATION UNLESS10. OTHERWISE DIRECTED BY THE ENGINEER. THE HEADER LOG SHALL EXTEND FROM THE SILL LOG TO BEYOND THE HOOK PORTION OF THE STRUCTURE, GENERALLY AT A SLOPE OF 2 - 4%. THE VANE ARM FOOTER LOG SHALL BE CUT TO FIT BETWEEN SILL LOG AND THE BOULDER HOOK PORTION OF THE STRUCTURE. THE FOOTER LOG OF THE VANE ARM SHALL BE INSTALLED FROM UPSTREAM SIDE AND INSTALLED AGAINST THE LOWER HALF OF THE HEADER LOG RESULTING IN A STAGGER WITH THE HEADER LOG BEING SLIGHTLY MORE DOWNSTREAM THAN THE FOOTER LOG. ANY GAPS BETWEEN THE HEADER AND FOOTER LOGS WIDER THAN 1" SHALL BE CHINKED WITH BRANCHES AND/OR BRUSH FROM THE UPSTREAM SIDE. WHEN COMPLETE THE FOOTER LOG WILL NOT BE VISIBLE BUT THE HEADER LOG WILL BE VISIBLE DURING LOW FLOWS.

TO FACILIATE THE INSTALLATION OF A ROW OF FOOTER BOULDERS THAT EXTEND FROM THE END OF THE FOOTER LOG OF THE VANE ARM ACROSS THE CHANNEL TO BEYOND BANKFULL ON THE OTHER SIDE OF THE CHANNEL CREATING A BURIED SILL. THE CONTRACTOR SHALL INSTALL HEADER BOULDERS ON TOP OF THE FOOTER BOULDERS. ALL BOULDERS SHALL BE FIT TIGHTLY TOGETHER AND ANY GAPS WIDER THAN 1" SHALL BE CHINKED WITH GRAVEL AND COBBLE FROM THE UPSTREAM SIDE WITH ROCKS. WHEN COMPLETE THE FOOTER BOULDERS WILL NOT BE VISIBLE BUT THE HEADER BOULDERS WILL BE VISIBLE DURING LOW FLOWS.

THE LOCATION AND ELEVATION OF THE SILL, VANE ARM AND THE BOULDER HOOK STRUCTURE MAY NOT VARY FROM THOSE SPECIFIED IN THE PLANSHEETS UNLESS DIRECTED OTHERWISE BY THE ENGINEER. THE FOOTER DEPTH ON ALL STRUCTURES REQUIRING FOOTERS SHALL BE 6 TIMES GREATER THAN THE DROP BETWEEN THE STRUCTURE AND THE FOOTERED STRUCTURE DIRECTLY DOWNSTREAM.

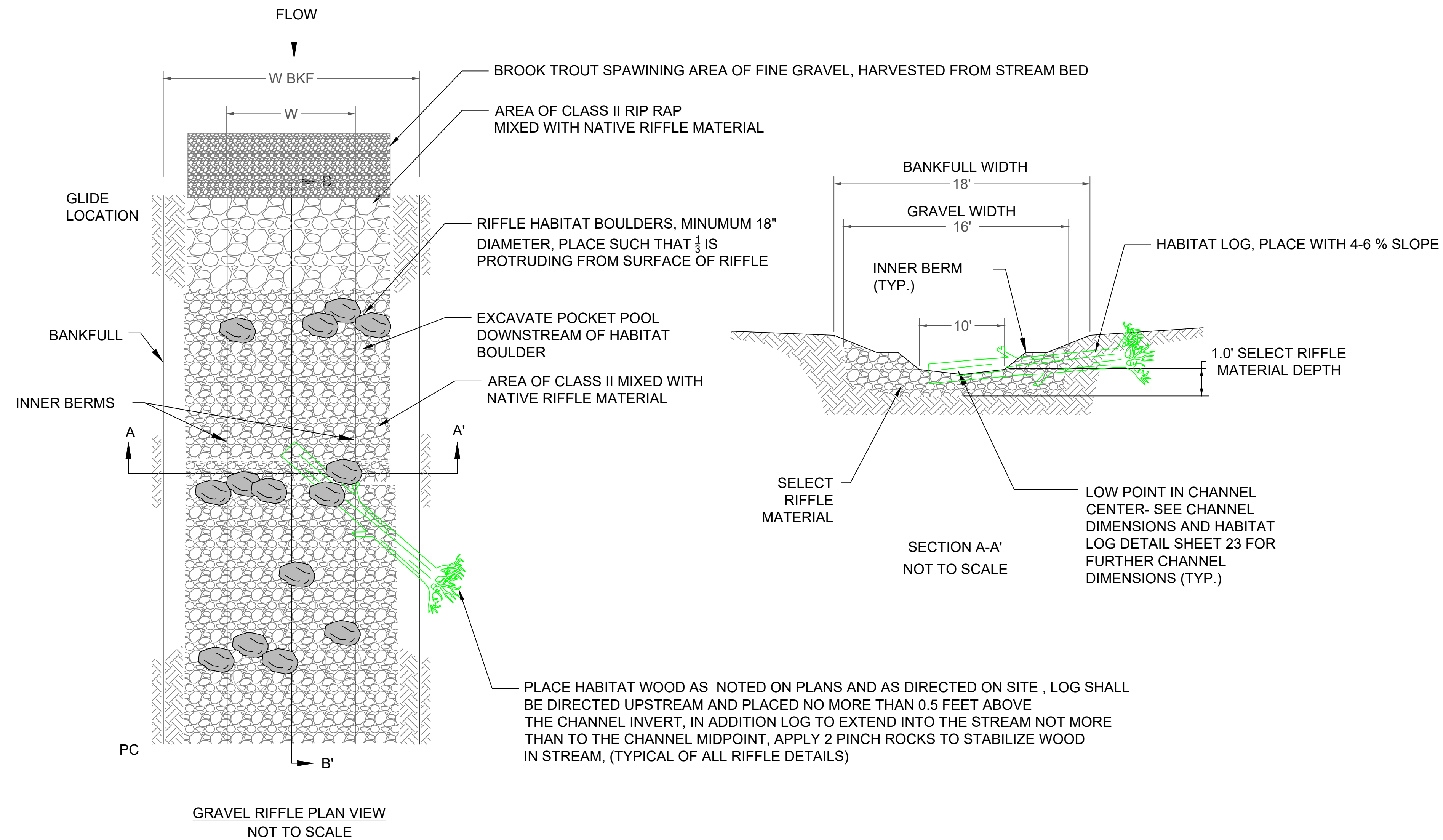
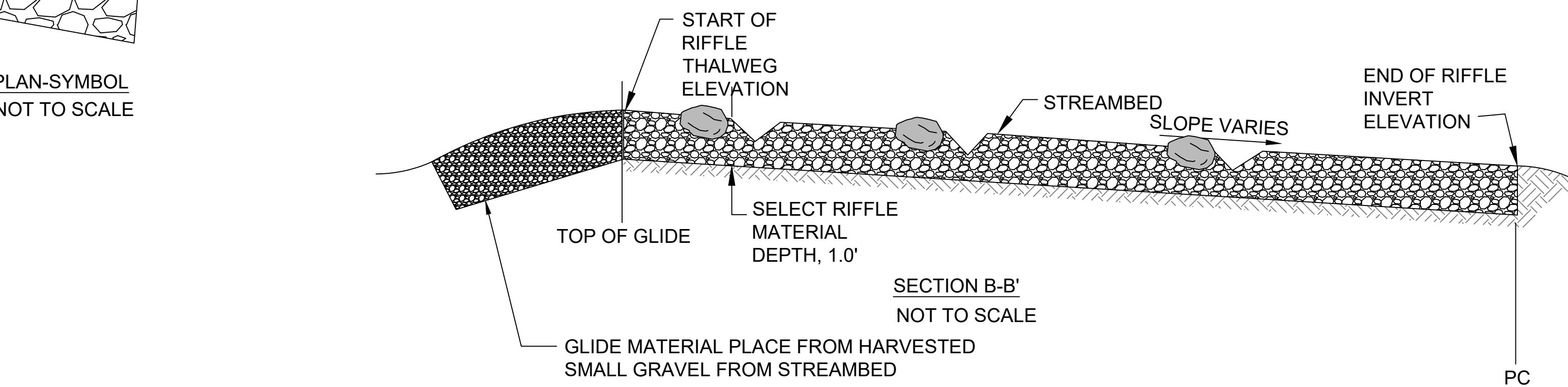
THE EXCAVATED AREAS UPSTREAM OF THE SILL, VANE ARM AND BOULDER HOOK SHOULD BE FILLED WITH SELECT BACKFILL MATERIAL AS SPECIFIED AND APPROVED BY THE ENGINEER. THE SELECT BACKFILL AND SOIL BACKFILL MATERIAL SHALL BE OVER COMPACTED USING EQUIPMENT SO THAT FUTURE SETTLEMENT IS KEPT TO A MINIMUM. THE STEAMBANK SHOULD BE BOWLED OUT BEHIND THE VANE ARM AT THE DOWNSTREAM END OF THE VANE ARM.

THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS . THE DEGREE OF FINISH FOR ELEVATIONS SHALL BE WITHIN 0.1' OF THE GRADES AND ELEVATIONS INDICATED. DRESSING OF THE CHANNEL, BANKFULL BENCH AND FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF THIS STRUCTURE AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

DETAILS REGARDING PLANTING REQUIREMENTS. NO LIVE STAKES SHALL BE INSTALLED ON THE UPSTREAM SIDE OF THE LOG VANE AT OR BELOW THE TIE-IN ELEVATION OF THE HEADER LOG WITH THE STEAMBANK UNLESS OTHERWISE DIRECTED BY THE ENGINEER. INSTALL LIVE STAKES PER THE PLAN VIEW DRAWING AND THE LIVE STAKE DETAIL. LIVE STAKES SHOULD BE INSTALLED BEHIND THE VANE ARM ABOVE THE BANKFULL ELEVATION ON 12" CENTERS. LIVE STAKES SHOULD BE INSTALLED DOWNSTREAM OF THE ROOT WAD ALONG THE TOP OF BANK AT A HIGHER DENSITY (I.E. 10" CENTERS).

APPROVED BY: XX	REV	CHECKED BY: XX	DESCRIPTION	DRAWN BY: GET	APPRV
KEENE CREEK PARK STREAM RESTORATION CITY OF HERMANTOWN ST. LOUIS COUNTY, MN  DRAFT 60% - NOT FOR CONSTRUCTION  ----- ----- DETAIL - LOG J-HOOK	1	XX	DRAFT 30%	XX	XX
	XX	XX	DRAFT 60%	XX	XX
	XX	XX	XX	XX	XX
	XX	XX	XX	XX	XX
	XX	XX	XX	XX	XX
	XX	XX	XX	XX	XX
	XX	XX	XX	XX	XX
	XX	XX	XX	XX	XX
FOR REVIEW NOT FOR CONSTRUCTION					DATE: 7/27/2020
NTS					
SHEET NUMBER 13 OF 16					






1. THE GRAVEL AND COBBLE SUBSTRATE USED FOR THIS FEATURE SHOULD BE PREFERENTIALLY HARVESTED FROM THE ARMOR LAYER OF THE EXISTING CHANNEL. AND AMENDED OR SORTED AS NOTED BY THE REGION OF THE RIFFLE/GLIDE.
2. SORTING AND SIEVING OF THE HARVESTED RIFFLE SUBSTRATE IS INCIDENTAL TO THE CONSTRUCTION OF THIS STRUCTURE
3. SELECT RIFFLE MATERIAL SHALL HAVE A GRADATION OF 50 % BY VOLUME OF CLASS II OR III RIP RAP AS NOTED IN THE DETAIL AND 50 PERCENT BY VOLUME HARVESTED IN PLACE STREAM BED MATERIAL.
4. SELECT RIFFLE MATERIAL WILL BE PLACED AT A MINIMUM THICKNESS OF 1.0'.
5. THE SELECT RIFFLE MATERIAL WILL BE PLACED SUCH THAT, IN CROSS-SECTION, ITS LOWEST ELEVATION OCCURS IN THE CENTER OF THE CHANNEL AS PER THE DETAIL.
6. HABITAT BOULDERS SHALL BE PLACED IN THE RIFFLE SUCH THAT NOT MORE THAN  $1/3 - \frac{1}{2}$  THE DIAMETER OF THE BOULDER PROTRUDES ABOVE THE STREAM BED. AS SHOWN SOME OF THE BOULDERS SHALL BE PLACED IN GROUPINGS OF 3 IN ORDER TO CREATE DOWNSTREAM SCOUR, THE BOULDERS SHALL BE 18-30" IN DIAMETER.
7. SET INVERTS AT ELEVATIONS SHOWN IN GRAVEL TABLE ON SHEET 19.
8. SELECT RIFFLE MATERIAL SHALL BE COMPACTED USING TRACK EQUIPMENT SUCH THAT FUTURE SETTLEMENT OF THE MATERIAL IS KEPT TO A MINIMUM.
9. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.1 FT OF THE GRADES AND ELEVATIONS INDICATED.
10. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
11. SEE TYPICAL RIFFLE CROSS SECTION FOR DIMENSIONS, SHEET 23.

APPROVED BY: XX		CHECKED BY: XX	DRAWN BY: GET
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1	DRAFT 30%	XX	
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KEENE CREEK PARK  
STREAM RESTORATION  
CITY OF HERMANTOWN  
ST. LOUIS COUNTY, MN

DRAFT 60% - NOT FOR CONSTRUCTION  
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-----  
DETAIL - GRAVEL RIFFLE



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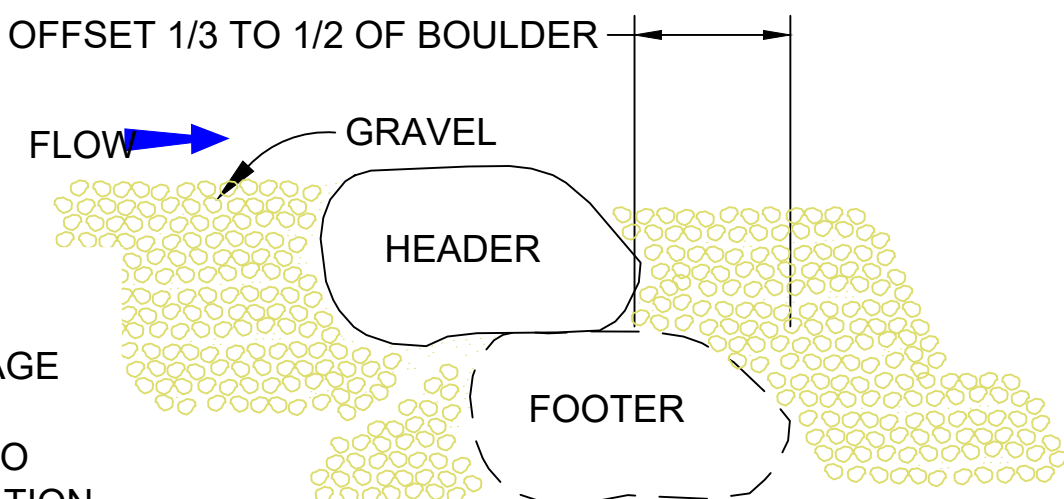
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DATE: 7/27/2020

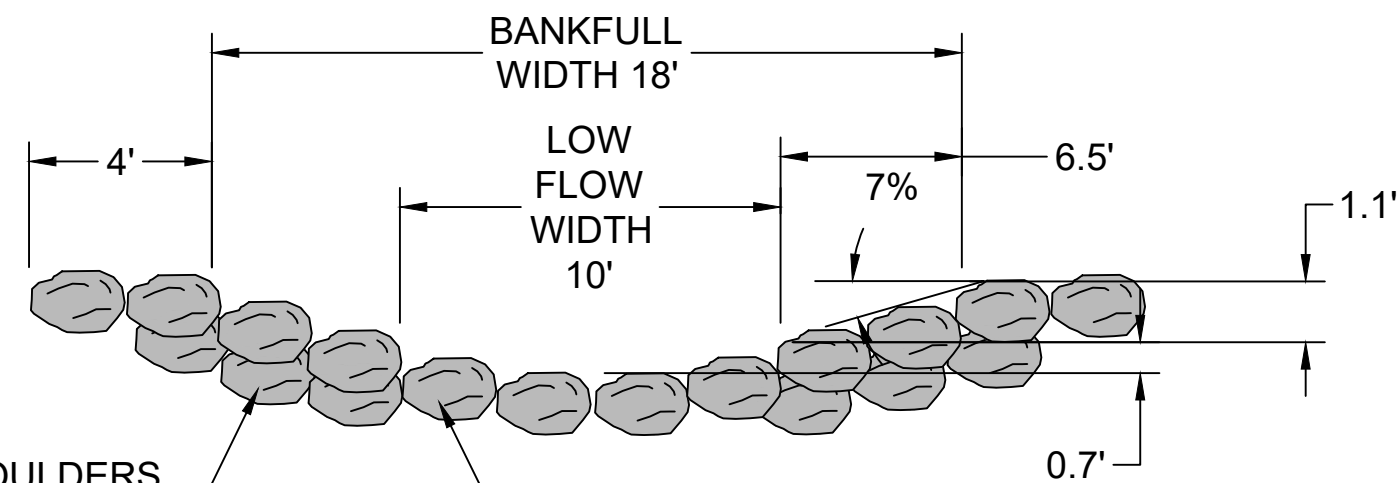
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14 OF 16

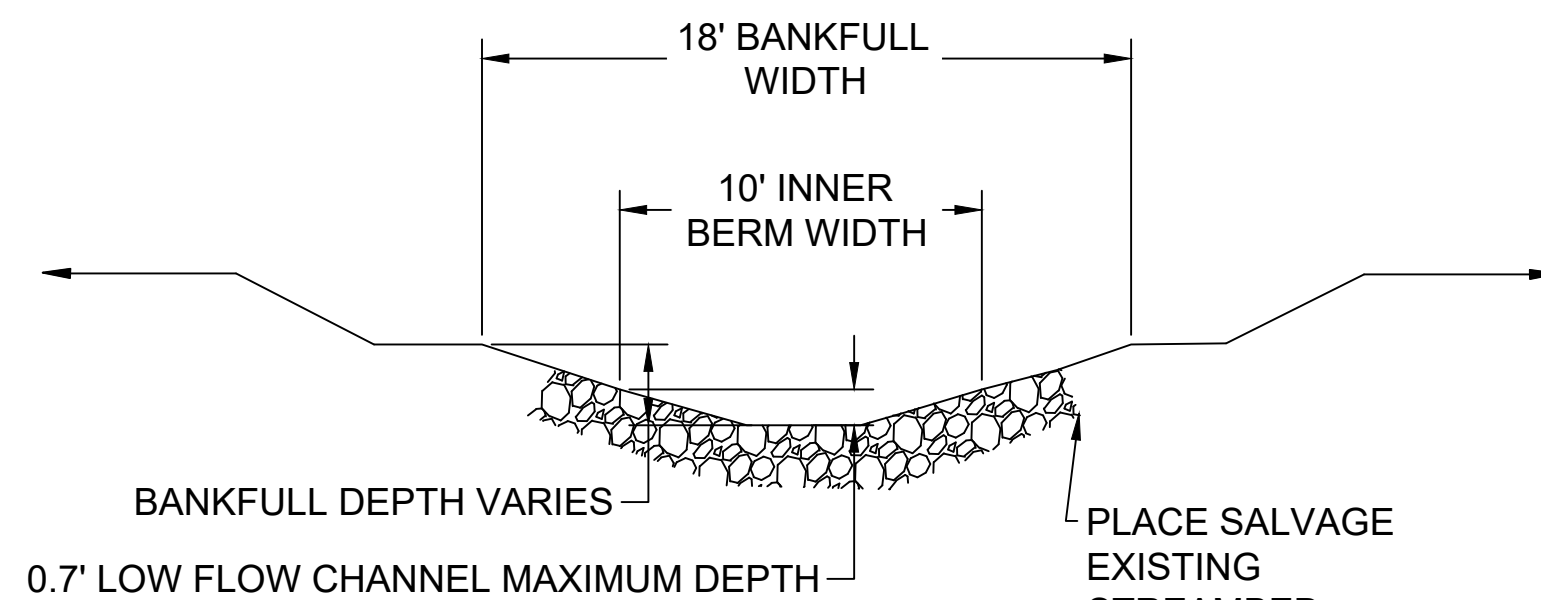




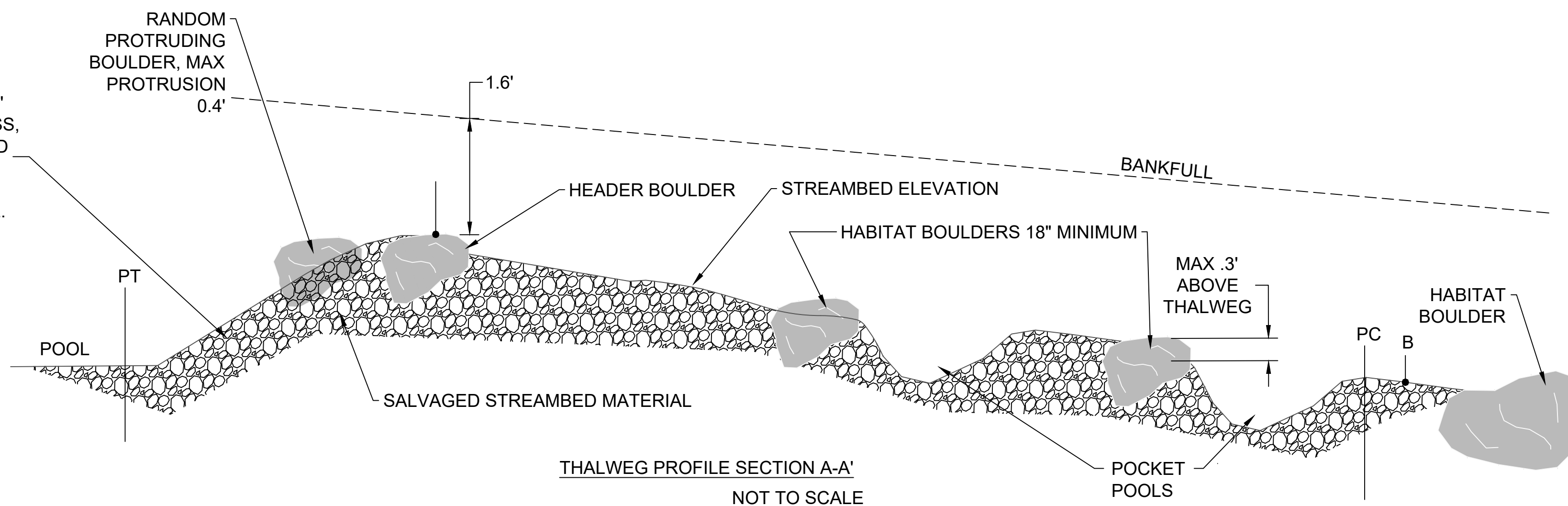
RIFFLE STRUCTURE CROSS SECTION  
NOT TO SCALE



SECTION B-B'  
NOT TO SCALE



SECTION C-C'  
NOT TO SCALE



THALWEG PROFILE SECTION A-A'  
NOT TO SCALE

- NOTES:**
1. HEADER BOULDERS MUST HAVE A MINIMUM DIAMETER OF 2.5'.
  2. IT IS ESTIMATED THAT THE GLIDE STRUCTURE WILL HAVE XXX BOULDERS PER GLIDE, ASSUMING A BOULDER DIAMETER OF 2.5'.
  3. SALVAGED STREAM BED MATERIAL SHALL CONSIST OF A RANGE OF PARTICLES SIZES TYPICALLY SEEN IN EXISTING STREAM BED RIFFLES.
  4. HEADER BOULDERS VARIES BETWEEN 0.2' AND 0.8' ABOVE THALWEG ELEVATIONS.
  5. SET INVERTS AT ELEVATIONS SHOWN ON THE PLAN AND PROFILE VIEWS.
  6. HEADER BOULDERS LOCATED BETWEEN THE INNER BERMS SHALL BE SPACED APPROXIMATELY 0.3' APART.
  7. BOULDERS, MINIMUM OF 18", SHALL BE SPACED RANDOMLY IN RIFFLE WITHIN THE LOW FLOW CHANNEL AND THROUGH OUT THE LENGTH OF THE RIFFLE, AS SHOWN.
  8. BOULDERS SHALL BE BURIED INTO THE RIFFLE EXPOSING A MAXIMUM OF 0.6'. A POCKET POOL NO DEEPER THAN THE BOULDER DEPTH SHALL BE DUG DOWNSTREAM OF EACH BOULDER.
  9. RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
  10. THE ENGINEER OR ENGINEERING TECHNICIAN MUST BE ONSITE DURING THE PLACEMENT OF ALL IN STREAM STRUCTURES. IF STRUCTURES ARE PLACED WITHOUT ENGINEERING APPROVAL, RECONSTRUCTION MAY BE REQUIRED AT THE CONTRACTOR'S EXPENSE.
  11. HABITAT BOULDER SHALL BE PLACED ON THE UPPER 3RD OF THE P;OOL.

REV	APPROVED BY: XX	CHECKED BY: XX	DRAWN BY: GET	APPRV
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XX				XX

KEENE CREEK PARK  
STREAM RESTORATION  
CITY OF HERMANTOWN  
ST. LOUIS COUNTY, MN

DRAFT 60% - NOT FOR CONSTRUCTION

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DETAIL - ROCK GLIDE RIFFLE



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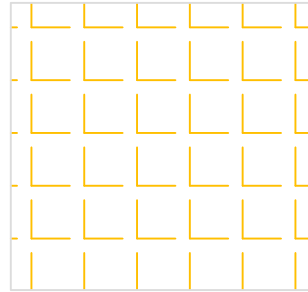
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SHEET NUMBER

15 OF 16





ZONE 1

PLANTING AREA-

MIN. 8' WIDE BANKFULL BENCH, IN ADDITION TO 1' INTO CHANNEL.

CANOPY-

THE FOLLOWING CANOPY PLANTS SHALL BE 1.5' HEIGHT CONTAINERIZED STOCK. PLANT AT 8 FOOT SPACING ABOVE BANKFULL ELEVATION:

- 1. WHITE SPRUCE (PICEA GLAUCA)-50%
- 2. \*WHITE CEDAR (*THUJA OCCIDENTALIS*)-10%
- 3. \*WHITE PINE (PINUS STROBUS) -40%

TRANSPLANTS:

- TRANSPLANT ALDER, WILLOW, AND DOGWOOD SHRUBS FROM THE EXCAVATED AREA. PLANT BEHIND THE TOEWOOD SOIL WRAPS, AND IN THE FLOODPLAIN AREAS AS DIRECTED BY THE ENGINEER . IF NOT IMMEDIATELY PLANTED, PLACE TEMPORARILY IN SOIL UNTIL PLANTING.

SEED AND COIR AND BACKER BLANKET

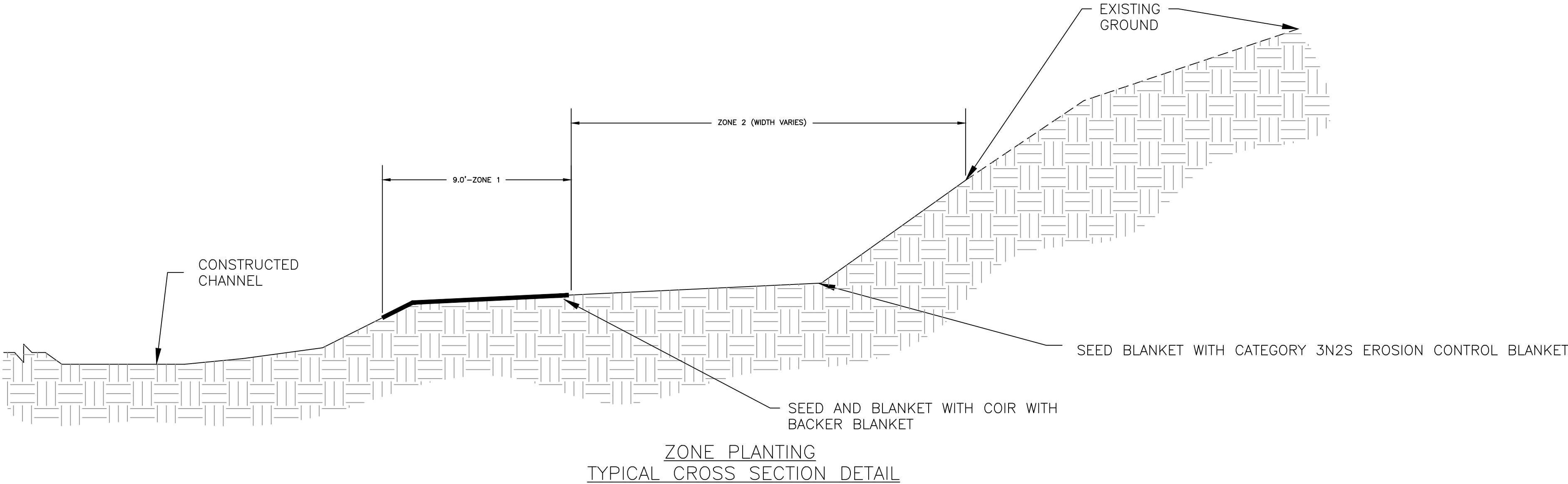
- BLANKET MAIN CHANNEL WITH 9.8' WIDE AND BACKED WITH MN DOT CATEGORY 3N, 2S, EROSION CONTROL BLANKET. INSTALL 2' LONG, 2"X2" WOOD STAKES WITH A ROOFING NAIL AT THE TOP TO SECURE THE BLANKET, INSTALL STAKES EVERY 5' ALONG BLANKET EDGES AND EVERY 5' ON THE CENTERLINE OF THE BLANKET. SEED WITH MIX 34-361 SEED MIX, AT 60 LBS PER ACRE.

TREE PROTECTION:

\* SPECIES THAT REQUIRE 6' HIGH X 3.0' DIAMETER FENCING WITH 2 T-POSTS PLACED ON THE UPSTREAM SIDE OF THE TREE CAGE

ZONE 3 ACCESS ROAD

SEED AND MULCH  
SEED EXPOSED SOILS WITH SEED MIX 36-311 AT 60 LBS PER ACRE



ZONE 2, INCLUDING FOREST RESTORATION AREAS

PLANTING AREA-

LIMITS OF RESTORATION OUTSIDE OF ZONE 1 FLOODPLAIN AREA.

CANOPY

THE FOLLOWING CANOPY PLANTS SHALL BE 2.0' HEIGHT 1 GALLON POT CONTAINERIZED STOCK. PLANT AT 8 FOOT SPACING:

- 1. WHITE SPRUCE (PICEA GLAUCA) -40%
- 2. YELLOW BIRCH (BETULA ALLEGHANIENSIS)-10%
- 3. BUR OAK (*QUERCUS MACROCARPA*)- 10%
- 4. \*WHITE PINE (PINUS STROBUS) -20%
- 5. PAPER BIRCH (BETULA PAPYRIFERA) -10%
- 6. SUGAR MAPLE (ACER SACCHARUM)-10%

SUB-CANOPY

THE FOLLOWING SUB-CANOPY PLANTS SHALL BE 1.5' HEIGHT CONTAINERIZED STOCK. PLANT THE FOLLOWING AT 8 FOOT SPACING,

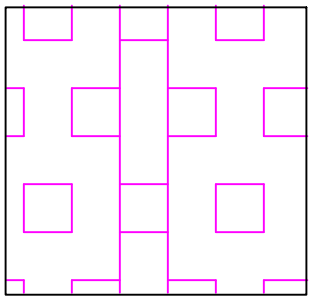
- 1. CHOKE CHERRY (PRUNIS VIRGINIANA)-20%
- 2. JUNEBSERRIES (AMELANCHIER SPP.)-30%
- 3. BUSH HONEYSUCKLE (DIERVILLA LONICERA)-50%

SEED AND MULCH

- APPLY CATETORY 3N2S EROSION CONTROL BLANKET
- SEED WITH 36-311 SEED MIX AT 60 LBS/ACRE.
- SCARIFY SOIL PRIOR TO SEEDING

TREE PROTECTION:

\* SPECIES THAT REQUIRE 6' HIGH X 3.0' DIAMETER FENCING WITH 2 T-POSTS PLACED ON THE UPSTREAM SIDE OF THE TREE CAGE



FOREST RESTORATION AREAS

PLANTING AREA AND SITE PREP-

AREAS AS NOTED ON THE PLANS, SITE PREP SHALL BE CLEARING ALL WOODY VEGETATION WITHIN IDENTIFIED AREA ON PLAN, CONFIRM AREAS WITH ENGINEER AND SWCD PRIOR TO CLEARING.

CANOPY

THE FOLLOWING CANOPY PLANTS SHALL BE 2.0' HEIGHT 1 GALLON POT CONTAINERIZED STOCK. PLANT AT 8 FOOT SPACING:

- 1. WHITE SPRUCE (PICEA GLAUCA) -40%
- 2. YELLOW BIRCH (BETULA ALLEGHANIENSIS)-10%
- 3. BUR OAK (*QUERCUS MACROCARPA*)- 10%
- 4. \*WHITE PINE (PINUS STROBUS) -20%
- 5. PAPER BIRCH (BETULA PAPYRIFERA) -10%
- 6. SUGAR MAPLE (ACER SACCHARUM)-10%

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- 1. CHOKE CHERRY (PRUNIS VIRGINIANA)-20%
- 2. JUNEBSERRIES (AMELANCHIER SPP.)-30%
- 3. BUSH HONEYSUCKLE (DIERVILLA LONICERA)-50%

APPROVED BY: XX	REV	CHECKED BY: XX	DRAWN BY: GET	APPRV
KEENE CREEK PARK STREAM RESTORATION CITY OF HERMANTOWN ST. LOUIS COUNTY, MN  DRAFT 60% - NOT FOR CONSTRUCTION  ----- ----- DETAIL - PLANTING	1	DESCRIPTION		XX
		DRAFT 30%		XX
		DRAFT 60%		XX
		XX		XX
		XX		XX
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		XX		XX
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FOR REVIEW NOT FOR CONSTRUCTION				
DATE:				7/27/2020
NTS				
SHEET NUMBER				
16 OF 16				



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United States  
Department of  
Agriculture

NRCS

Natural  
Resources  
Conservation  
Service

A product of the National  
Cooperative Soil Survey,  
a joint effort of the United  
States Department of  
Agriculture and other  
Federal agencies, State  
agencies including the  
Agricultural Experiment  
Stations, and local  
participants

# Custom Soil Resource Report for **St. Louis County, Minnesota, Duluth Part**



# Preface

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Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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# How Soil Surveys Are Made

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Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

## Custom Soil Resource Report

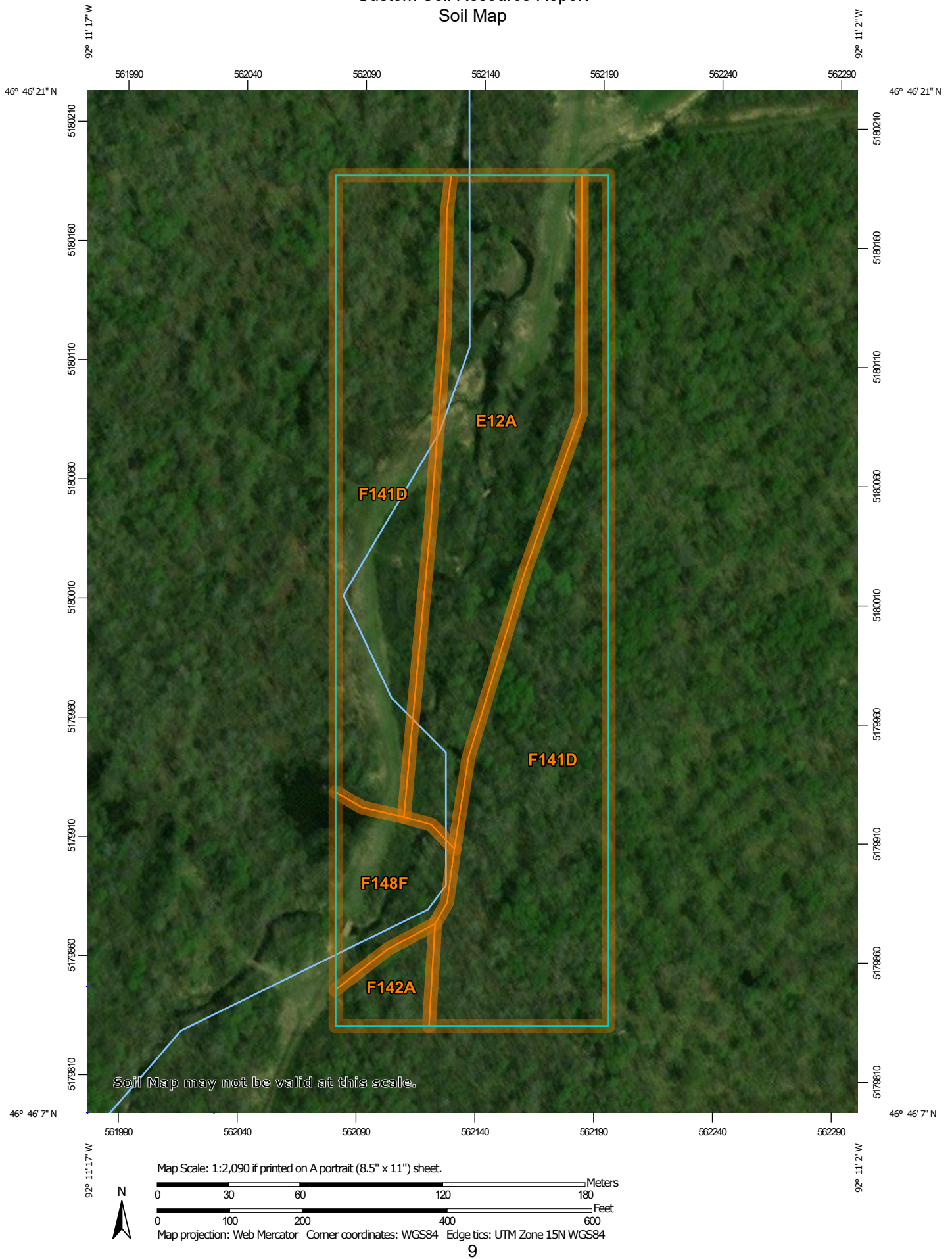
identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# Soil Map

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The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

# Custom Soil Resource Report Soil Map



# Custom Soil Resource Report


## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features

 Blowout

 Borrow Pit

 Clay Spot


 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

### Water Features

 Streams and Canals

### Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL:  
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: St. Louis County, Minnesota, Duluth Part  
Survey Area Data: Version 17, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 27, 2014—Sep 8, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
E12A	Udifluvents complex, 0 to 3 percent slopes, flooded	3.1	30.2%
F141D	Ahmeek-Normanna-Cathro, depressional, complex, pitted, 0 to 25 percent slopes	6.1	60.2%
F142A	Canosia loam, 0 to 2 percent slopes	0.3	3.0%
F148F	Ahmeek-Rock outcrop-Fluvaquents, frequently flooded, complex, 0 to 50 percent slopes	0.7	6.6%
<b>Totals for Area of Interest</b>		<b>10.2</b>	<b>100.0%</b>

## Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it



was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## St. Louis County, Minnesota, Duluth Part

### E12A—Udifuvents complex, 0 to 3 percent slopes, flooded

#### Map Unit Setting

*National map unit symbol:* p0gj  
*Elevation:* 490 to 1,310 feet  
*Mean annual precipitation:* 25 to 34 inches  
*Mean annual air temperature:* 37 to 43 degrees F  
*Frost-free period:* 100 to 140 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Udifuvents, frequently flooded, and similar soils:* 55 percent  
*Udifuvents, occasionally flooded, and similar soils:* 35 percent  
*Minor components:* 10 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Udifuvents, Frequently Flooded

##### Setting

*Landform:* Flats on flood plains, rises on flood plains  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Alluvium

##### Typical profile

*A - 0 to 8 inches:* sandy loam  
*C - 8 to 43 inches:* stratified very gravelly coarse sandy loam to silt loam  
*Ab - 43 to 48 inches:* sandy loam  
*Cb - 48 to 80 inches:* stratified loamy sand to gravelly silt loam

##### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Somewhat poorly drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 6.00 in/hr)  
*Depth to water table:* About 13 inches  
*Frequency of flooding:* Frequent  
*Frequency of ponding:* None  
*Available water storage in profile:* Moderate (about 6.0 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 5w  
*Hydrologic Soil Group:* A/D  
*Forage suitability group:* Frequently Flooded (G092XN016MN)  
*Hydric soil rating:* Yes

#### Description of Udifuvents, Occasionally Flooded

##### Setting

*Landform:* Levees on flood plains  
*Down-slope shape:* Convex  
*Across-slope shape:* Linear

## Custom Soil Resource Report

*Parent material:* Alluvium

### Typical profile

*A - 0 to 8 inches:* extremely gravelly loam

*C - 8 to 80 inches:* stratified extremely gravelly loam to sand

### Properties and qualities

*Slope:* 0 to 3 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Moderately well drained

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)

*Depth to water table:* About 30 inches

*Frequency of flooding:* Occasional

*Frequency of ponding:* None

*Available water storage in profile:* Low (about 5.7 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 5w

*Hydrologic Soil Group:* C

*Forage suitability group:* Wet Frequently Flooded (G092XN015MN)

*Hydric soil rating:* No

### Minor Components

#### Fluvaquents, frequently flooded

*Percent of map unit:* 10 percent

*Landform:* Depressions on flood plains

*Down-slope shape:* Concave

*Across-slope shape:* Concave

*Hydric soil rating:* Yes

## F141D—Ahmeek-Normanna-Cathro, depressional, complex, pitted, 0 to 25 percent slopes

### Map Unit Setting

*National map unit symbol:* h2tj

*Elevation:* 1,150 to 1,800 feet

*Mean annual precipitation:* 28 to 31 inches

*Mean annual air temperature:* 36 to 43 degrees F

*Frost-free period:* 80 to 140 days

*Farmland classification:* Not prime farmland

### Map Unit Composition

*Ahmeek and similar soils:* 50 percent

*Normanna and similar soils:* 20 percent

*Cathro, depressional, and similar soils:* 15 percent

*Minor components:* 15 percent

## Custom Soil Resource Report

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Ahmeek

#### Setting

*Landform:* Moraines  
*Landform position (two-dimensional):* Shoulder, backslope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Loamy material over dense loamy till

#### Typical profile

*A - 0 to 2 inches:* silt loam  
*E - 2 to 4 inches:* silt loam  
*Bw - 4 to 14 inches:* gravelly sandy loam  
*2Bw,2BC - 14 to 33 inches:* gravelly sandy loam  
*2BCd - 33 to 80 inches:* gravelly sandy loam

#### Properties and qualities

*Slope:* 8 to 25 percent  
*Depth to restrictive feature:* 30 to 80 inches to densic material  
*Natural drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Low (about 3.7 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 4e  
*Hydrologic Soil Group:* D  
*Ecological site:* Till Upland Mesic Hardwood Forests (F093AY001MN)  
*Forage suitability group:* Sandy (G093AN022MN)  
*Hydric soil rating:* No

### Description of Normanna

#### Setting

*Landform:* Moraines  
*Landform position (two-dimensional):* Summit, backslope  
*Down-slope shape:* Convex  
*Across-slope shape:* Linear  
*Parent material:* Loamy material over dense loamy till

#### Typical profile

*A - 0 to 4 inches:* loam  
*Bw - 4 to 45 inches:* gravelly sandy loam  
*2Bw,BC,2BC - 45 to 48 inches:* gravelly sandy loam  
*2BCd - 48 to 80 inches:* gravelly sandy loam

#### Properties and qualities

*Slope:* 3 to 8 percent  
*Depth to restrictive feature:* 30 to 60 inches to densic material  
*Natural drainage class:* Moderately well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)

## Custom Soil Resource Report

*Depth to water table:* About 18 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Low (about 5.2 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 3e  
*Hydrologic Soil Group:* B/D  
*Ecological site:* Till Upland Mesic Hardwood Forests (F093AY001MN)  
*Forage suitability group:* Sloping Upland, Acid (G093AN006MN)  
*Hydric soil rating:* No

### Description of Cathro, Depressional

#### Setting

*Landform:* Depressions on moraines  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Parent material:* Organic material over dense loamy till

#### Typical profile

*Oa - 0 to 36 inches:* muck  
*A - 36 to 40 inches:* mucky silt loam  
*Cg - 40 to 48 inches:* stratified loamy fine sand to loam  
*2Cd - 48 to 80 inches:* gravelly sandy loam

#### Properties and qualities

*Slope:* 0 to 1 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Very poorly drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)  
*Depth to water table:* About 0 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* Frequent  
*Available water storage in profile:* Very high (about 17.3 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 7w  
*Hydrologic Soil Group:* B/D  
*Forage suitability group:* Not Suited (G093AN024MN)  
*Hydric soil rating:* Yes

### Minor Components

#### Canosia

*Percent of map unit:* 5 percent  
*Landform:* Moraines  
*Landform position (two-dimensional):* Toeslope  
*Down-slope shape:* Concave  
*Across-slope shape:* Linear  
*Hydric soil rating:* Yes

#### Hermantown

*Percent of map unit:* 5 percent  
*Landform:* Moraines

## Custom Soil Resource Report

*Landform position (two-dimensional):* Footslope, summit  
*Down-slope shape:* Concave  
*Across-slope shape:* Linear  
*Hydric soil rating:* No

### **Giese, depressional**

*Percent of map unit:* 5 percent  
*Landform:* Depressions on moraines  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Ecological site:* Depressional Wet Hardwood Forests (F093AY003MN)  
*Hydric soil rating:* Yes

## **F142A—Canosia loam, 0 to 2 percent slopes**

### **Map Unit Setting**

*National map unit symbol:* h2tk  
*Elevation:* 1,150 to 1,800 feet  
*Mean annual precipitation:* 28 to 31 inches  
*Mean annual air temperature:* 36 to 43 degrees F  
*Frost-free period:* 80 to 140 days  
*Farmland classification:* Not prime farmland

### **Map Unit Composition**

*Canosia and similar soils:* 90 percent  
*Minor components:* 10 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### **Description of Canosia**

#### **Setting**

*Landform:* Flats on moraines  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Loamy material over dense loamy till

#### **Typical profile**

*A - 0 to 5 inches:* loam  
*Bw - 5 to 25 inches:* gravelly sandy loam  
*2Bw,2BC - 25 to 34 inches:* gravelly sandy loam  
*2BCd - 34 to 80 inches:* gravelly sandy loam

#### **Properties and qualities**

*Slope:* 0 to 2 percent  
*Depth to restrictive feature:* 30 to 60 inches to densic material  
*Natural drainage class:* Poorly drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)

## Custom Soil Resource Report

*Depth to water table:* About 0 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Low (about 3.8 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 3w

*Hydrologic Soil Group:* C/D

*Forage suitability group:* Level Swale, Acid (G093AN005MN)

*Hydric soil rating:* Yes

### Minor Components

#### Hermantown

*Percent of map unit:* 5 percent

*Landform:* Rises on moraines

*Down-slope shape:* Convex

*Across-slope shape:* Linear

*Hydric soil rating:* No

#### Giese, depressional

*Percent of map unit:* 5 percent

*Landform:* Depressions on moraines

*Down-slope shape:* Concave

*Across-slope shape:* Concave

*Hydric soil rating:* Yes

## F148F—Ahmeek-Rock outcrop-Fluvaquents, frequently flooded, complex, 0 to 50 percent slopes

### Map Unit Setting

*National map unit symbol:* tp0g

*Elevation:* 1,150 to 1,800 feet

*Mean annual precipitation:* 28 to 31 inches

*Mean annual air temperature:* 36 to 43 degrees F

*Frost-free period:* 80 to 140 days

*Farmland classification:* Not prime farmland

### Map Unit Composition

*Ahmeek and similar soils:* 65 percent

*Fluvaquents, frequently flooded, and similar soils:* 10 percent

*Rock outcrop:* 10 percent

*Minor components:* 15 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Ahmeek

#### Setting

*Landform:* Moraines

*Landform position (two-dimensional):* Shoulder, backslope, summit



## Custom Soil Resource Report

*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Loamy material over dense loamy till

### Typical profile

*A - 0 to 2 inches:* silt loam  
*E - 2 to 4 inches:* silt loam  
*Bw - 4 to 14 inches:* gravelly sandy loam  
*2Bw,2BC - 14 to 33 inches:* gravelly sandy loam  
*2BCd - 33 to 80 inches:* gravelly sandy loam

### Properties and qualities

*Slope:* 18 to 50 percent  
*Depth to restrictive feature:* 30 to 80 inches to densic material  
*Natural drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Low (about 3.7 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 7e  
*Hydrologic Soil Group:* D  
*Ecological site:* Till Upland Mesic Hardwood Forests (F093AY001MN)  
*Forage suitability group:* Not Suited (G093AN024MN)  
*Hydric soil rating:* No

## Description of Fluvaquents, Frequently Flooded

### Setting

*Landform:* Moraines  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Alluvium

### Typical profile

*A - 0 to 6 inches:* mucky silt loam  
*Cg - 6 to 80 inches:* stratified silt loam to gravelly loamy coarse sand

### Properties and qualities

*Slope:* 0 to 2 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Poorly drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)  
*Depth to water table:* About 0 inches  
*Frequency of flooding:* Frequent  
*Frequency of ponding:* None  
*Available water storage in profile:* Moderate (about 8.9 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 5w  
*Hydrologic Soil Group:* B/D  
*Forage suitability group:* Not Suited (G093AN024MN)

## Custom Soil Resource Report

*Hydric soil rating:* Yes

### Description of Rock Outcrop

#### Setting

*Landform:* Moraines

*Parent material:* Bedrock

#### Properties and qualities

*Slope:* 0 to 50 percent

*Depth to restrictive feature:* 0 inches to lithic bedrock

#### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 8s

*Forage suitability group:* Not Suited (G093AN024MN)

*Hydric soil rating:* Unranked

### Minor Components

#### Hermantown

*Percent of map unit:* 10 percent

*Landform:* Moraines

*Landform position (two-dimensional):* Footslope

*Down-slope shape:* Concave

*Across-slope shape:* Linear

*Hydric soil rating:* No

#### Normanna

*Percent of map unit:* 5 percent

*Landform:* Moraines

*Landform position (two-dimensional):* Summit, backslope

*Down-slope shape:* Convex

*Across-slope shape:* Linear

*Ecological site:* Till Upland Mesic Hardwood Forests (F093AY001MN)

*Hydric soil rating:* No

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**Wetlands**

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

**Riparian**

- Forested/Shrub
- Herbaceous

Keene Creek Project Area

PFO1D

PFO1D

PFO1D

PSS1Cd

PSS1D

PFO1/4D

PFO1D

PSS1D

PFO1D

Keene Creek  
Recreation  
Area

1:9,028

46.770 | -92.194





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

July 30, 2020

Correspondence # ERDB 20210009

Mr. Karl Koller  
MN DNR  
1201 East Highway 2  
Grand Rapids, MN 55744

RE: Natural Heritage Review of the proposed Keene Creek Stream Restoration,  
T50N R15W Section 36; St. Louis County

Dear Mr. Koller,

As requested, the above project has been reviewed for potential effects to known occurrences of rare features. Given the project details provided with the data request form, I do not believe the proposed project will negatively affect any known occurrences of rare features.

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

For environmental review purposes, the results of this Natural Heritage Review are valid for one year; the results are only valid for the project location (noted above) and the project description provided on the NHIS Data Request Form. Please contact me if project details change or for an updated review if construction has not occurred within one year.

The Natural Heritage Review does not constitute review or approval by the Department of Natural Resources as a whole. Instead, it identifies issues regarding known occurrences of rare features and potential effects to these rare features. If needed, please contact your [DNR Regional Environmental Assessment Ecologist](#) to determine whether there are other natural resource concerns associated with the proposed project. Please be aware that additional site assessments or review may be required. Thank you for consulting us on this matter, and for your

interest in preserving Minnesota's rare natural resources. Please include a copy of this letter in any state or local license or permit application.

Sincerely,

A handwritten signature in black ink that reads "Samantha Bump". The signature is written in a cursive style with a large, stylized 'S' and 'B'.

Samantha Bump  
Natural Heritage Review Specialist  
[Samantha.Bump@state.mn.us](mailto:Samantha.Bump@state.mn.us)

Links: DNR Regional Environmental Assessment Ecologist Contact Info  
[http://www.dnr.state.mn.us/eco/ereview/erp\\_regioncontacts.html](http://www.dnr.state.mn.us/eco/ereview/erp_regioncontacts.html)