July 2013 version

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:** Knowlton Creek Stream Restoration Project

2. **Proposer:** MN Department of Natural Resources
   Contact person: John Lindgren
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3. **RGU:** MN Department of Natural Resources
   Contact person: Ronald Wieland
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   Address: 500 Lafayette Road
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4. **Reason for EAW Preparation:** (check one)

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

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

   Minnesota Rule: part 4410.4300, Subpart 26 (Stream Diversion).

5. **Project Location:** County: St. Louis
   City/Township: Duluth
   PLS Location (¼, ¼, Section, Township, Range):

Subsection	Section	Township	Range
S1/2 SW1/4	14	49N	15W
NE1/4 NW1/4, NW1/4 NE1/4 S1/2 NE1/4, NE1/4 SE1/4	23	49N	15W

   Watershed (major watershed scale): St. Louis River

GPS Coordinates:
(NAD83) UTM ZONE 15: (X) 561030.3, (Y) 5173978.1
Latitude & Longitude (DMS): 46 42 59.7, -92 12 5.2
Latitude & Longitude (DD): 46.71657, -92.20145

Tax Parcel Numbers: Numerous (Most of the parcels owned by City of Duluth)

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

- County map showing the general location of the project;

Figure 1. Habitat Restoration Projects within the St. Louis River estuary Area of Concern (AOC), Knowlton Creek Stream Restoration Project

- U.S. Geological Survey 7.5 minute, 1:24,000 scale map indicating project boundaries (photocopy acceptable); and

Figure 2. Topographic Map of Knowlton Creek Stream Restoration Project.

Site plans showing all significant project and natural features. Pre-construction site plan and post-construction site plan.

Figure 3. Sector 1 - Lower Unknown Tributary of Knowlton Creek and Sector 3 - Knowlton Creek Main Stem.
Figure 4. Most of Sector 2 - Upper UT to Knowlton Creek, Pump Station, and Upland Area 3 and 4 (also see Figure 3).
Figure 5. Log Vane with Boulder Hook structure is one that contains an oblique vane.
Figure 6. The Boulder Jam Stem is a structure that contains a cross-vane.
Figure 7. Diagram of a Rock Riffle structure.
Figure 8. Diagram of Wood Toe with COIR Wrapped Soil
Figure 9. Public Lands and Reserves in Vicinity of Knowlton Creek
Figure 10. Wetlands in Knowlton Creek Stream Restoration Project Area

- Attachments
  - A. Background on St Louis River Area of Concern (AOC)
  - B. DNR Natural Heritage Information System Concurrence
  - C. Phase I Archaeology Report Abstract

6. Project Description:

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

The Minnesota Department of Natural Resources (MDNR) proposes to restore and enhance habitat for trout and associated cold-water organisms, using Natural Channel Design techniques, to stabilize approximately 6,491 linear feet of Knowlton Creek and tributaries in Duluth, Minnesota. This project supports the Lower St. Louis River Area of Concern (AOC) Remedial Action Plan.

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.

Anthropogenic land practices and uses within the Knowlton Creek Watershed have resulted in severe impacts to the stream channel. The snowmaking operations at Spirit Mountain Recreation Area (SMRA) increase Knowlton Creek's annual inflow by approximately twenty percent. Additionally,

snowmelt and rain events run off more quickly to Knowlton Creek from the semi-pervious surfaces of the ski runs. The other primary impairment identified are the backflow surge releases associated with the City of Cloquet Water Pumping Station, which pushes water up and over the hill from the St. Louis River to the Sappi Paper Mill. Until recently, backflow surges were released directly into a tributary of Knowlton Creek during power outages. The quick release of water resulted in substantial degradation of the stream channel and movement of sediment to the estuary.

Storm events during the last decade, highlighted by a significant flood occurred in the watershed in June 2012 (less than one percent probability of exceedance), resulted in the major failure of a derelict railroad causeway and severe bank erosion on both the main stem and tributaries of Knowlton Creek. Flooding caused significant bank erosion and channel incision in the upstream reaches and generated large amount of sedimentation. The sediment collected on the floodplain along the downstream, flatter reaches and contributed to the formation of a delta at the mouth of the creek in St. Louis Bay.

The Knowlton Creek Stream Restoration Project is being completed in coordination with a water control project at the base of the SMRA ski hill. The SMRA Authority is a component unit of the City of Duluth. During spring melt and high rainfall events, the runoff from the SMRA ski hill contributes to the degradation of the Knowlton Creek channel. The water control project will collect surplus runoff and direct it away from Knowlton Creek, down a pipeline to the St. Louis River estuary, allowing a calculated base flow to reach Knowlton Creek. The proposed work will include the construction of ditching, storm sewer piping, and culverts in order to convey the flow to both water bodies.

The MDNR, Division of Fish and Wildlife proposes the Knowlton Creek Stream Restoration Project (the project) to stabilize 6,491 ft (about 1.2 mi) of select reaches on the Knowlton Creek main stem and tributaries, located in the mid- and lower reaches of Knowlton Creek watershed. Knowlton Creek and its tributaries total over five miles (mi). The project area is located within the SMRA recreation park, City of Duluth, St. Louis County, Minnesota. Approximately 4.3 mi of Knowlton Creek and tributaries were recently designated as trout habitat (#S-002-003.5) by MDNR Fisheries (Figures 1 and 2). The MDNR will oversee all contracting and construction activities.

The project area (35 ac) encompasses 6,491 feet of channel (~3 ac), where boulder and log energy dissipation structures will be installed to improve channel stability and aquatic habitat. The stream restoration work has been partitioned into three sectors that are described in detail below. Floodplain areas along the channel will be re-graded to reconnect them to the channel and for maneuvering equipment (13 ac). The width of the disturbance zone along the creek ranges from 50 to 100 ft along the mid-reaches (Sector 2) and 100 to 200 ft along the lower reaches (Sectors 1 and 3). Corridors for equipment access and staging areas have been designated, some of which are outside the project area shown on Figures 3 and 4. Wetland creation is proposed at five locations, totaling 0.64 ac. The construction zone encompasses approximately 16 ac of project area, which includes all areas re-graded, the approximate channel area, material staging, equipment access routes, and created wetland areas. About 20 acres (ac) of the project area will not be disturbed. One acre is equivalent to 43,560 square feet.

The Knowlton Creek watershed ranges in elevation from 600 to 1300 ft above mean sea level (AMSL). The 1,472 acre-Knowlton Creek watershed lies mostly within the City of Duluth and extends into the village of Proctor. The upper three-quarters of the watershed (above 1000 ft) is situated above the project area. This part of the watershed has an average slope of around four percent and retains much of its original forest and wetland cover. Low density urban development and a more developed I-35 corridor cover about twenty percent of the upper watershed. Stream reaches in the upper watershed generally have stable banks and sedimentation rates are less problematic.

Glacial till covers the upper watershed but is thin or absent in the mid-elevations of the watershed (650 – 1000 ft AMSL) where bedrock is exposed at the land surface. The mid-section is part of the prominent steep rocky bluff composed of Duluth Complex bedrock that parallels the shoreline of the St. Louis River Estuary and Lake Superior. Many channel segments are very steep along the mid-section. The very lower part of the Knowlton Creek (600 – 670 ft AMSL) has a floodplain zone, with slopes averaging about four percent.

The Knowlton Creek and its tributaries flow down high gradient topography in its mid-section into the lower portion, which flattens before flowing into a shallow sheltered bay behind Tallas Island on the St. Louis River estuary. The calculated bankfull discharge (1 to 2 yr frequency) for Knowlton Creek is estimated to be between 112-130 cfs.

The proposed stream restoration involves adjusting the channel's dimensions, patterns of sinuosity, and profile (width, depth, bank dimensions, etc.) through channel shaping and the placement of wood and rock structures to improve stream stability and trout habitat. The structures largely create step-pool sequences along each reach. Through the development of channel control structures, the restoration will synergistically improve habitat for trout and associated cold-water organisms.

The restoration methodology being applied is a geomorphologic approach appropriate for the creek's hydrology following the Natural Channel Design methodology (Applied River Morphology, Rosgen, 1996). The approach applies engineering, geologic, and biological principles into designs that are based on fluvial geomorphology, the study of how the landscape is shaped by flowing water.

The basis of natural stream channel design is to focus on the entire stream system and use stable, natural channels in reaches of the stream as blueprints or reference reaches for the stream restoration. The reference reaches profile how stable stream systems transport its watershed's flows and sediment as it dissipates energy through its particular geometry and in-stream structures. The reference reaches for the proposed work on Knowlton Creek and Reach 11 of the Unnamed Tributary (UT) to Knowlton Creek are Basin Creek, UT Trickery Creek, Mitchell River Headwaters and Little Mill Seat.

The proposed restoration of Knowlton Creek uses analytical, empirical, and analogue design procedures. Data is analyzed using a set of process equations that link the three-dimensional morphology of the river (bankfull width, mean and maximum depths, slope, sinuosity, meander arc length, and velocity) with the controlling boundary conditions (bankfull discharge and bed material load, bed material caliber, bank sediment, vegetation, and valley slope). A HEC-RAS model was developed for this project using flows determined from USGS regression equations in the StreamStats application for small creek flows and other USGS data for larger flows. Stream gages, field measurements and observations were used to predict defensible flows to calibrate the model. The model was run for Bankfull, 10, 25, 50, 100, 500 – year storm events. The FLOWSED/POWERSED sediment transport models and the BANCs model were employed by Stantec engineering and design contractors to compare pre- and post-project channel bank erosion.

The proposed structures are designed for flows above bankfull and the work is designed to maintain integrity during a 25-yr storm event. The newly constructed channels are designed to meet existing creek baseflow condition that is higher than the historical flow in Knowlton Creek. Project designs will be certified by a Registered Professional Engineer licensed in Minnesota. Certification confirms that the design was overseen by a competent and experienced Engineer with the public welfare, environmental protection, and the goals of the project in mind.

Project design (i.e., channel configuration, structures, and nonstructural techniques, etc.) needs to account for the stream's ability to transport water and sediment. Three types of restoration approaches are identified for focus reaches: (Priority I, II, and III): establishing a hydraulic connection between the channel and floodplain (Priority I); cutting a new floodplain with the channel at its current (or sometimes raised) elevation (Priority 2); stabilizing stream banks (Priority 3). Designation of reaches was partially based on the best approach for achieving restoration goals and objectives. Other components of the project are: adjusting the stream channel size, location and shape and enhancing vegetation in the riparian corridor. The objective with the Priority I restoration is to ensure that the sediment transport of the bankfull channel upstream is maintained through the channel without significant aggradation or degradation.

Proposed habitat features include vanes, cross-vanes, riffles, and toe wood revetments. Eight types of stream stabilization structures, classified under these four general categories are proposed to be installed in or along the channel. A total of approximately 339 structures are proposed in three locations. Often these structures are collectively regarded as riffle structures because they create hydraulic complexity (turbulence, upwelling, downwelling) in stream flow. By increasing the creek's hydraulic complexity and channel stability (reduced erosion and sedimentation), the structures are regarded as habitat enhancement structures for fisheries, including brook trout and other aquatic organisms.

The types of structures proposed are: Oblique Vanes, including Rock and Log Riffles, Boulder Vane Riffles, and Log Vane Boulder Hooks; Cross-vanes, including Boulder Jam Steps and Log Steps; Riffles, including Rock Cascades and Rock Riffles; and Wood Toe with COIR (Fiber Mat) Wrapped Soil (Toe Wood). The average distance of separation of the riffle structures will be about 20 feet. The following include descriptions of these in-stream habitat features (Figures 5, 6, 7, and 8):

- **Oblique Vanes**: Oblique vanes provide for the proper natural conditions of secondary circulation patterns associated with channel pattern and shift boundary stress from the near-bank region towards the center and reduce the nearshore flow velocities. The vane is also a stream habitat improvement structure due to: 1) an increase in bank cover due to a differential raise of the water surface in the bank region; 2) the creation of holding and refuge cover in the deep pool during both high and low flow periods; 3) the development of feeding lanes in the flow separation zones (the interface between fast and slow water) due to the strong downwelling and upwelling forces in the center of the channel; and 4) the creation of spawning habitat in the tail-out or glide portion of the pool (Figure 5).

  Vanes are a series of boulders or logs that are placed in a line facing upstream from the outside bend of the stream. Vanes are intended to direct flow away from the stream bank to reduce erosion, and also to create habitat complexity for fish and other aquatic organisms. A trench is excavated from an outside bend in an upstream direction at approximately 10 to 15 degrees away from the stream bank until the trench reaches one-third of the stream width. Boulders are then placed in the trench as footers for the rock vane. The boulders for the rock vane are then placed on top of the footers, with the first rock fully buried in the bank with the top of the rock at bankfull elevation. Successive rocks are placed in a progressively lower position toward the bed elevation of the stream, so that the final rock placed at the end of the rock vane extends only one to two inches above the stream grade. Three of the types of structures proposed incorporate this bank erosion reduction technique (about 51 total structures): Boulder Vane Riffle (27), Log Vane with Boulder Hook (12), and Rock and Log Riffle (12).

The Boulder Vane Riffle is the placement of a series of oblique vanes that are anchored in sequence, alternating from one bank to the other bank. They create a meandering stream flow, scour pools, and local turbulence. The Log Vane with Boulder Hook structure incorporates header and footer logs buried into the streambed and angled upstream at about two-thirds to five-sixths of the perpendicular angle to stream flow to enhance bank stabilization. The structures are used for energy dissipation along the lower slopes and upper floodplain reaches of Knowlton Creek. The boulder hook component is a linear series of boulders that extend from the log to beyond the opposite bank bankfull mark. The Log Vane with Boulder Hook structure is used for grade control and habitat. It also serves as a way to protect against bank erosion by deflecting water away during high flow events. The Rock and Log Riffle is also a structure placed at oblique angles to stream flow, where boulders and root wads are alternately anchored from side to side. The low point of the channel will alternate left and right of the centerline and native cobble and gravel mixture will be placed an average of two feet deep between mini-vanes. Rock and Log Riffles include upper and lower cross channel logs with large diameter boulders and root wads serving as anchors. Scour pools are often established intermediate and below these structures.

Cross vanes: As noted by Rosgen, cross-vanes are grade control structures that decreases near-bank shear stress, velocity and stream power, but increases the energy in the center of the channel. The structure will establish grade control, reduce bank erosion, create a stable width/depth ratio, and maintain channel capacity, while maintaining sediment transport capacity, and sediment competence, i.e., size of particle that can be carried. Cross vanes are a series of boulders which extend from opposite stream banks, and where the two vanes are connected by a row of rocks across the middle third of the stream perpendicular to the current. Log cross vanes serve a similar purpose. Cross vanes are built generally in an arch configuration, with the center of the arch placed upstream of the side anchor boulders. The formation helps direct current to the center of the channel and to induce scour downstream. The resulting pool (where the current is directed) is a preferred habitat for adult trout due to the exaggerated depth scoured out by the concentrated stream energy.

When streams are disturbed, they sometimes erode into their own bed, which lowers the overall elevation of the stream. A lowered stream channel typically erodes upstream to equalize the slope across the reach. The upward erosion of the bed is typically referred to as a headcut. Rock and log cross-vanes help stabilize a stream vertically by providing grade control in the event the stream begins to headcut from below. Two types of structures serve mainly as cross vanes: Boulder Jam Steps (260), Log Steps (8) (Figure 6).

Log Steps consist of one or two series of stacked logs anchored with boulders placed more or less perpendicular to flow and embedded into both sides of the channel. Geotextile fabric and limbs will be used to fill gaps between logs. The sequence of steps creates sinuous flow along the channel and scour pools often form below each step. The Boulder Jam Step will be used mainly along the steeper reaches. Energy dissipation in these channels occurs as a result of dropping and churning water over Boulder Jam Step structures. The Log Steps will also be employed for energy dissipation in floodplain areas, where the channel enters the floodplain from the steeper reaches. The structures help to reconnect the channel to its floodplain.

- **Riffles**: These are rock ramps, configured with about a 4:1 or 5:1 grade on the glide section on the upstream end and a 20:1 to 40:1 grade on the pool section on the downstream end. They are often created on either end or above cross-vanes (see above) or as outfalls of culverts. Riffles serve the same function as cross vanes (i.e., to direct flow away from the stream bank to reduce erosion, and also to create habitat complexity for fish and other aquatic organisms). Riffles also

provide rock habitat required by many organisms, including the invertebrates that provide food for trout. The five proposed Rock Cascades have a total length of 348 ft, including plunge pools. The sixteen proposed Rock Riffles have a total length of 294 ft. (Figure 7).

Rock riffles are composed of compacted channel rock (riffle pavement) placed to the bankfull width and about 10 to 14 foot in length. Side portions will be buried by soil and replanted with live staked plants. The design shows structures are interspersed to suit the local stream attributes. The structures will reduce the potential for bed degradation (down-cutting) and bank erosion.

- **Toe Wood**: These are uprooted trees with the root ball attached to the first ten to fifteen feet of tree trunk. Toe wood is embedded with an excavator in the stream bank on the outside of stream bends so that the root ball extends upstream into the stream current, at an angle perpendicular to the stream current. The primary purpose of toe wood is to deflect current away from the stream bank to reduce stream velocities and erosion. The placement of toe wood also creates an area of slow current velocity on their downstream side that is preferred by juvenile fishes, and creates habitat for larger adults by deepening the stream outside of the root ball and by providing overhead cover. A root wad is constructed by embedding a log in the bank, pointing downstream, and acting as a basement anchor (footer) for the root wad log to rest upon; and the footer is placed at an elevation so that the trunk of the tree is centered between bankfull and the stream bottom. The root ball should be large enough to extend from the stream bottom to the top of the bankfull elevation, but usually stays submerged to prevent decay. A boulder is then set on either side of the root wad and footer, partially resting on the tree trunks to help hold them in place. Any areas that are excavated as part of toe wood placement are then backfilled with existing material.

  Root wads and logs will be harvested from the site but, if sufficient quantities are not available on-site, some may be brought in from off-site. Harvesting shall be executed in a manner as not to leave significant voids in the existing riparian corridor.

  Approximately 526 feet of toe wood will be installed along ten bank segments. The structures are called Wood Toe with COIR Wrapped Soil. COIR mats are made from a 100% natural and biodegradable spun coconut fiber. The mats temporarily stabilize soils within the structures and along the bank to allow vegetation to take root prior to the mat's decay. The COIR mats are used in other channel structures to prime or settle the structures until gravel or organic debris is reworked by stream hydraulics (Figure 8).

Due to the complexity of the project, which collectively includes 23 individual restoration reaches, Knowlton Creek and its tributaries were separated into three project sectors based on scheduling and types of structures used: Sector 1) Lower Unnamed Tributary to Knowlton Creek (LUTKC) (620 to 630 ft AMSL); Sector 2) Upper UT to Knowlton Creek Pump Station, and Upland Area 3 and 4 (Upper Area) (630 ft to 1000 ft AMSL); and Sector 3) Knowlton Creek (604 to 730 ft AMSL). The end of Sector 3 is near the mouth of the creek, just above its intersection with the Duluth Waterfront Trail crossing.

Sector 1: Lower Unnamed Tributary to Knowlton Creek (LUTKC) (257 ft) (Figure 3). Sector 1 is located in the lower section of the tributary where a floodplain is present and the channel has a flatter slope. The channel segment is 10 to 20 ft wide and about 300 ft long. The goals of the project in this sector are to dissipate energy from the stream system by reconnecting the channel to its floodplain and installing channel structures in step-pool sequences (includes Priority I, II, and III). Construction on the two reaches of the LUTKC is scheduled during late summer and fall of 2015.

The floodplain is composed of alluvial fill and alluvial fan landforms within valley types III and VIII. Valley type III is depositional in nature, allowing for the formation of alluvial fans. This valley type

developed because of the steep gradient above this part of the channel. An alluvial fan is not a stable formation for this geologic region. The concept plan is to have these fans re-graded to a more stable valley type VIII, a type with wide gentle valley slopes with well-developed flood plain features adjacent to river terraces. To prevent further excessive aggradation along this area, its sediment supply will be reduced by restoring the upstream reaches (Sector 2) that feed into the valley.

The plan in this sector is to replace a generally wide, straight, and entrenched channel (F type) and channels of a multiple-thread system (braided or bar-braided pattern) (D type) with a B4c and C4b type channels. B stream types are moderately entrenched and have a width-to depth ratio greater than 12, low sinuosity, and low meander width ratios. The C4b design channels are alluvial streams with large belt widths and meander wavelengths normally associated with flatter slopes.

Grade control, bank stabilizing, and riffle structures will be employed along this segment. Eight Log Steps, four Log Vane Boulder Hooks, and eight Rock Riffles are proposed along this reach. The average distance of separation of structures (DSS) is 19 feet, generally the average length of the step-pool sequences. Two swale/wetland areas will be created along a side-channel of the floodplain. They will retain hydrological connection to the main channel (2 to 3% slopes).

Sector 2: Upper UT to Knowlton Creek, Pump Station, and Upland Area 3 and 4 (Figures 3 and 4). Sector 2 contains most of the steep channel reaches where energy dissipation structures and bank stabilization will be the main focus. The channels are generally 10 to 15 ft wide over approximately 3,000 ft of channel. Construction is scheduled to begin during the late summer and fall of 2015.

These stream segments, classified as “A” or “B” stream types, are located in the mid-portion of the watershed. They are characterized by steep slopes, low channel width to depth ratios, and are not very sinuous. The average slope of seventeen reaches is 12 percent and the range is from 7 to 28 percent.

Work on these reaches is proposed to stabilize steep channel segments that presently exhibit major bed degradation and contribute significant sediment to the lower reaches of Knowlton Creek. The sediment is aggrading on the floodplain of lower reaches causing instability and excessive sediment loads reaching the St. Louis Bay. Primarily Boulder Jam Steps will be constructed to stabilize the steep channels by reducing the potential for bed degradation and bank erosion. Approximately 254 structures, with a DSS of 15 ft, are proposed along the reaches showing significant degradation. Two Rock Cascades will also be installed. Construction of these in-stream structures results in a step-pool morphology and riffle-pool sequences that improve aquatic habitat diversity and stabilize the stream bed. One reach in this sector may involve work in a wetland seepage area.

Sector 3: Knowlton Creek Main Stem (Figure 3). Sector 3 encompasses all construction work on the main stem of Knowlton Creek. This sector contains about 3000 ft of moderately steep (four to six percent) segments and gently sloping floodplain reaches (2 percent slope). The steeper reaches have 15 to 20 ft channel widths and the floodplain reaches have 20 to 25 ft widths. The goal of the restoration on the steeper area is to dissipate energy and stabilize channel banks and, on the floodplain segments, the goal of the restoration is to reconnect the stream to its floodplain to enable more frequent overbank flooding to occur within the valley. Ample woody materials will be used along the outer meander bends and within the stream channel to protect the bank and dissipate energy where larger stream volume is encountered. Construction is scheduled for the mid-summer through late fall of 2016.

The causeway over Knowlton Creek at the derelict DWP railroad line washed out in 2012. The concrete culvert has remained in the stream channel since that time. The SMRA reduced the grade of

the washed out banks and reseeded the slopes through application of funding associated with Minnesota flood relief. Removal of the concrete culvert, establishment of a restored channel, and stabilization of the streambanks will be completed as part of this project.

Restoration of stream morphology and reconnecting the floodplain/riparian zone along the main stem of Knowlton Creek will reduce sediment-related water quality impacts, improve aquatic habitat diversity, and enhance brook trout habitat along the lower reaches (includes Priority I, II, and III goals). Nine Boulder Jam Steps, along steeper segments, and 27 Boulder Vane Riffle structures will be installed to stabilize areas affected by ongoing scour and incision processes. These structures will be interspersed with eight Rock Riffles, totaling 209 linear feet, and a series of eight Log Vane with Boulder Hook structures (DSS equals 42 ft). The floodplain related developments will incorporate significant amounts of wood in the form of log vanes and Wood Toe with COIR Wrapped Soil structures installed along five bank sections, totaling 569 ft. Meander reconstruction will occur along about 660 feet of channel below Grand Avenue. Three wetland habitats will be created in the form of vernal pools, backwater features, and oxbows along Knowlton Creek (Reach 6) above Grand Avenue. Designs include naturalizing the channel below the proposed Grand Avenue bridge by the placement of several Boulder Vane Riffle structures.

Along the lower reach of the Unknown Tributary of Knowlton Creek and most of the Knowlton Creek Sector 3, the stream channel will be realigned in some locations. Borrow areas will be the high spots in the floodplain that are above bankfull elevation. The low areas that are being filled will fall below the bankfull elevation. The excavation and filling will bring both areas to the bankfull elevation, forming a fully functioning wetland floodplain that will disperse energy during flood events. By both narrowing the channel and restoring the banks and floodplain, the design channel will: (1) maintain the proper dimension, pattern, and profile to transport water and sediment; and (2) reduce the surface area of the stream and therefore reduce solar warming. Reduction in solar warming can be important as water temperature can increase due to direct solar radiation and convective heating of streams. Such changes can affect streams by altering the structure and productivity of macro-invertebrate communities and by changing temperature-dependent processes that influence early development, growth, and survival in fish.

Anticipated equipment used during construction may include 330-class or smaller excavators, a bulldozer, marookas (tracked dump trucks) and a front-end loader. The smaller excavators and tracked vehicles will operate primarily along the streambank in the immediate project area. Access trails have been located along existing roads and trails where possible.

Silt fences, seeding and mulching, erosion control blankets, and other appropriate erosion control measures (such as working during low flow periods and limiting the amount of disturbed area and soils exposed at one time) will be incorporated into the construction phase of this project. As the project construction progresses, disturbed sites will have the soil prepared for reseeding, be reseeded with appropriate vegetation, and be mulched to encourage rapid re-vegetation.

The Quality Assurance Project Plan Guidelines (QAPrP) for AOC projects indicates that successful BUI removal must be based on a premise that biological indicators will respond positively to aquatic habitat improvements completed at a restoration site. In order to evaluate progress and ultimately determine success, habitat improvement targets and appropriate biological response variables must be quantified. Quality System Documentation is required for any project involving the use of Great Lakes Restoration Initiative funding. A Quality Assurance Project Plan (QAPP) will be prepared for this project and submitted to the federal funding partners (US Environmental Protection Agency) as a condition of project fund application and reporting.

The following project monitoring will be incorporated into the QAPP. After project completion, the trout population in the project area will be monitored by MDNR Duluth Area Fisheries and the overall biological/ecological response will be evaluated against past surveys to determine if the goals of the project have been achieved. The MDNR's Stream Survey Manual will be used as the currently accepted methodology for watershed monitoring as applied by both the MDNR and the MPCA. Successful recruitment of brook trout will be one of the parameters used to indicate project success. Post-project monitoring of all AOC projects, including Knowlton Creek, will be conducted by the MPCA to address the elimination of Beneficial Use Impairments to Fish and Wildlife Populations and Habitat.

The newly constructed stream channel will be monitored for stability post-construction, including the reduction in erosion and sediment load to the St. Louis River. The Stantec engineering and design contractors used the FLOWSED/POWERSED sediment transport model developed by Dave Rosgen to analyze sediment transport for Knowlton Creek. They also used the BANCS model to provide an estimate of the reduction in sediment contributions from bank erosion after development. These modeling efforts were not intended to quantify sediment load from stream reaches further upstream of the project, which should remain consistent with pre-project levels. However, modeled results project that the bank stabilization developments will significantly reduce sediment contributions from the project site. Of the twenty reaches having comparative modelling data, the analysis of existing bank erosion rates and those calculated from design specifications indicated an average of 80 percent reduction in the overall bank erosion rate.

c. Project magnitude:

Total Project3age	35
Linear project length (river segment)	6,491 lineal feet
Number and type of residential units	N/A
Commercial building area (in square feet)	N/A
Industrial building area (in square feet)	N/A
Institutional building area (in square feet)	N/A
Other uses – specify (in square feet)	N/A
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 overall goal of the project is to improve hydrologic, habitat, and aesthetic functions of the stream corridor. Its purpose is to restore a severely impaired section of Knowlton Creek to a self-sustaining functional state, which will improve habitat for trout and the associated cold-water stream communities. Knowlton Creek functioning as a natural stable stream is desirable, not just because it will move water and sediment while maintaining its channel, but also it will potentially be more biologically productive and maintain the diversity of habitats important to native fish and invertebrate communities. A stable Knowlton Creek will also result in reduced transport of sediment to an area of the St. Louis River Estuary that was recently restored by removing approximately 50,000 cubic yards of sediment to establish a shallow open-water wetland. Reducing transport of sediment down the stream corridor and to the estuary will contribute to the long-term maintenance of the habitat gains realized from the previously completed wetland restoration.

The proposed project is needed to provide stable flows throughout the year for brook trout and the associated cold water community. Extended periods of low flow are detrimental to brook trout. In-stream oxygen levels can drop below the level at which brook trout can survive. Water temperatures in the pools, which become refugia for brook trout, begin to warm and can reach lethal temperatures

especially if low flow periods coincide with warm days. Concentrated numbers of brook trout increase competition for food items and make them more vulnerable to predators. MDNR re-introduced brook trout frylings to Knowlton Creek in 2014. Maintaining natural flows will reduce stressors on the newly reestablished population and increase the probability of survival and natural reproduction. Specifically, improved habitat conditions will be available for all life stages of brook trout. Riffle construction will provide spawning habitat for brook trout as well as feeding areas for invertebrates. Rearing habitat will be created for juvenile fish in the slack water areas around and behind rootwads. Cover and overwintering areas will be provided for adult brook trout with pool construction.

Lateral connectivity, which is the connection of a stream channel to its floodplain, is an important part of the geomorphic analysis for stream restoration. A stable stream will have a form that allows it to access its floodplain during bankfull and larger flood events. This reduces the sheer stress on the channel and allows some deposition of sediment in the floodplain. In addition, many riparian plants have adapted to this cycle of floods, with some even requiring flood flows.

The project will serve as a representative of modern stream restoration efforts, which can be used as a learning tool for other stream habitat restoration projects in Northeastern Minnesota.

The goal and purpose of the Knowlton Creek Stream Restoration Project is to return the system, as closely as possible, to a self-sustaining, functional state by mimicking the appropriate geomorphological structure. Specifically the project will benefit the citizens of Minnesota and Duluth by restoring an urban trout stream and reducing the amount of sediment being transported to the St. Louis River Estuary.

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

The St. Louis River was originally listed as one of 43 AOC's identified around the Great Lakes in 1987. In 1992, a Stage I Remedial Action Plan (RAP) was developed by a broad based group of AOC partners including state fish and wildlife agencies from Minnesota and Wisconsin, the Fond du Lac Band of Lake Superior Chippewa, the U.S. Fish and Wildlife Service (FWS), the MPCA, Minnesota Sea Grant, the U. S. Environmental Protection Agency (EPA), NOAA, and non-governmental organizations and academic institutions that outlined overall program objectives to address Beneficial Use Impairment (BUIs). In 2013, MPCA reconvened program partners to complete an update to the RAP that outlines, as much as possible, specific action steps to remove each BUI (Attachment A).

The Knowlton Creek Stream Restoration Project is one of 60 actions identified in Stage II Update to the St. Louis River Area of Concern (AOC) Remedial Action Plan (RAP). When all actions are completed, the AOC will be considered for delisting. This project is the one of ten aquatic habitat restoration projects included in the 2013 AOC RAP Update. The other restoration projects identified in this document include:

- Perch Lake – approximately seven miles upstream of Knowlton Creek. This oxbow is isolated from the river by an undersized road crossing. The project objective is to enhance aquatic organism passage to river and restore sheltered bay habitat. The construction date has not been scheduled.
- Radio Tower Bay – approximately five miles upstream of Knowlton Creek. The project objective is to dredge waste from historic sawmill operations and restore wild rice beds on 24 ac of sheltered bay habitat. This project is underway and construction will be completed in 2015.

- Mud and Spirit Lake - approximately one mile upstream Knowlton Creek. Project objectives are to address contamination found in sediments, restore historic depth of surface waters and restore sheltered bay habitat. Project construction has not been scheduled at this time.

- St. Louis Bay sites at Grassy Point, 40th Ave W, and 21st Ave W - approximately three to seven miles downstream from Knowlton Creek. These projects have similar objectives, which are to address possible chemical contaminants and other limiting factors causing impairments to aquatic life and restore sheltered bay and estuary flats habitat. The projects encompass approximately 890 ac in a near-continuous length of shoreline of approximately 3.5 mi. The combined state-federal environmental assessment is underway with the USACE Environmental Assessment (EA) recently completed. Additional state sponsored EAWs for each of these projects will be initiated soon. Construction is scheduled to occur intermittently in a phased approach during the period starting in 2016 and completing in 2022.

- Kingsbury Bay – approximately 0.4 miles downstream of Knowlton Creek. The project objective is to restore shallow sheltered bay habitat by excavation of the deposited sediment at the mouth of Kingsbury Bay as well as enhance hydrologic connection of the wetland complex. Project construction has not been scheduled.

The SMRA water control project managed by the City of Duluth is being constructed mostly outside the proposed project described in the EAW. Its purpose of reducing potential erosion on Knowlton Creek will help achieve stream stability improvements and will have a positive effect on its channel stability and flow regimen. The project will be discussed under potential cumulative effects listed in Item No. 19.

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

Since the Stage I RAP (1992), significant work has been done to restore the AOC with well over $420 million invested in the St. Louis River estuary since 1978 on infrastructure upgrades, remediation of contaminated sediments, and habitat restoration and protection in the AOC. Improved municipal wastewater treatment and significant progress on control of wet weather overflows have contributed to water quality improvement and returning fish and wildlife populations. Some contaminated sites have been remediated and/or restored, including Hog Island/Newton Creek in Wisconsin and the St. Louis River Interlake/Duluth Tar Superfund site in Minnesota. In addition, numerous habitat protection and restoration projects have been completed across the AOC (Attachment A). A few examples include:

- Nine acres of spawning habitat for lake sturgeon and other riffle spawning species enhanced below the Fond du Lac Dam;
- 16 ac of sheltered bay habitat restored at Tallas Island where Knowlton Creek reaches St. Louis Bay;
- More than 11,000 acres of erosion sensitive lands and forest and wetland habitat in Wisconsin's St. Louis/Red River Streambank Protection Area, two Wisconsin State Natural Areas within the Pokegama River watershed and Clough Island; and
- Two and a half acres of colonial waterbird nesting habitat were created at Wisconsin Point.

The project is also a phased action of the Tallas Island Wetland Restoration project which dredged surplus uncontaminated sediments from the shallow waters behind Tallas Island as a benefit to improving water access into the backwater area. The sediments were transferred to the St. Louis River/Interlake/Duluth Tar State Superfund (SLRIDT) site for use in capping subaqueous sediments

containing latent industrial contamination. The SLRIDT was cleaned up and restored in 2011 but continues to be monitored. Plans to address clean-up of the contaminants at the former U.S. Steel Duluth Works are now underway via the Great Lakes Legacy Act.

The June 2012 flood is largely responsible for creating a sediment delta at the mouth of Knowlton Creek, where it flows into the Tallas Island marsh area. A significant area of shallow marsh and open water habitats were filled by the flood, partially countering the beneficial effects gained from earlier dredging. There is an interest to re-dredge the Tallas Island marsh area to remove the Knowlton Creek delta and regain some of the shallow water habitats recently lost. The Knowlton Creek Stream Restoration Project will add resiliency and long-term stability to the ecological outcomes realized through completion of that SLRIDT project.

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	10.69	10.69	Lawn/landscaping	.45	.45
Deep water/streams	3.00	3.00	Impervious surface	0	0
Wooded/forest	20.84	20.84	Stormwater Pond	0	0
Brush/Grassland	0	0	Other (describe)		
Cropland	0	0			
			TOTAL	34.98[1]	34.98

[1]Disturbance area within the wetland, forest, and creek channel will total approximately 15.6 ac, with a minor portion of the construction zone (material staging areas and access corridors) (0.93 ac) occurring outside of the mapped project area (see Figures 3 and 4).

General land cover values for the Knowlton Creek watershed indicate 46% forest cover, 19% wetlands, 19% low/medium density residential and I-35 corridor developments, and 16% shrub/grass cover, largely attributable to the open ski slopes of SMRA located adjacent to the project area.

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.*

Unit of government	Type of application	Status
South St. Louis Soil and Water Conservation District	Erosion and sediment control review	To be submitted
City of Duluth	Special Use Permit, Shoreland & Floodplain Worksheet, Erosion & Sediment Control Permit Grading permit	To be submitted
	Temporary access agreement/license	To be submitted
	Wetland Conservation Act Permit	To be submitted
City of Cloquet	Temporary access agreement/license	To be submitted
St. Louis County with MDNR	Floodplain Standards & Zoning Compliance	To be submitted
MDNR	Public Waters Work Permit	To be submitted
	Prohibited Invasive Species Permit	Application pending
	LSCZ federal consistency review	Application pending
MPCA	NPDES/SDS Construction Stormwater General Permit	To be submitted
	CWA Section 401 Water Quality Certification[1]	To be submitted
Minnesota State Historic Preservation Office (SHPO)	Archaeological and Cultural Resource Reviews (NHPA Section 106)	Phase 1 Survey completed, SHPO/106 Concurrence pending
USACE	RHA, Section 10	To be submitted
	CWA Section 404 Permit[1]	To be submitted
NOAA	Environmental Checklist for Project	To be submitted

The project is being designed through a funding partnership between the USACE and the Minnesota Legacy – Clean Water Legacy Fund, under the direction of the MDNR and USACE. MDNR is constructing the project through a funding partnership between the United States Environmental Protection Agency, the National Fish and Wildlife Foundation and the Minnesota Legacy – Outdoor Heritage Fund. The project is also being implemented in concurrence with the runoff control project being implemented by SMRA. The SMRA project will be constructed in 2015 (see Item No. 6e).

[1] RHA-Rivers and Harbors Appropriation Act of 1899; CWA-Clean Water Act.

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

Land is mostly publicly owned by the City of Duluth and remains relatively undeveloped and forested.

The current land use is mostly related to outdoor recreation activities. The project area is within the SMRA, which is a component unit of the City of Duluth, and is 2 mi east of the Magney-Snively Natural Area. The project site is within a part of the Bardon's Peak Forest Park, which is included in the Duluth Natural Areas Program. Besides ski facilities, the SMRA also provides amenities for camping and

manages trail systems for a variety of other venues, including mountain bike, hiking, and snowmobile trails (Figure 9).

The lower part of project area contains numerous road, railroad, and trail corridors. Grand Avenue (Highway 23), a Burlington Northern-Santa Fe railroad grade and the DNR Parks and Trails Munger Trail transect the lower area and the Duluth Waterfront Trail is along the southeast boundary of the project area. The Munger State Trail terminates at 75th Avenue West, behind the Munger Hotel, just north of the project area. Other service roads, trails and pathways, including Disc Golf area (under development) and the Duluth Traverse Trail, transect the mid-section of the project area. The Duluth Traverse Trail is a proposed multi-use trail slated for construction in 2016. The Superior Hiking Trail intersects and parallels Knowlton Creek for a distance through and above the project area. SMRA service buildings and the City of Cloquet Pump Station and water tank are in the vicinity. Water, sewer, and other utility corridors also transect the project area. Several parcels of residential property generally adjoin the northeastern boundary of the lower project area.

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

The project area is part of the Western Planning Area for the City of Duluth. The Duluth Comprehensive Plan identifies the SMRA as Code 'R' (Recreational) - with the future land use designated as Recreational. Knowlton Creek and its' tributaries are identified as Code 'P' (Preservation) – with the future land use designated for Preservation. Knowlton Creek is within the boundaries of the SMRA complex and the majority of land surrounding the project area is currently designated as the Magney-Snively Natural Area (MSNA) and falls within a Sensitive Lands Overlay. These lands have high natural resource and scenic value and substantial restrictions to development due to limitations (e.g. soils, wetlands, or steep landscape). The project area is limited to low intensity uses, such as trails, viewshed protection and water access for passive use (e.g. walk-in fishing with limited parking) because it is located in a Preservation Area. The stream restoration project is being integrated with the SMRA water control project. The Knowlton Creek Stream Restoration Project will take place on lands owned and administered primarily by the City of Duluth.

St. Louis County, Minnesota, Comprehensive Water Management Plan (SLCWMP), Update 2010 – 2020 identifies priority water quality concerns that will require the most attention in the county in order to meet its water quality objectives (St. Louis County Planning and Development Department and St. Louis Soil and Water Conservation Districts). The Knowlton Creek Stream Restoration project is encompassed within Priority Concern #3, to protect ground and surface water from the combined impacts of point and not-point sources of pollution. The main focus of the Knowlton Creek project is to significantly reduce sediment pollution originating from chronic bank erosion occurring along the mid- and lower reaches of the creek.

The 2008 Spirit Mountain Master Plan for SMRA provides a conceptual framework for future operations of the recreation area. The recreational concept maps indicate a potential increase in activities in the mid- and lower areas of Knowlton Creek watershed, including the project area, which largely is contained in a designated "multi-use recreation development area." Additional development concepts affecting the watershed include removal and relocation of a maintenance building and trails; potential campground and terrain expansion into areas close to the Knowlton Creek main stem; and development of a new and expanded system for snowmaking coinciding with the development of a reliable water source and delivery system (see Item No. 6e).

The project is included as a component of the Lower St. Louis River Area of Concern (AOC) Remedial Action Plan (RAP) and is funded through the State of Minnesota Outdoor Heritage Fund (OHF), the National Fish and Wildlife Foundation (NFWF), the US Environmental Protection Agency (EPA) under the Great Lakes Restoration Initiative (GLRI), launched in 2010 to accelerate efforts to protect and restore the largest system of fresh surface water in the world. The Knowlton Creek Stream Restoration project will contribute to removal of St Louis River AOC Beneficial Use Impairments (BUIs) #2 - Degraded Fish and Wildlife Populations, #6 - Excessive Loading of Sediments and Nutrients and #9 - Loss of Fish and Wildlife Habitat.

The St. Louis County comprehensive plan and long-range resource management plan do not directly address aspects related to stream habitat improvements. The project and anticipated future land uses enabled by the project are compatible with the county comprehensive plans.

The project supports objectives identified by the MNDNR, in the Knowlton Creek Stream Management Plan (2010). The Plan identifies the reestablishment of a self-sustaining brook trout population for Knowlton Creek and management as a cold-water fishery into the future. Implementation of the Knowlton Creek Project will increase the amount of suitable trout habitat and improve the resilience of the stream to future impacts of climate change.

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

The SMRA is a year-round recreational facility with ski trails and ski hills operated in the winter and hiking and bike trails open all year. The area surrounding MSNA has been zoned for Residential-Rural, low density development with minimum lot sizes of five acres.

A City of Duluth Shoreland and Floodplain permit will be required for this project and is in process. City of Duluth Shoreland and Floodplain, Erosion and Sediment Control, and Fill, Excavation and Grading permits will be required for this project and are in process. Through the permitting process this project will adhere to all provisions of the City Unified Development Code (UDC) for floodplains and shorelands.

The project is within the Lake Superior Coastal Zone under the jurisdiction of the Minnesota Lake Superior Coastal Program (MLSCP). The project is a federal action that has reasonably foreseeable effects on coastal uses or resources. It will be subject to federal consistency review. The MDNR and federal agencies must follow the requirements of 15 Code of Federal Regulations (CFR) 930, Subpart C, which require a review of federal activities or federally funded projects to determine whether projects are consistent, to the maximum extent practicable, with the enforceable policies of MLSCP.

The evaluation of federal consistency with the Coastal Management Program is a brief evaluation on the relationship of the proposed activity and any reasonably foreseeable coastal effects to the enforceable policies of the management program. The review included identifying whether federally approved state coastal policies are met, including approved county shoreland ordinances and flood plain ordinances.

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 Knowlton Creek Stream Restoration Project is fully compatible with the nearby land use and local governmental zoning and plans for the project area and environs. City of Duluth engineers and planners will approve the finalized design plan, which is consistent with the city's comprehensive plan and its parks and trails development plan. The project will take place on lands owned primarily by the

City of Duluth. The project meets requirements of the local zoning and overlay districts. Proposed habitat enhancements are compatible with RR1 zoning. Natural Channel Design stabilization is compatible with "natural environment" shoreland management. Modeling results indicate no effect to flood water surface elevation due to the project.

An action item identified in the SLCWMP for addressing St. Louis County Priority Concern #3, the protection of ground and surface waters, is to install water protection practices and BMPs (best management practices). The Knowlton Creek Stream Restoration project contributes to meeting this action's objective by stabilizing the stream channel and reducing bank erosion. The project's stormwater BMPs will be applied according to EPA and MPCA regulations.

The project will improve the overall health of this trout stream, reduce the likelihood of future streambank erosion, reduce the impact on sedimentation to the St. Louis River Estuary, and improve the aquatic habitat of the stream. This project is compatible with the City's Unified Development Code (UDC) zoning.

The land is zoned 'R' and 'P', which means future land use is Recreation and Preservation. This project is consistent with current and future land use plans and zoning and will have beneficial environmental effects (improved stream function and aquatic/riparian habitat for fish and wildlife).

The project contributes directly to the Lower St. Louis River RAP to remove impairments causing loss of fish and wildlife habitat (BUI#2), excessive loading of sediments and nutrients (BUI#6), and loss of fish and wildlife populations (BUI#9). The project supports fisheries management objectives of the MDNR by increasing the amount and resiliency of trout habitat in the stream (Knowlton Creek Stream Management Plan 2010). This increase in cold water stream habitat will result in improved fish and wildlife populations and the biological functions on which they depend. Restoring the stream to a more stable channel will reduce erosion and sedimentation downstream to the St Louis River and Estuary. A more stable channel will be more resilient to future rain and flood events.

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

There are no known incompatibility issues due to project implementation. While work will take place in the streambed and along the streambank, the project will meet shoreland zoning ordinances, as defined in the Duluth shoreland standards. Restoring the stream to a more stable channel will reduce erosion and sedimentation downstream to the St Louis River and Estuary. A more stable channel will be more resilient to future rain and flood events.

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.

The Duluth Complex subtype of gabbro to troctolite forms the bedrock geology of the Knowlton Creek watershed. Depth of bedrock varies across the project area, but is generally shallow along stream reaches. Some reaches that showed more extensive outcropping were not selected for restoration. Miller, Keene, Kingsbury, and Stewart Creeks watersheds also occur largely on this bedrock type. There are large rock outcrops (Ely and Bardon's Peaks) two miles to the southwest of the project site. The Natural Resource Conservation Service (NRCS) Web Soil Survey indicates that the depth to bedrock

is 25-50 inches in the mid-elevations of Knowlton Creek watershed. In the lower reaches of the stream the depth to bedrock is greater than six feet.

The ecological land classification for this region is largely based on geological forces: Northern Superior Uplands Section, North Shore Highlands Subsection, and Split Rock Till Plain Land Type Association (LTA). The Split Rock Till Plain is a complex containing a Superior lobe (clayey) till plain and clayey lake sediments from Glacial Lake Duluth. The terrain is rolling but it slopes toward Lake Superior. Inclusions of steep bedrock controlled hills are present. Included in this LTA is a very narrow strip of land directly adjacent to Lake Superior that has a climate modified by the lake. Streams are deeply incised due to the clayey material.

The Knowlton Creek watershed ranges in elevation from 600 to 1300 ft. Surficial geology and geomorphology reports indicate that the upper watersheds of Knowlton Creek and nearby creeks (above 1,200 ft) are overlain by a supraglacial drift complex with loamy/sandy texture, which is thin or absent from the mid-elevations of the watersheds, where bedrock is often exposed at the land surface. Later glacial re-advances resulted in the deposition of finer textured till (silty loam, clay loam, silty clay loam, and clay till) classified in several series at altitudes ranging from 1020 ft to 1,200 ft, with visible shoreline features from wave action and beaches evident from about 1020 ft to 1,100 ft. The mid-elevations of the watersheds are dominated by bedrock near ground surface with a blanket of fine textured till materials. Lower elevations are part of the clayey lake-modified, till plain surrounding St. Louis Bay. No effects on geological features are anticipated from project activities.

b. Soils and topography - Describe the soils on the site, giving NRCS (SCS) classifications and descriptions, including limitations of soils. Describe topography, any special site conditions relating to erosion potential, soil stability or other soils limitations, such as steep slopes, 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.

NOTE: For silica sand projects, the EAW must include a hydrogeologic investigation assessing the potential groundwater and surface water effects and geologic conditions that could create an increased risk of potentially significant effects on groundwater and surface water. Descriptions of water resources and potential effects from the project in EAW Item 11 must be consistent with the geology, soils and topography/land forms and potential effects described in EAW Item 10.

The NRCS soil types within the project area are primarily classed as Barto, stony-Greysolon-Rock outcrop complex (B-G-ROC) with 0 to 18% slopes, Rock outcrop-Mesaba-Barto (ROC-M-B) with18-60% slopes, Ahmeek-Rock outcrop complex (A-ROC) with 0 to 50% slopes, and Amnicon-Cuttre complex (A-CC) with 5-18% slopes. Small amounts of Urban land-Amnicon-Rock outcrop complex (U-A-ROC) with 0-18% slopes, Miskoaki-Fluvaquents (M-F) with 0-45% slopes, frequently flooded, and Bowstring and Fluquavents (B&F), loamy with 0 to 2% slopes, frequently flooded.

The soils on the upper stream reaches of the project (ROC-M-B, B-G-ROC, A-ROC, A-CC, U-A-ROC, M-F) are partially hydric, classed primarily as 'D' Hydrologic Soils that exhibit slow infiltration with high runoff potential. The parent material on the Unnamed Tributaries include: gravely drift, clayey till and fill material from surrounding uplands. The parent material for Knowlton Creek is loamy material over dense loamy till and clayey till. The hydraulic conductivity (Ksat) for Knowlton Creek is variable, <1.578 and <11.786, and for the unnamed tributaries, is less than 1.578. The upper reaches were not rated.

The NRCS Erosion Hazard rating of the soil types on the Unnamed Tributaries is moderate to severe, indicating that erosion is likely and that erosion control measures are needed during and after construction to prevent soil erosion and stabilize disturbed slopes and stream banks. The Rutting Hazard rating for these soil types is moderate to severe. The Erosion Hazard ratings for Knowlton Creek area is very severe indicating that the steep slopes will need to be stabilized during and after construction to prevent soil erosion; the rutting hazard ratings is severe.

The overall project objective is to restore the stream channel to a more stable and resilient condition, better able to handle future rain and flood events, ultimately reducing sedimentation reaching the St Louis River. Construction vehicle traffic will be confined to a minimal number of access roads and routes to prevent rutting of compactable soils. Construction activities in areas of fine textured soils will be limited to periods when soils are dry to moist but not wet.

Any rock moved during construction will be reused on-site. Any additional rock needed to construct the in-stream features will be locally sourced from pits within 30 mi of the project site.

Approximately 10,000 cubic yards (cy) of soil will be excavated during the construction phase of this project. No ongoing impacts to soils are expected after construction of the project is complete.

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 entire project lies within the lower- and mid-elevations of Knowlton Creek watershed and includes both stream bank and in-stream work. The Knowlton Creek flows into the St. Louis River bay, a designated public water (PWI # 975W). It has a 1,472 ac watershed. Knowlton Creek empties into the St. Louis River, which flows about nine miles further where it empties into Lake Superior. Lake Superior is an Outstanding Resource Value Water (ORVW).

The creek and tributaries total about five miles in length with an average slope of 8.1%. Only 5% of the watershed is urban and 9% rural keeping most of the watershed in forest, wetland, or shrub/grass cover. The watershed is typical of those in Duluth in that they have short, steep gradients and run through areas of shallow soils over bedrock causing flashy flows that rise and dissipate quickly.

In 2008, MDNR designated Knowlton Creek as a trout stream, which automatically places it on the public waters inventory. The lower reaches of the stream have water temperatures consistently cool enough to support a brook trout population and the MDNR re-introduced them in 2014. Multiple years (2003-2006) of temperature logger data indicate that the stream is able to support a cold water fish assemblage.

Knowlton Creek is classified by the MPCA (see Minn R. 7050.0470) as a Class 2B, 3C, 4A, 4B, 5, and 6 waterbody. It is protected as outlined by the numeric and narrative water quality (WQ) standards found at Minn. R. 7050.0220 through 7050.0226. The applicable state classifications and the referenced water quality standards are provided below. The MPCA intends to reclassify Knowlton Creek and three others (Merritt, Coffee, and Buckingham Creeks) in the Duluth area to a Class 2A

water in future rulemaking to be consistent with the recent MDNR trout stream reclassification. This is explained on page three of the following document: http://www.pca.state.mn.us/index.php/view-document.html?gid=20530. Until then, the standards below apply.

- Class 2B: aquatic life and recreation (includes cool and warm water sport fish). The applicable WQ standards are defined in Minn. R. 7050.0222, subparts 1 and 4.
- Class 3C: industrial consumption (includes all waters of the state that are or may be used as a source of supply for industrial process or cooling water, or any other industrial or commercial purposes, and for which quality control is or may be necessary to protect the public health, safety, or welfare). Class 3C also specifies the protection of cool and warm water sport fish, indigenous aquatic life, and wetlands. The applicable WQ standards are defined in Minn. R. 7050.0223, subparts 1 and 4.
- Class 4: agriculture and wildlife. Includes all waters of the state that are or may be used for any agricultural purposes, including stock watering and irrigation, or by waterfowl or other wildlife and for which quality control is or may be necessary to protect terrestrial life and its habitat or the public health, safety, or welfare. Class 4A also includes a sulfate limit of 10 mg/L for the protection of wild rice where it is present. Class 4A waters also include cold water sport fish (trout waters) and 4B waters include cool and warm watersport fish. The applicable WQ standards are defined in Minn. R. 7050.0220 Subparts 3a and 4a, and 7050.0224, subparts 1, 2 and 3.
- Class 5: aesthetic enjoyment and navigation. The applicable WQS are defined in part Minn. R. 7050.0220, subpart 3a, and 7050.0225.
- Class 6: other uses and protection of border waters. The applicable WQS are defined in Minn. R. 7050.0226.

Also, the narrative standards at Minn. R. 7050.0210 apply to all waterbodies in Minnesota, including Knowlton Creek, regardless of their designated use classification.

Further, the more restrictive WQ standards for the parameters listed at Minn. R. 7052.0100, subpart 5 (e.g., total mercury limit of 1.3 ng/L), also apply to Knowlton Creek because it is within the Lake Superior Basin.

The MPCA has not yet assessed Knowlton Creek to determine whether it is meeting the applicable state water quality standards. Of the neighboring waterbodies located within, or close to, one mile of this project that have been assessed, two are currently not meeting some of the standards: Kingsbury Creek and the lower portion of Stewart Creek. Waters determined not to be meeting applicable standards are considered impaired, as identified on the MPCA's CWA 303(d) Impaired Waters List. Currently, the Kingsbury Creek's aquatic life designated use is listed as impaired based on macroinvertebrate bioassessments and fishes bioassessments. The lower portion of Stewart Creek's aquatic/recreation designated use is listed as impaired due to excessive e-coli. The Knowlton Creek restoration project will not have an effect on either of these nearby impaired waterbodies because they are in different minor watersheds.

The St. Louis Bay waters are managed by MDNR as class 2B waters, i.e., the waters are protected for a healthy warm water aquatic community and industrial cooling and materials transport use without a high level of treatment. The St. Louis River is Minnesota's largest tributary to Lake Superior and sections are listed as impaired waterways on the MPCA's Clean Water Act 303d Impaired Waters List. Specifically, the MPCA has identified that the following contaminants exceed the applicable state water quality standards for this reach of the St. Louis River (Fond du Lac to Mission Creek [No.04010201-513]): concentrations of DDT, dieldrin, PCB and mercury in fish tissue and PCBs and mercury in the water column.

The Lower St. Louis River is also a Great Lakes AOC because of legacy pollution and other impairments. The Lower St. Louis River Remedial Action Plan (RAP) lists nine beneficial use impairments (BUI's) for the AOC. The primary BUI's addressed with the proposed project outcomes is Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Populations.

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.

There are no wells located in the project area. The Minnesota Department of Health, online County Well Index database indicated no verified or unverified wells within one mile of the project area.

Depth to groundwater varies across the site. Seasonally flooded/shallow marsh and seasonally flooded/hillside seep type wetlands have been delineated on the preliminary wetland map in small areas along the upper reaches. These are located along steep concave slopes where groundwater flows laterally and surfaces near stream channels and rock outcrops. In working on stabilizing the small steep tributaries, equipment movement to build Boulder Jam Steps could occur within or near the marshy or seep areas.

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.

The project will not generate or release wastewater during construction or operation.

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.

Knowlton Creek is a tributary that flows into St. Louis Bay, about nine mi above the mouth of the bay where it enters Lake Superior. Knowlton Creek and tributary channels have been impaired by the impacts of excessive runoff moving down through the watershed. The outcome of the impairment extending over 40 years had been the deposition of sediment into the St. Louis River estuary behind Tallas Island, an aquatic area which was restored by deepening in 2010.

The primary cause of the increased flow is runoff from the deforested slopes of the Spirit Mountain Ski Hill and facilities and overflow events originating from a City of Cloquet water pumping station. The

stream channels of both the main stem and the tributary have been both agraded and degraded as a result of the excessive flows. Recent heavy rain events have also contributed to the erosion and sediment impairments. As described in earlier sections, flows from the ski hill will be partially removed from entry to Knowlton Creek as a result of the SMRA water project. The City of Cloquet has also taken mitigating steps that eliminated the excessive flow originating from their pumping station back surge releases into Knowlton Creek.

The project will result in the stabilization of eroded banks and establishment of a natural functioning floodplain, which will greatly reduce the amount of sediment that reaches the estuary. To maintain a stable channel system, project designs are meant to shuttle sediments originating from the upper watershed through the mid- and lower elevations of the creek. The objective is to ensure that the sediment transport of the bankfull channel upstream is maintained through the project area without significant aggradation or degradation. The upper watershed, which is above the project area, is relatively level and largely forested or wetland and likely contributes some additional sediment into the creek, due to approximately 20 percent of surface area in low to moderate density developments.

The steep mid-elevation channel banks are unstable, eroding badly, and contribute excessive sedimentation to the lower reaches. Aggradation in the lower elevations of the watershed has caused loss of flood plain connectivity to the channel and instability in the channel banks. The instability has caused excessive sediment to move through the Knowlton Creek channel into St. Louis Bay. A sediment delta formed at the mouth of Knowlton Creek in the bay during the June 2012 floods.

The project will temporarily have a higher risk of erosion if a high rainfall event occurs during construction. Work will occur along about 1.2 mi of channel. Approximately one or two growing seasons will be necessary to fully stabilize the area, after which erosion and sedimentation rates from the disturbed floodplain areas are anticipated to achieve pre-project levels but channel bank erosion is anticipated to be reduced by eighty percent of pre-project rates.

The disturbance zone of construction is estimated to be 16 ac in size over the length of the channels reworked. Project monitoring is intended to compare the proposed conditions of sedimentation to the existing conditions, thus identifying the amount of change in bank erosion rates.

Re-vegetation of the project area will include hand-planting of live stakes to minimize disturbance of the shoreland area. Natural vegetation and appropriate side slope grading will be used wherever possible. Construction activities will be completed in sectors and phased to reduce the size of the disturbance zone. Areas requiring erosion control measures will be handled sequentially as construction and final grading is completed.

The total disturbance zone will be approximately 16 ac. Erosion control treatments will include seeding 11.7 ac of disturbed soils with an approved native grass and forb seed mix and a cover crop of annual winter wheat and tame oats. One-inch caliper (eight foot tall), No 1. Container (two foot tall), and tubeling/bareroot (one foot tall) native trees and shrubs will be planted within the seeded area at an average spacing of eight feet (680 per ac). Site appropriate tree seedlings comprising species such as nannyberry, white cedar, northern red oak, American basswood, silver maple, white pine, balsam fir, paper birch, chokecherry, alternate-leaved dogwood, American hazel, and common winterberry will be planted at appropriate densities along the reconstructed channels. A double row of live staked plants of red osier dogwood and pussy willow will be planted at 3-foot spacing in double rows along about 1.2 mi of channel at critical areas, such as along the bends of meanders. Newly established seeding and planting will be monitored and areas will be reseeded or planted if necessary.

Steps to minimize potential effects to stormwater quality during construction include:

- Work will be administered during mid-summer to mid-fall, when flows rarely reach or exceed bankfull levels.
- Phasing of excavation, fill, and demolition of channel will minimize duration and extent of soil disturbance. (Maximum amount of stream disturbed at any given time will not exceed 400 feet.)
- Monitoring of creek flows and downstream conditions and stopping work if flows exceed suitable conditions for floodplain work.
- Movement of heavy equipment in the riparian areas will be minimized. All runoff control structures and devices will be installed before construction begins and will be maintained throughout the duration of the project.
- Best Management Practices to minimize soil erosion and control sediment will be incorporated into the project design and specified to the contractor in the engineering plans. The BMPs will include silt fencing, fabric logs, seeding, mulching, and limiting the amount of disturbed soil areas. Additional techniques to stabilize construction entrances and prevent sediment discharges to the Knowlton Creek and the St. Louis River may also be used.
- Seeding/mulching and erosion control blanket cover will be installed immediately and phased as sectors of construction are completed
- Emergency spill response protocol will be written into permit obligations.

The project will not result in any measurable change to the stormwater drainage patterns, discharge rates or locations because no structures or features (impervious surfaces) will be created that will affect the land surface elevations or surface drainage patterns. The quality of stormwater runoff reaching the estuary from the creek could improve as channel banks are stabilized, potentially reducing the in-project sediment contribution by 80 percent, thus distinctly reducing the current total load of sediment reaching the estuary. The channels are designed to naturally transport sediment from the upper watershed through the system to receiving water bodies, but at much lower levels.

Erosion and sedimentation during project construction, while having the potential to be moderate to severe, is being addressed with the implementation of the NPDES/SDS Construction Stormwater General Permit and associated Stormwater Pollution Prevention Plan (SWPPP) to comply with requirements per MPCA guidelines. The MDNR will also adhere to guidelines associated with the City of Duluth Erosion Control permit. This document will include practices for perimeter control as mentioned above, including vegetated buffers, silt fence, wattles, to control sediment, and erosion control practices such as minimizing the area of disturbance, rapid re-vegetation, mulching, erosion blankets, and/or hydromulch.

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.

The project will not appropriate water for construction or operation.

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.

A Phase I Wetland Scoping completed in April, 2015, identified 10.7 ac of potential wetland in the project area (Figures 3 and 4). The Wetland Scoping survey identified likely wetland features but does not meet the assessment requirements of the Corps of Engineers Wetlands Delineation Manual (1987). The potential wetland areas are tentatively identified as Type 1 seasonally flooded basins or flats located in depressions and in overflow bottomlands (7.3 ac), Type 2/3 fresh meadows or marshes on flooded or waterlogged soils (2.5 ac), and Type 3/5 shallow flooded marshes or open water wetlands (0.5 to 10 ft deep) (0.9 ac). Much of the wetland area overlaps the proposed construction area of the project. The construction area identifies areas of potential excavation, filling, leveling, tree removal, rutting by heavy machinery, and seeding/planting or other erosion control measures.

A Joint Application Form for Activities Affecting Water Resources in Minnesota will be submitted to the USACE for review and approval. Any development impacting wetlands requires the formal approval by the designated city wetland representative. City ordinances require the applicant submit a complete wetland delineation performed by a professional wetland delineator. Avoidance, minimization and mitigation protocol for wetlands is generally determined under consultation with the local TEP, which includes representatives of the US Army Corps of Engineers, MDNR, Board of Water and Soils Resources, St. Louis County Soil and Water Conservation District, City of Duluth, among possibly others.

The wetlands are not identified as public water wetlands and are not situated below the ordinary high water (bankfull level) (OHWL) of the Knowlton Creek channel. Therefore, Wetland Conservation Act rules apply. According to *Minnesota Rules*, part 8420.0415, subpart D, and possibly other subparts related to restoration, the proposer will seek a "No Net Loss Determination" from wetland authorities based on the restoration objectives of the project, including erosion control, bank stabilization, aquatic habitat improvement, and establishing a hydraulic connection between the channel and floodplain. Although existing wetlands will be impacted by construction related activity, their wetland features will generally be enhanced by increasing the frequency and duration of overbank flooding and reducing amount of sedimentation affecting those areas. In the riparian wetland areas that are disturbed, native vegetation will be seeded or planted and areas will be mulched with straw or covered with erosion control blankets.

About 0.5 ac of seasonally flooded wetlands will be created by filling of portions of old stream channels and retaining subtle basins.

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

Construction activities will occur in-water (below the OHWL) (about three acres) and on the floodplain (above the OHWL) (13 acres) in the mid and lower reaches of Knowlton Creek, a trout stream and public water resource. The OHWL is generally considered the bankfull level of the river, a stage that may be reached on an approximate annual or biennial frequency. A variety of BMPs will be applied to minimize turbidity and sedimentation during the construction and re-vegetation phases.

The work is scheduled during the months of August, September, and October 2015, and 2016 when monthly average flow rates are generally lowest. Real time gage data are not available on Knowlton Creek; however data are available for Kingsbury Creek, which runs only a mile north of Knowlton Creek. Kingsbury stream data might be useful for indicating flow trends on Knowlton Creek. A work stoppage due to high flows will be determined by the contractor based on potential safety of personnel, damage to equipment, and environmental effects on water quality, which are regulated by the NPDES/SDS Construction Stormwater General Permit that requires effective BMPS in place at all times.

New channels will be cut during low flows using an excavator. Stream flow will not be connected to the new stream channel unit until the channel construction has been completed and the channel is stabilized with vegetation. An excavator will be used to remove excess material, avoiding the existing stream channel. Excavated soil will be used later during project construction to fill the existing channel and grade the floodplain. Excavated soil will be temporarily placed in stockpile areas until needed. Each of these stockpile areas will be surrounded by a silt fence to minimize soil loss during the time needed to complete excavation of the new stream channel.

An excavator, using the material that was stockpiled during grading activities, will then fill the existing channel. The channel connecting the new stream to the existing channel will be stabilized with erosion control blanket and the downstream ends of channel block fill will have rock spread on the surface in an area approximately 15 feet wide from the edge of the new channel to check possible head cuts. Once the existing channel is filled in, a blanket of riprap approximately eight feet long by two feet high will be placed at the upstream and downstream ends to prevent the stream from eroding again into its old channel after project completion. Then, final grading using an excavator will be done in the area of the old channel to create a gradual transition to the existing grade that will serve as the new floodplain of the stream and possibly contribute to seasonally flooded wetlands. Channel relocation work will be completed and restored prior to allowing flow to enter into the newly constructed stream channel. If the channel relocation work is not completed prior to abandoning the old channel, a temporary dam and pump-around may be necessary.

The project will be constructed to minimize erosion to the greatest extent possible. Disturbed areas will be kept to a minimum. Erosion control measures will include seeding and mulching all exposed soils, stabilizing soils, installing erosion control blankets, re-vegetating exposed soils, and maintaining erosion control measures until re-vegetation is complete. Generally, exposed banks will be seeded or planted with native vegetation and/or covered with biodegradable erosion control blanket that will be staked in place. The plantings will minimize long-term erosion of stream banks. In the stream, toe wood, rock vanes, and riffles will protect against stream bank erosion. Toe wood and root wads reduce the potential for erosion by deflecting higher velocities away from the stream bank. The project has been designed to minimize sediment loss to downstream areas that may affect fish and wildlife resources.

Steps to minimize potential effects of in-stream construction include:

- Timing of construction is planned to coincide with a period of low flow in the river and the season of low precipitation season (mid-summer through fall).
- Timely monitoring of river flow and downstream conditions will be carried out; flows producing riffle depths greater than four inches will be considered high flow conditions.
- Work stoppage of in-water construction will be at the discretion of the contractor based on compliance with NPDES Construction Stormwater permit to maintain conditions that will not aggravate sedimentation from construction practices.
- The in-water construction activities will be scheduled in a manner that minimizes the amount of days necessary for disturbance to occur in the creek.
- Construction activities that will disturb soils on the river bank that are below the OHWM shall be conducted in phases to minimize soil exposure and erosion; grubbing, excavation, grading, and restoration phases will be coordinated to insure that no more than 400 linear feet of a project reach is disturbed at one time.
- Minimize repeated movement of equipment operating instream or below the OHWM. Construction will be carried out in dry conditions.
- In-water BMP control devices will be used, including turbidity curtains, to the extent practicable and will be deployed prior to any in-water construction activities; the contractor will use flow diversion methods including, but not limited to, pump around diversions, temporary dams, and ditch diversions to provide dry conditions during construction operations in streams. A diversion ditch may also be used if practical. All water will be pumped/drained around work area and area will be stabilized immediately (e.g., seed and mulch) following removal of pump-around/drainage system. Channel relocation work will be completed and restored prior to allowing flow to enter into the newly constructed stream channel. If the channel relocation work is not completed prior to abandoning the old channel, a temporary dam and pump-around will be installed to facilitate construction of the channel "in the dry."
- Best Management Practices to minimize soil erosion will be incorporated into project designs and specified to the contractor in the engineering plans. The BMPs will include silt fence, fabric logs, seeding/mulching, and limiting the size of disturbed soil areas. Erosion control will include all necessary measures to minimize the deposition of materials into Waters of the State and transport of sediment during in-water excavation.
- Imported rock and gravel materials will be required to be free of dirt and debris at delivery.

By requiring the contractor to develop and use these in-water BMPs during the construction activities, the project's short-term turbidity impacts will be mitigated to the extent practicable, cognizant of the applicable state water quality standards. The same BMPs will also serve to help avoid and/or minimize the project's potential to exacerbate the existing MPCA CWA 303(d) listed impairments that are identified for St. Louis Bay (item 11a.i).

The proposed project will not result in any permanent degradation of the water quality of Knowlton Creek for which the MPCA designated uses (classifications above) and the referenced water quality standards apply. The project does not include any application or release of compounds that will increase delivery of mercury, PCBs, phosphorous, nitrate/nitrite, or suspended solids to the water body. Also, controlling the project's short-term turbidity impacts using the instream BMPs identified above will help control the amount of total Hg attached to the sediment that may otherwise disperse into the water column and flow downstream during construction activities.

The project will be administered through the application of the US Army Corps of Engineers Section 404 Clean Water Act (CWA) permit and DNR Public Waters Work Permit obligations. The USACE has several options for authorizing projects under the Clean Water Act (CWA), including the Letter of Permission (LOP-05-MN), the Regional General Permit (RGP-003-MN), and the Individual Permit. The

basic form of authorization used by Corps is the standard or individual permit. Processing such permits involves evaluation of individual, project specific applications. The St. Paul District uses Section 404 RGP and LOP in place of the nationwide general permits. The RGP and LOP categories and procedures are separate and distinct documents. The RGPs are actual issued permits that must be reviewed and re-authorized every five years. In contrast, the LOP is an abbreviated individual permit. Once a process for their evaluation is established and published, LOPs do not need to be changed unless conditions warrant. The RGP and LOP and associated attachments already incorporate the MPCA's Section 401 WQ Certification determination. The 404 RGP defines restoration as the re-establishment or rehabilitation of sites that historically supported wetlands or streams and frequently retain some wetland components (e.g., hydric soils) or stream processes even after human-made disturbances such as drainage and urban development. A DNR Public Waters Work Permit application is in process.

The process for permitting commences with the completion of the Joint Application Form for Activities Affecting Water Resources in Minnesota. Some information that is included in the DNR Public Waters Work Permit application may be substituted, if applicable.

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 evidence of contamination has been identified in the project area. What's In My Neighborhood database (MPCA) indicates that the SMRA operations use hazardous materials and generate small or minimal quantities of hazardous wastes in the project vicinity. Several above ground and below ground petroleum tanks have been installed at SMRA. Some have been removed or replaced. Several petroleum storage tanks were identified and compliance records are available, with one indication of a petroleum spill. The monitored cleanup identified in 1993 at the maintenance facility resulted in no off-site contamination. Several registered users of hazardous materials along the I-35 corridor present potential sources of contamination that could enter the upper reaches of Knowlton Creek.

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.

Minor amounts of construction related wastes, such as plastic and paper containers and packaging, will be generated. Plant materials, soil, gravel, sand, rock, erosion control materials will be temporarily stockpiled onsite until fully used in construction. Much of this material will be harvested from the project area for use in the constructing channel structures, such as riffles, vanes, and toewood features.

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.

Excavation of soils could expose some hidden contamination. When unknown materials are encountered, i.e. buried containers, unknown seepage, oils, etc., the proposer will evaluate the risk of contamination and remove the materials under guidance from local or MPCA hazardous material authorities.

During the construction phases of the proposed project, fuels, oils, lubricants and other materials typical for use by earthmoving equipment will be used during construction of project elements. No other chemicals or hazardous materials are needed for or generated by this project.

The Contractor will be required to prepare a Spill Prevention and Response Plan to address accidental spills or the release of any hazardous material or petroleum products. The plan will be required to include the following measures to avoid and/or minimize spills during construction activities:

- Fueling and equipment maintenance will not be allowed within 100 feet of the water's edge without deploying spill capture methods.
- The contractor shall maintain fuel spill containment kits and trained spill response personnel on site at all times.
- Any spill or release of a hazardous material or petroleum products will be reported to the construction site supervisor who will take immediate action to minimize the potential for groundwater or surface water pollution.
- In the event of a significant spill or release of a hazardous material or a petroleum product, the construction site supervisor will immediately deploy on-site equipment and supplies to contain the spill and contact the MDNR, MPCA and the Minnesota Duty Officer, according to emergency procedures identified in Minnesota Rules, part 7045.0574.
- Temporary, above ground, on-site fuel storage will not be allowed within the 100 year floodplain.
- Below ground storage tanks will not be allowed.

There is a low potential for movement of liquids or chemicals from a spill on the fine texture soil types. To minimize any potential for spills, fuels for construction will be stored at staging areas away from the stream and pervious surfaces. Equipment refueling and maintenance will be done away from the stream and pervious surfaces, thus reducing the risk of potential contamination.

In addition to these measures and methods, to minimize the potential for spillage and associated effects from spills, the contractor will prepare and follow a Health and Safety Plan for use during 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.

The project will not generate or store hazardous wastes during construction.

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 project area is located within the Split Rock Till Plain Land Type Association (LTA), a part of the North Shore Highlands subsection and Northern Superior Uplands Section of the Ecological Classification System

of Minnesota. Historically, the forest type in the area was comprised of white and Norway pine, cedar, aspen, and birch. Aspen forest is the dominant forest type today.

The project site is a deeply incised stream valley within the North Shore Highlands ecological subsection. Clayey soils of this subsection were laid down in the beds of Glacial Lake Duluth. Historically, the area was forested with the upland forest cover type comprised primarily of Northern Hardwoods (sugar maple, northern red oak, American basswood) with scattered individuals or stands of white pine, white spruce, paper birch and trembling aspen. Riparian areas and wetlands were comprised of Lowland Hardwoods (black ash, elm, yellow birch) and Lowland Conifers (primarily white cedar). The current forest type remains relatively unchanged in mature northern hardwoods, lowland hardwoods and lowland conifers with representations of other cover types present. The Spirit Mountain area and the Bardon's Peak Forest Park were not burned in the Cloquet Fire of 1918, so the cover types present are representations of old growth forest. The White Cedar-Yellow Birch Native Plant Community is considered a federally imperiled plant community. Bardon's Peak Forest Park is protected under the Duluth Natural Areas Program and the planned future land use in the City of Duluth's Comprehensive Plan is identified as 'Preservation'.

Knowlton Creek is a MDNR Designated Trout Stream. Although brook trout have been anecdotally reported as present in the Creek in the past, no adult trout had been sampled by MDNR crews. Continuous reading thermometers placed at various locations along the stream channel have indicated that water temperatures are adequate for the survival of brook trout.

The MDNR stocked frylings in the upper reaches of Knowlton Creek in the early summer of 2014. Sampling conducted in late summer of 2014 documented the presence of young-of-the-year brook trout, brook stickleback, central mudminnow and creek chub.

The proposed project is designed to benefit brook trout. The biological diversity and species abundance in Knowlton Creek should also benefit from an increase in a diversity of habitats. The project is designed to enhance the natural ecological function of Knowlton Creek and improve the habitat for fish and wildlife species associated with this cold-water stream environment. The intended outcome of the proposed project is for Knowlton Creek to function as a natural stable stream, which not only moves water and sediment, but maintains its channel in a condition that will be more biologically productive to important native fish communities. Designated trout streams in urban Duluth are being marginalized by increased impervious surface areas, concomitant temperature rises of inflows, and cool water conditions of streams are further being exacerbated by the effects of climate change.

Because brook trout were sampled in 2014, the permitting process for the construction work will have to consider exclusion windows for work in state trout waters. However, because no natural reproduction is anticipated in 2015 or 2016 due to the young age of stocked fish present in the system, an exception may be made. The trout stocked in 2014 will not be mature during the proposed 2015 work season, therefore there will be no exclusion window applied. Indexing of the trout population will be completed in 2016 to determine the survival and age of stocked brook trout. The restoration site team will work together with the Duluth Area Fisheries Office to determine the correct actions for the 2016 construction season based on those results. The final determination will be made by the Section of Fisheries during the permitting process.

Resident wildlife species in the project area include white-tailed deer, black bears, furbearers (coyotes, bobcats, raccoon and mink), cottontail rabbits and a variety of small mammals (mice, voles, shrews). A wide variety of bird species frequent the area including raptors (bald eagles, hawks and owls), waterfowl (wood ducks, mallards, and Canada geese), waterbirds (kingfishers, great blue herons) and songbirds. Reptiles and amphibians also frequent the area. The improved stream habitat and connectivity may

benefit predatory species that feed on fish such as mink and kingfisher, as well as insect-eating birds and amphibians.

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 #20150233**) 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.

In March 2015, the MDNR Natural Heritage Information System (NHIS) was queried to determine if any rare species or other significant natural features are known to occur within an approximate one-mile radius of the proposed project (Attachment B).

Lake Sturgeon (*Acipenser fulvescens*), a species of Special Concern, was the only rare species identified as potentially being adversely affected by the project activities.

Tsuga canadensis (hemlock) is not known to occur within a mile of the project area. However, it is known to occur in cool forested ravines that resemble habitats found in the project area.

Effective May 4, 2015 the U.S. Fish and Wildlife Service listed the northern long-eared bat as threatened under the Endangered Species Act (ESA) and implemented an interim 4(d) rule. The ESA prohibits take of this species without a permit unless the take is exempt under the interim 4(d) rule. There are no known occurrences of northern long-eared bat roosts or hibernacula within an approximate one-mile radius of the proposed project.

The mouth of Knowlton Creek is within a Minnesota Biological Survey Site of Biological Significance. The Riverside to Grassy Point site is designated as a site of moderate biological diversity. The project area is near the Site.

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.

Short-term impacts to fish and wildlife species in the project vicinity may be temporary displacement of birds, mammals, reptiles and amphibians due to increased activity and noise levels during construction. Lake sturgeon residing in St. Louis Bay waters will not be directly affected because no project activities are proposed to take place in the bay. No long-term adverse impacts are anticipated.

Environmental effects to rare species are not anticipated, as there have been no known occurrences identified in the project area. With the proposed removal of live trees from the project area for use in constructing channel structures, including Log Riffles, Log Vane Boulder Hooks and Log Steps, inadvertent removal of hemlock trees and potential hibernacula of the northern long eared bat is a low risk. No invasive species other than purple loosestrife are expected to occur within the project site.

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

With the reduction of sediment reaching the bay and associated improvements of water quality from proposed development, an indirect beneficial effect on lake sturgeon is anticipated. Short-term impacts to fish and wildlife resources and habitats in downstream areas will be minimized using the following measures:

- Channel excavation scheduling will minimize area disturbed at one time.
- Constructing and stabilizing the new stream channels prior to the re-introduction of flow, thereby reducing erosion at the sites and minimizing downstream water quality effects.
- Use of erosion control blankets on all newly constructed stream channels, and rapid re-vegetation of areas affected by construction with native plants will minimize sediment transport off site and reestablish better wildlife habitat.
- Stockpiles of dirt, rock, and/or toe wood will be stored away from the stream and surrounded by silt fence to prevent sedimentation.
- Plantings and in-stream habitat structures such as rock vanes and cross rock vanes will minimize long-term erosion of streambanks.

Using the http://www.fws.gov/midwest/endangered/mammals/nleb/Interim4dRuleKeyNLEB.html (USFWS Key to the Interim 4(d) Rule), the incidental take that may result from the minimal tree removal associated with this project is exempt and no further action is necessary to comply with the Endangered Species Act prohibitions to protect northern long-eared bats. As an extra precaution, any trees proposed for removal will be inspected for cavities or loose bark which may serve as hibernacula for this species. Any suitable trees will be retained on-site. Trees chosen for harvesting for use in the channel structures will also be inspected to insure they are not hemlock trees.

As described in MDNR Operational Order 113 on Invasive Species, the following project management BMPs will be applied:

- Before arriving at a work site, inspect the equipment and remove visible plants, seeds, mud, dirt clods, and animals. All machinery will be thoroughly pressure washed before entering the project area to avoid the introduction of invasive species; using a broom or brush will be sufficient when moving within a work site.
- Before leaving a work site, inspect the equipment and remove visible plants, seeds, mud, dirt clods, and animals.
- Do not plant or introduce prohibited or regulated invasive species or other listed invasive species as listed on the DNR website and the "Op Order 113 Invasive Species List" unless by permit.
- Use only mulch, soil, gravel, etc. that is free of invasive species or remove the top six inches of material to reduce the likelihood invasive species will be introduced or spread. Certified weed-free products such as weed-free seed or hay will be used.
- Do not move soil, dredge material, or raw wood products that may harbor invasive species from infested sites except under contract specifications, permit or compliance agreements.
- Inspect transplanted vegetation for signs of invasive species that may be attached to the vegetation and remove them (i.e. other plant material and animals, etc.).
- Post-project treat any new infestations promptly where feasible to prevent populations from spreading.

Additional standard DNR protocols include:

- Work from the upper to the lower waters within a watershed.
- Minimize soil disturbance with equipment.
- Minimize number of access points to site.
- Carry boot brush in all vehicles and clean boots and clothing (in a controlled area) before leaving any site. Disinfect boot brush between sites.
- Avoid parking in or moving through existing patches of invasive species when getting to and from the work site. When unavoidable, clean vehicle of all visible evidence of soil and vegetation when leaving the parking site.

Additional procedures used to meet Operational Order 113 and FAW discipline standards include:

- No sediment or water should be moved between water bodies.
- Any water pumped out of a water body should be released into the same water body or drained on land where it cannot enter surface water.
- Aquatic vegetation cannot be transported from any water listed as infested.
- Construction equipment should be cleaned and disinfected according to specific Operational Order guidelines prior to leaving site.

"Movement of earth and water has the potential to spread various invasive species and pathogens. The risk is highest for snails, particularly if sediments are moved on equipment that is used in other water bodies. Particular concern could be the New Zealand mud snail. Plants, which can be spread by plant parts and seeds in lake and stream sediments, such as purple loosestrife and curly-leaf pondweed, have the highest risk of being moved on equipment if not cleaned (MDNR Division of Fish & Wildlife invasive species protocols for Habitat Improvement and Shoreland Restoration for Trout Streams)."

Post-project any new infestations will be treated promptly to prevent populations from spreading. A Prohibited Invasive Species Possession and Transport permit (# 351) for Purple Loosestrife has been obtained from the Invasive Species Program, MDNR.

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.

AECOM, under the Baird/URS Joint Venture, conducted a Phase I archaeological survey of the Knowlton Creek Stream Restoration Project area in St. Louis County, Minnesota. This work was conducted under contract to the Detroit District of the USACE pursuant to Section 106 of the National Historic Preservation Act in support of the Remedial Action Plan for the St. Louis River Area of Concern, which is being led by the MPCA.

Background research to develop the culture history for the project and identify previously conducted archaeological investigations and previously recorded archaeological sites within the project area and vicinity was conducted at a variety of institutions, including Minnesota Historical Society, St. Louis County Historical Society, Lake Superior Maritime Visitor Center, and Duluth Public Library. The database report from the Minnesota History Society, State Historical Preservation Office, was not provided in the report. Only two artifacts--a small piece of metal slag and a fragment of clear bottle glass-- were uncovered during the shovel test sampling. Both were recovered from fluvial deposits near the creek and appear to have been transported from upstream locations. The locations of the discoveries have not been designated as archaeological sites.

MDNR field crews as well as staff from the environmental engineering contractor that completed stream evaluations and project designs have not encountered any historic structures or artifacts of interest. If any Areas of Potential Effect (APE) are identified within the project footprint, project management staff will mark the APE and prohibit any disturbance within that area. Cultural resource specialists with the Fond du Lac Band of Lake Superior Chippewa will be consulted regarding potential significant sites within the project area due to its proximity to Spirit Mountain.

A concurrence letter from the State Historical Preservation Office (SHPO) will be required prior to commencing construction. The SHPO review is pending their inspection of project historical review documents.

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.

The project will occur in the viewshed of the Bardon's Peak Forest Park area. No vapor plumes will be generated and no intense lighting will be used during the construction of this project. The only visual effect anticipated is the addition of rock vanes, riffles, and toe wood into the streambed. These elements may temporarily impact the visual quality of the stream, especially before vegetation is re-established. The re-vegetation efforts and improved stream function will improve the visual quality of the stream over the long-term.

16. Air:

a. Stationary source emissions - Describe the type, sources, quantities and compositions of any emissions from stationary sources such as boilers or exhaust stacks. Include any hazardous air pollutants, criteria pollutants, 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 emissions.

No stationary source emissions will be created by 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.

Fuel exhaust emissions contain pollutants including carbon monoxide, nitrogen oxides, reactive organic gases, sulfur dioxide, and suspended particulate matter, all of which carry some associated health risks. Construction-related emissions will be exempt as de minimus and they will meet the conformity requirements under Section 176 (c) of the Clean Air Act, and 40 CFR 93.153. Emissions will be minor and temporary in nature, arising from the use of powered equipment during construction. Equipment used will include excavators, loaders and trucks.

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.

The proposed project may create some temporary dust during construction activities. Fugitive dust could arise during hauling and stockpiling of earthen materials and large tree branches and trunks. Offensive odors are unlikely as limited areas of organic soils will be disturbed and construction materials do not contain volatile compounds. Construction would involve the movement and grading of soils and rock materials in dry or moist soil condition. Most materials handled are stone and wood and do not cause fugitive dust generation or offensive odors. Affects associated with fugitive dust and

offensive odors will be limited to the construction site. The construction site is generally 600 to 1200 feet from the nearest sensitive receptors located in residential areas.

The contractor will be required to follow best management practices to reduce dust such as:

- Covering loads during transport if wind-blown debris could be generated during hauling.
- Watering access routes and exposed soils when powdery conditions are evident.
- Placing mulch, temporary cover and erosion control mats on exposed areas and stockpiles.
- Requiring fill and stone materials to be clean and free of dirt and debris.

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.

Minnesota Rules, part 7030.0040 establishes two noise levels, L_{10} and L_{50}, based on the percent of time noise levels exceed the standard over a one-hour time period: L_{10} is defined as "noise levels exceeding the standard for ten percent of the time for one hour (6 minutes/hour)" and L_{50} is defined as "noise levels exceeding the standard for 50 percent of the time for one hour (30 minutes/hour)." The rules also establish daytime and nighttime noise level standards based on Noise Activity Classification (NAC) levels. Minnesota Rules, part 7030.0050 defines NAC levels based on land uses as 1, 2, 3, or 4. NAC Level 1 includes residential areas.

Generally, work in the main stem of Knowlton Creek will be from 600 to 1200 ft from the nearest sensitive receptors, which is the neighbor to the east of the project area. Work on the main stem will be occurring in the floodplain, and the surrounding ridges will minimize the travel of noise. Additionally, the main access route for the main stem will be across SMRA property, which does not have permanent residents. Work on approximately 900 feet of stream channel in the lower portion of the tributary will occur within 200 feet of a residential area. MDNR will contact these residents to inform them of the project and provide them a description of work hours. No work is anticipated between the hours of 10:00 PM and 6:00 AM.

Noise standards established for NAC Level 1 areas are as follows (all noise levels are measured in decibels (dBA): daytime standards (7:00 am to 10:00 pm) for the respective L levels are 65 dBA (L10) and 60 dBA (L50); and nighttime standards (10:00 pm to 7:00 am) are 55 dBA (L_{10}) and 50 dBA (L_{50}). According to the Federal Highway Administration, the average noise level at 50 feet from typical diesel-powered mobile construction equipment is 87 dBA (FWHA Construction Noise Handbook, Table 9.1). Sound decreases from a point source at a rate of six dBA for every doubling of distance from the source (MPCA Guide to Noise Control in Minnesota). The table below provides an estimated noise level as a function of distance, based on information from the FHWA handbook and the MPCA guide.

Distance from Source (Feet)	Noise Level (dBA)	Notes/Reference point for Knowlton Creek work
50	87	Calculated from FHWA handbook
100	81	Average referenced for excavator/generator in Table 9.1, FHWA handbook
600	51	Calculated based on the MPCA guide
900	33	Calculated based on the MPCA guide

The contractor will be required to minimize noise effects by:

- Restrict equipment operation only during daylight hours (7am – 10 pm), Monday-Saturday.
- Require all equipment to have properly operating muffler systems.
- Restrict idling time for inactive equipment to 15 minutes.
- Notify adjacent landowners and businesses about the intent of the project, duration, expected noise levels and complaint procedures.

Project construction will temporarily generate noise above current use. Construction will use equipment classified as "mobile equipment" including dozers, cranes, graders, excavators etc. Equipment will operate in a cyclic fashion in which a period of full power is followed by a period of reduced power. Typical sounds will include engine noise, sounds of metal on rock, and safety back-up alarms. The residences immediately adjacent to the work site on the east side will be exposed to construction related noises. Hours of operation will mitigate this to some extent. Once complete the project will not generate noise.

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.

1) No additional parking spaces will be necessary during project operations. Construction crews will park vehicles at proposed staging areas, away from public highways. 2) Movement of crews, the acquisition of construction materials, and refueling will likely generate some increased traffic in the vicinity. 3) Off-site vehicle movements will occur during the start and end of the work schedules but could occur at any time during the hours of equipment operation from 6:00 AM to 10:00 PM. 4) Normally less than 20 daily trips are anticipated. 5) Alternative bus transportation is available along Grand Avenue.

Discussions have been ongoing between the MDNR and MnDOT regarding the new bridge under construction for the Grand Avenue crossing of Kingsbury Creek under construction (Project No SP 6910-89) and the proposed bridge for the Grand Avenue crossing of Knowlton Creek (Project No SP 6910-96), likely to begin construction next year. The MnDOT has coordinated with the City of Duluth and the MDNR fisheries staff on both bridges to meet the interests for recreation and fish ecology. The existing culverts hamper passage of fish and other organisms. The proposed new bridges are being designed with a natural stream bottom to restore fish passage. The Grand Avenue bridges will integrate water control structures and have wider channels below the crossings.

Crossing No. 5866 at the Munger State Trail is slated for replacement pending sufficient funding. The present culvert is perched and a barrier to fish passage. The Duluth Traverse Trail is a proposed multi-use trail that crosses the mid-section of the project area is slated for construction in 2016. SMRA also conducted some preliminary erosion control work on the washed out DWP causeway. The final restoration of this stretch of the creek will be completed this year. The bridge over Knowlton Creek just upstream of the blow out on the DWP causeway was replaced with a temporary structure by SMRA after the 2012 flood. A more permanent bridge is scheduled to be placed in this location by SMRA in 2015.

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.

This project will not generate an additional 250 vehicles, or 2,500 trips per day on affected roads and trails.

During construction, six to eight vehicle trips per day will be required, including 2-3 trips per day for the workday (generally 6:00 AM to 6:00 PM), plus 1-2 trips per day as required by the site construction crew between July 15, 2015 and December 31, 2015. Construction activities will be restricted to weekdays. Contractors will be allowed to use existing roads and trails for construction staging and equipment storage as long as the sites do not interfere with operations at the Spirit Mountain Recreation Area. This number of trips generated is not expected to adversely affect local traffic.

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

Access routes from public roads will be evaluated for safety and operators of equipment turning onto and off of public highways will use caution. No other additional measures will be needed to mitigate project-related transportation impacts. Potential traffic bottlenecks may occur due to MnDOT construction taking place along Grand Avenue. The MDNR will coordinate with MnDOT and use MnDOT project updates on the Grand Avenue construction activities to prevent conflicts, delays, and other inefficiencies from occurring during construction.

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 environmental effects that could combine with other environmental effects resulting in cumulative potential effects.

Anticipated short-term negative effects of construction in the project area are noise, dust, traffic, and water quality/stormwater pollution during the late summer and fall of 2015 and the mid-summer to late fall of 2016. The area of potential effect (APE) for noise, dust, and traffic generally is an approximate 1000 foot zone surrounding construction. The APE of water quality/stormwater pollution includes the mid- and lower elevations of Knowlton Creek and tributaries and wetland bay behind Tallas Island and downstream in the greater St. Louis Bay aquatic habitats.

Following construction, the project will have ongoing beneficial effects to aquatic habitat and water quality in the St. Louis River Estuary area.

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 several additional projects that the MDNR is aware of that were recently completed or planned to be built in the foreseeable future within the same geographic area (upper reaches of the lower St. Louis River) and timeframe (July to December 2015 and 2016) that were evaluated for interaction of environmental effects: 1) Spirit Mountain Water Control Project; 2) MN Dept. of Transportation Highway 23 pavement rehabilitation and replacement of the Grand Avenue bridges crossing Kingsbury and Knowlton Creek (SP 6910-89 and SP 6910-96); 3) several other projects involving the construction, repair, or replacement of segments of roadways, treadways, and pipelines; and 4) sediment removal at the mouth of Knowlton Creek. These projects will directly or indirectly affect the project area and take place over a period of approximately six years, beginning in 2012.

1) The Spirit Mountain water supply and diversion project. The project will allow for the SMRA to be removed from the City of Duluth Water supply for snowmaking. In 2013, the Spirit Mountain Recreation Authority (SMRA) and the St. Louis River Area of Concern (AOC) Implementation Team developed a design for a runoff collection system at the bottom of the ski hill. This system works by diverting snowmelt and storm water away from Knowlton Creek and returning it directly to the estuary through SMRA's pipeline from the estuary for snowmaking. The reduction in runoff achieved with the system will bring the hydrology of the watershed back to within a reasonable percentage above historical flows. The project will also allow for future development in Western Duluth. The work proposed to occur in the Northwest Area is repair existing erosion and stabilize the area to prevent further sedimentation of Knowlton Creek. This project component will include the construction of a conveyance ditch and erosion repairs and will take place in an existing snowmobile trail. The area's use as a snowmobile trail will be taken into consideration in the design of the conveyance system. The SMRA is completing a water infrastructure project in 2015. An objective of the project is to establish water control structures at the bottom of the ski hill that will direct a portion of the peak flows away from Knowlton Creek. The intent of the structures is to reduce the impacts of snowmelt and stormwater to the Knowlton Creek channel. The structures will be designed to allow base flows to reach Knowlton Creek, which eliminates the negative impacts of losing flow during low water periods. The stream restoration project design was based on the predicted amount of peak flow reduction and the MNDNR fisheries management plan was proposed as a result of these actions. The proposed actions of SMRA and MNDNR should result in the increased resiliency of Knowlton Creek to the anticipated negative impacts of climate change (increased rainfall and flood events). The work proposed for the Southeast Area focuses on a collection system to capture run-off from the Spirit Mountain ski runs. The proposed work will include the construction of ditching and storm sewer piping in order to convey the flow to both the St. Louis River and Knowlton. The work will involve the removal of one culvert and redesign of two others.

The work proposed for the Culvert Work Area will consist of the following: Culvert 3 and 4 will be redesigned in order to reduce constriction. The redesign consists of a half culvert which keeps the bottom open to the channel to a width of 12 to 13 feet. In order to install the new culvert, excavation of the embankment will be required and the existing culvert will need to be removed. Culvert 5 will be removed and a naturalized channel will be installed in order to restore the natural flow of Knowlton Creek. The majority of excavation work on this project will be on the passage ways which are previously disturbed soils.

2) Highway 23 (Grand Avenue) Construction (SP 6910-89 and SP 6910-90). The project will include pavement mill and overlay, lane configurations to include a designated bicycle lane, replace culvert located at Kingsbury Creek and Knowlton Creek with two new bridges; culvert and storm sewer repairs/replacements; new sidewalk and curb ramps, and grading with shoulder widening at select locations.

The proposed bridge projects will involve removal of the existing crossing structure (culvert) and replacing it with a new bridge. The new bridge will be constructed prior to removal of the existing culvert. Kingsbury Creek will continue to flow through the existing culvert during construction. After the new bridge has been constructed, the old bridge will be removed. Stream hydraulics will be affected by the removal of an upstream weir and the installation of a series of boulder jam steps and boulder vane riffle structures. It is expected that any indirect impacts will be limited to minor changes in water clarity during and immediately after removal of the in-place bridge (culvert). Therefore, the proposed project will have no direct impacts on fisheries habitat. Construction of the Kingsbury bridge (No. 69078) began in mid-June, 2015. Discussions have been ongoing for several years between the MDNR and MnDOT regarding the redesign of Kingsbury bridge.

The Grand Avenue causeway over Knowlton Creek currently transports water through an undersized culvert. The MNDOT is replacing this culvert with a bridge in 2016 as part of their Grand Avenue Renovation Project. The bridge will be constructed to contain the stream at bankfull width and a trail on both sides.

3) Other projects. Other projects include the construction, repair, or replacement of segments of roadways, treadways, and pipelines: previous SMRA work on stabilization of the Knowlton Creek channel at the DWP crossing; SMRA construction of a temporary bridge over Knowlton Creek just upstream of the blow out on the DWP causeway after the 2012 flood; SMRA plans construction of a more permanent bridge at this location in 2015; MDNR plans to replace the Munger Trail culvert on Knowlton Creek; Duluth proposes construction of the Duluth Traverse Trail crossing the project area; City of Cloquet completed pipeline stabilization work along a tributary of Knowlton Creek; AOC collaborators identified a potential need for sediment removal at the mouth of Knowlton Creek in St. Louis Bay.

SMRA conducted some preliminary work on the washed out DWP causeway. The causeway over Knowlton Creek at the derelict DWP railroad line washed out in 2012. The concrete culvert has remained in the stream channel since that time. The SMRA involved the placement of erosion fencing, reducing the grade of the washed out banks, and reseeding the slopes through application of funding associated with Minnesota flood relief. Removal of the concrete culvert, establishment of a restored channel and stabilization of the streambanks will be completed in 2015 as an objective of the proposed project. The final restoration of this stretch of the creek will be completed this year. The bridge over Knowlton Creek just upstream of the blown out DWP causeway was replaced with a temporary structure by SMRA after the 2012 flood. A more permanent bridge is scheduled to be placed in this location by SMRA in 2015. Also completed after the 2012 flood, SMRA built a temporary bridge structure just upstream of the blown out DWP causeway. A more permanent bridge is scheduled to be placed in this location by SMRA in 2015.

The Duluth Traverse Trail is a proposed multi-use trail crossing the mid-section of the project area. The trail is slated for construction in 2016. The Munger Trail culvert for Knowlton Creek is perched and a barrier to fish passage. The DNR is looking for funding and support from the Division of Parks and Trails to find necessary funding to replace this culvert at a later date. This is outside the scope of the current project.

The City of Cloquet completed stabilization of stream banks within their pipeline causeway along the mainstem above the proposed project after the 2012 flood. They also stabilized sloughing stream banks along two reaches of the tributary. All erosion control work was completed with rip-rap. The efforts did not require EAW's.

4) Sediment Removal at Mouth of Knowlton Creek. The MDNR and AOC partners are working toward identifying means to remove the sediment recently deposited at the mouth of Knowlton Creek after the stream restoration project is completed. This project is in the concept phase and cannot be evaluated for cumulative effects because a basis for expectation has not been sufficiently advanced to the planning phase.

Once complete, the Knowlton Creek Stream Restoration Project will have an overall positive effect on the local environment. The quality and area of suitable riparian habitat for trout, and other cold-water associated species will be improved. The restored, stabilized stream will benefit local infrastructure as it will be more resilient and better able to handle large rain events. Restoration of the trout stream and fishery will provide quality recreational opportunity within the City of Duluth.

The MNDNR has examined whether the proposed project could have a significant effect when considered along with other projects that: (1) are already in existence, are actually planned for, or for which a basis of expectation has been laid; (2) are located in the surrounding area; and/or (3) might reasonably be expected to affect the same natural resources.

This project is related to work being completed to delist the St. Louis River Estuary as an AOC. The AOC Remedial Action Plan Update includes additional aquatic habitat restoration projects including 21st Avenue W, 40th Avenue W, Grassy Point, Radio Tower Bay, Perch Lake, Spirit Lake, and Chambers Grove that cumulatively are anticipated to restore the ecological functions of the river and estuary."

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.

Noise, odors, dust, and increases in traffic will have limited potential for cumulative effects due to the minor incremental increases of these effects from project activities. Project managers will need to ascertain activities and potential environmental effects from projects of a similar nature to avoid unnecessary inconveniences or conflicts from arising within the vicinity of the project area. As noted under Item No. 17 of this EAW, MDNR will notify adjacent landowners and businesses about the intent of the project, duration, expected noise levels, and complaint procedures. As described under Item No. 18, the MDNR will coordinate with MnDOT and other project managers to prevent environmental effects and associated inconveniences or conflicts, delays, or other inefficiencies from occurring during construction.

Projects listed under Item No. 19b will take place over a period of approximately six years, beginning in 2012 and directly or indirectly affect water quality in the project area during this period. Projects will produce some additional sedimentation into Knowlton Creek, most of which will be temporary in nature. The number of construction projects indicates an active period of development in and around the project area. All projects will be required to meet NPDES/SDS Construction Stormwater GP provisions. With the project activities extended over the six year period, their generally small sizes, and likely beneficial aspects of several projects for reducing sedimentation, the cumulative environmental effects on water quality is likely to be temporary and manageable. Approximately an 80 percent reduction in stream bank erosion is anticipated after completion of the Knowlton Creek Stream Restoration Project. This project and others are focused on improved recreational opportunities and aquatic habitats along Knowlton Creek. Better stream connectivity, higher quality aquatic habitats, and improved stream stability will likely occur if BMPs and stormwater protection measures are properly employed. Monitoring will be conducted after project completion to evaluate whether project goals for reducing sedimentation into St. Louis Bay have been achieved.

The cumulative potential effects of this project include increased fish and wildlife habitat, increased fish and wildlife populations, and decreased sediment transport to the St. Louis River estuary. These cumulative potential effects will be beneficial to the St. Louis River estuary and support its delisting as an AOC.BUI. Potential beneficial effects of AOC restoration projects include additional aquatic habitat restoration projects at locations throughout the estuary including 21st Ave West, 40th Ave West, Grassy Point, Radio Tower Bay, Perch Lake, Spirit Lake, Kingsbury Bay and Knowlton Creek. The cumulative potential effects of these projects is anticipated to increase fish and wildlife habitat, increase fish and wildlife populations, and decrease anthropogenic impacts to St. Louis River Estuary.

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.

If the brook trout fishery is restored in Knowlton Creek and its tributaries, a secondary effect may be increased use and fishing pressure on the stream.

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

I hereby certify that:

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

Signature Ronald Wieland Date July 13, 2015

Title Environmental Review Planner