

Construction Feasibility Study for the Duluth Lakewalk

20th to 25th Avenues East

Prepared for the City of Duluth

SEH No. A-DULUT0701.00

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Detailed Cost Estimates

Construction Feasibility Study for the Duluth Lakewalk

20th to 25th Avenues East

1.0 Purpose

This document has been prepared to assess the feasibility of constructing the Duluth Lakewalk trail system along the shore of Lake Superior from 20th Avenue East to 25th Avenues East. Due to the complexity of construction, the City of Duluth has prepared this analysis to guide decision-makers and define funding requirements with the ultimate goal of providing a continuous trail system from Canal Park to East Duluth. This effort has evaluated five construction options and three alternative route locations. This analysis considers both the regulatory aspects and physical construction of the proposed trail.

2.0 Background/Study Area

The Lakewalk trail system is one of the most popular attractions in the City of Duluth for both residents and tourists. The trail currently begins in Canal Park and runs approximately three miles along the north shore of Lake Superior to 28th Avenue East. The first mile of the Lakewalk beginning in Canal Park includes both a wooden boardwalk and multi-use paved trail. The remaining two miles includes a multi-use paved trail with connections to Lake Avenue, Superior Street, and London Road at several locations. The trail is continuous to 20th Avenue East at the water's edge. The trail then follows Water Street to 23rd Avenue East where it is once again a separate corridor, but not adjacent to Lake Superior.

Between 20th and 23rd Avenues East, the Lakewalk connection follows the Water Street right-of-way along a five foot wide concrete sidewalk adjacent to the curb of Water Street. There is no delineated separation between the trail route and motorized vehicles, presenting a safety concern for trail users in this area. In addition, this route does not provide the trail user with a view of the lake or other significant features, diminishing the experience provided along much of the Lakewalk.

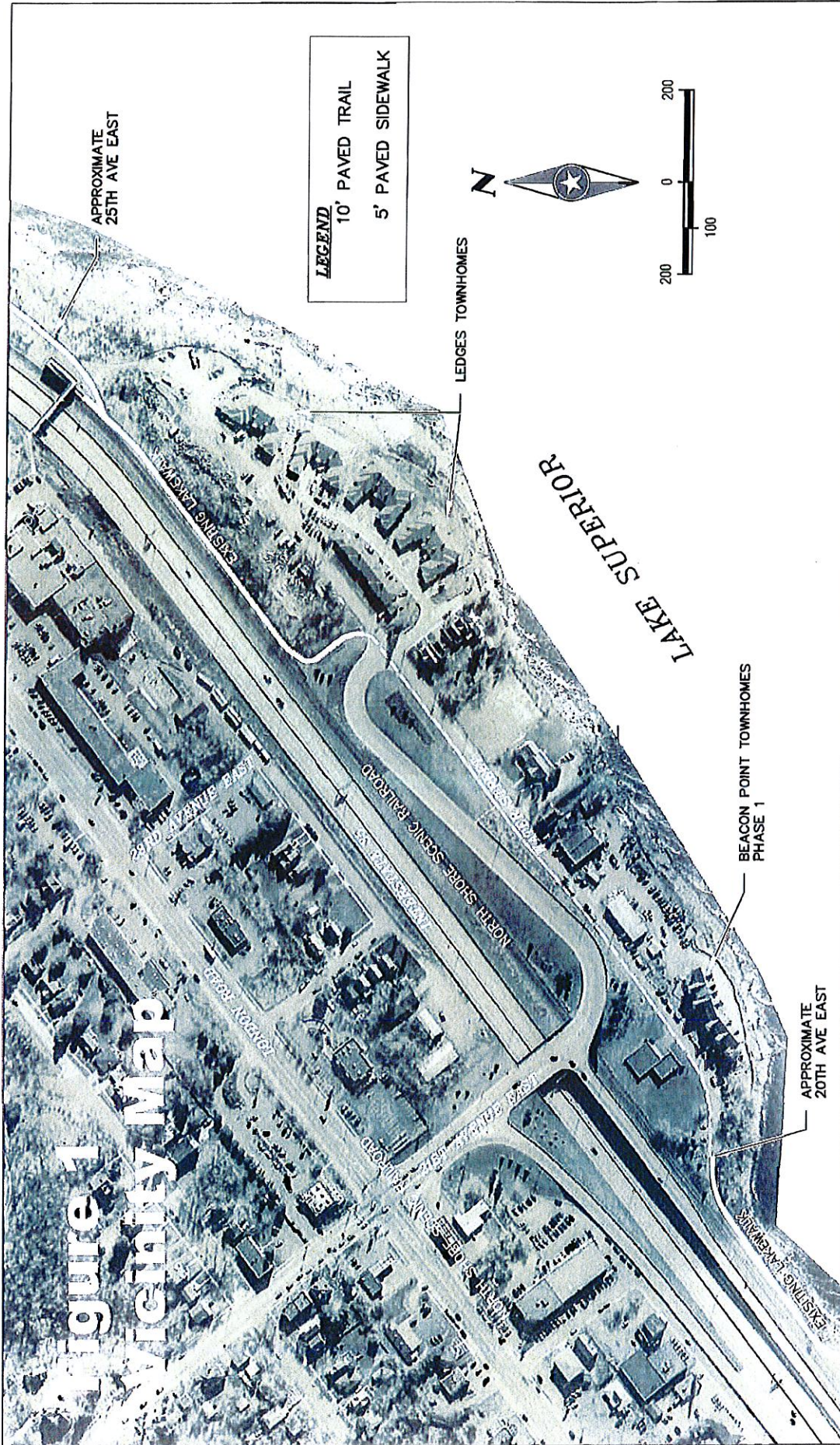


Figure 1
Vicinity Map

**CONSTRUCTION FEASIBILITY STUDY
FOR THE DULUTH LAKEWALK**



With the exception of the segment from 20th to 23rd Avenues East, the trail generally meets Minnesota Department of Transportation Trail Standards. This standard provides for a paved surface that is 10 feet wide plus one foot of clearance on each side, complies with American with Disabilities Act (ADA) accessibility standards, and is designed to accommodate pedestrians, inline skaters, and cyclists. This design standard applies to any of the proposed alternatives with the exception of the proposed footpath along the lakeshore.

The goal of the proposed Lakewalk connection from 20th to 25th Avenues East is to improve the connectivity, safety, and user experience. Figure 1 indicates the study area.

3.0 Potential Route Alternatives

The development of this feasibility study started with the identification of alternatives for the rerouting the trail. Three potential routes were identified and evaluated for additional study. Varying construction methods were also considered.

Figures 2 through 7 show the existing shoreline condition from 20th to 25th Avenues East. This area presents a significant challenge for trail construction and includes steep slopes, bedrock, heavy rubble and debris, and a very rugged natural shoreline. These site factors, along with high wind and waves and the potential for significant ice accumulation require a variety of engineering considerations.

Existing Conditions Photos

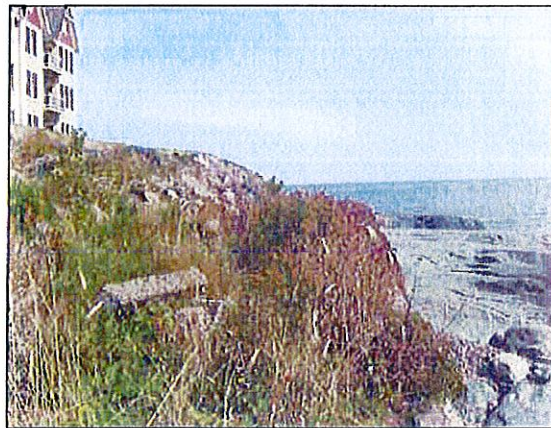


Figure 2 – west side of Beacon Point looking east

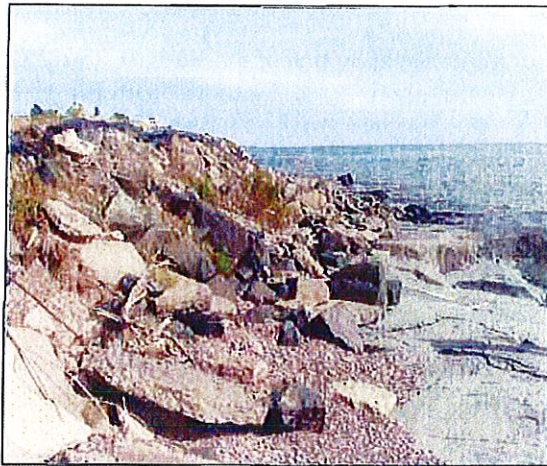


Figure 3 – east side of Beacon Point looking east

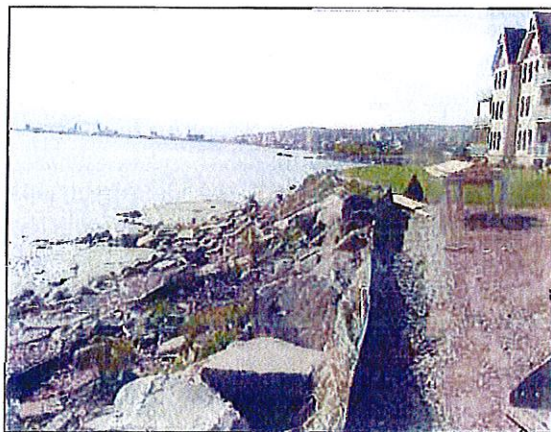


Figure 4 – east side of Beacon Point looking west



Figure 5 – east side of Beacon Point looking east

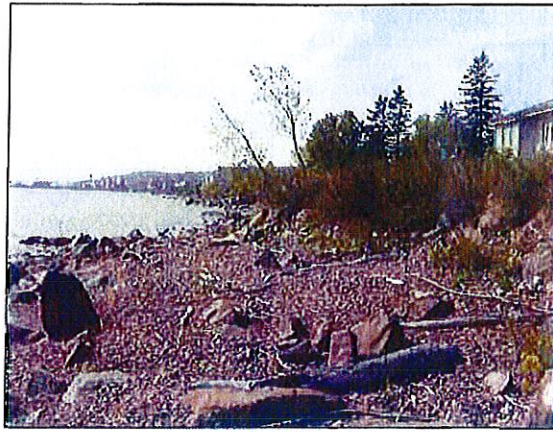


Figure 6 – west side of Ledges Townhomes looking west



Figure 7 – west side of Ledges Townhomes looking east

Three route alternatives have been evaluated:

3.1 Alternative 1

The first route alternative includes realigning the Lakewalk to follow the lakeshore within existing easements and public ownership from 20th to 25th Avenues East. Figure 8 on page 7 shows this alignment alternative.

3.2 Alternative 2

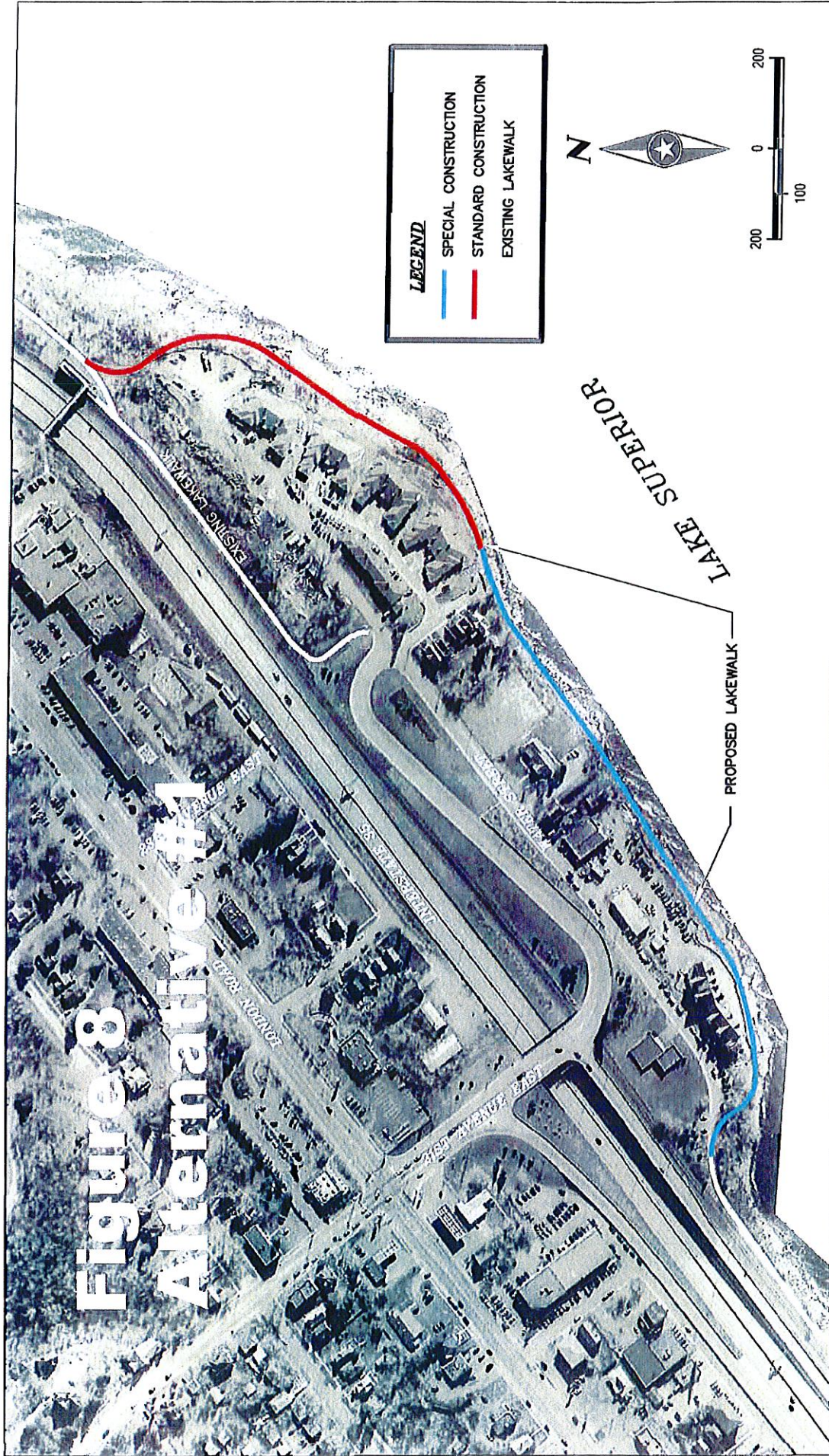
The second route alternative provides a dedicated trail along the northwest side of Water Street following the existing sidewalk from 20th to 23rd Avenues East. This route utilizes the existing street right-of-way but provides a standard trail and separation between trail users and vehicles for enhanced safety. Figure 9 on page 8 shows this alignment alternative.

3.3 Alternative 3

The final route alternative includes a combination of alternatives one and two. With this alternative, an improved, pedestrian-only path is constructed along the lakeshore, and a standard trail is constructed along Water Street. The pedestrian trail along the lakeshore could potentially be constructed as a variable three to four foot wide paved bituminous path. The final surface and construction methods used will be dependant on the site conditions. This type of pedestrian path may potentially need a series of small retaining walls in order to maintain a level surface. This pedestrian path would be susceptible to any type of major wave or wind damage. This solution minimizes the impacts along the lakeshore while providing a natural trail experience for pedestrians. Figure 10 on page 9 shows this alignment alternative.

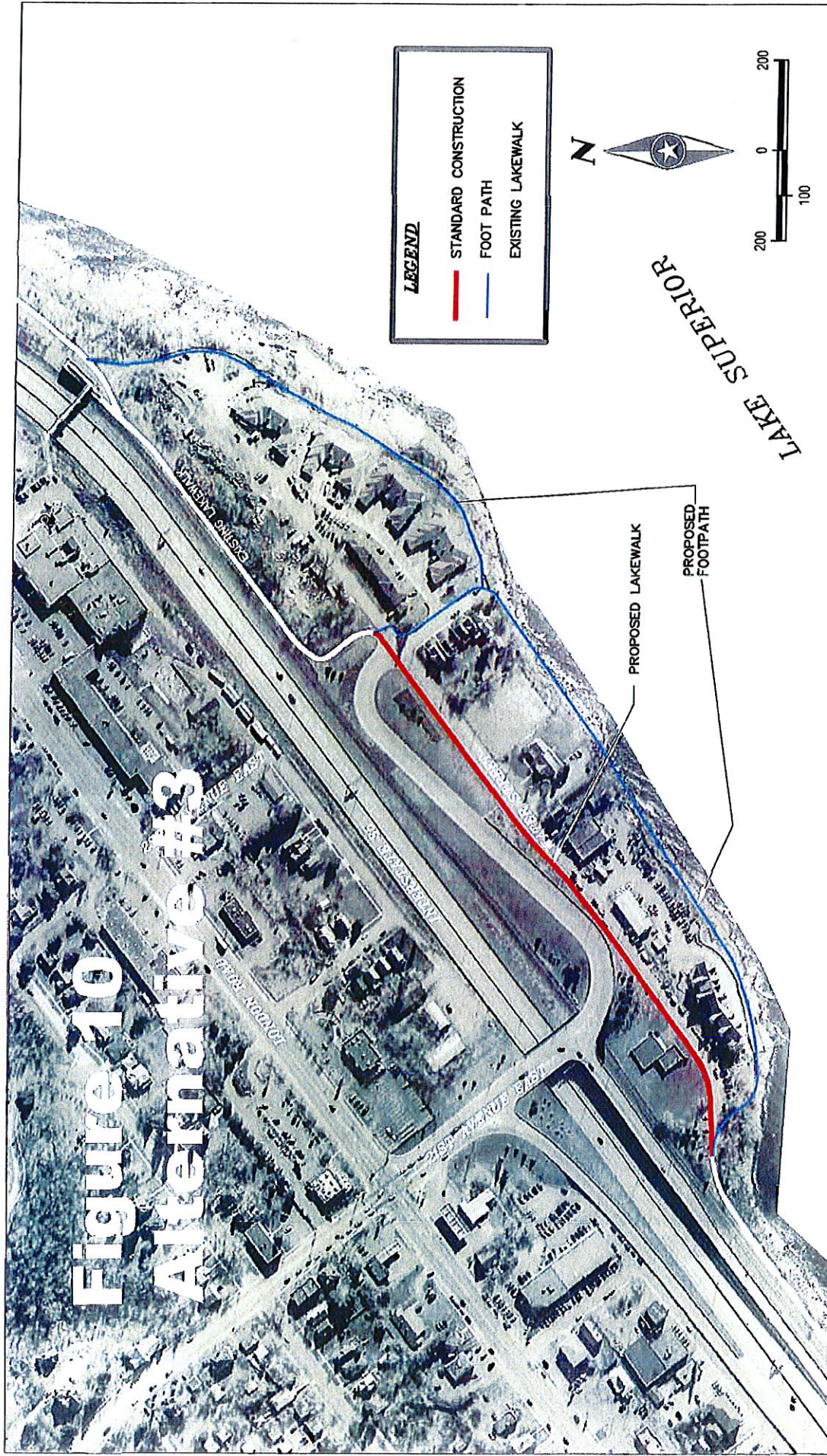
The criteria used to evaluate all route alternatives and construction methods includes construction and maintenance costs, impacts to the shoreline, difficulty of construction, user experience, and permit restrictions.

Figure 8 Alternative #1



CONSTRUCTION FEASIBILITY STUDY FOR THE DULUTH LAKEWALK

Figure 10 Alternative #3



CONSTRUCTION FEASIBILITY STUDY FOR THE DULUTH LAKEWALK

4.0 Construction Options

Five different construction options have been developed and analyzed for application within the study area. Constructability and regulatory compliance are key considerations for the routes following the lakeshore. Specifically, for trail construction along the lakeshore from 20th to 23rd Avenues East (a distance of 1,300 feet), the difficult terrain requires the use of special construction methods. This will include the removal of a significant amount of rubble for the placement of footings directly onto the bedrock in this area. It is anticipated that the terrain and site access restrictions will necessitate construction via barge directly from the lake during the summer months.

In addition to the various construction options that can be employed, other important engineering considerations will apply to any proposed route following the lakeshore. As the area is subjected to significant wind, waves, and ice, any structures placed in this area must be designed to withstand these elements to provide for maximum user safety and reliability. Even with the application of state-of-the-art engineering practices, it can be anticipated that water, rubble, and ice accumulation will require enhanced, on-going maintenance efforts. The various construction options are discussed below.

4.1 Alternative 1, Lakeshore Option A – Sea Wall

For this option, a continuous retaining wall would be constructed to facilitate trail construction along the shoreline from 20th to 23rd Avenues East. This includes a concrete wall poured on a spread footing that is connected directly to bedrock. The wall would be a minimum of 1.5 feet thick and would rise to an elevation of 610.00 feet. The current lake level is 601.50 feet and the ordinary high water mark is elevation 603.10 feet. The trail would be constructed on the inland side of the wall and could vary in width. A granular backfill would be placed under the trail to allow for drainage through the wall at various locations. For pedestrian safety, a railing would be installed on the lake side of the wall. A schematic of this option is shown in Figures 11A and 11B.

The construction option would be required from 20th Avenue East to approximately 23rd Avenue East, for approximately 1,300 lineal feet. From 23rd to 25th Avenues East, for approximately 1,500 lineal feet, traditional paved trail construction can be utilized. With this option, a massive excavation of rock, rubble, and debris is necessary in order to construct the sea wall.

Overall this option has a higher initial cost but the long term serviceability would result in lower maintenance costs due to structural stability.

4.2 Alternative 1, Lakeshore Option B – Wood/Steel Bridge on Pilings

This option would facilitate trail construction through the use of steel pilings connected to a base plate that is anchored to bedrock. Installation of a girder system and steel “I” beams allow a wood deck ten feet wide to be constructed. Conceptual analysis assumes that the pilings would span a maximum length of 30 feet. Railings would be constructed on both sides of the decking for user safety. This method is illustrated in Figures 12A and 12B.

This option would also need to be constructed from 20th Avenue East to approximately 23rd Avenue East with traditional trail construction from 23rd to 25th Avenues East. With this option, excavation of the shoreline debris down to bedrock would be necessary at all piling locations.

This option has a lower initial cost but would be more susceptible to the effects of the lake resulting in higher maintenance costs. A large storm event has the potential to cause damage to any type of wood boardwalk as is the case with the existing Lakewalk. With this type of structure, the railing system will not be as sturdy as Option A and would also be more susceptible to damage.

4.3 Alternative 1, Lakeshore Option C – Cast-in-Place Concrete Bridge

Similar in application to Option B, this construction option would utilize cast-in-place concrete to form a solid bridge deck. Concrete piers and abutments would be constructed at approximately 30 foot intervals to provide a bridge span. The piers would be anchored directly to bedrock. The deck would be 10 feet wide and railings would be provided on both sides for user safety. This method is illustrated in Figure 13A and 13B.

As with Options A and B, this option would be constructed from 20th Avenue East to approximately 23rd Avenue East with traditional trail construction continuing from 23rd to 25th Avenues East. With this option, excavation on the shoreline debris down to bedrock would be necessary at all pier locations.

This option would also have higher initial cost than Option B but would have lower maintenance costs and it would provide a stable structure which is minimally susceptible to the elements.

4.4 Alternative 2, Water Street – Standard Trail Construction

With this option, trail construction would occur on the northwest side of Water Street, following the alignment of the existing sidewalk from 20th to 23rd Avenues East. Adequate space exists within the public right-of-way to construct a standard 10' wide trail to accommodate all trail users. The right-of-way of Water Street is generally flat and would easily facilitate this trail construction. Maintenance costs for this option are essentially the same as the rest of the Lakewalk corridor.

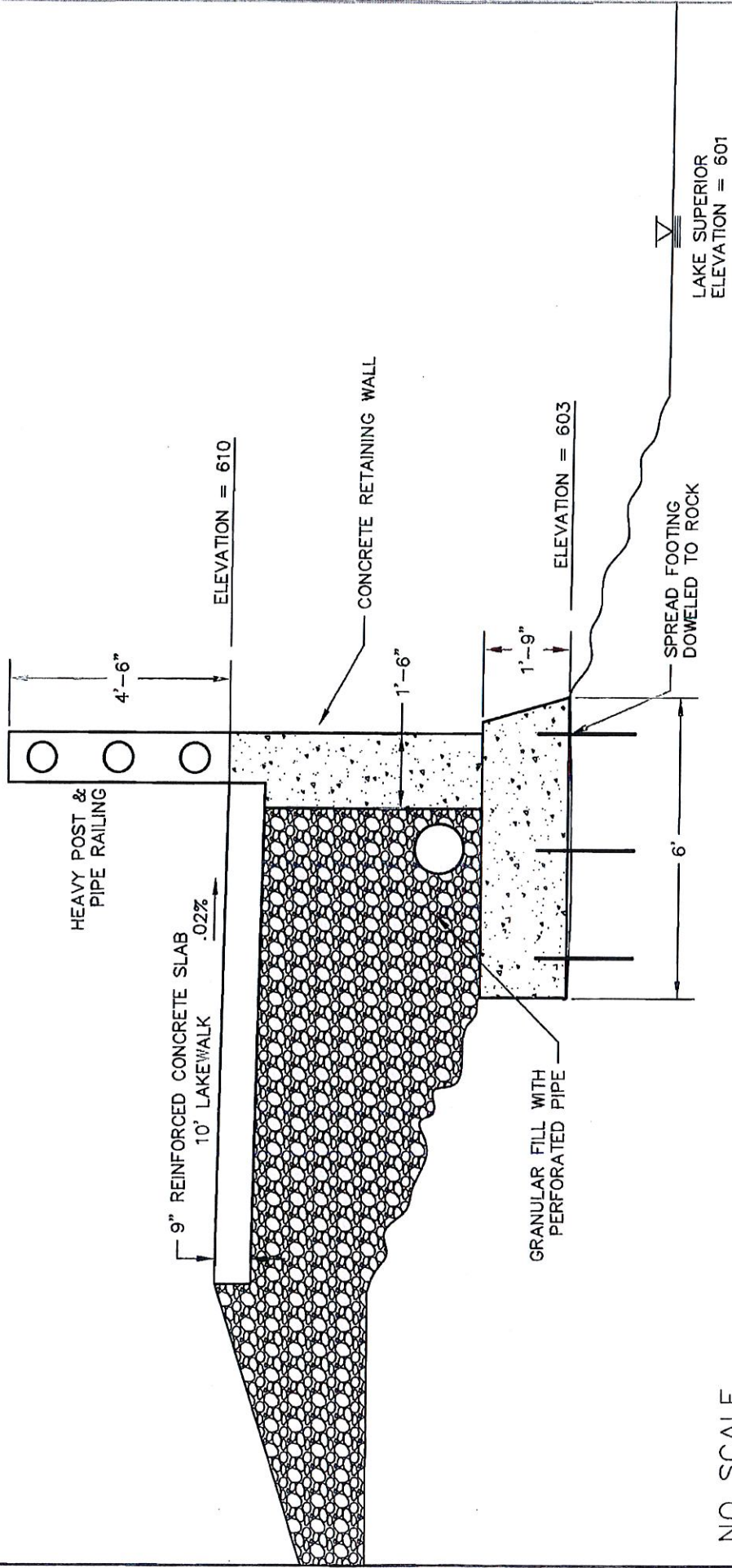
4.5 Alternative 3, Water Street/Lakeshore

This option would allow for a segment of the Lakewalk to be constructed along the lakeshore while minimizing the impacts to the shoreline itself. Bicycles, inline skaters, strollers, etc. would follow a standard trail along Water Street as outlined in Alternative 2, Water Street above. Pedestrians would have the option of using a signed foot-accessible trail that follows the shoreline from 20th to 23rd Avenues East. At 23rd Avenue East, the pedestrian trail would follow 23rd Avenue East and connect to the existing Lakewalk. As a variation, this foot trail could continue along the lakeshore to 25th Avenue East on city-owned land as shown in Figure 10.

A review of construction methods shows that there is no feasible way to provide an ADA accessible route along the lakeshore through this area without employing the construction methods identified in Lakeshore Options A, B, or C. For this reason, only minor improvements are proposed with this option to provide a moderately accessible footpath along the lakeshore.

This alternative would result in the same maintenance standard as the current Lakewalk. It is anticipated that this portion would not be susceptible to wave and ice damage and would require standard maintenance such as sweeping and plowing.

Figure 11-A
 Alternative 1-Lakeshore Option A - Sea Wall



NO SCALE



CONSTRUCTION FEASIBILITY STUDY
 FOR THE DULUTH LAKEWALK

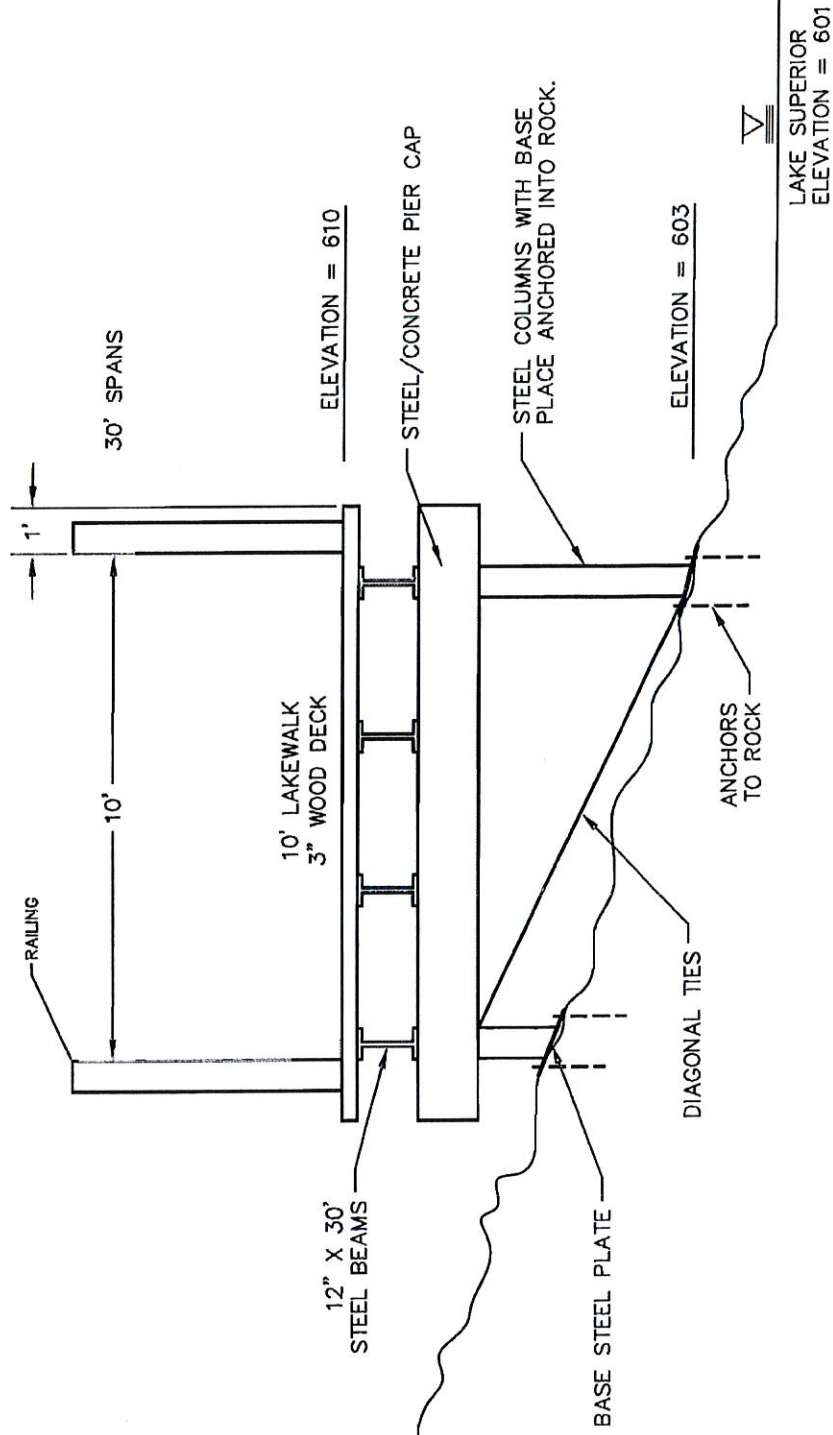
Figure 11-B
Alternative 1-Lakeshore Option A - Sea Wall



**CONSTRUCTION FEASIBILITY STUDY
FOR THE DULUTH LAKEWALK**



Figure 12-A
 Alternative 2-Lakeshore Option B -Wood/Steel Bridge on Pilings



NO SCALE



CONSTRUCTION FEASIBILITY STUDY
 FOR THE DULUTH LAKEWALK

**Figure 12-B
Alternative 1-Lakeshore Option B - Wood/Steel Bridge on Pilings**

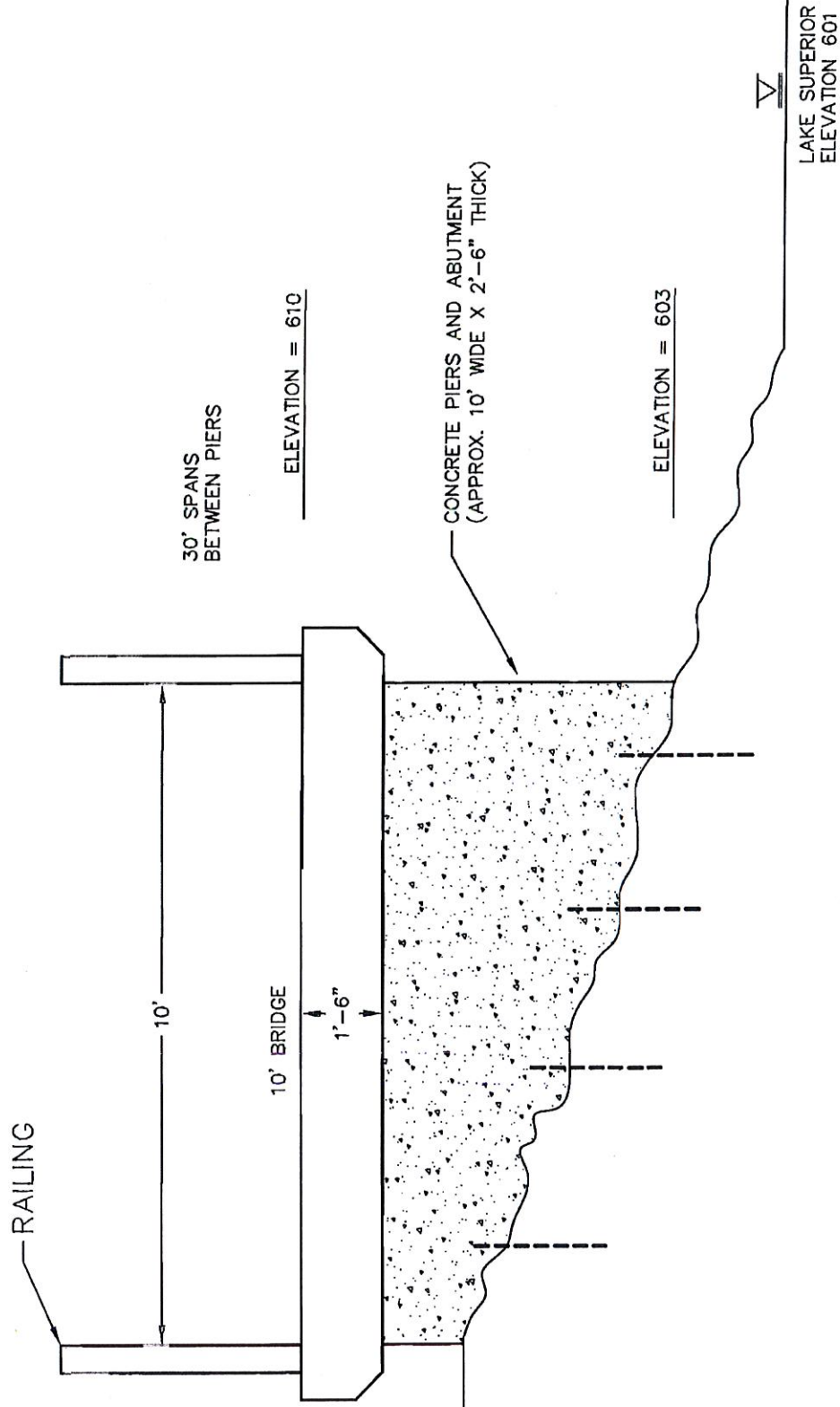


NO SCALE

**CONSTRUCTION FEASIBILITY STUDY
FOR THE DULUTH LAKEWALK**



Figure 13-A
Alternative 1-Lakeshore Option C - Cast in place Concrete Bridge

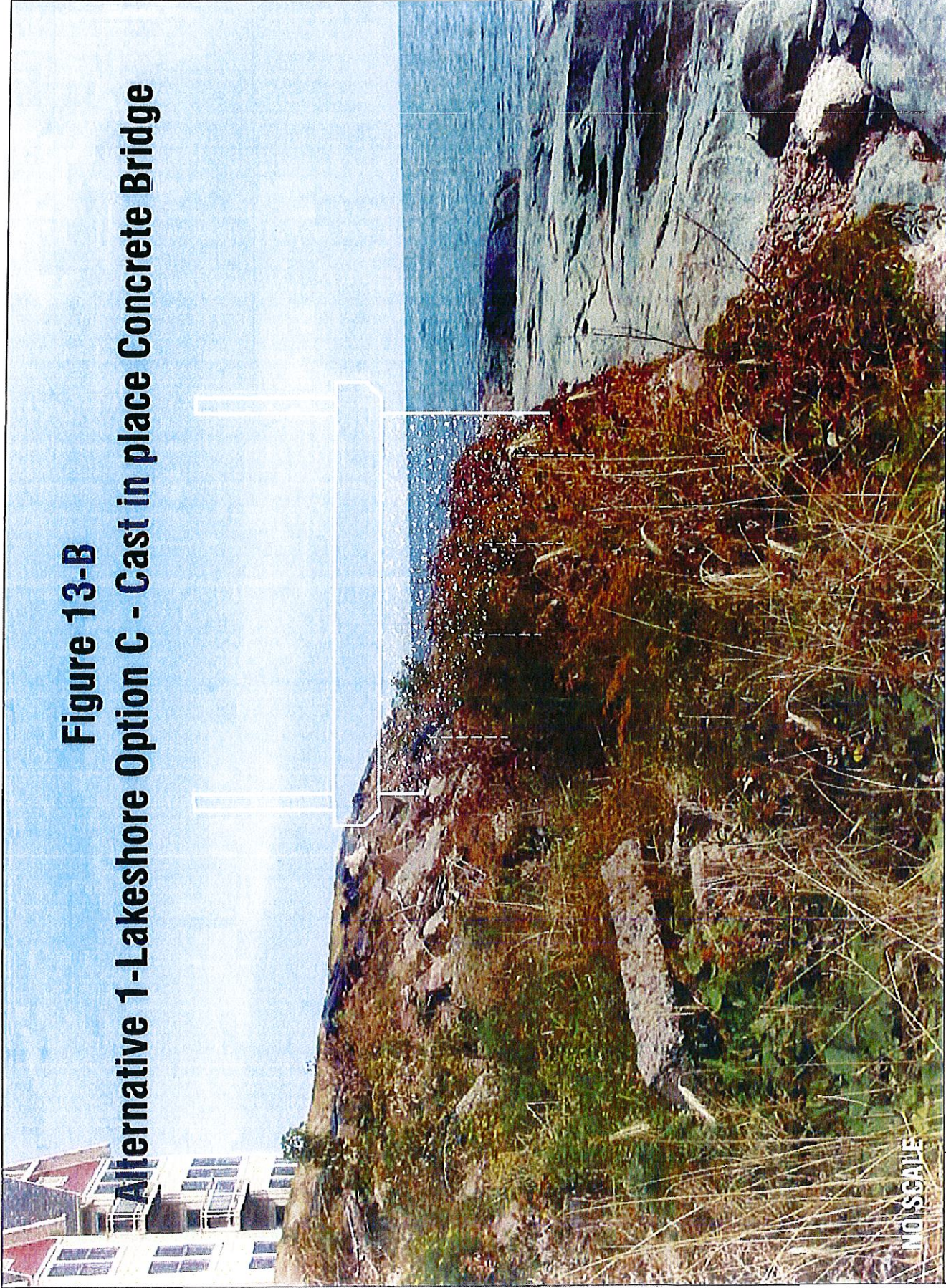


NO SCALE



**CONSTRUCTION FEASIBILITY STUDY
 FOR THE DULUTH LAKEWALK**

Figure 13-B
Alternative 1-Lakeshore Option C - Cast in place Concrete Bridge



**CONSTRUCTION FEASIBILITY STUDY
FOR THE DULUTH LAKEWALK**



5.0 Regulatory Permits

Due to the location of the proposed Lakewalk trail in proximity to Lake Superior, there are multiple regulatory agencies that have jurisdiction over this portion of the construction. In addition to the City of Duluth as the Local Governmental Unit (LGU), the U.S. Army Corps of Engineers (COE), Minnesota Department of Natural Resources (DNR), and the Minnesota Pollution Control Agency (MPCA) are all involved in regulating construction activities along the shore of Lake Superior.

5.1 U.S. Army Corps of Engineers

The COE has national jurisdiction over wetlands and within the High Water Elevation of Lake Superior. The High Water Elevation of Lake Superior as established by the COE is 603.1 feet above Mean Sea Level. Because there are no wetlands within the proposed project boundary and the construction of the proposed Lakewalk trail will not be lower than the High Water Elevation of Lake Superior, COE permits will not be required.

5.2 Minnesota Department of Natural Resources

The DNR has state jurisdiction over wetlands and any construction within public waters of the State. The boundary of the public water as determined by DNR extends to the Ordinary High Water Level (OHWL). The OHWL as defined by Minnesota Statute 103G.005 Subdivision 14 is “an elevation delineating the highest water level that has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial.” The OHWL is determined by examining, in the field, the physical features on the landscape that the presence and action of water make upon the bed and banks of a basin. These physical features include tree evidence, water-formed evidence, and vegetative evidence. These physical features are used to determine a line of equal elevation surrounding a basin from which the OHWL is set.

During previous projects adjacent to the proposed Lakewalk trail, the City of Duluth as LGU has established the OHWL along segments of the proposed alignment of the trail. Other areas of the trail alignment will require that the OHWL be established by a qualified professional and concurred by the DNR. Based on the established OHWL, a portion of the proposed Lakewalk trail may be constructed lakeward of the OHWL. This will require that a Public Waters Work Permit, Part 1 be completed and submitted to the DNR for review and approval.

Part 1 of the Public Waters Work Permit must identify the amount of fill or excavation within the OHWL, project purpose, description, dimensions, and the alternatives considered. At this time, there are no established criteria for mitigating the placement of fill within the OHWL in areas such as this that are not considered wetlands or part of a flood plain.

5.3 Minnesota Pollution Control Agency

The MPCA has the authority to administer the National Pollution Discharge Elimination System (NPDES) General Storm-Water Permit for Construction Activity (MN R100001). Prior to August 2003, only construction sites that disturbed five acres or more of land were required to apply for a NPDES General Storm-Water Permit for Construction. In August 2003, the new NPDES Phase II rules came into effect. The new rules reduced the regulated land disturbing activity from five acres down to one acre. The proposed Lakewalk Trail project will disturb more than one acre of land and will therefore need to apply to the MPCA for a NPDES General Storm-Water Permit for Construction Activity.

The NPDES General Storm-Water Permit for Construction Activity requires that the permittee prepare a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP includes temporary and permanent erosion prevention and sediment control Best Management Practices to minimize and prevent sediment and pollutants from leaving the construction site and contaminating adjacent waters. The NPDES General Storm-Water Permit for Construction Activity also identifies selected streams and lakes as special waters. Lake Superior is included in the list of special waters.

Because Lake Superior is designated as special water, additional rules are required for stormwater discharges. These rules require the contractor to temporarily or permanently stabilize disturbed soil areas more quickly and to treat additional stormwater run-off volume from new impervious surfaces.

In addition to erosion and stormwater management, MPCA rules require that an Undisturbed Buffer Zone of not less than 100 linear feet from the special water shall be maintained at all times. This undisturbed zone is measured from the High Water Elevation of Lake Superior (603.1 feet above Mean Sea Level) throughout the proposed alignment and no construction is permitted within this area unless approved by MPCA. Encroachment within the 100 foot Undisturbed Buffer Zone has been allowed where prior or existing development or disturbance has occurred and can be documented through aerial photos or field reviews with MPCA staff.

For all of the proposed lakeshore options, MPCA approval is required as most of the construction will occur within the 100 foot Undisturbed Buffer Zone. Based on initial reviews with MPCA staff, clear evidence of prior disturbance exists from 20th to 23rd Avenues East due to previous dumping and commercial activities. From 23rd to 25th Avenues East, additional documentation and conference with MPCA is necessary to determine if the prior disturbance along the lakeshore in the form of stone walls and debris is adequate to allow MPCA to approve encroachment within the Undisturbed Buffer Zone through this area.

Prior to finalizing a preferred course of action, a meeting with these regulatory agencies is recommended to obtain concurrence with the proposed construction.

6.0 Alternatives Analysis and Conclusions

Arriving at a straight-forward and cost-effective recommendation regarding the proposed Lakewalk trail construction through the Beacon Point and Ledges Townhomes is not easily accomplished. While it is clearly desirable to follow the lakeshore through this area to provide the most enjoyable trail experience, several significant factors must be considered. A comparison of the alternatives is provided in Table I below.

Construction Feasibility Study for the Duluth Lakewalk 20th to 25th Avenues East Alternatives Analysis

Alternative	Constructed Type and Length (Lineal Feet)			Within 100-foot OHWM* Required Setback	Additional Easements Required	Difficulty of Construction	Long Term Maintenance Cost (High/Med/Low)	Estimated Construction Cost
	Special	Standard	Total					
1, Lakeshore Option A	1,300	1,500	2,800	Yes	Yes	High	Medium	\$1,879,200
1, Lakeshore Option B	1,300	1,500	2,800	Yes	Yes	High	High	\$1,645,560
1, Lakeshore Option C	1,300	1,500	2,800	Yes	Yes	High	Medium	\$2,143,200
2, Water Street	0	1,500	1,500	No	No	Low	Low	\$68,120
3, Water Street/Lakeshore	1,750	1,500	3,250	Yes	Yes	Low	Medium	\$140,520

* OHWM = Ordinary High Water Mark as defined by Minnesota Pollution Control Agency

Some of the major decision elements are as follows:

MPCA Approval – If the MPCA will allow construction within the 100 foot Undisturbed Buffer Zone due to adequate documentation of prior disturbance within this area, a major regulatory issue will be resolved. If this approval does not occur, the City will have to determine to what extent it will challenge MPCA authority and interpretation of the lakeshore disturbance through this area. There are no feasible or allowable locations within the existing and planned easements that will allow the Lakewalk to be constructed outside of the 100 foot buffer zone.

Stormwater Management – Creation of a paved trail along the lakeshore will require an NPDES permit from the MPCA as outlined above. This permit will approve what methods of stormwater treatment, if any, will need to be employed to allow for construction of the Lakewalk along the shoreline. As there are no practical opportunities for stormwater treatment ponds within the easements, other solutions, and/or variances may be required to allow construction to occur.

Constructability – This is a major consideration as the proposed lakeshore construction will be very costly. The volume of rubble and debris to be removed makes land-based construction impractical, if not impossible. Additional evaluation of the shoreline for barge and crane access is necessary to determine if the area is accessible from the lake along the entire Lakewalk corridor. If this evaluation determines that the underwater conditions will not allow for barge access, then construction in this area may not be possible unless additional right-of-way or easements are acquired.

Shoreline Disruption – The proposed lakeshore routes will cause significant disruption and visual impact to the existing shoreline. These impacts may be viewed as undesirable by the public and could offset the benefits of providing a lakeshore trail experience.

Maintenance - Long-term maintenance and operation of the Lakewalk trail through this area may require different treatment from other parts of the Lakewalk. While all areas of the Lakewalk are plowed, swept, and maintained, this area will provide some additional challenges. Access to this location may require additional equipment and manpower for effective snow removal. Sweeping is necessary to provide a usable trail surface. This activity will also be difficult as the debris can neither be swept into the adjacent yards, or directly into the lake, again resulting in additional equipment and manpower for proper maintenance.

Construction Cost – Comparison of the total cost of each of the proposed routes and construction options is always an important consideration in the development of public works projects. The estimated costs provided in Table 1 are based on the conceptual designs prepared for this study and could vary widely depending on additional analysis and design details. There are no foreseeable scenarios where the cost difference between the Water Street and lakeshore options will be within \$1.0 million of each other and it is difficult to ignore such a significant disparity in this evaluation. It can be noted that if \$1 million in funding were available for trail construction, this would provide for completion of a trail extension from 47th to 60th Avenues East as well as completing the connection from 20th to 23rd Avenues East, along Water Street as outlined in Alternative 2.

User Experience – There is no way to quantify and compare the value of providing a lakeshore experience with that of an inland trail experience for this three-block stretch of the Lakewalk. While the lakeshore is quite rugged and typical of Minnesota’s North Shore, the adjacent urban development and the significant trail infrastructure required through this area may offset this natural experience. It must be noted that beginning at 25th Avenue East and continuing to 60th Avenue East, that Lakewalk is planned to be constructed as an inland trail. Despite this fact, public support for the Lakeside extension remains quite high.

The results of this study require a comparison between the value of the lakeshore user experience and the various costs and impacts of the proposed construction. While the lakeshore experience is one of the important reasons the Lakewalk trail system is such a major success, the total cost of developing the lakeshore route is very significant.

Following an evaluation of these factors, the following recommendations are forwarded for additional discussion and consideration:

1. Alternative 2 Water Street – Standard Trail Construction should be pursued at this time as the most cost-effective and easily constructed alternative. This will provide trail continuity and improved safety for trail users.

-
2. Easements along the lakeshore should be reserved and acquired from 20th to 25th Avenues East to allow for future construction of a trail following the lakeshore through this area at some point in the future as funding and construction methods allow.
 3. A foot trail following the lakeshore from 20th to 23rd Avenues East should be evaluated for “hand construction” and improvement with various trail advocates such as the Lake Superior Hiking Trail Committee.

As future development occurs in this area, easements should be acquired near 23rd Avenue East to provide a connection from Water Street to the lakeshore so a formal paved trail “loop” can be developed along the lakeshore from 23rd to 25th Avenues East. This will provide the lakeshore trail experience in an area where lower cost construction methods can be applied.

Appendix
Detailed Cost Estimates

**CONSTRUCTION FEASIBILITY STUDY FOR THE DULUTH LAKEWALK
ALTERNATIVE 1, LAKESHORE OPTION A
SEA WALL
Preliminary Construction Cost Estimate**

Item Description	Unit	Unit Price	Quantity	Amount
RETAINING WALL	LIN FT	\$1,010.00	1300	\$1,313,000.00
STANDARD TRAIL	LIN FT	\$102.00	1500	\$153,000.00
RUBBLE REMOVAL	LUMP	\$100,000.00	1	\$100,000.00
Sub Total Construction:				\$1,566,000
MOBILIZATION		5%		\$78,300.00
CONTINGENCIES		15%		\$234,900.00
Total Construction:				\$1,879,200

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*** ASSUMPTIONS**

NO ROCK EXCAVATION
1300 FOOT TRAIL LENGTH
1300 FEET RUBBLE REMOVAL

**CONSTRUCTION FEASIBILITY STUDY FOR THE DULUTH LAKEWALK
 ALTERNATIVE 1, LAKESHORE OPTION B
 WOOD/STEEL BRIDGE
 Preliminary Construction Cost Estimate**

Item Description	Unit	Unit Price	Quantity	Amount
WOOD/STEEL BRIDGE	LIN FT	\$891.00	1300	\$1,158,300.00
STANDARD TRAIL	LIN FT	\$102.00	1500	\$153,000.00
RUBBLE REMOVAL	LUMP	\$60,000.00	1	\$60,000.00
Sub Total Construction:				\$1,371,300
MOBILIZATION		5%		\$68,565.00
CONTINGENCIES		15%		\$205,695.00
Total Construction:				\$1,645,560

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*** ASSUMPTIONS**

- NO ROCK EXCAVATION
- 1300 FOOT TRAIL LENGTH
- RUBBLE REMOVAL AT PILINGS

**CONSTRUCTION FEASIBILITY STUDY FOR THE DULUTH LAKEWALK
 ALTERNATIVE 1, LAKESHORE OPTION C
 CAST-IN-PLACE CONCRETE BRIDGE
 Preliminary Construction Cost Estimate**

Item Description	Unit	Unit Price	Quantity	Amount
CONCRETE BRIDGE	LIN FT	\$1,210.00	1300	\$1,573,000.00
STANDARD TRAIL	LIN FT	\$102.00	1500	\$153,000.00
RUBBLE REMOVAL	LUMP	\$60,000.00	1	\$60,000.00
Sub Total Construction:				\$1,786,000
MOBILIZATION		5%		\$89,300.00
CONTINGENCIES		15%		\$267,900.00
Total Construction:				\$2,143,200

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*** ASSUMPTIONS**

- NO ROCK EXCAVATION
- 1300 FOOT TRAIL LENGTH
- RUBBLE REMOVAL AT PIER LOCATIONS

**CONSTRUCTION FEASIBILITY STUDY FOR THE DULUTH LAKEWALK
ALTERNATIVE 2, WATER STREET
STANDARD CONSTRUCTION
Preliminary Construction Cost Estimate**

Item Description	Unit	Unit Price	Quantity	Amount
COMMON EXCAVATION	CU YD	\$8.00	778	\$6,222.00
SCARIFICATION	CU YD	\$8.00	583	\$4,667.00
AGGREGATE BASE CLASS 5 (CV)	CU YD	\$20.00	389	\$7,777.78
GEOTEXTILE FABRIC	SQ YD	\$1.00	2333	\$2,333.33
BITUMINOUS	TON	\$60.00	350	\$21,000.00
RETAINING WALL	LUMP	\$10,000.00	1	\$10,000.00
Sub Total Construction:				\$52,000
TRAFFIC CONTROL		1%		\$520.00
MOBILIZATION		5%		\$2,600.00
MISCELLANEOUS CONSTRUCTION		10%		\$5,200.00
CONTINGENCIES		15%		\$7,800.00
Total Construction:				\$68,120

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*** ASSUMPTIONS**

NO ROCK EXCAVATION
1500 FOOT TRAIL LENGTH

**CONSTRUCTION FEASIBILITY STUDY FOR THE DULUTH LAKEWALK
ALTERNATIVE 3, WATER STREET/LAKESHORE**
Preliminary Construction Cost Estimate

Item Description	Unit	Unit Price	Quantity	Amount
WATER STREET				
COMMON EXCAVATION	CU YD	\$8.00	778	\$6,222.00
SCARIFICATION	CU YD	\$8.00	583	\$4,667.00
AGGREGATE BASE CLASS 5 (CV)	CU YD	\$20.00	389	\$7,777.78
GEOTEXTILE FABRIC	SQ YD	\$1.00	2333	\$2,333.33
BITUMINOUS	TON	\$60.00	350	\$21,000.00
RETAINING WALL	LUMP	\$10,000.00	1	\$10,000.00
FOOT PATH				
RUBBLE REMOVAL	LUMP	\$20,000.00	1	\$20,000.00
TRAIL	LUMP	\$30,000.00	1	\$30,000.00
RETAINING WALL	LUMP	\$10,000.00	1	\$10,000.00
Sub Total Construction:				\$112,000
TRAFFIC CONTROL		1%		\$1,120.00
MOBILIZATION		5%		\$5,600.00
MISCELLANEOUS CONSTRUCTION		10%		\$11,200.00
CONTINGENCIES		15%		\$16,800.00
Total Construction:				\$146,720

Short Elliott Hendrickson Inc. ®

*** ASSUMPTIONS**

NO ROCK EXCAVATION
1500 FOOT TRAIL LENGTH ON WATER STREET

**CONSTRUCTION FEASIBILITY STUDY FOR THE DULUTH LAKEWALK
23RD TO 25TH AVENUES EAST
STANDARD CONSTRUCTION
Preliminary Construction Cost Estimate**

Item Description	Unit	Unit Price	Quantity	Amount
COMMON EXCAVATION	CU YD	\$8.00	778	\$6,222.00
SCARIFICATION	CU YD	\$8.00	583	\$4,667.00
AGGREGATE BASE CLASS 5 (CV)	CU YD	\$20.00	389	\$7,777.78
GEOTEXTILE FABRIC	SQ YD	\$1.00	2333	\$2,333.33
BITUMINOUS	TON	\$60.00	350	\$21,000.00
DRAINAGE	LUMP	\$25,000.00	1	\$25,000.00
RIPRAP	LUMP	\$50,000.00	1	\$50,000.00
Sub Total Construction:				\$117,000
TRAFFIC CONTROL		1%		\$1,170.00
MOBILIZATION		5%		\$5,850.00
MISCELLANEOUS CONSTRUCTION		10%		\$11,700.00
CONTINGENCIES		15%		\$17,550.00
Total Construction:				\$153,270

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*** ASSUMPTIONS**

NO ROCK EXCAVATION
1500 FOOT TRAIL LENGTH