ALLIANT

MEMORANDUM

TO: Daniel Elias, Project Manager – Minneapolis Park and Recreation Board

FROM: Eric Nelson, PE
Megan Nutzmann, PE

DATE: September 18, 2020

SUBJECT: Kenilworth Channel Retaining Wall Analysis

At the request of the Minneapolis Park and Recreation Board (MPRB), Alliant Engineering completed a preliminary assessment of the costs, grading limits and land disturbance associated with constructing a replacement retaining wall along the northern bank of the Kenilworth Channel immediately west of the Burnham Road bridge. Conceptual grading impacts and preliminary cost estimates were determined for three types of retaining wall construction.

INTRODUCTION AND BACKGROUND

The Inter-Fluve/Alliant Engineering team is currently designing a slope stabilization project for the MPRB along the Kenilworth Channel in Minneapolis between Cedar Lake and Lake of the Isles. The proposed design would replace the deteriorated timber walls that currently line the channel with bioengineered naturalized shorelines. However, this solution would result in a slight reduction in the channel width at some locations. Alliant was asked to analyze the grading impacts and determine preliminary costs to construct a replacement retaining wall along the northern bank of the channel immediately west of the Burnham Road bridge. This memo summarizes the methodology and results of this analysis.

RESULTS

Using the survey information and base mapping obtained by MPRB, grading impacts for three types of retaining walls were determined based on a representative cross section of the area on the north side of the channel west of the Burnham Road. It should be noted that our analysis only included the north side of the Kenilworth Channel and that the existing channel width would be reduced from 40 feet to approximately 35 feet due to the proposed slope stabilization on the south side of the channel.

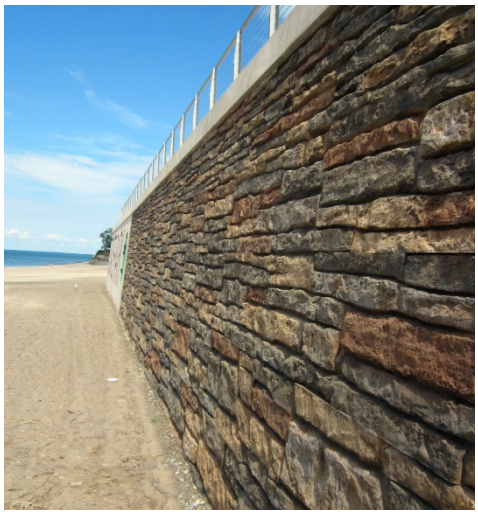
In all cases, the resulting vertical elevation difference between top and bottom of wall is greater than 30 inches and therefore requires a railing with a minimum height of 42 inches to be installed at the top of wall for fall protection (*Minnesota Building Code Section 1015.2, OSHA Section 1910.28)*. Excavation limits assume a 1H:1V excavation slope based on normal soil conditions and OSHA excavation requirements. If favorable soils are encountered in this location, OSHA allows increasing the excavation slope to a maximum of 1H:2V. If poor soils are encountered, OSHA requires the excavation slope to be

decreased to 1.5H:1V. Cost estimates are based on an assumed length of 160 feet and a finished face height of 8 feet, leading to a total finished square footage of 1,280 square feet and 160 feet of ornamental railing along the top of wall. Unit costs are based on recent project experience and MnDOT historical construction cost databases. The paragraphs below describe the three types of analyzed retaining walls in greater detail.

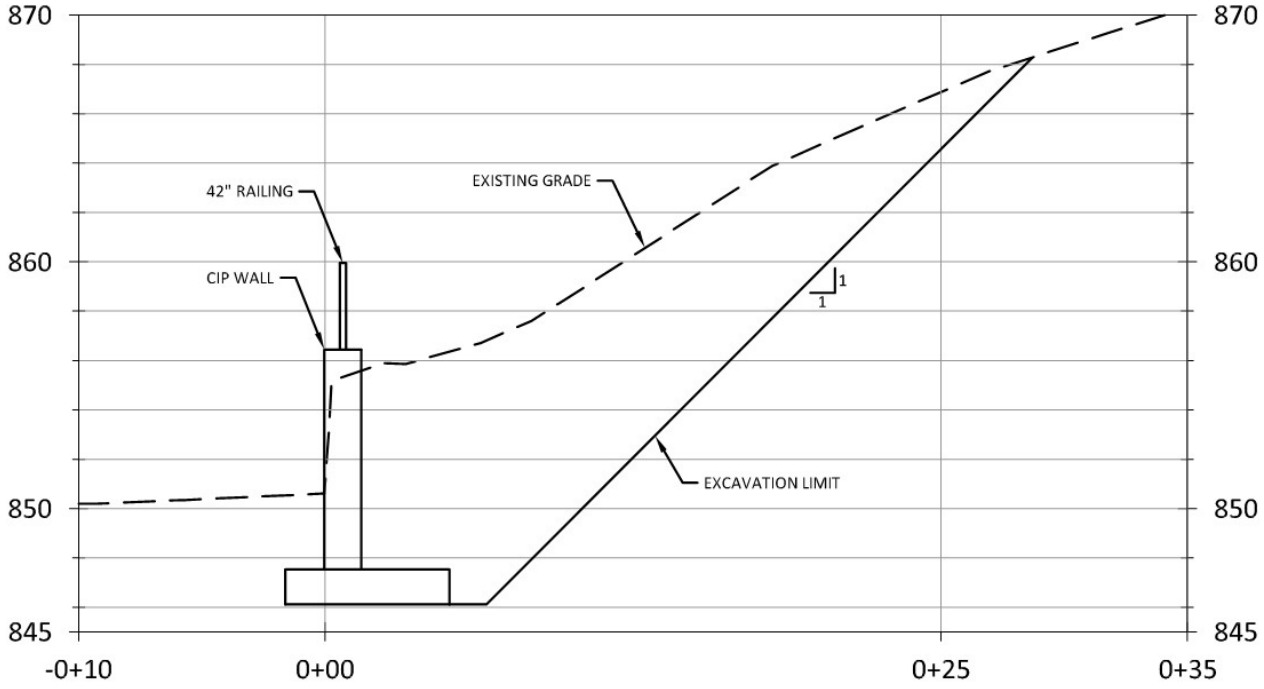
Cast-in-Place Concrete Wall

As shown in the graphic below, a cast-in-place (CIP) concrete retaining wall would require excavation of the channel bottom to construct a spread footing that provides structural stability for the wall. These walls can be constructed using customized form liners to create several different aesthetic designs, including mimicking boulders or other natural features. The unit cost used for this wall assumes some type of aesthetic treatment would be used.

Width of estimated excavation behind wall - 30 feet
Unit cost of wall - $200/SF
Unit cost of ornamental railing - $200/FT
Total estimated cost for cast-in-place wall (including railing) - $288,000



Cast-in-place retaining wall with custom rock form liner at Evangola State Park – Evans, NY
Photo Credit: Customrock Liners



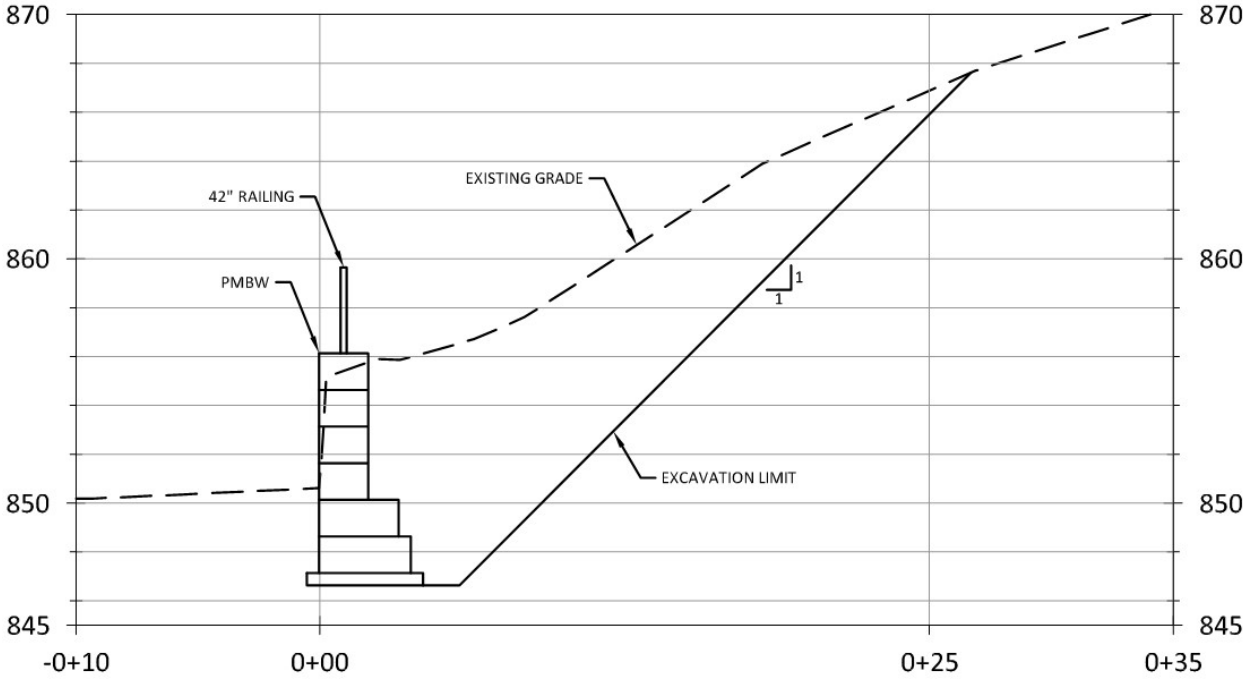
Cross-section of typical cast-in-place concrete retaining wall

Precast Modular Block Wall

Similar to a cast-in-place concrete retaining wall, a precast modular block wall (PMBW) would require excavation of the channel bottom to construct its footing. However, this type of wall draws additional strength from larger blocks at the bottom of the wall. These walls are typically supplied in blocks with standard styles and colors, leaving less flexibility to customize the aesthetic look of the wall. It should be noted that MnDOT typically does not allow PMBWs in areas with permanent standing water. However, these types of walls are used near water in other jurisdictions across the country.

"Big Block" precast modular block walls
Photo Credit: Versa-Lok

Width of estimated excavation behind wall - 25 feet
Unit cost of wall - $125/SF
Unit cost of ornamental railing - $200/FT
Total estimated cost for cast-in-place wall (including railing) - $192,000

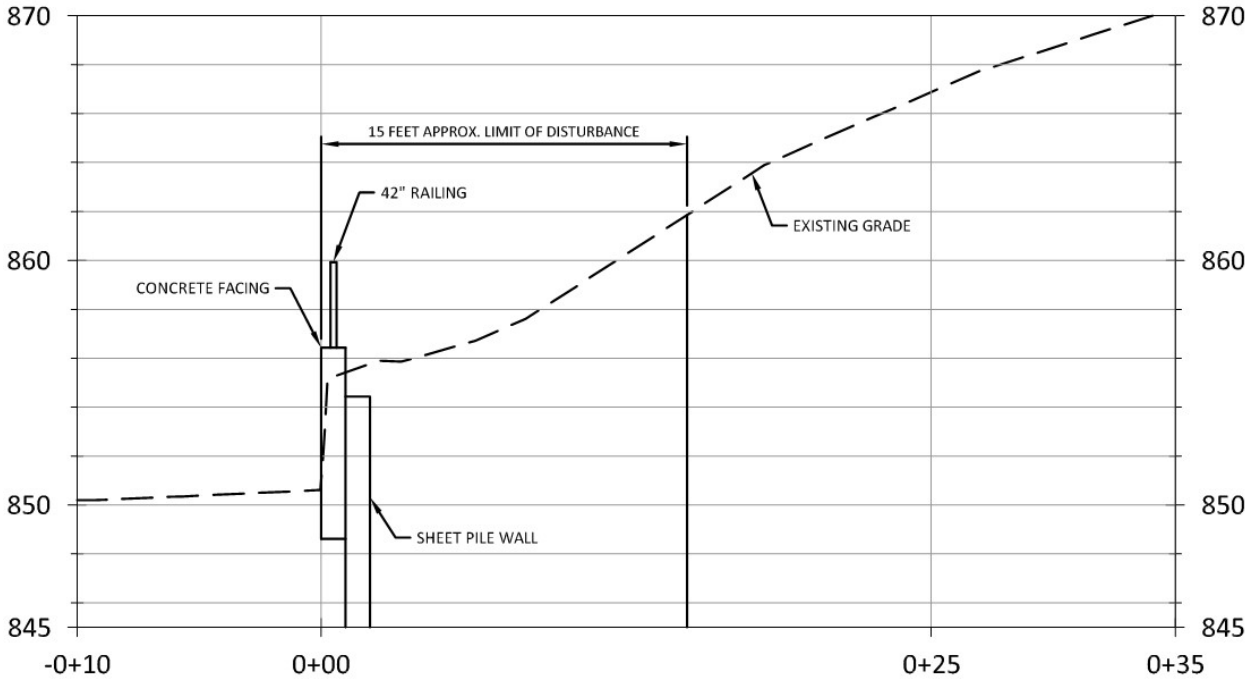


Cross-section of typical precast modular block retaining wall

Sheet Pile Wall with Cast-in-Place Concrete Aesthetic Face

A third option for this wall would be a steel sheet pile wall with a cast-in-place concrete finish. Steel sheet piles would be driven behind the existing timber wall to a required depth below the channel bottom based on a detailed structural and geotechnical analysis. The exposed face of the sheet pile could be covered with a cast-in-place concrete aesthetic treatment similar to those described and shown above for the cast-in-place concrete wall alternative. An assumed area of 15 feet behind the existing wall would be disturbed to construct the wall cap and railing and restore proper drainage.

Width of estimated grading behind wall - 15 feet
Unit cost of wall - $220/SF
Unit cost of ornamental railing - $200/FT
Total estimated cost for cast-in-place wall (including railing) - $313,600



Cross-section of typical sheet pile wall with cast-in-place concrete aesthetic face

GRADING AND NATURAL RESOURCES IMPACTS

All three of the identified retaining wall options will require grading and loss of vegetation in the area behind the existing wall. This area is currently covered by several large trees, along with shrubs and general understory vegetation. Figures 1 and 2 on the following page are intended to visualize the approximate grading impacts and loss of vegetation due to new retaining wall construction. These exhibits show the 30-foot disturbance width associated with a cast-in-place retaining wall and precast modular block wall as well as the 15-foot disturbance width associated with the sheet pile wall. As shown on Figure 1, up to 19 large trees would be removed in order to construct a cast-in-place retaining wall or precast modular block wall and up to 9 large trees would be removed in order to construct a sheet pile wall.

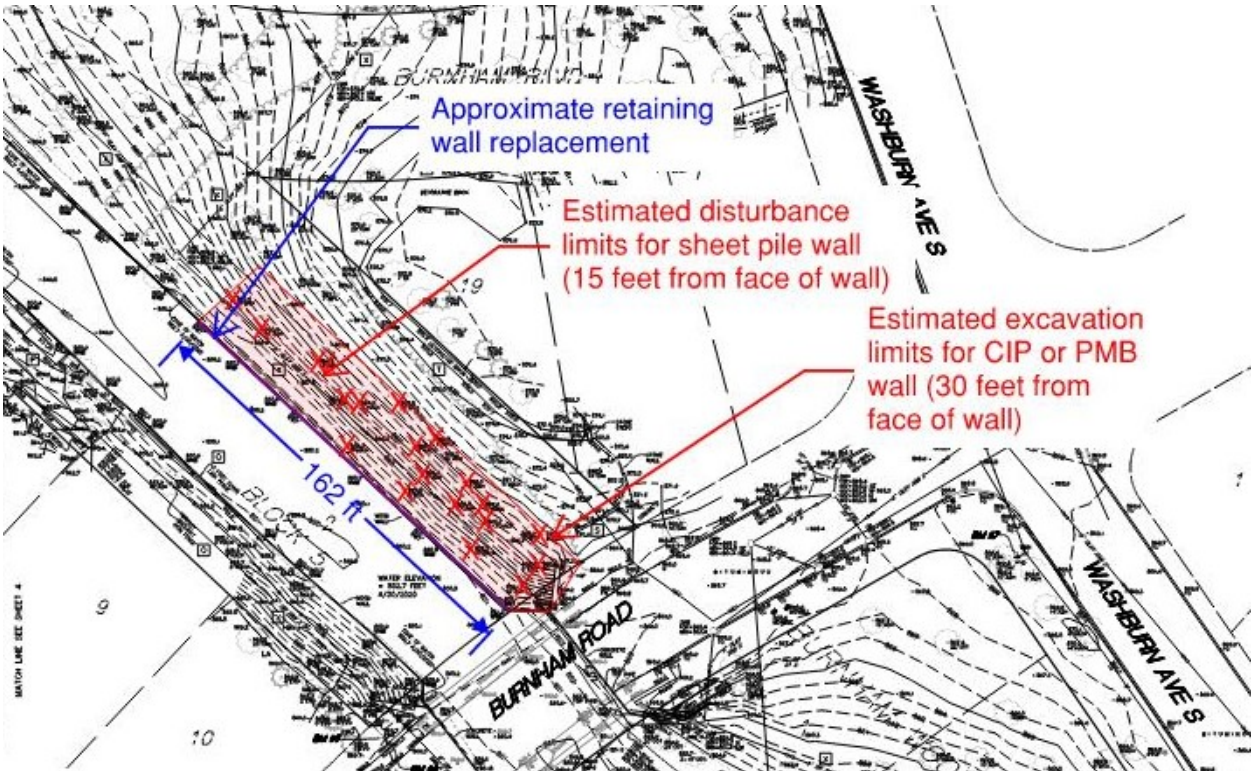


Figure 1: *Plan view of grading impacts for retaining wall construction*

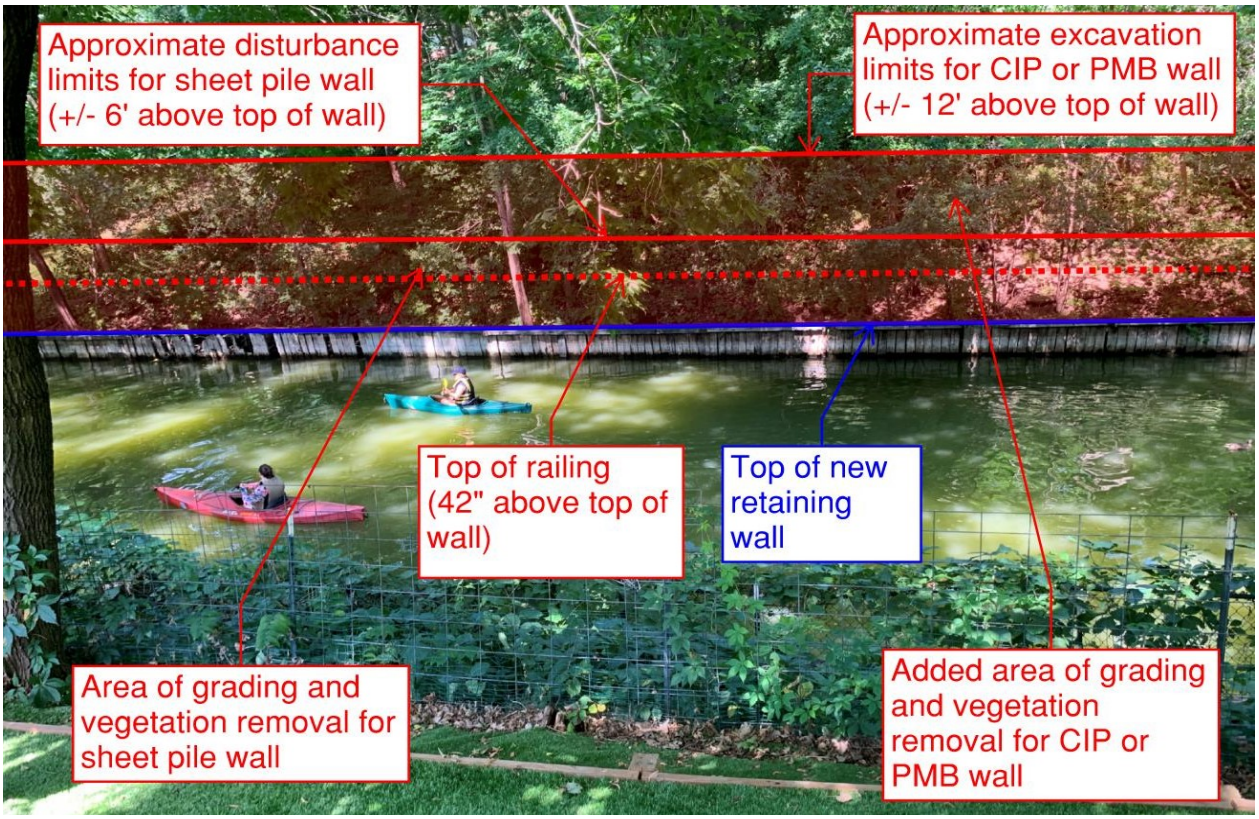


Figure 2: *View of retaining wall impacts from south side of channel*

OTHER CONSIDERATIONS

In addition to the impacts previously described, there are other retaining wall considerations to keep in mind that could potentially impact the restoration of the Kenilworth Channel as currently shown on the conceptual drawings:

- Construction is currently planned for fall 2021, in the shoulder season between summer and winter recreation activities. Weather in this timeframe is frequently colder than desirable for concrete construction, and the contractor may have to make provisions for temporary insulation to ensure proper concrete curing conditions to provide the structural integrity of a concrete wall, which would increase costs beyond those listed in this memorandum.
- The channel restoration work as shown on the conceptual drawings can likely all be self-performed by an earthwork/landscaping contractor. The construction of a retaining wall with railing may require additional subcontractors and coordination to ensure that the wall can be constructed within the timeframe when the channel is closed and dewatered, which could also increase the cost estimates previously described.
- Any constructed retaining wall will require routine inspection and maintenance by MPRB. While there are no specific standards for retaining wall inspection, our recommendation would be to inspect this wall every two years by an engineer with structural expertise. Any identified issues would need timely repair to prevent long-term degradation of the structure.

Finally, we were provided a copy of a letter from a landowner adjacent to the channel that included photos of vertical fiberglass reinforced concrete panels used in other locations, with the suggestion that a similar technique could be used on the Kenilworth Channel. Acknowledging that our only basis of evaluation is the provided photos, it does not appear that these walls are supporting the type of grade difference and associated lateral pressure that the Kenilworth Channel retaining wall would need to support. Alliant Engineering does not recommend a continued evaluation of a non-structural retaining wall at this location.

SUMMARY

The construction of a retaining wall on the north side of the Kenilworth Channel west of the Burnham Road bridge will result in added construction costs and increased tree loss when compared to the proposed conceptual design for a non-structural stabilized shoreline. The table on the following page summarizes the impacts of each wall alternative in comparison to the currently proposed design. The estimated costs do not include any long-term costs associated with inspection or maintenance of the retaining wall alternatives.

Design Alternative	Estimated Cost	Estimated Increase to Project Cost	Estimated Number of Large Trees Impacted
Proposed design – non-structural stabilized shoreline	$24,000	N/A	0
Cast-in-Place Concrete Wall	$288,000	$264,000	19
Precast Modular Block Wall	$192,000	$168,000	19
Sheet Pile Wall with Cast-in-Place Concrete Aesthetic Face	$313,600	$289,600	9

Notes:

1. Large trees defined as 4 inch or greater diameter at breast height (DBH).
2. Cost estimate for proposed design based on $150/lineal foot for shoreline stabilization.