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Memorandum

To: Bassett Creek Watershed Management Commission
From: Barr Engineering Co.
Subject: Item 5A – Consider Approval of 60% Design Plans for 2017 Plymouth Creek Stream Restoration Project, Plymouth (CIP 2017CR-P)
BCWMC June 15, 2017 Meeting Agenda
Date: June 7, 2017
Project: 23270051 2017 635

5A Consider Approval of 60% Design Plans for 2017 Plymouth Creek Stream Restoration Project, Plymouth (CIP 2017CR-P)

Summary:

Proposed Work: 2017 Plymouth Creek Stream Restoration Project (CIP 2017CR-P)

Basis for Commission Review: 60% Design Plans Review

Change in Impervious Surface: N.A.

Recommendations:

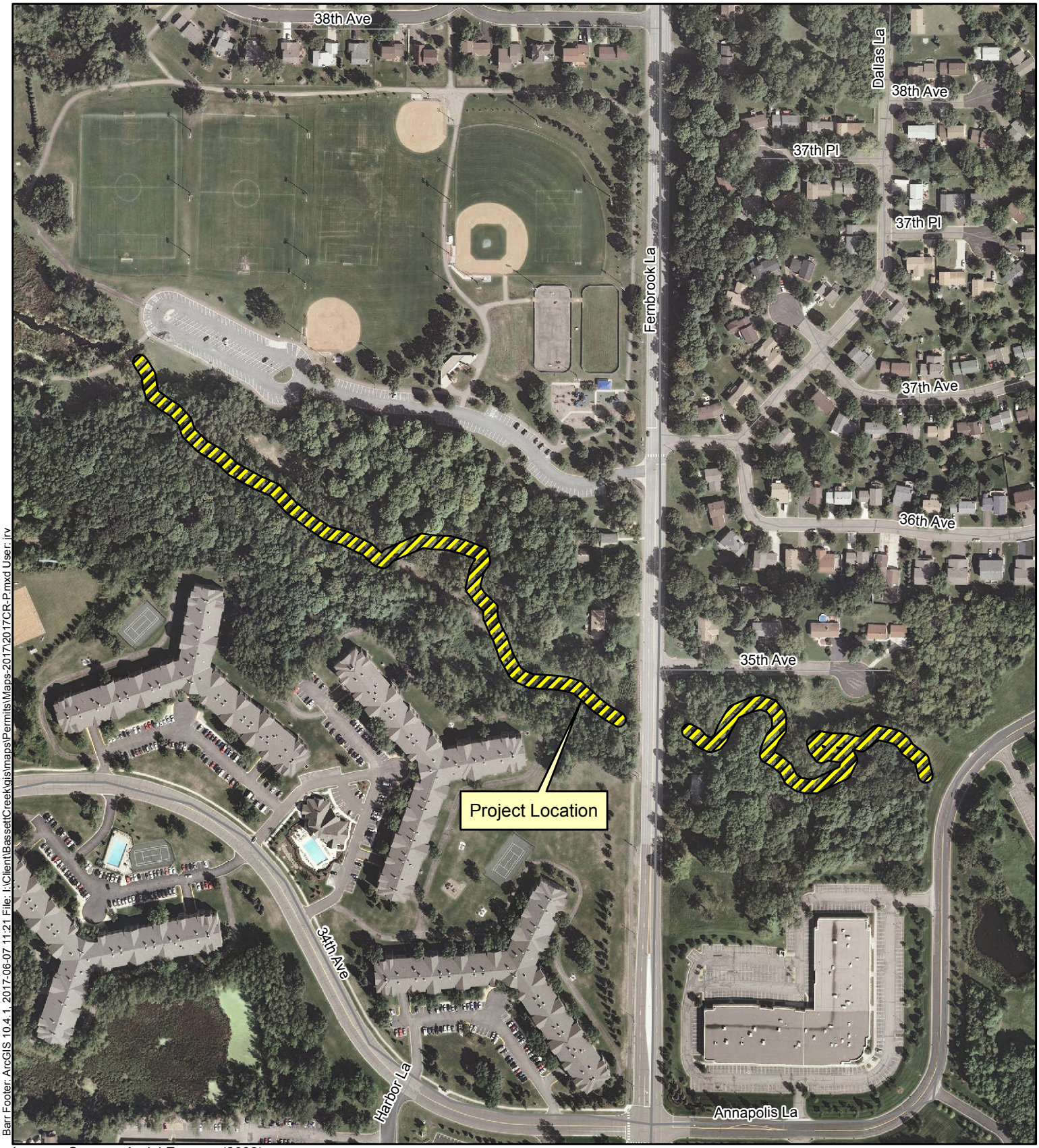
1) Conditional approval of 60% drawings
2) Authorize the City of Plymouth to proceed with final plans and contract documents

The 2017 Plymouth Creek Restoration project (CIP 2017CR-P) is being funded by the BCWMC's ad valorem levy (via Hennepin County), a Minnesota Board of Water and Soil Resources Clean Water Fund Grant, and a Hennepin County Opportunity Grant. The City of Plymouth provided the 60% design plans to the BCWMC for review and comment, as set forth in the BCWMC CIP project flow chart developed by the TAC.

Feasibility Study Summary

The BCWMC completed the 2017 Plymouth Creek Restoration Project Feasibility Report (Barr, March 2016) to examine the feasibility of restoring sites along the 2,500-foot reach of the creek in Plymouth Creek Park and between Fernbrook Lane North and Annapolis Lane North (Figure 1). The feasibility report identified 21 sites where bank erosion, bank failure, and infrastructure repairs were needed, in addition to removal of debris and fallen trees.

The feasibility report identified 2-4 design options for each site and a final recommendation for each site. For most sites, the feasibility report included two alternative designs: 1) a bioengineering (or soft armoring) approach that uses techniques that rely primarily on vegetation; 2) a more structural (or hard armoring) approach that uses rock and other non-vegetative materials. Some sites included additional alternatives that did not focus on preserving the existing alignment or channel configuration, such as



Barr Footer: ArcGIS 10.4.1, 2017-06-07 11:21 File: i:\Client\BassettCreek\gis\Maps\Permits\Maps-2017\2017CR-P.mxd User: jrv

Imagery Source: Aerial Express (2009)

- Project Location
- Bassett Creek
- WMC Boundary
- Major Subwatershed
- Municipality
- Stream

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Feet

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Bassett Creek Watershed Management Commission

LOCATION MAP
APPLICATION 2017CR-P
Plymouth Creek Stream Restoration Project
Plymouth, MN

remeandering the channel or reconnecting to the floodplain. Recommendations, based on site-specific considerations, included a mix of hard and soft armoring approaches, and additional alternatives to realign the channel.

The feasibility report estimated that this restoration project would require the removal of approximately 100-150 trees and estimated that project implementation would reduce the total phosphorus load by 52 pounds per year and the total suspended sediment load by 90,800 pounds per year.

60% Design Plans

The 60% design plans follow many of the recommendations from the feasibility study and include the use of root wads, log vanes, rock/cross vanes, debris clearing and vegetation management. The plans also include the use of vegetated riprap and specific measures to improve the disc golf course adjacent to the creek in Plymouth Creek Park. Measures to improve the disc golf course include a low flow crossing where it was observed that golfers are frequently retrieving discs; disc stop poles to prevent discs from damaging trees and going into the creek; installation of boardwalk sections; and improvements to greens to improve erosion control.

The following table was extracted from the 60% plan submittal to provide a concise summary of the feasibility study recommendations along with explanations for how and why the 60% plans differ from the recommendations. They include a mix of hard and soft armoring methods with the chosen methods utilizing hard armoring methods slightly more than the recommendations in the feasibility study. For example, the vegetated riprap can still be considered as hard armoring even if the riprap is effectively hidden below topsoil and grasses; and sections of root wads with stone toe are also a "harder" approach than just using root wads. The design plans also include infrastructure repairs, and removal of debris and fallen trees. The 60% design plan sheets show the total approximate tree removal to be from 50 to 75 trees.

The submitted drawings were at a 60% design stage, which means there are a number of details yet to be worked out before the design is final. The Commission Engineer expects the majority of the comments below to be addressed in the 90% design stage drawings.

Table 5-1 Plymouth Creek feasibility study recommended alternatives summary

Reach	Site	Alternative	Alternative Description	Advantages	Disadvantages	Wenck Rational
Reach 1	Site 1	Alternative C	Stabilize erosion areas with root wads, log vanes, and vegetation	Contributes to habitat, provides grade control, and utilizes materials generated on site.	Does not use historic channels, vegetation limited to shade-tolerant species.	Vegetation establishment will stabilize the banks. Crossing point will use stone steps & steppers across creek and function as grade control in addition to controlling foot traffic and disturbance of new vegetation.
Reach 1	Site 2	Alternative C	Stabilize erosion areas with root wads, log vanes, and vegetation	Contributes to habitat, provides grade control, and utilizes materials generated on site.	Does not use historic channels, vegetation limited to shade-tolerant species.	Remove trees so vegetation will stabilize area with use of deep rooted grasses. Vegetated riprap proposed from 24+80 to 25+60 to reinforce bridge abutments.
Reach 1	Site 3	Alternative B	Install log vanes within reach	Improves habitat by deepening channel, provides grade control, reduces upper bank stress.	Does not create vegetated floodplain.	Same as recommended but fewer, also use boulders to keep log vanes in place.
Reach 1	Site 3	Alternative C	Upper bank vegetation	Improves aesthetics of stream bank, reduces erosion.	Requires careful coordination with disc golf users, vegetation limited to shade-tolerant species.	Same as recommended. Selective tree and brush clearing. Hydroseeding with shade tolerant native seed. Follow up with spring plug planting?
Reach 1	Site 4	Alternative A	Establish vegetated buffer	Improves aesthetics of riparian area, reduces erosion.	Requires careful coordination with disc golf users, vegetation limited to shade-tolerant species.	Same as recommended.
Reach 1	Site 5	Alternative B	Vegetate steep, eroding bank with VRSS	Contributes to habitat, improves aesthetics.	More costly to install, vegetation limited to shade-tolerant species.	Vegetate steep eroded bank with Vegetated Riprap. Propose using vegetated riprap for longevity of stabilization and less distrubance. Creek turns a mjor bend and the existing bank is tall and steep. Building VRSS would impinge on the channel or require pulling the existing bank back.
Reach 1	Site 6	Alternative A	Stabilize bridge abutments with riprap and log vanes	Reduces erosion, reduces erosive pressure on abutments for added protection.	Riprap does not provide natural habitat, more complex design.	Stabilize bridge abutments with Vegetated Riprap. No log vanes proposed to minimize bank and bridge distrubance.
Reach 1	Site 7	Alternative A	Stabilize bridge abutments with riprap and log vanes	Reduces erosion, reduces erosive pressure on abutments for added protection.	Riprap does not provide natural habitat, more complex design.	Stabilize bridge abutments with Vegetated Riprap. No log vanes proposed to minimize bank and bridge distrubance.
Reach 2	Site 8	Alternative A	Stabilize bridge abutments with riprap and log vanes	Reduces erosion, reduces erosive pressure on abutments for added protection.	Riprap does not provide natural habitat, more complex design.	Stabilize bridge abutments with Vegetated Riprap. No log vanes proposed to minimize bank and bridge distrubance.
Reach 2	Site 9	Alternative A	Stabilize bridge abutments with riprap and log vanes	Reduces erosion, reduces erosive pressure on abutments for added protection.	Riprap does not provide natural habitat, more complex design.	Stabilize bridge abutments with Vegetated Riprap. No log vanes proposed to minimize bank and bridge distrubance.
Reach 2	Site 10	Alternative C	Raise channel bed using cross vanes/constructed riffles	Reduces bed and bank erosion, improves stream access to floodplain.	Decreases already shallow slope, does not address stream cross-section in other locations.	Same as recommended. Raise channel bed using cross vanes.
Reach 2	Site 10	Alternative D	Lower adjacent floodplain	Improves stream access to floodplain, improves buffer habitat, reduces flood elevation.	Significant disturbance of wetland, may require significant grading, requires coordination with sanitary manholes.	No excavation in floodplain (delineated wetland) to minimize wetland distrubance, minimize permitting and avoid wetland mitigation costs.
Reach 2	Site 11	Alternative B	Stabilize banks with root wads	Reduces bank erosion, improves in- stream habitat, utilizes materials generated on site.	Requires tree removals, more complex design.	Same as recommended.

Reach 2	Site 12	Alternative B	**Stabilize banks with root wads**	Reduces bank erosion, improves in- stream habitat, utilizes materials generated on site.	Requires tree removals, more complex design.	Same as recommended.
Reach 2	Site 13	Alternative B	Stabilize banks with root wads	Reduces bank erosion, improves in- stream habitat, utilizes materials generated on site.	Requires tree removals, more complex design.	Stabilize bank with vegetated riprap & bareroot shrub/livestakes instead of rootwads to minimize distrubance of dleineated wetland.
Reach 2	Site 14	Alternative A	**Stabilize culvert outfall with hard armor**	Inexpensive, effectively stabilizes outfall from erosion.	Does not provide natural habitat, not aesthetically pleasing.	Same as recommended .
Reach 3	Site 15	Alternative C	Install bank stabilization measures at eroding banks using toe wood	Stabilizes bank and reduces stress and erosion, provides habitat, utilizes materials generated on site.	Installation can be challenging, useful life is less than other options, requires significant woody debris.	Stabilize bank with vegetated Riprap & Boulder vanes to direct flows to center of channel. Did not propose toe wood to minimize distrubance to tall steep bank leading to property we do not have permission to work on.
Reach 3	Site 16	Alternative C	Install bank stabilization measures at eroding banks using **toe wood**	Stabilizes bank and reduces stress and erosion, provides habitat, utilizes materials generated on site.	Installation can be challenging, useful life is less than other options, requires significant woody debris.	Same as recommended. Added excavated wetland depression ~2ft deep + vegetate to create a canopy opening to allow stronger vegetation establishemnet on new toe wood installation.
Reach 3	Site 17	Alternative B	Install 4 rock vanes for bank protection	Reduces erosive stress and bank erosion, improves in-stream habitat.	Can result in increases in flood elevations, less effective at high flows.	Stabilize bank with vegetated Riprap & cross vane/constructed riffle. Did not propose toe wood to minimize distrubance to tall steep bank leading to property we do not have permission to work on.
Reach 3	Site 18	Alternative A	**Remove large woody debris**	Reduces flooding potential and bank erosion.	Decreases stream roughness and may increase flow velocity.	Same as recommended.
Reach 3	Site 19	Alternative A	**Remove large woody debris**	Reduces flooding potential and bank erosion.	Decreases stream roughness and may increase flow velocity.	Same as recommended.
Reach 3	Site 20	Alternative D	Realign channel and stabilize meanders with vanes and **toe wood**	Stabilizes bank and reduces stress and erosion, provides habitat, utilizes materials generated on site, improves cross section stability.	Reduces stream length and increases stream slope, installation can be challenging, useful life is less than other options, requires significant woody debris.	Propose leaving forming oxbow channel in place and increasing vegetated buffer around it. Hig flows are bypassing oxbow as channel cutoff is forming. Propose vegetated riprap to lock in the cuttoff bypass and not shortening the channel length.
Reach 3	Site 21	Alternative B	Install log vanes within reach	Improves habitat by deepening channel, provides grade control, reduces upper bank stress.	Does not create vegetated floodplain.	Install Rootwads with log toe. Propose rock cross vanes for longevity of stabilization and to keep flow centered on the culvert. Pull outfall back and create riprap plunge pool for additional treatment outside of the channel.

Table 5-1 Alternatives

Table extracted from 60% plan submittal. Green text signifies direct match with feasbility study recommendations. Red text signifies a deviation from the feasibility study recommendation.

Recommendations

A. Conditional approval of 60% drawings based on the following comments, recognizing that the current plans are preliminary:

1) The BCWMC does not allow filling in the floodplain unless compensatory storage is created, or it can be demonstrated that the fill will not adversely impact flood levels. Although the current design does not include significant earthen fill areas, the vegetated riprap and boulders that will be added to the channel banks may constitute fill. Modeling or other documentation must be submitted to verify no change in the flood level caused by the proposed design.

2) Modeling or other documentation must be provided to verify that the proposed rock sizes are adequate to meet the design stability criteria, including for vegetated riprap.

3) The plans call for riprap to be placed in swales near Station 24+00 and 21+00 on Sheet C-104; however the size of the riprap is not specified. Please specify a riprap class to be used.

4) The plans call for brush mattress to be used in two locations between Stations 23+00 and 21+50. The willow cuttings used in brush mattress require significant sunlight to grow; however the clearing plan indicates that much of the canopy in this area may remain intact. Please consider if the project will provide sufficient sunlight for this stabilization technique to be successful at this location.

5) The plans call for a double tall cross vane near Station11+75, which may lead to two unintended impacts: 1) a double tall cross vane may create a deeper than expected scour pool, which may undermine the footer boulders for the cross vane and result in failure; 2) the double tall cross vane may be an obstacle for aquatic organism passage. Please consider these potential impacts and consider if an alternate layout, such as two regular cross vanes near each other, may achieve the same result with reduced impacts.

6) The plans call for root wads with log toe from Station 7+00 to 8+50 in the left overbank. This segment contains tall banks with steep existing slopes. Please verify whether grading the 3:1 slope as shown on detail 3/D-101 is feasible given the existing conditions.

7) The proposed berm at the culvert outfall near Station 1+50 does not appear on any details. Please include the berm design on the design drawings.

8) Based on stream walks in 2016, significant woody debris was present between Sta. 2+50 and 4+00. The summary table indicated that the debris would be removed; however it is not called out on the plans. Please verify if debris removal will be conducted in this area and modify the plans accordingly.

9) The seed mix specified throughout the project is 34-262. Many species in this mix prefer full or partial sun; however it appears that much of the existing canopy will remain in place. Please consider the anticipated canopy after the project is complete and if an alternative or custom seed mix will be more appropriate than mix 34-262.

10) Instructions for the contractor to limit tree clearing as much as possible and only at the direction of the Engineer should be included on the plans.

11) Elevations and upstream/downstream stationing should be provided for all proposed toe stabilization measures.

B. Authorize the City of Plymouth to proceed with final plans and contract documents.