Item 5B.
BCWMC 7-16-15

Bassett Creek Watershed Management Commission

MEMO

TO: BCWMC Commissioners
FROM: Laura Jester, Administrator
DATE: July 7, 2015

RE: Item 5B Evaluations of Two Past CIP Projects by Minnesota DNR and BWSR

The Minnesota Department of Natural Resources (MDNR) and the Minnesota Board of Water and Soil Resources (BWSR) completed evaluations of two stream restoration projects in the BCWMC (attached). After review by an evaluation panel (consisting of staff with state and local agencies and the University of Minnesota), these evaluations will be part of a report to the Minnesota Legislature later this year. Here is link to the report prepared for 2013 projects: http://archive.leg.state.mn.us/docs/2014/mandated/141181.pdf

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In 2010 the Bassett Creek Watershed Management Commission implemented two capital improvement projects: the Plymouth Creek Restoration Project in Plymouth and the Bassett Creek Main Stem Restoration Project (Reach 2) in Golden Valley (from the Golden Valley-Crystal boarder to Regent Ave.). These projects were partially funded by Clean Water Fund grants from the BWSR.

In 2011, the State Legislature directed the MDNR and the BWSR to evaluate restoration projects completed with Clean Water Land and Legacy Funds including the Clean Water Fund, the Outdoor Heritage Fund, and the Parks and Trails Fund. The purpose of the Legacy Restoration Evaluation Program is to improve future restoration outcomes through a technical audit of restoration projects and to answer questions such as:
"Did project managers do what they said they would do?"
"Did project managers use commonly accepted guidelines and BMPs in project implementation?"
"Will the restoration actions be effective in meeting project goals?"

In October 2013, the projects listed above were selected for evaluation as part of this program. After reviewing the grant application for each project, along with each project's feasibility study and design, fisheries experts and program staff with the MDNR evaluated these projects in the field. City staff and I accompanied the MDNR staff in the field and discussed the project objectives, designs, and outcomes with the MDNR staff.

In January 2015 the completed evaluations were sent to me and city staff. Initially, the evaluations indicated that neither project was likely to meet its intended objectives, nor the outcomes stated in the grant applications. This spring, discussions and meetings were held with MDNR staff, BWSR staff, me, the Commission Engineer, city staff, and the consultant for Golden Valley (WSB & Associates) regarding the projects. The group reviewed and discussed project expectations, limitations of the projects, and water quality data indicating improved conditions (at the WOMP station and downstream of the Plymouth Creek Project). Ultimately, MDNR staff revised the evaluations to indicate the projects are likely to meet proposed objectives.

The evaluation process resulted in a good learning opportunity for all parties involved. We all agreed that earlier input and involvement by technical staff at State agencies could benefit future projects; and that there are limitations to designing restoration projects in urban areas.

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

PROJECT EVALUATION FORM

PROJECT BACKGROUND

Project Name: Bassett Creek and Plymouth Creek Stabilization Projects (Bassett Creek) Date of Review: 10/16/2013

Site Assessment Attendees - Reviewers: Brian Nerbonne MN DNR; Wade Johnson MN DNR - Project manager: Laura Jester, Administrator Bassett Creek Watershed Commission; __, City of Golden Valley - Property owners: -

Project Location: County Hennepin Township/Range/Section S- T- R-

Project Manager / Affiliated organization, Contact: Laura Jester, Administrator Bassett Creek Watershed Commission

Fund: OHF ☐ CWF ☒ PTF ☐ Fiscal Year Funds – FY 2011 Project Start Date 2011
Predominant Habitat Type: Prairie/Savanna/Grassland ☐ Wetland ☐ Forest ☐ Aquatic ☒

1. Goal(s) of the restoration These changes will reduce phosphorus and sediment loads to the lower creek.

Quantifiable objectives of the restoration "annually keep 96 pounds of phosphorus and 200,000 pounds of Total Suspended Solids from washing downstream"

What plans / record of project decisions / prescription worksheets are available? Where are they located?
Feasibility Report for Bassett Creek Restoration Project - Barr Eng. Aug 2009; Bassett Creek Restoration Project Reach II - WSB Eng, Oct 2010, Plymouth City Project No. 8128

2. What is the status of the project? Treatment / establishment phase ☒ Post-establishment phase ☐

3. Has the plan or project implementation been modified from the original plan? If yes, why and how? No

Have alterations in plan or implementation changed the proposed outcomes?

PROJECT ASSESSMENT

4. Site description (by reviewer): Bassett Creek flows through a portion of city-owned open space. A trail roughly follows the stream throught the project reach. Review of historic air photos of the project area show that prior to 1937 the stream through this reach had been straightened and channelized. Reaches upstream and downstream of the project area are highly sinuous, indicating what the natural condition for this stream would have been. By the early 2000's when the project was being planned, the stream had begun to remeander itself by eroding the formerly straightened channel. Channelization also created an entrenched stream channel that can not access its floodplain except during very large events. This exacerbates instream erosion during floods. Through the erosional and depositional processes at work since the channelization, the stream has built a narrow floodplain at a lower elevation than the surrounding topography.

Soils: Sandy loam alluvium

Topography: Relatively flat floodplain bordering a low-gradient stream. A trail that roughly follows the stream is elevated above the surrounding topography in places, suggesting either imported fill or that it is located along the top of the ditch spoils that were excavated when the stream was straightened.

Hydrology: Because of the predominantly urban land use in the watershed, the hydrology of the stream is flashy. Peak flows are high relative to watershed size and are relatively short in duration. Low flows are very low, although the presence of Medicine Lake and other smaller waterbodies likely helps to sustain some baseflow throughout the year.

Vegetation (structure, dominant species % cover, invasive species (MN DNR) % cover, other): Vegetation is typical of a disturbed urban stream corridor. Riparian tree species such as cottonwood, box elder, and silver maple predominate the overstory, with annual invasive species and reed canary grass making up most of the ground layer. Buckthorn and honeysuckle are abundant in areas away for the stream project.

Surrounding conditions (adjacent land use / veg.): Outside of the stream corridor and buffer the land use is residential. Adjacent to the stream there are two stormwater ponds that treat runoff from nearby impervious surfaces.

5. Survey methods used (include deliverable format, # of pgs.): Review of project documentation, plans, and specifications. Site visit with visual observation of the project.

6. Is the plan based on current science (best management practices, standards, and guidelines)? During project planning, the channel erosion at the site was determined to be detrimental to downstream water quality. Standard practices that combine hard armor and bioengineering approaches were selected to halt channel erosion within the project reach to reduce TSS and phosphorous loading. Although the design appears to be achieving the stated objectives, I feel that the project's goals could have been more broad in considering stream processes and habitat that a different approach could have achieved.

The decision to armor the stream channel to halt bank erosion focussed almost solely on that symptom rather than on the ultimate cause, which was the historic channelization of the stream. The erosional process that the project was intended to address is a natural one that streams undergo as it reforms itself into a more stable morphology that adequately dissapates energy and balances sediment transport. Given enough time, the stream could have returned to a more natural meander pattern and adequate floodplain so that the stream channel would have been stable. However, there are consequences to downstream water quality from the transport of eroded sediment that may be unacceptable. An alternative could have been to construct a new stream channel with an appropriate geomorphology for the stream's hydrologic regime. There appears to be room in the open space to accommodate this type of project, instream habitat could have been improved, hard armor would not have been necessary except at bridges and storm sewer outfalls, and the stream could have been stable and self-sustaining over time. Utilizing ample on-site trees for materials could have significantly reduced materials costs and allowed for a more complete restoration for a similar or perhaps even cheaper cost. Designers and the city had concerns about site constraints such as the trail, water quality ponds, and wetlands that would have made a remeander project difficult and potentially much more expensive.

7. List indicators of project outcomes at this project stage: Native plant establishment, bank and channel stability, TSS loading.

8. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project outcome(s)? As stated in question 6, the project plan appears to be meeting the narrow outcomes planned for the project. However, potential broader goals for instream habitat and channel self-maintenance are not fully realized using this approach, and hard armoring of the channel has habitat and stability consequences as well. Of note is a large depositional bar at the downstream end of the project that is likely related to the hard armoring of the channel. Riprap throughout the reach and a relatively narrower channel cross section increases the stream's velocity and sediment transport capability. Once the stream reaches the project's end, sediment transport decreases and material is deposited. This deposition will likely cause instability at that location and accelerate bank erosion.

There are minor issues with the implimentation of the plan that could have been improved. Planting success of live stakes was poor, potentially due in part to the use of long poles that only had a small percentage of their length buried in the ground. Live stakes are more successful when the majority of the stake is buried, with only a few inches exposed to leaf out. This minimizes desication that is generally responsible for planting failure. The vegetated reinforces soil stabilization was constructed higher than the surrounding topography, confining flood flows in the channel to a higher elevation. This increases shear stress in the channel and contributes to channel and bank instability.

9. Are corrections or modifications needed to meet proposed outcomes? Explain. Most of the changes I would suggest for this project would have happened in the planning stages, so they should instead be considered thoughts for future projects in similar situations. The watershed plans to involve DNR at earlier stages in these types of projects so that alternatives can be considered prior to significant investment in design.The project could have better taken advantage of the 65 trees harvested for the project by incorporating more wood into the design, such as toe wood bank stabilization. This would have saved on materials costs, increased habitat, and reduced the downstream destabilization issues. One actionable item going forward would be that any follow-up plantings with live stakes should modify their planting method as described above.

10. Has anything been done or planned that would detract from existing or potential habitat? Explain. Concerns regarding the potential for a more full restoration that addresses broader goals is described in the above questions.

11. Are proposed future steps, including long-term management, practical and reasonable? Explain. Vegetation maintenance may keep out some of the invasive species, but reed canary is likely to dominate the site unless live staking is successful at establishing shrubs. Perhaps with time some of the planted trees will shade out the reed canary, although other invasives such as garlic mustard will likely become established in its place. Ongoing maintenance and perhaps follow-up plantings will be needed to sustain a primarily native community.

12. Are follow-up assessments needed? Explain. The project partners should continue to monitor vegetation establishment and manage invasives. They should also watch what happens in the depositional area at the downstream end of the project for channel instability. This may require a follow-up project to help the stream to a more stable geomorphology.

13. Additional comments on the restoration project. Project proposers and grant funders should think more broadly that simply water quality measures when planning stream projects, and consider alternatives that work with natural stream processes rather than against them. Design should at historic disturbance and stream channel succession as both an explanation for symptoms of instability, and for potential solutions.

PROJECT EVALUATION

The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☐
c. Meet proposed outcomes ☒
d. Likely exceed proposed outcomes ☐
e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

1. Low ☐
2. Medium ☒
3. High ☐

Provide an explanation of the reason(s) for the determination. The project appears to be meeting goals for reducing bank erosion and TSS loading. However, the limitations on instream and riparian habitat caused by the hard-armor approach do not allow for broader potential goals to be realized.

Site Assessment Lead(s) Conducting Site Review (Signature Required):
Brian Nerbonne

RESTORATION EVALUATION PROGRAM for LEGACY PROJECTS
Minnesota Board of Water and Soil Resources
Minnesota Department of Natural Resources

PROJECT EVALUATION FORM

PROJECT BACKGROUND

Project Name: Plymouth Creek Stabilization Projects (Plymouth Creek) Date of Review: 05/6/2015

Site Assessment Attendees - Reviewers: Brian Nerbonne MN DNR; Wade Johnson MN DNR - Project manager: Laura Jester, Administrator Bassett Creek Watershed Commission; Derek Asche, City of Plymouth - Property owners: -

Project Location: County Hennepin Township/Range/Section S26 T118N R22W

Project Manager / Affiliated organization, Contact: Laura Jester, Administrator Bassett Creek Watershed Commission

Fund: OHF ☐ CWF ☒ PTF ☐ Fiscal Year Funds – FY 2011 Project Start Date 2011
Predominant Habitat Type: Prairie/Savanna/Grassland ☐ Wetland ☐ Forest ☐ Aquatic ☒

1. Goal(s) of the restoration Reduce nutrient loading to Medicine Lake (per TMDL plan) by repairing eroded banks , realign Plymouth Creek upstream of Medicine Lake to eliminate creek encroachment on adjacent private properties, .

Quantifiable objectives of the restoration "annually keep 160-200 lbs of phosphorus and 170-200 tons of Total Suspended Solids from flowing into Medicine Lake"

What plans / record of project decisions / prescription worksheets are available? Where are they located?
Feasibility Report for Plymouth Creek Restoration Project - Barr Eng. July 2009; Construction Plans for Plymouth Creek Rehabilitation - Wenck Eng, Nov 2010, Plymouth City Project No. 8128

2. What is the status of the project? Treatment / establishment phase ☒ Post-establishment phase ☐

3. Has the plan or project implementation been modified from the original plan? If yes, why and how? No

Have alterations in plan or implementation changed the proposed outcomes? -

PROJECT ASSESSMENT

4. Site description (by reviewer): Brian Nerbonne
Soils: Sandy loam alluvium in upstream portion of project, wetland muck in downstream reach.
Topography: Narrow valley with relatively steep slope in upstream reach, flat topography downstream
Hydrology: Plymouth Creek watershed is predominantly urban, resulting in a flashy hydrograph with high peak flow and low baseflow. Some wetlands in the upper part of the watershed likely sustain baseflow during dry periods.
Vegetation (structure, dominant species % cover, invasive species (MN DNR) % cover, other): Upstream reach has been planted primarily with live cuttings of willow and dogwood. Buckthorn is present in several locations. Downstream reach flows through a reed canary grass meadow.

Surrounding conditions (adjacent land use / veg.): Some yards with turf grass outside of a narrow buffer; other areas are a mix of non-native grasses and early-successional trees (box elder, cottonwood, ash) with some oaks away from the stream.

5. Survey methods used (include deliverable format, # of pgs.): Reivew of project documentation, historic air photos, and visual observation of project.

6. Is the plan based on current science (best management practices, standards, and guidelines)? The upstream portion of the project is appropriately designed for the most part, with the stream channel providing access to a flood plain during high water, bank stabilization at vulnerable locations, grade control structures, and densely rooted riparian vegetation. However, there are issues with the design and installation of some of the practices. The designed verticle drop of the cross vanes is just under two feet; this is a large drop that generates significant scour on the downstream bed and banks. More frequent cross vanes or riffles with smaller drops would have addressed this issue. In addition, some cross vanes and riffles are not built according to specifications, with relatively flat elevation across the structure rather than a gradual rise from the center of the stream toward the bankfull elevation at the ends. As constructed, they do not adequately concentrate flow in the center of the stream. In addition, some of the riffles or vanes are not adequately tied into the streambank as indicated on plans, and the stream is starting to flank around the structure. There are also issues with the designed placement of cross vanes or riffles at some locations. In at least two places the structures are placed just upstream of a bend. The high amount of scour created by these structures is already showing evidence of contributing to bank instability on the downstream bend. Rootwads were used in at least one channel bend, but it does not appear that the significant amount of wood harvested in conjunction with the project was utilized to stabilize the stream channel. Toe wood structures could have been employed at several locations as alternatives to hard-armor practices that were chosen. This would have decreased material and disposal costs, enhanced habitat, and still met other project goals. One additional concern in the upstream reach is an area between project stations 41+00 and 43+00 where the channel width increases significantly to over twice areas upstream and downstream. This change reduces the sediment transport capability of the stream and is causing aggrdadation of the stream that may cause channel instability. The width on the plans is supposed to be similar to other areas of the stream.

The plan for the downstream portion of the project appears to have misinterpreted both the current and historic site conditions and issues in designing the new stream channel. The feasibility study notes evidence from historic air photos of a channel further to the south within the wetland than existing (2009) conditions or those from historic airphotos going back to 1937. Based on these evidence, and to achieve a stated goal of reducing flooding of some properties on the north side of the wetland, a new meandering channel was excavated through the wetland. There are tradeoffs with this design that affect the long-term stability of the stream channel, as well as maintenance consequences at the water quality ponds located downstream.

The setting of this project has two distinct reaches, and they function in very different ways. The upstream reach has a high potential for sediment transport due to it's steeper slope and relatively narrow floodplain. In contrast, the wetland area downstream has very low sediment transport potential because of a gradual slope and broad floodplain. The construction plans are deceptive in that they indicate a similar slope (0.2%) in upstream and downstream reaches. However the upstream slope ignores the drop in elevation over cross vanes and riffles. During baseflow the slope is equal to what is shown on the plans, but during higher flows when most bedload transport occurs the effective slope will increase as those features are drown out by high water.

As a result of the steep slope in the upstream reach, the much of sediment transported downstream through the upper portion of the project can not be moved throught the wetland. Instead, that sediment is dropped out in the bed and banks of the stream. In effect, the wetland is functioning as a delta between the upsteam reach and Medicine Lake. Deltas typically have multiple stream channels that change course over time as they fill with material. Looking at the historic airphotos, there is evidence that is exactly how this stream reach behaves. The 1937 photo shows only a single straight ditch through the wetland. Only in the 1947 photo during a time of higher water are there a few meander scrolls in the upstream portion of the wetland that are visible. The ditch was no doubt cut prior to the 1937 photo to facilitate drainage. However, looking at succeeding airphotos over time the ditch fills in with

sediment and the channel begins to migrate north. By 2006 a single defined channel has disappeared, replaced by many smaller channels (see attached) typical of a delta setting.

The decision to cut the new stream channel through the wetland alters this situation, creating a more defined flow path with higher sediment transport capability. As a result, sediment that would have been deposited in the wetland previously is now routed through the wetland and into the water quality ponds downstream. This has resulted in annual dredging for the ponds since the stream restoration was completed. This increases ongoing maintenance costs to the city. Discussions with the city and with project designers indicates that this is an acceptable tradeoff in order to accomplish the goal of reducing flooding on properties to the north of the wetland.

The stream appears to already be adjusting to return to more of a delta situation, with deposition of gravel bars in the transition area between the upstream project and the wetland channel. Attempts to address instability in that locaiton following completion of the project have been unsuccessful. Project designers acknowledge that the stream channel will be active in this area, but the design was for that to occur on the south side of the wetland away from houses to the north.

A potential alternative design in the south part of the wetland away from houses could have used a braided channel design that mimics the stable form for this setting. This would have reduced sediment transport to the downstream pond, and taken better advantage of the wetland's potential to filter sediment and phosphorous. Another alternative could have been to buy out properties or purchase flooding easements on the affected properties to the north. It is unknown whether the city conisidered buyouts as an alternative, but they may have found them cost prohibitive or the landowners may not have been willing sellers.

7. List indicators of project outcomes at this project stage: Riparain plant establishement, streambank and channel stability, and TSS concentration enerting the water quality ponds. Measuring TSS leaving the ponds is measuring the two projects together. Grab samples of the flow prior to the ponds is a better measure of the success of the stream restoration to achieve stated goals, but data from below the ponds does indicate a preliminary trend toward reductions in TSS and phosphorous.

8. Does the project plan / implementation of the project plan reasonably allow for achieving proposed project outcome(s)? The issues with design and installation of structures listed in question 6 may require maintance in order to for the project to reach its potential in the upstream reach. The channel design within the wetland does not take advantage of the natural filtering potential of the wetland, but the water quality ponds are likely able to handle in inflow of sediment so long as regular maintenance is done to remove deposited sediment.

9. Are corrections or modifications needed to meet proposed outcomes? Explain. Maintenance of cross vanes and riffles that do not slope down at the center would address their potential to cause bank erosion or structure failure. There are localized areas where live stakes failed uniformly, and bank erosion is already occurring. These areas should be replanted.

Regarding the wetland reach, I recommend that if the stream channel shows signs of aggradation or if ongoing pond dredging costs are too high, that the project partners consider allowing the stream to again function more as a delta by flowing throught the wetland in multiple channels. If this causes recurring issues with flooding of property owners, consider localized mitigation at those properties.

10. Has anything been done or planned that would detract from existing or potential habitat? Explain. The stream design issues are less about stream habitat than they are issues with ongoing maintenance, as well as additional sediment removal that the wetland could have provided. Stream stability may be an ongoing issue due to the concerns listed above, but they are not likely to have detrimental effects on habitat. Installation issues with some of the structures in the upper reach of the project are causing some issues with bank erosion.

11. Are proposed future steps, including long-term management, practical and reasonable? Explain. Ongoing vegetation maintenance is not treating buckthorn appropriately. Rather than treated with a foliar spray, buckthorn

should either be cut and stump-treated, or uprooted.

Dredging of the water quality pond due to sedimentation is a long-term issue that the project partners will have to address.

12. Are follow-up assessments needed? Explain. To evaluate this project independently, monitoring of TSS and phosphorous flowing into the pond rather than between the two ponds would better assess water quality goals. However, treating the projects together is understandable because their goals are both to protect water quality in Medicine Lake.

13. Additional comments on the restoration project.

PROJECT EVALUATION

The project will:

a. Likely not meet proposed outcomes ☐
b. Minimally meet proposed outcomes ☐
c. Meet proposed outcomes ☒
d. Likely exceed proposed outcomes ☐
e. Greatly exceed proposed outcomes ☐

Confidence of outcome determination

1. Low ☐
2. Medium ☒
3. High ☐

Provide an explanation of the reason(s) for the determination. The stream restoration will reduce the TSS load from this watershed by stabilizing eroding stream banks. I have sediment transport and stream stability concerns associated with the channel design in the wetland as well as localized erosion issues associated with portions of the project, but the downstream water quality ponds appear to be effetively capturing sediment and phosphorous and will handle the impacts from these issues so long as the city continues to maintain them.

Site Assessment Lead(s) Conducting Site Review (Signature Required): Brian Nerbonne