technical memo

Project Name |	BCWD Community Demonstration BMP Projects	**Date** |	Sept. 3, 2019
To / Contact info |	Karen Kill, District Administrator		
Cc / Contact info |			
From / Contact info |	Brett H. Emmons, PE, Kerri Robinson		
Regarding |	Stormwater Harvesting/Reuse Options at Stillwater Country Club (DRAFT)		

Stillwater Country Club Stormwater Reuse Feasibility

The Brown's Creek Watershed District (BCWD) has been in discussions with the Stillwater Country Club (SCC) regarding ways to reduce the SCC's groundwater withdrawal for irrigation, and at the same time, reduce runoff that can impact downstream waterbodies, such as Brown's Creek. On Thursday July 25, 2018 District representatives (Karen Kill and Brett Emmons) as well as Mike Isensee, Middle St. Croix Watershed Management Organization (MSCWMO) met with three representatives at the Stillwater Country Club to explore options for rainwater harvesting/stormwater reuse. On August 15, 2018 the BCWD Board of Managers authorized a geotechnical investigation to characterize the soil conditions around the four potential irrigation pond locations identified during the meeting and field visit. The findings of this investigation were provided on November 6, 2018, indicating that the soils at the potential irrigation pond sites were generally suitable for construction of stormwater reuse ponds.

Following submission of the soils investigation, the BCWD Board authorized EOR to analyze the available runoff compared to the irrigation demands and the storage available in the areas identified, in order assess the feasibility of implementing a stormwater reuse system on site. EOR conducted a feasibility assessment of benefits and costs associated with capturing stormwater runoff on the golf course and using it to offset the well water demand for irrigation. This memo summarizes the findings so that SCC and BCWD are able to evaluate the cost effectiveness of installing reuse ponds and altering the irrigation system to offset groundwater pumping.

Stormwater Reuse and Irrigation Demand

EOR used a Stormwater Reuse Model to assess the feasibility of stormwater capture and reuse for irrigation at the SCC. A harvest and reuse system is based on a water balance, comparing the harvested water supply (surface runoff), the storage (ponding), along with the demand (irrigation) in order to determine how much reduction in the current water source (groundwater) can be achieved. Once the source of water has been identified, the ability to capitalize on the new water source depends on the storage available at the times the runoff is occurring. These three factors, water supply, water demand and storage, are the key aspects determining the performance and effectiveness of any harvesting and reuse system. EOR collected data from multiple sources including the BCWD, SCC, City of Stillwater and State resources to characterize the three factors within the Stormwater Reuse Model.

- Water Supply/Source
  - Size of contributing watershed
  - Soils mapping and geotechnical investigation
  - Land use characteristics of watersheds
  - Existing storm sewer infrastructure locations
  - Precipitation records
- Water Demand
  - Sprinkler and irrigation line locations/irrigation coverage
  - Irrigation depth estimate
  - Precipitation records (when is irrigation needed)
- Potential Storage Options
  - Topography
  - Existing waterbodies – nearby and on-site
  - Natural runoff flow paths

Existing Conditions

Stillwater Country Club uses well water to irrigate about 75 acres of turf and from May to October. They report that they typically irrigate around 0.5 inches per week and for this analysis, it was assumed to be between 0.5-0.8 inches per week. During the dry months (July/August) SCC estimates that around 4,000,000 gallons of well water per month are used for irrigation. Table 1 outlines the approximate annual irrigation demands of the SCC under current conditions.

Table 1 – Existing Conditions Summary

Option	Drainage Area (acres)	Pumped To Irrigation (ft^3/yr)	% Reduction of Golf Course Groundwater Withdrawals	% of Surface Runoff Diverted from Contributing Area
Existing	195.8	3,610,300	0%	0%

The eastern side of the golf course contains a wetland complex of three connected cells. This complex falls within the portion of the SCC under jurisdiction of the MSCWMO and is classified under Management Class as a Wetland B Maintain. MSCWMO Watershed Management Plan 2015-2025 says "the *wetlands in this category are rated high in those functions related to wildlife habitat, vegetation quality, and in wetland water quality; and/or rated moderate for protecting downstream water quality, groundwater quality, and/or providing flood and stormwater attenuation."*

The total area currently contributing runoff to potential ponding areas in the western side of the golf course is 157.2 ac. The area contributing to the east side of the golf course is 38.6 ac (Figure 1). Two drain tiles are used to reduce surface runoff across the golf course, draining Mud Pond and the wetland complex and running north to the closest surface drainage outlet.

While installing ponds on the north edge of the golf course is the easiest way to capture the stormwater runoff occurring, the space available for the ponds is constrained by the greens and fairways, restricting the volume that can be captured. Options 2 and 3 looked at the other features around the site to find additional areas for storage and Mud Pond (Option 2) and the wetland complex on the golf course (Option 3) were obvious opportunities, though not without challenges. Mud Pond currently receives stormwater runoff from residential, commercial and roadways to the south. Because it is surrounded by a natural area and has a controlled outlet, it would be relatively easy to add a berm and weir to raise the water level, providing considerably more storage than is currently available. Obvious challenges include obtaining regulatory permits to adjust the function of the pond and use water collected there for irrigation. Option 2 included the assumption that the new stormwater ponds would be pumped up to Mud Pond and the golf course would be irrigated out of Mud Pond.

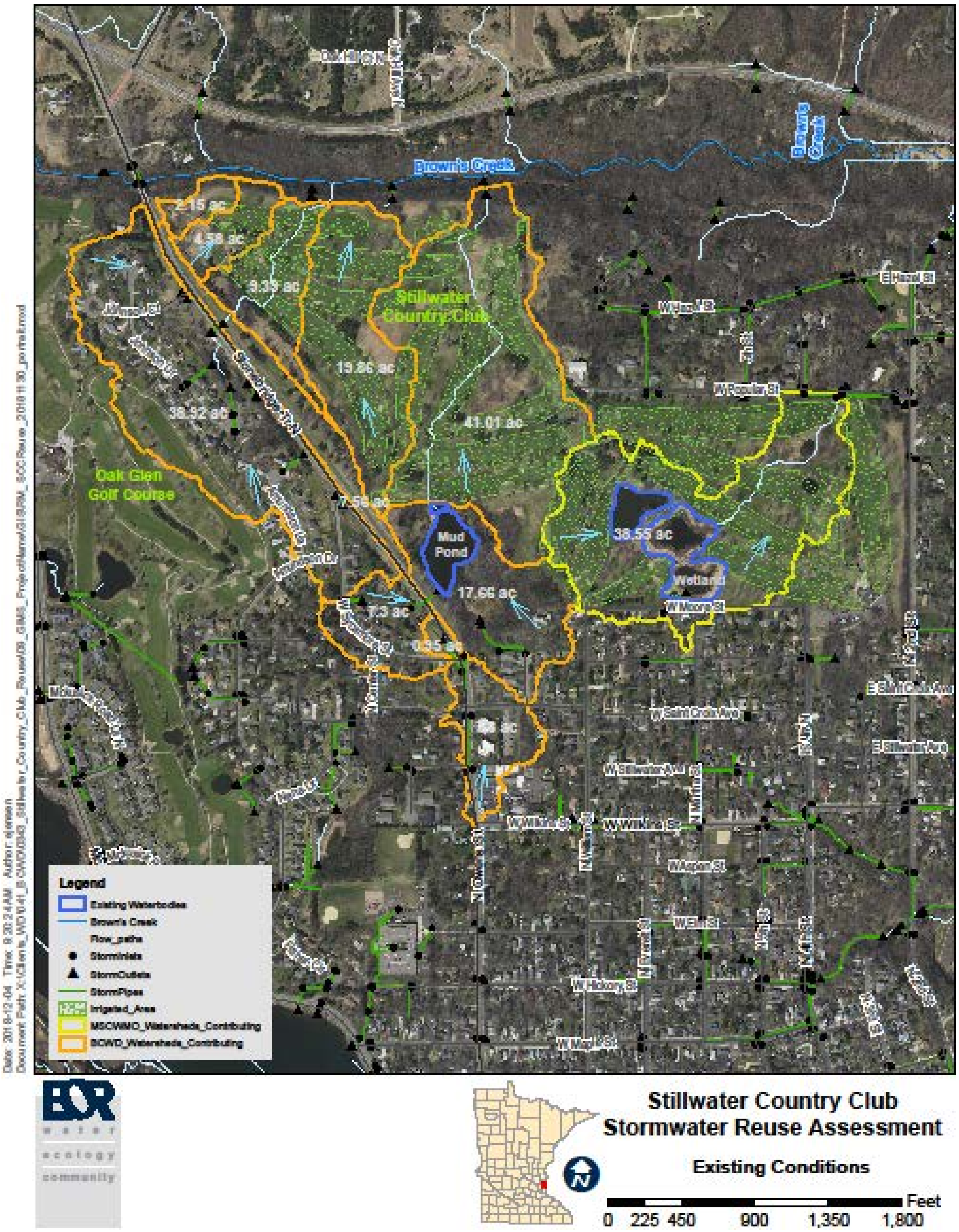

Figure 1 - Existing conditions at Stillwater Country Club

The wetland complex on the eastern side of the Stillwater Country Club does not have a large area, either on site or off site, draining to it. The consistent water level in the wetland therefore indicates that further investigation is required into the source of water sustaining the wetland. If this investigation concludes that it is reasonable to request regulatory permit to adjust the function of the wetland, the location is excellent to combine with the existing irrigation infrastructure on site since the well pump house is located within 100 feet of the wetland. Option 3 assumes that these adjustments are possible and that the stormwater ponds would be pumped to the wetland and the golf course irrigated out of the wetland.

Under the most optimistic reuse scenario in an average year, only about 25% of the current irrigation needs can be met with the stormwater available on site. Capturing stormwater from other areas and using it on the golf course is the logical next step. There are three catchments on the east and south east of the SCC that may be easily captured, with their own small ponds, and reused on site. This will increase the available contributing area by about 35 acres and will provide a small increase in the amount of irrigation occurring with stormwater. This potential opportunity is discussed at the end of this memo.

While it is intuitive that a larger storage volume will capture larger storms and allow more reuse, the model also includes water losses through evaporation which increase as the surface area of the storage increases. Deeper storage facilities will offset this loss however the topography and use of the site limits the depth that can be achieved in the new stormwater ponds and the existing pond and wetland. The model indicates that by building the stormwater facilities to capture the majority of the runoff (86%), the volumes available for irrigation are higher than when storage is added to the existing waterbodies.

The scenarios modelled are detailed below with graphics indicating the locations and sizes of each of the capture and storage facilities, and with summary tables of the key parameters and system performance.

- Option 1. Construct new stormwater ponds to capture stormwater runoff, optional cistern for irrigation.
- Option 2. Capture stormwater runoff in the new stormwater ponds, pumping to Mud Pond for irrigation.
- Option 3. Capture stormwater runoff in the new stormwater ponds, pumping to the existing wetland complex for irrigation.

Option 1 - Construct stormwater ponds for irrigation

In each of the options stormwater runoff is captured in up to four stormwater ponds on the north side of the golf course and used to offset the well water for irrigation (Figure 2).

Figure 2 - Proposed locations of stormwater ponds

Due to the topography of the region and the golf course, the ponds are most effective if located along the northern edge of SCC, in order to capture both off-site and on-site runoff via existing drainage patterns. Conceptual grading plans were developed for three ponds in order to have an order of magnitude on how much storage is available here. The ponds shown should not be considered final and their location and configuration is subject to the SCC input and approval. Some minor grading is required west of Pond 3 to direct the runoff across the western portion of the golf course into Pond 3 (Figure 3). Due to similar elevations, Ponds 1 and 3 can be connected by a surface channel, and controlled by a pump in one of the ponds, possibly with a water level controlled valve for allowing the upper pond to discharge down to a lower pond when the lower pond is being lowered by pumping.

As is clear in Figure 2, the location of Pond 2 is not directly along the existing flow path of surface runoff and therefore will not receive as much surface runoff as the other two ponds. The elevations suggest that water could be diverted into Pond 2 using a pipe from the swale along the primary flow path. Since Pond 2 is about 8 feet higher in elevation than Ponds 1 and 3, it cannot be directly linked with them to operate as a single pond, however it can drain into the other ponds, reducing the need for an extra pump to withdraw water.

Preliminary feedback from the SCC review group (staff and board representatives) was generally positive with some suggested changes. The addition of more water features (ponds) could be a positive for the course. The location of Pond 2 would likely need to be limited at the north end to not project as far north into the play of the course here. Some cart path/trail re-alignment might be needed around Ponds 1 & 3, but that seemed like a manageable issue as indicated in Figure 3.

Figure 2 indicates the general surface area available for each of the ponds. Ideally all of the ponds would be 6 feet deep however the original location for Pond 4 only allowed a depth of 4 ft and was constrained by topography, fairways and greens. Alternate locations for Pond 4 were identified by the golf course staff and Pond 4 in Figure 4 combines two natural depressions and lies along the natural drainage path. While they have slightly less contributing area, they may allow for a larger pond because they are not as constrained by the greens and fairways and since they are existing depressions in the landscape berming the overflow would enhance the potential storage. While there are no perfect locations available for Pond 4, a pond would be needed in this area to capture the runoff from the eastern side of the golf course.

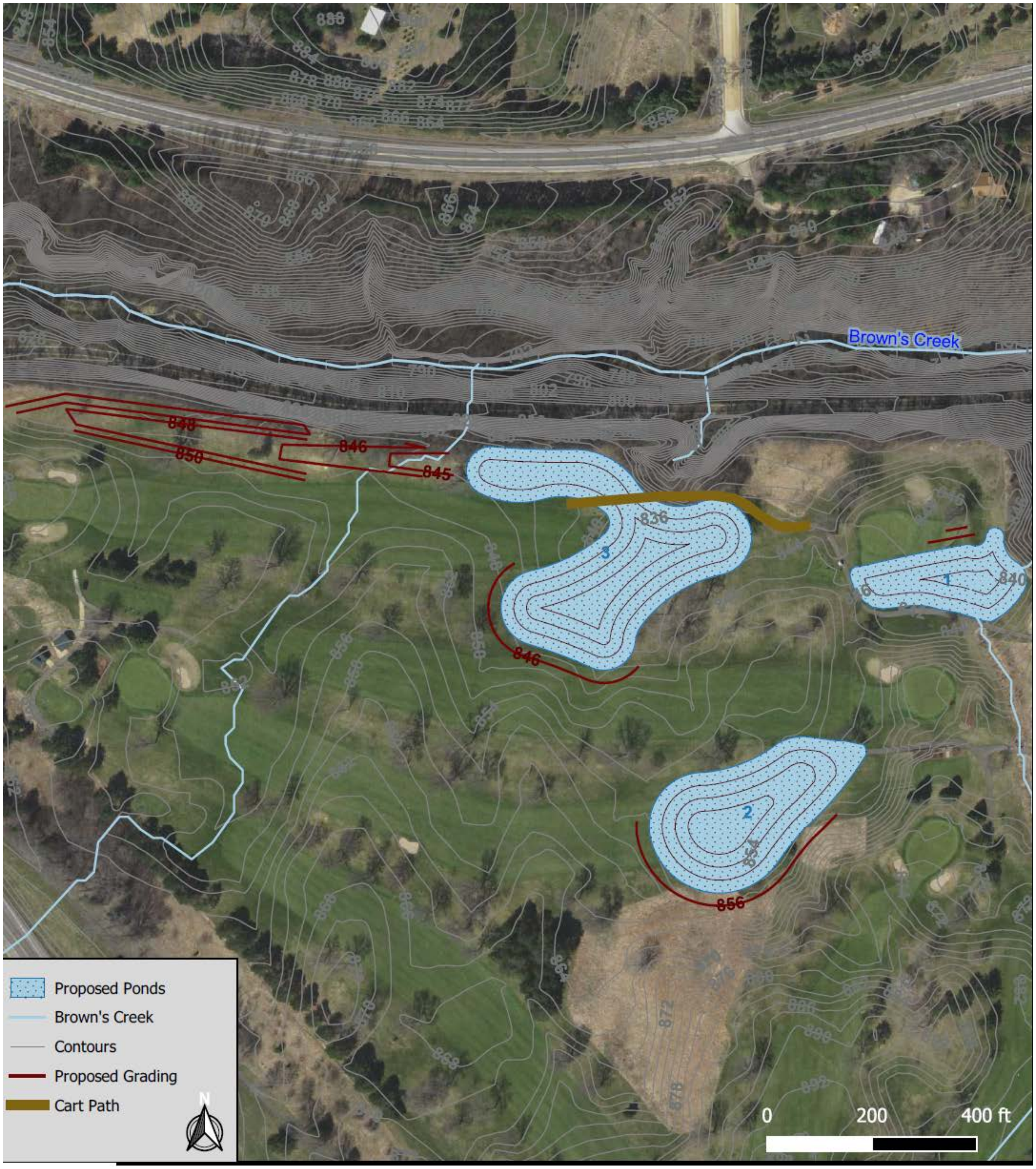

Figure 3 - Surface grading required for Ponds 1, 2, 3

Figure 4 - Surface grading required for Pond 4

In the SCC Reuse Model, all stormwater storage volumes and surface areas are combined. The details of constraints facing the location and sizes of the ponds require additional analysis and modelling during the preliminary design stage.

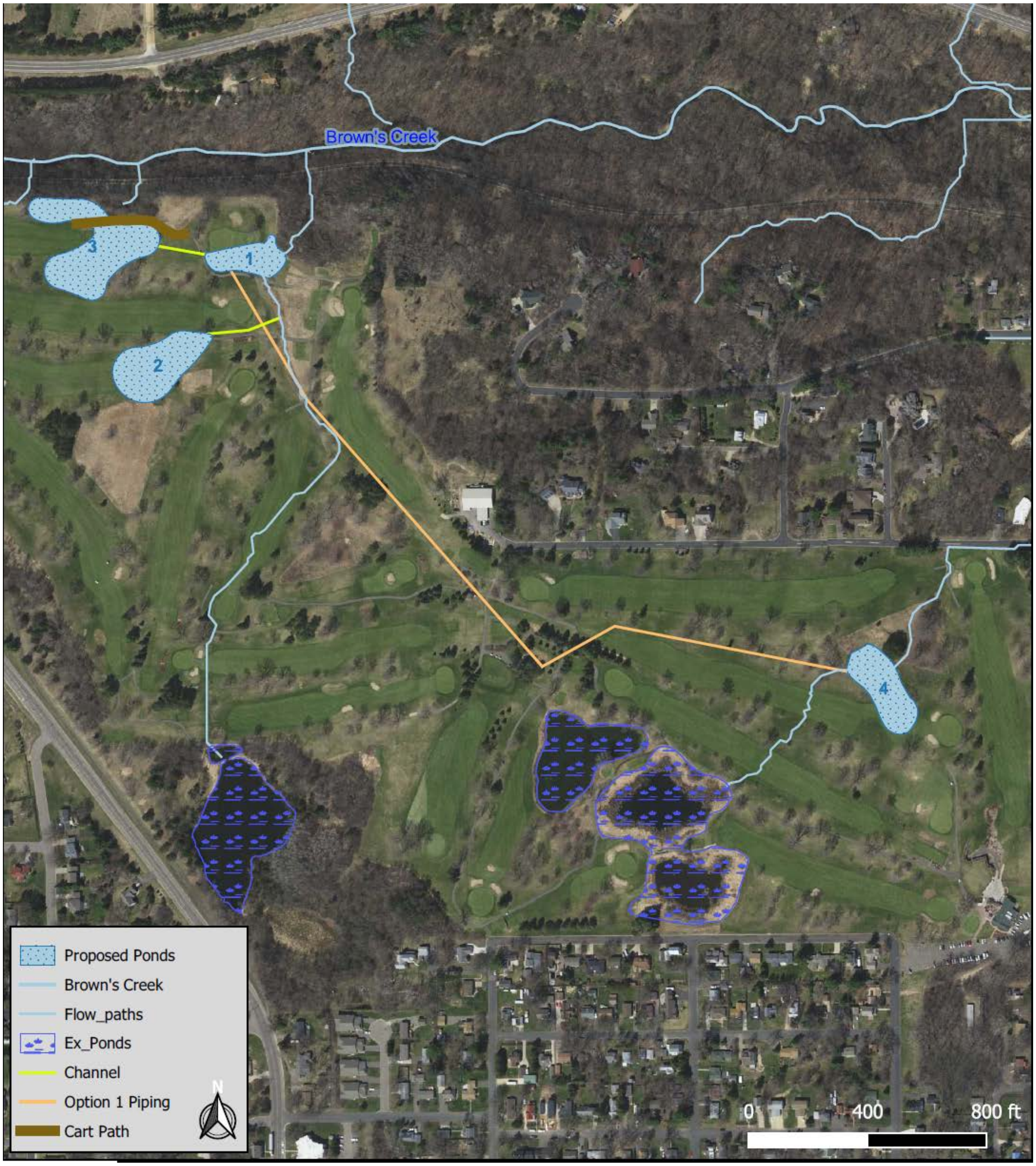

Figure 5 - Distribution Lines for Option 1 no cistern

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Table 2 – Reuse Model Outputs for Option 1

SUMMARY OF OUTPUTS							
Option	Drainage Area (acres)	From the Watershed (ft3/yr)	To Overflow (ft3/yr)	To Evaporation (ft3/yr)	To Irrigation (ft3/yr)	% Reduction of Golf Course Groundwater Withdrawals	% of Surface Runoff Diverted from Contributing Area
1	195.75	1,149,575	161,255	258,426	729,894	20%	86%

If a cistern were to be used to manage the pond volumes and switch to groundwater, during the day pumps located in Ponds 1 and 4 will draw water into a central distribution cistern, sized for the irrigation volume. At night, the existing irrigation system waters the golf course as usual, drawing water from the cistern instead of the well. When the ponds reach a critical depth (~2ft) the pump switches to draw well water to fill the cistern during the day, or directly irrigate as per the current regime. This allows the ponds to maintain capacity to capture stormwater runoff and prioritizes runoff water over well water, when it is available. The relationship between the weekly watering depth and the required cistern volume is illustrated in Table 1. The cistern was not included in the cost estimates for Option 1 since it may be possible, and more cost effective, to optimize the existing pump to draw water directly from the ponds.

Table 3 – Cistern volume based on weekly irrigation depth

Irrigation Cistern Size	
Weekly Irrigation Depth (in)	Daily Irrigation Volume (ft^3)
0.5	45,375
0.8	72,600
1.0	90,750

The costs for Option 1 were estimated under the assumption that the ponds would have to pump to a central location for distribution through the existing irrigation system. Based on the pump configuration as described to us (no documentation is yet available), integrating the existing pump system to draw from these locations could be very challenging and/or expensive. Rather than trying to meet the high flow rates of the entire irrigation system required, Stillwater Country Club has indicated that they have need of a lower volume/pressure system for uses other than full site-level irrigation, including spot irrigation, cleaning and other uses. Using smaller, lower cost pumps to direct the pond water to the existing lines near the ponds under lower pressure keeps pump costs lower and provides SCC with a beneficial low volume/pressure water source. Similarly, with the smaller pumps, the water could be supplied to just a portion of the course and irrigation area. The captured water is much less than the full needs of the irrigation for the entire course, so this approach is a much better pairing of the quantities of water available in this reuse system.

The estimated cost (concept level) for Option 1, without the cistern, is $175,000. When compared to the reduction in groundwater required for irrigation, the cost per cubic foot reduced is $0.24.

These costs are based on the original Pond 4 location and are expected to be less with the new location since less excavation and shorter pipes are required.

Benefits

- Ponds are located to intercept stormwater runoff, and sized to minimize disturbance to the golf course.
- Irrigating from the proposed stormwater ponds provides around 20% of the annual irrigation requirements on average.
- Reducing well volumes required by around 5.5 million gallons throughout the season during an average precipitation year.
- Since the system does not impact existing surface water bodies, permissions are not required from DNR or the watershed districts.
- The optional cistern can be installed away from fairways and trees, minimizing its impact on the function or design of the golf course.

Drawbacks

- The cistern adds considerable cost and does not have ecological or environmental value.
- Golf course design limits volume available in ponds.
- Large storm events overflow the ponds due to the small volumes available.
- Well water will need to make up the difference between the volume available and the volume required.
- Gravity flow from the stormwater ponds is not possible for irrigation.

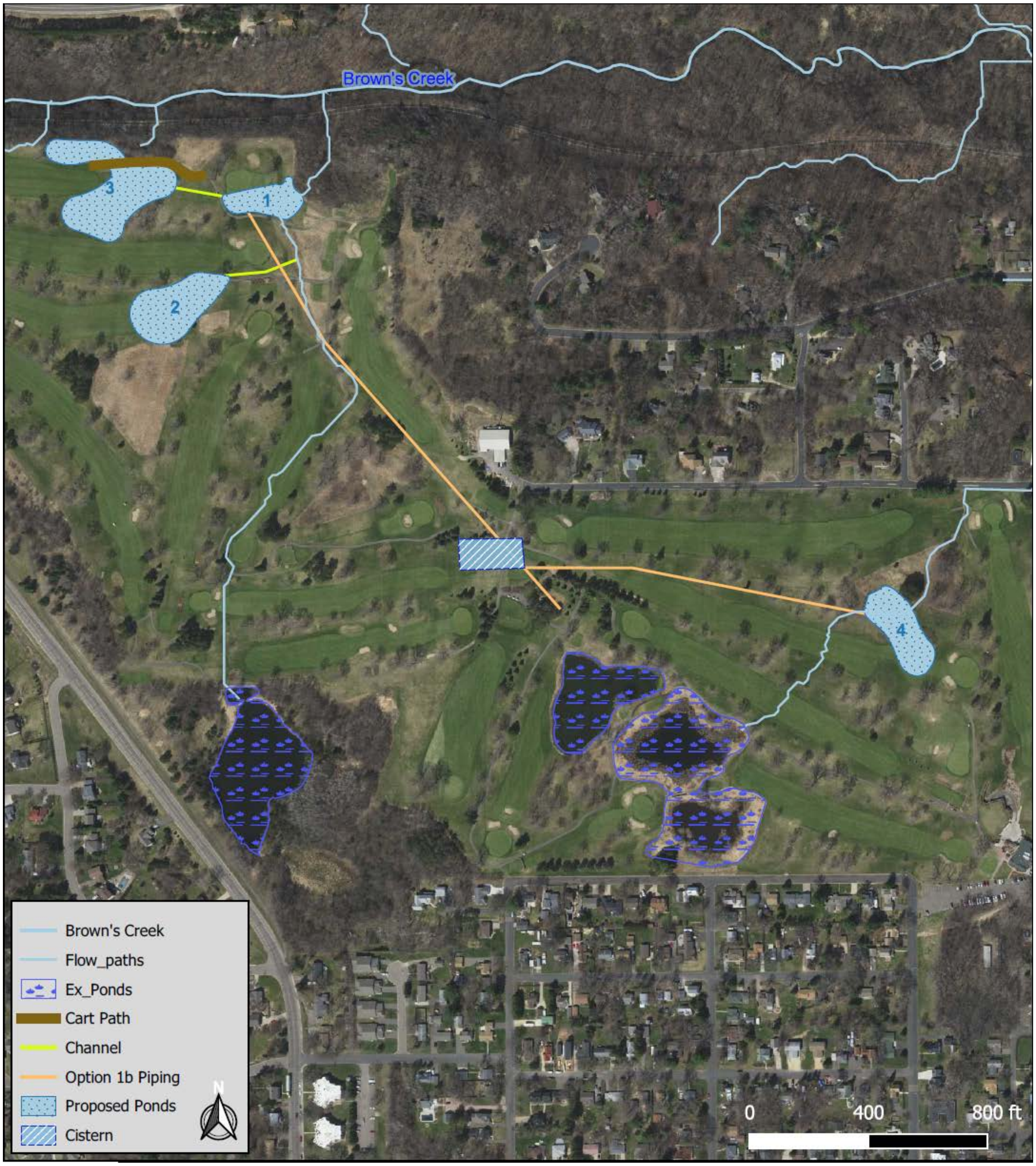

Figure 6 - Potential Cistern Location

Option 2 – Stormwater Ponds + Mud Pond

In Option 2, pumps located in Ponds 1 and 4 draw water into Mud Pond (Figure 7) until it reaches the design capacity resulting from raising the overflow depth to 900 ft (~2 ft above current water surface level), or when the volume remaining in Ponds 1 & 4 reaches a critical volume (2 ft of depth). The irrigation system draws water from Mud Pond until Mud Pond reaches its current water surface elevation (898 ft). Once the stormwater ponds and Mud Pond reach their critical depths, the irrigation system switches to irrigating with well water directly, as in the current circumstance. This provides the same benefits as option 1, and also provides some additional capacity for stormwater runoff in Mud Pond, replacing more well water with stormwater runoff for golf course irrigation.

The estimated cost (concept level) for Option 2 is $409,000. When compared to the reduction in groundwater required for irrigation, the cost per cubic foot reduced is $0.48.

Benefits

- Additional volume available in Mud Pond allows capture of larger storm events so that up to 100% of the runoff across the golf course can be captured.
- Irrigating from the proposed stormwater ponds provides around 24% of the annual irrigation requirements on average.
- Reducing well volumes required by around 6.4 million gallons throughout the season during an average precipitation year.
- Existing pump can be used to draw water from Mud Pond.

Drawbacks

- Two transfer pumps are required to move runoff water from the lower ponds to Mud Pond.
- Well water will need to make up the difference between the volume available and the volume required.
- Berm and weir is required to add depth to the pond and control overflows.
- A permit may be required from Minnesota Department of Natural Resources to adjust the function of Mud Pond by increasing the spill elevation to 900 ft (from 898 ft). The argument would be that we are withdrawing the added water of urban development.

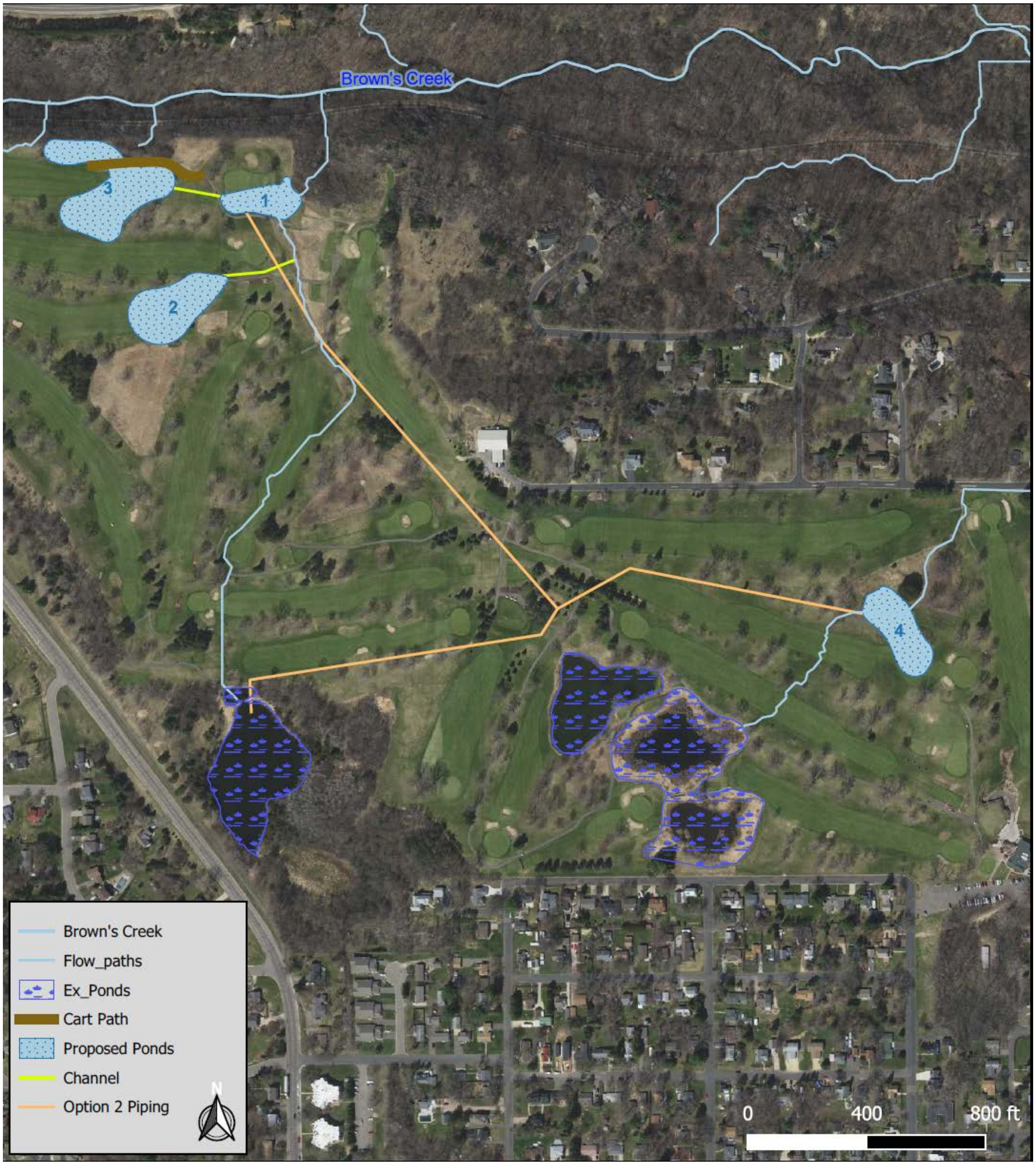

Figure 7 - Mud Pond storage with proposed stormwater ponds

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Table 4 – Reuse Model Outputs for Option 2

SUMMARY OF OUTPUTS							
Option	Drainage Area (acres)	From the Watershed (ft3/yr)	To Overflow (ft3/yr)	To Evaporation (ft3/yr)	To Irrigation (ft3/yr)	% Reduction of Golf Course Groundwater Withdrawals	% of Surface Runoff Diverted from Contributing Area
2	195.75	1,149,575	47,514	250,404	851,657	24%	96%

Option 3 – Stormwater Ponds + Waterbody Complex

The final option is similar to Option 2 however the waterbody/wetland complex on SCC land is used instead of Mud Pond. This may include some additional constraints in that, depending on the classification or type of waterbody or wetland, it could be sensitive to 'bounce', which is the amount the water depth can change in shorter periods of time. If this is managed as a natural wetland (vs. created basin) it can 'bounce' a few feet, on a temporary basis, before there are long-term functional changes.

Dredging the existing waterbodies may be an option and can be explored to provide additional storage in a convenient location, along with the country clubs desires for the waterbodies. Anecdotally, the waterbodies receive sediment-laden runoff from the surrounding community/streets and additional investigation into the source of water and amount of sedimentation due to urbanization is warranted to further understand whether dredging would be appropriate. The class of the waterbody, and if they are regulated as a wetland, based on its ecological function, must be determined prior to any conversation with regulators regarding approvals for dredging or any activities that will alter the function, including directing the addition of stormwater storage.

The estimated cost (concept level) for Option 3 is $297,000. When compared to the reduction in groundwater required for irrigation, the cost per cubic foot reduced is $0.33.

Benefits

- Additional volume available in the waterbody/wetland allows capture of larger storm events so that 100% of runoff across the golf course can be captured.
- Irrigating from the proposed stormwater ponds provides around 25% of the annual irrigation requirements on average.
- Reducing well volumes required by around 6.8 million gallons throughout the season during an average precipitation year.

Drawbacks

- Upto three pumps are required to move runoff water from the lower ponds to the waterbody and to draw water out of the waterbody for irrigation purposes.
- Grading will be required between the waterbody and fairway to the north in order to raise spill elevation.

- A wetland permit may be required to adjust the function of the waterbody by increasing the spill elevation to 926 ft, adding 2 feet of depth to the current normal water level (NWL). The argument would be that we are withdrawing the added water of urban development.

Table 5 – Reuse Model Outputs for Option 3

SUMMARY OF OUTPUTS							
Option	Drainage Area (acres)	From the Watershed (ft3/yr)	To Overflow (ft3/yr)	To Evaporation (ft3/yr)	To Irrigation (ft3/yr)	% Reduction of Golf Course Groundwater Withdrawals	% of Surface Runoff Diverted from Contributing Area
3	195.75	1,149,575	-	241,329	908,246	25%	100%

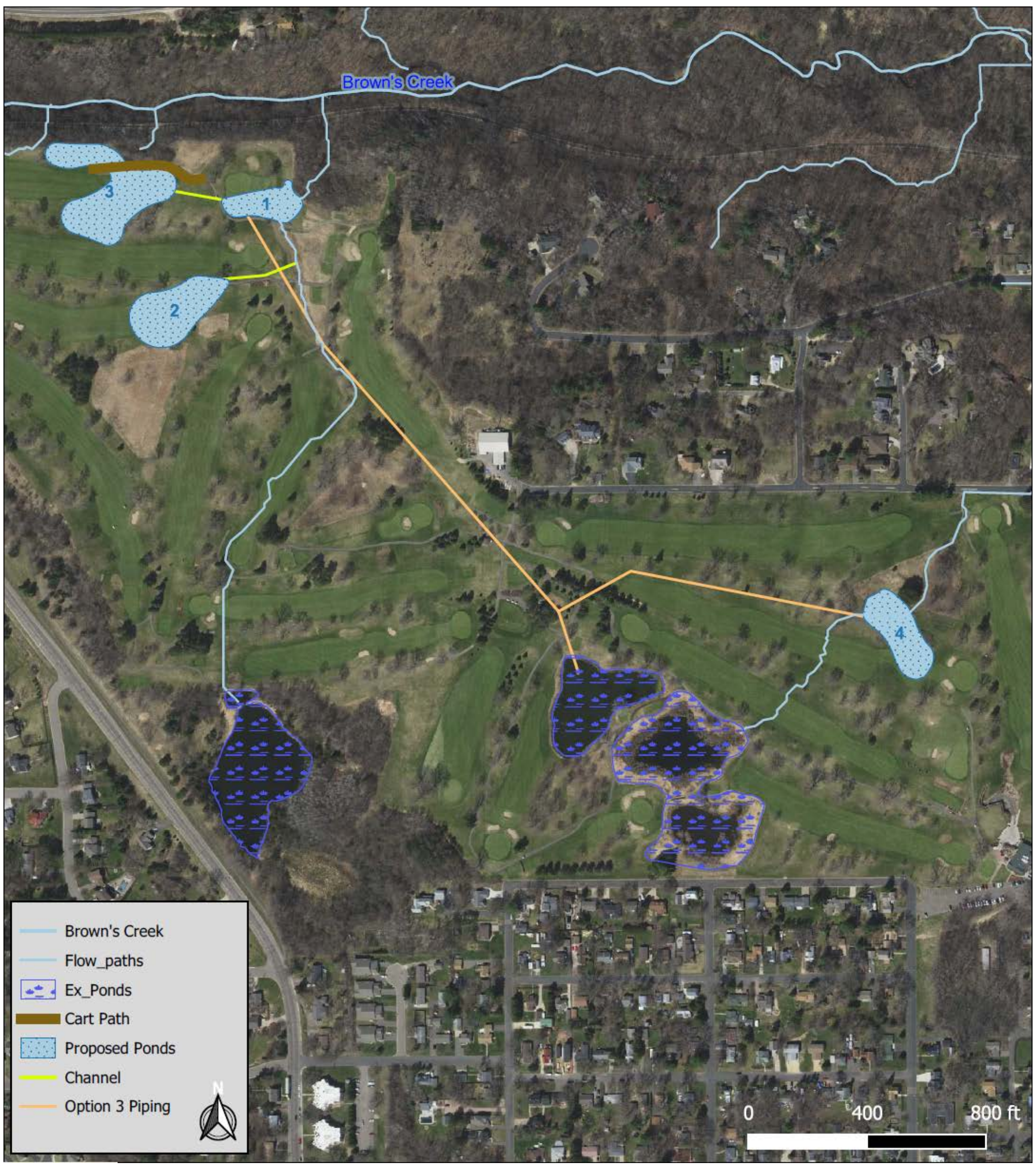

Figure 8 – Wetland storage combined with proposed stormwater ponds

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Options to Divert/Capture Additional Areas

Eastern Portion of Golf Course

The areas encompassing the eastern-most portion of the golf course were also reviewed as contributing area (Figure 9). The concept captures runoff on site with ponds in the NE and/or SE corners of the golf course. The steeper topography and limited natural basin areas were deemed to require too much excavation and grading for ponds in the SE and NE corners of the SCC site, however it is possible that the NE pond could replace Pond 4, reducing additional costs. Pumps would be needed in each pond to bring the volumes from the capture facilities, which would be small, to the central irrigation storage. Figure 9 indicates the NE and SE sub-catchments. Additionally, the area south of the site, at W. Poplar Street and N. Bloom Road, that currently receives runoff from the clubhouse and SCC parking lot, is not easily integrated into the site stormwater contributing area due to the topography. Due to the lack of easily compatible locations for ponding, expense of the considerable excavation, and additional pumps and water lines required for these options they were not considered further at this time.

Regional Options ("Option #4")

Another opportunity may exist to bring water from a nearby lake-wetland system to the west. That drainage is coming from a very large urbanized area (Long Lake drainage), and is responsible for its own challenges in the form of elevated water levels and water quality/thermal impacts. Addressing high water levels by reusing stormwater runoff, either before or after it reaches Lake McKusick, may be desirable to the parties affected – both for improving reductions of golf course groundwater pumping (more source water available) as well as decreased urban runoff impacts to Lake McKusick, St. Croix River, and Brown's Creek. The benefit and level of reduction on groundwater pumping by the golf course could be very significant, approaching 90%+ for most years. This source of surface water to the west has a few key advantages:

1. Large/urbanized drainage system produces a lot of runoff and thus greater source of water
2. Large amounts of storage naturally exists (lakes, wetlands, urban ponds), reducing costs and reduced need for on-site excavation/ponding
3. "Base-flow" of water coming through the system and storage provides a consistent source at a rate similar to the needs of the golf course's irrigation
4. Addresses other downstream problems
    a. Increasing high water levels on Lk McKusick
    b. Water quality impacts to St. Croix River
    c. Water quality and thermal impacts to Brown's Creek

Given the benefits of this system, we suggest further exploring the feasibility of using this source water to have much higher performance at reducing groundwater pumping for irrigation, the SCC's primary goal. It also accomplishes other stormwater treatment benefits for the watershed and St. Croix River.

Figure 9 –Potential eastern contributing areas

Conclusions

In the three options for stormwater capture and reuse detailed in this memo, we started with local/direct drainage opportunities. The analysis found reductions in groundwater irrigation on the golf course could range from 20% to 25% (Table 6) in normal years in best case scenarios. Construction of four strategically located stormwater ponds along the north side of the golf course intercepts urban stormwater runoff that would normally head directly into Brown's Creek and then

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the St. Croix River. Additional storage available in Mud Pond or the wetland complex on the golf course could allow nearly 100% capture of stormwater runoff from the contributing area (subject to permitting and hydraulic sizing). Reductions in well water pumping for irrigation may be slightly lower than modelled due to losses along the irrigation lines and other constraints within the golf course. Additional work with the golf course staff to understand their irrigation layout, pumping, zones, and operation will be needed to further refine how best to integrate this additional water source. Since the golf course does not use the typical set up of pumping into an irrigation pond, but pumps directly into their system, how the runoff water is incorporated into their system warrants further review.

Reductions of total phosphorus are a priority in the management of Brown's Creek, as well as the St. Croix River and meeting TMDL targets. By capturing stormwater runoff in the proposed ponds and using it for irrigation (under the assumption that irrigation is managed to avoid runoff), nearly 100% of the phosphorus contained in the stormwater captured is also captured. Approximately 50% is estimated to remain in the pond sediment and the other 50% is applied to the golf course through irrigation. Phosphorus would only leave the site through uncaptured flows and pond overflows during larger events. From the reuse model and its simple water quality analysis, it is estimated that a maximum of 30 lbs/yr of phosphorus could be removed in the scenario where 100% runoff is captured, It would be roughly proportionately less for scenarios that remove less than all the runoff.

Table 6 – Summary of SCC Stormwater Reuse Scenarios

SUMMARY OF OUTPUTS								
Option	**Summary**	**Drainage Area (acres)**	**Runoff From the Watershed (ft3/yr)**	**To Overflow (ft3/yr)**	**To Evaporation (ft3/yr)**	**To Irrigation (ft3/yr)**	**% Reduction of Golf Course Groundwater Withdrawals**	**% of Surface Runoff Diverted from Contributing Area**
Existing	Existing Conditions	195.75	0	0	0	3,610,307		
1	Added four stormwater ponds to capture runoff	195.75	1,149,575	161,255	258,426	729,894	20%	86%
2	Combined four ponds with Mud Pond	195.75	1,149,575	47,514	250,404	851,657	24%	96%
3	Combined four ponds with wetland	195.75	1,149,575	0	241,329	908,246	25%	100%

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SUMMARY OF PERFORMANCE AND COSTS						
Option	Option Name	Drainage Area (acres)	% Reduction of Golf Course Groundwater Withdrawals	% of Surface Runoff Diverted from 109 Acre Subshed	Estimated Cost (Design & Construction)	Cost/Unit Runoff Diverted to Irrigation ($/CF)
1	Construct stormwater ponds for irrigation	195.75	20%	86%	$175,000	$0.24
2	Stormwater Ponds + Mud Pond	195.75	24%	96%	$409,000	$0.48
3	Stormwater Ponds + Wetland Complex	195.75	25%	100%	$297,000	$0.33

Table 7 – Summary of SCC Stormwater Reuse Costs

Regional Opportunities ("Option #4") - Even once all possible localized capture options are exhausted on the SCC site, significant groundwater is still required to meet the irrigation needs of the golf course, even with their conservation approach to reducing irrigation. If other water sources are available nearby, it may be of interest to the BCWD, Stillwater, Washington County, and SCC to find a way to meet both the need for irrigation water and the need to reduce stormwater volumes in impacted waterbodies. Further discussion is required by the various stakeholders and EOR would be able to provide technical information and ideas in the discussion.

A "4th" option of bringing in larger volumes of water through a regional approach of capturing and using (for a beneficial use) runoff from the south/Long Lake diversion facilities into McKusick wetland and lake, opens up new opportunities and benefits. There has been extensive preliminary work on a regional system as part of work at Oak Glen Golf Course (EOR Memo, "Water Reuse and Management Options for the Diversion Drainage/McKusick Wetland System," 5/7/2019). That work was prompted by discovery of significant "leakage" of warm runoff water, with thermal threat to the creek, coming out of McKusick Wetland (EOR Report, "Lake McKusick Wetland – Assessment of Wetland and Surface Water Connections to Brown's Creek," 9/10/2018). Some of that "leakage" issue was addressed at a compromised weir, but review of the data indicates that with higher climatic variability, increased flows pose a threat downstream. This additional water can also be seen as an opportunity for an additional water source for irrigation (beneficial reuse).

The regional approach, drawing water from McKusick wetland or McKusick Lake, would be a larger project with more costs, but also would provide larger benefits. From the other analysis, we can extrapolate that costs would likely be 3 to 4 times that of the lower level costs mentioned here, and could provide much more irrigation off-set, perhaps ~4 times the amount.

Next Steps

The next steps necessary to move this concept forward will require discussions and collaboration between Stillwater Country Club, BCWD, MSCWMO, Washington County, and EOR. Potential actions include:

1. Integration of the stormwater sources into the golf course irrigation system.
    - How and where are irrigation zones established and managed on the golf course?

- Can the existing well water pump be optimized to draw water from around the site into a single location or other configuration?

2. Determine if integration of natural waterbodies into the stormwater management regime is feasible.
    - What are the permitting requirements and constraints for using the natural waterbodies for temporary storage? Preliminary meetings suggest some permitting constraints may exist if manipulation of the existing waterbodies were needed.
3. "Option #4" – Explore capture and reuse of regional stormwater via McKusick wetland (or lake).
    - Given the reductions to groundwater pumping could be significantly benefited (approaching 100% off-set of average year groundwater pumping), explore what additional costs would be needed and determine if it is cost effective.
    - Prevent additional impacts to downstream waterbodies – Brown's Creek, McKusick Lake, St. Croix River (TMDL limits).
    - Feasibility analysis of capturing regional water source would better understand how it might meet SCC and others' goals, i.e., develop an Option #4.
4. Preliminary design of selected capture and reuse option in coordination with the SCC.
5. Discuss cost-sharing options with partners and other funding sources (e.g., grants) if a golf course reuse project is pursued.