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Technical memorandum

To: Tina Carstens—Ramsey-Washington Metro Watershed District
From: Louise Heffernan, Tyler Olsen and Erin Anderson Wenz—Barr Engineering Co.
Subject: Gervais Creek subwatershed feasibility study
Date: October 22, 2020
Project: 23/62-1200.20
c: Paige Ahlborg, Ramsey-Washington Metro Watershed District

1.0 Introduction

This memorandum summarizes the conceptual designs for several proposed best management practices (BMPs) identified in the Gervais Creek subwatershed of the Ramsey-Washington Metro Watershed District (RWMWD). The identified BMPs aim to improve and maintain Gervais Creek's water quality by retaining or filtering runoff to remove sediment, nutrients, debris, and other pollutants. Barr identified BMP retrofit opportunities based on guidance from the accelerated implementation project category description of the Clean Water Fund, the watershed restoration and protection strategies (WRAPS) report, and the RWMWD watershed management plan (Plan). Barr considered more than 30 potential BMP retrofits in the watershed. This memo summarizes conceptual designs for BMPs and other water quality improvement recommendations for seven BMPs (six sites) in the Gervais Creek subwatershed.

2.0 Background information

The Gervais Creek subwatershed covers 1,847 acres, in the cities of Vadnais Heights and Little Canada. The total subwatershed area increases to 2,039 acres when the Twin Lake subwatershed is included, although discharge from the Twin Lake subwatershed to Gervais Creek is rare. The entire Gervais Creek subwatershed is located in Ramsey County. The Gervais Creek subwatershed is part of the larger Phalen Chain of Lakes watershed.

Gervais Creek is an intermittent stream that was previously managed as a county ditch (County Ditch 16). The subwatershed includes the entire area that drains to Gervais Creek under normal conditions, including County Ditch 7B. The county ditch system was historically managed by Ramsey County as a stormwater conveyance system, and continues to be managed by the RWMWD as a stormwater system. The RWMWD is responsible for the portion of the creek between Gervais Lake and Owasso Basin, and east to Interstate-35E (I-35E) and Interstate-694 (I-694).

The Gervais Creek subwatershed is fully developed. I-35E and I-694 run through the subwatershed. The northwest portion of the subwatershed, south of I-694, contains industrial and commercial areas and a high-density manufactured-home court. Multiple-family and single-family residential areas are scattered

throughout the subwatershed. Undeveloped areas in the southeast and southwest corners of the I-35E and I-694 interchange are considered fully developed, with industry surrounded by wetlands. Scattered areas of open space north of I-694 are also considered fully developed due to the predominance of wetlands. Metropolitan Council future land use projections for 2030 indicate that little change is expected in land use in the future.

The District-managed waterbodies within the Gervais Creek subwatershed include Round Lake in Little Canada and Gervais Creek. Two important regional stormwater detention basins, Owasso Basin and Gervais Mill Pond, are also located within the Gervais Creek subwatershed. The subwatershed includes numerous wetlands, including Black Tern Pond, a large wetland in the northwest corner of the subwatershed, and Savage Lake. Although its name implies that Savage Lake is a lake, it is not classified as lacustrine under the Cowardin system, and therefore is not classified as a District-managed lake.

Based on recommendations from the *Phalen Chain of Lakes Strategic Lake Management Plan* (Barr, 2004), several significant capital improvement projects were implemented in the Gervais Creek subwatershed to improve the water quality of the stream and downstream waterbodies, including the Owasso Basin and Gervais Mill Pond capital improvement projects.

Water quality goals for Gervais Creek are consistent with the MPCA's stream eutrophication standards. The RWMWD strives to ensure that the watercourse and banks of Gervais Creek are stable to minimize erosion and sediment problems. The RWMWD will continue to conduct physical monitoring of the stream to identify streambank and other erosion problems. The RWMWD will implement stream management and stream restoration projects and actions to address identified streambank erosion, gully erosion and other stream degradation problems.

The RWMWD installed a water quality monitoring station on Gervais Creek in 2007, which collects year-round water quality and flow rate samples and data. Biological monitoring of the creek was performed by the MDNR in 1999 and the MPCA in 2010. Recent monitoring data indicates the creek likely exceeds the MPCA's stream water quality standard for total phosphorus of 100 µg/L for the Central River Nutrient Region, although the creek is not listed as impaired for nutrients. Water quality monitoring data has also shown high chloride concentrations for Gervais Creek, though the annual average is lower than the chloride criterion. Thus, the District has assigned a RWMWD nutrient water quality classification of "At Risk" to Gervais Creek. Water quality monitoring data for Gervais Creek is shown on Figure 1 and Figure 2.

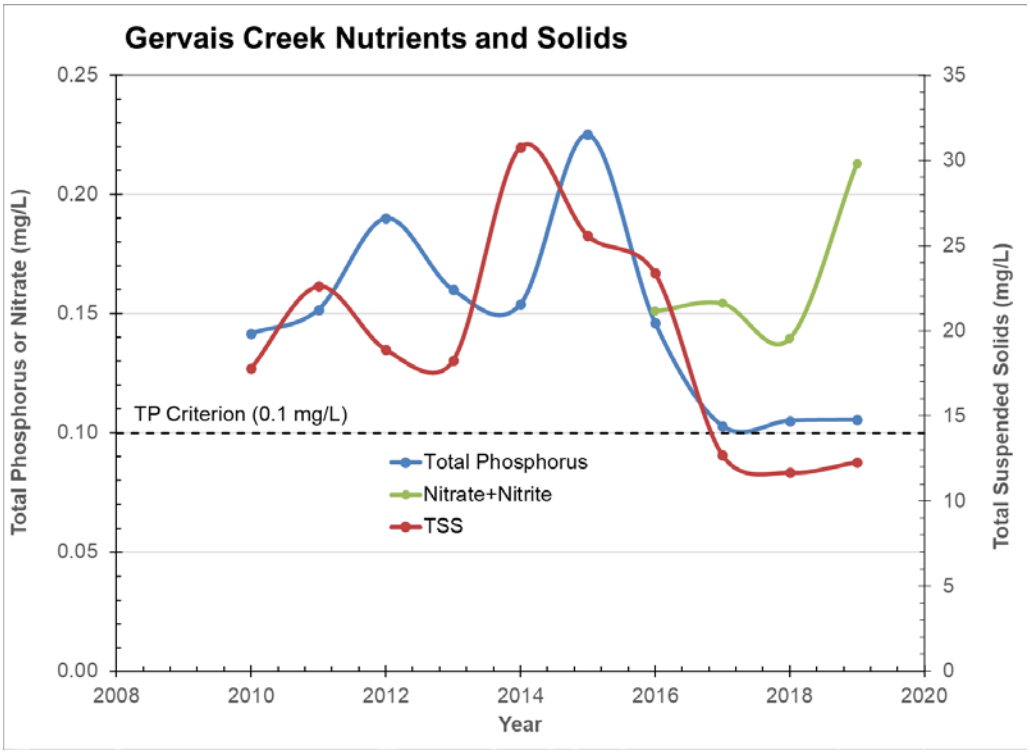

Figure 1 Gervais Creek nutrients and solids monitoring data through 2019

Though Gervais Creek is not identified in the Twin Cities Management Area (TCMA) Chloride TMDL as a "high risk" stream for chloride impairment, the chloride monitoring data suggests that Gervais Creek has the potential to become "high risk" or impaired. While there are no cost-effective BMP recommendations for reducing chloride already in waterbodies or stormwater, the MCPA recommends several practices to reduce the sources of chloride loading within watersheds. These practices are outlined in Section 3.2.7 of this memo.

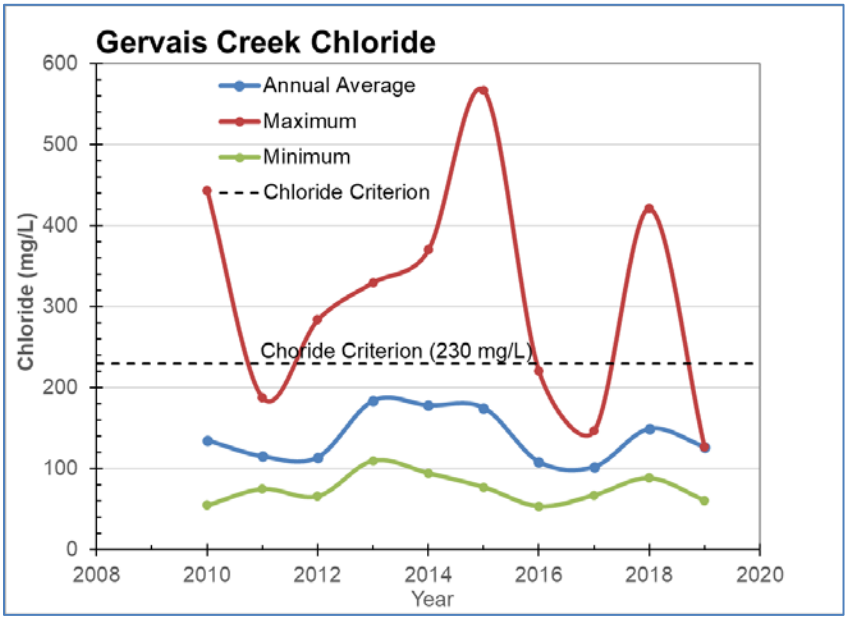

Figure 2 Gervais Creek chloride monitoring data through 2019

3.0 Proposed improvements

The goal of this study is to identify possible improvements that the RWMWD could implement throughout the Gervais Creek subwatershed to treat stormwater runoff and improve water quality. Where feasible, Barr prioritized infiltration BMPs because they are generally the most cost-effective solution to treating stormwater runoff. Where infiltration was not feasible, we recommended filtration or detention BMPs. This study also qualitatively considers the potential for educational features or partnership to promote continued awareness and mindfulness for improving water quality.

3.1 Site selection for BMP retrofits

Barr investigated the Gervais Creek subwatershed to identify potential locations for BMP retrofit projects and other water quality improvement opportunities. The preliminary method for site evaluation was a desktop analysis. Barr used elevation data, storm-sewer data, imperviousness data, national wetland inventory data, aerial imagery, and Google Street View™ imagery to identify potential sites. Additionally, Barr reviewed the RWMWD's cost-share, permitted, and capital improvements plan projects to identify locations where activity has already taken place in the Gervais Creek subwatershed.

The desktop analysis identified over 30 sites with varying imperviousness and space for an adjacent BMP. Barr considered sites with larger impervious areas more desirable, as the BMP would have a larger treatment impact. We also gave higher priority to sites with high public traffic, since they have more opportunity for public engagement and education. In addition, we considered sites owned by the city or county more promising, as a partnership with public entities is generally simpler to establish than a partnership with a private landowner. From this initial list, Barr prioritized sites by eliminating locations

with no immediate access for storm-sewer connections, limited direct drainage area, unfavorable (steep) grade change, complex grading in the BMP footprint, or significant trees within in the BMP footprint. This prioritization exercise narrowed down the list of sites to six preferred sites which include seven BMP locations. Barr staff visited these sites for further analysis and developed conceptual designs for them.

3.2 Proposed Water Quality Improvement Projects

The following section discusses the concept designs Barr developed for the six prioritized sites. Table 1 includes the estimated average annual phosphorus removal for each alternative using the MPCA's minimal impact design standards (MIDS) calculator and the Program for Predicting Polluting Particle Passage through Pits, Puddles, and Ponds (P8). Figure 3 shows the locations of the identified project locations in the Gervais Creek subwatershed.

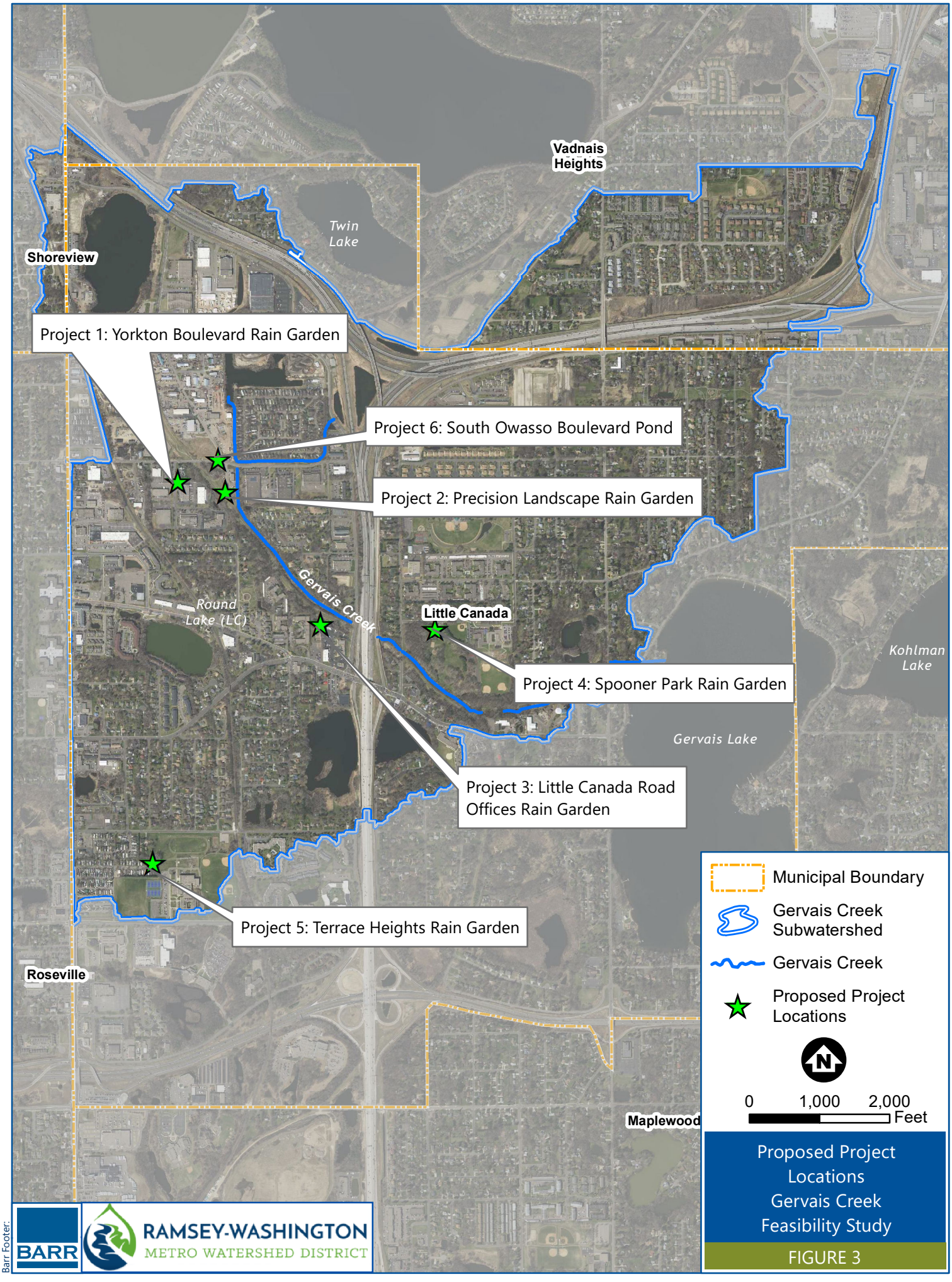
Vadnais Heights
Twin Lake
Shoreview
Project 1: Yorkton Boulevard Rain Garden
Project 6: South Owasso Boulevard Pond
Project 2: Precision Landscape Rain Garden
Gervais Creek
Round Lake (LC)
Little Canada
Project 4: Spooner Park Rain Garden
Kohlman Lake
Gervais Lake
Project 3: Little Canada Road Offices Rain Garden
Project 5: Terrace Heights Rain Garden
Roseville
Maplewood
Municipal Boundary
Gervais Creek Subwatershed
Gervais Creek
Proposed Project Locations
N
0
1,000
2,000
Feet
Proposed Project Locations
Gervais Creek
Feasibility Study
FIGURE 3
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Table 1 Summary water-quality benefits for BMPs in the Gervais Creek subwatershed

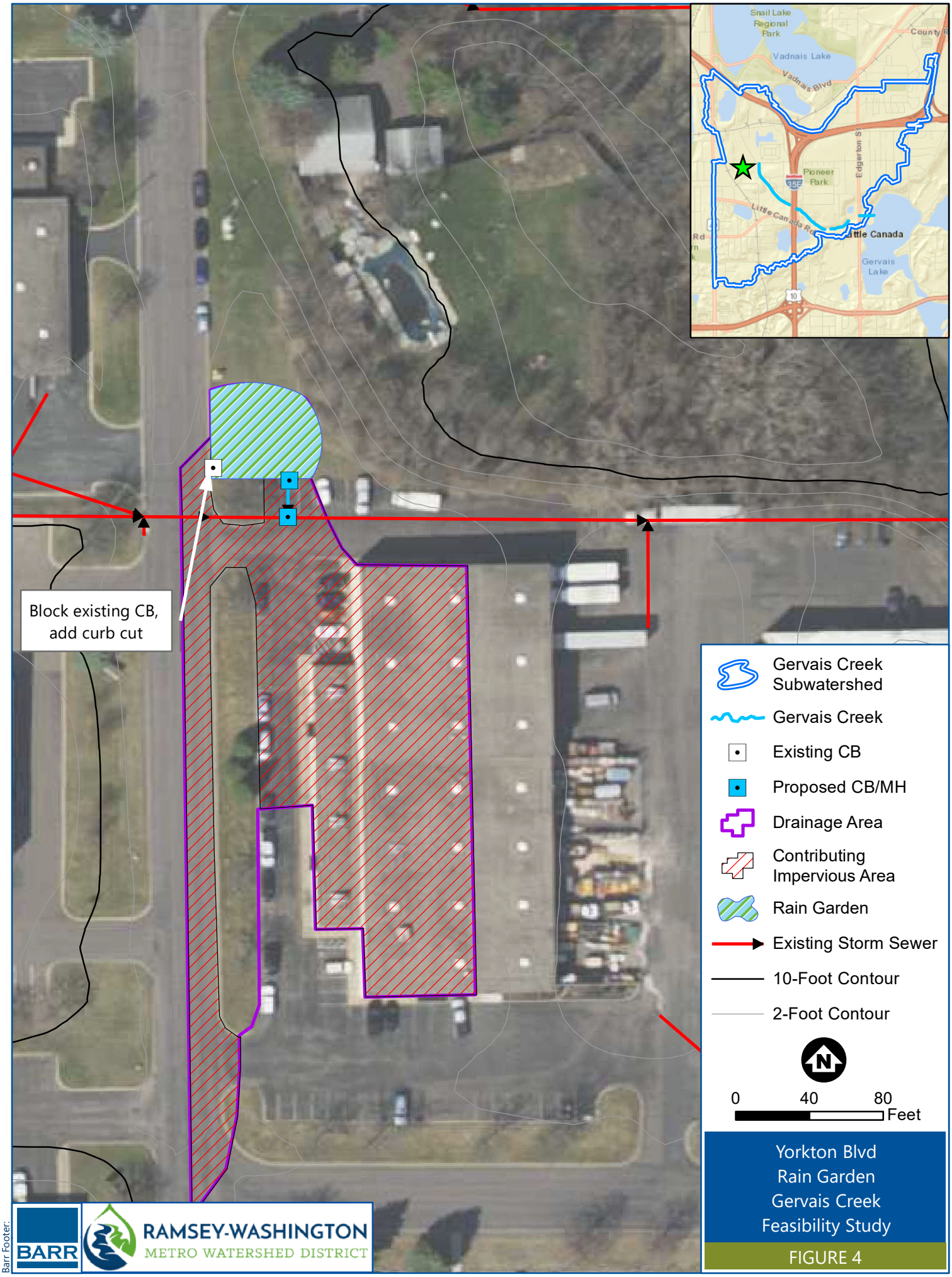
Proposed WQ Improvement Project	Estimated annual TP reduction (lbs/year)	Estimated annual TSS reduction (lbs/yr)
Yorkton Boulevard Rain Garden	1.4	253
Precision Landscape Rain Garden Location 1	0.4	64
Precision Landscape Rain Garden Location 2	1.4	248
Little Canada Road East Offices Rain Garden	3.6	661
Spooner Park Rain Garden	0.2	37
Terrace Heights Rain Garden	2.5	448
South Owasso Boulevard East Pond[1]	23.7	10,858

[1]Estimates based on potential flood management alternatives (i.e., raising Ryan Drive, modifications to existing storm sewer system, and construction of a berm near Owasso Basin) presented as part of the draft 2020 Owasso Basin Bypass Feasibility Study (Barr, 2020).

3.2.1 Project 1: Yorkton Boulevard Rain Garden

The first proposed project is a biofiltration basin (rain garden) located at a vacant lot along the east side of Yorkton Boulevard in Little Canada, approximately 300 feet south of South Owasso Boulevard East. Runoff is collected from a portion of impervious surface along Yorkton Boulevard, commercial area parking spaces, and a portion of The Retrofit Company business flat roof system at 2960 Yorkton Boulevard. Stormwater runoff is conveyed via the Yorkton Boulevard curb and gutter system to an existing catch basin north of 2960 Yorkton Boulevard and it is routed to a pond east of the Yorkton Court cul-de-sac, tributary to Gervais Creek.

The RWMWD could construct a rain garden in the green space at the vacant lot on the east side of Yorkton Avenue to capture runoff from parking areas, a portion of Yorkton Boulevard and a portion of The Retrofit Company flat roof system, as shown on Figure 4. The location receives runoff from 0.96 acres, including 0.74 acres of impervious area. Barr sized the rain garden to capture 1.1 inches of runoff from the contributing impervious areas, resulting in a footprint of approximately 2,900 square feet. Depending on the infiltration capacity of the soils, the rain garden could either infiltrate the volume within 48 hours or filter runoff through an underdrain connected to the existing storm sewer running southeast to the pond east of the Yorkton Court cul-de-sac. In order to effectively retain water in the rain garden, this project would require modification of the existing storm sewer inlet to route runoff into the rain garden.



Yorkton Blvd
Rain Garden
Gervais Creek
Feasibility Study

FIGURE 4

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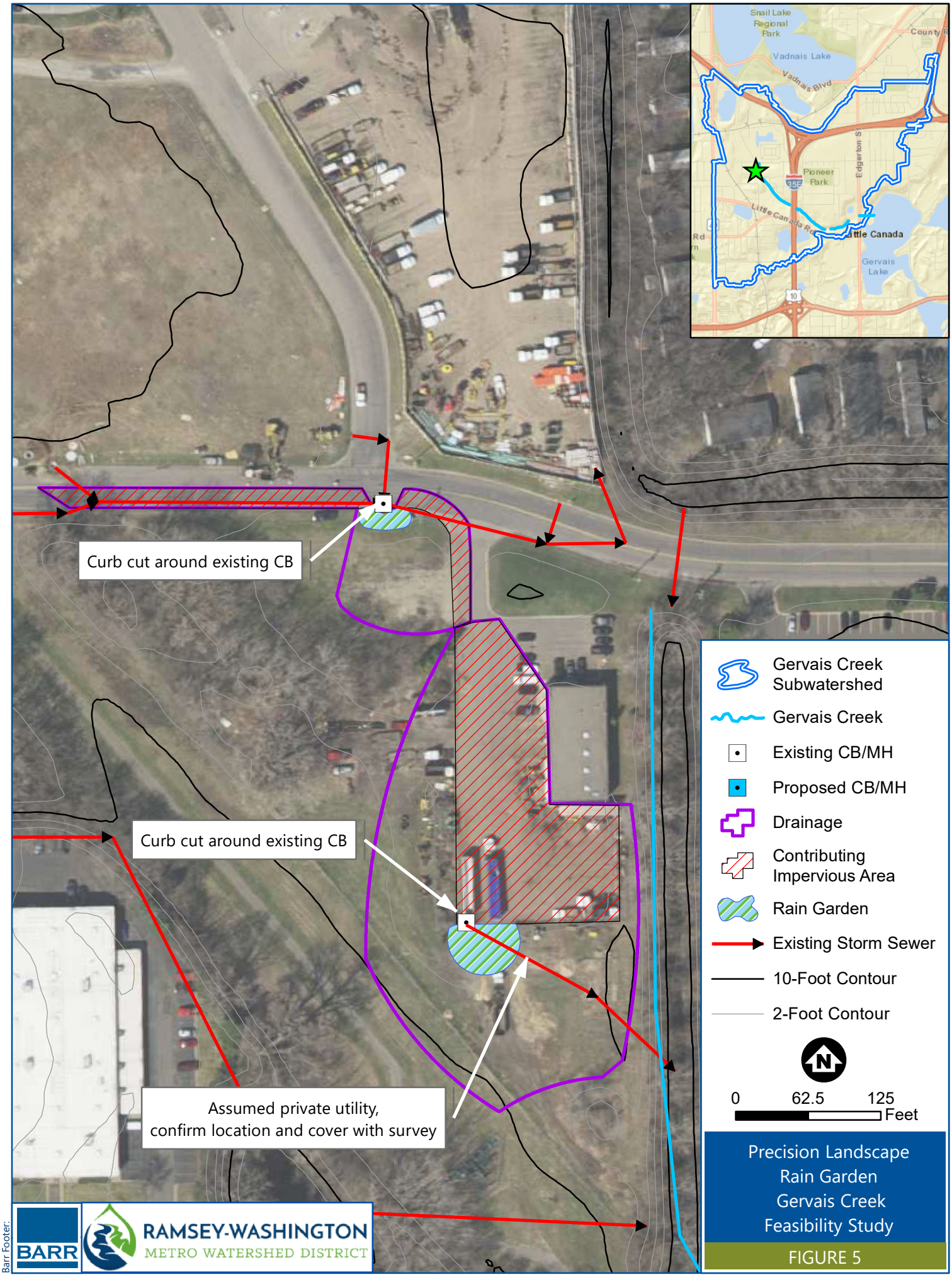
The benefits of this rain garden tributary to Gervais Creek include a reduction in downstream TP loading by 1.4 pounds per year. Additionally, the green space at the vacant lot has flat terrain and would require minimal grading where the proposed rain garden footprint is located. The location of the rain garden may add aesthetic value to the industrial neighborhood but would likely receive minimal foot traffic as a result of a lack of sidewalks in the area. The challenges to constructing a BMP at this location include coordination with and buy-in from the property owner.

3.2.2 Project 2: Precision Landscape Rain Gardens (2)

The second project proposes two rain garden locations south of the intersection of South Owasso Boulevard East and Spruce Street in Little Canada at a private commercial property, Precision Landscape and Tree. There is an existing catch basin located at the low point along the south side of South Owasso Boulevard East, and an existing catch basin located at the southwestern boundary of the Precision Landscape and Tree parking area.

The RWMWD could construct a rain garden at the northwest boundary of the lot located at 50 South Owasso Boulevard East in Little Canada. The green space at this location receives runoff from South Owasso Boulevard East and a portion of the Precision Landscape and Tree access drive, as shown on Figure 5. The first rain garden proposed at the site receives runoff from 0.37 acres, including 0.16 acres of impervious area and is already a grassed depression with a catch basin at the street low point. Barr sized the rain garden to capture 1.1 inches of runoff from the contributing impervious area, resulting in a footprint of 700 square feet. Depending on the infiltration capacity of the soils, the rain garden could either infiltrate the volume within 48 hours or filter runoff through an underdrain connected to the existing storm sewer in the middle of the rain garden. In order to effectively retain water in the rain garden, this project may require modification of the existing catch basin. Stormwater runoff discharging from the existing catch basin tie-in location is conveyed to the Owasso Basin creek south of the North Star Estates Manufactured Home Community, which is directly tributary to Gervais Creek.

The benefits of constructing this rain garden include a reduction in downstream TP loading by 0.4 pounds per year and some visibility for the BMP from residents in the area, however the educational impact may be limited by the rain garden's location at a commercial site with no nearby sidewalks and limited foot traffic. Additionally, the green space at the vacant lot has flat terrain and would require minimal grading where the proposed rain garden footprint is located. The challenges to constructing a BMP at this location include coordination with and buy-in from the property owner and, if the project extends into the right-of-way of South Owasso Boulevard East, coordination with the City.


Curb cut around existing CB
Curb cut around existing CB
Assumed private utility,
confirm location and cover with survey
Gervais Creek Subwatershed
Gervais Creek
Existing CB/MH
Proposed CB/MH
Drainage
Contributing Impervious Area
Rain Garden
Existing Storm Sewer
10-Foot Contour
2-Foot Contour
N
0
62.5
125
Feet
Snail Lake Regional Park
Vadnais Lake
Vadnais Blvd
Pioneer Park
Little Canada
Gervais Lake
Precision Landscape
Rain Garden
Gervais Creek
Feasibility Study
FIGURE 5
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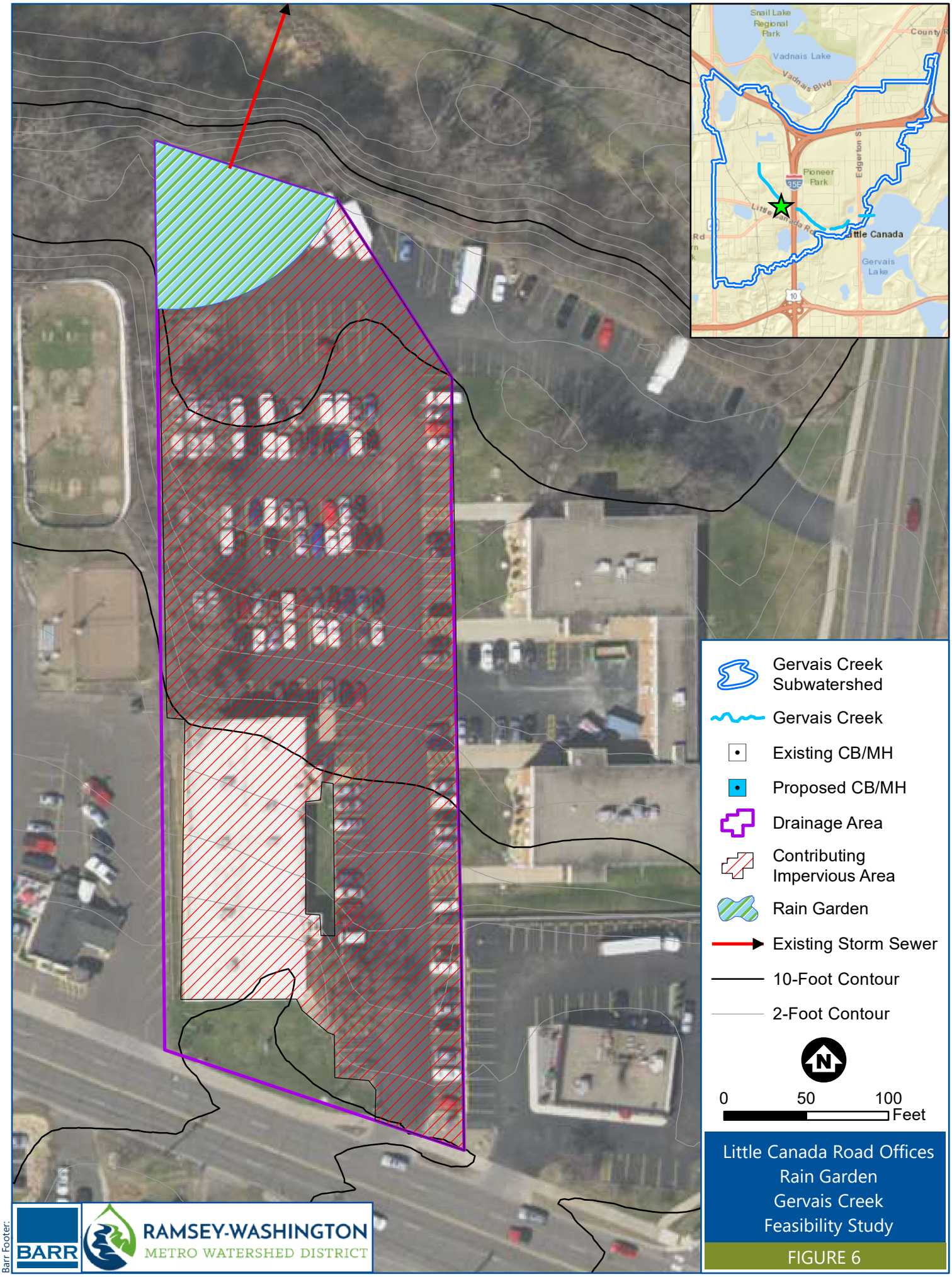
In conjunction with the first proposed location, the RWMWD could construct a rain garden at the southwestern portion of the lot located at 50 South Owasso Boulevard East in Little Canada. The green space proposed for the second rain garden at Precision Landscape and Tree is located at a low point which receives runoff from the majority of the parking area at the site, as shown on Figure 5. The location receives runoff from 1.57 acres, including 0.60 acres of impervious area and is already a depression with a catch basin at the parking area low point. Barr sized the rain garden to capture 1.1 inches of runoff from the contributing impervious area, resulting in a footprint of 2,300 square feet. Depending on the infiltration capacity of the soils, the rain garden could either infiltrate the volume within 48 hours or filter runoff through an underdrain connected to the existing storm sewer in the middle of the rain garden. In order to effectively retain water in the rain garden, this project may require removal or modification of the existing catch basin, and addition of a structure to tie into the storm sewer southeast of the proposed rain garden. Existing storm sewer conveys stormwater runoff from the parking area to Gervais Creek.

The benefits of constructing the rain garden at the southwest boundary of the Precision Landscape and Tree lot include a reduction in downstream TP loading by 1.4 pounds per year. Additionally, the rain garden will provide added benefit for sediment reduction, as significant sediment accumulation was identified in the Precision Landscape and Tree parking area during the site visit. The green space at the vacant lot has flat terrain and would require minimal grading where the proposed rain garden footprint is located. The challenges to constructing a BMP at this location include modification of the existing catch basin structure and coordination with and buy-in from the property owner.

3.2.3 Project 3: Little Canada Road East Offices Rain Garden

Project 3 is a rain garden at a commercial site located north of Little Canada Road East and west of I-35E in Little Canada. Runoff is collected from the majority of the commercial site parking area and the building located along the western boundary, and is conveyed via existing storm sewer to a parking area low point tributary to Gervais Creek.

The RWMWD could construct the Little Canada Road East offices rain garden in the parking area directly tributary to Gervais Creek on the northwestern portion of the parking area serving offices located at 219 Little Canada Road East. The proposed rain garden would capture runoff from the majority of the main parking areas and the building roof system of the offices on the western portion of the site, as shown on Figure 6. The location receives runoff from 2.22 acres, including 2.01 acres of impervious area. Barr sized the rain garden to capture 1.1 inches of runoff from the contributing impervious area, resulting in a footprint of 3,100 square feet. Depending on the infiltration capacity of the soils, the rain garden could either infiltrate the volume within 48 hours or filter runoff through an underdrain connected to a structure discharging to a low point tributary to Gervais Creek.



Little Canada Road Offices
Rain Garden
Gervais Creek
Feasibility Study

FIGURE 6

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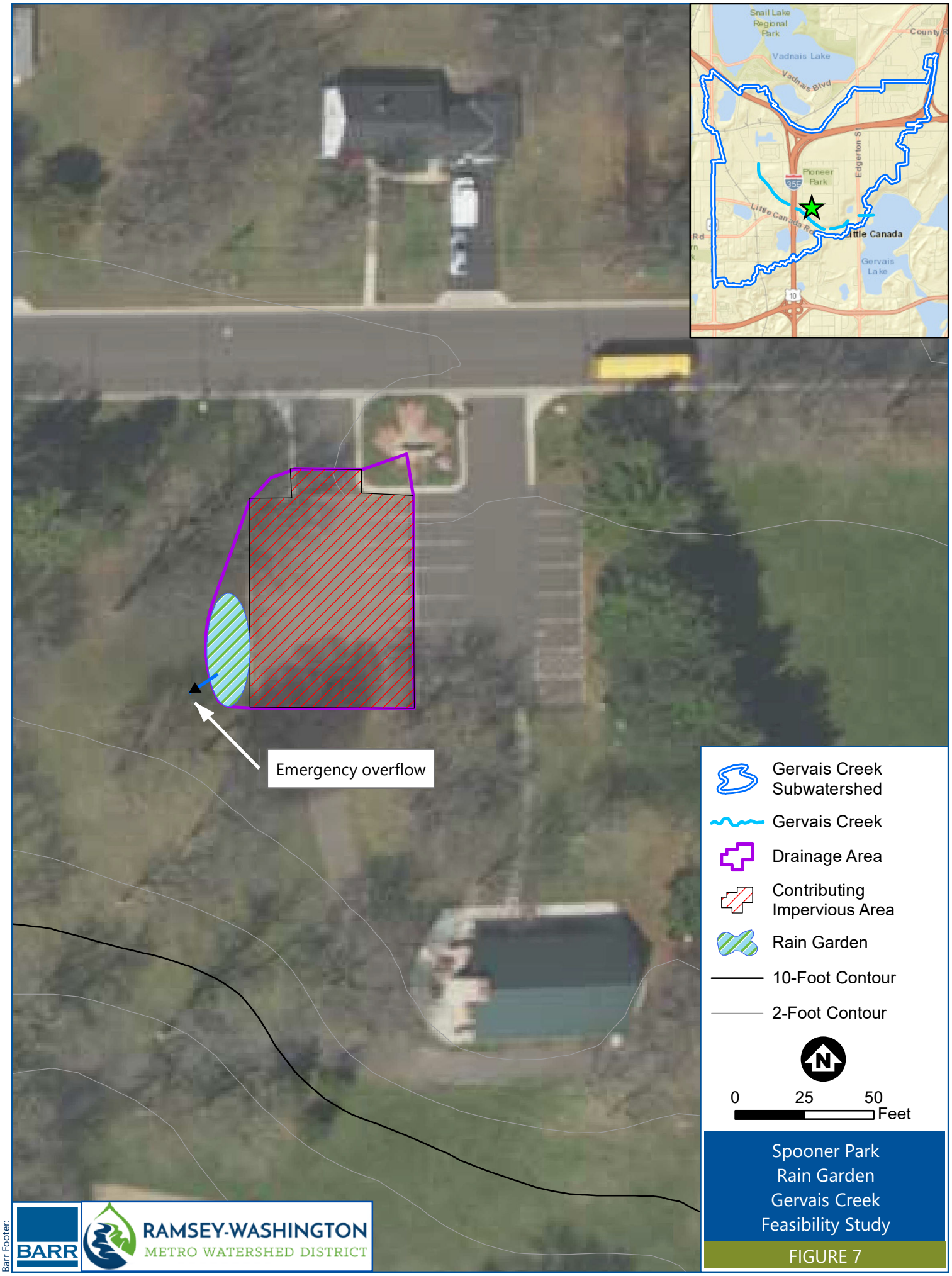
The benefits of constructing this rain garden include a reduction in downstream TP loading by 3.6 pounds per year. The challenges to constructing a BMP at this location include coordination with and buy-in from the property owner, which may be particularly difficult if the property owner requires the parking areas at the location of the proposed rain garden. The parking spots are primarily for large vehicle or trailer parking. The site would require moderate grading as there is a slight slope where the proposed rain garden footprint is located, requiring excavation of 0 to 2 feet of soil. The location appears to have moderate visibility and foot traffic from the commercial site, which limits the educational potential for the BMP. Additionally, no existing catch basin at the low point exists, and the proposed rain garden would require addition of a structure discharging to the low area tributary to Gervais Creek or utilization of the existing spillway.

3.2.4 Project 4: Spooner Park Rain Garden

Project 4 is a rain garden at Spooner Park in Little Canada, located south of Eli Road and east of Centerville Road. Runoff from the Spooner Park parking area located south of Eli Road is conveyed via overland flow to green space tributary to Gervais Creek. There are no existing catch basins located at the parking area.

The RWMWD could construct a rain garden in the green space at the southwest boundary of the parking area to capture runoff from a portion of the parking area, as shown on Figure 7. The location receives runoff from 0.13 acres, including 0.11 acres of impervious area. Barr sized the rain garden to capture 1.1 inches of runoff from the contributing impervious areas, resulting in a footprint of approximately 500 square feet. Depending on the infiltration capacity of the underlying soils at this location, this project may require addition of a storm sewer structure with an underdrain to meet drawdown requirements for the basin. Alternately, the system emergency overflow may route runoff overland to green space southwest of the parking area, matching existing drainage patterns.

The benefits of this rain garden include a reduction in downstream TP loading by 0.2 pounds per year and significant visibility for the BMP with the opportunity for an educational component located at the Spooner Park. The challenges to constructing a BMP at this location include coordination with the City of Little Canada (park property owner) and minor grading as there is a slight slope where the proposed rain garden footprint is located.



Spooner Park
Rain Garden
Gervais Creek
Feasibility Study

FIGURE 7

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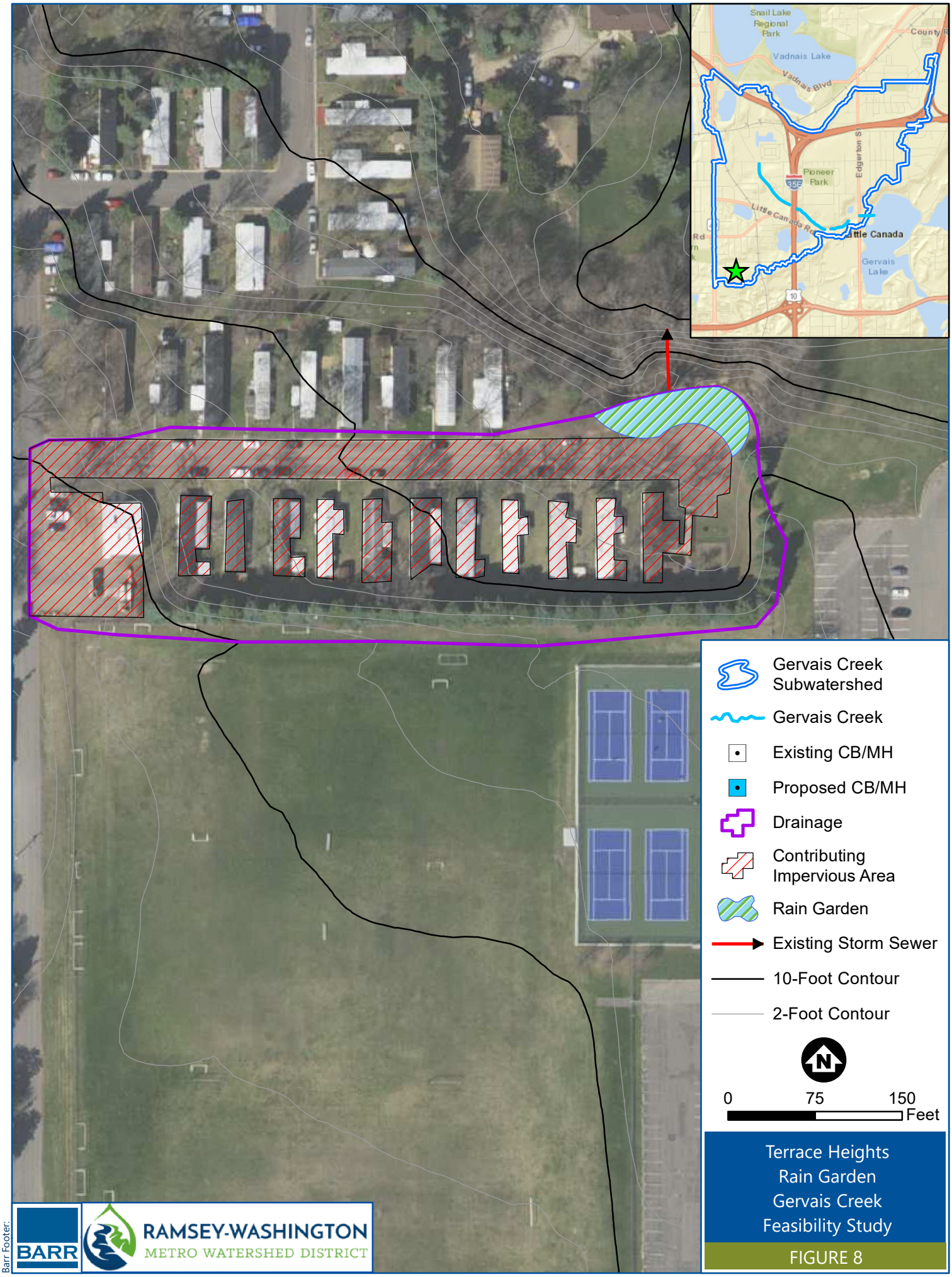
3.2.5 Project 5: Terrace Heights Rain Garden

Project 5 is a rain garden located at the low point of Day Avenue in the Terrace Heights Manufactured Home community in Little Canada. The low point receives runoff from the street, manufactured homes, and driveways. There is not an existing catch basin located at the low point. Runoff is conveyed through a flared-end corrugated metal pipe that discharges to a depression in land area tributary to Savage Lake.

The RWMWD could construct a rain garden in the green space and a portion of the Day Avenue cul-de-sac area to capture runoff from the street, manufactured homes and driveways, as shown on Figure 8. The location receives runoff from 2.67 acres, including 1.10 acres of impervious area. Barr sized the rain garden to capture 1.1 inches of runoff from the contributing impervious areas, resulting in a footprint of approximately 4,200 square feet. Depending on the infiltration capacity of the soils, the rain garden could either infiltrate the volume within 48 hours or filter runoff through an underdrain with the addition of a structure. In order to effectively retain water in the rain garden and depending on the infiltration capacity of the underlying soils at this location, this project may require addition of a storm sewer structure. Alternately, the system emergency overflow may route runoff overland to green space north of the Day Avenue cul-de-sac, matching existing drainage patterns.

The benefits of constructing this rain garden include a reduction in downstream TP loading by 2.5 pounds per year and some visibility for the BMP from residents, however the educational impact may be limited by the rain garden's location on a road with limited foot traffic. The challenges to constructing a BMP at this location include coordination with and buy-in from the property owner and, if the project extends onto city land, coordination with the city.



Terrace Heights
Rain Garden
Gervais Creek
Feasibility Study

FIGURE 8

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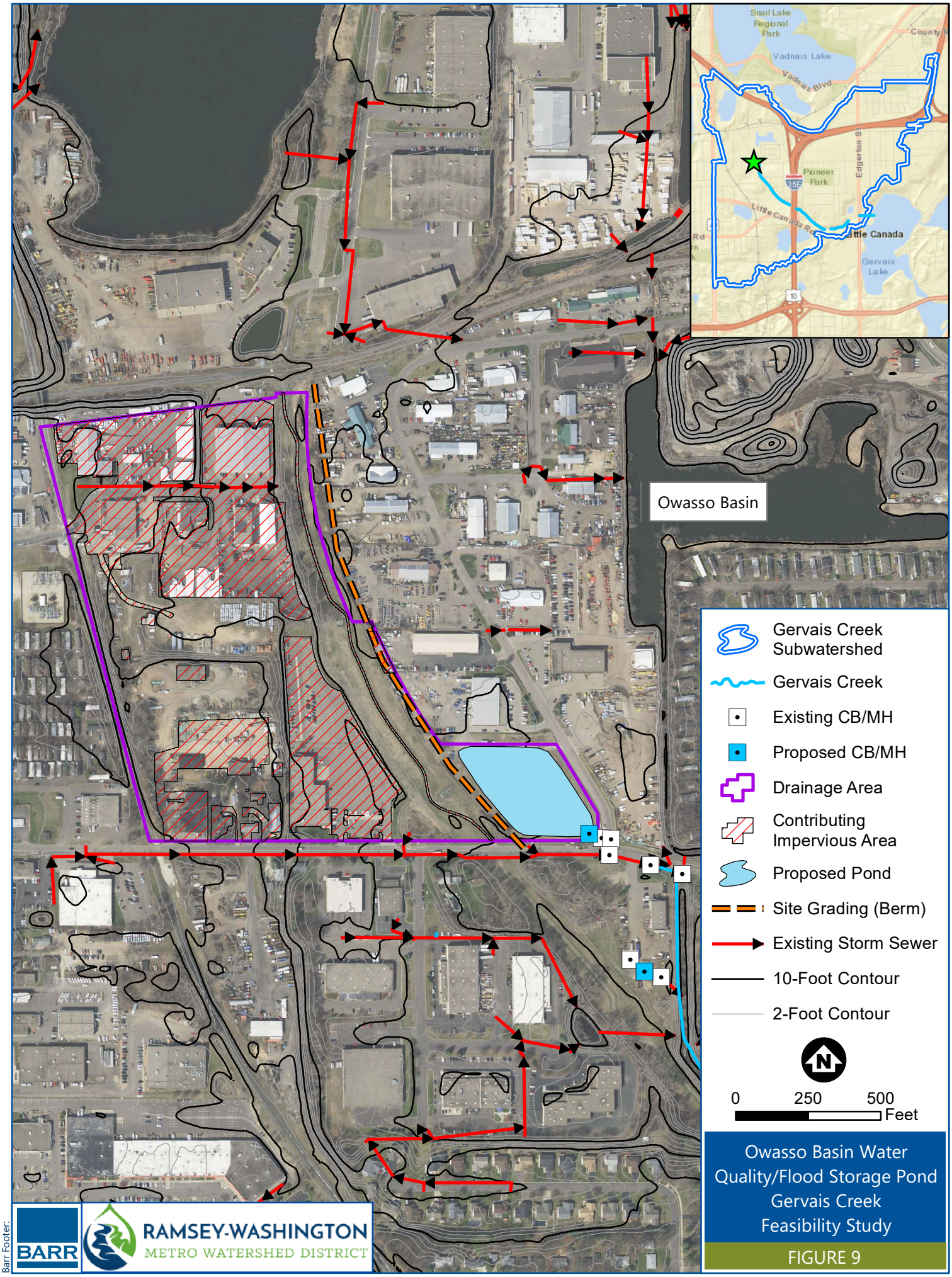
3.2.6 Project 6: South Owasso Boulevard East Pond

Project 6 is a proposed pond located in the Owasso Basin drainage area north of South Owasso Boulevard East and west of Spruce Street. The drainage area and pond size estimates for the proposed pond are based on potential flood management alternatives presented as part of the draft 2020 Owasso Basin Bypass Feasibility Study (Barr, 2020). The purpose of the Owasso Basin Bypass Feasibility Study is to evaluate system-level flood damage reduction options, including modification to drainage areas, outlet structures, and storm sewer infrastructure to actively management stormwater runoff from flood-prone areas in the Owasso Basin area.

Following evaluation of Owasso Basin Bypass flood study alternatives, the RWMWD could construct a pond for water quality and flood storage at the green space located at the vacant lot near the northwest corner of Spruce Street and South Owasso Boulevard East. The lot is currently for sale and could be purchased by the RWMWD or the City of Little Canada. Depending on various flood study alternatives (i.e., raising Ryan Drive, construction of a berm west of Spruce Street, infrastructure modifications, etc.), the pond could capture runoff from the neighborhood to the northwest, as shown on Figure 9.

Estimates for water quality modeling purposes assume the pond receives runoff from 36.5 acres, including 16.7 acres of impervious area. Barr developed a concept design which identifies the pond outlet tie-in location at the southeast corner of the site. Stormwater runoff would be conveyed to storm sewer discharging to Gervais Creek. Barr sized the pond based on the available space at the vacant lot to maximize the surface area, assuming a footprint of 93,600 square feet and a depth of 6 feet, with 3:1 side slopes. The depth of dead storage (permanent pool volume) in the pond for water quality purposes may be evaluated in the design phase, depending on flood storage needs in the area.

The benefits of constructing this pond include a reduction in downstream TP loading by up to 23.7 pounds per year, assuming the drainage area and impervious area identified above. The proposed location may add aesthetic value to the industrial neighborhood area. Additionally, the pond would provide flood storage for the contributing watershed, diverting flood volumes from Owasso Basin. Educational impact may be limited by the pond's location directly adjacent to the road with limited foot traffic. The water quality benefit of the pond will be coordinated with the Owasso Basin flood study to continue determining its feasibility and effectiveness.



Owasso Basin Water Quality/Flood Storage Pond
Gervais Creek
Feasibility Study

FIGURE 9

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3.2.7 Chloride Reduction Strategies for Gervais Creek Subwatershed

Because Gervais Creek has high chloride concentrations, some of the MPCA's guidance and recommendations for chloride management based on strategies outlined in the Twin Cities Chloride Management Plan (MPCA, 2016) are included in this technical memorandum. These strategies are focused on prevention rather than treatment, as there are currently no cost-effective or scalable treatment practices to remove chloride from surface water. Below are a sample of chloride reduction strategies targeted at both road salt application and water softener usage within the subwatershed.

Road Salt Reduction Strategies:

- Support local and state winter maintenance crews in their efforts to reduce their salt use
- Work with local government, businesses, schools, churches and non-profits to find ways to reduce salt use
- Encourage slow driving
- Shovel, rather than apply salt to melt snow and ice
- Use appropriate salt ratio: 4 pounds of salt per 1000 square feet

Water Softener Salt Reduction Strategies:

- Consider if a water softener is needed – test water for hardness
- Change from a timer-based to a demand-based softener that recharges only when needed, based on how much water is used
- Install a bypass so landscape irrigation water is not softened

The MPCA has also created guidance for monitoring surface waters that are categorized as high-risk for chloride impairment. The MPCA suggests the following guidance for additional monitoring of high-risk waters:

1. Identify dates or periods of past chloride concentrations that were either:
    a. Exceedances (exceeded the chronic chloride standard), and
    b. "high" occurrences, defining "high" as less than but within 10% of the chronic standard (thus >207 mg/L)

2. Select a 4-week period centered on each such date or period, and for each:
    a. Sample for chloride weekly, always on the same day of the week
    b. Sample at the same depth or depths as in past sampling

3. If an electrical conductivity meter is available, take and record a "matching" conductivity reading with each lab sample taken:
    a. "matching" = from the same primary sample that provides the lab subsample, if the primary sample is a sufficiently larger volume than the laboratory bottle used; or otherwise
    b. "matching" = same location and depth as the lab sample

4. Possible expanded effort:
    a. Monitor twice weekly rather than once, always on the same days of the week (e.g., Monday and Thursday) including, as resources permit:
        i. Chloride sample and conductivity measurement if possible
        ii. Chloride sample only if lacking conductivity meter
        iii. Conductivity measurement only on the increased frequency if laboratory costs limit sampling but a meter is available

Sampling for chloride at least weekly during the selected 4-week period(s) is a necessary minimum effort for ensuring the value of this additional monitoring; conductivity measurements alone will not suffice at present. This could change in the future if a reliable and accurate relationship between chloride and conductivity is developed for an individual waterbody.

There are dozens of other resources to reference for reducing salt use through application and policy at the following website: https://www.pca.state.mn.us/water/statewide-chloride-resources.

3.3 Planning-level opinions of probable cost of BMP retrofits

Barr developed planning-level cost estimates for each conceptual design and performed cost-benefit analyses, as shown in Table 2. As feasibility-level concepts, there is significant cost uncertainty associated with the proposed projects. The planning-level opinion of costs include a 25-percent contingency and estimated cost ranges of -30 percent to +50 percent. Additionally, we estimated the engineering cost for the design of each proposed project as 40 percent of the total cost. This 40-percent fee includes 30-percent engineering and design and 10-percent construction observation and administration. These costs assume that no wetland mitigation will be required as part of these projects, no contaminated soils will be encountered, and no purchase of easements or properties will be required.

Table 2 Summary of planning-level opinions of probable costs for BMPs in the Gervais Creek subwatershed

Proposed Project	planning-level opinion of cost[1,2]	estimated engineering cost[3]	total project cost
Yorkton Boulevard Rain Garden	$48,800 ($34,200-$73,200)	$19,500	$68,300 ($53,700-$92,700)
Precision Landscape Rain Garden Location 1	$23,200 ($16,200-$34,800)	$9,300	$32,500 ($25,500-$44,100)
Precision Landscape Rain Garden Location 2	$37,300 ($28,300-$60,600)	$15,000	$52,300 ($43,300-$75,600)
Little Canada Road East Offices Rain Garden	$93,000 ($65,100-$139,500)	$37,200	$130,200 ($102,300-$176,700)
Spooner Park Rain Garden	$14,800 ($10,300-$22,100)	$5,900	$20,700 ($16,200-$28,000)
Terrace Heights Rain Garden	$58,900 ($41,200-$88,300)	$23,600	$82,500 ($64,800-$111,900)
South Owasso Boulevard East Pond	$619,600 ($433,700-$929,400)	$247,900	$867,500 ($681,600-$1,177,300)

[1] Costs include 25-percent contingency. These do not include costs related to education and outreach, legal, long-term maintenance, or monitoring. Costs are represented as a feasibility-level class 4 cost estimate as defined by the Association for the Advancement of Cost Estimating with a +50% /-30% uncertainty.

[2] These costs assume that no wetland mitigation will be required as part of these projects, and that contaminated soils will not be encountered.

[3] Engineering cost is estimated to be 40 percent of the construction cost, excluding the purchase of properties and/or easements. This cost includes engineering and design and construction observation and administration.

To estimate the cost benefit for each proposed BMP retrofit project, Barr calculated annualized costs for each proposed BMP per pound of phosphorus removed. Table 3 presents the annualized costs as a range for BMP lifespans of 20 to 35 years. The capital cost used for each BMP includes the opinion of probable cost and the engineering design cost. Annual costs include an estimated annual maintenance cost for the BMPs and an assumed interest rate of 4 percent.

Table 3 Summary of annualized costs for BMPs in the Gervais Creek subwatershed

Proposed BMP	Annual cost per pound of TP removed ($/lb.)[1]	Annual cost per pound of TSS removed ($/lb.)[1]
Yorkton Boulevard Rain Garden	$3,100-$4,100	$17-$23
Precision Landscape Rain Garden Location 1	$5,900-$7,800	$32-$42
Precision Landscape Rain Garden Location 2	$2,400-$3,100	$13-$18
Little Canada Road East Offices Rain Garden	$2,300-$3,000	$12-$17
Spooner Park Rain Garden	$6,500-$8,500	$36-$47
Terrace Heights Rain Garden	$2,100-$2,800	$12-$15
South Owasso Boulevard East Pond	$2,300-$3,000	$5-$7

[1] Range represents the annualized cost based on a 35-year and 20-year lifespan at an interest rate of 4 percent.

3.4 Permits

The following permits may be required for one or more of the proposed BMP retrofit projects:

- **Fill permit (City of Little Canada):** An excavating and grading permit application (fill permit), along with an erosion control plan, must be submitted with the final grading plans to the City of Little Canada any time a significant amount of soil is being displaced or a drainage pattern is being altered. If disturbed area is greater than 1 acre, watershed and National Pollutant Discharge Elimination System permits will be required.
- **Right-of-way permit (City of Little Canada):** Any work in the public rights of way requires a city right-of-way permit.
- **Erosion and sediment control (RWMWD):** An erosion and sediment control permit is required if the proposed land disturbance is greater than 1 acre or if the proposed land disturbance is within the 100-year floodplain and greater than 10,000 square feet. If required, an erosion and sediment control plan must be submitted with the permit application.
- **Flood Control (RWMWD):** This permit is required because some work for the Owasso Pond may cause alterations of land below the 100-year flood elevation. The following are required for flood control management:
    - No placement of fill within the 100-year floodplain without compensatory storage.
    - Emergency overflow swales or areas must be constructed to convey the peak 100-year discharge.

- **Stormwater Management (RWMWD):** This permit is required due to land disturbing activities greater than on acre. The following are required for storm water management:
    - Rate control – Runoff rates shall not exceed existing runoff rates for the 2-year, 10-year, and 100-year critical storm events.
    - Volume reduction – Runoff volume reduction shall be achieved onsite in the amount equivalent to the runoff generated form a one-inch rainfall over the impervious surfaces of the development
    - Water quality – Developments must incorporate effective non-point source pollution reduction BMPs to achieve 90% total suspended solids removal for a 2.5" rainfall event.

4.0 Meetings

Barr staff presented the alternatives from this memo to the RWMWD Board of Managers on October 7, 2020. The Managers reacted favorably to the projects and indicated that they should be included in the project prioritization tool to be considered for future implementation. The Owasso Basin Pond alternative will continue to be pursued as part of the Owasso Basin Flood Study. Additionally, the Managers were interested in continuing to implement chloride reduction strategies in the subwatershed.

Discussion related to meetings with the RWMWD, City of Little Canada, or other property owners can be included in this section, if they occur.

5.0 Summary and recommendations

This memo includes conceptual design of seven water quality improvement BMP opportunities at six site locations to improve water quality of runoff entering Gervais Creek from the Gervais Creek subwatershed. Of the rain garden concepts, the Terrace Heights and Little Canada Road East offices rain gardens provide the best cost benefit for reducing TP loading to Gervais Creek. The Yorkton Avenue and Precision Landscape and Tree rain garden options provide a higher cost benefit for reducing TP loading to Gervais Creek, but may provide aesthetic value to the industrial neighborhoods near Owasso Basin. The Spooner Park rain garden option exhibits the highest rain garden cost benefit for reducing TP loading to Gervais Creek, but would have significant visibility with the opportunity for an educational component. Barr recommends including these projects in the District's project prioritization tool for comparison against other potential projects that have been identified through feasibility studies.

The South Owasso Boulevard East pond concept may provide flood management opportunities in conjunction with water quality improvements and may also benefit the community by providing aesthetic value to the industrial neighborhood. The South Owasso Boulevard East pond exhibits the highest reduction in downstream TP loading by up to 23.7 pounds per year. Barr recommends pursuing this option as the Owasso Basin Bypass Pipeline Feasibility Study progresses in the fall of 2020 and into 2021.

It is possible that the exact location of the pond, if pursued, could be shifted to the industrial lot to the east of the vacant lot (closer to Owasso Basin itself), based on plans the City of Little Canada may have for the area in the future.

While structural BMPs can help reduce TP loading to Gervais Creek, we also recommend considering other activities that could improve the water quality in the subwatershed, including:

- Regular maintenance of existing BMPs including rain garden vegetation trimming, inlet maintenance, cleanout of hydrodynamic structures, etc.
- Continued public education and outreach in the subwatershed about stormwater runoff and at-home practices that can be adopted to improve runoff water quality.
- Inspection and maintenance of stormwater ponds within the subwatershed. Recommended maintenance activities include dredging, inlet cleanout, and/or chemical treatment of the water or sediments.

6.0 References

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