City of Ramsey
Agenda
Environmental Policy Board (EPB)
Monday, July 19, 2021
6:30 pm
Council Chambers, 7550 Sunwood Drive NW

Remote Attendance available at www.cityoframsey.com/meetings. To maximize social distancing due to the COVID-19 Pandemic, those that can join remotely are encouraged to do so. Those joining remotely and requesting to speak are asked to use a webcam when speaking.

1. Call to Order

2. Citizen Input

3. Approve Agenda

4. Approve Minutes

1. Approve Meeting Minutes Dated June 28, 2021

5. Policy Board Business

1. Review Tree Preservation Plan Request for Trott Brook North

2. Consider Request for Variance to Deviate from Wetland Setback Requirement on Three Lots in Williams Woods (Project No. 20-138); Case of Landform and Bill Boyum

3. Consider Landscape Plan for Knoll Properties 2nd Addition

4. Environmental Policy Board Work Plan Update

6. Board/Staff Input

7. Adjournment

Environmental Policy Board (EPB) **4. 1.**

Meeting Date: 07/19/2021

By: Chris Anderson, Community Development

Information

Title:

Approve Meeting Minutes Dated June 28, 2021

Action:

Attachments

Meeting Minutes Dated June 28, 2021

Form Review

Inbox	Reviewed By	Date
Bruce Westby	Brian McCann	07/15/2021 04:05 PM
Form Started By: Chris Anderson		Started On: 07/15/2021 12:28 PM
Final Approval Date: 07/15/2021		

ENVIRONMENTAL POLICY BOARD
CITY OF RAMSEY
ANOKA COUNTY
STATE OF MINNESOTA

On Monday, June 28, 2021, the Environmental Policy Board (EPB) met in the Council Chambers at the Ramsey Municipal Center, 7550 Sunwood Drive N.W., Ramsey, Minnesota.

Members Present:	Chairperson Jane Covart Board Member Melissa Fetterley Board Member Michael Hiatt Board Member Jared Little Board Member Laura Moore Board Member Michael Valentine
Members Absent:	Board Member Reid Bernard
Also Present:	City Planner Chris Anderson City Council Liaison Chelsee Howell

1. CALL TO ORDER

Chairperson Covart called the meeting to order at 6:30 p.m.

2. CITIZEN INPUT

None.

3. APPROVE AGENDA

Motion by Board Member Little and seconded by Board Member Hiatt to approve the agenda as submitted.

A roll call vote was performed:

Board Member Valentine	aye
Board Member Moore	aye
Board Member Fetterley	aye
Board Member Little	aye
Board Member Hiatt	aye
Chair Covart	aye

Motion carried.

4. APPROVE MINUTES

4.01: Approve Meeting Minutes Dated May 17, 2021

Motion by Board Member Hiatt and seconded by Board Member Little to approve the regular meeting minutes dated May 17, 2021.

A roll call vote was performed:

Board Member Moore	aye
Board Member Valentine	aye
Board Member Little	aye
Board Member Hiatt	aye
Board Member Fetterley	aye
Chair Covart	aye

Motion carried.

5. POLICY BOARD BUSINESS

5.01: Review Lower Rum River Watershed Management Organization's Draft 4th Generation Plan

City Planner Anderson presented the staff report. He stated that the Lower Rum River Watershed Management Organization (LRRWMO) has drafted its 4th Generation Plan (their equivalent to a Comprehensive Plan) and distributed it for comments. The 60-day comment period will end on July 27, 2021. Any requested revisions must be submitted to the LRRWMO before the aforementioned deadline. This will be the EPB's only opportunity to provide advisory comments on the draft 4th Generation Plan. The LRRWMO 4th Generation Plan will also be forwarded to City Council for its consideration and for formal direction to submit any advisory comments to the LRRWMO. He reviewed the comments staff noted within the report.

Board Member Hiatt referenced the classification of the three lakes and asked the previous classification of the lakes.

City Planner Anderson commented that he was unsure. He noted that this question arose several years ago when the City was asked to look at some concerns with what is known as Rogers Lake.

Board Member Hiatt asked if this is an intentional tightening of those classifications and not a random change.

City Planner Anderson commented that he believes it could be an oversight or misclassification.

Motion by Board Member Little and seconded by Board Member Hiatt to forward all comments on the plan to City Council for consideration.

A roll call vote was performed:

Board Member Fetterley	aye
Board Member Valentine	aye
Board Member Moore	aye
Board Member Hiatt	aye

Board Member Little aye
Chair Covart aye

Motion carried.

5.02: Consider Recycling Program Funding for 2022

City Planner Anderson presented the staff report. He stated that the purpose of the case is to get initial feedback from the EPB on potential funding opportunities for the recycling program in 2022. The City's recycling program is funded through the Select Committee On Recycling and the Environment (SCORE) program. Annually, the City must submit a funding request to Anoka County for SCORE funds for the upcoming year. Typically, each community is allocated base funding of $10,000, plus $5 per household. In 2021, Ramsey's base funding allocation, along with enhancement funding was $41,650.

Board Member Fetterley asked if the question is whether the Board would support using those buildings for those purposes.

City Planner Anderson clarified that there is a portion of one of the buildings that was identified for future recycling use and therefore he is seeking feedback on whether to explore how to use a portion of that building for a mini recycling center. He stated that he did not want to start gathering information without input from the Board.

Board Member Fetterley asked if any other cities are pursuing those kinds of opportunities.

City Planner Anderson commented that many cities in Anoka County have a space where residents can drop items off for recycling within their city hall. He noted that some cities in Anoka County have full blown recycling centers, such as Coon Rapids. He noted that Andover and Nowthen also have year-round recycling centers. He stated that the intention would be to have a smaller scale opportunity in Ramsey.

Board Member Fetterley commented that this would be a great opportunity as often people want to do the right thing but do not always have the ability. She believed it would get great use from the community.

Board Member Little agreed.

Board Member Hiatt commented that his family often uses the Andover location. He asked if there would be additional funding resources if the program were expanded in this nature or whether the City would continue to receive the same level of SCORE funds.

City Planner Anderson commented that there is another category of funding that could be made available and provided additional details on the SCORE funds. He noted that it clearly states that the City should not solely rely on this type of funding to support this type of operation and the funds are intended to help implement new programs and ideas.

Board Member Hiatt commented that he believes this would be a great idea but would want to ensure the plan is well thought out and attended to. He noted that one location he has visited is

much better taken care of than a location in another community. He recognized that ongoing maintenance and attention would require ongoing funding and a system in order to move materials out and keep the area clean.

City Planner Anderson commented that staff is proposing baby steps, on a very small scale as this would be an unstaffed area. He recognized that there would be logistics that would need to be worked out in order to determine what would be needed. He stated that they are not contemplating a large-scale recycling center and do not want to get off on the wrong foot and be negatively impacted.

Board Member Hiatt commented that the spring and fall recycling days show that there would be support for this type of activity and the demand could grow with residents making good use of the opportunity. He stated that if the demand is there, there could be more funding dedicated from the City to grow the opportunity.

Chair Covart asked for details on the recycling events and whether the cost for the event is covered by the vendors.

City Planner Anderson commented that the event is not entirely self-sustaining, and the City incurs some costs to host the events.

Board Member Little asked if this is still in the rough draft phase and whether it would come back once further tuned.

City Planner Anderson commented that there could be an opportunity to bring this back to the Board at the July meeting if desired. He stated that he would need to ensure he could bring this to the Council at its second meeting in July to submit the grant application.

Board Member Hiatt asked if there is a timeframe in which some other use could occupy this space in the public works facility if this does not move forward quickly.

City Planner Anderson commented that a small space in the public works facility has been and will continue to be planned for recycling. He stated that the time sensitivity would be related to the deadline for the grant application with Anoka County.

Board Member Fetterley commented that she would support pursuing this opportunity.

Board Member Moore agreed that this is a great idea and supported submitting the application and attempting to move forward in a small-scale opportunity to begin this in the right way.

City Planner Anderson commented that ACE Solid Waste has a micro drop-off for organics and other recycling at its property as well.

Chair Covart confirmed consensus of the Board to support staff submitting the grant application to explore additional opportunities for recycling.

City Planner Anderson welcomed any additional recycling ideas the Board may have.

Chair Covart commented that cardboard recycling was popular and noted that there would seem to be a continued demand for that.

City Planner Anderson commented that the Public Works Committee decided not to explore that opportunity at this time because of the opportunity ACE Solid Waste is offering at its facility. He noted that perhaps that conversation be revisited again in the future.

5.03: Environmental Policy Board Work Plan Update

City Planner Anderson presented the staff report. He stated that the EPB has a draft Work Plan that was prepared as the City Council was initiating its strategic planning noting that the Strategic Plan was adopted by the Council on June 22, 2021. As was noted during the development of the draft Work Plan, once the Council adopted its Strategic Plan, the EPB would need to review that document and their Work Plan to make any necessary adjustments.

Board Member Hiatt stated that he would not be opposed to this but asked what the EPB would be asked to do in order to make this happen.

City Planner Anderson commented that this would be related to research on what other communities have done in terms of open space preservation and by using the natural resources inventory to identify properties that could be considered if there were willing sellers. He noted that this would simply explore mechanisms that could support that possibility.

Board Member Hiatt stated that perhaps this is related to exploring the feasibility of whether there are areas worth protecting and that this would be more related to policy development than action.

City Planner Anderson confirmed that although this is listed as an action item within the Strategic Plan it would be more policy related and information gathering.

Board Member Hiatt stated that he would encourage and support looking into that concept.

Chair Covart asked if this would be land that would be brought to the City or whether the City would be looking for land for this purpose.

City Planner Anderson stated that it is his understanding that this would be to look for ways in which the City could fund acquisition of higher quality areas. He noted that could occur as part of development proposals that come forward or willing seller. He noted that some cities have been successful using a referendum to gather funds that the city then used to acquire properties for open space preservation.

Chair Covart asked if these types of funding sources have already come to the attention of staff or whether that would be expanded.

City Planner Anderson stated that staff has not yet begun to explore this concept but noted that some additional funding sources came to the attention of staff during the Riverstone South planning in order to preserve the wooded area.

Board Member Valentine commented that this seems like a significant task compared to the other items on the EPB Work Plan. He stated that he does not see a clear picture of how the EPB would fit into that task.

City Planner Anderson stated that perhaps the discussion on this is tabled and he can gather additional information from staff members that were part of the strategic planning discussion with the Council in order to bring more information to the Board.

Board Member Fetterley agreed that she would find more information helpful. She stated that she does not understand how this item got on the radar of the Council or why it became a goal.

Councilmember Howell stated that the Riverstone South project initiated the discussion because of the need to find funding for that element. She stated that the information presented is a fairly accurate description as there was not a much broader discussion.

Chair Covart stated that she would prefer to have additional information and asked if this is time sensitive or if it could be postponed.

City Planner Anderson commented that this would simply be researching how the City could fund protection of open space and would not include identification of any certain parcels but how the activity could be funded. He noted that he would be more than happy to gather additional information for the July meeting for the Board to review. He noted that he would propose to carry over the language from the Strategic Plan to the EPB Work Plan.

Board Member Moore commented that she would prefer to leave the language as generic and open as possible to provide flexibility for things that may come up. She stated that she is very interested in adding this to the Work Plan in some form and is also interested in any mechanism that would allow the City to preserve open space areas.

Board Member Fetterley stated that she also supports protection of open spaces but is unsure if she could support the wording. She stated that it would seem that the funding is going to be considered by referendum and would prefer to leave it open to all potential funding mechanisms and not pigeonhole into that one source.

City Planner Anderson stated that when the Work Plan moves forward to the City Council for review there would be an opportunity to expand the discussion with the Council. He confirmed that he would bring this back to the Board in July.

5.04: Review Tree Preservation Plan Request for Trott Brook North

City Planner Anderson presented the staff report. He stated that the purpose of the case is to review a request from the Excelsior Group on the project generally known as Trott Brook North which is the area between Variolite Street and Nowthen Boulevard NW, north of Trott Brook. The application has requested a deviation from the City's standard tree preservation plan.

Board Member Little asked for input as to what would be considered a negative in allowing this plan to move forward.

City Planner Anderson commented that on the surface the concern would be whether the standards are being applied consistently and fairly. He stated that the tree inventory is based on inches rather than total trees and therefore there could be a deviation, although perhaps not significantly. He explained that there will be a lot of plantings with this large development along with areas of tree preservation. He noted that the applicant has stated that there would be more time and cost to provide a review in inches. He asked if the Board feels that this method would provide a fairly accurate depiction of what exists and what would need to be replaced.

Board Member Little commented that he has experience working with trees and he believes that this method would provide accurate information. He stated that in his opinion he believes that this would be an accurate method but agreed the question would be whether the City wants to deviate from policy.

Board Member Hiatt recognized that this was a planted area and therefore the type and size should be similar for the trees as they were planted at the same time. He stated that if this method is going to be allowed it should be noted that this was a planted area and not naturally occurring, in order to prevent precedent from being set.

Board Member Little stated that if this method is approved, he would agree to specify that was allowed because it was an artificially planted area.

Board Member Hiatt asked how staff feels about this method.

City Planner Anderson commented that he agrees it would give a fair representation of what is out there. He agreed that it would be critical to mention that this was allowed because it is unique in that it was a planted area in order to avoid setting precedent. He stated that the hardest challenge would be determining reforestation requirements if the removal threshold is exceeded.

Board Member Fetterley commented that this would be an exception to the normal process, and she would be hesitant although this seems like a fair method proposed. She asked if the Board wants to allow another reason for exceptions. She asked if there are other areas similar to this in Ramsey.

Board Member Valentine commented that this would seem to be a situation that points out a need for the City to have a process to systematically address variances. He stated that perhaps the developer would need to follow a variance request to request this approach for evaluating the site. He stated that there probably would not be a problem with this method but would be hesitant without having a more systematic variance request the developer could follow. He commented that if this approach is going to be allowed there should be a thorough statistical analysis.

Board Member Little asked how many more plots would exist to this.

City Planner Anderson commented that there are other pockets of plantings similar in nature but did not have an estimate. He stated that the group could choose to support this because of the planted setting along with perhaps consideration of a potential ordinance amendment that would dictate that this approach would be acceptable in certain circumstances. He stated that he could speak with the City Attorney to determine if the variance process could be applied in this case. He

stated that a third option would be to state that this method does not meet the Code and the typical process would need to be followed.

Chair Covart commented that she likes efficiency and understands the request from the developer but would prefer to follow City Code.

Board Member Fetterley asked if a sample of accuracy could be provided. She commented that she does not feel that she has enough information to say an exception could be granted.

Board Member Hiatt stated that it might be helpful to know what the developer is looking at in terms of cost savings and energy savings. He stated that if the potential to be reasonably accurate is there and it would cost five times as much to complete the review required by Code, he would see that as a reasonable request. He stated that he wants to work with developers when it makes sense. He noted that City Planner Anderson stated that this method could be fairly accurate, and the statement could be made that this is being allowed because it is unique in that it was a planted area. He believed that the developer should provide that additional information to support their request. He stated that two examples were given of where this method is used, but neither seems really comparable to this situation.

Board Member Valentine commented that it is not that complex to determine whether or not this would be a similar method for calculation and characterization of the area. He stated that it does not appear there is full support for this approach as of yet.

Chair Covart asked that staff bring this back at the next meeting with additional information provided and an invitation for the developer to attend.

City Planner Anderson stated that he agrees from a forestry standpoint this would be accurate, but the question would be related to the deviation from policy. He stated that if this method is found to be acceptable, he would prefer direction to amend the Code to allow an alternative method such as this when certain conditions are met.

Board Member Moore commented that she is unsure that she would feel comfortable changing Code requirements for this type of development. She noted that from the aerial map there are two properties that could fall under the same characterization, along with other areas in Ramsey. She stated that she would not be comfortable changing the requirements for the tree count and vegetation count for this type of development. She stated that the role of the EPB is not to make it easier for developers.

Chair Covart commented that perhaps the developer would not need to attend the July meeting and the information desired could simply be provided by staff.

Board Member Little stated that he would be curious as to the cost of doing the calculation under Code as well as the cost to use the method proposed by the developer. He stated that he would find that information helpful in making a determination on whether it would be appropriate to consider amending the Code.

6. BOARD / STAFF INPUT

No comments.

7. ADJOURNMENT

Motion by Board Member Little and seconded by Board Member Fetterley to adjourn the meeting.

A roll call vote was performed:

Board Member Moore	aye
Board Member Valentine	aye
Board Member Hiatt	aye
Board Member Fetterley	aye
Board Member Little	aye
Chair Covart	aye

Motion carried.

The meeting adjourned at 7:53 p.m.

Respectfully submitted,

_____
Chris Anderson
City Planner

ATTEST:

_____
JoAnn Shaw
Community Development Secretary

Drafted by Amanda Staple
TimeSaver Off Site Secretarial, Inc.

Environmental Policy Board (EPB) **5. 1.**

Meeting Date: 07/19/2021

By: Chris Anderson, Community Development

Information

Title:

Review Tree Preservation Plan Request for Trott Brook North

Purpose/Background:

At the June 28, 2021 Environmental Policy Board (EPB) meeting, the Board reviewed a request from a developer to utilize a Fixed Radius Plot (FRP) sampling technique to survey trees in a planted setting (a full tree inventory would be completed for all naturally occurring trees except those outside the development area, which is compliant with City Code). The EPB raised questions about cost/time savings and accuracy of such a sampling technique. The attached memorandum from Kjolhaug Environmental Services Company attempts to address those questions.

Observations/Alternatives:

Summary of Proposed Development Plan

- Number of lots: 270
- Developable Acreage: 124 Acres
- Zoning: R-1 Residential (MUSA) (Single Family Homes with 80 foot wide lots)
- Comprehensive Plan: Low Density Residential
- Net Density: 2.2 Units/Acre
- Dedicated Park Area: 13.4 Acres

Summary of Proposed Sampling Technique

Per the attached memorandum, the proposed FRP sampling technique would only be utilized in an area where the trees were planted, rather than occurring naturally. The FRP method would establish 1/10 acre plots within the roughly 17 acre planted area and all trees within that plot would be surveyed. The results would be extrapolated out to the entire planted area to provide a per acre relative basal area (equivalent to diameter inches), relative species abundance, and relative health condition for the planted area stand of trees.

Additional Information from Developer

The proposed method is estimated to reduce the labor hours for surveying the approximately seventeen (17) acres of planted trees by almost 150 hours. A cost savings was not provided (Staff has requested this information), but the estimated time savings does appear significant.

The EPB had requested additional information about the accuracy of this type of sampling as well. The memorandum includes multiple attachments of various studies that have been conducted on sampling techniques and their accuracy. FRP appears to be considered an accurate sampling technique.

Formal Process

Staff has reached out to the City Attorney regarding whether this type of sampling technique would require a formal variance. As of the writing of this case, a response has not been received. Staff hopes to be able to provide a verbal update on this at the meeting.

If a formal variance would be required, that would be routed through the EPB and then to the Planning Commission (authority on variances). If a formal variance is not required, any recommendation of the EPB would be forwarded to City Council for consideration.

Action:
Based on discussion.

Attachments

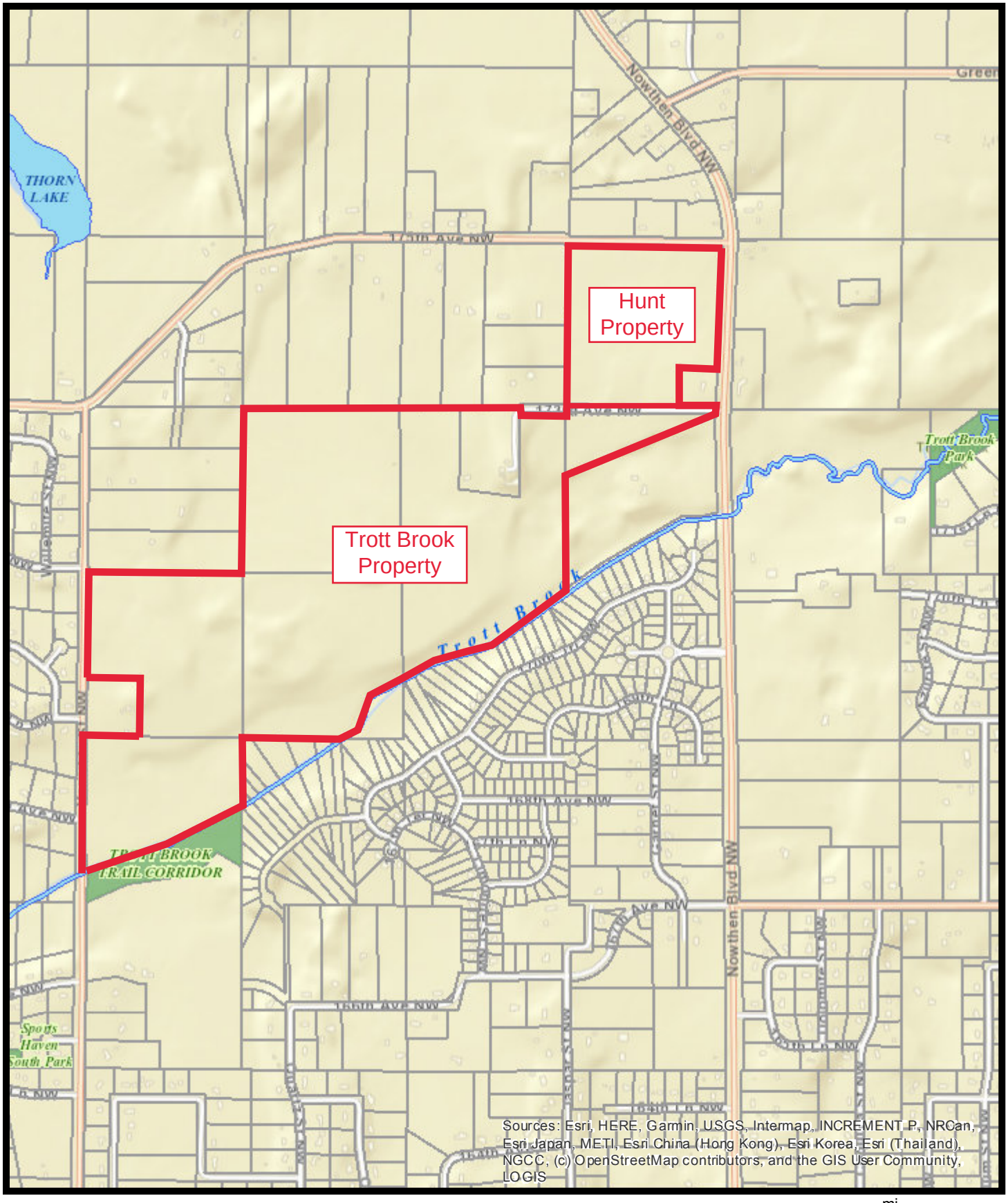
Site Location Map (Trott Brook Property Only)
Original Proposal
July 15, 2021 Memorandum from Developer

Form Review

Inbox	Reviewed By	Date
Bruce Westby	Brian McCann	07/15/2021 04:05 PM
Form Started By: Chris Anderson		Started On: 07/15/2021 10:48 AM
Final Approval Date: 07/15/2021		

Subject Properties

Trott Brook and Hunt Properties



March 18, 2020

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Providing Sound, Balanced, Comprehensive Natural Resource Solutions

Memorandum

Date: June 7, 2021

To: The City of Ramsey, MN

CC: Tracey Rust, Excelsior Group, LLC

From: Kyle Uhler, Kjolhaug Environmental Services Company (KES)

Re: Site Tree Survey Methods – Trott Brook Property Ramsey, MN (KES#2021-108)

The Trott Brook Property will be surveyed for the presence and extent of significant trees. The site was located in Section 9 & 10, Township 32N, Range 25W, City of Ramsey, Anoka County, Minnesota. Generally, the site was located north of Trout Brook, west of Nowthen Boulevard NW, south of 173rd Ave NW, and west of Variolite Street NW. The site boundaries corresponded to Anoka County PID: 10-32-25-21-0002, 10-32-25-22-0003, 10-32-25-22-0002, 09-32-25-11-0001, 09-32-25-14-0001, 09-32-25-13-0001, and 09-32-25-42-0003.

The 195.92-acres site was comprised of approximately 27.7 acres of trees observed in planted rows and growing naturally dispersed adjacent to the cropped areas. The purpose of this memo is to explain the survey methods that will be utilized to capture significant tree locations within the project boundaries as defined by the City of Ramsey; MN Code of Ordinances *Sec. 117-327 (C)(2) defines Significant Trees:*

a. *All species of oak that have a DBH of four inches or greater;*
b. *All evergreen species that have a DBH of four inches or greater; and*
c. *All other trees that have a DBH of eight inches or more.*

Tree Survey Methods

Natural Wooded Areas Survey (Figure 1)

- All significant trees located in "Natural Woodland" will be sampled, approximately 10.9-acres.
- All significant trees located within wetland impacts will be sampled.
- All significant trees sampled would capture species, DBH, location, and health condition.

Planted Wooded Areas Plot Survey (Figure 2)

- The plot survey will utilize 17 randomly located 1/10th acre plots centered systematically across the contiguous planted woodland. The planted woodland cover approximately ~16.58 acres on the site, so this method would sample 1.7-ac of that area.
- From each plot center all significant trees will be sampled within a 37.2 ft radius. Only plot centers with a minimal distance of 37.2 feet form the edge of the planted woodland edge were utilized.
- All significant trees sampled would be sampled for species, DBH, location, and health condition.

Summary

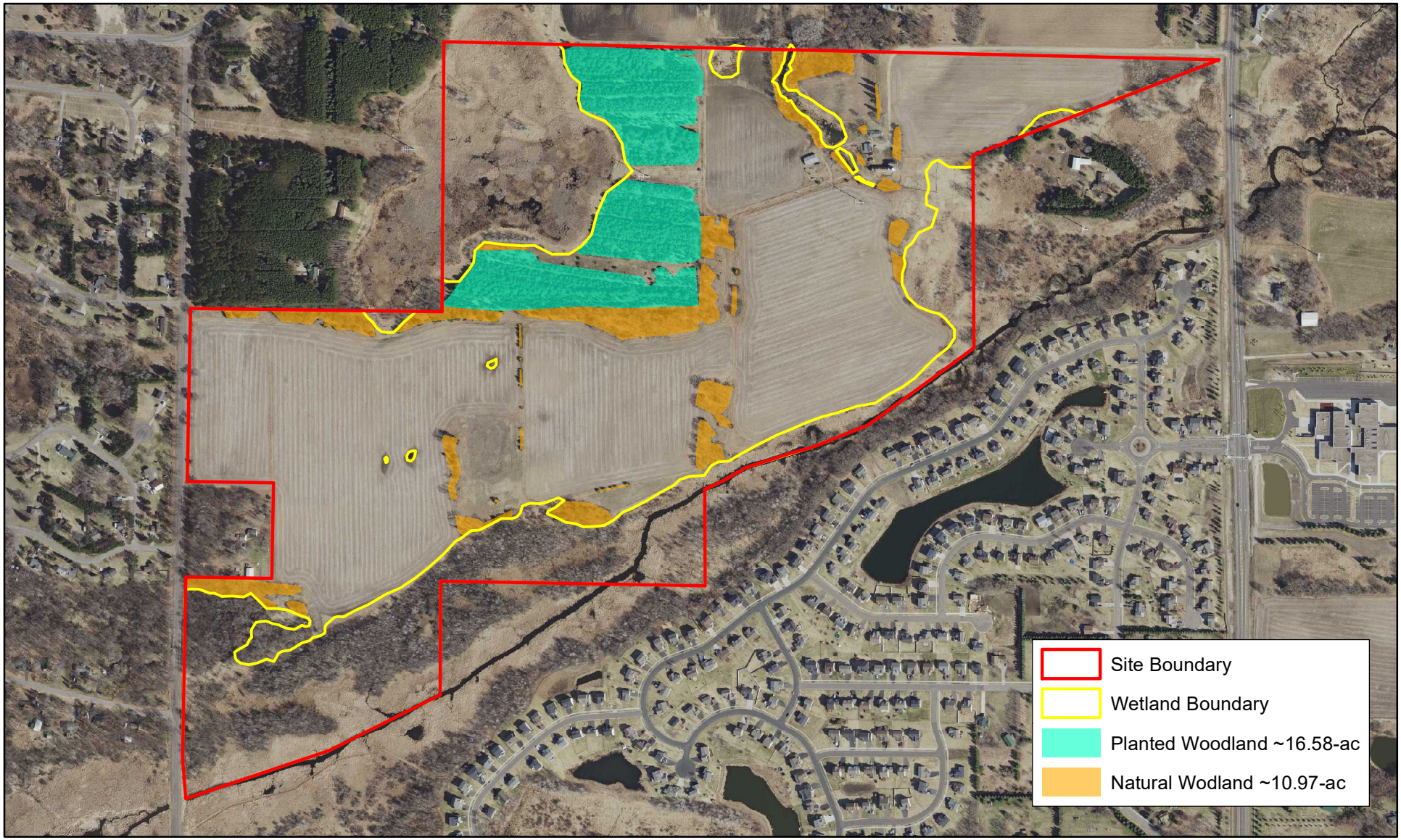
This method will produce; (1) the total basal area, species, location, and health condition for all trees in the natural woodland, (2) a per acre relative basal area, relative species abundances, and relative specie condition for the planted woodland areas. This survey will create a site-specific tree inventory for the Trott Brook Property in Ramsey, MN.

Trout Brook Property - Ramsey, MN

Site Assessment for Significant Trees

FIGURES

1. Tree Survey Overview
2. Planted Woodland Method



Tree Survey Overview

N

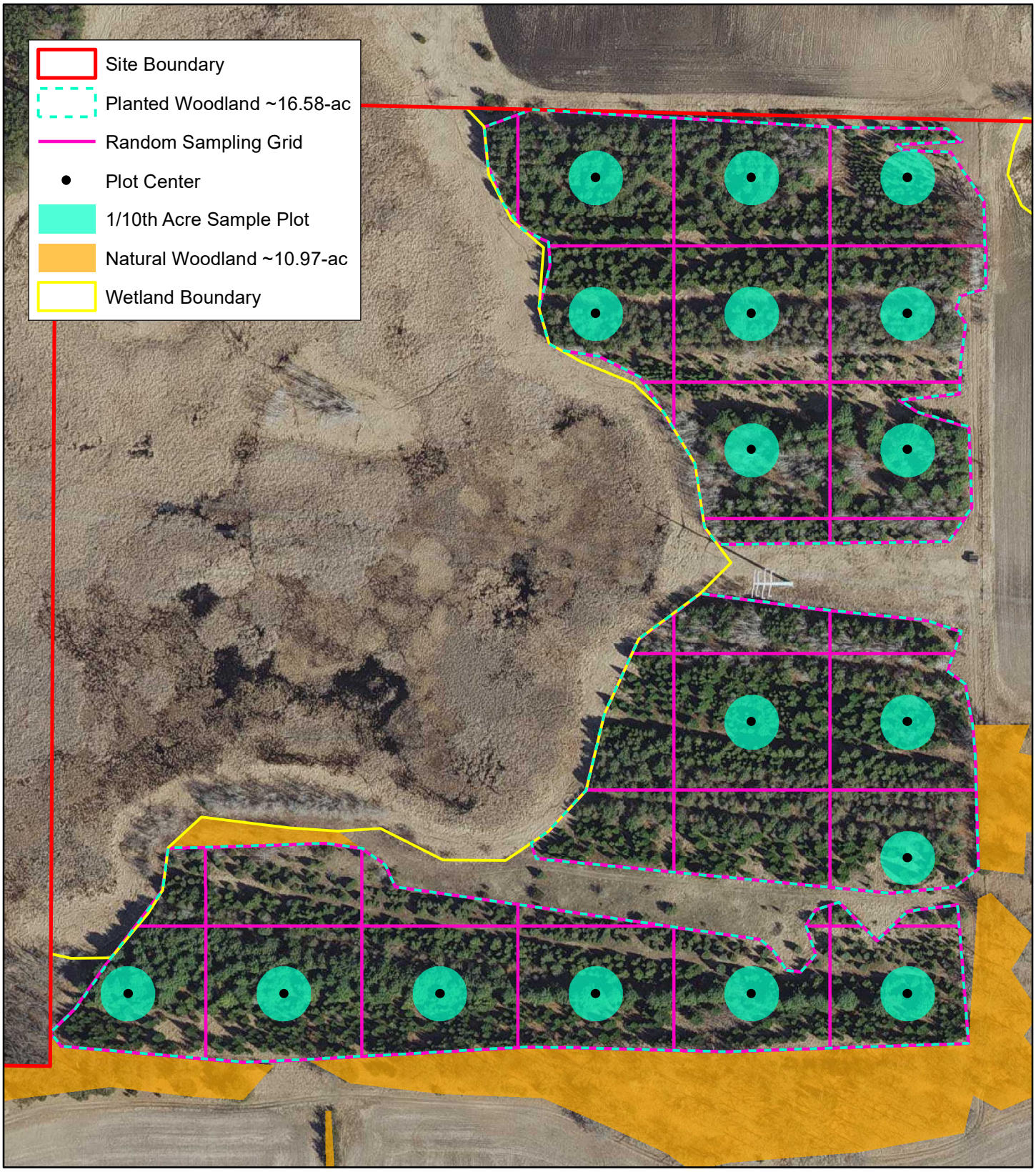
0 500 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons

Trott Brook Property (KES 2021-108)
Ramsey, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.



Planted Woodland Proposed Sampling Method 6/7/2021

N

0 185 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons

Trott Brook Property (KES 2021-108)
Ramsey, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Providing Sound, Balanced, Comprehensive Natural Resource Solutions

Memorandum

Date: July 15, 2021

To: The City of Ramsey, MN

CC: Tracey Rust, Excelsior Group, LLC

Mark Kjolhaug, Kjolhaug Environmental Services Company (KES)

From: Kyle Uhler, Kjolhaug Environmental Services Company (KES)

Re: Proposed Tree Survey Methods – Trott Brook Site Ramsey, MN (KES 2021-108)

The Trott Brook Site will be surveyed for the presence and extent of significant trees. The site was located in Section 9 and 10, Township 32N, Range 25W, City of Ramsey, Anoka County, Minnesota. Generally, the site was located north of Trott Brook, west of Nowthen Boulevard NW, and south of 173rd Ave NW (**Figure 1**).

The 196-acre site was comprised of approximately 27.55 acres of trees grouped into two woodland types; Natural and Planted. The purpose of this memo is to provide additional information about the proposed tree survey methods for the Trott Brook site.

Natural Woodland Areas Sampling Method

Within the natural woodland areas (**Figure 1**) all significant trees will be surveyed as defined by the City of Ramsey, MN Code of Ordinances *Sec. 117-327.* Significant trees shall include:

a.
b. All species of oak that have a DBH of four inches or greater;
c. All evergreen species that have a DBH of four inches or greater;
d. All other trees that have a DBH of eight inches or more; and
e. All dead or diseased trees will be included in the survey.

The natural woodland represents the long-term character of the Trott Brook site. Much of the natural woodland can be seen in the 1964 MNHAPO Imagery (**Figure 2**).

Planted Woodland Areas Sampling Method

Within the planted woodland areas, a Fixed Radius Plot Sampling (FRPs) method is proposed to sample significant trees. All significant trees within the FRPs will be surveyed as defined by the City of Ramsey, MN Code of Ordinances *Sec. 117-327.* FRPs are a common method utilized by foresters for developing management plans and commercial timber sales. The FRPs method is utilized on large relatively homogenous "stands" of trees. Stands are defined by the Natural Resources Conservation Services (NRCS) as, relatively uniform with respect to age, dominant crown cover, density, species composition, and landform. This method samples all individual trees at a defined distance from a center point. The plot locations are located throughout contiguous stands of trees at systematically centered $1/10^{th}$ acre plots. We chose $1/10^{th}$ acre plot size because of scalability e.g., every tree in a plot equals 10 trees per acre (**Figure 3**).

There are clear benefits to FRPs as they reduce the amount of labor and people on-site, are ideal for evenly aged stands or plantations with low diversity and produces simple statistics, trees per acre and basal area per acre (ACES, 2020). The 2002 Proceedings of the Oklahoma Academy of Science concluded that FRPs were the most time-efficient sampling method and produced the most accurate estimate of all stems in a stand regardless of size. Furthermore, this method was shown to yield an 88% relative accuracy based on the total number of trees sampled (Nowak 2008). The drawback to a FRPs would be that it can minimize larger individual trees within the stand that are not recorded. This drawback is diminished greatly because the area was planted less than 30 years ago and has low diversity. So, one would not expect significant size variation between sampled individuals and non-sampled individuals of the same species.

The fix plot method will provide accurate and cost-effective sampling method to determine the volume of trees per acre in the planted area. The planted woodland area is perfectly suited for a FRPs subsampling method due to;

- Similarly aged stand that was established between the 1991 USGS aerial image and the 2003 FSA (**Figure 4**).
- The trees are uniformly dense because they were planted.
- Species composition is low. Area dominated by planted Scots pine, Colorado blue spruce, and white spruce trees.
- The landform is similar throughout the planted woodland i.e., trees planted under similar constraints will produce uniform morphology.

Proposed Sampling Method Effects on Labor Cost

The Trott Brook site has approximately 16.58-ac of planted trees with an estimated density of ~300 trees per acre. If this tree stand is greater or equal to past surveys that would produce ≥ 4,974 trees in the planted woodland. One crew can record approximately 30 trees per hour (depending on understory conditions), that equals ~165+ hours of tagging trees (not including accessing the site, data quality control, data packaging, and figure creation).

Utilizing the fixed plot sampling would reduce the time tagging in the planted woodland to approximately ~17 hours with a total time saving of ~148 hours of labor.

Summary

This method will produce; (1) the total basal area, species, location, and health condition for all trees in the natural woodland, (2) a per acre relative basal area, relative species abundances, and relative health condition for the planted woodland areas. The proposed study methods will result in an accurate and efficient tree survey for the Trott Brook Property in Ramsey, MN.

Thank You

References

Alabama Cooperative Extension System (ACES). (2020, January 6). *Fixed-Radius Plots as Inventory Method in Southern Forests*. https://www.aces.edu/blog/topics/forestry/fixed-radius-plots-as-inventory-method-in-southern-forests/

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Nowak, D.J. et.al. Arboriculture & Urban Forestry (2008). 34(6):386-390. *Effect of Plot and Sample Size on Timing and Precision of Urban Forest Assessments.* https://www.nrs.fs.fed.us_nrs_2008_nowak_003

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Trott Brook Property - Ramsey, MN

Site Assessment for Significant Trees

FIGURES

1. Tree Survey Location & Overview
2. 1964 Historical Imagery
3. Fixed Radius Plots Method
4. Pre/Post Tree Planting Aerial Imagery

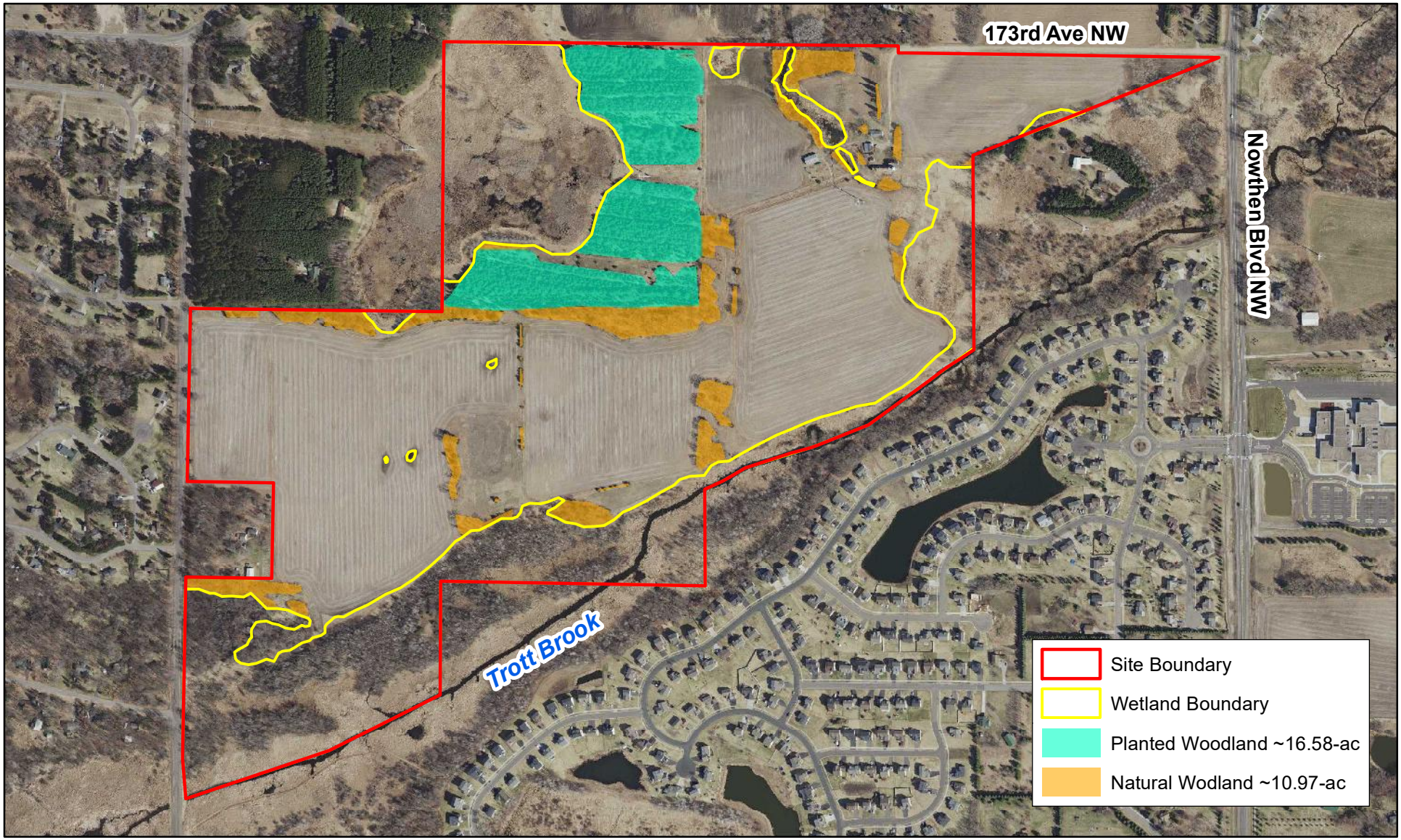

Figure 1 - Site location & Tree Survey Overview (2020 Imagery)

N

0 500 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons

Trott Brook Property (KES 2021-108)
Ramsey, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

Figure 2 - 1964 Historical Aerial Imagery

N

0 500 Feet

Site Boundary

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNHAPO

Trott Brook Property (KES 2021-108)
Ramsey, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

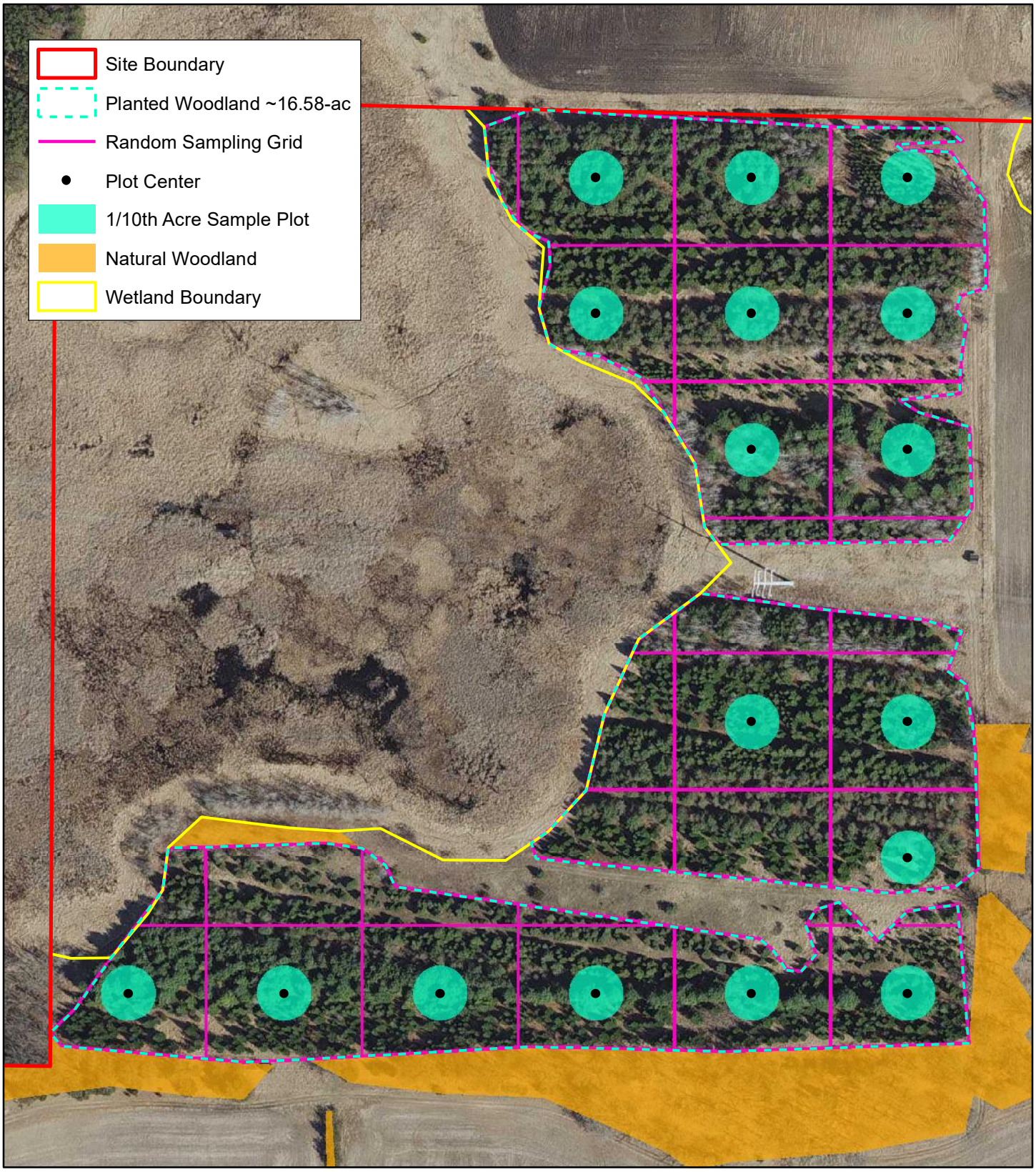

Figure 3 - Fixed Radius Plots Sampling Method (2020 Imagery)

N

0 185 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons

Trott Brook Property (KES 2021-108)
Ramsey, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

Figure 4 - Pre/Post Tree Planting Aerial Imagery

N

0 500 Feet

Site Boundary

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: USGS, FSA

Trott Brook Property (KES 2021-108)
Ramsey, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

Trott Brook Property - Ramsey, MN

Site Assessment for Significant Trees

Appendix A

Reference Documentation

United States Department of Agriculture
Natural Resources Conservation Service
July 2018

Forestry
Technical Note No. FOR–1

Forestry Inventory Methods

Issued July 2018

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Table of Contents

FORESTRY INVENTORY METHODS 1
General Information 1
Forest Stand Inventory 1
Stand Mapping 1
Choice of Inventory Methods 1
Purpose of Inventory 2
Stand Summary Information 3
Method 4
Point Sampling (or Variable-Radius Plot Sampling) 4
Fixed Plot Sampling 11
Strip Sampling 13
Tree Planting Inventory 14
Plot Sampling Methods for Tree Planting Inventory 15
Crop Tree Inventory and Demonstration 20
Zig-Zag Transect Method 23
References 25

FORESTRY INVENTORY METHODS

General Information

Title 180, National Planning Procedures Handbook (NPPH), Part 600, Subpart C, Section 600.23, "Inventory Resources," describes the resource inventory process used to collect information about a planning area's resources and related offsite information. Inventory information is used to determine the condition and trends of the resources, identify resource concerns and opportunities, and formulate and evaluate the effects of alternatives. The level of detail needed for an inventory depends on the level of planning—a forest management plan may utilize generalized information while a practice implementation plan will often require greater detail and statistical reliability.

This technical note provides a description of the common inventory methods and tools used in forestry and agroforestry applications and describes the methods used to conduct resource inventories that support planning processes for forestland.

Forest land is defined in Title 440, Conservation Programs Manual, Part 502, Subpart A, Section 502.0, "Definitions," as—

> "a land cover/use category that is at least 10 percent stocked by single-stemmed woody species of any size that will be at least 4 meters (13 feet) tall at maturity. Also included is land bearing evidence of natural regeneration of tree cover (cut over forest or abandoned farmland) that is not currently developed for nonforest use. Ten-percent stocked, when viewed from a vertical direction, equates to an aerial canopy cover of leaves and branches of 25 percent or greater. The minimum area for classification as forest land is 1 acre, and the area must be at least 100 feet wide."

Forest Stand Inventory

Stand Mapping

Prior to conducting an inventory, forested areas are mapped into relatively homogenous units (i.e., stands). Stands are relatively uniform with respect to aspect, dominant crown class, stocking density, species composition, landforms, etc. Information used for stand mapping includes using orthophotos, topographic images, soil maps, and ecological site descriptions. Information on geology, wetlands, and vegetation may also be useful. Refer to Web Soil Survey at website https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm for detailed soils information. Stand boundaries can be refined in the field with spatial data.

Choice of Inventory Methods

Generally applied methods for inventorying forest stands include point sampling (also known as variable-radius plot sampling) and fixed plot sampling. Methods applicable to specific situations, depending on stand conditions and objectives of the inventory, include strip sampling, line transect sampling, crop-tree inventory, and the zig-zag transect. The method chosen must be appropriate for the geographic location and condition of the stand and efficient with regard to information collected in a given amount of time.

Point and fixed plot sampling methods are used to collect information for developing management plans and silvicultural prescriptions. The inventory typically includes plot-level measurements that are summarized to provide stand-level information including site index, basal area ((BA), sq.ft./acre), trees per acre (TPA), species present in each canopy class from dominants to ground vegetation, size class, wood or nontimber production potential, and other metrics needed to plan and schedule future management activities, or implement near-term activities.

There are a number of considerations in choosing between point and fixed plot methods. Fixed plots may be better suited to large stands with low variability; generally, in these situations, fewer plots are needed for an adequate sample size than if point sampling is used. In many stands, especially those with open understories, point sampling usually requires less time per plot which allows more plots to be sampled. A relatively larger number of plots is needed to provide statistically reliable estimates in stands with variable density and a diversity of tree species (Oderwald 1981).

Plot sampling and strip sampling methods are based on measuring a percentage of the stand. A proportion of the area is measured based on the assumption that the samples are representative of the entire stand. The percentage of the area sampled depends on how the information will be used as well as the uniformity of the stand and its size. For most planning purposes, a low intensity inventory is sufficient. Sampling percentages can range from as low as 0.2 percent using fixed-radius regeneration plots in homogeneous stands, up to 20 percent for variable-radius plots in diverse forests of a small acreage. As acreage increases, inventory intensity typically decreases. A complete discussion on statistical sampling intensity can be found in forest mensuration textbooks, such as Avery and Burkhart (1994).

Strip sampling is a form of fixed plot sampling using long, narrow plots. This method may be suitable for sites with variation due to environmental gradients.

Transect sampling is often used for seedling survival inventories. It is an efficient method when the number of entities is the main attribute of interest.

Crop tree inventory identifies desired trees to retain for objectives that may include wildlife habitat, visual quality, water quality, timber and nontimber products, and others. A crop-tree inventory is supplemented with a demonstration plot to illustrate forest management concepts and allow landowners to determine the desired intensity of management.

The zig-zag transect method was developed by NRCS, then known as the Soil Conservation Service (SCS), in the 1960s. It allowed SCS foresters to use a simplified process to quantify forest tree and stand characteristics and was useful in communicating information to landowners. Although the zig-zag transect method is no longer a common inventory technique, under certain stand conditions it is an efficient method to use and provides good estimates for stands that are dominated by one tree species, are even-aged, and have a narrow diameter range.

Purpose of Inventory

Forest inventories are conducted for different purposes, but in NRCS they usually support the development of a forest management plan (FMP) or a conservation plan.

Inventory methods are chosen to—

- Collect information that addresses client objectives.
- Suit site conditions.
- Provide efficiency and cost-effectiveness.

The inventory—

- Is the basis for identifying, assessing, and addressing resource concerns.
- Collects ancillary information needed for the forest management plan such as maps.

Some inventories meet multiple needs, such as qualifying landowners for State programs, and may require specific types of information.

The components of an FMP are listed in the Cooperative Forestry Assistance Act of 1978 (16 U.S.C. Sec. 2103a), Section 5(f)(1)(B), as referenced in the Food, Conservation, and Energy Act of 2008 (16 U.S.C. Sec. 3839aa), Section 2506(a)(4). An FMP "identifies and describes actions to be taken by the landowner to protect soil, water, range, aesthetic quality, recreation, timber, water, and fish and wildlife resources on such land in a manner that is compatible with the objectives of the landowner."

- Criteria for the NRCS FMP are included in Title 190, National Forestry Manual (NFM), Part 536, Subpart B, Section 536.10, "Forest Management Plan Criteria."
- As a general rule, FMPs should be reviewed and updated as necessary every 10 years, as recommended in the document "Understanding Your Plan: A Guide for Landowners using Managing Your Woodlands: A Template for Your Plans for the Future" (USDA NRCS, and USDA-Forest Service. 2015c (revised)).
- The NRCS State conservationist may publish supplemental guidance or information on how to complete an FMP.

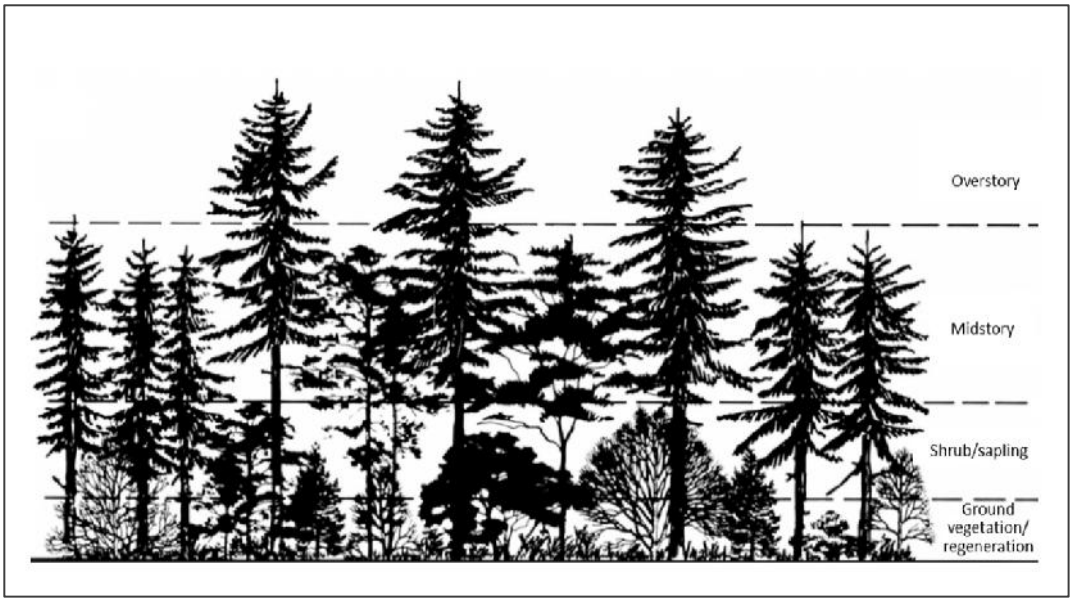
Stand Summary Information

Stand-level summaries provide information that allows foresters to describe current and potential future conditions to landowners, as an aid in setting goals for their property. Desired summaries may include stand-level information on structure by crown class and canopy stratification, average tree crown ratio, average tree growth rate, site index, diameter distribution, etc. Stand summaries are developed using various methods. Refer to State's "Resource Concern and Planning Criteria" document in the Field Office Technical Guide (FOTG), Section III, for guidance in selecting additional measurement and assessment tools.

- Stand Structure.—May be described by age classes or by canopy layers, from overstory to ground vegetation. Figure 1 shows the vegetation strata often found in a forest. Crown classes include dominants, codominants, intermediate, and overtopped.
- Crown Ratio.—Along with describing a stand by the different crown classes, crown ratio is a descriptive characteristic that conveys how well a tree is currently able to make use of available light for photosynthesis and how well it can be expected to respond to release. Crown ratio is simply what percentage of the total height of the tree includes live crown. An open grown tree may have nearly 100 percent crown ratio, while a suppressed tree has less than 25 percent.
- Tree Growth and Site Index

- Representative trees in the dominant crown class of each species in the stand are cored using an increment borer to determine tree age and growth. Choose a tree that is not growing close to a road or open area, as those trees express a growth advantage over trees deeper in the stand. Recording the radial growth for the past 10 years is a common practice. Noting the best 10 years growth is useful to understand potential growth and possible expectation of response to management activities.
- Site index trees, usually the same trees sampled for growth, are measured for age and height to determine stand growth potential. Site index curves are available from your forester. A cautionary note is that if the stand you are working in has been selectively harvested with numerous entries where the best lumber-producing trees were removed, the representative trees available may not offer an accurate site index.
- Site index information for a limited selection of tree species is often available by soil series from the Web Soil Survey at website https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Figure 1: Vertical Stratification in a Forest Stand



Graphic Adapted From Brown (1985)

Method

Point Sampling (or Variable-Radius Plot Sampling)

Point sampling, also known as variable-radius plot sampling, is a widely used forest inventory technique in which trees are selected and tallied based on their size relative to a preselected reference, either the BA prism or angle gauge. Results of point sampling can yield BA, TPA, and species composition depicted in a diameter distribution table if desired. Stand volume can also be estimated using point data.

- Determining the Number of Plots

- A low-intensity inventory is usually adequate for developing a forest management plan. The specific number of plots needed will vary, even for a low-intensity inventory. A stand that is relatively homogeneous in species composition and tree age can be represented with fewer plots, but as variability increases, so does the number of plots needed to provide adequate estimates of stand parameters.
- Table 1 offers minimum recommendations based on published sources and typical usage, but the optimal number of plots varies by forest type and other stand characteristics.

Table 1: Recommended Minimum Number of Plots for Low-Intensity Forest Inventory in Stands of Various Sizes

Acres	Minimum # of plots
10 or less	3
11–20	6
21–40	10
41–150	15
>150	1 plot/10 acres

- The minimum guideline of three plots for stands of 10 acres or less follows USDA-Forest Service (2015), which notes this recommendation is for homogenous stands. Other sources recommend a larger number of plots (e.g., Wenger 1984). Stand variability will determine the number of plots needed. Consult an area or State forester for recommendations on optimal numbers of plots to use in your location.
- For situations where a known level of statistical reliability is desired, refer to methods for determining the number of plots needed to provide an acceptable sampling error. See, for example, the "Number of Plots" discussion in chapter 2 of the FSVeg Common Stand Exam User Guide, Version: 2.12.6. (USDA-Forest Service 2015).

- Selecting Plot Locations
  - Plot locations are chosen without bias, so that all forested acres are equally represented in the sample. One way to locate plots is by using systematic sampling, which involves developing a parallel line pattern on a map with the plots evenly spaced along lines (fig. 2). Orienting the lines north-south or east-west makes it easier to establish on the ground, but other orientations may be used, such as aligning with a slope gradient. Make sure the sampling design places plots far enough away from property lines so that all the "in" trees are in the stand of interest. Plot locations can be preloaded into a device that uses spatial data (e.g., a data recorder, GPS navigation system, etc.). Alternatively, the distance between plots can be paced; in this case, bias will be reduced by stopping at the correctly paced distance even if the location is inconvenient.

Figure 2: Example of a Systematic Line-Plot Sampling Layout

- Another sampling protocol that limits bias involves using random distances and azimuths to locate plots. Note that it is possible, even when plots are located correctly using random or systematic protocols, that the resulting sampling design may not represent all parts of a stand equally. Sample enough plots that these random effects will not significantly affect stand-level summary data.

- Using the Prism
  - A wedge prism is an angle-cut glass at a given basal area factor (BAF). Trees are sighted through the prism at 4.5 feet above ground, or diameter at breast height (DBH). Trees are counted as either "in" or "out." If the bole displacement as viewed through the prism overlaps, the tree is in (fig. 3). Include every other borderline tree. At each sample point, keep the prism over the plot center and rotate around the prism in one direction only.
  - Note that a relatively small tree will need to be close to the plot center to be counted in, while a large tree can be quite far away.
- Using an Angle Gauge
  - An angle gauge works on the same principle as a prism. Unlike a prism, the eye is kept at plot center and the gauge is moved in a circle. An angle gauge such as the cruz-all has several BAFs in one tool. A tree is considered out if the bole is narrower than the sides of the chosen BAF (fig. 4).
  - A desirable number of trees per plot is between 5 and 12. If the number of trees in the plot tends to be fewer than 5, choose a prism or angle guage with a smaller BAF; if the plots routinely have more than 12 in trees, a larger BAF is appropriate. A stand of large trees requires a higher BAF and a stand of small trees a lower BAF. Keep the same BAF throughout the stand to simplify calculations later. As a recommendation, prior to conducting a forest cruise take a quick walk through the stand, using a prism or angle gauge occasionally to determine the appropriate BAF.

Figure 3: View of Tree Through Wedge Prism

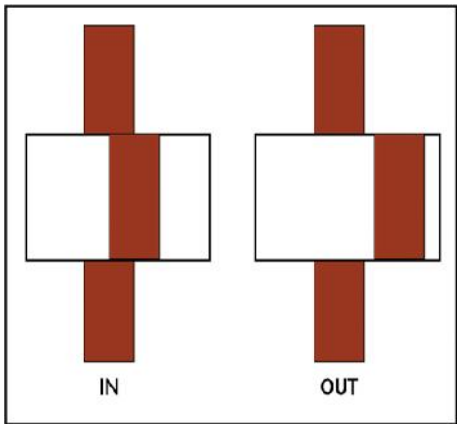
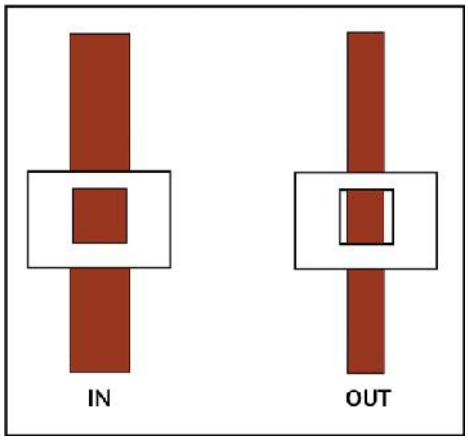
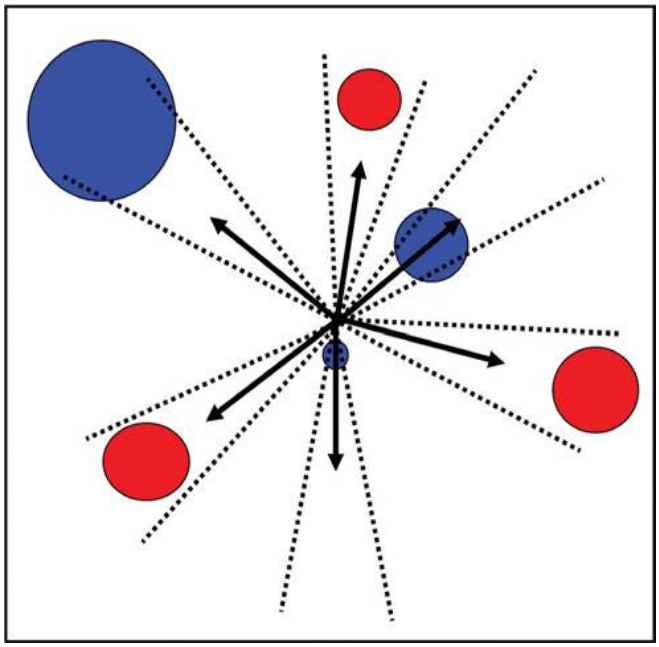


Figure 4: View of Tree Through Angle Gauge



- Establishing the Plot
  - At plot center, pivot in one direction, making a complete circle. Where to start the pivot is optional; some choose a cardinal direction, others simply the nearest tree. Use the wedge prism or angle gauge to identify trees that are in the plot. Inventory data will only be collected on the trees that are in the plot.
  - Note that each region will have a size threshold where trees below a certain diameter will not be included in a point sample; these trees will be sampled in regeneration plots. Consult with a forester on the lower size limit for point sampling.
  - If a tree is growing at an angle, tilt the prism or gauge to match. If the tree is obscured from view at DBH, either step away from plot center, maintaining the same distance to the tree in question, or target the tree above the obstruction. All trees counted in should be tallied by species and DBH within a 2-inch diameter class, at a minimum. Mark the plot center for reference if you need to physically measure the tree diameters; the eye quickly becomes calibrated and accurate ocular estimates of tree diameter can be achieved, but check your eye with actual measurements periodically.
  - Borderline trees are on the edge of the plot where it is difficult to determine whether they are in (fig. 5). The simplest approach is to count every other borderline tree as in; this approach provides an estimate of stand characteristics that is sufficient for most planning applications. If greater accuracy is desired, measure the distance from plot center to the borderline tree as per methods in appendix J of the FSVeg Common Stand Exam User Guide, Version: 2.12.6. (USDA-Forest Service 2015).

Figure 5: Trees indicated by blue circles are within the variable-radius plot; trees in red are outside the plot. Images used by permission of Pacific Northwest extension.



- Collecting Plot Data
  - Utilize a "tally sheet" (also known as a "cruise sheet"), similar to the one shown in figure 6, for recording plot data. Field data recorders with programmed tally sheets may be used.
  - For each tree in the plot—
    - Determine and record tree species using standard codes. Codes used by the Forest Inventory and Assessment (FIA) program are recommended for consistency; see appendix F in O'Connell et al. (2016).
    - Measure the diameter at DBH (4.5 feet) using a diameter tape, and record the measurement to the nearest inch.
    - Rate the tree's condition as vigorous, fair, or declining. A vigorous tree does not show signs of stress; it has a full healthy crown, no evidence of scars, wounds, or disease, and little or no epicormic branching. A declining tree may have a broken top, multiple forks, canker, wounds, scars, and disease; however, such trees may have high value for wildlife. Assign "fair" as an intermediate rating. Do not include species desirability in the condition rating; rate each tree on its merits, without regard to species. Record the condition rating in the field notes.
    - In the "notes" section, describe the reason for the tree's rating. Note features of the tree that are important as wildlife habitat, aesthetics, economic value, etc.

Figure 6: Example Tally Sheet With Three Plots

Notes on filling out cruise sheet													
Keep the same basal area factor **(BAF)** and fixed plot size		Property:	Producer/Stand 1			BAF:	10					
for all plots in a stand.		Date:			Fixed Plot Size:	1/100th ac						
In species column, record "in" trees as they occur while		Cruiser:	NRCS Planner		Field Office:							
pivoting in one circular direction.						GRTH/						
		WyPt	Plot	SPECIES	DBH	AGE	20ths	HT	CR %			
Use the dot grid tally to save space: DF alone is one tree,		256	1	DF	10		WEST ASPECT					
DF* is two trees, ect. The dot tally can include up to				DF*	12		30% SLOPE					
10 trees.				DF*	16							
Basal area "in" trees are 10" and greater Diameter Breast Height				DF**	14		OREGON GRAPE,					
(DBH) collected in 2" diameter classes.			R	LP**	8		KINNICKINICK,					
Trees 8" and smaller are recorded in nested fixed plot as				WL	6		PINE GRASS					
regeneration **(R)**; a 1/100th ac plot measures 11.8'				LP*	6							
and a 1/300th ac plot measures 6.8'												
Regeneration can be recorded by actual diameter or in		257	2	DF	16		SOME SPRUCE BUDWORM					
classes: 0-1, 2-3, 4-5, 6-7 and 8-9.				DF	14		NOT TOO BAD					
A growth tree **(GT)** is often a plot tree, however when it isn't,				WL*	12.4	75	10	62	40			
record it on its own line.				WL*	10							
Measure and record growth of the last 10 yrs.				SNAG	18							
Age is total age; need to add how many years it took for			R	DF**	0-1							
tree to reach DBH. When in doubt, use 10 yrs.												
Crown ratio **(CR)** is % of tree with live crown.			GT	DF	16.2	96	12	75	50			
Record a snag **(S)** as it occurs in the plot as if they were a separate												
species and you can determine snags per acre.		258	3	DF	14							
You can make additional notes recording insect or disease,				LP	10							
understory, aspect, or slope in unused space on right				LP	12							
side of cruise sheet.				DF	10							
				DF	12							
			R	DF*	0-1							

Note that this is only an example; consult a forester for a tally sheet adjusted to local forest types.

- Basic Inventory Calculations
  - A programmed spreadsheet is useful in making these calculations efficiently and consistently. Check with a local or State forester to see if a spreadsheet is available.
  - Determining BA
    - BA.—A measure of how much of an acre is occupied by trees. Each forest type has a BA range that is optimal for individual tree growth. Determining BA is fairly simple:

      BA = (total trees tallied ÷ total # of plots) × BAF
    - In the example, only BAs for trees 10 inches DBH and greater are determined. There are 19 trees 10 inches DBH and greater, so: 19÷3×10 BAF = 63 square feet of BA per acre.
  - Determining TPA

- TPA is a measure of stand density. Each tree size class has a recommended stocking level that can be expressed as TPA. Determining TPA in point sampling is more complicated than when using fixed plots. The tree tally must be expanded to a per acre basis and diameter classes summed for a total TPA. Again, a programmed worksheet simplifies this process.

  TPA = # of trees tallied × BAF ÷ BA per tree ÷ total number of plots

  Where BA per tree = $0.005454 \times DBH^2$

  The BA for a 10-inch DBH tree = $0.005454 \times 10^2 = 0.5454$

  The BAF in the cruise example is 10.

  Five trees are tallied in the 10-inch DBH class.

  TPA for 10-inch DBH class = 5 tallied trees × 10 BAF ÷ 0.5454÷3 plots = 31 trees per acre

  If this calculation is carried out for the remaining diameter classes found in the cruise:

  TPA for 12-inch DBH class = $6 \times 10 \div 0.7853 \div 3 = 25$ TPA

  TPA for 14-inch DBH class = $5 \times 10 \div 1.068 \div 3 = 16$ TPA

  TPA for 16-inch DBH class = $3 \times 10 \div 1.396 \div 3 = 7$ TPA

  Total = 79 TPA 10-inch DBH and greater

- Diameter Distribution Table

  A diameter distribution table is a useful visual to help with the decision-making process for possible management options. Using a programmed worksheet or applications such as the Forest Vegetation Simulator (FVS), a diameter distribution table can be developed for each stand, broken down by species (see table 2).

- Volume of merchantable and nonmerchantable timber and biomass

  It is possible to develop timber volume estimates using information collected during point sampling; however, the accuracy of a volume estimate depends on attributes such as tree form and defect. Collecting this type of information requires specialized training. In instances where volume estimates are desired, consult an area or State forester.

Table 2: Example Stand-Level Diameter Distribution Table Using 2-Inch Size Classes Between 10 and 18 Inches DBH

	Douglas-Fir		**Lodgepole Pine**		**Western Larch**	
DBH	TPA	BA	TPA	BA	TPA	BA
10	12	7	6	3	12	7
12	13	10	4	3	8	7
14	16	16	0	0	0	0
16	7	10	0	0	0	0
18	0	0	0	0	0	0
Totals	**48**	**43**	**10**	**6**	**20**	**14**

- Tree Regeneration Sampling in Conjunction With Point Sampling
  - To obtain a complete stand description, consider collecting nested fixed-radius plots for trees in the seedling, sapling, or pole size at the same time as conducting point sampling of the stand overstory. A fixed-radius plot with the same plot center as the point sample can yield useful information for either a forest management plan or a conservation practice job sheet. Plot size is dependent on tree density.
  - Choose a plot size that will capture stocking without having to count more trees than necessary; a cursory walk through the stand will help determine an appropriate plot size. If tree density appears low enough that a 1/300th acre plot will often be empty, where a 1/100th acre plot will capture regeneration, then utilize the larger plot. Conversely, when surveying an extremely dense stand, the smaller plot is better to avoid missing stems. As with the BA factor, keep the same plot size for the entire stand to make expansion calculations easier.
  - Calculating Regeneration TPA

    Using the example tally sheet in figure 6, the fixed area plots are 1/100th acre in size (11.8 feet).

    There were 11 trees tallied in the 8-inch diameter class and smaller. So,

    TPA = 11 counted trees × 100 / 3 = 366 trees per acre
  - Again, a diameter distribution table is very useful to help target treatment options (table 3).

Table 3: Example Stand-Level Conifer Regeneration Table Showing Number of Trees in Seedling, Sapling, and Pole Size Classes

DBH	**Douglas-Fir**	**Lodgepole Pine**	**Western Larch**	**Totals**
0–1	167	0	0	167
2–3	0	0	0	0
4–5	0	0	0	0
6–7	0	66	33	99
8–9	0	100	0	100
Totals	**167**	**166**	**33**	**366 TPA**

Note that in different geographic areas and forest types, size classes are defined differently, so that some of the DBH classes shown in this table would be part of overstory tallies.

Fixed Plot Sampling

In fixed plot sampling, a set of plots, generally all the same size, are located throughout the area. Plots can be any shape; circular plots are commonly used because it is convenient to set up a plot of this shape from a single center point, but rectangular plots are equally acceptable. The number and size of plots is determined by the desired inventory intensity, stand variability, and stand size.

An adequate total sampled area is needed for accurate estimates of stand-level characteristics. A standard size for fixed plots may have been established regionally; in this case the number of plots sampled may be varied to reach the desired total sampled area.

A smaller number of plots is often acceptable in locations where there is relatively low variability in stand density and composition; more plots are needed in stands with high variability. The number of plots along with plot sizes determines the total area sampled, generally expressed as a percentage of the stand area. Consult a local forestry expert for optimal sampling percentages.

Sample plots may be located throughout the area in a number of ways.

- One method is to locate the plots systematically, at predetermined intervals on lines that are a set distance apart (fig. 7).
- Other methods utilize randomly generated distances and azimuths to select random plots, sometimes using rejection criteria for unnatural disturbances or nonforested locations.
- Ecological site descriptions often use deliberate placement of plots to capture a reference state, however a forest inventory requires an unbiased sample.

Nested subplots, all sharing the same center, are often used to capture sequentially smaller size classes (e.g., 1/5th acre plot for sawtimber, 1/10th acre for pole class, and 1/300th for seedling/saplings).

Refer to table 4 for the radii commonly used to construct plots of various sizes. See also the discussion in the section “Point Sampling” on page 4 of this TN. To calculate sampling percentage, the formula is—

(total plot size in acres/acres represented) × 100 = % inventory

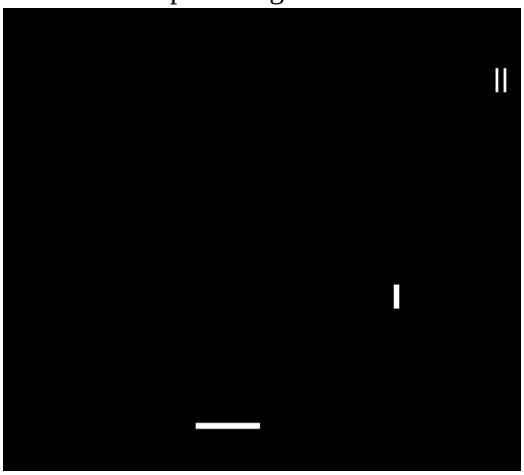
Using the systematic 1/4 acre plot sampling scenario shown in figure 7 as an example:

Total the number of plots.
Multiply by the area of each plot.
Divide by area of the stand.
Convert the figure to a percentage.

This percentage is the amount of the total stand area included in the sample.

((17 plots × 0.25 ac) / 40 ac) × 100 = 10.6% inventory

Figure 7: Example of a Systematic Line-Plot Sampling Layout for a 10-Percent Sample Using Fixed Plots in a 40-Acre Stand



Many features of point sampling and fixed plot sampling are identical.

- The number and location of plot centers are determined in the same manner.
- Methods for determining which borderline trees to sample are the same.
- Tree measurements (diameter, height, defects, etc.) are also measured or estimated by methods similar to those used in point sampling.
- The primary difference between the two methods is that fixed plot sampling requires measurement of plot dimensions. Also, fixed plots may be less efficient in stands with a large number of small trees, because of the additional time required to measure them.

Table 4: Commonly Utilized Dimensions for Fixed Plot Sampling, Showing Radii for Circular Plots

Plot Dimensions
1/1000-acre plot = 3.7-foot radius or 6.6 feet × 6.6 feet
1/500-acre plot = 5.3-foot radius or 9.3 feet × 9.3 feet
1/250-acre plot = 7.4-foot radius or 13.2 feet × 13.2 feet
1/100-acre plot = 11.8-foot radius or 20.9 feet × 20.9 feet
1/300 –acre plot = 6.8-foot radius or 12 feet × 12 feet
1/20-acre plot = 26.3-foot radius or 46.7 feet × 46.7 feet
1/10-acre plot = 37.2-foot radius or 66 feet × 66 feet
1/4-acre plot = 58.9-foot radius or 104.4 feet × 104.4 feet
1/5-acre plot = 52.7-foot radius or 93.3 feet × 93.3 feet
1/2-acre plot = 83.3-foot radius or 147.6 feet × 147.6 feet
1-acre plot = 118-foot radius or 208.7 feet × 208.7 feet

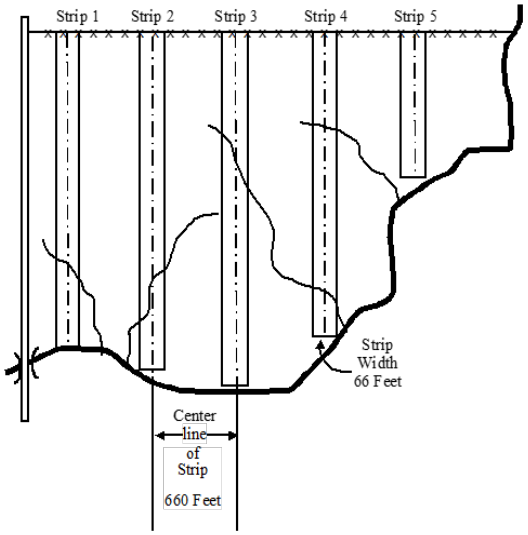
Strip Sampling

In strip sampling, the sample units are continuous strips of uniform width, spaced at a predetermined distance apart. The width of the strips and the distance between the centerline of the strips determines the percentage of the area sampled.

Strips are often used in tropical forests where there is such a dense understory that point sampling is limited by visibility.

These designs may also be useful in areas with strong environmental gradients, usually due to steep slopes, where they are oriented perpendiculuar to the slope. See figure 8 for an example of a strip sampling design.

Figure 8: Example Strip Sampling Layout



Tree Planting Inventory

Many factors can affect the postplanting success of tree and shrub establishment projects. Negative factors may include adverse weather conditions or livestock trampling, or other biotic and abiotic causes of mortality.

Regular inspections of tree planting sites or direct seeding sites are necessary to identify the many factors affecting survival and growth. Inspections help determine whether there are needs for replanting; additional weed control; moisture management; protection from deer, rabbits, or other herbivores; management of insect or disease problems; etc.

It is important to note that factors such as improper seedling shipping, handling, onsite storage, or planting procedures are elements of the actual tree planting project.

- These issues must be addressed in a properly designed job sheet, combined with the oversight of an experienced tree planting supervisor during the time of planting.
- These causes for failure are not the same as the ones that are the focus of tree planting inventories.
- The methods described in this section can be used to evaluate most newly planted tree and shrub establishment practices and very young plantations.

Timing for Inspections

Generally, survival should be assessed at 4 to 5 months after the initial planting and at least once a year until the trees and shrubs are established. This typically occurs within the first 3 years, but establishment may take longer in some geographic areas.

- For evergreen plantations, it may be easier to see small trees in the late fall or winter, when the brown ground cover or snow provides more contrast to their green foliage.
- For deciduous trees and shrubs, growing season (leaf-on) inspections may allow for better and easier species identification.
- If very adverse conditions, such as dry weather, high predation, or heavy weed competition, are noted, a second inspection in the fall may be recommended. End of the growing season (early fall) inspections can also make it easier to locate trees and shrubs with contrasting fall foliage colors.
- If deciduous trees and shrubs are inspected during dormancy, confirm survival by assessing the "suppleness" of the twig with presence of soft, current-year buds, or by scraping a very small patch to reveal green inner bark. Limit the number of scrapings by developing a general "feel" for which trees are alive.

Plot Sampling Methods for Tree Planting Inventory

- Circular Plots
  - This method is appropriate for all planting arrangements, including linear plantings, random spacing layouts, and direct seeding plantings.
    - Generally, a 1/100th acre circular plot will work for most typical tree and shrub plantings.
    - Larger 1/20th- and 1/5th-acre circular plots work well when tree plantings exceed a 10-foot by 10-foot spacing or for even wider spaced trees, such as those used in fruit and nut tree plantations (40-foot by 40-foot spacing).
    - Refer to table 4 for the radii commonly used to construct plots of various sizes. Choose a plot size large enough to inventory several planted trees per plot.
  - Count and inspect all seedlings within the plot. If desirable natural tree and shrub regeneration help meet planting objectives, include those plants in the tally. Count every other seedling that falls directly on the edge of the plot.
  - To calculate the average number of seedlings per acre, total the number of live seedlings in all plots, then divide by the total number of plots. Multiply the average number of seedlings per plot by 100 (for a 1/100th-acre plot) to obtain the average number of seedlings per acre.
- Linear Plots
  - Linear plots can be used for plantings that were installed with uniform row widths and evenly spaced trees and shrubs, (for example windbreaks, hedgerows, and other linear plantings). This method is often preferred in narrow plantings or under dense vegetation conditions, when a planting slit (or furrow) can be located.
  - Several variations of linear plots may be used depending on field conditions and planting scenarios. The two most common types of linear plots are assessing 10 consecutive seedlings in a row and assessing a row of seedlings over a distance of

100 feet. Variations of these two methods can be created by adjusting the number of seedlings counted in a row or the distance used within the row.

- Ten Consecutive Seedling Count Method
  - The 10 consecutive seedling count method is best used when all planted seedlings (live and dead) are present, planted at the original planned spacing, and natural tree and shrub regeneration will not be assessed.
  - For a 10 consecutive seedling row plot—
    - Follow one row and assess 10 consecutive (live and dead) planted trees and shrubs in that row.
    - After 10 planted plants have been inspected within that row, move over one or more rows and repeat the procedure until the required number of plots has been assessed.
  - To determine total number of surviving seedlings per acre—

    (# of live seedlings tallied ÷ # of plots) × 10 = % survival rate

    => (% survival rate × # of planted seedlings per acre) ÷ 100 = surviving seedlings per acre
- 100-Foot Row Seedling Count Method

  The 100-foot row seedling count method is best used when individual seedling spacing varies within a row but spacing between rows is relatively consistent. Much like the circular plot, this type of linear plot can be used to assess natural regeneration that may be occurring within planted rows. Include natural regeneration tallies only if it helps meet planting objectives. To use this method—
  - Count the number of seedlings in a 100-foot distance along the row. If desirable natural tree and shrub regeneration help meet planting objectives, include those plants in the tally.
  - Measure the width between rows.
  - After the 100-foot distance has been inspected, move over one or more rows and repeat the procedure until the required number of plots has been assessed.
  - To determine average number of surviving seedlings per acre—

    Average distance between rows, feet × 100 feet ÷ 43560 sq ft/acre = area sampled, acres—

    => total # of live seedlings tallied ÷ # of plots = average # of seedlings per plot

    => average seedlings per plot ÷ area sampled, acre = surviving seedlings per acre.

- Sampling Procedures
  - For any of the circular or linear plot methods, select plot locations in the planting area that best represent the variation of soils, topography, aspect, etc. Select a random starting spot (roughly 100 feet from the edge) in one corner of the planted area and install plots diagonally through the plantation. Alternatively, use two diagonals forming an “X” pattern. Record data on the “Tree and Shrub Planting Evaluation

Form," or a similar data collection form adapated to the setting (see fig. 9 in this section).

- To collect enough data for a reliable survival estimate, use at least the number of plots shown in table 5. For windbreaks and sites with highly variable soils, hydrology, etc., consider increasing the number of plots per acre, to increase the confidence level of the data collected.

Table 5: Minimum Number of Circular or Linear Plots Needed for Reliable Seedling Survival Estimates in Planted Areas of Different Sizes

Circular plots—1/100th acre	
Minimum number of circular plots needed	
≤ 5 ac.	5 plots
6 to 10 ac.	1 plot per ac.
> 10 ac.	10 plots + 1 plot/additional 5 ac.
Linear Plots	
Minimum number of linear plots needed*	
≤ 5 ac.	3 plots
6 to 10 ac.	1 plot per every 2 ac.
> 11 ac.	5 plots + 1 plot/additional 10 ac.
*Double the number of plots for windbreaks.	

Figure 9: Example Form for Recording Data During Tree or Shrub Survival Surveys

Tree and Shrub Planting Evaluation

Client:		Total acres in unit:		County:		Evaluation date:	
Tract #:		Field #:		Planned trees/ac. (a):		Planned spacing (ft.):	____X____	Evaluation by:	
Conservation practice:	☐Tree/Shrub Establishment (612); ☐Windbreak/Shelterbelt Establishment (380); ☐Riparian Forest Buffer (391); ☐Windbreak/Shelterbelt Renovation; ☐Other (specify):_____						

Assessment Method Used (check one):

☐ Circular Plots (1/100th ac.; radius 11.8 ft. (11', 9½"))

☐ Linear Plots assessing 10 consecutive seedlings plot

☐ Linear Plots assessing 100 ft. row seedling plot

Important! Be sure to inspect several areas or rows in the plantation to ensure the sampled area is representative of the site.

Plot Number	# of Live	Spacing between rows	Additional Field Notes (species observed, improper planting technique, deer and rodent damage, weed competition, O&M needs, etc. Include plot numbers if note does not apply to the whole planting unit):
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

Totals # plots (b)	Total # live (c)	Average ft. (d)

Circular 1/100th Plot Summary:

	÷		× 100 =		÷		=	%
Total # of live (c)		Total # of plots (b)		**Surviving trees/ac.**		Original # trees/ac. (a)		**Survival Rate**

Linear 10 Consecutive Seedling Plot Summary:

	÷		× 10 =	%	×		÷ 100 =	
Total # of live (c)		Total # of plots (b)		**Survival Rate**		Original # trees/ac. (a)		**Surviving trees/ac.**

Linear 100 ft. Row Seedling Plot Summary:

	× 100ft. ÷ 43,560 sq ft/ac =			÷		=	
Average row width, ft (d)		**Plot size in ac.**	Total # live (c)		Plot size in ac.		**Surviving trees/ac.**

This form is adapted from Michigan Technical Note Forestry #30, Evaluation of Tree and Shrub Establishment Practices, December 2011, developed by Tom Ward, NRCS retired.

Crop Tree Inventory and Demonstration

- Crop Tree Inventory
  - Crop tree management is a forest stand improvement treatment, also known as release, that provides potential crop trees with additional growing space, light, and air through opening the area around their crowns. It reduces competition from adjacent trees to promote survivial and more rapid growth of the desired crop trees, and in some cases can be used to increase seed production.
  - A crop tree can be any tree that has been identified as desirable and worth retaining, and may be selected for the purposes of wildlife habitat, economic value, water quality, aesthetics, etc., depending on landowner objectives.
  - Crop tree management is typically applied in multispecies forest stands, such as eastern and northern hardwoods (maple, oak, hickory, etc.), and bottomland hardwoods (elm, ash, cottonwood, silver maple, red maple, etc.).
  - Multiple purposes can be addressed through crop tree management. It can be used to create desired forest structure in stands that are primarily even-aged. See Perkey et al. (1994) for information on silvicultural aspects of crop tree selection and management.
  - Trees that are relatively young for their life spans, around 25 feet tall with large healthy crowns, are often good candidates for crop tree management.
  - Trees selected for economic value will have a desirable growth form.
  - Before commencing an inventory and demonstration, discuss crop tree management with the landowners to gauge interest and identify purposes.
  - Conduct a reconnaissance survey of the stand to determine whether crop trees that meet landowner objectives are present, and to identify representative stand conditions. Take point samples as described in the section “Point Sampling” on page 4 in this TN. At each point, use a tally sheet such as the one shown in figure 11 to record species and DBH (for all trees of 4 inches DBH or larger), and codes indicating whether the tree is a potential crop tree for one or more purposes. (e.g., “W” for wildlife, “T” for timber, “V” for visual quality, etc.). Also use codes to identify trees that compete with potential crop trees (“cut trees”).
- Crop Tree Demonstration
  - A demonstration plot is used to assist the landowners in deciding whether to manage for crop trees, and if so, how intensively.
  - One or more demonstration plots are located in representative portions of the forest stand.
    - A 1/5-acre plot is recommended; the plot may be circular with a radius of 53 feet or a square of 93 feet on a side.
    - Flag the plot boundaries sufficiently to allow the landowners to visualize plot dimensions. Within the plot—
      - Identify and flag high-value crop trees using criteria selected by the landowners.
      - Identify trees that are competing with crop trees for light (i.e., those with a crown that touches the crop tree crown).

- Flag these competing trees with flagging of a different color; they are the "cut trees" that will be cut or killed to release the crowns of crop trees. Trees that do not contact a crop tree crown, or that are growing below a crop tree crown, are disregarded since they do not compete with crop trees.
- Identify and flag competing trees on at least three out of four quadrats around the crop tree (fig. 10).

- Determine whether the landowners are satisfied with the amount of cutting. If less cutting is desired, first reduce the number of crop trees and then reduce the cut trees associated with those crop trees. This ensures that all remaining crop trees are fully released.
- Utilize information from the reconnaissance survey to calculate the number and average diameter of crop trees and cut trees, and the residual BA of the stand.
- The average number of crop trees and cut trees per acre, and the average diameter of these trees, will help the landowners or forestry contractor determine the potential for a timber sale and estimate the workload to cut or kill competing trees. In typical cases, 20–75 crop trees will be released per acre (4–15 crop trees per 1/5-acre plot).
- The calculation of residual BA will ensure that the stand remains fully stocked after crop tree management. See Perkey et al. (1994) for more information on crop tree management.

Figure 10: The crop tree crown in the center of this illustration has been separated into four quardrants. A free-to-grow rating is determined by evaluating each side for competition from neighboring crowns. This crop tree is free to grow on three sides (Wilkens 1994).

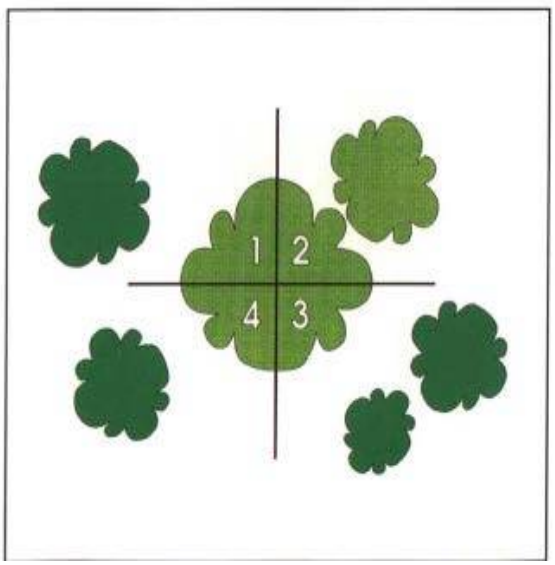


Figure 11: Example of a Crop Tree Tally Sheet, to be Adapted as Needed for Different Geographic Areas

CROP TREE TALLY SHEET

(Eastern Hardwoods and Bottomland Hardwoods)

LANDOWNER: **DATE:**

STAND HISTORY:

STAND NUMBER: **TYPE:** **APPROX. AGE:** **ACRES:**

LANDOWNER OBJECTIVES:

Plot No.	Species	DBH	Crop Tree [1] T,W, V, WQ	Cut Tree x

				AVG.
Basal Area - "leave" trees [4]				
Basal Area - cut trees				
TOTAL Basal Area [5]				

Crop Tree Totals				
Category	Total [2]	# Plots	Avg. No. Trees/Ac. [3]	Avg. DBH
Timber (T)				
Wildlife (W)				
Visual Quality (V)				
Water Quality (WQ)				
Total All Categories				
Cut Tree Totals				
Cut Trees (x)				

[1] Crop Tree Categories
T - Timber
W - Wildlife
V - Visual Quality
WQ - Water Quality

x - Cut Tree

1/5 acre plot radius = 53 feet

DBH - diameter breast height

[2] If a tree qualifies in more than one category (example: T & W) count it only once in the category where it makes the greatest contribution to to accomplishing the primary landowner objective.

[3] Ave. Number of Trees Per Acre = $\frac{\text{Total \# Trees}}{\text{\# Plots X 0.2 acre}}$

[4] "leave" trees are all trees that are not marked to be cut or killed, that is BOTH Crop Trees AND trees that are neither Crop Trees nor cut trees. BA reported in this space represents the total post-treatment BA. BA measurements should be made at 2 or 3 points near plot center.

[5] Total pre-treatment BA

NRCS-Michigan
11/22/2006

Zig-Zag Transect Method

The zig-zag transect is best suited for even-aged, single-layer, and single-species forest stands of a uniform nature. These conditions would likely be encountered in a plantation type of stand. However, experienced users are also able to apply this method in measuring multilayered stands with a diversity of tree species.

The zig-zag method can be used to determine—

- Average tree diameter.
- Range of tree diameters.
- Stocking rates (TPA).
- Stand composition.
- Stand condition (health).

Information from the zig-zag transect can be used to derive an estimate of the BA of the sampled stand.

The zig-zag transect is performed by selecting a point in the stand where the transit will begin, along with determining a direction of travel (a general route which will best capture the stand attributes) (fig. 12). A compass and bearing are used to guide the route. The transect will normally be conducted along the contour when stands are on sloping topography.

A "starter tree" anchors the transect and is not measured. An imaginary 90^{o} quadrant, bisected by the direction of travel, is used to determine the area where the first sample tree will be selected.

- From the starter tree, select the next closest sample tree from within the 90^{o} quadrant. This provides a degree of randomness. Measure the distance from the starter tree to the first tree. Species, DBH, height, tree condition and other attributes of this first sample tree are recorded.
- The first tree that was sampled serves as the reference point in selecting the second tree. The same process that was used with the starter tree is repeated in order to select the next sample tree. Continue in this manner until 20 or more trees have been sampled.
- Be careful to exclude uncharacteristic openings. The true tree-to-tree distances will reveal the general stand density only if openings are excluded. The same logic applies to clumps of trees or other configurations that obviously do not represent the general stand structure. Figure 13 illustrates this concept.
- Collectively, these "atypical" conditions should occur infrequently within the stand. If they don't, and if these areas become significant in cumulative size, then the overall stand description must be revised to account for the openings or clumps.
- See Montana's Technical Note MT-22 for additional detail on the zig-zag transect method (Logar and Wiersum 2003).

Figure 12: Configuration of a Zig-Zag Transect Showing Tree Selection Sequence and Direction of Travel

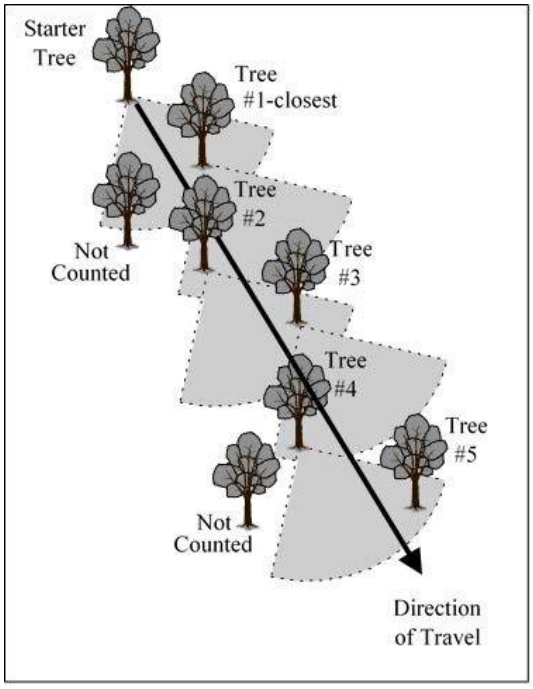
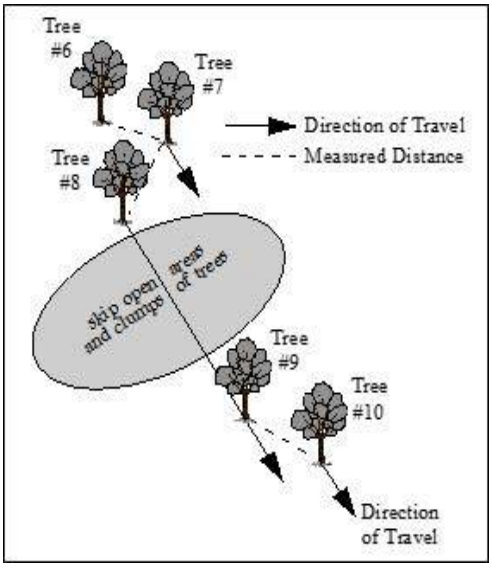


Figure 13: Using the Zig-Zag Method When Encountering Forest Openings or Clumps of Trees



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Effect of Plot and Sample Size on Timing and Precision of Urban Forest Assessments

David J. Nowak, Jeffrey T. Walton, Jack C. Stevens, Daniel E. Crane, and Robert E. Hoehn

Abstract. Accurate field data can be used to assess ecosystem services from trees and to improve urban forest management, yet little is known about the optimization of field data collection in the urban environment. Various field and Geographic Information System (GIS) tests were performed to help understand how time costs and precision of tree population estimates change with varying plot and sample sizes in urban areas using random sampling approaches. Using one-tenth acre (0.04 ha) plots, it is estimated that, on average, approximately three plots per day can be measured with plot data collected on several variables for all trees greater than 1 in (2.54 cm) in diameter along with general plot, ground cover, and shrub data. A field crew of two people can gather approximately 200 one-tenth acre (0.04 ha) plots during a 14 week summer field season depending on city traffic, city area, and tree cover conditions. These 200 plots typically yield approximately a 12% relative standard error on the total number of trees.

Key Words. Tree measurement; urban forest monitoring; urban forest sampling.

Measuring the urban forest structure (i.e., species composition, number of trees, tree sizes and locations, tree health) can give managers and planners a basis with which to develop and evaluate programs for managing urban trees and forests throughout a city. In addition, long-term monitoring of urban forest structure can provide essential data related to rates and factors of change affecting population totals, tree mortality, tree planting and natural regeneration, tree health, and species changes.

An accurate quantification of urban forest structure is also needed to assess the various ecosystem services and values provided by the urban forest. Urban vegetation, particularly trees, provides numerous benefits that can improve environmental quality and human health in and around urban areas. These benefits include improvements in air and water quality, building energy conservation, cooler air temperatures, reductions in ultraviolet radiation, and many other environmental and social benefits (Nowak and Dwyer 2007). By having accurate information on urban forest structure, managers can understand what the current urban forest provides in terms of various environmental benefits and also alter the structure of the urban forest (e.g., tree plantings, species and site selections, and tree maintenance and removals) to enhance these benefits in the future.

One of the best ways to assess the entire urban forest is through sampling procedures. However, varying sample and plot sizes affect total cost (time) of data collection and the precision of the urban forest estimate. The purpose of this article is to illustrate, based on field data collection tests, how plot and sample size of randomly located circular plots in urban areas can affect data collection time, number of permissions needed to access plots, and precision of tree cover and total tree population estimates. These types of data have been lacking related to urban forest sampling and can be useful in developing sampling schemes to help provide desired precision of estimates and understand the costs associated with obtaining that precision.

METHODS

Effect of Plot Size on Data Collection Time and Total Population Estimate Precision

To estimate the effect of plot size on time needed to collect field data and on total population estimates, a random sample of 26 residential plots (from a total of 100 residential plots that were measured and analyzed using the Urban Forest Effects [UFORE] model in Syracuse, NY, U.S. [Nowak and Crane 2000; Nowak and O'Connor 2001]) were measured and timed using a field crew of two people. Crews were trained before field data collection and were experienced in urban forest field data collection. For each plot, permission was obtained from the lot owner (where the plot center was located) by knocking on the front door of the lot residence. If the plot encompassed more than one lot, additional lot owners were contacted for permission if trees in those additional lots were located within the plot boundary.

On each plot, all UFORE variables (i-Tree 2007) were collected on concentric one-twenty-fourth acre (24 ft radius circle), one-tenth (37.2 ft radius), and one-sixth acre plots (48.1 ft radius) (0.0168 ha [7.3 m radius], 0.04 ha [11.3 m radius], and 0.067 ha [14.7 m radius] plots, respectively). These variables include several tree variables (e.g., species, diameter at breast height, crown, and health parameters) on all trees greater than 1 in (2.54 cm) in diameter at breast height (4.5 ft [1.37 m]) and general plot information (e.g., location, plot center, tree and shrub cover), ground cover types, and general shrub types and dimensions. Electronic distance measuring devices were used to record trees distances from plot center and tree heights. Data collection also included measures of general plot slope and aspect.

Data collection was cumulatively timed moving from the smallest to largest plot and number of access permissions needed was recorded. Average measurement time, number of lots accessed, and number of trees along with associated standard errors were assessed for each plot design. In addition, an estimated total number of trees in the residential area was calculated and compared with an estimate using 100 one-tenth acre (0.04 ha) plots

to illustrate how plot size affects the total tree and standard error estimate. Average plot time for field plot setup, cover estimates, and measurements per tree were used to estimate how average field measurement time would likely vary as tree cover changes.

In a separate analysis, an additional test of plot size and plot design was conducted using GIS tree cover, land use, and parcel data for the city of Syracuse. Five hundred points were randomly distributed throughout the city. At each point, the following seven different plot sizes or designs were constructed around the point using GIS: 1) one-twenty-fourth acre (0.017 ha) circular plot; 2) one-twelfth acre (0.034 ha) circular plot; 3) one-tenth (0.04 ha) circular plot; 4) one-eight acre (0.05 ha) circular plot; 5) one-sixth acre (0.067 ha) circular plot; 6) one-fourth acre (0.1 ha) circular plot; and 7) four one-twenty-fourth acre (0.017 ha) circular plots (cluster plot) using the USDA Forest Service Forest Inventory and Analysis (FIA) plot design (USDA Forest Service 2000). With this cluster plot design, three subplots were established 120 ft (36.6 m) from the center subplot at 120°, 240°, and 360° azimuths.

For each of the plot sizes and designs, total amount of tree cover within the plot was assessed using a 2 ft (0.61 m) resolution tree cover map (Myeong et al. 2003), and the number of parcels and associated number and area of land uses in each parcel within the plot design was recorded using a digital land use parcel map. The average amount of permissions required for each plot design was categorized among three classes: 1) permission required (residential land use parcels); 2) permission questionable—uncertain if crew would need to obtain permission (commercial/industrial, institutional, utility/transportation parcels); and 3) no permission needed (greenspace, street right-of-ways, and vacant parcels) to assess how permissions would vary based on plot size and design. The average percent of plot area within the parcel that contained the plot center was also calculated. This calculation was done to help determine how much of the plot area would require the crew to move to an additional parcel and how much of that extra plot space would require additional permissions. Mean tree cover and standard error for each plot design were calculated and compared with the actual tree cover as classified by the tree cover map.

Effect of Sample Size on Total Population Estimate Precision

To determine the effect of sample size on the standard error estimate for the total tree population, sample data from 14 cities were analyzed using the UFORE model (Nowak and Crane 2000; Nowak et al. 2002) (Table 1). For each city, population total, standard error (SE), and relative SE were calculated. The relative SE is a measure of estimated reliability and is the ratio of SE to the estimate, in this case, population total (SE/total × 100) (US Department of Health and Human Services, Centers for Disease Control and Prevention 2007). Eleven of the cities were sampled using a stratified random sampling approach, and three using a randomized grid approach, which was used to facilitate long-term monitoring of urban forest change. Standard error for each city was standardized to a population size of 200 plots using the formula: SE = standard deviation/$\sqrt{n}$. The average SE using 200 plots was calculated for the 14 cities and used to illustrate how SE of the total tree population estimate will vary as sample size varies between 10 and 500 plots.

RESULTS

Effect of Plot Size on Data Collection Time and Total Population Estimate Precision

Increasing plot size from a one-twenty-fourth acre (0.017 ha) plot to a one-sixth acre (0.067 ha) plot nearly doubled the amount of time needed to measure the plot variables, but also nearly cut in half the relative standard error for the total popu-

Table 1. Estimates of total number of trees and standard errors from 14 cities analyzed using the UFORE model.[z]

	Number of trees				200 plot[y]		
City	Total	SE	Year	No. plots	SE	RSE	Sample[x]
Atlanta, GA[w]	9,415,000	749,000	1997	205	758,000	8.1	Str. random
Baltimore, MD[v]	2,571,000	494,000	2004	200	494,000	19.2	Str. random
Boston, MA[w]	1,183,000	109,000	1996	217	114,000	9.6	Str. random
Freehold, NJ[u]	48,000	6,000	1998	144	5,000	10.1	Str. random
Jersey City, NJ[u]	136,000	22,000	1998	220	23,000	16.7	Str. random
Minneapolis, MN[t]	979,000	165,000	2004	110	122,000	12.5	Random grid
Moorestown, NJ[u]	583,000	53,000	2000	206	54,000	9.3	Str. random
Morgantown, WV[s]	658,000	79,000	2004	136	65,000	9.9	Str. random
New York, NY[w]	5,212,000	719,000	1996	206	729,000	14.0	Str. random
Philadelphia, PA[w]	2,113,000	211,000	1996	210	216,000	10.2	Str. random
San Francisco, CA[r]	668,000	98,000	2004	194	97,000	14.5	Random grid
Syracuse, NY[v]	876,000	119,000	2001	197	119,000	13.5	Str. random
Washington DC[q]	1,928,000	224,000	2004	201	224,000	11.6	Random grid
Woodbridge, NJ[u]	986,000	97,000	2000	215	100,000	10.2	Str. random

[z]Average relative standard error = 12.1%.
[y]Estimated standard error (SE) and relative standard error (SE/total × 100; RSE) using a sample of 200 one-tenth acre (0.04 ha) plots.
[x]Str. random = stratified random sample; random grid = randomized grid sample.
[w]Data collection by ACRT, Inc.
[v]Data collection by U.S. Forest Service.
[u]Data collection by New Jersey Department of Environmental Protection.
[t]Data collection by Davey Resource Group.
[s]Data collection by West Virginia University.
[r]Data collection by city personnel.
[q]Data collection by Casey Trees Endowment Fund.

lation estimate (Table 2). Average time per plot increased from approximately 62 min (SE = 7.4) for a one-twenty-fourth acre plot (0.017 ha) to 106 min (SE = 14.0) for a one-sixth acre (0.067 ha) plot. Number of permissions (lots) also increased from an average 1.9 (SE = 0.1) to 3.1 (SE = 0.2), and number of trees measured per plot increased from 2.6 (SE = 1.1) to 6.5 (SE = 1.5). All three plot sizes produced total population estimates with a sampling error within 1 SE of the estimated population total of 251,000 trees, but as plot size increased, the total estimate moved closer to the 251,000 estimate and SE decreased (Table 2). The trend of the overall estimate decreasing with plot size (Table 2) suggests that the sample size was not large enough for the two smaller plot sizes. The effect of increasing the number of plots for the smaller plots sizes such that the total sample area remains the same among all plots sizes remains to be investigated.

A similar pattern occurred when accessing tree cover from digital maps using plot sizes that ranged from one-twenty-fourth acre (0.017 ha) to one-fourth acre (0.1 ha), including an FIA cluster plot. Number of permissions increased and percent of plot in parcel with plot center decreased as plot size increased (Table 3). The one-fourth acre (0.1 ha) plot produced the closest estimate of actual tree cover value and had the lowest SE and relative SE. The one-twenty-fourth acre (0.017 ha) plot produced the estimate farthest from the actual tree cover value, although it was still within 1 SE from the true mean and had the highest SE and relative SE. The FIA cluster design, which is being used in the urban forest health monitoring program (Cumming et al. 2008), produced estimates of tree cover with a slightly higher SE and relative SE than a one-sixth acre (0.067 ha) single plot design. The FIA plot design also required nearly double the permissions of the one-sixth acre (0.067 ha) plot design (Table 3).

Average time to set up a residential plot (e.g., gain permission and establish plot center) was 15.6 min (SE = 1.9); average time needed to estimate cover types was 12.8 min per plot (SE = 1.1). Thus, the average fixed time per plot was approximately 30 min. The average time to record all measurements on one tree was 12.2 min (SE = 0.9).

Effect of Sample Size on Total Population Estimate Precision

The relative standard error (RSE) of total number of trees drops significantly with the first 50 to 100 one-tenth acre (0.04 ha) plots established, from 54.1% RSE with 10 plots to 17.1% RSE at 100 plots. After approximately 100 plots, the RSE continues to drop, but a reduced rate per additional plot (Figure 1). The average RSE for 200 plots is 12.1% (Table 1).

DISCUSSION

The key to assessing urban forests is to determine the optimal number of plots and plot size needed to gain the desired precision of an estimate at minimal cost. Unfortunately, there is not much information in the literature on costs of urban field plots and structural variability across the urban forest. A general rule of sampling is increasing the plot size and number of plots tends to increase precision, but at increased cost. Data presented in this article begin to reveal the increases in precision and time costs associated with different sample designs for sampling trees in urban areas.

Assuming an average tree density of 204 trees per acre of urban tree cover (504 trees/ha cover) (Dwyer et al. 2000) and a national average tree cover of 27.1% (Nowak et al. 2001), the average time to set up and measure a one-tenth acre (0.04 ha) urban plot in the United States would be approximately 95 min (five plots per 8 hr day). However, this estimate does not include travel time. The longer the distance between plots and the slower the traffic, the fewer the number of plots that can be measured per day. This estimate also includes plot permissions; however, plots on several land uses often do not require permission and access setup time could be reduced. Also, the fewer the trees per plot or fewer variables measured, the more plots can be measured per day. A reasonable estimate of average number of one-tenth acre (0.04 ha) plots per day for a field crew of two people would be approximately three plots per day for a full suite of tree and plot measurements in a midsized city.

Number of plots per day will vary by the amount of tree cover in a region because when tree cover increases, the amount of time measuring trees increases. In desert regions, urban tree cover averages 9.3% (Nowak et al. 2001) and average plot setup and measurement time would be approximately 51 min. In grasslands (urban tree cover averages 17.8%), average plot time would be approximately 72 min. In forested areas (urban tree cover averages 34.4%), average plot time would be approximately 113 min. Again, these estimates do not include travel time or office time needed to establish plot locations and maps.

The standard UFORE model sampling approach establishes approximately 200 one-tenth acre (0.04 ha) circular plots in randomized grid or stratified random sample. The selection of 200 plots was based on an estimated amount of plots that could be surveyed by field crew of two people during a summer season (14 weeks), given an average data collection rate of three plots per day. In some cities with high tree cover and/or traffic volumes, data collection will take longer than 14 weeks. In addition to data collection time, there are also costs associated with establishing the locations of the plots, transportation, equipment, data entry or data transfer, and data analysis and reporting costs.

The use of 200 one-tenth acre (0.04 ha) plots produces a reasonable population estimate if a 12% RSE is acceptable to the user. Depending on the desired precision, a smaller sample size may provide adequate estimates of the urban forest population.

Table 2. Average time, number of lots accessed, trees per plot, and total population estimate from 26 residential plots measured in Syracuse, New York, U.S. using different plot sizes.

	Time (min)		No. of lots		No. trees per plot			No. of residential trees		
Plot size (ac)	Mean	SE[z]	Mean	SE[z]	Mean	SE[z]	Range	Estimate[y]	SE[z]	RSE[x]
1/24 (0.017 ha)	61.8	7.4	1.9	0.1	2.6	1.1	0–27	429,998	178,366	41.5
1/10 (0.04 ha)	84.1	9.9	2.8	0.2	4.6	1.3	0–33	316,968	90,708	28.6
1/6 (0.067 ha)	106.1	14.0	3.1	0.2	6.5	1.5	0–34	267,922	61,220	22.8

[z]Standard error.
[y]Actual estimated number based on 100 one-tenth acre (0.04 ha) plots is 251,000 trees (SE = 35,000).
[x]Relative standard error.

Table 3. Effect of plot size and design on number of parcels per plot, number of access permissions required, and percent tree cover in Syracuse, NY, using 2 ft resolution tree cover and land use/parcel boundary maps of 500 randomly located plots.

	Number of parcels				Percent of plot area				Percent tree cover		
					First	Additional parcels					
Plot size (ac)[z]	Total	Perm. req.[y]	Perm. quest.[x]	No perm.[w]	parcel[v]	Perm. req.[y]	Perm. quest.[x]	No perm.[w]	Mean[u]	SE[t]	RSE[s]
1/24	1.9	0.9	0.4	0.6	84	9	2	5	25.8	1.1	4.1
1/12	2.3	1.2	0.4	0.7	78	13	3	7	26.1	0.9	3.3
1/10	2.4	1.3	0.4	0.7	76	14	3	7	26.2	0.8	3.1
1/8	2.6	1.4	0.4	0.8	74	15	4	7	26.3	0.8	2.9
1/6	2.9	1.6	0.5	0.8	70	17	4	8	26.4	0.7	2.6
1/4	3.4	2.0	0.5	0.9	65	20	5	8	26.6	0.6	2.2
FIA[r]	5.3	3.2	0.8	1.3	48	27	8	17	26.2	0.8	3.0

[z]1/24 ac = 0.017 ha; 1/12 ac = 0.034 ha; 1/10 ac = 0.04 ha; 1/8 ac = 0.05 ha; 1/6 ac = 0.067 ha; 1/4 ac = 0.1 ha.
[y]Permission required (residential land).
[x]Permission requirement is questionable; uncertain if crew would need to obtain permission (commercial/industrial; institutional; utility/transportation).
[w]No permission needed (greenspace; street right-of-way; vacant).
[v]Average percent of plot within parcel where plot center is located.
[u]Average tree cover in Syracuse = 26.6%.
[t]Standard error.
[s]Relative standard error (SE/mean × 100).
[r]USDA Forest Service, Forest Inventory and Analysis plot design of four 1/24 ac (0.067 ha) subplots.

However, when subdividing the analysis into smaller units (e.g., species, land use), the RSE will tend to increase. To increase precision for various estimates, more crews could be used to collect more plot data by either increasing plot size and/or increase the number of plots. In addition, stratification of plots in similar groups (e.g., land use classes, as done in the UFORE analyses) tends to increase precision. Increasing the number of plots from 200 to 500 will likely reduce the RSE on the total number of trees to 7.7% (a 36% reduction). Thus, increasing the number of plots enhances the precision of the estimate, but at an increased cost.

A sampling of 150 to 200 plots is a reasonable sample size given the costs associated with measuring field plots during a summer season and a goal of maximizing reduction in SE of the estimates per unit cost. If sample size increases to greater than 200 plots, it is likely a second field crew will be needed to collect the additional plot data. Thus, increasing sample size to greater than 200 plots increases costs (adding an additional crew) with relatively minimal gains in the reduction in SE as compared with the first 200 plots sampled. Increasing the plot size from one-tenth acre (0.04 ha) to one-sixth acre (0.067 ha) will also likely reduce the RSE by approximately 16% to 20%. However, increasing the plot size will increase the number of permissions needing to be obtained for the sample and thus the overall project time required.

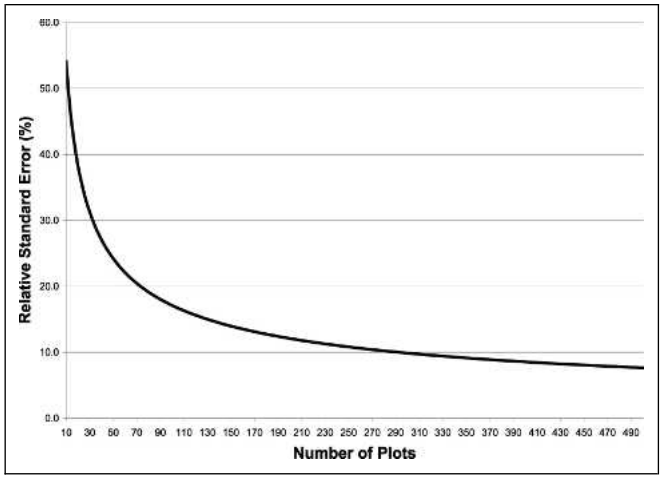

Figure 1. Estimated relative standard error (SE/total × 100) of total number of trees based on varying number of total one-tenth acre (0.04 ha) field plots.

CONCLUSION

Data gathered on urban forest structure is essential to improve urban forest management. Random sampling offers a relatively easy means to accurately assess urban forest structure and subsequently estimate its ecosystem services and values. The precision and cost of the estimate is dependent on sample and plot size. Managers need to plan their data collection procedures properly to ensure a desired precision of the estimate and adequately plan for data collection costs. Ensuring that the proper variables are collected will help guarantee that the data are useful for urban forest management. Incorporating these data within models to assess ecosystem services and values, and within long-term management and monitoring plans, can help improve urban forest health and sustain or increase urban tree cover and consequently environmental and human health in urban and urbanizing areas.

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Résumé. Des données de terrain précises peuvent être utilisées pour évaluer les bénéfices que procurent les arbres à un écosystème et pour améliorer la gestion de la forêt urbaine, encore que peu soit connu à propos de l'optimisation de la collecte des données de terrain dans un environnement urbain. Divers tests de terrains et de système d'informations géographiques ont été employés pour aider à comprendre comment les coûts en temps et le degré de précision des estimations de la population d'arbres peuvent changer en fonction de la variation des échantillons et de la taille de ces derniers en milieux urbains, et ce en utilisant des approches par échantillonnage aléatoire. Au moyen d'unités d'échantillonnage de 0,04 ha, il a été estimé qu'en moyenne trois unités d'échantillonnage pouvaient être mesurées par jour avec diverses données colligées pour les arbres de plus de 2,5 cm de D.H.P. en plus de données générales sur l'unité d'échantillonnage, le couvert au sol et les arbustes. Une équipe de deux personnes peut ainsi couvrir environ 200 unités d'échantillonnage en 14 semaines en été, et ce dépendant du degré de circulation de la ville, de la superficie de la ville et des conditions du couvert arboré. Ces 200 unités d'échantillonnage ont résulté en une erreur standard relative d'environ 12% par rapport au nombre total d'arbres.

Zusammenfassung. Akkurate Felddaten können dazu verwendet werden, den Beitrag von Bäumen in ihrem Ökosystem zu bewerten und das urbane Forstmanagement zu verbessern. Dennoch ist wenig bekannt über die Optimierung der Datenerhebung in urbanen Räumen. Verschiedene Feld- und GIS-Tests wurden ausgeführt, um ein besseres Verständnis dafür zu erlangen, wie Zeitkosten und Schätzungen der Baumpopulation bei zufälligen Probenahmen mit der Größe der Fläche und der Probenmenge variieren können. Bei Probeflächen von 0,4 ha wird geschätzt, dass durchschnittlich ca. 3 Flächen pro Tag gemessen werden können, wobei zusammen mit allgemeinen Daten zur Fläche, Bodenbedeckung und Unterpflanzung die Daten von allen Bäumen über 2,5 cm Durchmesser gesammelt wurden. Ein Team von 2 Leuten kann während einer 14wöchigen Sommersaison und in Abhängigkeit von Verkehr, Stadtbereich und Bedeckungsgrad ca. 200 Flächen á 0,4 ha erfassen. Diese 200 Flächen bergen durchschnittlich in Bezug auf die Gesamtzahl der Bäume pro Einheit ca. 12 % Fehler.

Resumen. Pueden utilizarse datos precisos para evaluar los servicios ambientales de los árboles y mejorar el manejo del bosque urbano, aunque aún no se conoce lo suficiente sobre la optimización de la colección de los datos de campo en el ambiente urbano. **Se** realizaron varias pruebas de campo y GIS para ayudar a entender cómo los costos en tiempo y precisión de la estimación de la población de árboles cambia con la variación de del tamaño y forma de la parcela en áreas urbanas usando aproximaciones por muestreo al azar. Con el uso de parcelas de una décima de acre (0.04 ha), se estima que, en promedio, aproximadamente tres parcelas por día pueden ser medidas con los datos colectados en varias variables para todos los árboles mayores a 2.5 cm (1 pulg) en diámetro junto con la parcela general, cobertura y datos de arbustos. Un equipo de campo de dos personas puede levantar aproximadamente 200 parcelas de una décima de acre durante una estación de verano de 14 semanas dependiendo del tráfico de la ciudad, área de la ciudad y condiciones de cobertura. Estas 200 parcelas típicamente rinden aproximadamente un 12% de error relativo estándar sobre el número total de árboles.

Comparative Evaluation of Accuracy and Efficiency of Six Forest Sampling Methods

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We compared estimates of woody stem density with known stem densities in three forest stands in southeast Oklahoma by using fixed-radius plots 3.64 m radius (0.01 acre; FRPs-AC), fixed-radius plots 5.64 m radius (0.01 ha; FRPs-HA); 10 m X 10 m quadrat (0.01 ha; QUAD), variable-radius plot (VRP), point-centered quarter (PCQ), and belt transect (BT) sampling techniques. These stands varied in stem density and were categorized as high, moderate, and low density stands. We found that FRPs were the most time-efficient and produced the most accurate estimates regardless of stem size. The VRP and PCQ methods were also time-efficient, but tended to underestimate actual stem density. Although FRPs of suitable size are accurate for large diameter stems in dense forest, time constraints limit applicability. We recommend using FRPs for small stems [(2.54–11.42 cm diameter breast height (DBH)] and VRPs for large stems (≥11.43 cm DBH). These methods with appropriate sample sizes should be applied after pre-sampling has been completed to determine sampling variance. This combination of methodologies provides a quick and relatively accurate manner to characterize or monitor change in the wide range of forest conditions found in Oklahoma.

INTRODUCTION

Quantitative data are essential to adequately characterize the woody component of forest communities (*1,2*). Some form of sampling is required because total counts of individuals in naturally occurring plant populations are generally impractical without an exhaustive expenditure of energy and resources (*3*). A number of sampling techniques are available to quantify forest communities. These techniques vary in quantitative capabilities, equipment required, and time necessary to obtain an adequate sample for statistical analysis (*4,5*). Obtaining adequate information with minimum effort and time is a major concern when sampling vegetation (*4,5*).

Variable radius plot (VRP), fixed radius plot (FRP), point-centered quarter (PCQ), belt transect (BT), and 10 m X 10 m plots (QUAD) are sampling methods commonly used to quantify forest vegetation (*2–6*). The purpose of this study was to determine the best sampling method for use in widely varying forest conditions that would adequately characterize forest communities in Oklahoma for the purpose of monitoring change in the woody component following either experimental manipulation or land use change. Our primary objective was to compare the accuracy of estimates of woody stem density for six forest sampling techniques under widely varying stand densities. A second objective was to compare

the time required by these methods to obtain a 10% sample (by area).

STUDY AREA

We conducted this study on the Pushmataha Forest Habitat Research Area (PFHRA) on the 7395 ha Pushmataha Wildlife Management Area, approximately 6 km southeast of Clayton, Oklahoma (*7*). The PFHRA was protected from logging, grazing, and fire until 1984 when a comprehensive study on the effects of fire and timber harvest began (*7–10*).

We selected three different stands in the research area to represent varying stand densities in both understory and overstory. Stands included

1. High density stand—unmanaged stand, no fire or timber harvest, 0.92 ha in size.
2. Moderate density stand—removal of 1/2 of the hardwood basal area, annual winter burn since 1985, 0.56 ha in size.
3. Low density stand—harvest all merchantable pine, annual winter burn since 1985, 1 ha in size.

The high density stand was dominated by post oak (*Quercus stellata*), shortleaf pine (*Pinus echinata*), with occasional blackjack oaks (*Q. marilandica*) and mockernut hickory (*Carya tomentosa*) (*7*). Shortleaf pine dominated the moderate density stand while the low density stand was dominated by post oak with occasional blackjack oak and mockernut hickory. Study area soils and vegetation on these sites were previously described by Masters and Masters et al. (*7–10*).

METHODS

We delineated the area to be sampled in each stand by using a compass and hip chain. We sampled experimental stands ≥20 m from stand boundaries to minimize edge effects from adjacent stands. After stand boundaries were surveyed and marked, we obtained a total count of stem density from each stand. We recorded species and diameter at breast height (DBH) of all stems with a DBH ≥2.54 cm. After a stem was tallied we marked the bark or foliage with paint to ensure that all trees were counted accurately.

We selected sampling points at random distances along a base line through the long axis of the stand after the method of Beason and Haucke (*3*). We then selected a random distance from the random point on the base line for location of plot center. This process continued until the desired number of samples had been taken (Table 1).

Sampling Methods: The six sampling methods compared with total census counts included VRPs, 3.64 m fixed-radius plot (FRP-AC), 5.64 m fixed-radius plot (0.01 ha; FRP-HA), QUAD, PCQ, and BT. We practiced each sampling method prior to sampling to familiarize ourselves with the methods. We performed only one sampling technique on a plot at a time. Sampling time was recorded with a stopwatch.

We sampled approximately 10% of the area of each experimental unit using all methods except VRP. For VRP, we used the same plot centers as those used in the PCQ method. We tallied all woody species with a DBH ≥2.54 cm, except when applying the PCQ, for which only stems ≥11.43 cm were tallied. We recorded species and DBH for all sampling methods.

We counted all stems of appropriate DBH in a given area for the FRP-AC, FRP-HA, QUAD, and BT. We used a 10-factor prism when applying the VRP method (*2,11,12*). We tallied trees that subtended an angle equal to or greater than that of the prism.

When using the PCQ method we divided sampling points into four quarters (*3,4*). In each quarter we tallied the nearest tree ≥11.43 cm. We did not sample small stems when using the PCQ method. We then measured from the sample point to the nearest tree in each quarter (quadrant) and recorded this measurement. We placed BTs on randomly located lines running the length of the stand by using a transect width of 1 m (Table 1). We tallied all trees within the 1 m transect width and tallied every other border-line tree.

Data Analysis: To facilitate comparison, density estimates were summarized on a hectare basis. Stems were classified into two size classes for analysis: 2.54 to 11.42 cm and ≥11.43 cm. A difference value was obtained by subtracting actual stems/ha from estimated stems/ha. Chi-square analysis was used to determine the accuracy of sampling methods ($P < 0.05$; 13). We also analyzed the data as a randomized complete block design (ANOVA) with stands as the block and sampling technique as the treatments to determine if mean density estimates were different between techniques. Technique means were separated with the protected least significant difference (LSD) test (*14*).

RESULTS

As expected, we found wide variation among sample plot estimates within a given technique by stand density. Therefore, we were not able to detect a significant difference in density estimates between sampling techniques by using the LSD test ($P > 0.05$). We found that technique performance was apparently dependent on the size class and distribution of woody stems in a given stand. We did detect differences in accuracy using chi-square analysis.

Stems 2.54 to 11.42 cm: The FRP-AC and FRP-HA methods were accurate in the high density stand ($\chi^2 = 0.11$ and 0.01, respectively, $P < 0.05$; Fig. 1). Both FRP methods underestimated stem density on less dense stands (Fig. 1). The QUAD method was not accurate and underestimated density in both high and moderate density stands, but did produce reasonable estimates in low density stands. The VRP method produced varied estimates across all three levels of stem density and was judged to be unsuitable for small stems (Fig. 1). The BT technique produced more accurate results at low densities than at moderate and high densities (Fig. 1).

Stems ≥ 11.43 cm: The FRP-AC and QUAD produced accurate ($\chi^2 = 3.20$ and 1.60, respectively, $P < 0.05$) estimates of stem density in high density stands (Fig. 2). The BT was somewhat accurate for high density stands ($\chi^2 = 4.10$, $P < 0.10$). The QUAD and BT methods produced accurate ($\chi^2 = 1.50$ and 2.30, respectively, $P < 0.05$) estimates at

TABLE 1. Total time (minutes) required to sample approximately 10% of a hectare using various sampling techniques on Pushmataha Forest Habitat Research Area, Summer 1994.

Stem Size-Class, Technique [a]	Stand Density		
	High	Moderate	Low
Stems 2.54-11.42 cm			
FRP-AC[b]	50	30	20
FRP-HA	55	34	25
QUAD	63	44	41
BT	144	99	86
Stems ≥ 11.43 cm			
PCQ	235	104	47
All stems			
FRP-AC	160	145	137
VRP	72	47	34
BT	327	225	195

[a] FRP-AC = fixed-radius plot, 3.64 m radius (0.01 acre); FRP-HA = fixed radius plot, 5.64 m (0.01 ha); QUAD = 10 m X 10 m quadrat, (0.01 ha); VRP = variable-radius plot; BT = belt transect; PCQ = point-center-quarter.

[b] These times for this technique were relative estimates because all stem size classes were counted when applying this technique.

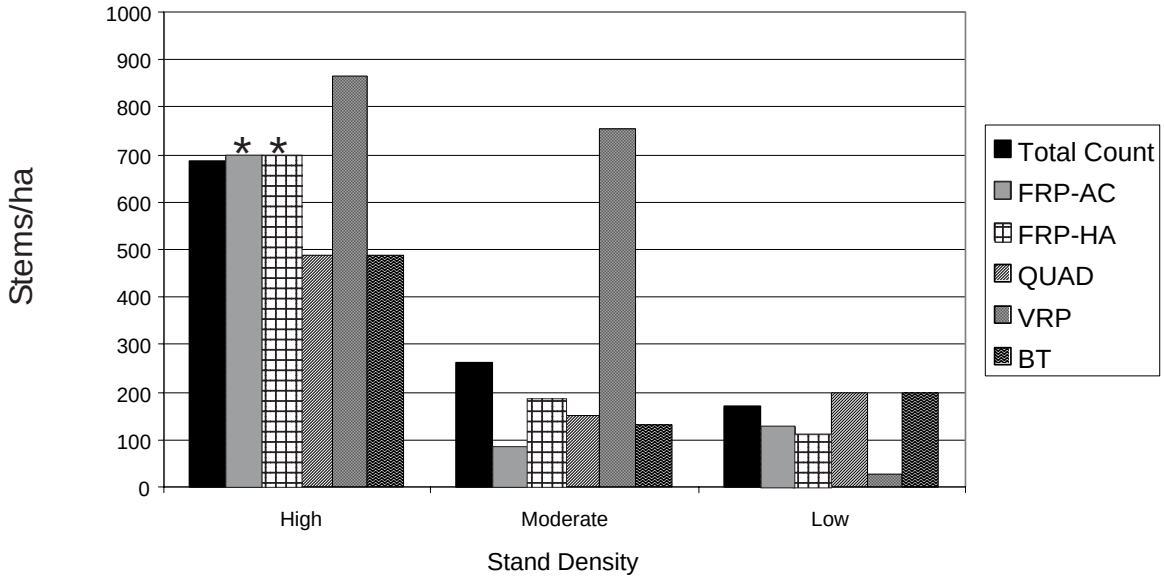

Figure 1. Comparison of five forest sampling techniques for stems 2.54 - 11.42 cm in diameter, in high-density, moderate-density, and low-density stands on Pushmataha Forest Habitat Research Area, summer, 1994. FRP-AC = fixed-radius plot, 3.64 m radius (0.01 acre); FRP-HA = fixed radius plot, 5.64 m (0.01 ha); QUAD = 10 m X 10 m quadrat (0.01 ha); VRP = variable-radius plot; BT = belt transect; PCQ = point-centered quarter. Those bars with an * were significantly accurate ($P < 0.05$) using the chi square test.

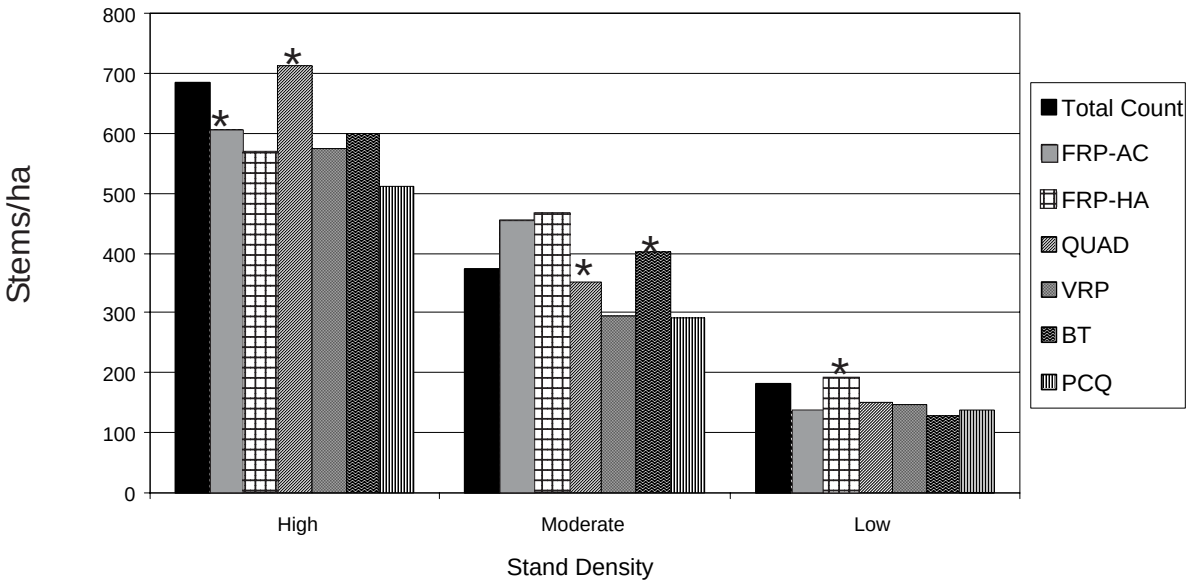

Figure 2. Comparison of six forest sampling techniques for stems $\geq$ 11.43 cm in diameter, in high density, moderate density, and low density stands on Pushmataha Forest Habitat Research Area, summer, 1994. FRP-AC = fixed-radius plot, 3.64 m radius (0.01 acre); FRP-HA = fixed radius plot, 5.64 m (0.01 ha); QUAD = 10 m X 10 m quadrat (0.01 ha); VRP = variable-radius plot; BT = belt transect; PCQ = point-centered quarter. Those bars with an * were significantly accurate ($P < 0.05$) using the chi square test.

moderate stem densities, and the FRP-HA produced accurate ($\chi^2 = 0.80$, $P < 0.05$) results in the low density stand (Fig. 2). The QUAD technique produced estimates within 26 stems of the actual, across all stands (Fig. 2). The PCQ and VRP methods underestimated stem densities in all three stands, but the difference was proportional and constant across all stand densities (Fig. 2).

Sampling Time: The FRP-AC was the fastest method applied, closely followed by the FRP-HA and QUAD methods for small diameter stems (Table 1). The BT was much slower because of setup time needed to apply this method. The PCQ method was not directly comparable to other methods because we used it for estimating larger diameter trees. It performed more time efficiently in stands with low density, but was much slower in stands with high densities (Table 1). The VRP method was the most rapid of all techniques to sample all stem size-classes. The BT method was the slowest technique, taking more than twice the time of other methods (Table 1).

DISCUSSION

Sampling Accuracy: Vegetation is often clumped or patchy in distribution (*5*). The high standard deviation we found associated with mean estimates derived from these sampling methods reflects the clumped and patchy distribution of trees within these stands. Four of the seven accurate estimates were from sampling techniques applied in the high density stand. Density estimates from the various sampling techniques in the high density stand were generally more accurate because our observations were that stems tended to be more evenly distributed. Stems in the moderate and low density stands tended to be clumped and patchy in distribution in violation of the statistical assumption that stems were randomly distributed. In situations with nonrandom distributions, sampling intensity must be increased until the variance is lowered rather than going with a set 10% minimum level sample.

VRPs and FRPs are unbiased for all distributions but distance measures are not (*6,15,16*). Any biases found in estimates may be related to field technique or may be attributable to stand conditions such as poor visibility in dense stands and bias arising when determining if a tree should be tallied when using the VRP method. This is particularly problematic when making determinations with a prism for small diameter stems close to the sampling point in dense stands (*6*). This was apparent in widely varying estimates of stems <11.43 cm derived by the VRP method in different density stands. However, we found that the VRP consistently underestimated density for larger stems.

FRPs (circular) were indeed accurate and unbiased at high stem densities, but variation increased between samples when applied to the lower density stands. Under these conditions sampling intensity must be increased and pre-sampling with attention to variance estimates should increase confidence in the estimates.

Sampling and Time Efficiency: The techniques that performed best for sampling stems <11.43 cm across different density stands included the FRP methods of different size. The FRP-AC was relatively time-efficient and produced excellent results regardless of stem size in the high density stand. However, it produced estimates of poor accuracy in our sparse stand. An advantage of this method is its ability to be applied to all stems regardless of size. The only problem with the method is that it requires more samples to obtain the same sampling intensity as other methods. The FRP-HA has the same advantages and produced similar results to those of the FRP-AC method, but has the additional advantage of sampling a larger area, therefore, requiring fewer samples than the FRP-AC to obtain the same sampling intensity.

All methods used to sample stems $\geq$11.43 cm produced relatively accurate estimates in the high density stand and may be attributed to the relatively high stem density and even distribution of stems in this stand. The QUAD method consistently produced the most efficient results for sampling larger stems ($\geq$11.43 cm), except for the low density stand. The QUAD

method can also be used to sample all stems in an area regardless of size, but produced less accurate estimates than those of the FRP-AC or FRP-HA methods when samp-ling small stems. However, the QUAD provided more accurate estimates of larger stems than did both FRP methods. The QUAD tended to be less time-efficient than the FRP methods and required the use of a transit and tape measure for accurate plot layout or a large sampling quadrat, which can be cumbersome to transport and set up in dense stands. The QUAD method requires considerable care so that stems are not counted twice.

Although the VRP method was one of the fastest methods, its use should be limited to primarily larger stems with a DBH ≥11.43 cm. The VRP method produced poor and wide ranging accuracies on smaller stems (<11.43 cm), overestimating dense stands and underestimating low-density stands. The VRP also tended to underestimate overall stem density of stems ≥11.43 cm, but estimates were a consistent percent difference across all stand densities and may be reduced if additional samples were taken.

The BT produced poor estimates on small stems, but relatively accurate estimates on larger stems. Although it can be used to sample all stems regardless of size, this method was not very time-efficient, primarily because transects must be set up and measured before sampling can begin. This method would be best suited to long transects, with the aid of a compass and a device to measure distance traveled. The BT method may be best applied in transition zones or gradients where the vegetation changes in composition and density (*6*).

The PCQ method was quite time-efficient, but was applied only to larger stems. The PCQ method tended to underestimate actual stem density in all stands, but like the VRP, the PCQ method also maintained a consistent percent difference in observed versus estimated stem densities across all stands regardless of overall stem density. That distance techniques may give biased estimates, depending on tree spatial distributions, is an inherent disadvantage.

Shape: FRPs with a circular shape tended to produce the most accurate results on smaller stems (2.54 to 11.42 cm), especially when applied in dense, evenly distributed stands. This can be attributed to the small perimeter to area ratio in a circle; therefore, an observer is less likely to have to make a decision to tally a stem or not because it intersects the plot (*17*). Also, the rotating radius of the plot allows an observer to ensure all stems are tallied and are only tallied once. When using a large quadrat (10 m x 10 m) it is easy to miss stems or to tally them twice (*6,18*). The FRP methods or circular-plot sampling methods are quick and simple to apply in areas with low to moderate density of stems or areas with low vegetation, but become awkward in dense, shrubby communities (*6,18*). Smaller FRP or square-plot methods can be used in stands with dense vegetation (*18*).

Size: It is essential for quadrat size to be adapted to the characteristics of the vegetation being sampled (*18*). The greater the species diversity and the more heterogeneous life forms found in a community, the larger the quadrat size needed to adequately characterize the community (*18*). Regardless of shape, perimeter to area ratios decrease with an increase in quadrat size (*17*). Based on the diversity found in many forested communities and on perimeter to area ratios, larger circular plots would be most appropriate (*17*).

CONCLUSIONS

It is important for managers to know the general characteristics of the stand they are attempting to sample because no single method is efficient for sampling all stem sizes and densities. Sample procedures provide only an estimate, and this estimate may be smaller or greater than actual stem density depending on the sample method applied and stand density. Methods should be chosen that reflect unbiased estimates of density given various stand conditions and distributions.

Circular and fixed area methods, such as the FRP-AC and FRP-HA, were the most

time-efficient and produced the most accurate estimates of all stems in a stand regardless of size. The QUAD produced slightly more accurate estimates of larger stems, but produced less accurate estimates of small stems and was also less time-efficient. The VRP was extremely time-efficient and produced precise estimates of larger stems, but tended to underestimate the actual number of stems. The PCQ method also produced time-efficient and precise estimates of larger stems, but underestimated actual stem density. Furthermore, the PCQ may produce biased estimates depending on stem distribution in a stand. Both the VRP and PCQ produced precise estimates, regardless of stem density; therefore, these methods are usable when the manager takes into account that the estimate obtained may be low. By calculating the appropriate sample size from a preliminary field size, estimates may be closer to the true mean and may reflect unbiased estimates of stem density when applying the VRP method.

We recommend using a combination of an FRP method and VRP method when sampling stems of all sizes in variable-density forested communities. FRP methods provide relatively accurate and time-efficient results on small stems (DBH 2.54-11.42 cm), while the VRP method is time-efficient and relatively accurate at sampling larger stems (DBH $\geq$11.43 cm). The number of samples should be based on the standard deviation or coefficient of variation of a preliminary field sample. The combination of these methods will provide accurate and time-efficient results for sampling woody species regardless of size.

ACKNOWLEDGMENTS

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Received: May 1, 2002; Accepted: June 24, 2002

Environmental Policy Board (EPB) **5. 2.**

Meeting Date: 07/19/2021

By: Chris Anderson, Community Development

Information

Title:

Consider Request for Variance to Deviate from Wetland Setback Requirement on Three Lots in Williams Woods (Project No. 20-138); Case of Landform and Bill Boyum

Purpose/Background:

The City has received an application from Landform (the "Applicant") for a Variance to deviate from the wetland setback requirement on Lots 3-5, Block 1 Williams Woods (the "Subject Property). The Preliminary Plat has been reviewed by both the Environmental Policy Board and Planning Commission and both bodies recommended approval, contingent upon compliance with Staff's review comments (which included addressing the encroachment into the wetland setback). The City Council formally approved the Preliminary Plat on June 22, again, contingent upon compliance with Staff's review comments.

Notification:

The City attempted to notify Property Owners, as reflected in the Anoka County Property Records, within 350 feet of the Subject Property of the request. A Public Hearing will be held by the Planning Commission on July 22, 2021.

Observations/Alternatives:

The Subject Property is approximately ninety-four (94) acres in size and of that, about thirty (30) acres is wetland. The City's Natural Resources Inventory (NRI) identifies multiple, moderate quality, natural areas within the Subject Property, including both Oak Forest and Dry Prairie. The Applicant has attempted to minimize impacts to natural resources by limiting the number of proposed lots (only proposed nine [9]) and by proposing the public road to generally follow the driveway path that led to the former residence on the Subject Property (this helped in terms of tree preservation).

There are three (3) lots, all on the north side of the proposed public road, that access is restricted due to the location of small pocket wetlands. The Applicant did relocate the proposed driveway for Lot 8, Block 1 (south side of proposed road), which eliminated the need for a variance on that lot. While it appears there *may be* space for a house pad on Lots 4-5 south of the small wetlands, it would be extremely tight considering the minimum front yard setback of forty (40) feet. More importantly, this would almost assuredly lead to future issues with encroachment into not only the wetland setback but likely the delineated wetlands as well. Staff has seen this play out in previous developments where homeowners wish to extend their 'usable' yard for play space and accessory buildings.

The Applicant has proposed ten (10) foot wide driveways, at least from the road through the encroachment areas, to minimize encroachment. On Lot 3, the impact is only to the setback area. On Lot 4, 178 square feet of wetland proper would be impacted, along with the encroachment into the wetland setback. On Lot 5, ninety-two (92) square feet of wetland proper would be impacted in addition to the wetland setback encroachment. Cumulatively, the wetland impacts (270 square feet) fall under the de minimus exemption, per the Wetland Conservation Act (meaning no mitigation is required). Furthermore, the Applicant has noted that additional fill could be placed (still under the de minimus exemption) to create the upland area to meet the sixteen and a half (16.5) foot wetland setback, but feels that would be contradictory to the spirit of the Wetland Conservation Act.

Staff has added several conditions to the attached Resolution concerning the proposed driveways. First, the driveways for Lots 3-5, plus Lot 8, shall be installed by the developer, at least through the encroachment area. This ensures that the driveways will comply with what has been proposed in terms of width and location of the

encroachment. Secondly, that Lots 3-5 will be restricted to a single driveway access point (the zoning district would allow for two access points) to eliminate future encroachments. Finally, that culverts are placed under the three (3) driveways to ensure ecological connectivity between the wetlands.

When contemplating a variance, a three (3) factor test must be applied to determine practical difficulties:

1. Reasonableness - The project is reasonable, as it is proposing nine (9) total lots over ninety-four (94) acres of land, of which, about thirty (30) acres is wetland. The proposed impacts of the three (3) driveways on actual wetland area is only 270 square feet, which is under the de minimus exemption outlined in the Wetland Conservation Act (WCA). It may be possible to add more fill within the wetland areas and still remain within the de minimus exemption; however, that does seem contradictory to the purpose of the WCA.
2. Uniqueness - There are unique conditions applicable to the Subject Property. Approximately 1/3 of the Subject Property is encumbered with wetland and floodplain. The Applicant has proposed a project that really does minimize impacts to natural resources. Access to the larger, buildable areas of Lots 3-5 (where encroachment in the form of fill, sod, etc.) is obstructed due to the location of several small, pocket wetlands, and the required wetland setback. The project is attempting to minimize impacts to existing natural site conditions (wetlands, flood plain, tree cover).
3. Essential Character - The proposed subdivision would not alter the essential character of the neighborhood. In fact, the project includes far fewer lots than would be allowed by City Code. The current configuration has the least impact to existing site conditions and includes lot sizes more compatible with surrounding properties. Furthermore, it is consistent with the community's desire to retain rural character.

Alternatives

Alternative 1: Recommend approval of the requested variance to wetland setback requirements on Lots 3-5 to accommodate driveway access to building sites. Locating the house pads north of the small, pocket wetlands (but south of the large wetland complex) provides more wide open space for future homeowners to establish a 'usable' yard without inadvertently filling wetland area. Overall, this project has strived to limit impacts to natural resources and attempted to retain rural character by proposing fewer total lots, that by and large, far exceed minimum lot size. Staff supports this alternative.

Alternative 2: Recommend denial of the variance. Should the requested variance be denied, the Applicant would need to revise the Preliminary Plat to eliminate encroachment into the wetland setback areas on Lots 3-5. The proposed impacts from the three (3) driveways fall under the de minimus exemption regarding actual wetland impacts. The location of the small, pocket wetlands restrict access to the larger, buildable areas on these lots, where there is much less likelihood of wetland encroachments by the future homeowners. Staff does not support this alternative.

Funding Source:

The Applicant is responsible for all costs associated with this request.

Action:

Motion to recommend approval of the requested variance to deviate from the wetland setback requirement on Lots 3-5, Block 1 Williams Woods.

Attachments

Site Location Map

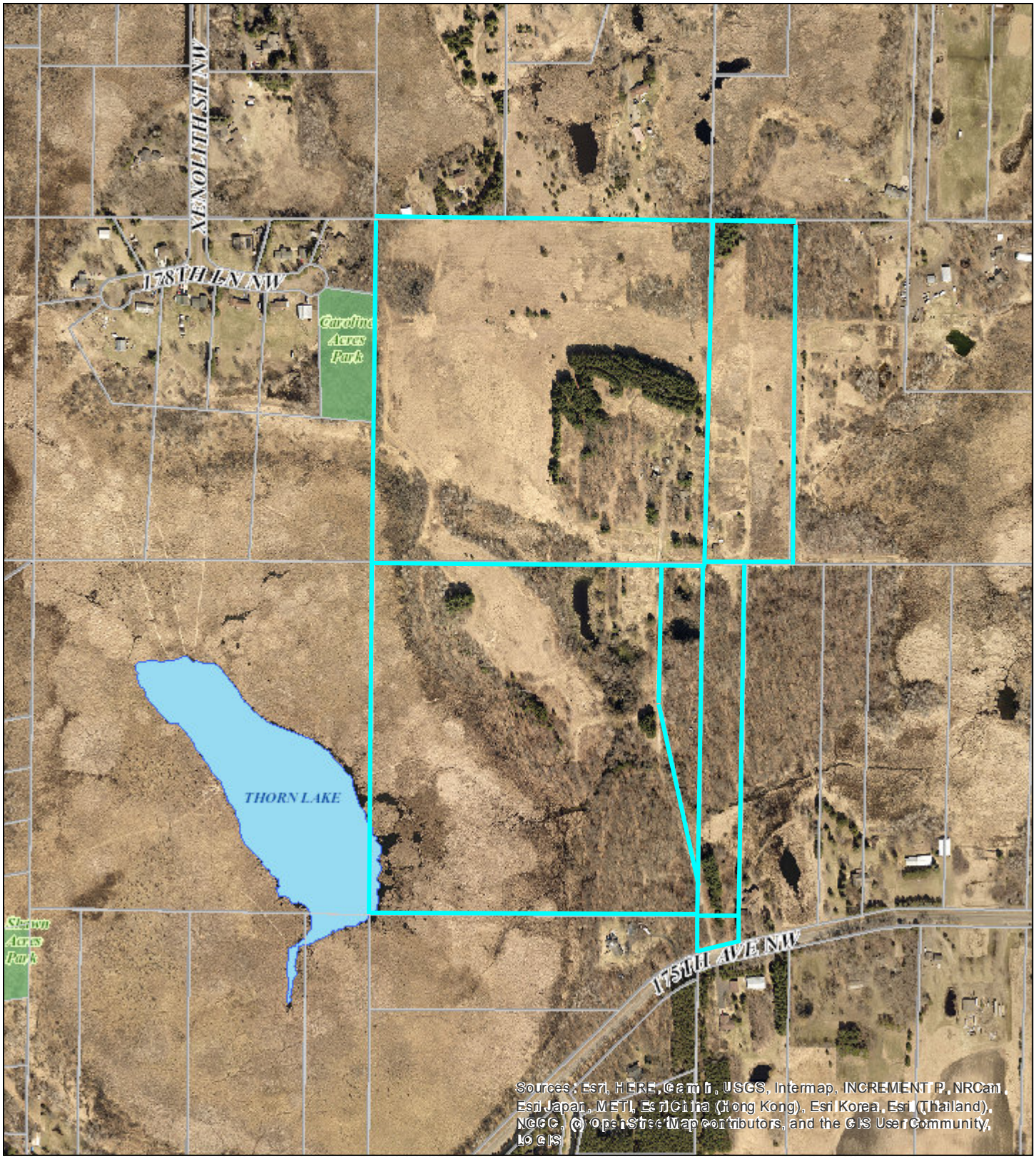
Applicant Summary of Variance Request

Wetland Setback Exhibits for Lots 3-5

Resolution #21-203: Draft Variance

Form Review

Inbox	Reviewed By	Date
Bruce Westby	Bruce Westby	07/15/2021 11:23 AM
Form Started By: Chris Anderson		Started On: 07/08/2021 08:43 AM
Final Approval Date: 07/15/2021		



City of RAMSEY

Williams Woods Preliminary Plat

Legend

- Site
- Parcels

N

November 20th, 2020

0 0.175 0.35 mi

LANDFORM
From Site to Finish

Narrative
Wetland Setback Variance for
William Woods 1st Addition

Prepared for:

Bill Bovum

June 22, 2021

SUBMITTED TO
City of Ramsey
7550 Sunwood Drive NW
Ramsey, MN 55303

CREATING MEMORABLE PLACES 25 YEARS

PREPARED BY
Landform Professional Services, LLC
105 5th Ave S, Suite 513
Minneapolis, MN 55401

TABLE OF CONTENTS

Introduction 1

Variance 1

Summary 3

Contact Information 3

Introduction

On behalf of Bill Boyum, Landform is pleased to submit this application for approval of a wetland setback variance for "Williams Woods", a nine lot rural subdivision on 94.4 acres located at 7363 175th Avenue NW (PIN #04-32-25-13-0001, 04-32-25-14-0005, 04-32-25-41-0002, 04-32-25-42-0002, 04-32-25-42-0003 and 04-32-25-44-0003).

At the June 3rd meeting, the Planning Commission approved a variance from the maximum cul-de-sac length. The Commission also recommended approval of the preliminary plat request, which is scheduled for City Council action on June 22nd.

Variance

Wetland Setback

We have completed our wetland delineation for the site and expect LRRWMO (Lower Rum River Watershed Management Organization) to approve the delineation on July 15th. We are requesting City approval for a variance from Section 117-289, which requires a 16.5-foot setback from all wetlands and stormwater ponds. This site is uniquely restricted by the wetlands and trees on site. We have designed the subdivision to limit the impacts to trees and wetlands by limiting the subdivision to nine lots where the code would allow up to 37 lots. However, some flexibility is requested to allow driveways to cross the wetlands for three of the lots.

The variance is needed to put the property to reasonable use. The location of the wetlands on the southern half of the property creates a hardship that makes it impossible for the developer to serve three of the lots and meet the wetland setback requirements. The physical characteristics of the site require the variance.

The wetland complex on the west side of the site does not allow driveway access for Lots 3-5 without some wetland setback flexibility. The Wetland Conservation Act (WCA) allows up to 2,500 sq. ft. of de minimis wetland fill on this site. We have worked to minimize the wetland impacts and have only 270 sq. ft. for these three driveways. Unfortunately, this means that we cannot meet the wetland setback for these lots and are requesting a variance to allow a 1.9-foot setback on Lot 3 and zero setback on Lots 4-5. While the WCA rules could allow additional de minimis fill under to create the required setbacks, we do not believe that filling wetlands to create the setback is in the spirit of the WCA.

If the driveways for Lots 4 and 5 were combined into a shared driveway, we could fill the wetland under the de minimis rule to create the driveway on Lot 3 and the new shared driveway on Lot 4 within the de minimum fill allowance and create the required wetland setbacks.

The following table summarizes the proposed impacts for the three affected lots:

	Wetland Impact	Wetland Setback Impact
Lot 3	0 sq. ft.	873 sq. ft.
Lot 4	178 sq. ft.	2,157 sq. ft.
Lot 5	92 sq. ft.	1,816 sq. ft.
Total	270 sq. ft.	3,973 sq. ft.

We have reviewed the request in accordance with MN law and the City ordinance standards in Section 117-53 and find that the ordinance standards have been met. Specifically, the proposed action will not:

1. *Impair an adequate supply of light and air to adjacent property.*

   The variance from the wetland buffer requirements will have no impact on the supply of light and air to adjacent property.

2. *Unreasonably increase the congestion in the public street.*

   The wetland buffer setback variance will not increase the congestion on public streets.

3. *Have the effect of allowing any uses prohibited in the applicable zoning district, permit a lesser degree of public health, safety, and general welfare protection than established by this chapter, or permit standards which are lower than those required by state law.*

   The variance will not allow any uses prohibited by ordinance and will only affect three homes. We have reduced the driveway width to 10 feet for these lots to minimize the wetland impacts, but the location of the wetlands makes it impossible to access the west side of the property without some flexibility. We would be well below the amount of de minimis fill allowed by WCA rules, but believe that requesting the variance rather than filing the wetland to create the setback is consistent with the spirit and intent of the ordinance.

4. *Increase the danger of fire or endanger the public safety.*

   The setback variance will not increase the danger of fire or endanger public safety. The plan provides driveways for each of the homes.

5. *Unreasonably diminish or impair established property values within the neighborhood, or in any way be contrary to the intent of this chapter.*

   The project will allow construction of nine custom homes. Three of the driveways require a variance from the wetland setback requirements for the driveway crossing, but the remainder of the wetlands on the lots will meet the setback requirements. Many other communities do allow some wetland setback averaging to accommodate common impacts like the driveway impacts proposed.

6. *Violate the intent and purpose of the comprehensive plan.*

   The development is consistent the intent and purpose of the Comprehensive Plan goals to maintain and expand the rural character of Ramsey by creating nine estate lots rather than maximizing the potential number of homes on the lot. The development was designed to minimize wetland impacts and tree loss by creating only nine lots on this 94.4-acre site.

7. *Violate any of the terms or conditions of subsection (b)(2)b of this section.*

   Granting the variance would not violate any of the terms or conditions of the subsection, which references the statutory requirements in MN Statute §462.357, subd. 6(2).

Furthermore, the City Code requires compliance with the following:

1. *A variance from the terms of this chapter shall not be granted unless it can be demonstrated that that the conditions for granting a variance under Minn. Stats. § 462.357, subd. 6(2) have been satisfied.*

   There are practical difficulties in complying with the wetland setback due to the physical site constraints. The hardship is caused by the location of the wetlands on site, which do not allow access to the western portion of the property without impact to the wetland setback. These physical constraints were not caused by the landowner. If the variance is granted it will not alter the essential character of the locality, but will reinforce the rural character of Ramsey.

2. *Application for a variance shall set forth reasons that the variance is justified in order to make reasonable use of the land, structure or building.*

   The variance is required to make reasonable use of the land. The site is zoned to allow up to 37 lots and our project is for only nine lots. The existing wetlands on site and the location of the trees that are proposed for preservation create challenges to accessing this portion of the property.

Summary

We respectfully request approval of the variance for wetland setbacks for Lots 3-5 in Williams Woods 1st Addition. It is our understanding that this item will be scheduled for the July 22nd Planning Commission meeting.

Contact Information

This document was prepared by:

Kendra Lindahl, AICP
Landform
105 South Fifth Avenue, Suite 513
Minneapolis, MN 55401

Any additional questions regarding this application can be directed to Kendra Lindahl at klindahl@landform.net or 612.638.0225.

OVERALL IMPACTS

WETLAND 6 IMPACT = 46 S.F.

WETLAND 7 IMPACT = 61 S.F.

WETLAND 8 IMPACT = 163 S.F.

SETBACK IMPACT = 4,846 S.F.

: DENOTES AREA OF WETLAND SETBACK IMPACT

: DENOTES AREA OF WETLAND IMPACT

N00°35'03"E 1360.45

N00°35'03"E 132

S00°38'21"E 1360.00

N01°06'48"E 178.79

L=82.38'
R=580.00'
N07°08'14"W
82.30'

S01°22'43"W 1495.87

S80°34'04"E 170.31

S01°15'51"W 1323.82

LOT 2

LOT 3

LOT 4

LOT 5

LOT 6

LOT 9

SEE PAGE 2 FOR LOT 3 IMPACTS

SEE PAGE 3 FOR LOT 4 IMPACTS

SEE PAGE 4 FOR LOT 5 IMPACTS

EDGE OF WETLAND

WETLAND BUFFER ZONE

100 YR FLOOD PLAIN

UTILITY EASEMENT

EXISTING GARAGE

NORTH

0 200

WETLAND SETBACK VARIANCE EXHIBIT

WILLIAMS WOODS • Ramsey, MN

PAGE 1 • 06.22.2021

LOT 3 IMPACTS

SETBACK IMPACT = 873 S.F.

: DENOTES AREA OF WETLAND SETBACK IMPACT

WETLAND 13

WETLAND BUFFER ZONE

SILT FENCE (TYP.)

1.9'

1.9'

EDGE OF WETLAND

16.50

WETLAND 9

10' DRIVEWAY

892

894

896

898

890

NORTH

0

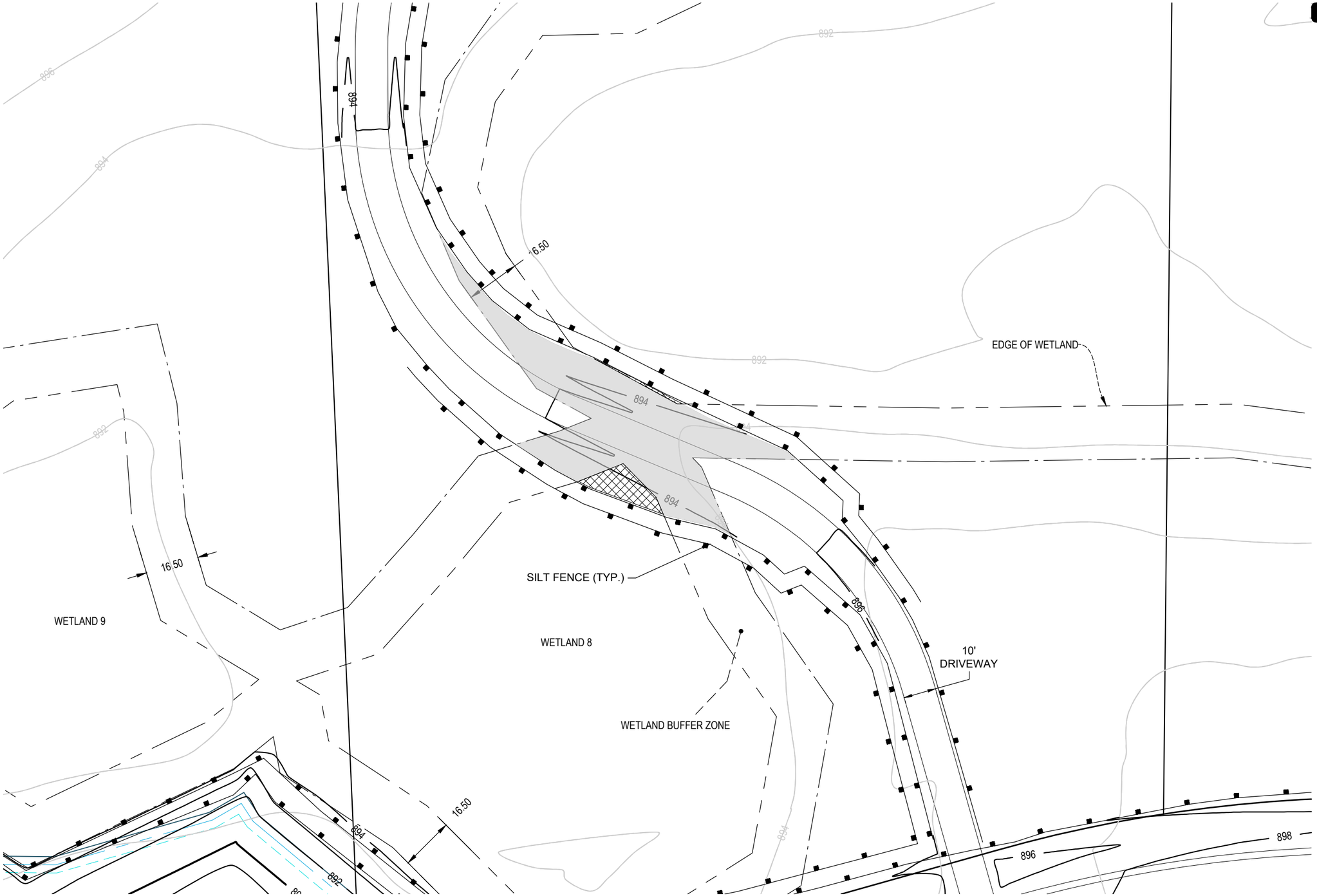
30

WETLAND SETBACK VARIANCE EXHIBIT

LANDFORM

WILLIAMS WOODS • Ramsey, MN

PAGE 2 • 06.22.2021



LOT 4 IMPACTS

WETLAND 7 IMPACT = 15 S.F.

WETLAND 8 IMPACT = 163 S.F.

SETBACK IMPACT = 2,157 S.F.

: DENOTES AREA OF WETLAND SETBACK IMPACT

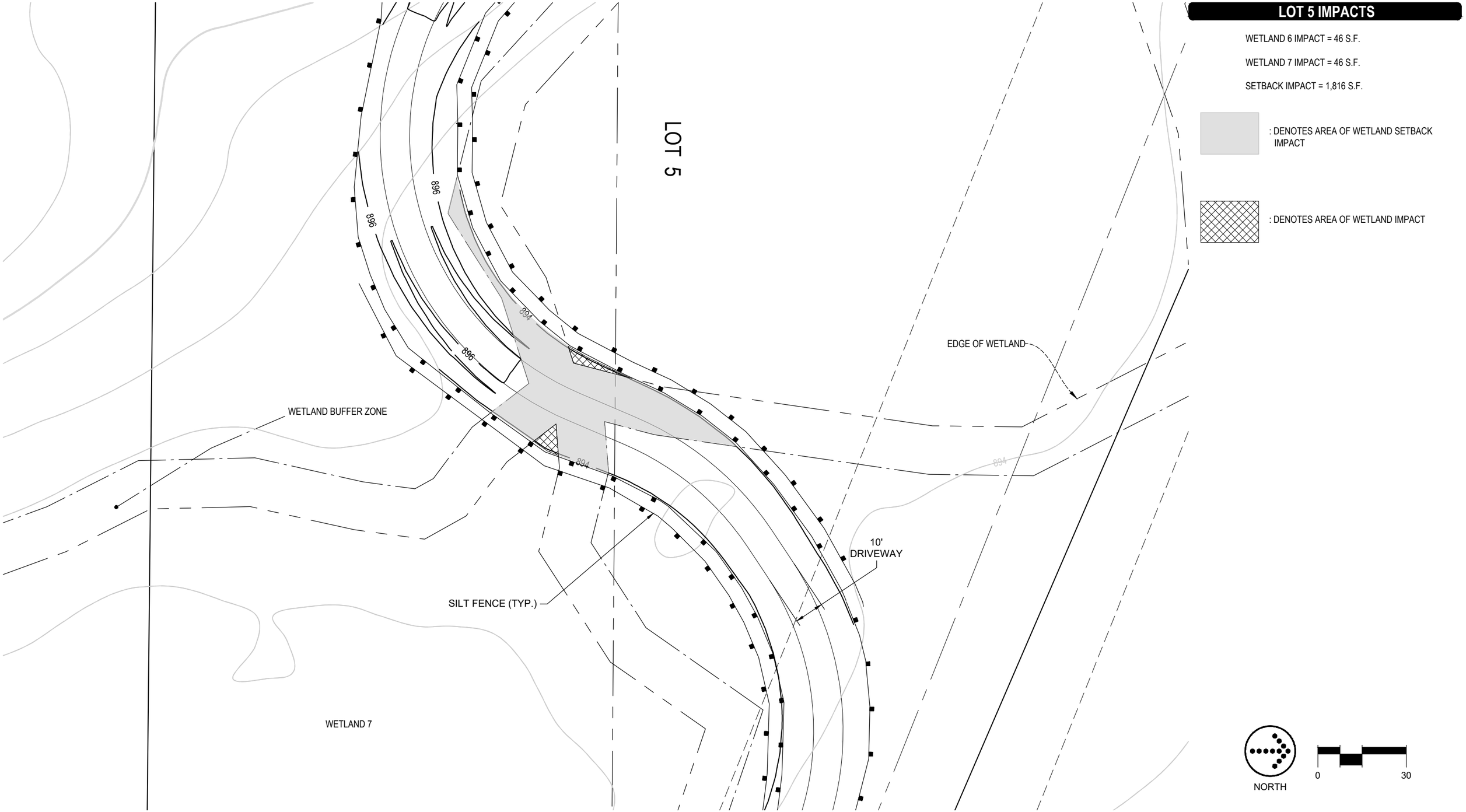
: DENOTES AREA OF WETLAND IMPACT

LANDFORM

WETLAND SETBACK VARIANCE EXHIBIT

WILLIAMS WOODS • Ramsey, MN

PAGE 3 • 06.22.2021



LOT 5 IMPACTS

WETLAND 6 IMPACT = 46 S.F.

WETLAND 7 IMPACT = 46 S.F.

SETBACK IMPACT = 1,816 S.F.

: DENOTES AREA OF WETLAND SETBACK IMPACT

: DENOTES AREA OF WETLAND IMPACT

LANDFORM

WETLAND SETBACK VARIANCE EXHIBIT

WILLIAMS WOODS • Ramsey, MN

PAGE 4 • 06.22.2021

Commissioner _____ introduced the following resolution and moved for its adoption:

RESOLUTION #21-203

A RESOLUTION APPROVING THE ISSUANCE OF A VARIANCE TO WETLAND SETBACK STANDARDS ON LOTS 3-5, BLOCK 1 WILLIAMS WOODS AND DECLARING TERMS OF PERMIT

RECITALS

1. The City of Ramsey received an application from Bill Boyum (the "Permittee") requesting a Variance to Section 117-289 (Permanent Wetland and Stormwater Pond Setbacks) of the Ramsey City Code for:

   Lots 3-5, Block 1 WILLIAMS WOODS

   (the "Subject Property")

2. That the Permittee appeared before the Planning Commission for a public hearing pursuant to Section 117-53 (Variances) of the Ramsey City Code on July 22, 2021, and that said public hearing was properly advertised and that the minutes of said public hearing are available.

3. That the Subject Property is approximately 94 acres in size and is zoned R-1 Residential (Rural Developing).

4. That the surrounding residential parcels are all also zoned R-1 Residential (Rural Developing) and range in size from about 1 acre to 20 acres.

5. That the Subject Property is guided as Rural Developing on the City's Future Land Use Map along with all of the surrounding parcels as well.

6. That the Permittee has applied for Preliminary Plat for a proposed nine (9) lot subdivision gaining access from a new public road.

7. That City Code Section 117-289 (Permanent Wetland and Stormwater Pond Setbacks) requires a wetland setback of sixteen and a half feet (16.5') from the delineated boundary of wetlands.

8. That driveways to Lots 3-5 would encroach into the required wetland setback to provide access to larger, buildable areas.

9. That based on acreage, the Subject Property could potentially be subdivided into thirty-seven (37) lots.

10. That the Permittee has opted for fewer lots with larger sizes in an attempt to incorporate public comments received and to minimize impacts to natural resources.

11. That the Permittee is attempting to minimize disruption of natural resources on the Subject Property, including wetlands (approximately one-third of the Subject Property), floodplain, and tree cover by locating the public road within the same corridor as the driveway that accessed the former residence.

12. That the City Council approved the Preliminary Plat on June 22, 2021 contingent upon compliance with review comments.

13. That the Environmental Policy Board reviewed the request for a variance to the wetland setback requirement on July 19, 2021.

FINDINGS OF FACT

1. That the wetland setback encroachment will not impair an adequate supply of light and air to adjacent property.

2. That the wetland setback encroachment will not unreasonably increase the congestion on the public street.

3. That the wetland setback encroachment will not have the effect of allowing any use prohibited in the R-1 Residential (Rural Developing) District.

4. That the wetland setback encroachment will not permit a lesser degree of public health, safety, and general welfare protection than established by Chapter 117 of the Ramsey City Code, or permit standards which are lower than those required by state law.

5. That the wetland setback encroachment will not increase the danger of fire or endanger the public safety.

6. That the wetland setback encroachment will not unreasonably diminish or impair established property values within the neighborhood, or in any way be contrary to the intent of Chapter 117 of the Ramsey City Code.

7. That the wetland setback encroachment will be harmonious and appropriate in appearance with the existing or intended character of the general vicinity and such use will not change the essential character of the area.

8. That the wetland setback encroachment will not violate the intent and purpose of the Comprehensive Plan.

9. That the wetland setback encroachment will be in accordance with the objectives of the intent of Section 117-53 (Variances) of the Ramsey City Code.

10. That the wetland setback encroachment is the minimum necessary to accomplish the Permittee's intended purpose.

NOW THEREFORE, BE IT RESOLVED BY THIS PLANNING COMMISSION OF THE CITY OF RAMSEY, ANOKA COUNTY, STATE OF MINNESOTA, as follows:

That the Ramsey Planning Commission hereby grants approval of a variance (the "Variance") to the wetland setback standard on the **Subject Property**, subject to review and approval as to legal form and contingent upon the following conditions:

CONDITIONS

1. That this **Variance** shall allow an encroachment into the wetland setback on the **Subject Property** as outlined in Exhibits 1-4.

2. That this **Variance** shall be perpetual in duration as long as the terms are herein complied with.

3. That the **Permittee** shall be responsible for all City costs incurred in administering and enforcing this **Variance**.

4. That the **Permittee** shall install the driveways on the **Subject Property** from the road to a point beyond the area of encroachment and in accordance with Exhibits 1-4.

5. That the **Permittee** shall install the driveway apron for Lot 8, Block 1 Williams Woods in accordance with Exhibit 5.

6. That the **Subject Property** lots shall be restricted to a single driveway access to avoid additional encroachments.

7. That the **Permittee** shall install adequately sized culverts under each driveway on the **Subject Property** to retain ecological connectivity between the wetlands.

8. That the City Administrator, or his/her designee, shall have the right to inspect the **Subject Property** for compliance and safety purposes annually or at any time, upon reasonable request.

9. That adequate water supply and on-site sewage disposal facilities shall be the responsibility of the **Permittee**.

10. That this **Variance** shall automatically expire if the use is not initiated by July 22, 2022, and initiation shall be considered recording of the Final Plat of WILLIAMS WOODS with Anoka County.

The motion for the adoption of the foregoing resolution was duly seconded by Commissioner _____, and upon vote being taken thereon, the following voted in favor thereof:

and the following voted against the same:

and the following abstained:

and the following were absent:

Whereupon said resolution was declared duly passed and adopted by the Ramsey Planning Commission this the 22nd day of July, 2021.

_____
Chairperson

ATTEST:

_____
City Clerk

CITY OF RAMSEY:

STATE OF MINNESOTA)
) ss.
COUNTY OF ANOKA)

On this _____ day of _____, _____, before me a Notary Public personally appeared Randy Bauer and Colleen Lasher, to me personally known, who, being each by me duly sworn, did say that they are respectively the Planning Commission Chairperson and City Clerk of the City of Ramsey, the Municipal Corporation named in the foregoing instrument, and seal affixed to said instrument is the corporate seal of said Municipal corporation, and the said instrument was signed and sealed on behalf of said Municipal Corporation by authority of its City Council, and said Randy Bauer and Colleen Lasher acknowledge said instrument to be the free act and deed of said Municipal Corporation.

_____
Notary Public

The document drafted by:
The City of Ramsey
7550 Sunwood Dr NW
Ramsey, Minnesota 55303

Exhibit 1

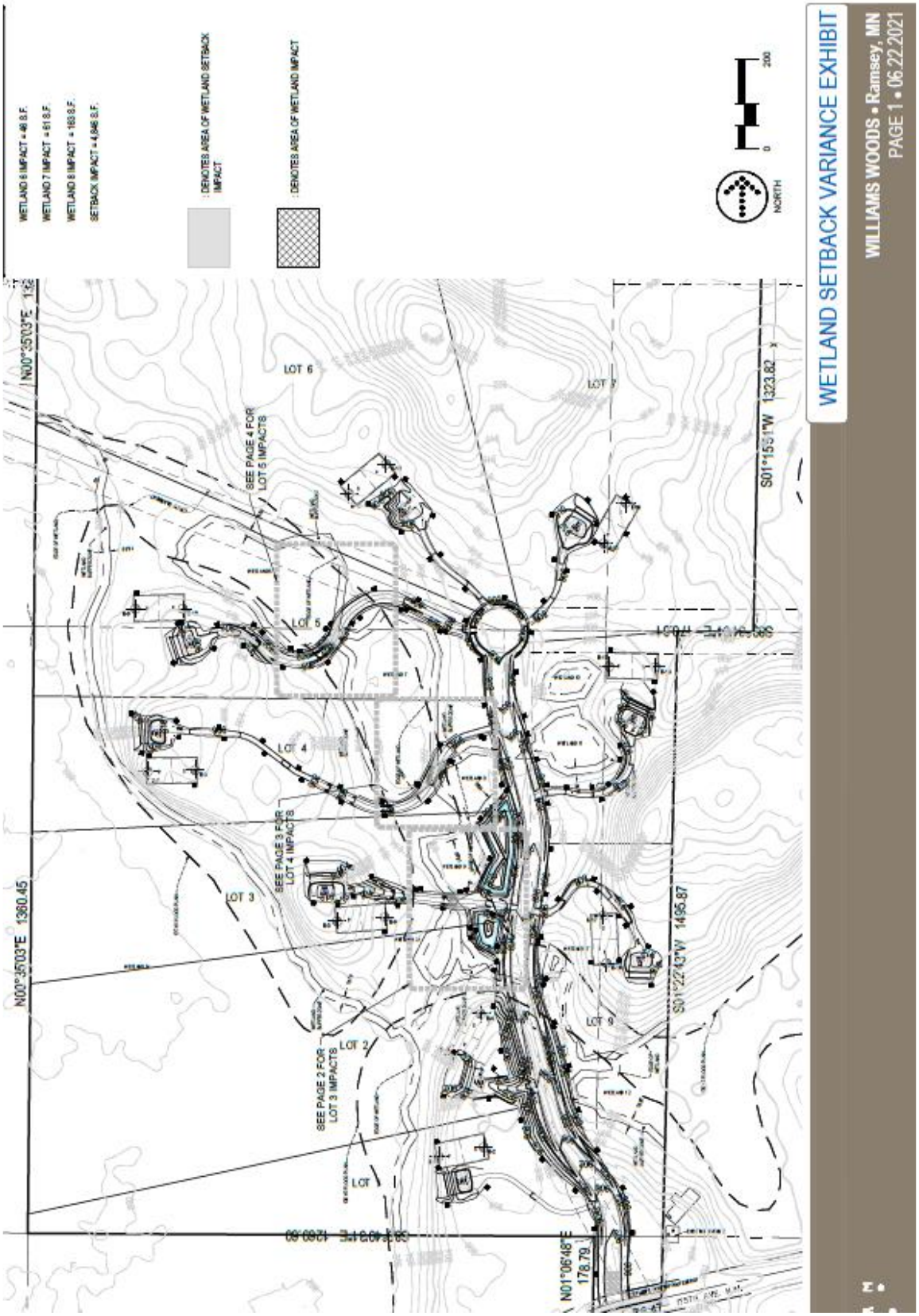

WETLAND SETBACK VARIANCE EXHIBIT
WILLIAMS WOODS • Ramsey, MN
PAGE 1 • 06.22.2021
WETLAND 6 IMPACT = 40 S.F.
WETLAND 7 IMPACT = 61 S.F.
WETLAND 6 IMPACT = 168 S.F.
SETBACK IMPACT = 4,846 S.F.
: DENOTES AREA OF WETLAND SETBACK IMPACT
: DENOTES AREA OF WETLAND IMPACT
200
0
NORTH
LOT 6
LOT 7
LOT 5
LOT 4
LOT 3
LOT 2
LOT 1
LOT 8
LOT 9
SEE PAGE 4 FOR LOT 5 IMPACTS
SEE PAGE 3 FOR LOT 4 IMPACTS
SEE PAGE 2 FOR LOT 3 IMPACTS
N00°35'03"E 1360.45
S01°15'51"W 1323.82
S01°22'43"W 1495.87
N01°06'48"E 178.79

Exhibit 2
Lot 3, Block 1 Williams Woods

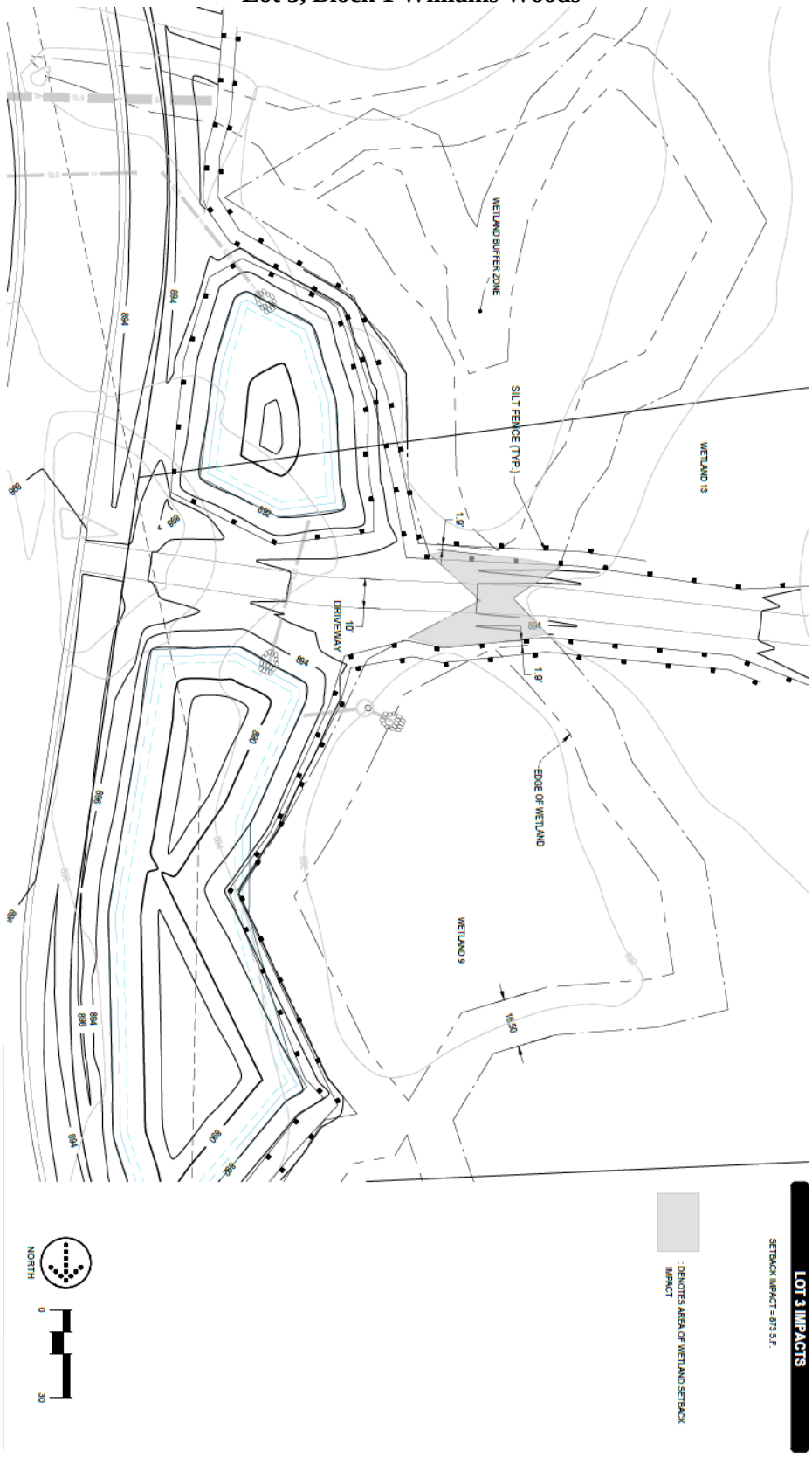


Exhibit 3
Lot 4, Block 1 Williams Woods

Exhibit 4
Lot 5, Block 1 Williams Woods

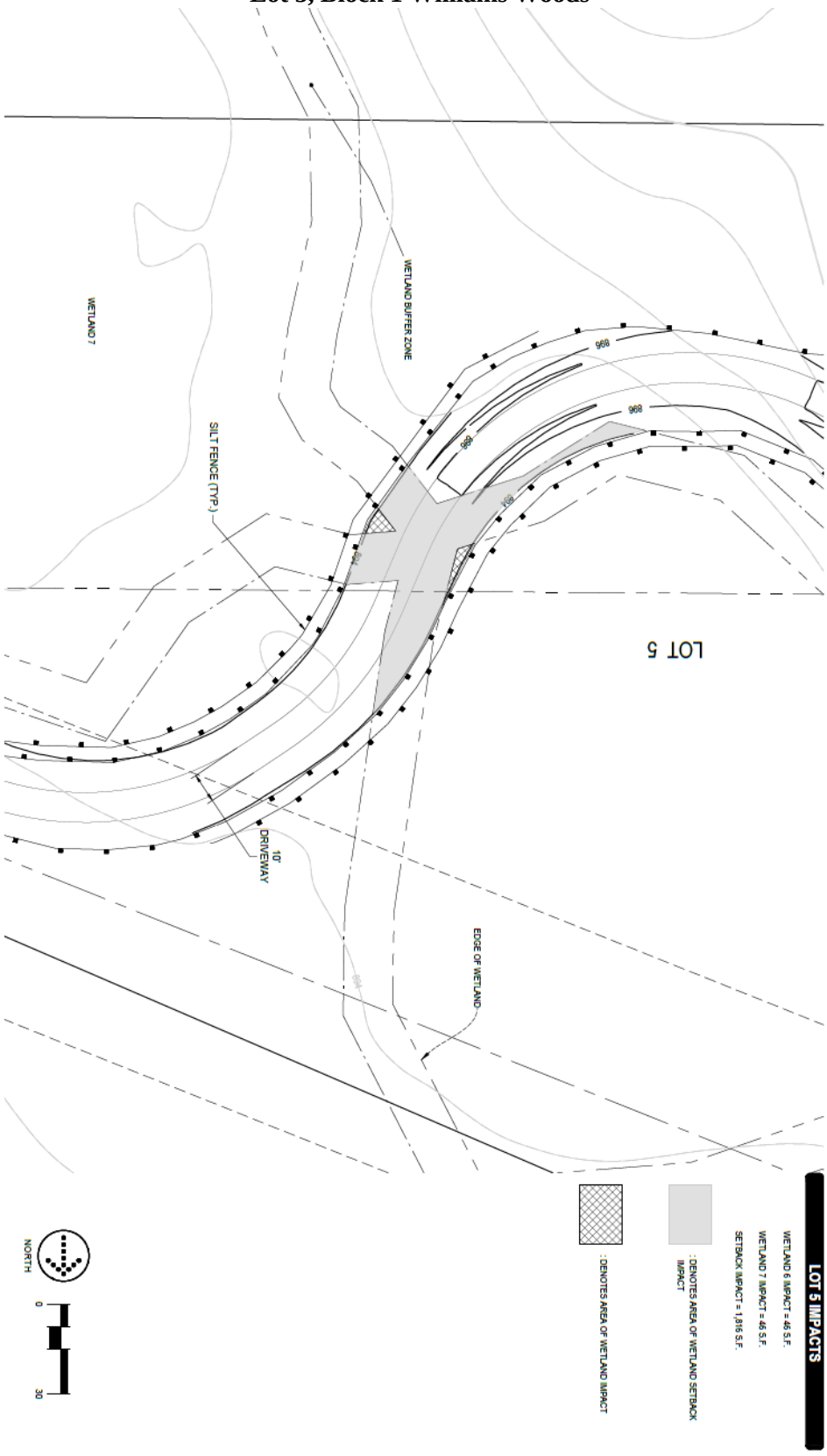
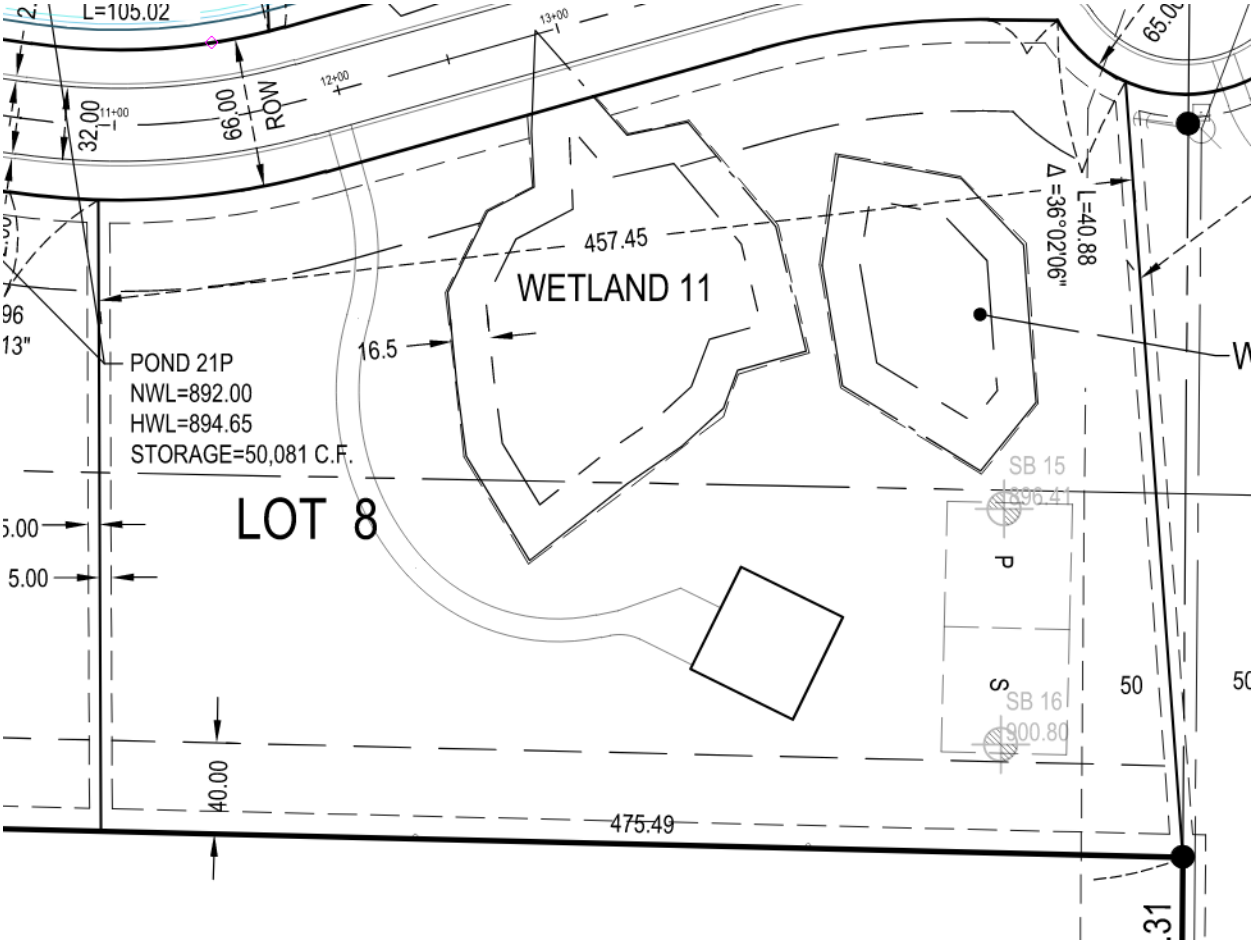


Exhibit 5
Lot 8, Block 1 Williams Woods



Environmental Policy Board (EPB) **5. 3.**

Meeting Date: 07/19/2021

By: Chris Anderson, Community Development

Information

Title:

Consider Landscape Plan for Knoll Properties 2nd Addition

Purpose/Background:

The City has received an application for Site Plan and Plat review for Knoll Properties 2nd Addition. The proposed project is located at the northeast corner of Ramsey Boulevard and Sunwood Drive (the "Subject Property"). Anderson Dahlen (the "Applicant"), which is an existing Ramsey business (located at 6850 Sunwood Drive, just east of the Subject Property and south side of Sunwood Drive), is expanding and this site allows them to continue operating in Ramsey. They are proposing construction of a roughly 64,000 square foot building with the potential for a future addition of another 52,000 square feet.

Observations/Alternatives:

General Background

The Subject Property is zoned E-2 Employment District. The Plat would create one (1) buildable lot and two (2) outlots. The proposed, buildable lot would be approximately 9.25 acres (500 feet x 804 feet) and would meet all minimum bulk standards of the E-2 Employment District.

Natural Resources Inventory

The Subject Property is identified as an altered/non-native plant community in the City's Natural Resources Inventory (NRI). It consists of dry grassland per the Minnesota Land Cover Classification System (MLCCS). There are some scattered trees on the Subject Property, but no woodlands or forest.

Wetlands/Floodplain

The National Wetlands Inventory (NWI) does not show any wetlands present on the Subject Property and there are no floodplains present either.

Tree Inventory and Preservation Plan

As previously noted, there are some scattered trees across the Subject Property. The project should preserve at least thirty percent (30%) of the existing significant tree inches on site. However, existing trees consist primarily of Siberian Elm (invasive species) and Red Cedar. Invasive species, as well as trees removed for stormwater ponding, are excluded from the removal threshold calculation (470 of the 589 significant tree inches on site). Per the Tree Inventory and Preservation Plan, thirty-six inches (36) are required to be saved and the project proposes preservation of sixteen inches (16"). Reforestation will be required; however, it seems clear that the base landscaping will ultimately satisfy this standard.

Landscape Plan

The submitted Landscape Plan is based on the old standards (1 tree per 1,000 square feet of building footprint or 1 tree per 50 linear feet of site perimeter and 1 shrub per 300 square feet of building footprint or 1 shrub per 30 linear feet of site perimeter). Landscaping standards in the Employment Districts are now based on the canopy cover formula. Additional information is needed from the Applicant (total site area, total impervious area, total pervious area) to determine if the Landscape Plan, as proposed, meets the current standards. Proposed species and sizes are all acceptable.

Funding Source:

The Applicant is responsible for all costs associated with this project.

Action:

Motion to recommend approval of the Landscape Plan and Tree Inventory and Preservation Plan, contingent upon compliance with Staff comments in Projectdox.

Attachments

Site Location Map

Tree Inventory and Preservation Plan

Landscape Plan with Comments

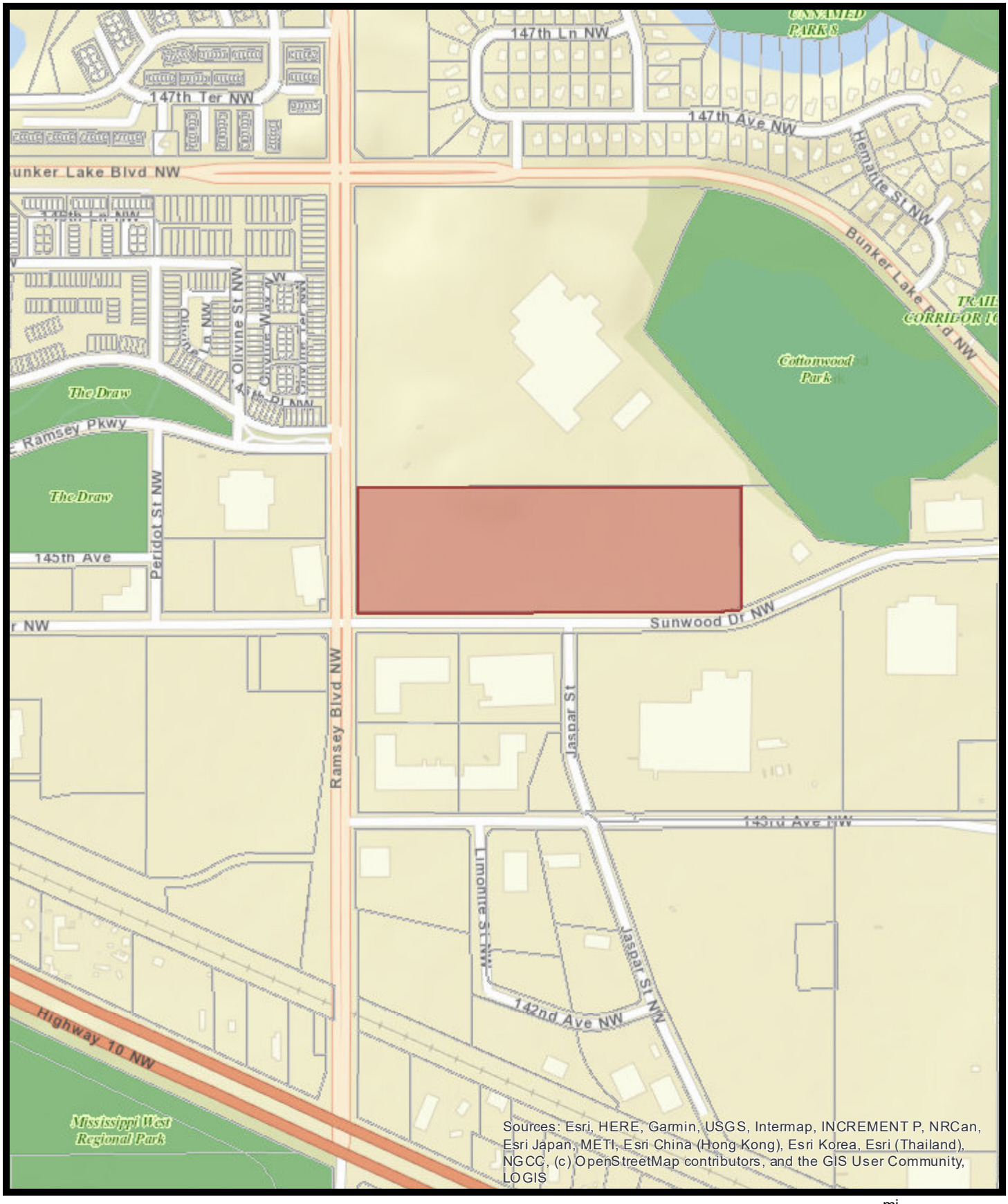
Site Plan

Form Review

Inbox	Reviewed By	Date
Bruce Westby	Bruce Westby	07/15/2021 11:21 AM
Form Started By: Chris Anderson		Started On: 07/07/2021 03:36 PM
Final Approval Date: 07/15/2021		

Knoll Properties 2nd Addition

PID
27-32-25-32-0008



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7/1/2021 12:51:02 PM

GENERAL NOTES:

1. SILT FENCE/TREE PROTECTION FENCE SHALL BE IN PLACE PRIOR TO THE START OF ANY REMOVAL ACTIVITIES. SEE THE GRADING, DRAINAGE AND EROSION CONTROL PLAN FOR SILT FENCE LOCATIONS.
2. CLEARING OF ANY OAK TREES SHALL NOT OCCUR PRIOR TO JULY 15TH. IF OAK TREE CLEARING IS NECESSARY PRIOR TO JULY 15TH, AN OAK WILT MANAGEMENT PLAN MUST BE PREPARED AND SUBMITTED TO THE CITY FOR REVIEW TO ENSURE ADEQUATE MEASURES ARE IMPLEMENTED TO PROTECT FROM THE INTRODUCTION OF OAK WILT.
3. CLEAR AND GRUB BRUSH, SHRUBS AND SMALL TREES WITHIN THE CONSTRUCTION LIMITS (NOT SHOWN).
4. CONTRACTOR SHALL PREPARE A TRAFFIC CONTROL PLAN FOR THE WORK IN SUNWOOD DRIVE. PLAN SHALL BE SUBMITTED TO THE CITY OF RAMSEY A MINIMUM OF 7 DAYS PRIOR TO CONSTRUCTION.

REFERENCE NOTES:

① FENCE MATERIAL SHALL MEET THE REQUIREMENTS OF MN/DOT SPEC. 2572.2.B. FENCE SHALL BE INSTALLED PER MN/DOT SPEC. 2572.3.A.1.

② ONLY THE SIGNIFICANT TREES, AS DEFINED BY THE CITY OF RAMSEY, ARE NUMBERED. SEE SHEET C2 FOR THE SIGNIFICANT TREE INVENTORY TABULATION.

LOT 1

LOT 2

SB-1 SB-2 SB-3 SB-4 SB-5 SB-6 SB-7 SB-8 SB-9 SB-10 SB-11

SUNWOOD DRIVE

JASPAR STREET

SAN/MH
RIM=867.96
INV=853.46

SAN/MH
RIM=866.30
INV=853.00

CB
RIM=865.21
INV(S)=862.11

CB
RIM=865.33
INV(S)=862.03
INV(N,E)=861.93

REMOVE 6" DIP WATER SERVICE, GATE VALVE AND DIP TEE

SALVAGE SIGN

REMOVE CATCH BASIN AND STORM SEWER TO FIRST PIPE JOINT

CB
RIM=865.22
INV(S)=862.02
INV(W,E)=861.82

CB
RIM=865.38
INV(E)=862.38
INV(W)=861.78
INV(N,S)=861.63

CB
RIM=864.94
INV(S)=861.69

SAN/MH
RIM=865.92
INV=851.82

CB
RIM=865.44
INV(W)=862.89

SAWCUT, MILL AND REMOVE BITUMINOUS PAVEMENT PER CITY PLATE NO. STR-25

SAWCUT, MILL AND REMOVE BITUMINOUS PAVEMENT PER CITY PLATE NO. STR-25

LEGEND

- PROPERTY LINE
- EASEMENT LINE
- SECTION LINE
- XXX EXISTING CONTOUR
- EXISTING CONCRETE CURB
- G GAS MAIN
- P-BUR BURIED ELECTRIC LINE
- T-BUR BURIED TELEPHONE LINE
- TV-BUR BURIED TELEVISION LINE
- FO-BUR BURIED FIBER OPTIC LINE
- EXISTING WATERMAIN
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- X FENCE
- Ⓢ EXISTING SANITARY SEWER MANHOLE
- Ⓓ EXISTING STORM SEWER MANHOLE
- EXISTING CATCH BASIN
- EXISTING WATERMAIN VALVE
- EXISTING HYDRANT
- LIGHT POLE
- SIGN
- DECIDUOUS AND CONIFEROUS TREES
- SB-X APPROXIMATE SOIL BORING LOCATION
- EXISTING BITUMINOUS PAVEMENT
- REMOVE BITUMINOUS PAVEMENT
- CLEAR AND GRUB TREES
- REMOVE CONCRETE CURB
- SAWCUT BITUMINOUS PAVEMENT
- TREE PROTECTION FENCE ①
- XXX TREE NUMBER ②

N

SCALE 30 0 30 60 IN FEET

DATE	REVISION	DATE	REVISION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

TIMOTHY A. EDGERRIN, P.E.
Date 6/18/21 Lic. No. 43362

DESIGNED BY: TAE
DRAWN BY: TAE
CHECKED BY: CJJ

Hakanson Anderson
Civil Engineers and Land Surveyors
3601 Thurston Ave., Anoka, Minnesota 55303
763-427-5860 FAX 763-427-0520
www.hakanson-anderson.com

LOT 1, BLOCK 1
KNOLL PROPERTIES SECOND ADDITION

EXISTING TOPOGRAPHY AND REMOVALS PLAN

CITY OF RAMSEY, MINNESOTA

SHEET C5 OF C10 SHEETS

3395.12

Jun 18, 2021 - 8:42am
K:\PRJTA ES\3395.12\ENGINEERING\3395.12_EXISTING.dwg

GENERAL CONSTRUCTION AND SOILS NOTES:

1. STRIP ALL INPLACE TOPSOIL IN AREAS TO BE DISTURBED BY CONSTRUCTION AND REUSE AS SLOPE DRESSING. IN AREAS OF PARKING LOT AND BUILDING CONSTRUCTION, THE EXPOSED SAND SHALL BE SURFACE COMPACTED TO AT LEAST 100% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY, ASTM D698, IN AT LEAST THE UPPER 3 FEET.
2. UNLESS OTHERWISE RECOMMENDED IN THESE PLANS, THE GRADING SUBGRADE SHALL BE CONSTRUCTED OF SUITABLE GRADING MATERIAL. THE FILL SHALL BE PLACED IN 8'' TO 10'' LOOSE LIFTS, AND COMPACTED TO 100% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY.
3. SUITABLE GRADING MATERIAL FOR THIS PROJECT SHALL CONSIST OF ALL SOILS ENCOUNTERED WITH THE EXCEPTION OF TOPSOIL, SILT, DEBRIS, ORGANIC MATERIAL AND OTHER UNSTABLE MATERIAL.
4. CONTRACTOR SHALL REVIEW THE REPORT OF GEOTECHNICAL EXPLORATION PREPARED BY AMERICAN ENGINEERING TESTING, INC. AND DATED APRIL 26, 2021 FOR ADDITIONAL SITE PREPARATION REQUIREMENTS.
5. PROVIDE A SAW CUT WHEN PLACING NEW PAVEMENT ADJACENT TO INPLACE PAVEMENT AND AT TERMINI OF CONSTRUCTION TO ENSURE A UNIFORM JOINT.
6. BITUMINOUS AND CONCRETE ITEMS DISTURBED BY CONSTRUCTION SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE DISPOSED OF IN ACCORDANCE WITH MN/DOT SPEC. 2104.
7. USE TACK COAT BETWEEN ALL BITUMINOUS MIXTURES. THE BITUMINOUS TACK COAT MATERIAL SHALL BE APPLIED AT A UNIFORM RATE OF 0.04 GAL/SY TO 0.06 GAL/SY BETWEEN BITUMINOUS LAYERS. THE APPLICATION RATES ARE FOR UNDILUTED EMULSIONS.
8. THE BITUMINOUS MIXTURES SHALL MEET THE REQUIREMENTS OF SPECIFICATIONS 2360 AND 3139.
9. CONTRACTOR SHALL APPLY FOR A DEPARTMENT OF LABOR AND INDUSTRY PERMIT PRIOR TO CONSTRUCTING ANY UNDERGROUND UTILITIES SHOWN ON THESE PLANS. CONTRACTOR SHALL ADDRESS ALL THE COMMENTS FROM THE DEPARTMENT OF LABOR AND INDUSTRY AS PART OF THE PERMIT APPLICATION PROCESS.

GENERAL EROSION CONTROL NOTES:

1. EROSION CONTROL SHALL CONFORM TO THE MN/DOT EROSION CONTROL HANDBOOK.
2. PRIOR TO ANY CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL ACQUIRE THE MPCA NPDES CONSTRUCTION STORMWATER GENERAL PERMIT. A COPY OF THE PERMIT SHALL BE SUBMITTED TO THE CITY PRIOR TO THE PRECONSTRUCTION MEETING.
3. THE CONTRACTOR SHALL INSTALL EROSION AND SEDIMENT CONTROL FACILITIES (BMP'S) PRIOR TO GRADING AND REMOVAL ACTIVITIES. BMP'S SHALL BE MAINTAINED FOR THE DURATION OF CONSTRUCTION ACTIVITIES AND POTENTIAL FOR EROSION HAS PASSED.
4. THE CONTRACTOR SHALL SCHEDULE HIS OPERATION TO MINIMIZE THE AMOUNT OF DISTURBED AREA AT ANY GIVEN TIME.
5. BMP'S SHALL BE INSPECTED DAILY BY THE CONTRACTOR. OBSERVATIONS SHALL BE RECORDED IN AN INSPECTION LOG. WEEKLY INSPECTION LOGS AND INSPECTION LOGS AFTER EVERY 1/2" RAIN EVENT SHALL BE SUBMITTED TO THE CITY INSPECTOR.
6. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE PROPERLY DISPOSED OF WITHIN THIRTY (30) DAYS AFTER FINAL SITE STABILIZATION.
7. THE CONTRACTOR SHALL FILE A NOTICE OF TERMINATION WITH THE MPCA AFTER FINAL STABILIZATION HAS BEEN APPROVED. THE CITY SHALL REVIEW AND APPROVE THE NOTICE OF TERMINATION PRIOR TO SUBMITTAL TO THE MPCA.

REFERENCE NOTES:

① TYPE 1 INLET PROTECTION SHALL BE INSTALLED AS NECESSARY TO MINIMIZE PONDING OF WATER DURING CONSTRUCTION. WIMCO MODEL RD 23 IS SHOWN.

② TYPE 2 INLET PROTECTION SHALL BE INSTALLED ON ALL CASTINGS RECEIVING RUNOFF FROM THE PROJECT AREA. INLET PROTECTION SHALL BE INSTALLED ON EXISTING, OFF SITE CASTINGS PRIOR TO THE START OF CONSTRUCTION. WIMCO MODEL CG 3067 IS SHOWN.

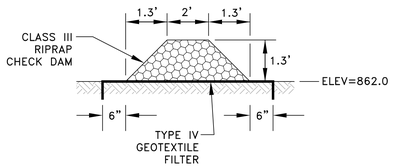
③ TYPE 3 INLET PROTECTION SHALL BE INSTALLED AS NECESSARY TO MINIMIZE PONDING OF WATER DURING CONSTRUCTION. WIMCO MODEL RD 27 IS SHOWN.

④ SEE CITY PLATE NO. STR-26 ON SHEET C3 FOR MODIFIED CLASS 5 AGGREGATE BASE SPECIFICATIONS.

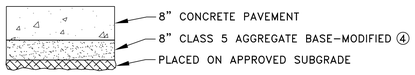
⑤ CONTRACTOR SHALL PROTECT THE INFILTRATION BASIN WITH 48" HIGH ORANGE SAFETY FENCE PRIOR TO THE START OF CONSTRUCTION.

⑥ CONSTRUCTION EQUIPMENT SHALL BE MINIMIZED OVER THE FOOTPRINT OF THE BASIN. ONLY LOW PRESSURE, WIDE TRACKED EQUIPMENT SHALL BE USED FOR CONSTRUCTION.

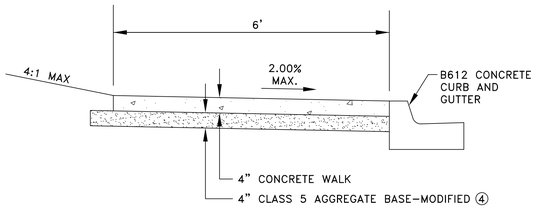
⑦ INFILTRATION BASINS SHALL NOT BE GRADED TO WITHIN THREE FEET OF THE FINAL GRADES UNTIL THE CONTRIBUTING DRAINAGE AREA HAS BEEN CONSTRUCTED AND FULLY STABILIZED OR RIGOROUS EROSION PREVENTION AND SEDIMENT CONTROLS, SUCH AS DIVERSION BERMS, TO KEEP SEDIMENT AND RUNOFF COMPLETELY AWAY FROM THE INFILTRATION AREAS HAVE BEEN PROVIDED.



4 C2 CHECK DAM DETAIL



8 C2 CONCRETE PAVEMENT SECTION
NO SCALE



9 C2 CONCRETE SIDEWALK
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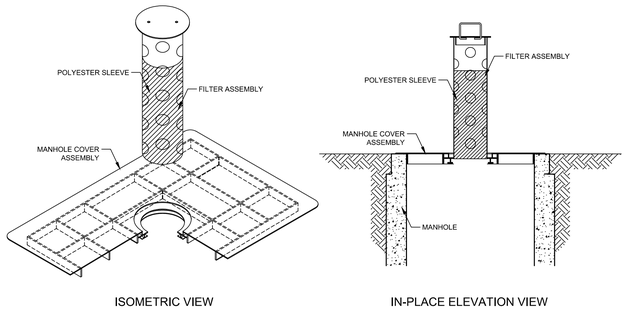
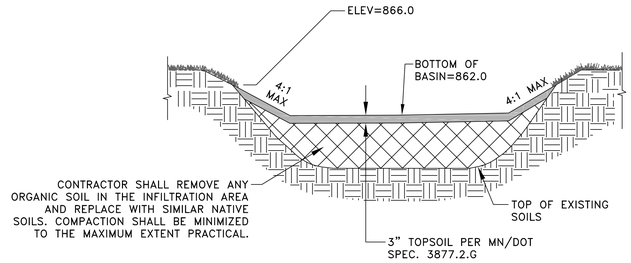
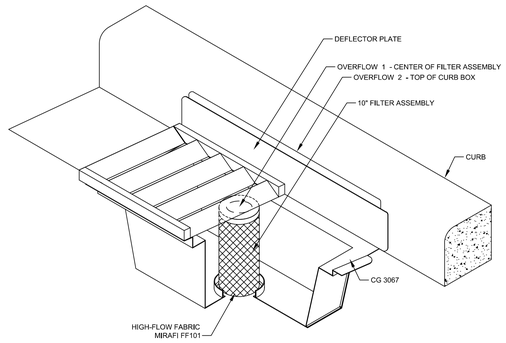


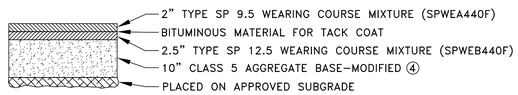
5 C2 STORM DRAIN INLET PROTECTION TYPE 1 ①
PRE-CURB



10 C2 INFILTRATION BASIN ⑤⑥⑦
NO SCALE



6 C2 STORM DRAIN INLET PROTECTION TYPE 2 ②
POST-CURB



1 C2 HEAVY DUTY BITUMINOUS PAVEMENT SECTION
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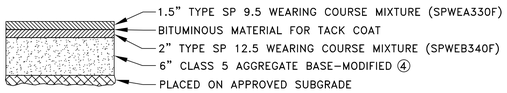

2 C2 LIGHT DUTY BITUMINOUS PAVEMENT SECTION
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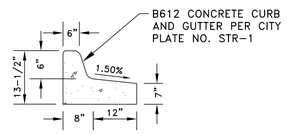
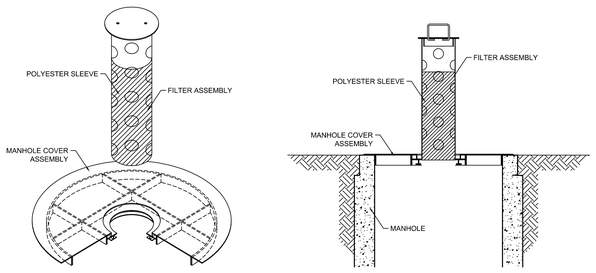
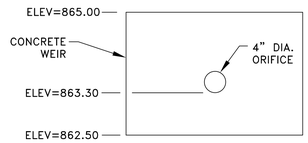


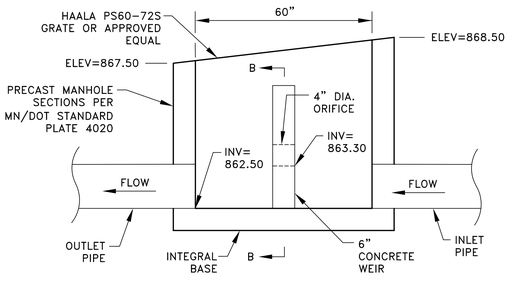
3 C2 TIPOUT CURB DETAIL
NO SCALE



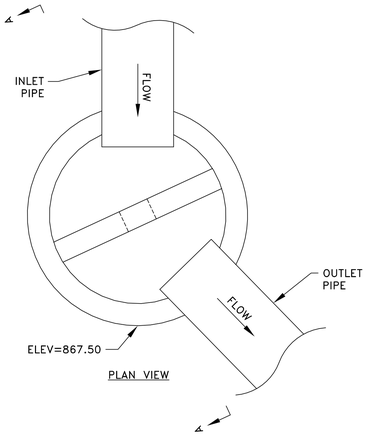
7 C2 STORM DRAIN INLET PROTECTION TYPE 3 ③



SECTION B-B



SECTION A-A



PLAN VIEW

11 C2 POND OUTLET STRUCTURE
NO SCALE

SIGNIFICANT TREE INVENTORY TABULATION				
Tree Number	Common Name	Scientific Name	Diameter (inches)	Action
713	American Elm	*Ulmus americana*	8	Protect
714	Siberian Elm *	*Ulmus pumila*	16	Clear & Grub - Pond
715	Siberian Elm *	*Ulmus pumila*	9	Clear & Grub - Parking Lot
716	Siberian Elm *	*Ulmus pumila*	9	Clear & Grub - Building
717	Cottonwood	*Populus deltoides*	16	Clear & Grub - Parking Lot
718	Eastern Red Cedar	*Juniperus virginiana*	4	Clear & Grub - Parking Lot
719	Eastern Red Cedar	*Juniperus virginiana*	5	Clear & Grub - Parking Lot
720	Siberian Elm *	*Ulmus pumila*	11	Clear & Grub - Pond
721	Eastern Red Cedar	*Juniperus virginiana*	5	Clear & Grub - Pond
722	Eastern Red Cedar	*Juniperus virginiana*	5	Clear & Grub - Building
723	Eastern Red Cedar	*Juniperus virginiana*	6	Clear & Grub - Building
725	Siberian Elm *	*Ulmus pumila*	9	Clear & Grub - Building
726	Eastern Red Cedar	*Juniperus virginiana*	4	Clear & Grub - Building
727	Siberian Elm *	*Ulmus pumila*	10	Clear & Grub - Building
728	Siberian Elm *	*Ulmus pumila*	8	Clear & Grub - Parking Lot
729	Siberian Elm *	*Ulmus pumila*	14	Clear & Grub - Parking Lot
730	Siberian Elm *	*Ulmus pumila*	10	Clear & Grub - Building
731	Siberian Elm *	*Ulmus pumila*	10	Clear & Grub - Parking Lot
732	Siberian Elm *	*Ulmus pumila*	9	Clear & Grub - Parking Lot
733	Siberian Elm *	*Ulmus pumila*	13	Clear & Grub - Parking Lot
734	Siberian Elm *	*Ulmus pumila*	18	Clear & Grub - Building
735	Siberian Elm *	*Ulmus pumila*	13	Clear & Grub - Building
736	Eastern Red Cedar	*Juniperus virginiana*	5	Clear & Grub - Building
737	Siberian Elm *	*Ulmus pumila*	10	Clear & Grub - Building
738	Sugar Maple	*Acer saccharum*	8	Protect
739	Siberian Elm *	*Ulmus pumila*	12	Clear & Grub - Building
740	Siberian Elm *	*Ulmus pumila*	11	Clear & Grub - Building
741	Scotch Pine	*Pinus Sylvestris*	10	Clear & Grub - Building
742	Eastern Red Cedar	*Juniperus virginiana*	4	Clear & Grub - Building
743	Scotch Pine	*Pinus Sylvestris*	11	Clear & Grub - Building
744	Siberian Elm *	*Ulmus pumila*	12	Clear & Grub - Building
745	Siberian Elm *	*Ulmus pumila*	17	Clear & Grub - Building
746	Cottonwood	*Populus deltoides*	17	Clear & Grub - Parking Lot
747	Siberian Elm *	*Ulmus pumila*	21	Clear & Grub - Parking Lot
748	Siberian Elm *	*Ulmus pumila*	12	Clear & Grub - Parking Lot
749	Siberian Elm *	*Ulmus pumila*	12	Clear & Grub - Parking Lot
750	Siberian Elm *	*Ulmus pumila*	14	Clear & Grub - Building
751	Siberian Elm *	*Ulmus pumila*	12	Clear & Grub - Building
752	Siberian Elm *	*Ulmus pumila*	16	Clear & Grub - Building
753	Eastern Red Cedar	Juniperus virginiana	6	Clear & Grub - Building
754	Eastern Red Cedar	Juniperus virginiana	4	Clear & Grub - Building
755	Eastern Red Cedar	Juniperus virginiana	6	Clear & Grub - Building
756	Siberian Elm *	Ulmus pumila	16	Clear & Grub - Parking Lot
757	Siberian Elm *	Ulmus pumila	11	Clear & Grub - Parking Lot
758	Siberian Elm *	Ulmus pumila	9	Clear & Grub - Parking Lot
759	Siberian Elm *	Ulmus pumila	12	Clear & Grub - Parking Lot
771	Siberian Elm *	Ulmus pumila	15	Clear & Grub - Parking Lot
772	Siberian Elm *	Ulmus pumila	14	Clear & Grub - Parking Lot
773	Eastern Red Cedar	Juniperus virginiana	7	Clear & Grub - Parking Lot
774	Siberian Elm *	Ulmus pumila	9	Clear & Grub - Parking Lot
776	Siberian Elm *	Ulmus pumila	13	Clear & Grub - Parking Lot
777	Cottonwood	Populus deltoides	10	Clear & Grub - Parking Lot
778	Siberian Elm *	Ulmus pumila	14	Clear & Grub - Parking Lot
779	Siberian Elm *	Ulmus pumila	8	Clear & Grub - Parking Lot
780	Cottonwood	Populus deltoides	10	Clear & Grub - Parking Lot
781	Siberian Elm *	Ulmus pumila	9	Clear & Grub - Parking Lot

* Invasive Species

SIGNIFICANT TREE SUMMARY

TOTAL SIGNIFICANT TREE DBH ON SITE:	589 INCHES
EXCLUDE (FOR POND, INVASIVES, ETC.):	470 INCHES
REQUIRED TO BE SAVED (30% X 119):	36 INCHES
PROPOSED TO BE SAVED:	16 INCHES

DATE	REVISION	DATE	REVISION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.
TIMOTHY A. EDDERMANS, P.E.
Date 6/18/21 Lic. No. 43362

DESIGNED BY: TAE
DRAWN BY: TAE
CHECKED BY: CJJ

Hakanson Anderson
Civil Engineers and Land Surveyors
3601 Thurston Ave., Anoka, Minnesota 55303
763-427-5860 FAX 763-427-0520
www.hakanson-anderson.com

LOT 1, BLOCK 1
KNOLL PROPERTIES SECOND ADDITION

CONSTRUCTION NOTES AND DETAILS
CITY OF RAMSEY, MINNESOTA

SHEET C2 OF C10 SHEETS

3395.12

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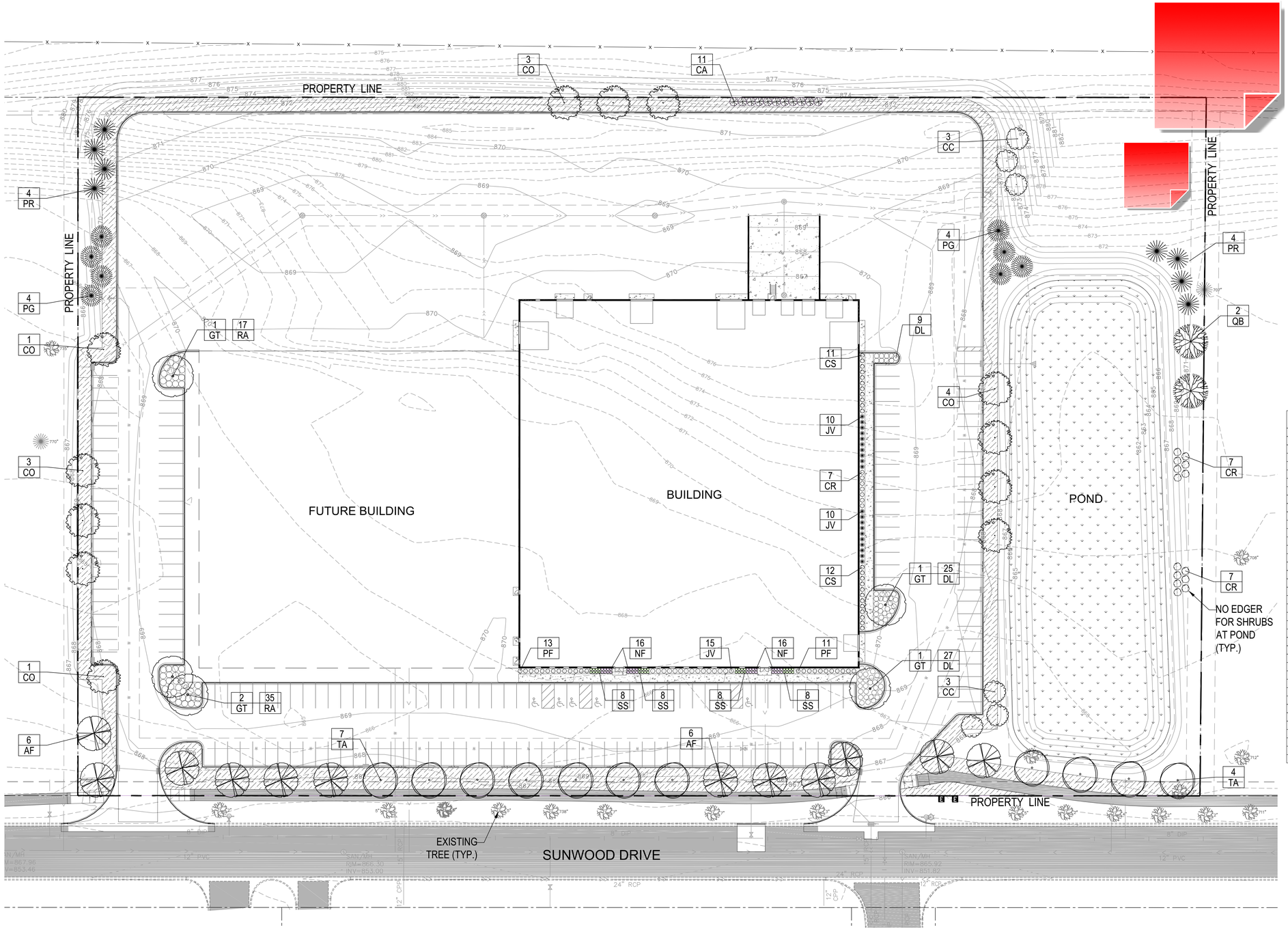


LANDSCAPE REQUIREMENTS

DETERMINING NUMBER OF PLANTS

LOT PERIMETER: 2612 LF/50 LF = 52 TREES

BUILDING FOOTPRINT: 64,414 SF/1,000 SF = 64 TREES

E-2 EMPLOYMENT DISTRICT

PLANTS BASED ON 64,000 SF BUILDING FOOTPRINT	REQUIRED	ON THIS PLAN
DECIDUOUS/CONIFEROUS TREES PER 1,000 SF (INCLUDES 23 EXISTING OVERSTORY TREES)	64	64
SHRUBS PER 300 SF	215	227
TREE DISTRIBUTION	**REQUIRED**	
OVERSTORY TREES ≥ 25%	≥ 16	43
CONIFER TREES ≥ 25%	≥ 16	16
ORNAMENTAL TREES ≤ 25%	≤ 16	6
OVERSTORY TREES ADJACENT TO PUBLIC R.O.W.	**REQUIRED**	
PUBLIC R.O.W. 804 LF/35 LF	23	23
PARKING LOT LANDSCAPING - 192 STALLS	**REQUIRED**	
1 TREE PER 10 STALLS	19	29

NOTES:
1. SEE SHEET L2 FOR PLANT SCHEDULE, PLANTING DETAILS & LANDSCAPE SPECIFICATIONS.
2. ALL LANDSCAPE AREAS TO RECEIVE 4" OF TOPSOIL.
3. RESTORE ALL DISTURBED AREAS WITH MNDOT LOW MAINTENANCE TURF MIX 25-131 UNLESS OTHERWISE NOTED.

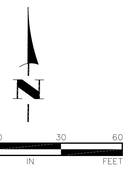
LEGEND

SOD 10' STRIP BEHIND ALL CURBS

MNDOT NATIVE SEED MIX 33-262 POND AREAS

PLANT SCHEDULE

QTY	CODE	SCIENTIFIC NAME/COMMON NAME	SIZE	ROOT	REMARKS
		OVERSTORY TREES			
12	AF	**Acer x freemanii 'Jeffersred'**	2.5" cal.	BB	space 35' o.c.
		Autumn Blaze maple			straight trunk, single leader
12	CO	**Celtis occidentalis**	2.5" cal.	BB	space 35' o.c.
		Hackberry			straight trunk, single leader
5	GT	**Gleditsia triacanthos inermis 'Skycole'**	2.5" cal.	BB	see plan for spacing
		Skyline honeylocust			straight trunk, single leader
11	TA	**Tilia americana 'McKSentry'**	2.5" cal.	BB	space 35' o.c.
		American Sentry linden			straight trunk, single leader
2	QB	**Quercus bicolor**	2.5" cal.	BB	space 35' o.c.
		Swamp white oak			straight trunk, single leader
		ORNAMENTAL TREES			
6	CC	**Crataegus crusgallis inermis**	2" cal.	BB	space 16' o.c.
		Thornless hawthorne			straight trunk, single leader
		EVERGREEN TREES			
8	PG	**Picea glauca densata**	6' ht.	BB	space 16' o.c.
		Black Hills Spruce			straight trunk, single leader
8	PR	**Pinus resinosa**	6' ht.	BB	space 16' o.c.
		Red pine			straight trunk, single leader
		SHRUBS (24" MIN. SHRUB SIZE AT TIME OF INSTALLATION)			
11	CA	**Corylus americana**	#5	cont.	space 6' o.c.
		American hazelnut			
14	CR	**Cornus racemosa**	#5	cont.	space 6' o.c.
		Gray dogwood			
30	CS	**Cornus sericea 'Alleman's Compact'**	#5	cont.	space 4' o.c.
		Alleman's compact redtwig dogwood			
61	DL	**Diervilla lonicera**	#5	cont.	space 3.5' o.c.
		Dwarf bush honeysuckle			
35	JV	**Juniperus virginiana 'Grey Owl'**	#5	cont.	space 4' o.c.
		Grey Owl juniper			
24	PO	**Potentilla fruticosa 'Goldfinger**	#5	cont.	space 4' o.c.
		Goldfinger potentilla			
52	RA	**Rhus aromatica 'Gro-Low'**	#5	cont.	space 4.5' o.c.
		Gro-Low fragrant sumac			
		PERENNIALS			
32	NF	**Nepeta fassenii 'Walker's Low'**	#1	cont.	space 2' o.c.
		Walker's Low catmint			
32	SS	**Schizachyrium scoparium**	#1	cont.	space 2' o.c.
		Little bluestem			



DATE	REVISION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Landscape Architect under the laws of the State of Minnesota. Name: Carmen Simonet

Signature: Carmen Simonet

License # 24236 Date 06.18.2021

LANDSCAPE ARCHITECT:
Carmen Simonet Design LLC
354 Stonebridge Blvd., St. Paul, MN 55105
(651) 695-0273 carmen@simonetdesign.com
www.simonetdesign.com

Hakanson Anderson
Civil Engineers and Land Surveyors
3601 Thurston Ave., Anoka, Minnesota 55303
763-427-5860 FAX 763-427-0520
www.hakanson-anderson.com

LOT 1, BLOCK 1
KNOLL PROPERTIES SECOND ADDITION

LANDSCAPE PLAN

CITY OF RAMSEY, MINNESOTA

SHEET L1 OF L2 SHEETS

3395.12

14601 RAMSEY BOULEVARD NW
ZONING: E-2: EMPLOYMENT DISTRICT

OUTLOT A

UNASSIGNED ADDRESS
ZONING: E-2: EMPLOYMENT DISTRICT

LOT 1

FUTURE
51,983 SF
BUILDING
(229'X227')

PROPOSED
64,416 SF
BUILDING
(244'X264')

OUTLOT B

UNASSIGNED ADDRESS
ZONING: E-2: EMPLOYMENT DISTRICT

SUNWOOD DRIVE

7180 SUNWOOD DRIVE NW
ZONING: E-2: EMPLOYMENT DISTRICT

7100 SUNWOOD DRIVE NW
ZONING: E-2: EMPLOYMENT DISTRICT

JASPAR STREET

7000 SUNWOOD DRIVE NW
ZONING: E-2: EMPLOYMENT DISTRICT

LEGAL DESCRIPTION
LOT 1, BLOCK 1-KNOLL PROPERTIES SECOND ADDITION

ZONING: E-2: EMPLOYMENT DISTRICT
FRONT YARD SETBACK: 35'
REAR YARD SETBACK: 25'
SIDE YARD SETBACK: 25'
PARKING SETBACK FROM RIGHT-OF-WAY: 20'

LOT SUMMARY

TOTAL LOT AREA=	402,943 SF	
TOTAL DISTURBED AREA=	401,159 SF	
PRE-CONSTRUCTION IMPERVIOUS AREA=	3,547 SF	
POST CONSTRUCTION IMPERVIOUS AREA=	292,632 SF	(73%)
BUILDING COVERAGE AREA (PHASES 1 & 2)	116,399 SF	(29%)
GREEN SPACE AREA	110,311 SF	(27%)

ESTIMATED NUMBER OF EMPLOYEES-PHASE 1= 10 OFFICE EMPLOYEES
45 INDUSTRIAL EMPLOYEES

PHASE 1 OFFICE SPACE=	12,922 SF
PHASE 1 WAREHOUSE SPACE=	51,972 SF
REQUIRED PARKING STALLS (OFFICE=1 STALL/300 SF)=	43 STALLS
REQUIRED PARKING STALLS (WAREHOUSE=1 STALL/1000 SF)=	52 STALLS
TOTAL REQUIRED PARKING STALLS-PHASE 1=	95 STALLS
TOTAL PROPOSED PARKING STALLS=	192 STALLS

LEGEND
- PROPERTY LINE
- EASEMENT LINE
- SECTION LINE
- EXISTING CONCRETE CURB
- PROPOSED CONCRETE CURB
- (XX) PARKING STALL QUANTITY

SIGN LEGEND

(1) PARKING VEHICLE 1 ID. REQUIRED UP TO $200 FINE FOR VIOLATION — R7-8m 12"X18"

(2) ACCESS AISLE / NO PARKING — 12"X18"

SCALE IN FEET: 30 0 30 60

DATE	REVISION	DATE	REVISION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.
TIMOTHY A. ENDERICHS, P.E.
Date 6/18/21 Lic. No. 43362

DESIGNED BY: TAE
DRAWN BY: TAE
CHECKED BY: CJJ

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LOT 1, BLOCK 1
KNOLL PROPERTIES SECOND ADDITION

SITE PLAN

CITY OF RAMSEY, MINNESOTA

SHEET C6 OF C10 SHEETS

3395.12

Jun 18, 2021 - 8:51pm
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Environmental Policy Board (EPB) **5. 4.**

Meeting Date: 07/19/2021

By: Chris Anderson, Community Development

Information

Title:

Environmental Policy Board Work Plan Update

Purpose/Background:

The Environmental Policy Board (EPB) has a draft Work Plan that was prepared as the City Council was initiating their Strategic Planning. On June 22, 2021, it is anticipated that the City Council will adopt the attached Strategic Plan. As was noted during the development of the draft Work Plan, once the City Council adopted their Strategic Plan, the EPB would need to review that document and their Work Plan and make any necessary adjustments. Please note that this case has been drafted prior to formal adoption of the Strategic Plan. If there are revisions to the draft Strategic Plan prior to adoption, Staff will provide a verbal update at the meeting.

Observations/Alternatives:

Action Item #19 of the Strategic Plan is to "Consider Local Open Space Preservation Funding, if Initiated by Ballot Referendum". This item is currently assigned to the EPB (and Staff) with the intended outcome of preservation of high/exceptional quality ecological areas (as identified by the Natural Resources Inventory). This item is not included presently in the EPB's draft Work Plan. Assuming the Strategic Plan is adopted (as presented), the draft EPB Work Plan will need to be modified to incorporate this item. There do not appear to be any other items on the Strategic Plan that would impact the EPB or the EPB's draft Work Plan.

Attached to this case are the City Council Work Session meeting minutes from May 18, 2021. This includes the brief discussion around the addition of Action Item #19 to the Strategic Plan and provides slightly more context. It seems that the City Council wanted to further explore whether there is public support or not for an open space referendum that would levy public dollars for acquisition and protection of open space. The City Council was interested in the EPB's thoughts on how best to approach this (e.g. a public education campaign, survey, etc.).

Alternatives

Alternative 1: Amend the draft Work Plan to include the language from Action Item #19 of the City Council's Strategic Plan and direct Staff to add the Work Plan to a future City Council Work Session agenda for review and discussion.

Alternative 2: Do not amend the draft Work Plan and direct Staff to add it, as presented, to a future City Council Work Session agenda.

As part of either alternative, the EPB would have the opportunity to further discuss Action Item #19 with the City Council as part of the Work Session when the Work Plan is reviewed.

Action:

Motion to direct Staff to update the draft EPB Work Plan to incorporate Action Item #19 from the City Council's Strategic Plan.

Attachments

EPB Draft Work Plan

Draft City Council Strategic Plan

Excerpt from Draft City Council Work Session Meeting Minutes Dated May 18, 2021

Form Review

Inbox	Reviewed By	Date
Bruce Westby	Chris Anderson	07/12/2021 04:50 PM
Chris Anderson (Originator)	Chris Anderson	07/12/2021 05:01 PM
Bruce Westby	Bruce Westby	07/15/2021 11:32 AM
Form Started By: Chris Anderson		Started On: 07/12/2021 08:26 AM
Final Approval Date: 07/15/2021		

Environmental Policy Board Work Plan

2021-2022

About Ramsey

Ramsey is a suburban city located in the northwestern part of Anoka County, with a population of approximately 28,000. Two rivers dominate its borders, the Rum River and the Mississippi River.

The first settlement in Ramsey began because of trading along the banks of the Mississippi. Many settlers came here on a steamboat called *The Governor Ramsey* named after our first territorial governor, from which the City reportedly acquired the name.

Only a few of the first houses and structures built in Ramsey remain today. The most notable structure of historic significance is on the National Register of Historic Places, the Old Ramsey Town Hall, located west of Highway 47 (Saint Francis Boulevard) just north of County Road 116 (Bunker Lake Boulevard). This 19th century structure was originally used as a schoolhouse. The building is a community landmark and the City is working on a long term plan for the structure.

Two school districts now serve Ramsey - Elk River #728, and Anoka-Hennepin #11. Students from both districts regularly exceed the state average on the Minnesota Basic Standards in math, reading, and writing, and score well above the national average on college entrance exams.

Many people have chosen to live in Ramsey because of its rural character, wetlands, wildlife, parks, recreation and the housing choices. Ramsey is a mixture of farms, large-lot single family, urban single-family, and multi-family with a range of prices that appeals to a wide variety of families and individuals. The City is expected to grow by approximately 11,000 people over the next 20 years. Economic Development continues to be a priority for our City. With nearly 7,000 employees working in Ramsey everyday, new industrial and retail growth may add an additional 1,500 employees over the next 20 years. We are proud of our commitment to attract economically and environmentally sound commercial development.

Ramsey is committed to manage future growth to provide a high quality of life, enhanced employment opportunities and a stable tax base. Looking ahead, our city is working toward retail and commercial growth that includes restaurants, shopping, entertainment and additional employment opportunities.

City Council Strategic Plan

The Environmental Policy Board Work Plan is an important component of achieving the City Council Strategic Plan. The initial sections of this Work Plan are an incorporation of the City Council's Strategic Plan.

Environmental Policy Board Statement of Purpose

The Environmental Policy Board (EPB) will promote environmental awareness and conservation practice by advising the City Council on policy issues, review of new development proposals, communication and education. Through careful review, the EPB will present multiple perspectives, ideas and new technologies that promote both discovery and accountability.

VALUES

Ethics and Integrity

Fiscal Responsibility

Cooperation and Teamwork

Open and Honest Communications

Excellence and Quality in the Delivery of Service

Treating People with Respect and Fairness

Adaptability and Continuous Learning

VISION

Ramsey will be a secure, citizen-driven, collaborative community that respects the balance and connectivity between its unique urban, rural and natural environments.

MISSION

To work together to responsibly grow our community and to provide quality, cost-effective and efficient government services.

OBJECTIVES

Financial Stability

A Balance of Rural Character and Urban Growth

An Active and Connected Community

Smart, Citizen-Focused Government

An Effective Organization

ENVIRONMENTAL POLICY BOARD (EPB) WORK PLAN

Action	Timeframe	Resources	Key Outcomes and Indicators	Responsible Party
Strategy: Enhance sustainability and efficiency through *public policy*, public facilities and infrastructure investments.				
1. Create a Shoreline Erosion Control Plan for the Mississippi River	~~2020~~ 2022	Budget Impact = Low	Reduced erosion along the Mississippi River that adds sediment load and reduces water quality. High priority shorelines are identified for partnerships with Owners to improve stabilization of shoreline.	Chris Anderson
2. Revitalize Focus on Environment Column	2021	Budget Impact = Low	Increase public awareness of environmental initiatives and issues in the community	Chris Anderson
3. Enhance Public Engagement Efforts Related to Natural Resources	2022	Budget Impact = Low	Increase interagency cooperation and collaboration and connect youth to natural resources. Invite 'guest speakers' from other agencies to familiarize the Board (and the general public) about current policies, processes, and programs related to natural resources. Work with local schools to identify natural resources topics that mesh with ongoing or planned curriculum. Establish a 'Student Liaison' position that can provide a unique perspective on topics being reviewed/discussed by the EPB.	Chris Anderson
4. Research Opportunities to Increase Accessibility of EV Charging Stations within The COR	2021-2022	Budget Impact = Low	Identify potential partnerships (e.g. Connexus Energy, Anoka County, etc.) Identify potential grant programs that could be pursued. Understand what, if any, incentives may assist in incorporating EV charging stations as part of private development.	Chris Anderson
5. Design and Implement a Demonstration Garden	2021-2022	Budget Impact = Low	Through collaborative efforts with other advisory boards, civic organizations, and schools, establish a "hands on" demonstration garden, including pollinator plants, vegetables, and aspects of a food forest. Promote sustainable and local food production Establish a volunteer network for ongoing maintenance.	Chris Anderson

Action	Timeframe	Resources	Key Outcomes and Indicators	Responsible Party
6. Complete a Lighting Audit of the Parking Ramp	2022	Budget Impact = Medium	Determine if there is a cost benefit to converting the parking ramp lighting to LED. Determine what the timeframe is before the City would realize it's return on investment. Understand what the energy savings would be if the lighting system were upgraded.	Chris Anderson

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RCP Report = Partnership with the University of Minnesota completed in 2018. This partnership created a library of resources and policy alternatives. A full list of completed reports can be found online at rcp.umn.edu/ramsey-projects.

CULTURE

- Utilize Strategic Plan to prioritize budget requests.
- Leverage additional funding sources.
- Seek grants to do high priority projects.
- Seek public and private partnerships.
- Improve Park and Recreation revenue through user fees and sponsorships.
- Provide adequate public safety staffing based upon common metrics (i.e., calls for service, time of day caseload, land use and population, citizen expectations).
- Continue Staff Recognition Programs.
- Increase awareness of various employee resources.

2021-2022 Strategic Plan Update

Values

Ethics and Integrity

Fiscal Responsibility

Cooperation and Teamwork

Open and Honest Communications

Excellence and Quality in the Delivery of Service

Treating People with Respect and Fairness

Adaptability and Continuous Learning

Vision

Ramsey will be a secure, citizen-driven, collaborative community that respects the balance and connectivity between its unique urban, rural and natural environments.

Mission

To work together to responsibly grow our community and to provide quality, cost-effective and efficient government services.

Objectives

Financial Stability

A Balance of Rural Character and Urban Growth

An Active and Connected Community

Smart, Citizen-Focused Government

An Effective Organization

STRATEGIES

Identify and implement operational efficiencies, cost savings and additional funding sources while maintaining and increasing transparency and accountability.

Promote economic growth and development.

Create a positive image for residential neighborhoods, business districts and key corridors.

Improve the safety and mobility of transportation corridors.

Connect the community through Parks and Trails Capital Improvements along with Recreational Programming.

Spotlight sustainability and efficiency through public facilities and infrastructure investments.

Strengthen and enhance our identity, brand and image.

Improve City's communication.

Improve and sustain high organizational morale.

ACTION PLAN

Action	Timeframe	Resources	Key Outcomes and Indicators	Responsible Party
Strategy: Identify and implement operational efficiencies, cost savings and additional funding sources while maintaining and increasing transparency and accountability.				
1. Evaluate current funding source of Pavement Management Program (and history) and determine whether or not to implement a new funding source for Program.	Q3 2021	Budget Impact = High	Review the history of the Franchise Fee Implementation. Retain existing program or choose a new program. Include regular pavement maintenance in discussion.	Kurt Ulrich
2. Implement a Workflow Tool	2021	Budget Impact = Low	Experienced cost savings as a result of improved workflow. Improved service.	Jason Fredrickson
3. Consider refinancing debt to capitalize on low interest rate	2021	Budget Impact = Medium	Cost savings and debt service.	Diana Lund
4. Consider better social media management platform	Q4 2021	Existing Staff Budget Impact = Low	Simplified and streamlined social media posting process to increase breadth of messaging.	Megan Thorstad/Jason Fredrickson
5. Improve the Employee Union Contract Negotiation Process	Q3 2021	Existing Staff Budget Impact = Low	Improved communication and decision-making conduit with City Council.	Colleen Lasher
6. Consider interactive modules to enhance the customer experience to quickly find information.	Q1 2022	Budget Impact = Medium	Improved interaction with technology to improve customer self-service options.	Jason Fredrickson
Strategy: Promote economic growth and development.				
7. Continue Business Retention and Expansion efforts for retail and industrial.	Ongoing	Existing Staff: Budget Impact = Low	Stable base of local employers, representing the largest opportunity for future growth of jobs and tax base. Increase the number of business visits. Improve the quality and attendance at EDA events. 5,000 square feet of new retail space per year on average. 50,000 square feet of new industrial per year on average.	Sean Sullivan/EDA
8. Consider strategic infrastructure investments to prepare more shovel ready parcels.	Q2 2022	Budget Impact = Medium	Primary Effort = West Armstrong Retail/West Armstrong Industrial Redevelopment Area.	Sean Sullivan/EDA

Action	Timeframe	Resources	Key Outcomes and Indicators	Responsible Party
9. Complete a Comprehensive City Code Audit and Update	Q1 2022	Budget Impact Medium	Reduce redundant regulations and regulations that conflict with City's vision or otherwise detract from City's economic development goals.	Chloe McGuire/Planning Commission
Strategy: Create a positive image for residential neighborhoods, business districts and key corridors.				
~~10. Deleted~~			*City Council is committed to meeting with the Planning Commission to review the development plan/master plan for The COR in the Fall of 2021.*	
11. Consider a Proactive Multifamily Property Management Program and Crime Free Multifamily Housing Program	2021	Existing Staff Budget Impact = High RCP Report	Ensure that multifamily properties maintain high quality and free of nuisance. Consider a Crime Prevention Multifamily Program. Consider a coalition of multifamily property managers to ensure property managers hold each other accountable and provide adequate long-term maintenance.	Jeff Katers Chloe McGuire
12. Create a Volunteer Program to partner with local community members that create opportunities for the community to own cleanup projects and spotlight in communications.	2022	Budget Impact = Medium	Better community ownership of community events and community cleanup efforts. Spotlight existing community cleanup efforts on social media.	Joint Venture between Public Works and Community Development
Strategy: Improve the safety and mobility of transportation corridors.				
13. Complete County Road 5 Corridor Study.	Q4 2022	Budget Impact = Medium	Unified long term vision for Nowthen Boulevard. Improved safety and reduced congestion. Ensure adequate capacity for planned development.	Bruce Westby/Public Works Committee
14. Advance the Ramsey Gateway Plan.	Ongoing	Existing Staff/Resources Budget Impact = High RCP Report	Unified vision for Highway 10. Improved safety and reduced congestion. Secured final funding for the Highway 10/169 Plan (currently at $92M of $138M)	Bruce Westby/Public Works Committee
15. Update Priority Street Light Program and Pedestrian Safety Plan.	Q1 2022	Existing Staff/Resources Budget Impact = Medium	Improved pedestrian and vehicle safety at critical intersections.	Bruce Westby/Public Works Committee
Strategy: Connect the community through Parks and Trails Capital Improvements along with Recreational Programming.				
16. Establish a Funding Plan to Complete Parks Capital Replacement Improvements.	Q2 2022	Existing Staff/Resources Budget Impact = Medium RCP Report	Adequate parks, trails and public spaces, both future and existing. Unique recreation destinations.	Mark Riverblood/Park and Recreation Commission

Action	Timeframe	Resources	Key Outcomes and Indicators	Responsible Party
17. Implement and Spotlight the Recreation Programming Plan	Q3 2021 Ongoing	Existing Staff/Resources Budget Impact = Low	Increased awareness of recreational opportunities.	Mark Riverblood/Park and Recreation Commission
Strategy: Spotlight sustainability and efficiency through public facilities and infrastructure investments.				
18. Develop Implementation Plan for Water Supply Treatment.	Q4 2021	Budget Impact = High	Reduce levels of iron and manganese in municipal water supply.	Bruce Westby/Public Works Committee
19. Consider Local Open Space Preservation Funding, if initiated by Ballot Referendum.	2022	Budget Impact = High	Preservation of many Exceptional Quality Ecological Areas (as defined by Natural Resources Inventory).	Chris Anderson/EPB
Strategy: Strengthen and enhance our identity, brand and image.				
20. Provide quarterly updates to USPS to secure new Ramsey ZIP Code.	Ongoing	Existing Staff Budget Impact = Low RCP Report (community identity)	ZIP Code will identify itself as Ramsey. Provide regular updates. Detailed Update in 2026.	Kurt Ulrich
21. Consider Creating and Promoting a Holiday Light Challenge	Q4 2021	Existing Staff Budget Impact = Low	Create additional awareness of community and create additional social connections.	Megan Thorstad/Recreation Specialist
Strategy: Improve City's communication.				
22. Improve proactive and time-relevant communication.	Ongoing	Existing Staff Budget Impact = Low RCP Report	Explore new avenues to tell the story of Ramsey and market the community to prospective residents and businesses. Stay relevant by harnessing new technologies and social media platforms to evolve with the ever-changing media landscape.	Megan Thorstad
Improve and sustain high organizational morale.				
23. Update Telecommuting Policy	Q3 2021	Existing Staff Budget Impact = Low	Recruitment and retention tool for existing and future employees.	Colleen Lasher
24. Consider additional Employee Events to strengthen relationships.	Q2 2022	Existing Staff Budget Impact = Low	Improved organizational morale.	Colleen Lasher
25. Complete an Employee Survey	Q4 2021	Existing Staff Budget Impact = Low	Establish baseline metric of existing organizational morale.	Colleen Lasher

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PARKING LOT LIST/FUTURE PROJECTS

Action	Strategy
Improve background data provided in conjunction with establishing Rates and Charges, especially for Development Impact Fees. .	Identify and implement operational efficiencies, cost savings and additional funding sources.
Complete Organization Staffing Plan.	Improve and sustain high organizational morale.
Complete Streetscape Plan for Key Corridors.	Create a positive image for residential neighborhoods, business districts and key corridors.
Complete a Highway 47 Plan *(after current Bunker/47 intersection improvements)*	Improve the safety and mobility of transportation corridors.

The above are important topics, but are not the highest priority of the Council and will only be worked on if not interfering with approved Action Items and as time/resources allow.

CULTURE

- Utilize Strategic Plan to prioritize budget requests.
- Leverage additional funding sources.
- Seek grants to do high priority projects.
- Seek public and private partnerships.
- Improve Park and Recreation revenue through user fees and sponsorships.
- Provide adequate public safety staffing based upon common metrics (i.e., calls for service, time of day caseload, land use and population, citizen expectations).
- Continue Staff Recognition Programs.
- Increase awareness of various employee resources.
- Enhance Community Engagement in policy decision-making processes.
- Enhance customer service through process improvement.
- Strive to reflect the demographics of the community.

Excerpt from May 18, 2021 City Council Work Session Minutes

Deputy City Administrator Gladhill confirmed the consensus to change that action item to introduce an interactive request feature as part of the redesign of the website. He moved to the next strategy related to enhancing sustainability and efficiency and asked for input from the Council.

Councilmember Heineman asked for input on what the word "enhance" would mean.

Deputy City Administrator Gladhill commented that the intention would be to do more than what the City is currently doing related to sustainability and natural environment.

Councilmember Heineman commented that the City does this well but does not market it well enough and suggested replacing the word "enhance" with "spotlight". The Council agreed with that language change.

Deputy City Administrator Gladhill stated that staff would recommend adding an action item related to solar, electric charging stations and other opportunities.

Councilmember Howell commented that the Environmental Policy Board places electronic charging stations as a high priority on its Work Plan.

Councilmember Musgrove stated that she would prefer private industry making those improvements rather than the City.

Deputy City Administrator Gladhill confirmed that there is not consensus from the Council to add that action item. He confirmed the consensus of the Council to keep the water treatment plant in the plan and to remove the public works facility from the plan. He stated that Andover set aside dollars for the sole purpose of locally funding open space preservation and asked if there would be an appetite from the Council to look into that type of opportunity.

Councilmember Musgrove asked what is meant by that and if there are any areas that the City would have in mind.

Deputy City Administrator Gladhill stated that Andover went out to its residents with an advisory ballot question to determine if they supported levying public dollars to set aside to acquire and preserve open space property to protect it from development.

Councilmember Specht asked if those dollars could have been used for the tree area within Riverstone South.

Deputy City Administrator Gladhill confirmed that the funds could be used for that type of purpose.

Councilmember Musgrove commented that while she thinks it could be a good idea, it would be difficult to ask for taxpayer dollars to secure land that they may not ever visit and could eventually be sold for another purpose.

City Administrator Ulrich clarified that if land is purchased in this manner, it could not be sold for a future purpose and would be dedicated similarly to park land. He stated that the property would not generate taxes but would also preserve areas from development.

Councilmember Woestehoff commented that he would support that concept as the land could not be sold for another use in the future. He believed that most residents would support that type of use, as long as the intent is clearly communicated. He stated that there is a "park" on Variolite that he would consider a good concept of open space. He stated that perhaps this could provide funding to protect land sources of that nature that have a value outside of development.

Councilmember Specht commented that he could support this if it is put on the ballot and supported by residents.

Councilmember Musgrove asked if there would be a provision that would protect the residents from having to purchase property because a neighbor wants the vacant lot next to them protected.

Deputy City Administrator Gladhill commented that the City would make the choice on which properties to acquire most likely choosing properties that rank highly on the natural resources inventory. The Council supported further exploring the concept. He confirmed the consensus to keep the overarching strategy to strengthen and enhance the overall brand of the City. He stated that perhaps image is added to make the strategy more well-rounded. He confirmed agreement to keep the zip code strategy and summarized some of the advisory comments.