

April 6, 2020

Town Board
Corinna Township
9801 Ireland Avenue NW
Annandale, MN 55302

Re: P&Z Administrator's Report

Dear Town Board Members:

The Planning Commission/Board of Adjustment (PC/BOA) held their regular meeting on March 4, 2020. They held five public hearings, none of which requires Town Board action.

Attachments, drawings and photos related to the application are included in the previously distributed PC/BOA staff report. They are also available at: www.hometownplanning.com. Public comments (if any) are also at the same location.

PUBLIC HEARING #1

Application: Requests related to the construction of a 25' x 26' attached garage with living space above. Approvals required include variances to construct a garage/dwelling addition approximately 65 feet from Cedar Lake (min. 75 ft required) and to a dwelling that is approximately 40 feet from the lake and for the addition to be approximately 10 feet from a side lot line (min. 15 ft required).

Applicant and Property Owner: Mike Mack

Background Information:

- Proposal:** The applicant is proposing to construct a 25' x 26' addition to the non-lakeside portion of their existing 20' x 24' cabin. The addition would include a ground level garage with living space above that would include two bedrooms a bathroom. The existing cabin area would not include any bedrooms – just a kitchen and bathroom and living area. The existing cabin is currently within the required 75 ft lake setback (about 40 ft) and the required 15 ft side yard setback (about 9.8 feet). The addition would also be about 9.8 feet from the side lot line and would be about 65 feet from the lake.
- Location:**
 - Property address: 7916 IRVINE AVE NW , ANNANDALE
 - Sec/Twp/Range: 27-121-27
 - Parcel number(s): 206000272101

- **Zoning:** R-1 Urban/Rural Transition/S-2 Residential-Recreational Shorelands, Cedar Lake (General Development lake)

Town Board Direction: No Town Board action is required.

Planning Commission/Board of Adjustment Action: The PC/BOA, on a unanimous vote, has taken action on the application as follows:

Variance(s) withdrawn:

Variations to construct a garage/dwelling addition approximately 10 feet from a side lot line (min. 15 ft required).

Variance(s) approved:

Variations to construct a garage/dwelling addition approximately 65 feet from Cedar Lake (min. 75 ft required) and to a dwelling that is approximately 40 feet from the lake.

Conditions of approval:

1. That the sewer be upgraded to meet current Wright County standards.
2. That the lowest floor of the addition (including the garage floor) must meet an elevation of at least 1003.3 (NGVD29).
3. Erosion and sedimentation control measures must be installed and maintained until the construction areas have been stabilized. These shall include at a minimum silt fences between any areas of disturbance (if there will be any) and the lake as well as to any neighboring properties which are downslope of the disturbed areas. Once disturbed areas are no longer being used for construction purposes, these shall be covered with mulch, erosion control blankets, hydroseed or other forms of temporary cover until vegetation is re-established.
4. The applicant shall submit a permanent stormwater management plan designed to minimize the potential for ongoing erosion or sedimentation and to allow adequate time for infiltration or other treatment of rainwater from the lot prior to it flowing into the lake. These may include directing rain gutters to appropriate areas, rain barrels, establishing or maintaining a buffer of native vegetation along the shoreline, or other acceptable best management practices. Once approved, the plan should be implemented at the time of construction or within a reasonable time period after construction is completed and maintained indefinitely.

It was also noted that the existing RV on the property that does not meet required setbacks will need to be moved to meet requirements.

PUBLIC HEARING #2

Application: Requests related to a landscaping and deck replacement project involving the reconfiguration of impervious surfaces. Approvals required include a variance to reduce impervious coverage from

approximately 32% to approximately 30 (maximum 25% allowed).

Applicant: Susan Shellberg

Property Owner: SUSAN K SHELLBERG TRUST

Background Information:

- Proposal:** The applicants are proposing to install numerous landscaping changes to their lot and to replace two existing decks to a smaller size. A variance is required for the land alteration permit that is required for such work due to the lot being over the maximum allowed 25% impervious coverage limit under current conditions (approx. 32% coverage) and the proposed impervious coverage remaining above 25% (approx. 30% coverage) despite an overall reduction. The Township's policy has been that if a project requires a permit and a property exceeding the impervious limit does not come down to the required 25%, a variance is required to allow for review by the Board of Adjustment.

Additions to existing impervious surfaces would come from the addition of more stone steps and landings than exists now, the addition of a new permeable paver patio and additional boulder retaining walls.

Subtractions to existing impervious surfaces would come from a reduction in deck size, a reduction in the size of the driveway and the replacement of plastic weed barrier with fabric weed barrier.

In order to reduce coverage to 25%, an additional 570 sq ft of impervious would have to be removed from the site.

Note that it appears that the previous owner of this property constructed significantly more impervious surfaces on the lot than was authorized in a 2001 Wright County variance approval or by permit or by any other explicit authorization. See the section on Findings of Fact for more detail.

- Location:**
 - o Property address: 8947 INGRAM AVE NW, ANNANDALE
 - o Sec/Twp/Range: 22-121-27
 - o Parcel number(s): 206021000010
- Zoning:** R-1 Urban/Rural Transition/S-2 Residential-Recreational Shorelands, Cedar Lake (General Development lake)

Town Board Direction: No Town Board action is required.

Planning Commission/Board of Adjustment Action: The PC/BOA, on a unanimous vote, has tabled the application for the applicant to revise their plans to reduce impervious coverage further.

Application:	<p>Ordinance amendment to Section 707 (Parking). Amendments would clarify allowable durable and dustless surfaces allowed and match amendments recently adopted by Wright County.</p> <p>Ordinance amendment to add a new Section 781 (Private/Vacation Home Rental) and make related changes in Section 6 (Zoning Districts and District Provisions). Amendments would add regulations relating to the short-term rental of dwellings in all zoning districts. The regulations would consider rentals with less than 3 overnight guests per bedroom (up to 12 persons) a permitted use with those having more guests an interim use. Other regulations relating to parking, sewage treatment, noise, management of such rentals, and information required to be provided to nearby property owners would also be included. The proposal would make certain property management, neighbor notification and parking requirements applicable immediately upon adoption while other regulations would not become effective until 2021.</p>
Applicant:	Corinna Township

Background Information:

Proposal:

Parking Regulations: Wright County recently adopted an amendment to the parking section of their ordinance (Section 707 is the equivalent section of the Township ordinance) to clarify what types of surfaces are allowable “durable and dustless surfaces”. The proposal is to match that language in the Township ordinance.

Vacation Rental Regulations: The Town Board had requested, earlier in 2019, that the Planning Commission discuss possible regulations relating to the rental of private homes/cabins for vacation purposes – i.e. nightly or weekly rental (as opposed to month-to-month rental). After a brief discussion at the August 13, 2019 meeting, the Planning Commission requested that Staff bring examples of such regulations in other Minnesota communities to the September meeting. Staff provided two examples of ordinances at the September meeting, as described below. A follow-up discussion was held at the November meeting, where a resident also expressed concerns regarding the impacts of vacation rentals on the use and enjoyment of their own property next door. The Commission discussed a number of issues of concern that can arise with vacation rentals, including:

1. Ensuring septic systems are designed to manage the larger amounts of wastewater;
2. Ensuring enough off-street parking and preventing on-street parking;
3. Trespass onto neighboring properties;
4. Possible impacts on lake or groundwater quality;
5. Noise impacts on nearby properties;

6. Possible need for a minimum lot size to have a vacation rental;
7. Possible limits on the number of guests/renters at a site;

Following the November discussion, the issue was tabled for additional thought. At the December meeting, the Commission suggested that the Town Board discuss how they would like the Commission to proceed. The Town Board determined, at its following meeting, that a public hearing to gather initial thoughts and comments from the public regarding the two example ordinances (or other possible regulations not in either of those) and what would be appropriate for Corinna Township. This public hearing was held at the January 14, 2020 meeting of the Planning Commission.

Following the public hearing, a subcommittee set up to discuss the results of the public hearing and make a recommendation on regulations to the Planning Commission met. That committee directed Staff to draft an ordinance regulating short-term/vacation rentals based largely on the ordinance put in place by Douglas County, but with several modifications. Based partly on public comment received at the January hearing, the subcommittee is suggesting that only a limited portion of the attached ordinance be implemented during 2020 while the rest of it would be implemented in 2021. This will give time for vacation rental owners to adjust to the new requirements, should they be adopted by the Town Board.

The portions of the attached ordinance that would be implemented in 2020 are highlighted and relate primarily to information that vacation rental owners would be required to provide to their renters and to nearby property owners.

Another issue the subcommittee directed Staff to research was whether a public health licensing requirement, similar to that in Douglas County, was feasible. Staff's research indicates that Wright County Public Health does not currently regulate lodging facilities like hotels, Bed and Breakfast facilities and resorts; those regulations are left to the Minnesota Department of Health which generally has the responsibility to enforce those regulations unless a County requests and is granted that authority (such as in Douglas County). Staff talked with the state health inspector that covers the Township area and she noted that the state regulations only apply to those facilities that are rented for less than one week at a time. Additional research would need to be done to determine if the Township could enforce stricter health inspection requirements should it want to and whether the state inspectors would enforce those regulations on behalf of the Township or if the Township would have to hire its own inspectors.

Town Board Direction: No Town Board action is required unless it wishes to adopt the amendments related to general parking regulations as recommended by the Planning Commission. Alternatively, the Board can table any action until the recommendation regarding vacation rentals is also received (possibly at the second meeting in April).

Planning Commission/Board of Adjustment Action: The PC/BOA, on a unanimous vote, has:

1. Recommended approval of the amendments to Section 707 relating to general parking requirements as follows:

707. PARKING

707.1 Surfacing and Drainage

Off-street parking areas shall be improved with a durable and dustless surface ~~which may include an aggregate material or similar treatment~~. Such areas shall be so graded and drained as to dispose of all surface water without damage to adjoining property. These requirements shall also apply to open sales lots. ~~Durable and dustless surface may include crushed rock and similar treatment for parking accessory to one, two, three, and four unit residential structures; all other uses shall utilize asphalt, concrete, or other surface (water sealed) as approved by the Zoning Administrator. The Planning Commission may require the use of asphalt, concrete or other aggregate material as part of a conditional or interim use permit.~~

2. Tabled any amendments relating to vacation rentals for further drafting.

tabled the application for the applicant to revise their plans to reduce impervious coverage further.

FINAL PLAT APPLICATION - "SANDY SHORES AT SUGAR LAKE"

Application: Final plat approval of "Sandy Shores at Sugar Lake"

Applicant/Property Owner: Robert Gruys

Proposal: Robert Gruys has applied for final plat approval from Corinna Township for the preliminary plat of "Sandy Shores at Sugar Lake" - a three lot residential plat on the northeast portion of Sugar Lake.

The preliminary plat application was approved by the Town Board in 2012 under the name "Maple Knoll at Sugar Lake" when the property was owned by a different landowner, with the following conditions of approval (beyond the normal ordinance requirements for final plats):

1. That the applicant dedicates enough land to create a full 66-foot public road right-of-way from 110th Avenue on the south, following the existing north extension of Hart Avenue, and running adjacent to the proposed lots - ending in a cul-de-sac. The Commission notes that an existing 16.5 ft wide public road right-of-way already exists along the southern portion of this area from the Maple Villa plat.
2. That a public road, built to Township standards, be constructed within the dedicated right-of-way as shown on the preliminary plat and preliminary grading plan dated 8/9/2012. The existing road leading from 110th to this area need not be upgraded to Township standards by the applicant.
3. That the applicant installs the stormwater management practices and facilities as stipulated on the submitted plans, or as may be required by NPDES requirements. The Commission acknowledges that the Township will become responsible for long-term maintenance of the stormwater facilities.

The landowner/subdivider in 2012 also applied for a variance to extend the one-year time frame that normally applies to bring a final plat application to five years. They were granted that extension. As that five-year time frame approached, the previous landowner asked for and was approved for another extension that could last until September 18, 2022. The sole condition of these time extensions (in addition to the conditions of the preliminary plat approval) was as follows:

1. If the applicant does not apply for final plat approval within two years of the date of preliminary plat approval, the applicant, or their heirs or assigns shall amend their plans, if necessary, to adhere to any Township regulations regarding road construction, stormwater facilities or other public facilities applicable at the time of application for final plat approval.

The property has since been sold to Mr. Gruys and he is seeking final plat approval for the same number and layout of lots as was approved in the 2012 preliminary plat. He has submitted updated drawings and road/stormwater designs that are consistent with those approved in 2012.

Findings of Fact: The following represent proposed findings related to the final plat application, relating to the Township's requirements for final plat approval:

Required Items:

1. The final plat shall have incorporated all changes or modifications required by the Township in its approval of the preliminary plat. In all other respects, the final plat shall conform substantially to the preliminary plat.
 - **Staff Finding:** The final plat conforms substantially to that of the preliminary plat. The applicant has submitted an updated preliminary plat drawing and stormwater/road construction plans.
2. The final subdivision plat shall be drawn to scale of not more than 200 feet to the inch or as approved by the Township. The sheers shall be numbered in sequence, of more than one sheer, and shall be submitted on 20" x 30" paper sheets or as otherwise approved by the Township.
 - **Staff Finding:** The final plat has been submitted within the required parameters. They have also been sent in electronic form, allowing the township to zoom into any details it needs.
3. Final subdivision plat shall be prepared by a land surveyor licensed by the State of Minnesota.
 - **Staff Finding:** The final plat has been prepared by Otto Associates. The surveyor's license number is No. 40062 (Paul E. Otto).
4. The final plat shall be prepared for recording purposes and must include all information and be presented as required by the Wright County Recorder's Office.
 - **Staff Finding:** The final plat has not been prepared in mylar form yet for recording. This will be done after the Town Board has given its preliminary

approval, as well as any other County departments that will be reviewing the final plat before final preparation.

5. The applicant has requested that the final plat be approved before the road and stormwater improvements are constructed. This is allowed by the Township's Subdivision Ordinance as follows:

5.1 Improvements and Developer's Agreement

2. Completion of Improvements After Final Plat Approval.

- a. Developer's Agreement. The Township Board in its sole discretion may waive the requirement that the applicant complete all public improvements prior to approval of the final plat and, as an alternative, the Township may permit the applicant to enter into a Developer's Agreement by which the subdivider agrees to complete all required public improvements no later than **two (2) years** following the date of approval of the final plat. The Developer's Agreement shall contain the terms and conditions agreed to by the applicant and the Township Board in approving the standard subdivision, including all applicable provisions for maintenance, warranties, construction or placement of structures or other improvements, and other terms and conditions of subdivision approval. The Developer's Agreement shall also include any self-imposed restrictions proposed by the developer, such as the locations of any structures, if agreed to by the Township Board.
- b. Financial Security. Whenever the Township Board permits an applicant to enter into a Developer's Agreement, it shall require the applicant to provide a financial security for the promises contained in the Developer's Agreement. The security shall be in an amount equal to one hundred twenty five percent (125%) of the estimated cost of completion of the required public improvements, including lot improvements. Whenever it is deemed necessary by the Township to defer the construction of any improvement required under these regulations **beyond 2 years**, the subdivider shall either pay its share of the costs of the future improvements to the Township prior to signing of the final subdivision plat by the Chair of the Township Board or the subdivider may guarantee completion of the deferred improvements in the Developer's Agreement upon demand of the Township and secured by financial security. The following methods of financial security may be used:
 - i. Letter of Credit. If the applicant posts a letter of credit as security for its promises contained in the Developer's agreement, the credit shall (1) be irrevocable; (2) be for a term sufficient to cover the completion, maintenance and warranty periods in this Section; and (3) require only that the Township present the issuing bank with a sight draft and an affidavit signed by the Township Attorney attesting to the Township's right to draw funds under the credit.
 - ii. Cash Escrow. If the applicant posts a cash escrow as security for its promises contained in the Developer's agreement, the escrow instructions shall provide: (1) that the subdivider will have no right to a return of any of the funds except as provided in this Section; and (2) that the escrow agent shall have a legal duty to deliver the funds to the Township after following the procedure set forth in Section 4.1(2)(c). If and when the

Township accepts the offer of dedication for the last completed required public improvement, the Township shall execute a waiver of its right to receive all but twenty-five percent (25%) of the funds represented by the letter of credit or cash escrow if the subdivider is not in breach of the Developer's agreement. The residual funds shall be security for the subdivider's covenant to maintain the required public improvements and its warranty that the improvements are free from defect.

- iii. Performance Bond. A performance bond may be provided as a financial security in a form as approved by the Township.
- c. Failure to Complete Improvements. In those cases where a Developer's Agreement has been executed and security has been posted and required public improvements have not been installed within the terms of the agreement, the Township may then:
- i. Provide **thirty (30) calendar days** notice for the developer to meet with the Township Board to review the status of the improvements and resolve the problems;
 - ii. Declare the agreement to be in default and require that all the improvements be installed regardless of the extent of the building development at the time the agreement is declared to be in default;
 - iii. Obtain funds under the security and complete improvements itself or through a third party;
 - iv. Assign its right to receive funds under the security to any third party, including a subsequent owner of the subdivision for which improvements were not constructed, in whole or in part, in exchange for that subsequent owner's promise to complete improvements in the subdivision; or
 - v. Exercise any other rights available under the law.
- d. Maintenance. The developer shall agree to maintain the required public improvements for a period of **one (1) year** following the acceptance of the completed public improvements. The developer may organize a homeowner's association and assign responsibility to maintain public improvements to the homeowners association but the ultimate responsibility rests with the developer.
- e. Warranty. The developer shall warrant that all required public improvements will be free from defect for a period of **two (2) years** following the acceptance by the Township of the last completed public improvement.
- f. Snow Removal and Emergency Repairs. The developer shall be required, in accordance with any applicable Township ordinances or regulations, to provide snow removal on all streets, and pedestrian facilities if applicable, in the subdivision until all of the streets and pedestrian facilities in the subdivision are accepted by the Township. The developer may organize a homeowner's association and assign responsibility to maintain public improvements to the homeowners association but the ultimate responsibility rests with the developer. The developer shall be responsible to make emergency repairs until the improvements are accepted. The Township, after twenty-four (24) hours notice with no action by the developer, may plow the streets or

make emergency repairs and charge those costs to the developer.

- g. Adequate Access. The Township Engineer shall determine the extent of street improvements necessary for adequate vehicular access by the prospective occupant(s) and by police and fire equipment prior to the construction or placement of structures or other improvements.
 - o **Staff Finding:** Staff has been working with the Township Attorney and Applicant to have a developer's agreement consistent with the above requirements drafted and signed. As of the writing of this report, that agreement has not been completed. Staff is awaiting the initial draft language from the Township Attorney so that it can be provided to the applicant for review and eventual signature.
- 6. **Title:** A current title opinion from a private attorney on their letterhead to the description of the property being platted. "Current" shall mean that the document shall have originated within 30 days or less at the date of submission of the final plat. (NOTE: For purposes of Township review, a Title Commitment may be submitted instead of a Title Opinion. However, Wright County will only accept a Title Opinion during their stage of the review process. Contact Wright County Planning & Zoning for more information.)
 - o **Staff Finding:** The applicant has completed a Title Opinion, but that Title Opinion has not yet been reviewed by the Township Attorney.
 - o The County Attorney also requires submittal of a Title Opinion and will not sign off on the final plat prior to approving the document.
- 7. **Covenants:** Any restrictive covenants, subdivision agreements, declarations of restriction or certificates of transfer of development rights shall be submitted with the final plat.
 - o **Staff Finding:** Staff is not aware of any new private covenants. The applicant has not provided any such restrictions. If there are to be private covenants, those will need to be enforced by the subdivider and future landowners; the Township is not involved with enforcing private covenants.
- 8. **Corinna Township Zoning Administrator/Township Attorney Review:** The final plat shall be considered a complete application when the Zoning Administrator has determined that all requirements have been met, including a review of the Title Opinion/Title Commitment by the Township Attorney.
 - o **Staff Finding:** The application fee required by the Township has been paid. The application form has been completed and submitted. See finding under #6 above regarding the review of the title opinion.

Town Board Direction: The Township will need to make a decision regarding the final plat application. If it needs additional information before making that decision, or if certain required items are not provided by the applicant before the meeting, it may table the decision until such information has been provided.

Staff recommends that the Town Board either:

- 1) Table the application until the Township Attorney has reviewed and approved both the Title Opinion and the Developer's Agreement; or
- 2) Approve the application on the condition that the Town Board Chair and Clerk are authorized to sign the final plat only after the Township Attorney has reviewed and approved both the Title Opinion and the Developer's Agreement.

OTHER ITEMS

- The Zoning Administrator has received a request from those involved with constructing the solar farm at the Schueler property (9656 105th Street NW - PID 206000092401) to finalize the financial securities and agreements related to both 1) maintenance of 105th Street NW during construction of the solar farm and 2) decommissioning of the site when the solar farm is no longer operational. Both of these were requirements in the conditions of approval for the solar farm when it was approved in 2019. The full list of conditions is as follows:
 1. All requirements of the Township land use ordinance shall be met.
 2. The applicant shall install screening that will plant two rows of coniferous trees on the entire south and east sides, one row of mixed in dogwood shrubs along the entire south and east sides, and one row of coniferous trees along the entire north side, within 30 days of installation of the solar panels or by September 15, 2019 - whichever is sooner, unless otherwise approved by the Planning Commission.
 - **NOTE:** The September 15, 2019 deadline was requested to be extended by the applicant last fall and the Planning Commission agreed to extend the timeline to June of 2020.
 3. The applicant shall meet all stormwater requirements of the state and as recommended by the Wright County SWCD office.
 4. The applicant shall provide a financial security in an amount acceptable to the Corinna Town Board to ensure restoration of 105th Street NW to its pre-construction condition. This security shall remain in effect until all construction activities have ceased and/or the Town Board has agreed that the security is no longer necessary.
 5. The applicant shall provide a financial security as required by the ordinance for decommissioning of the site. The amount shall be subject to annual review by the Township and based on reasonable estimates of the cost to remove the materials from the site. Estimates for removal costs may be obtained by the Township and the costs of providing such estimate passed on to the applicant/landowner.
 6. The final utility interconnection design and approval must be submitted to the Township before the building permit can be issued.
 7. The use requires a building entitlement to exist. As of today, the use is allowed due to a dwelling already existing on the property. Should the dwelling ever be removed, the solar farm will continue to use the entitlement and no other entitlements exist on the property.
 8. The interim use permit shall be valid for thirty (30) years, unless an amendment to the Zoning Ordinance is adopted which no longer allows the use as an interim or

permitted use, in which case the use shall cease within 24 months of the amendment being adopted (as per Section 507.4 of the Corinna Township Land Use Ordinance).

- **NOTE:** The Township Board subsequently adopted an ordinance amendment that exempted solar farms from the possible expiration of an interim use permit due to ordinance changes that no longer allowed for solar farms in the County. As such, the term of the interim use permit for this site is 30 years, provided all conditions of the interim use permit (as amended) are met.

The Zoning Administrator has been working with the Township Attorney to prepare agreements that lay out the amounts and form of the financial securities and the specifics as to maintenance of 105th Street NW and decommissioning. A first draft was prepared and sent back to the Township Attorney for review, but has not received comment back as of the writing of this report. The applicant has yet to see a draft agreement that they can review and sign.

Road Maintenance

The Town Board had previously indicated that the applicant was required to place \$10,000 into escrow for road maintenance purposes or \$25,000 as a performance bond. Staff's understanding is that the applicant is choosing the \$25,000 bond option, although this has to be confirmed.

Decommissioning

The applicant is requesting that the amount of the decommissioning security be \$105,000. This is less than the 150% of the \$130,561.24 (150% = 195,841.86) that is the default requirement of the Township ordinance. However, the ordinance does allow for the Town Board to reduce or increase this amount "based upon such consideration as the size of the project, past performance by the applicant and/or financial credibility of the applicant, but in no case shall the amount be less than 50% of the estimate."

The request for an amount of \$105,000 represents 80% of the estimated cost to decommission the site. The applicant notes in their request "A lot of costs outlined in the plan should probably not be counted for the bond purposes. Contingencies, overhead and profit, as well as the significant grading costs estimated, which we feel are overstated. (No grading is planned initially for this project, so no major restoration should be required in this category)...The final entity placing the bond will be NextEra, so creditworthiness should not be an issue."

A copy of the applicant's decommissioning plan and cost estimates is attached to this report.

The Town Board is essentially being asked to confirm whether the \$105,000 decommissioning security will be acceptable. If it is, Staff will continue to work with the applicant and Township Attorney to finalize all written agreements related to decommissioning and road maintenance. Those agreements will ultimately need to be approved by the Town Board. Once that, and all other conditions have been met, Staff would issue the permit to construct the solar farm.

If you have questions or concerns on the items in this report or any other issues, please do not hesitate to contact me. You can reach me by email at oleson@hometownplanning.com or by phone at 888-439-9793.

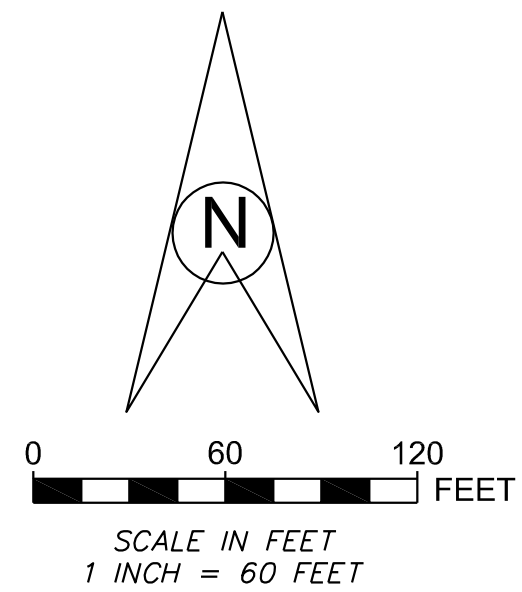
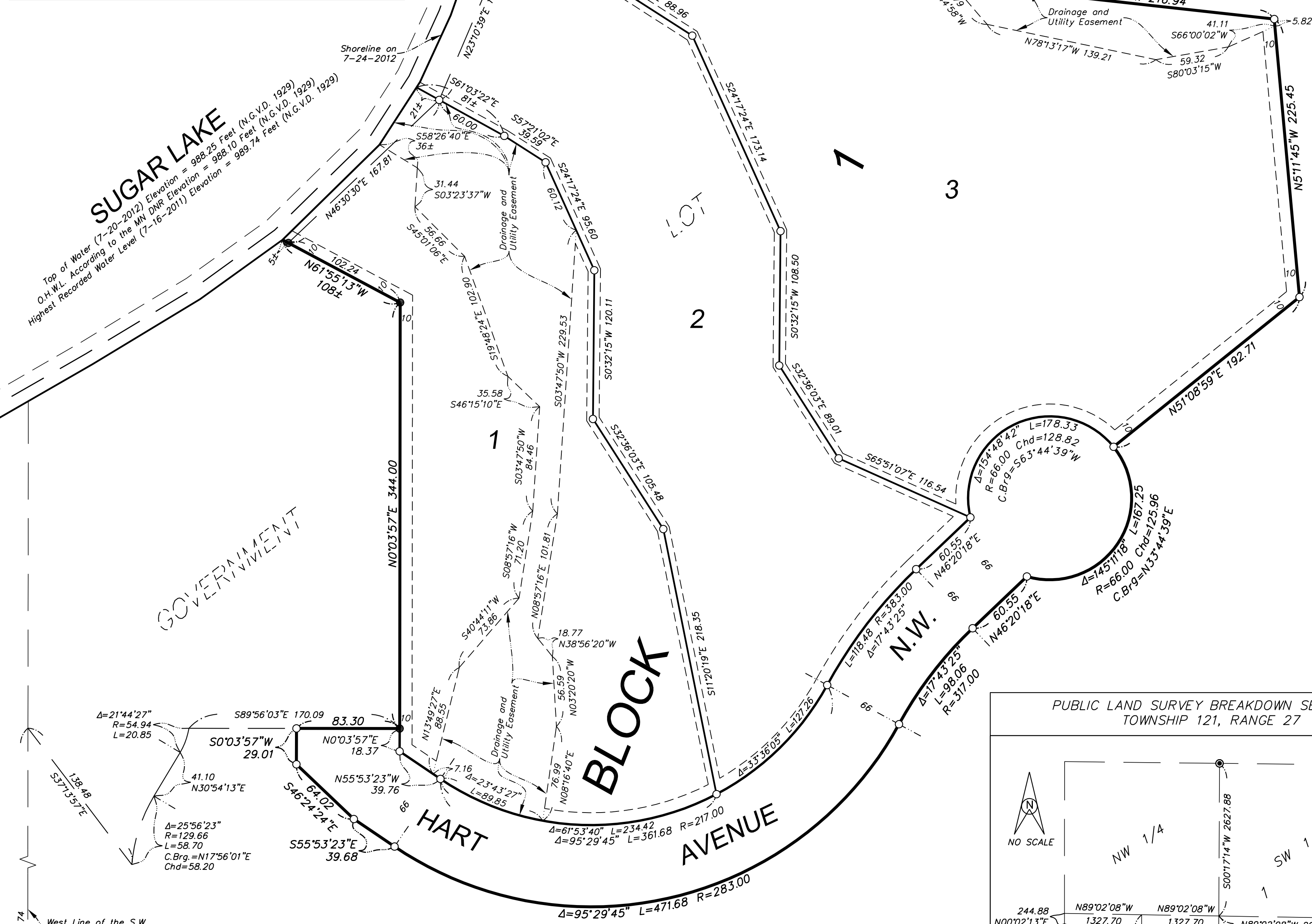
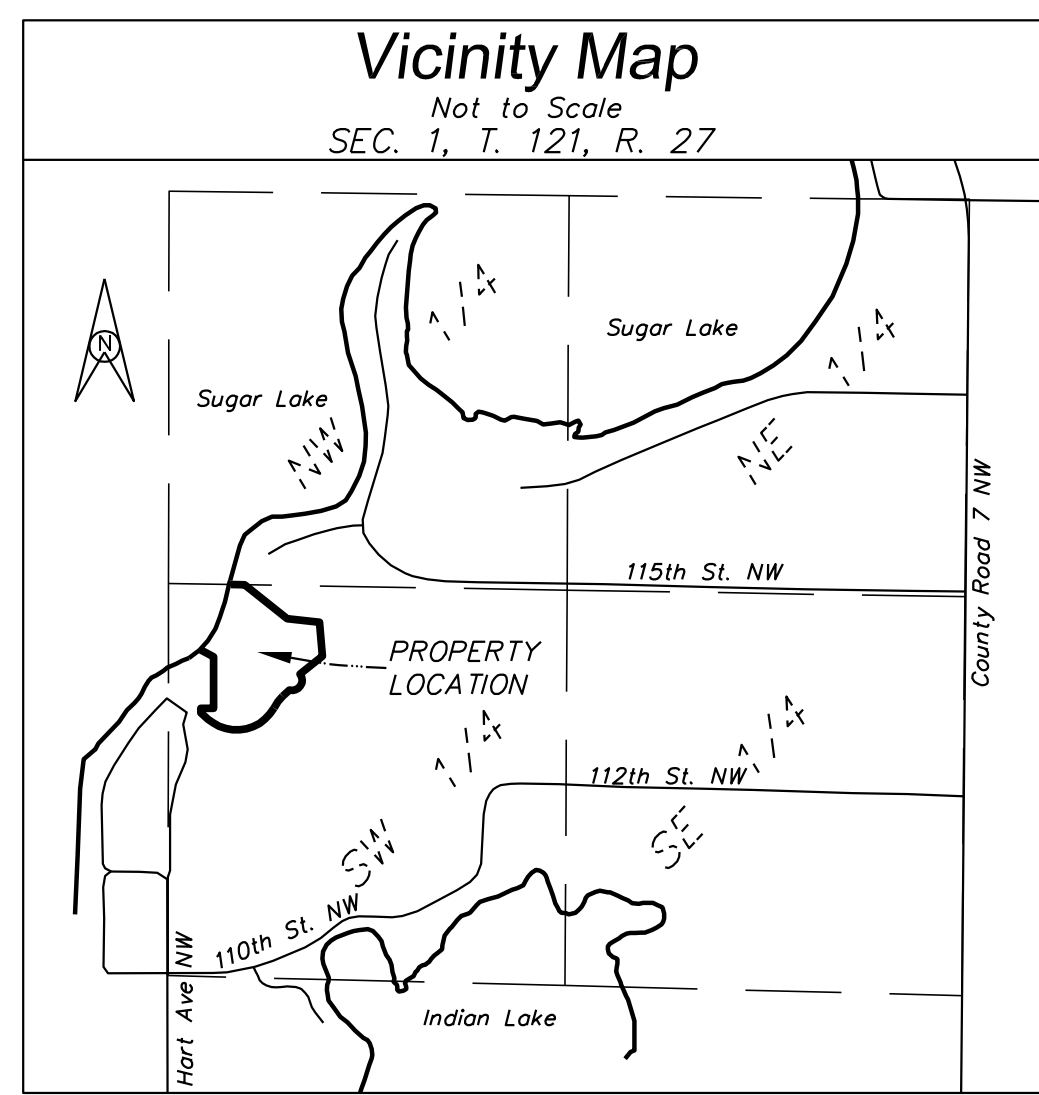
Sincerely,
HOMETOWN PLANNING

A handwritten signature in black ink, appearing to read 'Ben Oleson', with a stylized flourish at the end.

Ben Oleson
Planning and Zoning Administrator

Attachments related to Final Plat of "Sandy Shores at Sugar lake"

SANDY SHORES AT SUGAR LAKE



KNOW ALL PERSONS BY THESE PRESENTS: That Robert I. Gruys Jr. and Katherine L. Gruys, husband and wife, fee owners of the following described property situated in the County of Wright, State of Minnesota, to wit:

That part of Government Lot 5, Section 1, Township 121, Range 27, Wright County, Minnesota, described as follows:

Commencing at the Southwest corner of the Southwest Quarter of said Section 1; thence on an assumed bearing of North 00 degrees 03 minutes 57 seconds East, along the West line of said Southwest Quarter, a distance of 1780.74 feet; thence South 37 degrees 13 minutes 57 seconds East, a distance of 138.48 feet; thence 58.70 feet Northerly along a nontangential curve concave to the East, having a radius of 129.66 feet, a central angle of 25 degrees 56 minutes 23 seconds, a chord distance of 58.20 feet, and a chord bearing of North 17 degrees 19 minutes 03 seconds East; thence North 30 degrees 54 minutes 13 seconds East, tangent to said curve, a distance of 41.10 feet; thence 20.85 feet Northerly along a tangential curve concave to the West, having a radius of 54.94 feet, and a central angle of 21 degrees 44 minutes 27 seconds; thence South 89 degrees 56 minutes 03 seconds East, not tangent to said curve, a distance of 170.09 feet; thence North 00 degrees 03 minute 57 seconds East, a distance of 344.00 feet to the point of beginning; thence return South 00 degrees 03 minutes 57 seconds West, a distance of 344.00 feet; thence North 89 degrees 56 minutes 03 seconds West, a distance of 83.30 feet; thence South 00 degrees 03 minutes 57 seconds West, a distance of 29.01 feet; thence South 46 degrees 24 minutes 24 seconds East, a distance of 64.02 feet; thence South 55 degrees 53 minutes 23 seconds East, a distance of 39.68 feet; thence 471.68 feet Easterly along a tangential curve concave to the North, having a radius of 283.00 feet and a central angle of 95 degrees 29 minutes 45 seconds; thence 98.06 feet Northeasterly along a reverse curve concave to the Southeast, having a radius of 317.00 feet and a central angle of 17 degrees 43 minutes 25 seconds; thence North 46 degrees 20 minutes 18 seconds East, tangent to said curve, a distance of 60.55 feet; thence 167.25 feet Northeasterly along a nontangential curve concave to the Northwest, having a radius of 66.00 feet, a central angle of 145 degrees 11 minutes 18 seconds, a chord distance of 125.96 feet, and a chord bearing of North 33 degrees 44 minutes 39 seconds East; thence North 51 degrees 08 minutes 59 seconds East, not tangent to said curve, a distance of 192.71 feet; thence North 05 degrees 11 minutes 45 seconds West, a distance of 225.45 feet; thence North 83 degrees 41 minutes 17 seconds West, a distance of 216.94 feet; thence North 51 degrees 14 minutes 52 seconds West, a distance of 363.33 feet to the North line of said Government Lot 5; thence North 89 degrees 02 minutes 08 seconds West, along said North line of Government Lot 5 to the shoreline of Sugar Lake; thence Southwesterly along said shoreline to a line that bears North 61 degrees 55 minutes 13 seconds West from the point of beginning; thence South 61 degrees 55 minutes 13 seconds East to the point of beginning.

Have caused the same to be surveyed and platted as SANDY SHORES AT SUGAR LAKE and do hereby dedicate to the public for public use the public way and drainage and utility easements as created by this plat.

In witness whereof said Robert I. Gruys Jr. and Katherine L. Gruys, husband and wife, have hereunto set their hands this _____ day of _____, 20____.

Robert I. Gruys, Jr. Katherine L. Gruys

STATE OF _____
 COUNTY OF _____
 This instrument was acknowledged before me this _____ day of _____, 20____ by Robert I. Gruys, Jr. and Katherine L. Gruys, husband and wife.

(Signature) _____
 (Printed Name) _____
 Notary Public, _____ County,
 My commission expires _____

SURVEYOR'S CERTIFICATE
 I, Paul E. Otto, do hereby certify that this plat was prepared by me or under my direct supervision; that I am a duly Licensed Land Surveyor in the State of Minnesota; that this plat is a correct representation of the boundary survey; that all mathematical data and labels are correctly designated on this plat; that all monuments depicted on this plat have been, or will be correctly set within one year; that all water boundaries and wet lands, as defined in Minnesota Statutes, Section 505.01, Subd. 3, as of the date of this certificate are shown and labeled on this plat; and all public ways are shown and labeled on this plat.

Dated this _____ day of _____, 20____.

Paul E. Otto, Licensed Land Surveyor
 Minnesota License Number 40062

STATE OF MINNESOTA
 COUNTY OF _____
 The foregoing Surveyor's Certificate was acknowledged before me this _____ day of _____, 20____ by Paul E. Otto, Land Surveyor, Minnesota License No. 40062.

(Signature) _____
 (Printed Name) _____
 Notary Public, _____ County, Minnesota
 My commission expires _____

CORINNA TOWNSHIP BOARD
 We do hereby certify that on this _____ day of _____, 20____, the Board of Township Supervisors for Corinna Township, Wright County, Minnesota, approved this plat.

Chairperson _____ Clerk (Attest) _____

WRIGHT COUNTY PLANNING COMMISSION
 Be it known that at a meeting held this _____ day of _____, 20____, the Planning Commission of the County of Wright, Minnesota, did hereby approve this plat of SANDY SHORES AT SUGAR LAKE.

Chairperson _____

WRIGHT COUNTY BOARD OF COMMISSIONERS
 This plat of SANDY SHORES AT SUGAR LAKE was approved and accepted by the Board of County Commissioners of Wright County, Minnesota, at a meeting held this _____ day of _____, 20____.

Chairperson _____ County Administrator _____

WRIGHT COUNTY SURVEYOR
 I hereby certify that in accordance with Minnesota Statutes, Section 505.021, Subd. 11, this plat has been reviewed and approved this _____ day of _____, 20____.

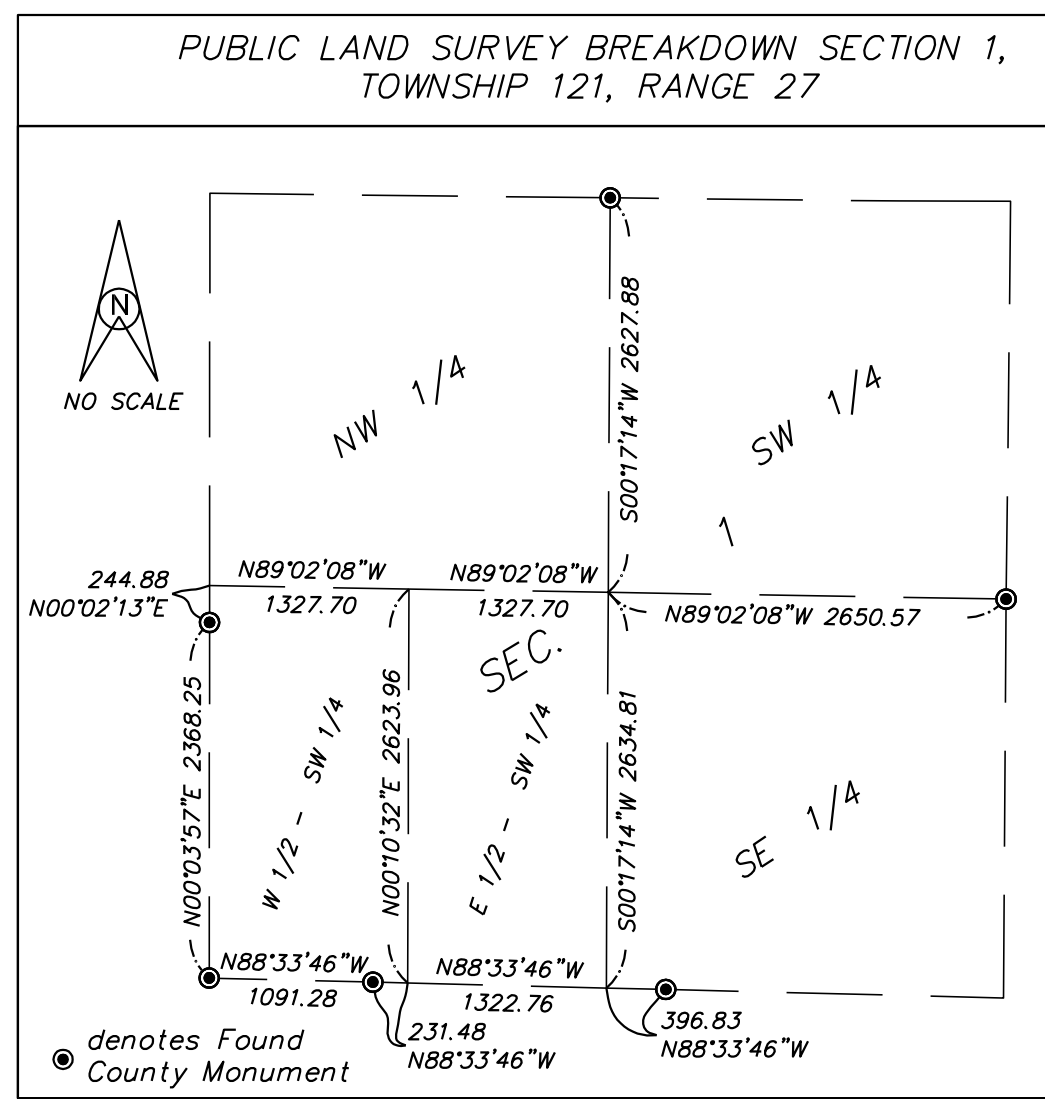
Wright County Surveyor _____

WRIGHT COUNTY AUDITOR/TREASURER
 Pursuant to Minnesota Statutes, Section 505.021, Subd. 9, taxes payable for the year 20____ on the land hereinbefore described have been paid. Also, pursuant to Minnesota Statutes, Section 272.12, there are no delinquent taxes and transfer entered this _____ day of _____, 20____.

Wright County Auditor/Treasurer _____ Deputy _____

WRIGHT COUNTY RECORDER
 I hereby certify that this instrument was filed in the office of the County Recorder for record on this _____ day of _____, 20____, at _____ o'clock _____ M. and was duly recorded in Cabinet No. _____, Sleeve _____ as Document No. _____.

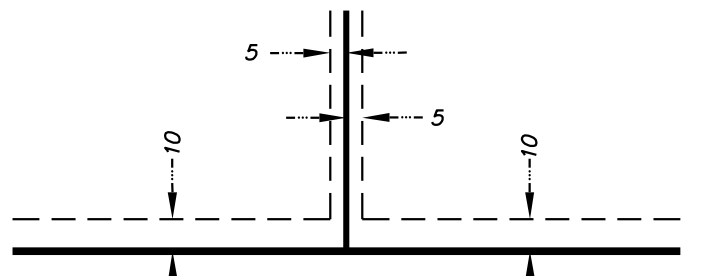
Wright County Recorder _____



Bearing Note:
 The North line of Government Lot 5 of Section 1, Township 121, Range 27, Wright County, Minnesota, is assumed to bear N89°02'08\"/>

- denotes iron monument found RLS Cap No. 7439 (Unless Otherwise Noted)
- denotes 1/2 iron by 14 inch iron pipe set and marked by License number 40062
- ⊙ denotes found Wright County Cast Iron Monument (Unless Otherwise Noted)

DRAINAGE AND UTILITY EASEMENTS ARE SHOWN THUS:



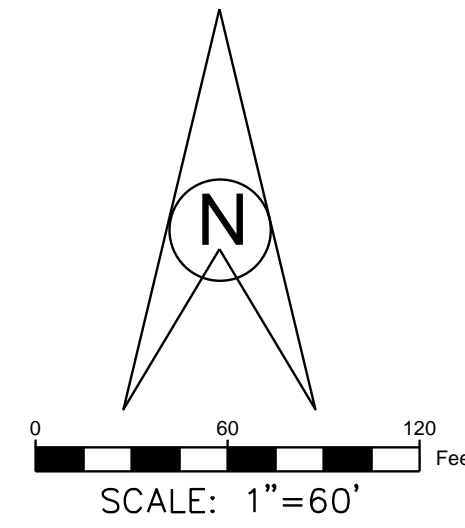
BEING 10 FEET IN WIDTH, UNLESS OTHERWISE INDICATED, AND ADJOINING RIGHT-OF-WAY LINES, AND BEING 5 FEET IN WIDTH, UNLESS OTHERWISE INDICATED, AND ADJOINING LOT LINES, AS SHOWN ON THE PLAT.

Wright County Cast Iron Monument of the S.W. Corner of the S.W. 1/4 of Section 1, Township 121, Range 27
 Benchmark:
 Top of Cast Iron Monument
 Elevation=1034.27 Feet
 (N.G.V.D. 1929)



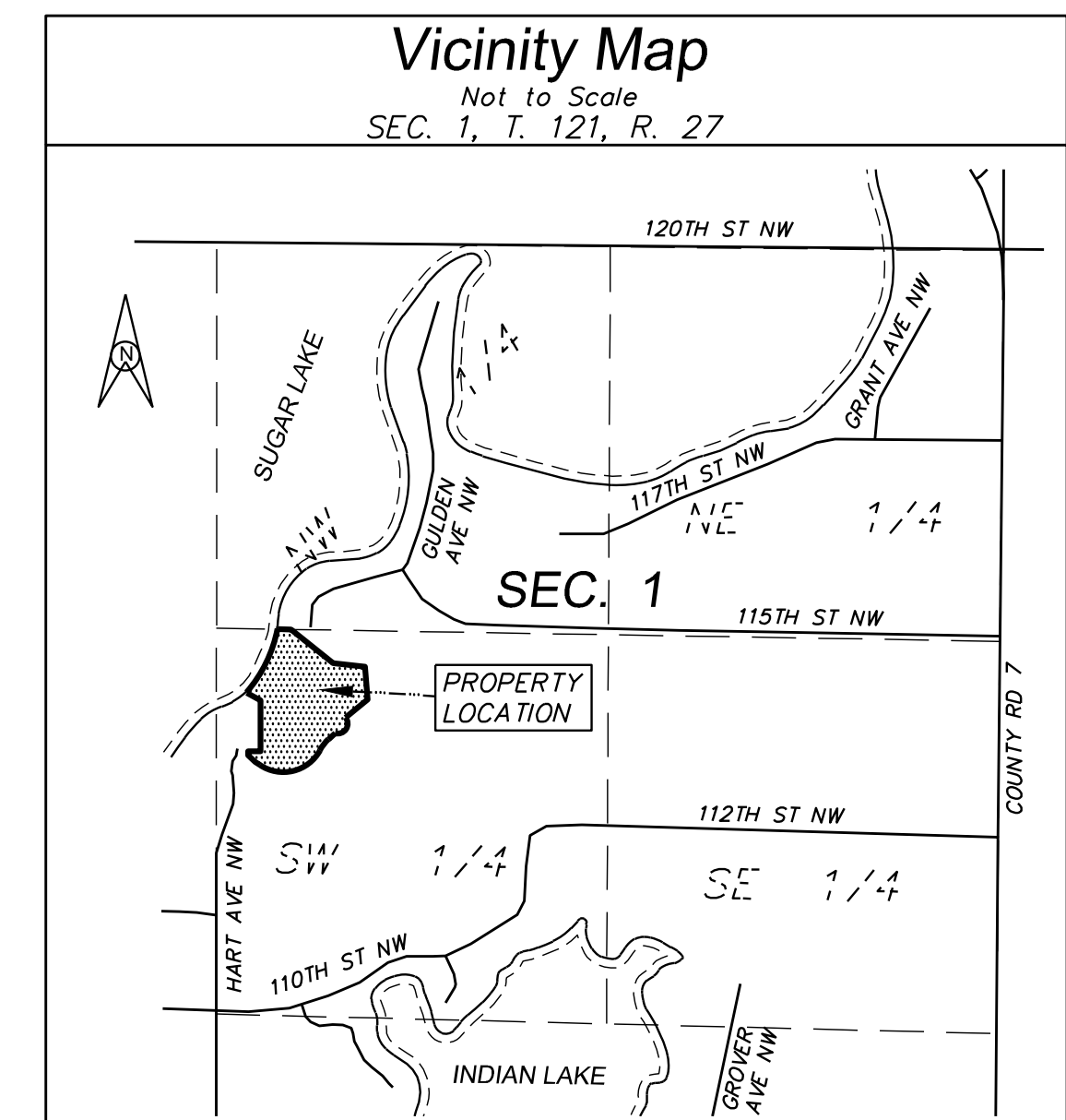
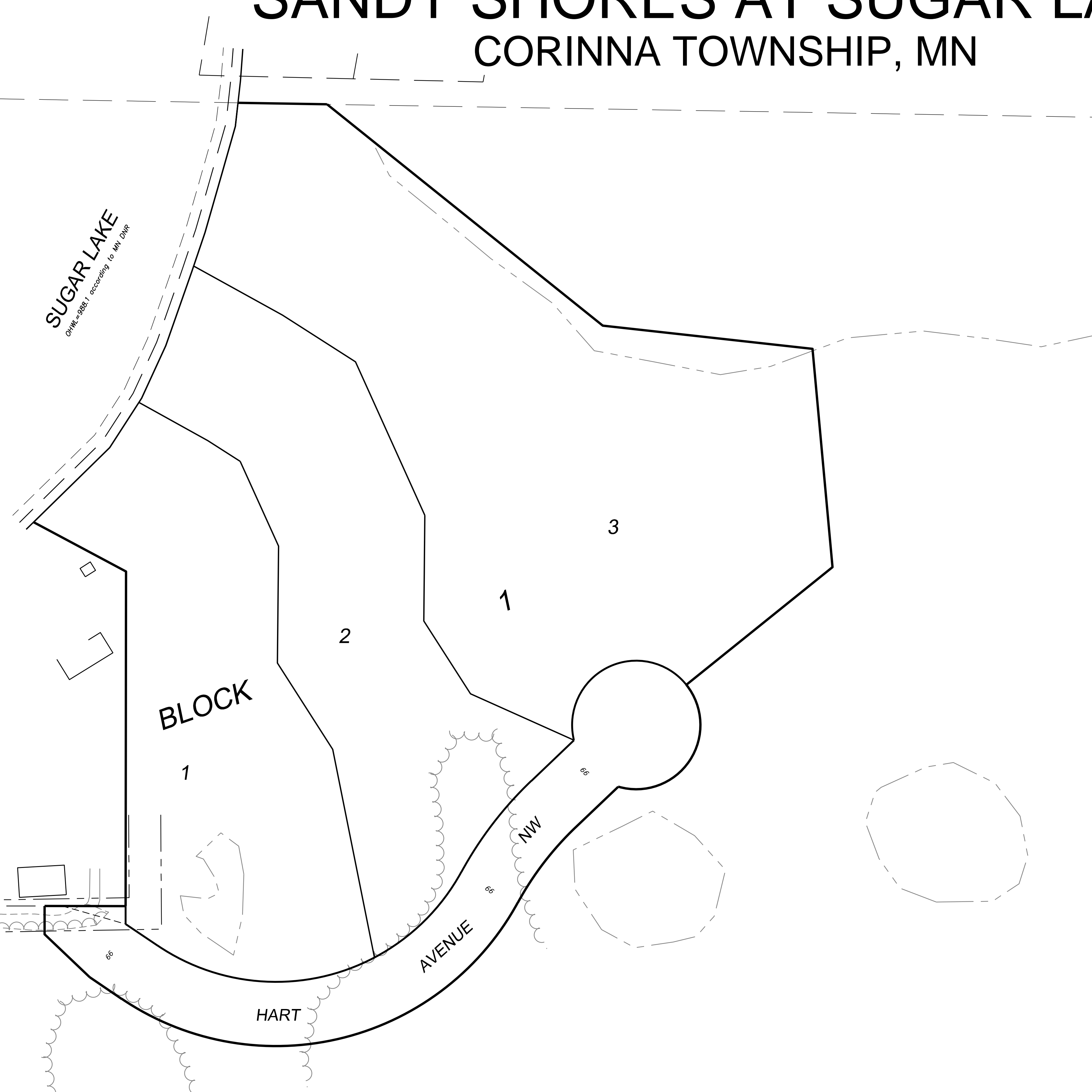
SANDY SHORES AT SUGAR LAKE

CORINNA TOWNSHIP, MN



SHEET INDEX

SHEET NO.	DESCRIPTION
1	COVER SHEET
2	STREET & STORM SEWER – HART AVENUE NW
3	GRADING PLAN
4	STORMWATER POLLUTION PREVENTION PLAN
5	STORMWATER POLLUTION PREVENTION PLAN NARRATIVE
6	DETAILS
7	DETAILS



REV. NO.	DATE	BY	DESCRIPTION

DESIGNED
P.E.O.
T.J.B.

DRAWN
T.J.B.

CHECKED
P.E.O.

I hereby certify that this survey, plan, or report was prepared by my or under my direct supervision and that I am a duly Licensed Land Surveyor under the laws of the State of Minnesota.

Paul E. Otto

Paul E. Otto
License #40062 Date: 3-20-20

www.ottoassociates.com

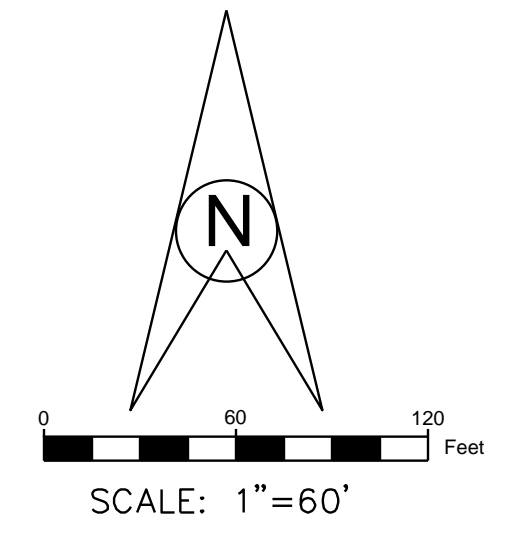
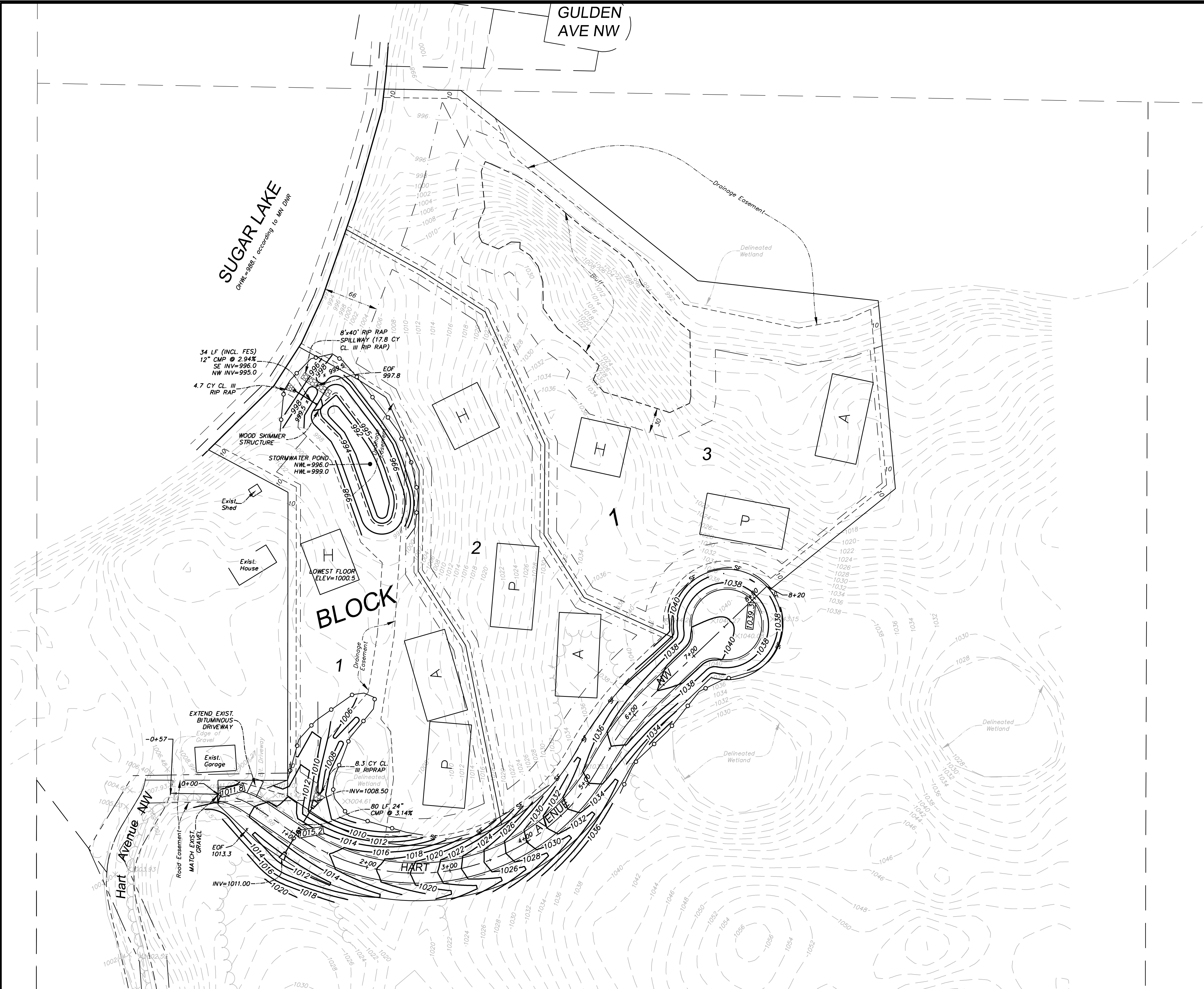
9 West Division Street
Buffalo, MN 55313
(763)682-4727
Fax: (763)682-3522

SANDY SHORES AT SUGAR LAKE
BOB GRUYS
CORINNA TOWNSHIP, MN

COVER SHEET
SHEET NO. 1 OF 7 SHEETS

PROJECT NO:
19-0544

DATE:
3-20-20



- LEGEND**
- 988 — denotes Existing Contour
 - 988.00 x denotes Existing Spot Elevation
 - 1010 — denotes Proposed Contour
 - 1017.5 x denotes Proposed Spot Elevation
 - denotes Proposed Drainage
-
- P denotes Possible Primary Septic Area
 - A denotes Possible Alternate Septic Area
 - H denotes Possible House Pad Location
-
- SF — denotes pre-construction silt fence
 - denotes pre-construction silt fence with bioroll barrier

REV. NO.	DATE	BY	DESCRIPTION

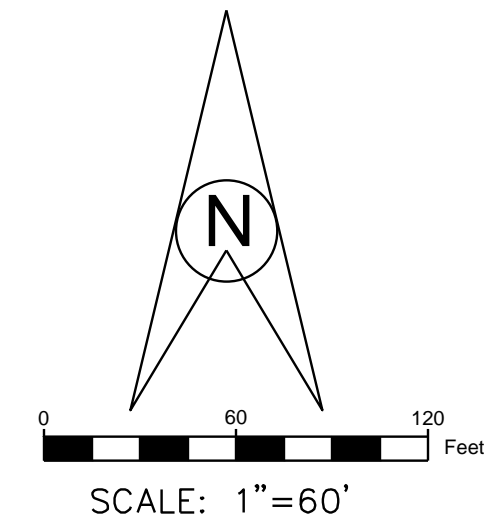
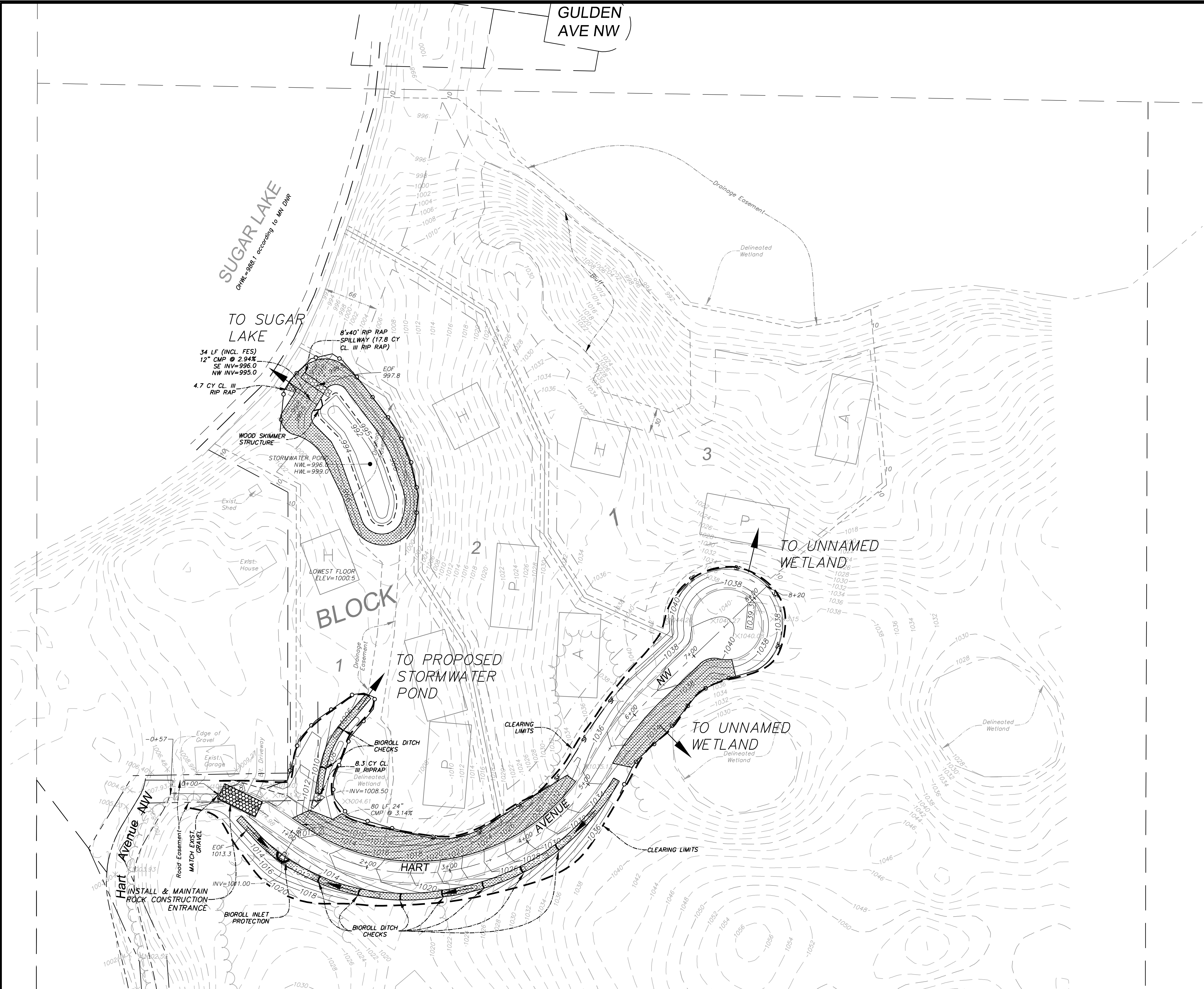
DESIGNED P.E.O. DRAWN T.J.B.
 CHECKED P.E.O.
 I hereby certify that this survey, plan, or report was prepared by me or under my direct supervision and that I am a duly Licensed Land Surveyor under the laws of the State of Minnesota.
 Paul E. Otto
 License #40062 Date: 3-20-20

OTTO ASSOCIATES
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 Fax: (763)682-3522

SANDY SHORES AT SUGAR LAKE
 BOB GRUYS
 CORINNA TOWNSHIP, MN

GRADING PLAN
 SHEET NO. 3 OF 7 SHEETS

PROJECT NO: 19-0544
 DATE: 3-20-20



- LEGEND**
- 988 — denotes Existing Contour
 - 988.00 X denotes Existing Spot Elevation
 - 1010 — denotes Proposed Contour
 - 1017.5 X denotes Proposed Spot Elevation
 - denotes Proposed Drainage
- P denotes Possible Primary Septic Area
 - A denotes Possible Alternate Septic Area
 - H denotes Possible House Pad Location
- sf — denotes pre-construction silt fence
 - denotes pre-construction silt fence with biroll barrier
 - ▨ denotes Cat. 3 erosion control blanket

REV. NO.	DATE	BY	DESCRIPTION

DESIGNED: P.E.O. T.J.B.
 DRAWN: T.J.B.
 CHECKED: P.E.O.
 I hereby certify that this survey, plan, or report was prepared by me or under my direct supervision and that I am a duly Licensed Land Surveyor under the laws of the State of Minnesota.
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SANDY SHORES AT SUGAR LAKE
 BOB GRUYS
 CORINNA TOWNSHIP, MN

STORMWATER POLLUTION PREVENTION PLAN
 SHEET NO. 4 OF 7 SHEETS

PROJECT NO: 19-0544
 DATE: 3-20-20

GENERAL PROJECT INFORMATION

PROJECT LOCATION AND NARRATIVE:

THIS PROJECT CONSISTS OF A 3 LOT SUBDIVISION IN CORINNA TOWNSHIP, MN. THE SITE IS LOCATED NEAR LONGITUDE -94.0322, LATITUDE 45.3169. THE SITE IS ACCESSED FROM HART AVENUE NW.

CONSTRUCTION ACTIVITIES INCLUDE GRADING, ROAD CONSTRUCTION, AND STORMWATER POND CONSTRUCTION.

CONSTRUCTION IS PLANNED TO BEGIN SPRING OF 2020 AND END FALL OF 2020.

RESPONSIBLE PARTIES:

CONTRACTOR MUST BE TRAINED FOR BOTH CONSTRUCTION INSTALLER AND SITE MANAGEMENT PER REQUIREMENTS OF THE PERMIT, PART III.F.

OWNER	CONTACT PERSON	PHONE
OTTO ASSOCIATES, INC.	PAUL E. OTTO	763-682-4727
PLAN PREPARER	CONTACT PERSON	PHONE
TRAINING: 11/29/2018 (EXPIRES 2022) U OF MN CERTIFICATION – DESIGN OF CONSTRUCTION SWPPP		

CONTRACTOR (RESPONSIBLE FOR INSTALLATION & INSPECTION)	CONTACT PERSON	PHONE
--------------------------------------------------------	----------------	-------

PARTY RESPONSIBLE FOR LONG TERM O&M OF PERMANENT STORMWATER MANAGEMENT SYSTEM	CONTACT PERSON	PHONE
-------------------------------------------------------------------------------	----------------	-------

PROJECT AREAS:

TOTAL PROJECT SIZE (DISTURBED AREA) = 2.3 ACRES

EXISTING AREA OF IMPERVIOUS SURFACE = 0.0 ACRES
 POST-CONSTRUCTION AREA OF IMPERVIOUS SURFACE = 1.35 ACRES
 TOTAL NEW IMPERVIOUS SURFACE AREA CREATED = 1.35 ACRES

RECEIVING WATERS:

SURFACE WATERS AND WETLANDS THAT WILL RECEIVE STORM WATER RUNOFF FROM THE SITE AND ARE WITHIN ONE (1) MILE OF THE SITE ARE INDICATED WITH DIRECTION ARROW ON THE SWPPP PLAN SHEET AND ARE LISTED BELOW:

NAME OF WATER BODY	IMPAIRED WATER
UNNAMED WETLANDS	NO
SUGAR LAKE	NO

THE OWNER SHALL SUBMIT A NOTICE OF TERMINATION (NOT) AFTER ONE OF THE FOLLOWING HAS BEEN COMPLETED, WHICHEVER OCCURS FIRST.

- WITHIN 30 DAYS AFTER FINAL STABILIZATION (PERMIT SECTION 13) IS COMPLETE.
- WITHIN 30 DAYS AFTER SELLING OR OTHERWISE LEGALLY TRANSFERRING THE ENTIRE SITE.
- IF 90% (BY AREA) OF ALL ORIGINALLY PROPOSED CONSTRUCTION ACTIVITY HAS BEEN COMPLETED AND PERMANENT COVER HAS BEEN ESTABLISHED ON THOSE AREAS.

ALTERNATIVELY, THE OWNER MAY SUBMIT A PERMIT MODIFICATION FORM FOR EACH HOMEBUILDER/HOMEOWNER AS LOTS ARE SOLD. THE NEW OWNER/CONTRACTOR SHALL BE RESPONSIBLE FOR AMENDING THE SWPPP AS NECESSARY TO SPECIFICALLY ADDRESS THEIR WORK AND SUBMIT A NOTICE OF TERMINATION (NOT) ACCORDING TO THE SAME REQUIREMENTS ABOVE.

CONSTRUCTION ACTIVITY NOTES

ALL CONSTRUCTION ACTIVITIES MUST MEET THE REQUIREMENTS OF THE MPCA'S NPDES GENERAL STORMWATER PERMIT FOR CONSTRUCTION ACTIVITY.

EROSION PREVENTION:

ALL EXPOSED SOIL AREAS (INCL. STOCKPILES) MUST BE STABILIZED. STABILIZATION MUST BE INITIATED IMMEDIATELY TO LIMIT SOIL EROSION BUT COMPLETED NO CASE LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED.

TEMPORARY TURF RESTORATION SHALL BE MNDOT SEED MIX 25-111 @ 100 LB/ACRE WITH MNDOT TYPE 1 MULCH @ 2 TONS/ACRE (DISC ANCHORED) AND 22-5-10 TYPE 3 FERTILIZER (350 LBS/ACRE). STABILIZATION MUST BE INITIATED IMMEDIATELY BUT IN NO CASE COMPLETED LATER THAN 14 DAYS AFTER THE ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED.

PERMANENT TURF RESTORATION SHALL BE MNDOT SEED MIX 25-131 @ 220 LB/ACRE WITH MNDOT TYPE 1 MULCH @ 2 TONS/ACRE (DISC ANCHORED).

THE FOLLOWING SHALL BE INSTALLED WITHIN 24 HOURS OF CONNECTION TO SURFACE WATER:

- STABILIZATION OF THE NORMAL WETTED PERIMETER OF ANY TEMPORARY OR PERMANENT DRAINAGE SWALES WITHIN 200' OF EDGE OF SITE OR CONNECTION TO SURFACE WATER

SEDIMENT CONTROL PRACTICES:

A 50 FOOT NATURAL BUFFER IS INFEASIBLE DUE TO PROVIDING PROPER DRAINAGE. REDUNDANT SEDIMENT CONTROLS WILL BE INSTALLED WITH THIS PERMIT (REFER TO PLAN FOR LOCATIONS & TYPES).

ENTERING/EXITING THE SITE SHALL OCCUR ONLY AT ROCK CONSTRUCTION ENTRANCES TO LIMIT TRACKING OF SEDIMENT ONTO STREETS.

SEDIMENT TRACKED ONTO STREETS DURING WORKING HOURS MUST BE RECLAIMED VIA SCRAPING AND SWEEPING AT END OF EACH WORKING DAY.

TEMPORARY SOIL STOCKPILES SHALL HAVE SILT FENCE OR OTHER EFFECTIVE SEDIMENT CONTROLS INSTALLED AT THE BASE ON THE DOWNGRADE PERIMETER. NO STOCKPILE MAY BE PLACED IN ANY NATURAL BUFFERS OR SURFACE WATER.

IF DEWATERING IS NECESSARY, DISCHARGE SHALL BE TO A TEMPORARY OR PERMANENT SEDIMENT BASIN. IF INFEASIBLE, CONTRACTOR MAY DEWATER TO SURFACE WATERS IF THEY VISUALLY CHECK TO ENSURE ADEQUATE TREATMENT HAS BEEN OBTAINED AND NUISANCE CONDITIONS WILL NOT RESULT. NO EROSION OR SCOUR AT THE DISCHARGE POINT SHALL OCCUR AND WETLAND INUNDATION SHALL BE CHECKED THAT IT DOESN'T CAUSE ADVERSE IMPACT TO THE WETLAND.

CONSTRUCTION SEQUENCING:

- PRECONSTRUCTION MEETING.
- INSTALL PERIMETER SILT FENCE & ROCK CONSTRUCTION ENTRANCE.
- CLEARING & GRUBBING.
- STRIP TOPSOIL & STOCKPILE.
- ROUGH GRADE SITE.
- INSTALL OUTLET CONTROL STRUCTURES.
- TEMPORARY STABILIZE SITE AS INDICATED ON THE PLANS.
- COMPLETE STREET CONSTRUCTION.
- PRIVATE UTILITY INSTALLATION.
- TOPSOIL RESPREAD.
- RESTORE SITE WITH PERMANENT RESTORATION.
- REMOVE SEDIMENT CONTROL DEVICES & SUBMIT NOTICE OF TERMINATION (NOT) TO MPCA ONCE ALL DISTURBED AREAS HAVE 70% VEGETATIVE DENSITY.

EROSION & SEDIMENT CONTROL BMP ESTIMATED QUANTITIES:

QUANTITIES LISTED ARE APPROXIMATE. REFER TO CONTRACT DOCUMENTS FOR EXACT QUANTITIES.

BMP	EST. QUANTITY
SILT FENCE	600 LF
SILT FENCE W/ BIOROLL	1,035 LF
ROCK CONST. ENTRANCE	1 EACH
MNDOT SEED MIX 21-111, TYPE 1 MULCH	1.5 AC
MNDOT SEED MIX 25-131, TYPE 1 MULCH	1.5 AC
MNDOT 3885 CAT 3 EROSION CONTROL BLANKET	3,309 SY
BIOROLL DITCH CHECKS	9 EACH
BIOROLL INLET PROTECTION	1 EACH
WOOD SKIMMER STRUCTURE	1 EACH
CL. III RIPRAP	30.8 CY

CONSTRUCTION NOTES

INSPECTIONS AND MAINTENANCE:

THE CONTRACTOR MUST HAVE A TRAINED PERSON TO ROUTINELY INSPECT THE CONSTRUCTION SITE ONCE EVERY SEVEN (7) DAYS DURING ACTIVE CONSTRUCTION AND WITHIN 24 HOURS OF A RAINFALL EVENT GREATER THAN 0.5 INCHES IN A 24-HR PERIOD. INSPECTION LOGS SHALL INCLUDE ANY CORRECTIVE MEASURES TO BE TAKEN. CORRECTIVE MEASURES SHALL BE COMPLETED BY THE END OF THE NEXT BUSINESS DAY AFTER DISCOVERY UNLESS OTHERWISE SPECIFIED DUE TO FIELD CONDITIONS THAT PREVENT ACCESS TO THE AREA.

ALL INSPECTIONS MUST BE RECORDED AND RECORDS RETAINED WITH THE SWPPP ON SITE. THE SWPPP, ALONG WITH INSPECTIONS AND MAINTENANCE RECORDS, SHALL BE RETAINED FOR THREE YEARS AFTER SUBMITTAL OF THE NOTICE OF TERMINATION (NOT).

SILT FENCE MUST BE MAINTAINED WHEN ACCUMULATED SEDIMENT REACHES 1/2 OF THE DEVICE HEIGHT. INLET PROTECTION DEVICES SHALL BE CLEANED ON A ROUTINE BASIS SUCH THAT THE DEVICES ARE FULLY FUNCTIONAL FOR THE NEXT RAINSTORM EVENT. REMOVAL AND DISPOSAL OF THE SEDIMENT SHALL BE INCIDENTAL TO THE CONTRACT.

ROCK CONSTRUCTION ENTRANCE(S) SHALL BE CLEANED AND REFRESHED AS NECESSARY TO CONFORM TO DETAIL.

STREET SWEEPING SHALL BE USED IF VEHICLE TRACKING BMP'S ARE NOT ADEQUATE TO PREVENT SEDIMENT TRACKING ONTO STREETS.

POLLUTION PREVENTION:

ALL SOLID WASTE GENERATED BY/COLLECTED FROM THE CONSTRUCTION SITE MUST BE DEPOSITED IN A DUMPSTER.

BUILDING PRODUCTS AND LANDSCAPE MATERIALS SHALL BE PLACED UNDER COVER (I.E. PLASTIC SHEETING OR TEMPORARY ROOFS). THIS ALSO APPLIES TO PESTICIDES, FERTILIZER AND TREATMENT CHEMICALS.

NO CONSTRUCTION MATERIAL SHALL BE BURIED OR BURNED ONSITE.

ALL HAZARDOUS MATERIALS (OIL, GASOLINE, FUEL, HYDRAULIC FLUIDS, PAINT, ETC) MUST BE PROPERLY STORED IN SEALED CONTAINERS TO PREVENT SPILLS, LEAKS OR OTHER DISCHARGE. STORAGE AND DISPOSAL OF HAZARDOUS WASTE MUST BE IN COMPLIANCE WITH MINN. R. CH. 7045. CONTRACTOR SHALL ENSURE ADEQUATE SUPPLIES ARE AVAILABLE TO CLEAN UP DISCHARGED MATERIAL AND THAT AN APPROPRIATE DISPOSAL METHOD IS AVAILABLE FOR RECOVERED SPILLED MATERIALS. CONTRACTOR MUST REPORT AND CLEAN UP SPILLS IMMEDIATELY.

ALL VEHICLES LEFT ONSITE SHALL BE MONITORED FOR LEAKS TO REDUCE THE CHANCE OF CONTAMINATION.

EXTERNAL WASHING OF TRUCKS OR OTHER CONSTRUCTION VEHICLES, ENGINE DEGREASING, NOR CONCRETE WASHOUTS ARE ALLOWED ON SITE. TRUCKS ARE TO USE SELF-CONTAINED WASHOUT SYSTEM.

PORTABLE TOILETS SHALL BE SECURED FROM BEING TIPPED OR KNOCKED OVER.

THE CONTRACTOR SHALL MONITOR AND PROVIDE DUST CONTROL CORRECTION WHEN NEEDED. THIS WORK IS CONSIDERED INCIDENTAL TO THE CONTRACT.

ALL SPILLS SHALL BE CLEANED IMMEDIATELY UPON DISCOVERY. SPILLS LARGE ENOUGH TO REACH THE STORM CONVEYANCE SYSTEM SHALL BE REPORTED TO THE MPCA STATE DUTY OFFICER AT 1-800-422-0798.

FINAL STABILIZATION:

THE CONTRACTOR MUST ENSURE FINAL STABILIZATION OF THE SITE PRIOR TO SUBMITTING NOT.

SUFFICIENT TOPSOIL (4") SHALL BE PLACED ON DISTURBED AREAS FOR RE-VEGETATION. TOPSOIL SHALL BE PLACED IN A MANNER TO MINIMIZE COMPACTION (LOW GROUND PRESSURE DOZERS, TRACKED EQUIPMENT, ETC).

VEGETATIVE COVER MUST CONSIST OF A UNIFORM PERENNIAL VEGETATION WITH A DENSITY OF 70% OF ITS EXPECTED FINAL GROWTH.

PERMANENT STORMWATER TREATMENT SYSTEMS MUST BE CLEANED OF ANY ACCUMULATED SEDIMENT PRIOR TO SUBMITTING THE NOT.

ALL TEMPORARY EROSION CONTROL MEASURES AND BMP'S MUST BE REMOVED AS PART OF THE FINAL SITE STABILIZATION.

TRAINING REQUIREMENTS:

CONTRACTOR MUST BE TRAINED FOR BOTH CONSTRUCTION INSTALLER AND SITE MANAGEMENT PER REQUIREMENTS OF THE PERMIT, PART III.F. DOCUMENTATION SHALL BE ADDED TO THE SWPPP DOCUMENTS LOCATED ONSITE.

REV. NO.	DATE	BY	DESCRIPTION

DESIGNED P.E.O.	DRAWN T.J.B.	I hereby certify that this survey, plan, or report was prepared by me or under my direct supervision and that I am a duly Licensed Land Surveyor under the laws of the State of Minnesota. <i>Paul E. Otto</i> Paul E. Otto License #40062 Date: 3-20-20
CHECKED P.E.O.		

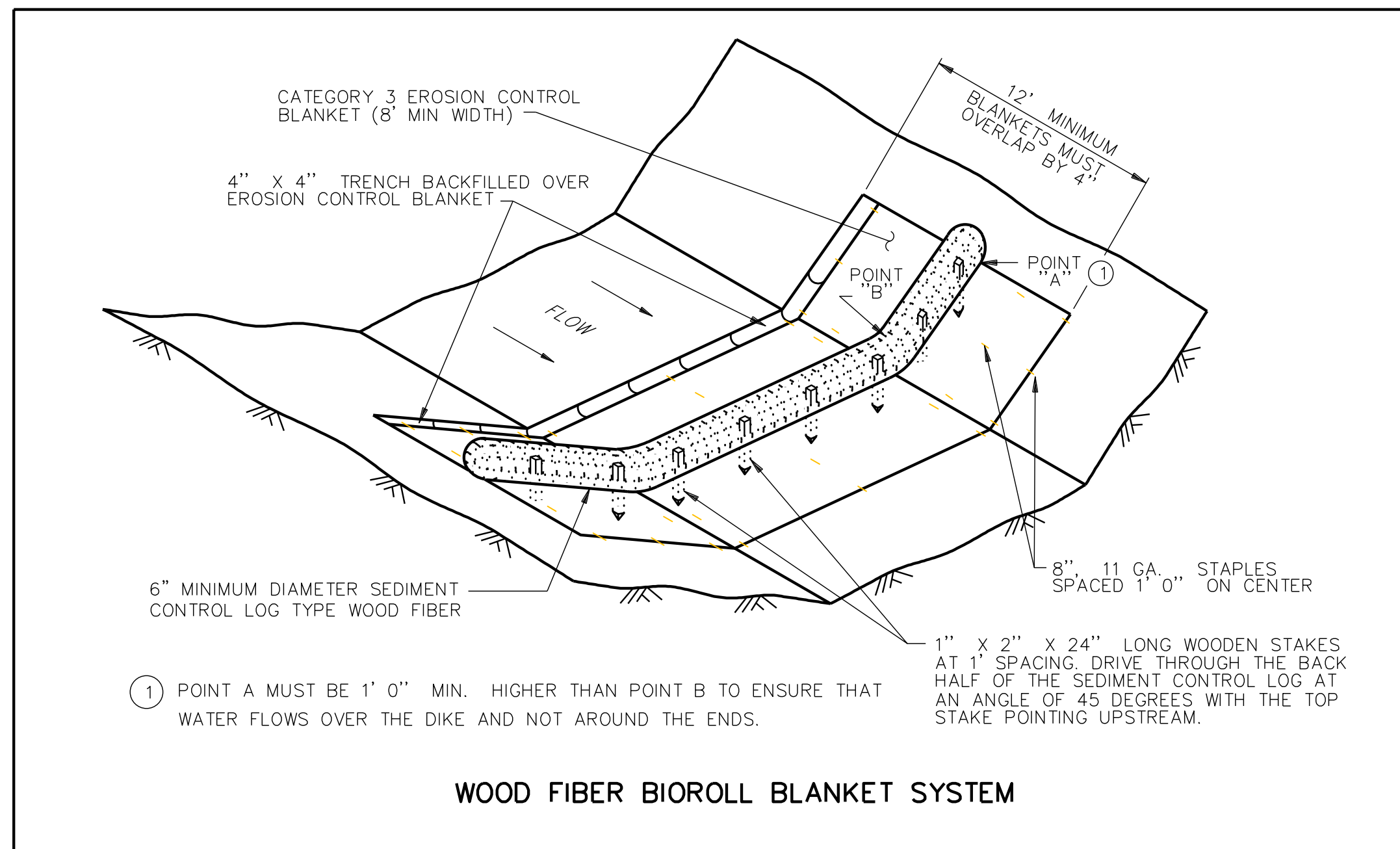
www.ottoassociates.com

 9 West Division Street
 Buffalo, MN 55313
 (763)682-4727
 Fax: (763)682-3522
 Engineers & Land Surveyors, Inc.

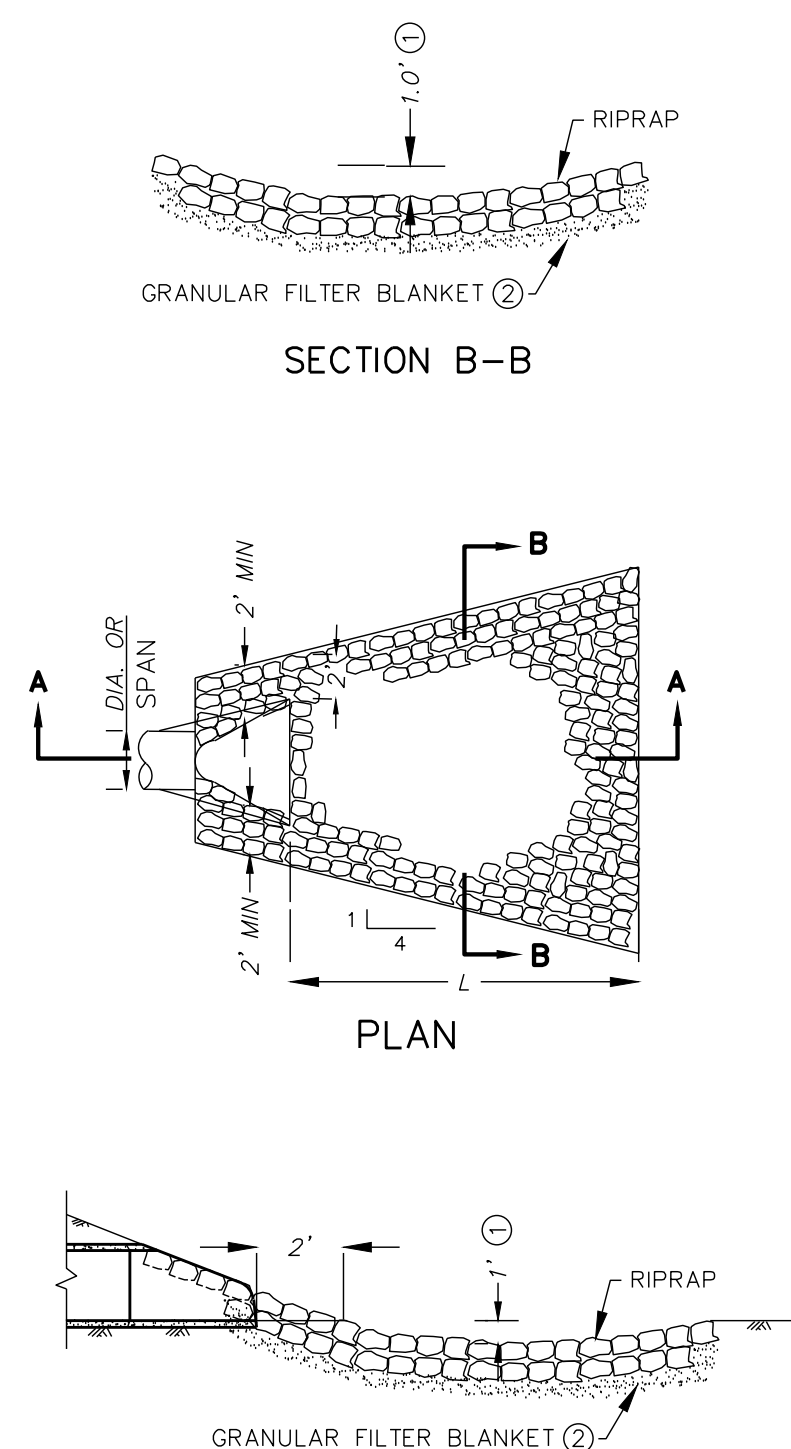
SANDY SHORES AT SUGAR LAKE
 BOB GRUYS
 CORINNA TOWNSHIP, MN

STORMWATER POLLUTION PREVENTION PLAN NARRATIVE
 SHEET NO. 5 OF 7 SHEETS

PROJECT NO: 19-0544
 DATE: 3-20-20



WOOD FIBER BIOROLL BLANKET SYSTEM

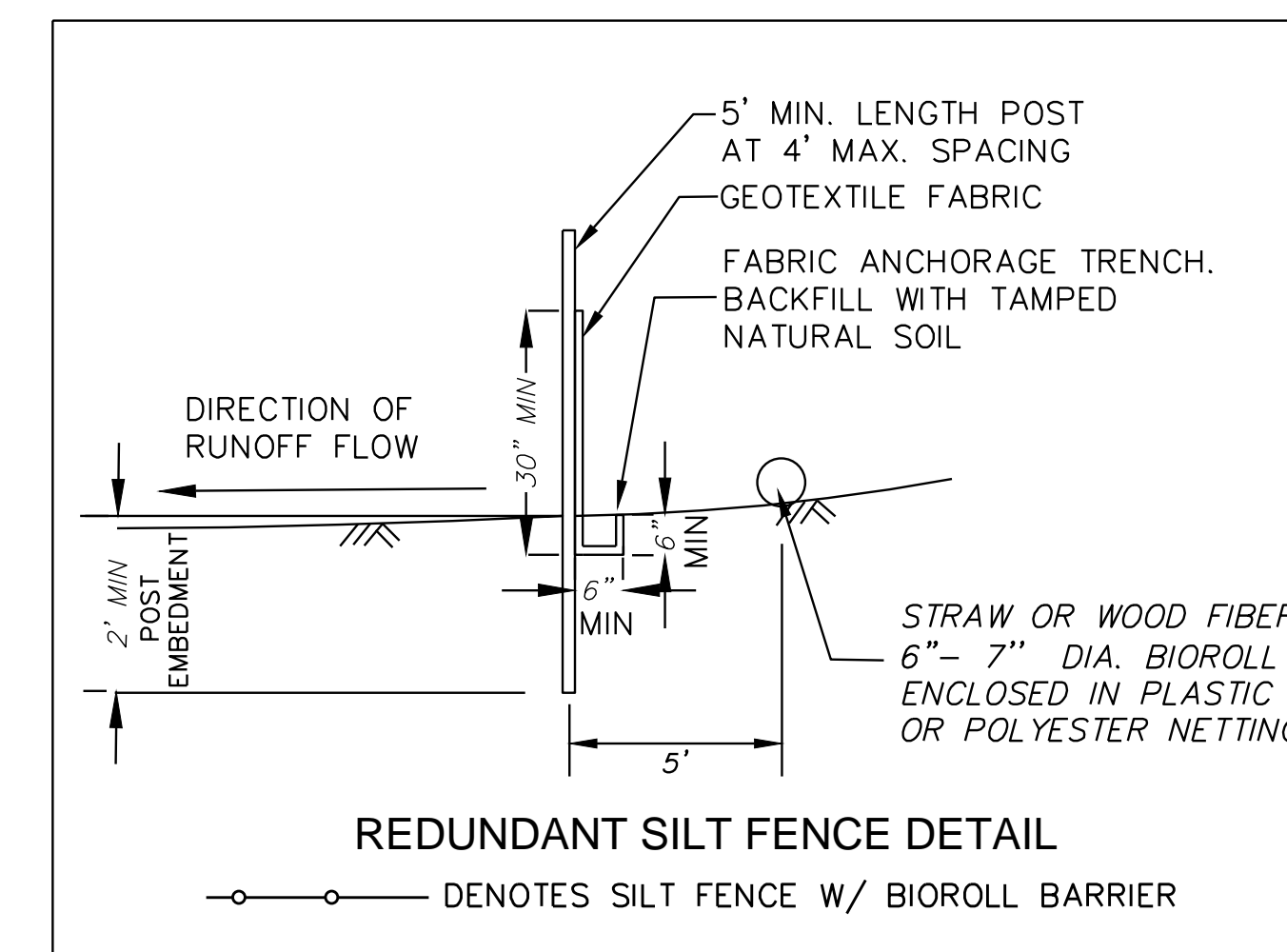


RIPRAP AT RCP OUTLETS

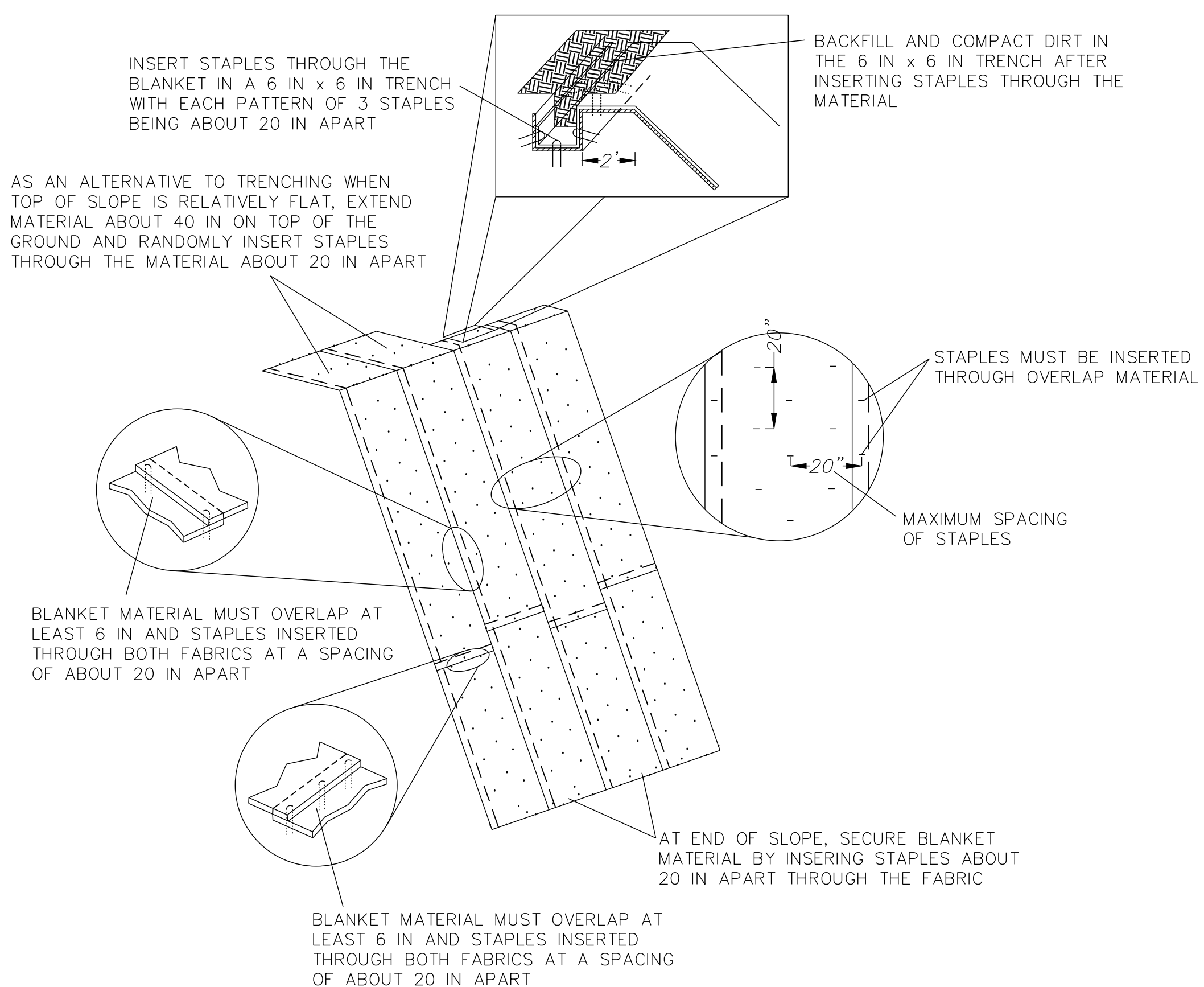
TABLE OF QUANTITIES
RIPRAP AT RCP OUTLETS

DIA. OF ROUND PIPE (IN.)	L (FT.)	CLASS II $d_{50} = 6"$		CLASS III $d_{50} = 9"$		CLASS IV $d_{50} = 12"$	
		12" DEPTH RIPRAP (CU.YD.)	6" DEPTH GRANULAR FILTER (CU.YD.)	18" DEPTH RIPRAP (CU.YD.)	9" DEPTH GRANULAR FILTER (CU.YD.)	24" DEPTH RIPRAP (CU.YD.)	12" DEPTH GRANULAR FILTER (CU.YD.)
12	8	2.8	1.4	4.1	2.1	5.5	2.8
15	8	2.9	1.5	4.4	2.2	5.8	2.9
18	10	3.9	2.0	5.9	3.0	7.9	3.9
21	10	4.2	2.1	6.3	3.2	8.4	4.2
24	12	5.5	2.8	8.3	4.2	11.0	5.5
27	12	5.8	2.9	8.7	4.4	11.6	5.8
30	14	7.3	3.7	10.9	5.5	14.5	7.3
36	16	9.2	4.6	13.8	6.9	18.3	9.2
42	18	10.9	5.5	16.3	8.2	21.7	10.9
48	20	12.9	6.5	19.4	9.7	25.8	12.9

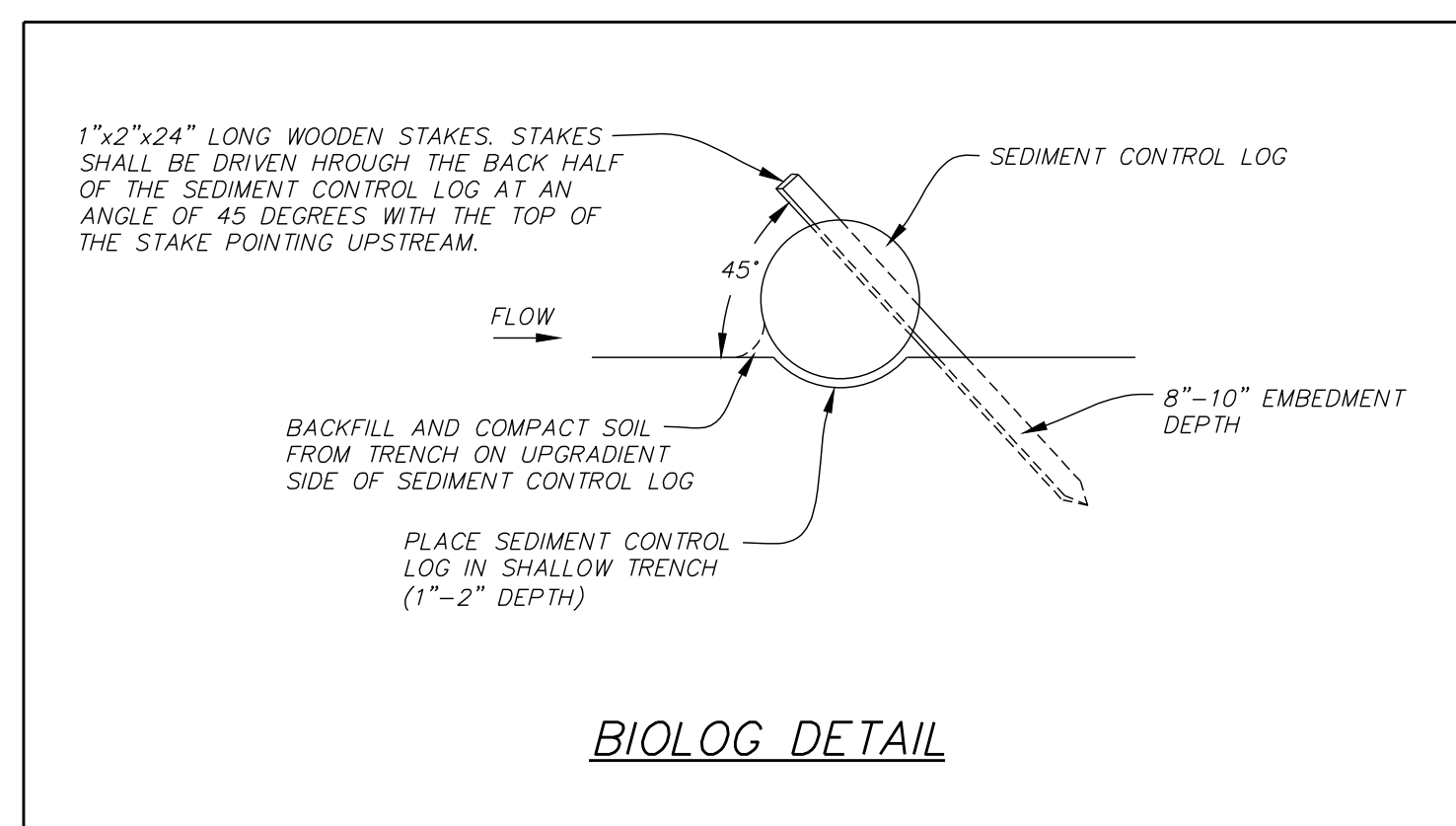
- NOTES:
REQUIREMENTS FOR RIPRAP SIZE AND THICKNESS AND FILTER BLANKET WILL BE DESIGNATED IN THE PLANS.
- FOR PIPES GREATER THAN OR EQUAL TO 30", USE 1.5'.
 - THE CONTRACTOR, AT HIS OPTION, MAY SUBSTITUTE A GEOTEXTILE FABRIC, SPEC. 3601, FOR THE GRANULAR FILTER BLANKET UNLESS OTHERWISE SPECIFIED IN THE PLANS. THE FABRIC SHOULD COVER THE AREA OF THE RIPRAP AND EXTEND UNDER THE CULVERT APRON 3 FT.



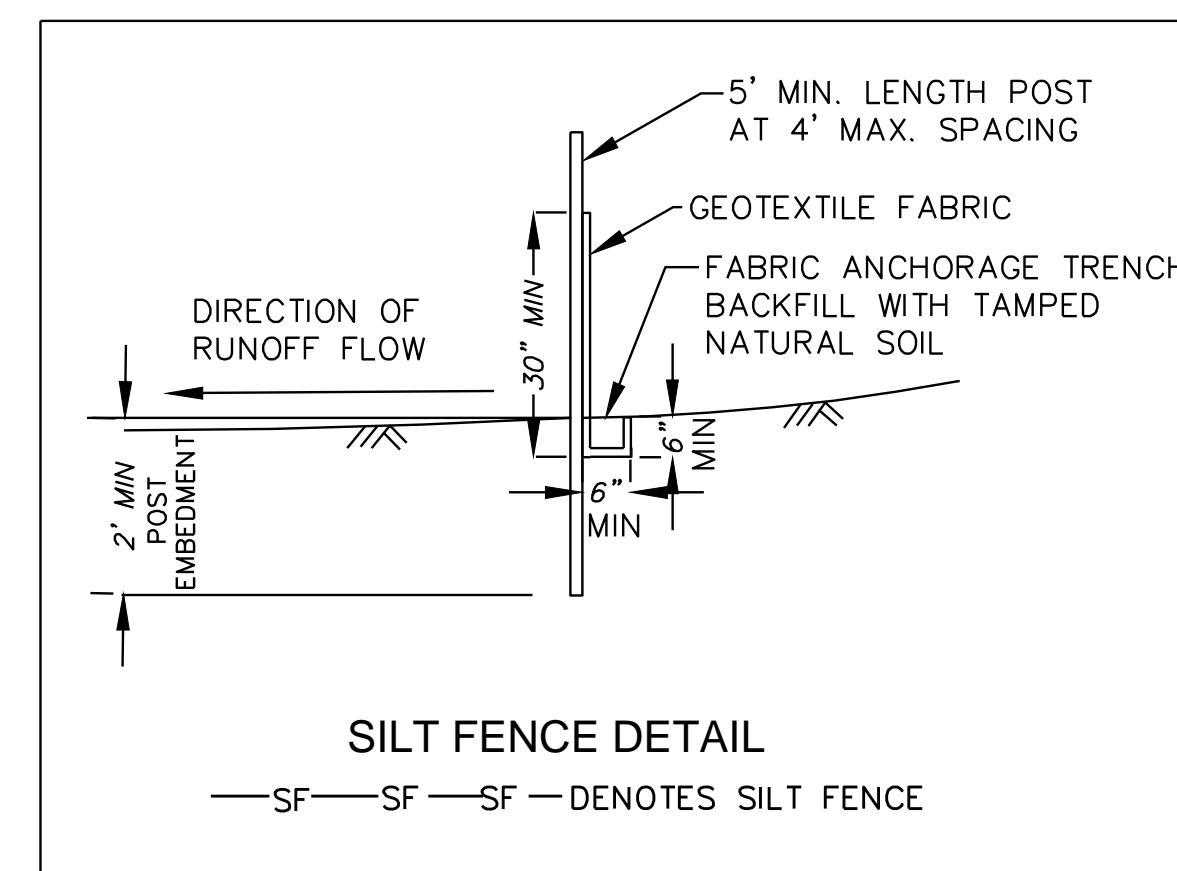
REDUNDANT SILT FENCE DETAIL



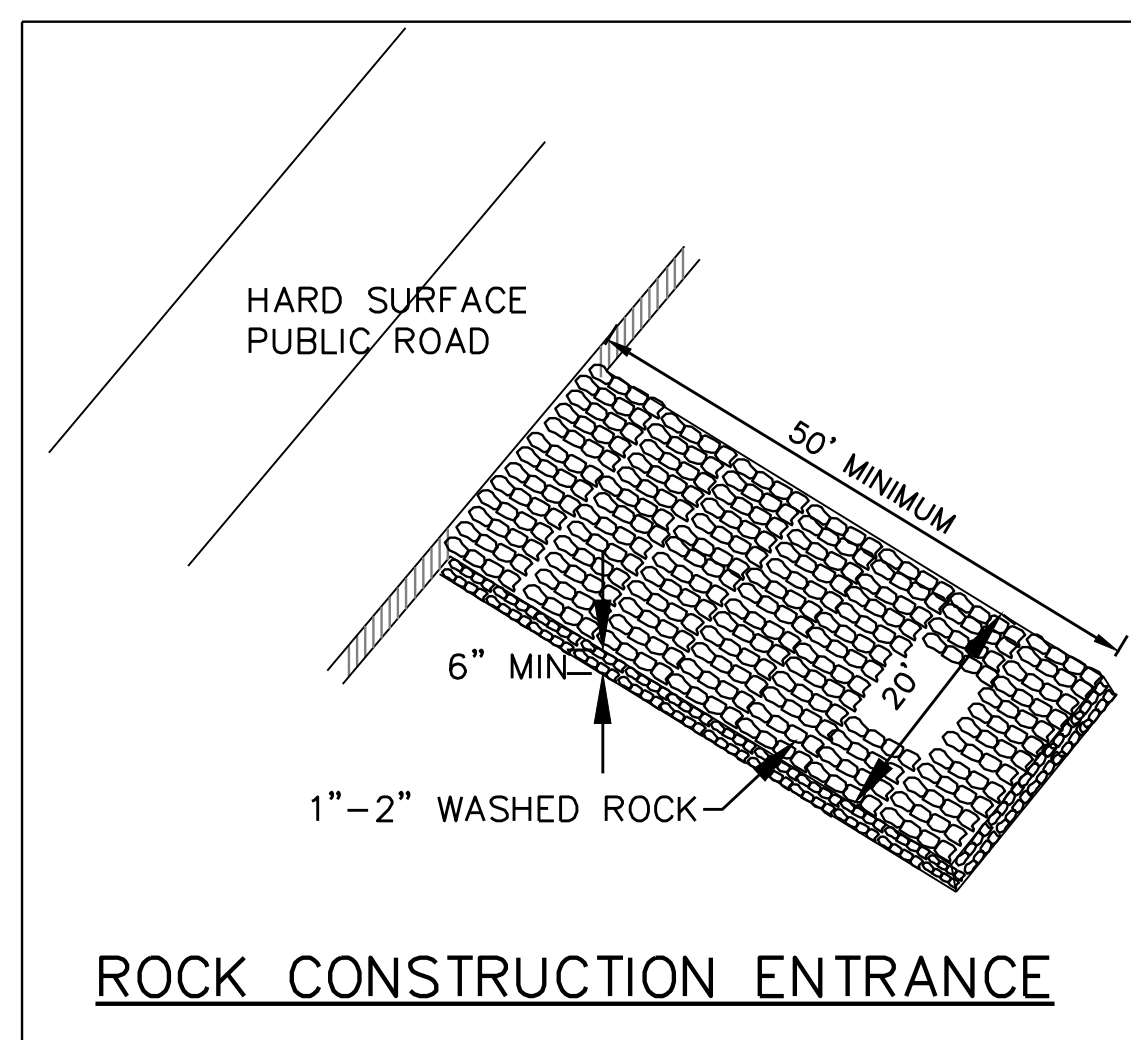
SLOPE EROSION CONTROL BLANKET INSTALLATION
(MN/DOT 3885 CATEGORY 3 BLANKET)



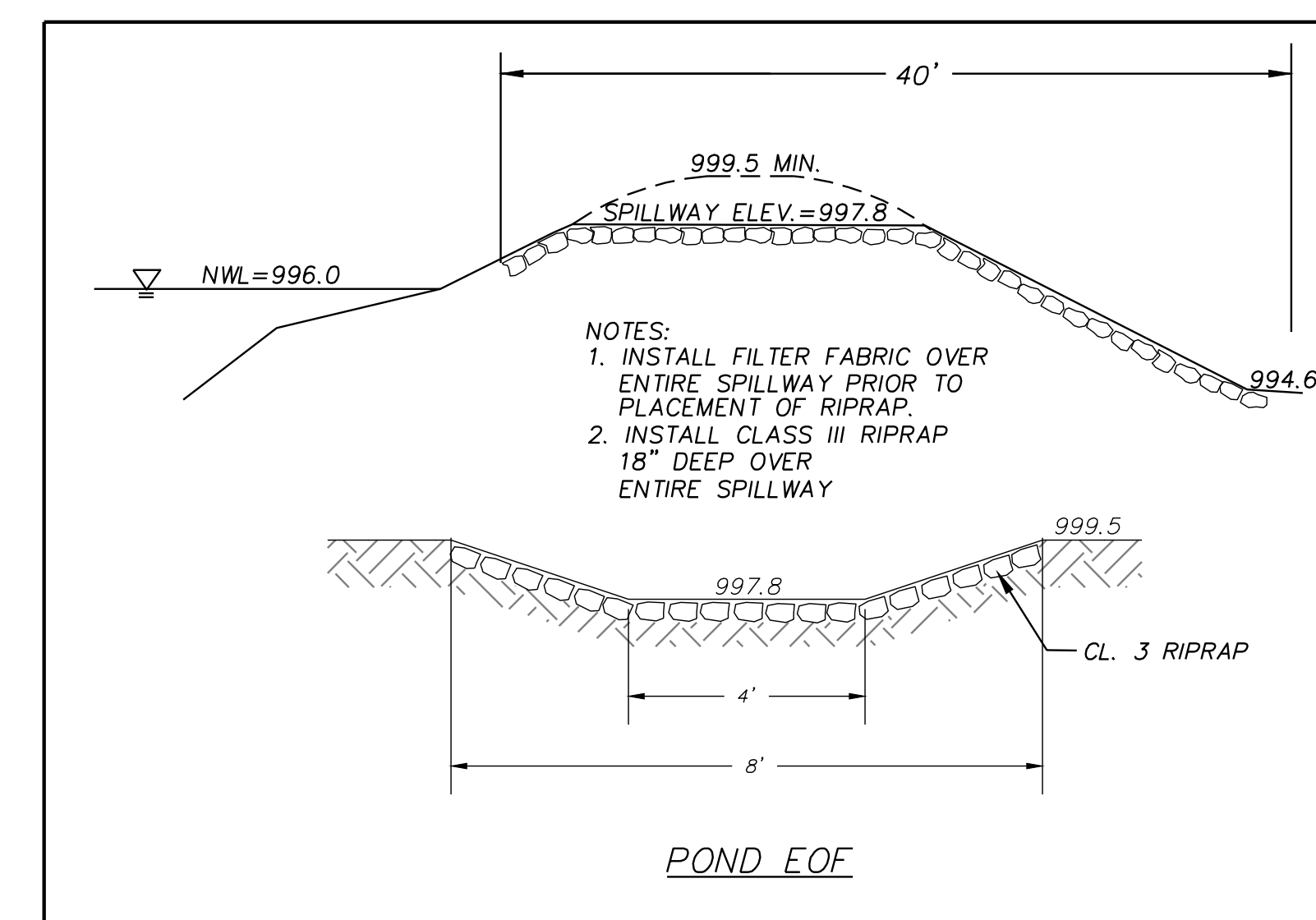
BIOLOG DETAIL



SILT FENCE DETAIL



ROCK CONSTRUCTION ENTRANCE



- NOTES:
1. INSTALL FILTER FABRIC OVER ENTIRE SPILLWAY PRIOR TO PLACEMENT OF RIPRAP.
2. INSTALL CLASS III RIPRAP 18" DEEP OVER ENTIRE SPILLWAY

POND EOF

REV. NO.	DATE	BY	DESCRIPTION

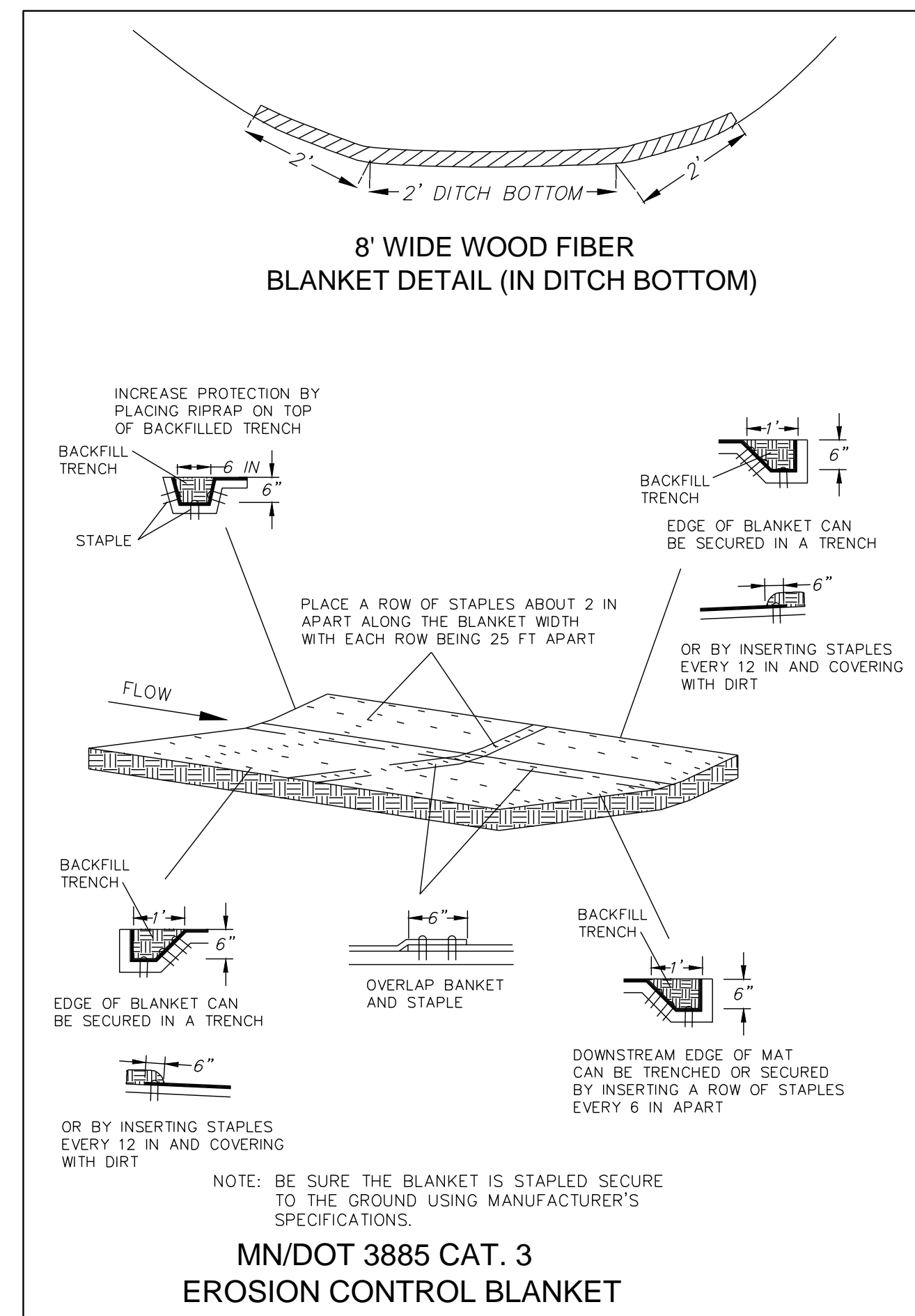
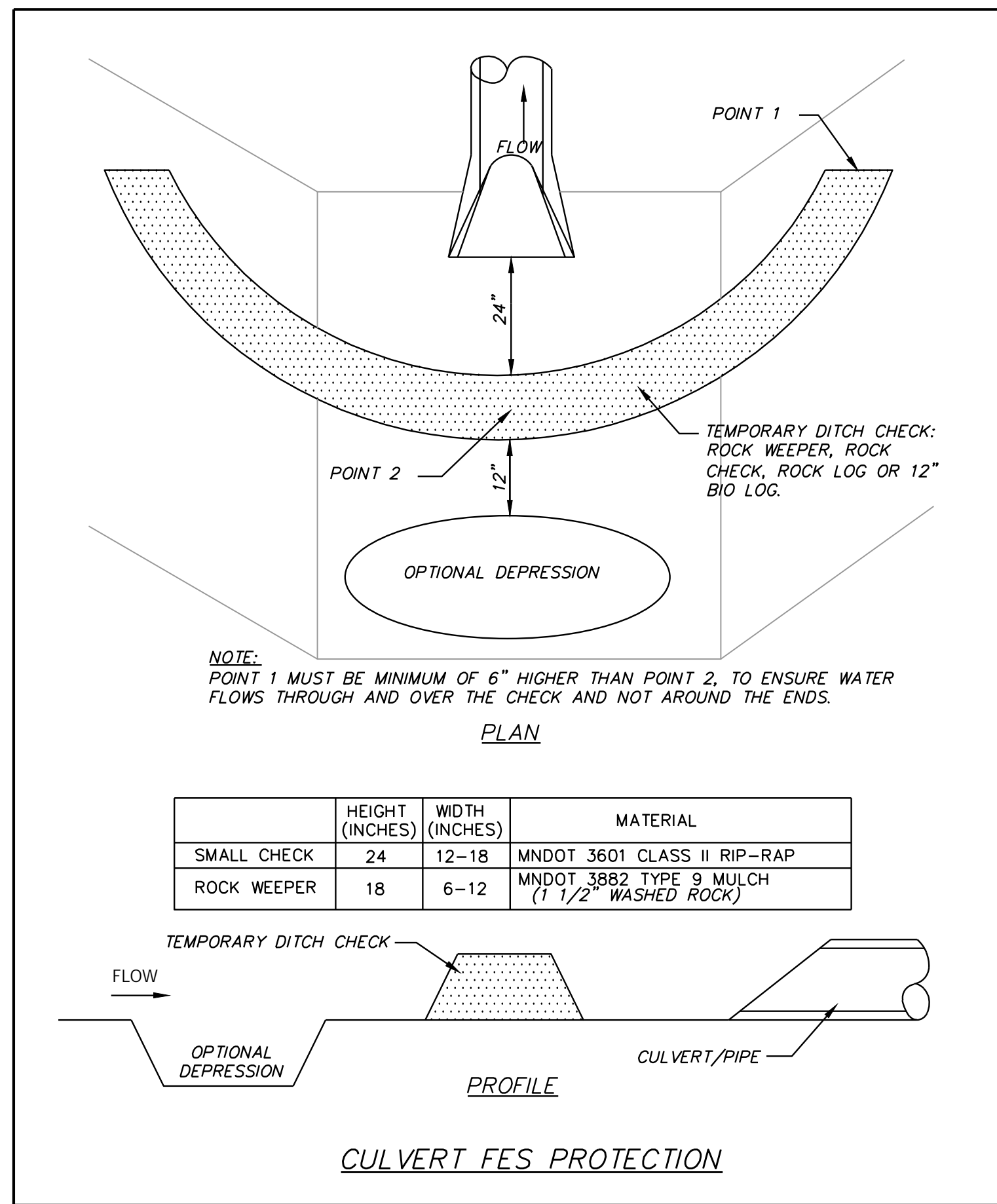
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CORINNA TOWNSHIP, MN

DETAILS
SHEET NO. 6 OF 7 SHEETS

PROJECT NO:
19-0544
DATE: 3-20-20



REV. NO.	DATE	BY	DESCRIPTION

DESIGNED DRAWN
P.E.O. T.J.B.

CHECKED
P.E.O.

I hereby certify that this survey, plan, or report was prepared by my or under my direct supervision and that I am a duly Licensed Land Surveyor under the laws of the State of Minnesota.

Paul E. Otto
Paul E. Otto
License #40062 Date: 3-20-20

OTTO ASSOCIATES
Engineers & Land Surveyors, Inc.

www.ottoassociates.com
9 West Division Street
Buffalo, MN 55313
(763)682-4727
Fax: (763)682-3522

SANDY SHORES AT SUGAR LAKE
BOB GRUYS
CORINNA TOWNSHIP, MN


DETAILS
SHEET NO. 7 OF 7 SHEETS

PROJECT NO:
19-0544
DATE: 3-20-20

STORMWATER REPORT
FOR
SANDY SHORES AT SUGAR LAKE

Wright County, Minnesota
March 19, 2020
Otto Project No. 19-0544

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

Cara Schwahn Otto 
Reg. No. 40433 Date March 19, 2020



Engineers & Land Surveyors, Inc.

9 West Division Street, Buffalo, MN 55313 • 763-682-4727 • Fax 763-682-3522 • www.ottoassociates.com

SUMMARY

EXISTING CONDITIONS

The 11 acre property is primarily wooded with row crops to the south. It is accessed from Hart Avenue NW. The property drains north to Sugar Lake.

Hydrologic Group B soils are predominately present. Soil borings taken onsite found seasonally saturated soils within less than 36" from the surface. Therefore, infiltration/filtration is prohibited. To meet the NPDES requirements, the proposed stormwater pond is designed to provide live storage for the 1" water quality volume.

PROPOSED DESIGN

The site is being developed into 6 large rural lots, one of which contains the existing home.

Existing Impervious = 0.0 acres

Proposed Impervious = 1.35 acres

Water Quality Volume Required = 1.35 acres x 1" = 4,901 cf

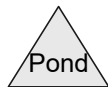
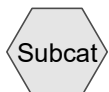
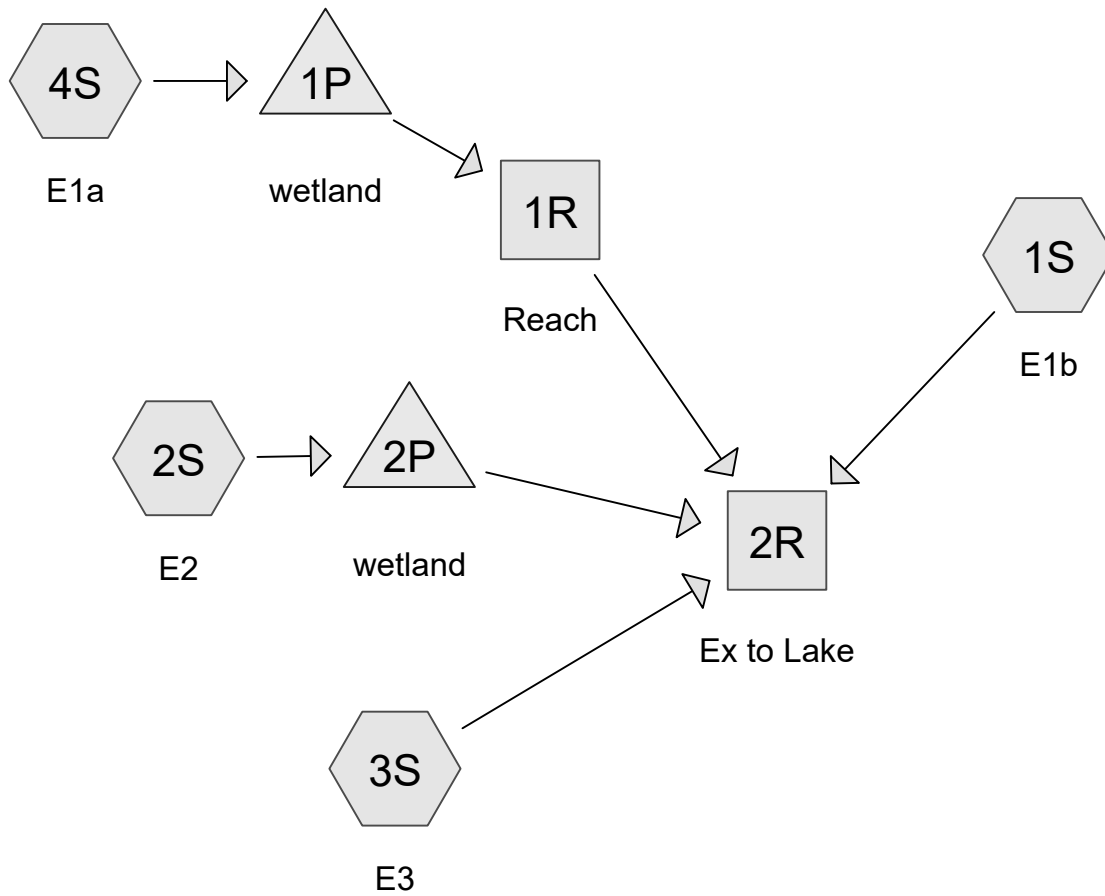
Water Quality Volume Proposed = 6,035 cf

Peak runoff flow rates are as follows:

RUNOFF (cfs)

SITE RUNOFF	2 Year	10 Year	100 Year
Existing to Sugar Lake	1.53	7.45	29.19
Proposed to Sugar Lake	1.79*	5.04	26.36

*negligible increase



Routing Diagram for 19-0544 Existing
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19-0544 Existing

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.500	61	>75% Grass cover, Good, HSG B (1S)
0.970	58	Meadow, non-grazed, HSG B (1S, 2S, 3S, 4S)
5.030	78	Row crops, straight row, Good, HSG B (1S, 2S, 4S)
0.170	98	Unconnected roofs, HSG B (1S)
0.300	89	Wetland (2S)
12.130	55	Woods, Good, HSG B (1S, 2S, 3S, 4S)
19.100	62	TOTAL AREA

19-0544 Existing

MSE 24-hr 3 2-Year Rainfall=2.81"

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Time span=1.00-200.00 hrs, dt=0.01 hrs, 19901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: E1b Runoff Area=8.700 ac 1.95% Impervious Runoff Depth=0.24"
Flow Length=1,005' Tc=24.8 min UI Adjusted CN=59 Runoff=1.09 cfs 0.175 af

Subcatchment2S: E2 Runoff Area=2.600 ac 0.00% Impervious Runoff Depth=0.46"
Flow Length=215' Tc=10.8 min CN=66 Runoff=1.40 cfs 0.099 af

Subcatchment3S: E3 Runoff Area=3.800 ac 0.00% Impervious Runoff Depth=0.15"
Flow Length=370' Tc=20.3 min CN=55 Runoff=0.21 cfs 0.047 af

Subcatchment4S: E1a Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=0.70"
Flow Length=300' Slope=0.1100 '/' Tc=14.1 min CN=72 Runoff=3.39 cfs 0.232 af

Reach 1R: Reach Avg. Flow Depth=0.29' Max Vel=0.24 fps Inflow=2.76 cfs 0.232 af
n=0.400 L=760.0' S=0.0367 '/' Capacity=3.42 cfs Outflow=1.02 cfs 0.232 af

Reach 2R: Ex to Lake Inflow=1.53 cfs 0.454 af
Outflow=1.53 cfs 0.454 af

Pond 1P: wetland Peak Elev=1,018.04' Storage=1,004 cf Inflow=3.39 cfs 0.232 af
Outflow=2.76 cfs 0.232 af

Pond 2P: wetland Peak Elev=1,030.24' Storage=4,313 cf Inflow=1.40 cfs 0.099 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 19.100 ac Runoff Volume = 0.553 af Average Runoff Depth = 0.35"
99.11% Pervious = 18.930 ac 0.89% Impervious = 0.170 ac

19-0544 Existing

MSE 24-hr 3 2-Year Rainfall=2.81"

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Summary for Subcatchment 1S: E1b

Runoff = 1.09 cfs @ 12.53 hrs, Volume= 0.175 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (ac)	CN	Adj	Description
1.300	78		Row crops, straight row, Good, HSG B
0.170	98		Unconnected roofs, HSG B
6.330	55		Woods, Good, HSG B
0.500	61		>75% Grass cover, Good, HSG B
0.400	58		Meadow, non-grazed, HSG B
8.700	60	59	Weighted Average, UI Adjusted
8.530			98.05% Pervious Area
0.170			1.95% Impervious Area
0.170			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	300	0.1100	0.36		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"
10.7	705	0.0480	1.10		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.8	1,005	Total			

Summary for Subcatchment 2S: E2

Runoff = 1.40 cfs @ 12.21 hrs, Volume= 0.099 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (ac)	CN	Description
0.730	78	Row crops, straight row, Good, HSG B
1.350	55	Woods, Good, HSG B
0.220	58	Meadow, non-grazed, HSG B
* 0.300	89	Wetland
2.600	66	Weighted Average
2.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0600	0.24		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"
0.5	65	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
10.8	215	Total			

19-0544 Existing

MSE 24-hr 3 2-Year Rainfall=2.81"

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Summary for Subcatchment 3S: E3

Runoff = 0.21 cfs @ 12.58 hrs, Volume= 0.047 af, Depth= 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (ac)	CN	Description
3.550	55	Woods, Good, HSG B
0.250	58	Meadow, non-grazed, HSG B
3.800	55	Weighted Average
3.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	200	0.1300	0.18		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	170	0.1600	2.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
20.3	370	Total			

Summary for Subcatchment 4S: E1a

Runoff = 3.39 cfs @ 12.24 hrs, Volume= 0.232 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (ac)	CN	Description
3.000	78	Row crops, straight row, Good, HSG B
0.900	55	Woods, Good, HSG B
0.100	58	Meadow, non-grazed, HSG B
4.000	72	Weighted Average
4.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	300	0.1100	0.36		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"

Summary for Reach 1R: Reach

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 0.70" for 2-Year event
 Inflow = 2.76 cfs @ 12.33 hrs, Volume= 0.232 af
 Outflow = 1.02 cfs @ 13.66 hrs, Volume= 0.232 af, Atten= 63%, Lag= 79.9 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Max. Velocity= 0.24 fps, Min. Travel Time= 53.8 min
 Avg. Velocity = 0.03 fps, Avg. Travel Time= 362.1 min

19-0544 Existing

MSE 24-hr 3 2-Year Rainfall=2.81"

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Peak Storage= 3,284 cf @ 12.77 hrs
 Average Depth at Peak Storage= 0.29'
 Bank-Full Depth= 0.50' Flow Area= 10.0 sf, Capacity= 3.42 cfs

30.00' x 0.50' deep Parabolic Channel, n= 0.400 Sheet flow: Woods+light brush
 Length= 760.0' Slope= 0.0367 '
 Inlet Invert= 1,017.90', Outlet Invert= 990.00'



Summary for Reach 2R: Ex to Lake

Inflow Area = 19.100 ac, 0.89% Impervious, Inflow Depth = 0.29" for 2-Year event
 Inflow = 1.53 cfs @ 13.58 hrs, Volume= 0.454 af
 Outflow = 1.53 cfs @ 13.58 hrs, Volume= 0.454 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: wetland

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 0.70" for 2-Year event
 Inflow = 3.39 cfs @ 12.24 hrs, Volume= 0.232 af
 Outflow = 2.76 cfs @ 12.33 hrs, Volume= 0.232 af, Atten= 18%, Lag= 5.4 min
 Primary = 2.76 cfs @ 12.33 hrs, Volume= 0.232 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,018.04' @ 12.33 hrs Surf.Area= 25,603 sf Storage= 1,004 cf

Plug-Flow detention time= 6.1 min calculated for 0.232 af (100% of inflow)
 Center-of-Mass det. time= 6.1 min (854.1 - 848.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,018.00'	138,450 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,018.00	25,450	0	0
1,020.00	33,250	58,700	58,700
1,022.00	46,500	79,750	138,450

Device	Routing	Invert	Outlet Devices
#1	Primary	1,017.90'	20.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

19-0544 Existing

MSE 24-hr 3 2-Year Rainfall=2.81"

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Primary OutFlow Max=2.79 cfs @ 12.33 hrs HW=1,018.04' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir**(Weir Controls 2.79 cfs @ 1.00 fps)

Summary for Pond 2P: wetland

Inflow Area = 2.600 ac, 0.00% Impervious, Inflow Depth = 0.46" for 2-Year event
 Inflow = 1.40 cfs @ 12.21 hrs, Volume= 0.099 af
 Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,030.24' @ 24.61 hrs Surf.Area= 18,303 sf Storage= 4,313 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,030.00'	163,150 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,030.00	17,900	0	0
1,032.00	21,280	39,180	39,180
1,034.00	30,250	51,530	90,710
1,036.00	42,190	72,440	163,150

Device	Routing	Invert	Outlet Devices
#1	Primary	1,035.13'	40.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,030.00' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

19-0544 Existing

MSE 24-hr 3 10-Year Rainfall=4.18"

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Time span=1.00-200.00 hrs, dt=0.01 hrs, 19901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: E1b Runoff Area=8.700 ac 1.95% Impervious Runoff Depth=0.80"
Flow Length=1,005' Tc=24.8 min UI Adjusted CN=59 Runoff=5.66 cfs 0.580 af

Subcatchment2S: E2 Runoff Area=2.600 ac 0.00% Impervious Runoff Depth=1.20"
Flow Length=215' Tc=10.8 min CN=66 Runoff=4.46 cfs 0.259 af

Subcatchment3S: E3 Runoff Area=3.800 ac 0.00% Impervious Runoff Depth=0.60"
Flow Length=370' Tc=20.3 min CN=55 Runoff=1.82 cfs 0.191 af

Subcatchment4S: E1a Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=1.59"
Flow Length=300' Slope=0.1100 '/' Tc=14.1 min CN=72 Runoff=8.34 cfs 0.529 af

Reach 1R: Reach Avg. Flow Depth=0.48' Max Vel=0.33 fps Inflow=5.79 cfs 0.529 af
n=0.400 L=760.0' S=0.0367 '/' Capacity=3.42 cfs Outflow=3.15 cfs 0.529 af

Reach 2R: Ex to Lake Inflow=7.45 cfs 1.300 af
Outflow=7.45 cfs 1.300 af

Pond 1P: wetland Peak Elev=1,018.13' Storage=3,249 cf Inflow=8.34 cfs 0.529 af
Outflow=5.79 cfs 0.529 af

Pond 2P: wetland Peak Elev=1,030.61' Storage=11,279 cf Inflow=4.46 cfs 0.259 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 19.100 ac Runoff Volume = 1.559 af Average Runoff Depth = 0.98"
99.11% Pervious = 18.930 ac 0.89% Impervious = 0.170 ac

19-0544 Existing

MSE 24-hr 3 10-Year Rainfall=4.18"

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Summary for Subcatchment 1S: E1b

Runoff = 5.66 cfs @ 12.43 hrs, Volume= 0.580 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.18"

Area (ac)	CN	Adj	Description
1.300	78		Row crops, straight row, Good, HSG B
0.170	98		Unconnected roofs, HSG B
6.330	55		Woods, Good, HSG B
0.500	61		>75% Grass cover, Good, HSG B
0.400	58		Meadow, non-grazed, HSG B
8.700	60	59	Weighted Average, UI Adjusted
8.530			98.05% Pervious Area
0.170			1.95% Impervious Area
0.170			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	300	0.1100	0.36		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"
10.7	705	0.0480	1.10		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.8	1,005	Total			

Summary for Subcatchment 2S: E2

Runoff = 4.46 cfs @ 12.20 hrs, Volume= 0.259 af, Depth= 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.18"

Area (ac)	CN	Description
0.730	78	Row crops, straight row, Good, HSG B
1.350	55	Woods, Good, HSG B
0.220	58	Meadow, non-grazed, HSG B
* 0.300	89	Wetland
2.600	66	Weighted Average
2.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0600	0.24		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"
0.5	65	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
10.8	215	Total			

19-0544 Existing

MSE 24-hr 3 10-Year Rainfall=4.18"

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Summary for Subcatchment 3S: E3

Runoff = 1.82 cfs @ 12.38 hrs, Volume= 0.191 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.18"

Area (ac)	CN	Description
3.550	55	Woods, Good, HSG B
0.250	58	Meadow, non-grazed, HSG B
3.800	55	Weighted Average
3.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	200	0.1300	0.18		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	170	0.1600	2.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
20.3	370	Total			

Summary for Subcatchment 4S: E1a

Runoff = 8.34 cfs @ 12.23 hrs, Volume= 0.529 af, Depth= 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.18"

Area (ac)	CN	Description
3.000	78	Row crops, straight row, Good, HSG B
0.900	55	Woods, Good, HSG B
0.100	58	Meadow, non-grazed, HSG B
4.000	72	Weighted Average
4.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	300	0.1100	0.36		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"

Summary for Reach 1R: Reach

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 1.59" for 10-Year event

Inflow = 5.79 cfs @ 12.36 hrs, Volume= 0.529 af

Outflow = 3.15 cfs @ 13.37 hrs, Volume= 0.529 af, Atten= 46%, Lag= 60.9 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs

Max. Velocity= 0.33 fps, Min. Travel Time= 38.0 min

Avg. Velocity = 0.04 fps, Avg. Travel Time= 318.8 min

19-0544 Existing

MSE 24-hr 3 10-Year Rainfall=4.18"

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Peak Storage= 7,182 cf @ 12.74 hrs
 Average Depth at Peak Storage= 0.48'
 Bank-Full Depth= 0.50' Flow Area= 10.0 sf, Capacity= 3.42 cfs

30.00' x 0.50' deep Parabolic Channel, n= 0.400 Sheet flow: Woods+light brush
 Length= 760.0' Slope= 0.0367 '
 Inlet Invert= 1,017.90', Outlet Invert= 990.00'



Summary for Reach 2R: Ex to Lake

Inflow Area = 19.100 ac, 0.89% Impervious, Inflow Depth = 0.82" for 10-Year event
 Inflow = 7.45 cfs @ 12.41 hrs, Volume= 1.300 af
 Outflow = 7.45 cfs @ 12.41 hrs, Volume= 1.300 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: wetland

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 1.59" for 10-Year event
 Inflow = 8.34 cfs @ 12.23 hrs, Volume= 0.529 af
 Outflow = 5.79 cfs @ 12.36 hrs, Volume= 0.529 af, Atten= 31%, Lag= 7.4 min
 Primary = 5.79 cfs @ 12.36 hrs, Volume= 0.529 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,018.13' @ 12.36 hrs Surf.Area= 25,943 sf Storage= 3,249 cf

Plug-Flow detention time= 7.2 min calculated for 0.529 af (100% of inflow)
 Center-of-Mass det. time= 7.2 min (835.8 - 828.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,018.00'	138,450 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,018.00	25,450	0	0
1,020.00	33,250	58,700	58,700
1,022.00	46,500	79,750	138,450

Device	Routing	Invert	Outlet Devices
#1	Primary	1,017.90'	20.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

19-0544 Existing

MSE 24-hr 3 10-Year Rainfall=4.18"

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Primary OutFlow Max=5.78 cfs @ 12.36 hrs HW=1,018.13' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir**(Weir Controls 5.78 cfs @ 1.28 fps)

Summary for Pond 2P: wetland

Inflow Area = 2.600 ac, 0.00% Impervious, Inflow Depth = 1.20" for 10-Year event
 Inflow = 4.46 cfs @ 12.20 hrs, Volume= 0.259 af
 Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,030.61' @ 24.61 hrs Surf.Area= 18,935 sf Storage= 11,279 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,030.00'	163,150 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,030.00	17,900	0	0
1,032.00	21,280	39,180	39,180
1,034.00	30,250	51,530	90,710
1,036.00	42,190	72,440	163,150

Device	Routing	Invert	Outlet Devices
#1	Primary	1,035.13'	40.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,030.00' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

19-0544 Existing

MSE 24-hr 3 100-Year Rainfall=6.93"

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Time span=1.00-200.00 hrs, dt=0.01 hrs, 19901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: E1b Runoff Area=8.700 ac 1.95% Impervious Runoff Depth=2.46"
Flow Length=1,005' Tc=24.8 min UI Adjusted CN=59 Runoff=20.61 cfs 1.782 af

Subcatchment2S: E2 Runoff Area=2.600 ac 0.00% Impervious Runoff Depth=3.15"
Flow Length=215' Tc=10.8 min CN=66 Runoff=12.36 cfs 0.682 af

Subcatchment3S: E3 Runoff Area=3.800 ac 0.00% Impervious Runoff Depth=2.08"
Flow Length=370' Tc=20.3 min CN=55 Runoff=8.25 cfs 0.659 af

Subcatchment4S: E1a Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=3.77"
Flow Length=300' Slope=0.1100 '/' Tc=14.1 min CN=72 Runoff=20.15 cfs 1.256 af

Reach 1R: Reach Avg. Flow Depth=0.84' Max Vel=0.42 fps Inflow=14.81 cfs 1.256 af
n=0.400 L=760.0' S=0.0367 '/' Capacity=3.42 cfs Outflow=8.47 cfs 1.256 af

Reach 2R: Ex to Lake Inflow=29.19 cfs 3.697 af
Outflow=29.19 cfs 3.697 af

Pond 1P: wetland Peak Elev=1,018.32' Storage=8,401 cf Inflow=20.15 cfs 1.256 af
Outflow=14.81 cfs 1.256 af

Pond 2P: wetland Peak Elev=1,031.55' Storage=29,725 cf Inflow=12.36 cfs 0.682 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 19.100 ac Runoff Volume = 4.379 af Average Runoff Depth = 2.75"
99.11% Pervious = 18.930 ac 0.89% Impervious = 0.170 ac

19-0544 Existing

MSE 24-hr 3 100-Year Rainfall=6.93"

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Summary for Subcatchment 1S: E1b

Runoff = 20.61 cfs @ 12.37 hrs, Volume= 1.782 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=6.93"

Area (ac)	CN	Adj	Description
1.300	78		Row crops, straight row, Good, HSG B
0.170	98		Unconnected roofs, HSG B
6.330	55		Woods, Good, HSG B
0.500	61		>75% Grass cover, Good, HSG B
0.400	58		Meadow, non-grazed, HSG B
8.700	60	59	Weighted Average, UI Adjusted
8.530			98.05% Pervious Area
0.170			1.95% Impervious Area
0.170			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	300	0.1100	0.36		Sheet Flow,
					Cultivated: Residue>20% n= 0.170 P2= 2.81"
10.7	705	0.0480	1.10		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
24.8	1,005	Total			

Summary for Subcatchment 2S: E2

Runoff = 12.36 cfs @ 12.19 hrs, Volume= 0.682 af, Depth= 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=6.93"

Area (ac)	CN	Description
0.730	78	Row crops, straight row, Good, HSG B
1.350	55	Woods, Good, HSG B
0.220	58	Meadow, non-grazed, HSG B
* 0.300	89	Wetland
2.600	66	Weighted Average
2.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0600	0.24		Sheet Flow,
					Cultivated: Residue>20% n= 0.170 P2= 2.81"
0.5	65	0.1800	2.12		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
10.8	215	Total			

19-0544 Existing

MSE 24-hr 3 100-Year Rainfall=6.93"

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Summary for Subcatchment 3S: E3

Runoff = 8.25 cfs @ 12.33 hrs, Volume= 0.659 af, Depth= 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=6.93"

Area (ac)	CN	Description
3.550	55	Woods, Good, HSG B
0.250	58	Meadow, non-grazed, HSG B
3.800	55	Weighted Average
3.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	200	0.1300	0.18		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"
1.4	170	0.1600	2.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
20.3	370	Total			

Summary for Subcatchment 4S: E1a

Runoff = 20.15 cfs @ 12.22 hrs, Volume= 1.256 af, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=6.93"

Area (ac)	CN	Description
3.000	78	Row crops, straight row, Good, HSG B
0.900	55	Woods, Good, HSG B
0.100	58	Meadow, non-grazed, HSG B
4.000	72	Weighted Average
4.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	300	0.1100	0.36		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"

Summary for Reach 1R: Reach

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 3.77" for 100-Year event

Inflow = 14.81 cfs @ 12.33 hrs, Volume= 1.256 af

Outflow = 8.47 cfs @ 13.13 hrs, Volume= 1.256 af, Atten= 43%, Lag= 47.9 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs

Max. Velocity= 0.42 fps, Min. Travel Time= 30.3 min

Avg. Velocity = 0.05 fps, Avg. Travel Time= 273.1 min

19-0544 Existing

MSE 24-hr 3 100-Year Rainfall=6.93"

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Peak Storage= 15,402 cf @ 12.62 hrs
 Average Depth at Peak Storage= 0.84'
 Bank-Full Depth= 0.50' Flow Area= 10.0 sf, Capacity= 3.42 cfs

30.00' x 0.50' deep Parabolic Channel, n= 0.400 Sheet flow: Woods+light brush
 Length= 760.0' Slope= 0.0367 '
 Inlet Invert= 1,017.90', Outlet Invert= 990.00'



Summary for Reach 2R: Ex to Lake

Inflow Area = 19.100 ac, 0.89% Impervious, Inflow Depth = 2.32" for 100-Year event
 Inflow = 29.19 cfs @ 12.37 hrs, Volume= 3.697 af
 Outflow = 29.19 cfs @ 12.37 hrs, Volume= 3.697 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: wetland

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 3.77" for 100-Year event
 Inflow = 20.15 cfs @ 12.22 hrs, Volume= 1.256 af
 Outflow = 14.81 cfs @ 12.33 hrs, Volume= 1.256 af, Atten= 26%, Lag= 6.4 min
 Primary = 14.81 cfs @ 12.33 hrs, Volume= 1.256 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,018.32' @ 12.33 hrs Surf.Area= 26,706 sf Storage= 8,401 cf

Plug-Flow detention time= 8.0 min calculated for 1.256 af (100% of inflow)
 Center-of-Mass det. time= 8.0 min (818.6 - 810.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,018.00'	138,450 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,018.00	25,450	0	0
1,020.00	33,250	58,700	58,700
1,022.00	46,500	79,750	138,450

Device	Routing	Invert	Outlet Devices
#1	Primary	1,017.90'	20.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

19-0544 Existing

MSE 24-hr 3 100-Year Rainfall=6.93"

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Primary OutFlow Max=14.81 cfs @ 12.33 hrs HW=1,018.32' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir**(Weir Controls 14.81 cfs @ 1.75 fps)

Summary for Pond 2P: wetland

Inflow Area = 2.600 ac, 0.00% Impervious, Inflow Depth = 3.15" for 100-Year event
 Inflow = 12.36 cfs @ 12.19 hrs, Volume= 0.682 af
 Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,031.55' @ 24.61 hrs Surf.Area= 20,515 sf Storage= 29,725 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

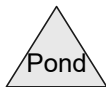
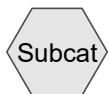
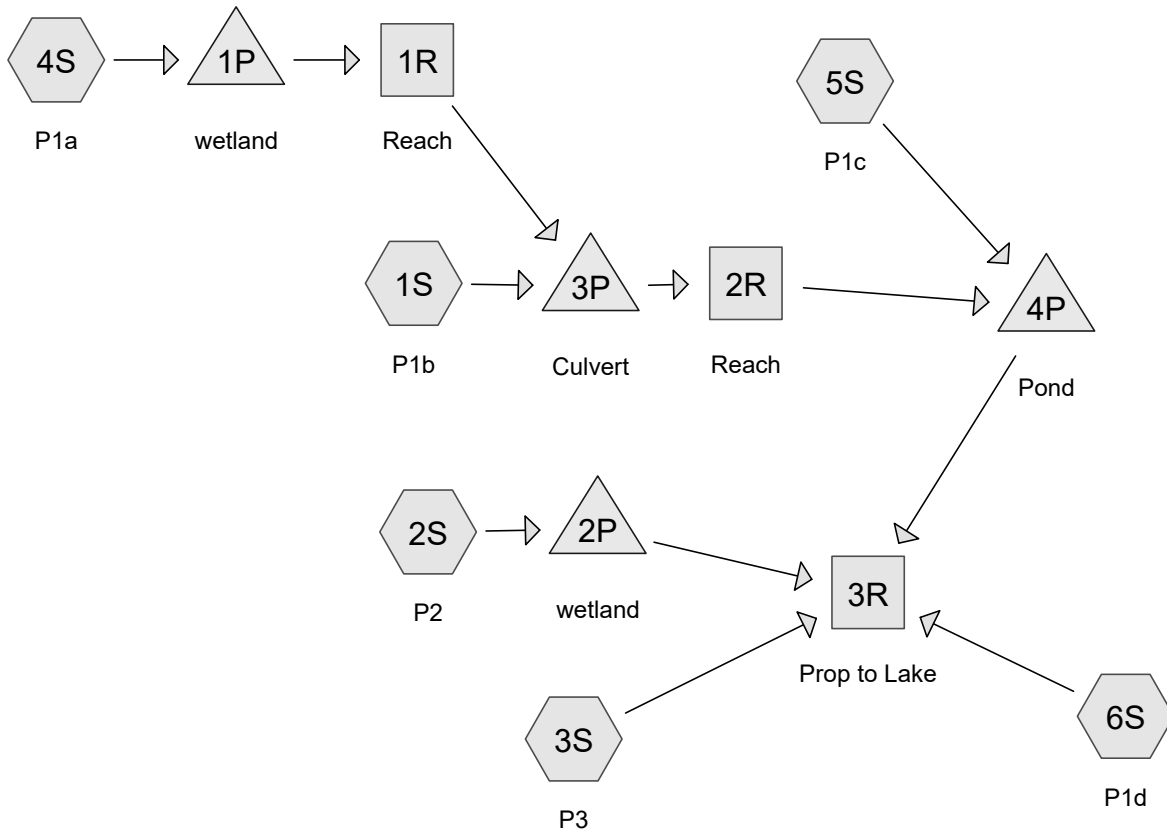
Volume	Invert	Avail.Storage	Storage Description
#1	1,030.00'	163,150 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,030.00	17,900	0	0
1,032.00	21,280	39,180	39,180
1,034.00	30,250	51,530	90,710
1,036.00	42,190	72,440	163,150

Device	Routing	Invert	Outlet Devices
#1	Primary	1,035.13'	40.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,030.00' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir**(Controls 0.00 cfs)



Routing Diagram for 19-0544 Proposed
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.100	61	>75% Grass cover, Good, HSG B (3S, 5S, 6S)
1.520	98	Impervious, HSG B (1S, 2S, 3S, 5S, 6S)
2.690	58	Meadow, non-grazed, HSG B (1S, 2S, 3S, 4S, 5S)
4.230	78	Row crops, straight row, Good, HSG B (1S, 2S, 4S)
0.300	89	Wetland (2S)
7.260	55	Woods, Good, HSG B (1S, 2S, 3S, 4S, 5S, 6S)
19.100	65	TOTAL AREA

19-0544 Proposed

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MSE 24-hr 3 2-Year Rainfall=2.81"

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Time span=1.00-200.00 hrs, dt=0.01 hrs, 19901 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: P1b Runoff Area=1.500 ac 10.67% Impervious Runoff Depth=0.57"
 Flow Length=560' Tc=13.5 min CN=69 Runoff=0.99 cfs 0.071 af

Subcatchment2S: P2 Runoff Area=2.300 ac 4.78% Impervious Runoff Depth=0.57"
 Flow Length=215' Tc=10.8 min CN=69 Runoff=1.71 cfs 0.109 af

Subcatchment3S: P3 Runoff Area=3.800 ac 7.89% Impervious Runoff Depth=0.24"
 Flow Length=310' Tc=11.4 min CN=59 Runoff=0.63 cfs 0.076 af

Subcatchment4S: P1a Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=0.70"
 Flow Length=300' Slope=0.1100 '/' Tc=14.1 min CN=72 Runoff=3.39 cfs 0.232 af

Subcatchment5S: P1c Runoff Area=5.450 ac 13.76% Impervious Runoff Depth=0.36"
 Flow Length=495' Tc=31.0 min CN=63 Runoff=1.16 cfs 0.162 af

Subcatchment6S: P1d Runoff Area=2.050 ac 9.76% Impervious Runoff Depth=0.33"
 Flow Length=270' Slope=0.1400 '/' Tc=23.3 min CN=62 Runoff=0.43 cfs 0.056 af

Reach 1R: Reach Avg. Flow Depth=0.50' Max Vel=0.59 fps Inflow=2.76 cfs 0.232 af
 n=0.240 L=180.0' S=0.0389 '/' Capacity=16.73 cfs Outflow=2.57 cfs 0.232 af

Reach 2R: Reach Avg. Flow Depth=0.64' Max Vel=0.73 fps Inflow=3.06 cfs 0.304 af
 n=0.240 L=330.0' S=0.0379 '/' Capacity=27.24 cfs Outflow=2.78 cfs 0.304 af

Reach 3R: Prop to Lake Inflow=1.79 cfs 0.597 af
 Outflow=1.79 cfs 0.597 af

Pond 1P: wetland Peak Elev=1,018.04' Storage=1,004 cf Inflow=3.39 cfs 0.232 af
 Outflow=2.76 cfs 0.232 af

Pond 2P: wetland Peak Elev=1,030.26' Storage=4,762 cf Inflow=1.71 cfs 0.109 af
 Outflow=0.00 cfs 0.000 af

Pond 3P: Culvert Peak Elev=1,011.73' Storage=208 cf Inflow=3.07 cfs 0.304 af
 24.0" Round Culvert n=0.025 L=80.0' S=0.0313 '/' Outflow=3.06 cfs 0.304 af

Pond 4P: Pond Peak Elev=996.66' Storage=6,692 cf Inflow=3.81 cfs 0.466 af
 Outflow=1.44 cfs 0.466 af

Total Runoff Area = 19.100 ac Runoff Volume = 0.707 af Average Runoff Depth = 0.44"
92.04% Pervious = 17.580 ac 7.96% Impervious = 1.520 ac

19-0544 Proposed

MSE 24-hr 3 2-Year Rainfall=2.81"

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Summary for Subcatchment 1S: P1b

Runoff = 0.99 cfs @ 12.24 hrs, Volume= 0.071 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (ac)	CN	Description
0.500	78	Row crops, straight row, Good, HSG B
* 0.160	98	Impervious, HSG B
0.200	55	Woods, Good, HSG B
0.640	58	Meadow, non-grazed, HSG B
1.500	69	Weighted Average
1.340		89.33% Pervious Area
0.160		10.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	245	0.1100	0.34		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"
1.5	315	0.0570	3.58		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
13.5	560	Total			

Summary for Subcatchment 2S: P2

Runoff = 1.71 cfs @ 12.20 hrs, Volume= 0.109 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (ac)	CN	Description
0.760	55	Woods, Good, HSG B
0.400	58	Meadow, non-grazed, HSG B
* 0.300	89	Wetland
* 0.110	98	Impervious, HSG B
0.730	78	Row crops, straight row, Good, HSG B
2.300	69	Weighted Average
2.190		95.22% Pervious Area
0.110		4.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0600	0.24		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"
0.5	65	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
10.8	215	Total			

19-0544 Proposed

MSE 24-hr 3 2-Year Rainfall=2.81"

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Summary for Subcatchment 3S: P3

Runoff = 0.63 cfs @ 12.27 hrs, Volume= 0.076 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (ac)	CN	Description
2.750	55	Woods, Good, HSG B
0.250	58	Meadow, non-grazed, HSG B
* 0.300	98	Impervious, HSG B
0.500	61	>75% Grass cover, Good, HSG B
3.800	59	Weighted Average
3.500		92.11% Pervious Area
0.300		7.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.2000	0.18		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"
2.3	210	0.0950	1.54		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.4	310	Total			

Summary for Subcatchment 4S: P1a

Runoff = 3.39 cfs @ 12.24 hrs, Volume= 0.232 af, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (ac)	CN	Description
3.000	78	Row crops, straight row, Good, HSG B
0.900	55	Woods, Good, HSG B
0.100	58	Meadow, non-grazed, HSG B
4.000	72	Weighted Average
4.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	300	0.1100	0.36		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"

Summary for Subcatchment 5S: P1c

Runoff = 1.16 cfs @ 12.57 hrs, Volume= 0.162 af, Depth= 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

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MSE 24-hr 3 2-Year Rainfall=2.81"

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Area (ac)	CN	Description
* 0.750	98	Impervious, HSG B
1.800	55	Woods, Good, HSG B
1.300	58	Meadow, non-grazed, HSG B
1.600	61	>75% Grass cover, Good, HSG B
5.450	63	Weighted Average
4.700		86.24% Pervious Area
0.750		13.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0600	0.17		Sheet Flow, Grass: Dense n= 0.240 P2= 2.81"
18.3	200	0.1400	0.18		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"
2.9	195	0.0510	1.13		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
31.0	495	Total			

Summary for Subcatchment 6S: P1d

Runoff = 0.43 cfs @ 12.45 hrs, Volume= 0.056 af, Depth= 0.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.81"

Area (ac)	CN	Description
* 0.200	98	Impervious, HSG B
0.850	55	Woods, Good, HSG B
1.000	61	>75% Grass cover, Good, HSG B
2.050	62	Weighted Average
1.850		90.24% Pervious Area
0.200		9.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.3	270	0.1400	0.19		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"

Summary for Reach 1R: Reach

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 0.70" for 2-Year event
Inflow = 2.76 cfs @ 12.33 hrs, Volume= 0.232 af
Outflow = 2.57 cfs @ 12.49 hrs, Volume= 0.232 af, Atten= 7%, Lag= 9.4 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.59 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 0.17 fps, Avg. Travel Time= 17.4 min

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Peak Storage= 785 cf @ 12.40 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 1.20' Flow Area= 16.0 sf, Capacity= 16.73 cfs

20.00' x 1.20' deep Parabolic Channel, n= 0.240 Sheet flow over Dense Grass
Length= 180.0' Slope= 0.0389 '/'
Inlet Invert= 1,018.00', Outlet Invert= 1,011.00'



Summary for Reach 2R: Reach

Inflow Area =	5.500 ac,	2.91% Impervious,	Inflow Depth = 0.66"	for 2-Year event
Inflow =	3.06 cfs @	12.49 hrs,	Volume=	0.304 af
Outflow =	2.78 cfs @	12.72 hrs,	Volume=	0.304 af, Atten= 9%, Lag= 13.4 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.73 fps, Min. Travel Time= 7.5 min
Avg. Velocity = 0.21 fps, Avg. Travel Time= 26.1 min

Peak Storage= 1,256 cf @ 12.59 hrs
Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 27.24 cfs

4.00' x 2.00' deep channel, n= 0.240 Sheet flow over Dense Grass
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 330.0' Slope= 0.0379 '/'
Inlet Invert= 1,008.50', Outlet Invert= 996.00'



Summary for Reach 3R: Prop to Lake

Inflow Area =	19.100 ac,	7.96% Impervious,	Inflow Depth = 0.38"	for 2-Year event
Inflow =	1.79 cfs @	13.24 hrs,	Volume=	0.597 af
Outflow =	1.79 cfs @	13.24 hrs,	Volume=	0.597 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs

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Summary for Pond 1P: wetland

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 0.70" for 2-Year event
 Inflow = 3.39 cfs @ 12.24 hrs, Volume= 0.232 af
 Outflow = 2.76 cfs @ 12.33 hrs, Volume= 0.232 af, Atten= 18%, Lag= 5.4 min
 Primary = 2.76 cfs @ 12.33 hrs, Volume= 0.232 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,018.04' @ 12.33 hrs Surf.Area= 25,603 sf Storage= 1,004 cf

Plug-Flow detention time= 6.1 min calculated for 0.232 af (100% of inflow)
 Center-of-Mass det. time= 6.1 min (854.1 - 848.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,018.00'	138,450 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,018.00	25,450	0	0
1,020.00	33,250	58,700	58,700
1,022.00	46,500	79,750	138,450

Device	Routing	Invert	Outlet Devices
#1	Primary	1,017.90'	20.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.79 cfs @ 12.33 hrs HW=1,018.04' (Free Discharge)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 2.79 cfs @ 1.00 fps)

Summary for Pond 2P: wetland

Inflow Area = 2.300 ac, 4.78% Impervious, Inflow Depth = 0.57" for 2-Year event
 Inflow = 1.71 cfs @ 12.20 hrs, Volume= 0.109 af
 Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,030.26' @ 24.61 hrs Surf.Area= 18,344 sf Storage= 4,762 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,030.00'	163,150 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,030.00	17,900	0	0
1,032.00	21,280	39,180	39,180
1,034.00	30,250	51,530	90,710
1,036.00	42,190	72,440	163,150

Device	Routing	Invert	Outlet Devices
#1	Primary	1,035.13'	40.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,030.00' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Culvert

Inflow Area = 5.500 ac, 2.91% Impervious, Inflow Depth = 0.66" for 2-Year event
 Inflow = 3.07 cfs @ 12.47 hrs, Volume= 0.304 af
 Outflow = 3.06 cfs @ 12.49 hrs, Volume= 0.304 af, Atten= 1%, Lag= 1.3 min
 Primary = 3.06 cfs @ 12.49 hrs, Volume= 0.304 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,011.73' @ 12.49 hrs Surf.Area= 566 sf Storage= 208 cf

Plug-Flow detention time= 1.1 min calculated for 0.304 af (100% of inflow)
 Center-of-Mass det. time= 1.1 min (866.7 - 865.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,011.00'	2,370 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,011.00	0	0	0
1,012.00	770	385	385
1,013.00	1,885	1,328	1,713
1,013.30	2,500	658	2,370

Device	Routing	Invert	Outlet Devices
#1	Primary	1,011.00'	24.0" Round Culvert L= 80.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 1,011.00' / 1,008.50' S= 0.0313 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=3.06 cfs @ 12.49 hrs HW=1,011.73' (Free Discharge)

↑1=**Culvert** (Inlet Controls 3.06 cfs @ 2.92 fps)

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Summary for Pond 4P: Pond

Inflow Area = 10.950 ac, 8.31% Impervious, Inflow Depth = 0.51" for 2-Year event
 Inflow = 3.81 cfs @ 12.69 hrs, Volume= 0.466 af
 Outflow = 1.44 cfs @ 13.34 hrs, Volume= 0.466 af, Atten= 62%, Lag= 39.0 min
 Primary = 1.44 cfs @ 13.34 hrs, Volume= 0.466 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 996.66' @ 13.34 hrs Surf.Area= 10,610 sf Storage= 6,692 cf

Plug-Flow detention time= 173.5 min calculated for 0.466 af (100% of inflow)
 Center-of-Mass det. time= 173.5 min (1,064.3 - 890.8)

Volume	Invert	Avail.Storage	Storage Description
#1	996.00'	35,875 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
996.00	9,600	0	0
998.00	12,650	22,250	22,250
999.00	14,600	13,625	35,875

Device	Routing	Invert	Outlet Devices
#1	Primary	996.00'	12.0" Round Culvert L= 34.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 996.00' / 995.00' S= 0.0294 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Primary	997.80'	5.0' long x 12.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=1.44 cfs @ 13.34 hrs HW=996.66' (Free Discharge)

- 1=Culvert (Barrel Controls 1.44 cfs @ 3.70 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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Time span=1.00-200.00 hrs, dt=0.01 hrs, 19901 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: P1b Runoff Area=1.500 ac 10.67% Impervious Runoff Depth=1.39"
Flow Length=560' Tc=13.5 min CN=69 Runoff=2.74 cfs 0.173 af

Subcatchment2S: P2 Runoff Area=2.300 ac 4.78% Impervious Runoff Depth=1.39"
Flow Length=215' Tc=10.8 min CN=69 Runoff=4.68 cfs 0.265 af

Subcatchment3S: P3 Runoff Area=3.800 ac 7.89% Impervious Runoff Depth=0.80"
Flow Length=310' Tc=11.4 min CN=59 Runoff=3.75 cfs 0.253 af

Subcatchment4S: P1a Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=1.59"
Flow Length=300' Slope=0.1100 '/' Tc=14.1 min CN=72 Runoff=8.34 cfs 0.529 af

Subcatchment5S: P1c Runoff Area=5.450 ac 13.76% Impervious Runoff Depth=1.02"
Flow Length=495' Tc=31.0 min CN=63 Runoff=4.32 cfs 0.462 af

Subcatchment6S: P1d Runoff Area=2.050 ac 9.76% Impervious Runoff Depth=0.96"
Flow Length=270' Slope=0.1400 '/' Tc=23.3 min CN=62 Runoff=1.77 cfs 0.164 af

Reach 1R: Reach Avg. Flow Depth=0.73' Max Vel=0.75 fps Inflow=5.79 cfs 0.529 af
n=0.240 L=180.0' S=0.0389 '/' Capacity=16.73 cfs Outflow=5.63 cfs 0.529 af

Reach 2R: Reach Avg. Flow Depth=1.01' Max Vel=0.93 fps Inflow=6.86 cfs 0.702 af
n=0.240 L=330.0' S=0.0379 '/' Capacity=27.24 cfs Outflow=6.61 cfs 0.702 af

Reach 3R: Prop to Lake Inflow=5.04 cfs 1.582 af
Outflow=5.04 cfs 1.582 af

Pond 1P: wetland Peak Elev=1,018.13' Storage=3,249 cf Inflow=8.34 cfs 0.529 af
Outflow=5.79 cfs 0.529 af

Pond 2P: wetland Peak Elev=1,030.63' Storage=11,563 cf Inflow=4.68 cfs 0.265 af
Outflow=0.00 cfs 0.000 af

Pond 3P: Culvert Peak Elev=1,012.15' Storage=516 cf Inflow=6.90 cfs 0.702 af
24.0" Round Culvert n=0.025 L=80.0' S=0.0313 '/' Outflow=6.86 cfs 0.702 af

Pond 4P: Pond Peak Elev=997.72' Storage=18,737 cf Inflow=10.54 cfs 1.164 af
Outflow=3.54 cfs 1.164 af

Total Runoff Area = 19.100 ac Runoff Volume = 1.847 af Average Runoff Depth = 1.16"
92.04% Pervious = 17.580 ac 7.96% Impervious = 1.520 ac

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Summary for Subcatchment 1S: P1b

Runoff = 2.74 cfs @ 12.23 hrs, Volume= 0.173 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.18"

Area (ac)	CN	Description
0.500	78	Row crops, straight row, Good, HSG B
* 0.160	98	Impervious, HSG B
0.200	55	Woods, Good, HSG B
0.640	58	Meadow, non-grazed, HSG B
1.500	69	Weighted Average
1.340		89.33% Pervious Area
0.160		10.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	245	0.1100	0.34		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"
1.5	315	0.0570	3.58		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
13.5	560	Total			

Summary for Subcatchment 2S: P2

Runoff = 4.68 cfs @ 12.19 hrs, Volume= 0.265 af, Depth= 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.18"

Area (ac)	CN	Description
0.760	55	Woods, Good, HSG B
0.400	58	Meadow, non-grazed, HSG B
* 0.300	89	Wetland
* 0.110	98	Impervious, HSG B
0.730	78	Row crops, straight row, Good, HSG B
2.300	69	Weighted Average
2.190		95.22% Pervious Area
0.110		4.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0600	0.24		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"
0.5	65	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
10.8	215	Total			

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Summary for Subcatchment 3S: P3

Runoff = 3.75 cfs @ 12.21 hrs, Volume= 0.253 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.18"

Area (ac)	CN	Description
2.750	55	Woods, Good, HSG B
0.250	58	Meadow, non-grazed, HSG B
* 0.300	98	Impervious, HSG B
0.500	61	>75% Grass cover, Good, HSG B
3.800	59	Weighted Average
3.500		92.11% Pervious Area
0.300		7.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.2000	0.18		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"
2.3	210	0.0950	1.54		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.4	310	Total			

Summary for Subcatchment 4S: P1a

Runoff = 8.34 cfs @ 12.23 hrs, Volume= 0.529 af, Depth= 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.18"

Area (ac)	CN	Description
3.000	78	Row crops, straight row, Good, HSG B
0.900	55	Woods, Good, HSG B
0.100	58	Meadow, non-grazed, HSG B
4.000	72	Weighted Average
4.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	300	0.1100	0.36		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"

Summary for Subcatchment 5S: P1c

Runoff = 4.32 cfs @ 12.50 hrs, Volume= 0.462 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.18"

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Area (ac)	CN	Description
* 0.750	98	Impervious, HSG B
1.800	55	Woods, Good, HSG B
1.300	58	Meadow, non-grazed, HSG B
1.600	61	>75% Grass cover, Good, HSG B
5.450	63	Weighted Average
4.700		86.24% Pervious Area
0.750		13.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0600	0.17		Sheet Flow, Grass: Dense n= 0.240 P2= 2.81"
18.3	200	0.1400	0.18		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"
2.9	195	0.0510	1.13		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
31.0	495	Total			

Summary for Subcatchment 6S: P1d

Runoff = 1.77 cfs @ 12.38 hrs, Volume= 0.164 af, Depth= 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.18"

Area (ac)	CN	Description
* 0.200	98	Impervious, HSG B
0.850	55	Woods, Good, HSG B
1.000	61	>75% Grass cover, Good, HSG B
2.050	62	Weighted Average
1.850		90.24% Pervious Area
0.200		9.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.3	270	0.1400	0.19		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"

Summary for Reach 1R: Reach

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 1.59" for 10-Year event
 Inflow = 5.79 cfs @ 12.36 hrs, Volume= 0.529 af
 Outflow = 5.63 cfs @ 12.48 hrs, Volume= 0.529 af, Atten= 3%, Lag= 7.3 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Max. Velocity= 0.75 fps, Min. Travel Time= 4.0 min
 Avg. Velocity = 0.21 fps, Avg. Travel Time= 14.4 min

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Peak Storage= 1,353 cf @ 12.41 hrs
Average Depth at Peak Storage= 0.73'
Bank-Full Depth= 1.20' Flow Area= 16.0 sf, Capacity= 16.73 cfs

20.00' x 1.20' deep Parabolic Channel, n= 0.240 Sheet flow over Dense Grass
Length= 180.0' Slope= 0.0389 '/'
Inlet Invert= 1,018.00', Outlet Invert= 1,011.00'



Summary for Reach 2R: Reach

Inflow Area =	5.500 ac,	2.91% Impervious,	Inflow Depth = 1.53"	for 10-Year event
Inflow =	6.86 cfs @	12.47 hrs,	Volume=	0.702 af
Outflow =	6.61 cfs @	12.63 hrs,	Volume=	0.702 af, Atten= 4%, Lag= 10.2 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.93 fps, Min. Travel Time= 5.9 min
Avg. Velocity = 0.26 fps, Avg. Travel Time= 21.4 min

Peak Storage= 2,336 cf @ 12.54 hrs
Average Depth at Peak Storage= 1.01'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 27.24 cfs

4.00' x 2.00' deep channel, n= 0.240 Sheet flow over Dense Grass
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 330.0' Slope= 0.0379 '/'
Inlet Invert= 1,008.50', Outlet Invert= 996.00'



Summary for Reach 3R: Prop to Lake

Inflow Area =	19.100 ac,	7.96% Impervious,	Inflow Depth = 0.99"	for 10-Year event
Inflow =	5.04 cfs @	12.68 hrs,	Volume=	1.582 af
Outflow =	5.04 cfs @	12.68 hrs,	Volume=	1.582 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs

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MSE 24-hr 3 10-Year Rainfall=4.18"

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Summary for Pond 1P: wetland

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 1.59" for 10-Year event
 Inflow = 8.34 cfs @ 12.23 hrs, Volume= 0.529 af
 Outflow = 5.79 cfs @ 12.36 hrs, Volume= 0.529 af, Atten= 31%, Lag= 7.4 min
 Primary = 5.79 cfs @ 12.36 hrs, Volume= 0.529 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,018.13' @ 12.36 hrs Surf.Area= 25,943 sf Storage= 3,249 cf

Plug-Flow detention time= 7.2 min calculated for 0.529 af (100% of inflow)
 Center-of-Mass det. time= 7.2 min (835.8 - 828.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,018.00'	138,450 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,018.00	25,450	0	0
1,020.00	33,250	58,700	58,700
1,022.00	46,500	79,750	138,450

Device	Routing	Invert	Outlet Devices
#1	Primary	1,017.90'	20.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=5.78 cfs @ 12.36 hrs HW=1,018.13' (Free Discharge)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 5.78 cfs @ 1.28 fps)

Summary for Pond 2P: wetland

Inflow Area = 2.300 ac, 4.78% Impervious, Inflow Depth = 1.39" for 10-Year event
 Inflow = 4.68 cfs @ 12.19 hrs, Volume= 0.265 af
 Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,030.63' @ 24.61 hrs Surf.Area= 18,960 sf Storage= 11,563 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,030.00'	163,150 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

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MSE 24-hr 3 10-Year Rainfall=4.18"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,030.00	17,900	0	0
1,032.00	21,280	39,180	39,180
1,034.00	30,250	51,530	90,710
1,036.00	42,190	72,440	163,150

Device	Routing	Invert	Outlet Devices
#1	Primary	1,035.13'	40.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,030.00' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Culvert

Inflow Area = 5.500 ac, 2.91% Impervious, Inflow Depth = 1.53" for 10-Year event
 Inflow = 6.90 cfs @ 12.44 hrs, Volume= 0.702 af
 Outflow = 6.86 cfs @ 12.47 hrs, Volume= 0.702 af, Atten= 1%, Lag= 1.6 min
 Primary = 6.86 cfs @ 12.47 hrs, Volume= 0.702 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,012.15' @ 12.47 hrs Surf.Area= 941 sf Storage= 516 cf

Plug-Flow detention time= 1.1 min calculated for 0.702 af (100% of inflow)
 Center-of-Mass det. time= 1.1 min (844.8 - 843.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,011.00'	2,370 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,011.00	0	0	0
1,012.00	770	385	385
1,013.00	1,885	1,328	1,713
1,013.30	2,500	658	2,370

Device	Routing	Invert	Outlet Devices
#1	Primary	1,011.00'	24.0" Round Culvert L= 80.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 1,011.00' / 1,008.50' S= 0.0313 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=6.86 cfs @ 12.47 hrs HW=1,012.15' (Free Discharge)

↑1=**Culvert** (Inlet Controls 6.86 cfs @ 3.66 fps)

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Summary for Pond 4P: Pond

Inflow Area = 10.950 ac, 8.31% Impervious, Inflow Depth = 1.28" for 10-Year event
 Inflow = 10.54 cfs @ 12.58 hrs, Volume= 1.164 af
 Outflow = 3.54 cfs @ 13.26 hrs, Volume= 1.164 af, Atten= 66%, Lag= 40.9 min
 Primary = 3.54 cfs @ 13.26 hrs, Volume= 1.164 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 997.72' @ 13.26 hrs Surf.Area= 12,219 sf Storage= 18,737 cf

Plug-Flow detention time= 113.5 min calculated for 1.164 af (100% of inflow)
 Center-of-Mass det. time= 113.9 min (976.2 - 862.2)

Volume	Invert	Avail.Storage	Storage Description
#1	996.00'	35,875 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
996.00	9,600	0	0
998.00	12,650	22,250	22,250
999.00	14,600	13,625	35,875

Device	Routing	Invert	Outlet Devices
#1	Primary	996.00'	12.0" Round Culvert L= 34.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 996.00' / 995.00' S= 0.0294 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Primary	997.80'	5.0' long x 12.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=3.54 cfs @ 13.26 hrs HW=997.72' (Free Discharge)

- 1=Culvert (Barrel Controls 3.54 cfs @ 4.51 fps)
- 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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Time span=1.00-200.00 hrs, dt=0.01 hrs, 19901 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: P1b Runoff Area=1.500 ac 10.67% Impervious Runoff Depth=3.46"
 Flow Length=560' Tc=13.5 min CN=69 Runoff=7.06 cfs 0.432 af

Subcatchment2S: P2 Runoff Area=2.300 ac 4.78% Impervious Runoff Depth=3.46"
 Flow Length=215' Tc=10.8 min CN=69 Runoff=12.02 cfs 0.663 af

Subcatchment3S: P3 Runoff Area=3.800 ac 7.89% Impervious Runoff Depth=2.46"
 Flow Length=310' Tc=11.4 min CN=59 Runoff=13.46 cfs 0.778 af

Subcatchment4S: P1a Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=3.77"
 Flow Length=300' Slope=0.1100 '/' Tc=14.1 min CN=72 Runoff=20.15 cfs 1.256 af

Subcatchment5S: P1c Runoff Area=5.450 ac 13.76% Impervious Runoff Depth=2.85"
 Flow Length=495' Tc=31.0 min CN=63 Runoff=13.39 cfs 1.294 af

Subcatchment6S: P1d Runoff Area=2.050 ac 9.76% Impervious Runoff Depth=2.75"
 Flow Length=270' Slope=0.1400 '/' Tc=23.3 min CN=62 Runoff=5.72 cfs 0.470 af

Reach 1R: Reach Avg. Flow Depth=1.12' Max Vel=1.00 fps Inflow=14.81 cfs 1.256 af
 n=0.240 L=180.0' S=0.0389 '/' Capacity=16.73 cfs Outflow=14.50 cfs 1.256 af

Reach 2R: Reach Avg. Flow Depth=1.60' Max Vel=1.20 fps Inflow=17.22 cfs 1.689 af
 n=0.240 L=330.0' S=0.0379 '/' Capacity=27.24 cfs Outflow=16.86 cfs 1.689 af

Reach 3R: Prop to Lake Inflow=26.36 cfs 4.230 af
 Outflow=26.36 cfs 4.230 af

Pond 1P: wetland Peak Elev=1,018.32' Storage=8,401 cf Inflow=20.15 cfs 1.256 af
 Outflow=14.81 cfs 1.256 af

Pond 2P: wetland Peak Elev=1,031.51' Storage=28,859 cf Inflow=12.02 cfs 0.663 af
 Outflow=0.00 cfs 0.000 af

Pond 3P: Culvert Peak Elev=1,013.30' Storage=2,359 cf Inflow=18.14 cfs 1.689 af
 24.0" Round Culvert n=0.025 L=80.0' S=0.0313 '/' Outflow=17.22 cfs 1.689 af

Pond 4P: Pond Peak Elev=998.99' Storage=35,687 cf Inflow=29.31 cfs 2.982 af
 Outflow=21.93 cfs 2.982 af

Total Runoff Area = 19.100 ac Runoff Volume = 4.893 af Average Runoff Depth = 3.07"
92.04% Pervious = 17.580 ac 7.96% Impervious = 1.520 ac

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Summary for Subcatchment 1S: P1b

Runoff = 7.06 cfs @ 12.22 hrs, Volume= 0.432 af, Depth= 3.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=6.93"

Area (ac)	CN	Description
0.500	78	Row crops, straight row, Good, HSG B
* 0.160	98	Impervious, HSG B
0.200	55	Woods, Good, HSG B
0.640	58	Meadow, non-grazed, HSG B
1.500	69	Weighted Average
1.340		89.33% Pervious Area
0.160		10.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	245	0.1100	0.34		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"
1.5	315	0.0570	3.58		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
13.5	560	Total			

Summary for Subcatchment 2S: P2

Runoff = 12.02 cfs @ 12.19 hrs, Volume= 0.663 af, Depth= 3.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=6.93"

Area (ac)	CN	Description
0.760	55	Woods, Good, HSG B
0.400	58	Meadow, non-grazed, HSG B
* 0.300	89	Wetland
* 0.110	98	Impervious, HSG B
0.730	78	Row crops, straight row, Good, HSG B
2.300	69	Weighted Average
2.190		95.22% Pervious Area
0.110		4.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.0600	0.24		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"
0.5	65	0.1800	2.12		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
10.8	215	Total			

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Summary for Subcatchment 3S: P3

Runoff = 13.46 cfs @ 12.20 hrs, Volume= 0.778 af, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=6.93"

Area (ac)	CN	Description
2.750	55	Woods, Good, HSG B
0.250	58	Meadow, non-grazed, HSG B
* 0.300	98	Impervious, HSG B
0.500	61	>75% Grass cover, Good, HSG B
3.800	59	Weighted Average
3.500		92.11% Pervious Area
0.300		7.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	100	0.2000	0.18		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"
2.3	210	0.0950	1.54		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
11.4	310	Total			

Summary for Subcatchment 4S: P1a

Runoff = 20.15 cfs @ 12.22 hrs, Volume= 1.256 af, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=6.93"

Area (ac)	CN	Description
3.000	78	Row crops, straight row, Good, HSG B
0.900	55	Woods, Good, HSG B
0.100	58	Meadow, non-grazed, HSG B
4.000	72	Weighted Average
4.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	300	0.1100	0.36		Sheet Flow, Cultivated: Residue>20% n= 0.170 P2= 2.81"

Summary for Subcatchment 5S: P1c

Runoff = 13.39 cfs @ 12.44 hrs, Volume= 1.294 af, Depth= 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
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Area (ac)	CN	Description
* 0.750	98	Impervious, HSG B
1.800	55	Woods, Good, HSG B
1.300	58	Meadow, non-grazed, HSG B
1.600	61	>75% Grass cover, Good, HSG B
5.450	63	Weighted Average
4.700		86.24% Pervious Area
0.750		13.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	100	0.0600	0.17		Sheet Flow, Grass: Dense n= 0.240 P2= 2.81"
18.3	200	0.1400	0.18		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"
2.9	195	0.0510	1.13		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
31.0	495	Total			

Summary for Subcatchment 6S: P1d

Runoff = 5.72 cfs @ 12.35 hrs, Volume= 0.470 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=6.93"

Area (ac)	CN	Description
* 0.200	98	Impervious, HSG B
0.850	55	Woods, Good, HSG B
1.000	61	>75% Grass cover, Good, HSG B
2.050	62	Weighted Average
1.850		90.24% Pervious Area
0.200		9.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.3	270	0.1400	0.19		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 2.81"

Summary for Reach 1R: Reach

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 3.77" for 100-Year event
Inflow = 14.81 cfs @ 12.33 hrs, Volume= 1.256 af
Outflow = 14.50 cfs @ 12.42 hrs, Volume= 1.256 af, Atten= 2%, Lag= 5.4 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.00 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 0.26 fps, Avg. Travel Time= 11.7 min

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Peak Storage= 2,607 cf @ 12.37 hrs
Average Depth at Peak Storage= 1.12'
Bank-Full Depth= 1.20' Flow Area= 16.0 sf, Capacity= 16.73 cfs

20.00' x 1.20' deep Parabolic Channel, n= 0.240 Sheet flow over Dense Grass
Length= 180.0' Slope= 0.0389 '/'
Inlet Invert= 1,018.00', Outlet Invert= 1,011.00'



Summary for Reach 2R: Reach

Inflow Area =	5.500 ac,	2.91% Impervious,	Inflow Depth = 3.68"	for 100-Year event
Inflow =	17.22 cfs @	12.46 hrs,	Volume=	1.689 af
Outflow =	16.86 cfs @	12.59 hrs,	Volume=	1.689 af, Atten= 2%, Lag= 7.9 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.20 fps, Min. Travel Time= 4.6 min
Avg. Velocity = 0.32 fps, Avg. Travel Time= 17.3 min

Peak Storage= 4,632 cf @ 12.51 hrs
Average Depth at Peak Storage= 1.60'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 27.24 cfs

4.00' x 2.00' deep channel, n= 0.240 Sheet flow over Dense Grass
Side Slope Z-value= 3.0 '/' Top Width= 16.00'
Length= 330.0' Slope= 0.0379 '/'
Inlet Invert= 1,008.50', Outlet Invert= 996.00'



Summary for Reach 3R: Prop to Lake

Inflow Area =	19.100 ac,	7.96% Impervious,	Inflow Depth = 2.66"	for 100-Year event
Inflow =	26.36 cfs @	12.73 hrs,	Volume=	4.230 af
Outflow =	26.36 cfs @	12.73 hrs,	Volume=	4.230 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs

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Summary for Pond 1P: wetland

Inflow Area = 4.000 ac, 0.00% Impervious, Inflow Depth = 3.77" for 100-Year event
 Inflow = 20.15 cfs @ 12.22 hrs, Volume= 1.256 af
 Outflow = 14.81 cfs @ 12.33 hrs, Volume= 1.256 af, Atten= 26%, Lag= 6.4 min
 Primary = 14.81 cfs @ 12.33 hrs, Volume= 1.256 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,018.32' @ 12.33 hrs Surf.Area= 26,706 sf Storage= 8,401 cf

Plug-Flow detention time= 8.0 min calculated for 1.256 af (100% of inflow)
 Center-of-Mass det. time= 8.0 min (818.6 - 810.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,018.00'	138,450 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,018.00	25,450	0	0
1,020.00	33,250	58,700	58,700
1,022.00	46,500	79,750	138,450

Device	Routing	Invert	Outlet Devices
#1	Primary	1,017.90'	20.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=14.81 cfs @ 12.33 hrs HW=1,018.32' (Free Discharge)
 ↑1=**Broad-Crested Rectangular Weir**(Weir Controls 14.81 cfs @ 1.75 fps)

Summary for Pond 2P: wetland

Inflow Area = 2.300 ac, 4.78% Impervious, Inflow Depth = 3.46" for 100-Year event
 Inflow = 12.02 cfs @ 12.19 hrs, Volume= 0.663 af
 Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,031.51' @ 24.61 hrs Surf.Area= 20,444 sf Storage= 28,859 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	1,030.00'	163,150 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,030.00	17,900	0	0
1,032.00	21,280	39,180	39,180
1,034.00	30,250	51,530	90,710
1,036.00	42,190	72,440	163,150

Device	Routing	Invert	Outlet Devices
#1	Primary	1,035.13'	40.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 1.00 hrs HW=1,030.00' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Culvert

Inflow Area = 5.500 ac, 2.91% Impervious, Inflow Depth = 3.68" for 100-Year event
 Inflow = 18.14 cfs @ 12.39 hrs, Volume= 1.689 af
 Outflow = 17.22 cfs @ 12.46 hrs, Volume= 1.689 af, Atten= 5%, Lag= 4.1 min
 Primary = 17.22 cfs @ 12.46 hrs, Volume= 1.689 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,013.30' @ 12.46 hrs Surf.Area= 2,490 sf Storage= 2,359 cf

Plug-Flow detention time= 1.5 min calculated for 1.688 af (100% of inflow)
 Center-of-Mass det. time= 1.5 min (825.2 - 823.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,011.00'	2,370 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,011.00	0	0	0
1,012.00	770	385	385
1,013.00	1,885	1,328	1,713
1,013.30	2,500	658	2,370

Device	Routing	Invert	Outlet Devices
#1	Primary	1,011.00'	24.0" Round Culvert L= 80.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 1,011.00' / 1,008.50' S= 0.0313 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=17.21 cfs @ 12.46 hrs HW=1,013.30' (Free Discharge)

↑1=**Culvert** (Inlet Controls 17.21 cfs @ 5.48 fps)

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Summary for Pond 4P: Pond

Inflow Area = 10.950 ac, 8.31% Impervious, Inflow Depth = 3.27" for 100-Year event
 Inflow = 29.31 cfs @ 12.53 hrs, Volume= 2.982 af
 Outflow = 21.93 cfs @ 12.76 hrs, Volume= 2.982 af, Atten= 25%, Lag= 14.1 min
 Primary = 21.93 cfs @ 12.76 hrs, Volume= 2.982 af

Routing by Stor-Ind method, Time Span= 1.00-200.00 hrs, dt= 0.01 hrs
 Peak Elev= 998.99' @ 12.76 hrs Surf.Area= 14,575 sf Storage= 35,687 cf

Plug-Flow detention time= 69.8 min calculated for 2.982 af (100% of inflow)
 Center-of-Mass det. time= 70.2 min (909.0 - 838.8)

Volume	Invert	Avail.Storage	Storage Description
#1	996.00'	35,875 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
996.00	9,600	0	0
998.00	12,650	22,250	22,250
999.00	14,600	13,625	35,875

Device	Routing	Invert	Outlet Devices
#1	Primary	996.00'	12.0" Round Culvert L= 34.0' CMP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 996.00' / 995.00' S= 0.0294 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Primary	997.80'	5.0' long x 12.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=21.93 cfs @ 12.76 hrs HW=998.99' (Free Discharge)
 1=Culvert (Barrel Controls 4.67 cfs @ 5.94 fps)
 2=Broad-Crested Rectangular Weir(Weir Controls 17.26 cfs @ 2.91 fps)

**Pond Calculations
SANDY SHORES AT SUGAR LAKE
Wright County, MN**

Water quality volume	=	0.91 ac	X	1 inches	=	3,303 cf
Water elevation at water quality volume					=	996.34
Allowable water quality discharge	=	9,700 sf	X	5.66 cfs/ac	=	1.26 cfs
Proposed discharge at water elevation					=	0.44 cfs

Permanent pool volume required	=	10.95 ac	X	1800 cf/ac	=	19,710 cf
Permanent pool volume provided					=	19,950 cf

CN=67

NURP vol required =	=	10.95 acres	x	0.36 inches	=	14,309 cf
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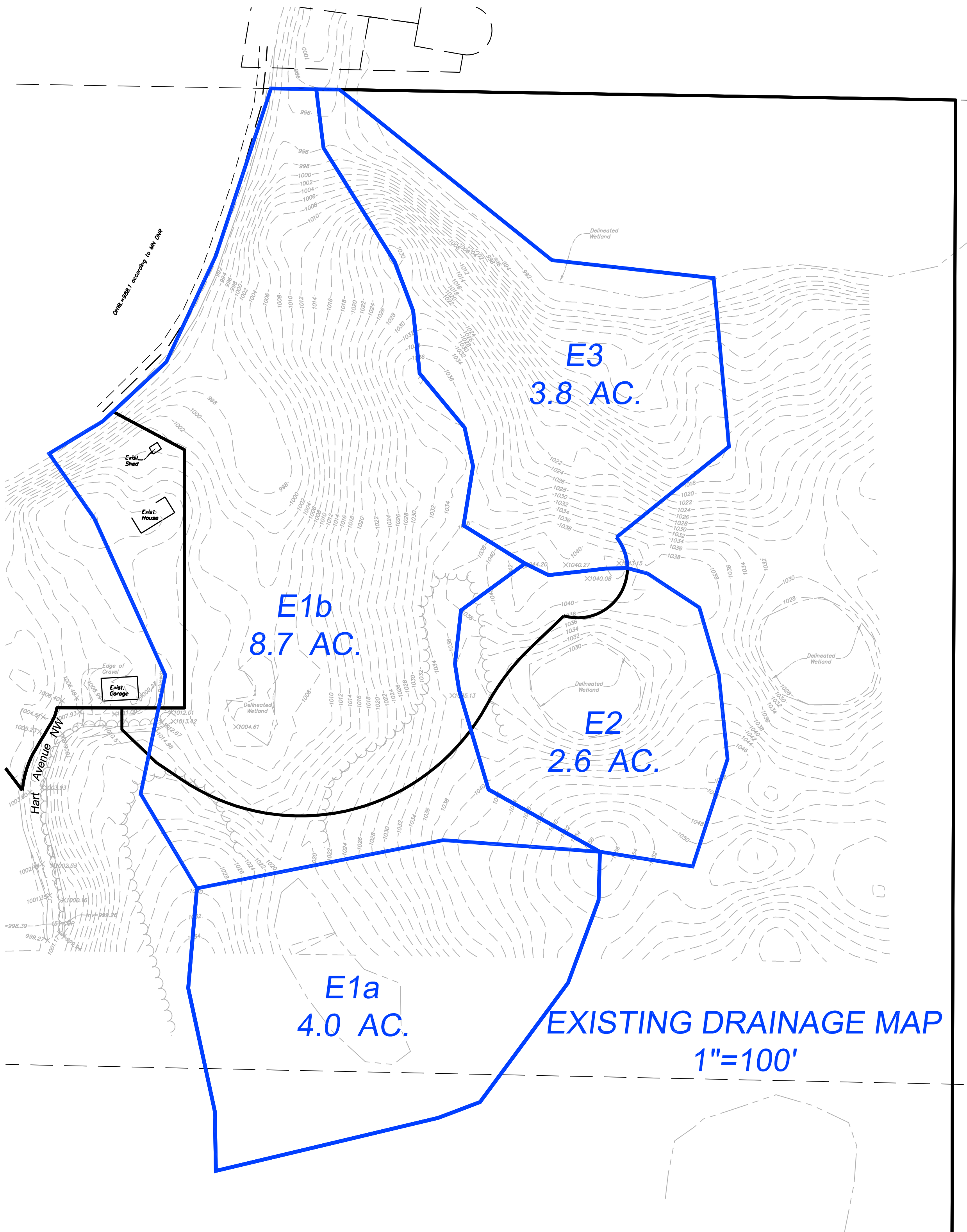
Permanent Pool Vol Proposed:

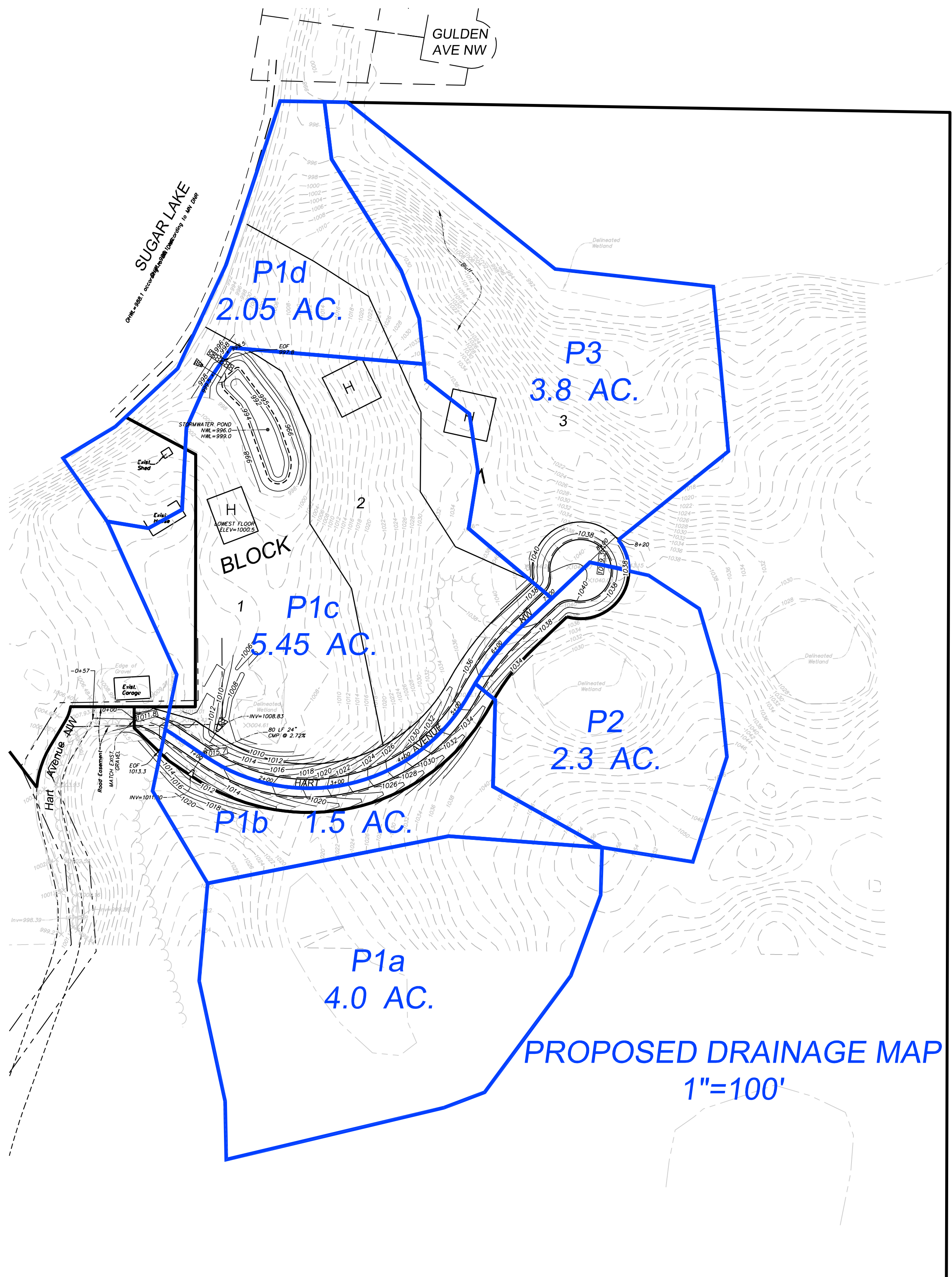
contour	area (sf)	vol (cf)
996	9700	7700
995	5700	5150
994	4600	7100
992	2500	

Total = 19,950

TOTAL WATER QUALITY VOLUME PROVIDED IN POND:

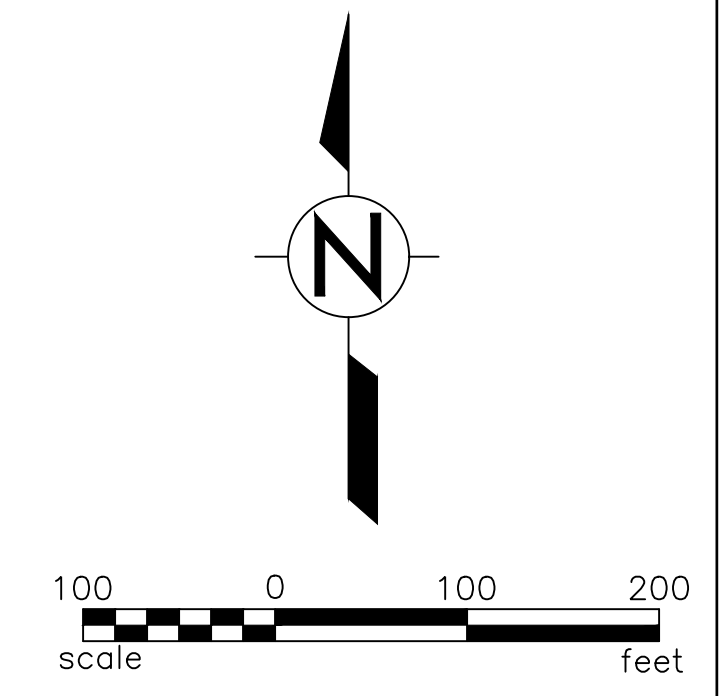
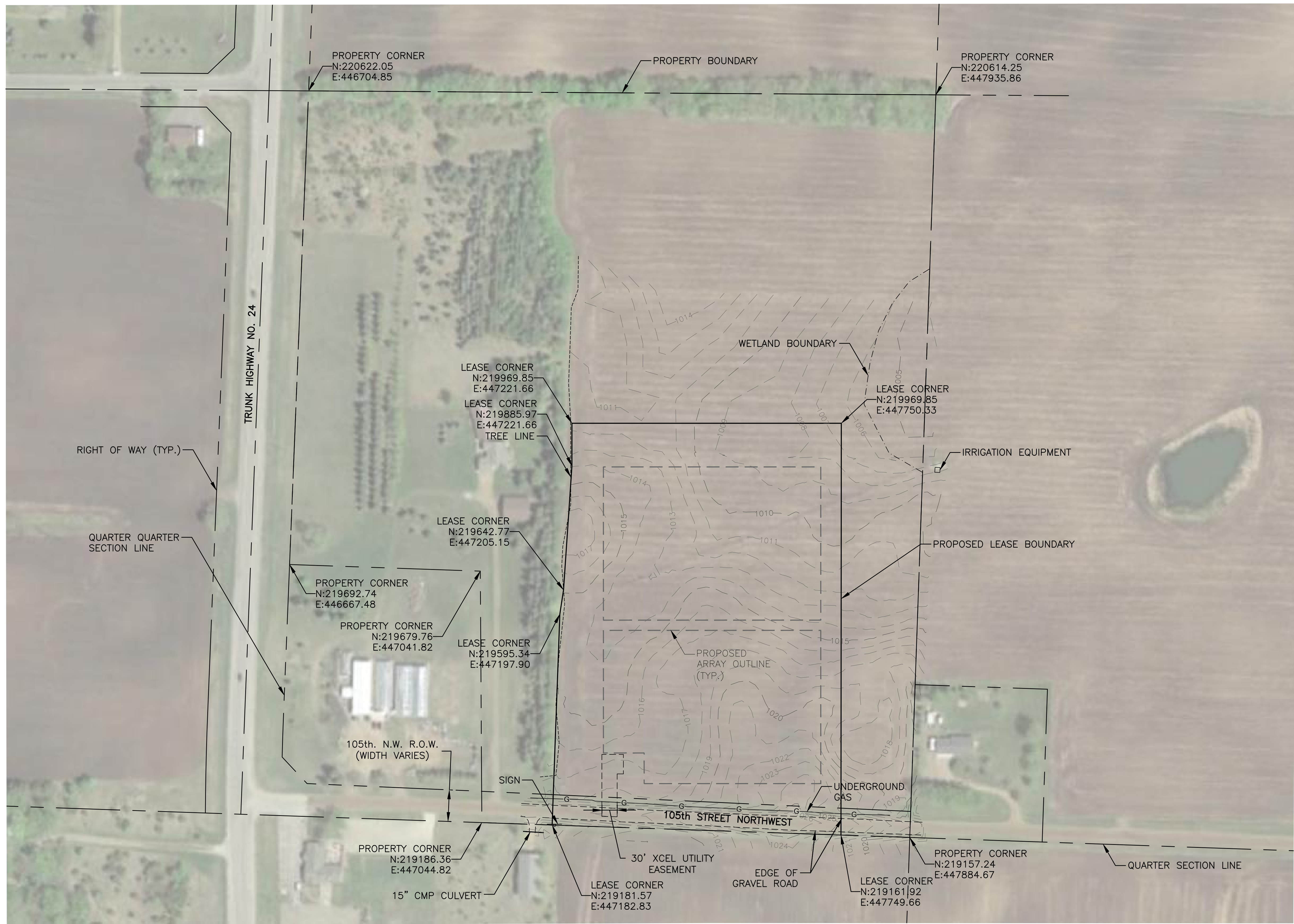
Total Site Water Quality Volume Required =		1.35 ac	X	1 inches	=	4,901 cf
Water quality vol. at allowable discharge =		6,035 cf				





PROPOSED DRAINAGE MAP
1"=100'

Attachments related to Solar Farm



ENGINEER
AZTEC
TYP/SA Group

OWNER
NEW ENERGY EQUITY

CONTRACTOR
KNOBELSDORFF ELECTRIC INC

REV	DATE	DESCRIPTION	DRW	CK	APV
			MJS	TDF	SAS
0	2/20/20	ISSUED FOR PERMIT	MJS	TDF	SAS
1	2/21/20	ISSUED FOR PERMIT	MJS	TDF	SAS

SCALE: 1"=100'
SIZE: 22"x34"
PROJECT#: AZENE1937-05

PROJECT
SCHUELER COMMUNITY SOLAR GARDEN
9656 105TH STREET NW, ANNANDALE, MN 55302

TITLE
EXISTING CONDITIONS

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.



Sarah Smedley

SARAH SMEDLEY, MINNESOTA LICENSE NO. 52904
DATE OF SIGNATURE: FEBRUARY 21, 2020

SHEET
C03.01

REV
1

Schueler CSG

Decommissioning Plan

Prepared for:

New Energy Equity
2530 Riva Road, Suite 200
Annapolis, MD 21401

Location: Annandale, MN
March 12th, 2020



EVS Project #: 2020-014.1



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1.0 Introduction

The purpose of this report is to describe the decommissioning process for the Schueler solar photovoltaic generation facility (“the project”) located at 9656 105th St NW, Annandale, MN 55302. The project consists of 3,888 solar modules mounted to a driven pile, single axis tracking system. Both direct current (DC) and alternating current (AC) conductors will be trenched in conduit. After final circuit consolidation at the PV system pad mounted switchboard, the system’s voltage will be stepped-up to distribution level at the Xcel owned transformer and interconnected onto an existing utility distribution circuit.

The project converted approximately 9.3 acres of agricultural land into a power generation facility. Construction included elevated solar modules mounted on driven steel piles, concrete inverter/transformer pads, and gravel access roads.

2.0 Summary Statement of Expected Decommissioning Cost

The expected residual value of the solar facility is the difference between the removal/restoration cost and the salvage value. The decommissioning cost to remove the solar pv facility and reestablish the property back to a grassy field is not expected to exceed a net expenditure of **\$62,000** at the end of the project’s expected service life.

3.0 Basis of Plan Narrative

The following is a list of assumptions and clarifications to further define the methodology used to establish the scope and values of the removal costs and salvage values.

3.1 General

- The intent of the decommissioning work will be to fully remove the solar facility, dispose of any components, and restore the site to a permanently stabilized grassed field.
- The service life of the facility is assumed to be 25 years. All dollar amounts are in net-present-value. It is assumed that all values will inflate/deflate at consistent with baseline inflation, therefore, the net-present-value comparison of removal cost to salvage value will remain relevant at the end of the service life.
- Costs associated with this plan represent a “turn key” operation for a general contractor to be hired for this work, including permits, mobilization, contingency, etc.
- Haul costs assume a maximum distance of 60 miles between the project and nearest disposal or recycling facility.
- No maximum duration has been assigned for this work. It has been assumed that this work would be handled by a single crew without full time site personnel.

3.2 Civil Infrastructure

- Topsoil used to backfill excavations will be borrowed from onsite locations. No topsoil import is included.
- Remove rip rap at stormwater basins.

- Aggregate removal will be the full depth of the aggregate section for roads, equipment pads, and other areas utilizing aggregate. No aggregate will be buried. Includes subgrade scarification prior to backfilling with topsoil.
- Turf establishment includes mulch, fertilizer, and water as necessary to achieve 70% ground cover as required to satisfy the NPDES Construction General Permit.
- Sediment control cost consists of silt fence but could also be fiber logs. Location of sediment control will be downslope from exposed soils only in areas where sedimentation offsite or into onsite water bodies can reasonably be expected.
- Trees and shrubs shall be protected and shall remain in place.

3.3 Structural Infrastructure

- Steel pile foundation removal is estimated at 25% the effort and cost as pile installation.
- Steel racking removal is estimated at 50% the effort and cost of racking installation.

3.4 Electrical Infrastructure

- PV modules to be recycled. Assumption is that the modules are 72 cell polysilicon modules, having an approximate dimension of 6' x 3' in dimension.
- Switchgear including transformers will be removed from their respective concrete pads and recycled or returned to the manufacturer.
- copper wiring will be dug up (if required) and recycled.
- Aluminum wiring will be dug up (if required) and recycled.
- On site riser or interconnection poles shall be removed.
- String inverters/combiner boxes are no more than 130 lbs. in weight and not more than 40" x 25" x 12" in dimension. A two-person crew can dismantle a string inverter and recycle the components.
- Transformers are pad mounted and weigh approximately 8,500 pounds. These are dry type transformers, so there is no need for any oil disposal.
- Underground power and communication cables can be removed by excavating with a power trencher or excavator.

3.5 Recycling PV Modules

- Recycling solar modules have environmental benefits such as
 - Creating a useful and sustainable method of disposal
 - Providing raw materials for repurposing and reprocessing
 - Recovering up to 90% of the photovoltaic glass and up to 95% of the semiconductor material necessary for further production
 - Recycling of rare earth metals.

4.0 Schedule of Removal and Restoration Costs

SCHUELER CSG						
ENGINEER'S ESTIMATE						
3/12/2020						
Schedule of Removal and Restoration Costs						
		QUANTITY	UNITS	\$/UNIT	COST	NOTES
CIVIL INFRASTRUCTURE						
1	Aggregate Removal	75	CY	\$4.00	\$300.48	remove full section of aggregate road, structural concrete base material, and surfacing around equipment pads
2	Aggregate Haul and Offsite Disposal	75	CY	\$12.00	\$901.45	
3	Geotextile Removal under Aggregate Roads	1,800	SF	\$0.18	\$324.00	
4	Geotextile Haul and Offsite Disposal	1,800	SF	\$0.01	\$18.00	
5	Topsoil Backfill	23	CY	\$12.00	\$277.37	onsite relocation of topsoil to backfill road and equipment pad excavations
6	Rip Rap Removal	120	CY	\$15.00	\$1,800.00	remove CMP of approximate 30' length with no greater than 2' of cover
7	Rip Rap Haul and Offsite Disposal	120	CY	\$12.00	\$1,440.00	
8	Chainlink Fence Removal	2,300	LF	\$3.00	\$6,900.00	Includes fence mesh, post framing, concrete foundations, gates, etc.
9	Chainlink Fence Haul and Offsite Disposal	2,300	LF	\$0.50	\$1,150.00	Assumes min 20' clearance from energized equipment
10	Reinforced Concrete Equipment Pad Removal	1	EA	\$500.00	\$500.00	
11	Concrete Waste Haul and Offsite Disposal	1	EA	\$500.00	\$500.00	
12	Site Grading	2.37	AC	\$8,000.00	\$18,943.92	grading smooth all areas disturbed by removals, excavations, etc, assumed (0.25 x project area) + Road Area + Equipment Pad Area
13	Turf Establishment	2.37	AC	\$5,000.00	\$11,839.95	Hydroseed all areas disturbed by removals, excavations, etc
14	Sediment Control	1,334	LF	\$3.00	\$4,002.00	silt fence, assumed 2 x the project area N-S length
Structural Infrastructure						
15	Foundation Removal	820	EA	\$7.50	\$6,150.00	Assumed [19] posts for 90 mod tables and [15] posts for 75 mod tables
16	Foundation Haul and Offsite Disposal	820	EA	\$3.00	\$2,460.00	
17	Steel Racking Removal	1,439	MW	\$7,000.00	\$10,069.92	
18	Steel Racking Haul and Offsite Disposal	1,439	MW	\$700.00	\$1,006.99	
Electrical Infrastructure						
19	Removal of Solar Modules	3,888	EA	\$5.00	\$19,440.00	
20	Removal of String Inverters	17	EA	\$60.00	\$1,020.00	
21	Removal of Switchgear/Xfmr	2	EA	\$1,500.00	\$3,000.00	
22	Removal of Riser and Interconnection Poles	3	EA	\$1,000.00	\$3,000.00	
23	Removal of SCADA/Aux Panel/Weather Station	1	EA	\$500.00	\$500.00	
24	Removal of Medium Voltage AL Cables	1,000	MW	\$2,000.00	\$2,000.00	
25	Removal of Fiber Optic Cables	1,000	MW	\$500.00	\$500.00	
	Subtotal				\$98,044.10	
General						
26	Permits	1	ea	\$3,000.00	\$3,000.00	NPDES Construction General Permit and SWPPP preparation
27	Mobilization	1	ea	\$7,843.53	\$7,843.53	8% of project cost
28	Contingency	1	ea	\$9,804.41	\$9,804.41	10% of project cost
	Total Cost				\$118,692.03	
	Gross Margin				\$11,869.20	10% of project cost
	Total Construction Cost				\$ 130,561.24	



5.0 Schedule of Salvage Values

SCHUELER CSG						
ENGINEER'S ESTIMATE						
3/12/2020						
Schedule of Salvage Value						
		QUANTITY	UNITS	\$/UNIT	Value	NOTES
Structural Infrastructure						
1	Steel Pile	32.80	TONS	\$70.00	\$2,296.00	Assuming 80 lbs. per pile
2	Steel Racking	65.60	TONS	\$70.00	\$4,592.00	
3	Chainlink Fence	2,300	LF	\$1.00	\$2,300.00	
Electrical Infrastructure						
4	PV Modules	3,888	EA	\$6.00	\$23,328.00	
5	String Inverters	17	EA	\$500.00	\$8,500.00	
6	Equipment Switchgear in Xfmrs	2	EA	\$1,500.00	\$3,000.00	
7	SCADA/Aux/Weather Station Equipment	1	EA	\$500.00	\$500.00	
8	MV AL Collection Lines	164	lbs	\$0.55	\$90.06	http://www.nebringwire.com/aluminum/aac-all-aluminum-conductor/
9	DC Copper Wires	9,452	lbs	\$2.50	\$23,630.52	http://colonialwire.com/wp-content/uploads/2013/09/WIRE-WEIGHTS1.pdf
10	AC Aluminum Wires	1,980	lbs	\$0.55	\$1,089.00	
Total Cost					\$69,325.58	

NET EXPENSE = REMOVAL – SALVAGE = \$61,235.66