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Letter of Transmittal

DATE	May 15, 2012
JOB NO.	19051
PHASE	3002.2
ATTENTION	Beckie Olson
CLIENT	MFS Farms, Inc.
RE:	Full Circle Organics- Good Thunder Site Organic Composting Facility Plan and Permit Report Resubmittal Site Relocated

TO: MPCA
ADDRESS 520 Lafayette Road N
CITY, STATE St. Paul, MN
ZIP 55155

WE ARE SENDING ☐ Mail ☒ UPS ☐ Messenger NEXT DAY The following Items:

☐ Shop Drawings ☐ Prints ☐ Change Order ☐ Specifications
☐ Copy of Letter ☒ Plans ☐ Samples ☒ Permit Report

COPIES	DATE	REV.	DESCRIPTION
1	May 2012		Permit Report Book
1	May 15, 2012	C	Full Size Plan Set

THESE ARE TRANSMITTED as checked below:

☐ For Approval ☐ Approved as submitted ☐ Resubmit ____ copies for approval
☒ For Your Use ☐ Approved as noted ☐ Submit ____ copies for distribution
☐ As Requested ☐ Returned for corrections ☐ Return ____ corrected prints
☐ Review and comment ☐ PRINTS RETURNED AFTER LOAN TO US
☐ FOR BIDS DUE ____ 20____ ☐ ____

REMARKS:

COPY TO ____________

SIGNED Steven E. Gebauer, P.E.

If enclosures are not as noted, kindly notify us.

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Report

Permit Application for Full Circle Organics, LLC Good Thunder, MN Site Source Separated Organic Waste Compost Facility

MFS Farms and Full Circle Organics, LLC
Minneapolis, Minnesota

November 2011
Revised December 2011
Revised February 2012
Revised May 2012

Prepared by:
MFRA, Inc.

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PERMIT APPLICATION

FOR

Full Circle Organics, LLC – Good Thunder Organic Composting Site
Good Thunder, Minnesota

PREPARED FOR:

MFS Farms / Full Circle Organics, LLC

May, 2012

I hereby certify that this specification 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.

05/15/2012..Minn. Reg. No. 42661
Michael C. Brandt, P.E.

Table of Contents

1. Introduction

1.1. Objective

The objective of the Full Circle Organics, LLC Good Thunder Site is to reduce the amount of organics going to the traditional solid waste landfill in Blue Earth County and surrounding regions. This facility will contract with haulers and food waste suppliers for organic recyclable product to provide source separated organic waste to produce a certified grade A compost material for use by local landscaping companies. By composting organic waste generated by food suppliers, restaurants, hospitals, schools, and universities to produce a usable compost product, we can reduce the loading on the local landfills by approximately 2,000 to 2,400 tons per month at full production. In addition to organic waste, Full Circle Organics, LLC will use yard waste from Blue Earth County and surrounding regions as the carbon source for the composting process. This facility will serve the 60,393 residents of Blue Earth County and more from the surrounding regions by reducing the organic and yard waste going to the landfill to extend the usable life of the landfill.

1.2. General Site Information

Facility:	Full Circle Organics, LLC – Good Thunder Composting Facility MFS Farms, LLC 56437 164th Street Good Thunder, Minnesota 56037
Facility Owner:	MFS Farms 56437 164th Street Good Thunder, Minnesota 56037 Full Circle Organics, LLC 5029 13th Ave South Minneapolis, Minnesota 55417
Operator:	Full Circle Organics, LLC 5029 13th Ave South Minneapolis, Minnesota 55417
Primary Contacts:	Max Milinkovich Full Circle Organics, LLC 5029 13th Ave South Minneapolis, Minnesota 55417 Phone: 612-282-9383
Property Owner:	MFS Farms, Inc. 56437 164th Street Good Thunder, Minnesota 56037

Primary Contact: Kevin Fitzsimmons
56437 164th Street
Good Thunder, Minnesota 56037
Phone: 507-317-0746

Engineering Consultant: MFRA, Inc.
Mike Brandt, P.E.
14800 28th Avenue N, Suite 140
Plymouth, Minnesota 55447
Phone: 763-476-6010

Adjacent Landowner: Russell & Constance Peters
54707 164th Street
Good Thunder, Minnesota 56037

1.3. Project History

Full Circle Organics, LLC is based on the vision of its founder Max Milinkovich to find a way to reduce the loading to our current landfill system and create a useable product from the organic portion of the solid waste stream. Mr. Milinkovich saw the potential of source separated organics while working for a major municipal solid waste company and a large retail company. From his past experience Full Circle Organics, LLC was created and the Good Thunder, MN location is the first site to become reality. The reason for the site in Good Thunder, MN is the proximity to several college campuses with their own cafeteria, and the proximity to a reliable carbon and nitrogen source for composting in the straw and hay used at MFS Farms.

1.4. Existing Conditions

Currently the site is used as an agriculture producing field. The site tends to drain from the Northwest to the Southeast. Drain tile lines have been installed throughout the field and will be rerouted from below the site through the construction of the project. A topographical survey was completed by MFRA, Inc. on 10/27/11 and soil borings were completed by American Engineering Testing, Inc. on 11/7/11. The site generally has approximately six feet of relief. Soils consist mostly of clay soils. A map of the existing conditions survey and soils boring logs are attached in Appendix A and B, respectively.

1.5. Surrounding Land Uses

Farm fields and homes surround the property. The closest home is approximately a quarter mile to the north and is owned by MFS Farms. The closest home to the south is approximately one quarter mile away. The property surrounding the proposed compost facility is currently in crop production. A location map is provided in Appendix C.

1.6. Zoning

Currently the property is zoned Agricultural according to the Lyra Township Zoning Map with the effective date of March 17, 2005. The Agricultural zoning districted is intended to preserve the land for agricultural purposes. A composting facility is a similar use to a solid waste and landfill which is permitted Conditional Use in the agricultural zoning district. A zoning map and location map are in Appendix C.

2. Operations and Maintenance Manual

2.1. General

2.1.1. General Operations Description

Full Circle Organics, LLC will operate the Full Circle Organics, LLC - Good Thunder composting facility. Employees from MFS Farms will assist Full Circle Organics, LLC under the direction of Max Milinkovich. The Facility will be located on property owned by MFS farms and leased to Full Circle Organics, LLC. A site plan and building layout is attached in Appendix E.

2.1.2. Site Plan

Trucks will enter the site from County Road 165 and proceed to the scale house. After weighing, the truck will proceed to the processing building where the load will be dumped and inspected. The operator will inspect the load for compliance prior to the hauler being allowed to leave the site. Once inspected, the load will be processed in the processing area to the required recipe. Once a temp of 55 degrees Celsius (131 degrees Fahrenheit) is reach the processed material will be placed in a windrow on the curing pad. The windrows will be turned and moisture will be added as required. The operator will inspect and log temperatures of the rows on a daily bases. Once the windrows have completed the compost cycle, the material will be tested for compliance with the MPCA standards and piled for delivery. Area landscape contractors will be contracted to use the final product and will come to the facility to obtain the end product. The total compost area is approximately 4.25 acres. An attached site map can be found in Appendix E.

2.1.3. Population/Area Served

The Full Circle Organics, LLC - Good Thunder site will serve Blue Earth County, consisting of a population of 60,393 residents and more from the surrounding regions by reducing the organic waste load to the current landfill. More specific, the residents of Mankato and the local college campuses will be the primary source of the organic material for compost. The facility will be open to contract haulers that have specific contracts with the Good Thunder facility. Other targeted source businesses will include restaurants, grocery stores, gas stations, catering companies, and large food producers. Additionally, local hospitals, schools, college campuses, nursing homes or facilities with a cafeteria will also be targeted source businesses for the Full Circle Organics, LLC - Good Thunder composting facility.

2.1.4. Authorized Customers

The Full Circle Organics, LLC – Good Thunder site will only accept material from authorized customers. Authorized customers will consist of clients who have a contract in place with Full Circle Organics, LLC prior to tipping. To be an authorized customer, a representative from Full Circle Organics, LLC will meet with the potential client and conduct a survey of their waste to determine if the waste is acceptable. Full Circle Organics, LLC will train the customer on how to separate the waste, to meet the criteria set by the contract. A locked gate at the main entrance of the site will secure the site, and will only be opened during the hours of operation when an operator is on site.

2.2. Hours of Operation

The facility will be open on Monday thru Friday from 7 a.m. to 6 p.m. and Saturday from 7 a.m. to 2 p.m. The site will be closed Sunday and legal holidays. Equipment will operate within the scheduled hours of operation. Delivery trucks are anticipated to arrive between the hours of 8 a.m. and 2 p.m. Monday through Friday and 8 a.m. and 10 a.m. on Saturday.

2.3 Tipping Fees

Tipping fees require not only hard costs to run the facility, but have to be competitive with the current cost to landfill the waste. Full Circle Organics, LLC will calculate a fair tipping fee for each of its authorized customers based on the amount, quantity and quality of the product they will be delivering to this facility.

2.4 Access to the Facility

2.4.1. Traffic Routes

- From Mankato:

From the intersection of Stadium Road and Warren Street, travel east a distance of 1.8 miles to South Victory Drive. Turn south onto South Victory Drive and travel a distance of 0.5 miles to the intersection of Victory Drive and MN State Highway 22. Turn right on MN State Highway 22 and travel south a distance of 9.1 miles to 158th Street/County Road 10. Turn west on 158th Street/County Road 10 and travel west for a distance of 2.5 miles. Turn south on County Road 10/County Road 39 and stay on County Road 10 around the curve to the west for a distance of 1.5 miles to County Road 165. Turn north on County Road 165, travel a distance of 1.2 miles to the site. Full Circle Organics, LLC-Good Thunder compost facility will be on the east side of County Road 165.

2.4.2. Access Control and Regulation

Access to the site will only be from County Road 165 and will be gated to prevent non-contracted deliveries to the site. The gate will be opened during business hours while personnel are on site. Contract haulers will be required to weigh their vehicle at the scale and log into the computer to make sure they are an authorized customer for the composting facility. All haulers to the facility will be required to be a licensed commercial hauler with Blue Earth County and surrounding area. All haulers will need to contact Jean Lundquist at Blue Earth County to obtain a haulers license.

2.4.3. Inspection of Waste Deliveries

All incoming waste deliveries will be inspected by trained personnel to verify that the wastes delivered are appropriate for this site. All incoming vehicles are required to report at the scale area. Haulers with incoming waste loads will identify the nature of the load prior to tipping. The operator will direct the hauler to the tipping area.

Upon reporting to the tipping floor, the following information will be recorded at the scale:

1.) Date and Time of delivery
2.) Origin of the material, (Location, City, County)
3.) Weight/volume of material
4.) Hauling Company.
5.) Driver Name and signature.

Only hauling companies with contracts with the facility will be allowed to tip at the facility. If the hauler and/or location is not in the computer system, the operator will confirm with Management that an account can be entered into the computer. Upon approval, the operator will allow the hauler to tip their load at this facility.

Inspection:

1.) Logged loads will be directed to the tipping floor.
2.) Tipped loads will be visually inspected by the operator to confirm the load is consistent and contains acceptable material. Hauling vehicles will be required to stay on the tipping floor until the inspection is completed.
3.) Loads containing unacceptable material will be rejected and re-loaded to the delivery truck for removal.
4.) The operator will complete a load inspection report and allow the drive to leave the tipping area.

If the material falls under our guidelines we will proceed to move the material onto the section of the pad where the composting process will begin.

2.4.4. Potential Vehicle Types and Waste Quantities

The vehicles entering the facility will vary from day to day. Full Circle Organics, LLC expects to receive waste trucks and semi-trailers of waste material daily. A scale will be set at the entrance of the facility to weigh the vehicles. The scale will be capable of handling vehicles as large as semi tractors and trailer units.

The average truck will carry approximately four tons of organic material per load. The addition of straw or leaves is anticipated to each batch. The straw or leaves will, approximately, add forty to fifty percent by weight to the organic material on a daily basis.

During the initial phase of the project, it is anticipated an average of four to eight truck loads of material will enter the site. When the facility reaches full production, we anticipate as many as fifteen to twenty truck loads of material per day.

The following table outlines the anticipated waste quantities the facility will be able to handle from the initial start up to the final build out.

Phase	Organic Waste/Day (tons)	Yard waste or Straw/ Day (tons)	Number of Windrows Required
Initial	32	12.8	9
Full Production	110	44	29

2.5. Acceptable Wastes and Materials

Only two types of waste materials will be processed and composted at the facility: (1) source separated organic materials. (2) Yard waste.

Source separated organic materials are compostable materials segregated, accumulated, and presorted by the generator. Likely sources of feedstock materials include institutional generators with significant food preparation components, industrial sources from paper or food processing sectors, or commercial enterprises such as groceries, restaurants and other processing facilities.

Full Circle Organics, LLC will establish clear specifications for wastes acceptable at the facility and will work with waste haulers to insure compliance. Any hauler tipping an unacceptable waste load will be required to immediately reload the material or will be surcharged for the cost of its collection and disposal at an appropriate facility. This strong economic incentive is expected to be the most direct means of assuring receipt of acceptable source separated organic wastes.

- All Food Waste (Meat and Bones)
- All Food Soiled Paper Products
- Paper cups and Plates
- Paper towels, placemats, napkins
- Milk and juice containers(other paper beverage containers)
- Paper Bags
- Pizza Boxes (other paper food containers)
- Coffee filters
- Teabags
- Waxed cardboard
- Paper vacuum bags
- Floral trimmings
- Plants
- Liquid Food Products

2.5.1 Organic Wastes

2.5.1.1 Food Waste

Food waste includes food processing and food preparation wastes such as hulls, coffee grounds, egg shells, scrapings, peelings, rejects, and by-products.

2.5.1.2 Paper Waste

Paper waste includes wet, soiled, or otherwise unrecyclable fiber products, including cardboard, paper towels, paper food liners, coffee filters, fast-food wrappings, or other compostable but not readily recyclable materials.

2.5.1.3 Garden Waste

Garden waste is classified as a yard waste. Garden waste includes plants, floral waste, trimmings, overripe vegetables, and other compostable discards from gardening and horticultural activities, or from florists or garden markets.

2.5.1.4 Animal Bedding

Animal bedding (which contains no more than 40% manure) offer an excellent source of nitrogen, sometimes needed to balance the carbon-nitrogen ratio of paper-rich loads.

2.5.1.5 Liquid Food Products

Liquid food product waste may be accepted and stored on site for use in the mixing area and on the windrows to provide moisture. A 20,000 gallon storage tank will be on site to store the liquid food product waste. However, the use and delivery of the liquid food product will occur only during periods when the stormwater and leachate ponds are below their pre-determined pumping levels.

2.5.2. Yard Waste

Yard waste is defined as garden waste, leaves, lawn cuttings, weeds, tree waste and prunnings as generated by residential and commercial properties.

2.6 Prohibited Wastes

The Full Circle Organics, LLC will not accept hazardous waste, non-compostable Municipal Solid Waste (MSW), or any waste deemed unacceptable by management. On-site personnel will be responsible for visually inspecting all loads to insure that prohibited materials are not accepted at the facility. The Contingency Plan, included in Section 6, addresses actions in the event that prohibited materials are inadvertently received.

2.7 Waste Handling, Shipment and Disposal

The raw product will be delivered to the site through different trucks by authorized haulers. All delivered wastes to the facility will be processed or removed. Within one week, in order to present odor, vectors and maintain aesthetics. Once onsite the product will move through each of the following areas and process:

2.7.1 Source Separated Organic Materials

- **Tipping Floor:** Upon arrival at the tipping floor, loads will be visually scanned to confirm the acceptability and type of material delivered. Acceptable waste will be transferred to the mixing station, while rejected waste will be reloaded into the haulers truck and removed from the site.

- **Mixing Station and Load out:** Organic materials will be mixed with straw according to proven recipes. Moisture content will be adjusted to 50 to 60 percent. Front-end loaders will be used to load and mix the organic material and straw according to the predetermined mix ratio.. The scale on the loader will be used to determine the specified amounts of each material. The mix itself will achieve thorough blending of the feedstock materials, at this point, nitrogen, water, or other materials can readily be added if needed or desired. The product will remain in the mixing area until the batch reaches a temperature of 55 degrees Celsius (131 degrees Fahrenheit) prior to being placed in windrows.

- **Composting Pad:** An all-weather pad has been installed for the composting windrows. The facility is designed to have up to 29 windrows in varying stages of composting at any one time. Each windrow will be approximately 10 feet wide and 9 feet tall. The top of the pad is built of recycled class 5 aggregate, underlain by 24 inches of compacted clay. The compost will be monitored to maintain an internal temperature of 55 degrees Celsius (131 degrees Fahrenheit) for a minimum of 3 weeks, and will be turned at least once every three to five days to reduce pathogens.

- **Finished Product Storage:** Each batch (windrow) will be tested by an independent lab in accordance to Minnesota Statue 7035.2836 subp. 5 (J). A detailed sampling plan and test method for determining the maturity of the compost is described in section 4.2, Compost Sampling. Each basin will be piled separately in the storage area to ensure proper disclosure and chain of custody to the final customer.

2.7.2. Yard Waste

There will be a supply of straw and fall leaves that are saved for use as a carbon source. The straw and leaves are not turned or ground so that they stay dry and, therefore, stay in a less decomposed state. Storing the straw and leaves helps the entire process throughout the year so that the compost mix is adequate. Straw and yard waste from the product storage area will be directly introduced into our recipe through the mixing process.

2.7.3. Feedstock Analysis Plan

The finished product will vary according to current markets. Some of these could include the following: soil amendment, commercial use for nurseries, commercial bagging for residential resale and bulk sales. We are planning on selling our finished compost to the general public, state, county, nurseries and landscapers. Based on our calculations a batch of compost will be generated every 21 to 24 days. This will produce approximately 17 batches of compost per year. Each batch is estimated to produce approximately 700 cubic yards of compost, for a total year production of approximately 11,900 cubic yards.

2.8 By-Product Management

Unacceptable materials will be rejected during inspections to the extent identifiable. The hauler is responsible for removal of such unaccepted wastes (or for the cost of removal and disposal). From the compost facility, rejects from pre-composting operations and any residuals from finished product screening will be loaded into containers such as dumpsters and delivered, at least weekly, to an approved facility. The types of materials that could be found among the rejects include rock and concrete chunks, plastics, glass and other inerts. If uncompostable recyclable materials are present, they will be removed and recycled. There will be a small hazardous material container onsite for batteries and other potential containers that may be mixed in the waste delivered to the site. All recyclable and residual material must be contained and stored under a roof to prevent contact with natures elements. All non-recyclable material must be removed on a weekly basis.

2.9 Maintenance

Checklists which provide examples of the steps that will be followed for facility start-up, shutdown, and other routing operations are included as Appendix D. Key aspects of day-to-day operation are also briefly described below.

Routine daily start-up steps will include completion of an initial visual security check, preparation of the tipping floor and spreading of an absorbent layer (yard waste or compostable paper) to absorb free liquids. Gates will be locked until start-up tasks are completed and the facility is staffed and ready to receive incoming materials. Equipment maintenance records will be kept at the site office.

2.10 Storage Capacity

The Full Circle Organics, LLC has adequate capacity to provide:

- 29 days storage for unprocessed materials, initially.
- The clay lined pads has room for 29 windrows.
- An area has been provided to store up to 12,000 cubic yards of finished product.

2.11 Equipment

Equipment that will routinely be available and utilized for site operations will include:

- *Front End Loader(s):* Conventional front-end and skid steer type loaders will be used to move tipped waste loads, charge the grinder, load the mixer truck, and move finished compost.

- *Water Truck:* Water needed to control dust on interior and exterior haul routes will be applied with a rubber tired sprayer. The water truck can also be used to add moisture to stockpiled wastes that need increased moisture content.

- *Compost Turner:* The turner will be used to turn the windrows until material is at the acceptable stage.

All equipment will be cleaned in the mixing building. Waste water from the cleaning will drain to the leachate tank through the building floor drain.

2.12 Water Source and Septic Tank

The Full Circle Organics site will drill a well to provide domestic water to the site. The water line will serve the restrooms, sinks and potential source for vehicle cleaning. The well will be offset from the north property line 300 feet and from the right-of-way 100 feet.

The Full Circle Organics site will use a septic holding tank for restrooms for staff and visitors. The septic tank will be able to store up to 2,500 gallons. The sanitary holding tank will be pumped as needed when reaching capacity and hauled from the site by a contracted professional.

2.13 Nuisance Control Methods

2.13.1 Dust

The access road to the facility is not paved, nor is the on-site traffic routes. The facility is equipped with a water truck. The access road and interior traffic routes will be watered with well water from MFS Farms as needed to control dust. Full Circle Organics, LLC will work with the Blue Earth County Highway Department to determine acceptable dust control methods for the County Road. At a minimum Full Circle Organics, LLC will apply calcium chloride (CaCl) to the access road twice per year. Prior to processing, yard waste may be stockpiled without cover at the facility. The compost material will be kept at a 50% moisture content to prevent dusty conditions. If dusty conditions are created by the compost material, sufficient water will be applied to control the dust.

2.13.2 Noise

On-site noise is reduced by the enclosure of operations within the tipping and mixing building. Outdoor noise from delivery, shipment traffic and heavy machinery (during construction, cleaning or snow removal) should not adversely affect the public, as the equipment will only operate during the designated hours of operation. The nearest residential dwelling is over 1/4 mile away.

Delivery of waste loads and most compost processing steps will be completed within an enclosed structure, minimizing the potential for external noise impacts. All engine-powered equipment used external to the building (e.g., front-end loaders, snowthrower, lawnmower) will be equipped with backup beepers, as required by law. The distance between the facility and any residential or other development will further ensure that facility noise is not a nuisance.

2.13.3 Vector Control

Rapid processing of incoming organic matter and thorough housekeeping practices will provide effective control of insects, rodents, or other vectors.

Steps taken to establish vector control include:

- Total enclosure of tipping floor within a steel building.
- Doors to steel building will be closed at night.
- Source separated organic materials spilled out of doors will be promptly cleaned up.
- Landscaping adjacent to the building and clay pad liner will be regularly mowed to reduce nearby safe habitat.

2.13.4 Odor

There are three general areas from which odors might originate at the facility: (1) the tipping floor and processing area (located within an enclosed structure); (2) the active composting windrow area; and (3) composting stockpile area.

Odor control within the processing building will be achieved through a combination of techniques. The doors along all sides of the building provide flexibility to both enhance as well as restrict air flow through the structure.

Odor can originate in compost for three reasons. The reasons include internal temperature is too low, moisture content is too high and a carbon/nitrogen ratio is unbalanced. Through continuous monitoring, recipe adjustments and turning, the odor can be minimized or eliminated.

Operational practices within the processing building will be key contributors to effective odor control. Thorough inspections of incoming loads and *prompt* blending of straw or yard waste with organic wastes plus rapid movement of feedstocks from the tipping floor through the processing area and into the composting windrows are all essential operating steps. Under routine operations, wastes will be processed into the windrows on the day received.

Windrow or static pile composting is intended to be used for final finishing, curing, and maturing. Attention to moisture content and turning of the windows/static piles as needed will all assist maintenance of aerobic conditions and will minimize odor potential. A stock pile of wood chips will be kept on site to mix in the windows to control any odor issues that may arise.

2.13.5 Waste Products and Residuals

All by-products, including residuals and recyclables, must be stored in a manner that prevents vector problems and aesthetic degradation. Residuals and recyclable material shall be kept under cover in separate, labeled containers. As noticed, material will be collected and placed in the respective container. However, at a minimum, non-compostable material must be removed from the compost site weekly.

Litter, waste products and residuals will be collected from compost pads, mixing station, leachate pond, and any on site location where present on a daily basis. The leachate pond will not be pumped for use or disposal until residual material has been removed and disposed of properly.

2.14 Runoff Controls & Leachate Management Plan

Currently, the proposed site drains from the north across the property to the south. The site has three and a half feet of relief over 835 feet. Additionally, the west side of the site drains the road and some field area with the public right-of-way ditch.

2.14.1 Storm Water Pond

A storm water pond is designed to capture and rate control the stormwater runoff from the building roof and gravel drive in front of the building. This storm pond is designed in accordance with the MPCA Stormwater runoff requirements and NURP standards. The control structure will allow for a slow release of the small storm events to maximize sediment settlement.

2.14.2 Leachate Tank and Pond

The leachate and wash water from the tipping floor and mixing building will be collected by a drain inside the building and stored in a 20,000 gallon tank outside the building's south wall. The leachate will be pumped out and used to obtain the proper moisture content of each batch in the mixing facility and/or windrows. This tank will be continuously monitored for BOD, chloride, hardness (calcium & magnesium), total magnesium, nitrites, nitrates, nitrogen, phosphorus, sodium, total dissolved solids, total suspended solids, specific conductance, total sulfates, and oil and grease. In the event the tank will need to be discharged a pumper will be contracted and the effluent will be hauled to a wastewater treatment plant to be properly disposed.

The south pond receives the storm water drainage from the compost windrows and surrounding green area. Leachate from the windrow area is anticipated to be very low, as the windrows should act as a sponge and absorb most of the rain water. However, the pond system has been designed to hold the back-to-back 24 hour-100 year storm event without discharging off site. This will allow the operators to test the water prior to pumping the stormwater runoff to the windrows to keep them at their optimum moisture content. After testing has been done, the water in the pond will first be used to maintain moisture content in the compost windrows. In the event the water needs to be discharged, a pumper will be contracted and the effluent will be hauled to a wastewater treatment plant to be properly disposed. In the event the leachate tanks and ponds do not meet discharge standards and need to be pumped, the leachate will be hauled to a wastewater treatment facility in Mankato or to a Met Council Facility for proper disposal.

The leachate tests will monitor the storm water's BOD, chloride, hardness (calcium & magnesium), total magnesium, nitrites, nitrates, nitrogen, phosphorus, sodium, total dissolved solids, total suspended solids, specific conductance, total sulfates, and oil and grease.

2.14.3 Liquid Food Product Tank

The liquid food product tank will be located on the outer perimeter of the mixing building. The delivery trucks will discharge through a hose connection, gravity flow from inside the building. The tank will be able to hold 20,000 gallons of material at any moment. In case of a spill, the liquid food product waste will flow to the leachate tank drain that is also located within the building floor.

2.15 Site Safety

Full Circle Organics, LLC Safety Policy clearly delineates personnel responsibilities, orientation procedures, scheduling and responsibilities for regular safety meetings, and requirements for regular training and inspections. It contains accident investigation procedures, reporting procedures and obligations, first aid information, general safety rules, and rules for specific situations and requirements. The MPCA's *Safety in Recycling Facilities* manual will be utilized to supplement Full Circle Organics, LLC policy, as appropriate, for this facility's operation.

Ear plugs, hard hats, safety glasses, and steel-toed boots are all examples of the safety equipment that all employees on site will be required to use. All employees will have ready access to phones or radios at all times on site. Other safety precautions and on-site equipment are described in the contingency plan (Section 6).

2.16 Personnel Training Program Plan

The facility will have at least one operator on site during operating hours who has been trained in industry standards for composting facilities. All staff on site will receive direction from the trained operator. The facility will be staffed by an on-site manager and at least one assistant on all days with active site operations. All Full Circle Organics, LLC staff will have completed a rigorous company mandated safety training program. Operators will have training updates on a quarterly basis.

Personnel training will include, but is not limited to the following:

A. Using, inspecting, repairing and replacing facility emergency and monitoring equipment;
B. Activating communication and alarm systems;
C. Activating automatic waste feed cutoff systems;
D. Responding to fires;
E. Responding to facility failures, including erosion and failure of liners or monitoring devices;
F. Responding to ground water or surface pollution incidents;
G. Accepting and managing waste other than mixed municipal solid waste approved for storage or disposal at the facility;
H. Rejecting waste not permitted at the facility; and
I. Water sampling.

On a yearly basis, the training program will review the current training standards and update the program to enhance the facilities workers expertise. Any updates to Minnesota Reg. 7035.2545 Subp. 3 & 4 shall be adopted into the training program.

2.17 Inspections

Inspections to observe the site, safety and emergency equipment, security devices, fencing, floor integrity, and other conditions are performed and recorded on a routine basis. Inspection records will be kept at the site office.

3. Construction Documentation

3.1 Clay Pad Lines/Windrow Area Construction

Construction of the clay pad under the windrows will be in accordance with the plans and specification in Appendix H. The clay liner will be constructed of clay material compacted in lifts not greater than six inches to obtain coefficient of permeability no greater than 1×10^{-7} centimeters per second. The total thickness of the clay liner will be a minimum of twenty four inches.

The clay liner will be constructed to handle and control site run-off during construction. The clay liner will be placed and compacted in 8-inch lifts, maximum. A minimum of three lifts will be required to achieve the minimum 24-inch thickness.

3.2 Process Building Construction

The process building will be constructed of metal and concrete. There will be five concrete lined compartmental areas inside the building to separate the batches during mixing and dry carbon stock for the mixing process. The building will have a concrete floor with a floor drain to contain any leachate and liquids not absorbed by the composting mixing process. The building will have a sliding door for ventilation and to allow trucks into the facility. Air louvers will be provided to allow proper air flow and contain odors.

4. Environmental Monitoring Plan

4.1 Introduction

Monitoring activities will include, but not be limited to those needed to meet facility permit requirements as specified by state and local regulatory agencies.

4.2 Compost Sampling and Testing Plan

The plan includes identifying the characteristics of incoming waste by source (feedstock) and evaluating its compatibility with existing composting recipes.

Staff will perform daily monitoring. The monitoring will establish that the process to further reduce pathogens (PFRP) has been met. The PFRP method used, according to Minn. R. 7035.2836 subp. 5(I)(1) defines the windrow method and reads as follows:

(*)The windrow method for reducing pathogens consists of an unconfined composting process involving periodic aeration and mixing. Aerobic conditions must be maintained in the windrow for at least three weeks. The windrow must be turned at least once every three to five days.

When the facility is operating at capacity, we will produce a batch of compost every 21 days for approximately 17 batches per year. Each batch will produce approximately 700 cubic yards of compost.

Testing requirements for the finished product will be as follows to determine the maturity of the compost; In accordance with Minn. R. 7035.2836 subp. 6 & 7:

1.) Ignition Loss analysis to determine more than 60 % decomposition has been achieved.
2.) Carbon/nitrogen ratio US EPA Method 9060A, Total Carbon and Dumas. In the range of 10:1 to 20:1.
3.) Each Batch of Compost will be analyzed the following metal contaminants, using EPA test methods outlined in EPA SW-846, and 8080 for PCBS.

Contaminant	Concentration (mg/L)
Arsenic (As)	41
Cadmium (Cd)	39
Copper (Cu)	1,500
Lead (Pb)	300
Mercury (Hg)	5
Molybdenum (Mo)	18

Nickel (Ni)	420
Selenium (Se)	100
PCB	6
Zinc (Zn)	2,800

4.) Inert content greater than four millimeters shall be determined by passing four replicates of 250 cc oven-dried (70 degrees Celsius) samples of compost through a four millimeter sieve. Material retained on the sieve shall be visually inspected and inerts, including glass, metal, and plastic shall be separated and weighed. The weight of the separated material divided by weight of the total sample, multiplied by 100, shall be the percent dry weight of inert material. The percent of dry weight inert material may not exceed three percent.

5.) The mature compost will be analyzed for the following parameters:
   a. pH
   b. moisture contenet
   c. particle size
   d. NPK ratio
   e. Soluble Salt content

Each of the testing results will be recorded and retained as part of the chain of custody for each batch of compost produced.

Sampling of the compost material will be done by the operator or trained responsible person from Full Circle Organics, LLC. Each 100 cubic yards of compost will be sampled for maturity and meeting Class I compost standards for the tests describe earlier. Each sample will be composed of individual samples throughout the windrow. Seven different samples of ten pounds shall be completed for each 100 cubic yards of compost material to be tested. The samples shall come from different areas in the windrow that include an area 2 ft below the top, one foot from the bottom, and in two feet from the edges of the windrow. Each sample shall be 10 pounds in size, and shall be obtained with a shovel with the assistance of a loader to open the windrow for sampling. All equipment and containers shall be thoroughly cleaned, washed, rinsed, and free from any debris or contamination prior to sampling and after sampling. The operator and/or trained person in charge of the sampling procedure must document the chain of custody for each sample and batch of compost tested. The seven samples shall be combined by mixing in a clean container to obtain a combined sample for the lab to analyze.

The results of each batch must be retained on-site by Full Circle Organics, LLC staff and a copy provided to the buyer or each compost load hauled from the site. Each batch shall be piled separately to clearly identify which batch goes to each individual recipient.

The monitoring and analyses required by regulatory agencies will be necessary, but may not be sufficient to satisfy some potential end-market-derived requirements. Therefore, additional analyses may also be conducted. If Full Circle Organics, LLC can historically demonstrate that some of the testing requirements by the MPCA are not applicable to source separated composting, then it may suggest that the testing requirements by modified.

4.3 Leachate Tank and Pond Sampling Plan

The storm water pond located on the south side of the property is designed to hold the runoff generated by a back-to-back 100 year-24 hour storm event. The pond water will be used to keep the moisture content of the windrows within acceptable limits by pumping the water onto the windrows. Weekly tests will be conducted in the basin to ensure water quality standards are being met.

A storm water leachate tank will collect water from the tipping floor, equipment cleaning, and other activities within the building. Tank will be a 20,000 gallon septic tank which will be tested regularly and pumped out to apply to the windrows.

Water from the leachate tank and pond will be sampled for the following contaminates:

Contaminant
TSS
BOD
Chloride
Magnesium
Total Hardnes (Calcium and Magnesium)
Nitrites
Nitratres
Nitrogen
Phosphorous
TDS
Sodium
Specific conductance
Total Sulfates
Oil and Grease
Arsenic (As)
Cadmium (Cd)
Copper (Cu)
Lead (Pb)
Mercury (Hg)
Molybdenum (Mo)
Nickel (Ni)
Selenium (Se)
PCB
Zinc (Zn)

Test results will be logged into the SWPPP and filed with the Industrial Stormwater Permit. Records will also indicate the amount of water used for watering the windrows.

5. Closure and Post Closure Plan

5.1 Introduction

This document constitutes a closure and post-closure plan for The Full Circle Organics, LLC Good Thunder facility. In the sections which follow, the plan identifies proposed closure and post-closure activities appropriate to this facility, addresses end use, and describes information about facility development and operations that will be regularly added to the Plan record.

5.2 Dates of Operation

Acceptance of organic materials and operation of the processing and composting facility is anticipated to begin in the spring of 2012. A closure date of the facility is not specified.

5.3 Site Contacts/Important Persons

Facility Owner:	MFS Farms 56437 164th Street Good Thunder, Minnesota 56037
Operator:	Full Circle Organics, LLC 5029 13th Ave South Minneapolis, Minnesota 55417
Primary Contacts:	Max Milinkovich Full Circle Organics, LLC 5029 13th Ave South Minneapolis, Minnesota 55417 Phone: 612-282-9382
Property Owner:	MFS Farms, Inc. 56437 164th Street Good Thunder, Minnesota 56037
Primary Contact:	Kevin Fitzsimmons 56437 164th Street Good Thunder, Minnesota 56037 Phone: 507-317-0746
Engineering Consultant:	MFRA, Inc. Mike Brandt, P.E. 14800 28th Avenue N, Suite 140 Plymouth, Minnesota 55447 Phone: 763-476-6010

5.4 Notification of Final Closure

Full Circle Organics, LLC will provide at least a five-month written notice to Blue Earth County and MPCA regarding the decision to close its facility. The notice would specify the date on which wastes would cease to be accepted, and also specify a date, several months later, by which time all on-site composting will have been completed. Subsequent closure activities could include removal of finished product, removal of site equipment and other site improvements and any required site restoration to the satisfaction of the landowner.

A minimum of four-and-a-half months prior to the selected closure date for composting operations, Full Circle Organics, LLC will provide a two-week (14-day) notice to Blue Earth County, MPCA and all regular customers of the effective date on which it will cease to accept wastes. Public notice of intent to cease acceptance of wastes at the facility will also be published. A notice will be posted at the entrance of the facility indicating the date of closure and provide a listing of other facilities accepting similar materials. Effective the published date, the facility will cease to accept waste.

All acceptable wastes delivered during this two-week period will be processed and composted, or transferred from the facility.

5.5 Closure Activities

5.5.1 Termination of Composting Activity

Facility personnel will continue to complete daily monitoring and servicing of composting material until all materials have attained a finished product status. As other elements of the facility are decommissioned, the composting aeration system will remain intact and operational until all materials are fully composted.

5.5.2 Removal of Stockpiled Materials

Finished product will be marketed from the site until no stockpile remains or permission to land-spread remaining quantities will be obtained from regulatory agencies. Removal of finished product and all other facility closure activities will be completed within six months of the termination of composting activity, weather permitting.

5.5.3 Access Control

The entrance and exit gates to the facility will remain in place at least until all other planned and required closure activities have been completed.

5.5.4 Drainage Plan

The surface water management plan, which is included in Appendix I, also identifies the final post-closure drainage plan for the site. There is one possible exception to the plan shown-if the composting pad is removed for any reason, the retention basin will also be removed.

5.5.5 End Use

The facility site is owned by MFS Farms and operated by Full Circle Organics, LLC. Termination of the lease would follow completion of final facility closure activities, site restoration as required in the lease and issuance of a Certification of Closure by the Blue Earth County Board of Commissioners. Full Circle Organics, LLC will leave the site in a state satisfactory to the landowner (MFS Farms).

The closure procedure for the areas impacted by compost and leachate will be handled carefully. The leachate pond will be tested and pumped out. The leachate will be disposed of at a wastewater treatment facility, or if it meets discharge standards will be disposed of through the sand filter and ditch system. The compost windrows and leachate pond will be stripped of the top two feet of material, hauled off-site, and disposed of at a properly permitted landfill. The site will be re-graded to allow natural drainage to occur through the site. The leachate tank will be pumped dry. The leachate from the tank will be disposed of at a wastewater treatment facility. The tank will be filled with sand and capped or removed from the site per the existing standards at the time of closure.

It is anticipated that Blue Earth County will not require Full Circle Organics, LLC to perform long-term post-closure activities because the facility is not intended to be a site of permanent waste disposal. Accordingly, there should not be any restrictions on potential end uses, other than those established by local zoning controls. The site is located within an area zoned for agricultural uses, with other uses allowed through conditional approval by Blue Earth County. If the compost process and mixing building are left on site, they could be converted to a variety of other purposes, with necessary approvals.

5.5.6 Closure Provisions Not Applicable to Facility

A significant number of the provisions typically governing closure of waste disposal facilities are not applicable to this organics processing facility. The following are examples of requirements which are applicable only to disposal sites (i.e., not applicable for the composting facility): final cover, landscape maintenance, establishment of vegetation, slopes, cover maintenance, post-closure maintenance, cross-sections of disposal areas, and leachate and gas evaluation, control, and monitoring requirements, and closure/post-closure cost estimating.

5.5.7 Closure Plan Record

This closure plan will be supplemented at least annually to ensure that it provides an up-to-date compilation of significant records and information about the facility, its development, and its operational history. The information records that will be maintained are identified in Table 5-1. Comments are provided either regarding the approach that will be followed to maintain records or the status of specific decisions.

Table 5-1

Information Records to be Maintained

Record	Comments/Status
Dates of Operation	With MPCA and Blue Earth County approvals, the earliest date by which the facility is to be ready to receive waste deliveries.
Chronological Record of Waste Acceptance	Quarterly reports of waste receipts, types, and disposition are required by the MPCA. Copies of these reports will be appended to the Closure Plan.
Notarized Affidavits	Notarized affidavits from persons knowledgeable about the facility will be provided at the end of the two-year start-up period and at least every three years thereafter that lists types and quantities of wastes received, haulers and known generators, and which identifies all persons with such knowledge, including knowledge about siting, design, construction, operation, maintenance and closure of the site. Supporting records will be provided, and the location of operating records will be specified.
Important Regulatory Documents	The closure plan will be appended to include copies of all permits and approvals obtained for development and operation of the facility, including lease agreement, conditional use permit, county license, MPCA compost facility permit, construction stormwater management permit application, and copies of all known covenants or easements. Any modifications to these documents made during the operating life of the site will be incorporated into the plan record.
Deviations from Specifications	A record will be maintained that describes, documents, and illustrates deviations from the planned site layout, design, and/or operations. As design elements for the facility are refined, these detailed additions will be added to the plan record.

6. Contingency Plan

6.1 Unauthorized Deposits of Acceptable Materials

On a daily basis, a designated site employee will check the boundaries of the property for deposits of material that, although acceptable, have been delivered to the wrong spot or at a time other than normal working hours.

Any unacceptable materials found will be collected by the employee, using equipment as needed and transported to an appropriate facility.

6.2 Delivery of Hazardous or Otherwise Prohibited Wastes

Facility employees will act according to the following policies and procedures in the event that prohibited wastes are delivered.

Any prohibited material, despite the quantity, remains the property and responsibility of the hauler attempting delivery and the original property owner.

Prohibited waste will be rejected and turned away at the gate.

Prohibited wastes will be rejected and removed from the facility via the delivery vehicle if it is identified after the vehicle has entered the facility but before the vehicle leaves the site. If the material can be readily identified and is not hazardous to the health of personnel or the environment of the facility, the driver of the delivery vehicle will be required to remove the prohibited material and any adjacent material that may have become intermixed with the prohibited material.

If facility personnel determine the prohibited material to be hazardous to the health or the environment of the facility, or if the hazards associated with the material cannot be identified, County and State authorities will immediately be notified and an appropriate handling plan negotiated among those agencies, the hauler, the actual material owner, and Full Circle Organics, LLC.

If prohibited material is identified after the vehicle has left the facility and the material can be readily identified as not hazardous to the health of personnel or the environment of the facility, Full Circle Organics, LLC personnel will remove the prohibited material and any adjacent material that may have become intermixed with the prohibited material from the facility. Any materials removed in such a manner will be disposed of at an appropriate facility.

If Full Circle Organics, LLC site personnel determine the prohibited material left behind to be hazardous to the health or the environment of the facility, or if the hazards associated with the material cannot be identified, County and State authorities will immediately be notified and an appropriate handling plan negotiated among those agencies, the hauler and original material owner (if identified), and Full Circle Organics, LLC.

6.3 Fires On Site

Minor fires such as equipment fires or within roll-off boxes or dumpsters will be handled by on-site fire extinguishers located in the office and on operating equipment.

Fires, other than those discussed in the previous paragraph, will be handled by the local Fire Department.

6.4 Unauthorized Access to the Full Circle Organics, LLC Good Thunder Facility

Only authorized individuals will be allowed to access to the facility. These individuals are anticipated to include:

- Full Circle Organics, LLC personnel.
- Drivers of commercial vehicles delivering yard waste, or organic materials.
- Inspectors, as may be required by permit or regulation, from Blue Earth County, or the MPCA.

Unauthorized individuals who gain access to the facility will be escorted off site by Full Circle Organics, LLC personnel to the extent that is deemed safe to interact with the unauthorized individuals. If staff considers the unauthorized individuals to be a threat to their safety or to the safety of authorized users of the facility, they will call 911 and contact the Sherriff's Department for assistance.

6.5 Unscheduled Shutdown

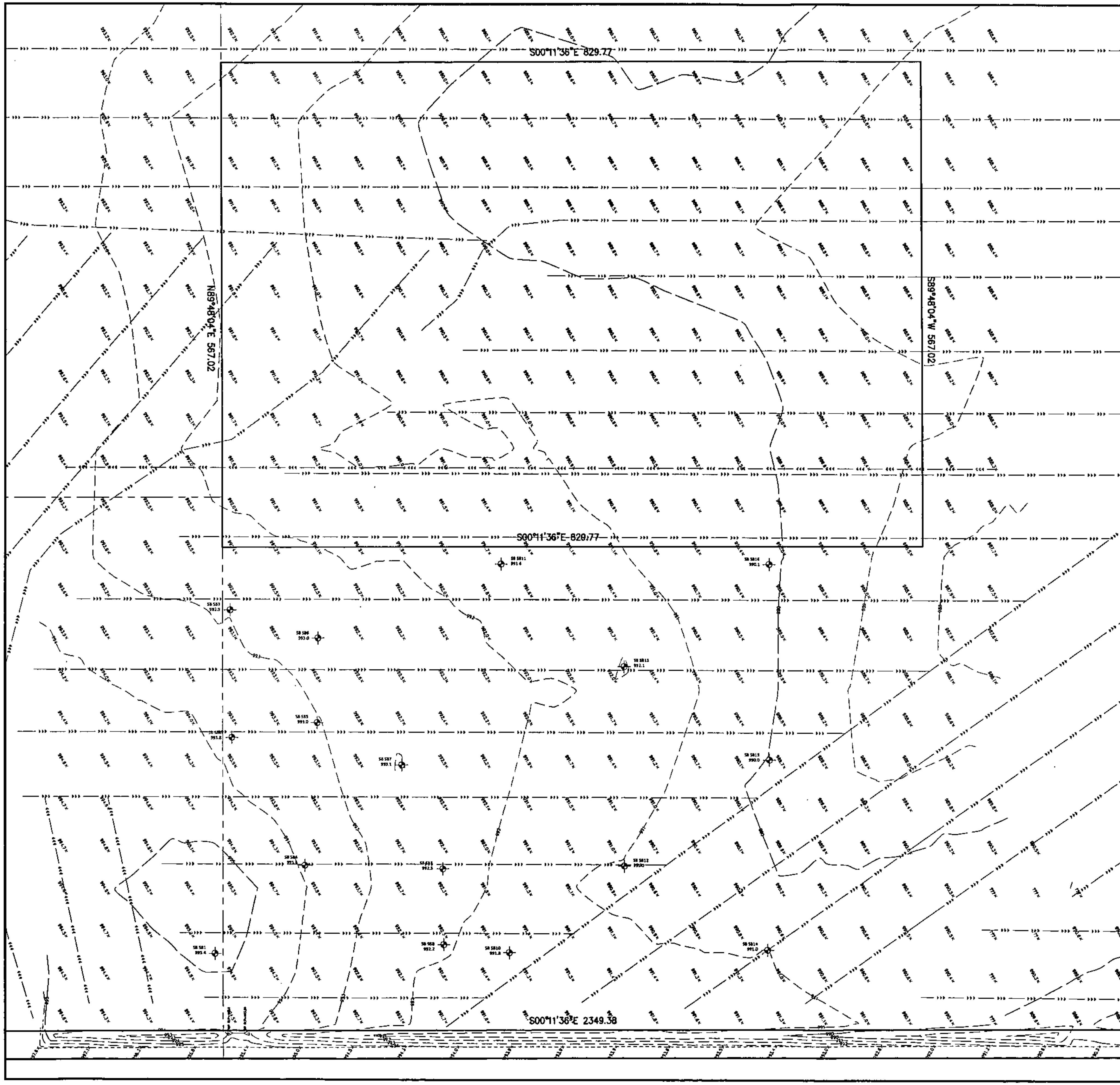
If shutdown is due to an emergency situation, the Full Circle Organics, LLC personnel will follow all applicable emergency response steps and procedures before starting the unscheduled shutdown cycle. The unscheduled shutdown cycle procedures will include the following:

- Call Full Circle Organics, LLC
  - Notify headquarters of the shutdown, its reasons, and expected duration.
  - If appropriate, have headquarters staff notify regular customers.
  - If shutdown will be extended due to heavy weather damage or other unusual event, have headquarters staff notify Blue Earth County and the MPCA.
- Close and Lock Entrance Roadway Gates
  - Obtain "Unscheduled Shutdown" signs from office. The sign says: "Temporarily Closed – For information Call Full Circle Organics, LLC at 612-282-9383.
  - Close and Lock entrance roadway gate. Hang "Unscheduled Shutdown" sign on the gate.
- Complete Routine On-site Operational and Closure Activities
  - **Short-term Shutdown:** Complete as many remaining activities as possible under conditions.
  - **Extended Shutdown:** Complete routine daily operational activities, if possible. Complete all other routine on-site closure activities.
- Close Exit Gates
  - Close and lock exit roadway gates at facility.
  - Drive past entrance gate and confirm gate is closed and padlocked.

Appendix Table of Contents

Appendix A

Existing Conditions



LEGEND

FOUND MONUMENT	WATERMAIN	EASEMENT LINE
SET MONUMENT	SANITARY SEWER	SETBACK LINE
ELECTRIC METER	STORM SEWER	RIGHT OF ACCESS
LIGHT	FLARED END SECTION	CONCRETE CURB
AIR CONDITIONER	ELECTRIC TRANSFORMER	BUILDING LINE
GUY ANCHOR	TELEPHONE PEDESTAL	BUILDING CANOPY
HANDICAP STALL	GAS METER	BITUMINOUS SURFACE
UTILITY POLE	OVERHEAD WIRE	CONCRETE SURFACE
GUARD POST	CHAIN LINK FENCE	LANDSCAPE SURFACE
BOLLARD	IRON FENCE	DECIDUOUS TREE
SIGN	WIRE FENCE	CONIFEROUS TREE
	WOOD FENCE	

GENERAL NOTES

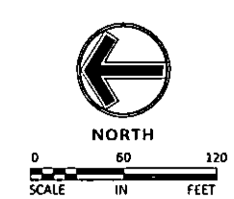
1. SITE IS LOCATED AT LATITUDE N45.3213 LONGITUDE W95.8052

DESCRIPTION

THE NORTHWEST QUARTER OF SECTION 1, TOWNSHIP 106N, RANGE 27W, EXCEPT THE NORTH 5 ACRES OF THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER THEREOF.

PROPERTY SUMMARY

TOTAL SITE AREA:	6,818,506 S.F.	OR	156.531 AC.	(GROSS)
COMPOST SITE AREA	435,600 S.F.	OR	10.0 AC.	
REMAINING SITE AREA	6,240,097 S.F.	OR	143.253 AC.	
EXISTING LESS 563RD AVE. RIGHT-OF-WAY:	77,534 S.F.	OR	1.780 AC.	
EXISTING LESS 164TH ST. RIGHT-OF-WAY:	65,275 S.F	OR	1.498 AC.	
	6,675,697 S.F.	OR	153.253 AC.	(NET)



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Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

Certification

Summary
Designed: MCB Drawn: ERW
Approved: MCB Book / Page:
Phase: FINAL Initial issue: 12/13/2011

Revision History

No.	Date	By	Submittal / Revision
A	01/05/12	ERW	COUNTY COMMENTS
B	02/17/12	SEG	MPCA COMMENTS
C	05/10/12	JN	REVISED LOCATION

Sheet Title
EXISTING CONDITIONS

Sheet No. Revision
C2.01 C

Project No. MFS19051

Appendix B

Soils Report

American Engineering Testing, Inc.

CONSULTANTS
• ENVIRONMENTAL
• GEOTECHNICAL
• MATERIALS
• FORENSICS

PRELIMINARY REPORT OF GEOTECHNICAL EXPLORATION AND REVIEW

Full Circle Organics Compost Site

56437 164th Street
Good Thunder, Minnesota

Report No. 22-00941

Date:

December 8, 2011

Prepared for:

MFS Farms, LLC
c/o MFRA, Inc.
14800 28th Avenue North, Suite 140
Plymouth, Minnesota 55447

www.amengtest.com

AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
• ENVIRONMENTAL
• GEOTECHNICAL
• MATERIALS
• FORENSICS

December 8, 2011

MFS Farms, LLC
c/o MFRA, Inc.
14800 28th Avenue North, Suite 140
Plymouth, Minnesota 55447

Attn: Mr. Michael C. Brandt, P.E.

RE: Preliminary Geotechnical Exploration and Review
Full Circle Organics Compost Site
56437 164th Street
Good Thunder, Minnesota 56037
Report No. 22-00941

Dear Mr. Brandt:

American Engineering Testing, Inc. (AET) is pleased to present the results of our subsurface exploration program and geotechnical engineering review for the Full Circle Organics Compost Site project in Good Thunder, Minnesota. These services were performed according to our proposal to you dated August 11, 2011.

We are submitting two hard copies and one electronic copy of the report to you.

Please contact me if you have any questions about the report. I can also be contacted for arranging construction observation and testing services during the earthwork phase.

Sincerely,
American Engineering Testing, Inc.

Derek S. Van Heuveln, P.E.
Staff Engineer II
Phone: (651) 789-4656
Fax: (651) 659-1379
dvanheuveln@amengtest.com

550 Cleveland Avenue North | St. Paul, MN 55114
Phone 651-659-9001 | Toll Free 800-972-6364 | Fax 651-659-1379 | www.amengtest.com | AA/EEO

SIGNATURE PAGE

Prepared for:

MFS Farms, Inc.
c/o MFRA, Inc.
14800 28th Avenue North, Suite 140
Plymouth, Minnesota 55447

Attn: Mr. Michael C. Brandt, P.E.

Prepared by:

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
(651) 659-9001/www.amengtest.com

Authored by:

Derek S. Van Heuveln, P.E.
Staff Engineer II

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 Minnesota Statute Section 326.02 to 326.15

Date: 12/8/2011 **License #: 45922**

Reviewed by:

Thomas P. Venema

Thomas P. Venema, P.E., LEED AP
Principal Engineer/Vice President

TABLE OF CONTENTS

TABLE OF CONTENTS

1.0 INTRODUCTION

You are designing a new compost facility for MFS Farms, Inc. at a site near Good Thunder, Minnesota. To assist planning and design, you have authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site, conduct soil laboratory testing, and perform a geotechnical engineering review for the project. This report presents the results of the above services, and provides our engineering recommendations based on this data.

2.0 SCOPE OF SERVICES

AET's services were performed according to our proposal to you dated August 11, 2011, which was authorized by Mr. Kevin FitzSimmons with MFS Farms, Inc. on August 12, 2011. The authorized scope consists of the following:

- 16 standard penetration test borings to depths ranging from 8 to 15 feet.
- Soil laboratory testing, which included water content tests, two sieve/hydrometer tests, two flexible wall permeability tests, and two Atterberg Limit tests.
- Geotechnical engineering analysis based on the gained data and preparation of this report.

These services are intended for geotechnical purposes. The scope is not intended to explore for the presence or extent of environmental contamination.

3.0 PROJECT INFORMATION

MFS Farms, Inc. is planning to develop approximately 10 acres of farmland into a composting site for Full Circle Organics. The site is located primarily in the northwest quarter of the southwest quarter of the northwest quarter of Section 1, Township 106N (Lyra Township), Range 27W. This is located along the east side of 563rd Avenue approximately ½ to ¾ mile south of 164th Street. The site will consist of a one-story building, a scale and scale house, access driveway and drive areas, three windrow areas, a "Final Product Storage" area, three stormwater ponds, and a filtration basin. Based on the plans, grades across the site will be raised 2 to 5 feet for the project; cuts of up to 4 to 7 feet are anticipated in the pond areas.

The 37,980 square foot building will have steel frame walls with the roof extending approximately 16 to 20 feet high. The building, which will have a finished floor elevation of 996.6, is being designed as an unheated structure at this time. The storage building will be set at the northeast corner of the site and will be connected to 563rd Avenue by a gravel driveway. The gravel driveway will consist of 8 inches of crushed rock aggregate base. A concrete truck dock will be located at the southeast corner of the building. The concrete pavement section will consist of 6 inches of concrete over 8 inches of crushed rock aggregate base. A truck scale will be installed near the entrance of the gravel driveway; the scale building will be a portable structure (e.g., trailer) that will not be permanently founded into the ground.

The composting windrow areas and "Final Product Storage" area will be located to the west and south of the building. The section in these areas will consist of 8 inches of Mn/DOT Class 5 aggregate base over 24 inches of compacted clay with a permeability of no greater than 1×10^{-7} centimeters per second (cm/sec); the intent of the clay is to restrict infiltration. These areas will be open air. The windrow area west of the mixing area will measure approximately 230 feet square; the twin windrow areas and "Final Product Storage" area to the south of the driveway will cover an area approximately 468 feet wide (east-west) by 326 feet long (north-south).

Pond Nos. 1 and 3, as well as the filtration basin, are located along the west edge of the site adjacent to 563rd Avenue. Pond No. 2 is located just north of the 'Final Product Storage' area.

Our foundation design assumptions include a minimum factor of safety of 3 with respect to localized shear or base failure of the foundations. We assume the structure will be able to tolerate total settlements of up to 1 inch, and differential settlements over a 30 foot distance of up to ½ inch.

The above stated information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 Field Exploration Program

The subsurface exploration program conducted for the project consisted of 16 standard penetration test borings. The logs of the borings and details of the methods used appear in Appendix A. The logs contain information concerning soil layering, soil classification, geologic description, and moisture condition. Relative density or consistency is also noted for the natural soils, which is based on the standard penetration resistance (N-value).

The boring locations are shown on Figure 1 in Appendix A. The borings were located in the field by MFRA personnel based on recommendations by AET. Surface elevations were also measured in the field by MFRA personnel.

4.2 Laboratory Testing

The laboratory test program included 103 water content tests, 10 organic content tests, 2 sieve/hydrometer tests, 2 flexible wall permeability tests, and 2 Atterberg Limit tests. The test results appear in Appendix A on the individual boring logs adjacent to the samples upon which they were performed, or on the data sheets following the logs.

5.0 SITE CONDITIONS

5.1 Surface Observations

The project site was a recently harvested cornfield at the time of our borings. The topography slopes up from the southeast corner to the northwest corner; the surface elevation at our boring locations varies from a low of 990.0 at Boring SB-15 to a high of 995.4 at Boring SB-1.

5.2 Subsurface Soils/Geology

The general site geology consists of a surficial zone of mixed plow zone soils at a depth of 2 to 5 feet below grade. The plowed zone soils are native to the site but have been disturbed by agricultural activities; these soils are noted as "Fill" on our boring logs. The plowed zone fill soils are underlain by fine alluvium or weathered glacial till and glacial till soils to the boring termination depths. The fine alluvium or weathered till soils were not encountered in Boring No. SB-4.

5.3 Ground Water

Ground water was measured in boring SB-3 at a depth of 15.2 feet below grade (elevation 977); ground water was not observed in any of the remaining 15 borings. Considering the majority of the soils consist of slow draining clays and sandy clays, it often takes several hours or even days for the hydrostatic ground water level to stabilize in an open borehole. More accurate ground water readings are obtained using temporary piezometers and obtaining readings for an extended period of time. Our scope of services did not allow for long-term monitoring of the water levels. We caution that ground water can become trapped or perched within layers of sands and silty sands above or surrounded by slower draining clays and clayey sands.

Ground water levels fluctuate due to varying seasonal and annual rainfall and snow melt amounts, as well as other factors.

5.4 Review of Soil Properties

5.4.1 Strength/Stability

The plowed zone fill soils are judged to have moderate strength and poor to moderate stability unless disturbed. The naturally-deposited fine alluvial and weathered till soils are judged to have moderate to moderately high strength and moderate to high stability. The glacial till sandy lean clay and lean clay are judged to have moderate to high strength and moderate to high stability. When exposed to moisture and disturbed by traffic, the fill, fine alluvium and till have relatively low strength and poor stability.

5.4.2 Compressibility

The plowed zone fill soils are judged to be at least moderately compressible under the anticipated fill and foundation loads. The naturally-deposited fine alluvial, weathered till, and till soils are judged to have a low compressibility potential.

5.4.3 Subgrade Drainage

The soils encountered at this site, both plowed zone fill and naturally-deposited soils, are clayey and have poor drainage properties. Water can be expected to be trapped within the upper subgrade. This can result in increased periods of subgrade saturation, which leads to increased detrimental frost effects and subgrade weakening.

5.4.4 Frost Susceptibility

The fill and naturally-deposited soils encountered at the project are considered to be highly frost susceptible.

6.0 RECOMMENDATIONS

6.1 Approach Discussion

It should be possible to support the proposed building addition on conventional spread footings, after some corrective grading operations. It is our opinion that relying on the existing plowed zone fill soils to support the footings of the building will result in some risks to the Owner. These risks are associated with the high organic content of the upper plowed zone fill soils, which could lead to excess differential settlement of the building under the additional fill and foundations loadings. The naturally deposited glacial till and alluvial soils would also be suitable for support of the building foundations and floor slab.

However, the building is planned as an unheated building, and freeze-thaw related movement of the highly frost susceptible subgrade and concrete slab should be considered. These frost related movements may affect the performance of the slab. In our opinion, these issues would also affect the truck scale. For the building slab and truck scale, we recommend constructing a subgrade of non-frost susceptible (NFS) sand.

In our opinion, the existing fill soils would generally be suitable to support the planned gravel drives, windrow areas, and "Final Product Storage" area after stripping the upper, more highly organic portion of these soils. This would consist of approximately 2 feet of stripping in the driveway areas, based on our organic content test results. Organic contents over 5% are considered high, and the organic content test results in the upper 2 feet of the subgrade generally varied from 5 to 8%; below 2 feet, the organic contents were generally less than 5%, primarily around 2 to 3%. However, if more than 3 feet of new subgrade fill will be placed, the existing plowed zone fill soils can be left in place after stripping the upper vegetative mat; the new fill soils would act to bridge over the more highly organic native soils.

In our opinion, the proposed 8-inch thick aggregate base section of the driveway and windrow areas is not sufficient to support truck and heavy machinery traffic. The clayey subgrade soils are considered poor from a frost and drainage standpoint. These conditions results in accelerated subgrade and aggregate base weakening, particularly during the spring when the subgrade soils are at the lowest strength when coming out of the freeze-thaw cycle. We recommend increasing the aggregate base section to a minimum of 12 inches. As an alternative in the driveway areas, a 12-inch thick sand subbase could be installed as the upper subgrade to better control infiltrating water and the associated frost movements. The aggregate base section could remain at the 8-inches in the drive areas if a 1-foot sand subbase is incorporated into the design. However, there is an increased cost with increasing the aggregate base section and installing a sand subbase. The Owner must consider the cost versus performance expectations when evaluating each option.

6.2 Site Grading

6.2.1 Excavation

To prepare the building area for foundation and slab support, we recommend complete excavation of the plow zone fill (black fat clay) within the building pad, thereby exposing the naturally-deposited brown and gray lean clay and sandy lean clay soils. In the scale area, we also recommend excavating the plow zone fill to the underlying naturally-deposited lean clay soils. For the remainder of the site, we recommend stripping the upper portion of the plowed zone fill soils, which are more highly organic in the upper 2 feet based on our organic content tests. However, if more than 3 feet of new subgrade fill will be placed, the upper plowed zone fill soils can remain in place after stripping the upper vegetative mat. This would result in excavation depths at the boring locations as shown in Table A.

Table A – Recommended Excavation Depths

Boring Number	Location	Surface Elevation (ft)	Excavation Depth (ft)	Approximate Excavation Elevation (ft)
1	Site	995.4	2*	995
2	Building	993.8	2½	991½
3	Building	992.9	4	989
4	Site	993.8	2*	993
5	Building	993.0	3	990
6	Building	993.0	4	989
7	Site	993.1	2*	992½
8	Site	992.2	2*	991½
9	Scale	992.5	2	990½
10	Site	991.8	2*	991
11	Site	991.6	2*	991
12	Site	991.0	2*	990½
13	Site	992.1	2*	991½
14	Site	991.0	2*	989
15	Site	990.0	2*	988
16	Site	990.1	2*	988

*Depth of excavation can be reduced to stripping the vegetative mat if more than 3 feet of new subgrade fill will be placed, based on final site grades.

The depth/elevation indicated in Table A is based on the soil condition at the specific boring location. Since conditions will vary away from the boring location, it is recommended that AET geotechnical personnel observe and confirm the competency of the soils in the entire excavation bottom prior to new fill or footing placement.

Where the excavation extends below foundation grade, the excavation bottom and resultant engineered fill system must be oversized laterally beyond the planned outside edges of the foundations to properly support the lateral loads exerted by that foundation. This excavation/engineered fill lateral extension should at least be equal to the vertical depth of fill needed to attain foundation grade at that location (i.e., 1:1 lateral oversize).

6.2.2 Building Slab and Scale Subgrade

A floor slab subgrade consisting of the cohesive engineered fill over the naturally-deposited lean clay and sandy lean clay soils would be susceptible to freeze-thaw related movements, which would affect the performance of the slab. These issues would also affect the proposed truck scale. For these building slab and truck scale, we recommend constructing a subgrade of non-frost susceptible (NFS) sand. This would require excavating the plowed zone fill and naturally-deposited alluvial and till soils to a depth of at least 4 feet below bottom of the new interior building slab and scale, or to the depths recommended in Table A, whichever is greater. Any other soft or unsuitable material encountered should also be excavated. The base soils of this excavation should be engineered fill or naturally-deposited fine alluvial or glacial till soils. The NFS soils should have no more than 35% (by weight) passing the No. 40 sieve and no more than 5% (by weight) passing the No. 200% sieve. The NFS sand soils should be placed in lifts and compacted to at least 95% of the maximum Standard Proctor dry density (ASTM D 698), extending to a distance of at least 2 feet horizontally beyond the outside edges of the scale slab.

Where the excavation abuts existing structures or site elements that are not founded on frost footings or do not have an NFS subgrade, such as the gravel driveway, the sand subbase should be sloped at a 4:1 (H:V) ratio to prevent creating an abrupt differential frost heave during winter conditions.

The NFS sand will need to be drained. This is typically performed by installing drainpipes at the base of the sand subbase excavation which are outletted to a lower area, such as the proposed ponds. If the sand subbase is not drained, it will accumulate infiltrating water and create a bathtub effect, where the water will pool in the sand subbase before it infiltrates into the underlying slower draining lean clay and sandy lean clay soils. This would increase the likelihood of frost heave and freeze thaw weakening of the sand subbase, and frost related movements of the building slab and scale.

6.2.3Fill Placement and Compaction

Fill placed to attain grade for foundation support should be compacted in thin lifts, such that the entire lift achieves a minimum compaction level of 98% of the standard maximum dry unit weight per ASTM:D698 (Standard Proctor test). Fill placed which supports the floor slab of the building only (outside of the 1:1 oversize zone below footings) or for general site grading in the windrow and 'Final Product Storage' areas can have a reduced minimum compaction level of 95% of the standard maximum dry unit weight.

In our opinion, the onsite sandy lean clay and lean clay soils can be used as engineered fill provided they are carefully segregated from the more organic upper portions of the plowed zone fill. The onsite fat clays should not be used as engineered fill. If additional fill is required, we recommend importing clay fill similar to the onsite soils (lean clays and sandy lean clays). Granular fill can be imported; however, it should not be used in the windrow areas or in areas where it cannot be drained and water can become trapped between the cohesive soil layers. We recommend that the contractor submit a sample of the proposed fill material to our laboratory for testing and review by a Geotechnical Engineer.

Sandy lean clays and lean clays are more difficult to work with than silty sands and sands. The lean clays and sandy lean clays are moisture sensitive, and should be compacted at water contents within 2% to 3% of their respective optimum water contents (based on the Standard Proctor test). The majority of the onsite clayey soils were above optimum, with some being significantly above the optimum moisture content, based on the Standard proctor test. For reuse of the onsite soils, it should be anticipated that significant moisture conditioning (e.g., drying) of the clayey soils would be required to reduce the water content into the proper range for compaction. The lean clays and sandy lean clays are more susceptible to freeze-thaw movements when exposed to freezing temperatures. Refer to the standard sheet "Freezing Weather Effects on Building Construction" at the end of this report for concerns about frost-related movements and precautions.

If there are areas where fill is placed on slopes, we recommend benching the sloped surface (benches cut parallel to the slope contour) prior to placing the fill. Benching is recommended where slopes are steeper than 4:1 (H: V).

Our borings indicate variable depths of fill at the boring locations. We cannot determine the volume of fill that can be considered reusable; this must be determined at the time of excavation when full view of the fill is available.

6.3 Foundation Design

The storage building structure can be supported on conventional spread foundations placed on naturally-deposited fine alluvial or glacial till soils or engineered fill. We recommend foundations for unheated building space (such as the storage building) extend to a minimum of 60 inches below exterior grade. We recommend perimeter foundations is placed such that the bottom is a minimum of 42 inches below exterior grade if the building is heated. There should be a 'bond break' placed against the exterior of the building foundation wall, such as rigid foam insulation, so that frozen soil does not grip the foundation walls (adfreezing) and heave the structure.

Based on the conditions encountered, it is our opinion the building foundations can be designed based on a net maximum allowable soil bearing pressure of 3,000 psf. It is our judgment this design pressure will have a factor of safety of at least 3 against localized shear or base failure. We judge that total settlements under this loading should not exceed 1 inch. We also judge that differential settlements of conditions depicted by the borings should not exceed ½ inch.

6.4 Floor Slab Design

After successful completion of this grading, it is our opinion that the floor slabs can be supported on grade by the compacted fill. Assuming the recommended 4 feet of NFS sand is used as the subgrade, a modulus of subgrade reaction of 200 pci can be used to design the slab. If the floor slabs of the new building are supported by the sandy lean clay or lean clay fill, we recommend they be designed using a Modulus of Subgrade Reaction (k-value) of 150 pci. These are ultimate values; therefore, a factor of safety of 1.5 should be applied.

For recommendations pertaining to moisture and vapor protection of interior floor slabs, if required, we refer you to the standard sheet entitled "Floor Slab Moisture/Vapor Protection" at the end of this report.

6.5 Exterior Building Backfilling

Fill that is placed below sidewalks, stoops, and exterior slabs should be compacted to a minimum of 95% of the Standard Proctor maximum dry density. Fill placed in landscaped areas should be compacted to a minimum of 90% of the Standard Proctor maximum dry density. Because the majority of the soils at this site are fat clays, sandy lean clays, and lean clays, it is important that precautions are taken to prepare for frost-related slab movements outside the building during freezing temperatures, and after the soils thaw. We refer you to the sheet entitled "Freezing Weather Effects on Building Construction" at the end of this report for details concerning protection against freeze-thaw related movements.

6.6 Windrow and Final Product Storage Areas

6.7.1 Clay Liner Permeability Comments

Based on our discussions with you and our review of the project drawings, the clay liner for the windrow and 'Final Product Storage' areas will consist of 2 feet of imported clay with a permeability of no greater than 1 x 10^{-7} cm/sec. The average hydraulic conductivity of the samples that we tested was 1.25 x 10^{-6} cm/sec in SB-2 in the sample from 4 to 6 feet below grade and 1.05 x 10^{-7} cm/sec in SB-15 in the sample from 4 to 6 feet below grade. Based on the results of the flexible wall permeability tests performed on the soils retained from the project site, additional testing is recommended potential borrow areas to determine if onsite soils are available that meet the project requirements for the clay liner.

6.7 Pavements – Gravel and Concrete

6.7.1 Definitions

Italicized words used in this section have a specific definition or are a Mn/DOT reference. The definitions are presented on the attached standard sheet entitled "Definitions Relating to Pavement Construction", or are defined in an ASTM standard or a Mn/DOT specification.

6.7.2 Pavement Section Comments

In our opinion, the proposed 8-inch thick aggregate base section of the driveway and windrow areas is not sufficient to support truck and heavy machinery traffic. The clayey subgrade soils are considered poor from a frost and drainage standpoint. These conditions results in accelerated subgrade and aggregate base weakening, particularly during the spring when the subgrade soils are at the lowest strength when coming out of the freeze-thaw cycle. We recommend increasing the aggregate base section to a minimum of 12 inches. As an alternative in the driveway areas, a 12-inch thick *sand subbase* could be installed as the upper subgrade to better control infiltrating water and the associated frost movements. The aggregate base section could remain at the 8-inches in the drive areas if a 1-foot *sand subbase* is incorporated into the design. However, there is an increased cost with increasing the aggregate base section and installing a *sand subbase.* The Owner must consider the cost versus performance expectations when evaluating each option.

6.7.3 Frost/Drainage Improvement

The clayey subgrade soils are considered poor from a frost and drainage standpoint. These conditions result in accelerated subgrade and aggregate base/surfacing. Long-term performance in fine grained soils can be improved by placing a *sand subbase* layer as the top of subgrade to better control infiltrating water and the associated frost movements. The thickness of the *sand subbase* recommended is usually dependent on soil stability conditions, the road function, and cost versus performance expectations. At this site, the underlying soils are relatively stable, and because of this, it is our opinion the *sand subbase* thickness should be at least 1-foot thick.

Sand subbase layers are typically comprised of *Select Granular Material.* This specification allows for the possibility of a fine grained sand material approaching a silty sand classification. This type of material does not drain as fast as a cleaner sand material, and the stability can be affected by the presence of excess water. Therefore, the use of *Modified Select Granular Material* can further improve performance, if your budget allows.

Where there is a need to vary the thickness of the *sand subbase*, we recommend the thickness have a taper of no steeper than 10:1 (H:V). The subcut and sand layer placement should extend slightly beyond the outer edge of the curb to maintain frost uniformity.

The *sand subbase* should be provided with proper subsurface drainage to prevent build-up of water within the sand. This can be accomplished by placing properly engineered drainage lines along the length of the roadway which are connected to the onsite ponds or outfall into ditch areas.

A Type V geotextile fabric can be used to maintain separation between the clayey subgrade soils and the *sand subbase*, although the need for separation is not judged necessary when the native subgrade is stable beneath the *sand subbase*.

6.7.4 Subgrade Preparation

We recommend removing the fill as described in Table A, and any organic soils and soft clays which exist within the upper 3 feet of the pavement subgrade (*critical subgrade zone*). After removal of the materials as recommended above, we recommend scarifying the exposed subgrade soils to a depth of about 12 inches and then compacting the soils with a large, self-propelled sheepsfoot compactor to at least 100% of the *standard maximum dry unit weight* defined in ASTM: D698 (Standard Proctor test); or 95% if the grade is more than 3 feet below final subgrade elevation.

6.7.3 Fill Placement and Compaction

All fill placed to re-establish subgrade elevation should be compacted per the requirements of Mn/DOT Specification 2105.3F1 (Specified Density Method). This specification requires soils placed within the *critical subgrade zone* be compacted to a minimum of 100% of the *standard* *maximum dry unit weight* defined in ASTM: D698 (Standard Proctor test), at a water content 65% to 102% of the *standard optimum water content.* If fill is needed below the upper 3 feet of the *critical subgrade zone*, this fill can be compacted to a reduced level of 95% of the Standard Proctor maximum dry density.

6.7.4 Subgrade Stability and Test Roll

Subgrade stability within the *critical subgrade zone* of the new pavements is important for pavement support, construction, and performance. Stability of the subgrade soils in the *critical subgrade zone* should be evaluated using the *test roll* procedure before placement of the aggregate surfacing layer or aggregate base layers for the concrete pavements.

After establishing subgrade elevations, but before placement of the *sand subbase,* aggregate surfacing, or base layers, we recommend the subgrade soils be subjected to a *test roll* procedure using a loaded, tandem-axle dump truck. The *test roll* will help to delineate any *unstable soils* that will not be acceptable as pavement subgrade soils. These *unstable soils* should be removed and replaced; or be aerated, dried and recompacted back into place as recommended by AET geotechnical personnel. After the subgrade soils pass a test roll procedure, fill and the aggregate surfacing or base layer can be placed and compacted. The aggregate surfacing and base layers should be compacted to at least 100% of the Standard Proctor density.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Potential Difficulties

7.1.1 Runoff Water in Excavation

Water can be expected to collect in the excavation bottom during times of inclement weather or snow melt. To allow observation of the excavation bottom, to reduce the potential for soil disturbance, and to facilitate filling operations, we recommend water be removed from within the excavation during construction. Based on the soils encountered, we anticipate the ground water can be handled with conventional sump pumping.

7.1.2 Disturbance of Soils

The on-site soils can become disturbed under construction traffic, especially if the soils are wet. If soils become disturbed, they should be subcut to the underlying undisturbed soils. The subcut soils can then be dried and recompacted back into place, or they should be removed and replaced with drier imported fill.

7.2 Excavation Backsloping

If excavation faces are not retained, the excavations should maintain maximum allowable slopes in accordance with *OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations"* (can be found on www.osha.gov). Even with the required OSHA sloping, water seepage or surface runoff can potentially induce sideslope erosion or running which could require slope maintenance.

7.3 Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observation by a geotechnical engineer/technician during construction to evaluate these potential changes. Soil density testing should also be performed on new fill placed in order to document that project specifications for compaction have been satisfied.

8.0 LIMITATIONS

Within the limitations of scope, budget, and schedule, our services have been conducted according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, either expressed or implied, is intended.

Important information regarding risk management and proper use of this report is given in Appendix B entitled "Geotechnical Report Limitations and Guidelines for Use".

Floor slab design relative to moisture/vapor protection should consider the type and location of two elements, a granular layer and a vapor membrane (vapor retarder, water resistant barrier or vapor barrier). In the following sections, the pros and cons of the possible options regarding these elements will be presented, such that you and your specifier can make an engineering decision based on the benefits and costs of the choices.

GRANULAR LAYER

In American Concrete Institute (ACI) 302.1R-04, a "base material" is recommended over the vapor membrane, rather than the conventional clean "sand cushion" material. The base layer should be a minimum of 4 inches (100 mm) thick, trimmable, compactable, granular fill (not sand), a so-called crusher-run material. Usually graded from 1½ inches to 2 inches (38 to 50 mm) down to rock dust is suitable. Following compaction, the surface can be choked off with a fine-grade material. We refer you to ACI 302.1R-04 for additional details regarding the requirements for the base material.

In cases where potential static water levels or significant perched water sources appear near or above the floor slab, an under floor drainage system may be needed wherein a draintile system is placed within a thicker clean sand or gravel layer. Such a system should be properly engineered depending on subgrade soil types and rate/head of water inflow.

VAPOR MEMBRANE

The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. Your decision will then relate to whether to use the ACI base material or a conventional sand cushion layer. However, if any of the above sensitivity issues apply, placement of a vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) require installation of a vapor membrane to limit the slab moisture content as a condition of their warranty.

VAPOR MEMBRANE/GRANULAR LAYER PLACEMENT

A number of issues should be considered when deciding whether to place the vapor membrane above or below the granular layer. The benefits of placing the slab on a granular layer, with the vapor membrane placed **below** the granular layer, include **reduction** of the following:

- Slab curling during the curing and drying process.
- Time of bleeding, which allows for quicker finishing.
- Vapor membrane puncturing.
- Surface blistering or delamination caused by an extended bleeding period.
- Cracking caused by plastic or drying shrinkage.

The benefits of placing the vapor membrane over the granular layer include the following:

- A lower moisture emission rate is achieved faster.
- Eliminates a potential water reservoir within the granular layer above the membrane.
- Provides a "slip surface", thereby reducing slab restraint and the associated random cracking.

If a membrane is to be used in conjunction with a granular layer, the approach recommended depends on slab usage and the construction schedule. The vapor membrane should be placed above the granular layer when:

- Vapor sensitive floor covering systems are used or vapor sensitive items will be directly placed on the slab.
- The area will be humidity controlled, but the slab will be placed before the building is enclosed and sealed from rain.
- Required by a floor covering manufacturer's system warranty.

The vapor membrane should be placed below the granular layer when:

- Used in humidity controlled areas (without vapor sensitive coverings/stored items), with the roof membrane in place, and the building enclosed to the point where precipitation will not intrude into the slab area. Consideration should be given to slight sloping of the membrane to edges where draintile or other disposal methods can alleviate potential water sources, such as pipe or roof leaks, foundation wall damp proofing failure, fire sprinkler system activation, etc.

There may be cases where membrane placement may have a detrimental effect on the subgrade support system (e.g., expansive soils). In these cases, your decision will need to weigh the cost of subgrade options and the performance risks.

DRAINAGE

Below-grade basements should include a perimeter backfill drainage system on the exterior side of the wall. The exception may be where basements lie within free draining sands where water will not perch in the backfill. Drainage systems should consist of perforated or slotted PVC drainage pipes located at the bottom of the backfill trench, lower than the interior floor grade. The drain pipe should be surrounded by properly graded filter rock. A filter fabric should then envelope the filter rock. The drain pipe should be connected to a suitable means of disposal, such as a sump basket or a gravity outfall. A storm sewer gravity outfall would be preferred over exterior gravity drainage, as the latter may freeze during winter. For non-building, exterior retaining walls, weep holes at the base of the wall can be substituted for a drain pipe.

BACKFILLING

Prior to backfilling, dampproofing or waterproofing should be applied on perimeter basement walls. The backfill materials placed against basement walls will exert lateral loadings. To reduce this loading by allowing for drainage, we recommend using free draining sands for backfill. The zone of sand backfill should extend outward from the wall at least 2 feet, and then extend upward and outward from the wall at a 30 degree or greater angle from vertical. As a minimum, the sands used on this project should contain no greater than 7% of the particles (by weight) finer than the #200 sieve and no more than 40% of the particles (by weight) finer than the #40 sieve. The sand backfill should be placed in lifts and compacted with portable compaction equipment. This compaction should be to the specified levels if slabs or pavements are placed above. Where slabs or pavements are not above, we recommend capping the sand backfill with a layer of clayey soil to minimize surface water infiltration. Positive surface drainage away from the building should also be maintained. If surface capping or positive surface drainage cannot be maintained, then the trench should be filled with more permeable soils, such as the Fine Filter or Coarse Filter Aggregates defined in MnDOT Specification 3149. You should recognize that if the backfill soils are not properly compacted, settlements may occur which may affect surface drainage away from the building.

Backfilling with silty or clayey soil is possible but not preferred. These soils can build-up water which increases lateral pressures and results in wet wall conditions and possible water infiltration into the basement. If you elect to place silty or clayey soils as backfill, we recommend you place a prefabricated drainage composite against the wall which is hydraulically connected to a drainage pipe at the base of the backfill trench. High plasticity clays should be avoided as backfill due to their swelling potential.

LATERAL PRESSURES

Lateral earth pressures on below-grade walls vary, depending on backfill soil classification, backfill compaction, and slope of the backfill surface. Static or dynamic surcharge loads near the wall will also increase lateral wall pressure. For design, we recommend the following ultimate lateral earth pressure values (given in equivalent fluid pressure values) for a drained soil compacted to 95% of the Standard Proctor density and a level ground surface.

	Equivalent Fluid Density	
Soil Type	**Active Pressure (pcf)**	**At-Rest Pressure (pcf)**
Sands (SP or SP-SM)	35	50
Silty Sands (SM	45	65
Fine Grained Soils (SC, CL or ML)	70	90

Basement walls are normally restrained at the top which restricts movement. In this case, the design lateral pressures should be the "at-rest" pressure situation. Retaining walls which are free to rotate or deflect should be designed using the active case. Lateral earth pressures will be significantly higher than that shown if the backfill soils are not drained and become saturated.

EXCAVATION AND REFILLING FOR STRUCTURAL SUPPORT

EXCAVATION

Excavations for structural support at soil boring locations should be taken to depths recommended in the geotechnical report. Since conditions can vary, recommended excavation depths between and beyond the boring locations should be evaluated by geotechnical field personnel. If ground water is present, the excavation should be dewatered to avoid the risk of unobservable poor soils being left in-place. Excavation base soils may become disturbed due to construction traffic, ground water or other reasons. Such soils should be subcut to underlying undisturbed soils. Where the excavation base slopes steeper than 4:1, the excavation bottom should be benched across the slope parallel to the excavation contour.

Soil stresses under footings spread out with depth. Therefore, the excavation bottom and subsequent fill system should be laterally oversized beyond footing edges to support the footing stresses. A lateral oversize equal to the depth of fill below the footing (i.e., 1:1 oversize) is usually recommended. The lateral oversize is usually increased to 1.5:1 where compressible organic soils are exposed on the excavation sides. Variations in oversize requirements may be recommended in the geotechnical report or can be evaluated by the geotechnical field personnel.

Unless the excavation is retained, the backslopes should be maintained in accordance with OSHA Regulations (Standards - 29 CFR), Part 1926, Subpart P, "Excavations" (found on www.osha.gov). Even with the required OSHA sloping, ground water can induce sideslope raveling or running which could require that flatter slopes or other approaches be used.

FILLING

Filling should proceed only after the excavation bottom has been approved by the geotechnical engineer/technician. Approved fill material should be uniformly compacted in thin lifts to the compaction levels specified in the geotechnical report. The lift thickness should be thin enough to achieve specified compaction through the full lift thickness with the compaction equipment utilized. Typical thicknesses are 6" to 9" for clays and 12" to 18" for sands. Fine grained soils are moisture sensitive and are often wet (water content exceeds the "optimum moisture content" defined by a Proctor test). In this case, the soils should be scarified and dried to achieve a water content suitable for compaction. This drying process can be time consuming, labor intensive, and requires favorable weather.

Select fill material may be needed where the excavation bottom is sensitive to disturbance or where standing water is present. Sands (SP) which are medium to coarse grained are preferred, and can be compacted in thicker lift thicknesses than finer grained soils.

Filling operations for structural support should be closely monitored for fill type and compaction by a geotechnical technician. Monitoring should be on a full-time basis in cases where vertical fill placement is rapid; during freezing weather conditions; where ground water is present; or where sensitive bottom conditions are present.

EXCAVATION/REFILLING DURING FREEZING TEMPERATURES

Soils that freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density loss depends on the soil type and moisture condition; and is most pronounced in clays and silts. Foundations, slabs, and other improvements should be protected from frost intrusion during freezing weather. For earthwork during freezing weather, the areas to be filled should be stripped of frozen soil, snow and ice prior to new fill placement. In addition, new fill should not be allowed to freeze during or after placement. For this reason, it may be preferable to do earthwork operations in small plan areas so grade can be quickly attained instead of large areas where much frost stripping may be needed.

FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION

GENERAL

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/ strength loss depends on the soil type and moisture condition. Heave is greater in soils with higher percentages of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about 1/4" to 3/8" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

DESIGN CONSIDERATIONS

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 12% passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

Adfreezing can occur on exterior piers (such as deck, fence or other similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where soils become saturated. Additional footing embedment and/or widened footings below the frost zones (which include tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

CONSTRUCTION CONSIDERATIONS

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

DEFINITIONS RELATING TO PAVEMENT CONSTRUCTION

TOP OF SUBGRADE
Grade which contacts the bottom of the aggregate base layer.

SAND SUBBASE
Uniform thickness sand layer placed as the top of subgrade which is intended to improve the frost and drainage characteristics of the pavement system by better draining excess water in the base/subbase, by reducing and "bridging" frost heaving and by reducing spring thaw weakening effects.

CRITICAL SUBGRADE ZONE
The subgrade portion beneath and within three vertical feet of the top of subgrade. A sand subbase, if placed, would be considered the upper portion of the critical subgrade zone.

GRANULAR BORROW
Soils meeting Mn/DOT Specification 3149.2B1. This refers to granular soils which, of the portion passing the 1" sieve, contain less than 20% by weight passing the #200 sieve.

SELECT GRANULAR BORROW
Soils meeting Mn/DOT Specification 3149.2B2. This refers to granular soils which, of the portion passing the 1" sieve, contain less than 12% by weight passing the #200 sieve.

MODIFIED SELECT GRANULAR BORROW
Clean, medium grained sands which, of the portion passing the 1" sieve, contain less than 5% by weight passing the #200 sieve and less than 40% by weight passing the #40 sieve.

GEOTEXTILE STABILIZATION FABRIC
Geotextile meeting Type V requirements defined in Mn/DOT Specification 3733. When using fabric, installation should also meet the requirements outlined in Mn/DOT Specification 3733.

COMPACTION SUBCUT
Construction of a uniform thickness subcut below a designated grade to provide uniformity and compaction within the subcut zone. Replacement fill can be the materials subcut, although the reused soils should be blended to a uniform soil condition and recompacted per the Specified Density Method (Mn/DOT Specification 2105.3F1).

TEST ROLL
A means of evaluating the near-surface stability of subgrade soils (usually non-granular). Suitability is determined by the depth of rutting or deflection caused by passage of heavy rubber-tired construction equipment, such as a loaded dump truck, over the test area. Yielding of less than 1" is normally considered acceptable, although engineering judgment may be applied depending on equipment used, soil conditions present, and/or pavement performance expectations.

UNSTABLE SOILS
Subgrade soils which do not pass a test roll. Unstable soils typically have water content exceeding the "standard optimum water content" defined in ASTM:D698 (Standard Proctor test).

ORGANIC SOILS
Soils which have sufficient organic content such that engineering properties/stability are affected. These soils are usually black to dark brown in color.

Appendix A

Geotechnical Field Exploration and Testing
Boring Log Notes
Unified Soil Classification System
Figure 1 – Boring Locations
Subsurface Boring Logs
Results of Sieve/Hydrometer Analysis Tests
Results of Organic Content Tests
Results of Flexible Wall Permeability Tests

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling 16 standard penetration test borings. The locations of the borings appear on Figure 1, preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS) - Calibrated to N_{60} Values

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586 with one primary modification. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value. Our method uses a modified hammer weight, which is determined by measuring the system energy using a Pile Driving Analyzer (PDA) and an instrumented rod.

In the past, standard penetration N-value tests were performed using a rope and cathead for the lift and drop system. The energy transferred to the split-spoon sampler was typically limited to about 60% of its potential energy due to the friction inherent in this system. This converted energy then provides what is known as an N_{60} blow count.

The most recent drill rigs incorporate an automatic hammer lift and drop system, which has higher energy efficiency and subsequently results in lower N-values than the traditional N_{60} values. By using the PDA energy measurement equipment, we are able to determine actual energy generated by the drop hammer. With the various hammer systems available, we have found highly variable energies ranging from 55% to over 100%. Therefore, the intent of AET's hammer calibrations is to vary the hammer weight such that hammer energies lie within about 60% to 65% of the theoretical energy of a 140-pound weight falling 30 inches. The current ASTM procedure acknowledges the wide variation in N-values, stating that N-values of 100% or more have been observed. Although we have not yet determined the statistical measurement uncertainty of our calibrated method to date, we can state that the accuracy deviation of the N-values using this method is significantly better than the standard ASTM Method.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as "DS" or "SU" on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of "topsoil" layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

Visual-manual judgment of the AASHTO Soil Group is also noted as a part of the soil description. A chart presenting details of the AASHTO Soil Classification System is also attached.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests
Conducted per AET Procedure 01-LAB-010, which is performed in general accordance with ASTM: D2216 and AASHTO: T265.

A.5.2 Atterberg Limits Tests
Conducted per AET Procedure 01-LAB-030, which is performed in general accordance with ASTM: D4318 and AASHTO: T89, T90.

A.5.3 Sieve Analysis of Soils (thru #200 Sieve)
Conducted per AET Procedure 01-LAB-040, which is performed in general conformance with ASTM: D6913, Method A.

A.5.4 Particle Size Analysis of Soils (with hydrometer)
Conducted per AET Procedure 01-LAB-050, which is performed in general accordance with ASTM: D422 and AASHTO: T88.

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
AR:	Sample of material obtained from cuttings blown out the top of the borehole during air rotary procedure.
B, H, N:	Size of flush-joint casing
CAS:	Pipe casing, number indicates nominal diameter in inches
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights.
DP:	Direct push drilling; a 2.125 inch OD outer casing with an inner 1½ inch ID plastic tube is driven continuously into the ground.
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RDA:	Rotary drilling with compressed air and roller or drag bit.
RDF:	Rotary drilling with drilling fluid and roller or drag bit
REC:	In split-spoon (see notes), direct push and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
SS:	Standard split-spoon sampler (steel; 1.5" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
$\underline{\nabla}$:	Water level directly measured in boring
$\underline{\nabla}$:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (<u>approximate</u>)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remolded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES
(Calibrated Hammer Weight)

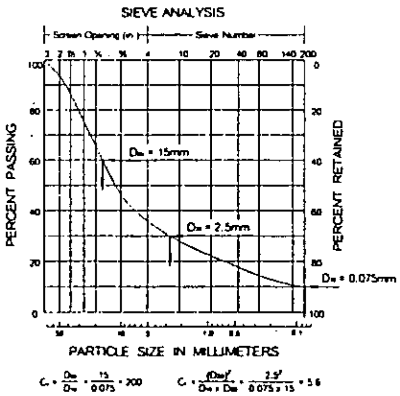
The standard penetration test consists of driving a split-spoon sampler with a drop hammer (calibrated weight varies to provide N_{60} values) and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM: D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

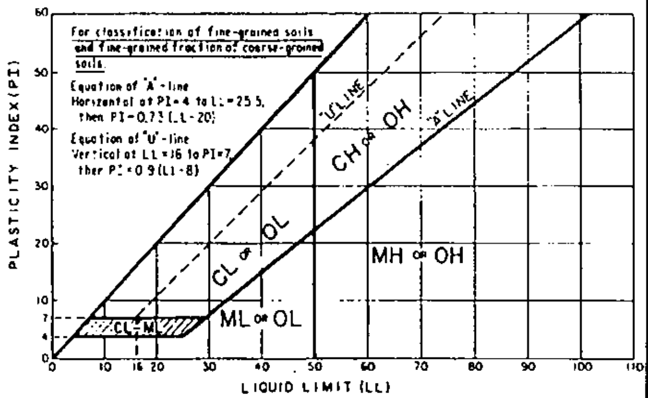
The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM: D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$C_u \geq 4$ and $1 \leq C_c \leq 3$[E]	GW	Well graded gravel[F]
			$C_u < 4$ and/or $1 > C_c > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$C_u \geq 6$ and $1 \leq C_c \leq 3$[E]	SW	Well-graded sand[I]
			$C_u < 6$ and/or $1 > C_c > 3$[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	$\frac{\text{Liquid limit–oven dried}}{\text{Liquid limit – not dried}} < 0.75$	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	$\frac{\text{Liquid limit–oven dried}}{\text{Liquid limit – not dried}} < 0.75$	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]





Plasticity Chart

Notes

[A] Based on the material passing the 3-in (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols:
- GW-GM well-graded gravel with silt
- GW-GC well-graded gravel with clay
- GP-GM poorly graded gravel with silt
- GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12% fines require dual symbols:
- SW-SM well-graded sand with silt
- SW-SC well-graded sand with clay
- SP-SM poorly graded sand with silt
- SP-SC poorly graded sand with clay

[E] $C_u = D_{60}/D_{10}$, $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.

[K] If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

[L] If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.

[M] If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI≥4 and plots on or above "A" line.

[O] PI<4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

[R] Fiber Content description shown below.

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition
(MC Column)

D (Dry):	Absense of moisture, dusty, dry to touch.
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").
W (Wet/ Waterbearing):	Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.
F (Frozen):	Soil frozen

Layering Notes

Laminations:	Layers less than ½" thick of differing material or color.
Lenses:	Pockets or layers greater than ½" thick of differing material or color.

Peat Description

Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. *Slightly organic* used for borderline cases.

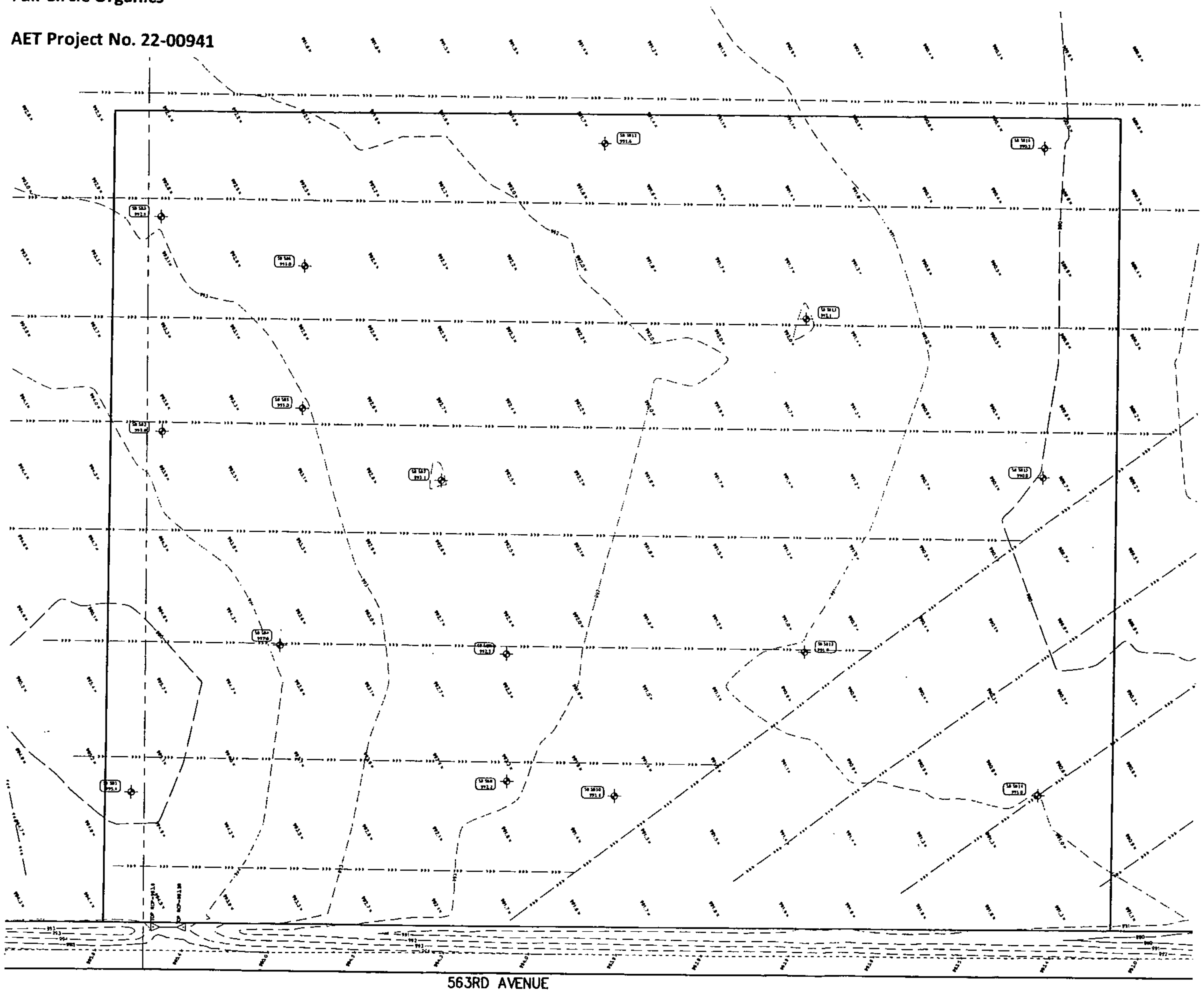
Root Inclusions

With roots:	Judged to have sufficient quantity of roots to influence the soil properties.
Trace roots:	Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.

Figure 1 – Soil Boring Locations

Full Circle Organics

AET Project No. 22-00941



LEGEND

FOUND MONUMENT	WATERMAIN	EASEMENT LINE
SET MONUMENT	SANITARY SEWER	SETBACK LINE
ELECTRIC METER	STORM SEWER	RIGHT OF ACCESS
LIGHT	FLARED END SECTION	CONCRETE CURB
AIR CONDITIONER	ELECTRIC TRANSFORMER	BUILDING LINE
GUY ANCHOR	TELEPHONE PEDESTAL	BUILDING CANOPY
HANDICAP STALL	GAS METER	BITUMINOUS SURFACE
UTILITY POLE	OVERHEAD WIRE	CONCRETE SURFACE
GUARD POST	CHAIN LINK FENCE	LANDSCAPE SURFACE
BOLLARD	IRON FENCE	DECIDUOUS TREE
SIGN	WIRE FENCE	CONIFEROUS TREE
	WOOD FENCE	

GENERAL NOTES

1. SITE IS LOCATED AT LATITUDE N45.3213 LONGITUDE W95.8052

NORTH

0 40 80

SCALE IN FEET

mfra

engineering surveying planning energy

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Client
MFS FARMS LLC & FULL CIRCLE ORGANICS

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

Certification

PRELIMINARY

Summary

Designed: MCB Drawn: ERW
Approved: MCB Book / Page:
Phase: PRELIMINARY Initial Issue: 11/22/2011

Revision History

No. Date By Submittal / Revision

Sheet Title
EXISTING CONDITIONS

Sheet No. Revision
C2.01

Project No. MFS19051

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-1 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: 995.4

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–3	FILL, mixture of lean clay and fat clay, trace roots, dark brown and brownish gray, a little black (plowed zone)	FILL	9	M	SS	4	28				
			9	M	SS	8	24				
3–6.5	LEAN CLAY, gray and brown mottled, a little light gray, stiff, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL					29				
			11	M	SS	14	20				
6.5–14	SANDY LEAN CLAY, a little gravel, light brownish gray, a little brown, stiff to very stiff, laminations of fine silty sand (CL)	TILL	13	M	SS	16	22				
			16	M	SS	18	22				
			15	M	SS	18	22				
14–16	SANDY LEAN CLAY, a little gravel, grayish brown, a little brown, very stiff, laminations of sand (CL)		21	M	SS	18	20				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	3.25" HSA	11/7/11	2:25	16.0	14.5	16.0		None
BORING COMPLETED:	11/7/11							
DR: JM	LG: JMM Rig: 68C							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-2 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 993.8 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, trace roots, black (plowed zone)	FILL	8	M	SS	10	28				
2–2.5	FILL, mixture of lean clay and fat clay, a little sand, trace roots, gray and black (plowed zone)		9	M	SS	12	24				
2.5–5	LEAN CLAY, gray and brown mottled, a little light gray, stiff, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL					33				
					TW	24			62	21	87
5–16	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff to very stiff, laminations of fine silty sand (CL)	TILL	9	M	SS	16					
			16	M	SS	16	22				
			15	M	SS	18	22				
			23	M	SS	16	20				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	**3.25" HSA**	**11/7/11**	**5:06**	**16.0**	**14.5**	**16.0**		**None**

BORING COMPLETED: **11/7/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-3 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: 992.3

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2.5	FILL, mostly fat clay, trace roots, black (plowed zone)	FILL	8	M	SS	4	27				
2.5–4	FILL, mixture of lean clay and fat clay, gray and black (plowed zone)		9	M	SS	6	27				
4–6.5	LEAN CLAY, gray and brown mottled, a little light gray, firm, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	8	M	SS	12	32				
6.5–11.5	SANDY LEAN CLAY, a little gravel, light brownish gray, a little brown, stiff to very stiff, laminations of fine silty sand (CL)	TILL	10	M	SS	16	22				
			12	M	SS	16	21				
11.5–14	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, very stiff, laminations of fine silty sand and sand (CL)		23	M	SS	18	20				
14–16	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of medium waterbearing sand and fine silty sand (CL)		14	M/W	SS	16	25				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	**3.25" HSA**							
		11/7/11	**4:10**	**11.0**	**9.5**	**11.0**		**None**
		11/7/11	**4:18**	**16.0**	**14.5**	**15.3**		**15.2**
BORING COMPLETED: **11/7/11**		**11/7/11**	**4:25**	**16.0**	**14.5**	**15.4**		**None**
DR: **JM** LG: **JMM** Rig: **68C**								

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-4 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 993.8 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, dark brown (plowed zone)	FILL	9	M	SS	6	23				
2–4	FILL, mostly fat clay, trace roots, gray and black (plowed zone)		10	M	SS	6	25 33				
4–6.5	LEAN CLAY, trace roots, brown and gray mottled, stiff, laminations of silt (CL)	TILL	10	M	SS	10	39				
6.5–11	SANDY LEAN CLAY, a little gravel, light brownish gray, a little brown to brownish gray, a little brown, firm to stiff, laminations of fine silty sand (CL)		8	M	SS	18	30				
			15	M	SS	16	24				
11	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-9½'	**3.25" HSA**	**11/7/11**	**2:56**	**11.0**	**9.5**	**10.9**		**None**

BORING COMPLETED: **11/7/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-5 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 993.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–3	FILL, mixture of fat clay, slightly organic and lean clay, trace roots, black and brownish gray (plowed zone)	FILL	7	M	SS	4	25				
			9	M	SS	6	27				
3–4	LEAN CLAY, gray, a little black and light gray, stiff laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL					29				
4–6.5	LEAN CLAY WITH SAND, gray, a little brown, firm, laminations of sandy silt (CL)	TILL	8	M	SS	16	29				
6.5–8.5	SANDY LEAN CLAY, a little gravel, grayish brown, a little brown, stiff, laminations of fine silty sand (CL)		11	M	SS	18	23				
	END OF BORING										

DEPTH:	DRILLING METHOD
0-7'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/7/11	3:20	8.5	7.0	8.5		None

BORING COMPLETED: 11/7/11

DR: JM LG: JMM Rig: 68C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-6 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 992.9 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
1	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	7	M	SS	10	28				
2–3	FILL, mostly lean clay, a little fat clay, gray, a little black (plowed zone)		9	M	SS	2	31				
4–6	LEAN CLAY, gray and brown mottled, a little light gray, stiff, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	9	M	SS	18	42				
7–8	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)	TILL	12	M	SS	14	22				
	END OF BORING										

DEPTH:	DRILLING METHOD
0-7'	3.25" HSA

BORING COMPLETED: 11/7/11

DR: JM LG: JMM Rig: 68C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/7/11	3:40	8.5	7.0	8.5		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-7 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **993.1**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	10	M	SS	4	24				
2–4	FAT CLAY, brownish gray, firm (CH)	FINE ALLUVIUM	7	M	SS	6	29				
4–9	LEAN CLAY, gray and brown mottled, stiff, laminations of silt (CL)		9	M	SS	8	36				
			9	M	SS	12	32				
9–16	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff to very stiff, laminations of fine silty sand (CL)	TILL	11	M	SS	16	26				
			14	M	SS	18	23				
			18	M	SS	14	21				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-14½'	3.25" HSA

BORING COMPLETED: **11/8/11**

DR: **JM** LG: **JMM** Rig: **68C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/8/11	10:07	16.0	14.5	15.8		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-8 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **992.3**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–3	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	9	M	SS	2	20				
			9	M	SS	8	26				
3–4	LEAN CLAY, gray, a little light gray, stiff, laminations of silt (CL)	FINE ALLUVIUM					30				
4–9	LEAN CLAY, gray and brown mottled, firm, laminations of sandy silt (CL)		6	M	SS	12	31				
			7	M	SS	14	35				
9–11.5	LEAN CLAY, brownish gray, a little brown, stiff, laminations of sandy silt (CL)		13	M	SS	16	33				
11.5–13.5	LEAN CLAY, gray, stiff, laminations of fine sand (CL)		10	M	SS	16	30				
	END OF BORING										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-12'	3.25" HSA	11/8/11	8:10	13.5	12.0	13.4		None

BORING COMPLETED: **11/8/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-9 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 992.5 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	9	M	SS	4	24				
2–4	FAT CLAY, gray, a little light gray, firm, laminations of silt (CH)	FINE ALLUVIUM OR WEATHERED TILL	8	M	SS	4	29				
4–9	LEAN CLAY, gray and brown mottled, firm, laminations of sandy silt (CL)		8	M	SS	8	38				
			8	M	SS	14	26				
9–13.5	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)		12	M	SS	16	23				
			14	M	SS	16	23				
	END OF BORING										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-12'	3.25" HSA	11/8/11	9:32	13.5	12.0	13.5		None

BORING COMPLETED: 11/8/11

DR: JM LG: JMM Rig: 68C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-10 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 991.8 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–4	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	7	M	SS	10	22				
			9	M	SS	2	22				
4–6.5	LEAN CLAY, gray and brown mottled, firm, laminations of sandy silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	6	M	SS	12	40				
6.5–9	LEAN CLAY, a little gravel, gray and brown mottled, firm, laminations of sandy silt (CL)		8	M	SS	14	33				
9–11.5	LEAN CLAY WITH SAND, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)	TILL	11	M	SS	14	30				
11.5–14	LEAN CLAY WITH SAND, gray, stiff (CL)		11	M	SS	18	29				
14–18	SANDY LEAN CLAY, a little gravel, gray, firm (CL)		7	M	SS	18	25				
18–21	SANDY LEAN CLAY, a little gravel, gray, stiff, laminations of fine sand (CL)		12	M	SS	16	20				
21	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-19½'	**3.25" HSA**	**11/8/11**	**8:56**	**21.0**	**19.5**	**21.0**		**None**

BORING COMPLETED: **11/8/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941**   LOG OF BORING NO. **SB-11 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **991.6**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	10	M	SS	3	23				
2–3	FILL, mostly fat clay, slightly organic, a little fat clay, trace roots, black, a little brownish gray (plowed zone)		10	M	SS	8	28 31				
3–4	LEAN CLAY, gray mottled, a little brown and light gray, stiff, laminations of sandy silt and silt (CL)	FINE ALLUVIUM OR WEATHERED TILL									
4–6	SANDY LEAN CLAY, a little gravel, brown, a little gray, firm, laminations of sandy silt (CL)	TILL	8	M	SS	18	26				
6–9	LEAN CLAY WITH SAND, gray, a little brown,stiff, laminations of sandy silt (CL)		9	M	SS	16	34				
9–16	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)		12	M	SS	20	25				
			14	M	SS	16	18				
			13	M	SS	16	21				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-14½'	3.25" HSA

BORING COMPLETED: **11/8/11**

DR: **JM** LG: **JMM** Rig: **68C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/8/11	10:46	16.0	14.5	15.9		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-12 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 991.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	8	M	SS	3	29				
2–4	LEAN CLAY, trace roots, gray and brown mottled, a little light gray, stiff, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	10	M	SS	3	28				
4–6.5	LEAN CLAY, gray and brown mottled, stiff, laminations of silt (CL)	TILL	9	M	SS	8	38				
6.5–9	SANDY LEAN CLAY, brown, a little gray, stiff (CL)		9	M	SS	16	25				
9–11	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)		15	M	SS	16	25				
11	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-9½'	3.25" HSA

BORING COMPLETED: **11/8/11**

DR: **JM** LG: **JMM** Rig: **68C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/8/11	12:02	11.0	9.5	11.0		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 22-00941 LOG OF BORING NO. SB-13 (p. 1 of 1)

PROJECT: Full Circle Organics; Good Thunder, MN

SURFACE ELEVATION: 992.1

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	7	M	SS	4	26				
2–4	FILL, mostly fat clay, slightly organic, trace roots, gray and black (plowed zone)		9	M	SS	4	29				
4–6.5	LEAN CLAY, brown and gray mottled, firm, laminations of sandy silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	7	M	SS	8	39				
6.5–9	SANDY LEAN CLAY, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)	TILL	10	M	SS	16	27				
9–11	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)		15	M	SS	14	22				

END OF BORING

DEPTH:	DRILLING METHOD
0-9½'	3.25" HSA

BORING COMPLETED: 11/8/11

DR: JM LG: JMM Rig: 68C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/8/11	11:15	11.0	9.5	11.0		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

03/2011 01-DHR-060

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-14 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 991.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	11	M	SS	10	25				
2–4	FILL, mixture of fat clay and fat clay, slightly organic, trace roots, gray and black (plowed zone)		10	M	SS	4	28				
4–9	LEAN CLAY, brown and gray mottled, firm, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	8	M	SS	12	39				
			8	M	SS	14	38				
9–14	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown to brownish gray, a little brown, stiff, laminations of fine silty sand (CL)	TILL	12	M	SS	16	25				
			13	M	SS	18	31				
14–16	SANDY LEAN CLAY, a little gravel, gray, a little brown, very stiff, laminations of fine silty sand (CL)		17	M	SS	14	20				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	3.25" HSA	11/8/11	12:38	16.0	14.5	16.0		None

WATER LEVEL MEASUREMENTS

BORING COMPLETED: **11/8/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-15 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **990.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	6	M	SS	8	29				
2–5	FILL, mixture of fat clay, slightly organic and fat clay, trace roots, black and gray (plowed zone)		8	M	SS	4	29				
5–9	LEAN CLAY, brown and gray mottled, firm, laminations of sandy silt (CL)	FINE ALLUVIUM OR WEATHERED TILL		M	TW	18			55	29	98
			8	M	SS	18	33				
9–11.5	LEAN CLAY WITH SAND, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)	TILL	10	M	SS	20	29				
11.5–14	SANDY LEAN CLAY, a little gravel, gray, a little brown, stiff, laminations of fine silty sand (CL)		13	M	SS	16	21				
14–16	SANDY LEAN CLAY, a little gravel, gray, stiff (CL)		15	M	SS	16	20				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-14½'	3.25" HSA

BORING COMPLETED: 11/8/11

DR: JM LG: JMM Rig: 68C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/8/11	1:17	16.0	14.5	15.8		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-16 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 990.1 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	8	M	SS	4	28				
2–4	FILL, mixture of fat clay, slightly organic, and fat clay, trace roots, black and brownish gray (plowed zone)		9	M	SS	6	24				
4–6.5	LEAN CLAY, brown and gray mottled, stiff, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	10	M	SS	14	38				
6.5–9	SANDY LEAN CLAY, a little gravel, light grayish brown, a little brown, stiff, laminations of fine silty sand (CL)	TILL	9	M	SS	18	28				
9–16	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown to gray, a little brown, stiff, laminations of fine silty sand (CL)		14	M	SS	16	26				
			12	M	SS	16	21				
			15	M	SS	16	23				
16	END OF BORING										

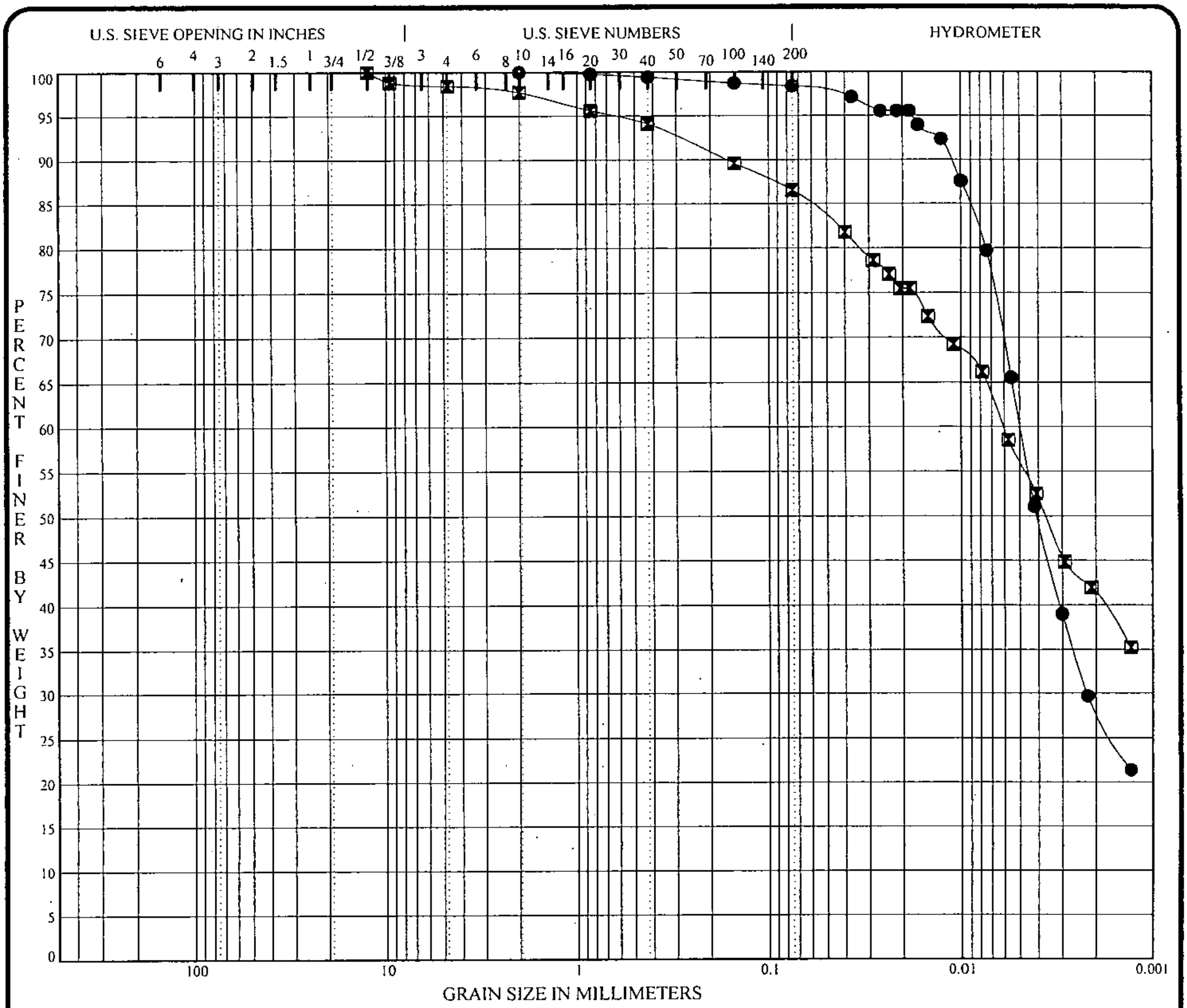
DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	3.25" HSA	11/8/11	1:56	16.0	14.5	16.0		None

BORING COMPLETED: 11/8/11

DR: JM LG: JMM Rig: 68C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
● SB-15	4.0'	**FAT CLAY**		**55**	**29**	**26**		
⊠ SB-2	4.0'	**FAT CLAY**		**62**	**21**	**41**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● SB-15	4.0'	**2.00**	**0.00**	**0.002**		**0.0**	**1.6**	**38.0**	**60.4**
⊠ SB-2	4.0'	**12.50**	**0.01**			**1.6**	**11.9**	**30.4**	**56.1**

PROJECT **Full Circle Organics Cornfield;**

AET JOB NO. **22-00941**
DATE **11/7/11**

AMERICAN ENGINEERING TESTING, INC.

GRADATION CURVES

REPORT OF TEST ORGANIC CONTENT

PROJECT:
FULL CIRCLE ORGANICS
COMPOST SITE
56437 164TH STREET
GOOD THUNDER, MINNESOTA 56037

REPORTED TO:
MFS FARMS, LLC
C/O MCCOMBS FRANKS ROOS ASSOC.
14800 28TH AVENUE N, SUITE 140
PLYMOUTH, MN 55447
ATTN: MICHAEL C. BRANDT,

AET PROJECT NO: 22-00941

DATE: NOVEMBER 23, 2011

RESULTS:

BORING NUMBER (DEPTH)	SB-2 (0-2 FEET)	
Organic Content, %	4.955	ASTM: D2974
BORING NUMBER (DEPTH)	SB-3 (0-2 FEET)	
Organic Content, %	6.58	ASTM: D2974
BORING NUMBER (DEPTH)	SB-4 (0-2 FEET)	
Organic Content, %	7.755	ASTM: D2974
BORING NUMBER (DEPTH)	SB-5 (0-2 FEET)	
Organic Content, %	5.584	ASTM: D2974
BORING NUMBER (DEPTH)	SB-5 (2-3 FEET)	
Organic Content, %	5.203	ASTM: D2974
BORING NUMBER (DEPTH)	SB-5 (3-3.5 FEET)	
Organic Content, %	2.151	ASTM: D2974
BORING NUMBER (DEPTH)	SB-6 (0-2 FEET)	
Organic Content, %	7.008	ASTM: D2974
BORING NUMBER (DEPTH)	SB-6 (2-3.5 FEET)	
Organic Content, %	2.572	ASTM: D2974
BORING NUMBER (DEPTH)	SB-10 (0-2 FEET)	
Organic Content, %	6.173	ASTM: D2974
BORING NUMBER (DEPTH)	SB-13 (0-2 FEET)	
Organic Content, %	8.327	ASTM: D2974

REMARKS: The samples were submitted to our laboratory on November 21, 2011 by Derek Van Heuveln of American Engineering Testing, Inc.

Report Prepared and Reviewed By:
American Engineering Testing, Inc.

Derek Van Heuveln
Staff Engineer II

AMERICAN ENGINEERING TESTING, INC.

AET, Inc
American Engineering Testing
550 Cleveland Ave. North
St. Paul, MN 55114
651-659-9001

Hydraulic Conductivity/Permeability

ASTM D 5084

AET Project No.: 22-00941 Project Name: Full Circle Organics Cornfield

Project Location: Good Thunder, MN Engineer: DVH

Date Submitted: 11/18/2011 By: DVH Date Tested: 11/23/2011 Tested By: BAP

Sample Description: Gray/Brown Mottled Lean Clay (CL)

Boring Number: SB-2 Sample No.: P-1 Depth: 4'-6'

Initial Sample		**Final Sample**			
Sample Wt: (g)	1039.03	Sample Wt: (g)	1056.43	Specific Gravity:	2.65
Length: (in)	5.160	Length: (in)	5.176	Assumed/Tested:	Assumed
Diameter: (in)	2.846	Diameter: (in)	2.854		
Area: (in^2)	6.361	Area: (in^2)	6.398	Permeant Liquid:	Deaired Tap Water
Volume: (cf)	0.0190	Volume: (cf)	0.0192	Cell Pressure: (psi)	80
MC: (%)	27.71	MC: (%)	29.84	Consolidation Stress: (psi)	4.0
Dry Unit Wt: (pcf)	94.49	Dry Unit Wt: (pcf)	93.62	Burette Area: (cm)	1.00
Saturation: (%)	97.90	Saturation: (%)	103.20		

Average Hydraulic Conductivity at 20 oC: 1.25E-06 cm/sec

3.55E-03 ft/day

Reviewed By: DLS.V

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St. Paul, MN 55114
651-659-9001

Hydraulic Conductivity/Permeability
ASTM D 5084

AET Project No.: 22-00941 Project Name: Full Circle Organics Cornfield

Project Location: Good Thunder, MN Engineer: DVH

Date Submitted: 11/18/2011 By: DVH Date Tested: 11/23/2011 Tested By: BAP

Sample Description: Gray/Brown Mottled Lean Clay (CL)

Boring Number: SB-15 Sample No.: P-2 Depth: 4'-6'

Initial Sample		Final Sample			
Sample Wt: (g)	969.94	Sample Wt: (g)	975.92	Specific Gravity:	2.65
Length: (in)	5.170	Length: (in)	5.172	Assumed/Tested:	Assumed
Diameter: (in)	2.832	Diameter: (in)	2.847		
Area: (in^2)	6.299	Area: (in^2)	6.364	Permeant Liquid:	Deaired Tap Water
Volume: (cf)	0.0188	Volume: (cf)	0.0190	Cell Pressure: (psi)	80
MC: (%)	40.22	MC: (%)	41.08	Consolidation Stress: (psi)	4.0
Dry Unit Wt: (pcf)	80.98	Dry Unit Wt: (pcf)	80.08	Burette Area: (cm)	1.00
Saturation: (%)	102.28	Saturation: (%)	102.24		

Average Hydraulic Conductivity at 20 oC: 1.05E-07 cm/sec

2.98E-04 ft/day

Reviewed By: D. S. V[illegible]

Appendix B

Geotechnical Report Limitations and Guidelines for Use

Appendix B
Geotechnical Report Limitations and Guidelines for Use
Report No. 22-00941

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by ASFE[1], of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Geotechnical Services are Performed for Specific Purposes, Persons, and Projects
Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. And no one, not even you, should apply the report for any purpose or project except the one originally contemplated.

B.2.2 Read the Full Report
Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

B.2.3 A Geotechnical Engineering Report is Based on A Unique Set of Project-Specific Factors
Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typically factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes, even minor ones, and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

B.2.4 Subsurface Conditions Can Change
A geotechnical engineering report is based on conditions that existed at the time the study was performed. Do not rely on a geotechnical engineering report whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

1 ASFE, 8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733: www.asfe.org

B.2.5 Most Geotechnical Findings Are Professional Opinions
Site exploration identified subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

B.2.6 A Report's Recommendations Are Not Final
Do not overrely on the construction recommendations included in your report. Those recommendations are not final, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

B.2.7 A Geotechnical Engineering Report Is Subject to Misinterpretation
Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

B.2.8 Do Not Redraw the Engineer's Logs
Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognizes that separating logs from the report can elevate risk.

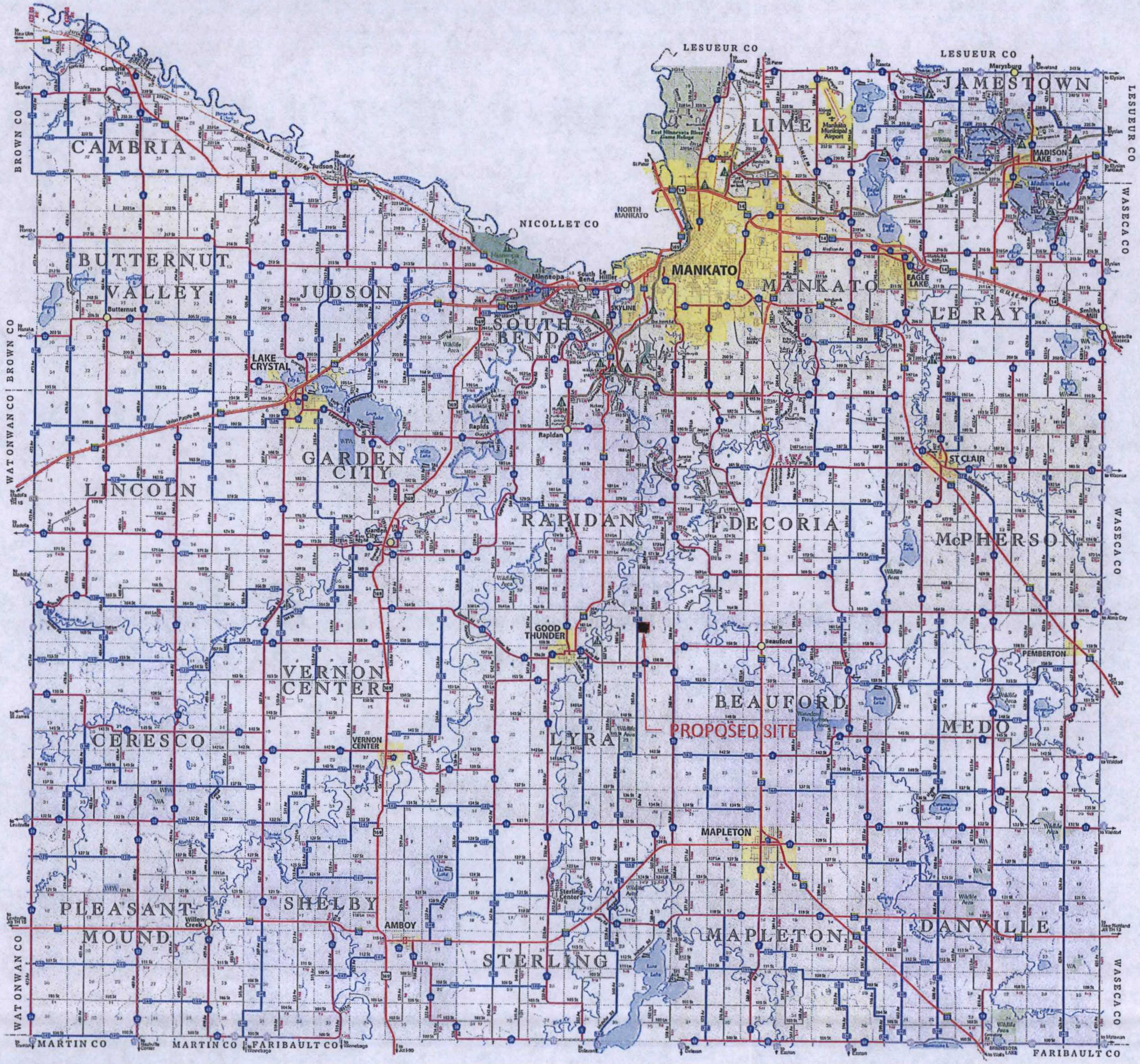
B.2.9 Give Contractors a Complete Report and Guidance
Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In the letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

B.2.10 Read Responsibility Provisions Closely
Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their report. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.11 Geoenvironmental Concerns Are Not Covered
The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. Do not rely on an environmental report prepared for someone else.

Appendix C

Zoning and Location Map



*THE INFORMATION USED TO CREATE THIS MAP HAS BEEN OBTAINED FROM BLUE EARTH COUNTY'S WEBSITE.

NORTH

NOT TO SCALE

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Client
FULL CIRCLE ORGANICS, LLC.

Project
COMPOSTING SITE

Location
LYRA TOWNSHIP

Certification

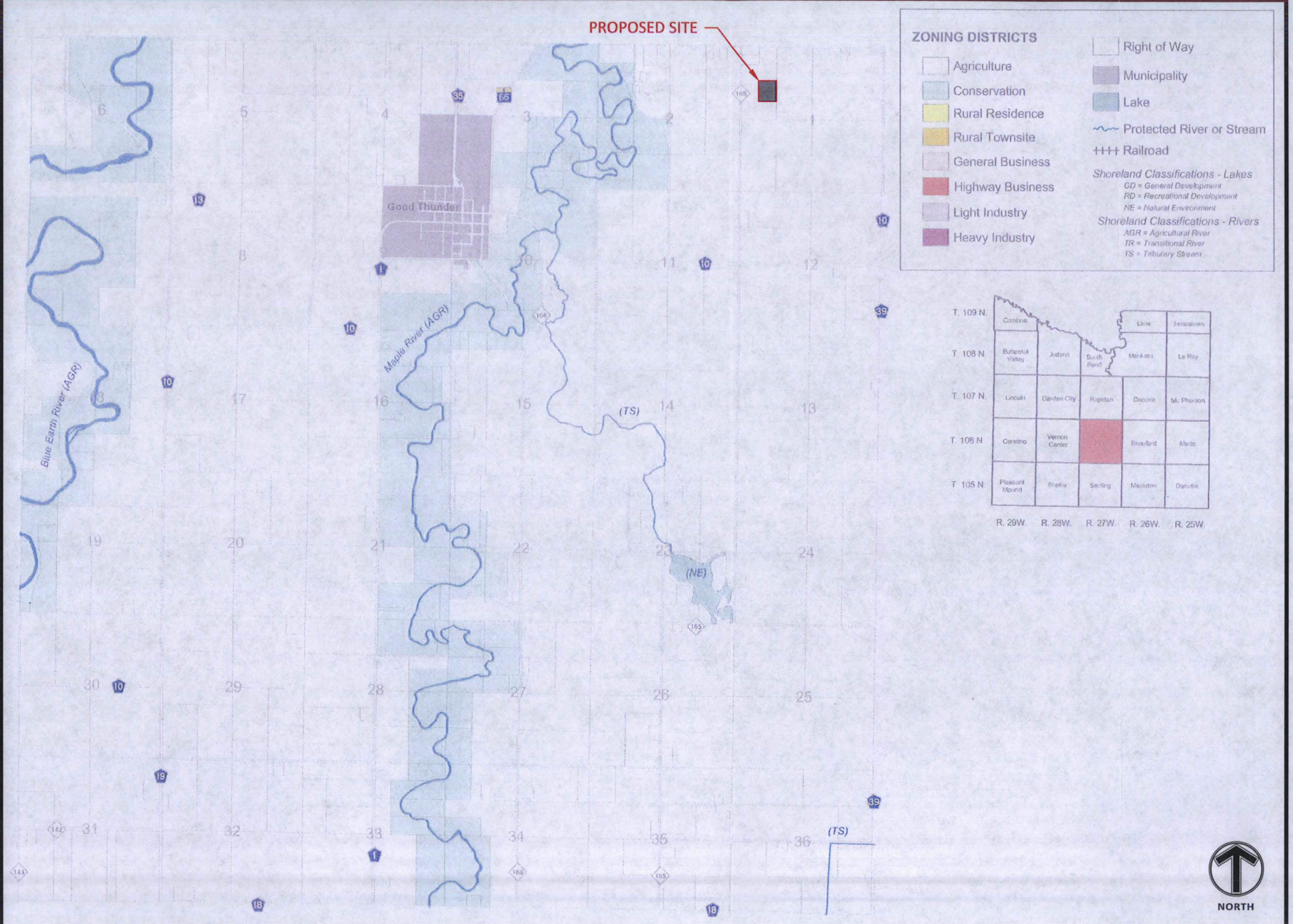
Summary
Approved: MCB Drawn: ERW

Revision History
No. Date By Submittal / Rev.

Sheet Title
SITE LOCATION EXHIBIT

Sheet No. Revision
EX-A

Project No. MFS19051



*THE INFORMATION USED TO CREATE THIS MAP HAS BEEN OBTAINED FROM BLUE EARTH COUNTY'S WEBSITE.

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Client
FULL CIRCLE ORGANICS, LLC.

Project
COMPOSTING SITE

Location
LYRA TOWNSHIP

Certification

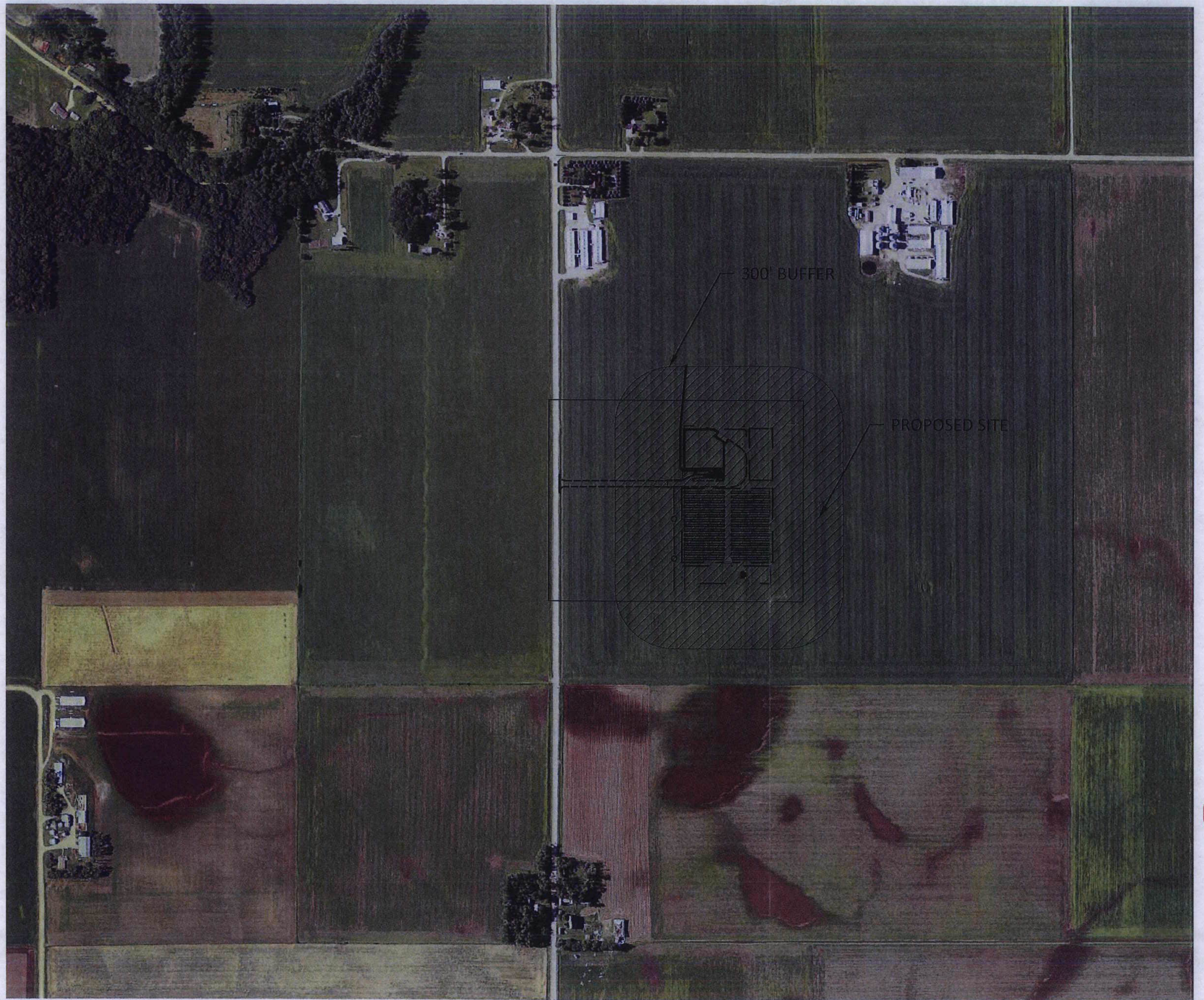
Summary
Approved: MCB Drawn: ERW

Revision History
No. Date By Submittal / Rev.

Sheet Title
ZONING EXHIBIT

Sheet No. Revision
EX-B

Project No. MFS19051



DENOTES 300' WELL CONSTRUCTION BUFFER

NORTH

0 500

SCALE IN FEET

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Client
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Project
COMPOSTING SITE

Location
LYRA TOWNSHIP

Certification

Summary
Approved: MCB Drawn: ERW

Revision History
No. Date By Submittal / Rev.

Sheet Title
SITE LOCATION EXHIBIT

Sheet No. Revision
EX-C

Project No. MFS19051

NORTH

0 1000 2000

SCALE IN FEET

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Client
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Project
COMPOSTING SITE

Location
LYRA TOWNSHIP

Certification

Summary
Approved: MCB Drawn: ERW

Revision History
No. Date By Submittal / Rev.

Sheet Title
ADJACENT LANDOWNERS

Sheet No. Revision
EX-D

Project No. MFS19051

Appendix D

Operational Check Lists

Appendix D-1

Daily Start-up

Daily Start-up (tasks to be completed in the order listed) .

- ✓ **Perimeter Check**
  - o Drive past exit and entrance roadway, visually checking that gates are locked and padlocked.
  - o Check for litter along roadway.

- ✓ **Enter Facility**
  - o Open Entrance gate at 563rd Avenue.
  - o Lock entrance roadway gate to the facility behind you.

- ✓ **Scan Facility**
  - o Drive around compost windrows to visually confirm the integrity of the windrows, and walk around building to ensure building integrity.

- ✓ **Open Processing Building and Ready for Operations**
  - o Unlock Building
  - o Turn-off alarm system
  - o Spread yard waste straw or wood chips on tipping floor. (Reminder: replenish blanket if needed during operations; process the day's blanket material after the last batch of source separated organics are sent through the grinder.)

- ✓ **Check Exterior Equipment**
  - o Use equipment checklist for operational check of loader, trommel, and other equipment.

- ✓ **Seasonal Roadway Servicing**
  - o Plow snow from access roadway around composting windrows.

- ✓ **Open Office**
  - o Turn on Computer
  - o Check phone messages
  - o Record any problems identified in initial facility scan and schedule appropriate actions such as litter clean-up, fix equipment, etc.

- ✓ **Open Gates**
  - o Open entrance and exit roadway gate.

Appendix D-2

Daily Shutdown

Daily Shutdown (tasks to be completed in the order listed)

- ✓ **Close Entrance Gates**
  - Close entrance roadway gates at 563rd Avenue.
- ✓ **Collect Equipment Keys**
  - Collect keys for heavy equipment.
  - Place in office key box and lock.
- ✓ **Close Processing Building**
  - Sweep working floor area.
  - Close and lock exterior doors.
  - Complete back-up of computer files.
  - Shutdown computer.
  - Turn on Phone answering machine.
  - Turn on security system
  - Lock office door.
- ✓ **Scan Facility**
  - Drive past compost windrows to confirm site and windrow integrity.
- ✓ **Close Exit Gates**
  - Close and lock exit roadway gates at 563rd Avenue.

Appendix D-3

Daily Log – Windrow Temperatures and Events

Daily Log – Windrow Temperatures and Events

- ✓ Obtain clipboard, log form for the day, marker, and prove from office.
- ✓ Record daily meteorological observations prior to beginning pod checks. Check and record thermometer reading and rain gauge/ snow gauge. Note wind speed and cloud cover at time of recording.
- ✓ Monitor the windrows in sequence, in ascending numerical order.
- ✓ Insert probe into center of windrow; wait until temperature has stabilized prior to recording temperature.
- ✓ Verify windrow number at sampling prior to data entry.
- ✓ Note status of turning at time of temperature reading.
- ✓ Note any adjustments to next turning based on reading.
- ✓ Record any unusual observations or occurrences (such as significant or unusual odor from windrows when sampling, power outage, etc.)

Date:	Day of Week (Circle one): Mon Tue Wed Thur Fri Sat Sun	
Time of Day:	(Cirle one): AM PM	Your Name:
Outdoor Temp: °F	Wind Conditions (Circle one): Calm Slight Breeze Steady Breeze Gusty Steady Strong Wind High Winds	
(Circle One): Cloudy Partly Cloudy Clear		Rain/Snow (Circle): inches since last record

Windrow No.	Sampling No.	Recorded Temp °F	Time of last Turning	Time of next Turning	Observations
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
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26					
27					
28					
29					

Appendix D-4

Unscheduled Shutdown

Unscheduled Shutdown

An unscheduled shutdown of the facility is most likely to occur as a result of severe weather or following a medical or other on-site emergency. If shutdown is due to an emergency, FOLLOW EMERGENCY RESPONSE STEPS AND PROCEDURES **BEFORE** starting the unscheduled shutdown cycle.

- ✓ Call Headquarters
  - Notify staff of the shutdown, its reasons, and expected duration.
  - If shutdown will clearly last for more than the balance of that day, then have headquarters staff notify regular customers.
  - If shutdown will be extended (due to heavy weather damage or other unusual event), then have headquarters staff notify Blue Earth County and MPCA.

- ✓ Close and Lock Entrance Roadway Gates
  - Obtain "Unscheduled Shutdown" signs from office (sign says: "Temporarily Closed – For Information Call Max at 612-282-9383").
  - Close and lock entrance roadway gate at 563rd Avenue and hang "Unscheduled Shutdown" sign on gate.

- ✓ Complete Routine On-site Operational and Closure Activities
  - Short Term Shutdown: Complete as many remaining activities as possible under conditions.
  - Extended Shutdown: Complete routine daily operational activities if possible. Either process all remaining organic material wastes or call hauler to pick up materials for disposal. Complete all other routine on-site closure activities.

- ✓ Close Exit Gates
  - Close and lock exit roadway gates to facility at 563rd Avenue.

Appendix D-5

Equipment Checklist

Equipment Checklist / Maintenance Record

- ✓ Complete checklist below everyday BEFORE putting the unit into service.
- ✓ Use the "Remarks" column for the following: type of fluids added; record any other scheduled or unscheduled maintenance of this equipment that takes place during the day, make a note of future actions that should be scheduled or questions to follow up later, etc. Follow Maintenance Policy and Procedures.
- ✓ Ask the supervisor if you are uncertain how to proceed or how to deal with an equipment problem. If an equipment problem could jeopardize the safety of the unit or its ability to operate, DO NOT proceed until you have notified your supervisor. Your supervisor MUST be informed of all such problems.

Month (circle): Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.					Equipment ID No.		Equipment Type (fill in)		
Day	Operator ID	Engine Oil	Coolant Level	Fuel Level	Hydraulic Fluid Level	Walk Around Check	Hours on Meter	Total Fluids Added	Remarks
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
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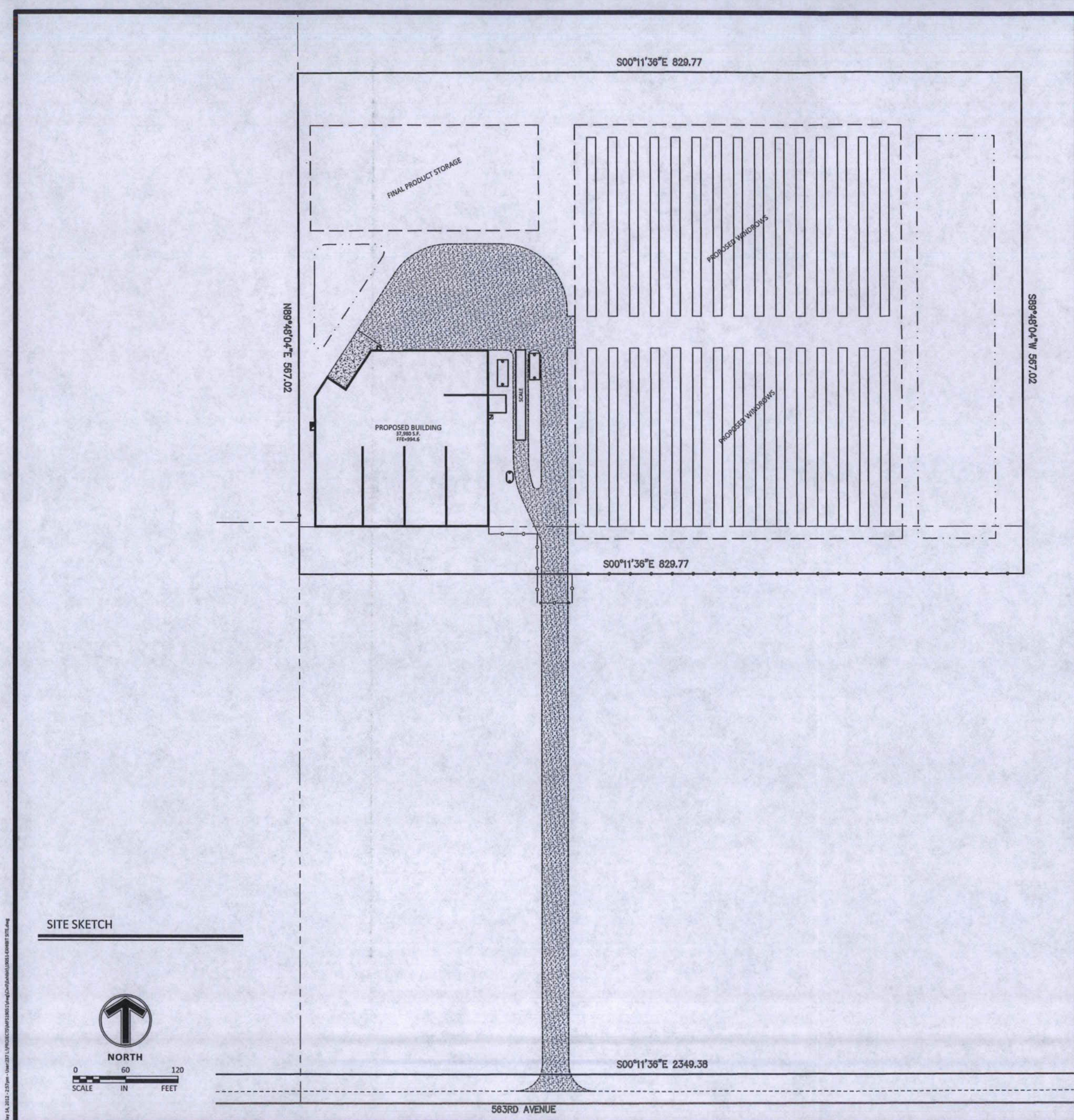
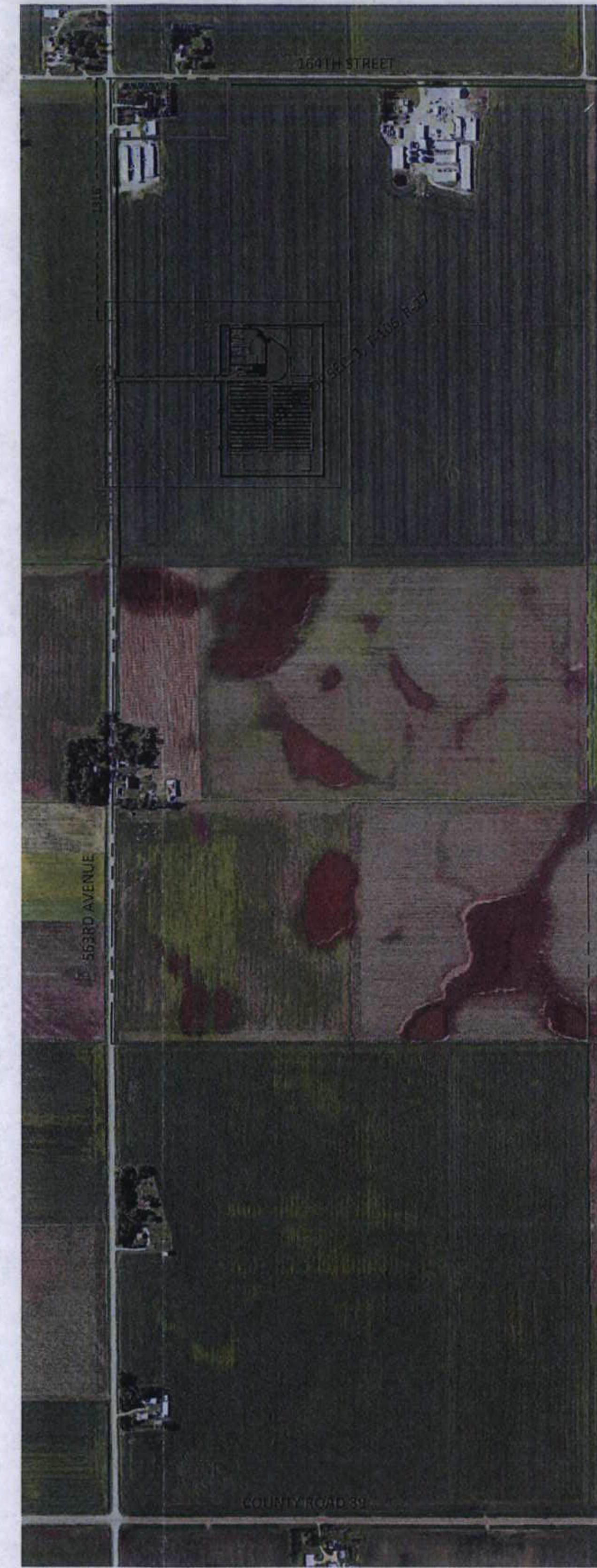
Appendix E

Site Plan



SITE SKETCH



VICINITY MAP

1" = 500'

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Client
FULL CIRCLE ORGANICS

Project
COMPOST SITE

Location
LYRA TOWNSHIP

BLUE EARTH COUNTY, MN

Certification

Summary
Designed: MCB Drawn: ERW
Approved: Book / Page:
Phase: PRELIMINARY Initial Issue: 07/26/2011

Revision History
No. Date By Submittal / Revision

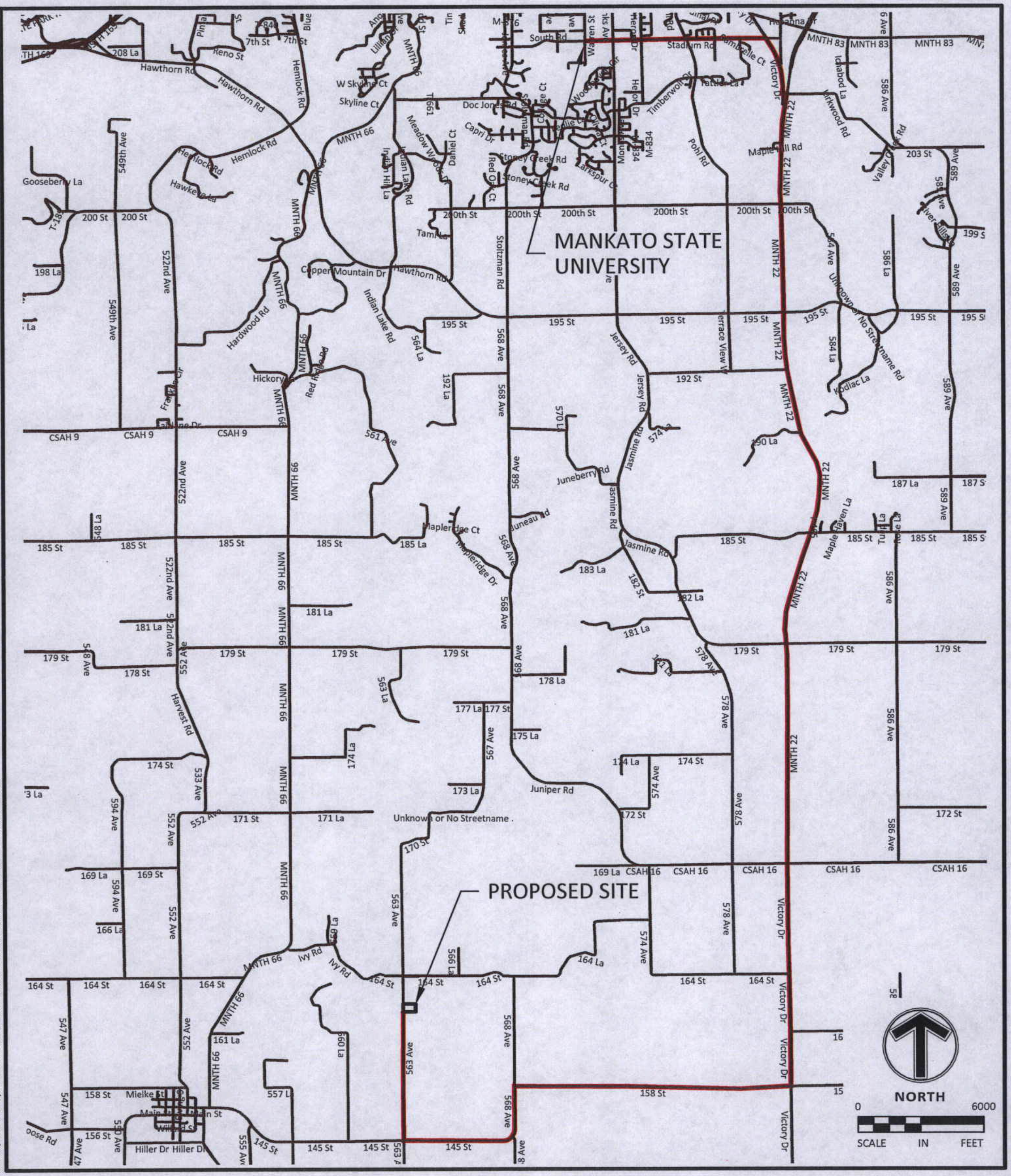
Sheet Title
SITE PLAN EXHIBIT

Sheet No. Revision
CP-4

Project No. MFS19051

Appendix F

Access Route Map



Oct 17, 2011 - 3:09pm - User:528 L:\PROJECTS\MFS19051\dwg\Civil\Exhibit\19051-EXHIBIT-B.dwg

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MFS Farms LLC
Full Circle Organics
Good Thunder
Route Exhibit

Designed: MCB
Drawn: ERW
Approved: MCB
Issued: 09/29/2011
Rev.:
Date:

Exhibit Number

B

Project No. MFS19079

Appendix G

Storage Calculations

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Full Circle Organics- Good Thunder Site

Phase 1 Storage Calculations.

Raw material: 100 lbs/cy

Windrow Material: 75 lbs/cy

Truck Loads per day	Tons per Load	Tons/CY	Volume CY/day	
8	4	0.05	640	Raw Material

Mixing Area Required:

Raw Material Volume/Day 640 CY

Mixed Volume 896 CY Assumes 40 % additional volume from carbon source

Pile Height	10	ft
Pile Length	90	ft
Pile Width	27	ft

Windrow Length per day: Assumes Mixed Volume will shrink by 70 %

Width:	10	ft			
Height:	9	ft			
Length	81	ft	Windrow Length	207	ft
Windrows Used F	0.4				

Capacity of Facility

Days in Mixing Area 4

Days in Windrow 21

Number of Windrows Req. 8

Full Circle Organics- Good Thunder Site
Ultimate Storage Calculations.

Raw material: 100 lbs/cy

Windrow Material: 75 lbs/cy

Truck Loads per day	Tons per Load	Tons/CY	Volume CY/day	
27	4	0.05	2160	Raw Material

Mixing Area Required:

Raw Material Volume/Day 2160 CY

Mixed Volume 3024 CY Assumes 40 % additional volume from carbon source

Pile Height	12	ft
Pile Length	90	ft
Pile Width	76	ft

Windrow Length per day: Assumes Mixed Volume will shrink by 70 %

Width:	10	ft			
Height:	9	ft			
Length	272	ft	Windrow Length	207	ft
Windrows Used Per Day	1.3				

Capacity of Facility

Days in Mixing Area	4
Days in Windrow	21
Number of Windrows Req.	28

Appendix H

Construction Plans & Specification

Final Site Development Plans
for
Full Circle Organics - Good Thunder Composting Facility
Blue Earth County, Minnesota
Presented by:
MFS Farms, LLC & Full Circle Organics

CONSULTANT CONTACT LIST:

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FULL CIRCLE ORGANICS
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MINNEAPOLIS, MN. 55417
612-282-9382
CONTACT: Max Milinkovich

CIVIL ENGINEER
MFRA
14800 28TH AVENUE, SUITE 140
PLYMOUTH, MN 55447
TEL 763-476-6010
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SURVEYOR
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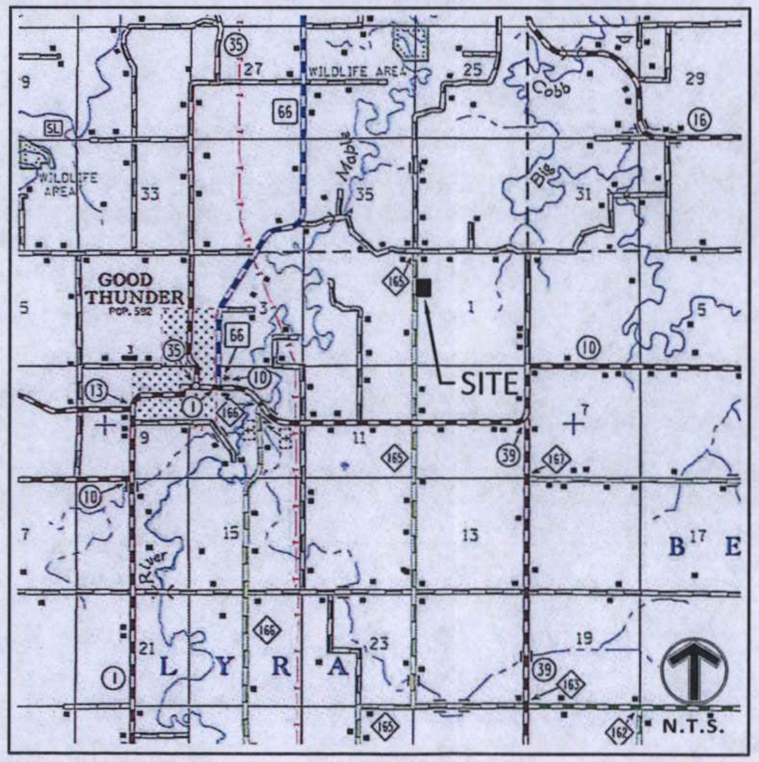
FAX 763-476-8532
CONTACT: Marcus Hampton RLS



VICINITY MAP
NO SCALE

SHEET INDEX

Sheet Number	Sheet Title
C1.01	COVER SHEET
C2.01	EXISTING CONDITIONS
C3.01	SITE PLAN
C3.02	SITE PLAN
C4.01	GRADING PLAN
C4.02	GRADING PLAN
C5.01	EROSION CONTROL PLAN
C5.02	EROSION CONTROL PLAN
C5.03	EROSION CONTROL DETAILS
C6.01	UTILITY PLAN
C6.02	OVERALL UTILITY PLAN
C6.03	DRAINTILE REMOVAL PLAN
C7.01	CONSTRUCTION DETAILS
C7.02	CONSTRUCTION DETAILS

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Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

Certification
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.

Michael C. Brandt
Registration No. 42661 Date: 02/17/2012

If applicable, contact us for a wet signed copy of this plan which is available upon request at MFRA, Inc., Plymouth, MN office.

Summary
Designed: MCB Drawn: ERW
Approved: MCB Book / Page:
Phase: FINAL Initial Issue: 12/13/2011

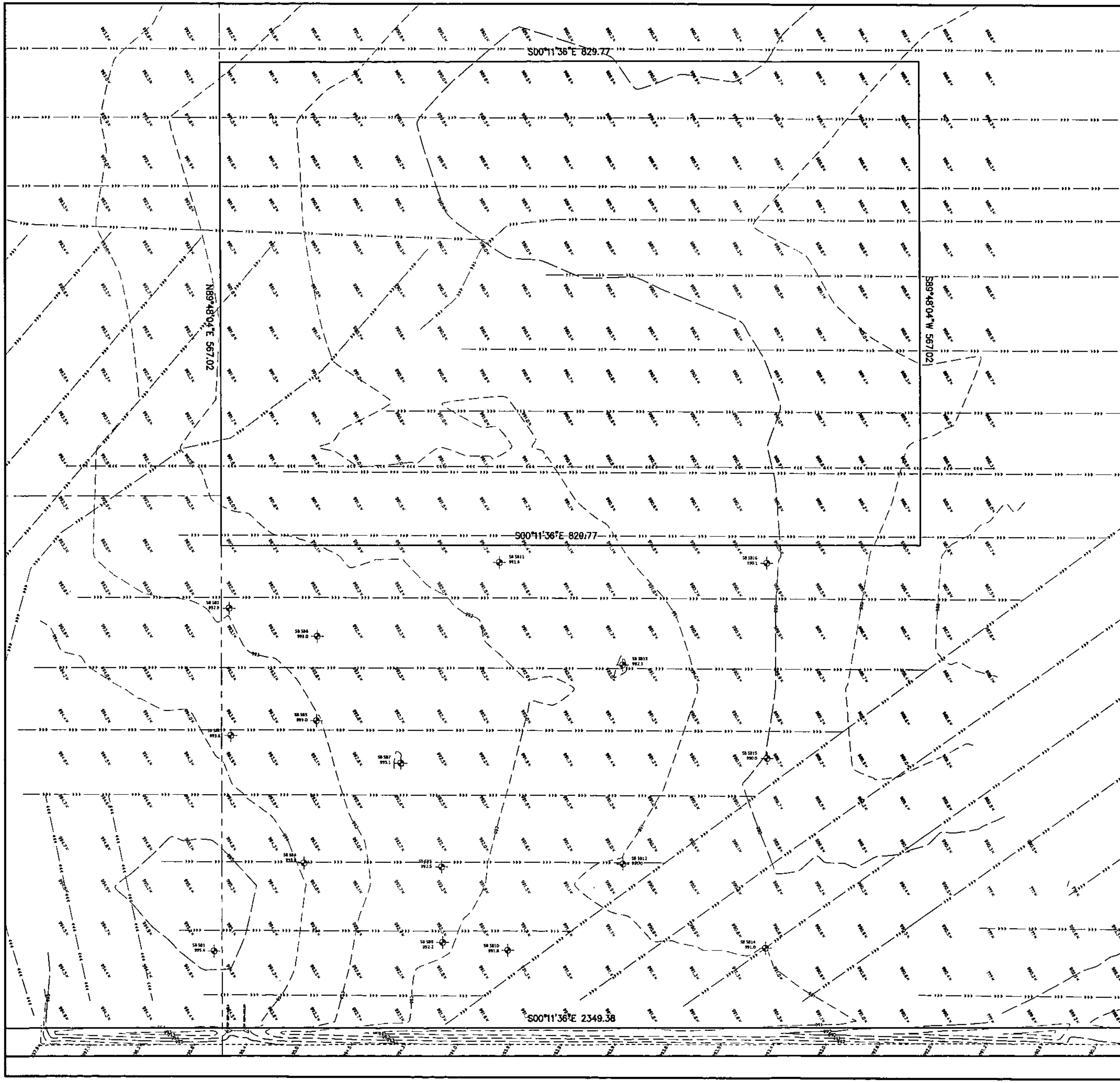
Revision History

No.	Date	By	Submittal / Revision
A	01/05/12	ERW	COUNTY COMMENTS
B	02/17/12	SEG	MPCA COMMENTS
C	05/10/12	JN	REVISED LOCATION

Sheet Title
COVER SHEET

Sheet No. C1.01 **Revision** C

Project No. MFS19051



LEGEND

FOUND MONUMENT	WATERMAIN	EASEMENT LINE
SET MONUMENT	SANITARY SEWER	SETBACK LINE
ELECTRIC METER	STORM SEWER	RIGHT OF ACCESS
LIGHT	FLARED END SECTION	CONCRETE CURB
AIR CONDITIONER	ELECTRIC TRANSFORMER	BUILDING LINE
GUY ANCHOR	TELEPHONE PEDESTAL	BUILDING CANOPY
HANDICAP STALL	GAS METER	BITUMINOUS SURFACE
UTILITY POLE	OVERHEAD WIRE	CONCRETE SURFACE
GUARD POST	CHAIN LINK FENCE	LANDSCAPE SURFACE
BOLLARD	IRON FENCE	DECIDUOUS TREE
SIGN	WIRE FENCE	CONIFEROUS TREE
	WOOD FENCE	

GENERAL NOTES

1. SITE IS LOCATED AT LATITUDE N45.3213 LONGITUDE W95.8052

DESCRIPTION

THE NORTHWEST QUARTER OF SECTION 1, TOWNSHIP 106N, RANGE 27W, EXCEPT THE NORTH 5 ACRES OF THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER OF THE NORTHWEST QUARTER THEREOF.

PROPERTY SUMMARY

TOTAL SITE AREA:	6,818,506 S.F.	OR	156.531 AC.	(GROSS)
COMPOST SITE AREA	435,600 S.F.	OR	10.0 AC.	
REMAINING SITE AREA	6,240,097 S.F.	OR	143.253 AC.	
EXISTING LESS 563RD AVE. RIGHT-OF-WAY:	77,534 S.F.	OR	1.780 AC.	
EXISTING LESS 164TH ST. RIGHT-OF-WAY:	65,275 S.F	OR	1.498 AC.	
	6,675,697 S.F.	OR	153.253 AC.	(NET)

NORTH

SCALE 0 60 120 IN FEET

mfra
engineering surveying planning energy
14800 28th Ave. N, Ste 140
Plymouth, Minnesota 55447
(763) 476.6010 telephone
(763) 476.8532 facsimile
www.mfra.com

Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

Certification

Summary

Designed: MCB   Drawn: ERW
Approved: MCB   Book / Page:
Phase: FINAL   Initial Issue: 12/13/2011

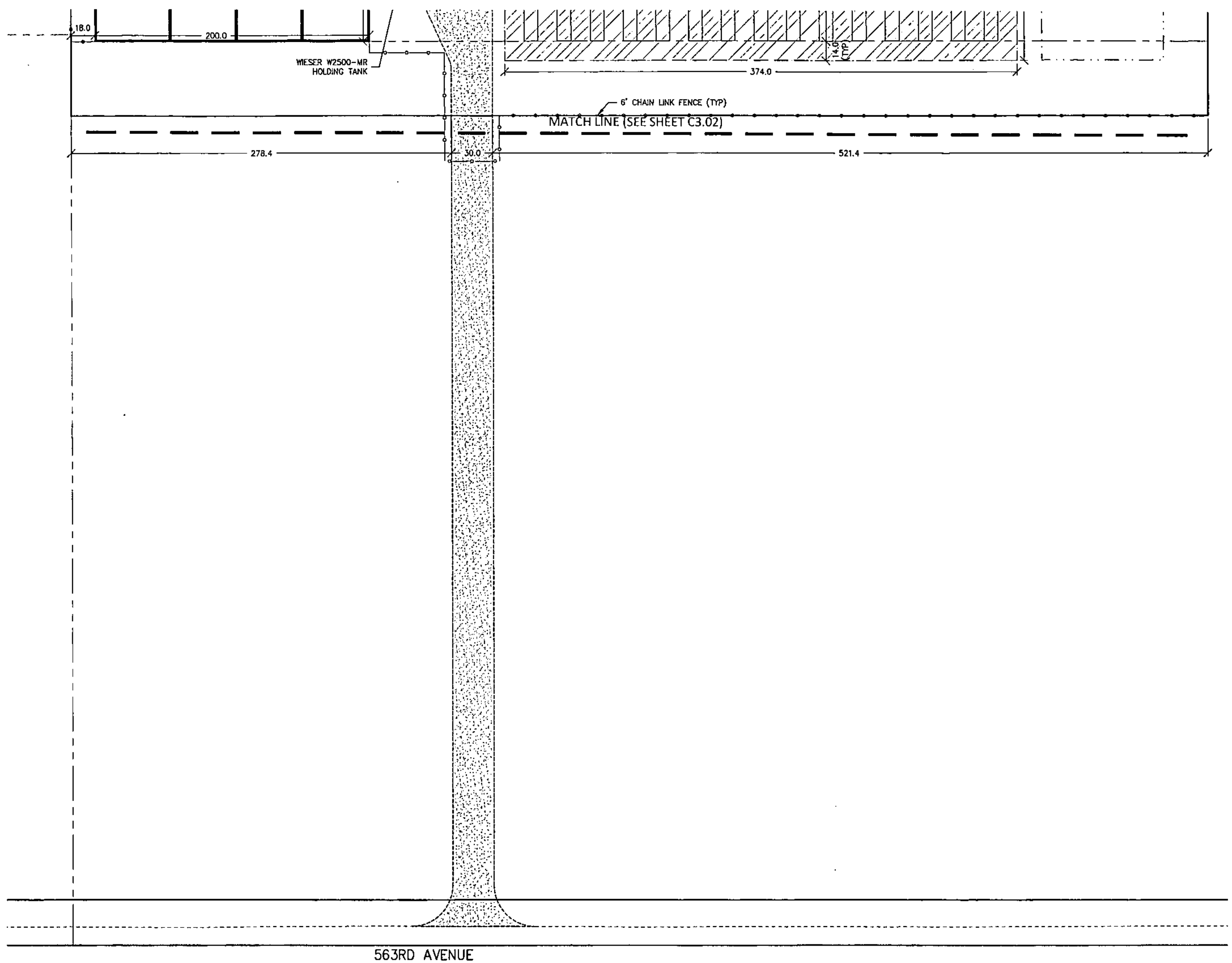
Revision History

No.	Date	By	Submittal / Revision
A	01/05/12	ERW	COUNTY COMMENTS
B	02/17/12	SEG	MPCA COMMENTS
C	05/10/12	JN	REVISED LOCATION

Sheet Title
EXISTING CONDITIONS

Sheet No. Revision
C2.01 C

Project No. MFS19051



LEGEND

PROPERTY LIMIT
CURB & GUTTER
EDGE OF GRAVEL
BUILDING
GRAVEL (SEE C7.01 FOR SECTION)
WINDROW AREAS (SEE C7.01 FOR SECTION)
CONCRETE PAVING (SEE C7.01 FOR SECTION)

DEVELOPMENT NOTES

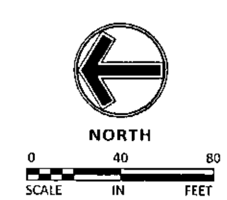
A. ALL DIMENSIONS ARE ROUNDED TO THE NEAREST TENTH FOOT.

B. ALL AREAS ARE ROUNDED TO THE NEAREST SQUARE FOOT.

C. CONTRACTOR SHALL REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATIONS AND DIMENSIONS OF EXIT PORCHES, RAMPS, PRECISE BUILDING DIMENSIONS AND EXACT BUILDING UTILITY ENTRANCE LOCATIONS.

D. REFER TO FINAL PLAT FOR LOT BOUNDARIES, LOT NUMBERS, LOT AREAS, AND LOT DIMENSIONS.

E. DRAINAGE AND UTILITY EASEMENTS SHALL BE PROVIDED AS REQUIRED. DRAINAGE AND UTILITY EASEMENTS WILL BE PROVIDED OVER ALL PUBLIC UTILITIES AND UP TO THE HIGH WATER LEVEL OF ALL PONDS



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Certification

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.

Michael C. Brandt
Registration No. 42661 Date: 02/17/2012

If applicable, contact us for a wet signed copy of this plan which is available upon request at MFRA, Inc., Plymouth, MN office.

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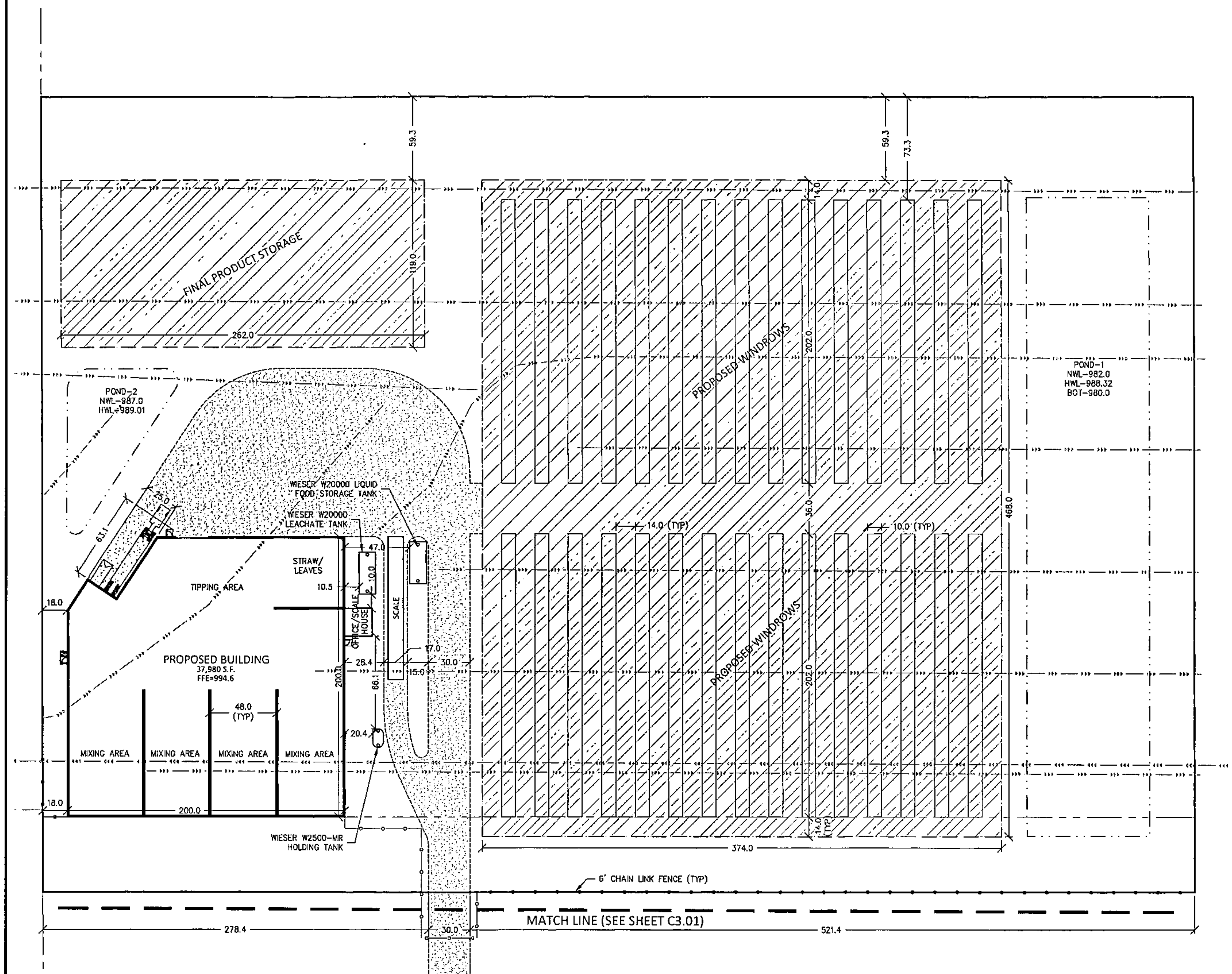
Sheet Title
SITE PLAN

Sheet No. **Revision**
C3.01 C

Project No. MFS19051



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EDGE OF GRAVEL
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SCALE IN FEET

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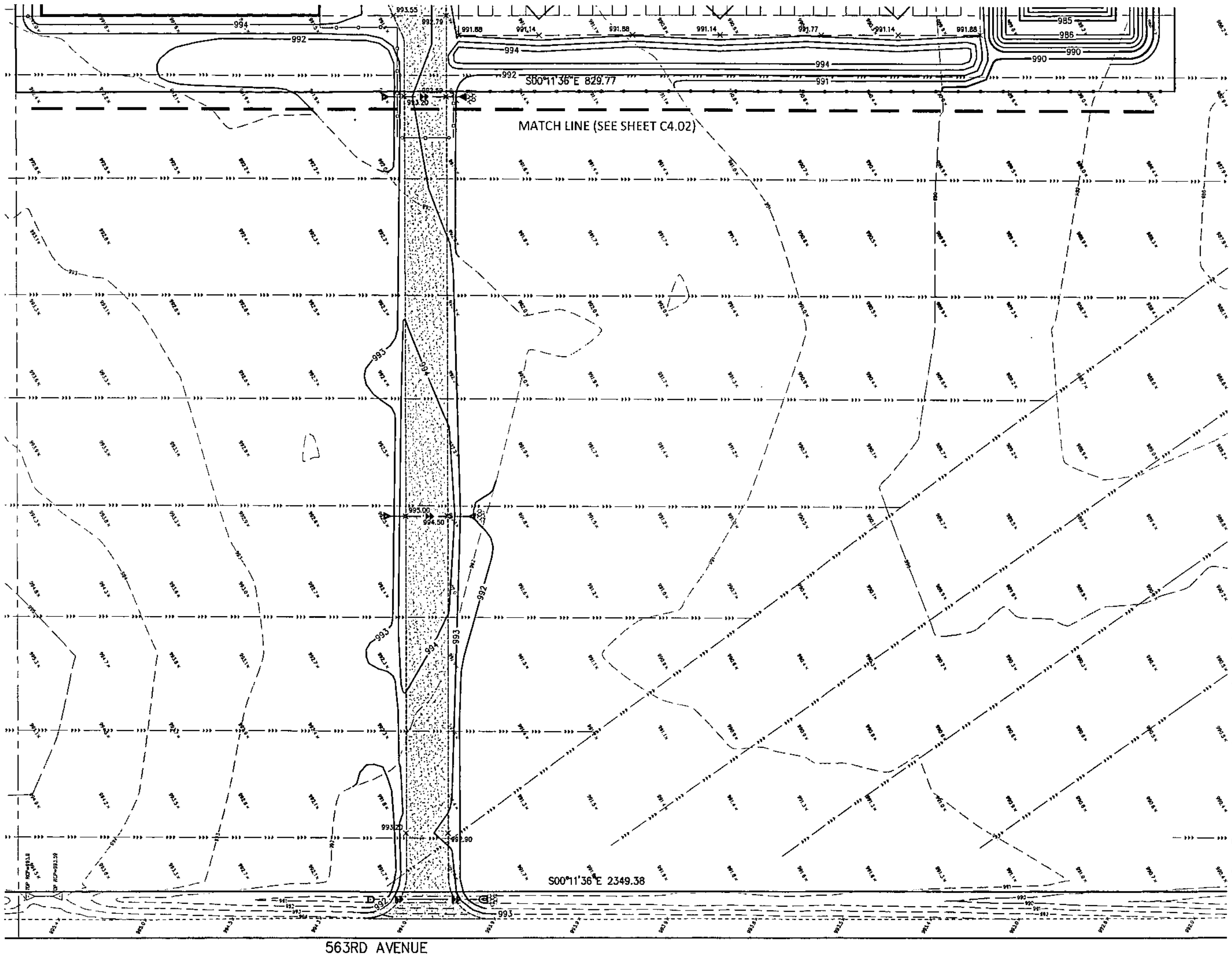
Sheet Title
SITE PLAN

Sheet No. Revision
C3.02 C

Project No. MFS19051



LEGEND

	PROPOSED	EXISTING
PROPERTY LIMIT		
CURB & GUTTER		
STORM SEWER		
DRAINTILE		
BUILDING		
RETAINING WALL		
WETLAND LIMITS		
TREELINE		
SPOT ELEVATION	962.5	962.5
CONTOUR	902	902
RIP RAP		
OVERFLOW ELEV.	EOF XXX.X	
SOIL BORINGS		

GRADING NOTES

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C. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID PROPERTY DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION PHASES OF THIS PROJECT. THE CONTRACTOR WILL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES TO THE ADJACENT PROPERTIES OCCURRING DURING THE CONSTRUCTION PHASES OF THIS PROJECT.

D. SAFETY NOTICE TO CONTRACTORS: IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS ON THE JOB SITE, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT WILL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE DUTY OF THE ENGINEER OR THE DEVELOPER TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES IN, ON OR NEAR THE CONSTRUCTION SITE.

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A GEOTECHNICAL ENGINEERING SOILS REPORT HAS BEEN COMPLETED BY:

COMPANY: AMERICAN ENGINEERING TESTING
ADDRESS: 550 CLEVELAND AVE NORTH, SAINT PAUL MN 55114
PHONE: 651-659-9001
DATED:

THE CONTRACTOR SHALL OBTAIN A COPY OF THE SOILS REPORT.

F. THE CONTRACTOR SHALL COMPLETE DEWATERING AS REQUIRED TO COMPLETE THE SITE GRADING CONSTRUCTION.

G. PRIOR TO PLACEMENT OF THE AGGREGATE BASE, A TEST ROLL WILL BE REQUIRED ON THE STREET AND PARKING AREA SUBGRADE. THE CONTRACTOR SHALL PROVIDE A LOADED TANDEM AXLE TRUCK WITH A GROSS WEIGHT OF 25 TONS. THE TEST ROLLING SHALL BE AT THE DIRECTION OF THE SOILS ENGINEER AND SHALL BE COMPLETED IN AREAS AS DIRECTED BY THE SOILS ENGINEER. THE SOILS ENGINEER SHALL DETERMINE WHICH SECTIONS OF THE STREET OR PARKING AREA ARE UNSTABLE. CORRECTION OF THE SUBGRADE SOILS SHALL BE COMPLETED IN ACCORDANCE WITH THE REQUIREMENTS OF THE SOILS ENGINEER.

H. REPLACE ALL SUBGRADE SOIL DISTURBED DURING THE CONSTRUCTION THAT HAVE BECOME UNSUITABLE AND WILL NOT PASS A TEST ROLL. REMOVE UNSUITABLE SOIL FROM THE SITE AND IMPORT SUITABLE SOIL AT NO ADDITIONAL COST TO THE OWNER.

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J. THE TREES AND OTHER NATURAL VEGETATION WITHIN THE PROJECT AND/OR ADJACENT TO THE PROJECT ARE OF PRIME CONCERN TO THE CONTRACTOR'S OPERATIONS. HE WILL BE REQUIRED TO PROTECT THE TREES WHICH ARE TO BE SAVED TO BE SURE THAT EQUIPMENT IS NOT NEEDLESSLY OPERATED UNDER NEARBY TREES AND SHALL EXERCISE EXTREME CAUTION IN WORKING ADJACENT TO TREES. SHOULD ANY PORTION OF THE TREE BRANCHES REQUIRE REMOVAL TO PERMIT OPERATION OF THE CONTRACTOR'S EQUIPMENT, HE SHALL OBTAIN THE SERVICES OF A PROFESSIONAL TREE TRIMMING SERVICE TO TRIM THE TREES PRIOR TO THE BEGINNING OF OPERATION. SHOULD THE CONTRACTOR'S OPERATIONS RESULT IN THE BREAKING OF ANY LIMBS, THE BROKEN LIMBS SHOULD BE REMOVED IMMEDIATELY AND CUTS SHALL BE PROPERLY PROTECTED TO MINIMIZE ANY LASTING DAMAGE TO THE TREE. NO TREES SHALL BE REMOVED WITHOUT AUTHORIZATION BY THE ENGINEER. COSTS FOR TRIMMING SERVICES SHALL BE CONSIDERED INCIDENTAL TO THE GRADING CONSTRUCTION AND NO SPECIAL PAYMENT WILL BE MADE.

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O. TOLERANCES

1. THE COMMERCIAL BUILDING SUBGRADE FINISHED SURFACE ELEVATION SHALL NOT VARY BY MORE THAN 0.10 FOOT ABOVE, OR 0.10 FOOT BELOW, THE PRESCRIBED ELEVATION AT ANY POINT WHERE MEASUREMENT IS MADE.
2. THE STREET OR PARKING AREA SUBGRADE FINISHED SURFACE ELEVATION SHALL NOT VARY BY MORE THAN 0.05 FOOT ABOVE, OR 0.10 FOOT BELOW, THE PRESCRIBED ELEVATION OF ANY POINT WHERE MEASUREMENT IS MADE.
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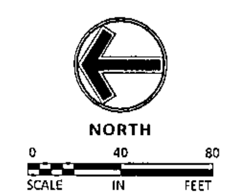

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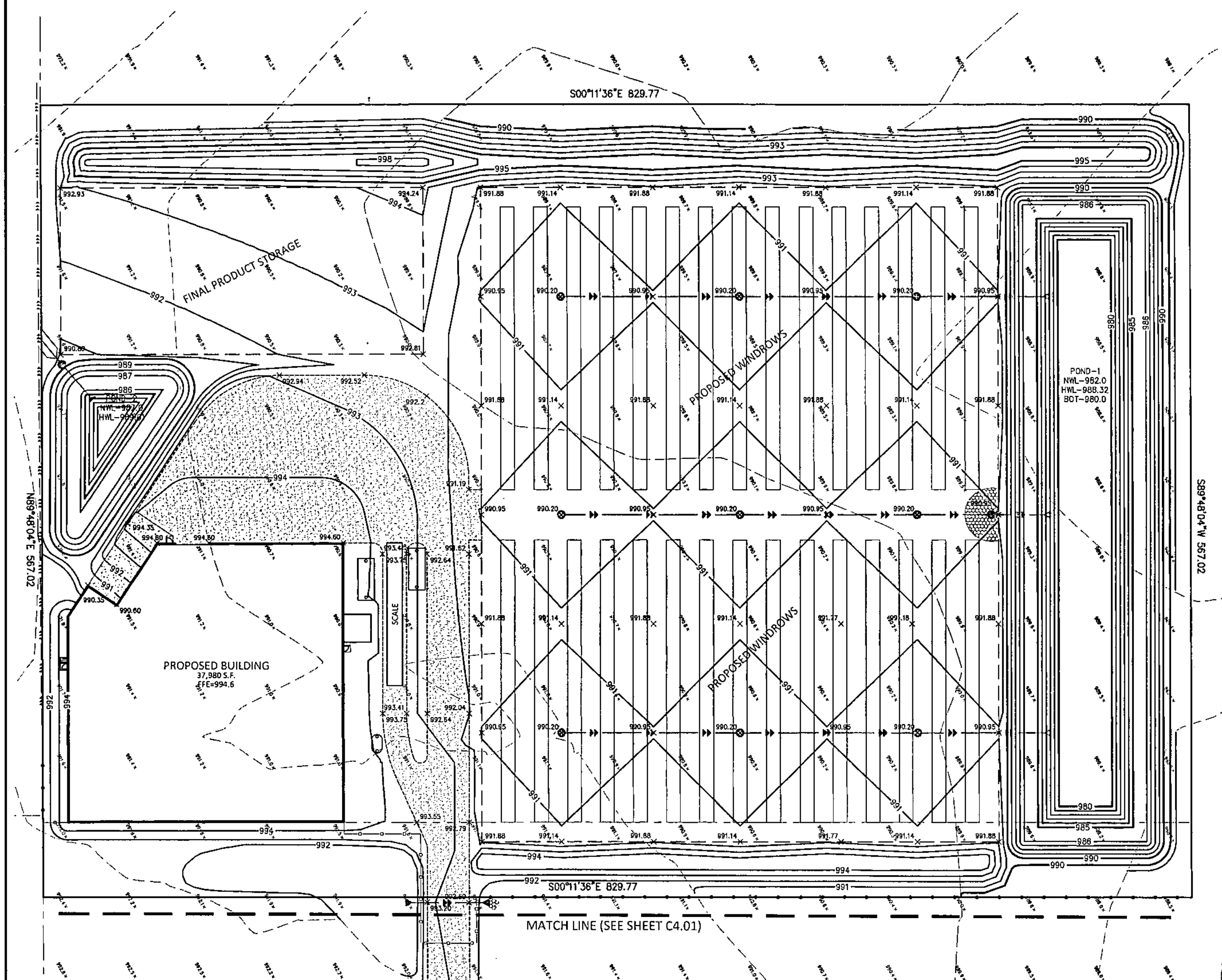
Sheet Title
GRADING PLAN

Sheet No. Revision
C4.01 C

Project No. MFS19051



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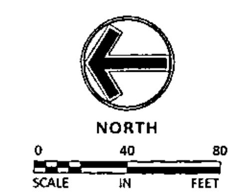

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(763) 476.6010 telephone
(763) 476.8532 facsimile
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Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP

BLUE EARTH COUNTY, MN

Certification
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.

Michael C. Brandt
Registration No. 42661 Date: 02/17/2012

If applicable, contact us for a wet signed copy of this plan which is available upon request at MFRA, Inc., Plymouth, MN office.

Summary
Designed: MCB Drawn: ERW
Approved: MCB Book / Page:
Phase: FINAL Initial Issue: 12/13/2011

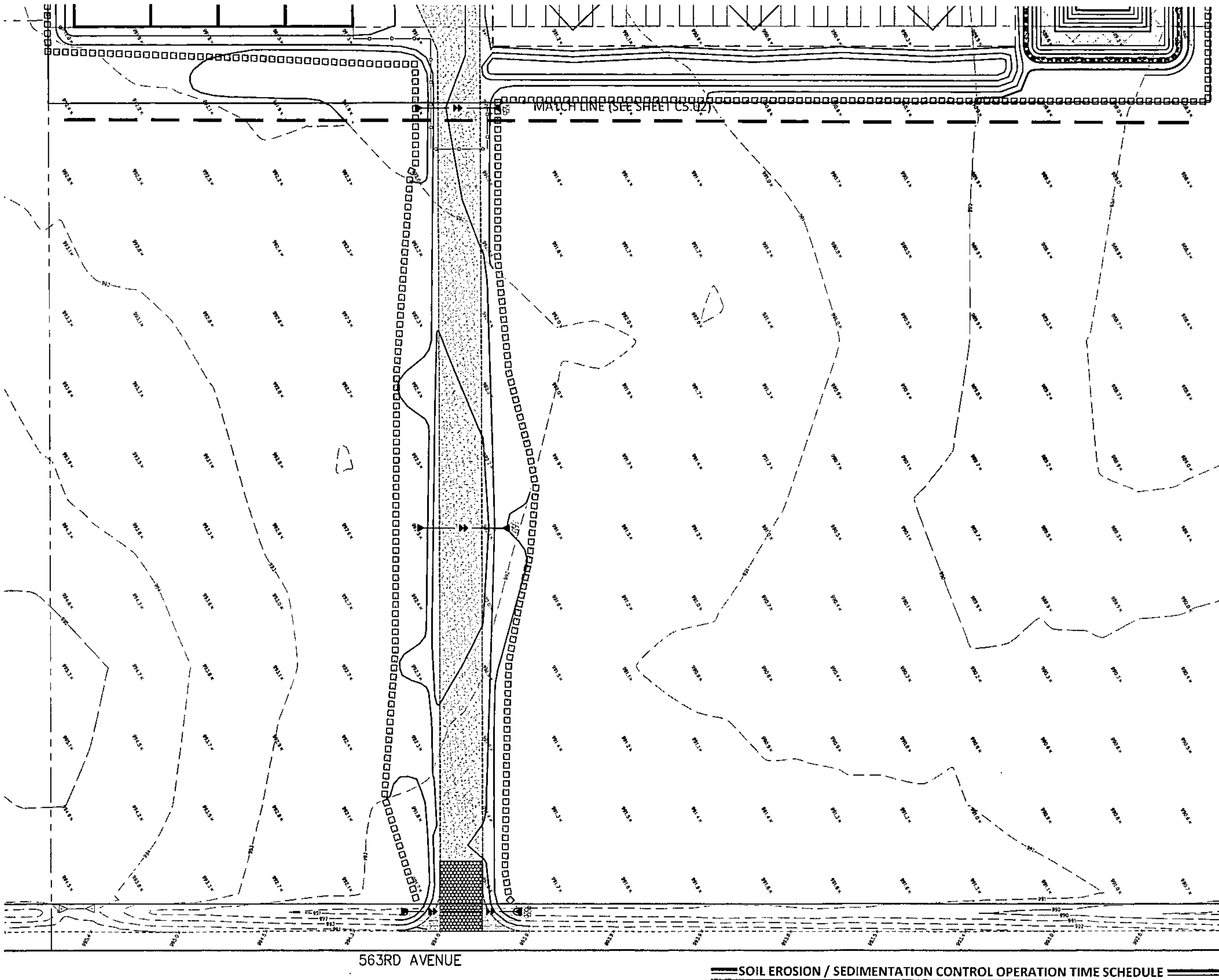
Revision History

No.	Date	By	Submittal / Revision
A	01/05/12	ERW	COUNTY COMMENTS
B	02/17/12	SEG	MPCA COMMENTS
C	05/10/12	JN	REVISED LOCATION

Sheet Title
GRADING PLAN

Sheet No. Revision
C4.02 C

Project No. MFS19051



LEGEND

	PROPOSED	EXISTING
CURB & GUTTER		
STORM SEWER		
DRAINTILE		
CONTOUR	902	902
RIP RAP		
OVERFLOW ELEV.	EOF XXX.X	
SILT FENCE - PHASE 1		
SILT FENCE - PHASE 2		
LIMITS OF DISTURBANCE		
SOIL BORINGS		ST-9 PA-10
DIRECTION OF OVERLAND FLOW		
TEMPORARY DIVERSION DITCH		
EROSION CONTROL BLANKET		
LIMITS OF DRAINAGE SUB-BASIN		
BIO-ROLL		
INLET PROTECTION DEVICE 1	IP1	
INLET PROTECTION DEVICE 2	IP2	
TEMPORARY STONE CONSTRUCTION ENTRANCE		
TEMPORARY SEDIMENT BASIN	SB	
TEMPORARY STORAGE AND PARKING AREA	TS	
TEMPORARY STABILIZATION MEASURES (SEED, MULCH, MATS OR BLANKETS AS OUTLINED IN THE SWPPP)	TSM	

SEQUENCE OF CONSTRUCTION

PHASE I:

1. INSTALL STABILIZED CONSTRUCTION ENTRANCES.
2. PREPARE TEMPORARY PARKING AND STORAGE AREA.
3. CONSTRUCT THE SILT FENCES ON THE SITE.
4. CONSTRUCT THE SEDIMENTATION AND SEDIMENT TRAP BASINS.
5. HALT ALL ACTIVITIES AND CONTACT THE CIVIL ENGINEERING CONSULTANT TO PERFORM INSPECTION OF BMPs. GENERAL CONTRACTOR SHALL SCHEDULE AND CONDUCT STORM WATER PRE-CONSTRUCTION MEETING WITH ENGINEER AND ALL GROUND DISTURBING CONTRACTORS BEFORE PROCEEDING WITH CONSTRUCTION.
6. CONSTRUCT SEDIMENTATION BASINS.
7. CLEAR AND GRUB THE SITE.
8. BEGIN GRADING THE SITE.
9. START CONSTRUCTION OF BUILDING PAD AND STRUCTURES.

PHASE II:

1. TEMPORARILY SEED DENUDED AREAS.
2. INSTALL UTILITIES, UNDERDRAINS, STORM SEWERS.
3. INSTALL RIP RAP AROUND OUTLET STRUCTURES.
4. INSTALL INLET PROTECTION AROUND ALL STORM SEWER STRUCTURES.
5. PREPARE SITE FOR PAVING.
6. PAVE SITE.
7. INSTALL INLET PROTECTION DEVICES.
8. COMPLETE GRADING AND INSTALL PERMANENT SEEDING AND PLANTING.
9. REMOVE ALL TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES (ONLY IF SITE IS STABILIZED), IF REQUIRED BY THE CONTRACT

NOTE TO CONTRACTOR

THE EROSION CONTROL PLAN SHEETS ALONG WITH THE REST OF THE SWPPP MUST BE KEPT ONSITE UNTIL THE NOTICE OF TERMINATION IS FILED WITH THE MPCA, THE CONTRACTOR MUST UPDATE THE SWPPP, INCLUDING THE EROSION CONTROL PLAN SHEETS AS NECESSARY TO INCLUDE ADDITIONAL REQUIREMENTS, SUCH AS ADDITIONAL OR MODIFIED BMPS DESIGNED TO CORRECT PROBLEMS IDENTIFIED. AFTER FILING THE NOTICE OF TERMINATION, THE SWPPP, INCLUDING THE EROSION CONTROL PLAN SHEETS, AND ALL REVISIONS TO IT MUST BE SUBMITTED TO THE OWNER, TO BE KEPT ON FILE IN ACCORDANCE WITH THE RECORD RETENTION REQUIREMENTS DESCRIBED IN THE SWPPP NARRATIVE.

AREA SUMMARY IN ACRES

PAVEMENT AREA	5.40 AC±
BUILDING AREA	0.90 AC±
SEEDED AREA	1.60 AC±
TOTAL DISTURBED	10.0 AC±
PRE - CONSTRUCTION IMPERVIOUS	0.00 AC±
POST - CONSTRUCTION IMPERVIOUS	6.30 AC±

* REFER TO SHEET C5.02 FOR GENERAL NOTES, MAINTENANCE NOTES, LOCATION MAPS, AND STANDARD DETAILS

EROSION CONTROL MATERIALS QUANTITIES

ITEM	UNIT	QUANTITY
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SILT FENCE - PHASE 2	LINEAR FEET	1700
EROSION BLANKET	SQUARE FEET	60,300
CONSTRUCTION ENTRANCE	UNIT	1
INLET PROTECTION DEVICE (IP-1)	UNIT	10

SOIL EROSION / SEDIMENTATION CONTROL OPERATION TIME SCHEDULE

CONSTRUCTION SEQUENCE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
TEMPORARY CONTROL MEASURES																		
STRIP & STOCKPILE TOPSOIL																		
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FOUNDATION / BUILDING CONSTRUCTION																		
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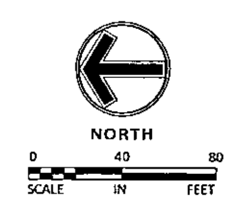

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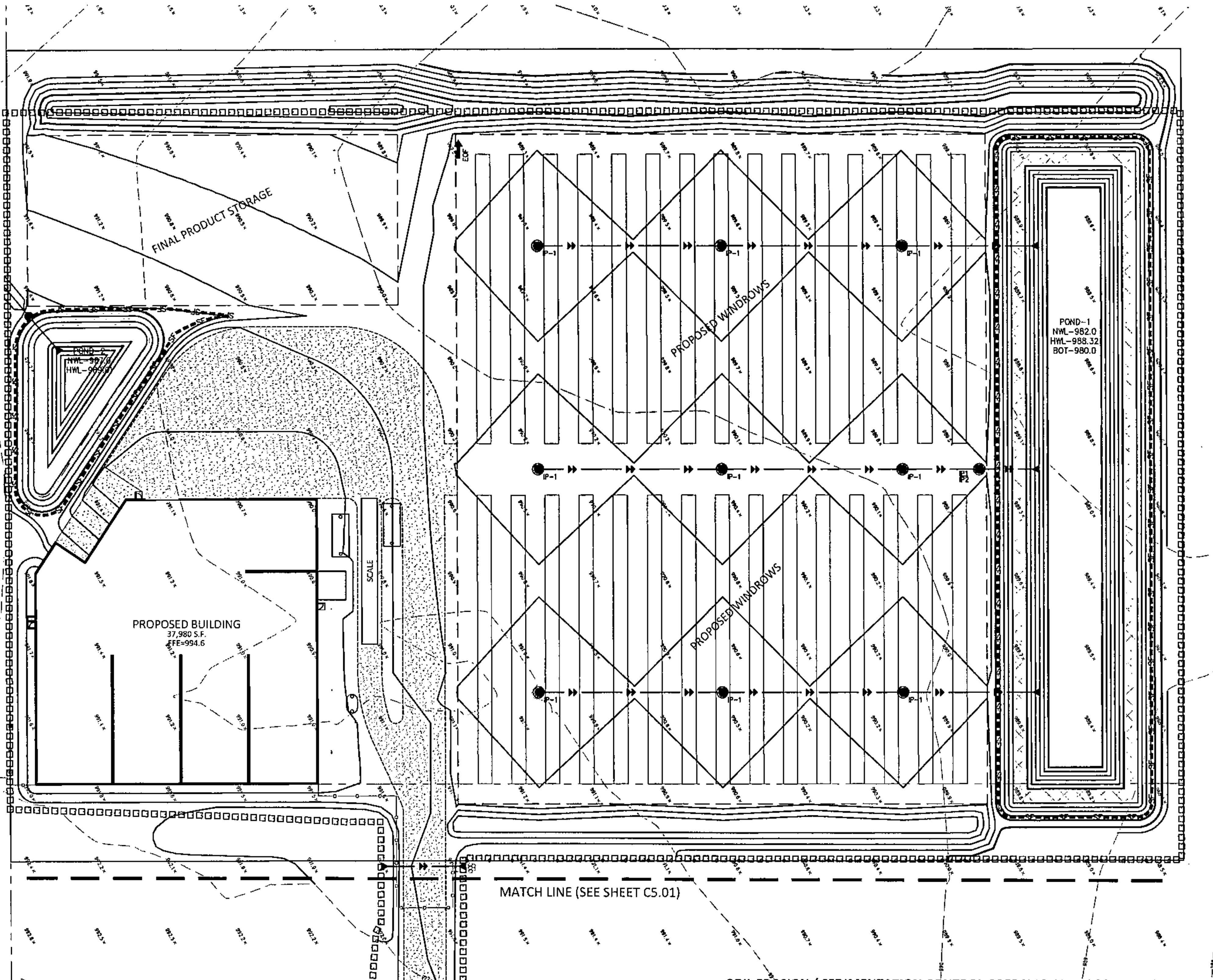
Sheet Title
EROSION CONTROL PLAN

Sheet No. Revision
C5.01 C

Project No. MFS19051



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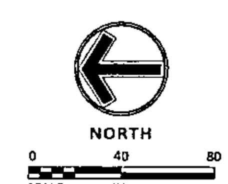

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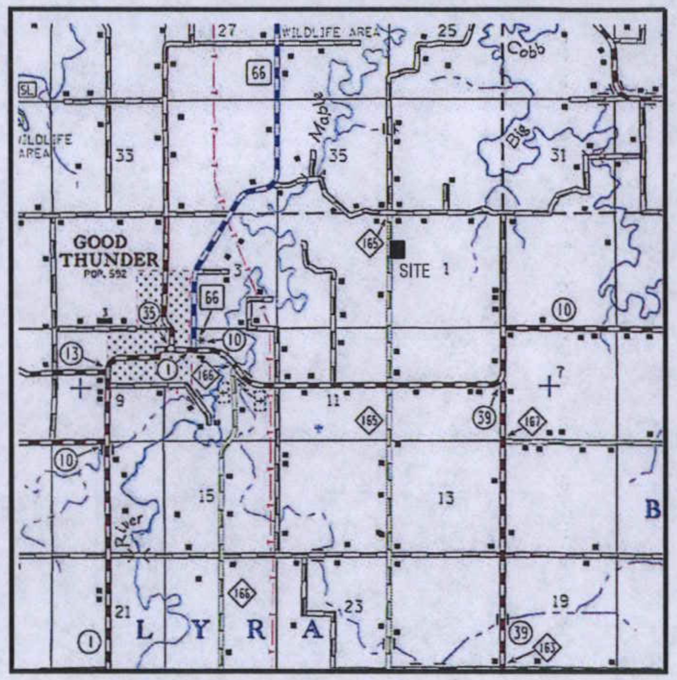
Sheet Title
EROSION CONTROL PLAN

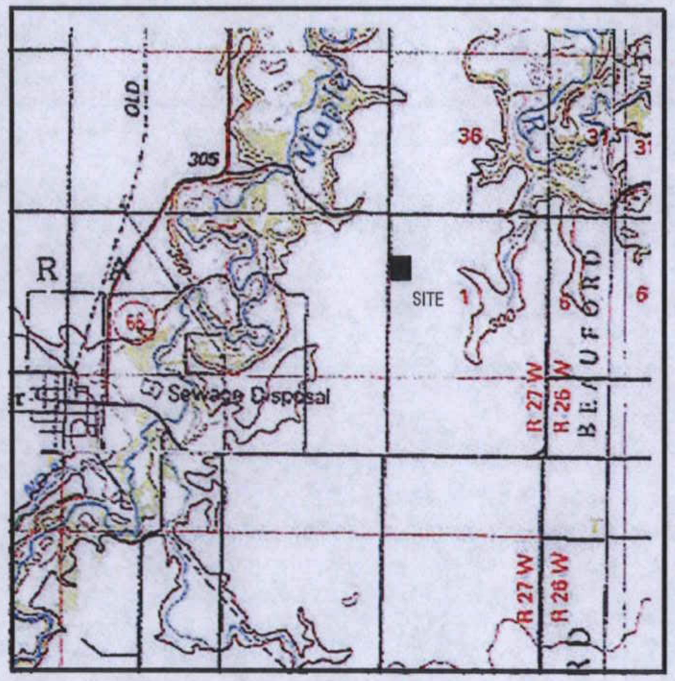
Sheet No. Revision
C5.02 C

Project No. MFS19051

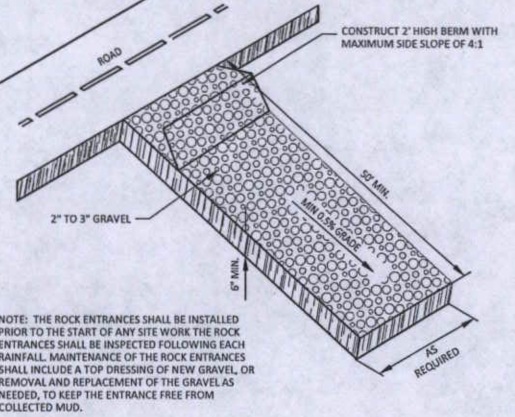
EROSION & SEDIMENTATION CONTROL NOTES & DETAILS / "SITE MAP"



SITE LOCATION MAP
NOT TO SCALE

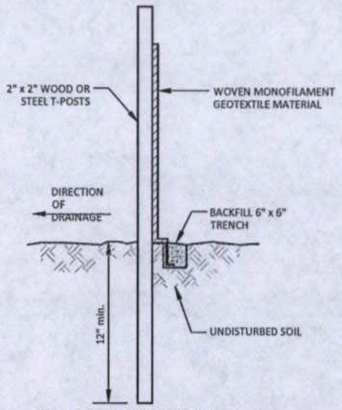


USGS MAP
NOT TO SCALE

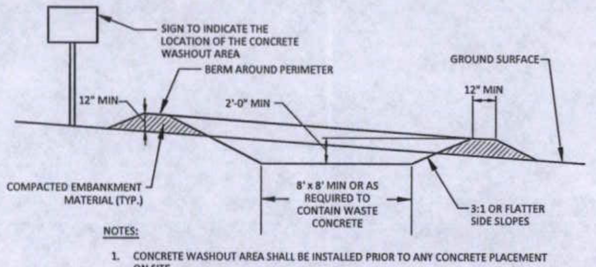


NOTE: THE ROCK ENTRANCES SHALL BE INSTALLED PRIOR TO THE START OF ANY SITE WORK THE ROCK ENTRANCES SHALL BE INSPECTED FOLLOWING EACH RAINFALL. MAINTENANCE OF THE ROCK ENTRANCES SHALL INCLUDE A TOP DRESSING OF NEW GRAVEL, OR REMOVAL AND REPLACEMENT OF THE GRAVEL AS NEEDED, TO KEEP THE ENTRANCE FREE FROM COLLECTED MUD.

ROCK ENTRANCE DRIVE
NOT TO SCALE



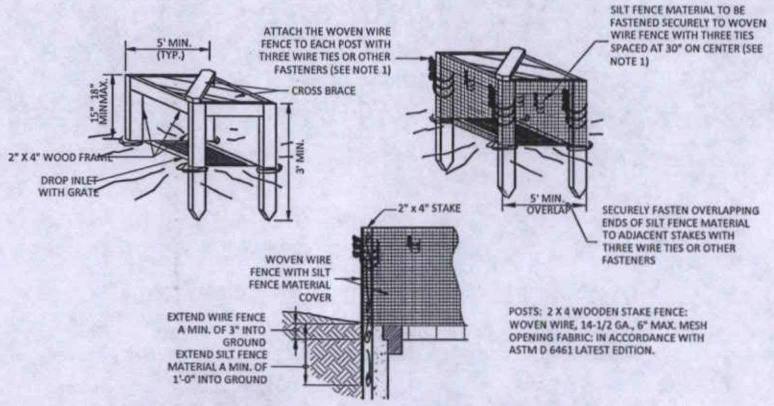
SILT FENCE DETAIL
NOT TO SCALE



NOTES:

1. CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE.
2. CONCRETE WASHOUT AREA SHALL BE LINED WITH MINIMUM 10 MIL THICK PLASTIC LINER.
3. VEHICLE TRACKING CONTROL IS REQUIRED IF ACCESS TO CONCRETE WASHOUT AREA IS OFF PAVEMENT.
4. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE WASHOUT AREA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT AREA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.
5. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND ENLARGED OR CLEANED OUT AS NECESSARY TO MAINTAIN CAPACITY FOR WASTED CONCRETE.
6. AT THE END OF CONSTRUCTION, ALL CONCRETE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT AN ACCEPTED WASTE SITE.
7. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, THE DISTURBED AREA SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER ACCEPTED BY THE CITY.

CONCRETE WASHOUT AREA
NOT TO SCALE



1. ATTACH THE WOVEN WIRE FENCE TO EACH POST AND THE GEOTEXTILE TO THE WOVEN WIRE FENCE (SPACED EVERY 30") WITH THREE WIRE TIES OR OTHER FASTENERS, ALL SPACED WITHIN THE TOP 8" OF THE FABRIC. ATTACH EACH TIE DIAGONALLY 45 DEGREES THROUGH THE FABRIC, WITH EACH PUNCTURE AT LEAST 1" VERTICALLY APART.
2. WHEN TWO SECTIONS OF SILT FENCE MATERIAL ADJOIN EACH OTHER, THEY SHALL BE OVERLAPPED ACROSS TWO POSTS.
3. MAINTENANCE SHALL BE PERFORMED AS NOTED IN THE SWPPP. DEPTH OF ACCUMULATED SEDIMENTS MAY NOT EXCEED ONE-HALF THE HEIGHT OF THE FABRIC. MAINTENANCE CLEANOUT MUST BE CONDUCTED REGULARLY TO PREVENT ACCUMULATED SEDIMENTS FROM REACHING ONE-HALF THE HEIGHT OF THE SILT FENCE MATERIAL ABOVE GRADE.
4. ALL SILT FENCE INLETS SHALL INCLUDE WIRE SUPPORT.

SILT FENCE INLET PROTECTION (IP-1)
NOT TO SCALE

DEVELOPER/OWNER: MAX MILINKOVICH FULL CIRCLE ORGANICS 5029 13th AVE. S. MINNEAPOLIS, MN. 55417 612-282-9382
SITE OPERATOR / GENERAL CONTRACTOR
SUPERINTENDENT:

GENERAL EROSION NOTES:

1. CONSTRUCTION SHALL COMPLY WITH ALL APPLICABLE GOVERNING CODES AND BE CONSTRUCTED TO SAME. WHERE A CONFLICT EXISTS BETWEEN LOCAL JURISDICTIONAL STANDARD SPECIFICATIONS AND MFRA STANDARD SPECIFICATIONS, THE MORE STRINGENT SPECIFICATION SHALL APPLY.
2. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATIONS AND/OR ELEVATIONS OF EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE SUBSURFACE UTILITY INFORMATION SHOWN ON THESE PLANS IS A UTILITY QUALITY LEVEL D. THIS QUALITY LEVEL WAS DETERMINED ACCORDING TO THE GUIDELINES OF CI/ASCE 38-02, ENTITLED "STANDARD GUIDELINES FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA." THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CONTACT ALL THE APPROPRIATE UTILITY COMPANIES AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS. THE LOCATIONS OF SMALL UTILITIES SHALL BE OBTAINED BY THE CONTRACTOR BY CALLING MINNESOTA GOPHER STATE ONE CALL AT 800-252-1166 OR 651-454-0002
3. THE DESIGN SHOWN IS BASED UPON THE ENGINEER'S UNDERSTANDING OF THE EXISTING CONDITIONS. THE EXISTING CONDITIONS SHOWN ON THIS PLAN ARE BASED UPON AN ALTA OR TOPOGRAPHIC SURVEY PREPARED BY MFRA DATED 11-21-2011. IF CONTRACTOR DOES NOT ACCEPT EXISTING TOPOGRAPHY AS SHOWN ON THE PLANS WITHOUT EXCEPTION, THEY SHALL HAVE MADE, AT THEIR EXPENSE, A TOPOGRAPHIC SURVEY BY A REGISTERED LAND SURVEYOR AND SUBMIT IT TO THE OWNER FOR REVIEW. SEE ATTACHED SURVEY SHEETS.
4. THE GENERAL CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID PROPERTY DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION PHASES OF THIS PROJECT. THE CONTRACTOR WILL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES OCCURRING TO THE ADJACENT PROPERTIES DURING THE CONSTRUCTION PHASES OF THIS PROJECT.
5. THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) IS COMPRISED OF THIS DRAWING (EROSION & SEDIMENTATION CONTROL PLAN-ESC PLAN), THE STANDARD DETAILS, THE PLAN NARRATIVE, AND ITS APPENDICES, PLUS THE PERMIT AND ALL SUBSEQUENT REPORTS AND RELATED DOCUMENTS.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLETING & SUBMITTING THE APPLICATION FOR THE MPCA GENERAL STORMWATER PERMIT FOR CONSTRUCTION ACTIVITY. ALL CONTRACTORS AND SUBCONTRACTORS INVOLVED WITH STORM WATER POLLUTION PREVENTION SHALL OBTAIN A COPY OF THE SWPPP AND THE STATE OF MINNESOTA NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM GENERAL PERMIT (NPDES PERMIT) AND BECOME FAMILIAR WITH THEIR CONTENTS. THE SWPPP AND ALL OTHER RELATED DOCUMENTS MUST BE KEPT AT THE SITE DURING CONSTRUCTION.
7. CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES (BMP'S) AS REQUIRED BY THE SWPPP & PERMITS. THE CONTRACTOR SHALL OVERSEE THE INSPECTION & MAINTENANCE OF THE BMP'S AND EROSION PREVENTION FROM BEGINNING OF CONSTRUCTION AND UNTIL CONSTRUCTION IS COMPLETED, IS APPROVED BY ALL AUTHORITIES, THE NOTICE OF TERMINATION (NOT) HAS BEEN FILED WITH THE MPCA BY EITHER THE OWNER OR OPERATOR AS APPROVED ON PERMIT. ADDITIONAL BMP'S SHALL BE IMPLEMENTED AS DICTATED BY CONDITIONS AT NO ADDITIONAL COST TO OWNER THROUGHOUT ALL PHASES OF CONSTRUCTION.
8. CONTRACTOR SHALL COMPLY WITH TRAINING REQUIREMENTS IN PART III.A.2 OF THE GENERAL PERMIT.
9. BMP'S AND CONTROLS SHALL CONFORM TO FEDERAL, STATE, OR LOCAL REQUIREMENTS OR MANUAL OF PRACTICE, AS APPLICABLE. CONTRACTOR SHALL IMPLEMENT ADDITIONAL CONTROLS AS DIRECTED BY PERMITTING AGENCY OR OWNER.
10. ESC PLAN MUST CLEARLY DELINEATE ALL STATE WATERS. PERMITS FOR ANY CONSTRUCTION ACTIVITY IMPACTING STATE WATERS OR REGULATED WETLANDS MUST BE MAINTAINED ON SITE AT ALL TIMES.
11. CONTRACTOR SHALL MINIMIZE CLEARING TO THE MAXIMUM EXTENT PRACTICAL OR AS REQUIRED BY THE GENERAL PERMIT. THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THE ESC PLANS SHALL BE CLEARLY DELINEATED (E.G. WITH FLAGS, STAKES, SIGNS, SILT FENCE, ETC.) ON THE DEVELOPMENT SITE BEFORE WORK BEGINS. GROUND DISTURBING ACTIVITIES MUST NOT OCCUR OUTSIDE THE LIMITS OF DISTURBANCE.
12. GENERAL CONTRACTOR SHALL DENOTE ON PLAN THE TEMPORARY PARKING AND STORAGE AREA WHICH SHALL ALSO BE USED AS THE EQUIPMENT MAINTENANCE AND CLEANING AREA, EMPLOYEE PARKING AREA, AND AREA FOR LOCATING PORTABLE FACILITIES, OFFICE TRAILERS, AND TOILET FACILITIES.
13. ALL WASH WATER (CONCRETE TRUCKS, VEHICLE CLEANING, EQUIPMENT CLEANING, ETC.) MUST BE LIMITED TO A DEFINED AREA OF THE SITE AND SHALL BE CONTAINED AND PROPERLY TREATED OR DISPOSED. NO ENGINE DEGREASING IS ALLOWED ON SITE.
14. ALL LIQUID AND SOLID WASTES GENERATED BY CONCRETE WASHOUT OPERATIONS MUST BE CONTAINED IN A LEAK-PROOF CONTAINMENT FACILITY OR IMPERMEABLE LINER. A COMPACTED CLAY LINER THAT DOES NOT ALLOW WASHOUT LIQUIDS TO ENTER GROUND WATER IS CONSIDERED AN IMPERMEABLE LINER. THE LIQUID AND SOLID WASTES MUST NOT CONTACT THE GROUND, AND THERE MUST NOT BE RUNOFF FROM THE CONCRETE WASHOUT OPERATIONS OR AREAS. LIQUID AND SOLID WASTES MUST BE DISPOSED OF PROPERLY AND IN COMPLIANCE WITH MPCA REGULATIONS. A SIGN MUST BE INSTALLED ADJACENT TO EACH WASHOUT FACILITY TO INFORM CONCRETE EQUIPMENT OPERATORS TO UTILIZE THE PROPER FACILITIES.
15. SUFFICIENT OIL AND GREASE ABSORBING MATERIALS AND FLOTATION BOOMS SHALL BE MAINTAINED ON SITE OR READILY AVAILABLE TO CONTAIN AND CLEAN-UP FUEL OR CHEMICAL SPILLS AND LEAKS.
16. DUST ON THE SITE SHALL BE CONTROLLED. THE USE OF MOTOR OILS AND OTHER PETROLEUM BASED OR TOXIC LIQUIDS FOR DUST SUPPRESSION OPERATIONS IS PROHIBITED.
17. SOLID WASTE: COLLECTED SEDIMENT, ASPHALT & CONCRETE MILLINGS, FLOATING DEBRIS, PAPER, PLASTIC, FABRIC, CONSTRUCTION & DEMOLITION DEBRIS & OTHER WASTES MUST BE DISPOSED OF PROPERLY & MUST COMPLY WITH MPCA DISPOSAL REQUIREMENTS.
18. HAZARDOUS MATERIALS: OIL, GASOLINE, PAINT & ANY HAZARDOUS SUBSTANCES MUST BE PROPERLY STORED, INCLUDING SECONDARY CONTAINMENT, TO PREVENT SPILLS, LEAKS OR OTHER DISCHARGE. RESTRICTED ACCESS TO STORAGE AREAS MUST BE PROVIDED TO PREVENT VANDALISM. STORAGE & DISPOSAL OF HAZARDOUS WASTE MUST BE IN COMPLIANCE WITH MPCA REGULATIONS.
19. ALL STORM WATER POLLUTION PREVENTION MEASURES PRESENTED ON THIS PLAN, AND IN THE SWPPP, SHALL BE INITIATED AS SOON AS PRACTICABLE AND PRIOR TO SOIL DISTURBING ACTIVITIES UPSLOPE.
20. DISTURBED PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITY HAS STOPPED SHALL BE TEMPORARILY SEEDED, WITHIN 14 DAYS OF INACTIVITY. SEEDING SHALL BE IN ACCORDANCE WITH MN/DOT SEED MIXTURE NUMBER 100 OR 110 DEPENDING ON THE SEASON OF PLANTING (SEE MN/DOT SPECIFICATION SECTION 2575.3) SEEDING METHOD AND APPLICATION RATE SHALL CONFORM TO MN/DOT SPECIFICATION SECTION 2575.3. TEMPORARY MULCH SHALL BE APPLIED IN ACCORDANCE WITH MN/DOT SPECIFICATION SECTION 2575.3F1 AND 2575.3G. ALTERNATIVELY, HYDRAULIC SOIL STABILIZER IN ACCORDANCE WITH MN/DOT SPECIFICATION SECTION 2575.3H MAY BE USED IN PLACE OF TEMPORARY MULCH.
21. DISTURBED PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITY HAS PERMANENTLY STOPPED SHALL BE PERMANENTLY STABILIZED. THESE AREAS SHALL BE STABILIZED IN ACCORDANCE WITH THE TIME TABLE DESCRIBED ABOVE. REFER TO THE GRADING PLAN AND/OR LANDSCAPE PLAN FOR VEGETATIVE COVER.
22. CONTRACTORS OR SUBCONTRACTORS WILL BE RESPONSIBLE FOR REMOVING SEDIMENT FROM CONVEYANCES & FROM TEMPORARY SEDIMENTATION BASINS THAT ARE TO BE USED AS PERMANENT WATER QUALITY MANAGEMENT BASINS. SEDIMENT MUST BE STABILIZED TO PREVENT IT FROM BEING WASHED BACK INTO THE BASIN, CONVEYANCES, OR DRAINAGEWAYS DISCHARGING OFF-SITE OR TO SURFACE WATERS. THE CLEANOUT OF PERMANENT BASINS MUST BE SUFFICIENT TO RETURN THE BASIN TO DESIGN CAPACITY.
23. ON-SITE & OFF-SITE SOIL STOCKPILE AND BORROW AREAS SHALL BE PROTECTED FROM EROSION AND SEDIMENTATION THROUGH IMPLEMENTATION OF BMP'S. STOCKPILE AND BORROW AREA LOCATIONS SHALL BE NOTED ON THE SITE MAP AND PERMITTED IN ACCORDANCE WITH GENERAL PERMIT REQUIREMENTS.
24. TEMPORARY SOIL STOCKPILES MUST HAVE SILT FENCE OR OTHER EFFECTIVE SEDIMENT CONTROLS & CANNOT BE PLACED IN SURFACE WATERS, INCLUDING STORMWATER CONVEYANCES SUCH AS CURB & GUTTER SYSTEMS OR CONDUITS & DITCHES.
25. SLOPES SHALL BE LEFT IN A ROUGHENED CONDITION DURING THE GRADING PHASE TO REDUCE RUNOFF VELOCITIES AND EROSION.
26. DUE TO THE GRADE CHANGES DURING THE DEVELOPMENT OF THE PROJECT, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTING THE EROSION CONTROL MEASURES (SILT FENCES, CHECK DAMS, INLET PROTECTION DEVICES, ETC.) TO PREVENT EROSION.
27. ALL CONSTRUCTION SHALL BE STABILIZED AT THE END OF EACH WORKING DAY, THIS INCLUDES BACKFILLING OF TRENCHES FOR UTILITY CONSTRUCTION AND PLACEMENT OF GRAVEL OR BITUMINOUS PAVING FOR ROAD CONSTRUCTION.

MAINTENANCE NOTES:

ALL MEASURES STATED ON THIS EROSION AND SEDIMENT CONTROL PLAN, AND IN THE STORM WATER POLLUTION PREVENTION PLAN SHALL BE MAINTAINED IN FULLY FUNCTIONAL CONDITION UNTIL NO LONGER REQUIRED FOR A COMPLETED PHASE OF WORK OR FINAL STABILIZATION OF THE SITE. THE DESIGNATED CONTACT PERSON NOTED ON THIS PLAN MUST ROUTINELY INSPECT THE CONSTRUCTION ON SITE ONCE EVERY SEVEN DAYS DURING ACTIVE CONSTRUCTION AND WITHIN 24 HOURS AFTER A RAINFALL EVENT GREATER THAN 0.5 INCHES IN 24 HOURS. ALL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE CLEANED AND REPAIRED IN ACCORDANCE WITH THE FOLLOWING:

1. ALL SILT FENCES MUST BE REPAIRED, REPLACED, OR SUPPLEMENTED WHEN THEY BECOME NONFUNCTIONAL OR THE SEDIMENT REACHES 1/3 OF THE HEIGHT OF THE FENCE. THESE REPAIRS MUST BE MADE WITHIN 24 HOURS OF DISCOVERY, OR AS SOON AS FIELD CONDITIONS ALLOW ACCESS.
2. TEMPORARY AND PERMANENT SEDIMENTATION BASINS MUST BE DRAINED AND THE SEDIMENT REMOVED WHEN THE DEPTH OF SEDIMENT COLLECTED IN THE BASIN REACHES 1/2 THE STORAGE VOLUME. DRAINAGE AND REMOVAL MUST BE COMPLETED WITHIN 72 HOURS OF DISCOVERY, OR AS SOON AS FIELD CONDITIONS ALLOW ACCESS (SEE PART IV.D. OF THE GENERAL PERMIT).
3. SURFACE WATERS, INCLUDING DRAINAGE DITCHES AND CONVEYANCE SYSTEMS, MUST BE INSPECTED FOR EVIDENCE OF SEDIMENT BEING DEPOSITED BY EROSION. THE CONTRACTOR MUST REMOVE ALL DELTAS AND SEDIMENT DEPOSITED IN SURFACE WATERS, INCLUDING DRAINAGE WAYS, CATCH BASINS, AND OTHER DRAINAGE SYSTEMS, AND RESTABILIZE THE AREAS WHERE SEDIMENT REMOVAL RESULTS IN EXPOSED SOIL. THE REMOVAL AND STABILIZATION MUST TAKE PLACE WITHIN SEVEN (7) DAYS OF DISCOVERY UNLESS PRECLUDED BY LEGAL, REGULATORY, OR PHYSICAL ACCESS CONSTRAINTS. THE CONTRACTOR SHALL USE ALL REASONABLE EFFORTS TO OBTAIN ACCESS. IF PRECLUDED, REMOVAL AND STABILIZATION MUST TAKE PLACE WITHIN SEVEN (7) CALENDAR DAYS OF OBTAINING ACCESS. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING ALL LOCAL, REGIONAL, STATE AND FEDERAL AUTHORITIES AND RECEIVING ANY APPLICABLE PERMITS, PRIOR TO CONDUCTING ANY WORK.
4. CONSTRUCTION SITE VEHICLE EXIT LOCATIONS MUST BE INSPECTED FOR EVIDENCE OF OFF-SITE SEDIMENT TRACKING ONTO PAVED SURFACES. TRACKED SEDIMENT MUST BE REMOVED FROM ALL OFF-SITE PAVED SURFACES, WITHIN 24 HOURS OF DISCOVERY, OR IF APPLICABLE, WITHIN A SHORTER TIME TO COMPLY WITH PART IV.C.6 OF THE GENERAL PERMIT.
5. THE CONTRACTOR IS RESPONSIBLE FOR THE OPERATION AND MAINTENANCE OF TEMPORARY AND PERMANENT WATER QUALITY MANAGEMENT BMPS, AS WELL AS ALL EROSION PREVENTION AND SEDIMENT CONTROL BMPS, FOR THE DURATION OF THE CONSTRUCTION WORK AT THE SITE. THE PERMITTEE(S) ARE RESPONSIBLE UNTIL ANOTHER PERMITTEE HAS ASSUMED CONTROL ACCORDING TO PART II.B.5 OVER ALL AREAS OF THE SITE THAT HAVE NOT BEEN FINALLY STABILIZED OR THE SITE HAS UNDERGONE FINAL STABILIZATION, AND A NOT HAS BEEN SUBMITTED TO THE MPCA.
6. IF SEDIMENT ESCAPES THE CONSTRUCTION SITE, OFF-SITE ACCUMULATIONS OF SEDIMENT MUST BE REMOVED IN A MANNER AND AT A FREQUENCY SUFFICIENT TO MINIMIZE OFF-SITE IMPACTS (E.G., FUGITIVE SEDIMENT IN STREETS COULD BE WASHED INTO STORM SEWERS BY THE NEXT RAIN AND/OR POSE A SAFETY HAZARD TO USERS OF PUBLIC STREETS).
7. ALL INFILTRATION AREAS MUST BE INSPECTED TO ENSURE THAT NO SEDIMENT FROM ONGOING CONSTRUCTION ACTIVITIES IS REACHING THE INFILTRATION AREA AND THESE AREAS ARE PROTECTED FROM COMPACTION DUE TO CONSTRUCTION EQUIPMENT DRIVING ACROSS THE INFILTRATION AREA.

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Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

Certification
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Michael C. Brandt
Registration No. 42661 Date: 02/17/2012

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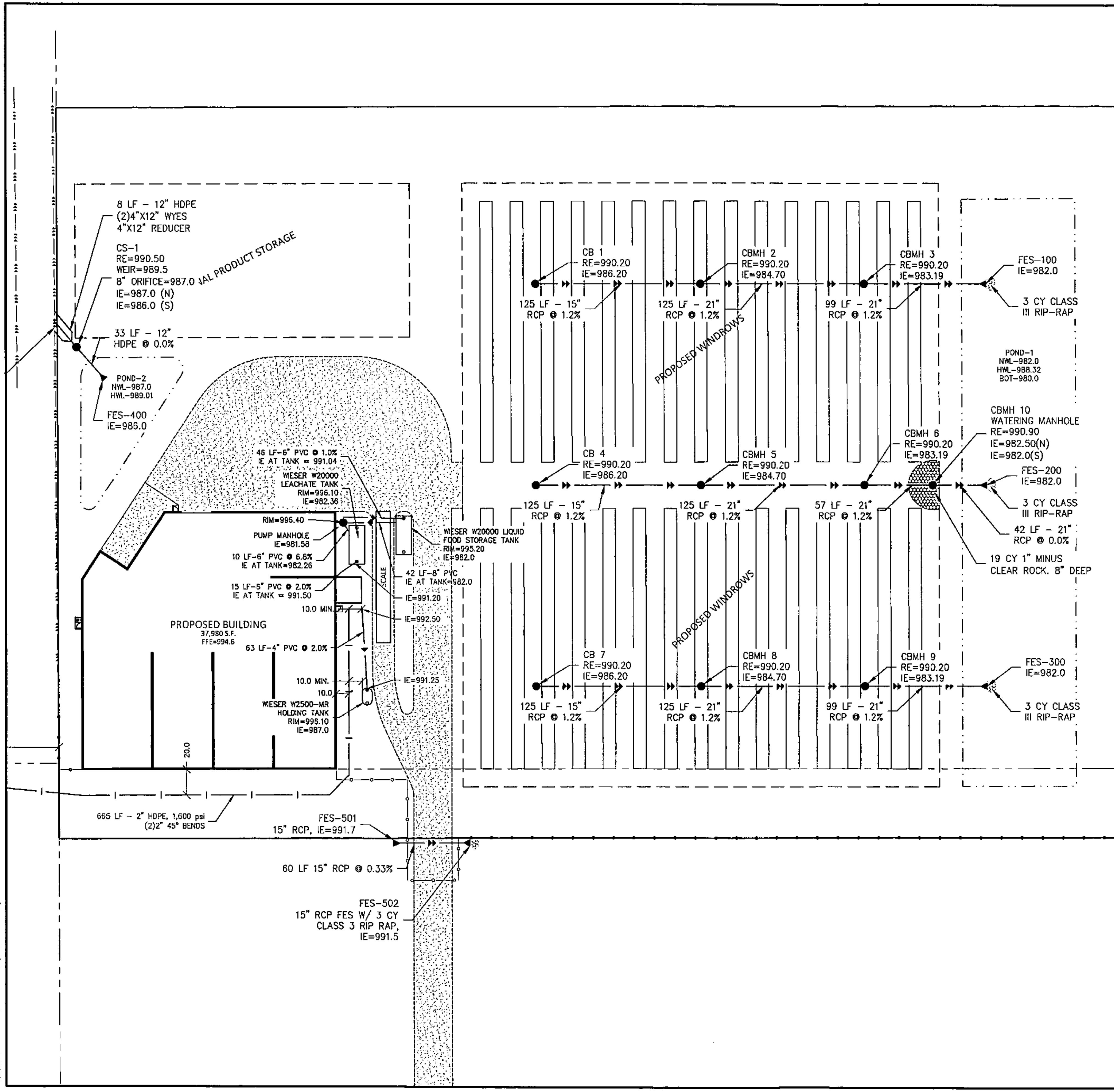
Sheet Title
EROSION CONTROL DETAILS

Sheet No. C5.03 **Revision** C

Project No. MFS19051



LEGEND

	PROPOSED	EXISTING
CURB & GUTTER		
STORM SEWER		
SANITARY SEWER		
FORCEMAIN (SAN.)	FM	FM
WATERMAIN		
EASEMENT		
DRAINTILE		
GAS LINE	UG	UG
ELECTRIC	UE	UE
TELEPHONE	UT	UT

UTILITY CONSTRUCTION NOTES

A. CONTRACTOR SHALL REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATIONS AND DIMENSIONS OF VESTIBULE, EXIT PORCHES, RAMPS, TRUCK DOCKS, PRECISE BUILDING DIMENSIONS AND EXACT BUILDING UTILITY ENTRANCE LOCATIONS.

B. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANY AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS. THE LOCATIONS OF SMALL UTILITIES SHALL BE OBTAINED BY THE CONTRACTOR, BY CALLING GOPHER STATE ONE CALL AT 454-0002.

C. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO AVOID PROPERTY DAMAGE TO ADJACENT PROPERTIES DURING THE CONSTRUCTION PHASES OF THIS PROJECT. THE CONTRACTOR WILL BE HELD SOLELY RESPONSIBLE FOR ANY DAMAGES TO THE ADJACENT PROPERTIES OCCURRING DURING THE CONSTRUCTION PHASES OF THIS PROJECT.

D. SAFETY NOTICE TO CONTRACTORS: IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS ON THE JOB SITE, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY DURING PERFORMANCE OF THE WORK. THIS REQUIREMENT WILL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE DUTY OF THE ENGINEER OR THE DEVELOPER TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES IN, ON OR NEAR THE CONSTRUCTION SITE.

E. ALL AREAS OUTSIDE THE PROPERTY BOUNDARIES THAT ARE DISTURBED BY UTILITY CONSTRUCTION SHALL BE RESTORED IN KIND. SODDED AREAS SHALL BE RESTORED WITH 6 INCHES OF TOPSOIL PLACED BENEATH THE SOD.

F. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING TRAFFIC CONTROL DEVICES SUCH AS BARRICADES, WARNING SIGNS, DIRECTIONAL SIGNS, FLAGMEN AND LIGHTS TO CONTROL THE MOVEMENT OF TRAFFIC WHERE NECESSARY. TRAFFIC CONTROL DEVICES SHALL CONFORM TO APPROPRIATE MINNESOTA DEPARTMENT OF TRANSPORTATION STANDARDS.

G. PRIOR TO PLACEMENT OF AGGREGATE BASE, A TEST ROLL WILL BE REQUIRED ON THE STREET AND PARKING AREA SUBGRADE. THE CONTRACTOR SHALL PROVIDE A LOADED TANDEM AXLE TRUCK WITH A GROSS WEIGHT OF 25 TONS. THE TEST ROLLING SHALL BE AT THE DIRECTION OF THE SOILS ENGINEER AND SHALL BE COMPLETED IN AREAS AS DIRECTED BY THE SOILS ENGINEER. THE SOILS ENGINEER SHALL DETERMINE WHICH SECTIONS OF THE STREET OR PARKING AREA ARE UNSTABLE. CORRECTION OF THE SUBGRADE SOILS SHALL BE COMPLETED IN ACCORDANCE WITH THE REQUIREMENTS OF THE SOILS ENGINEER.

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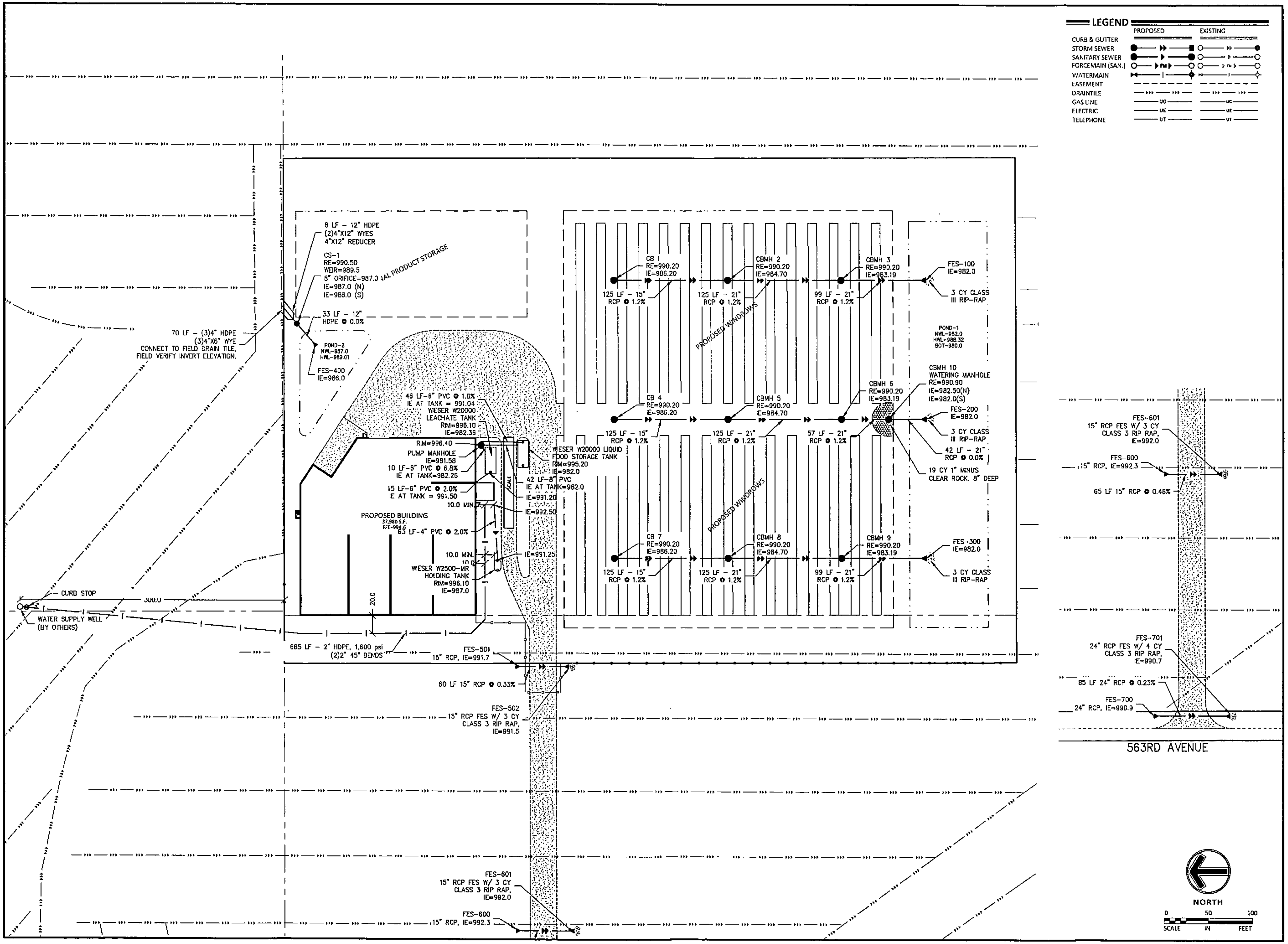
Sheet Title
UTILITY PLAN

Sheet No. C6.01 **Revision** C

Project No. MFS19051



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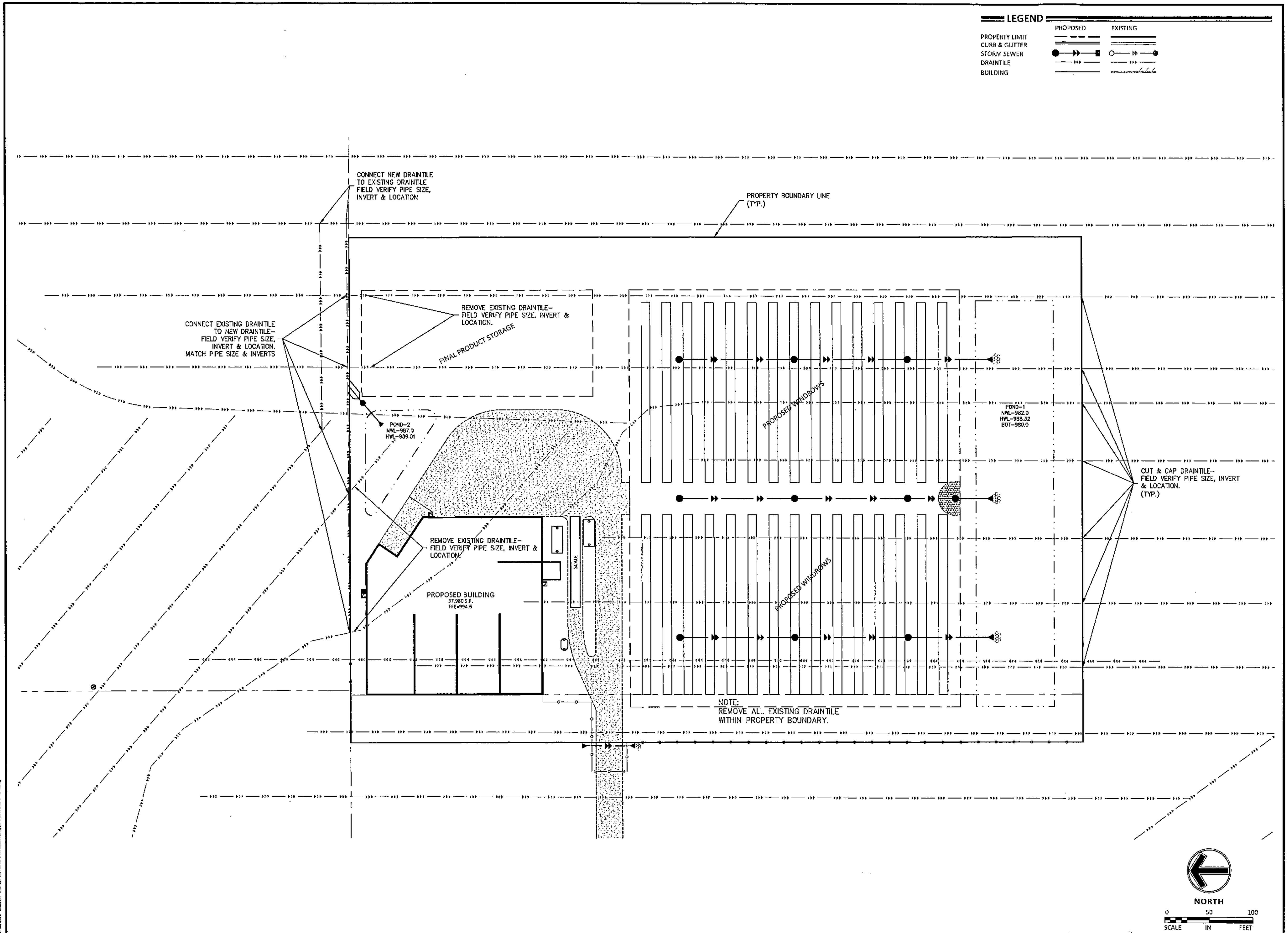
Sheet Title
OVERALL UTILITY PLAN

Sheet No. Revision
C6.02 C

Project No. MFS19051



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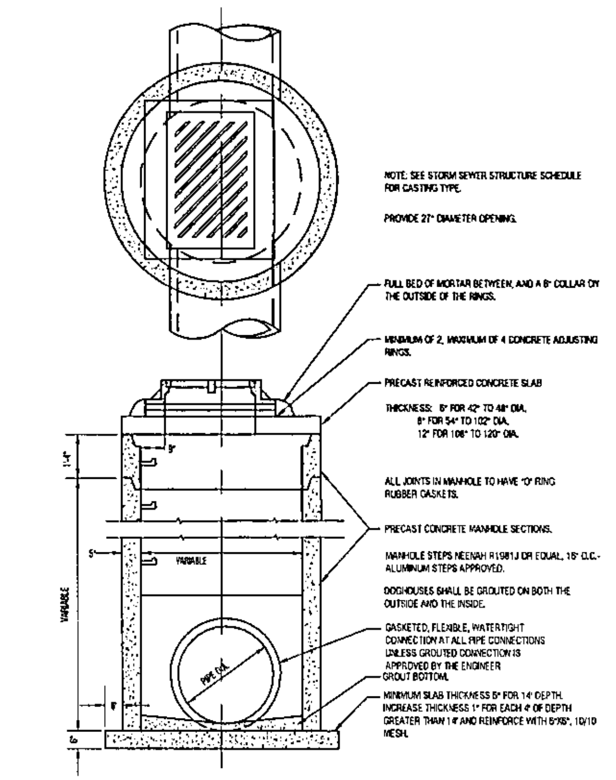
Sheet Title
DRAINTILE REMOVAL PLAN

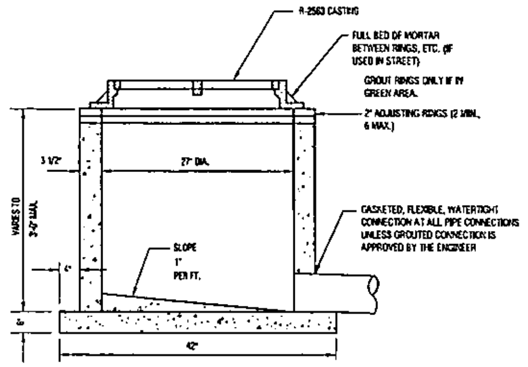
Sheet No. C6.03 **Revision** C

Project No. MFS19051



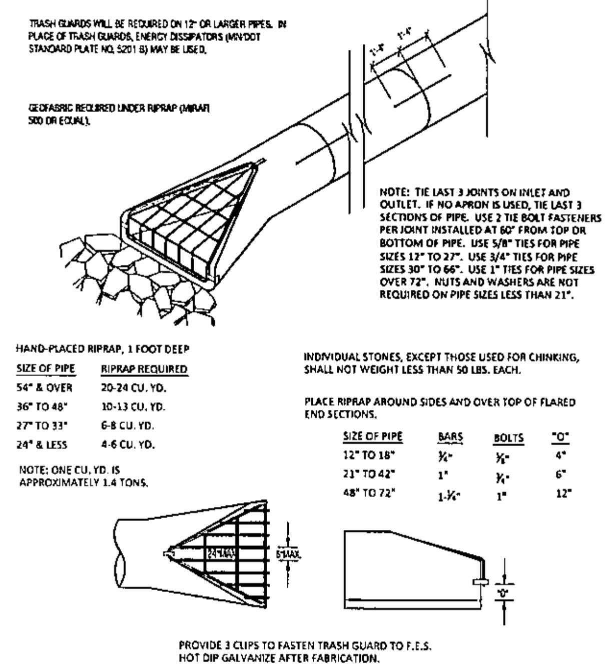
SS-02
05/06
NO SCALE

CATCH BASIN MANHOLE



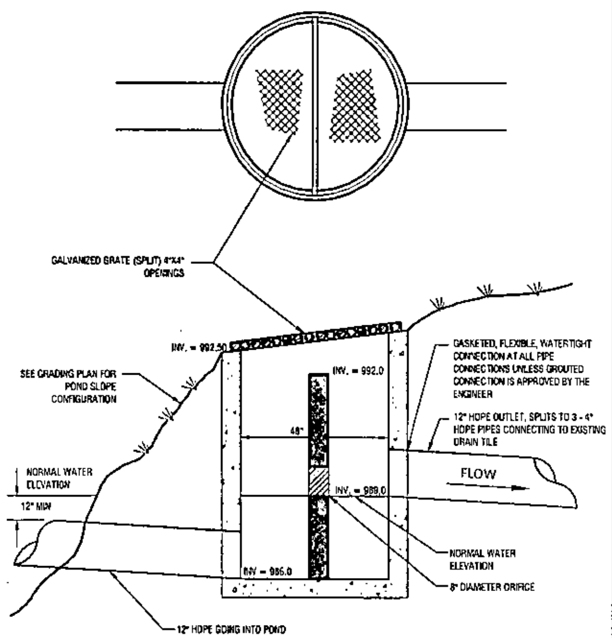
SS-04
05/06
NO SCALE

27" DIAMETER CATCH BASIN



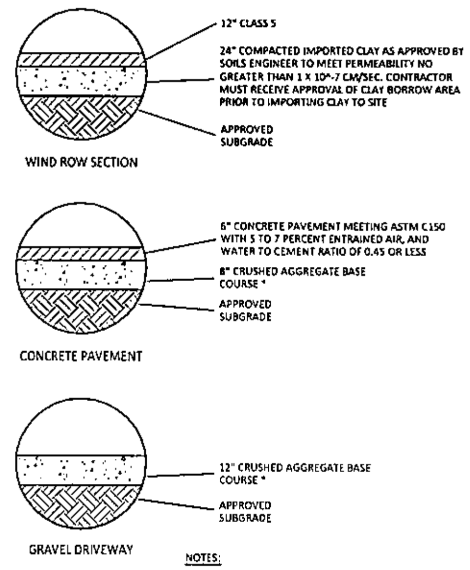
SS-06
10/08
NO SCALE

FLARED END SECTION



SS-10
05/06
NO SCALE

CONTROL STRUCTURE



*REFER TO MN/DOT SPECIFICATIONS

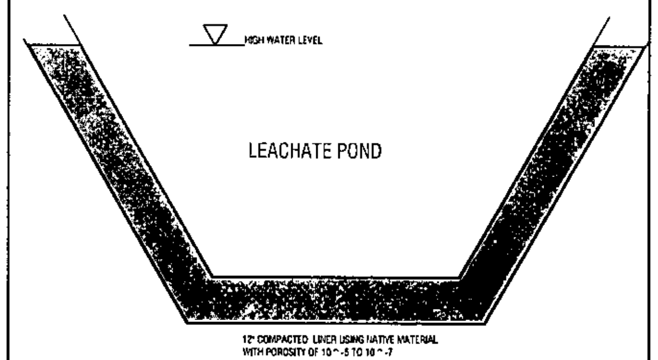
NOTES:

1. THE PAVEMENT SECTIONS SHALL BE CONSTRUCTED IN ACCORDANCE WITH MNDOT "STANDARD SPECIFICATION FOR CONSTRUCTION", AND ALSO THE REQUIREMENTS OF THE OWNER'S SOIL ENGINEER.

2. ALL THICKNESSES, AS SPECIFIED, ARE TO BE CONSIDERED MINIMUM DEPTHS, AFTER COMPACTION.

NO SCALE

PAVEMENT SECTIONS



NO SCALE

CLAY LINER FOR LEACHATE POND

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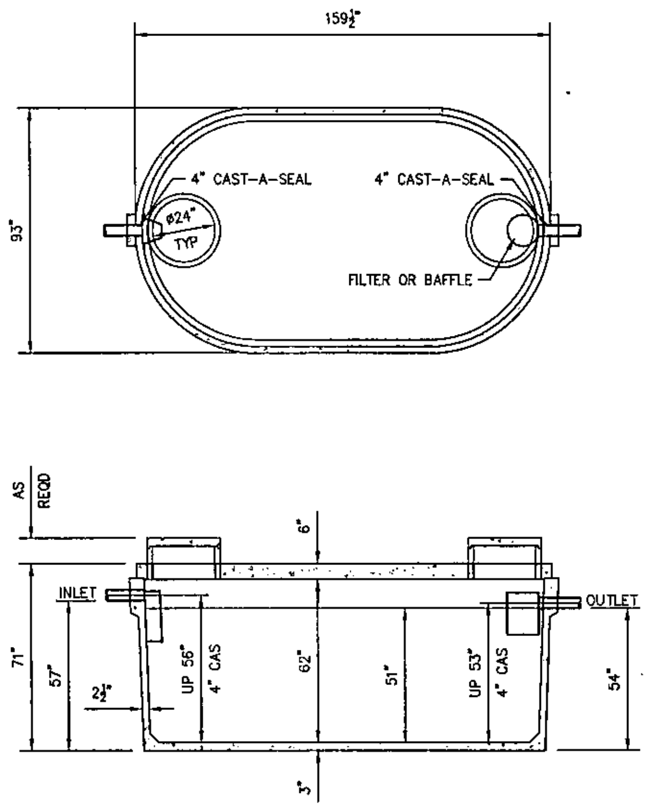
Sheet Title
CONSTRUCTION DETAILS

Sheet No. Revision
C7.01 C

Project No. MFS19051

W2500-MR
TANK SPECIFICATIONS



DIMENSIONS:
WALL: 2 1/2"
BOTTOM: SEPTIC 3"
HEAVY DUTY 5" (ADD 2,300 LBS.)
COVER: 6"
MANHOLE: 24" I.D. PRECAST CONCRETE RISER
HEIGHT: 71" O.D.
LENGTH: 159 1/2" O.D.
WIDTH: 93" O.D.
BELOW INLET: 57" O.D.
LIQUID LEVEL: 51"
WEIGHT: 15,205 LBS. SEPTIC
17,505 LBS. HOLDING

INLET AND OUTLET:
4" CAST-A-SEAL BOOT OR EQUAL
GASKET, CAST-A-SEAL BOOT OR EQUAL

INLET AND OUTLET BAFFLE AND FILTER:
WISCONSIN, SEE DETAIL #10
(OTHER STATES SEE CHART)

LIQUID CAPACITY: 49.46 GAL/IN

LOADING DESIGN: 8' 0" UNSATURATED SOIL

HOLDING TANK:
OUTLET HOLE PLUGGED
ACTUAL CAPACITY: 2,671 GALLONS

MN TANKS:
WILL HAVE ONE VENT OVER OUTLET
AND WILL HAVE TWO VENTS IN COVER OVER INLET

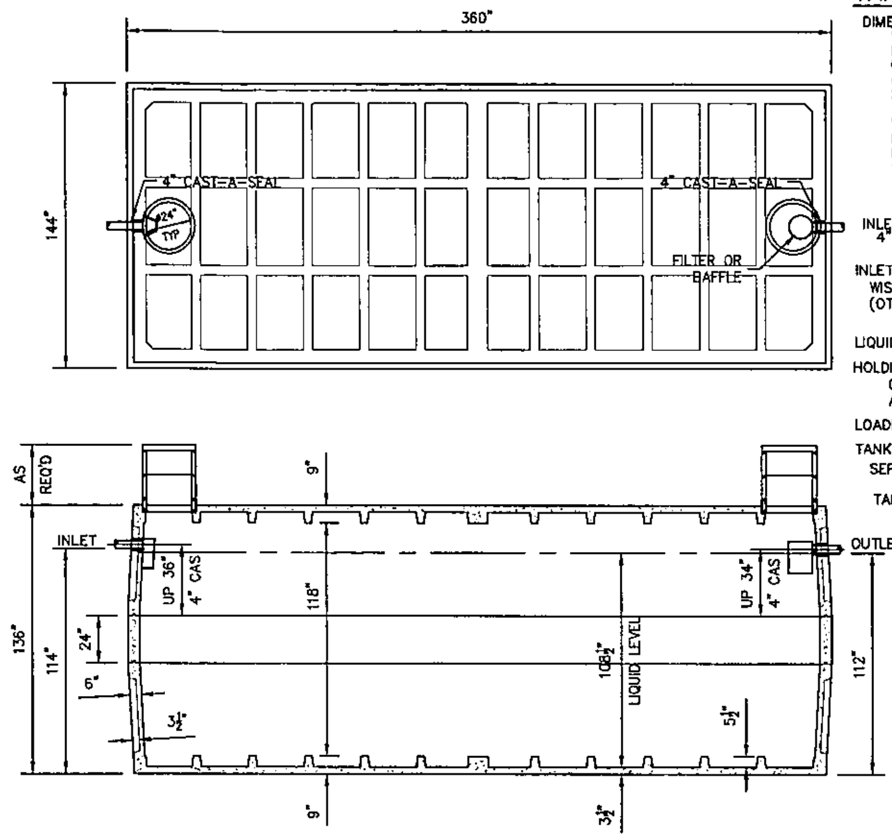
TANK CAN BE USED AS:
SEPTIC/ HOLDING/ PUMP OR SIPHON

COVER: MIX DESIGN #8 (NO FIBER)
TANK: MIX DESIGN #9 (SMALL FIBER)

CUSTOMIZED TANKS:
FOR CUSTOM TANKS CONTACT WIESER CONCRETE

TANKS ARE MANUFACTURED TO MEET OR EXCEED ASTM C-1227 REQUIREMENTS

W20000
TANK SPECIFICATIONS



DIMENSIONS:
WALL: 6" RIBBED
BOTTOM: 9" RIBBED
COVER: 9" RIBBED
MANHOLE: 24" I.D. PRECAST RISER
HEIGHT: 136" O.D.
LENGTH: 360" O.D.
WIDTH: 144" O.D.
BELOW INLET: 114" O.D.
LIQUID LEVEL 108.5"
WEIGHT: 42,000 LBS
PER TOP OR BOTTOM SECTION
12,600 FOR MIDDLE SECTION

INLET AND OUTLET:
4" CAST-A-SEAL BOOT OR EQUAL

INLET AND OUTLET BAFFLE AND FILTER:
WISCONSIN, SEE DETAIL #10
(OTHER STATES SEE CHART)

LIQUID CAPACITY: 194.63 GAL/IN

HOLDING TANK:
OUTLET HOLE PLUGGED
ACTUAL CAPACITY: 21,507 GALLONS

LOADING DESIGN: 8'-0" UNSATURATED SOIL

TANK CAN BE USED AS:
SEPTIC / HOLDING / PUMP OR SIPHON

TANK: MIX DESIGN #9 (SMALL FIBER)

CUSTOMIZED TANKS:
FOR CUSTOM TANKS CONTACT WIESER CONCRETE

TANKS ARE MANUFACTURED TO MEET OR EXCEED ASTM C-1227 REQUIREMENTS

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Michael C. Brandt
Registration No. 42661 Date: 02/17/2012

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Sheet Title
CONSTRUCTION DETAILS

Sheet No. C7.02 **Revision** C

Project No. MFS19051

Specifications

for

Full Circle Organics – Good Thunder Organic Composting Site
Good Thunder, Minnesota

Grading, Erosion Control, Utilities and Road Work

prepared for:

MFS Farms / Full Circle Organics

November, 2011

Revised February, 2012

SPECIFICATIONS

FOR

Full Circle Organics – Good Thunder Organic Composting Site
Good Thunder, Minnesota

Grading, Erosion Control, Utilities and Road Work

PREPARED FOR:

MFS Farms / Full Circle Organics

November, 2011
Revised February, 2012

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___/___/___..Minn. Reg. No. 42661
Michael C. Brandt, P.E.

SECTION 00005
TABLE OF CONTENTS

END OF TABLE OF CONTENTS

SECTION 00020
INVITATION TO BID

MFS Farms / Full Circle Organics

Full Circle Organics Good Thunder Site Composting Facility

Grading, Erosion Control, Utilities and Road Work

MFRA #19051

Bids are due at the offices of:

MFRA, Inc.
14800 28th Avenue North, Suite 140
Plymouth, Minnesota 55447
at:

TBD ___.M.
__________, ______________ ___, 20___
at which time they will be opened.

The proposal may be faxed to:

MFRA, Inc.
ATTN: Michael C. Brandt
(Project engineer)
(763) 476-8532

Copies of the plans and specifications and other proposed contract documents are on file at the offices of MFRA, Inc., 14800 28th Avenue North, Suite 140, Plymouth, Minnesota 55447. Plans and specifications for use in preparing bids may be obtained at the offices of the Engineer, upon payment of $_______ per set (includes MN sales tax), which is NON-REFUNDABLE.

A Bid Bond is not required.

END OF INVITATION TO BID

SECTION 00100
INSTRUCTIONS TO BIDDERS

1-1 PROPOSAL: Each Proposal shall be typed or written in ink on the Bid Form provided by the OWNER. No alterations in proposals, or in the printed forms therefore, by erasures, interpolations, or otherwise will be acceptable unless each such alteration is signed or initialed by the Bidder. Acknowledgment of all Addenda to the Contract Documents shall be made on the Bid Form. In the event of a conflict between the stipulated amount of the proposal written in words and the stipulated amount written in figures, the amount written in words shall govern.

No bidder may submit more than one proposal. Two proposals under different names will not be accepted from one firm or association.

1-2 PROPOSAL GUARANTEE: Bid security will not be required in submitting a proposal.

1-3 WITHDRAWAL OF BID: No bidder may withdraw a proposal for a period of sixty (60) days after the date and hour set for the opening. A bidder may, upon written request, withdraw a proposal at any time prior to the deadline for submission of bids.

1-4 ACCEPTANCE AND REJECTIONS OF BIDS: The OWNER reserves the right to accept the bid which is the lowest responsive, responsible bidder; to award the contract by sections; to reject any or all bids; and to waive irregularities or informalities in any bid. Bids received after the specified time of closing will be returned unopened.

1-5 SIGNATURE OF BIDDERS: Each bidder shall sign the proposal using his/her usual signature and giving a full business address. Bids by partnerships shall be signed with the partnership name, followed by the signature and designation of one partner or other authorized representative. Bids by corporations shall be signed with the name of the corporation, followed by the signature and designation of the person authorized to bind the corporation.

1-6 INTERPRETATION OF CONTRACT DOCUMENTS: If any questions should arise as to the true meaning of any part of the plans, specifications or other proposed contract documents, the prospective bidder may submit a written request to the Engineer for an interpretation thereof. The interpretation of the proposed contract documents will be made by addendum. A copy of each addendum will be mailed or delivered to each person obtaining a set of contract documents from the Engineer.

1-7 LOCAL CONDITIONS AFFECTING WORK: Each bidder shall visit the site of the work and shall be thoroughly and fully informed, relative to construction hazards and procedure, labor, and all other conditions and factors, local and otherwise, which would affect the prosecution and completion of the work and its cost. Such considerations shall include the arrangement and conditions of existing structures and facilities affecting, or which are affected by, the proposed work, procedure necessary for maintenance of uninterrupted operation of existing facilities, availability and cost of labor, and facilities for transportation, handling, and storage of materials and equipment. All such factors shall be properly investigated and considered in the preparation of the bidder's proposal. There will be no subsequent financial adjustment to any contract for lack of such prior information or its effect on the cost of the work.

1-8 PAYMENTS: Payment for all work performed under the proposed contract will be issued and paid as provided in the General Conditions.

1-9 TIME OF COMPLETION: The time of completion is an essential part of the contract and it will be necessary for each bidder to satisfy the OWNER of the ability to complete the work within the allowable time. In this regard, attention is directed to the provisions of the General Conditions and Supplementary Conditions relative to delays, completion date, extensions of time, and liquidated damages.

1-10 QUALIFICATIONS OF BIDDERS: Bidders may be required to submit satisfactory evidence that they have a practical and technical knowledge of the particular work bid upon and that they have the necessary financial resources to complete the proposed work.

Each bidder may be required to show that former work performed has been handled in such a manner that there are no just or proper claims pending against such work. No bid submitted by a bidder who is engaged on any work which would impair his ability to finance the work covered by such bid or to provide suitable equipment for its proper prosecution and completion will be accepted.

A bidder will be disqualified for any of the following reasons: submission of more than one proposal for the same work, collusion, unbalance bids, or failure to submit a price for each item of work called for in the proposal.

1-11 PERFORMANCE AND PAYMENT BONDS: Each bidder to whom a contract is awarded will be required to furnish a Performance and a Payment Bond to the OWNER, each in an amount equal to one hundred (100) percent of the contract price as required by law.

1-12 NON-DISCRIMINATION IN EMPLOYMENT: Contracts for work under this proposal will obligate the contractors and all subcontractors not to discriminate in the employment of common or skilled persons who are citizens of the United States and qualified to do the work required because of their race, creed, or color.

END OF INSTRUCTIONS TO BIDDERS

SECTION 00300
BID FORM

November 22, 2011

MFS Farms / Full Circle Organics
c/o MFRA, Inc.
14800 28th Avenue North, Suite 140
Plymouth, Minnesota 55447

SUBJECT: MFS Farms / Full Circle Organics
Earthwork, Erosion Control, Road Construction and Utility Work
MFRA #19051

To Whom It May Concern:

We, the undersigned, having carefully examined the site of the proposed work and the plans and specifications, instructions to bidders and contract documents prepared by MFRA, Inc., Consulting Engineers for the subject project, do hereby propose to furnish all labor, tools, materials and equipment, and incidentals required for the complete construction of said project and such other work as may be incidental thereto for the following unit or lump sum prices:

ITEM		QUANTITY		UNIT PRICE	TOTAL
1.	Clear and Grub	1	LS	$ _______/	$__________
2.	Silt Fence	4,500	LF	$ _______/	$__________
3.	Common Excavation	10,000	CY	$ _______/	$__________
4.	Muck Excavation	10,000	CY	$ _______/	$__________
5.	Drain Tile Abandonment	1	LS	$ _______/	$__________
6.	Import Clay	33,500	CY	$ _______/	$__________
7.	Class V	13,000	TON	$ _______/	$__________
8.	12" RCP Pipe	90	LF	$ _______/	$__________
9.	15" RCP Pipe	730	LF	$ _______/	$__________
10.	18" RCP Pipe	82	LF	$ _______/	$__________
11.	27" Catch Basin	7	EA	$ _______/	$__________
12.	48" Storm Manhole	1	EA	$ _______/	$__________
13.	4" HDPE Drain Tile	300	LF	$ _______/	$__________
14.	Outlet Control Structure	3	EA	$ _______/	$__________
15.	24" RCP Pipe	132	LF	$ _______/	$__________
16.	12" FES RCP	5	EA	$ _______/	$__________
17.	18" FES RCP	1	EA	$ _______/	$__________
18.	24" RCP FES	4	EA	$ _______/	$__________
19.	12" RSV	1	EA	$ _______/	$__________
20.	Inlet Protection	10	EA	$ _______/	$__________
21.	Rock Entrance	1	EA	$ _______/	$__________

22.	Seeding	4	AC	$	______/	$________
23.	Erosion Control Blanket	16,600	SY	$	______/	$________
24.	4" x 12" WYE	6	EA	$	______/	$________
25.	Rip Rap	1	LS	$	______/	$________
26.	15" FES RCP	2	EA	$	______/	$________
27.	12" PVC, SDR26	12	LF	$	______/	$________
28.	12" HDPE Pipe	38	LF			
29.	8" Structural Concrete at Dock	1,650	SF	$	______/	$________
30.	Sand Fill	5,000	CY	$	______/	$________
	TOTAL BID					$________

The undersigned bidder also agrees to furnish the required bond and to enter into a contract with the OWNER within ten (10) days after the OWNER'S acceptance of this Proposal or any section or sections thereof, and further agrees to complete the entire work covered in the contract award within the time period outlined in Section 2 of the Supplementary Conditions (Section 00800).

In submitting this bid, it is understood that the OWNER reserves all rights to reject any and all bids, and it is understood that this bid may not be withdrawn within a period of sixty (60) days after the scheduled time for the receipt of bids.

Receipt of Addendum No. __________ is acknowledged.

____
(Individual; Partnership; Corporation)

By: ____________________________________

Address: _________________________________

Phone: __________________________________

END OF BID FORM

SECTION 00500
CONTRACT

THIS AGREEMENT, made this ______ day of ________________, 20____ by and between ____________________, party of the first part and hereinafter called the OWNER, and _________________________, party of the second part and hereinafter called the CONTRACTOR.

THE CONTRACTOR did on ________________, 20____ submit a Proposal for _________________________________, as detailed on certain plans and specifications prepared for the OWNER by MFRA, Inc., Engineers and Land Surveyors, and entitled "____." A copy of the proposal is attached hereto and made a part hereof.

IT IS MUTUALLY understood and agreed by the parties hereto that the instructions to bidders, forms of proposal, construction bond when required by the specifications, general detailed plans and specifications and Addendum No. _______ are part of this contract the same as if each had been fully set out and attached hereto.

IN CONSIDERATION of the following mutual agreements and covenants to be kept by each party, the CONTRACTOR agrees to furnish all tools, labor, equipment and materials to complete the project in accordance with said plans and specifications.

THE OWNER agrees to pay the CONTRACTOR in accordance with the provisions of said Specifications and the lump sum and/or unit prices as set forth in the attached proposal in the amount of: ____($______________).

IT IS mutually agreed by each party hereto that all provisions of said plans and specifications shall be strictly complied with the same as if rewritten herein, and that no substitution or change in said plans and specifications shall be made except upon the written consent of the Owner's Engineer, MFRA, Inc., and such allowance shall in no manner be construed to release either party from any specified or implied obligation of said plans and specifications.

IN WITNESS whereof, We, the contracting parties by our agents hereto affix our signatures.

______________________________	______________________________
(OWNER)	(CONTRACTOR)
By:___________________________	By:___________________________
Date:_________________________	Date:_________________________

END OF CONTRACT

SECTION 00510
NOTICE OF AWARD

To: ____

____

Project Description: ____

____

The OWNER has considered the BID submitted by you for the above described WORK dated the ________ day of ____________________, 20____.

You are hereby notified that your BID has been accepted for items in the amount of: ____($______________).

You are required by the Instructions To Bidders to execute the Agreement and furnish the required CONTRACTOR'S BOND when required by the specification and Certificates of Insurance within ten (10) days from the date of this Notice to you. Copies of the pertinent specifications relating to the Insurance requirements are attached.

If you fail to execute said Agreement and to furnish said BOND within ten (10) days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER's acceptance of your BID as abandoned.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

Dated this ______ day of ______________, 20___.

By: ____
MFRA, Inc.

For: ____
Owner

- ACCEPTANCE OF NOTICE -

Receipt of the above NOTICE OF AWARD is hereby acknowledged by:_________________

________________________________ this _______ day of ____________, 20___.

By: ____

____
Title

END OF NOTICE OF AWARD

SECTION 00520
NOTICE TO PROCEED

DATE: ______________________________

TO: ______________________________

____

PROJECT: ______________________________

____

You are hereby notified to commence WORK in accordance with the Agreement dated ____________ __, 20___, on or before the Contract Time date of ______________ ____, 20___, and you are to substantially complete the WORK within _____ consecutive calendar days thereafter. The date of substantial completion of all WORK is therefore ______________________________.

BY: ______________________________
MFRA, INC.

FOR: ______________________________
OWNER

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by ______________________________, this ______ day of __________, 20__.

BY: ______________________________

____

END OF NOTICE TO PROCEED

SECTION 00800
SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC C-700, 2002 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

ARTICLE 1 DEFINITIONS

The terms used in these Supplementary Conditions which are defined in the Standard General Conditions of the Construction Contract (EJCDC C-700, 2002 Edition) have the meanings assigned to them in the General Conditions.

ARTICLE 2 PRELIMINARY MATTERS

SC-2.03 Commencement of Contract Time; Notice to Proceed

1. Amend this Section to include the following definition of the Contract Time:

   The CONTRACTOR shall substantially complete the work within 180 consecutive calendar days from the date of the commencement of the Contract Time. (The date indicated in the Notice to Proceed.)

2. ADD the following sentence at the end of Section 2.03:

   "The amount of liquidated damage shall be $2,500 per day for each and every calendar day the WORK is not substantially completed. This amount will be assessed, not as a penalty, but as a predetermined and agreed liquidated damage that will be sustained by the OWNER and the CONTRACTOR shall be responsible for all construction related engineering service costs provided by the Engineer for the OWNER for each day after the WORK is not substantial completed. The damages and costs will be deducted from payments requested by the CONTRACTOR.

ARTICLE 3 CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

SC-3.02 Reference Standards

ADD the following paragraphs at the end of Section 3.02:

All WORK shall conform with the requirements of the latest standards and codes as published by:

American Concrete Institute
American Institute of Electrical Engineers

American Society of Civil Engineers
American Society of Heating and Ventilating Engineers
American Society of Mechanical Engineers
American Society of Testing Materials
American Water Works Association
American Welding Society
Minnesota Department of Health
Minnesota Department of Transportation
Minnesota Pollution Control Agency
National Board of Fire Underwriters
National Electrical Manufacturer's Association

When the plans and specifications require a grade of construction in excess of the standards and codes, they shall not be construed as permitting a lower grade of construction.

ARTICLE 4 AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

SC-4.02 Subsurface and Physical Conditions

ADD the following paragraphs at the end of Section 4.02:

The OWNER has had a subsurface exploration performed by a soils consultant, the results of which are contained in the consultant's report, which is attached hereto in the Appendix of these Specifications. The consultant's report presents his conclusions on the subsurface conditions, based on his interpretation of the data obtained in the exploration. The CONTRACTOR acknowledges that he has reviewed the consultant's report and any addenda thereto.

The CONTRACTOR may complete his own subsurface exploration within the site if approved by the OWNER after receiving a written request by the CONTRACTOR.

The CONTRACTOR, by submitting a bid, acknowledges that he has investigated the site to determine the type, quantity, quality, and character of excavation work to be performed.

SC-4.03 Differing Subsurface or Physical Conditions:

If the Site Grading Construction is to be paid at a lump sum price, the CONTRACTOR waives his rights under Section 4.03 of the Standard General Conditions of the Construction Contract for a possible Contract Price and/or Contract Time Adjustment.

SC-4.04 Underground Facilities

ADD the following paragraphs at the end of Section 4.04:

Underground facilities include all pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems, or water.

"Utility quality level" means a professional opinion about the quality and reliability of utility information. There are four levels ranging from most precise, level A, to least precise, level D. The level must be determined in accordance with the guidelines established by the Construction Institute of the American Society of Civil Engineers in document CI/ASCE 38-02 titled "Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data."

SC-4.05 Reference Points

ADD the following paragraphs at the end of Section 4.05:

B. Primary staking for location and grade shall be provided by the Engineer at the expense of the OWNER. Restaking for reasons other than the fault of the Engineer or OWNER shall be at the CONTRACTOR'S expense.

The CONTRACTOR shall give the Engineer a minimum of 48 hours notice of his need for the establishment of lines and grades and shall provide at his own expense such assistance as is required for setting lines and grade stakes and other reference points. No additional compensation will be allowed the CONTRACTOR for any delay claim due to a lack of line and grades stakes.

Unless otherwise specified, the following schedule indicates the standard locations and number of stakes to be established by the Engineer.

1. Two sets of grade stakes shall be placed on street centerline at 50 foot intervals (one set for rough grading and one set for fine grading for tolerancing); on single-family residential subdivisions, one set of grade stakes will be placed at each lot corner, and one stake on the building pad for final grade verification and tolerancing; on building centerline, building corners, or building pads for multi-family development; and on building corners or building pads and driveway centerline and/or parking lot corners for commercial, industrial, and apartment development.

2. Stakes for sanitary sewers and storm sewers will be placed at 50 foot intervals and stakes for watermain will be placed at 50 foot intervals on an offset line parallel to the proposed pipeline. Unless the CONTRACTOR specifies to the contrary, the location of the offset line will be determined by the survey crew;

3. Stakes for concrete curb will be placed at 25 foot intervals on horizontal and vertical curves, and 50-foot intervals otherwise. Unless otherwise requested, stakes shall be on a three foot offset line;

4. Stakes for gravel base shall be set only when no concrete curb is proposed or when the roadway width between the concrete curb exceeds 50 feet. Stakes shall be set on centerline at 50 foot intervals. When concrete curb is proposed, the CONTRACTOR shall use the curb to determine the proper elevations of all WORK between the curbs.

C. Grades as marked in the field shall be to finished grade unless otherwise marked. The finished grade shall refer to the following unless otherwise marked.

1. Top of curb grade for curb and gutter construction.

2. Finished centerline surface grade for street construction.

3. Pipe invert grade for underground sewer construction.

4. Top of pipe grade for watermain construction.

D. It is the responsibility of the CONTRACTOR to preserve all construction stakes and other survey control points. The costs incurred in replacement of disturbed stakes may be deducted from payments to the CONTRACTOR in any case where the disturbance or loss is not directly attributable to an error or act of the OWNER or Engineer.

Survey staking crews shall use a separate cut-sheet for restaking and no initial or primary staking computations shall be shown on that same sheet. In addition to the normal information given, a cut-sheet used for restaking shall also contain the following information:

1. A statement that the staking is restaking for original stakes which have been lost or disturbed;

2. The actual number of hours to be charged as restaking;

3. The reason that the stakes were lost or disturbed if the reason is apparent.

E. The Engineer shall periodically report the details of the restaking to the CONTRACTOR and to the OWNER and shall, at the end of the pay period, recommend the amount of money to be withheld from the payment to the CONTRACTOR.

The CONTRACTOR shall make no change from the alignment or grade as established by the staking, but shall use his best prudent judgment as an expert in construction in questioning a possible error in staking. Whenever such a possible error exists, it shall be the CONTRACTOR'S responsibility to contact the Engineer for a clarification or field check. Any WORK performed after such notification and prior to such clarification by the Engineer shall be replaced or repaired at the CONTRACTOR'S expense if the WORK is determined to be incorrect or unacceptable.

If, after the completion of any portion of the WORK, an error is discovered, the Engineer shall immediately relocate any remaining construction stakes to determine the cause for such error. If the remaining stakes are insufficient to determine an error by the Engineer or OWNER, and if no errors are found on the cut-sheets or other staking notes, it shall be deemed to be the CONTRACTOR'S error and will be acceptably corrected at his own expense.

ARTICLE 5 BONDS AND INSURANCE

SC-5.01 Performance, Payment and Other Bonds:

ADD the following paragraphs at the end of Section 5.01:

E. Upon completion of all work included in the public ROW and after the County is satisfied that all work has been completed in accordance with the plans and specifications, the CONTRACTOR shall be required to furnish the County a 1-year maintenance bond guaranteeing said work to the County. Costs for this item shall be merged with the contract costs, and no special payment shall be made for this item.

F. No bid bond is required for this project.

G. The Performance Bond and Payment Bond form to be used shall be AIA Document A312. This form is available at the following location:

The American Institute of Architects (AIA)
275 Market Street, Suite 54

Minneapolis, Minnesota 55405
Phone: (612) 338-6763

H. This project includes work within a right of way of 563rd Avenue and Blue Earth (County) who has jurisdiction. A permit has been applied for and is held by the right of way authority. The right of way authority requires a surety bond or certified check in the amount of $________________ to be deposited as surety. The deposited surety is to assure that the work conducted within the right of way is done in accordance with the rules and regulations, the special provisions and the sketches contained within the permit.

The Contractor shall provide the required surety directly to the right of way authority to obtain the permit to work in the right of way of 563rd Avenue. A copy of the permit document shall be provided to the Project Engineer and the Owner before work can commence. A copy of the permit shall be on file at the construction site until the work is completed and accepted. Costs for this item shall be merged with the contract costs, and no special payment will be made for this item.

SC-5.03 "Certificate of Insurance"

ADD the following paragraph at the end of Section 5.03:

C. Acceptance of a Certificate of Insurance, by any party to the contract or the failure of the OWNER to not object to the coverage as meeting the specified requirements, does not relieve any other party of its responsibility to provide insurance as required by the contract documents or any amendment or addendum thereof. In the cancellation section of Certificate of Insurance, delete "endeavor to" and "but failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents or representatives."

SC-5.04 CONTRACTOR'S Liability Insurance

ADD the following at the end of Section 5.04:

C. Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:

1. Premises Operations (including X, C, U coverage as applicable)

2. Independent Contractors' Protective

3. Products and Completed Operations

4. Personal Injury Liability with Employment Exclusion deleted.

5. Contractual, including specified provision for CONTRACTOR'S obligation under Paragraph 6.30 and 6.31.

6. Owned, non-owned and hired motor vehicles

7. Broad Form Property Damage including Completed Operations.

If the General Liability coverages required by Paragraph 5.04 are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extending reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment is made.

D. The insurance required by 5.04 shall be written for not less than the following limits, or greater if required by law.

1. Worker's Compensation:

   a. State: Statutory

2. Commercial General Liability (including Premises- Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage):

   a. Bodily Injury and Property Damage - Combined Single Limit:

      $1,000,000 Each Occurrence
      $2,000,000 Aggregate

   b. Products and Completed Operations to be maintained for one year after final payment.

   c. Property Damage Liability Insurance shall provide X, C and U coverage.

   d. Broad Form Property Damage Coverage shall include Completed Operations.

   e. Personal Injury, with Employment Exclusion deleted:

      $1,000,000 Aggregate

f. Fire Damage Limit shall be not less than $50,000 on any one fire.

g. Medical Expense Limit shall be not less than $5,000 on any one person.

3. Business Auto Liability (including owned, non-owned and hired vehicles):

   a. Combined single limits for bodily injury and property damage of $1,000,000 for each occurrence.

4. Umbrella Excess Liability:

   $2,000,000 over primary insurance
   $10,000 retention for self-insured hazards each occurrence

SC-5.06 Property Insurance

Section A

Modify the first sentence of 5.06A as follows: DELETE "Unless otherwise provided in the Supplementary Conditions, the OWNER" and substitute "The CONTRACTOR".

ADD the following sentences:

The form of policy for this coverage shall be Completed Value.

If the OWNER is damaged by the failure of the CONTRACTOR to maintain such insurance, then the CONTRACTOR shall bear all reasonable costs properly attributable thereto.

Section B

Change the first word of 5.06B from "OWNER" to "CONTRACTOR".

Section E

Where "OWNER" appears in 5.06E, change to "CONTRACTOR" and where "CONTRACTOR" appears, change to "OWNER."

SC-5.07 Waiver of Rights

In Section 5.07A, in the last sentence, change "OWNER" to "CONTRACTOR".

SC-5.08 Receipt and Application of Insurance Proceeds

Where "OWNER" appears in 5.08A and B, change to "CONTRACTOR".

ARTICLE 6 CONTRACTOR'S RESPONSIBILITIES

SC-6.06 Concerning Subcontractors, Suppliers and Others

ADD the following to Section 6.06B:

At the preconstruction conference, the CONTRACTOR will furnish to the Engineer, a complete list of the subcontractors and suppliers he proposes to use on the project. This list will be reviewed by the Engineer and local unit of government and concerns will be brought to the Contractor's attention.

SC-6.17 Shop Drawings and Samples

ADD the following sentence to Section 6.17A: "The CONTRACTOR shall submit five (5) copies of all shop drawings and samples and allow the Engineer fifteen (15) working days for shop and working drawing review."

ARTICLE 8 OWNER'S RESPONSIBILITIES

SC-8.11 Evidence of Financial Arrangements

ADD the following:

B. "The low bidder shall have the right to receive financial data from the OWNER which provides information to the bidder under consideration for award that the payment provisions under the contract can be met by the OWNER. In the event that the OWNER refuses to provide financing information to the bidder, or should the bidder consider the OWNER'S resources are inadequate, the bidder may withdraw his bid without penalty."

ARTICLE 14 PAYMENTS TO CONTRACTOR AND COMPLETION

SC-14.02 Progress Payments

A. Applications for Payment

DELETE 14.02A3 and SUBSTITUTE the following:

3. "The amount of retainage, with respect to progress payments, will be as follows: The OWNER shall retain ten (10) percent of the amount of each payment until final completion and acceptance of all work covered by the Contract Documents. When the work is substantially complete (operational or beneficial occupancy), the retained amount may be further reduced below ten (10) percent to only that amount necessary to assure completion.

SC-14.04 Substantial Completion

ADD the following at the end of the Section 14.04:

C. The CONTRACTOR shall complete the tentative list of items to be completed or corrected, within 14 calendar days from the date as shown on the written summary from the ENGINEER. The CONTRACTOR shall notify the ENGINEER upon completion of the completed or corrected work. If the work as described on the written summary is not completed within 14 calendar days, liquidated damages will be assessed..

The amount of liquidated damage shall be $200.00 per day for each and every calendar day the work as described on the written summary, is not completed. This amount will be assessed, not as a penalty, but as a predetermined and agreed liquidated damage that will be sustained by the OWNER, and the CONTRACTOR shall be responsible for all construction related engineering service costs provided by the ENGINEER for the OWNER for each day after the work as described on the written summary, is not completed. The damages and costs will be deducted from payments requested by the CONTRACTOR.

ARTICLE 15 SUSPENSION OF WORK AND TERMINATION

SC-15.03 OWNER May Terminate for Convenience

ADD the following at the end of the Section:

C. Upon receipt of written notice from the OWNER of such termination for the OWNER'S convenience, the CONTRACTOR shall:

1. Cease operations as directed by the OWNER in the notice;

2. Take actions necessary, or that the OWNER may direct, for the protection and preservation of the WORK; and

3. Except for WORK directed to be performed prior to the effective date of termination stated in the notice, terminate all existing Subcontracts and purchase orders and enter into no further Subcontracts and purchase orders.

END OF SUPPLEMENTARY CONDITIONS

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. The contract drawings or plans on which the proposal and Contract are based consist of ______ (___) plan sheet(s). The sheet(s) bear(s) the following general title:

MFS Farms / Full Circle Organics (Client)
Full Circle Organics Good Thunder Composting Facility (Project Name)
Good Thunder, MN (City, State)

The drawings described above are to be supplemented by additional shop and dimension drawings to be prepared by the CONTRACTOR as set forth in the Specifications.

B. Scope of Work:

The Scope of Work includes, but is not necessarily limited, to the following:

1. Grading
2. Road Construction
3. Stormwater Utilities
4. Erosion Control

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions and Divisions 1 and 2 apply to this project.

1.03 WORK HOURS

A. No work shall be done between 6:00 P.M. and 7:00 A.M. nor on Sundays or legal holidays, without the approval of the OWNER or the Engineer. However, work necessary for emergencies or for the protection of equipment or finished work may be done as required.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SUMMARY OF WORK

SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of method of measurement and payment for the proposed improvements.

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions and Divisions 1 and 2 apply to this section.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Payment shall be on a unit price or lump sum basis for furnishing and installing each item as specified herein.

B. The cost of all labor and materials required to complete this project as specified herein or as shown on the plans, but not specifically included in pay items, shall be considered incidentals and shall be merged with the various unit prices or lump sum prices bid.

3.02 METHOD OF MEASUREMENT AND PAYMENT

A. <u>Clearing and Grubbing</u> shall be at the contract lump sum price and shall include the costs for removal and disposal of the limbs, trunk, stump and brush as required by local regulations.

B. <u>Common Excavation</u> shall be paid at the contract unit price per cubic yard of material excavated as measured in its original position. The quantity of excavation for which payment shall be made will be those shown on the Bid Form. However, payment shall be made on the basis of plan quantities. Common excavation shall include common excavation cut to finished grade, subgrade excavation, building pads and street subgrade holddown, and topsoil holddown in cut areas.

The respreading of topsoil, to the specified depth, shall be considered incidental to the site grading construction and no payment shall be made for this work.

C. <u>Muck Excavation</u>, if required, shall be paid at the contract unit price per cubic yard of material excavated as measured in its original position. The quantity of excavation for which payment shall be made will be those shown in the Bid Form. However, payment shall be made on the basis of actual quantities instead of plan quantities if any volume changes are established through remeasurement of the excavation as provided herein. Either the Engineer or the Contractor may cause remeasurement of the excavation quantity in question or on the entire project, in which case, the quantities will be recomputed or otherwise adjusted on the basis of final measurements.

The muck excavation quantity is based on excavated material which must be moved with a backhoe or dragline. The quantity includes both organic and inorganic material which is unstable or too moist to excavate by common excavation procedures, i.e., scrapers and dozers. If the Contractor elects to excavate stable material that is saturated or unsaturated with a backhoe, it shall be paid as common excavation.

In muck areas, sump pumps or wells may be required for dewatering. All costs for equipment and labor for dewatering shall be incidental to the muck excavation.

D. Erosion Control Fence shall be paid at the contract unit price per lineal foot of silt fence furnished, installed, and maintained as indicated on the plans. The unit price shall also include removal and proper disposal when permanent cover is established.

E. Trench Borrow, if required, shall be paid at the contract unit price per cubic yard of material excavated as measured in its original position. Payment shall be made on the basis of actual quantities measured. The unit price shall include all costs to excavate, place and compact the trench borrow material, as well as backfilling and restoration of the trench borrow area.

F. Common Borrow (import off-site) shall be paid at the contract unit price per cubic yard placed in embankments, as measured in its final position, compacted volume. The unit price shall be payment in full for material, equipment and labor required to import and place material on-site. The Contractor shall obtain the borrow material from a site of his/her choosing. The quantity of borrow for which payment will be made shall be those shown on the Bid Form. However, payment shall be made on the basis of actual quantities instead of plan quantities, if any volume changes are established through remeasurement of the embankment as provided herein. Either the Engineer or the Contractor may cause remeasurement of the embankment quantity in question or on the entire project. In which case, the quantities will be recomputed or otherwise adjusted on the basis of final measurement.

G. Traffic Control during construction shall be considered incidental to the project and no special payment will be made. If the Engineer orders additional barricades, barriers, barrels, flashers or flagmen, these items shall be considered incidental to the project and no special payment shall be made.

H. Rock Construction Entrance installed as shown on the plans shall be incidental to the project and no special payment will be made for the placement and maintenance of the rock construction at each entrance. The rock construction entrance shall be placed at each entrance to the project.

I. Erosion Control Blankets shall be paid at the contract unit price per square yard furnished and installed, and shall include payment for furnishing and placing seed at a rate of 100 pounds per acre.

J. Seed and Mulch shall be paid at the contract unit price per acre of seed and mulch furnished and placed as specified.

K. Gate valves shall be paid at the contact unit price of each size furnished and installed. The price shall include the valve and valve box and any specified appurtenances.

L. Storm sewer pipe in-place shall be paid at the contract unit price per lineal foot for each diameter and class of pipe furnished and installed, as itemized in the Proposal Form. The pay length will be measured from center of manhole to center of manhole. The pay length does not include flared end section, or energy dissipater. The pay depth will be measured from the existing ground profile as measured by the Engineer to the invert of the pipe.

M. Catch basins, catch basin manholes, storm manholes and pond outlet skimmers shall be paid at the contract unit price for each catch basin, manhole, or skimmer furnished and installed. This price shall include barrel, base, casting, rings and appurtenances.

N. Flared End Sections shall be paid at the contract unit price for each unit furnished and installed of the size and classification specified. This price shall include trashguard (where required) and placement of riprap and filter blanket as identified on the plans.

O. Riprap shall be paid at the contract unit price per ton of riprap furnished and installed. Said unit price shall include costs for furnishing and installing geotextile and sand, if required.

P. Mn/DOT Class V - Aggregate Base shall be paid at the contract unit price per ton of aggregate furnished and placed at the depth specified.

   The quantity listed on the Bid Form for the street construction includes aggregate for the maximum tolerance allowance of 0.1 feet, or a maximum allowable rock depth of 0.9 feet for the aggregate base construction. (See Section 2230, item 3.03)

   Costs for furnishing and placing aggregate material, exceeding the amount shown on the Bid Form, will not be paid for.

Q. Modified Select Granular Borrow for placement in building pad shall be paid for at the contract unit price per cubic yard, compacted volume (C.V.), furnished and placed at the depth required.

R. <u>Drain Tile</u> shall be paid at the contract unit price per lineal foot furnished and installed. The price shall include the pipe, fittings, filter aggregate, filter fabric and connection to drainage structure.

S. <u>Small utility conduit crossings</u> shall be paid at the contract unit price per lineal foot of excavated trench as directed by the Engineer. The conduit will be furnished to the Contractor by the Utility Company at the site and shall be installed by the Contractor. The Contractor shall backfill the trench. Costs for installing additional conduit in the excavated trench shall be considered incidental to the conduit crossing construction and no special payment shall be made.

T. <u>Seed and Mulch</u> shall be paid at the contract unit price per acre of seed and mulch furnished and placed as specified.

U. <u>Subgrade preparation</u> for streets, trails and sidewalks shall be considered incidental to the project and no special payment will be made.

V. <u>Subgrade Excavation, (if required)</u>, shall be paid at the contract unit price per cubic yard of excavation. Subgrade excavation shall be considered as required to remove unstable soils in the road bed after grading and utility operations have been completed and approved. Subgrade excavation shall be measured from the top of the proposed subgrade to the bottom of the excavation and shall include removal of the material from the road bed and the replacement with suitable on-site materials.

W. <u>Geofabric, (if required)</u>, shall be paid at the contract unit price per square yard of fabric material furnished and placed.

X. <u> - 100% Crushed Quarry Rock, (if required)</u> shall be paid at the contract unit price per ton of aggregate furnished and placed at the depth specified by the Engineer.

END OF MEASUREMENT AND PAYMENT

SECTION 01060
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Local, State and Federal regulations.

1.02 LOCAL, STATE AND FEDERAL REGULATIONS

A. The Contractor shall comply with all Local, State and Federal regulations.

1.03 RELATED SECTIONS

A. General Conditions, Supplementary Conditions, and Divisions 1 and 2 apply to this project.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END REGULATORY REQUIREMENTS

SECTION 01090
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Schedule of references.

1.02 RELATED SECTIONS

A. General Conditions, Division 1 and Division 2 Sections apply to this work.

1.03 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids.

1.04 SCHEDULE OF REFERENCES

A. References are made in these specifications to the following:
1. Mn/DOT "Standard Specifications for Construction, 2005 Edition," and all supplements.
2. City Engineers Association of Minnesota (CEAM) "Standard Utilities Specifications, 1999 Edition."
3. Additional Specifications: Blue Earth County Specification

The Mn/DOT Specification is available upon request from the following, at a fee of $24.30 (includes tax and shipping):

Minnesota Department of Transportation
Mail Stop 260 Manual Sales
395 John Ireland Boulevard
St. Paul, Minnesota 55155

The CEAM Specifications are available upon request from the City Engineers Association of Minnesota, or www.ceam.org.

It is the Contractor's responsibility to obtain these specifications. Fees as listed are subject to change.

END OF REFERENCE STANDARDS

SECTION 01400
QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section defines the responsibilities for providing quality control required by the contract documents.

B. Tests indicated hereinafter are considered a minimum.

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions, and Division 1 and 2 Sections shall apply to this work.

1.03 REFERENCES

A. ASTM C31-87 (Standard for making Concrete Test Specimens).

B. ASTM C39-86 (Test Method for Compressive Strength of Concrete Cylinders).

C. Mn/DOT "Standard Specifications for Construction," 2005 Edition and all supplements.

D. City Engineer's Association of Minnesota, "Standard Utilities Specifications, 1999 Edition."

E. Soils Report.

1.04 SUBMITTALS

A. The Contractor is required to submit the following to the Engineer a minimum of 48 hours prior to commencement of the construction:

1. Asphaltic Concrete Mix designs for the bituminous base and wear courses.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 GENERAL SCOPE OF TESTING, INSPECTION

A. The Owner has retained the services of an independent Soils Engineer. The Contractor shall be responsible for coordinating all required tests and inspections with the Soils Engineer, AET.

B. The following are minimum tests and inspections that shall be conducted for this project:

1. Site Grading:

a. The Soils Engineer shall provide necessary observations and tests, to evaluate whether the site grading improvements are completed in accordance with the requirements of the plans and specifications, including the requirements of FHA 79G.

b. The Engineer will observe the specified tolerance requirements.

2. Utility Construction:

a. The Soils Engineer will complete observations, and testing for the compaction required for the trench backfill in accordance with the requirements of the Soils Engineer.

b. The Engineer will observe the testing procedures as are outlined in the Utilities Specifications.

3. Aggregate Base Construction:

a. Random samples of the aggregate base shall be taken for gradation testing by the Owner's Soils Engineer. Unless directed otherwise by the Engineer, a minimum of 2 samples per 3,000 square yards of parking lot surface shall be obtained, or two samples per 1,000 linear feet of street.

b. Prior to placement of the aggregate base, the Engineer will require the completion of a test roll on the street subgrade. The test roll shall be completed in the presence of the Engineer. The Contractor shall provide a loaded tandem axle truck with a gross weight of 25 tons.

Test rolling shall be at the direction of the Soils Engineer and shall be completed in areas as directed by the Soils Engineer. The Soils Engineer shall determine which sections of the parking lot or street are unstable. Correction of the subgrade soils may be required.

Costs for the completion of test rolling shall be considered incidental to the street construction and no special payment will be made.

4. Asphaltic Concrete:

a. Random samples of the bituminous base and bituminous wear course materials shall be obtained for gradation and extraction testing by the Soils Engineer. A minimum of 3 samples per day of each course shall be obtained.

b. The Engineer will require the completion of density tests of the in-place Asphaltic Concrete material for each bituminous course placed. The testing shall be at the direction of the Soils Engineer and as specified in 02511, 3.02 of these Specifications.

END OF QUALITY CONTROL

SECTION 01410
TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Includes:

1. Cooperate with the Owner's selected testing agency and all others responsible for testing and inspecting the work.

2. Provide such other testing and inspecting as are specified to be furnished by the Contractor in this section and/or elsewhere in the Contract documents.

3. The determination of the extent of the removal of organic or unstable soil materials, and the backfilling shall be at the direction of the Soils Engineer.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 and 2 of these specifications.

2. Requirements for testing may be described in various sections of these specifications.

3. Where no testing requirements are described, but the Owner decides that testing is required, the Owner may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made as described in this section.

C. Work not included:

1. Selection of testing laboratory: The Owner will select a prequalified independent testing laboratory.

2. Payment for initial testing: The Owner will pay for all initial services of the testing laboratory as further described in Section 2.01 of this section.

1.02 QUALITY ASSURANCE

A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E329.

B. Testing, when required, will be in accordance with all pertinent codes and regulations, and with selected standards of the American Society for Testing and Materials.

C. The Soils Engineer shall promptly process and distribute a copy of test reports to the Owner, Contractor and Engineer. The test reports shall include recommendations for correction, if correction is required.

PART 2 PRODUCTS

2.01 PAYMENT FOR TESTING

A. Initial Services:

1. The Owner will pay for initial testing services requested by the Owner, except as noted in Mn/DOT Section 2360, Plant Mixed Asphalt Pavement.

B. Retesting: When initial tests indicate non-compliance with the Contract Documents, subsequent retesting occasioned by the non-compliance shall be performed by the same testing agency, and costs for retesting will be deducted by the Owner from the Contract Sum.

2.02 CODE COMPLIANCE TESTING

A. Inspections and tests required by codes and ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Owner, unless otherwise provided in the Contract Documents.

2.03 CONTRACTOR'S CONVENIENCE TESTING

A. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

PART 3 EXECUTION

3.01 COOPERATION WITH TESTING LABORATORY

A. Representatives of the testing laboratory shall have access to the work at all times and at all locations where the work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.

3.02 TAKING SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

3.03 SCHEDULES FOR TESTING

A. Establishing schedule:

1. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.

2. Provide all required time within the construction schedule.

B. Revising schedule: When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

C. Adherence to schedule: When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the work, all extra charges for testing attributable to the delay may be backcharged to the Contractor and shall not be borne by the Owner.

END OF TESTING LABORATORY SERVICES

SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The Availability of On-Site Utilities

B. Traffic Control

C. Street Cleaning

1.02 THE AVAILABILITY OF ON-SITE UTILITIES

A. Water for use by the Contractor shall be arranged for by the Contractor. All service connections will be made by the Contractor at his own expense. The utilities will be used only to the extent required by construction. No electricity will be furnished.

1.03 TRAFFIC CONTROL

A. The Contractor shall be responsible for providing and maintaining barricades, warning signs, directional signs, flagmen and lights to control the movement of traffic where necessary. Placement of these devices shall be approved by the Engineer prior to placement or the City Engineer for devices placed on public right-of-way. Traffic control devices shall conform to appropriate Minnesota Highway Department Standards.

1.04 ENVIRONMENTAL PROTECTION REQUIREMENTS

A. The CONTRACTOR shall perform all work in such a manner as to minimize the pollution of air, water, or land, and shall within reasonable limits control noise and the disposal of solid waste materials as well as other pollutants, (see Section 02370).

B. Prior to start of any on-site construction activities, the CONTRACTOR and the ENGINEER shall make a joint condition survey indicating, on a layout plan, the condition of areas immediately adjacent to the site of the work and adjacent to his/her assigned storage area and access route as applicable.

C. The CONTRACTOR shall confine his/her construction activities to areas defined for work on the plans or specifically assigned for his/her use. Storage and related areas and access routes required temporarily by the CONTRACTOR in the performance of work will be assigned by the OWNER. The CONTRACTOR shall submit a description of his scheme for disposing of waste materials resulting from the work under this contract. If any waste material is dumped in unauthorized areas, the CONTRACTOR shall remove all material and restore the area to the condition of the adjacent undisturbed areas, (see Section 02370).

D. The CONTRACTOR shall maintain all access routes and other work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to the public, (see Section 02370).

E. The CONTRACTOR shall, unless otherwise instructed in writing by the OWNER, obliterate all signs of temporary construction facilities such as work areas, structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Damage to roads by equipment shall be repaired in kind.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

SECTION 01600
MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Products

B. Transportation and handling

C. Storage and protection

D. Substitutions

E. Warranties

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions, Division 1 Sections apply to this work.

1.03 PRODUCTS

A. Unless otherwise specified, all materials shall be new, and both workmanship and materials shall be of good quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

B. In selecting and/or approving equipment for installation in the project, the Engineer assume no responsibility for injury or claims resulting from failure of the equipment to comply with applicable Federal, State, and local safety codes or requirements, or the safety requirements of a recognized agency, or failure due to faulty design concepts, or defective workmanship and materials.

1.04 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged. Contractor shall pay all transportation and handling costs.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage. Contractor shall have a representative at the site to accept delivery of equipment.

1.05 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

Pumps, motors and electric equipment shall be maintained at a minimum temperature of 50° F.

B. For exterior storage of fabricated products, place on sloped supports above ground.

C. The Contractor may provide off-site storage and protection when site does not permit on-site storage or protection if adequate insurance coverage is provided.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

H. The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this contract. The Contractor shall at all times safely guard and protect from damage his own work, and that of adjacent property (as provided by law and the contract documents). All passageways, guard fences, lights, and other facilities required for protection by Federal, State, or municipal laws and regulations and local conditions, must be provided and maintained.

I. The Contractor shall protect his work and materials from damage due to the nature of the work, the elements, carelessness of other contractors, or from any cause whatever until the completion and acceptance of the work. All loss or damages arising out of the nature of the work to be done under these contract documents, or from any unforeseen obstruction or defects which may be encountered in the prosecution of the work, or from the action of the elements, shall be sustained by the Contractor.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF MATERIAL AND EQUIPMENT

SECTION 01700
CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements stated in the specifications necessary to be completed prior to closing out the contract.

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions, and Division 1 Sections apply to this work.

1.03 REGULATORY REQUIREMENTS

A. Evidence of compliance from the applicable authorities.

B. Warranties and bonds.

C. Evidence of payment and lien waivers.

1.04 SUBSTANTIAL COMPLETION

A. Substantial completion is defined in the General Conditions, Section 14.04.

B. The Contractor shall state, in writing to the Engineer, that substantial completion has been reached and shall include a list of items that still need to be completed.

C. After inspection by the Engineer, a written notice shall be provided by the Engineer to the Contractor indicating whether the work is substantially complete.

D. All inspection costs past the original contract completion date shall be the Contractor's responsibility.

E. If the work is not substantially complete, all reinspection costs borne by the Owner shall be the Contractor's responsibility.

1.05 FINAL COMPLETION

A. When Contractor considers the work is complete, he shall submit written certification that work has been finally completed in accordance with the contract documents and is ready for final inspection.

B. When the Engineer and City agree that the work is acceptable, the Engineer shall notify the Contractor.

C. The Contractor shall furnish the required warranties, maintenance bonds and two copies of all Operation and Maintenance Manuals to the Engineer.

1.06 FINAL PAYMENT

A. The Contractor shall submit a final payment request to the Engineer based on the following adjustments:

1. Previous Change Orders
2. Unit Prices or Lump Sum Prices
3. Deductions for uncorrected work
4. Deductions for liquidated damages
5. Deductions for inspection payments
6. Other adjustments

B. The Engineer will prepare a final Change Order, reflecting approved adjustments to the contract sum which were not previously made by Change Orders.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF CONTRACT CLOSEOUT

DIVISION 2 - SITE WORK

SECTION 02050
DEMOLITION

PART 1 GENERAL

1.01 WORK INCLUDES

A. Removal of equipment and structures.

B. Abandonment of existing draintile.

C. Removal of materials from site.

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions and Division 1 section apply to this work.

B. Section 02210 – Grading.

C. Section 02370 – Erosion and Sedimentation Control (including SWPPP).

1.03 EXISTING CONDITIONS

A. Provide, erect, and maintain temporary barriers and security devices.

B. Conduct operations with minimum interference to public or private thoroughfares.

C. Do not close or obstruct roadways without permits.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Protect existing structures which are not to be demolished.

B. Except where noted otherwise, protect existing utilities.

3.02 GENERAL OPERATIONS

A. Remove demolished and removed material from site immediately following demolition.

B. Remove and promptly dispose of contaminated, vermin infested, or dangerous materials encountered.

C. Remove materials to be reinstalled. Protect and store under provisions of Section 01600.

D. Do not burn or bury materials on site.

E. Plug ends of buried pipe to be abandoned in-place with two feet of grout at each end.

F. Backfill areas excavated, open pits and holes caused as a result of demolition. See Section 02210 for backfilling requirements.

G. Grade and compact areas affected by demolition to maintain site grades and contours.

H. Leave site in orderly, clean condition.

END OF DEMOLITION

SECTION 02210
GRADING

PART 1 GENERAL

1.01 WORK INCLUDES

The work included in this section consists of furnishing all labor, equipment and materials to complete the following:

1. Install Erosion Control measures in accordance with Section 2370.

2. Clear and grub the site where site grading is to be completed.

3. Excavate the topsoil, or unstable material beneath the streets and building areas as specified, or as directed by the Soils Engineer.

4. Grade site to the grades as shown on the plan and as specified herein.

5. Complete Finished Grading.

6. Turf Establishment, in accordance with Section 2370.

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions and Divisions 1 and 2 sections apply to this work.

B. The Soils Reports (included in the Appendix) apply to this grading work. The contractor shall comply with the recommendations of the Soils Engineer as outlined in the Soils Report, except as modified herein.

1.03 PROTECTION

A. Protect benchmarks, property corner monuments, fences, sidewalks, existing streets and trees which are not to be removed.

B. Protect above or below grade utilities and appurtenances (i.e. manholes, hydrants, gate valves, etc.) which are to remain.

C. The trees and other natural vegetation within the project and/or adjacent to the project are of prime concern to the Contractor's operations. The Contractor will be required to protect the trees which are to be saved to be sure that equipment is not needlessly operated under nearby trees and shall exercise extreme caution in working adjacent to trees. Should any portion of the tree branches require removal to permit operation of the Contractor's equipment, he shall obtain the services of a professional tree trimming service to trim the trees prior to the beginning of operation. Should the Contractor's operations result in the breaking of any limbs, the broken limbs should be removed immediately and cuts shall be properly protected to minimize any lasting damage to the tree. No trees shall be removed without authorization by the Engineer. Costs for trimming services shall be considered incidental to the grading construction and no special payment will be made.

1.04 REFERENCES

A. Mn/DOT "Standard Specifications for Construction", 2005 Edition and all supplements.

B. Soils Report (included in the Appendix).

C. MPCA - National Pollutant Discharge Elimination System (NPDES) Permit (see Section 02370).

1.05 QUALITY ASSURANCE

A. Perform grading in compliance with the requirements specified herein, and in accordance with the governing authorities having jurisdiction.

B. The Soils Engineer will provide soil testing and inspection services for quality control testing during the grading construction.

C. Refer to Section 01400 and 01410.

PART 2 PRODUCTS

2.01 MATERIALS

The definitions for types of materials shall be as specified in the Mn/DOT "Standard Specifications for Construction," except as modified herein.

A. On-site excavated materials shall be utilized to the fullest extent practicable and so far as the material is suitable for the construction of the embankments.

Snow, ice and frozen lumps exceeding 6 inches in greatest dimension will not be permitted in the embankments. Sod and frozen lumps less than 6 inches in greatest dimension may be placed in embankments only with approval of the Engineer.

No stones exceeding 3 inches in greatest dimension will be permitted in the upper 12 inches of the area to be paved nor within 18 inches of a structure.

B. Salvaged topsoil which is to be respread on the site shall be free of lumps, rocks greater than 1 inch diameter, and debris.

C. Common excavation shall be as defined in Mn/DOT 2105.2 except as modified herein. Common excavation shall be considered stable or unstable, saturated or unsaturated material which can be excavated using common excavating procedures, i.e., scrapers and dozers. Excavation below subgrade that can be removed with scrapers and dozers shall be considered common excavation.

D. Muck excavation shall be as defined in Mn/DOT 2105.2, except as modified herein. Muck excavation shall include organic and inorganic material which must be moved with a backhoe or dragline. Muck shall include organic and inorganic material which is unstable or too moist to excavate by common excavation procedures, i.e., scrapers and dozers. Stable material that is saturated or unsaturated that is excavated with a backhoe or dragline, shall be considered common excavation.

E. Common Borrow material (if required) shall meet the requirements of Mn/DOT Specification 2105.2 B2. The material shall, as a minimum, comply with the standards of an A-6 AASHTO Soil Type. The material shall be plus or minus 3% of optimum moisture content. The material shall be approved by the Soils Engineer prior to placement. Contractor shall also refer to the Soils Report for additional specification requirements.

F. Granular Material for backfill below water level, if required, shall comply with the requirements of the Soils Report.

G. Topsoil borrow material (if required) shall meet the requirements of Mn/DOT Specification No. 3877.2A.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify known below grade utilities. Stake and flag locations.

B. Identify and flag above grade utilities.

C. Maintain and protect existing utilities remaining which pass through work area.

D. Notify utility company to relocate utilities.

E. Upon discovery of unknown utility or concealed conditions, discontinue affected work; notify Engineer.

F. Examine the areas and conditions under which dewatering, excavating, filling, and grading are to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 CLEARING AND GRUBBING

A. Work shall consist of removing and disposing of all trees, shrubs, brush, stumps, roots, windfalls and other plant life, including dead and decayed matter that exist within the areas shown on the plans. The Contractor will consider that all of the areas marked on the plans for grading will be cleared and grubbed as specified herein. The clearing operation shall consist of cutting and removing trees, shrubs, bushes, windfalls and other vegetation in the designated areas. Brush shall be defined as all bushes, shrubs, and other vegetation that can be cut with a brush saw or mowing machine, together with isolated trees having a diameter of six inches or less at a point two feet above ground surface. The trees shall be completely removed including tree trunk and main root structure.

The grubbing operation shall consist of removing and disposing of the stumps, roots and other remains in the designated areas. Unless otherwise directed, the stumps should be removed completely. If any stumps are permitted to remain, they should be cut off not more than six inches above ground and flush with and below the ground surface if so directed.

All material which is cleared and grubbed shall be burned on-site if ordinances allow or shall be removed from the site and placed in an area as selected by the Contractor. The Contractor shall determine if burning of the material is allowed, and shall obtain all necessary permits and post the required security with the appropriate government authority, if required.

All elmwood timber, stumps, roots and debris, together with the bark and any byproducts with adhering bark of Elm tree origin, shall either be completely debarked or chemically treated before being removed from the project. Chemical treatment of elmwood with adhering bark and of the bark resulting from debarking operations shall consist of thoroughly spraying all bark surfaces with an approved chemical solution prepared and applied as recommended by the manufacturer. For clearing and grubbing operations performed between April 1 and September 30, chemical treatment or final disposal of elmwood debris and bark shall be accomplished within 30 days; and for those operations performed between October 1 and March 31, the chemical treatment or final disposal shall be accomplished before the succeeding May 1.

If any wood is run through a chipping machine, the wood chips shall be removed from the site and disposed of in an area as selected by the Contractor.

3.03 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated or regraded and stockpile in areas designated on the site. The Contractor shall salvage enough topsoil for respreading on the site as specified. Excess topsoil shall be placed in embankment areas, outside of building pads, roadways and parking areas.

3.04 EXCAVATING OPERATIONS

A. All excavations shall be made in accordance with the lines, grades and slopes staked by the Engineer and as he may otherwise direct, based on the typical section and elevation controls as shown in the plans. Side slopes of excavations shall comply with local codes and ordinances having jurisdiction.

B. Excavations for the purpose of removing unstable, or unsuitable materials, shall be completed as required by the Soils Engineer.

1. Common excavation shall be defined in Mn/DOT 2105.2, except as modified herein. Common excavation shall be considered stable or unstable, saturated or unsaturated material which can be excavated using common excavating procedures, i.e., scrapers and dozers. Excavation below subgrade that can be removed with scrapers and dozers shall be considered common excavation.

2. Muck excavation shall be as defined in Mn/DOT 2105.2 except as modified herein. Muck excavation shall include organic and inorganic material which must be moved with a backhoe or dragline. Muck shall include organic and inorganic material which is unstable or too moist to excavate by common excavation procedures, i.e., scrapers and dozers. Stable material that is saturated or unsaturated that is excavated with a backhoe or dragline, shall be considered common excavation.

C. The Contractor shall subcut cut areas, excluding the street surface and building pad area to the specified depth, based on the depth of topsoil to be placed.

3.05 EMBANKMENT CONSTRUCTION

A. Embankment construction required below all structures, roadways, sidewalks, pavements, pipelines, utilities, culverts, and ductbanks shall not be placed until rock or soil conditions encountered have been approved by the Soils Engineer. Do not place any fill in or under water, unless approved by the Soils Engineer.

B. Where necessary to place fill under the water level, the excavated area shall be dewatered as required by the Soils Engineer. If required by the Soils Engineer, granular material shall be placed on the approved subgrade, and to a depth as required by the Soils Engineer. The Contractor shall backfill the granular material in accordance with the requirements of the Soils Engineer. The granular material shall meet the gradation requirements as specified by the Soils Engineer.

C. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials, as directed by the Soils Engineer, from ground surface prior to placement of fill.

D. Before placing embankment on an existing slope steeper than 4 horizontal to 1 vertical (4:1), the Contractor shall, at his option, a) Flatten the existing slope to the extent that it will not be steeper than 4 to 1; or b) construct steps in the slope, with the back surface being as nearly vertical as practicable and with the horizontal cuts being made as close together as the slope permits, but with no step being less than one foot in width. All work required by the above provisions will be considered to be incidental work for which no direct compensation will be made.

E. Backfilling of excavations shall proceed as promptly as work permits.

Embankments shall not be constructed during periods when the embankment material freezes while being placed and compacted, nor shall any embankment material be placed on soil that is frozen to a depth greater than 6 inches. Where the foundation soil is frozen to a depth exceeding 6 inches, at a time when weather conditions are such that embankment construction could be continued without the material freezing as it is being placed and compacted, the Contractor may be permitted to excavate the frozen foundation soil and proceed with the embankment construction for so long as the weather will permit, but only if and to the extent approved by the Engineer, and with the understanding that the additional costs involved shall be borne by the Contractor. The Frozen soil shall be pulverized or wasted and replaced with other suitable soil, as may be necessary to construct the embankments as specified.

Excavations below subgrade, together with any seepage trenches excavated to provide drainage, shall be backfilled with suitable materials obtained from the excavations, if available.

F. Place backfill and fill materials in layers no more than six inches in loose depth for material compacted by heavy compaction equipment and not more than four inches in loose depth for material compacted by hand operated tampers and to the density specified. Before compaction, moisten or aerate each layer as necessary to provide the moisture content as directed by the Soils Engineer. Compact each layer to the required percentage of maximum density that is specified for each area classification.

G. Place embankment materials evenly adjacent to utilities and structures, to required elevations. Exercise care to prevent wedging action of backfill, or unbalanced forces, against structures by carrying the material uniformly around structure to approximately the same elevation in each lift.

H. If applicable, hand tamp fill immediately adjacent to walls or use hand operated vibratory equipment.

3.06 COMPACTING EMBANKMENTS

A. Embankment material placed beneath the building shall be compacted in accordance with the requirements of the Soils Report.

B. Embankment material placed beneath the street or parking area shall be compacted in accordance with the Specified Density Method as outlined in Mn/DOT 2105.3F1.

C. Embankment Material not placed in the building pad or streets or parking area, shall be compacted in accordance with requirements of the Quality Compaction Method as outlined in Mn/DOT 2105.3F2.

D. Where subgrade or layer soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until moisture content is reduced to a satisfactory value, as determined by moisture-density relation tests.

3.07 TRENCH BORROW CONSTRUCTION

A. If required by the Engineer, the Contractor shall complete "trench borrow" excavation in areas directed by the Engineer, located behind the building pad in the rear yard area. Trench borrow construction shall be completed only within the plat boundaries. Trees shall not be removed or damaged as a result of the excavation, unless approved by the Engineer.

The excavation shall commence a minimum of 10 feet from the rear limit of the building pad. The excavation from this limit shall extend at a minimum slope of 1 foot horizontal to 1 foot vertical (1:1) downward and outward from the finished surface grade elevation.

The trench borrow excavation shall be backfilled to the proposed finished grade elevation, and shall be compacted in accordance with requirements of the Quality Compaction Method as outlined in Mn/DOT Specification 2105.3F2.

Snow fence shall be furnished and placed along the perimeter of the trench borrow area where the slopes exceed 2 foot horizontal to 1 foot vertical (2:1).

3.08 FINISHED GRADING

A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Provide a smooth finished surface within specified tolerances, with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

1. Do not commence finish grading until site construction and rough grading have been completed and approved, unless directed otherwise by the Engineer.

2. Areas that have been finish graded shall be protected from subsequent construction operations, traffic and erosion. Repair all areas that have become rutted by traffic or eroded by water or has settled below the correct grade.

3. All areas disturbed by the Contractor's operations shall be restored to equal or better than original condition or to the requirements of the new work.

B. Spread topsoil in areas outside of the building, parking areas and street to a minimum depth of 6 inches.

3.09 TOLERANCES

A. The commercial building subgrade finished surface elevation shall not vary by more than 0.10 foot above, or 0.10 foot below, the prescribed elevation at any point where measurement is made.

B. The street subgrade finished surface elevation shall not vary by more than 0.05 foot above, or 0.10 foot below, the prescribed elevation of any point where measurement is made.

C. Areas which are to receive topsoil shall be graded to within 0.30 foot above or below the required elevation, unless directed otherwise by the Engineer.

D. Topsoil shall be graded to plus or minus 1/2 inch of the specified thickness.

3.10 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion, and keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded and rutted areas to specified tolerances. During the construction, if required, and during the warranty period, eroded areas where turf is to be established, shall be reseeded and mulched.

C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

D. After the site construction has been completed, the Contractor shall remove all sediment from the pond. The sediment shall be removed from the site.

3.11 DISPOSAL OF EXCESS SOIL MATERIAL

A. The project has not been designed to balance the earthwork on site.

The Contractor shall stockpile all excess soil material on-site in an area selected by the Owner or Engineer.

3.12 DISPOSAL OF WASTE MATERIALS

A. Dispose of trash and debris in accordance with applicable laws.

B. When disposal operations are complete, leave the site in a condition acceptable to the Owner.

3.13 HAUL ROADS

The Contractor shall determine the location of any haul roads that may be required to complete the site grading construction. The Contractor shall comply with the requirements of the governing authority of each roadway. The Contractor shall post whatever security, and comply with all conditions which are required by each governing authority of each roadway.

3.14 DEWATERING

The Contractor shall complete dewatering as required to complete the site grading construction.

3.15 MINNESOTA POLLUTION CONTROL AGENCY - NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT REQUIREMENTS

The Contractor shall comply with the requirements of the NPDES Permit. The Contractor shall be required to be a co-applicant with the Owner. See Section 02370.

END OF GRADING

SECTION 02230
AGGREGATE SUBBASE AND BASE CONSTRUCTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Base Construction

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions, and Division 1 Sections apply to this work.

B. Division 2 Sections apply to this work.

1.03 REFERENCES

A. Mn/DOT "Standard Specifications for Construction," 2005 Edition, and all supplements.

B. ASTM: D698-78 - Standard Proctor.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with the State of Minnesota Department of Transportation specifications.

B. Obtain materials from same source throughout.

1.05 TESTS

A. Testing and analysis of the aggregate base will be performed in accordance with the provisions of Section 01400.

B. The subgrade soil shall be compacted to at least 95% of the maximum laboratory dry density with 100% required in the upper three feet as designated by ASTM: D-698-78, Standard Proctor Density Method (Mn/DOT Specification No. 2105.3F1).

PART 2 PRODUCTS

2.01 MATERIALS

A. 100% Crushed Quarry Rock (Mn/DOT Specification 3138), with class as specified. Limestone from the Platteville formation is not acceptable for aggregate base material.

B. Modified Select Granular Borrow subbase shall comply with Mn/DOT Specification 3149.2B2; however, of the portion passing a 1-inch sieve, not more than 3 by weight shall pass a #200 sieve.

C. 3" to 4" Clear - 100% Crushed Quarry Rock shall meet the following gradation requirements:

Sieve Size	% Passing Specification
3-1/2"	100%
2"	65-90%
1-1/2"	35-60%
1"	10-30%
3/4"	0-10%
1/2"	0- 3%

D. Geofabric shall be Mirafi 500X, or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Contractor shall not proceed with the subbase or aggregate base construction until the Soils Engineer has indicated that the embankment construction has been completed in accordance with the specification requirements.

B. Contractor shall not proceed with the select granular borrow or aggregate base construction until after the test roll has been completed and approved by the Soils Engineer.

C. The subgrade elevations shall be checked for tolerance by the Engineer and Contractor prior to commencement of construction.

D. Beginning of subbase or aggregate base construction means acceptance of subgrade by Contractor.

3.02 SUBBASE AND BASE CONSTRUCTION

A. Subbase construction shall be completed in accordance with the requirement of Mn/DOT Specification No. 2105.

B. Aggregate base construction shall be completed in accordance with the requirement of Mn/DOT Specification No. 2211.

C. If required by the Engineer, the Contractor shall complete subgrade excavation in areas as directed by the Engineer.

D. If required by the Engineer, the Contractor shall place geofabric in areas as directed, prior to placing the subbase or aggregate base.

E. Compaction of the subbase and aggregate base shall be the Specified Density Method (Mn/DOT Specification No. 2105.3F1 and 2211.3C1).

3.03 TOLERANCES

A. The finished street subgrade surface shall not vary by more than 0.05 foot above, or 0.1 foot below, the plan elevation at any point where measurement is made.

B. The Contractor shall tolerance the aggregate base surface to the plan elevation prior to paving. The allowable deviation of the bituminous mixture from plan depth shall be no greater than, nor no less than, ten percent (10%) of the plan depth. Therefore, the aggregate base surface shall be constructed to the plan elevation plus or minus ten percent (10%) of the total bituminous mixture depth. If the total depth of bituminous mixture is greater than, or equal to, a depth of six (6) inches, the aggregate base surface elevation shall not vary by more than 0.05 feet above or below the plan elevation at any point where measurement is made.

3.04 FIELD QUALITY CONTROL

A. Refer to Section 01400.

B. A copy of the aggregate base course weight tickets shall be submitted to the Engineer. Weight tickets shall include the following:

1. Material Source
2. Type of Class of Material
3. Truck Identification
4. Date
5. Project Dispatched To
6. Gross Weight

7. Mean Vehicular Weight
8. Net Weight of Material
9. Which part of site material was delivered (i.e., street, parking lot with lot and block).

Weight tickets shall be delivered to the Engineer daily.

3.05 DISPOSAL OF WASTE MATERIALS

A. Disposal of bituminous, trash and debris shall be in accordance with applicable laws. Burial of this material on site will not be allowed.

B. When disposal operations are completed, leave the site in a condition acceptable to the Owner.

3.06 DISPOSAL OF EXCESS SUBGRADE EXCAVATION MATERIAL, IF REQUIRED

A. The Contractor shall:

stockpile the excess material at a location within the site as designated by the Engineer.

END OF AGGREGATE SUBBASE AND BASE CONSTRUCTION

SECTION 02370
EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 WORK INCLUDES

The work included in this section consists of furnishing all labor, equipment and materials to complete the following:

A. Installation of temporary and permanent erosion control systems.

B. Installation of temporary and permanent slope protection systems.

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions, and Division 1 Sections apply to this work.

B. Division 2 Sections apply to this work.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent properties and water resources from erosion and sediment damage throughout life of contract.

1.04 REFERENCES

A. Mn/DOT "Standard Specifications for Construction", 2005 Edition and all supplements.

PART 2 PRODUCTS

2.01 MATERIALS

A. For temporary seeding, provide quick growing grasses such as Temporary Mixes 100, 110, or 130 in accordance with Mn/DOT Specification Section 2575.3 D1 and Section 3876.

B. Temporary mulches in accordance with Mn/DOT Specification Section 2573.3E.

C. Hay Bales not allowed.

D. Silt Fence as shown on the Construction Drawings and as specified in Mn/DOT Specification Section 3886.

E. Riprap in accordance with Mn/DOT Specification Section 2511 and as shown on the Construction Drawings.

F. Temporary and Permanent Outfall Structures as specified on Construction Drawings.

G. Permanent seeding shall conform to Mn/DOT Specification No. 3876 with use of Mix No. 270.

H. Permanent mulch shall conform to Mn/DOT Specification 3882, Type 1.

I. Erosion Control Blankets shall conform to Mn/DOT Specification 3885, Category 2.

PART 3 EXECUTION

3.01 PREPARATION

A. Review Construction Drawings and Storm Water Pollution Prevention Plan.

B. Conduct pre-construction meeting with Site Contractor.

3.02 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place erosion control systems in accordance with Construction Drawings and Storm Water Pollution Prevention Plan or as may be dictated by site conditions in order to maintain the intent of the specifications and permits.

B. Contractor shall note deficiencies or changes on Construction Drawings or the Storm Water Pollution Prevention Plan kept at the site, or as implemented by Contractor as site conditions change.

C. Owner has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct Contractor to provide immediate permanent or temporary pollution control measures.

D. After topsoil has been placed to the specified depth, the Contractor shall permanently seed and mulch those disturbed areas as required by the Engineer. The seed shall be applied at the rate of 120 pounds per acre. The seeded area shall be mulched. The mulch shall be applied and anchored in accordance with Mn/DOT Specification No. 2575.3 F1. The mulch shall be anchored with a disc, clod buster or other approved equipment.

Erosion control blanket shall be furnished and placed in areas as directed by the Engineer.

E. Slopes that erode easily or that will not be graded for a period of 14 days or more (includes temporary stockpiles) shall be temporarily seeded and mulched as work progresses in accordance with these specifications and Mn/DOT Specification Section 2573 unless otherwise specified on the Construction Drawings. For exposed areas near surface waters, see Section V.A.1c of the Storm Water Pollution Prevention Plan.

F. Contractor will be required to incorporate permanent erosion control features into the project at earliest practical time to minimize need for temporary controls. Permanently seed and mulch cut slopes as excavation proceeds to extent considered desirable and practical.

Stormwater Pollution Prevention Plan

for:

Full Circle Organics
Blue Earth County, Minnesota

Owner:

Full Circle Organics
5029 13th Avenue South
Minneapolis, MN 55417
612-282-9382
Contact: Max Milinkovich

SWPPP Preparer:

MFRA, Inc.
14800 28th Avenue N Suite 140
Plymouth, MN 55447
763-476-6010
Contact: Michael C. Brandt

SWPPP Preparation Date:

November 22, 2011

Contents

Appendix F – SWPPP Amendment Log
Appendix G – Contractor/Subcontractor Certifications/Agreements
Appendix H – Grading and Stabilization Activities Log
Appendix I – Training Log
Appendix J – Delegation of Authority
Appendix K –Environmental Reviews
Appendix L – Temporary & Permanent Stormwater Design Calculations

SECTION 1: SITE EVALUATION, ASSESSMENT, AND PLANNING

1.1 Project/Site Information

Project/Site Name: Full Circle Organics		
Project Street/Location: 563rd Avenue		
City: Lyra Township	State: MN	ZIP Code:
County: Blue Earth		
The surrounding area is rural, agricultural farm land.		
NPDES permit number:__________________________________		

1.2 Contact Information/Responsable Parties

Owner:
Company/Organization Name: Full Circle Organics / MFS Farms
Contact Name: Max Milinkovich
Address: 5029 – 13th Avenue South
City, State, Zip Code: Minneapolis, MN 55417
Telephone Number: 612-282-9383
General Contractor (To be Completed by General Contractor):
Company/Organization Name:
Contact Name:
Address:
City, State, Zip Code:
Telephone Number:
Fax/Email:
Insert area of control (if more than one operator at site):
The General Contractor shall comply with the requirements of the Minnesota General Permit

Authorization to Discharge Storm Water Associated With Construction Activity Under the National Pollution Discharge Elimination System/State Disposal System Permit Program (General Permit) attached as Appendix C. The General Contractor must comply with any local governing agency (LGU) having jurisdiction concerning erosion and sediment control. The General Contractor shall be required to be a co-applicant with the Owner. The General Contractor shall be responsible for maintenance of the erosion and sediment control devices. The "Application for General Storm-water Permit for Construction Activity (MN R100001)" found in Appendix D shall be completed by the General Contractor and sent, along with the required application fee, by the General Contractor to:

Minnesota Pollution Control Agency
REM Division, Construction Storm-water Permit Program
520 Lafayette Road North
St. Paul, Minnesota, 55155-4194

Unless notified by the Minnesota Pollution Control Agency (MPCA) to the contrary, applicants who submit a complete application form in accordance with the requirements of the General Permit are authorized to discharge storm water from the construction site under the terms and conditions of this permit seven (7) calendar days after the postmarked date of the completed application, or two (2) calendar days after the online application process is complete (https://netweb.pca.state.mn.us/private/). Additionally, authorization will be delayed under the following circumstances:

- If the Project disturbs 50 acres or more and has a discharge point within 1 mile and flows to an impaired or special water whose discharge may reach an impaired or special water listed in Appendix A of the general permit the applicant shall submit the Storm Water Pollution Prevention Plan and a completed application at least 30 calendar days prior to the commencement of construction activities. Unless notified by the MPCA to the contrary, coverage becomes effective 30 calendar days after the postmarked date of the completed application.

- If the project includes alternative methods the application and two alternative treatment plans must be submitted a minimum of 90 day before construction starts.

Erosion & Sediment Control Subcontractor (responsible for implementing & updating SWPPP - To be completed by Contractor):
Company/Organization Name:
Contact Name:
Address:
City, State, Zip Code:

Telephone Number:	
Fax/Email:	
Erosion & Sediment Control Inspector (See Part 5.1 of this SWPPP for more information on inspection responsibilities- To be completed by Contractor):	
Company/Organization Name:	
Contact Name:	
Address:	
City, State, Zip Code:	
Telephone Number:	
Fax/Email:	
Ground Disturbing Subcontractor(s):	
The General Contractor shall provide names and addresses of all subcontractors in the form provided in Appendix G working on this project who will be involved with construction activities that disturb site soil, along with a chain of responsibility with all operators on the site to ensure that the SWPPP will be implemented and stay in effect until the construction project is complete and the NOT submitted.	
This SWPPP was Prepared by:	
Company/Organization Name: MFRA, Inc.	
Contact Name: Mike Brandt, PE	
Address: 14800 – 28th Avenue North, Suite 140	
City, State, Zip Code: Plymouth, MN 55447	
Telephone Number: 763-476-6010	
Fax/Email: 763-476-8532 / mbrandt@mfra.com	

1.3 Nature of Construction Activity

Nature of Construction:	
This SWPPP has been prepared for major activities associated with construction of Full Circle Organics in Blue Earth County.	
Anticipated Approximate Timelines:	
Estimated Project Start Date:	3/15/2012
Estimated Project Completion Date:	11/15/2012

1.4 Soils, Slopes, Vegetation, and Current Drainage Patterns

Soil Type(s):
Soils on site are a mix of clays.
Slopes:
Existing slopes range from 0.5% to 1.5% draining from North to South through the site. The proposed site maintains a minimum 1.2% slope to catchbasins that collect the windrow runoff. The perimeter of the site builds up 3 to 1 slopes to create the containment of the windrow areas.
Drainage Patterns:
The drainage of the windrows are captured by catchbasins. The catchbasins transport the water to a holding pond. The holding pond will hold the 24 hour – 100 year storm event. Direct runoff occurs on the perimeter of the site.
Vegetation:
Current site is an open field. Vegetation will be established on bare soils not used for composting activity.
Rainfall Information:
Rainfall Information – The average total annual precipitation is about 28.32 inches. Of this about 17.31 inches, or 61 percent, usually falls in May through September. The average annual snowfall is 57.3 inches.

1.5 Construction Site Estimates

Project Area Summary:	
Total project area:	10 acres
Construction site area to be disturbed:	10 acres
Impervious Areas:	
Impervious area before construction (acres):	0

Impervious area after construction (acres):	6.30

1.6 Potential Sources of Pollution

Potential Sources of Sediment and Other Pollutants to Stormwater Runoff:
Construction phase pollutant sources anticipated at the site are disturbed (bare) soil, vehicle fuels and lubricants, chemicals associated with building construction, and building materials. Without adequate control there is the potential for each type of pollutant to be transported by storm water.

1.7 Maps

Erosion and Sediment Control Plans:
(revise the following as necessary) The following site development plan sheets are an integral part of this SWPPP: C-5.01 – Erosion Control Plan C-5.02 – Erosion Control Details

SECTION 2: EROSION AND SEDIMENT CONTROL BMPS

Erosion Control BMPs:

The purpose of erosion control is to prevent soil particles from becoming suspended in water and being transported to either downstream surface waters or downstream properties.

Appropriate construction phasing, vegetative buffer strips, horizontal slope grading, and other construction practices that minimize erosion must be planned for and implemented.

In the natural condition, soil is stabilized by native vegetation. The primary technique to be used at this project for final stabilization of site soil will be to provide a protective cover of vegetation, pavement, or building.

All exposed areas must be stabilized as soon as possible to limit soil erosion, but in no case later than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. Temporary soil stockpiles without significant silt, clay or organic components (e.g. clean aggregated stockpiles, demolition concrete stockpiles, sand stockpiles) and the constructed base components of roads, parking lots and similar surfaces are exempt from this requirement, but must comply with section 2.7 of this SWPPP (part IV.C.5 of the general permit).

Sediment Control BMPs:

The purpose of sediment control is to prevent soil particles that have been suspended in water from entering surface waters, including curb and gutter systems and storm sewer inlets. Sediment control BMPs have been designed as part of this SWPPP.

If the down gradient treatment system is overloaded, the Contractor is responsible for implementing additional up gradient sediment control practices or redundant BMPs to eliminate the overloading and must amend the SWPPP to identify the additional practices.

Sediment control practices must always be established on all down gradient perimeters before any up gradient land disturbing activities begin. These practices must remain in place until final stabilization is achieved (see section 7 of this SWPPP).

The timing of the installation of sediment control practices may be adjusted to accommodate short-term activities such as clearing or grubbing, or passage of vehicles. Any short term activity must be completed as quickly as possible and the sediment control practices must be

re-installed immediately after the activity is completed. Sediment control practices must be installed before the next rain event even if the activity is not complete.

2.1 Phase Construction Activity

Sequence of Construction:
1. Install stabilized construction exits
2. Prepare temporary parking and storage area
3. Construct perimeter controls
4. Install inlet protection in existing inlets per erosion and sediment control site maps
5. Halt all activities and contact civil engineer to perform inspection of BMPs. General Contractor shall schedule and conduct storm water pre-construction meeting with engineer and all ground disturbing contractors before proceeding with construction.
6. Construct sedimentation basin(s)
7. Clear and grub the site
8. Begin grading the site
9. Start construction of building pad and structures
Phase II
1. Temporarily seed denuded areas
2. Install utilities, underdrains, storm sewers, curbs and gutters
3. Install rip rap around outlet structures
4. Install inlet protection around storm sewer structures as they are constructed
5. Prepare site for paving
6. Pave site
7. Install Inlet Protection
8. Complete grading and permanent seeding and planting
9. When final stabilization has been achieved, remove all temporary erosion and sediment control devices
The actual schedule for implementing pollutant control measures will be determined by project construction progress. Down gradient protective measures must always be in place before soil is disturbed. Temporary sediment control devices may be removed as final stabilization is achieved on all contributing up gradient areas.

2.2 Control Stormwater Flowing onto and through the Project

Measures should be taken to ensure that "clean" runoff from off site is diverted around disturbed areas on site. Care should be taken that re-routing off site runoff does not result in flooding or

other issues on adjacent properties.	
BMP Description:	Temporary Diversion Ditch
Installation Schedule:	Install temporary diversion ditches as shown on the SWPPP plan sheets, and as needed throughout construction, prior to up gradient ground disturbing activities
Maintenance and Inspection Requirements:	The wetted perimeter of any temporary or permanent drainage ditch must be stabilized within 200 lineal feet from the property edge or from the point of discharge into any surface water. This stabilization must be completed within 24 hours of connecting to a surface water. The remainder of the ditch must be stabilized within 14 days of connecting to a surface water and after construction has ceased. Temporary or permanent ditches that are being used as a sediment containment system do not need to be stabilized, but must be stabilized within 24 hours after no longer being used as a sediment containment system. Ditches must be inspected every 7 days, and within 24 hours after a 0.5" 24-hour rain event. Any sediment deposited in diversion ditches must be removed and any exposed soils stabilized within 7 days of discovery unless precluded by legal, regulatory, or physical access constraints. If precluded, note reason for delay on maintenance log.
Responsible Staff (Contractor to Complete):	

2.3 Stabilize Soils

1. **Temporary Seeding** – Disturbed areas that are not yet at final grade but that will not be actively worked for 14 days or more must be temporarily seeded. Seeding shall be in accordance with MN/DOT seed mixture number 100 or 110 depending on the season of planting (see MN/DOT specification section 2575.3) seeding method and application rate shall conform to MN/DOT specification section 2575.3. Temporary mulch shall be applied in accordance with MN/DOT specification section 2575.3F1 and 2575.3G. Alternatively, hydraulic soil stabilizer in accordance with MN/DOT specification section 2575.3H may be used in place of temporary mulch.
2. **Permanent Stabilization** – All areas at final grade must be stabilized within 14 days after

completion of the major construction activity. Except for small level spots, seeded areas should generally be protected with mulch. Permanent mulch shall conform to Mn/DOT Specification 3882, Type 3 at 2 tons/acre and shall be disk anchored. Hydraulic Soil Stabilizer may be used in place of mulch if approved by Civil Engineer. If Hydraulic Soil Stabilizer is used, it shall be Mn/DOT Type 6.

2.4 Protect Slopes

Steep Slope Areas – Unbroken slope length shall not exceed 75 feet for all disturbed areas that are 3:1 or steeper. The 75-foot requirement will maintain sheet flow and minimize rills or gullies. Slopes steeper than 3:1 should be protected by erosion control blankets.

BMP Description:	Erosion Control Blanket
Installation Schedule:	Install erosion control blankets as shown on the SWPPP plan sheets, and as needed throughout construction, within the timeframe allowed for stabilization after work has ceased in an area, depending on the location (i.e. 24 hours, 7 days, 14 days)
Maintenance and Inspection Requirements:	To function properly, erosion control blankets must be in contact with the soil beneath the blanket. Blankets must be secured per the construction detail provided with the SWPPP plan sheets. Inspect blankets every 7 days or within 24 hours after a 0.5" 24-hour rain event. Repair or replace non-functional blankets within 24 hours after discovery.
Responsible Staff (Contractor to Complete):	

2.5 Protect Storm Drain Inlets

All storm drain inlets must be protected by appropriate means during construction until all sources with potential for discharging to the inlet have been stabilized. Inlet protection may be removed for a particular inlet if a specific safety concern (street flooding/freezing) has been identified and permittee(s) have received written correspondence from the jurisdictional authority (e.g. city/county/township/MnDOT/etc.) verifying the need for removal. The written correspondence must be documented in this SWPPP and be available within 72 hours of request. When written correspondence cannot be obtained in a timely

manner, the specific inlet protection can be removed to alleviate the immediate safety concern. However, efforts to obtain written correspondence must be documented in the SWPPP and available within 72 hours upon request. Permission to remove inlet protection based on a specific safety concern must still be obtained from the jurisdictional authority within 30 days of removal.	
BMP Description:	J-hook Curb Trap
Installation Schedule:	Install inlet protection in existing structures as directed on the SWPPP plan sheets, and as needed throughout construction, prior to beginning ground disturbing activities up gradient of the inlet. Install inlet protection on new structures as soon as the structures are put into use.
Maintenance and Inspection Requirements:	Inspect j-hook curb traps every 7 days or within 24 hours after a 0.5" 24-hour rain event. J-hook curb traps should be cleaned out when the sediment build-up reached 1/3 the height of the trap. This maintenance must be completed within 24 hours of discovery.
Responsible Staff (Contractor to Complete):	
BMP Description:	Wimco (or Approved Equal) Inlet Protection
Installation Schedule:	Install inlet protection in existing structures as directed on the SWPPP plan sheets, and as needed throughout construction, prior to beginning ground disturbing activities up gradient of the inlet. Install inlet protection on new structures as soon as the structures are put into use.
Maintenance and Inspection Requirements:	Inspect inlet protection every 7 days or within 24 hours after a 0.5" 24-hour rain event. Sediment accumulations should be removed when sediment build-up reaches 1/2 the capacity of the device, or, if more stringent, in accordance with manufacturer recommendations. This maintenance must be completed within 24 hours of discovery.
Responsible Staff (Contractor to Complete):	

2.6 Establish Perimeter Controls and Sediment Barriers

All structural sediment controls intended to receive and treat construction runoff must be in

place before any up gradient land alteration can begin and must stay in operation until final stabilization of the site has been achieved. Temporary soil stockpiles must have silt fence or other effective sediment controls, and cannot be placed in surface waters, including stormwater conveyances such as curb and gutter systems, or conduits and ditches unless there is a bypass in place for the stormwater.

BMP Description:	Silt Fence
Installation Schedule:	Install silt fence as directed on the SWPPP plan sheets, and as needed throughout construction, prior to commencing up gradient land disturbing activities.
Maintenance and Inspection Requirements:	Inspect silt fence every 7 days or within 24 hours after a 0.5" 24-hour rain event. Sediment accumulations should be removed when sediment build-up reaches 1/3 the height of the silt fence. This maintenance must be completed within 24 hours of discovery.
Responsible Staff (Contractor to Complete):	

BMP Description:	Biologs
Installation Schedule:	Install biologs as directed on the SWPPP plan sheets, and as needed throughout construction, prior to commencing up gradient land disturbing activities.
Maintenance and Inspection Requirements:	Inspect biologs every 7 days or within 24 hours after a 0.5" 24-hour rain event. Sediment accumulations should be removed when sediment build-up reaches 1/3 the height of the biolog. This maintenance must be completed within 24 hours of discovery.
Responsible Staff (Contractor to Complete):	

2.7 Retain Sediment On-Site

Any off-site accumulations of sediment must be removed in a manner and at a frequency sufficient to minimize off-site impact (e.g. fugitive sediment in streets could be washed into storm sewers by the next rain and/or pose a safety hazard to users of public streets).

Sedimentation basins are to be utilized during construction to capture and treat sediment laded run off. The sedimentation basins have been designed to retain the runoff from a 100 year, 24 hour storm event in accordance with part III.B of the General Permit.

BMP Description:	Sedimentation Basin
Installation Schedule:	Install sedimentation basin prior to beginning upslope land disturbing activities. If this is not possible due to existing topography, limit disturbance to only those areas necessary to install sedimentation basin.
Maintenance and Inspection Requirements:	Inspect sedimentation basins every 7 days or within 24 hours after a 0.5" 24-hour rain event. Sedimentation basins must be drained and the sediment removed when the volume of sediment collected in the basin reaches ½ the storage volume. This maintenance must be completed within 72 hours of discovery, or as soon as field conditions allow access. If conditions do not allow maintenance to be performed within 72 hours, document the cause of delay on the maintenance form. Refer to section 3.8 of this SWPPP for basin draining guidelines.
Responsible Staff (Contractor to Complete):	

2.8 Establish Stabilized Construction Exits

Rock construction exits have been designed to prevent sediment track off. If there is evidence of sediment tracking from vehicles in paved areas, the sediment must be removed by street sweeping or other method as soon as feasibly possible, but no longer than 24 hours after discovery.

BMP Description:	Rock Exit Drive
Installation Schedule:	Install rock exits as shown on the SWPPP plan sheets as soon as possible at the beginning of construction activities. Install additional rock exit drives as needed throughout construction.
Maintenance and Inspection Requirements:	Inspect rock exit drives every 7 days or within 24 hours after a 0.5" 24-hour rain event. Rock exit drives must be periodically 'refreshed' to ensure proper functionality. Maintenance should be performed when the exit appears smooth and compacted or when the rock exit drive ceases to function properly. Exit locations should be inspected for signs of off-site sediment

	tracking. Tracked sediment must be removed from all paved surfaces within 24 hours of discovery. Street sweeping must be used if rock exit drives are not adequate to prevent sediment from being tracked onto the street.
Responsible Staff (Contractor to Complete):	

2.9 Control Stormwater Discharge Points

Pipe or other temporary or permanent outlets must be stabilized with temporary or permanent energy dissipation within 24 hours after connection to a surface water.	
BMP Description:	Riprap
Installation Schedule:	Install riprap as shown on SWPPP plans and/or grading plans. Installation must be completed within 24 hours of connecting to a surface water.
Maintenance and Inspection Requirements:	Inspect outlets every 7 days or within 24 hours after a 0.5" 24-hour rain event. Repair, replace or supplement non-functioning riprap energy dissipation within 24 hours of discovery. Any off site accumulation of sediment must be removed in manner and at a frequency to minimize off-site impacts.
Responsible Staff (Contractor to Complete):	

SECTION 3: GOOD HOUSEKEEPING BMPS

3.1 Material Handling and Waste Management

1. **Solid Waste Disposal** – No solid materials, including construction and demolition materials, collected sediment, asphalt and concrete millings, shall be allowed to be carried from the site with storm water. All solid waste, including disposable materials incidental to the major construction activities, must be collected and placed in containers. The containers will be emptied periodically by a contract trash disposal service and hauled away from the site. Disposal of solid wastes must comply with MPCA requirements.
2. **Groundwater Protection** – Substances that have the potential for polluting surface and/or groundwater must be controlled by whatever means necessary in order to ensure that they do not discharge from the site. As an example, special care must be exercised during equipment fueling and servicing operations. If a spill occurs, it must be contained and disposed of so that it will not flow from the site or enter groundwater, even if this requires removal, treatment, and disposal of soil. In this regard, potentially polluting substances should be handled in a manner consistent with the impact they represent
3. **Sanitary Facilities** – All personnel involved with construction activities must comply with state and local sanitary septic system regulations. Temporary sanitary facilities will be provided at the site throughout the construction phase where required by state or local regulations. They must be utilized by all construction personnel and be serviced by a commercial operator.

3.2 Establish Proper Building Material Staging Areas

Chemicals, paints, solvents, fertilizers, and other toxic materials must be stored in waterproof containers, and include secondary containment. Except during application, the contents must be kept in trucks or within storage facilities with restricted access to prevent vandalism. Storage and disposal of hazardous waste must be in compliance with MCPA regulations. Runoff containing such material must be collected, removed from the site, treated, and disposed at an approved solid waste or chemical disposal facility.

3.3 Designate Washout Areas

The contractor shall designate areas for concrete washout, and note the locations on the site

map. All liquid and solid wastes generated by concrete washout operations must be contained in a leak proof containment facility or impermeable layer. The liquid and solid wastes must not contact the ground, and there must not be runoff from the concrete washout operations or areas. Liquid and solid waste must be disposed of properly and in compliance with MPCA regulations. A sign must be installed adjacent to each washout facility to inform concrete equipment operators to utilize proper facilities.

BMP Description:	Concrete Washout
Installation Schedule:	Prior to concrete work.
Maintenance and Inspection Requirements:	Inspect concrete washouts for evidence of discharge every 7 days or within 24 hours after a 0.5" 24-hour rain event. Repair, replace or supplement non-functioning concrete washouts within 24 hours or prior to next use.
Responsible Staff (Contractor to Complete):	

3.4 Establish Proper Equipment/Vehicle Fueling and Maintenance Practices

The contractor shall designate areas for equipment cleaning, maintenance and repair, and note the location(s) on the SWPPP site maps. Runoff must be contained within the designated areas (i.e. through use of a temporary berm). The areas must not be located in any surface water. Special care must be exercised during equipment fueling and servicing operations. If a spill occurs, it must be contained and disposed of so that it will not flow from the site or enter groundwater, even if this requires removal, treatment, and disposal of soil. No engine degreasing is allowed on site.

3.5 Control Equipment/Vehicle Washing

The contractor shall designate location(s) for vehicle washing, and note the location(s) on the SWPPP site map. The use of detergents for large-scale washing is prohibited (i.e. vehicles, buildings, pavement surfaces, etc.). Engine degreasing of trucks and other construction vehicles is also prohibited.

3.6 Spill Prevention and Control Plan

1. **Accidental Spill** – Discharge of oil or other hazardous substances is subject to reporting and clean up requirements. In case of an accidental spill, the Minnesota Pollution Control Agency is to be notified at their **24-hour telephone number: 651-649-5451**. Refer to Section V, Item C of the General Permit.
2. **Groundwater Protection** – Substances that have the potential for polluting surface and/or groundwater must be controlled by whatever means necessary in order to ensure that they do not discharge from the site. As an example, special care must be exercised during equipment fueling and servicing operations. If a spill occurs, it must be contained and disposed of so that it will not flow from the site or enter groundwater, even if this requires removal, treatment, and disposal of soil. In this regard, potentially polluting substances should be handled in a manner consistent with the impact they represent

SECTION 4: POST-CONSTRUCTION BMPs

The post-construction BMP's consist of a holding pond, sand filter and a leachate storage tank. The holding pond will receive runoff from the windrow pads and holds the 100-year, 24-hour storm event. Storm events larger than the 100-year, 24-hour storm will spill into the sand filter basin that will discharge to the roadside ditch. The leachate from new compost material will be contained in the leachate tank. The leachate tank and holding pond will be pumped back to the compost pads to provide a constant moisture source.

BMP Description:	Holding Pond
Installation Schedule:	At start of construction activities.
Maintenance and Inspection Requirements:	Routine pumping to provide storage volume.
Responsible Staff (Contractor to Complete):	

BMP Description:	Sand Filter
Installation Schedule:	At start of construction activities.
Maintenance and Inspection Requirements:	During storm events where water enters the sand filter basin.
Responsible Staff (Contractor to Complete):	

BMP Description:	Leachate Tank
Installation Schedule:	Prior to building pad construction.
Maintenance and Inspection Requirements:	Routine pumping to ensure volume storage capability.
Responsible Staff (Contractor to Complete):	

SECTION 5: INSPECTIONS

5.1 Inspections

1. **Inspection Frequency and Responsibility** Between the time this SWPPP is implemented and final site stabilization is achieved and the Notice of Termination filed with the MPCA, all disturbed areas and pollutant controls must be inspected at least once every seven calendar days and within 24 hours following a rainfall of 0.5 inches or greater. The purpose of site inspections is to assess performance of pollutant controls. The inspections will be conducted by the Contractor's designated representative. Based on these inspections, the Contractor will decide whether it is necessary to modify this SWPPP, add or relocate structural BMPs, or whatever else may be needed in order to prevent pollutants from leaving the site via storm water runoff. If the SWPPP requires modification, those changes to the SWPPP must be documented. The Contractor has the duty to cause pollutant control measures to be repaired, modified, maintained, supplemented, or whatever else is necessary in order to achieve effective pollutant control.
2. **Inspection Procedures** – Examples of particular items to evaluate during site inspections are listed below. This list is not intended to be comprehensive. During each inspection the inspector must evaluate overall pollutant control system performance as well as particular details of individual system components. Additional factors should be considered as appropriate to the circumstances.
A. Pre-Inspection Preparation:
1. Inspectors should be familiar with the SWPPP, including the erosion and sediment control plans, past inspection reports, and maintenance logs.
B. Site Entry:
1. Before entering the site, observe the surroundings and various stages of construction. Note areas for in-depth review and any potential issues.
2. This is a good time to view construction site vehicle exit locations and perimeter controls.
C. Records Review:
1. Verify that a copy of the SWPPP and application for the NPDES Storm Water Permit, and copies of all construction site inspections are on site.
2. Verify that the timing for installation of all erosion prevention and sediment control BMPs, as well as construction phasing, is generally being followed.
3. SWPPPs are intended to be dynamic documents, verify that amendments or

changes to the SWPPP are being made when:
a. A change in design, construction, operation, maintenance, weather or seasonal conditions have a significant effect on storm water discharges
b. Inspections indicate the SWPPP is not effective
c. The SWPPP is not consistent with the terms of the General Permit
D. Site Inspection (note timelines for maintenance included in inspection/maintenance report; refer to Appendix E for inspection report/maintenance form)
1. Inspect discharge points downstream and off-site areas for signs of impact.
2. Inspect perimeter controls:
a. Have perimeter controls been properly installed and maintained?
b. Are construction entrances/exits functioning properly? Are additional entrances/exits being used that are not stabilized?
c. All storm drains must be protected and temporary stockpiles must have sediment controls installed.
d. All exposed soils must have temporary or permanent erosion protection within 14 days of inactivity.
3. Compare BMPs in the SWPPP with construction site conditions: Are required BMPs in place; are additional BMPs needed; are BMPs in place properly installed and maintained?
4. Inspect areas that have been disturbed and are not currently being worked. Any unseeded or unmulched bare areas that have been idle for 2 weeks should be noted.
5. Inspect areas with final stabilization. In order for final stabilization to be achieved, areas must have a uniform cover with a density of 70% over entire area. Temporary BMPs should be removed and areas disturbed by removal seeded as necessary.
E. Exit Interview:
1. Debrief the person in charge. Explain the identified deficiencies and any areas of concern.
F. A copy of the completed inspection report must be kept with the SWPPP on site.

If an inspection form other than the one provided in Section 02370 is used, the inspection report used should include, at a minimum, the following:

- Date & time of inspection
- Name of inspector(s)
- Findings of inspections and recommendations for corrective actions
- Corrective actions taken, including dates, times and names of party completing maintenance
- Date & amount of rainfall
- Note to update the SWPPP

5.2 Delegation of Authority

Duly Authorized Representative(s) or Position(s):
Company or Organization Name:
Name:
Position:
Address:
City, State, Zip Code:
Telephone Number:
Fax/Email:
A copy of the signed delegation of authority form is attached in Appendix J.

5.3 Corrective Action Log

The inspection/maintenance form attached as Appendix E incorporates both inspection and maintenance reporting into a single form. This form also specifies the time allowed for corrections to be performed. If the party performing inspections chooses to use another inspection form, a separate corrective action log must be provided.

SECTION 6: RECORDKEEPING AND TRAINING

6.1 Recordkeeping

Record Retention – The Owner must keep the SWPPP including all changes made to it during construction (see section 6.2), along with the following additional records on file for three years after completion of the construction project (final stabilization and Notice of Termination):
1. Any other permits required for the project
2. Records of all inspections and maintenance conducted during construction
3. All permanent operation and maintenance agreements that have been implemented, including all right of way, contracts, covenants and other binding requirements regarding perpetual maintenance
4. All required calculations for design of the temporary and permanent storm water management systems

6.2 Log of Changes to the SWPPP

A copy of the SWPPP update log form is attached in Appendix F.
Modifications to the SWPPP – This SWPPP intends to control water-borne and liquid pollutant discharges by some combination of interception, filtration, and containment. The general contractor and subcontractors implementing this SWPPP must remain alert to the need to periodically refine and update the SWPPP in order to accomplish the intended goals. This SWPPP must be amended as necessary during the course of construction in order to keep it current with the pollutant control measures utilized at the site. Amending the SWPPP does not mean that it has to be reprinted. It is acceptable to add addenda, sketches, new sections, and/or revised drawings. This SWPPP must be updated as necessary to include additional requirements, such as additional or modified BMPs, designed to correct problems identified or address situations whenever:
1. There is a change in design, construction, operation, maintenance, weather or seasonal conditions that has a significant effect on the discharge of pollutants to surface waters or underground waters.
2. Inspections or investigations by site operators, local, state or federal officials indicate the SWPPP is not effective in eliminating or significantly minimizing the discharge of pollutants to surface waters or underground waters or that the discharges are causing water quality standard exceedances.
3. The SWPPP is not achieving the general objectives of controlling pollutants in storm water discharges associated with construction activity, or the SWPPP is not consistent

with the terms and conditions of the general permit.

4. The MPCA has determined that the project's storm water discharges may cause or contribute to non-attainment of any applicable water standard, or that the SWPPP does not incorporate requirements related to an approved Total Maximum Daily Load (TMDL) implementation plan. In this case, the SWPPP must be updated or a supplemental BMP action plan developed to address the identified concerns.

6.3 Training

Within 18 months of the issuance of the general permit (by February 1, 2010), the permittee(s) must fulfill training requirements and include records of training in the SWPPP. Individuals required to be trained include:

1. Individuals preparing the SWPPP
2. Individuals overseeing implementation of, revising, and amending the SWPPP and individuals performing inspections. One of these individuals must be available for an on site inspection within 72 hours upon request by the MPCA.
3. Individuals performing or supervising the installation, maintenance and repair of BMPs.

The content and extent of training must be commensurate with the individual's job duties and responsibilities with regard to activities covered under the general permit. At least one individual trained in the job duties listed above must be present on the site or available to the site in 72 hours.

Training documentation must include:

1. Names of personnel associated with the project that are required to be trained
2. Dates of training and names of instructor and entity providing training
3. Content of training course, including number of hours of training

Documentation must be kept with the SWPPP. Copies of training records/certifications are attached in Appendix I.

Individuals must be trained by local, state, federal agencies, professional organizations, or other entities with expertise in erosion prevention, sediment control, or permanent stormwater management such as the University of Minnesota, Minnesota Erosion Control Association, Soil and Water Conservation Districts, or the MPCA.

SECTION 7: FINAL STABILIZATION

Final Stabilization – To achieve final stabilization of the site, the contractor will implement the following measures after all soil disturbing activities at the site have been completed.
1. All soils must be stabilized by a uniform perennial vegetative cover over the entire pervious surface area, or by other equivalent means necessary to prevent soil failure under erosive conditions. ***Refer to landscaping plans/specifications for type of vegetative cover.***
2. All drainage ditches constructed to drain water from the site after construction is complete must be stabilized to preclude erosion. ***[delete if there are no permanent drainage ditches as part of the design]***
3. All temporary erosion prevention and sediment control BMPs must be removed.
4. All sediment must be cleaned from conveyances (i.e. storm sewer, curb & gutter, etc.) and from temporary sedimentation basins that are to be used as permanent water quality management basins. Sediment removed during the cleaning process must be stabilized immediately. Cleanout of permanent basins must be sufficient to return the basin to design capacity. The contractor shall verify each basin normal water elevation and bottom elevation coincide to what is shown on the approved Grading Plan. ***[modify this item to be site specific – delete references to permanent or temporary sedimentation basins if none are designed]***
5. For construction projects on land used for agricultural purposes final stabilization may be accomplished by returning the disturbed land to its preconstruction agricultural use.
6. Coverage may be terminated prior to completion of all construction activity if all of the following conditions are met in addition to numbers 3 & 4 above: a. Construction activity has ceased for at least 90 days b. At least 90% (by area) of all originally proposed construction activity has been completed and permanent cover established on those areas c. On areas where construction activity is not complete, permanent cover has been established

SECTION 8: CERTIFICATION AND NOTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: Michael C. Brandt Title: Project Manager

Signature: [signature] Date: 11-22-11

SWPPP APPENDICES

Appendix A – General Location Map

Appendix B – Site Maps

Appendix C – General Permit

Appendix D – Permit Application, Authorization and Notice of Termination/Permit Modification Form

Appendix E – Inspection Reports/Corrective Action Log

Appendix F – SWPPP Amendment Log

Appendix G – Contractor/ Subcontractor Certifications/Agreements

Appendix H – Grading and Stabilization Activities Log

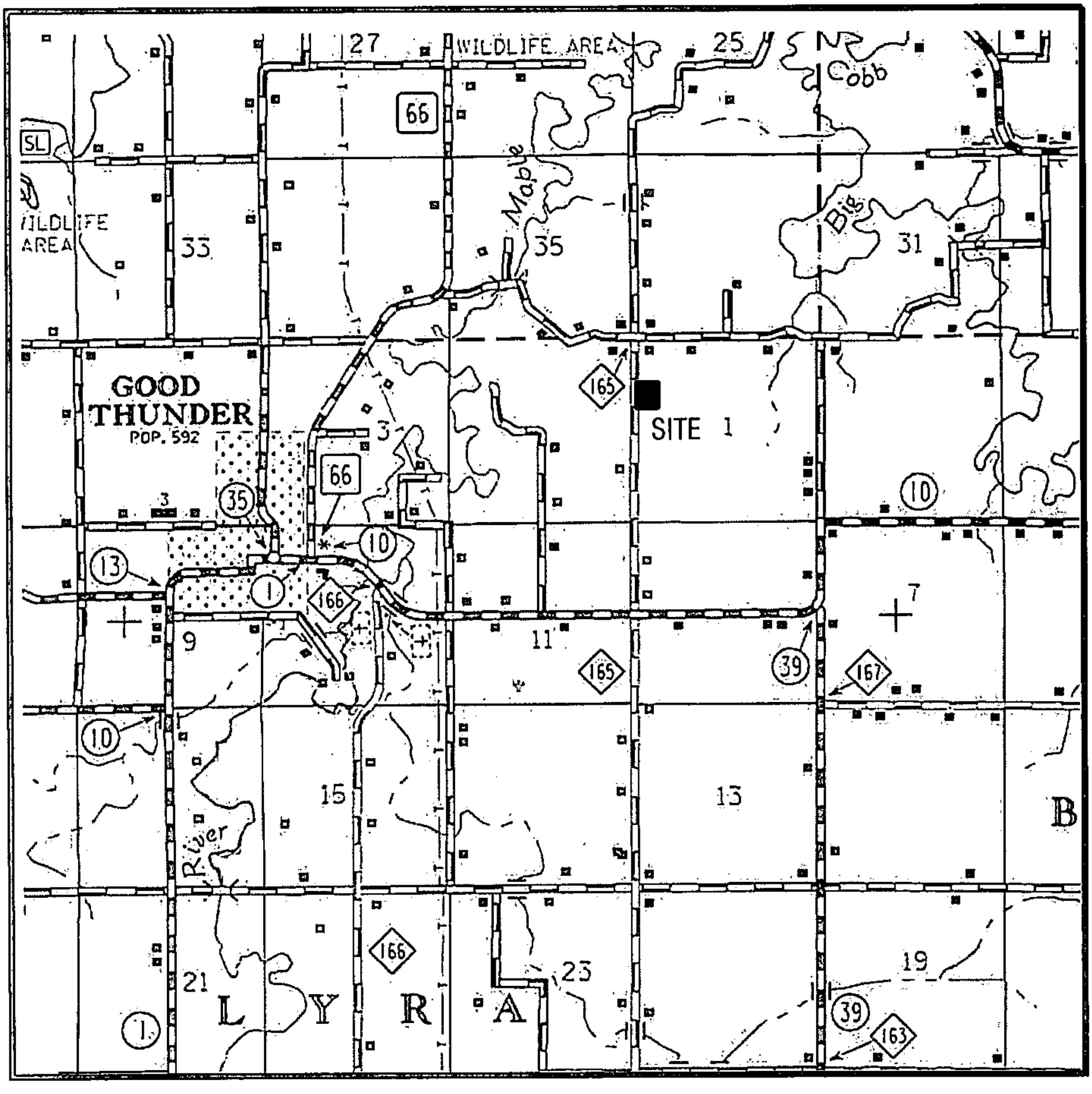
Appendix I – Training Log

Appendix J – Delegation of Authority

Appendix K – Environmental Reviews (IF APPLICABLE)

Appendix L –Temporary & Permanent Stormwater Design Calculations

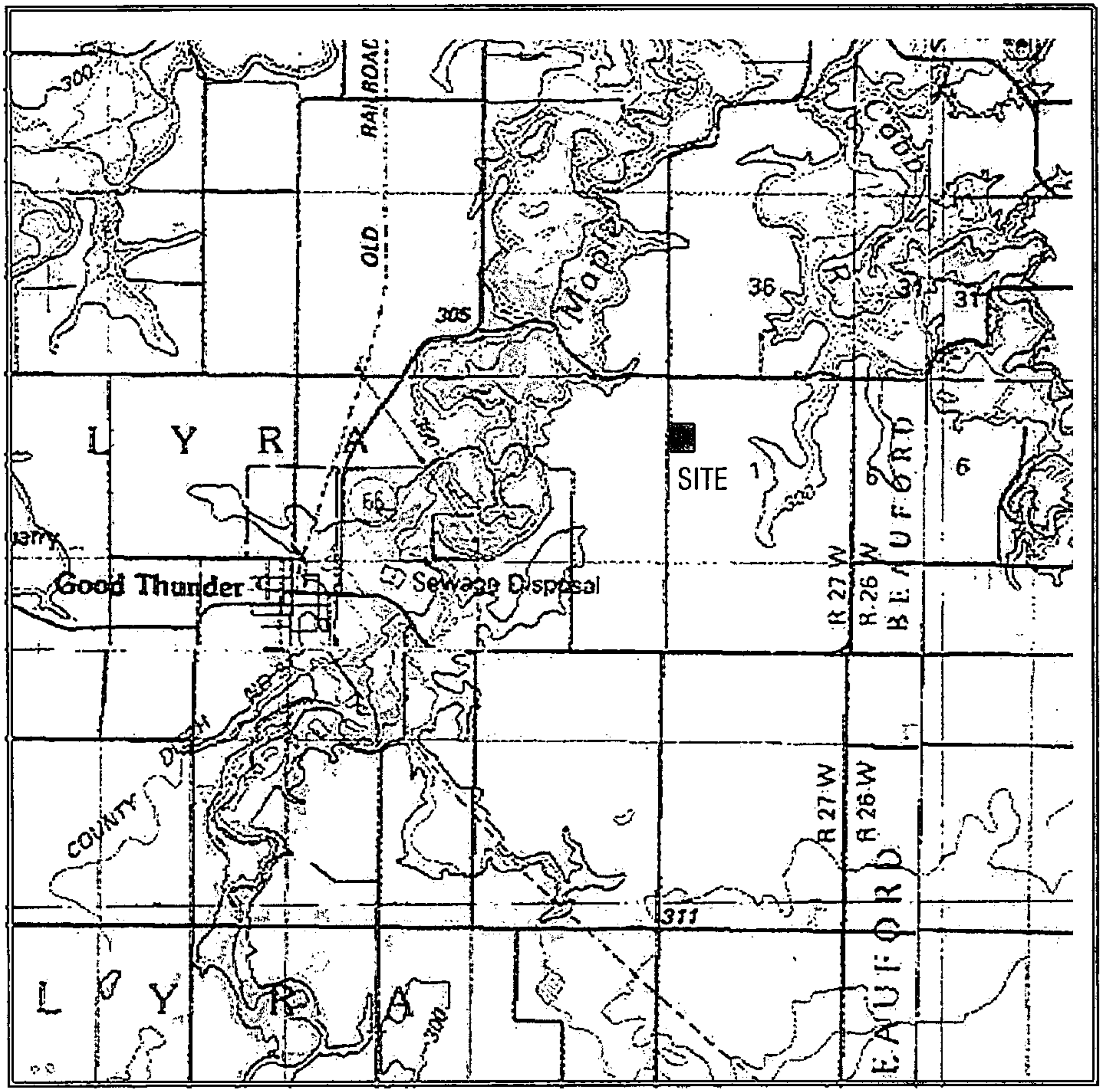
Appendix A – General Location Map



SITE LOCATION MAP

NOT TO SCALE

Appendix B – Site Maps



USGS MAP

NOT TO SCALE

Appendix C – MN General Permit (MN R00001)

Appendix D –Permit Application/Permit Coverage

Appendix E – Inspection Reports/Corrective Action Logs

Appendix F – SWPPP Amendment Log

Project Name:
SWPPP Contact:

Amendment No.	Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]

Appendix G – Subcontractor Certifications/Agreements

SUBCONTRACTOR CERTIFICATION
STORMWATER POLLUTION PREVENTION PLAN

Project Number: ______________________________

Project Title: ______________________________

Operator(s): ______________________________

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the BMPs and practices described in the SWPPP.

This certification is hereby signed in reference to the above named project:

Company: ______________________________

Address: ______________________________

Telephone Number: ____________________

Type of construction service to be provided: ______________________________

____

____

Signature: ____________________

Title: ____________________

Date: ____________________

Appendix H – Grading and Stabilization Activities Log

Project Name:
SWPPP Contact:

Date Grading Activity Initiated	Description of Grading Activity	Date Grading Activity Ceased (Indicate Temporary or Permanent)	Date When Stabilization Measures are Initiated	Description of Stabilization Measure and Location

Appendix I – SWPPP Training Log

Stormwater Pollution Prevention Training Log

Project Name:

Project Location:

Instructor's Name(s):

Instructor's Title(s):

Course Location: ________________________ Date: ______________

Course Length (hours): ______________________

Stormwater Training Topic: *(check as appropriate)*

- ☐ **Erosion Control BMPs**
- ☐ **Emergency Procedures**
- ☐ **Sediment Control BMPs**
- ☐ **Good Housekeeping BMPs**
- ☐ **Non-Stormwater BMPs**

Specific Training Objective: ______________________________________

____

Attendee Roster: *(attach additional pages as necessary)*

No.	Name of Attendee	Company
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Appendix J – Delegation of Authority

Delegation of Authority

I, ______________________ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Construction General Permit, at the ____________________________________ construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

____ (name of person or position)
____ (company)
____ (address)
____ (city, state, zip)
____ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in ____________________________________ MN General Stormwater Permit (MN R100001), and that the designee above meets the definition of a "duly authorized representative" as set forth in ____________________________________ MN General Stormwater Permit (MN R100001).

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: ____

Company: ____

Title: ____

Signature: ____

Date: ____

Appendix K – Environmental Reviews

Appendix L – Temporary & Permanent Stormwater Design Calculations

SECTION 02510
HDPE WATER MAIN

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water main pipe, hydrants, valves, fittings, and miscellaneous appurtenances.

1.02 RELATED SECTIONS

A. Section 02320 – Trench Excavation and Backfill.

B. Section 02445 – Jacking.

1.03 REFERENCES

A. American Water Works Association (AWWA):

1. C651 - AWWA Standard for Disinfecting Water Mains.

2. C906 – AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 in. through 63 in., for Water Distribution.

B. State of Minnesota Department of Transportation "Standard Specifications for Construction", 1988 Edition and the Supplement Specifications dated May 2, 1994 (MnDOT Spec.):

1. MnDOT Spec. 3760 – Insulation Board (Polystyrene).

C. National Electrical Manufacturers Association (NEMA):

1. WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

2. WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

3. WC 7 - Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

1.04 SEQUENCING AND SCHEDULING

A. Successfully complete required test and inspections before restoration of surface.

PART 2 PRODUCTS

2.01 HIGH DENSITY POLYETHYLENE PROFILE WALL PIPE AND FITTINGS (HDPE)

A. General Requirement: AWWA C906.

B. Minimum Hydrostatic Design Basis (HDR): 1,600 psi, in accordance with ASTM D 2837.

C. Marking: Each pipe shall be identified with the manufacturer's name, trade name or trademark and code from which plant location, machine, and date of manufacturer; nominal pipe size, in inches; the Ring Stiffness Constant Classification; and ASTM F714.

D. Fittings: Meeting requirements of ASTM D2683 for socket-type fittings, or ASTM D3261 for butt-type fittings.

2.02 JOINT RESTRAINT

A. Mechanical Joint Restraint:

1. Ductile Iron.

2. Working Pressure: Minimum 250 psi.

2. EBAA Iron, Inc., Mega-lug, or equal. Mega-lug and retainer glands are not allowed on existing cast iron pipe.

3. Spray exterior nuts and bolts using a bituminous coal tar as supplied by the manufacturer.

2.03 TRACER WIRE

A. Conform to the applicable requirements of NEMA WC3, WC5, and WC7.

B. Use #8 copper insulated and rated for underground service.

C. Shall be connected to all valves.

PART 3 EXECUTION

3.01 PREPARATION

A. See Section 02320 - Trench Excavation and Backfill.

B. HDPE Pipe:

1. Section of polyethylene pipe shall be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method, flange assemblies, or mechanical method as recommended by the pipe supplier:

   a. HDPE shall not be joined by solvent cements, adhesives, or threaded-type connections.

3.02 INSTALLATION OF PIPE

A. Install pipe and fittings in accordance with the manufacturer's instructions and with the details shown on the drawings.

B. Permanently support, remove, relocate or reconstruct existing utility pipes, cables, structures or other appurtenances when they obstruct the line, grade or location of the pipe or appurtenance.

C. Remove foreign matter or dirt from the inside of pipe.

D. All jointing of mechanical joint pipe and push-on joint pipe in accordance to AWWA C600.

E. Outside of the spigot and the inside of the bell, wire brush, wipe clean and dry. Keep pipe ends clean until joints are made.

F. Lay and maintain pipe and appurtenances to the alignment, grade and location shown on the drawings. No deviation from the plan alignment, grade or location is allowed unless approved by the Engineer. No pipe shall be laid in water or when the trench conditions are unsuitable for such work.

G. Precautions are to be taken to prevent debris or groundwater from entering the pipe being laid.

H. Installing Fittings:

   1. General Requirements: AWWA C600.

   2. Set and jointing to existing pipe and fittings as specified for cleaning, laying and joining pipe.

I. Backfilling: See Section 02320.

3.03 PIPE CONFLICTS

A. Shall apply to any pipe conflicts where a minimum clear separation of 1' is not possible.

B. Remove the abandoned water main and install offset as encountered during construction.

C. All offset piping shall be DIP.

3.04 FIELD QUALITY CONTROL

A. Scope:

1. Perform hydrostatic pressure, disinfection, and conductivity tests.

2. The Engineer will observe and verify all tests and visually inspect final work for compliance.

B. Required Tests and Inspection:

1. Hydrostatic Pressure Test:

a. Minimum Test Pressure: 150 psi.

b. Test Duration: 2 hours

c. Criteria: No drop in pressure allowed.

d. Testing gauge shall be liquid filled, 4-½ inch diameter, labeled in one-psi increments, such as Ashcroft model 1082 or approved equal.

e. All lines, including hydrant leads, water services and stubs, shall be tested.

2. Disinfection:

a. General Requirement: AWWA C651- Disinfecting Water Mains (Tablet Method)

b. Place hypochlorite tablets in each section of pipe and all appurtenances:

Attach tablets to top of pipe with a food grade adhesive such as denture grip.

2) The number of tablets required per 20-foot length of pipe based on 3¼-grain available chlorine per tablet is as follows:

Diameter	No. of Tablets
4"	1
6"	2
8"	3
10"	4
12"	5

16"	9
18"	12
20"	14
24"	20

c. Fill main with water at a velocity of less than 1' per second if tablet method is used.

d. Flushing, by Contractor, may begin after the chlorinated water has been allowed to disinfect the new pipe for 24 hours.

e. One (1) bacteria test is required for every two thousand (2000') feet of water main installed, with a minimum of 2 sample tests per project. Bacteria test shall be done by Engineer.

3.05 MEASUREMENT AND PAYMENT

A. Bid items have been provided for water main. Measurement and payment will be based upon the units listed below:

1. Water Main Pipe: Measurement will be based upon units of lineal feet for each size and type of pipe installed, as measured along the axis of pipe without regard to intervening valves or fittings. Water main over depth shall not be measured. Payment at the bid unit price shall include furnishing and installing pipe complete in place as specified.

2. DIP Fittings: Measurement shall be based on the total fitting weight installed. The fitting weight shall be construed to mean equivalent cast iron weight. Payment at the bid unit price shall include DIP fitting, poly encasement, bituminous coal tar spray and Cor-Blue T-Bolts.

3. Joint Restraint: Measurement shall be based on units of each joint restraint installed by size. Payment at the bid unit price shall include furnishing and installing DIP pipe restraint, poly encasement, bituminous coal tar spray and Cor-Blue T-Bolts.

4. Tracer Wire: No measurement will be made for tracer wire installed. Payment shall be included in the price for water main.

B. No bid items have been provided for steel rodding. Steel rodding shall be considered incidental to water main installation with no direct payment made.

C. No bid items have been provided for testing. Testing shall be considered incidental to water main installation with no direct payment made.

END OF HDPE WATERMAIN INSTALLATION

SECTION 02520
CONCRETE DRIVEWAY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work includes furnishing all material, labor, forms, equipment, and miscellaneous items necessary for the installation of a concrete sidewalk and/or concrete driveway or any combination thereof in accordance with the plans and specifications herein.

1.02 RELATED SECTIONS

A. General Conditions and Division 1 Sections apply to this work.

B. Division 2 Sections that apply to this work are:

02210 Aggregate Subbase and Base Construction
02370 Erosion and Sedimentation Control (including SWPPP)
02930 Sodding and Seeding Turf Establishment

1.03 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

B. Mn/DOT "Standard Specifications for Construction," 2005 Edition, and all supplements.

C. Minnesota ADA Accessibility Guidelines (ADAAG) and all supplements.

PART 2 PRODUCT

2.01 CEMENT

A. The cement shall be Portland Cement and shall conform to the current specification of Mn/DOT.

2.02 AGGREGATE

A. The fine and coarse aggregate shall conform to the sidewalk mix design.

2.03 CONCRETE MIXTURE

A. The concrete mixture shall conform to the requirements of MnDOT Specifications 2461. The concrete mix shall also conform to the requirements of Concrete Mix No. 3A32.

B. Minimum compressive strength after 28 days shall be a minimum of 3900 psi.

2.04 EXPANSION MATERIAL

A. Expansion material shall conform to AASHTO M213. The material shall be 1/2 inch think and have a width equal to the full depth of the slab in which it is to be used.

2.05 AGGREGATE MATERIAL

A. Aggregate material under the concrete shall be a well-graded granular material meeting the requirements of Mn/DOT Specification 3149.

PART 3 EXECUTION

3.01 PLACING CONCRETE

A. The concrete shall be placed on the moist subbase, or aggregate base and spread uniformly with as little handling as possible. The concrete shall be rough finished with a mechanically vibrated screed and vibrated with a hand vibrator next to the forms to prevent voids or honeycomb surfaces.

3.02 CONTRACTION JOINTS

A. Contraction joints shall be constructed so as to divide the slab area into square slabs with the greatest horizontal dimension of which shall not exceed 5 feet. The contraction joints shall be cut with a pointed trowel and edged to a radius of 1/2 inch, or sawed to a depth of one-third the depth of the slab within 72 hours of being placed.

3.03 EXPANSION JOINTS

A. Expansion joints in the sidewalks shall be placed at driveways, abutting curb and gutter, other existing sidewalks, building, or as directed by the Engineer.

3.04 FINISHING

A. Immediately after placing and rough finishing the concrete shall be floated to a uniform surface. The concrete surface shall have a slightly rough wood-float finish or a light broom finish. No apparent surface defects shall be allowed.

3.05 CURING AND PROTECTION

A. The Contractor shall cure the concrete by spraying with an approved curing agent. The Contractor shall erect suitable barriers, protected by warning lights to protect the concrete and public. The Contractor is responsible for all damage and repair to the concrete. The new concrete sidewalk shall be closed to pedestrian traffic for a minimum of 24 hours. Driveways shall be closed to vehicular traffic for a minimum of 7 days.

END OF CONCRETE SIDEWALK AND DRIVEWAY

SECTION 02621
STORM SEWER INSTALLATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work included in this section consists of furnishing all labor, equipment and materials to complete the following:

1. Trench excavation.

2. Construction of utilities, as shown on plans or as specified herein.

3. Backfill and compact utility trenches as specified herein.

4. Complete Finished Grading.

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions and Division 1 sections apply to this work.

B. Division 2 sections apply to this work.

C. Appendix - Subsurface Investigation. The Soils Report applies to this utility construction work. The contractor shall comply with the recommendations of the Soils Engineer as outlined in the Soils Report.

1.03 PROTECTION

A. The Contractor shall protect benchmarks, property corner monuments, fences, sidewalks, existing streets and trees which are not to be removed. If said items are damaged during construction and were not designated to be removed, the Contractor shall replace all items, as directed by the Engineer, at no cost to the Owner.

B. The Contractor shall protect above or below grade utilities which are to remain.

1.04 REFERENCES

A. City Engineer's Association of Minnesota (CEAM) "Standard Utilities Specifications," 1999 Edition.

B. Mn/DOT "Standard Specifications for Construction," 2005 Edition, and all supplements.

C. MPCA - National Pollutant Discharge Elimination System (NPDES) Permit. (See Section 02370.)

1.05 QUALITY ASSURANCE

A. The Contractor shall perform utility construction in compliance with the requirements specified herein, and in accordance with the governing authorities having jurisdiction.

B. The Soils Engineer will provide soil testing and inspection services for quality control testing during the utility construction.

1.06 TESTS

A. Testing of completed utility construction shall be in accordance with CEAM Specification 2621.3, except as modified herein.

1. The Contractor shall comply with the testing requirements as required by the County.

B. The Contractor shall be responsible for coordinating all required inspections and tests with the Engineer and County Personnel.

PART 2 PRODUCTS

2.01 MATERIALS

A. The definitions for types of materials shall be as specified in CEAM Specification 2621.2, except as modified herein.

1. RCP storm sewer pipe shall be RCP with class as shown on plans and R-4 joints with rubber gaskets.

2. Riprap shall be MnDOT Class 3, or as required by County.

3. High density dual wall polyethylene pipe and flared end sections may be furnished for storm sewer if allowed by the governing authority. The materials shall conform to AASHTO M-294. Material to be 100% virgin resin. Pipe joints shall consist of a bell and spigot type joint with an O-ring rubber gasket meeting ASTM F477 placed on the spigot end.

4. All storm sewer manholes shall be furnished with a neoprene rubber boot at each pipe opening.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Contractor shall identify known below grade utilities. Stake and flag locations.

B. The Contractor shall identify and flag above grade utilities.

C. The Contractor shall maintain and protect existing utilities remaining which pass through work area.

D. The Contractor shall notify utility company to relocate utilities, which may conflict with project construction.

E. Upon discovery of unknown utility or concealed conditions, the Contractor shall discontinue affected work and notify the Engineer.

F. The Contractor shall examine the areas and conditions under which dewatering, excavating, filling and grading are to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 CONSTRUCTION REQUIREMENTS

A. The sanitary sewer and storm sewer installation shall be in accordance with CEAM specification 2600.3 and 2621.3, except as modified herein.

1. As an item incidental to the installation of the pipe, the Contractor shall, if needed, provide trench dewatering sufficient to maintain the groundwater level not less than one foot below the bottom of the Sewer. No payment will be made for rock or stabilization material used to facilitate dewatering. Methods and equipment to be used for dewatering shall be reviewed with and approved by the Engineer prior to starting the dewatering operation.

2. If natural, suitable, granular bedding material is not encountered during the normal excavation for the sewer trench or when the material encountered is determined unsuitable by the Engineer for backfilling around the conduit, the Contractor shall provide and place granular bedding material as required at no extra compensation.

3. High density dual wall polyethylene storm sewer pipe shall also be installed in accordance with manufacturer's installation guidelines. At least two (2) corrugatious of the spigot end must insert into the bell end.

4. Place embankment materials evenly adjacent to utilities and structures, to required elevations. Exercise care to prevent wedging action of backfill, of unbalanced forces, against structures by carrying the material uniformly around structure to

approximately the same elevation in each lift. If applicable, hand tamp fill immediately adjacent to walls or use hand operated vibratory equipment.

5. Embankment material placed beneath the building shall be compacted in accordance with the requirements of the Soils Engineer.

6. Embankment material placed beneath the street or parking area shall be compacted in accordance with the Mn/DOT Specified Density Method.

7. Embankment Material not placed in the building pad or streets or parking area, shall be compacted in accordance with requirements of the Mn/DOT "Quality Compaction Method."

8. All areas disturbed by the Contractor's operations shall be restored to equal or better than original condition or to the requirements of the new work.

3.03 FINISH GRADING

A. The building subgrade finished surface elevation shall not vary by more than 0.30 foot above, or 0.30 foot below the prescribed elevation at any point where measurement is made.

B. The street subgrade finished surface elevation shall not vary by more than 0.05 foot above, or 0.10 foot below the prescribed elevation of any point where measurement is made.

C. Areas which are to receive topsoil shall be graded to within 0.10 foot above or below the required subgrade elevation.

3.04 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion, and keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.

C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.05 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. The Contractor shall transport all excess excavated material off-site, to an area as selected by the Contractor and approved by the Engineer. The cost of disposal of excess and waste material shall be considered incidental to the project and not special payment will be made.

B. Dispose of trash and debris in accordance with applicable laws. Burial of this material on site will not be allowed.

C. When disposal operations are complete, the Contractor shall leave the site in a condition acceptable to the Owner.

3.06 TREE PROTECTION

A. The trees and other natural vegetation within the project and/or adjacent to the project are of prime concern to the Contractor's operations. The Contractor will be required to protect the trees which are to be saved with snow fencing to be sure that equipment is not needlessly operated under nearby trees and shall exercise extreme caution in working adjacent to trees. Should any portion of the tree branches require removal to permit operation of the Contractor's equipment, he shall obtain the services of a professional tree trimming service to trim the trees prior to the beginning of operation. Should the Contractor's operations result in the breaking of any limbs, the broken limbs should be removed immediately and cuts shall be properly protected to minimize any lasting damage to the tree. No trees shall be removed without authorization by the Engineer. Costs for trimming services shall be considered incidental to the utility construction and no special payment shall be made.

The Utility Contractor shall comply with the requirements of the City.

3.07 MINNESOTA POLLUTION CONTROL AGENCY - NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT REQUIREMENTS

A. The Contractor shall comply with the requirements of the NPDES Permit. The Contractor shall be required to be a co-applicant with the Owner. See Section 02370.

END OF SANITARY SEWER AND STORM SEWER INSTALLATION

SECTION 02622
SANITARY SEWER INSTALLATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work included in this section consists of furnishing all labor, equipment and materials to complete the following:

1. Trench excavation.

2. Construction of utilities, as shown on plans or as specified herein.

3. Backfill and compact utility trenches as specified herein.

4. Complete Finished Grading.

1.02 RELATED SECTIONS

A. General Conditions, Supplementary Conditions and Division 1 sections apply to this work.

B. Division 2 sections apply to this work.

C. Appendix - Subsurface Investigation. The Soils Report applies to this utility construction work. The contractor shall comply with the recommendations of the Soils Engineer as outlined in the Soils Report.

1.03 PROTECTION

A. The Contractor shall protect benchmarks, property corner monuments, fences, sidewalks, existing streets and trees which are not to be removed. If said items are damaged during construction and were not designated to be removed, the Contractor shall replace all items, as directed by the Engineer, at no cost to the Owner.

B. The Contractor shall protect above or below grade utilities which are to remain.

C. The Contractor shall protect all construction stakes until the work is completed. If the construction stakes are destroyed and need to be replaced, it will be done at the contractor's expense.

1.04 REFERENCES

A. City Engineer's Association of Minnesota (CEAM) "Standard Utilities Specifications," 1999 Edition.

B. Mn/DOT "Standard Specifications for Construction," 2005 Edition, and all supplements.

C. MPCA - National Pollutant Discharge Elimination System (NPDES) Permit. (See Section 02370.)

1.05 QUALITY ASSURANCE

A. The Contractor shall perform utility construction in compliance with the requirements specified herein, and in accordance with the governing authorities having jurisdiction.

B. The Soils Engineer will provide soil testing and inspection services for quality control testing during the utility construction.

1.06 TESTS

A. Testing of completed utility construction shall be in accordance with CEAM Specification 2621.3, except as modified herein.

1. The Contractor shall comply with the testing requirements as required by the City.

2. The Engineer will require the measurement of the deflection of the PVC sewer pipe after complete placement of backfill material in the trench and prior to acceptance of the project. Deflections greater than 5% of the inside pipe diameter shall be considered failure of the bedding procedure and the Contractor shall be required to re-excavate the trench and provide additional compaction along the side of the sewer pipe. Costs for the work to correct the failure shall be completed at the Contractor's expense. The deflection test shall be performed no earlier than 30 days after the final backfill has been placed. If the deflection test fails, the deflection test shall be repeated 30 days after the date of the corrected failure.

3. Televising of the public sanitary sewer main shall be completed. Two copies of the test results shall be furnished to the Engineer.

B. The Contractor shall furnish all labor and materials for testing the sewers and forcemain, and shall assist the Engineer in making measurements.

C. The Contractor shall be responsible for coordinating all required inspections and tests with the Engineer and City Personnel.

PART 2 PRODUCTS

2.01 MATERIALS

A. The definitions for types of materials shall be as specified in CEAM Specification 2621.2, except as modified herein.

1. Sanitary sewer pipe materials, and type of pipe for varying depth zones, shall comply with the requirements of the governing authority.

   Polyvinyl Chloride (PVC) sewer pipe shall comply with ASTM 3034. Elastometric gaskets shall be furnished and installed.

   The following type of sewer pipe shall be furnished for varying depth zones:

Type of Pipe	Depth from Finished Grade to Invert
PVC – SDR35	22 feet

   The sanitary sewer pipe shall be PVC SDR26 pressure pipe at watermain crossing where the vertical separation between the pipes is less than 18 inches.

2. Insulation shall be Dow Styrofoam HI Brand 35 or equivalent, 2-inch thickness.

2.02 PRE-CAST CONCRETE TANK

A. Shall be manufactured by Weiser Concrete and the size indicated on the Plans. All tanks shall meet the specifications of MN Chapter 7080.

2.03 TANK ACCESS COVER

A. Shall be manufactured and sized indicated on the plan and meet specifications of MN Chapter 7080.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Contractor shall identify known below grade utilities. Stake and flag locations.

B. The Contractor shall identify and flag above grade utilities.

C. The Contractor shall maintain and protect existing utilities remaining which pass through work area.

D. The Contractor shall notify utility company to relocate utilities, which may conflict with project construction.

E. Upon discovery of unknown utility or concealed conditions, the Contractor shall discontinue affected work and notify the Engineer.

F. The Contractor shall examine the areas and conditions under which dewatering, excavating, filling and grading are to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 CONSTRUCTION REQUIREMENTS

A. The sanitary sewer installation shall be in accordance with CEAM specification 2600.3 and 2621.3, except as modified herein.

1. As an item incidental to the installation of the pipe, the Contractor shall, if needed, provide trench dewatering sufficient to maintain the groundwater level not less than one foot below the bottom of the Sewer. No payment will be made for rock or stabilization material used to facilitate dewatering. Methods and equipment to be used for dewatering shall be reviewed with and approved by the Engineer prior to starting the dewatering operation.

2. If natural, suitable, granular bedding material is not encountered during the normal excavation for the sewer trench or when the material encountered is determined unsuitable by the Engineer for backfilling around the conduit, the Contractor shall provide and place granular bedding material as required at no extra compensation.

3. Place embankment materials evenly adjacent to utilities and structures, to required elevations. Exercise care to prevent wedging action of backfill, of unbalanced forces, against structures by carrying the material uniformly around structure to approximately the same elevation in each lift. If applicable, hand tamp fill immediately adjacent to walls or use hand operated vibratory equipment.

4. Embankment material placed beneath the building shall be compacted in accordance with the requirements of the Soils Engineer.

5. Embankment material placed beneath the street or parking area shall be compacted in accordance with the Mn/DOT Specified Density Method.

6. Embankment Material not placed in the building pad or streets or parking area, shall be compacted in accordance with requirements of the Mn/DOT "Quality Compaction Method."

7. All areas disturbed by the Contractor's operations shall be restored to equal or better than original condition or to the requirements of the new work.

3.03 INSTALLATION – SEPTIC TANKS

A. Install Pre-cast concrete Filter Tank.

B. Install Tank Covers.

C. Piping.

1. Install typical 4" or 6" PVC pipe at 5' from building to septic tanks as shown on plans.

3.04 FINISH GRADING

A. The building subgrade finished surface elevation shall not vary by more than 0.30 foot above, or 0.30 foot below the prescribed elevation at any point where measurement is made.

B. The street subgrade finished surface elevation shall not vary by more than 0.05 foot above, or 0.10 foot below the prescribed elevation of any point where measurement is made.

C. Areas which are to receive topsoil shall be graded to within 0.10 foot above or below the required subgrade elevation.

3.05 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion, and keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.

C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.06 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. The Contractor shall transport all excess excavated material off-site, to an area as selected by the Contractor and approved by the Engineer. The cost of disposal of excess and waste material shall be considered incidental to the project and not special payment will be made.

B. Dispose of trash and debris in accordance with applicable laws. Burial of this material on site will not be allowed.

C. When disposal operations are complete, the Contractor shall leave the site in a condition acceptable to the Owner.

3.07 TREE PROTECTION

A. The trees and other natural vegetation within the project and/or adjacent to the project are of prime concern to the Contractor's operations. The Contractor will be required to protect the trees which are to be saved with snow fencing to be sure that equipment is not needlessly operated under nearby trees and shall exercise extreme caution in working adjacent to trees. Should any portion of the tree branches require removal to permit operation of the Contractor's equipment, he shall obtain the services of a professional tree trimming service to trim the trees prior to the beginning of operation. Should the Contractor's operations result in the breaking of any limbs, the broken limbs should be removed immediately and cuts shall be properly protected to minimize any lasting damage to the tree. No trees shall be removed without authorization by the Engineer. Costs for trimming services shall be considered incidental to the utility construction and no special payment shall be made.

The Utility Contractor shall comply with the requirements of the City.

3.08 MINNESOTA POLLUTION CONTROL AGENCY - NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT REQUIREMENTS

A. The Contractor shall comply with the requirements of the NPDES Permit. The Contractor shall be required to be a co-applicant with the Owner. See Section 02370.

END OF SANITARY SEWER AND STORM SEWER INSTALLATION

SECTION 02910
FILTRATION SYSTEM

PART 1 GENERAL

1.01 CONDITIONS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

1.02 SCOPE OF WORK

A. Furnish all labor, material, equipment and services necessary to provide all Filtration System Stormwater work, complete in place, as indicated on Plans and Specifications herein.

Work specified in this Section, but is not limited to the following:

1. Installation of the Draintile Collection system.
2. Survey work shall ensure the subgrade of the installation is prepared as stated on the Plans and is approved by the engineer prior to installation of subsequent system components. If the subgrade is not accepted by the engineer the Contractor shall make if acceptable at the expense of the Contractor.
3. Plans and provisions are made for adequate containment of sand and aggregate along the Filtration Stormwater facility perimeter edges as specified on the plans.
4. Grading, leveling and final compaction of the sand fill are to be completed by the Contractor and approved by *the engineer* on or before proceeding to final vegetation & Stormwater system stabilization phase.
5. Locate and protect all existing draintile components, connection pipe and other physical features in the Stormwater system and the immediate vicinity.
6. Protect all pavement areas and hard surface areas. Damaged areas will be replaced at Contractor's expense.
7. Settling and compaction shall be done with water, vibra-plate and/or rolling as specified and as approved by *engineer.*
8. Furnish and apply specified amendments and fertilizer.
9. Incorporate amendments using a Toro sand pro, or equivalent machine with 2-4" cultivating attachments.
10. .
11. Finish grade as specified.
12. Seed, Sod or plant as described in grading, drainage and erosion control plan set a prepared by others…

1.03 QUALITY ASSURANCE

A. Approved Filtratio Stormwater System Contractors

1. The Contractor must take part in an installation training program and at the end of the program must have met certain objectives to be approved for installation of the specified systems. Approval does not mean the Contractor is certified but rather they have an adequate understanding to install the Filtration Stormwater System

2. Training shall include retaining a Construction Engineer for the installation process at the Contractor's expense. Depending on the Contractor's competency, the Construction Engineer may or may not be on site throughout the entire installation process.

B. Tested and approved sand source includes:

C. Tested and approved aggregate source includes:

D. If the Contractor chooses different sand and/or aggregate source from what is approved they must have the material samples tested as outline in Subsection E of this section.

E. The Contractor shall obtain and submit imported sand and aggregate samples to *the engineer* for inspection prior to using imported fill material for each filtration area.

1. The imported bottom aggregate layer: Submit a one (1) gallon sample of washed, ¼" minus aggregate meeting the general specifications for ASTM C33-03 (Table 2 Grading Requirements for Coarse Aggregates, Size No. 89), Standard Specifications for Concrete Aggregates. This material shall be tested by the Testing Agent at the Contractor's expense.
2. The imported sand layer: Refer to recommendations for "Choosing the Right Sand" and "Sand Testing Procedure" as preliminary screening tools. Submit a two (2) gallon sample of medium washed sand meeting the general specifications for ASTM F2396-04, Standard Guide for Construction of High Performance Sand-Based Rootzones for Sports Fields. The imported sand layer shall also meet the specifications detailed by the engineer in regards to particle size, , compaction and drainage characteristics. This material shall be tested by the Testing Agent at the Contractor's expense.
3. The test results of the sand and aggregate shall be reviewed by the Owner and *engineer,* who has the right to reject the imported sand and aggregate if either does not meet specifications.
4. Submit executed Guarantee of Contractor/Subcontractor.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver undamaged products to job with tags and labels intact.

B. Store materials in protected areas, off the ground, and in areas as not to interfere with the progress of the work.

C. Transport, store and handle in strict accord with the manufacture's written recommendations.

D. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this section and that arrangements have been made to properly store, handle and protect such materials and work.

1.05 JOB CONDITIONS

A. Contractor shall acquaint himself or herself with all existing site conditions. If unknown active utilities are encountered during work, notify Project Engineer promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.06 FIELD MEASUREMENTS

A. Make and be responsible for all field dimensions necessary for proper fitting and completion of work. Report discrepancies to *engineer* before proceeding.

PART 2 MATERIALS

2.01 GENERAL

A. All materials shall be of standard, approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the Manufacturer's guaranteed analysis. The Contractor shall supply the Owner with a sample of all supplied materials accompanied by analytical data from an approved laboratory source illustrating compliance of bearing the Manufacturer's analysis.

2.02 MANUFACTURERS

A. ADS
B. Primsco.

2.03 DRAINTILE COMPONENTS

A. Un-Socked slotted HDPE or PVC Draintile Pipe

2.04 SAND AND AGGREGATE FILL MATERIAL

A. The sand shall meet the specifications of:

1. General Specifications of ASTM F2396-04, Standard Guide for Construction for High Performance Sand-Based Rootzones for Sports Fields.
2. The sand should be advertised as "washed sand", where most of the silt and clay particles have been removed.
3. The pH of the sand should be in the neutral range (6.5-7.5).
4. The sand should feel "gritty" when rubbed between the fingers, crumble readily when dry, and absorb water quickly when water is poured on top of it.
5. Ideal sand should have 90 to 100 percent of its particles between 0.2mm and 1.0mm in diameter. Within this range, the medium sized particles, with a diameter between 0.25mm and 0.50mm, should comprise at least 50 to 70 percent. However, the preferred acceptable ranges are as listed below:

<table>
<tr><th>CLASSIFICATION</th><th>PARTICLE SIZE (mm)</th><th>SIEVE #</th><th>ACCEPTABLE RANGE (%)</th></tr>
<tr><td>FINE GRAVEL</td><td>2.00 AND UP</td><td>10</td><td rowspan="2">0 – 10</td></tr>
<tr><td>VERY COURSE SAND</td><td>1.00 – 2.00</td><td>18</td></tr>
<tr><td>COURSE SAND</td><td>0.50 – 1.00</td><td>35</td><td rowspan="3">82 – 100</td></tr>
<tr><td>MEDIUM SAND</td><td>0.25 – 0.50</td><td>60</td></tr>
<tr><td>FINE SAND</td><td>0.10 – 0.25</td><td>140</td></tr>
<tr><td>VERY FINE SAND</td><td>0.05 – 0.10</td><td>270</td><td rowspan="3">0 – 8</td></tr>
<tr><td>SILT AND CLAY</td><td>under 0.05</td><td>-</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

6. The sand should be evaluated to ensure after the sand evaluation, it meets the proper capillary rise and drainage dynamics.

B. The aggregate shall meet the specifications of:

1. General Specifications of ASTM C33-03 (Table 2 Grading Requirements for Coarse Aggregates, Size No. 89), Standard Specifications for Concrete Aggregates.
2. The aggregate should be advertised as "washed gravel", where most of the silt and clay particles have been removed.
3. For most gravels the sieve size should fall within the following parameters:

PARTICLE SIZE (mm)	ACCEPTABLE RANGE (%)
Less than 1	Under 10
2 to 8	**80**
Greater than 9	Under 10

4. The aggregate should be evaluated to ensure after the gravel evaluation, it meets proper bridging capacity.
5. The aggregate layer must provide an interface barrier to bridge the overlying sand above it.
6. As sand sizes vary from very fine (0.05mm) to course (2.0mm), the gravel layer generally follows the 8:1 ratio rule – where most of the gravel particles in the gravel are not larger than 8 times the particle size of the sand above it.

2.05 SODDING

A. Sod shall be a minimum of 80% Kentucky bluegrass or Rhizomatous Tall Fescue (RTF) as specified by…

B. Other approved sand based sod approved by *engineer*.

C. Sod shall be cut to a minimum thickness of ½" to 1" (soil depth) and grown on a minimum of 85% sand. Submit a one (1) square foot sample of sod to the *RESI* Testing Agent for acceptance analysis. The soil within the sod profile shall be tested at the Contractor's expense. This testing shall determine whether the sod soil is compatible with the specified sands below. Layering or capping of the vegetated areas is undesirable and shall be prevented.

D. Sod shall be minimum of 30" wide rolls.

E. If possible, the sod shall be pre-aerated to allow underseeding to rise through perforations.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. Subcut the Filtration System areas to the elevations specified on the plans.

B. Rip existing soils to the depths specified on the plans below subgrade to a maximum compaction of 85% std. proctor density.

C. An excavated containment area shall be prepared prior to the subgrade preparation to receive imported washed sand, 2" aggregate fill material and EPIC components over the System surface. Overall minimum depths of EPIC areas are 24" as specified on plans as determined by tested and approved sand & aggregate samples per Section 1.03 Quality Assurance.

D. The subgrade of the filtration containment areas shall be in accordance to the plans meeting tolerances for grading.

E. After the subgrade has been properly graded, it shall be consolidated using a suitable vibrating roller or compactor to no more than 85% Standard Proctor Density. The subgrade shall be sloped in accordance to the plans meeting the tolerances for grading.

F. The Contractor shall provide consolidation testing in accordance with the Geotechnical Report as prepared by others.

3.02 SUBGRADE EVALUATION AND FINISH

A. After subgrade consolidation the end result should be a smooth, level and permeable surface.

3.03 GEOTEXTILE FABRIC INSTALLATION

A. After the subgrade is deemed acceptable by *engineer* the installation of 4oz. non-woven geotextile fabric may proceed where specified.

B. Roll out the 4oz. non-woven geotextile fabric over subgrade. Overlap edges minimum of 6" and stake on slopes where necessary to ensure geotextile does not creep during aggregate installation.

3.04 DRAINTILE CONNECTION AND AGGREGATE FILL

A. Drinatile are to be installed "laser level" flat with 0% grade.

B. Use an appropriate alignment method to maintain straight line separation distance between draintile rows as specified on plans.

C. Driantile connection pipes through storm sewer outlet control structures using means approved by Project Engineer.

D. Place approved washed ¼" minus aggregate 2" deep along bottom of geotextile fabric and along sides of draintile. The aggregate fill must cover the draintile.

3.05 SAND PLACEMENT AND FILL

A. Place all imported sand over aggregate or subgrade as specified on plans.

B. Water settle and roll using a 2ft. x 6ft. smooth roller delivering approximately 100 pounds weight per linear foot width.

C. Upon final completion of fine grading and placement of all sand, the Contractor shall notify *the engineer* and have available laser pláne system with slope control for inspection.

3.06 SOD INSTALLATION

A. Sod Material

1. Use only high quality sod (sandy athletic field type sod) of known genetic origin that is free of noxious weeds, disease, and insect problems. It should appear healthy and vigorous and should conform to the following.

2. Selected Sod should have been grown in soil comprising a minimum 85% sand, or bare rooted sod grown with soil-less techniques. Submit a one (1) square foot sample of sod to the Testing Agent for acceptance analysis. The soil within the sod profile shall be tested at the Contractor's expense. This testing shall determine the whether the sod soil is compatible with the specified sands below. Layering or capping of the vegetated areas is undesirable and shall be prevented.

3. Sod should be machine cut at a uniform depth of ½" to 1" (soil depth) – excluding shoot growth and thatch.

4. Sod should not have been cut in excessively wet or dry weather.

5. Sections of sod should be a standard size (as determined by the supplier), uniform and untorn.

6. Sections of sod should be strong enough to support their own weight and retain their size and shape when lifted by one end.

7. Harvest, delivery, and installation of sod should take place within a period of 36 hours.

3.07 SOD INSTALLATION

1. Moistening sod after it is unrolled helps maintain viability. Store it in the shade during installation.

2. Rake the soil surface to break the crust just before laying sod. During the summer, the sand should be wet on the surface before laying the sod to cool the sand and reduce root burning and dieback.

3. Do not sod on gravel or soils that may have been recently treated with sterilants or herbicides.

4. Lay the first row of sod in a straight line with subsequent rows placed parallel to and butting tightly against each other. Stagger strips in a brick- like pattern. Be sure that the sod is not stretched or overlapped and that the joints are butted tightly to prevent voids. Use a knife or sharp spade to trim and fit irregularly shaped areas.

5. As sodding of clearly defined areas is completed, roll sod to provide firm contact between roots and sand.

6. After rolling, irrigate until the soil is wet 4 inches (102 mm) below sod.

7. Keep sodded areas moist to a depth of 4 in. (102 mm) until the grass takes root. This can be determined by gently tugging on the sod – resistance indicates that rooting has occurred.

8. Mowing should not be attempted until the sod is firmly rooted, usually 2-3 weeks. See operations and maintenance manual.

END OF SECTION

DIVISION 3 - CONCRETE

SECTION 03100
CONCRETE FORMWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.02 RELATED SECTIONS

A. Section 03200 - Concrete Reinforcement

B. Section 03300 - Cast-in-Place Concrete

1.03 REFERENCES

A. ACI - American Concrete Institute

1.04 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with ACI 347 Recommended Practice for Concrete Formwork.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for design, fabrication, erection and removal of formwork.

1.07 COORDINATION

A. Coordinate this section with other sections of work which require attachment of components to formwork.

B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from the Engineer before proceeding.

PART 2 PRODUCTS

2.01 WOOD FORM MATERIALS

A. Plywood: Douglas Fir species; Class I or II; sound undamaged sheets with clean, true edges, minimum 5/8" thick.

B. Lumber: Douglas Fir-Larch, Ponderosa Pine, Sugar Pine, White Fir or Lodgepole Pine species; No. 2, seasoned, surfaced four sides; with grade stamp clearly visible.

2.02 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, free of defects that could leave holes larger than one inch in concrete surface; as manufactured by the Dayton Sure Grip and Shore Company or approved equal.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

C. Waterstops Between New and Existing Concrete: Bentonite clay type, Swellstop as manufactured by Greenstreak Bluestop as manufactured by Vinylex or equal.

D. Waterstops Between Adjacent Pours of New Concrete: PVC, ribbed with center bulb, watertight to 175'. Use factory made fabrications at directional changes and intersections. Field weld straight splices only.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members which are not indicated on drawings.

3.03 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent. Soak inside surface of untreated forms with clean water.

C. Keep surfaces coated prior to placement of concrete.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate work of other sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops continuous without displacing reinforcement. Provide minimum concrete cover as recommended by manufacturer.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.05 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms, unless formwork and concrete construction proceed within heat enclosure. Use compressed air or other means to remove foreign matter.

3.06 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.07 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties and items are secure.

3.08 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads, and remain undamaged from removal operations.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF CONCRETE FORMWORK

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.02 RELATED SECTIONS

A. Section 03100 - Concrete Formwork

B. Section 03300 - Cast-in-Place Concrete

1.03 REFERENCES

A. ACI - American Concrete Institute

B. ANSI - American National Standards Institute

C. ASTM - American Society of Testing and Materials

D. AWS - American Welding Standards

E. CRSI - Concrete Reinforcing Steel Institute

1.04 SUBMITTALS

A. Submit under provisions of Section 01300 - Submittals.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

C. Manufacturer's Certification: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with ACI 318 - Building Code Requirements for Reinforced Concrete.

1.06 COORDINATION

A. Coordinate with placement of formwork, formed openings and other work.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, Grade 60.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI 318.

B. Locate reinforcing splices not indicated on drawings, at point of minimum stress.

PART 3 EXECUTION

3.01 PREPARATION

A. Inspect materials for loose flaky rust, soil, oil, concrete or other coating which may reduce or destroy bond with concrete.

B. Correct unsatisfactory conditions prior to starting work.

C. Set elevations and locations for the placement of reinforcing bars.

3.02 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Accommodate placement of formed openings.

C. Maintain concrete cover around reinforcing as follows:

Item	Coverage
Walls (exposed to weather or backfill)	2 inch
Footings and Concrete Formed Against Earth	3 inch
Slabs on Fill	3 inch

D. Place bars prior to pouring concrete.

E. Do not bend bars partially embedded in hardened concrete.

3.03 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01400.

B. Pour concrete after reinforcing bar placement and anchorage has been observed by the Engineer.

END OF CONCRETE REINFORCEMENT

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete.

B. Control, and expansion and contraction joint devices associates with concrete work.

1.02 RELATED SECTIONS

A. Section 03100 - Concrete Formwork

B. Section 03200 - Concrete Reinforcement

1.03 REFERENCES

A. ACI - American Concrete Institute

B. ASTM - American Society of Testing and Materials

1.04 SUBMITTALS

A. Submit under provisions of Section 01300 - Submittals.

B. Concrete mix proportions including any admixtures, certified by testing laboratory, listing name of supplier.

C. Results of 7 and 28 day compressive strength cylinder tests.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01720 - Project Record Documents.

B. Accurately record actual locations of embedded utilities and components which are concealed from view.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Acquire cement and aggregate from same source for all work.

C. Conform to ACI 305R when concreting during hot weather.

D. Conform to ACI 306R when concreting during cold weather.

1.07 COORDINATION

A. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C595, Type IP-MS-A, Portland-Pozzolan cement with 20% fly ash, moderate sulfate resistant, air-entraining.

B. Fine and Coarse Aggregates: ASTM C33 with maximum size of coarse aggregate 3/4".

C. Water: Clean and not detrimental to concrete.

2.02 ADMIXTURES

A. Air Entrainment: ASTM C260; five to seven percent; Euclid, Sika, L&M or equal.

B. Fly Ash: ASTM C618; Class C.

2.03 ACCESSORIES

A. Bonding Agent: Polyvinyl Acetate; Weld-Crete manufactured by Larsen or equal.

B. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.04 JOINT DEVICES AND FILLER MATERIALS

A. Sealant: ASTM C309 type 1, acrylic curing and sealing compound. CS-309 as manufactured by W.R. Meadows or equal.

2.05 CONCRETE MIX

A. Mix and deliver concrete in accordance with ASTM C94, Alternative No. 2.

B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1.

C. Provide concrete to the following criteria:

1. Compressive Strength (7 days): 2,800 psi
2. Compressive Strength (28 days): 4,000 psi
3. Slump: 1 to 4 inches
4. Maximum Water/Cement + Pozzolan Ratio: 0.48

D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.

E. Calcium chloride admixtures are not permitted.

F. Use set retarding admixtures during hot weather only when approved by the Engineer.

G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Notify the Engineer a minimum of 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, and embedded parts are not disturbed during concrete placement.

D. Install sealant in accordance with manufacturer's instructions.

E. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

F. Place concrete continuously between predetermined expansion, control, and construction joints.

G. Do not interrupt successive placement; do not permit cold joints to occur.

3.04 CONCRETE FINISHING

A. Provide formed concrete surfaces to be left exposed with smooth rubbed finish.

B. Finish concrete surfaces to be coated per Section 09900 - Painting.

3.05 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.06 FIELD QUALITY CONTROL

A. Field testing will be performed in accordance with ACI 301 and under provisions of Section 01400.

B. Provide free access to work and cooperate with testing firm.

C. Submit proposed mix design to testing firm for review prior to commencement of work.

D. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

E. Three concrete test cylinders will be taken for every 75 or less cubic yards of concrete placed.

F. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. One slump test will be taken for each set of test cylinders taken.

3.07 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify the Engineer upon discovery.

C. Patch imperfections as directed at no additional cost to Owner.

3.08 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF CAST-IN-PLACE CONCRETE

APPENDIX

A. Geotechnical Exploration

The Soil Borings were taken by the Soils Engineer, for purposes of project design. Neither MFRA, Inc., nor the Owner are responsible for their accuracy, or the recommendations by the Soils Engineer.

Appendix I

Drainage Calculations

STORMWATER MANAGEMENT REPORT

for

Full Circle Organics

Blue Earth County, MN

Prepared By:

mfra
innovation beyond design

14800 28th Ave N, Suite 140
Plymouth, MN 55447
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May 15, 2012

I. Existing Conditions

The existing site encompasses ten acres and has a current use of agricultural farming. The property is in the township of Lyra and is 12 miles south of Mankato. The site has an approximate relief from the north to south of six feet. Currently, there is no road access onto the property and has two sub-watershed drainage paths. The majority of the site will drain overland continuing south through the agricultural fields. The westerly portion of the site that abuts the road flows to the drainage ditch that carries the water south. There is no present impervious surface, nor any storm water management system.

The soils on site are a mixture of clays. The soil boring records show the top two to three feet of soil as fill material that consists of fat clays and lean clays. This is also the plow zone that has roots from the agricultural farming. Below this section, the soils consist of lean clay and sandy lean clay to a maximum depth of sixteen feet.

II. Proposed Conditions

Full Circle Organics, LLC will operate the compost facility. Proposed development provides 29 windrows for compost material. The site will receive the compost material in a 37,980 square foot building designed to house the material, establish a core temperature of 55 degrees Celsius, and mix the recipe prior to the compost being placed on the windrows. Additionally, the site will have a designated area for rejected material and finished product material.

Impervious surfaces on site will include the proposed building, gravel roads, and the class five windrow pads. However, the gravel roads and windrow pad's storm water runoff will be collected by storm sewer and conveyed to the south storm pond that will store the back-to-back 24 hour-100 year storm event, two 6.15 inch rainfalls. While in the storm ponds, the water will be tested to meet MPCA leachate requirements. The storm water will be reapplied to the windrows to maintain desired moisture content of the compost material or hauled off-site by a contracted professional and delivered to an approved waste water facility. All runoff from the windrows will be detained, holding the storm water during the 24 hour – 2 year, 10 year, 100 year, and back-to-back 100 year storm events. The storm water leachate pond also has a free board of two feet above the back-to-back 24 hour-100 year storm event. Additionally, any leachate present in the compost material while stored in the building will drain to a floor drain that is connected to a storage tank. This water will also be tested to meet MPCA requirements before the tank is drained or pumped. The detention of the leachate on site creates a large decrease in storm water discharge rate and discharge volume. In addition to holding the water, it is anticipated that the windrows will absorb a majority of the storm water as compared to the HydroCAD modeling.

A second pond located on the north portion of the site will receive water from surrounding green areas, gravel drive, and the building roof. The pond design follows NURP guidelines and has a control structure that controls the rate of release from the pond also allowing sediment to settle out. The normal water elevation of the storm pond is 987.0. The discharge from the pond is controlled by an eight inch orifice at 987.0 and a weir wall at elevation 990.0. The pond has a high water elevation during the back-to-back 24 hour-100 year storm of 989.01. The discharge from this pond will be to the existing underground drain tile system.

The following two sections will provide further detail for rate control and volume measures for the existing and proposed 24 hour – 2 year, 10 year, and 100 year storm events.

III. Rate Control

Storm water requirements for this site follow the MPCA guidelines for a compost facility. The MPCA guidelines require capture, hold, and testing of the 24 hour – 100 year storm event. The requirement exceeds the local governing unit that is Blue Earth County. The storm water modeling was performed using HydroCAD. The SCS Type II rainfall was the basis of the model in which the 24 hour – 2 year, 10 year, 100 year, and back-to-back 100 year storm events were modeled.

The results of the runoff rate comparison are summarized in the table below; please refer to the attached calculations and drainage diagrams for further detail.

	Maximum Rate of Runoff (cfs)	
Storm Event	**Existing**	**Proposed**
2-year	17.50	8.89
10-year	26.47	14.40
100-year	40.64	23.41
100-year (2)	42.06	26.66

IV. Volume Control

The results of the runoff volume analysis are summarized in the table below; please refer to the attached calculations for further detail.

	Discharge Volume (ac-ft)	
Storm Event	**Existing**	**Proposed**
2-year	2.108	0.710
10-year	3.248	1.165
100-year	5.094	1.930
100-year (2)	10.821	4.381

V. Emergency Overflow

One emergency overflow for the site will be from the ponds over-topping the high water elevation and spilling off-site. The emergency overflow is set at 990.50 from the south pond, and 991.0 for the north pond.

VI. Erosion & Sediment Control

The site is an existing farm field. At the start of construction activities, silt fence will be installed around the perimeter of the site. As storm water structures and ponds are constructed, additional erosion control measures will be installed. Additional information can be found on plan sheet C5.01, C5.02, and the SWPP specification section.

VII. Summary

The Full Circle Organics compost facility exceeds the local county requirements and meets the requirements of the Minnesota Pollution Control Agency's regulations for composting facilities. All storm water runoff from the windrow areas are collected and stored to the 24 hour – 100 year storm event. Conditionally, the site therefore reduces the rate and volume of storm water leaving the site. The site is providing emergency overflows through the storm water ponds on site.

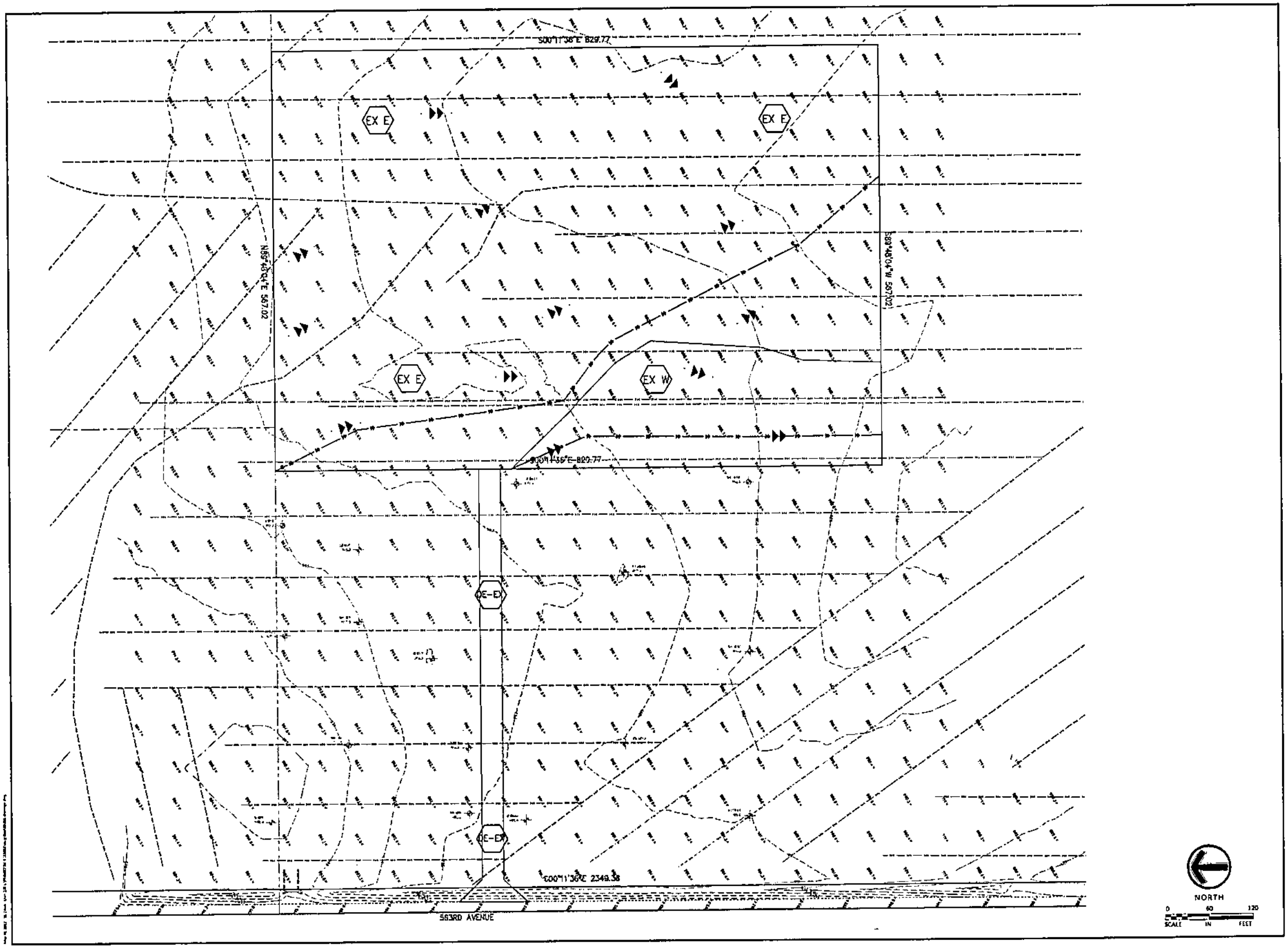
VIII. Certification

I hereby certify that this 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.

Michael Brandt, PE
License #42661

Appendix A

Drainage Diagrams



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Client
MFS FARMS LLC & FULL CIRCLE ORGANICS, LLC.

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

Certification

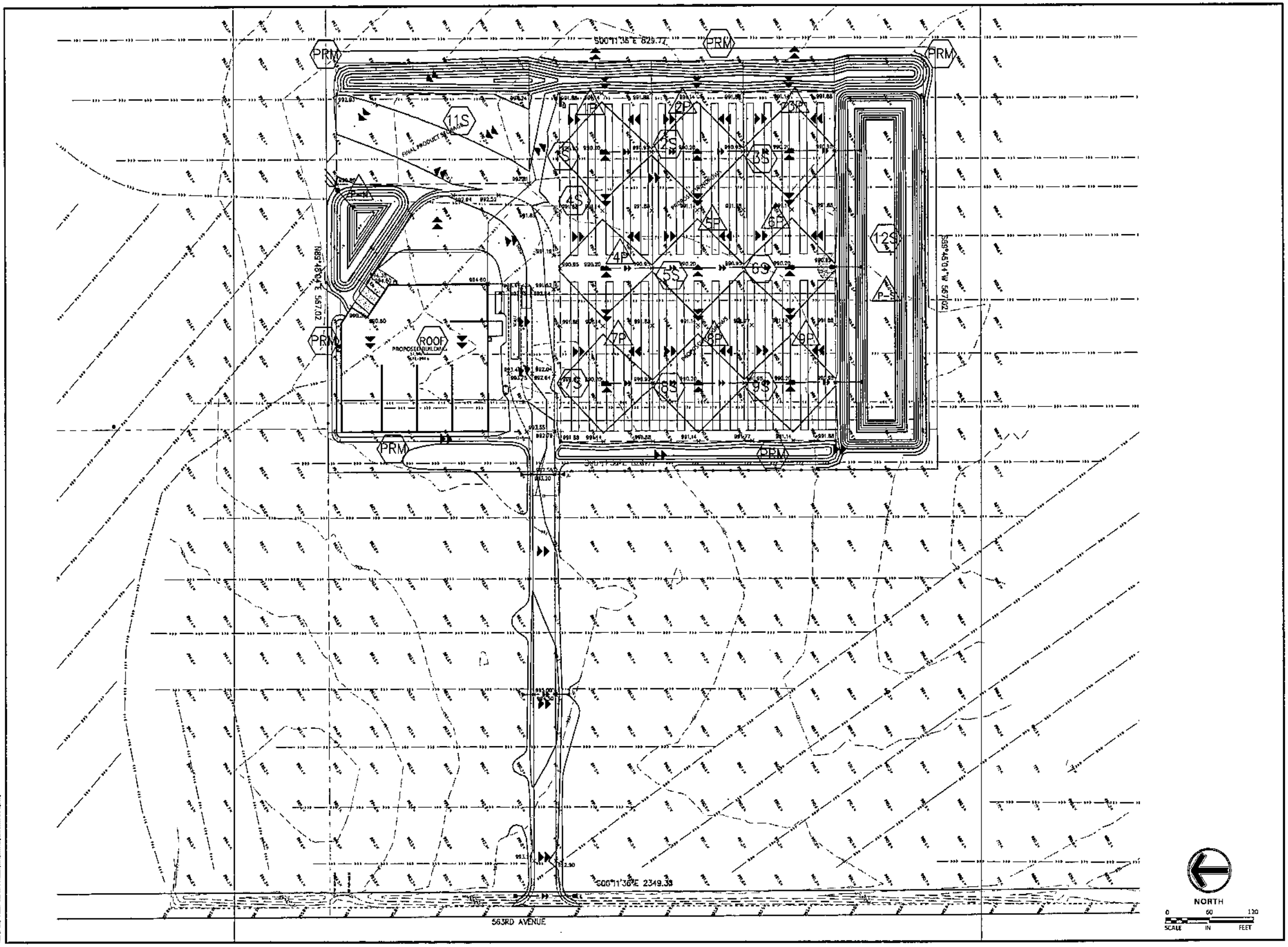
Summary
Designed: MCB Drawn: EBW
Approved: MCB Book / Page:
Phase: FINAL Initial Issue: 12/13/2011

Revision History
No. Date By Submittal / Revision

Sheet Title
EXISTING DRAINAGE PLAN

Sheet No. Revision
EX DRAIN

Project No. MFS19051



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Summary
Designed: MCB Drawn: EBW
Approved: MCB Book / Page:
Phase: FINAL Initial Issue: 12/13/2021

Revision History
No. Date By Submittal / Revision

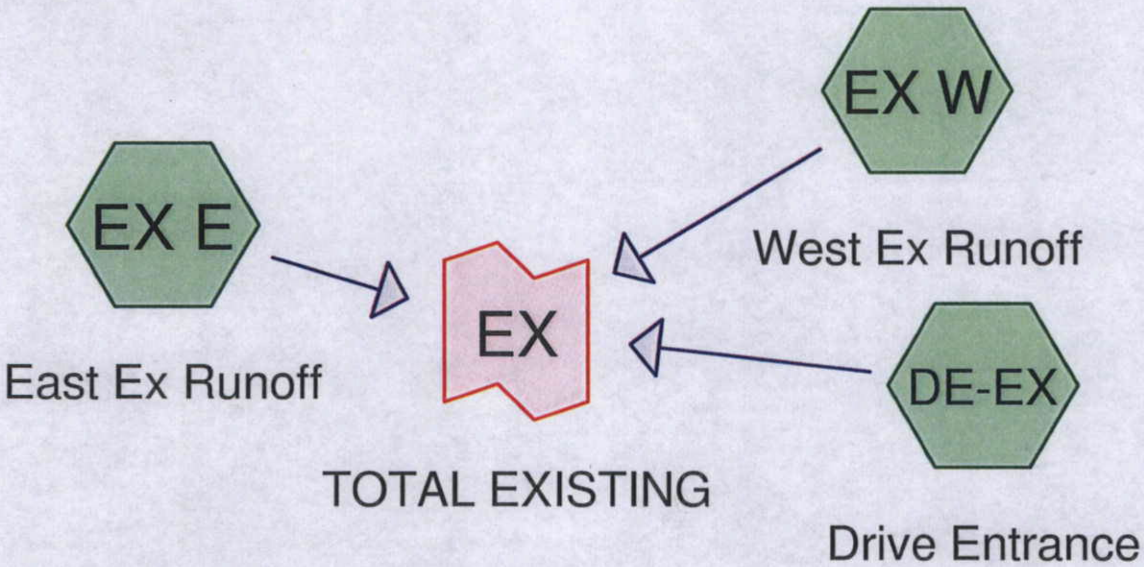
Sheet Title
PROPOSED DRAINAGE PLAN

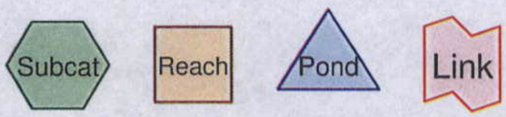
Sheet No. Revision
P DRAIN

Project No. MFS19051

Appendix B

HydroCAD Calculations





Drainage Diagram for 19051 - Site Relocation Redesign
Prepared by Microsoft, Printed 5/14/2012
HydroCAD® 9.10 s/n 01775 © 2010 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
11.227	94	Fallow, bare soil, HSG D (DE-EX, EX E, EX W)
11.227		**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
11.227	HSG D	DE-EX, EX E, EX W
0.000	Other	
11.227		**TOTAL AREA**

Time span=0.00-128.00 hrs, dt=0.01 hrs, 12801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DE-EX: Drive Entrance Runoff Area=18,545 sf 0.00% Impervious Runoff Depth=2.25"
Tc=10.0 min CN=94 Runoff=1.40 cfs 0.080 af

Subcatchment EX E: East Ex Runoff Runoff Area=404,110 sf 0.00% Impervious Runoff Depth=2.25"
Flow Length=945' Tc=39.7 min CN=94 Runoff=14.74 cfs 1.742 af

Subcatchment EX W: West Ex Runoff Runoff Area=66,380 sf 0.00% Impervious Runoff Depth=2.25"
Flow Length=515' Tc=26.4 min CN=94 Runoff=3.15 cfs 0.286 af

Link EX: TOTAL EXISTING Inflow=17.50 cfs 2.108 af
Primary=17.50 cfs 2.108 af

Total Runoff Area = 11.227 ac Runoff Volume = 2.108 af Average Runoff Depth = 2.25"
100.00% Pervious = 11.227 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment DE-EX: Drive Entrance

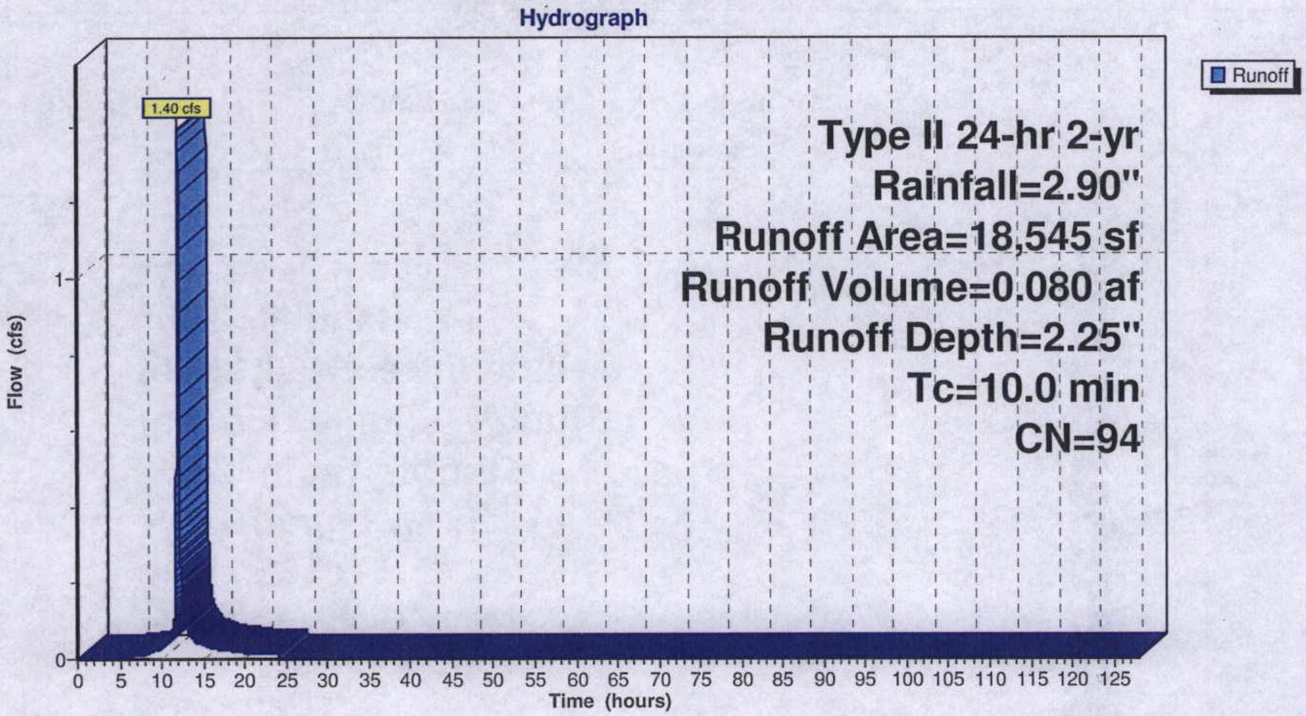
Runoff = 1.40 cfs @ 12.01 hrs, Volume= 0.080 af, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (sf)	CN	Description
18,545	94	Fallow, bare soil, HSG D
18,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment DE-EX: Drive Entrance



Summary for Subcatchment EX E: East Ex Runoff

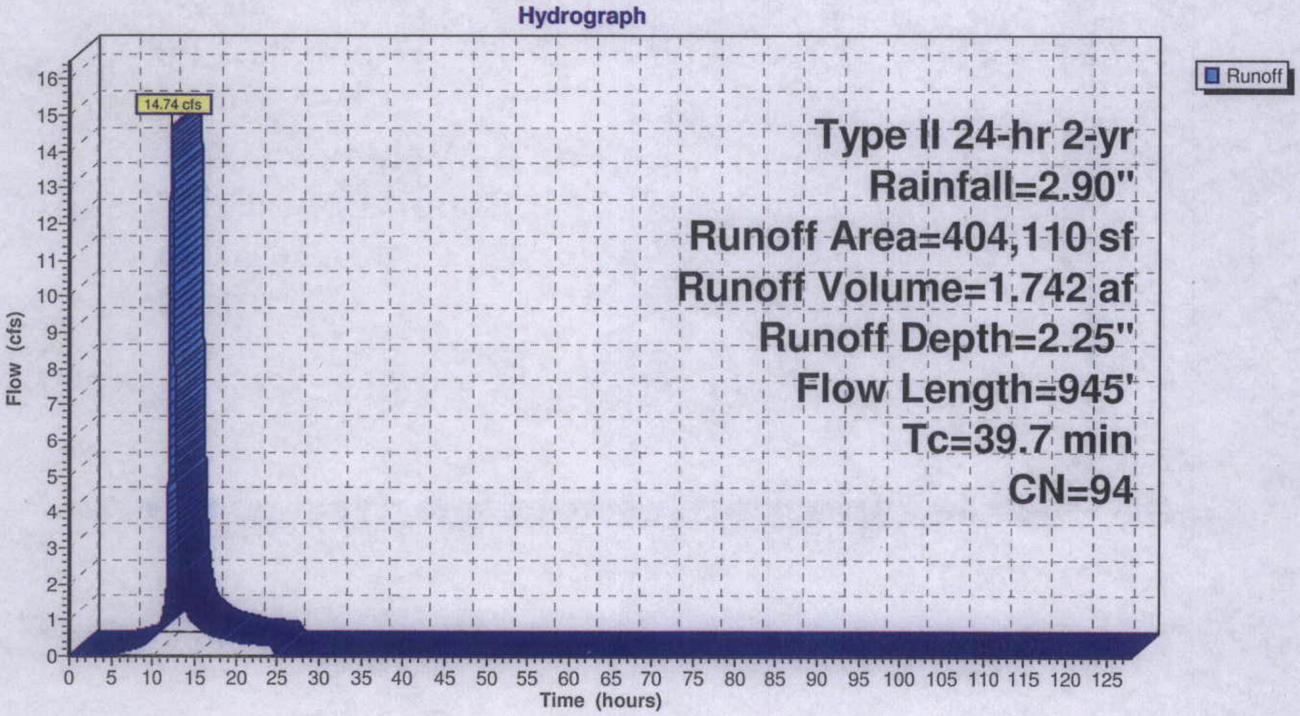
Runoff = 14.74 cfs @ 12.35 hrs, Volume= 1.742 af, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (sf)	CN	Description
404,110	94	Fallow, bare soil, HSG D
404,110		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	300	0.0037	0.21		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
15.9	645	0.0046	0.68		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
39.7	945	Total			

Subcatchment EX E: East Ex Runoff



Summary for Subcatchment EX W: West Ex Runoff

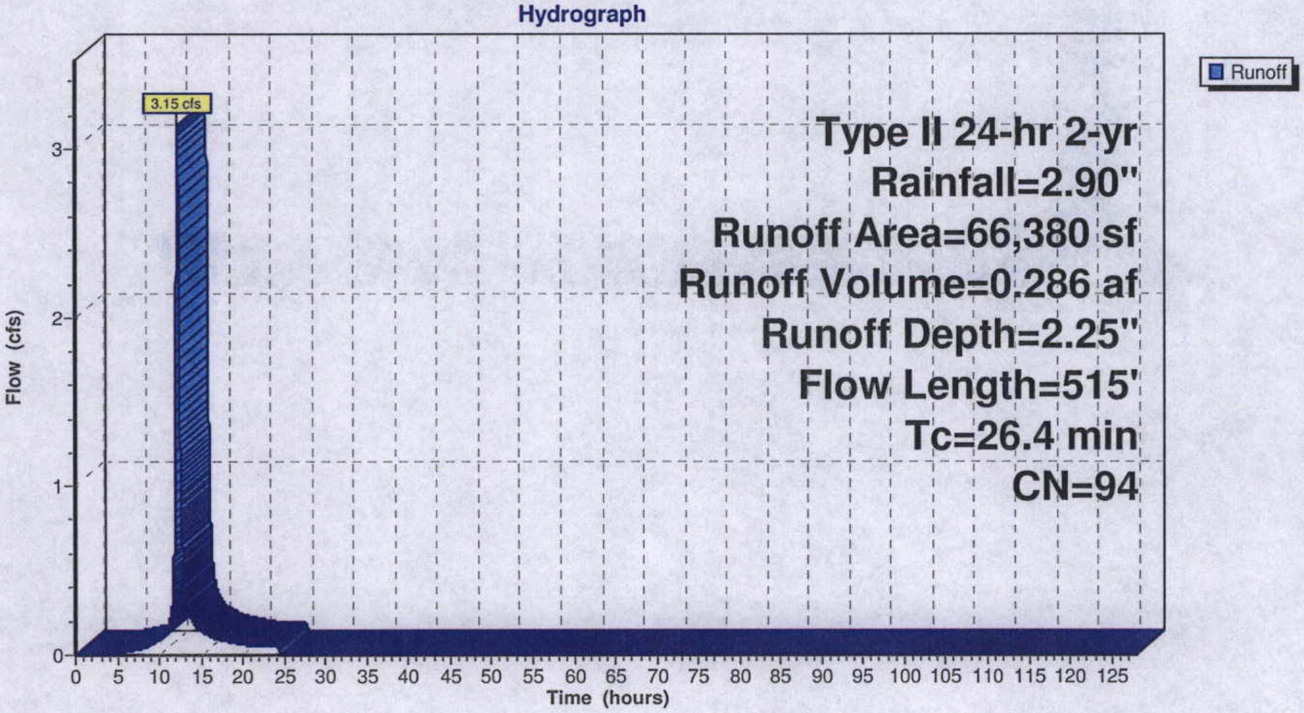
Runoff = 3.15 cfs @ 12.18 hrs, Volume= 0.286 af, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (sf)	CN	Description
66,380	94	Fallow, bare soil, HSG D
66,380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	300	0.0043	0.22		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
4.0	215	0.0079	0.89		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
26.4	515	Total			

Subcatchment EX W: West Ex Runoff

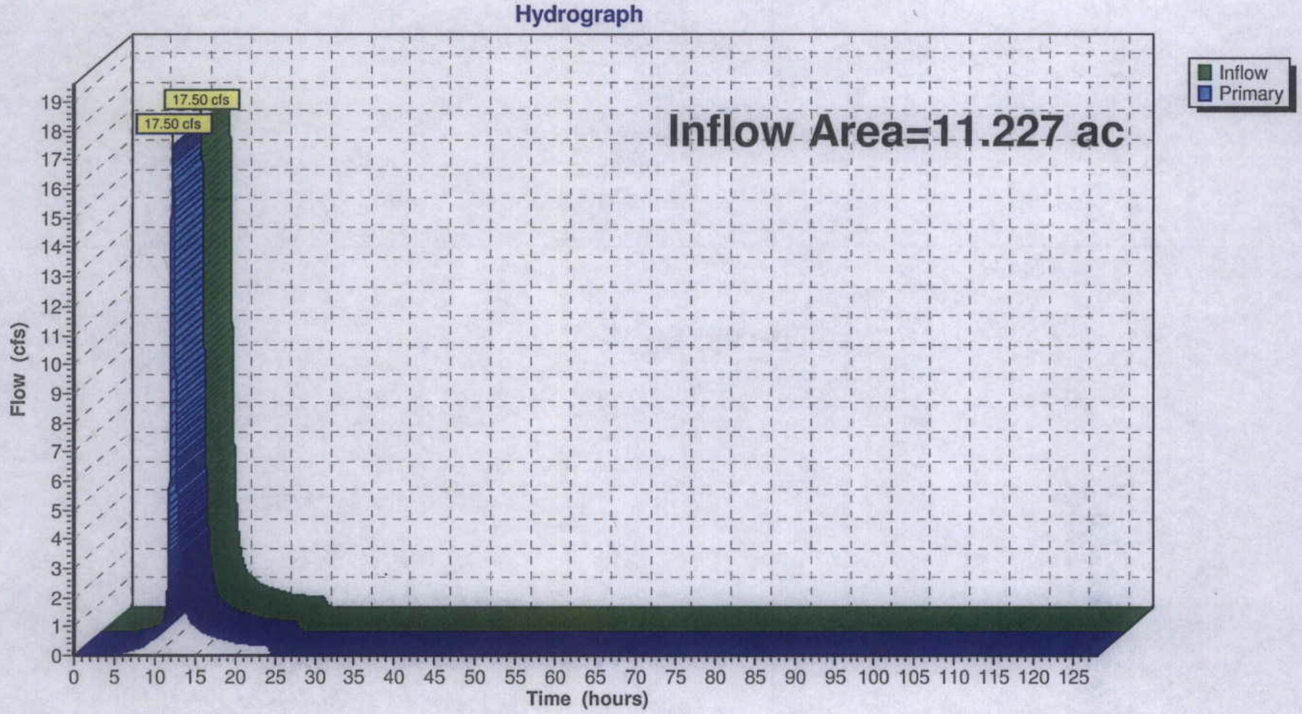


Summary for Link EX: TOTAL EXISTING

Inflow Area =	11.227 ac,	0.00% Impervious,	Inflow Depth = 2.25"	for 2-yr event	
Inflow =	17.50 cfs @	12.31 hrs, Volume=	2.108 af		
Primary =	17.50 cfs @	12.31 hrs, Volume=	2.108 af,	Atten= 0%,	Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs

Link EX: TOTAL EXISTING



Time span=0.00-128.00 hrs, dt=0.01 hrs, 12801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DE-EX: Drive Entrance Runoff Area=18,545 sf 0.00% Impervious Runoff Depth=3.47"
Tc=10.0 min CN=94 Runoff=2.10 cfs 0.123 af

Subcatchment EX E: East Ex Runoff Runoff Area=404,110 sf 0.00% Impervious Runoff Depth=3.47"
Flow Length=945' Tc=39.7 min CN=94 Runoff=22.29 cfs 2.684 af

Subcatchment EX W: West Ex Runoff Runoff Area=66,380 sf 0.00% Impervious Runoff Depth=3.47"
Flow Length=515' Tc=26.4 min CN=94 Runoff=4.76 cfs 0.441 af

Link EX: TOTAL EXISTING Inflow=26.47 cfs 3.248 af
Primary=26.47 cfs 3.248 af

Total Runoff Area = 11.227 ac Runoff Volume = 3.248 af Average Runoff Depth = 3.47"
100.00% Pervious = 11.227 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment DE-EX: Drive Entrance

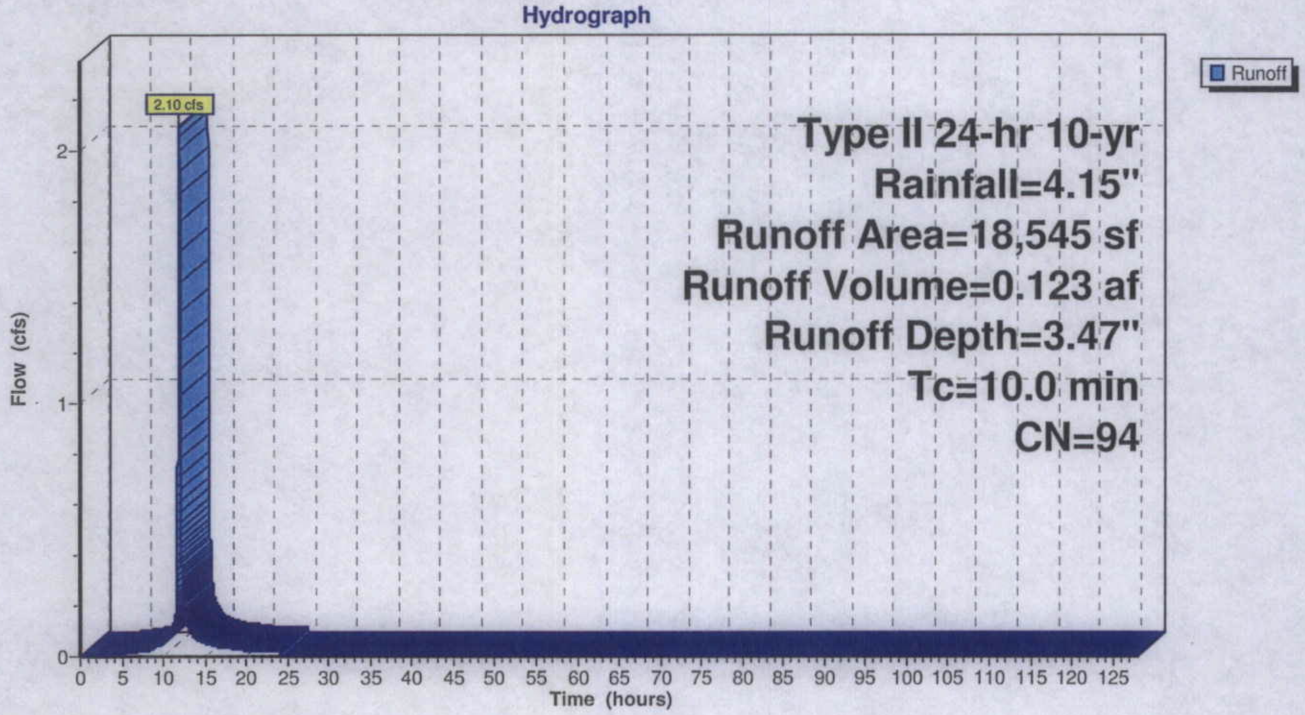
Runoff = 2.10 cfs @ 12.01 hrs, Volume= 0.123 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

Area (sf)	CN	Description
18,545	94	Fallow, bare soil, HSG D
18,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment DE-EX: Drive Entrance



Summary for Subcatchment EX E: East Ex Runoff

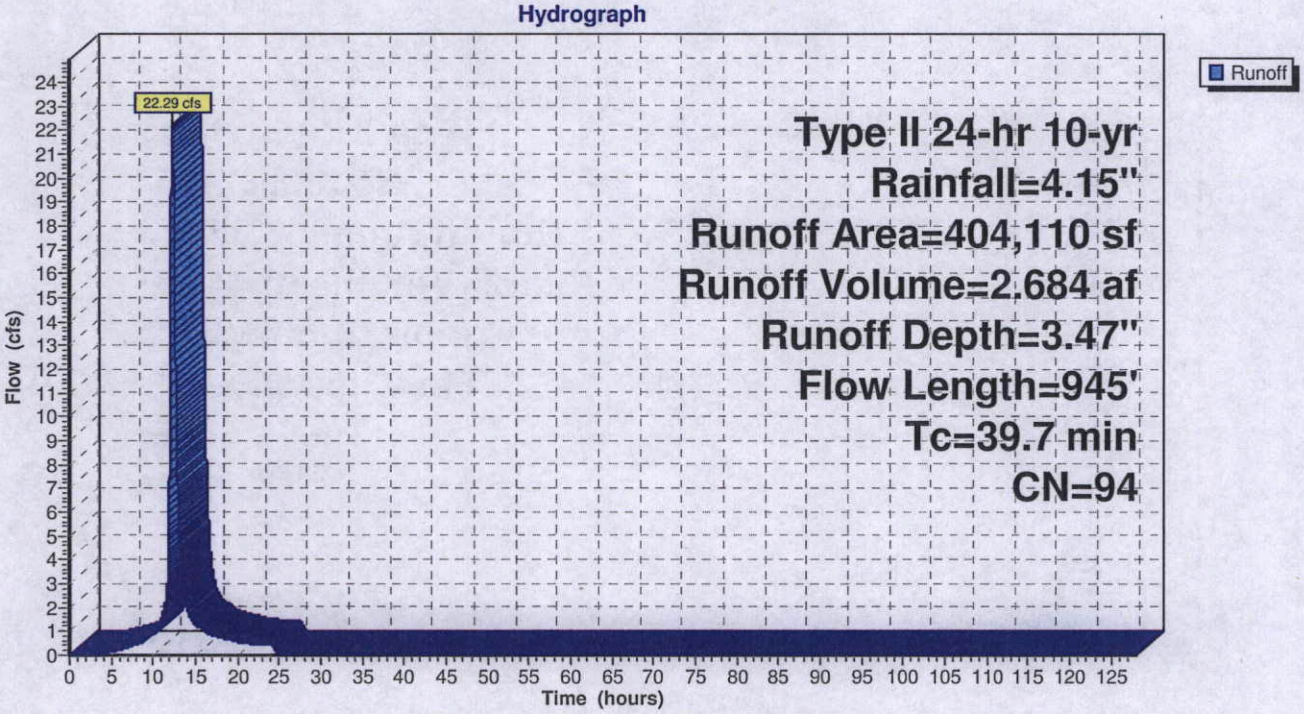
Runoff = 22.29 cfs @ 12.35 hrs, Volume= 2.684 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

Area (sf)	CN	Description
404,110	94	Fallow, bare soil, HSG D
404,110		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	300	0.0037	0.21		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
15.9	645	0.0046	0.68		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
39.7	945	Total			

Subcatchment EX E: East Ex Runoff



Summary for Subcatchment EX W: West Ex Runoff

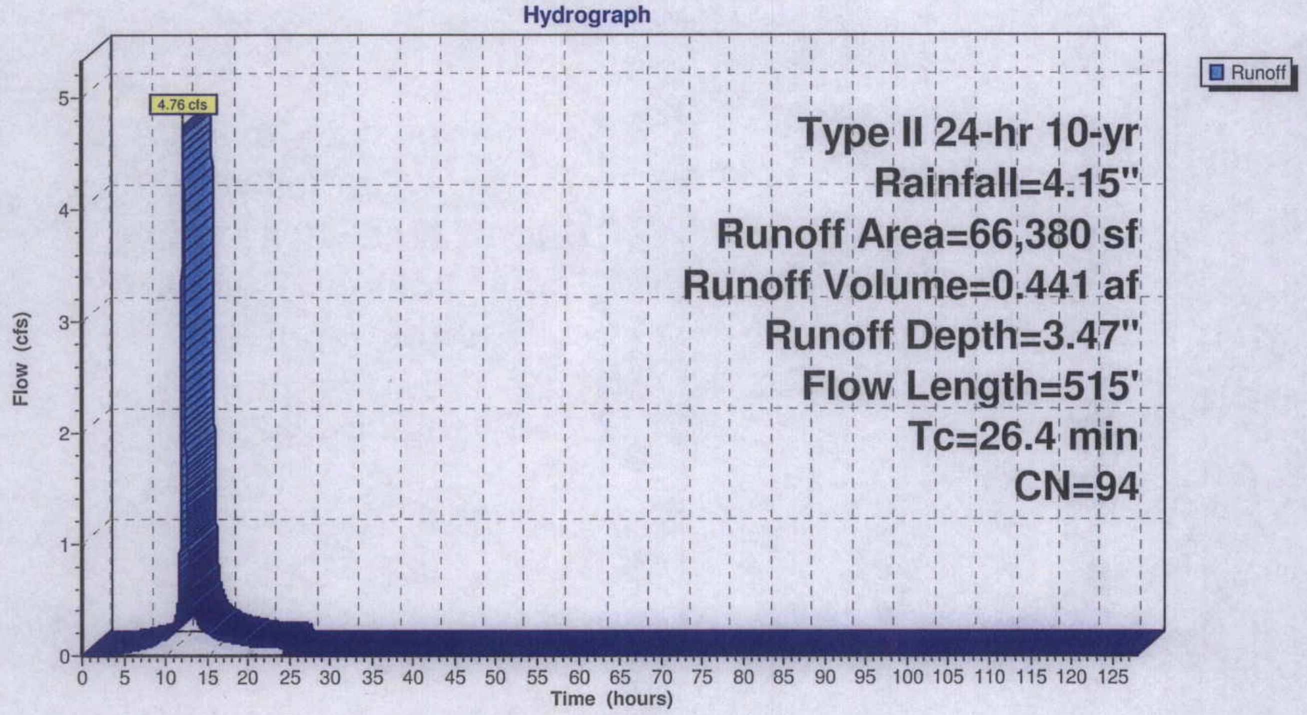
Runoff = 4.76 cfs @ 12.18 hrs, Volume= 0.441 af, Depth= 3.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

Area (sf)	CN	Description
66,380	94	Fallow, bare soil, HSG D
66,380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	300	0.0043	0.22		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
4.0	215	0.0079	0.89		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
26.4	515	Total			

Subcatchment EX W: West Ex Runoff

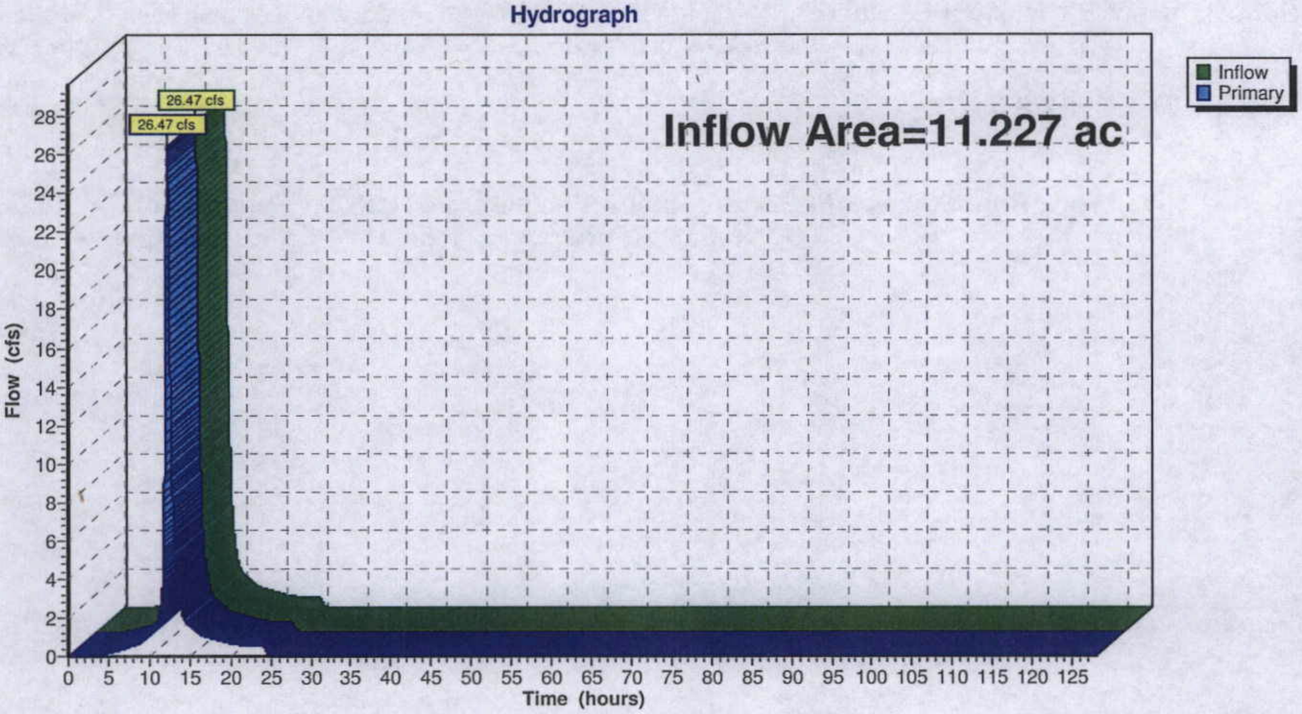


Summary for Link EX: TOTAL EXISTING

Inflow Area =	11.227 ac,	0.00% Impervious,	Inflow Depth = 3.47"	for 10-yr event
Inflow =	26.47 cfs @	12.31 hrs, Volume=	3.248 af	
Primary =	26.47 cfs @	12.31 hrs, Volume=	3.248 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs

Link EX: TOTAL EXISTING



Time span=0.00-128.00 hrs, dt=0.01 hrs, 12801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DE-EX: Drive Entrance Runoff Area=18,545 sf 0.00% Impervious Runoff Depth=5.45"
Tc=10.0 min CN=94 Runoff=3.20 cfs 0.193 af

Subcatchment EX E: East Ex Runoff Runoff Area=404,110 sf 0.00% Impervious Runoff Depth=5.45"
Flow Length=945' Tc=39.7 min CN=94 Runoff=34.22 cfs 4.210 af

Subcatchment EX W: West Ex Runoff Runoff Area=66,380 sf 0.00% Impervious Runoff Depth=5.45"
Flow Length=515' Tc=26.4 min CN=94 Runoff=7.30 cfs 0.691 af

Link EX: TOTAL EXISTING Inflow=40.64 cfs 5.094 af
Primary=40.64 cfs 5.094 af

Total Runoff Area = 11.227 ac Runoff Volume = 5.094 af Average Runoff Depth = 5.45"
100.00% Pervious = 11.227 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment DE-EX: Drive Entrance

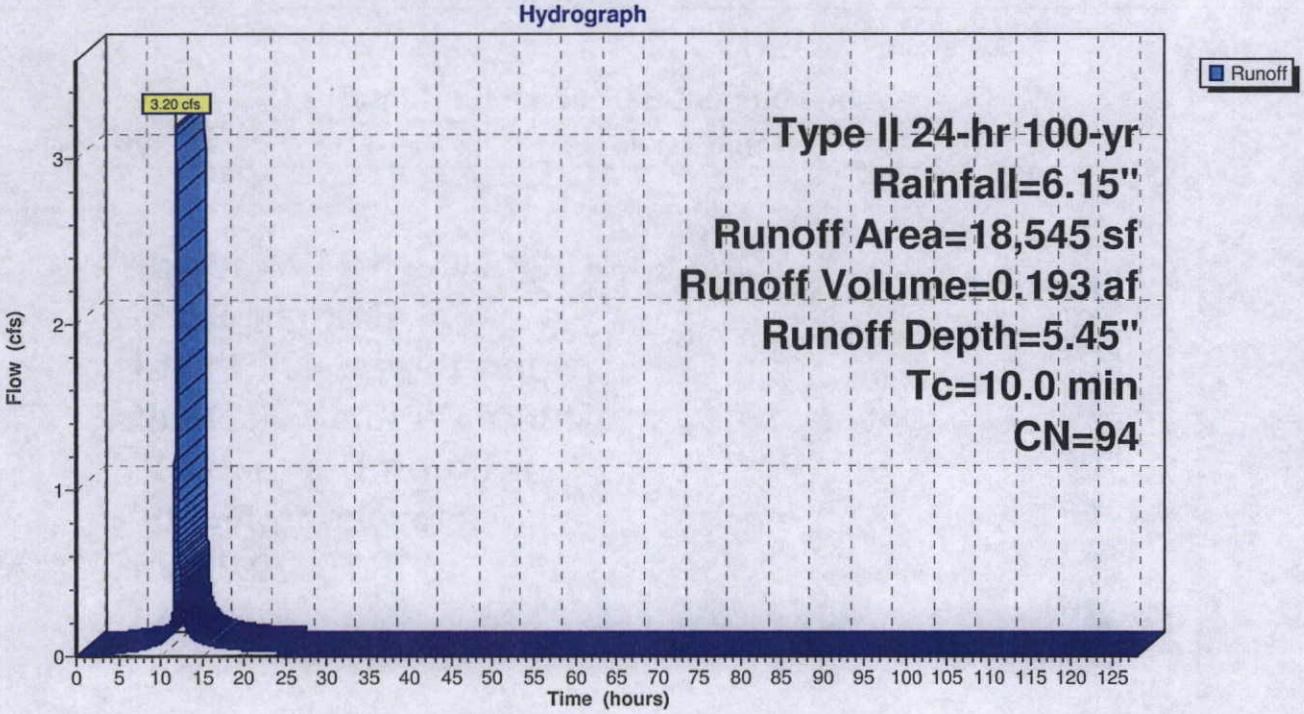
Runoff = 3.20 cfs @ 12.01 hrs, Volume= 0.193 af, Depth= 5.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

Area (sf)	CN	Description
18,545	94	Fallow, bare soil, HSG D
18,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,

Subcatchment DE-EX: Drive Entrance



Summary for Subcatchment EX E: East Ex Runoff

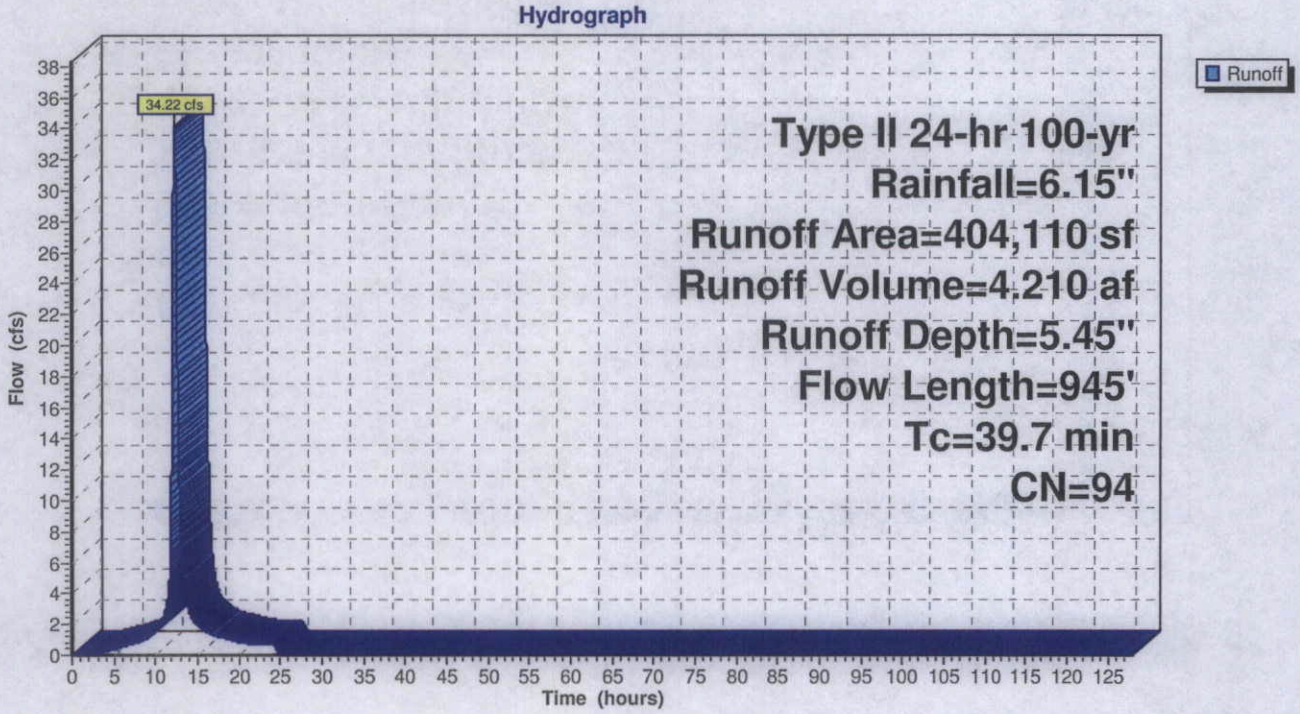
Runoff = 34.22 cfs @ 12.35 hrs, Volume= 4.210 af, Depth= 5.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

Area (sf)	CN	Description
404,110	94	Fallow, bare soil, HSG D
404,110		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	300	0.0037	0.21		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
15.9	645	0.0046	0.68		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
39.7	945	Total			

Subcatchment EX E: East Ex Runoff



Summary for Subcatchment EX W: West Ex Runoff

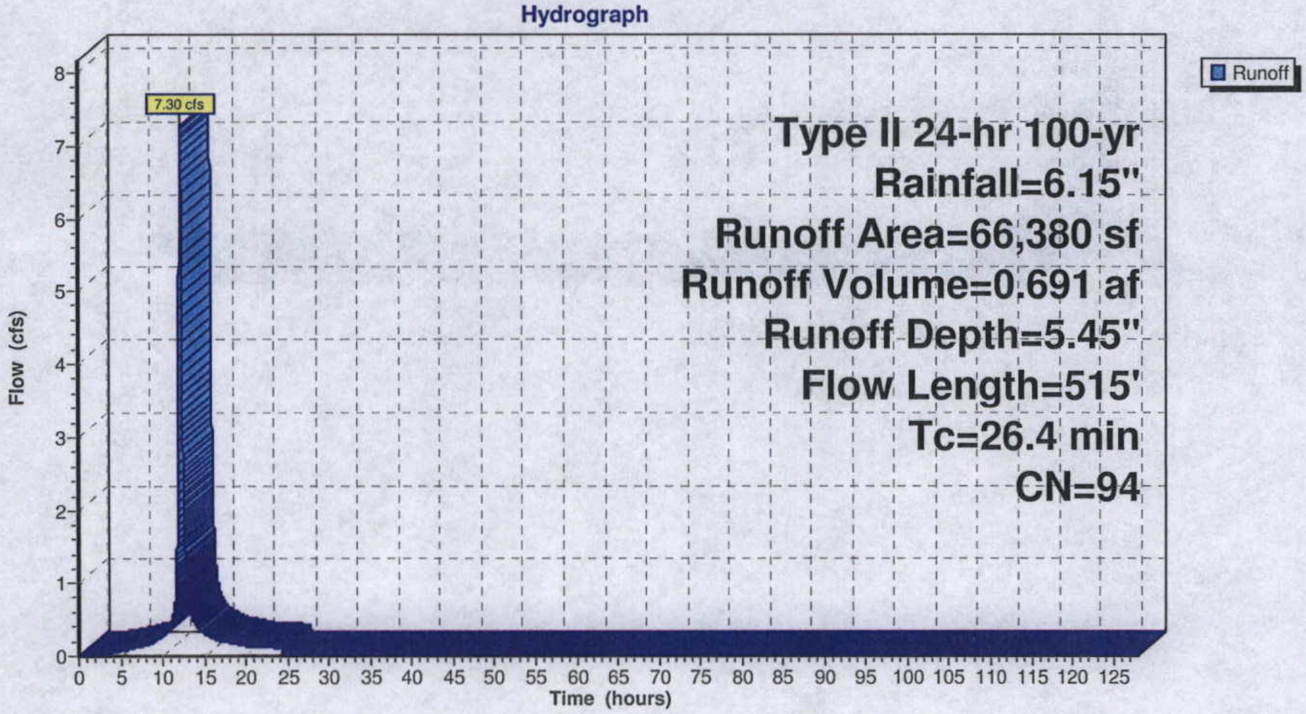
Runoff = 7.30 cfs @ 12.18 hrs, Volume= 0.691 af, Depth= 5.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

Area (sf)	CN	Description
66,380	94	Fallow, bare soil, HSG D
66,380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	300	0.0043	0.22		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
4.0	215	0.0079	0.89		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
26.4	515	Total			

Subcatchment EX W: West Ex Runoff

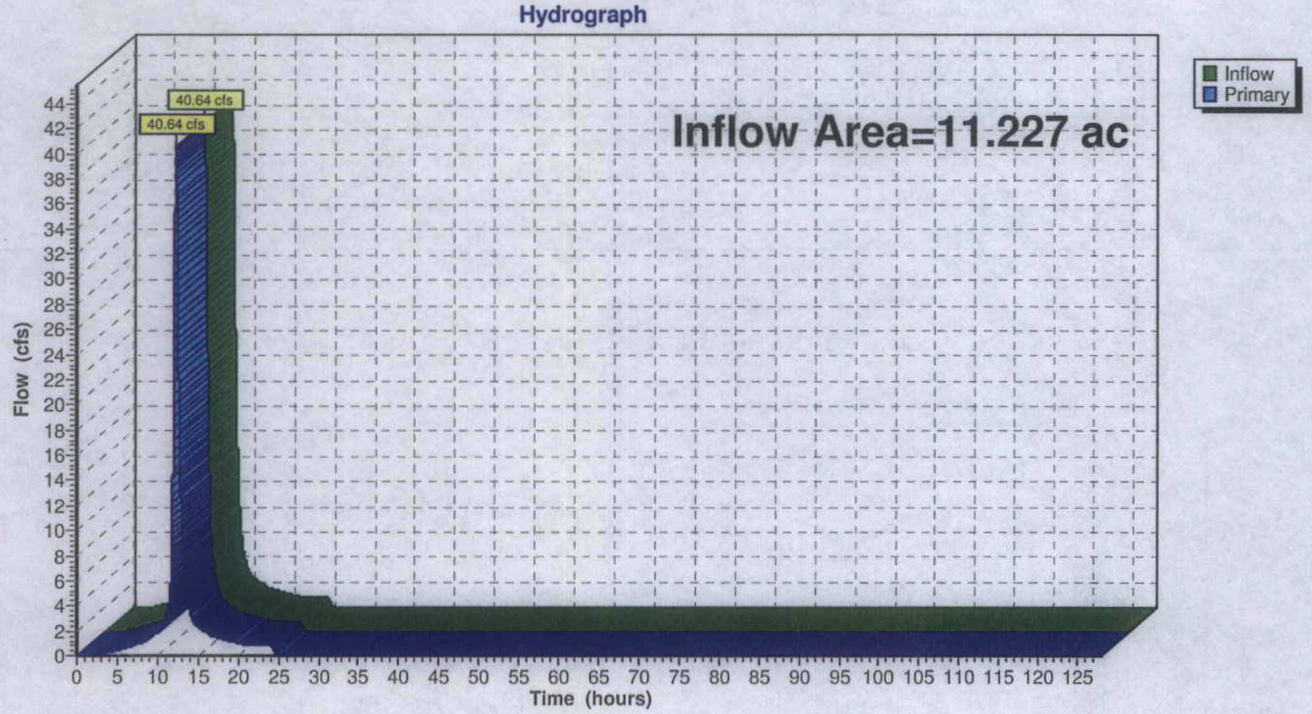


Summary for Link EX: TOTAL EXISTING

Inflow Area =	11.227 ac,	0.00% Impervious,	Inflow Depth = 5.45"	for 100-yr event
Inflow =	40.64 cfs @	12.31 hrs, Volume=	5.094 af	
Primary =	40.64 cfs @	12.31 hrs, Volume=	5.094 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs

Link EX: TOTAL EXISTING



Time span=0.00-128.00 hrs, dt=0.01 hrs, 12801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DE-EX: Drive Entrance Runoff Area=18,545 sf 0.00% Impervious Runoff Depth=11.57"
Tc=10.0 min CN=94 Runoff=3.29 cfs 0.410 af

Subcatchment EX E: East Ex Runoff Runoff Area=404,110 sf 0.00% Impervious Runoff Depth=11.57"
Flow Length=945' Tc=39.7 min CN=94 Runoff=35.41 cfs 8.941 af

Subcatchment EX W: West Ex Runoff Runoff Area=66,380 sf 0.00% Impervious Runoff Depth=11.57"
Flow Length=515' Tc=26.4 min CN=94 Runoff=7.52 cfs 1.469 af

Link EX: TOTAL EXISTING Inflow=42.06 cfs 10.821 af
Primary=42.06 cfs 10.821 af

Total Runoff Area = 11.227 ac Runoff Volume = 10.821 af Average Runoff Depth = 11.57"
100.00% Pervious = 11.227 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment DE-EX: Drive Entrance

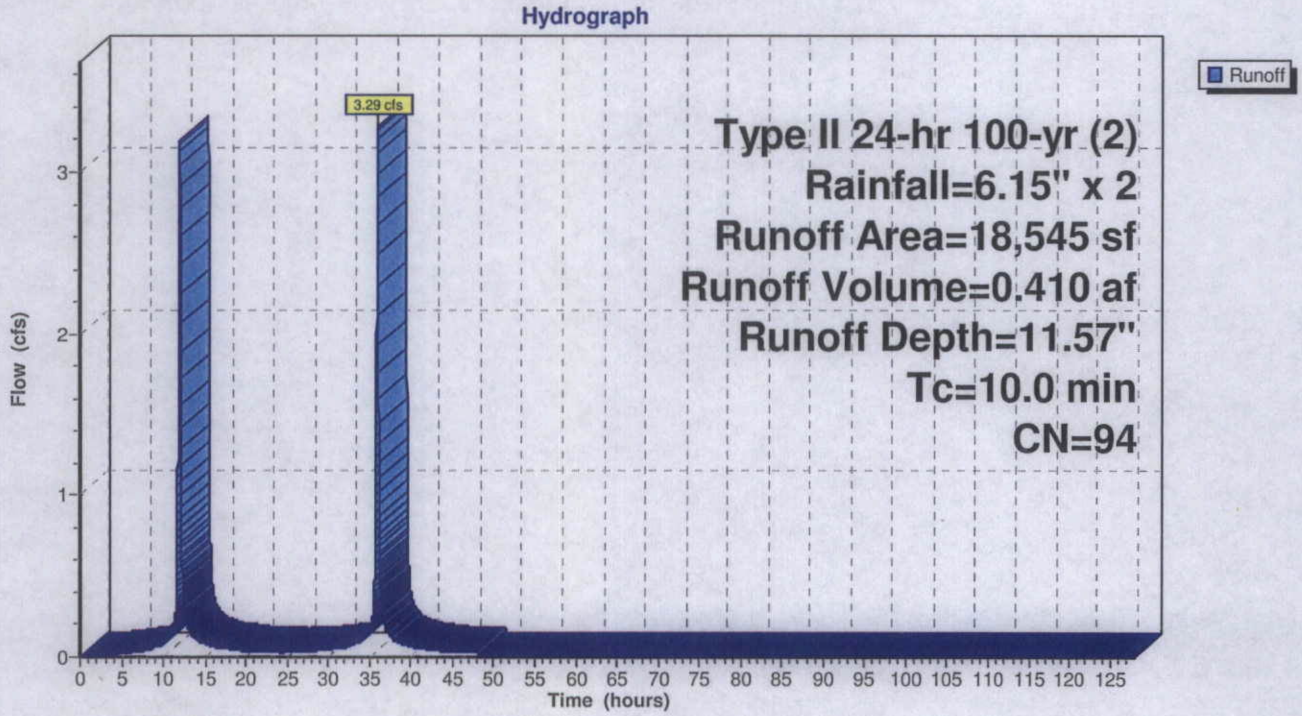
Runoff = 3.29 cfs @ 36.01 hrs, Volume= 0.410 af, Depth=11.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

Area (sf)	CN	Description
18,545	94	Fallow, bare soil, HSG D
18,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment DE-EX: Drive Entrance



Summary for Subcatchment EX E: East Ex Runoff

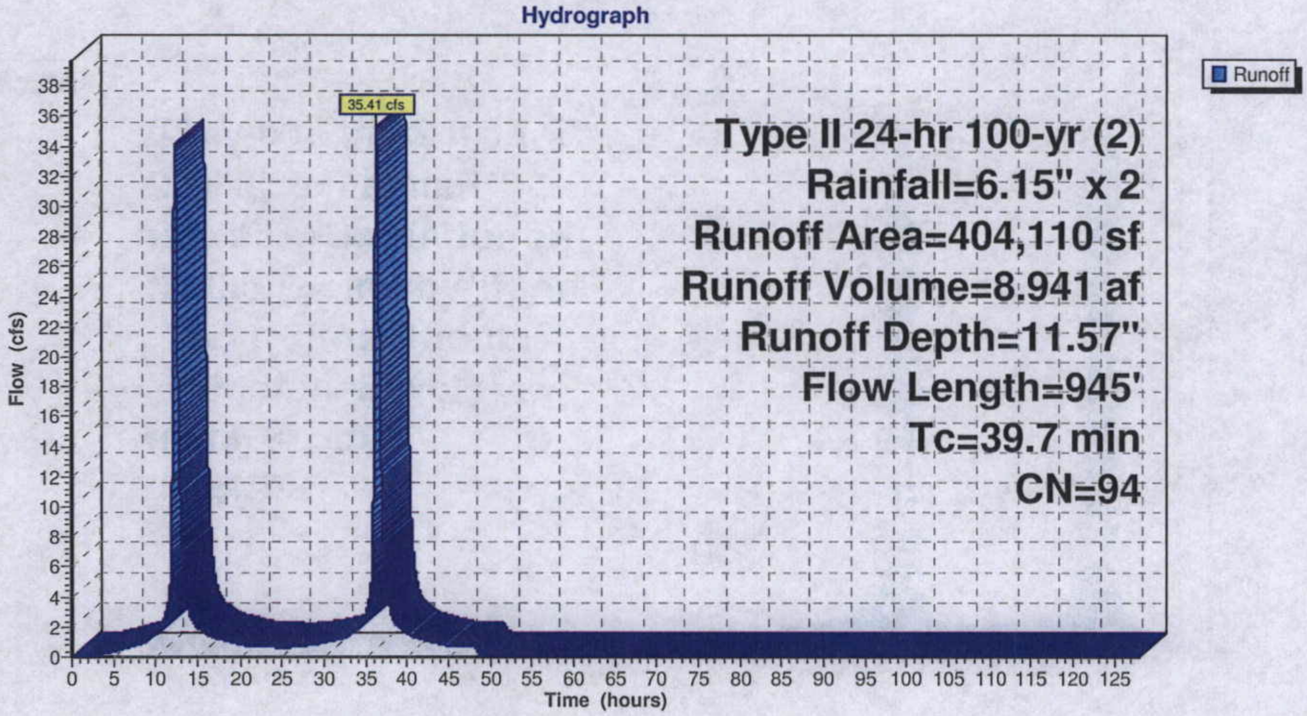
Runoff = 35.41 cfs @ 36.34 hrs, Volume= 8.941 af, Depth=11.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

Area (sf)	CN	Description
404,110	94	Fallow, bare soil, HSG D
404,110		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	300	0.0037	0.21		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
15.9	645	0.0046	0.68		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
39.7	945	Total			

Subcatchment EX E: East Ex Runoff



Summary for Subcatchment EX W: West Ex Runoff

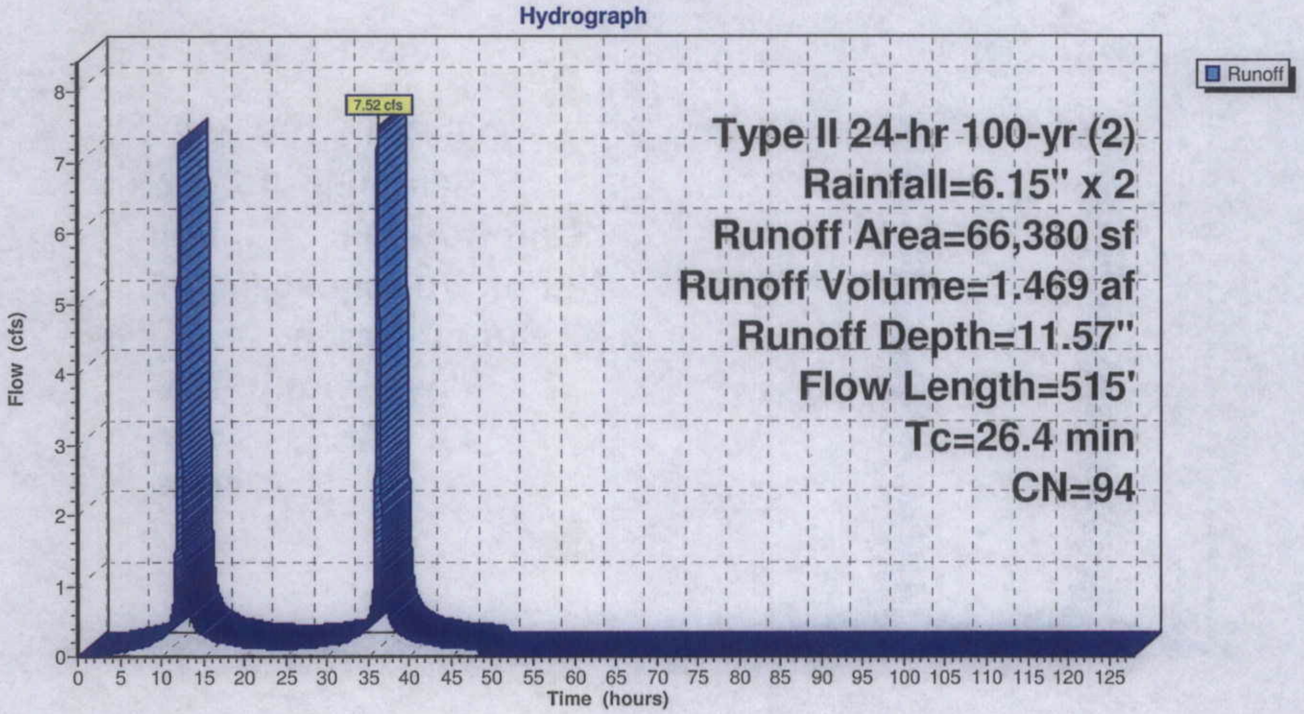
Runoff = 7.52 cfs @ 36.17 hrs, Volume= 1.469 af, Depth=11.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

Area (sf)	CN	Description
66,380	94	Fallow, bare soil, HSG D
66,380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	300	0.0043	0.22		**Sheet Flow,** Cultivated: Residue<=20% n= 0.060 P2= 2.80"
4.0	215	0.0079	0.89		**Shallow Concentrated Flow,** Nearly Bare & Untilled Kv= 10.0 fps
26.4	515	Total			

Subcatchment EX W: West Ex Runoff

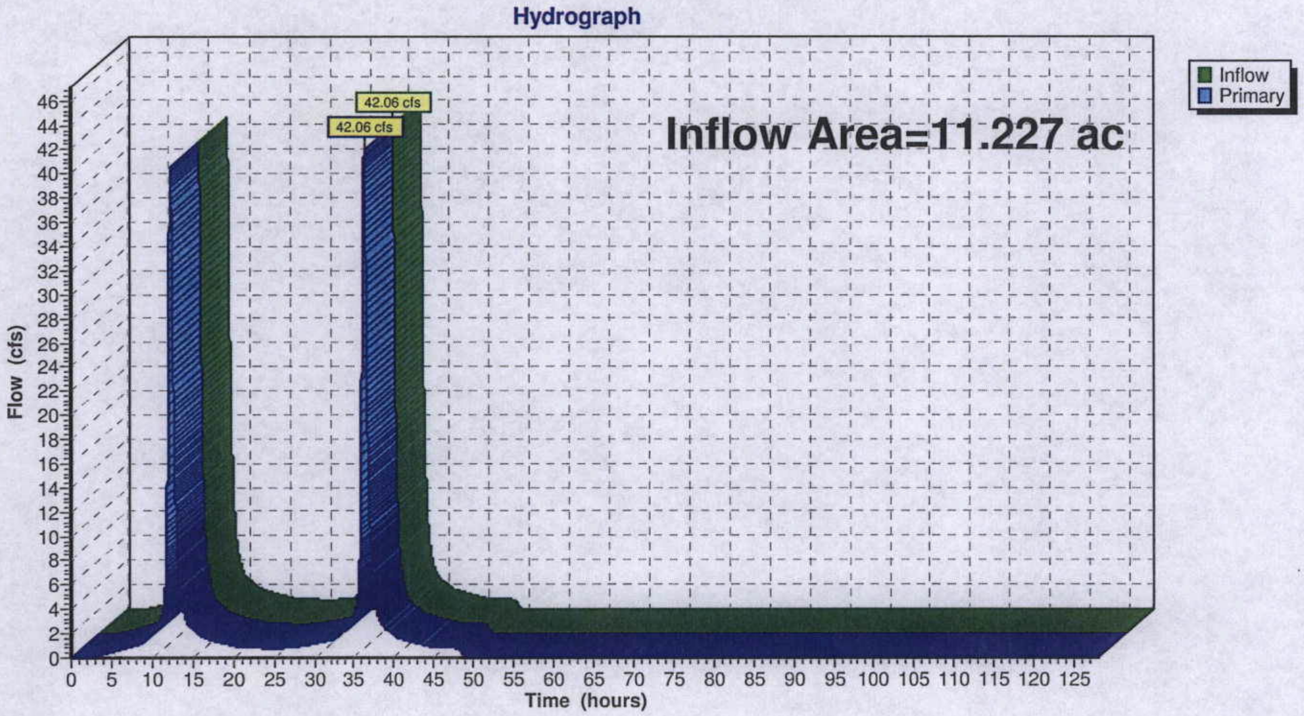


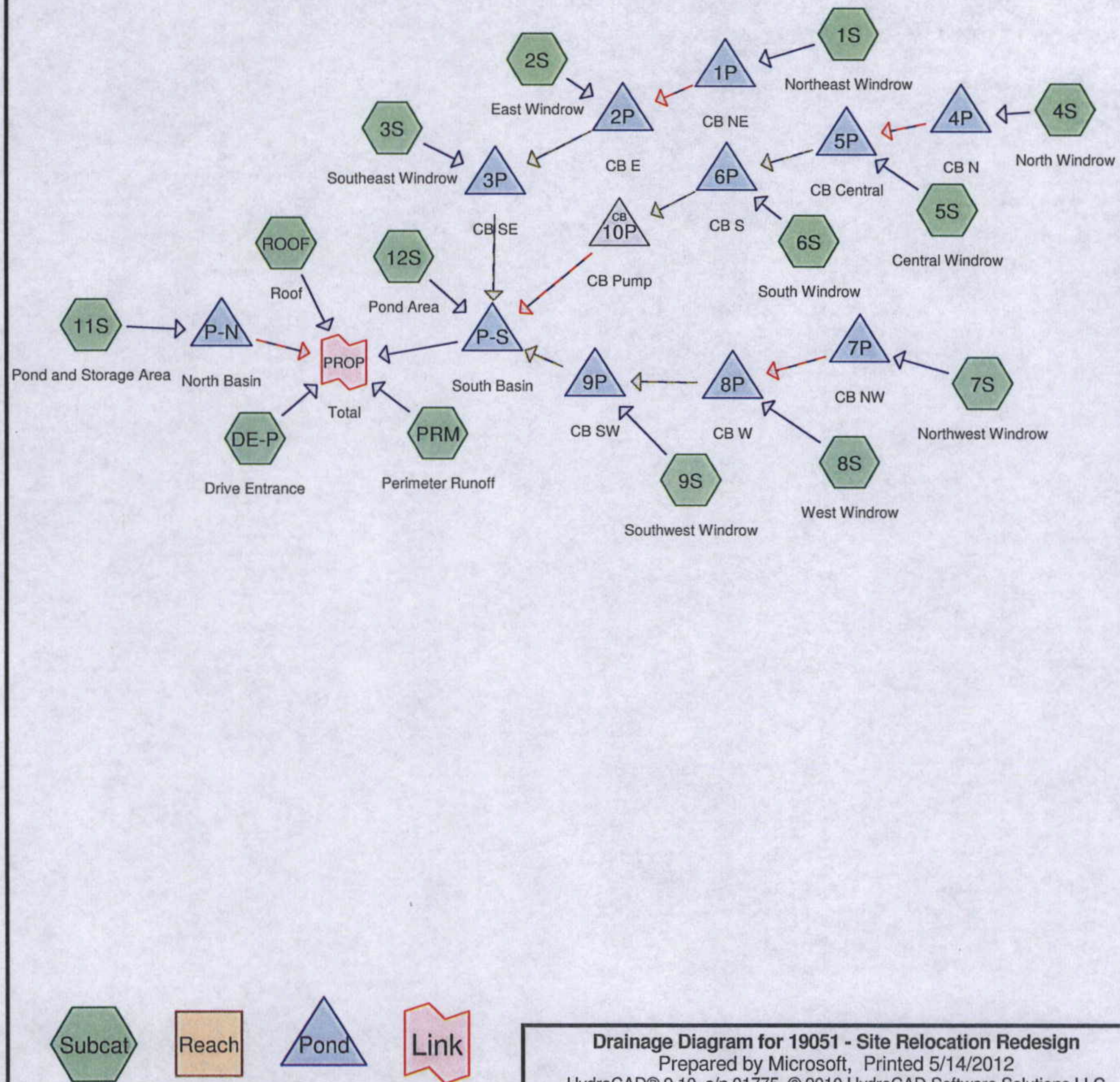
Summary for Link EX: TOTAL EXISTING

Inflow Area = 11.227 ac, 0.00% Impervious, Inflow Depth = 11.57" for 100-yr (2) event
Inflow = 42.06 cfs @ 36.30 hrs, Volume= 10.821 af
Primary = 42.06 cfs @ 36.30 hrs, Volume= 10.821 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs

Link EX: TOTAL EXISTING





Drainage Diagram for 19051 - Site Relocation Redesign
Prepared by Microsoft, Printed 5/14/2012
HydroCAD® 9.10 s/n 01775 © 2010 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.807	80	>75% Grass cover, Good, HSG D (1S, 4S, 7S, 8S, 9S, 11S, 12S, PRM)
0.881	91	Gravel pads, HSG D (1S, 2S)
2.654	91	Gravel paths, HSG D (3S, 4S, 5S, 6S, 7S)
2.492	91	Gravel roads, HSG D (8S, 9S, 11S, DE-P, PRM)
0.872	98	Roof (ROOF)
0.038	98	Unconnected pavement, HSG D (11S)
0.484	98	Water Surface, HSG D (11S, 12S)
11.227		**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
10.355	HSG D	1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 11S, 12S, DE-P, PRM
0.872	Other	ROOF
11.227		**TOTAL AREA**

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Fill (inches)
1	1P	986.20	984.70	125.0	0.0120	0.013	15.0	0.0	0.0
2	2P	984.70	983.19	125.0	0.0121	0.013	21.0	0.0	0.0
3	3P	983.19	982.00	99.0	0.0120	0.013	21.0	0.0	0.0
4	4P	986.20	984.70	125.0	0.0120	0.013	15.0	0.0	0.0
5	5P	984.70	983.19	125.0	0.0121	0.013	21.0	0.0	0.0
6	6P	983.19	982.50	57.0	0.0121	0.013	21.0	0.0	0.0
7	7P	986.20	984.70	125.0	0.0120	0.013	15.0	0.0	0.0
8	8P	984.70	983.19	125.0	0.0121	0.013	21.0	0.0	0.0
9	9P	983.19	982.00	99.0	0.0120	0.013	21.0	0.0	0.0
10	10P	982.00	982.00	42.0	0.0000	0.013	21.0	0.0	0.0
11	P-N	987.00	986.80	20.0	0.0100	0.010	4.0	0.0	0.0

Time span=0.00-128.00 hrs, dt=0.01 hrs, 12801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Northeast Windrow Runoff Area=25,745 sf 0.00% Impervious Runoff Depth=1.73"
Tc=10.0 min CN=88 Runoff=1.56 cfs 0.085 af

Subcatchment 2S: East Windrow Runoff Area=19,347 sf 0.00% Impervious Runoff Depth=1.98"
Tc=10.0 min CN=91 Runoff=1.32 cfs 0.073 af

Subcatchment 3S: Southeast Windrow Runoff Area=19,357 sf 0.00% Impervious Runoff Depth=1.98"
Tc=10.0 min CN=91 Runoff=1.32 cfs 0.073 af

Subcatchment 4S: North Windrow Runoff Area=33,157 sf 0.00% Impervious Runoff Depth=1.89"
Tc=10.0 min CN=90 Runoff=2.18 cfs 0.120 af

Subcatchment 5S: Central Windrow Runoff Area=19,622 sf 0.00% Impervious Runoff Depth=1.98"
Tc=10.0 min CN=91 Runoff=1.34 cfs 0.074 af

Subcatchment 6S: South Windrow Runoff Area=19,624 sf 0.00% Impervious Runoff Depth=1.98"
Tc=10.0 min CN=91 Runoff=1.34 cfs 0.074 af

Subcatchment 7S: Northwest Windrow Runoff Area=36,257 sf 0.00% Impervious Runoff Depth=1.73"
Tc=10.0 min CN=88 Runoff=2.20 cfs 0.120 af

Subcatchment 8S: West Windrow Runoff Area=21,248 sf 0.00% Impervious Runoff Depth=1.89"
Tc=10.0 min CN=90 Runoff=1.40 cfs 0.077 af

Subcatchment 9S: Southwest Windrow Runoff Area=21,244 sf 0.00% Impervious Runoff Depth=1.89"
Tc=10.0 min CN=90 Runoff=1.40 cfs 0.077 af

Subcatchment 11S: Pond and Storage Area Runoff Area=67,737 sf 10.60% Impervious Runoff Depth=1.89"
Tc=10.0 min CN=90 Runoff=4.45 cfs 0.245 af

Subcatchment 12S: Pond Area Runoff Area=59,175 sf 26.23% Impervious Runoff Depth=1.50"
Tc=10.0 min CN=85 Runoff=3.15 cfs 0.170 af

Subcatchment DE-P: Drive Entrance Runoff Area=18,545 sf 0.00% Impervious Runoff Depth=1.98"
Tc=10.0 min CN=91 Runoff=1.27 cfs 0.070 af

Subcatchment PRM: Perimeter Runoff Runoff Area=90,004 sf 0.00% Impervious Runoff Depth=1.18"
Flow Length=60' Tc=10.0 min CN=80 Runoff=3.73 cfs 0.202 af

Subcatchment ROOF: Roof Runoff Area=37,980 sf 100.00% Impervious Runoff Depth=2.67"
Tc=10.0 min CN=98 Runoff=3.14 cfs 0.194 af

Pond 1P: CB NE Peak Elev=990.52' Storage=611 cf Inflow=1.56 cfs 0.085 af
Primary=0.94 cfs 0.085 af Secondary=0.00 cfs 0.000 af Outflow=0.94 cfs 0.085 af

Pond 2P: CB E Peak Elev=990.48' Storage=471 cf Inflow=2.12 cfs 0.158 af
Primary=1.82 cfs 0.158 af Tertiary=0.00 cfs 0.000 af Outflow=1.82 cfs 0.158 af

Pond 3P: CB SE Peak Elev=990.45' Storage=357 cf Inflow=2.96 cfs 0.232 af
Primary=2.82 cfs 0.232 af Tertiary=0.00 cfs 0.000 af Outflow=2.82 cfs 0.232 af

Pond 4P: CB N Peak Elev=990.58' Storage=851 cf Inflow=2.18 cfs 0.120 af
Primary=1.24 cfs 0.120 af Secondary=0.00 cfs 0.000 af Outflow=1.24 cfs 0.120 af

Pond 5P: CB Central Peak Elev=990.51' Storage=569 cf Inflow=2.46 cfs 0.194 af
Primary=2.09 cfs 0.194 af Tertiary=0.00 cfs 0.000 af Outflow=2.09 cfs 0.194 af

Pond 6P: CB S Peak Elev=990.46' Storage=396 cf Inflow=3.19 cfs 0.269 af
Primary=3.05 cfs 0.269 af Tertiary=0.00 cfs 0.000 af Outflow=3.05 cfs 0.269 af

Pond 7P: CB NW Peak Elev=990.58' Storage=861 cf Inflow=2.20 cfs 0.120 af
Primary=1.26 cfs 0.120 af Secondary=0.00 cfs 0.000 af Outflow=1.26 cfs 0.120 af

Pond 8P: CB W Peak Elev=990.51' Storage=567 cf Inflow=2.51 cfs 0.197 af
Primary=2.17 cfs 0.197 af Tertiary=0.00 cfs 0.000 af Outflow=2.17 cfs 0.197 af

Pond 9P: CB SW Peak Elev=990.47' Storage=418 cf Inflow=3.34 cfs 0.274 af
Primary=3.17 cfs 0.274 af Tertiary=0.00 cfs 0.000 af Outflow=3.17 cfs 0.274 af

Pond 10P: CB Pump Peak Elev=983.07' Inflow=3.05 cfs 0.269 af
Primary=3.05 cfs 0.269 af Secondary=0.00 cfs 0.000 af Outflow=3.05 cfs 0.269 af

Pond P-N: North Basin Peak Elev=987.76' Storage=4,639 cf Inflow=4.45 cfs 0.245 af
Primary=0.94 cfs 0.243 af Secondary=0.00 cfs 0.000 af Outflow=0.94 cfs 0.243 af

Pond P-S: South Basin Peak Elev=982.21' Storage=41,136 cf Inflow=11.75 cfs 0.944 af
Outflow=0.00 cfs 0.000 af

Link PROP: Total Inflow=8.89 cfs 0.710 af
Primary=8.89 cfs 0.710 af

Total Runoff Area = 11.227 ac Runoff Volume = 1.656 af Average Runoff Depth = 1.77"
87.59% Pervious = 9.834 ac 12.41% Impervious = 1.393 ac

Summary for Subcatchment 1S: Northeast Windrow

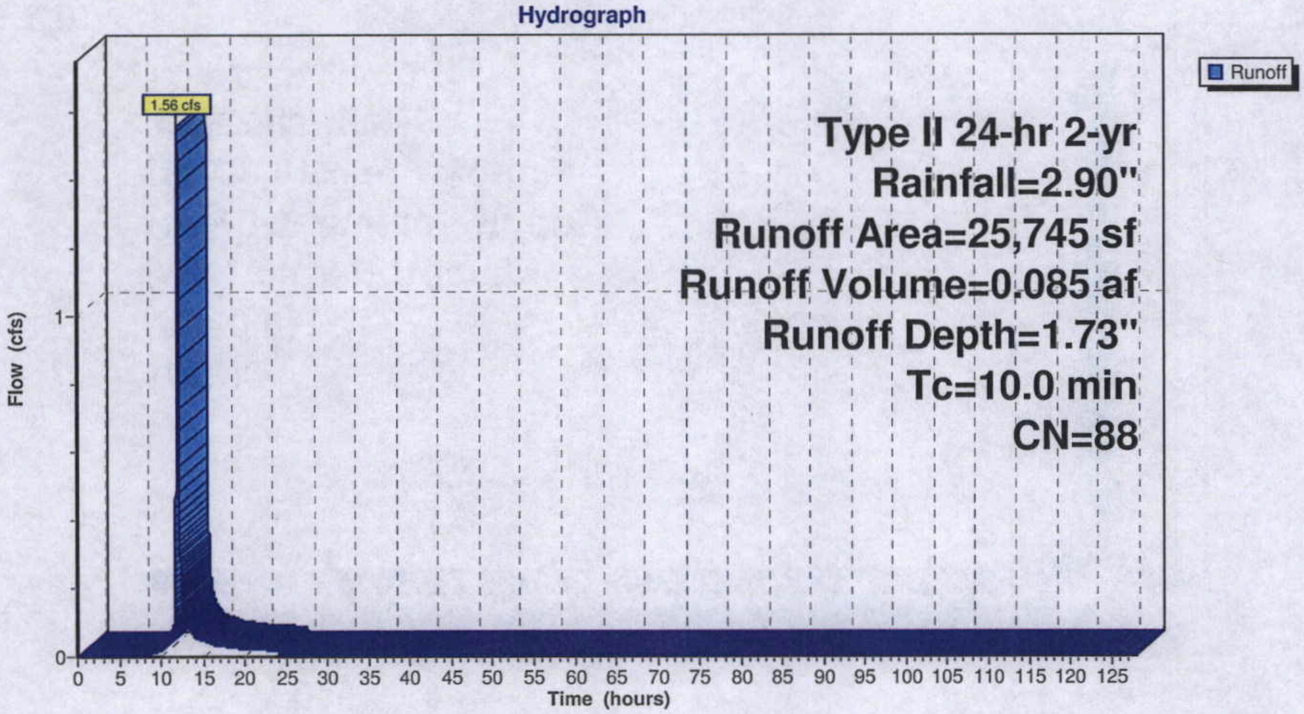
Runoff = 1.56 cfs @ 12.01 hrs, Volume= 0.085 af, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

	Area (sf)	CN	Description
*	19,012	91	Gravel pads, HSG D
	6,733	80	>75% Grass cover, Good, HSG D
	25,745	88	Weighted Average
	25,745		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: Northeast Windrow



Summary for Subcatchment 2S: East Windrow

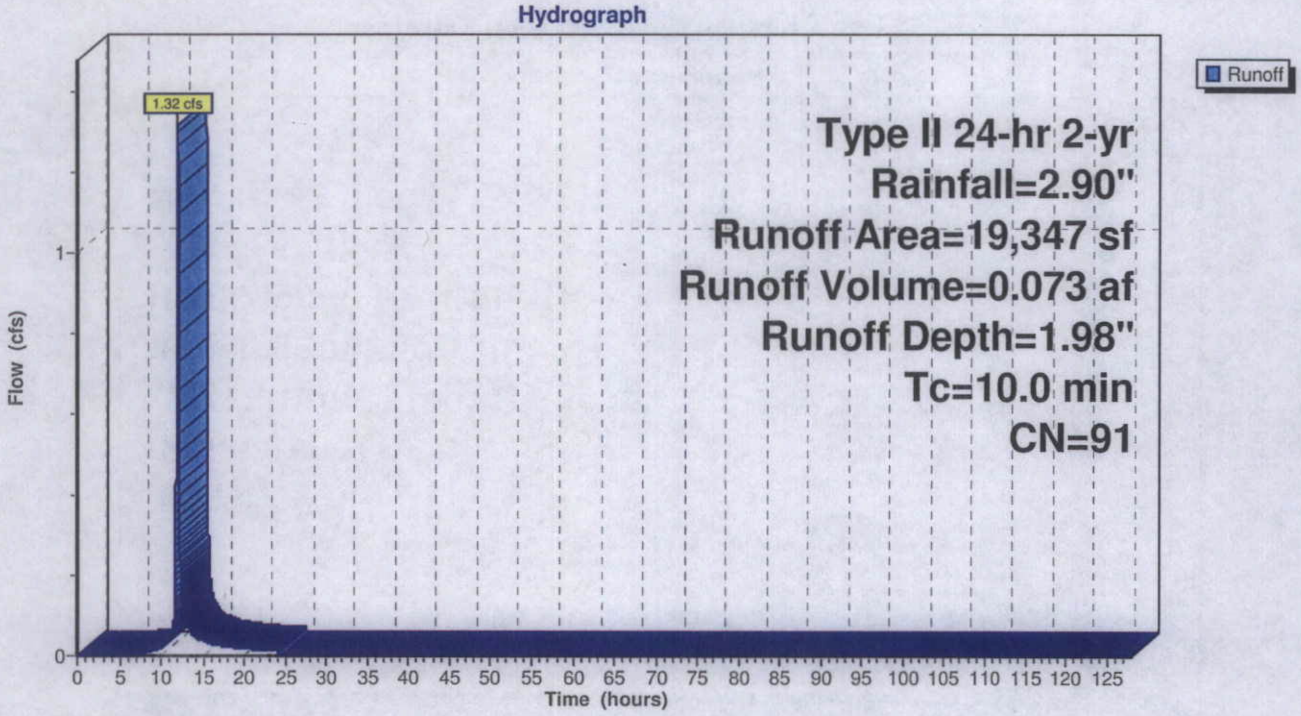
Runoff = 1.32 cfs @ 12.01 hrs, Volume= 0.073 af, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

	Area (sf)	CN	Description
*	19,347	91	Gravel pads, HSG D
	19,347		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2S: East Windrow



Summary for Subcatchment 3S: Southeast Windrow

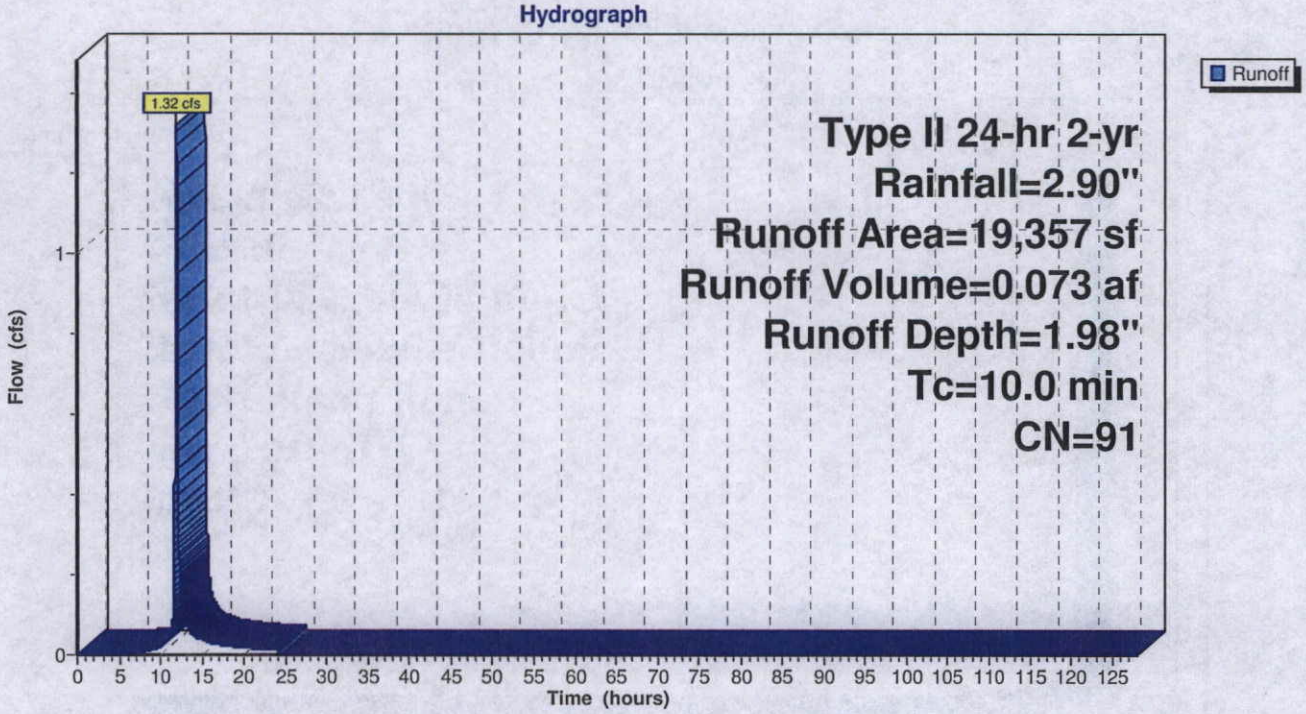
Runoff = 1.32 cfs @ 12.01 hrs, Volume= 0.073 af, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

	Area (sf)	CN	Description
*	19,357	91	Gravel paths, HSG D
	19,357		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 3S: Southeast Windrow



Summary for Subcatchment 4S: North Windrow

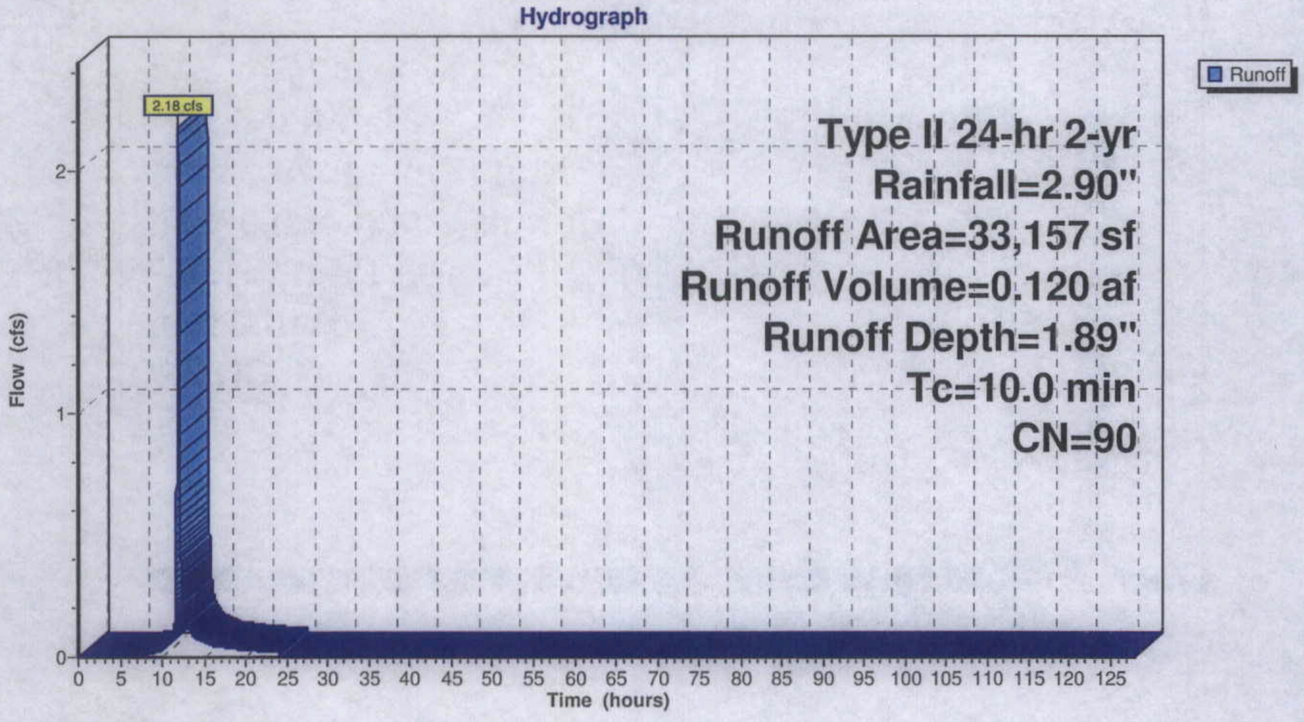
Runoff = 2.18 cfs @ 12.01 hrs, Volume= 0.120 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

	Area (sf)	CN	Description
*	29,932	91	Gravel paths, HSG D
	3,225	80	>75% Grass cover, Good, HSG D
	33,157	90	Weighted Average
	33,157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 4S: North Windrow



Summary for Subcatchment 5S: Central Windrow

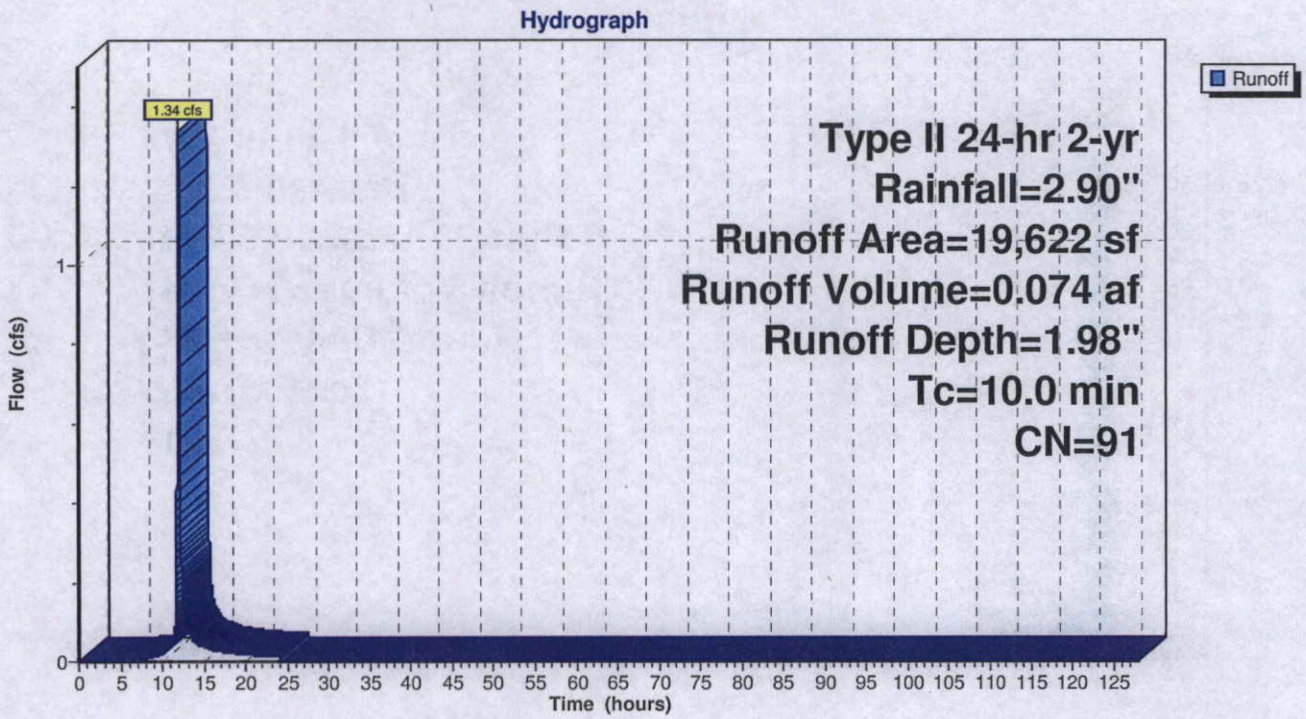
Runoff = 1.34 cfs @ 12.01 hrs, Volume= 0.074 af, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

	Area (sf)	CN	Description
*	19,622	91	Gravel paths, HSG D
	19,622		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 5S: Central Windrow



Summary for Subcatchment 6S: South Windrow

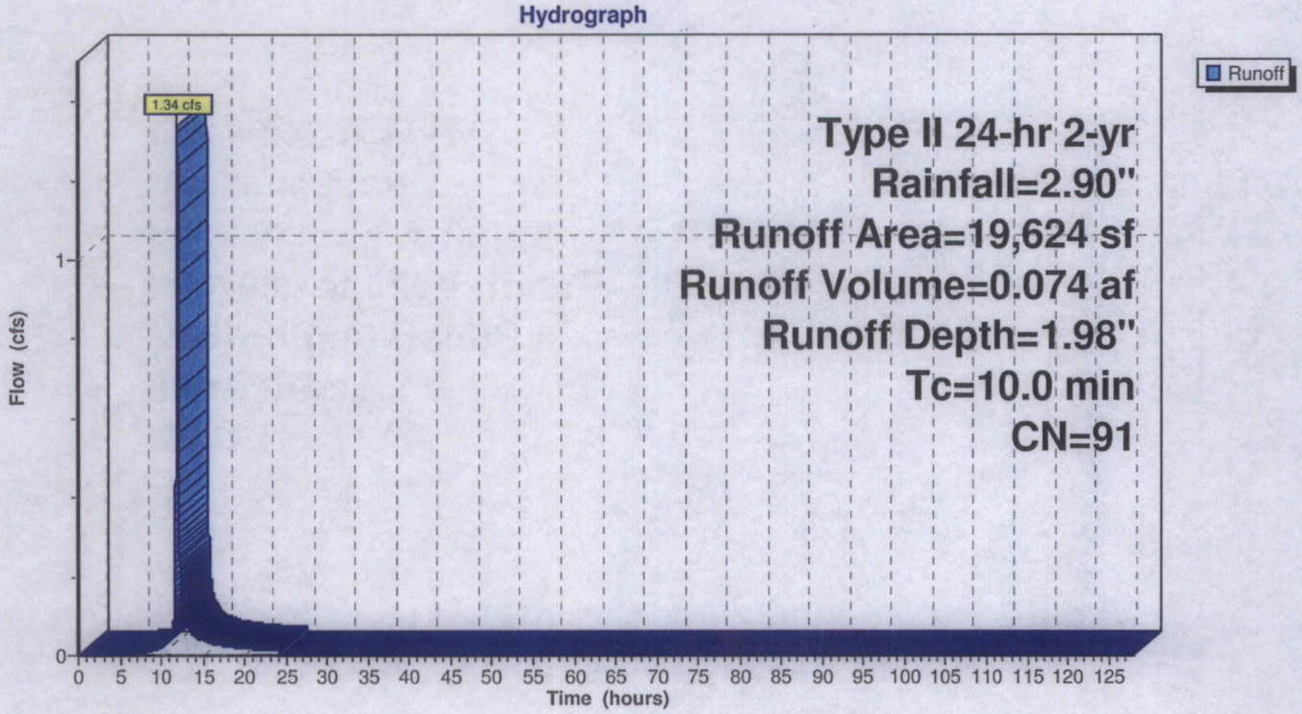
Runoff = 1.34 cfs @ 12.01 hrs, Volume= 0.074 af, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

	Area (sf)	CN	Description
*	19,624	91	Gravel paths, HSG D
	19,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 6S: South Windrow



Summary for Subcatchment 7S: Northwest Windrow

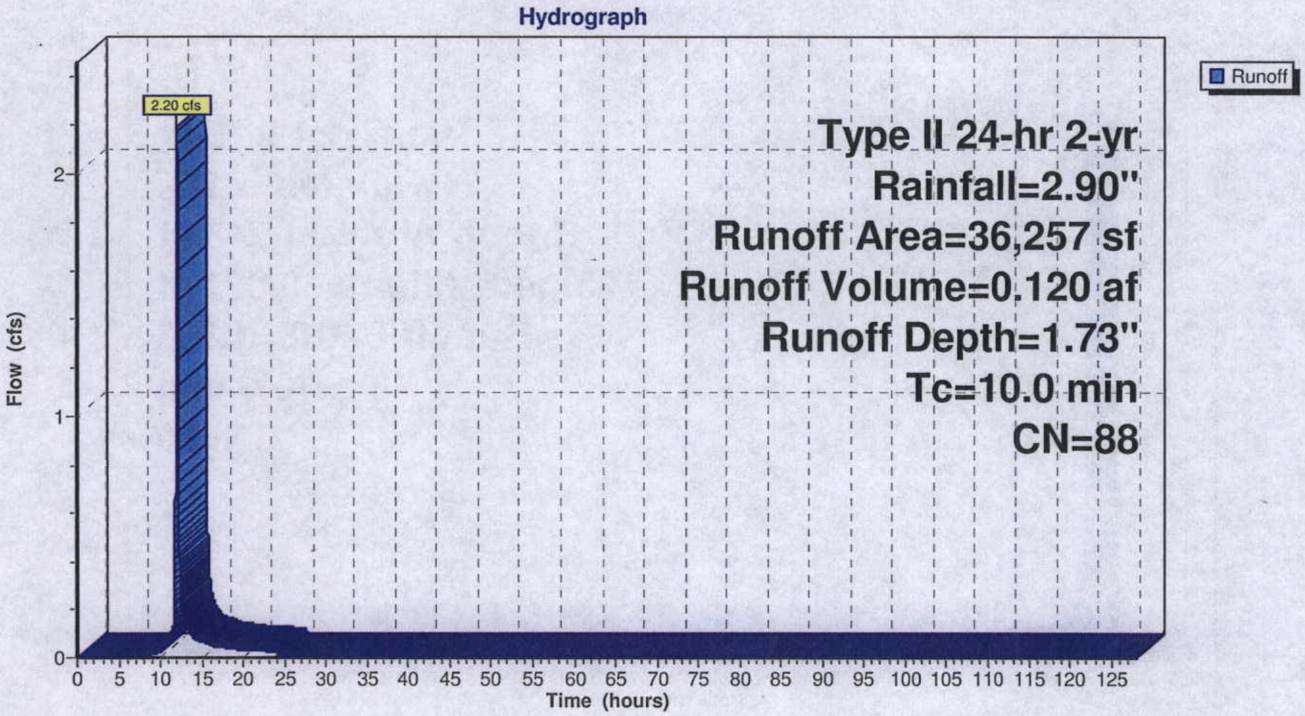
Runoff = 2.20 cfs @ 12.01 hrs, Volume= 0.120 af, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

	Area (sf)	CN	Description
*	27,075	91	Gravel paths, HSG D
	9,182	80	>75% Grass cover, Good, HSG D
	36,257	88	Weighted Average
	36,257		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 7S: Northwest Windrow



Summary for Subcatchment 8S: West Windrow

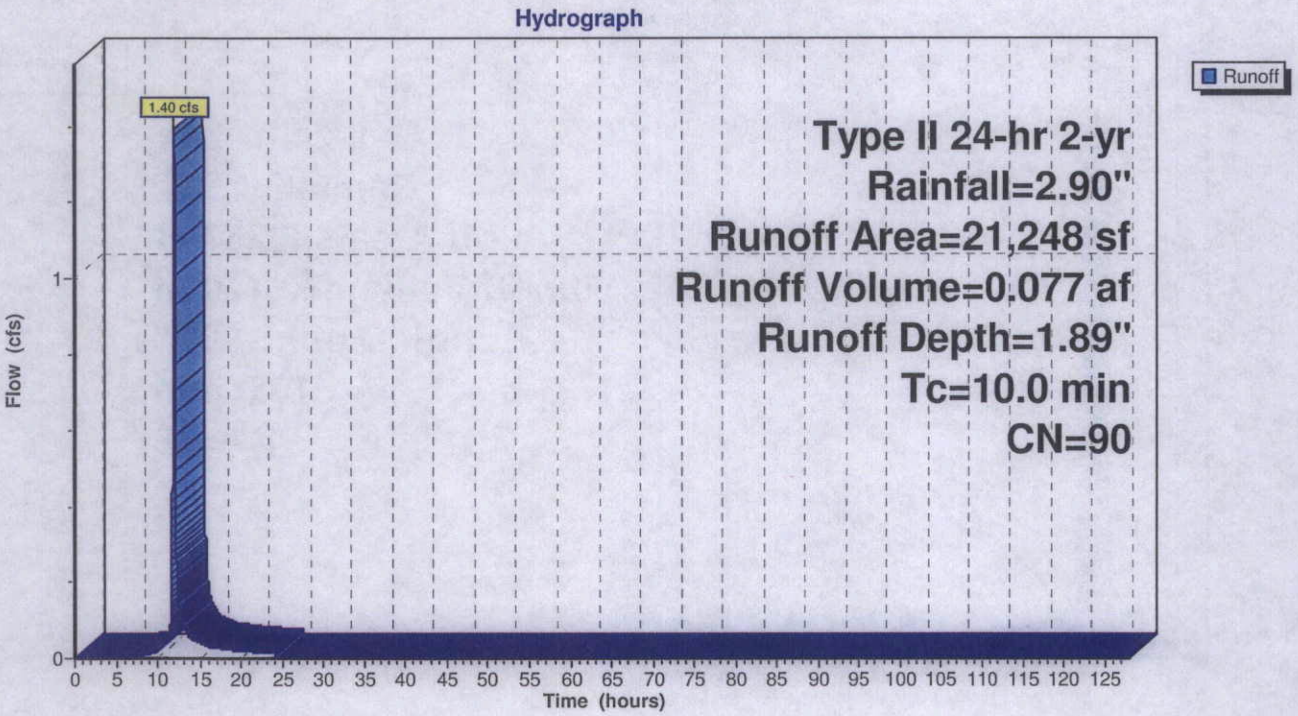
Runoff = 1.40 cfs @ 12.01 hrs, Volume= 0.077 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (sf)	CN	Description
19,338	91	Gravel roads, HSG D
1,910	80	>75% Grass cover, Good, HSG D
21,248	90	Weighted Average
21,248		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 8S: West Windrow



Summary for Subcatchment 9S: Southwest Windrow

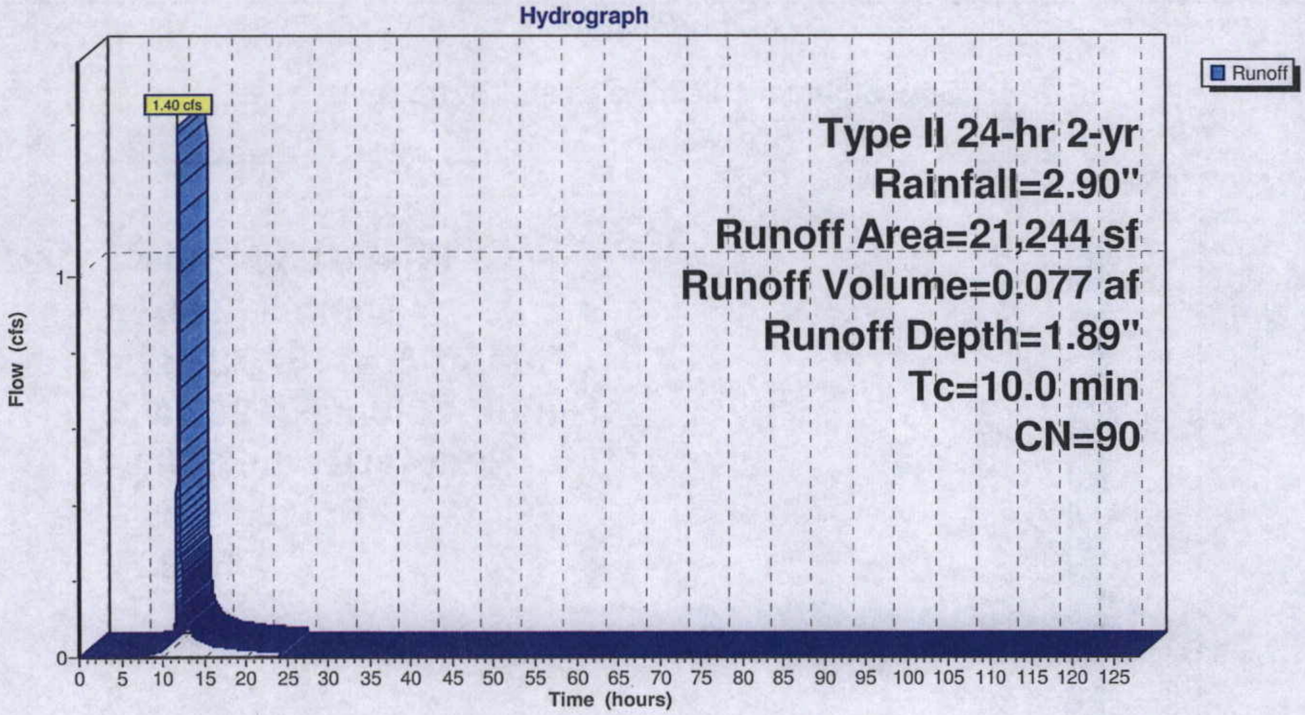
Runoff = 1.40 cfs @ 12.01 hrs, Volume= 0.077 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (sf)	CN	Description
19,289	91	Gravel roads, HSG D
1,955	80	>75% Grass cover, Good, HSG D
21,244	90	Weighted Average
21,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 9S: Southwest Windrow



Summary for Subcatchment 11S: Pond and Storage Area

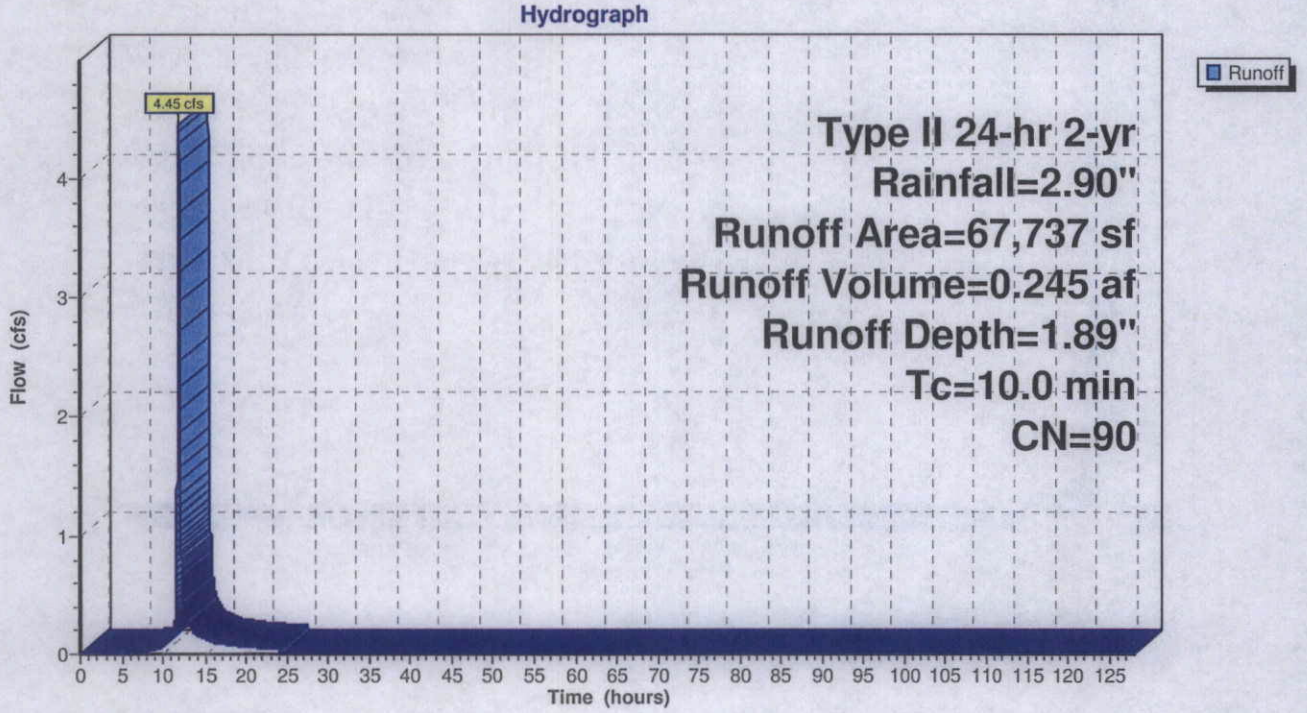
Runoff = 4.45 cfs @ 12.01 hrs, Volume= 0.245 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (sf)	CN	Description
11,601	80	>75% Grass cover, Good, HSG D
48,954	91	Gravel roads, HSG D
1,639	98	Unconnected pavement, HSG D
5,543	98	Water Surface, HSG D
67,737	90	Weighted Average
60,555		89.40% Pervious Area
7,182		10.60% Impervious Area
1,639		22.82% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Pond and Storage Area



Summary for Subcatchment 12S: Pond Area

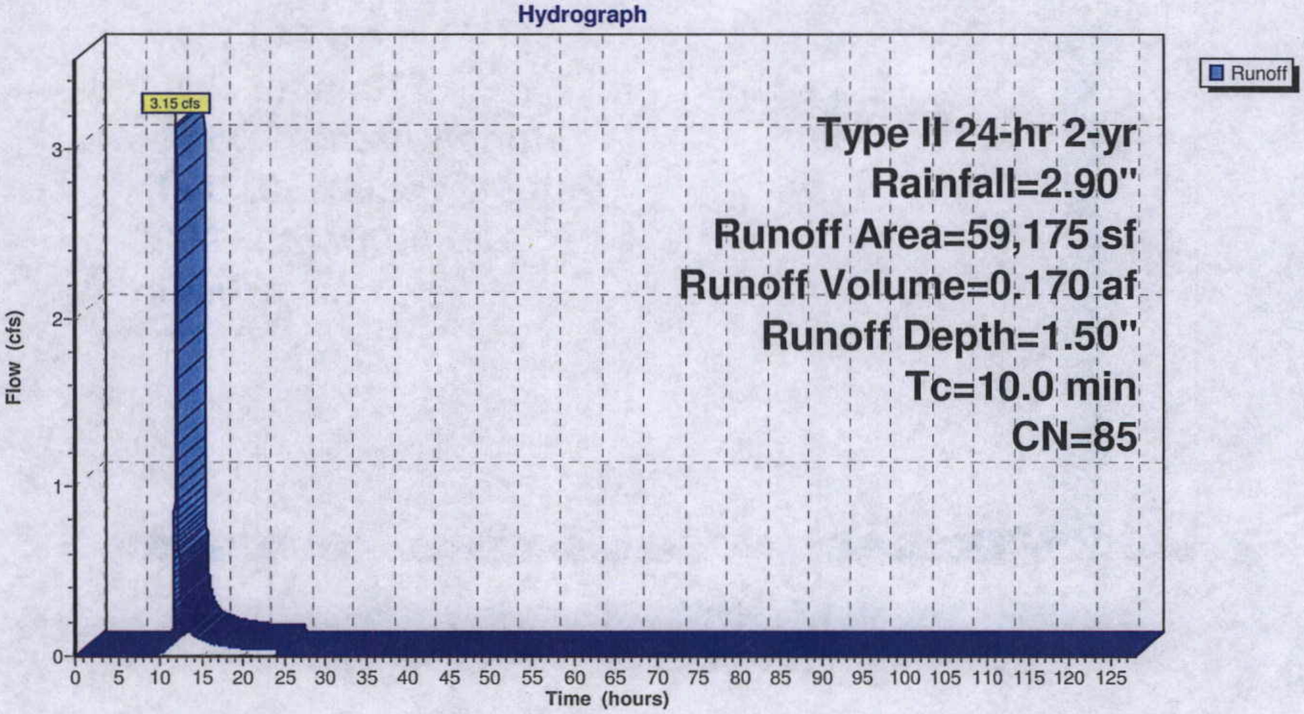
Runoff = 3.15 cfs @ 12.02 hrs, Volume= 0.170 af, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (sf)	CN	Description
43,654	80	>75% Grass cover, Good, HSG D
15,521	98	Water Surface, HSG D
59,175	85	Weighted Average
43,654		73.77% Pervious Area
15,521		26.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 12S: Pond Area



Summary for Subcatchment DE-P: Drive Entrance

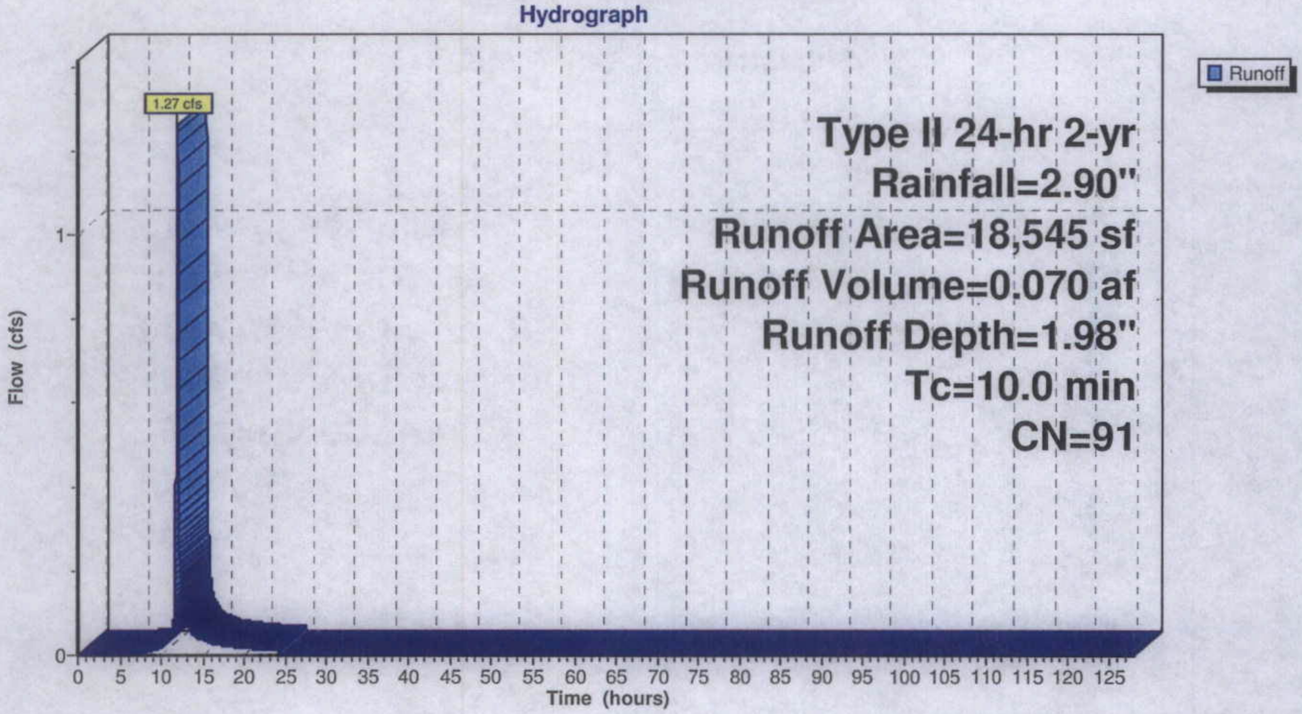
Runoff = 1.27 cfs @ 12.01 hrs, Volume= 0.070 af, Depth= 1.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (sf)	CN	Description
18,545	91	Gravel roads, HSG D
18,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment DE-P: Drive Entrance



Summary for Subcatchment PRM: Perimeter Runoff

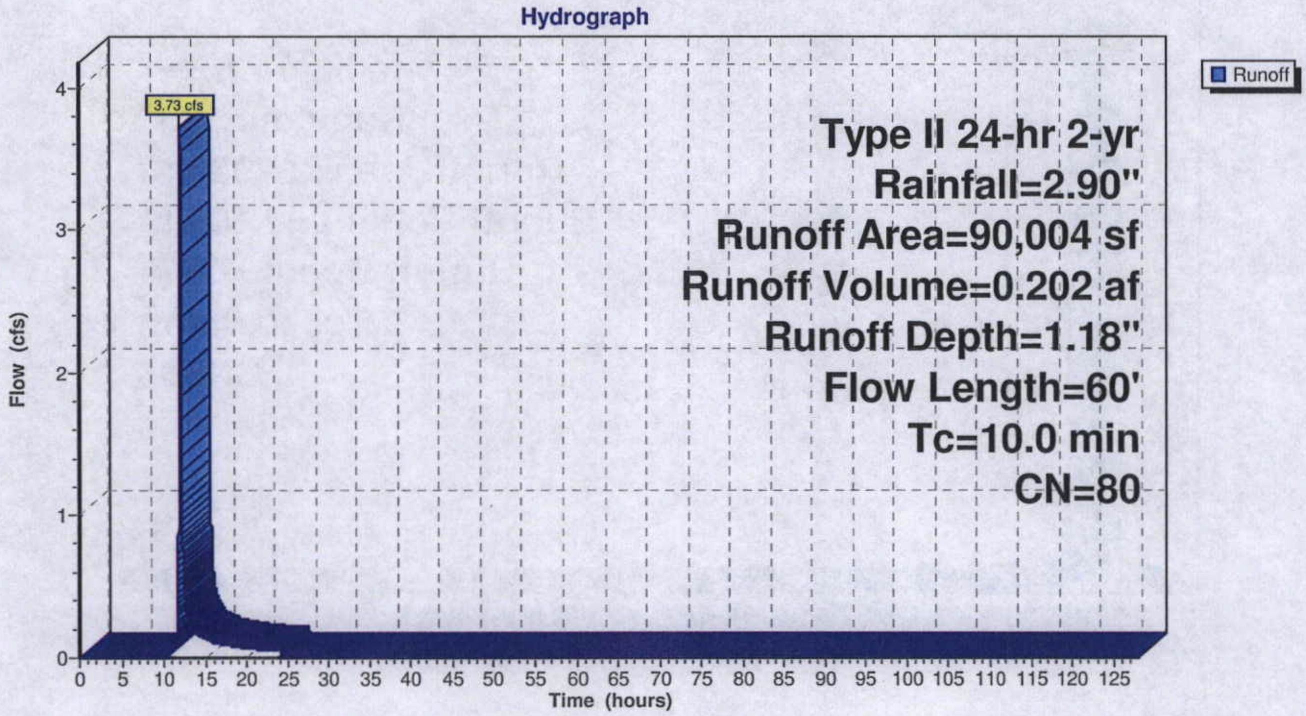
Runoff = 3.73 cfs @ 12.02 hrs, Volume= 0.202 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

Area (sf)	CN	Description
87,582	80	>75% Grass cover, Good, HSG D
2,422	91	Gravel roads, HSG D
90,004	80	Weighted Average
90,004		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	60		0.10		**Direct Entry,**

Subcatchment PRM: Perimeter Runoff



Summary for Subcatchment ROOF: Roof

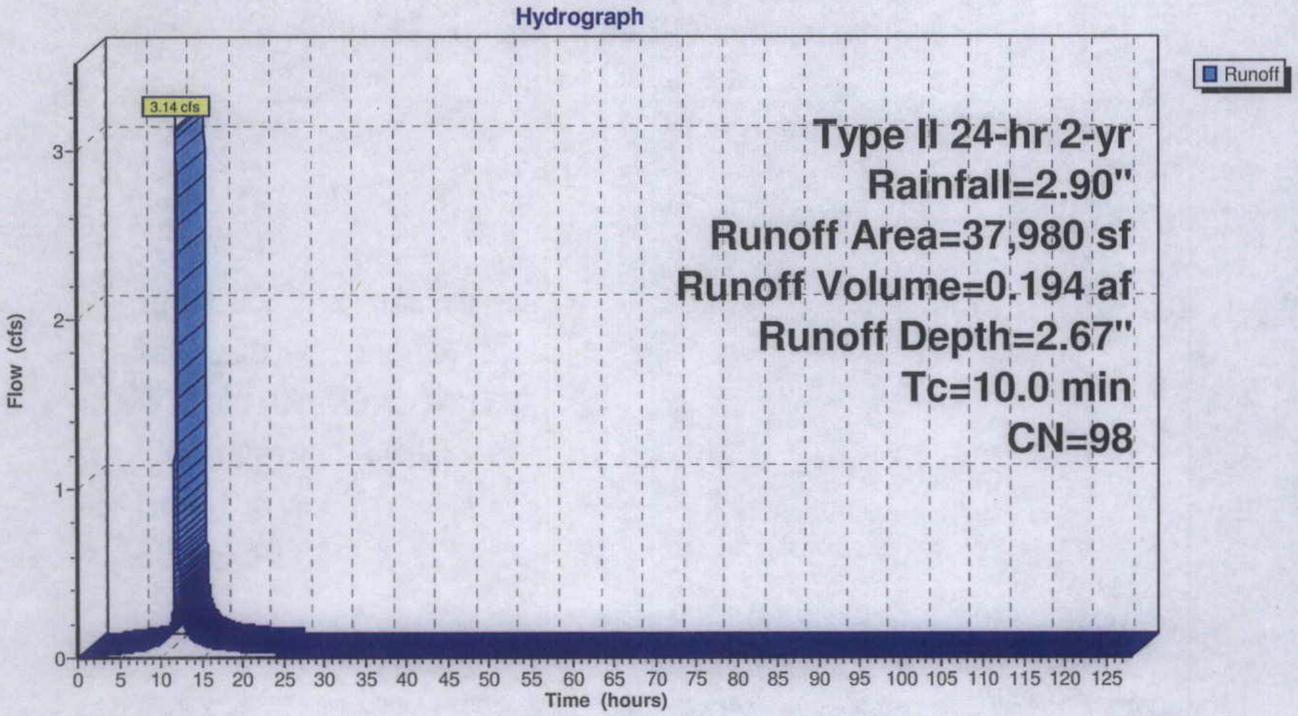
Runoff = 3.14 cfs @ 12.01 hrs, Volume= 0.194 af, Depth= 2.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=2.90"

	Area (sf)	CN	Description
*	37,980	98	Roof
	37,980		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment ROOF: Roof



Summary for Pond 1P: CB NE

Inflow Area =	0.591 ac,	0.00% Impervious, Inflow Depth = 1.73" for 2-yr event		
Inflow =	1.56 cfs @	12.01 hrs, Volume=	0.085 af	
Outflow =	0.94 cfs @	12.15 hrs, Volume=	0.085 af,	Atten= 40%, Lag= 8.1 min
Primary =	0.94 cfs @	12.15 hrs, Volume=	0.085 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.52' @ 12.11 hrs Surf.Area= 3,798 sf Storage= 611 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 5.6 min calculated for 0.085 af (100% of inflow)
Center-of-Mass det. time= 5.6 min (825.4 - 819.8)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

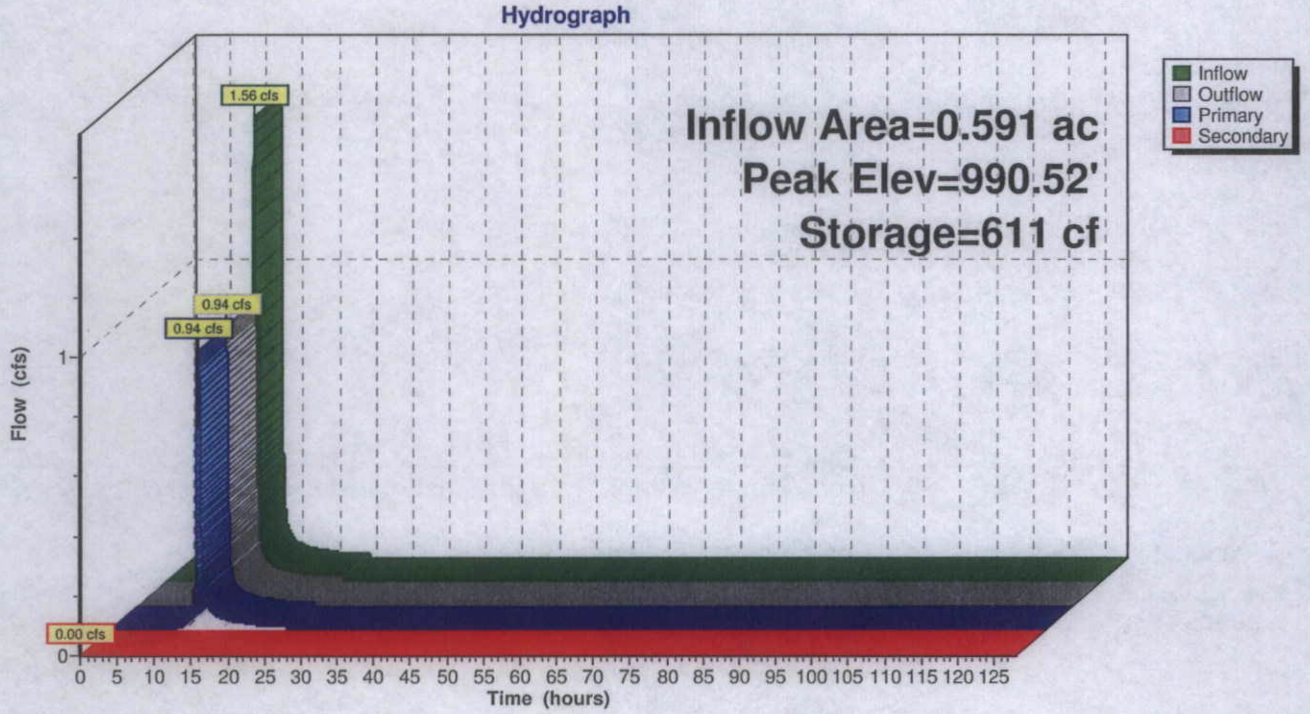
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.98 cfs @ 12.15 hrs HW=990.52' TW=990.47' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 0.98 cfs @ 0.80 fps)
  └─**2=Orifice/Grate** (Passes 0.98 cfs of 2.21 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: CB NE


Hydrograph
1.56 cfs
0.94 cfs
0.94 cfs
0.00 cfs
Inflow Area=0.591 ac
Peak Elev=990.52'
Storage=611 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0
1
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 2P: CB E

Inflow Area = 1.035 ac, 0.00% Impervious, Inflow Depth = 1.84" for 2-yr event
Inflow = 2.12 cfs @ 12.03 hrs, Volume= 0.158 af
Outflow = 1.82 cfs @ 12.10 hrs, Volume= 0.158 af, Atten= 14%, Lag= 4.6 min
Primary = 1.82 cfs @ 12.10 hrs, Volume= 0.158 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.48' @ 12.10 hrs Surf.Area= 3,333 sf Storage= 471 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 2.5 min calculated for 0.158 af (100% of inflow)
Center-of-Mass det. time= 2.5 min (819.3 - 816.8)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

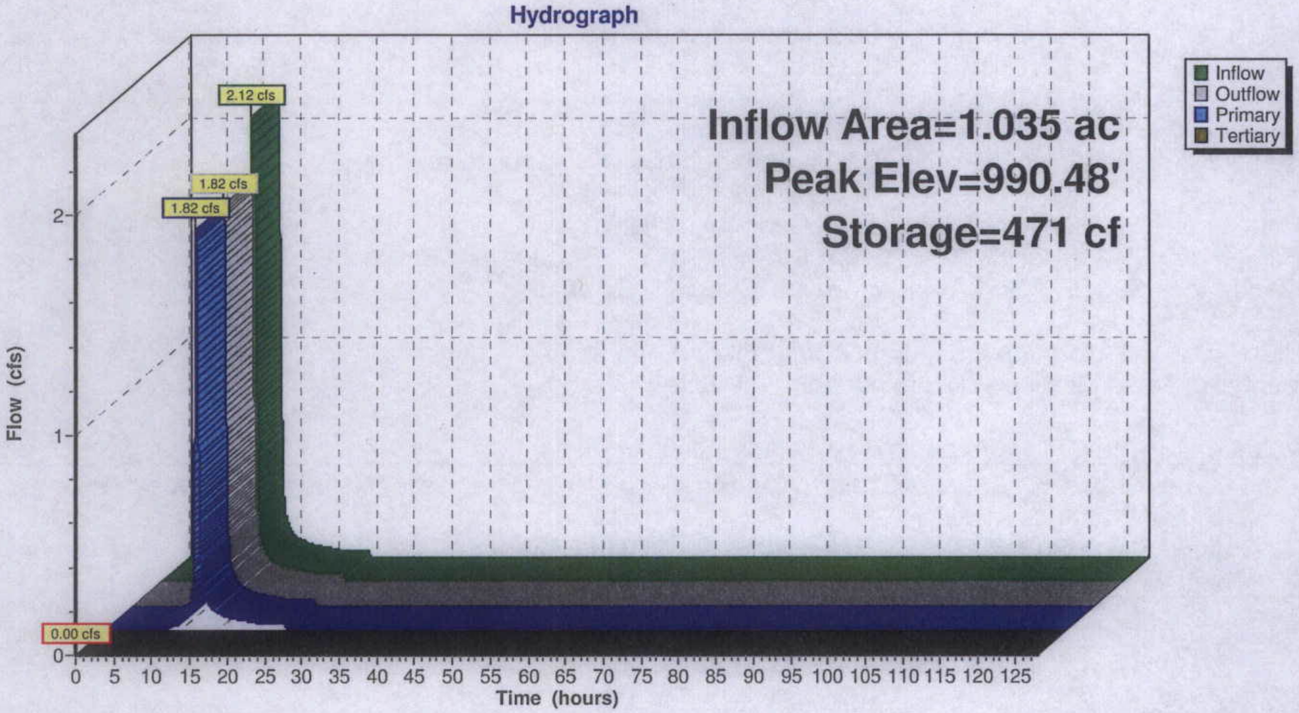
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.85 cfs @ 12.10 hrs HW=990.48' TW=990.44' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.85 cfs of 2.05 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 1.85 cfs @ 0.93 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: CB E


Hydrograph
Inflow Area=1.035 ac
Peak Elev=990.48'
Storage=471 cf
2.12 cfs
1.82 cfs
1.82 cfs
0.00 cfs
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
0
1
2
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 3P: CB SE

Inflow Area = 1.480 ac, 0.00% Impervious, Inflow Depth = 1.88" for 2-yr event
Inflow = 2.96 cfs @ 12.04 hrs, Volume= 0.232 af
Outflow = 2.82 cfs @ 12.08 hrs, Volume= 0.232 af, Atten= 5%, Lag= 2.5 min
Primary = 2.82 cfs @ 12.08 hrs, Volume= 0.232 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.45' @ 12.08 hrs Surf.Area= 2,901 sf Storage= 357 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.3 min calculated for 0.232 af (100% of inflow)
Center-of-Mass det. time= 1.3 min (816.7 - 815.4)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

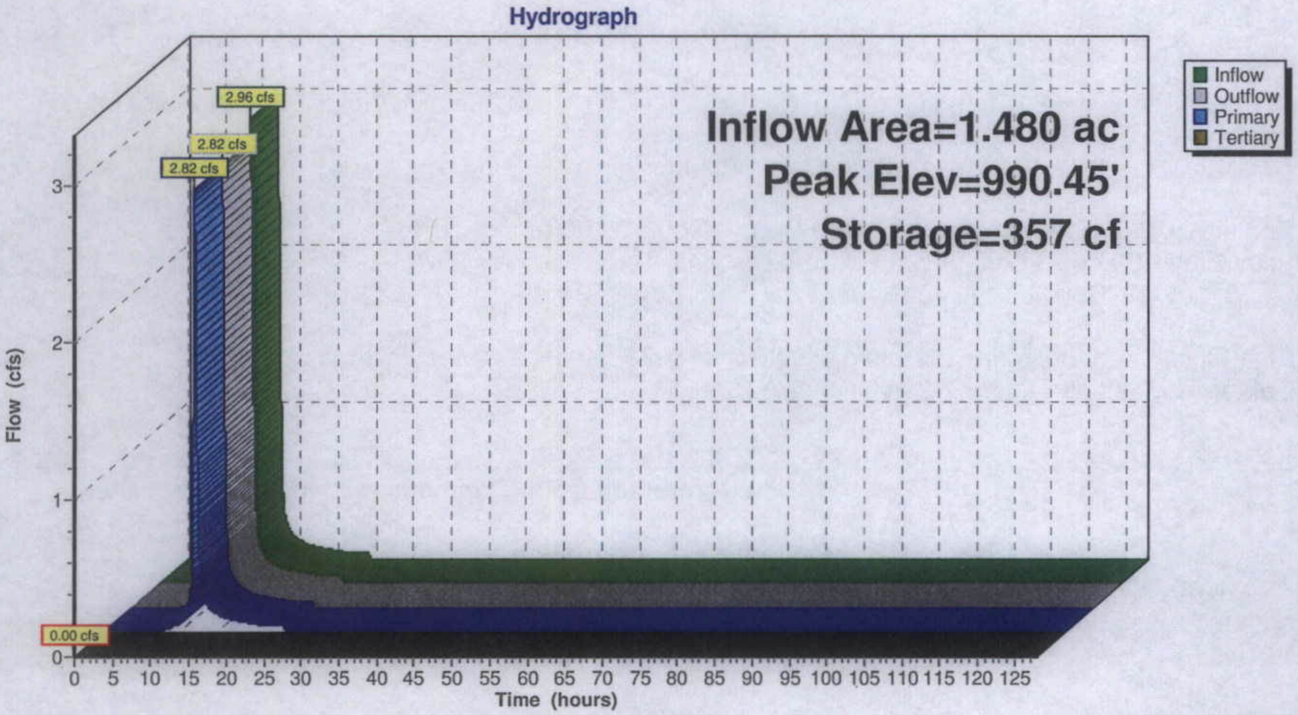
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 99.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.19' / 982.00' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.82 cfs @ 12.08 hrs HW=990.45' TW=980.80' (Dynamic Tailwater)
└─**1=Culvert** (Passes 2.82 cfs of 28.96 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 2.82 cfs @ 1.62 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=979.99' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: CB SE


Hydrograph
Inflow
Outflow
Primary
Tertiary
Inflow Area=1.480 ac
Peak Elev=990.45'
Storage=357 cf
2.96 cfs
2.82 cfs
2.82 cfs
0.00 cfs
Flow (cfs)
0
1
2
3
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 4P: CB N

Inflow Area = 0.761 ac, 0.00% Impervious, Inflow Depth = 1.89" for 2-yr event
Inflow = 2.18 cfs @ 12.01 hrs, Volume= 0.120 af
Outflow = 1.24 cfs @ 12.14 hrs, Volume= 0.120 af, Atten= 43%, Lag= 7.5 min
Primary = 1.24 cfs @ 12.14 hrs, Volume= 0.120 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.58' @ 12.12 hrs Surf.Area= 4,481 sf Storage= 851 cf
Flood Elev= 990.95' Surf.Area= 8,853 sf Storage= 3,320 cf

Plug-Flow detention time= 5.5 min calculated for 0.120 af (100% of inflow)
Center-of-Mass det. time= 5.5 min (816.9 - 811.4)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

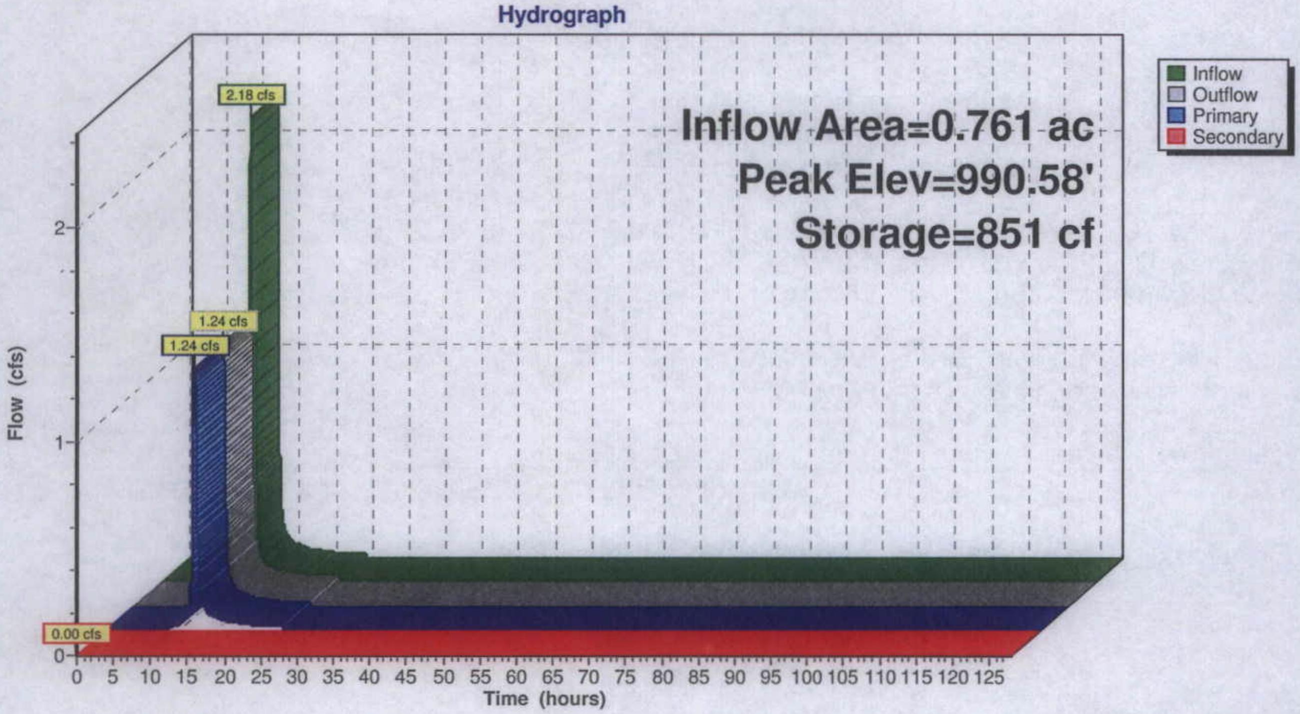
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,853	3,320	3,320

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.25 cfs @ 12.14 hrs HW=990.58' TW=990.51' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.25 cfs @ 1.02 fps)
  └─**2=Orifice/Grate** (Passes 1.25 cfs of 3.24 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: CB N


Hydrograph
2.18 cfs
1.24 cfs
1.24 cfs
0.00 cfs
Inflow Area=0.761 ac
Peak Elev=990.58'
Storage=851 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0
1
2
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 5P: CB Central

Inflow Area = 1.212 ac, 0.00% Impervious, Inflow Depth = 1.92" for 2-yr event
Inflow = 2.46 cfs @ 12.03 hrs, Volume= 0.194 af
Outflow = 2.09 cfs @ 12.13 hrs, Volume= 0.194 af, Atten= 15%, Lag= 6.1 min
Primary = 2.09 cfs @ 12.13 hrs, Volume= 0.194 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.51' @ 12.11 hrs Surf.Area= 3,664 sf Storage= 569 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 2.6 min calculated for 0.194 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (815.6 - 813.0)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

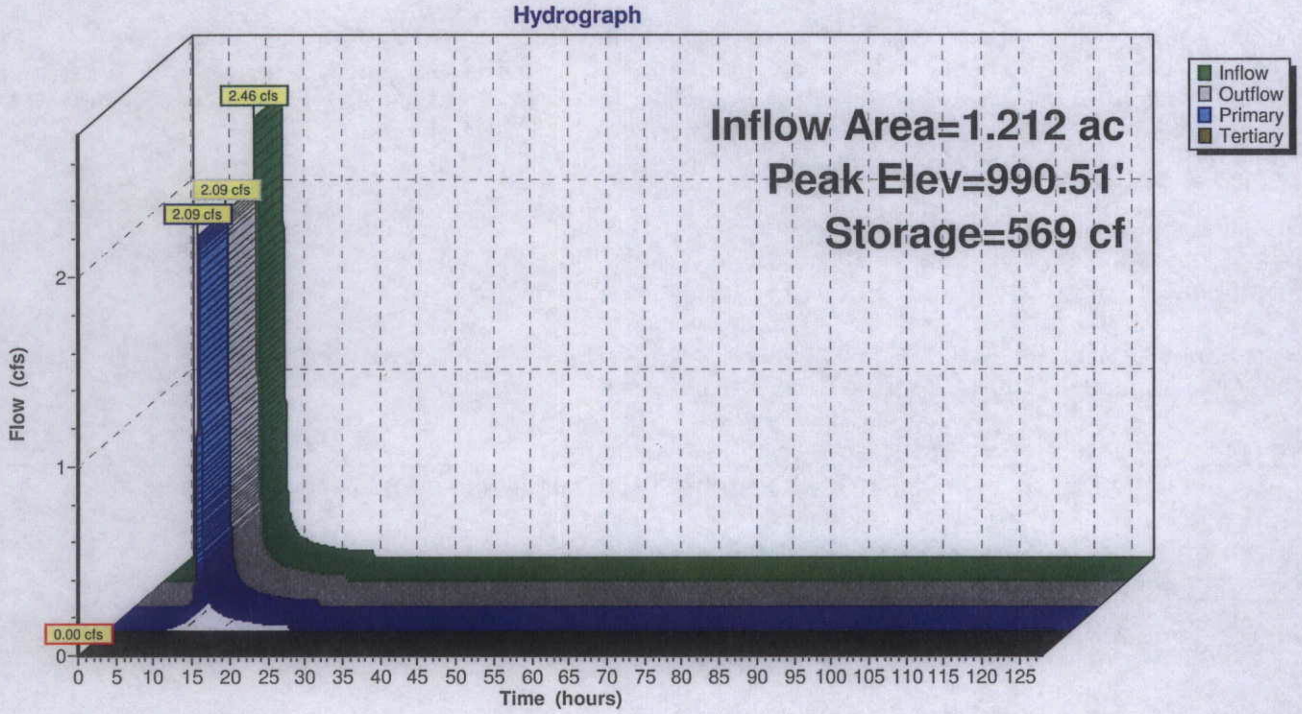
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.13 cfs @ 12.13 hrs HW=990.51' TW=990.45' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.13 cfs @ 0.89 fps)
↑—**2=Orifice/Grate** (Passes 2.13 cfs of 2.33 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: CB Central



Summary for Pond 6P: CB S

Inflow Area =	1.662 ac,	0.00% Impervious,	Inflow Depth = 1.94"	for 2-yr event
Inflow =	3.19 cfs @	12.04 hrs, Volume=	0.269 af	
Outflow =	3.05 cfs @	12.09 hrs, Volume=	0.269 af,	Atten= 4%, Lag= 3.0 min
Primary =	3.05 cfs @	12.09 hrs, Volume=	0.269 af	
Tertiary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.46' @ 12.09 hrs Surf.Area= 3,058 sf Storage= 396 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.3 min calculated for 0.269 af (100% of inflow)
Center-of-Mass det. time= 1.3 min (814.5 - 813.2)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

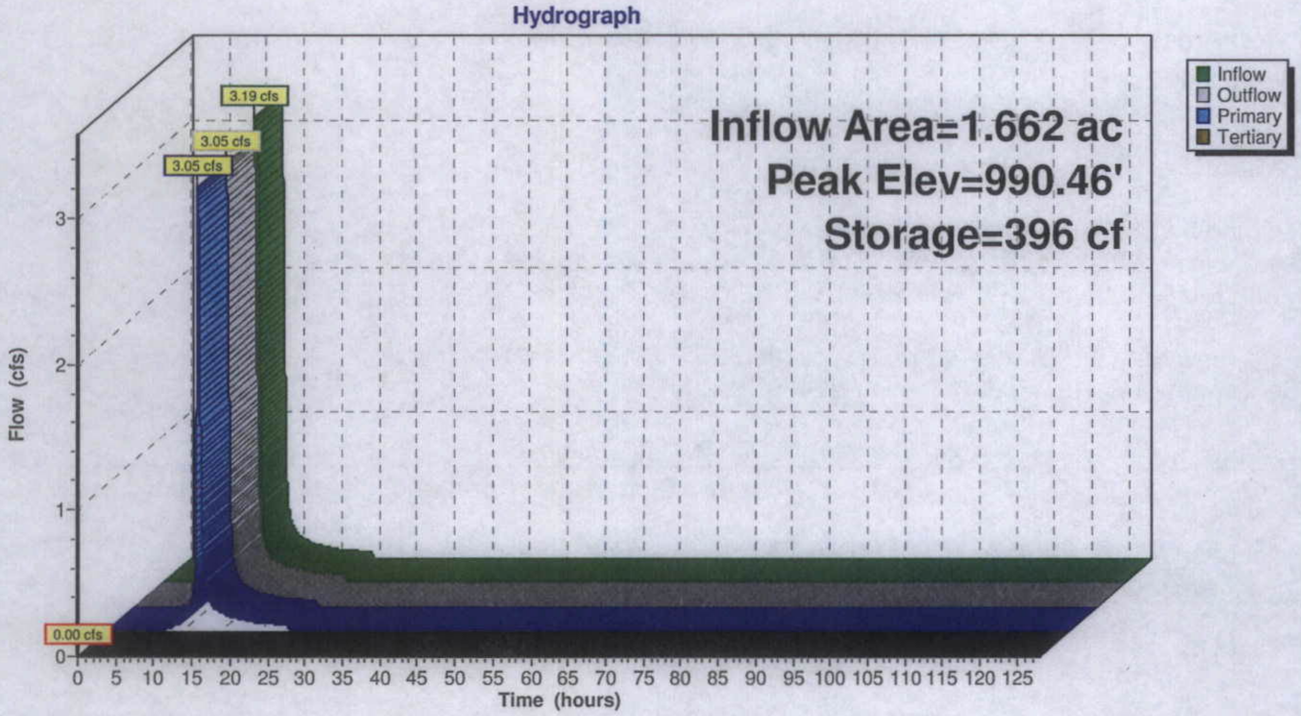
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 57.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 983.19' / 982.50' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.05 cfs @ 12.09 hrs HW=990.46' TW=983.07' (Dynamic Tailwater)
└─**1=Culvert** (Passes 3.05 cfs of 23.12 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 3.05 cfs @ 1.66 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=982.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: CB S


Hydrograph
3.19 cfs
3.05 cfs
3.05 cfs
0.00 cfs
Inflow Area=1.662 ac
Peak Elev=990.46'
Storage=396 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
0
1
2
3
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 7P: CB NW

Inflow Area = 0.832 ac, 0.00% Impervious, Inflow Depth = 1.73" for 2-yr event
Inflow = 2.20 cfs @ 12.01 hrs, Volume= 0.120 af
Outflow = 1.26 cfs @ 12.14 hrs, Volume= 0.120 af, Atten= 43%, Lag= 7.3 min
Primary = 1.26 cfs @ 12.14 hrs, Volume= 0.120 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.58' @ 12.12 hrs Surf.Area= 4,507 sf Storage= 861 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 5.6 min calculated for 0.120 af (100% of inflow)
Center-of-Mass det. time= 5.6 min (825.4 - 819.8)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

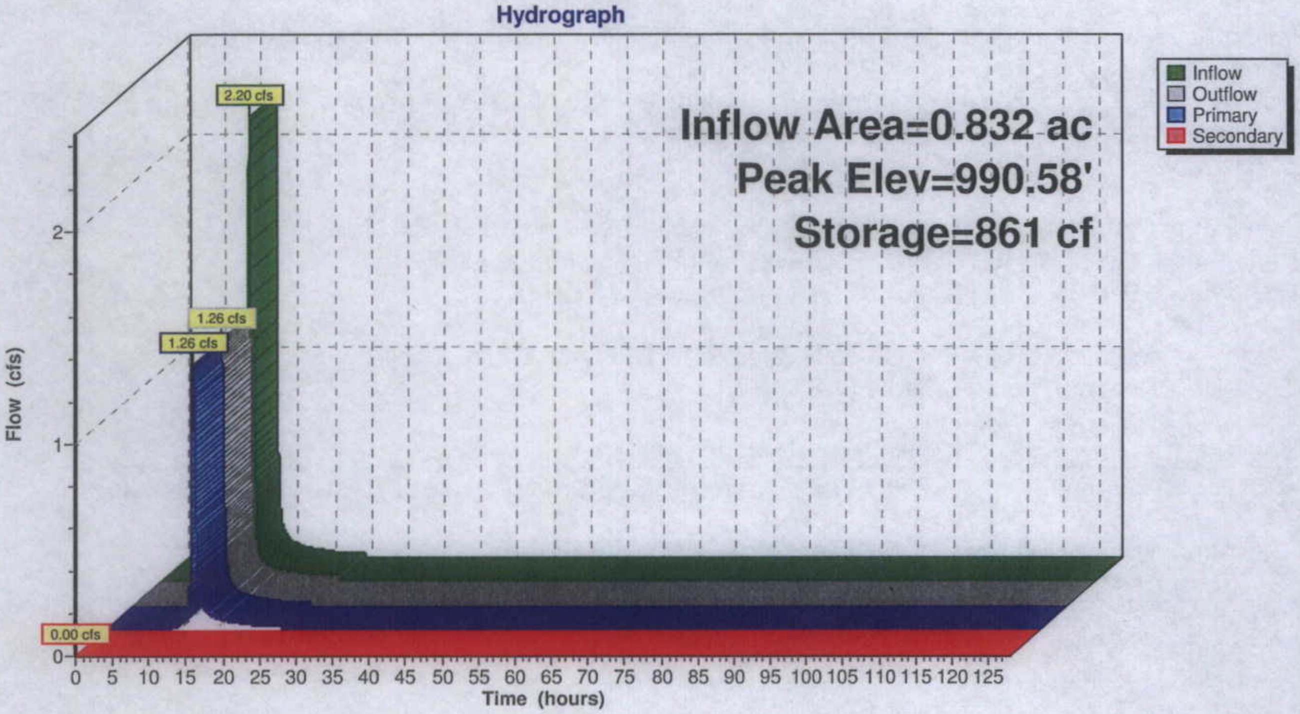
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.28 cfs @ 12.14 hrs HW=990.58' TW=990.51' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.28 cfs @ 1.04 fps)
↑—**2=Orifice/Grate** (Passes 1.28 cfs of 3.31 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: CB NW


Hydrograph
2.20 cfs
1.26 cfs
1.26 cfs
0.00 cfs
Inflow Area=0.832 ac
Peak Elev=990.58'
Storage=861 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0
1
2
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 8P: CB W

Inflow Area =	1.320 ac,	0.00% Impervious, Inflow Depth = 1.79"	for 2-yr event
Inflow =	2.51 cfs @	12.03 hrs, Volume=	0.197 af
Outflow =	2.17 cfs @	12.11 hrs, Volume=	0.197 af, Atten= 14%, Lag= 4.8 min
Primary =	2.17 cfs @	12.11 hrs, Volume=	0.197 af
Tertiary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.51' @ 12.10 hrs Surf.Area= 3,657 sf Storage= 567 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 2.6 min calculated for 0.197 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (822.5 - 819.9)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

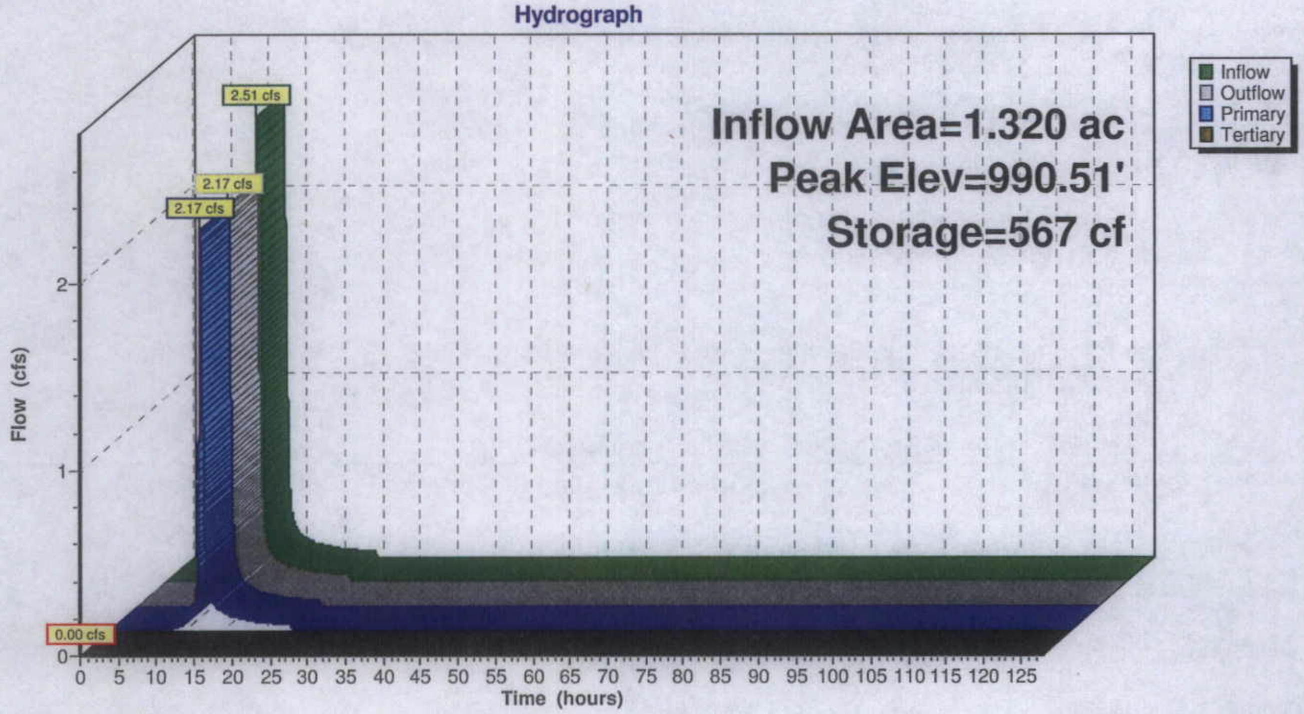
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.19 cfs @ 12.11 hrs HW=990.51' TW=990.46' (Dynamic Tailwater)
└─**1=Culvert** (Passes 2.19 cfs of 2.24 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 2.19 cfs @ 1.00 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 8P: CB W


Hydrograph
2.51 cfs
2.17 cfs
2.17 cfs
0.00 cfs
Inflow Area=1.320 ac
Peak Elev=990.51'
Storage=567 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
0
1
2
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 9P: CB SW

Inflow Area = 1.808 ac, 0.00% Impervious, Inflow Depth = 1.82" for 2-yr event
Inflow = 3.34 cfs @ 12.04 hrs, Volume= 0.274 af
Outflow = 3.17 cfs @ 12.09 hrs, Volume= 0.274 af, Atten= 5%, Lag= 2.7 min
Primary = 3.17 cfs @ 12.09 hrs, Volume= 0.274 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.47' @ 12.09 hrs Surf.Area= 3,141 sf Storage= 418 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.3 min calculated for 0.274 af (100% of inflow)
Center-of-Mass det. time= 1.3 min (820.7 - 819.4)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

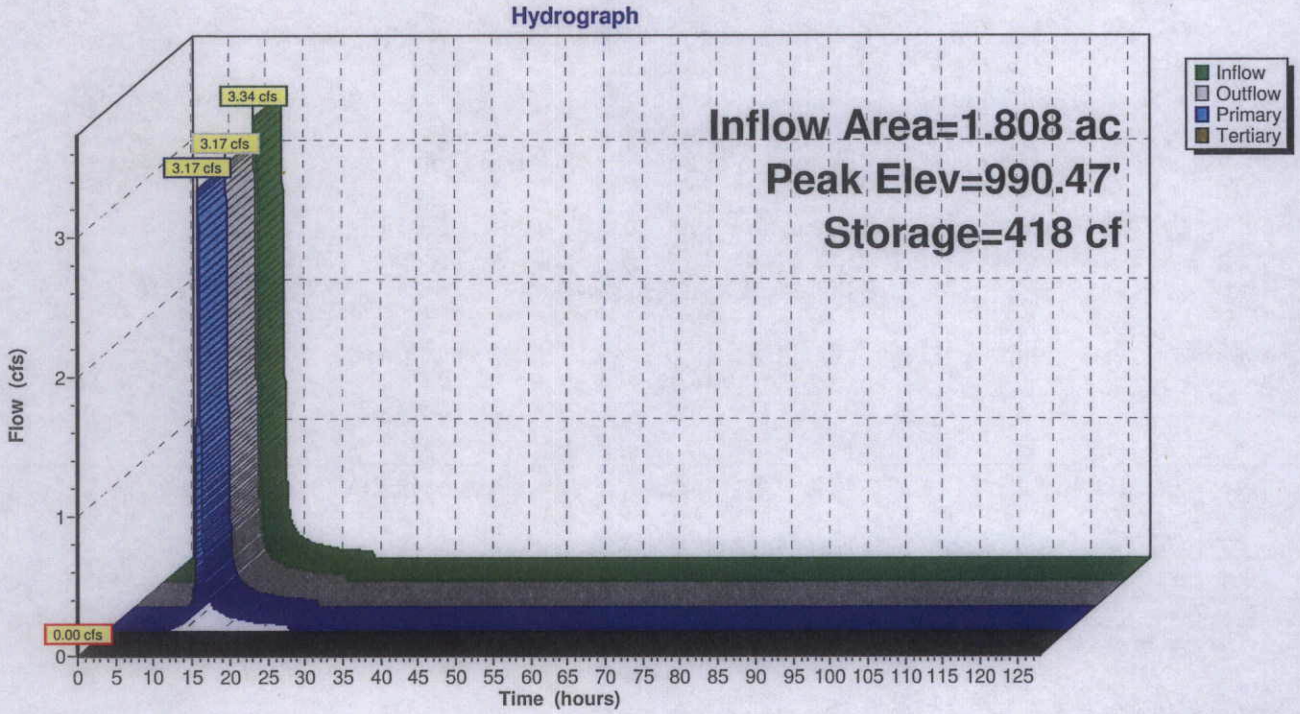
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 99.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.19' / 982.00' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=3.17 cfs @ 12.09 hrs HW=990.47' TW=980.81' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 3.17 cfs of 29.01 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 3.17 cfs @ 1.69 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=979.99' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: CB SW


Hydrograph
3.34 cfs
3.17 cfs
3.17 cfs
0.00 cfs
Inflow Area=1.808 ac
Peak Elev=990.47'
Storage=418 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
0
1
2
3
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 10P: CB Pump

Inflow Area =	1.662 ac,	0.00% Impervious,	Inflow Depth = 1.94"	for 2-yr event
Inflow =	3.05 cfs @	12.09 hrs, Volume=	0.269 af	
Outflow =	3.05 cfs @	12.09 hrs, Volume=	0.269 af,	Atten= 0%, Lag= 0.0 min
Primary =	3.05 cfs @	12.09 hrs, Volume=	0.269 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

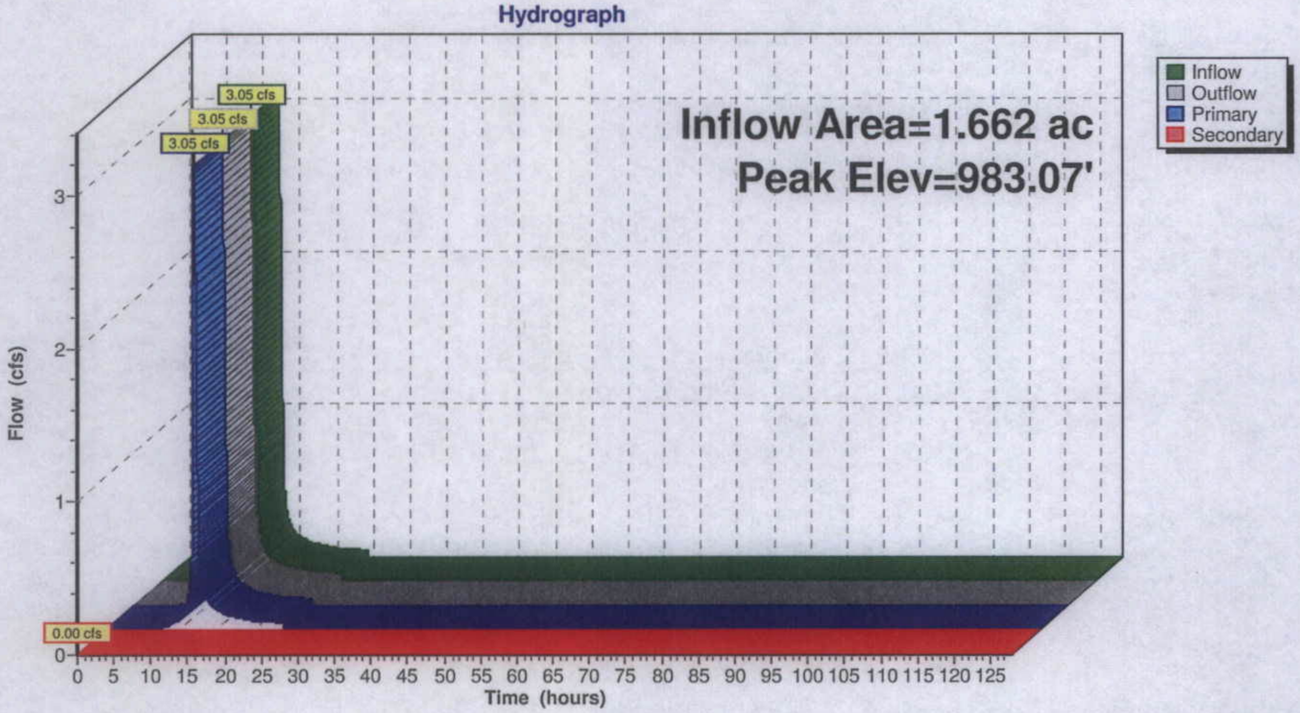
Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 983.07' @ 12.09 hrs
Flood Elev= 990.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	982.00'	**21.0" Round Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 982.00' / 982.00' S= 0.0000 '/' Cc= 0.900 n= 0.013
#2	Secondary	990.95'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=3.05 cfs @ 12.09 hrs HW=983.07' TW=980.80' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 3.05 cfs @ 2.82 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=982.00' TW=979.99' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 10P: CB Pump



Summary for Pond P-N: North Basin

Inflow Area = 1.555 ac, 10.60% Impervious, Inflow Depth = 1.89" for 2-yr event
Inflow = 4.45 cfs @ 12.01 hrs, Volume= 0.245 af
Outflow = 0.94 cfs @ 12.25 hrs, Volume= 0.243 af, Atten= 79%, Lag= 14.3 min
Primary = 0.94 cfs @ 12.25 hrs, Volume= 0.243 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 987.76' @ 12.25 hrs Surf.Area= 6,580 sf Storage= 4,639 cf
Flood Elev= 993.00' Surf.Area= 12,166 sf Storage= 34,171 cf

Plug-Flow detention time= 143.3 min calculated for 0.243 af (99% of inflow)
Center-of-Mass det. time= 138.8 min (950.1 - 811.4)

Volume	Invert	Avail.Storage	Storage Description
#1	982.00'	34,171 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

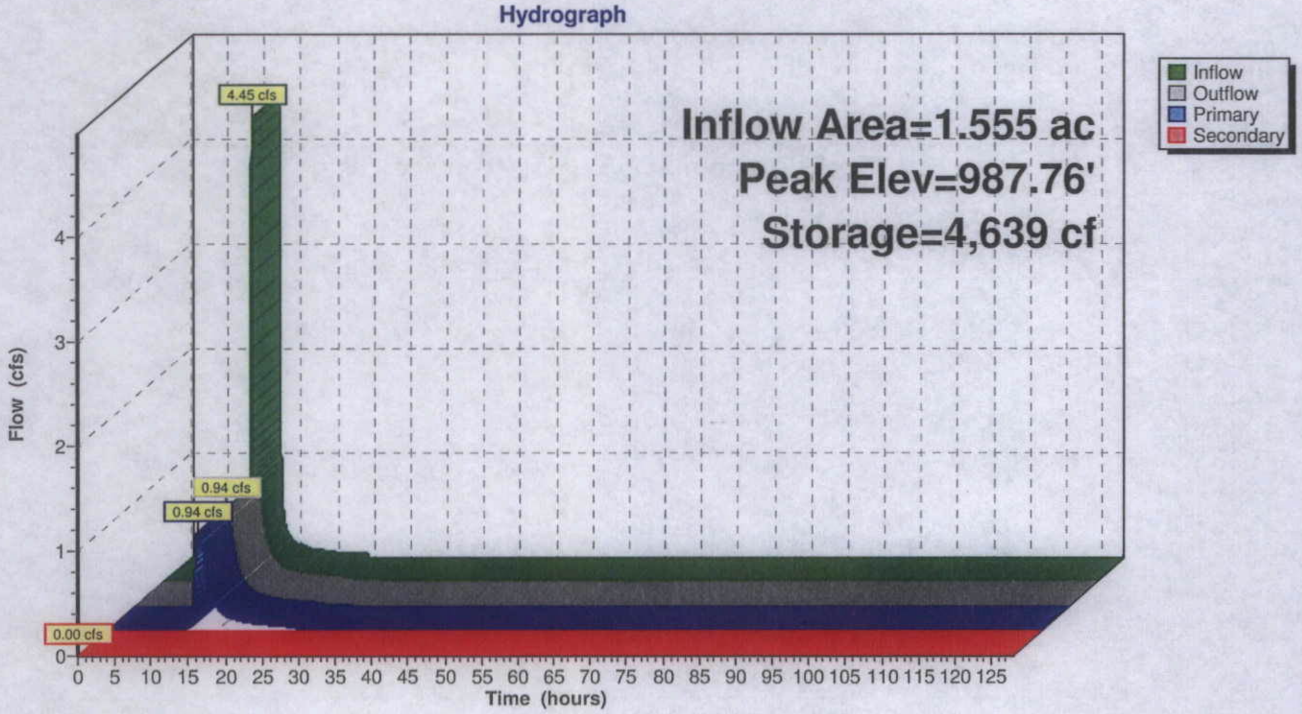
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
982.00	443	0.0	0	0
983.00	812	0.0	0	0
984.00	1,293	0.0	0	0
985.00	1,886	0.0	0	0
986.00	2,589	0.0	0	0
986.99	5,543	0.0	0	0
987.00	5,543	100.0	55	55
988.00	6,914	100.0	6,229	6,284
989.00	8,387	100.0	7,651	13,934
990.00	9,960	100.0	9,174	23,108
991.00	12,166	100.0	11,063	34,171

Device	Routing	Invert	Outlet Devices
#1	Primary	987.00'	**4.0" Round Culvert X 3.00** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 987.00' / 986.80' S= 0.0100 '/' Cc= 0.900 n= 0.010
#2	Device 1	987.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	990.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	990.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" Grate Limited to weir flow at low heads
#5	Secondary	991.00'	**20.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.94 cfs @ 12.25 hrs HW=987.76' TW=0.00' (Dynamic Tailwater)
└1=**Culvert** (Barrel Controls 0.94 cfs @ 3.59 fps)
  ├2=**Orifice/Grate** (Passes 0.94 cfs of 1.09 cfs potential flow)
  ├3=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └4=**Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=982.00' TW=0.00' (Dynamic Tailwater)
└5=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P-N: North Basin



Summary for Pond P-S: South Basin

Inflow Area = 6.308 ac, 5.65% Impervious, Inflow Depth = 1.80" for 2-yr event
Inflow = 11.75 cfs @ 12.05 hrs, Volume= 0.944 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 982.21' @ 24.63 hrs Surf.Area= 21,590 sf Storage= 41,136 cf
Flood Elev= 990.50' Surf.Area= 57,219 sf Storage= 362,790 cf

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

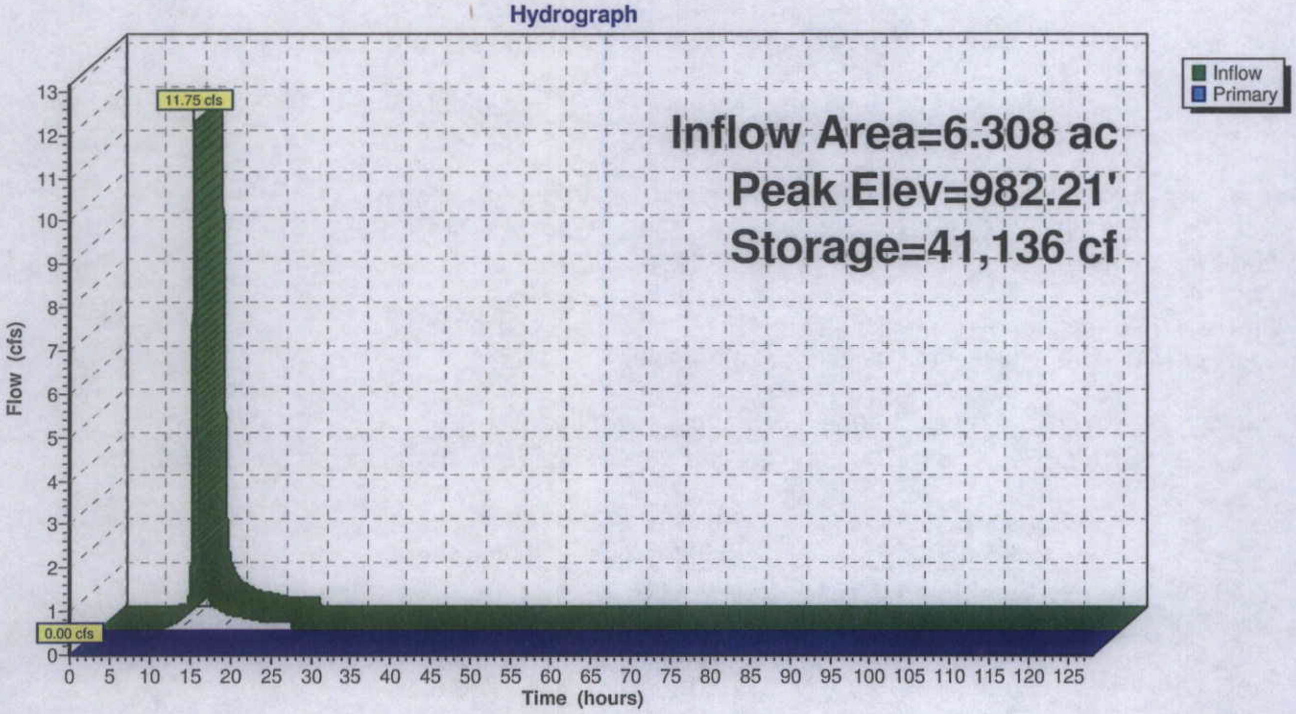
Volume	Invert	Avail.Storage	Storage Description
#1	979.99'	362,790 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
979.99	15,521	0.0	0	0
980.00	15,521	100.0	155	155
981.00	18,219	100.0	16,870	17,025
982.00	20,989	100.0	19,604	36,629
983.00	23,830	100.0	22,410	59,039
984.00	26,744	100.0	25,287	84,326
985.00	29,730	100.0	28,237	112,563
986.00	40,204	100.0	34,967	147,530
987.00	43,493	100.0	41,849	189,378
988.00	46,840	100.0	45,167	234,545
989.00	50,243	100.0	48,542	283,086
990.00	53,703	100.0	51,973	335,059
990.50	57,219	100.0	27,731	362,790

Device	Routing	Invert	Outlet Devices
#1	Primary	990.50'	**150.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=979.99' TW=0.00' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond P-S: South Basin

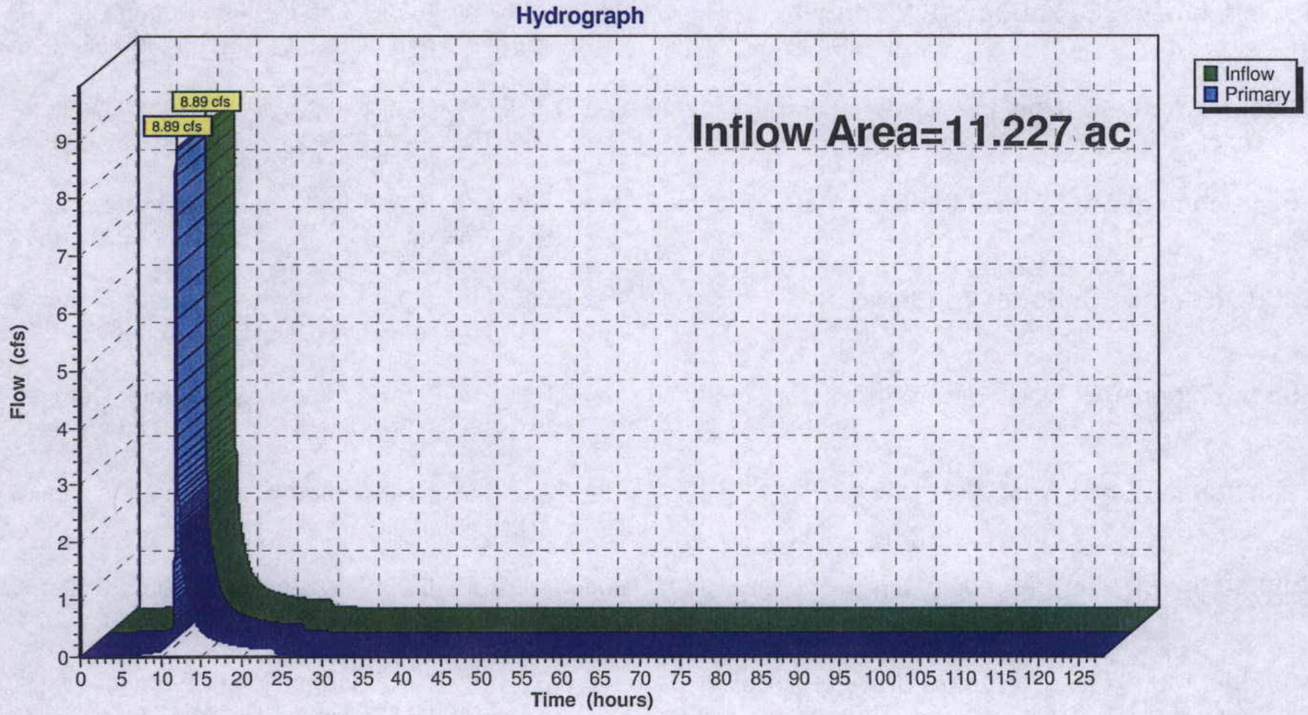


Summary for Link PROP: Total

Inflow Area =	11.227 ac, 12.41% Impervious,	Inflow Depth = 0.76"	for 2-yr event
Inflow =	8.89 cfs @ 12.02 hrs, Volume=	0.710 af	
Primary =	8.89 cfs @ 12.02 hrs, Volume=	0.710 af, Atten= 0%, Lag= 0.0 min	

Primary outflow = Inflow, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs

Link PROP: Total



Time span=0.00-128.00 hrs, dt=0.01 hrs, 12801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Northeast Windrow Runoff Area=25,745 sf 0.00% Impervious Runoff Depth=2.87"
Tc=10.0 min CN=88 Runoff=2.54 cfs 0.141 af

Subcatchment 2S: East Windrow Runoff Area=19,347 sf 0.00% Impervious Runoff Depth=3.16"
Tc=10.0 min CN=91 Runoff=2.06 cfs 0.117 af

Subcatchment 3S: Southeast Windrow Runoff Area=19,357 sf 0.00% Impervious Runoff Depth=3.16"
Tc=10.0 min CN=91 Runoff=2.06 cfs 0.117 af

Subcatchment 4S: North Windrow Runoff Area=33,157 sf 0.00% Impervious Runoff Depth=3.06"
Tc=10.0 min CN=90 Runoff=3.45 cfs 0.194 af

Subcatchment 5S: Central Windrow Runoff Area=19,622 sf 0.00% Impervious Runoff Depth=3.16"
Tc=10.0 min CN=91 Runoff=2.09 cfs 0.119 af

Subcatchment 6S: South Windrow Runoff Area=19,624 sf 0.00% Impervious Runoff Depth=3.16"
Tc=10.0 min CN=91 Runoff=2.09 cfs 0.119 af

Subcatchment 7S: Northwest Windrow Runoff Area=36,257 sf 0.00% Impervious Runoff Depth=2.87"
Tc=10.0 min CN=88 Runoff=3.58 cfs 0.199 af

Subcatchment 8S: West Windrow Runoff Area=21,248 sf 0.00% Impervious Runoff Depth=3.06"
Tc=10.0 min CN=90 Runoff=2.21 cfs 0.124 af

Subcatchment 9S: Southwest Windrow Runoff Area=21,244 sf 0.00% Impervious Runoff Depth=3.06"
Tc=10.0 min CN=90 Runoff=2.21 cfs 0.124 af

Subcatchment 11S: Pond and Storage Area Runoff Area=67,737 sf 10.60% Impervious Runoff Depth=3.06"
Tc=10.0 min CN=90 Runoff=7.04 cfs 0.397 af

Subcatchment 12S: Pond Area Runoff Area=59,175 sf 26.23% Impervious Runoff Depth=2.59"
Tc=10.0 min CN=85 Runoff=5.36 cfs 0.293 af

Subcatchment DE-P: Drive Entrance Runoff Area=18,545 sf 0.00% Impervious Runoff Depth=3.16"
Tc=10.0 min CN=91 Runoff=1.97 cfs 0.112 af

Subcatchment PRM: Perimeter Runoff Runoff Area=90,004 sf 0.00% Impervious Runoff Depth=2.17"
Flow Length=60' Tc=10.0 min CN=80 Runoff=6.89 cfs 0.373 af

Subcatchment ROOF: Roof Runoff Area=37,980 sf 100.00% Impervious Runoff Depth=3.91"
Tc=10.0 min CN=98 Runoff=4.53 cfs 0.284 af

Pond 1P: CB NE Peak Elev=990.65' Storage=1,193 cf Inflow=2.54 cfs 0.141 af
Primary=1.36 cfs 0.141 af Secondary=0.00 cfs 0.000 af Outflow=1.36 cfs 0.141 af

Pond 2P: CB E Peak Elev=990.57' Storage=828 cf Inflow=3.17 cfs 0.258 af
Primary=2.61 cfs 0.258 af Tertiary=0.00 cfs 0.000 af Outflow=2.61 cfs 0.258 af

Pond 3P: CB SE Peak Elev=990.52' Storage=587 cf Inflow=4.32 cfs 0.375 af
Primary=4.09 cfs 0.375 af Tertiary=0.00 cfs 0.000 af Outflow=4.09 cfs 0.375 af

Pond 4P: CB N Peak Elev=990.73' Storage=1,674 cf Inflow=3.45 cfs 0.194 af
Primary=1.64 cfs 0.194 af Secondary=0.00 cfs 0.000 af Outflow=1.64 cfs 0.194 af

Pond 5P: CB Central Peak Elev=990.62' Storage=1,017 cf Inflow=3.52 cfs 0.313 af
Primary=2.84 cfs 0.313 af Tertiary=0.00 cfs 0.000 af Outflow=2.84 cfs 0.313 af

Pond 6P: CB S Peak Elev=990.52' Storage=619 cf Inflow=4.49 cfs 0.432 af
Primary=4.26 cfs 0.432 af Tertiary=0.00 cfs 0.000 af Outflow=4.26 cfs 0.432 af

Pond 7P: CB NW Peak Elev=990.74' Storage=1,741 cf Inflow=3.58 cfs 0.199 af
Primary=1.73 cfs 0.199 af Secondary=0.00 cfs 0.000 af Outflow=1.73 cfs 0.199 af

Pond 8P: CB W Peak Elev=990.62' Storage=1,019 cf Inflow=3.69 cfs 0.323 af
Primary=3.01 cfs 0.323 af Tertiary=0.00 cfs 0.000 af Outflow=3.01 cfs 0.323 af

Pond 9P: CB SW Peak Elev=990.54' Storage=671 cf Inflow=4.78 cfs 0.448 af
Primary=4.53 cfs 0.448 af Tertiary=0.00 cfs 0.000 af Outflow=4.53 cfs 0.448 af

Pond 10P: CB Pump Peak Elev=983.35' Inflow=4.26 cfs 0.432 af
Primary=4.26 cfs 0.432 af Secondary=0.00 cfs 0.000 af Outflow=4.26 cfs 0.432 af

Pond P-N: North Basin Peak Elev=988.19' Storage=7,632 cf Inflow=7.04 cfs 0.397 af
Primary=1.23 cfs 0.395 af Secondary=0.00 cfs 0.000 af Outflow=1.23 cfs 0.395 af

Pond P-S: South Basin Peak Elev=983.35' Storage=67,439 cf Inflow=17.58 cfs 1.548 af
Outflow=0.00 cfs 0.000 af

Link PROP: Total Inflow=14.40 cfs 1.165 af
Primary=14.40 cfs 1.165 af

Total Runoff Area = 11.227 ac Runoff Volume = 2.715 af Average Runoff Depth = 2.90"
87.59% Pervious = 9.834 ac 12.41% Impervious = 1.393 ac

Summary for Subcatchment 1S: Northeast Windrow

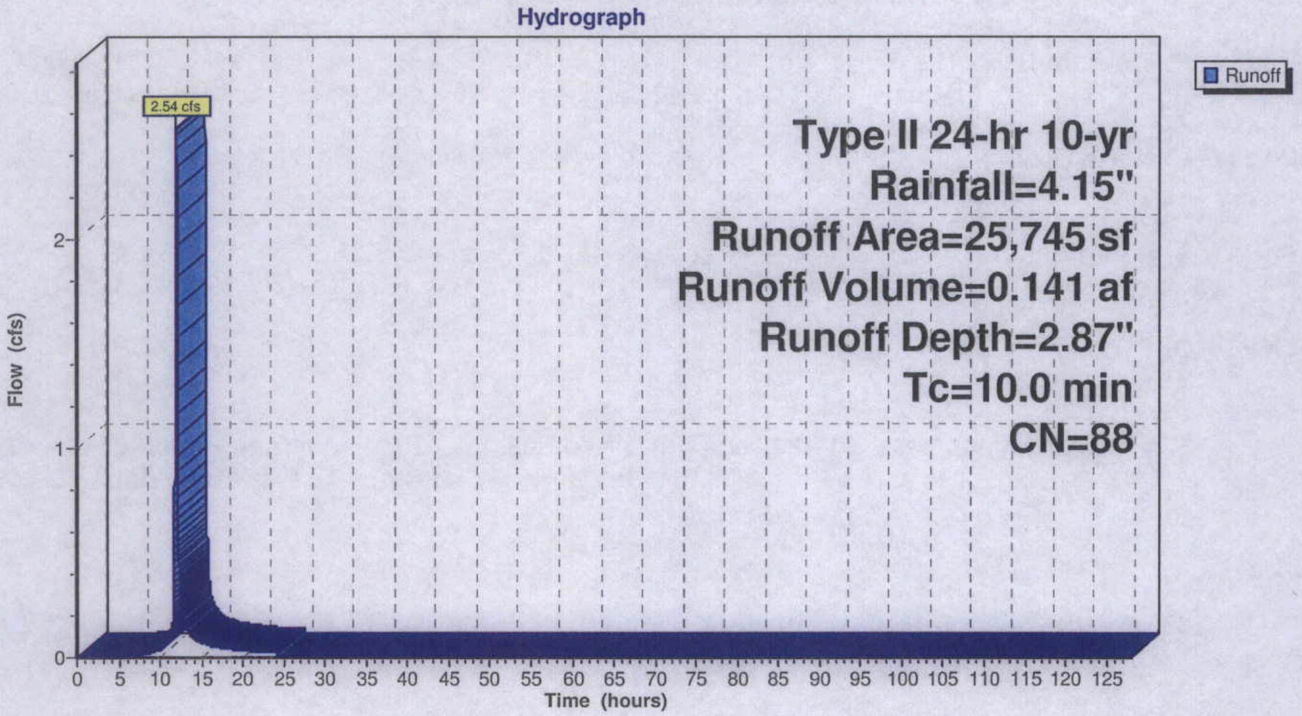
Runoff = 2.54 cfs @ 12.01 hrs, Volume= 0.141 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

	Area (sf)	CN	Description
*	19,012	91	Gravel pads, HSG D
	6,733	80	>75% Grass cover, Good, HSG D
	25,745	88	Weighted Average
	25,745		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: Northeast Windrow



Summary for Subcatchment 2S: East Windrow

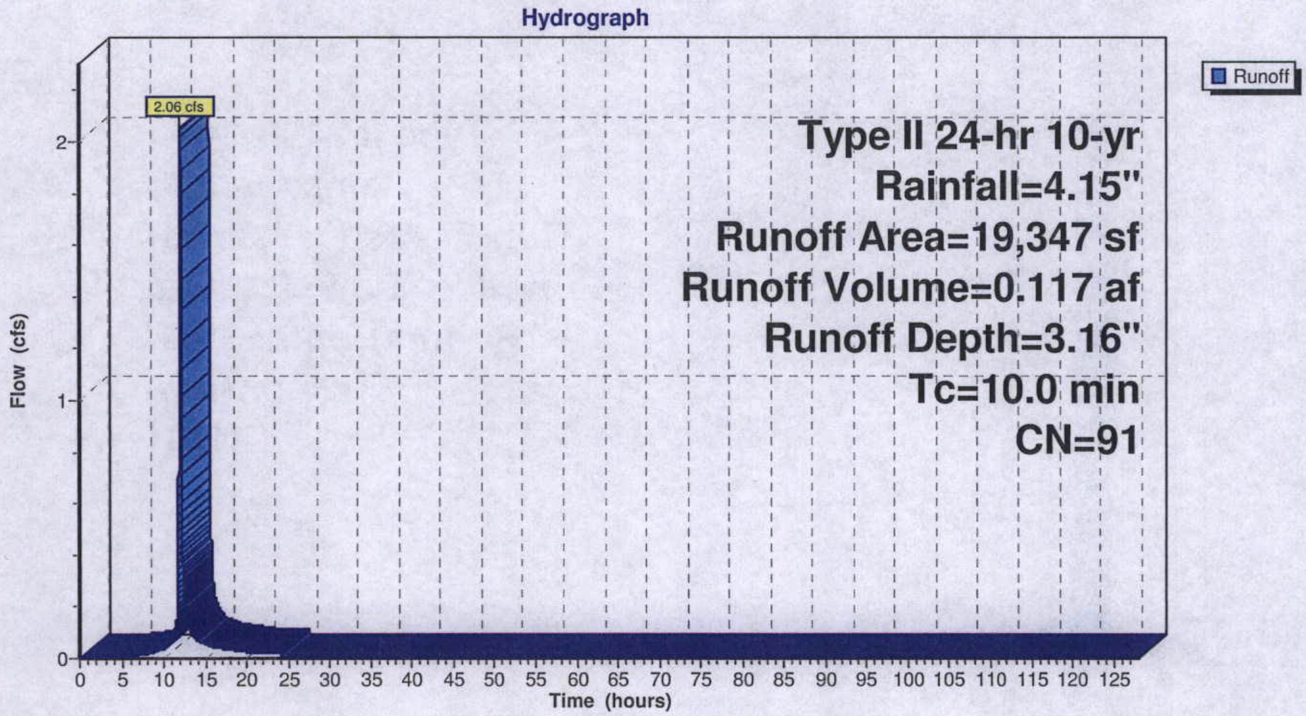
Runoff = 2.06 cfs @ 12.01 hrs, Volume= 0.117 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

	Area (sf)	CN	Description
*	19,347	91	Gravel pads, HSG D
	19,347		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2S: East Windrow



Summary for Subcatchment 3S: Southeast Windrow

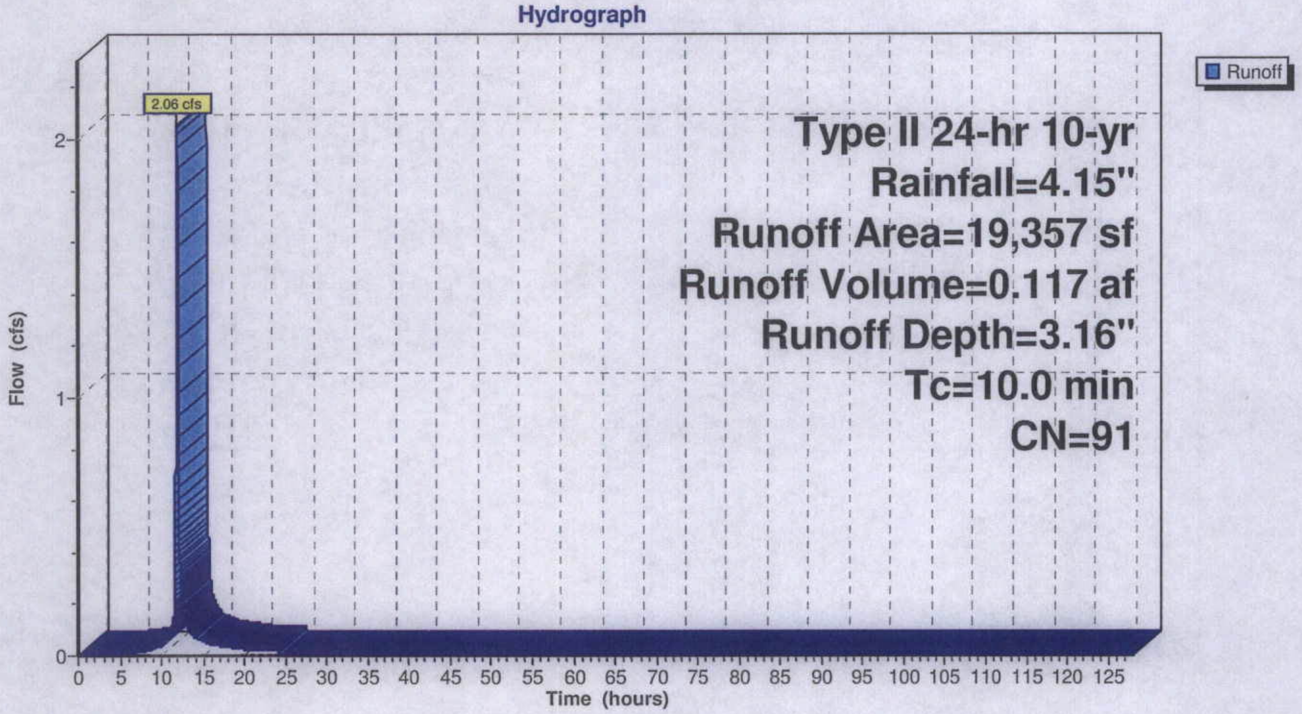
Runoff = 2.06 cfs @ 12.01 hrs, Volume= 0.117 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

	Area (sf)	CN	Description
*	19,357	91	Gravel paths, HSG D
	19,357		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 3S: Southeast Windrow



Summary for Subcatchment 4S: North Windrow

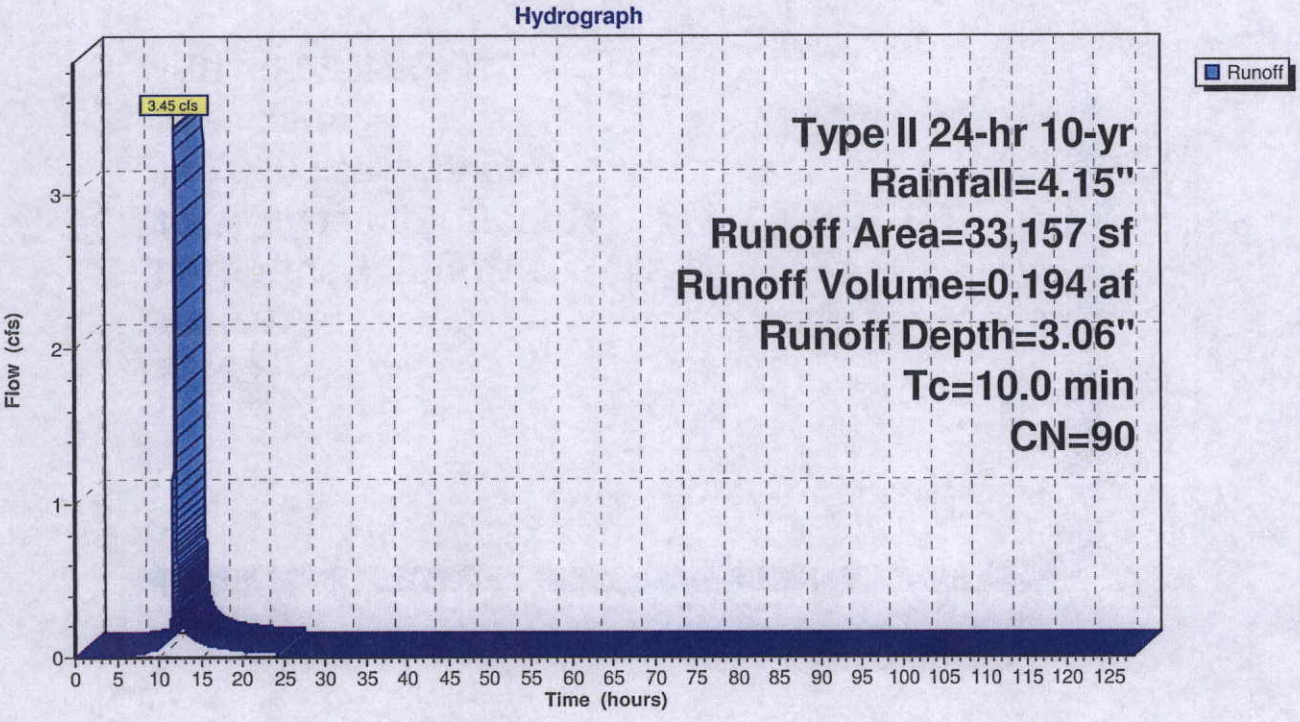
Runoff = 3.45 cfs @ 12.01 hrs, Volume= 0.194 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

	Area (sf)	CN	Description
*	29,932	91	Gravel paths, HSG D
	3,225	80	>75% Grass cover, Good, HSG D
	33,157	90	Weighted Average
	33,157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 4S: North Windrow



Summary for Subcatchment 5S: Central Windrow

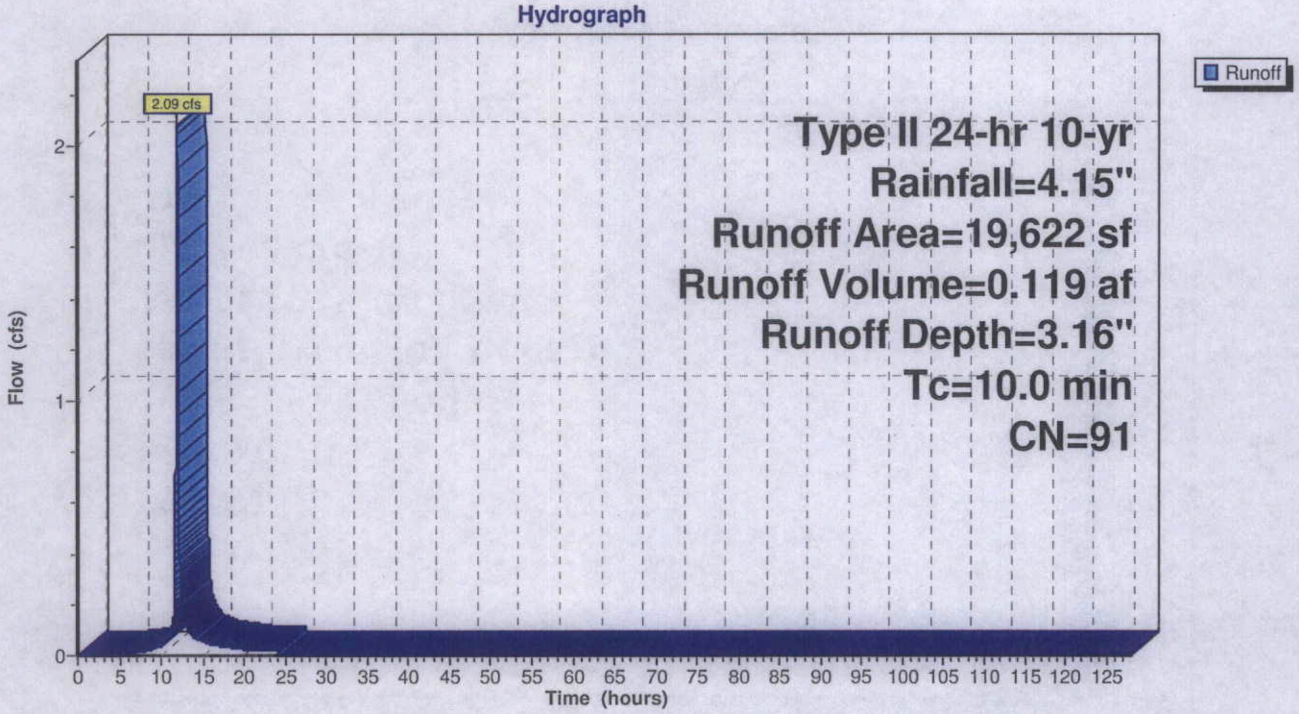
Runoff = 2.09 cfs @ 12.01 hrs, Volume= 0.119 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

	Area (sf)	CN	Description
*	19,622	91	Gravel paths, HSG D
	19,622		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 5S: Central Windrow



Summary for Subcatchment 6S: South Windrow

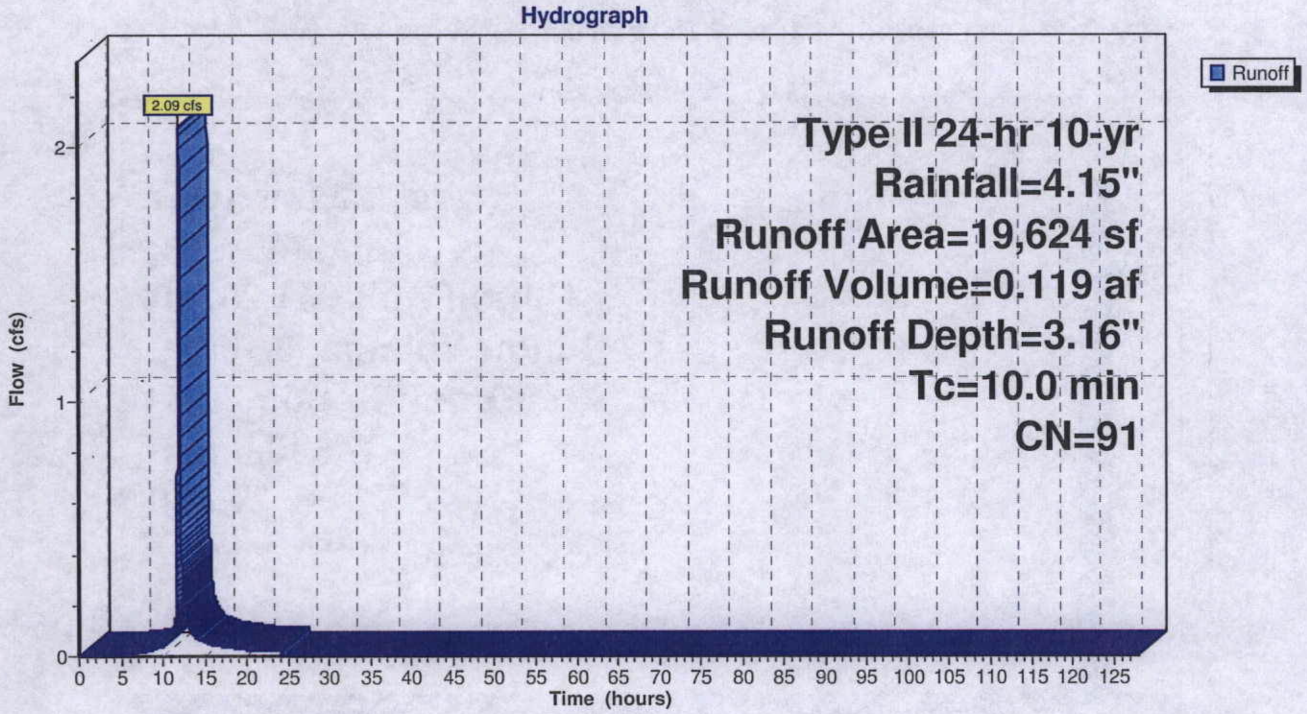
Runoff = 2.09 cfs @ 12.01 hrs, Volume= 0.119 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

	Area (sf)	CN	Description
*	19,624	91	Gravel paths, HSG D
	19,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 6S: South Windrow



Summary for Subcatchment 7S: Northwest Windrow

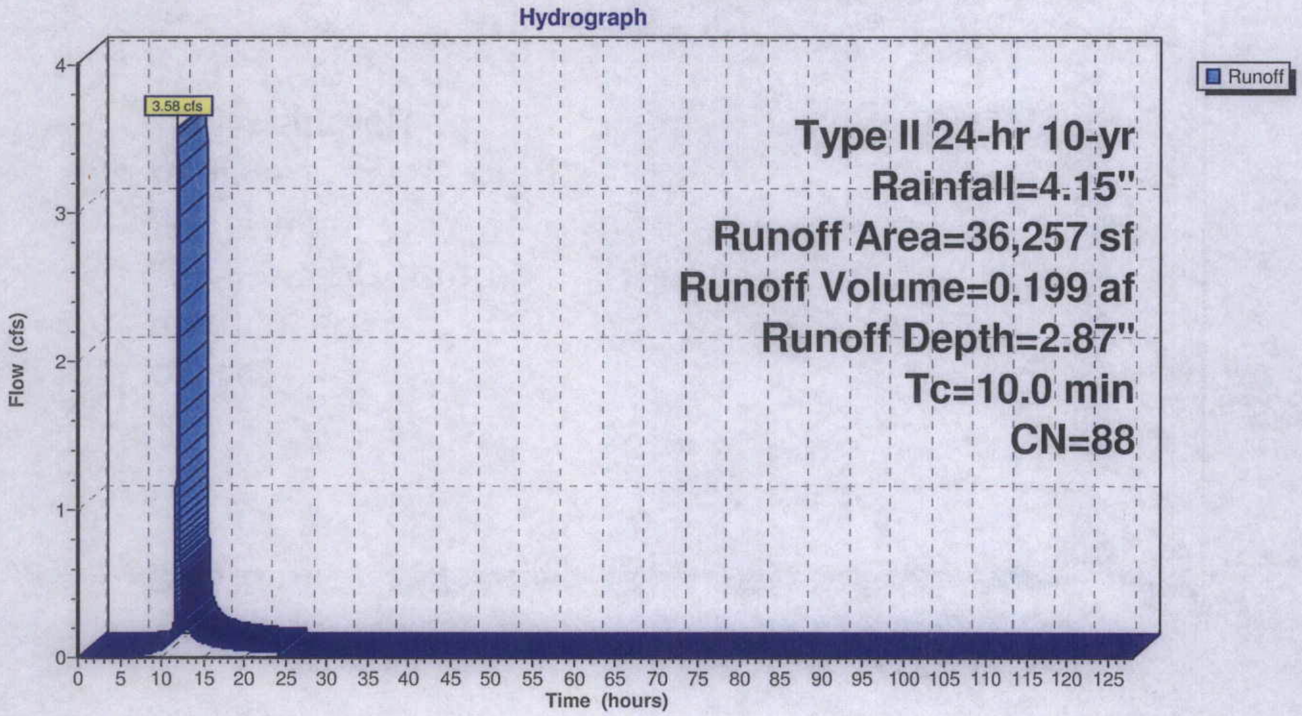
Runoff = 3.58 cfs @ 12.01 hrs, Volume= 0.199 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

	Area (sf)	CN	Description
*	27,075	91	Gravel paths, HSG D
	9,182	80	>75% Grass cover, Good, HSG D
	36,257	88	Weighted Average
	36,257		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 7S: Northwest Windrow



Summary for Subcatchment 8S: West Windrow

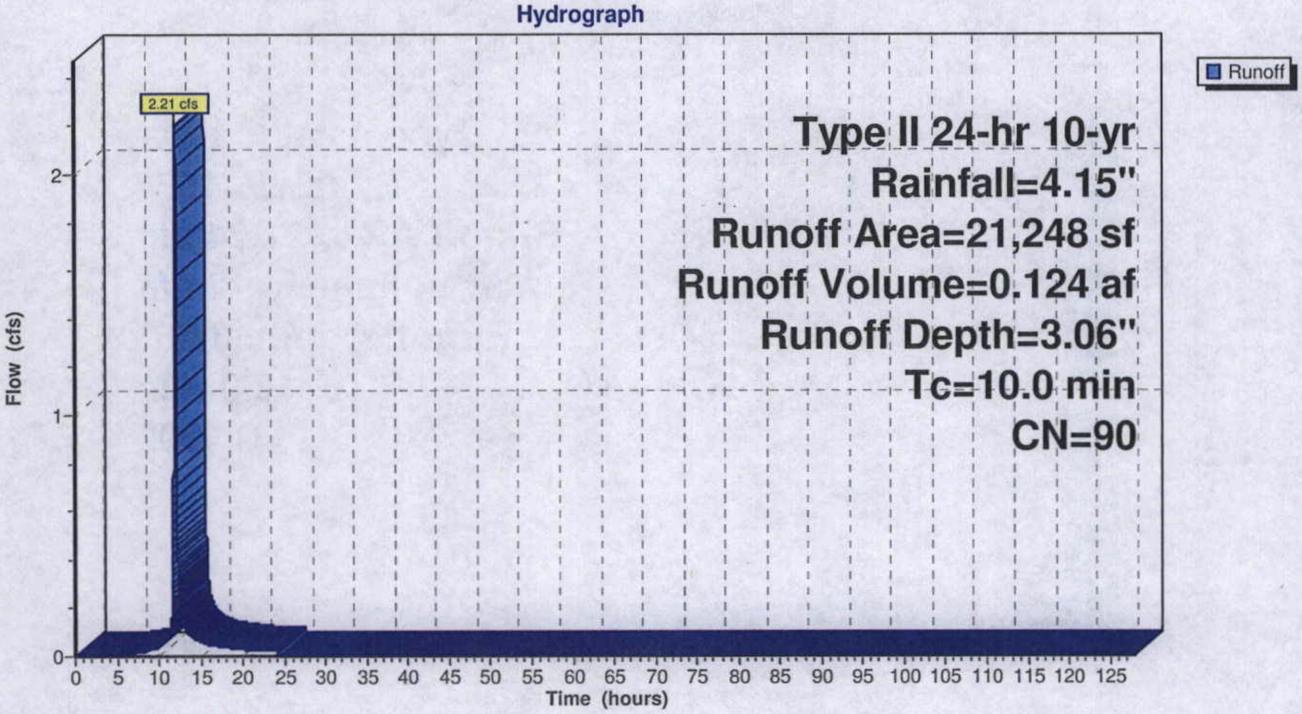
Runoff = 2.21 cfs @ 12.01 hrs, Volume= 0.124 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

Area (sf)	CN	Description
19,338	91	Gravel roads, HSG D
1,910	80	>75% Grass cover, Good, HSG D
21,248	90	Weighted Average
21,248		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 8S: West Windrow



Summary for Subcatchment 9S: Southwest Windrow

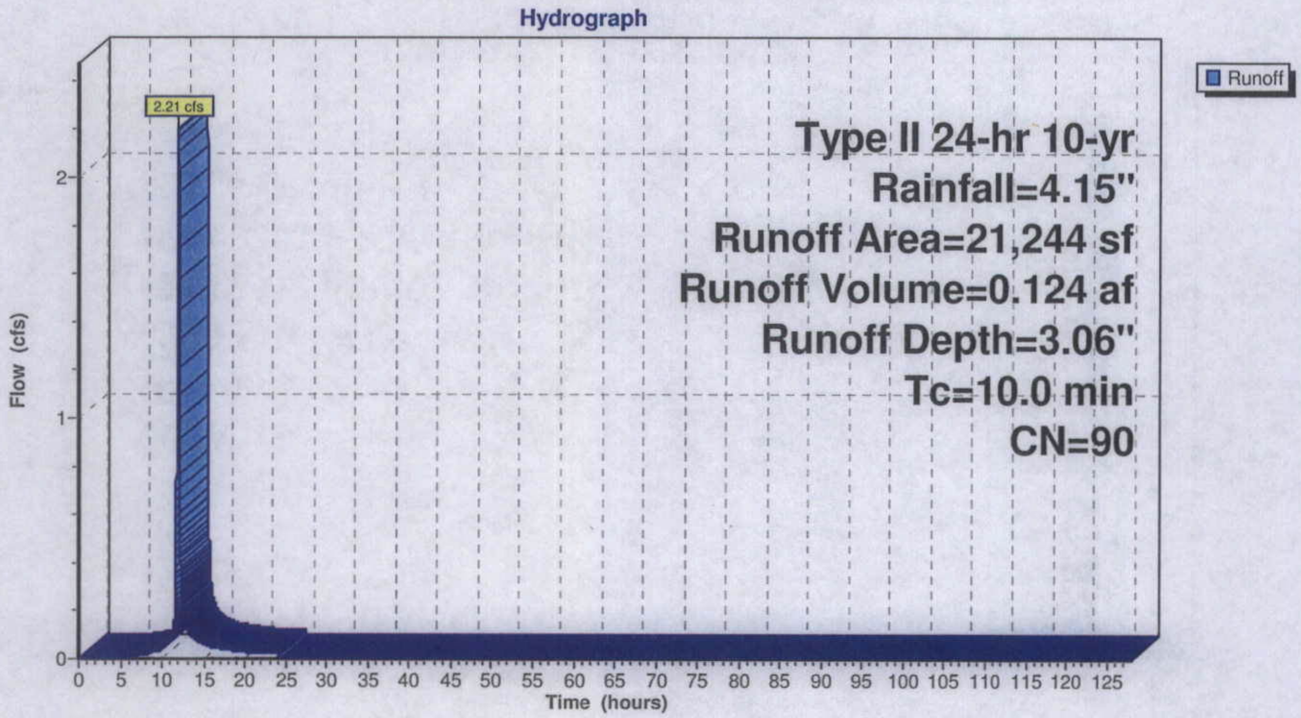
Runoff = 2.21 cfs @ 12.01 hrs, Volume= 0.124 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

Area (sf)	CN	Description
19,289	91	Gravel roads, HSG D
1,955	80	>75% Grass cover, Good, HSG D
21,244	90	Weighted Average
21,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 9S: Southwest Windrow



Summary for Subcatchment 11S: Pond and Storage Area

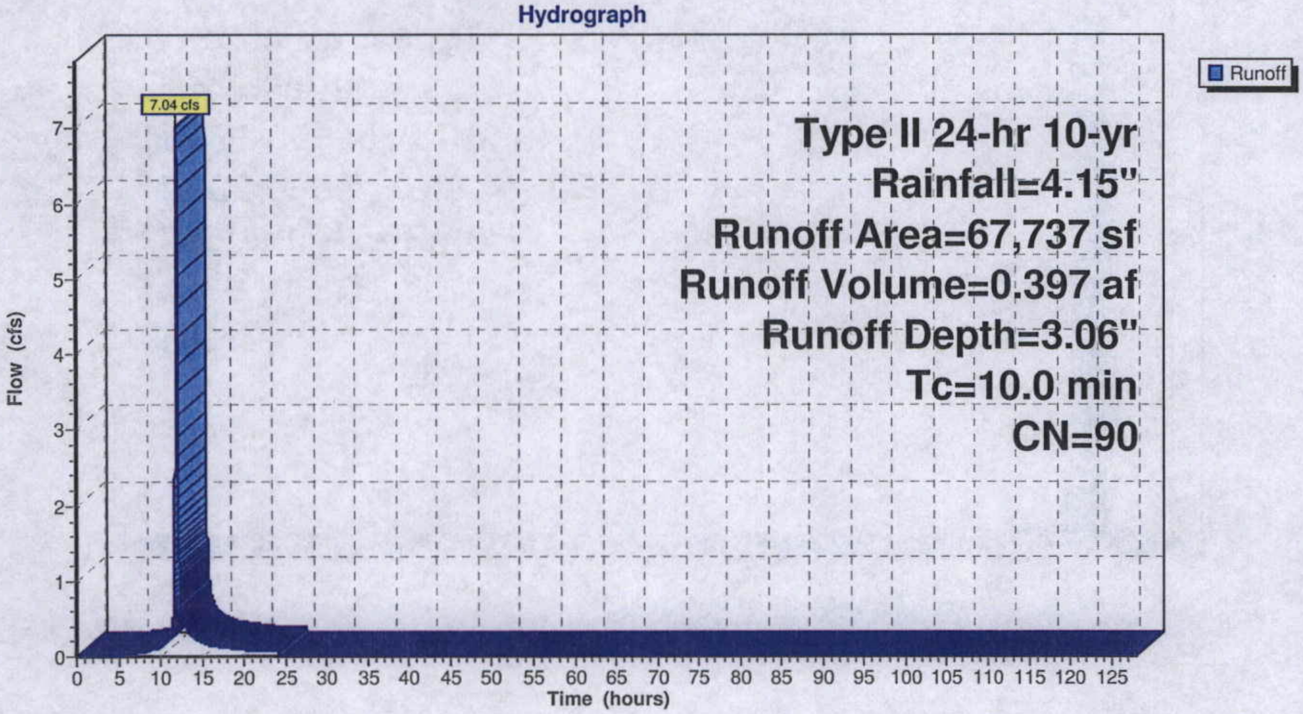
Runoff = 7.04 cfs @ 12.01 hrs, Volume= 0.397 af, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

Area (sf)	CN	Description
11,601	80	>75% Grass cover, Good, HSG D
48,954	91	Gravel roads, HSG D
1,639	98	Unconnected pavement, HSG D
5,543	98	Water Surface, HSG D
67,737	90	Weighted Average
60,555		89.40% Pervious Area
7,182		10.60% Impervious Area
1,639		22.82% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Pond and Storage Area



Summary for Subcatchment 12S: Pond Area

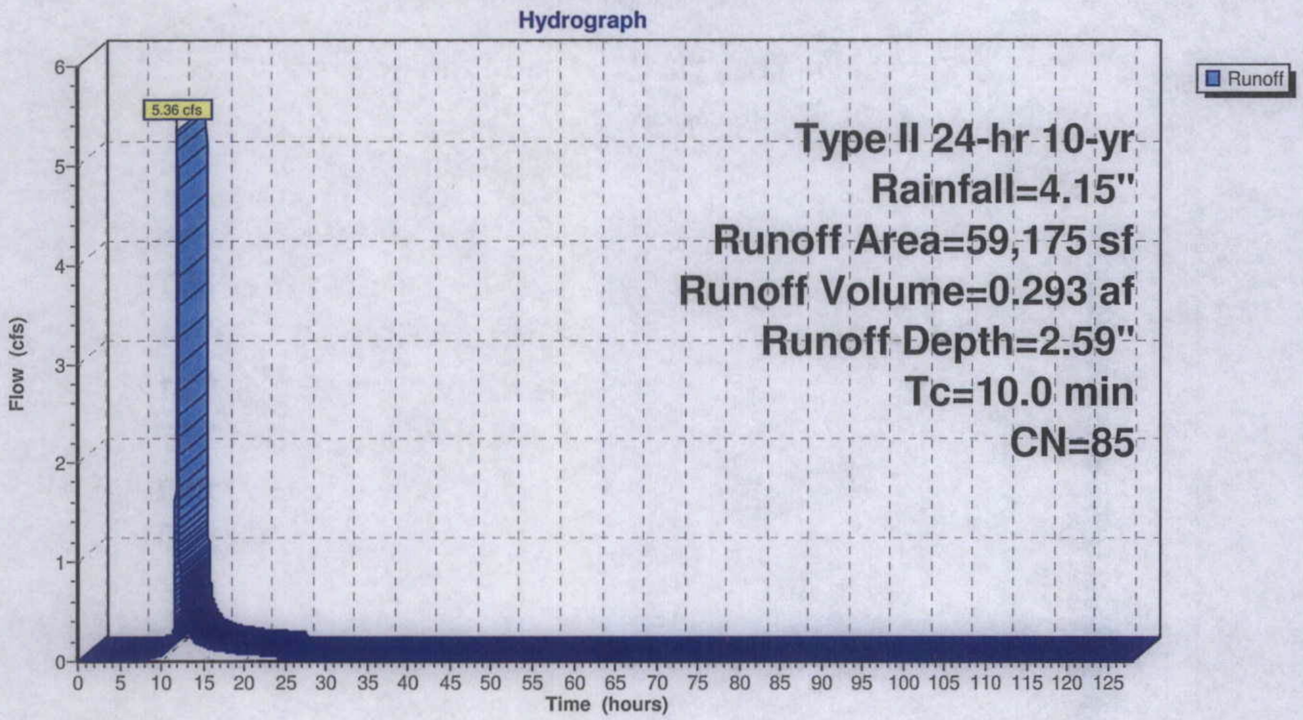
Runoff = 5.36 cfs @ 12.01 hrs, Volume= 0.293 af, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

Area (sf)	CN	Description
43,654	80	>75% Grass cover, Good, HSG D
15,521	98	Water Surface, HSG D
59,175	85	Weighted Average
43,654		73.77% Pervious Area
15,521		26.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 12S: Pond Area



Summary for Subcatchment DE-P: Drive Entrance

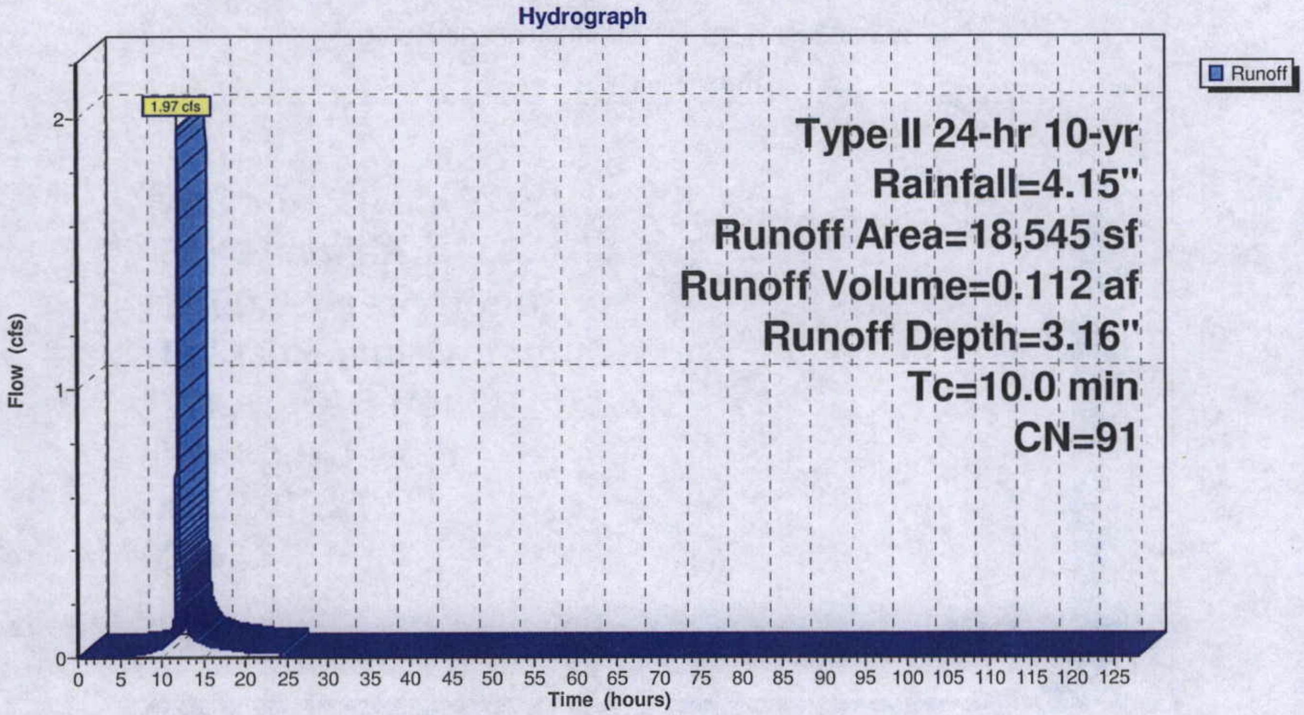
Runoff = 1.97 cfs @ 12.01 hrs, Volume= 0.112 af, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

Area (sf)	CN	Description
18,545	91	Gravel roads, HSG D
18,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment DE-P: Drive Entrance



Summary for Subcatchment PRM: Perimeter Runoff

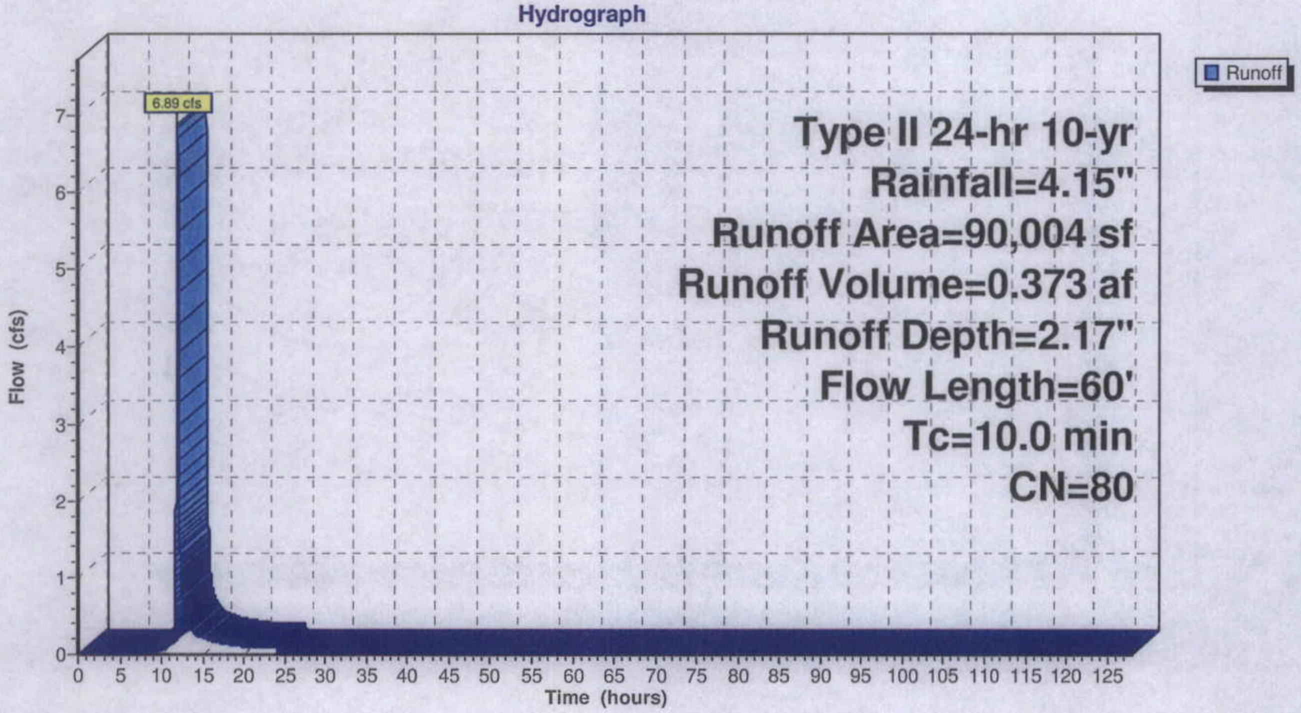
Runoff = 6.89 cfs @ 12.02 hrs, Volume= 0.373 af, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

Area (sf)	CN	Description
87,582	80	>75% Grass cover, Good, HSG D
2,422	91	Gravel roads, HSG D
90,004	80	Weighted Average
90,004		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	60		0.10		**Direct Entry,**

Subcatchment PRM: Perimeter Runoff



Summary for Subcatchment ROOF: Roof

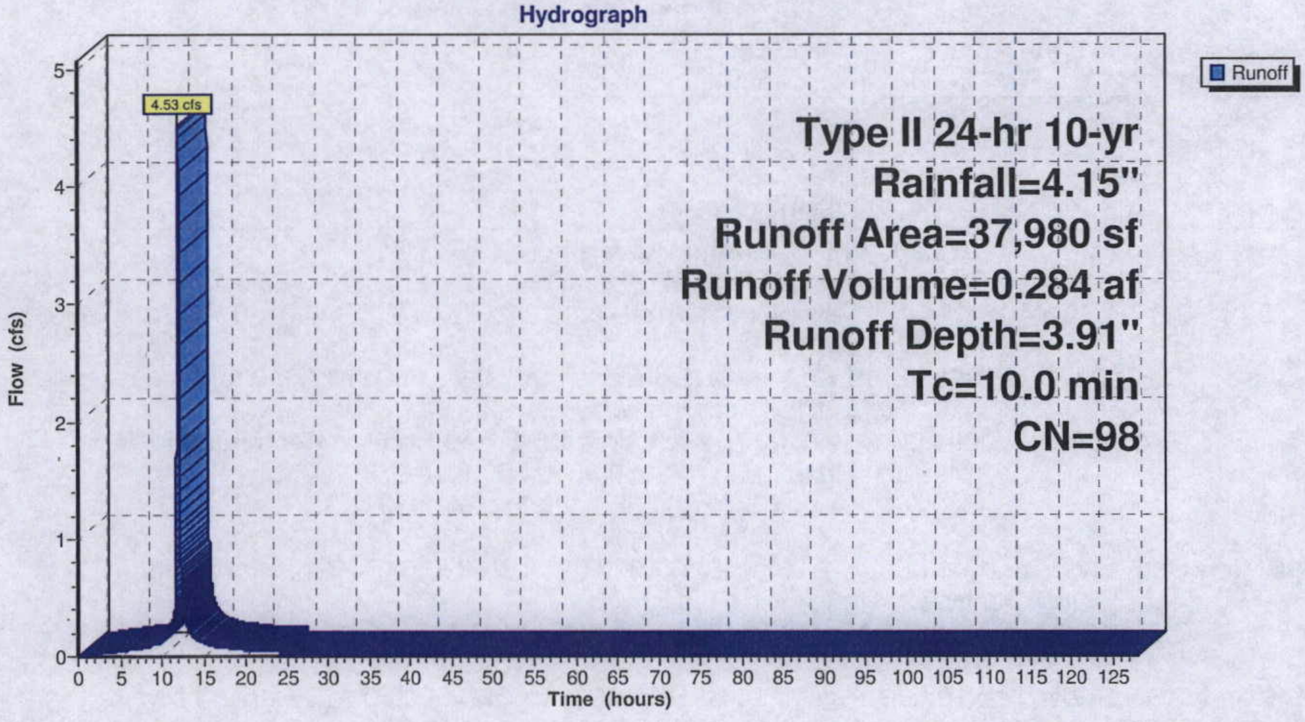
Runoff = 4.53 cfs @ 12.01 hrs, Volume= 0.284 af, Depth= 3.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.15"

	Area (sf)	CN	Description
*	37,980	98	Roof
	37,980		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment ROOF: Roof



Summary for Pond 1P: CB NE

Inflow Area = 0.591 ac, 0.00% Impervious, Inflow Depth = 2.87" for 10-yr event
Inflow = 2.54 cfs @ 12.01 hrs, Volume= 0.141 af
Outflow = 1.36 cfs @ 12.22 hrs, Volume= 0.141 af, Atten= 46%, Lag= 12.5 min
Primary = 1.36 cfs @ 12.22 hrs, Volume= 0.141 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.65' @ 12.13 hrs Surf.Area= 5,307 sf Storage= 1,193 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 7.0 min calculated for 0.141 af (100% of inflow)
Center-of-Mass det. time= 7.0 min (812.4 - 805.4)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

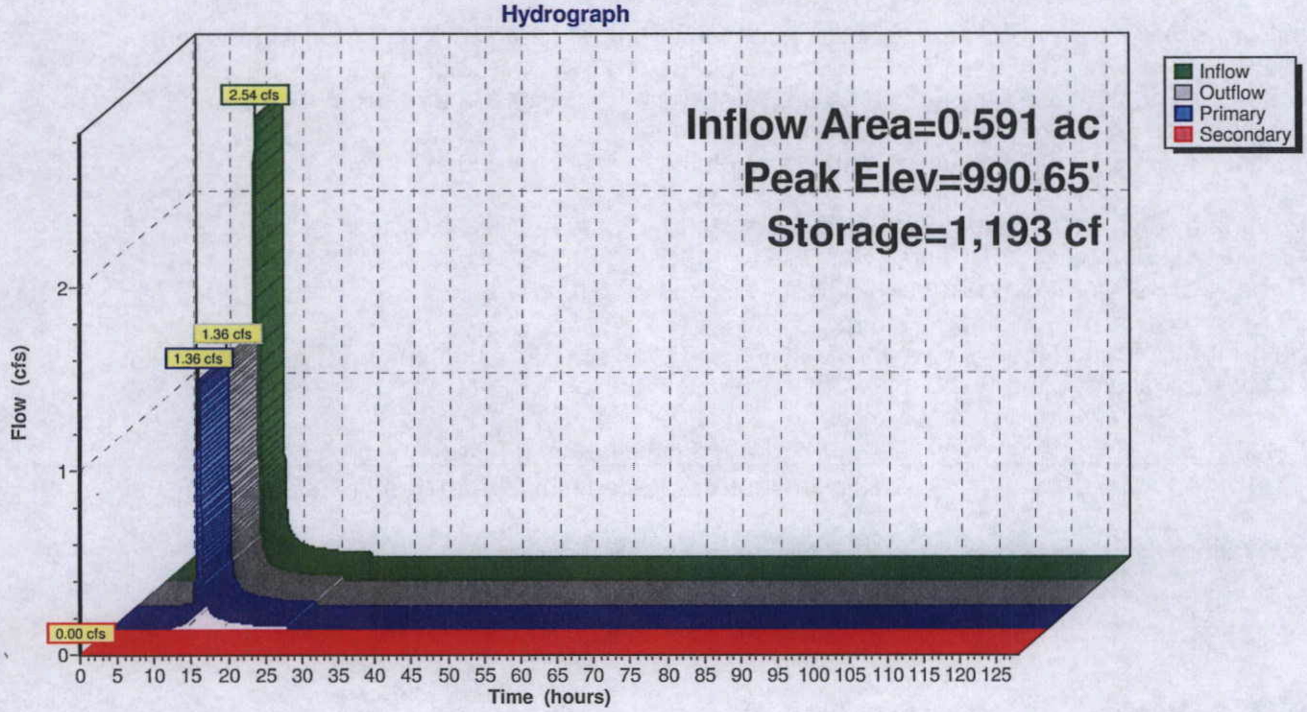
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.41 cfs @ 12.22 hrs HW=990.62' TW=990.53' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.41 cfs @ 1.15 fps)
  └─**2=Orifice/Grate** (Passes 1.41 cfs of 3.98 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: CB NE


Hydrograph
Inflow
Outflow
Primary
Secondary
2.54 cfs
1.36 cfs
1.36 cfs
0.00 cfs
Inflow Area=0.591 ac
Peak Elev=990.65'
Storage=1,193 cf
Flow (cfs)
0
1
2
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 2P: CB E

Inflow Area = 1.035 ac, 0.00% Impervious, Inflow Depth = 2.99" for 10-yr event
Inflow = 3.17 cfs @ 12.02 hrs, Volume= 0.258 af
Outflow = 2.61 cfs @ 12.14 hrs, Volume= 0.258 af, Atten= 18%, Lag= 7.0 min
Primary = 2.61 cfs @ 12.14 hrs, Volume= 0.258 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.57' @ 12.10 hrs Surf.Area= 4,422 sf Storage= 828 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 3.0 min calculated for 0.258 af (100% of inflow)
Center-of-Mass det. time= 3.0 min (806.9 - 803.9)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

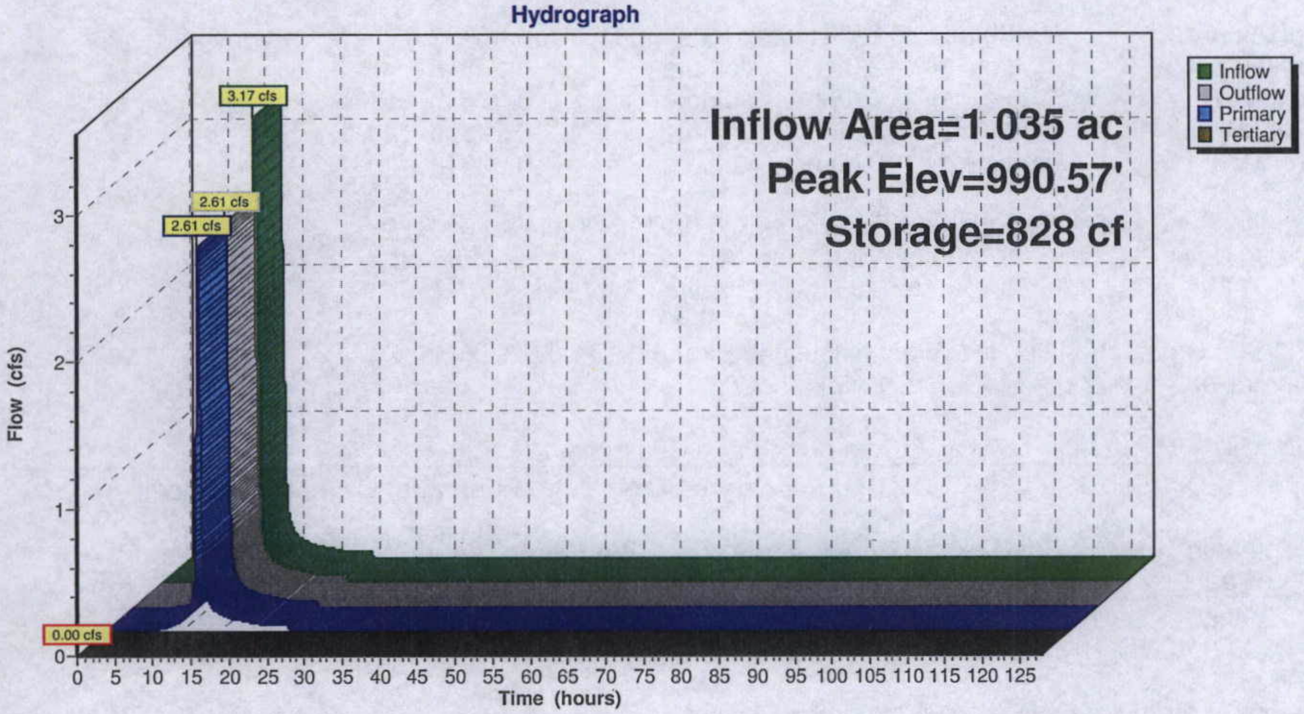
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.67 cfs @ 12.14 hrs HW=990.57' TW=990.50' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 2.67 cfs @ 1.11 fps)
  └─**2=Orifice/Grate** (Passes 2.67 cfs of 3.04 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: CB E


Hydrograph
3.17 cfs
2.61 cfs
2.61 cfs
0.00 cfs
Inflow Area=1.035 ac
Peak Elev=990.57'
Storage=828 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
0
1
2
3
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 3P: CB SE

Inflow Area = 1.480 ac, 0.00% Impervious, Inflow Depth = 3.04" for 10-yr event
Inflow = 4.32 cfs @ 12.03 hrs, Volume= 0.375 af
Outflow = 4.09 cfs @ 12.08 hrs, Volume= 0.375 af, Atten= 5%, Lag= 2.8 min
Primary = 4.09 cfs @ 12.08 hrs, Volume= 0.375 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.52' @ 12.08 hrs Surf.Area= 3,721 sf Storage= 587 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.5 min calculated for 0.375 af (100% of inflow)
Center-of-Mass det. time= 1.5 min (804.2 - 802.7)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

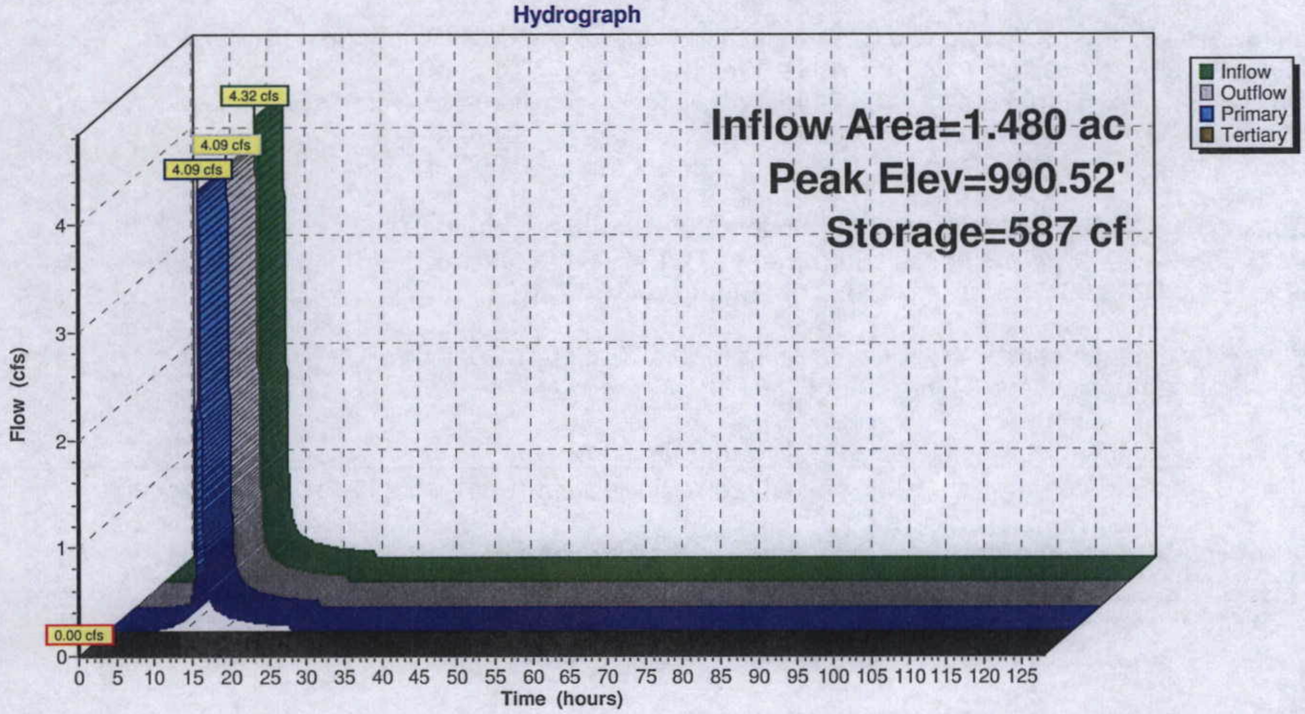
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 99.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.19' / 982.00' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.09 cfs @ 12.08 hrs HW=990.52' TW=981.34' (Dynamic Tailwater)
1=Culvert (Passes 4.09 cfs of 29.11 cfs potential flow)
2=Orifice/Grate (Weir Controls 4.09 cfs @ 1.84 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=979.99' (Dynamic Tailwater)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 3P: CB SE


Hydrograph
4.32 cfs
4.09 cfs
4.09 cfs
0.00 cfs
Inflow Area=1.480 ac
Peak Elev=990.52'
Storage=587 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 4P: CB N

Inflow Area = 0.761 ac, 0.00% Impervious, Inflow Depth = 3.06" for 10-yr event
Inflow = 3.45 cfs @ 12.01 hrs, Volume= 0.194 af
Outflow = 1.64 cfs @ 12.22 hrs, Volume= 0.194 af, Atten= 52%, Lag= 12.2 min
Primary = 1.64 cfs @ 12.22 hrs, Volume= 0.194 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.73' @ 12.14 hrs Surf.Area= 6,287 sf Storage= 1,674 cf
Flood Elev= 990.95' Surf.Area= 8,853 sf Storage= 3,320 cf

Plug-Flow detention time= 7.4 min calculated for 0.194 af (100% of inflow)
Center-of-Mass det. time= 7.4 min (805.2 - 797.8)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

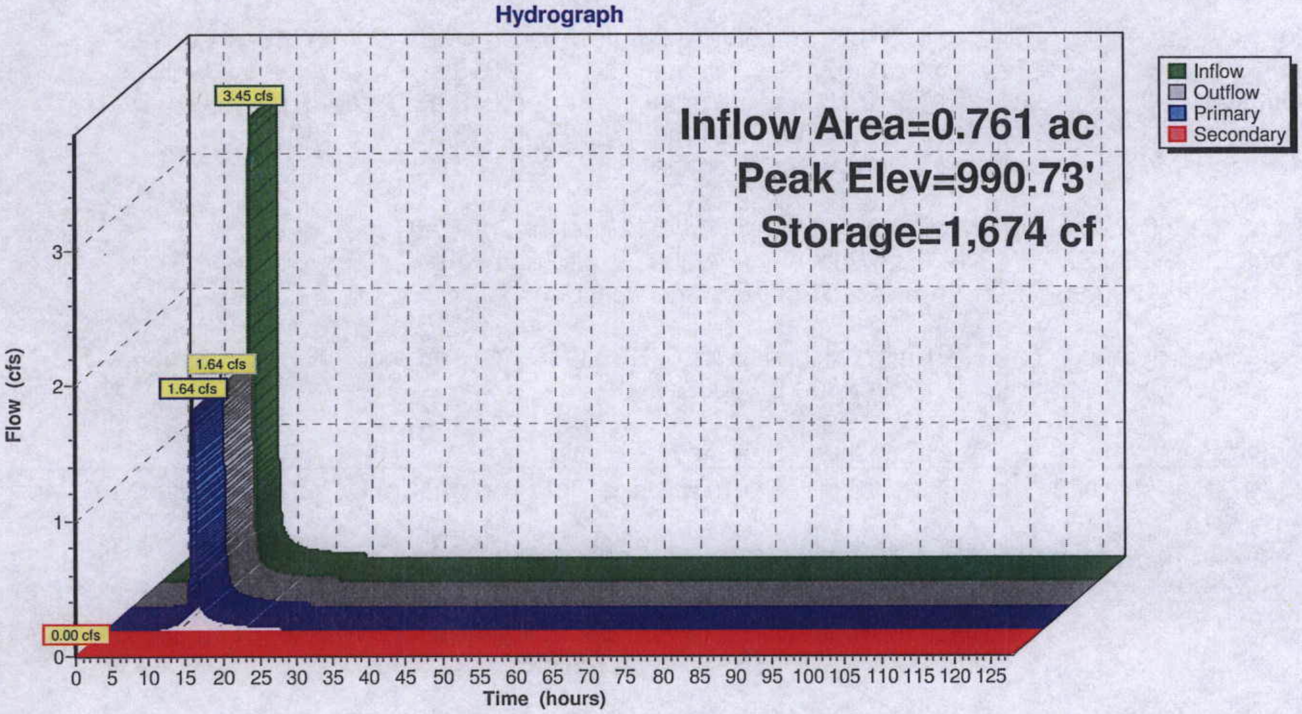
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,853	3,320	3,320

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.67 cfs @ 12.22 hrs HW=990.71' TW=990.58' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.67 cfs @ 1.36 fps)
  └─**2=Orifice/Grate** (Passes 1.67 cfs of 5.64 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: CB N


Hydrograph
3.45 cfs
1.64 cfs
1.64 cfs
0.00 cfs
Inflow Area=0.761 ac
Peak Elev=990.73'
Storage=1,674 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0
1
2
3
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 5P: CB Central

Inflow Area = 1.212 ac, 0.00% Impervious, Inflow Depth = 3.10" for 10-yr event
Inflow = 3.52 cfs @ 12.02 hrs, Volume= 0.313 af
Outflow = 2.84 cfs @ 12.16 hrs, Volume= 0.313 af, Atten= 19%, Lag= 8.1 min
Primary = 2.84 cfs @ 12.16 hrs, Volume= 0.313 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.62' @ 12.12 hrs Surf.Area= 4,900 sf Storage= 1,017 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 3.1 min calculated for 0.313 af (100% of inflow)
Center-of-Mass det. time= 3.1 min (803.9 - 800.8)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

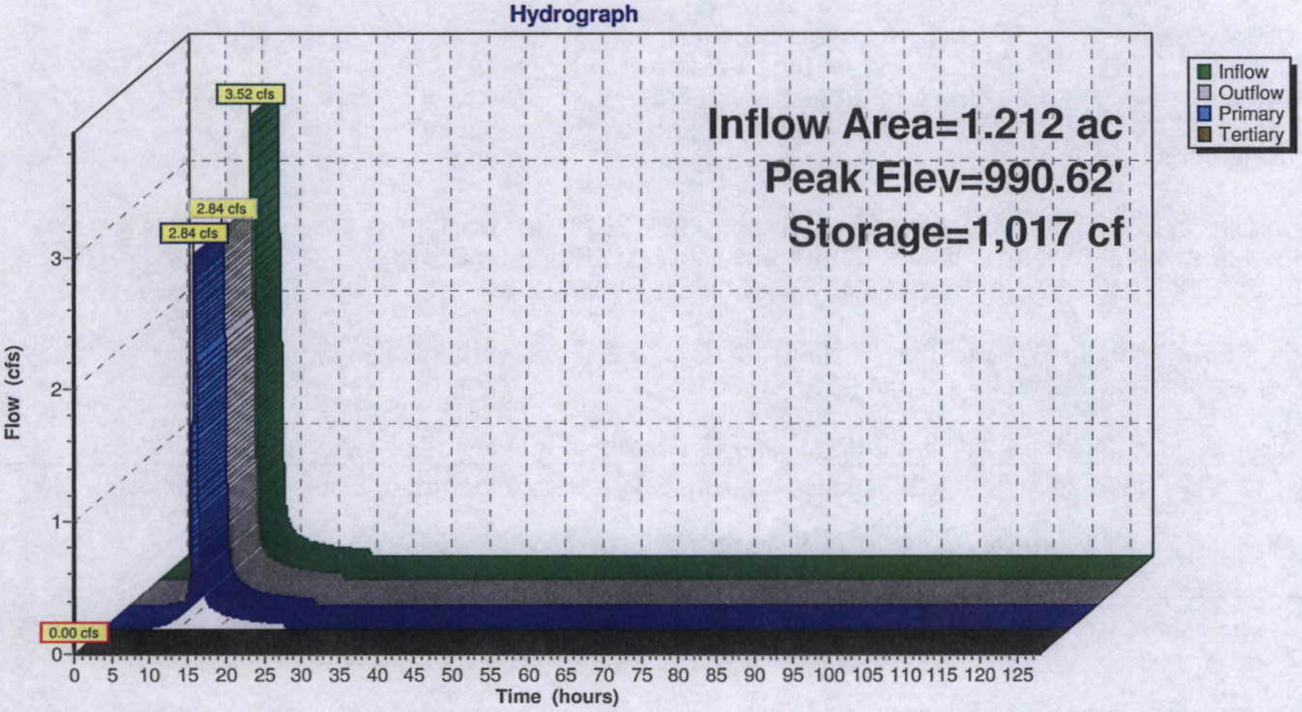
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.88 cfs @ 12.16 hrs HW=990.61' TW=990.51' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.88 cfs @ 1.20 fps)
↑—**2=Orifice/Grate** (Passes 2.88 cfs of 3.98 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: CB Central



Summary for Pond 6P: CB S

Inflow Area = 1.662 ac, 0.00% Impervious, Inflow Depth = 3.12" for 10-yr event
Inflow = 4.49 cfs @ 12.04 hrs, Volume= 0.432 af
Outflow = 4.26 cfs @ 12.08 hrs, Volume= 0.432 af, Atten= 5%, Lag= 2.9 min
Primary = 4.26 cfs @ 12.08 hrs, Volume= 0.432 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.52' @ 12.08 hrs Surf.Area= 3,822 sf Storage= 619 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.5 min calculated for 0.432 af (100% of inflow)
Center-of-Mass det. time= 1.5 min (802.6 - 801.1)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

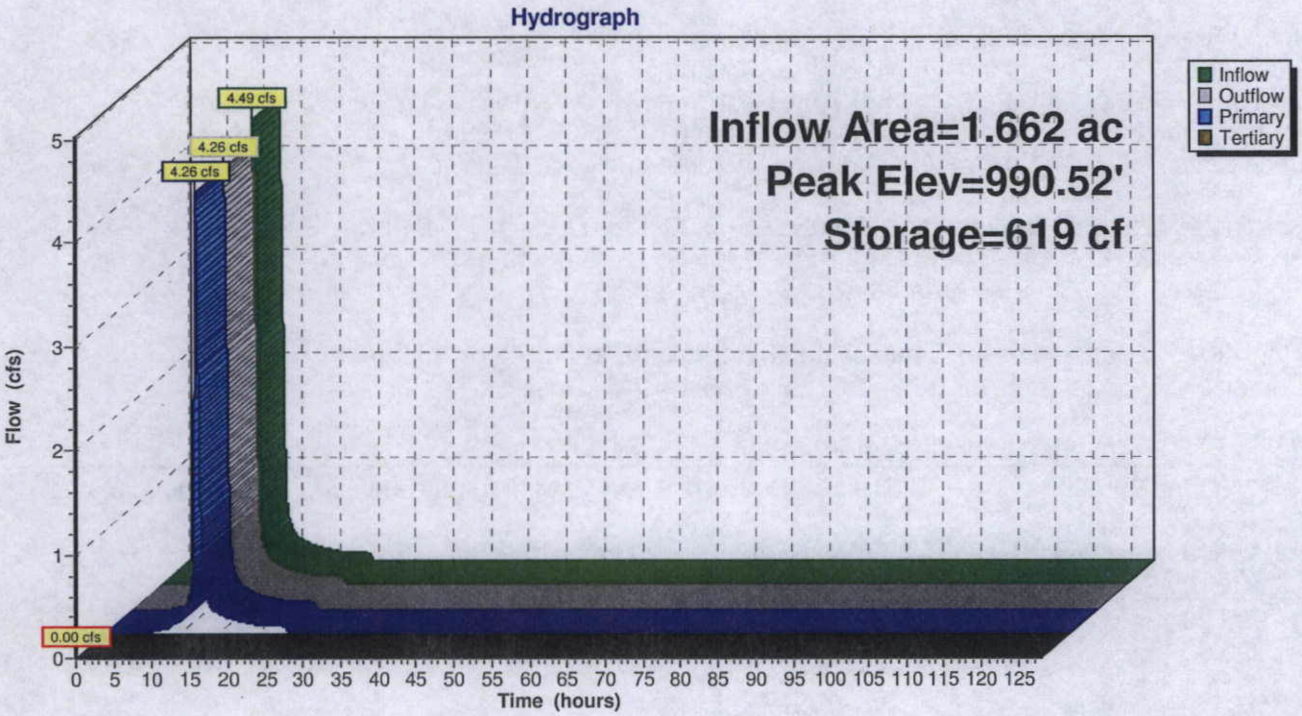
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 57.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 983.19' / 982.50' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.26 cfs @ 12.08 hrs HW=990.52' TW=983.28' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 4.26 cfs of 23.24 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 4.26 cfs @ 1.86 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=982.00' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: CB S


Hydrograph
4.49 cfs
4.26 cfs
4.26 cfs
0.00 cfs
Inflow Area=1.662 ac
Peak Elev=990.52'
Storage=619 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
0
1
2
3
4
5
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 7P: CB NW

Inflow Area =	0.832 ac,	0.00% Impervious, Inflow Depth =	2.87"	for 10-yr event
Inflow =	3.58 cfs @	12.01 hrs, Volume=	0.199 af	
Outflow =	1.73 cfs @	12.22 hrs, Volume=	0.199 af,	Atten= 52%, Lag= 12.6 min
Primary =	1.73 cfs @	12.22 hrs, Volume=	0.199 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.74' @ 12.14 hrs Surf.Area= 6,410 sf Storage= 1,741 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 7.5 min calculated for 0.199 af (100% of inflow)
Center-of-Mass det. time= 7.5 min (812.9 - 805.4)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

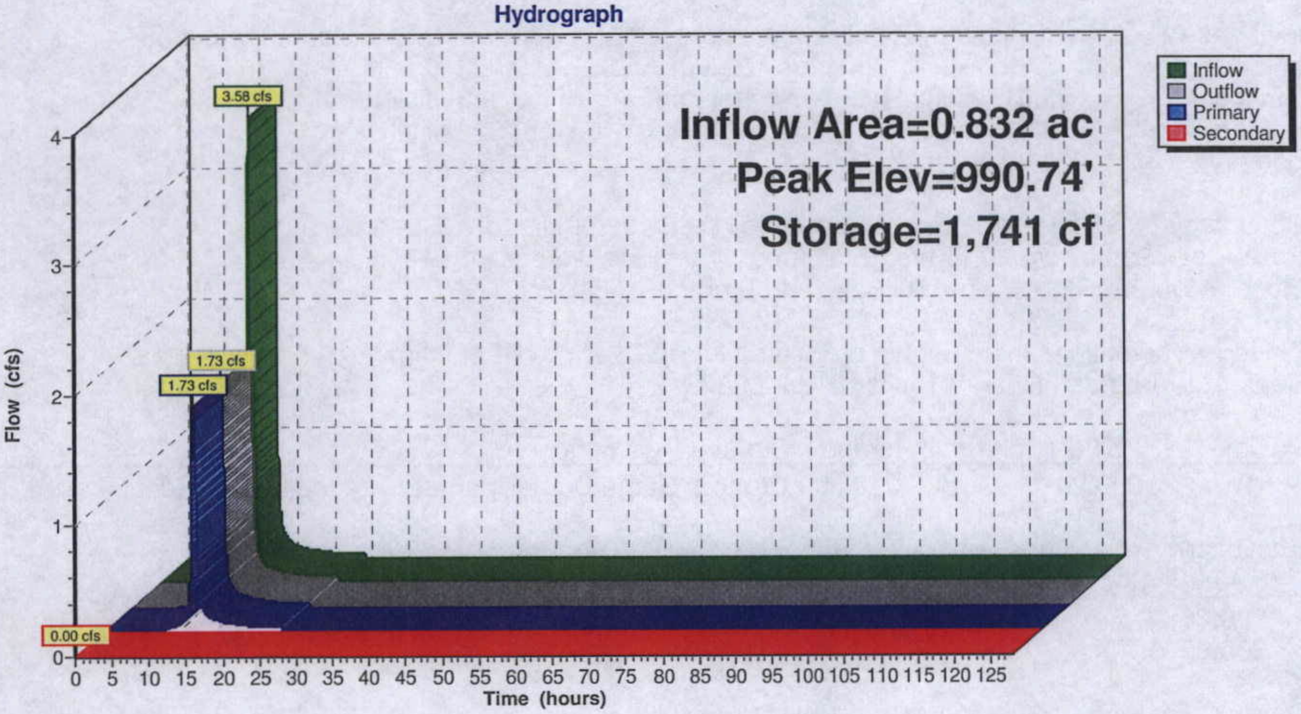
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.76 cfs @ 12.22 hrs HW=990.72' TW=990.58' (Dynamic Tailwater)
↑1=**Culvert** (Outlet Controls 1.76 cfs @ 1.43 fps)
↑2=**Orifice/Grate** (Passes 1.76 cfs of 5.93 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
↑3=**Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: CB NW


Hydrograph
3.58 cfs
1.73 cfs
1.73 cfs
0.00 cfs
Inflow Area=0.832 ac
Peak Elev=990.74'
Storage=1,741 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0
1
2
3
4
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 8P: CB W

Inflow Area = 1.320 ac, 0.00% Impervious, Inflow Depth = 2.94" for 10-yr event
Inflow = 3.69 cfs @ 12.02 hrs, Volume= 0.323 af
Outflow = 3.01 cfs @ 12.15 hrs, Volume= 0.323 af, Atten= 18%, Lag= 7.6 min
Primary = 3.01 cfs @ 12.15 hrs, Volume= 0.323 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.62' @ 12.11 hrs Surf.Area= 4,903 sf Storage= 1,019 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 3.1 min calculated for 0.323 af (100% of inflow)
Center-of-Mass det. time= 3.1 min (810.2 - 807.1)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

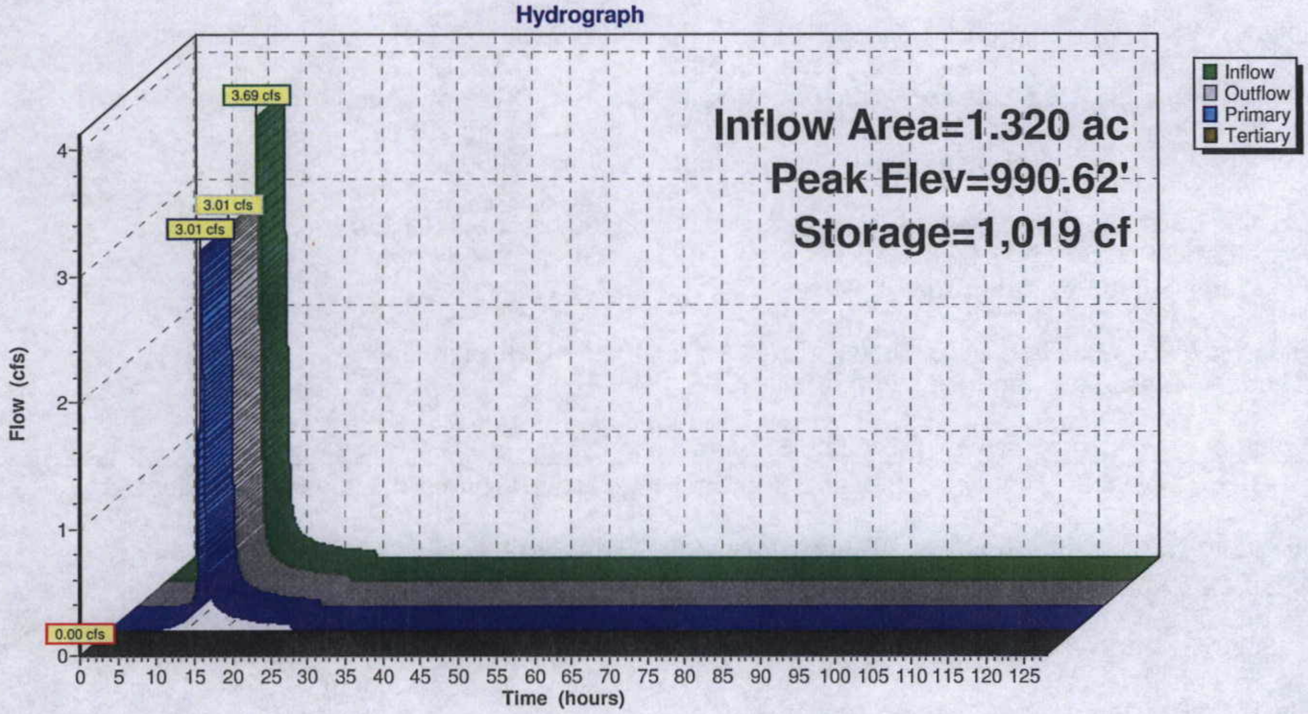
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.07 cfs @ 12.15 hrs HW=990.61' TW=990.52' (Dynamic Tailwater)
1=Culvert (Outlet Controls 3.07 cfs @ 1.28 fps)
2=Orifice/Grate (Passes 3.07 cfs of 3.78 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 8P: CB W


Hydrograph
3.69 cfs
3.01 cfs
3.01 cfs
0.00 cfs
Inflow Area=1.320 ac
Peak Elev=990.62'
Storage=1,019 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
Time (hours)
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 9P: CB SW

Inflow Area = 1.808 ac, 0.00% Impervious, Inflow Depth = 2.97" for 10-yr event
Inflow = 4.78 cfs @ 12.04 hrs, Volume= 0.448 af
Outflow = 4.53 cfs @ 12.09 hrs, Volume= 0.448 af, Atten= 5%, Lag= 3.0 min
Primary = 4.53 cfs @ 12.09 hrs, Volume= 0.448 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.54' @ 12.09 hrs Surf.Area= 3,979 sf Storage= 671 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.5 min calculated for 0.448 af (100% of inflow)
Center-of-Mass det. time= 1.5 min (808.3 - 806.7)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

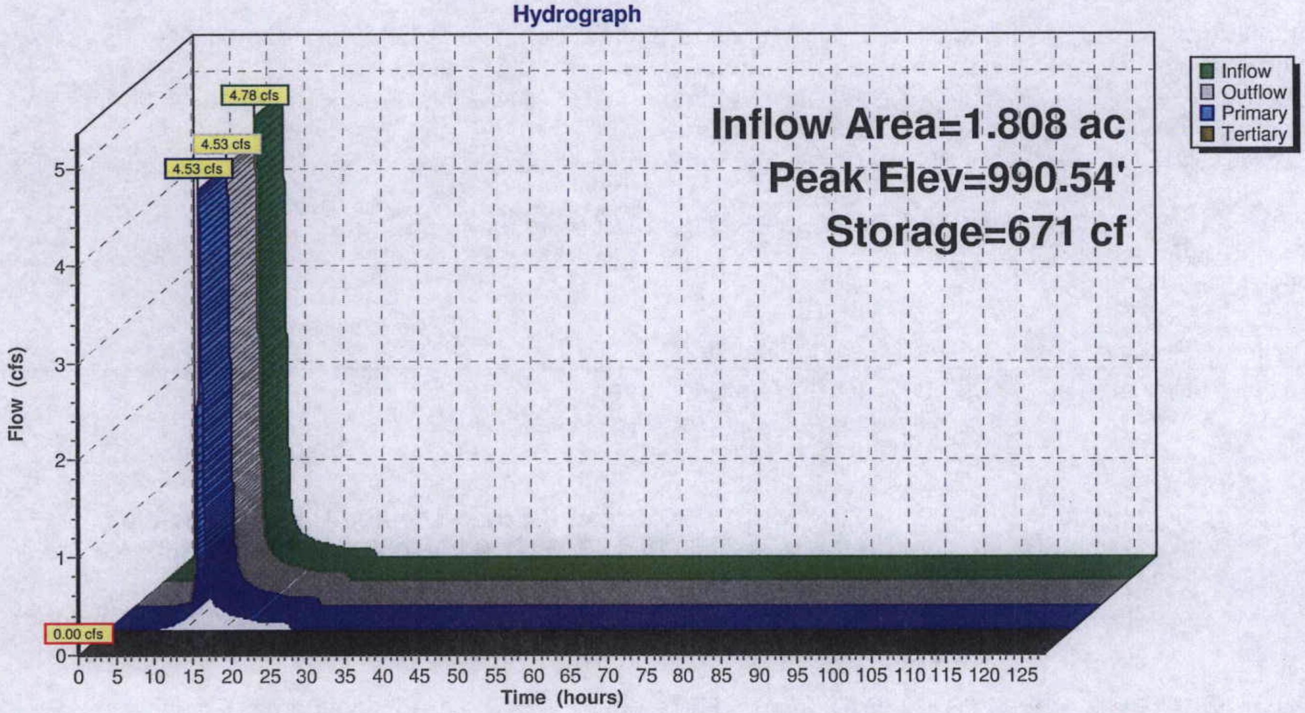
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 99.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.19' / 982.00' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=4.52 cfs @ 12.09 hrs HW=990.54' TW=981.35' (Dynamic Tailwater)
└─**1=Culvert** (Passes 4.52 cfs of 29.16 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 4.52 cfs @ 1.90 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=979.99' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: CB SW


Hydrograph
Inflow
Outflow
Primary
Tertiary
Inflow Area=1.808 ac
Peak Elev=990.54'
Storage=671 cf
4.78 cfs
4.53 cfs
4.53 cfs
0.00 cfs
Flow (cfs)
0
1
2
3
4
5
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 10P: CB Pump

Inflow Area =	1.662 ac,	0.00% Impervious,	Inflow Depth = 3.12"	for 10-yr event
Inflow =	4.26 cfs @	12.08 hrs, Volume=	0.432 af	
Outflow =	4.26 cfs @	12.08 hrs, Volume=	0.432 af,	Atten= 0%, Lag= 0.0 min
Primary =	4.26 cfs @	12.08 hrs, Volume=	0.432 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

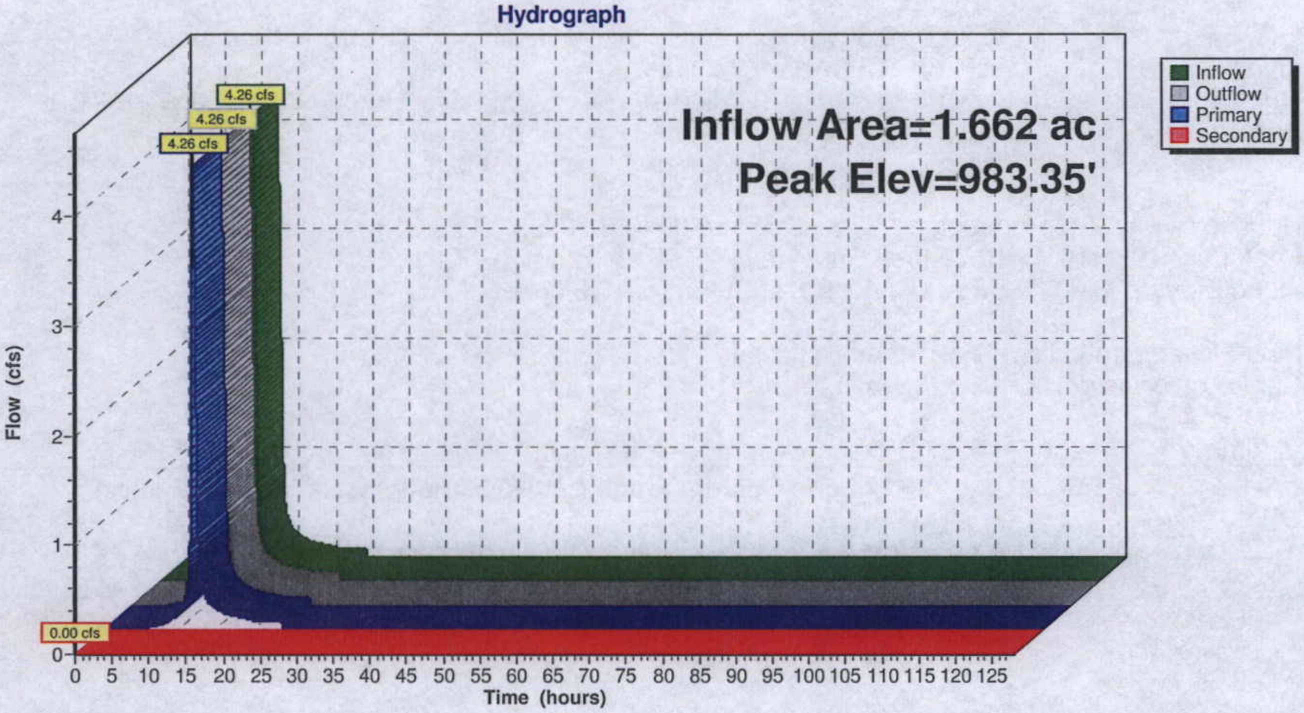
Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 983.35' @ 24.35 hrs
Flood Elev= 990.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	982.00'	**21.0" Round Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 982.00' / 982.00' S= 0.0000 '/' Cc= 0.900 n= 0.013
#2	Secondary	990.95'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=4.26 cfs @ 12.08 hrs HW=983.28' TW=981.35' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 4.26 cfs @ 3.15 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=982.00' TW=979.99' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 10P: CB Pump



Summary for Pond P-N: North Basin

Inflow Area = 1.555 ac, 10.60% Impervious, Inflow Depth = 3.06" for 10-yr event
Inflow = 7.04 cfs @ 12.01 hrs, Volume= 0.397 af
Outflow = 1.23 cfs @ 12.29 hrs, Volume= 0.395 af, Atten= 83%, Lag= 16.7 min
Primary = 1.23 cfs @ 12.29 hrs, Volume= 0.395 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 988.19' @ 12.29 hrs Surf.Area= 7,195 sf Storage= 7,632 cf
Flood Elev= 993.00' Surf.Area= 12,166 sf Storage= 34,171 cf

Plug-Flow detention time= 127.0 min calculated for 0.395 af (100% of inflow)
Center-of-Mass det. time= 124.1 min (921.9 - 797.8)

Volume	Invert	Avail.Storage	Storage Description
#1	982.00'	34,171 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

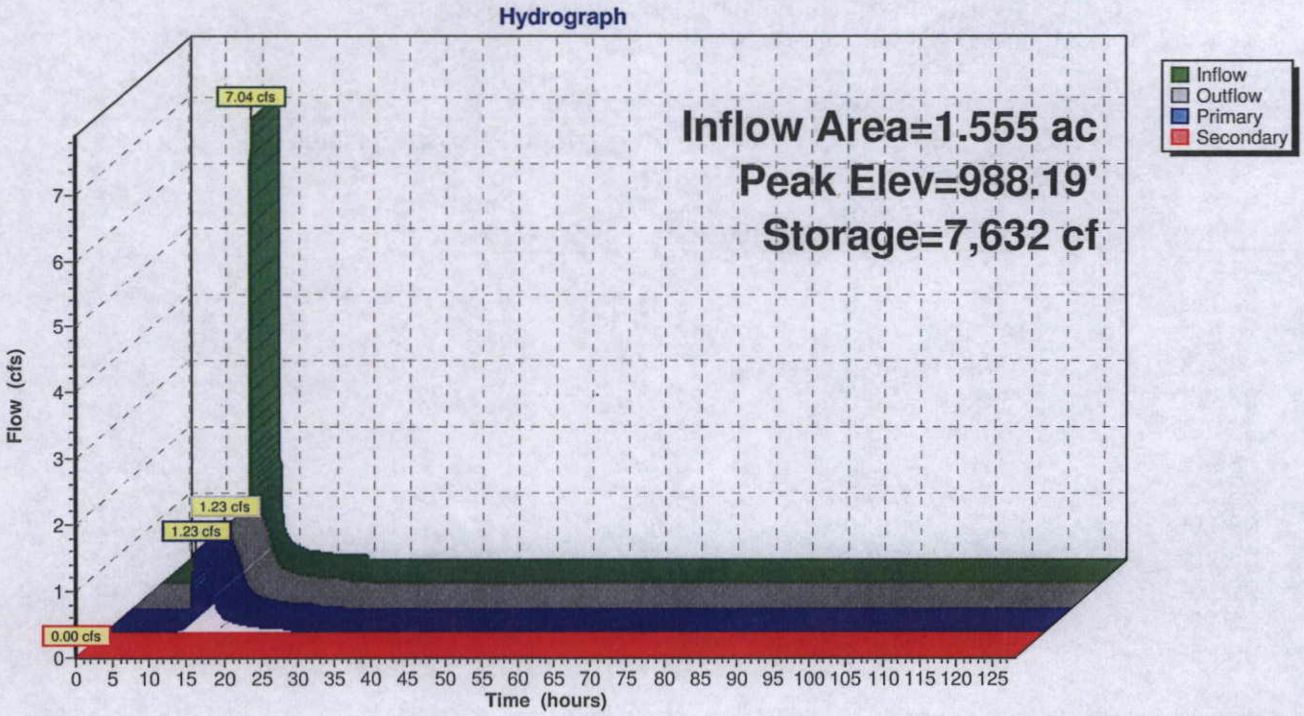
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
982.00	443	0.0	0	0
983.00	812	0.0	0	0
984.00	1,293	0.0	0	0
985.00	1,886	0.0	0	0
986.00	2,589	0.0	0	0
986.99	5,543	0.0	0	0
987.00	5,543	100.0	55	55
988.00	6,914	100.0	6,229	6,284
989.00	8,387	100.0	7,651	13,934
990.00	9,960	100.0	9,174	23,108
991.00	12,166	100.0	11,063	34,171

Device	Routing	Invert	Outlet Devices
#1	Primary	987.00'	**4.0" Round Culvert X 3.00** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 987.00' / 986.80' S= 0.0100 '/' Cc= 0.900 n= 0.010
#2	Device 1	987.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	990.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	990.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" Grate Limited to weir flow at low heads
#5	Secondary	991.00'	**20.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=1.23 cfs @ 12.29 hrs HW=988.19' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.23 cfs @ 4.68 fps)
  ├─**2=Orifice/Grate** (Passes 1.23 cfs of 1.56 cfs potential flow)
  ├─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=982.00' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P-N: North Basin



Summary for Pond P-S: South Basin

Inflow Area = 6.308 ac, 5.65% Impervious, Inflow Depth = 2.95" for 10-yr event
Inflow = 17.58 cfs @ 12.05 hrs, Volume= 1.548 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 983.35' @ 24.64 hrs Surf.Area= 24,836 sf Storage= 67,439 cf
Flood Elev= 990.50' Surf.Area= 57,219 sf Storage= 362,790 cf

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

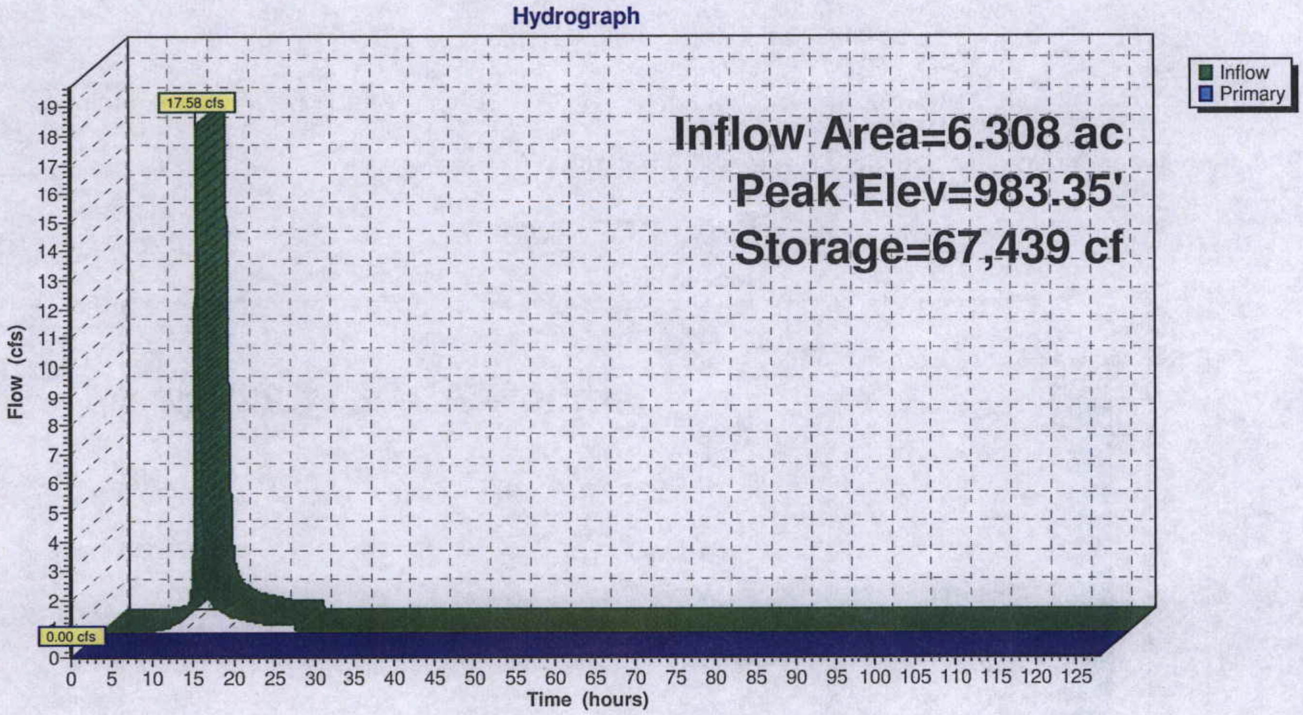
Volume	Invert	Avail.Storage	Storage Description
#1	979.99'	362,790 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
979.99	15,521	0.0	0	0
980.00	15,521	100.0	155	155
981.00	18,219	100.0	16,870	17,025
982.00	20,989	100.0	19,604	36,629
983.00	23,830	100.0	22,410	59,039
984.00	26,744	100.0	25,287	84,326
985.00	29,730	100.0	28,237	112,563
986.00	40,204	100.0	34,967	147,530
987.00	43,493	100.0	41,849	189,378
988.00	46,840	100.0	45,167	234,545
989.00	50,243	100.0	48,542	283,086
990.00	53,703	100.0	51,973	335,059
990.50	57,219	100.0	27,731	362,790

Device	Routing	Invert	Outlet Devices
#1	Primary	990.50'	**150.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=979.99' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P-S: South Basin

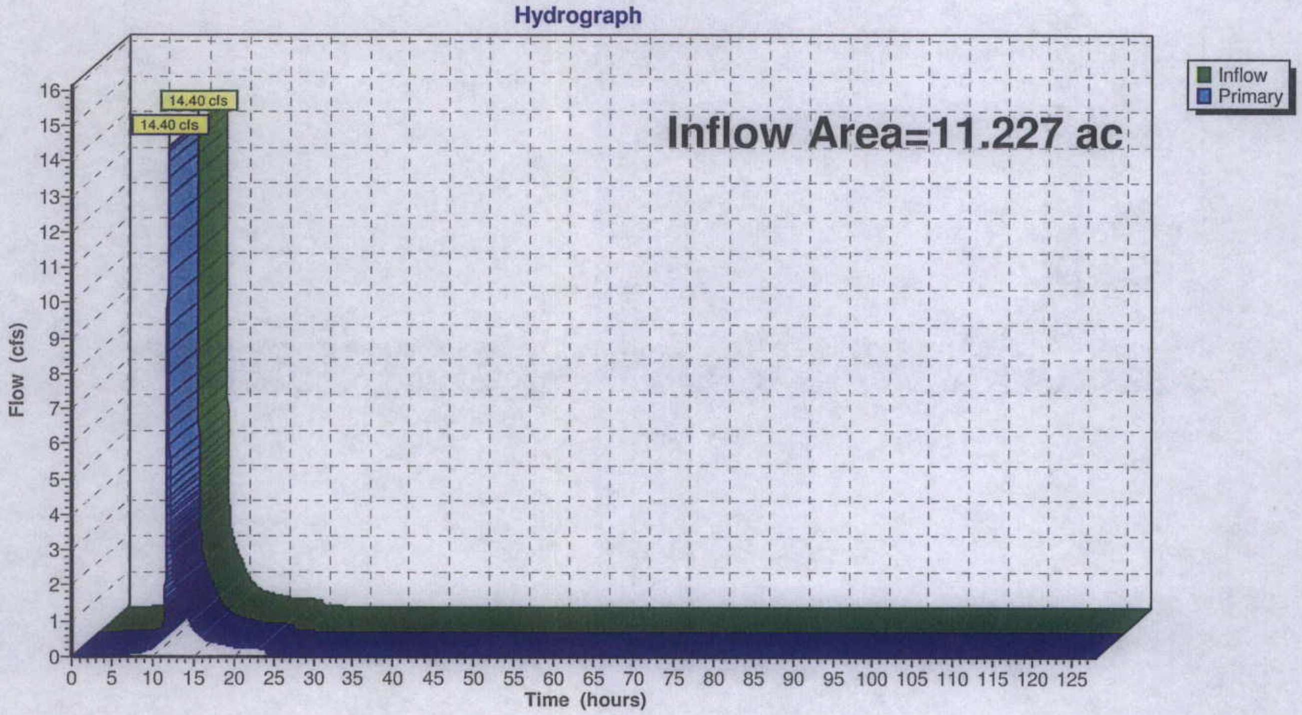


Summary for Link PROP: Total

Inflow Area =	11.227 ac, 12.41% Impervious, Inflow Depth = 1.24"	for 10-yr event
Inflow =	14.40 cfs @ 12.01 hrs, Volume=	1.165 af
Primary =	14.40 cfs @ 12.01 hrs, Volume=	1.165 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs

Link PROP: Total



Time span=0.00-128.00 hrs, dt=0.01 hrs, 12801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Northeast Windrow Runoff Area=25,745 sf 0.00% Impervious Runoff Depth=4.77"
Tc=10.0 min CN=88 Runoff=4.11 cfs 0.235 af

Subcatchment 2S: East Windrow Runoff Area=19,347 sf 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=91 Runoff=3.23 cfs 0.189 af

Subcatchment 3S: Southeast Windrow Runoff Area=19,357 sf 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=91 Runoff=3.23 cfs 0.189 af

Subcatchment 4S: North Windrow Runoff Area=33,157 sf 0.00% Impervious Runoff Depth=4.99"
Tc=10.0 min CN=90 Runoff=5.46 cfs 0.317 af

Subcatchment 5S: Central Windrow Runoff Area=19,622 sf 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=91 Runoff=3.28 cfs 0.192 af

Subcatchment 6S: South Windrow Runoff Area=19,624 sf 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=91 Runoff=3.28 cfs 0.192 af

Subcatchment 7S: Northwest Windrow Runoff Area=36,257 sf 0.00% Impervious Runoff Depth=4.77"
Tc=10.0 min CN=88 Runoff=5.79 cfs 0.331 af

Subcatchment 8S: West Windrow Runoff Area=21,248 sf 0.00% Impervious Runoff Depth=4.99"
Tc=10.0 min CN=90 Runoff=3.50 cfs 0.203 af

Subcatchment 9S: Southwest Windrow Runoff Area=21,244 sf 0.00% Impervious Runoff Depth=4.99"
Tc=10.0 min CN=90 Runoff=3.50 cfs 0.203 af

Subcatchment 11S: Pond and Storage Area Runoff Area=67,737 sf 10.60% Impervious Runoff Depth=4.99"
Tc=10.0 min CN=90 Runoff=11.15 cfs 0.647 af

Subcatchment 12S: Pond Area Runoff Area=59,175 sf 26.23% Impervious Runoff Depth=4.44"
Tc=10.0 min CN=85 Runoff=8.97 cfs 0.503 af

Subcatchment DE-P: Drive Entrance Runoff Area=18,545 sf 0.00% Impervious Runoff Depth=5.10"
Tc=10.0 min CN=91 Runoff=3.10 cfs 0.181 af

Subcatchment PRM: Perimeter Runoff Runoff Area=90,004 sf 0.00% Impervious Runoff Depth=3.92"
Flow Length=60' Tc=10.0 min CN=80 Runoff=12.29 cfs 0.674 af

Subcatchment ROOF: Roof Runoff Area=37,980 sf 100.00% Impervious Runoff Depth=5.91"
Tc=10.0 min CN=98 Runoff=6.74 cfs 0.430 af

Pond 1P: CB NE Peak Elev=990.83' Storage=2,350 cf Inflow=4.11 cfs 0.235 af
Primary=1.84 cfs 0.235 af Secondary=0.00 cfs 0.000 af Outflow=1.84 cfs 0.235 af

Pond 2P: CB E Peak Elev=990.71' Storage=1,510 cf Inflow=4.64 cfs 0.424 af
Primary=3.57 cfs 0.424 af Tertiary=0.00 cfs 0.000 af Outflow=3.57 cfs 0.424 af

Pond 3P: CB SE Peak Elev=990.60' Storage=937 cf Inflow=6.21 cfs 0.613 af
Primary=5.82 cfs 0.613 af Tertiary=0.00 cfs 0.000 af Outflow=5.82 cfs 0.613 af

Pond 4P: CB N Peak Elev=990.94' Storage=3,250 cf Inflow=5.46 cfs 0.317 af
Primary=2.12 cfs 0.317 af Secondary=0.00 cfs 0.000 af Outflow=2.12 cfs 0.317 af

Pond 5P: CB Central Peak Elev=990.76' Storage=1,832 cf Inflow=5.05 cfs 0.508 af
Primary=3.75 cfs 0.508 af Tertiary=0.00 cfs 0.000 af Outflow=3.75 cfs 0.508 af

Pond 6P: CB S Peak Elev=990.60' Storage=963 cf Inflow=6.33 cfs 0.700 af
Primary=5.94 cfs 0.700 af Tertiary=0.00 cfs 0.000 af Outflow=5.94 cfs 0.700 af

Pond 7P: CB NW Peak Elev=991.06' Storage=3,319 cf Inflow=5.79 cfs 0.331 af
Primary=2.57 cfs 0.329 af Secondary=0.96 cfs 0.002 af Outflow=3.54 cfs 0.331 af

Pond 8P: CB W Peak Elev=990.78' Storage=1,953 cf Inflow=5.57 cfs 0.534 af
Primary=4.22 cfs 0.534 af Tertiary=0.00 cfs 0.000 af Outflow=4.22 cfs 0.534 af

Pond 9P: CB SW Peak Elev=990.62' Storage=1,062 cf Inflow=6.83 cfs 0.737 af
Primary=6.39 cfs 0.737 af Tertiary=0.00 cfs 0.000 af Outflow=6.39 cfs 0.737 af

Pond 10P: CB Pump Peak Elev=984.95' Inflow=5.94 cfs 0.700 af
Primary=5.94 cfs 0.700 af Secondary=0.00 cfs 0.000 af Outflow=5.94 cfs 0.700 af

Pond P-N: North Basin Peak Elev=988.84' Storage=12,593 cf Inflow=11.15 cfs 0.647 af
Primary=1.56 cfs 0.645 af Secondary=0.00 cfs 0.000 af Outflow=1.56 cfs 0.645 af

Pond P-S: South Basin Peak Elev=984.95' Storage=111,189 cf Inflow=26.12 cfs 2.553 af
Outflow=0.00 cfs 0.000 af

Link PROP: Total Inflow=23.41 cfs 1.930 af
Primary=23.41 cfs 1.930 af

Total Runoff Area = 11.227 ac Runoff Volume = 4.484 af Average Runoff Depth = 4.79"
87.59% Pervious = 9.834 ac 12.41% Impervious = 1.393 ac

Summary for Subcatchment 1S: Northeast Windrow

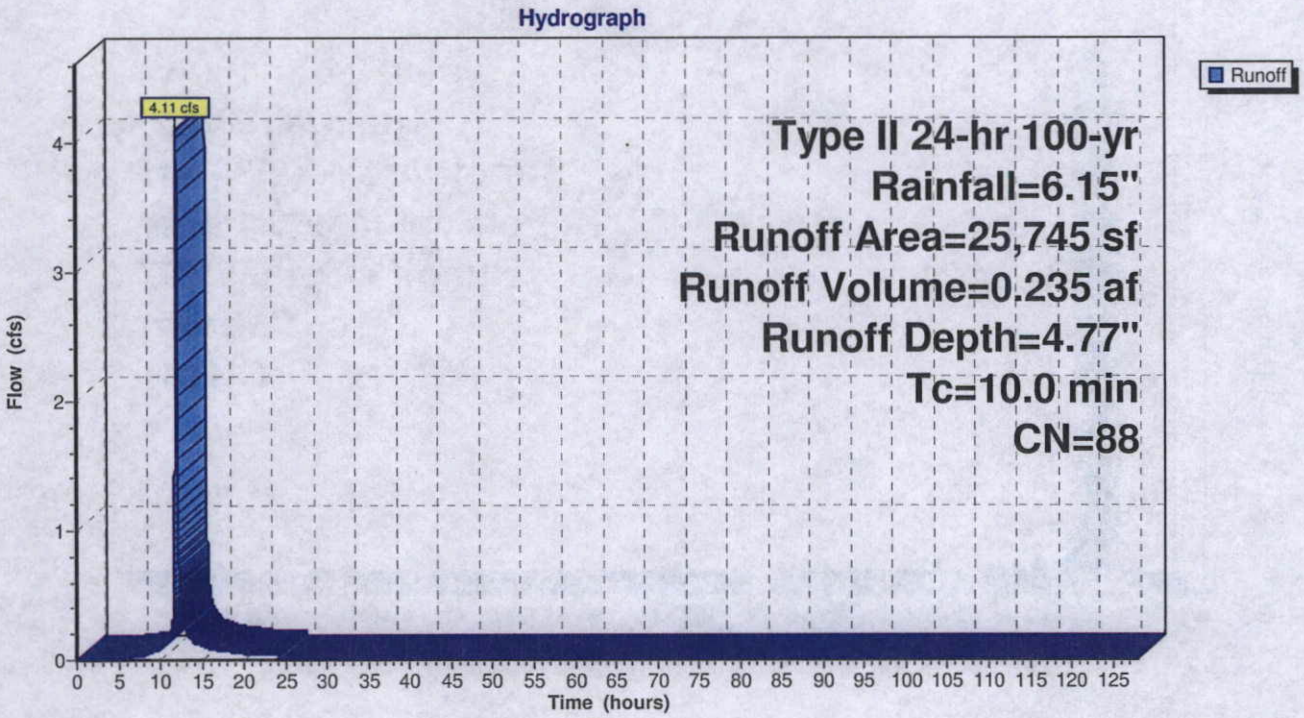
Runoff = 4.11 cfs @ 12.01 hrs, Volume= 0.235 af, Depth= 4.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	19,012	91	Gravel pads, HSG D
	6,733	80	>75% Grass cover, Good, HSG D
	25,745	88	Weighted Average
	25,745		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: Northeast Windrow



Summary for Subcatchment 2S: East Windrow

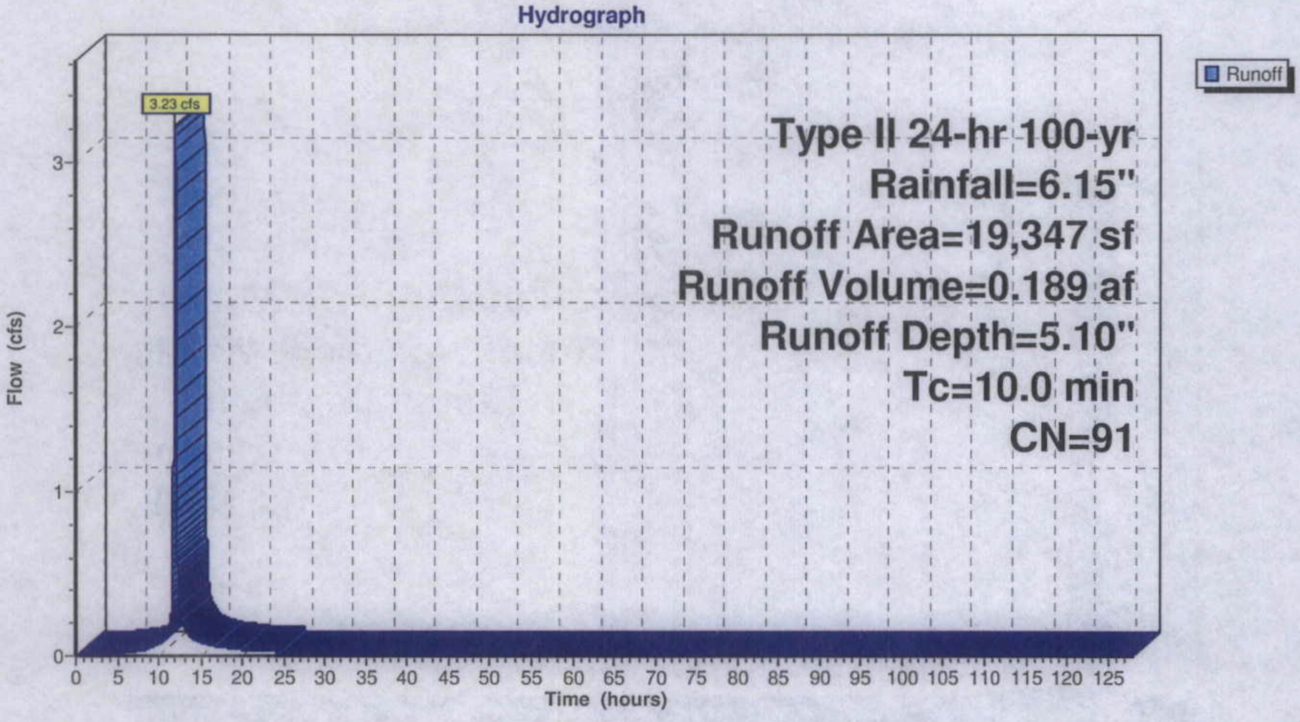
Runoff = 3.23 cfs @ 12.01 hrs, Volume= 0.189 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	19,347	91	Gravel pads, HSG D
	19,347		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2S: East Windrow



Summary for Subcatchment 3S: Southeast Windrow

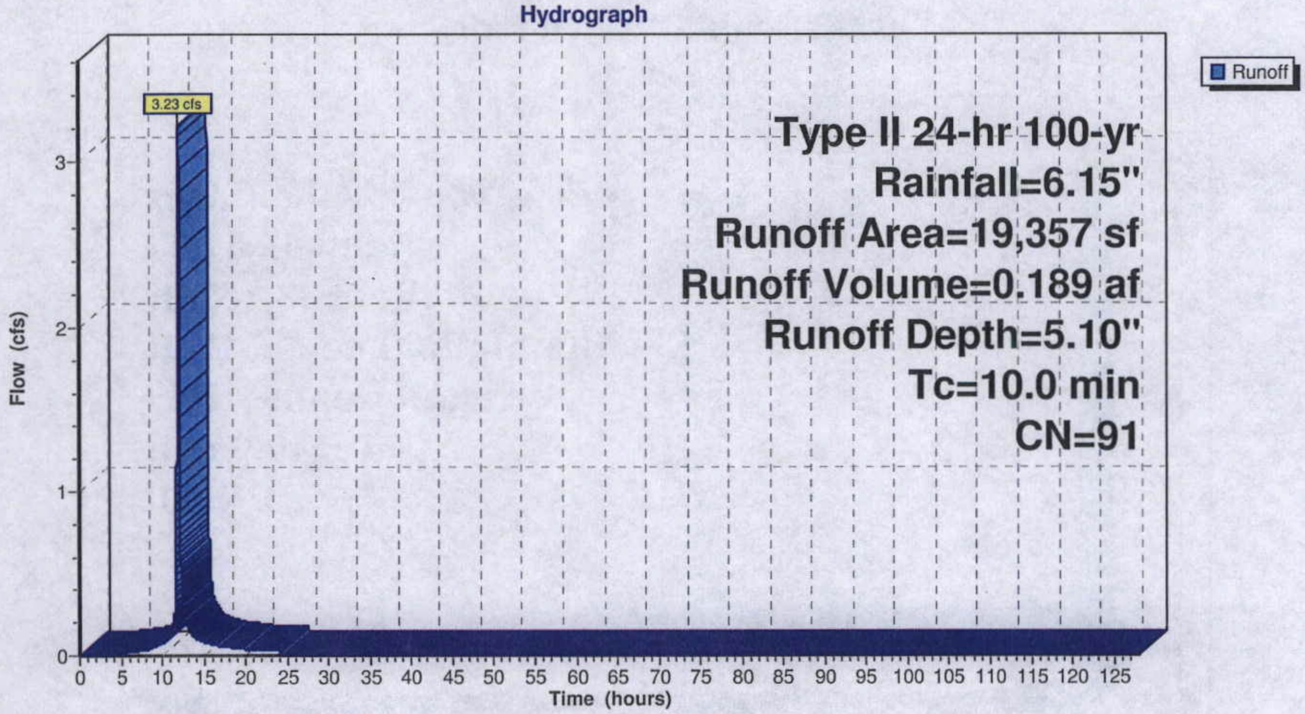
Runoff = 3.23 cfs @ 12.01 hrs, Volume= 0.189 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	19,357	91	Gravel paths, HSG D
	19,357		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 3S: Southeast Windrow



Summary for Subcatchment 4S: North Windrow

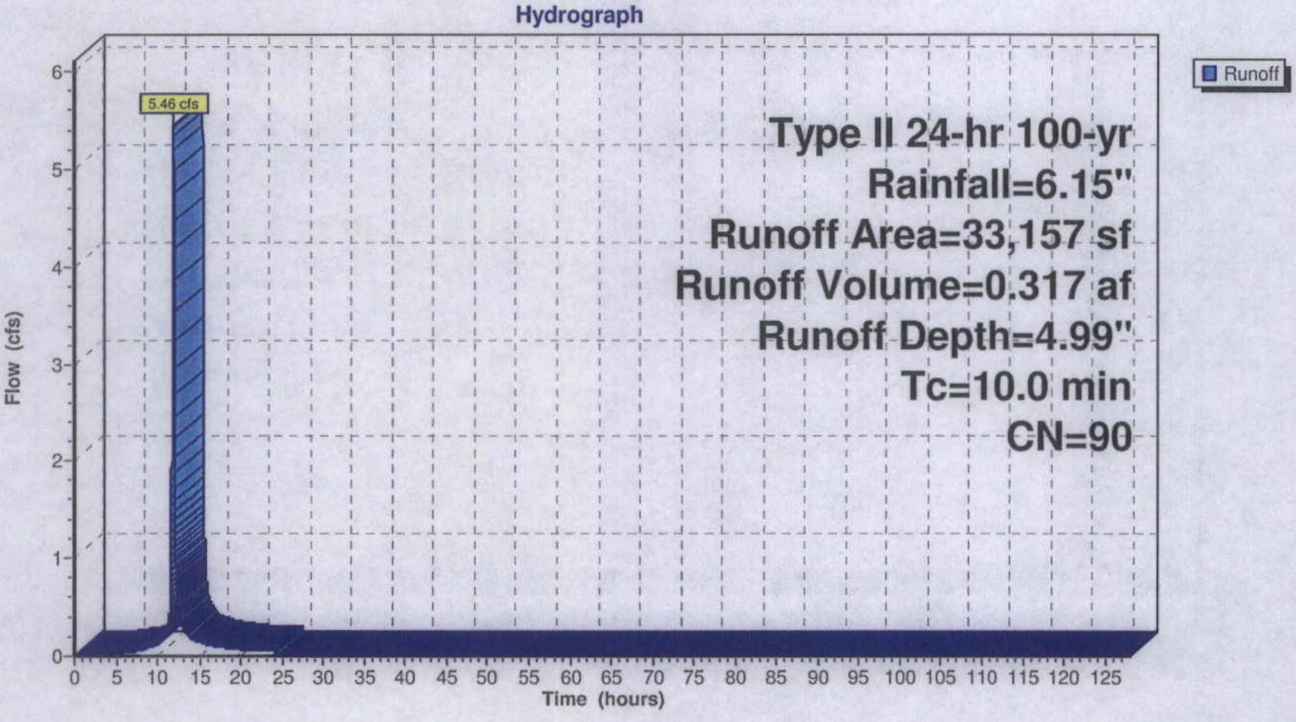
Runoff = 5.46 cfs @ 12.01 hrs, Volume= 0.317 af, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	29,932	91	Gravel paths, HSG D
	3,225	80	>75% Grass cover, Good, HSG D
	33,157	90	Weighted Average
	33,157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 4S: North Windrow



Summary for Subcatchment 5S: Central Windrow

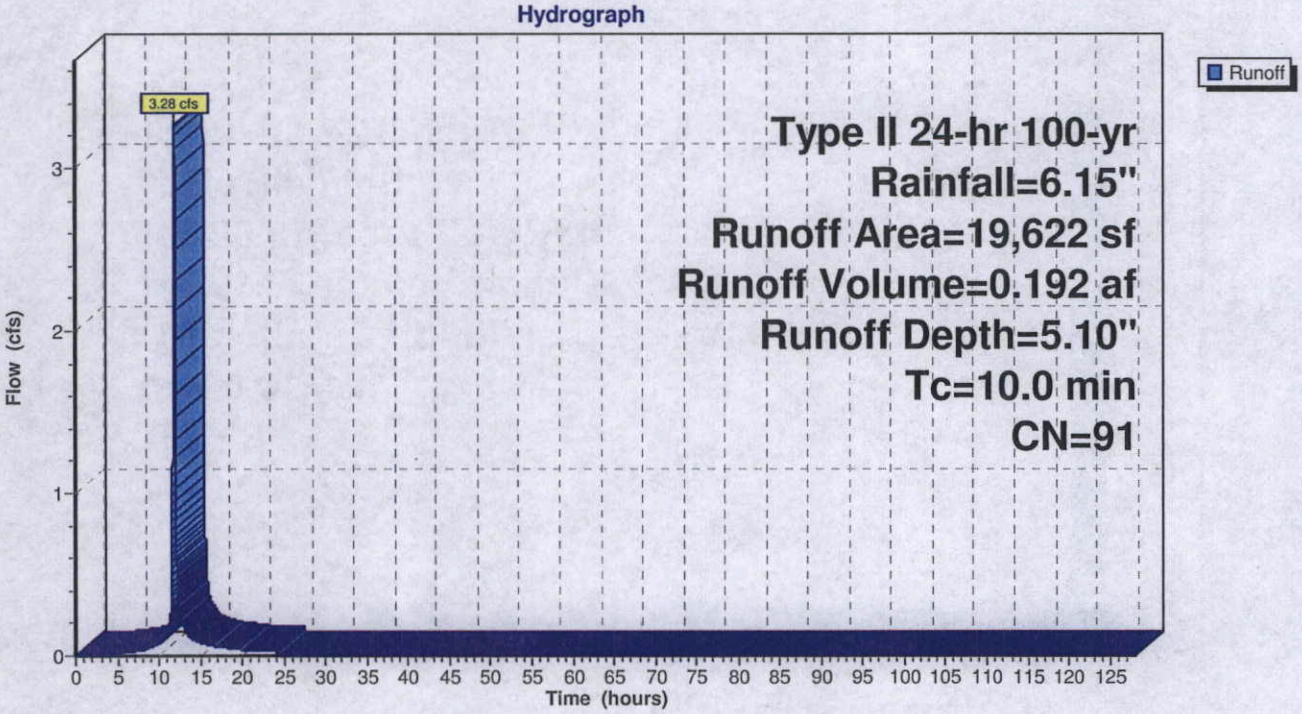
Runoff = 3.28 cfs @ 12.01 hrs, Volume= 0.192 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	19,622	91	Gravel paths, HSG D
	19,622		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 5S: Central Windrow



Summary for Subcatchment 6S: South Windrow

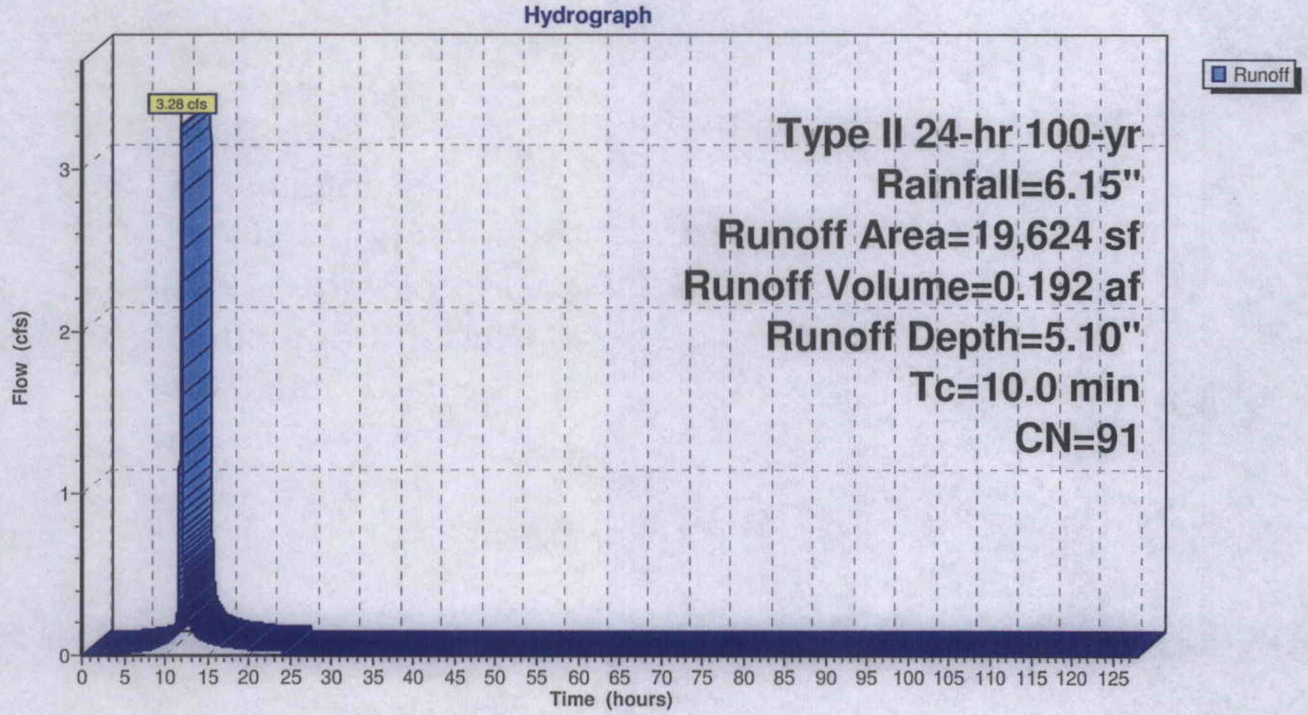
Runoff = 3.28 cfs @ 12.01 hrs, Volume= 0.192 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	19,624	91	Gravel paths, HSG D
	19,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 6S: South Windrow



Summary for Subcatchment 7S: Northwest Windrow

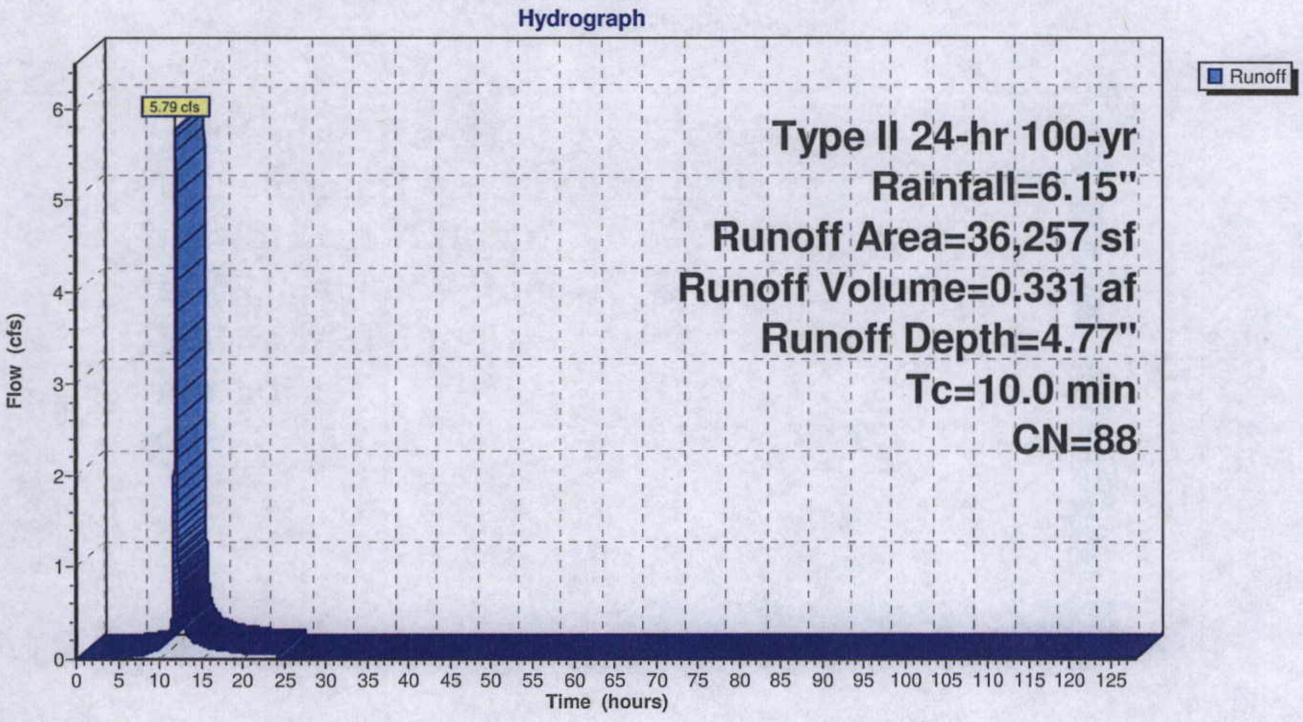
Runoff = 5.79 cfs @ 12.01 hrs, Volume= 0.331 af, Depth= 4.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	27,075	91	Gravel paths, HSG D
	9,182	80	>75% Grass cover, Good, HSG D
	36,257	88	Weighted Average
	36,257		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 7S: Northwest Windrow



Summary for Subcatchment 8S: West Windrow

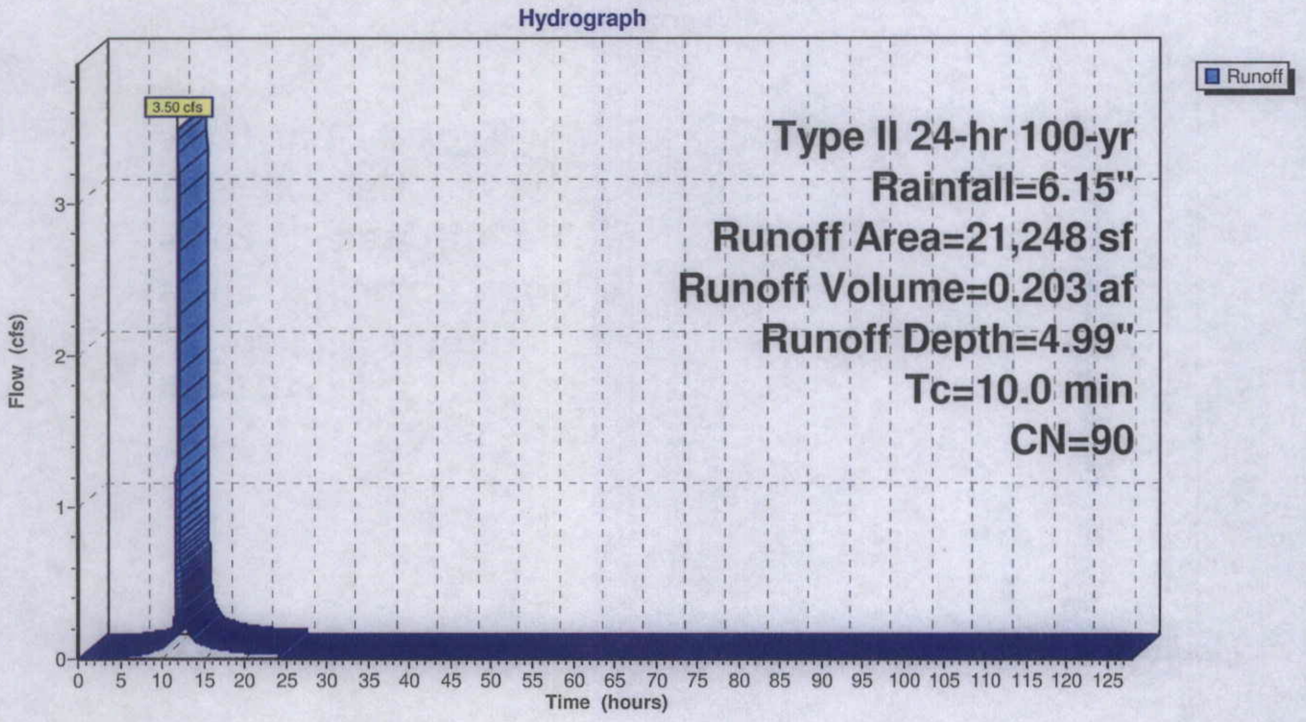
Runoff = 3.50 cfs @ 12.01 hrs, Volume= 0.203 af, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

Area (sf)	CN	Description
19,338	91	Gravel roads, HSG D
1,910	80	>75% Grass cover, Good, HSG D
21,248	90	Weighted Average
21,248		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 8S: West Windrow



Summary for Subcatchment 9S: Southwest Windrow

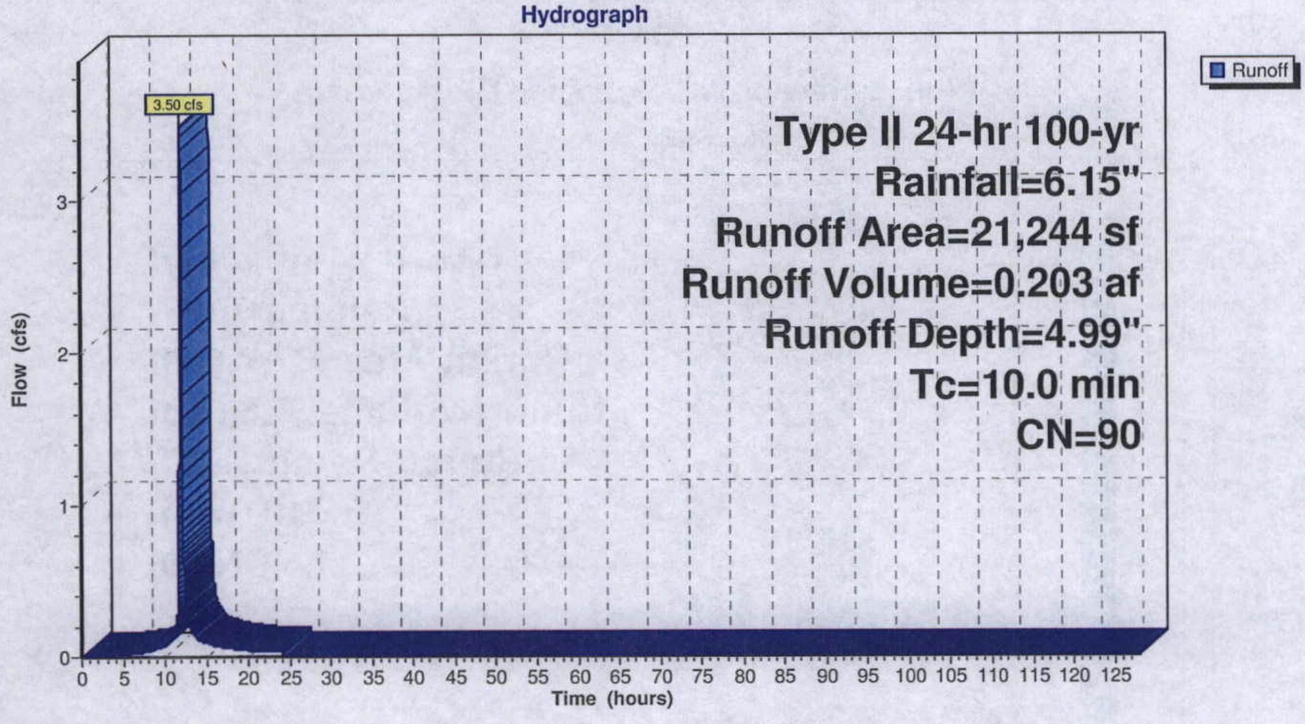
Runoff = 3.50 cfs @ 12.01 hrs, Volume= 0.203 af, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

Area (sf)	CN	Description
19,289	91	Gravel roads, HSG D
1,955	80	>75% Grass cover, Good, HSG D
21,244	90	Weighted Average
21,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 9S: Southwest Windrow



Summary for Subcatchment 11S: Pond and Storage Area

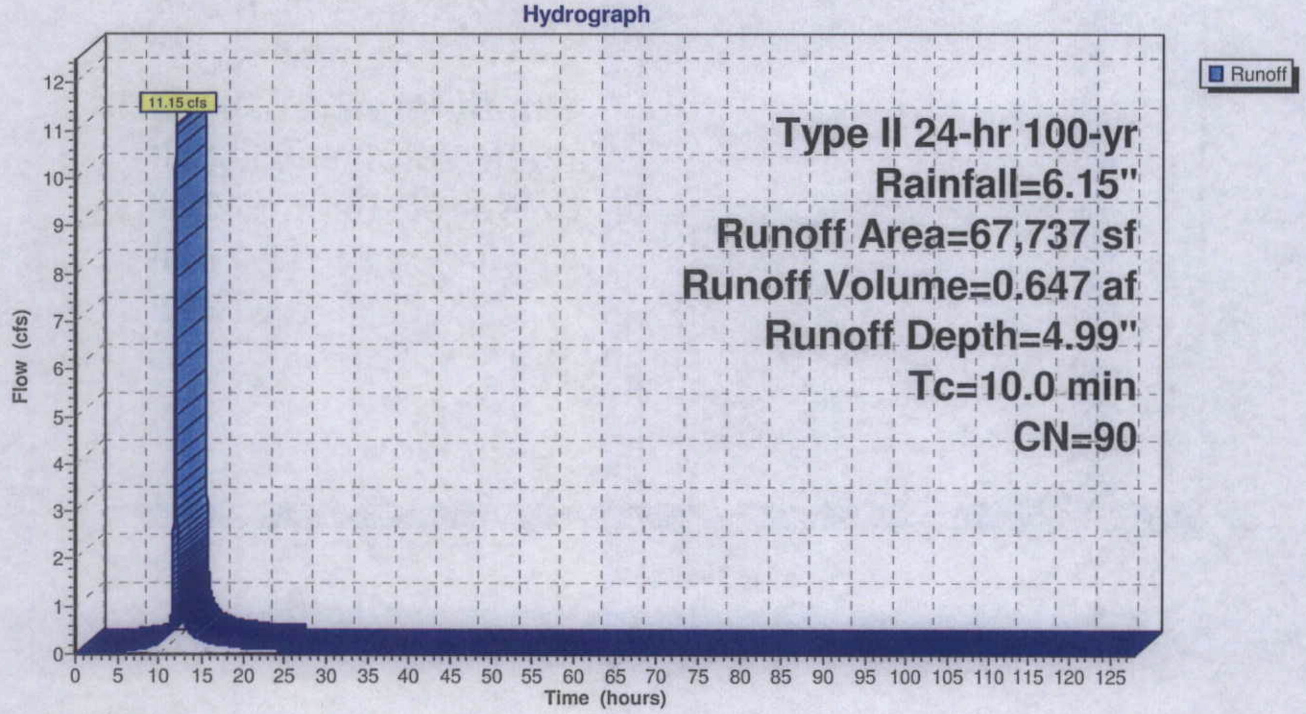
Runoff = 11.15 cfs @ 12.01 hrs, Volume= 0.647 af, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

Area (sf)	CN	Description
11,601	80	>75% Grass cover, Good, HSG D
48,954	91	Gravel roads, HSG D
1,639	98	Unconnected pavement, HSG D
5,543	98	Water Surface, HSG D
67,737	90	Weighted Average
60,555		89.40% Pervious Area
7,182		10.60% Impervious Area
1,639		22.82% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Pond and Storage Area



Summary for Subcatchment 12S: Pond Area

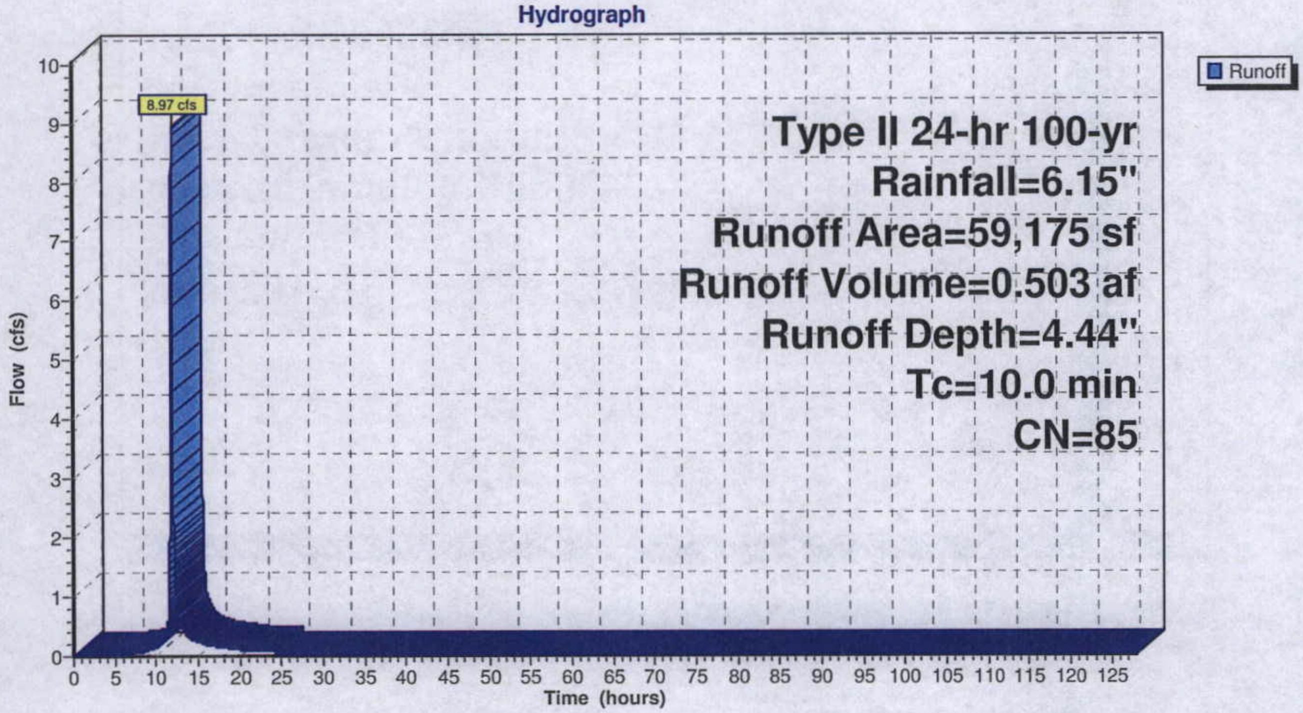
Runoff = 8.97 cfs @ 12.01 hrs, Volume= 0.503 af, Depth= 4.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

Area (sf)	CN	Description
43,654	80	>75% Grass cover, Good, HSG D
15,521	98	Water Surface, HSG D
59,175	85	Weighted Average
43,654		73.77% Pervious Area
15,521		26.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 12S: Pond Area



Summary for Subcatchment DE-P: Drive Entrance

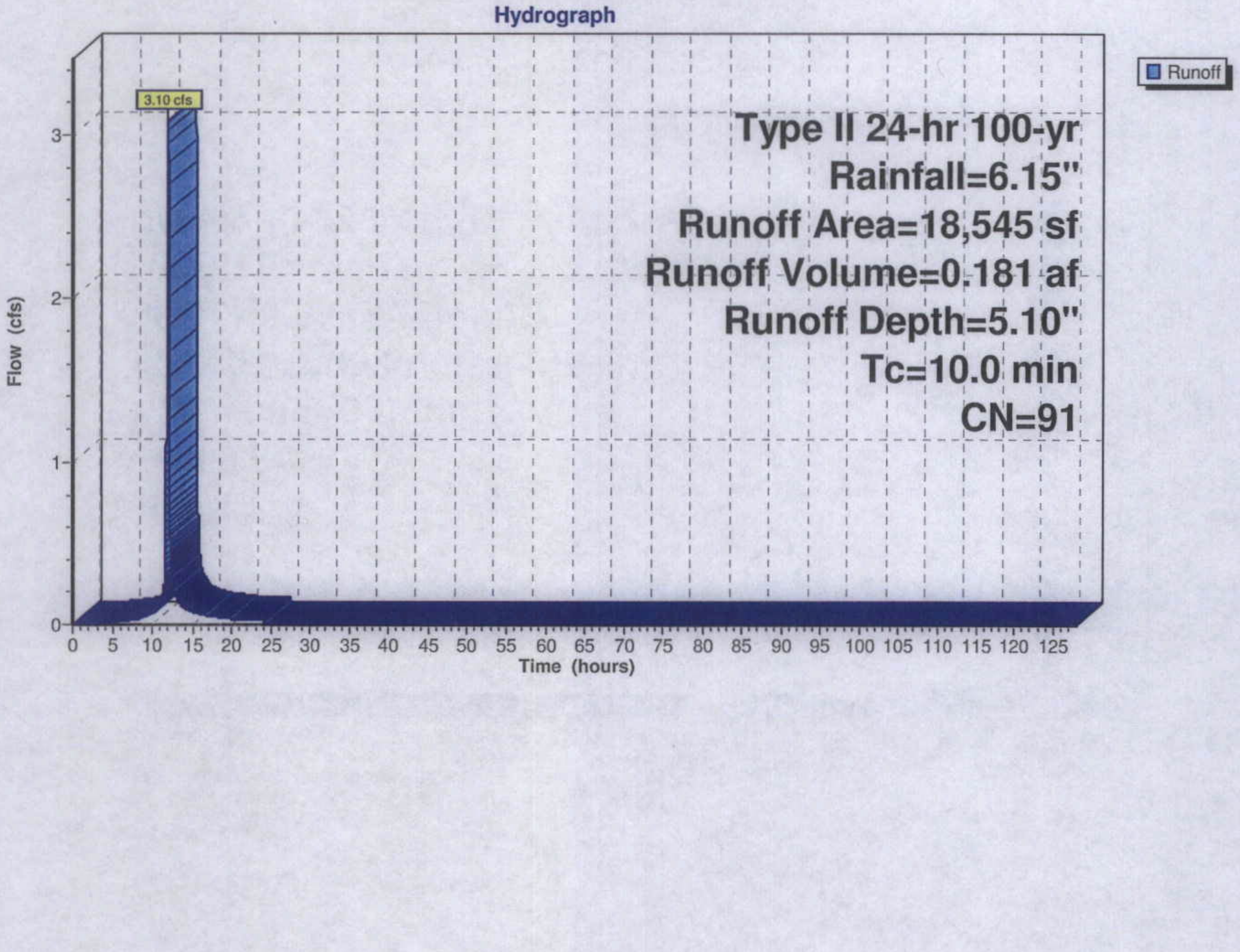
Runoff = 3.10 cfs @ 12.01 hrs, Volume= 0.181 af, Depth= 5.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

Area (sf)	CN	Description
18,545	91	Gravel roads, HSG D
18,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment DE-P: Drive Entrance



Summary for Subcatchment PRM: Perimeter Runoff

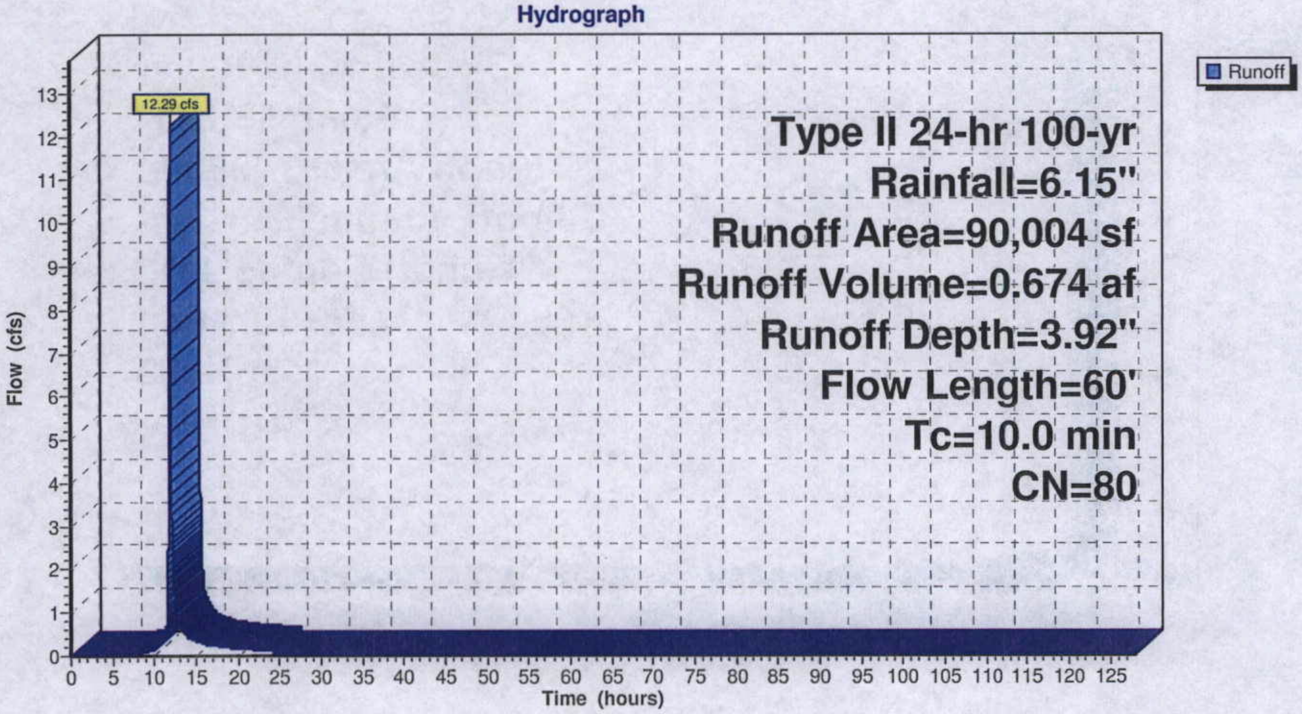
Runoff = 12.29 cfs @ 12.01 hrs, Volume= 0.674 af, Depth= 3.92"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

Area (sf)	CN	Description
87,582	80	>75% Grass cover, Good, HSG D
2,422	91	Gravel roads, HSG D
90,004	80	Weighted Average
90,004		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	60		0.10		**Direct Entry,**

Subcatchment PRM: Perimeter Runoff



Summary for Subcatchment ROOF: Roof

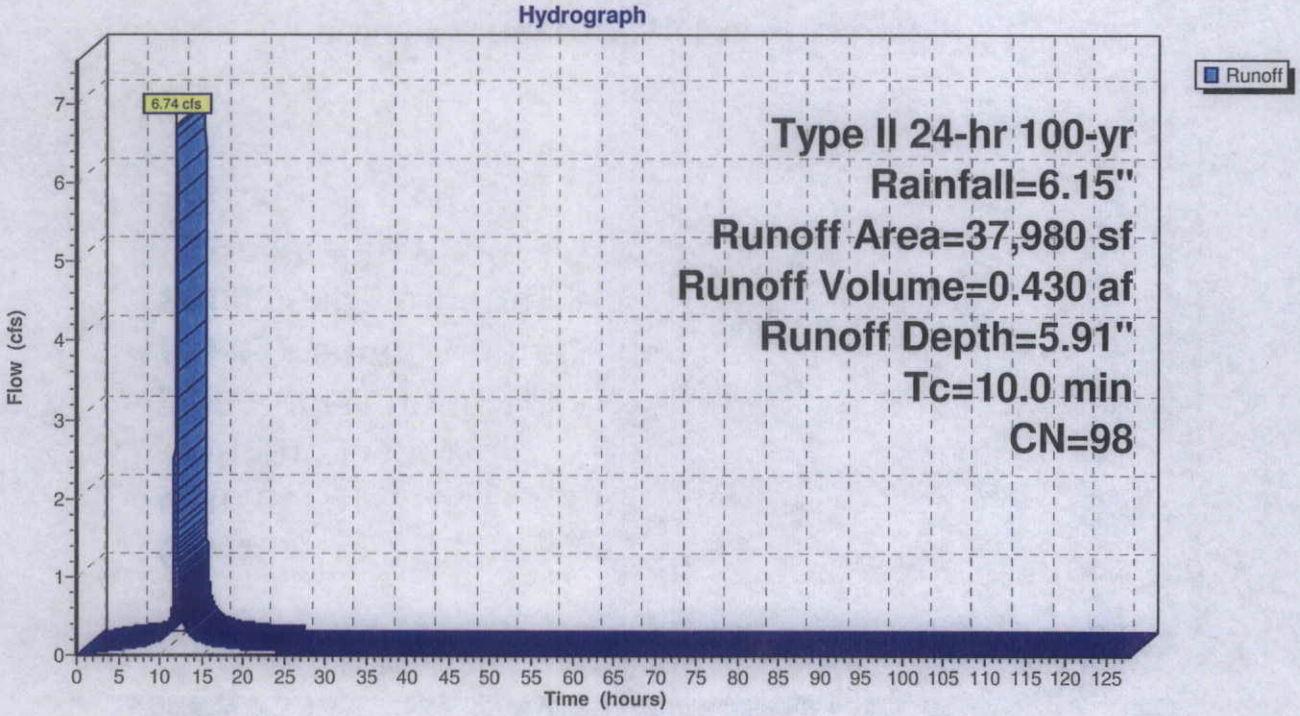
Runoff = 6.74 cfs @ 12.01 hrs, Volume= 0.430 af, Depth= 5.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=6.15"

	Area (sf)	CN	Description
*	37,980	98	Roof
	37,980		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment ROOF: Roof



Summary for Pond 1P: CB NE

Inflow Area =	0.591 ac,	0.00% Impervious,	Inflow Depth = 4.77"	for 100-yr event
Inflow =	4.11 cfs @	12.01 hrs, Volume=	0.235 af	
Outflow =	1.84 cfs @	12.30 hrs, Volume=	0.235 af,	Atten= 55%, Lag= 17.4 min
Primary =	1.84 cfs @	12.30 hrs, Volume=	0.235 af	
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.83' @ 12.15 hrs Surf.Area= 7,447 sf Storage= 2,350 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 9.4 min calculated for 0.235 af (100% of inflow)
Center-of-Mass det. time= 9.4 min (800.6 - 791.1)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

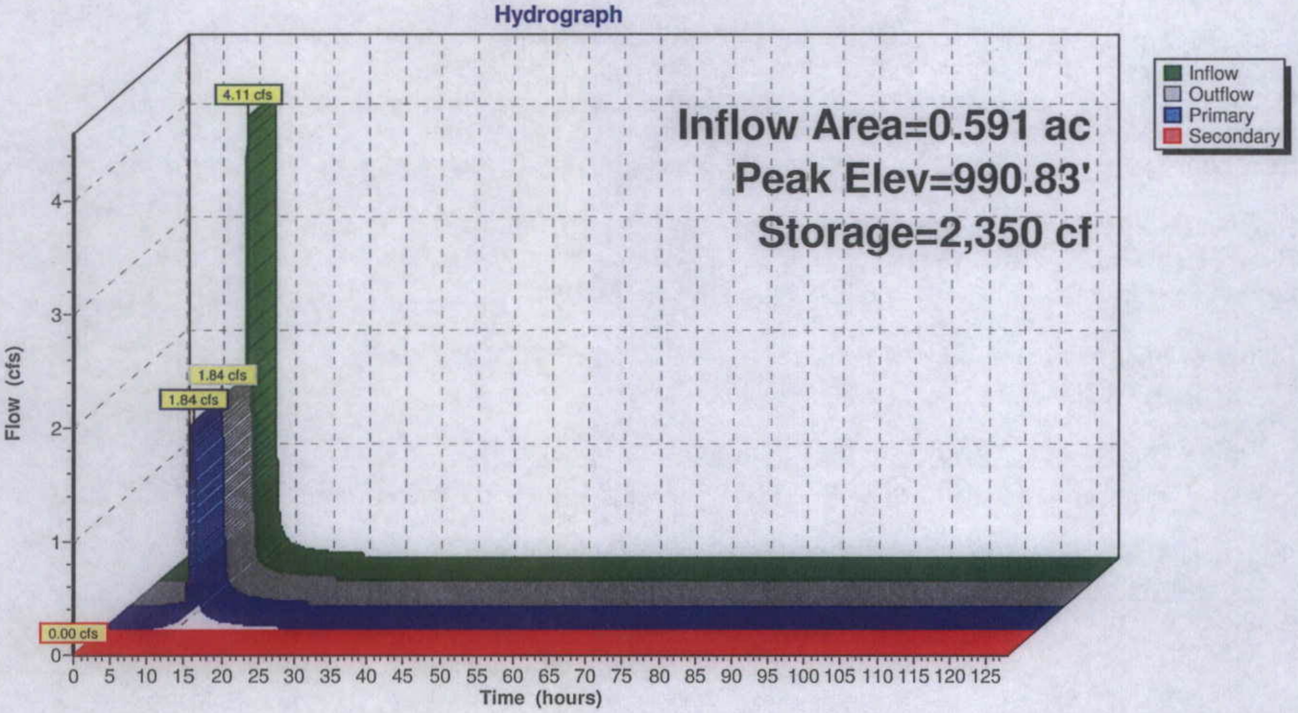
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.88 cfs @ 12.30 hrs HW=990.77' TW=990.61' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.88 cfs @ 1.53 fps)
　↑—**2=Orifice/Grate** (Passes 1.88 cfs of 6.98 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: CB NE


Hydrograph
4.11 cfs
1.84 cfs
1.84 cfs
0.00 cfs
Inflow Area=0.591 ac
Peak Elev=990.83'
Storage=2,350 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0
1
2
3
4
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 2P: CB E

Inflow Area = 1.035 ac, 0.00% Impervious, Inflow Depth = 4.91" for 100-yr event
Inflow = 4.64 cfs @ 12.02 hrs, Volume= 0.424 af
Outflow = 3.57 cfs @ 12.17 hrs, Volume= 0.424 af, Atten= 23%, Lag= 8.9 min
Primary = 3.57 cfs @ 12.17 hrs, Volume= 0.424 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.71' @ 12.11 hrs Surf.Area= 5,969 sf Storage= 1,510 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 3.6 min calculated for 0.424 af (100% of inflow)
Center-of-Mass det. time= 3.6 min (795.2 - 791.7)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

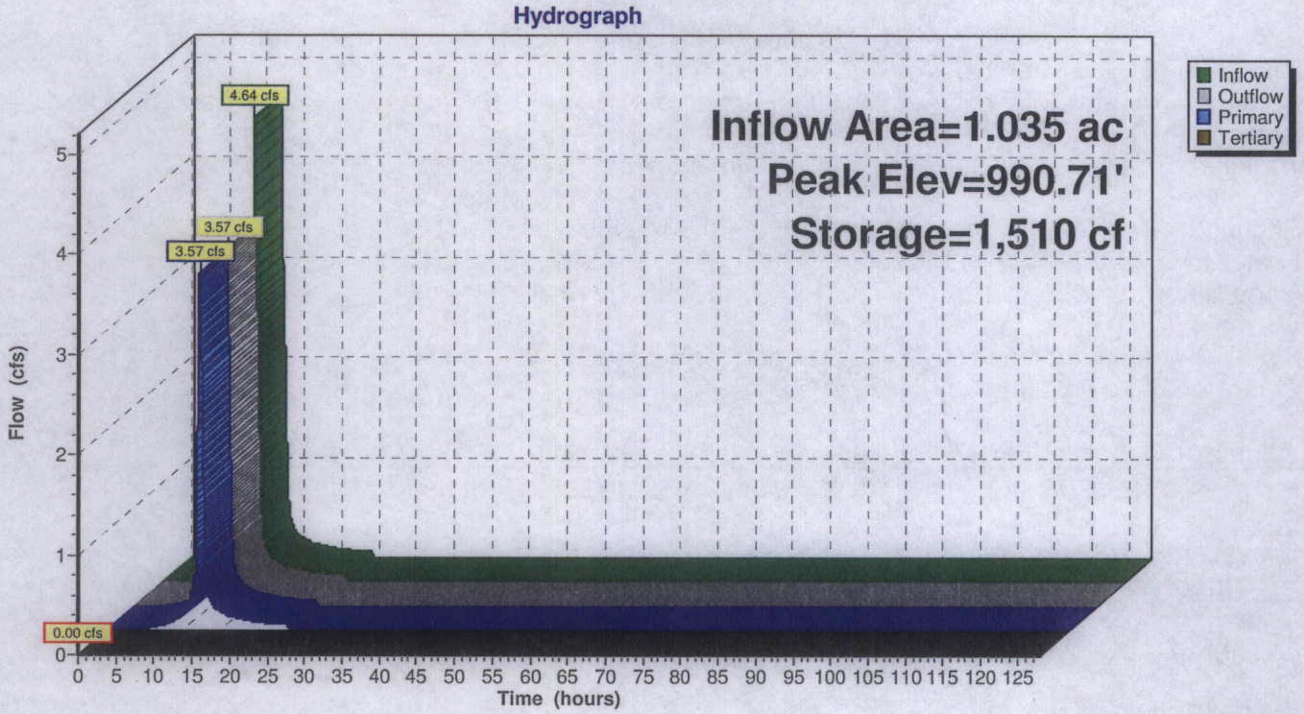
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.64 cfs @ 12.17 hrs HW=990.69' TW=990.57' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 3.64 cfs @ 1.51 fps)
  └─**2=Orifice/Grate** (Passes 3.64 cfs of 5.28 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: CB E


Hydrograph
4.64 cfs
3.57 cfs
3.57 cfs
0.00 cfs
Inflow Area=1.035 ac
Peak Elev=990.71'
Storage=1,510 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
0 1 2 3 4 5

Summary for Pond 3P: CB SE

Inflow Area = 1.480 ac, 0.00% Impervious, Inflow Depth = 4.97" for 100-yr event
Inflow = 6.21 cfs @ 12.03 hrs, Volume= 0.613 af
Outflow = 5.82 cfs @ 12.08 hrs, Volume= 0.613 af, Atten= 6%, Lag= 3.0 min
Primary = 5.82 cfs @ 12.08 hrs, Volume= 0.613 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.60' @ 12.08 hrs Surf.Area= 4,703 sf Storage= 937 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.7 min calculated for 0.613 af (100% of inflow)
Center-of-Mass det. time= 1.7 min (792.4 - 790.7)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

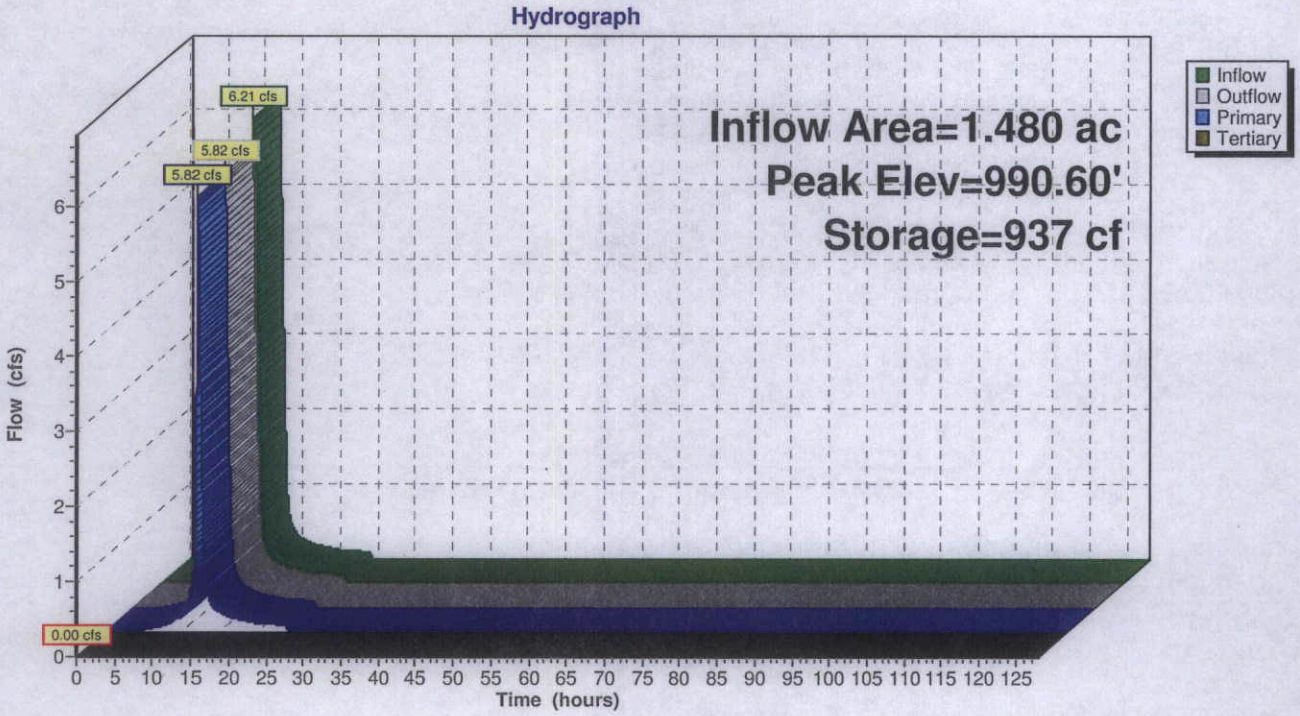
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 99.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.19' / 982.00' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=5.81 cfs @ 12.08 hrs HW=990.60' TW=982.18' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 5.81 cfs of 29.29 cfs potential flow)
  ↑—**2=Orifice/Grate** (Weir Controls 5.81 cfs @ 2.06 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=979.99' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: CB SE


Hydrograph
6.21 cfs
5.82 cfs
5.82 cfs
0.00 cfs
Inflow Area=1.480 ac
Peak Elev=990.60'
Storage=937 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
0
1
2
3
4
5
6
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 4P: CB N

Inflow Area = 0.761 ac, 0.00% Impervious, Inflow Depth = 4.99" for 100-yr event
Inflow = 5.46 cfs @ 12.01 hrs, Volume= 0.317 af
Outflow = 2.12 cfs @ 12.31 hrs, Volume= 0.317 af, Atten= 61%, Lag= 18.1 min
Primary = 2.12 cfs @ 12.31 hrs, Volume= 0.317 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.94' @ 12.16 hrs Surf.Area= 8,759 sf Storage= 3,250 cf
Flood Elev= 990.95' Surf.Area= 8,853 sf Storage= 3,320 cf

Plug-Flow detention time= 10.4 min calculated for 0.317 af (100% of inflow)
Center-of-Mass det. time= 10.4 min (794.7 - 784.3)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

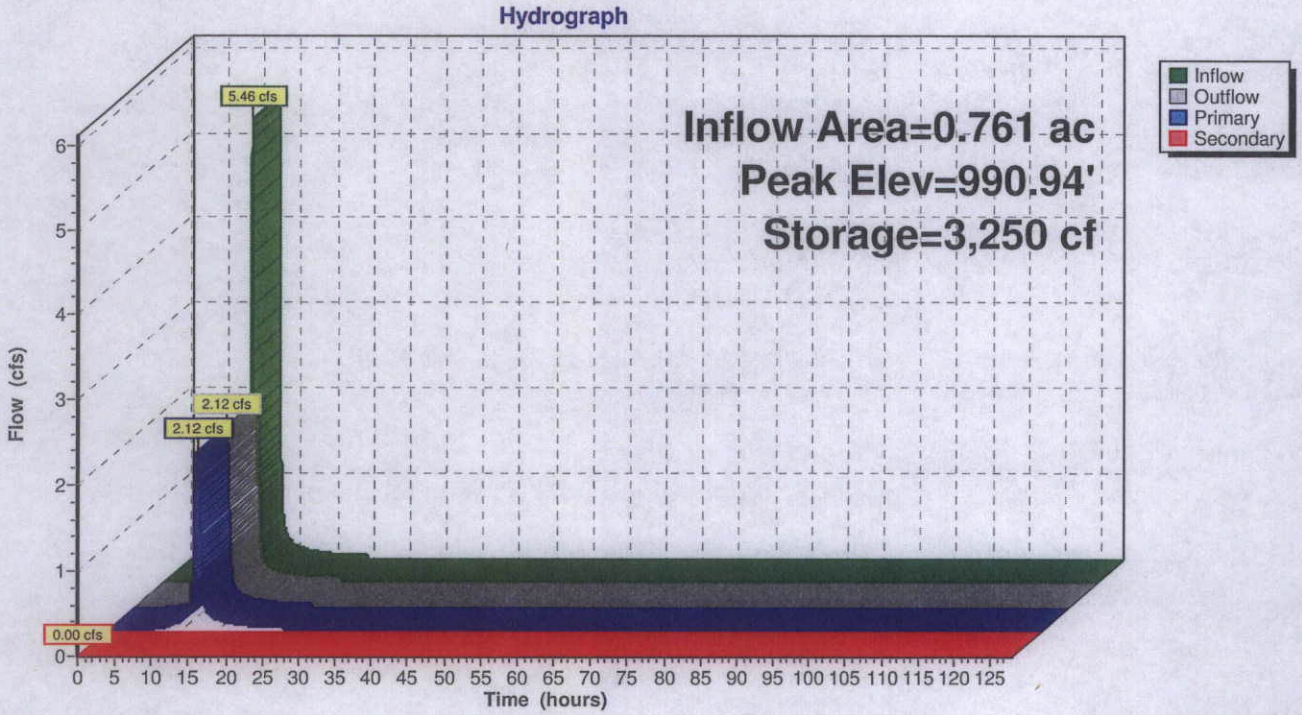
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,853	3,320	3,320

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.15 cfs @ 12.31 hrs HW=990.89' TW=990.68' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 2.15 cfs @ 1.75 fps)
  └─**2=Orifice/Grate** (Passes 2.15 cfs of 8.79 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: CB N


Hydrograph
5.46 cfs
2.12 cfs
2.12 cfs
0.00 cfs
Inflow Area=0.761 ac
Peak Elev=990.94'
Storage=3,250 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0
1
2
3
4
5
6
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 5P: CB Central

Inflow Area = 1.212 ac, 0.00% Impervious, Inflow Depth = 5.03" for 100-yr event
Inflow = 5.05 cfs @ 12.02 hrs, Volume= 0.508 af
Outflow = 3.75 cfs @ 12.19 hrs, Volume= 0.508 af, Atten= 26%, Lag= 10.3 min
Primary = 3.75 cfs @ 12.19 hrs, Volume= 0.508 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.76' @ 12.13 hrs Surf.Area= 6,576 sf Storage= 1,832 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 3.9 min calculated for 0.508 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (793.4 - 789.4)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

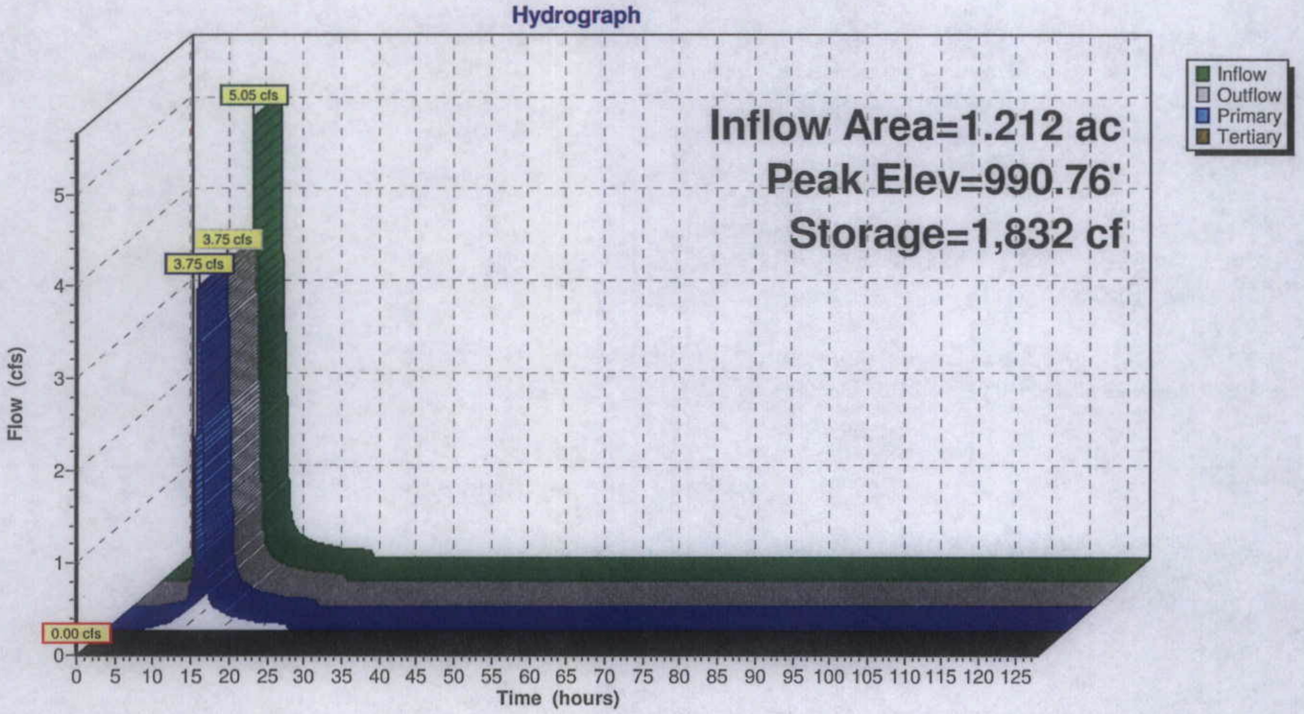
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.80 cfs @ 12.19 hrs HW=990.74' TW=990.57' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 3.80 cfs @ 1.58 fps)
  └─**2=Orifice/Grate** (Passes 3.80 cfs of 6.70 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: CB Central



Summary for Pond 6P: CB S

Inflow Area = 1.662 ac, 0.00% Impervious, Inflow Depth = 5.05" for 100-yr event
Inflow = 6.33 cfs @ 12.03 hrs, Volume= 0.700 af
Outflow = 5.94 cfs @ 12.08 hrs, Volume= 0.700 af, Atten= 6%, Lag= 3.0 min
Primary = 5.94 cfs @ 12.08 hrs, Volume= 0.700 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.60' @ 12.08 hrs Surf.Area= 4,768 sf Storage= 963 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.7 min calculated for 0.700 af (100% of inflow)
Center-of-Mass det. time= 1.7 min (791.6 - 789.9)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

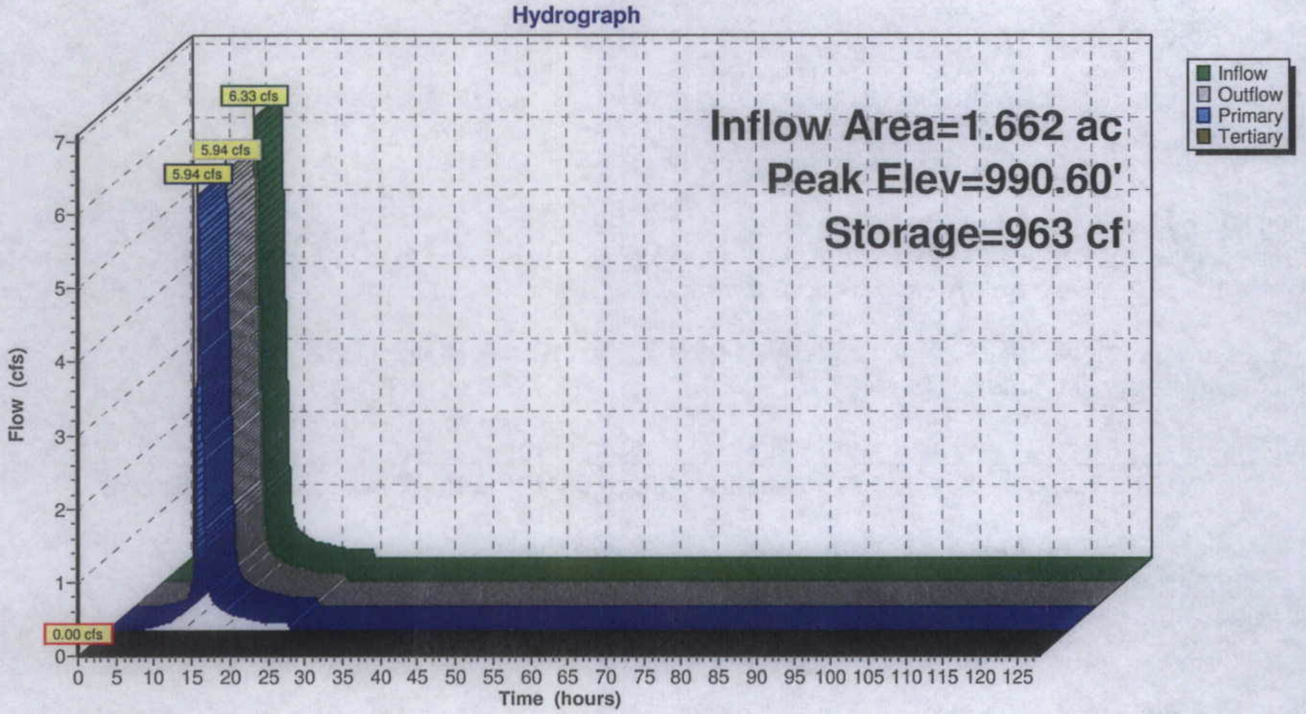
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 57.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 983.19' / 982.50' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=5.94 cfs @ 12.08 hrs HW=990.60' TW=983.54' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 5.94 cfs of 23.38 cfs potential flow)
  ↑—**2=Orifice/Grate** (Weir Controls 5.94 cfs @ 2.08 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=982.00' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: CB S


Hydrograph
6.33 cfs
5.94 cfs
5.94 cfs
0.00 cfs
Inflow Area=1.662 ac
Peak Elev=990.60'
Storage=963 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
7
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 7P: CB NW

Inflow Area = 0.832 ac, 0.00% Impervious, Inflow Depth = 4.77" for 100-yr event
Inflow = 5.79 cfs @ 12.01 hrs, Volume= 0.331 af
Outflow = 3.54 cfs @ 12.11 hrs, Volume= 0.331 af, Atten= 39%, Lag= 6.1 min
Primary = 2.57 cfs @ 12.11 hrs, Volume= 0.329 af
Secondary = 0.96 cfs @ 12.11 hrs, Volume= 0.002 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 991.06' @ 12.11 hrs Surf.Area= 8,851 sf Storage= 3,319 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 10.4 min calculated for 0.331 af (100% of inflow)
Center-of-Mass det. time= 10.4 min (801.6 - 791.1)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

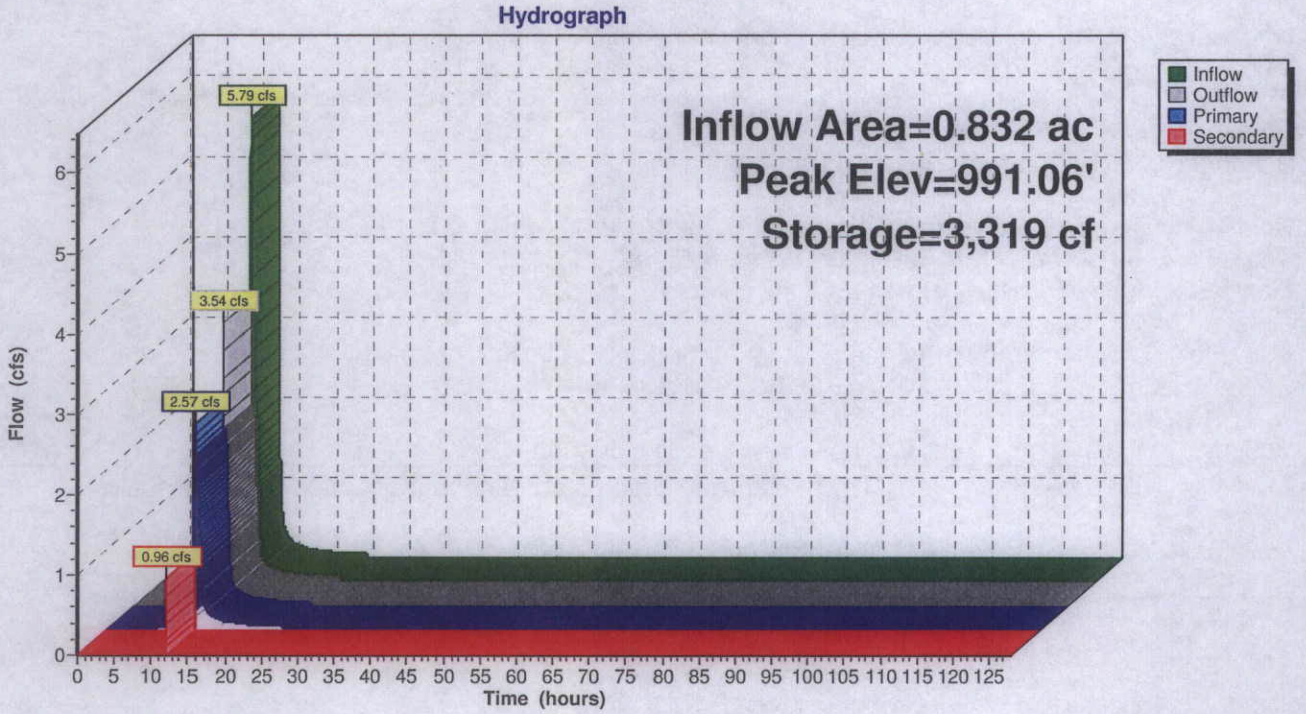
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.48 cfs @ 12.11 hrs HW=991.05' TW=990.77' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 2.48 cfs @ 2.02 fps)
  └─**2=Orifice/Grate** (Passes 2.48 cfs of 10.14 cfs potential flow)

Secondary OutFlow Max=0.84 cfs @ 12.11 hrs HW=991.05' TW=990.77' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Weir Controls 0.84 cfs @ 0.87 fps)

Pond 7P: CB NW


Hydrograph
5.79 cfs
3.54 cfs
2.57 cfs
0.96 cfs
Inflow Area=0.832 ac
Peak Elev=991.06'
Storage=3,319 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0 1 2 3 4 5 6
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 8P: CB W

Inflow Area =	1.320 ac,	0.00% Impervious,	Inflow Depth = 4.85"	for 100-yr event
Inflow =	5.57 cfs @	12.11 hrs, Volume=	0.534 af	
Outflow =	4.22 cfs @	12.16 hrs, Volume=	0.534 af,	Atten= 24%, Lag= 2.6 min
Primary =	4.22 cfs @	12.16 hrs, Volume=	0.534 af	
Tertiary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.78' @ 12.14 hrs Surf.Area= 6,789 sf Storage= 1,953 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 3.8 min calculated for 0.534 af (100% of inflow)
Center-of-Mass det. time= 3.8 min (798.8 - 795.0)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

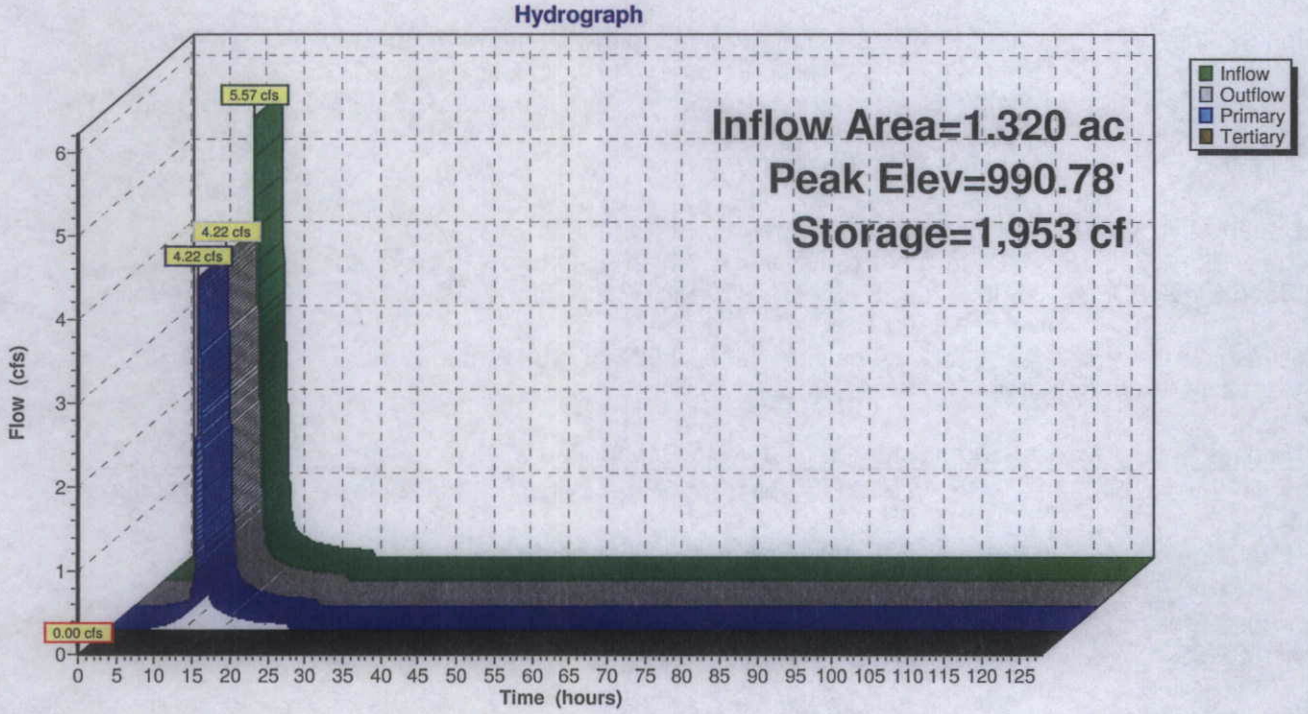
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.26 cfs @ 12.16 hrs HW=990.77' TW=990.61' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 4.26 cfs @ 1.77 fps)
  └─**2=Orifice/Grate** (Passes 4.26 cfs of 7.01 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 8P: CB W


Hydrograph
5.57 cfs
4.22 cfs
4.22 cfs
0.00 cfs
Inflow Area=1.320 ac
Peak Elev=990.78'
Storage=1,953 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 9P: CB SW

Inflow Area = 1.808 ac, 0.00% Impervious, Inflow Depth = 4.89" for 100-yr event
Inflow = 6.83 cfs @ 12.03 hrs, Volume= 0.737 af
Outflow = 6.39 cfs @ 12.08 hrs, Volume= 0.737 af, Atten= 7%, Lag= 3.1 min
Primary = 6.39 cfs @ 12.08 hrs, Volume= 0.737 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.62' @ 12.08 hrs Surf.Area= 5,006 sf Storage= 1,062 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.7 min calculated for 0.737 af (100% of inflow)
Center-of-Mass det. time= 1.7 min (796.6 - 794.8)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

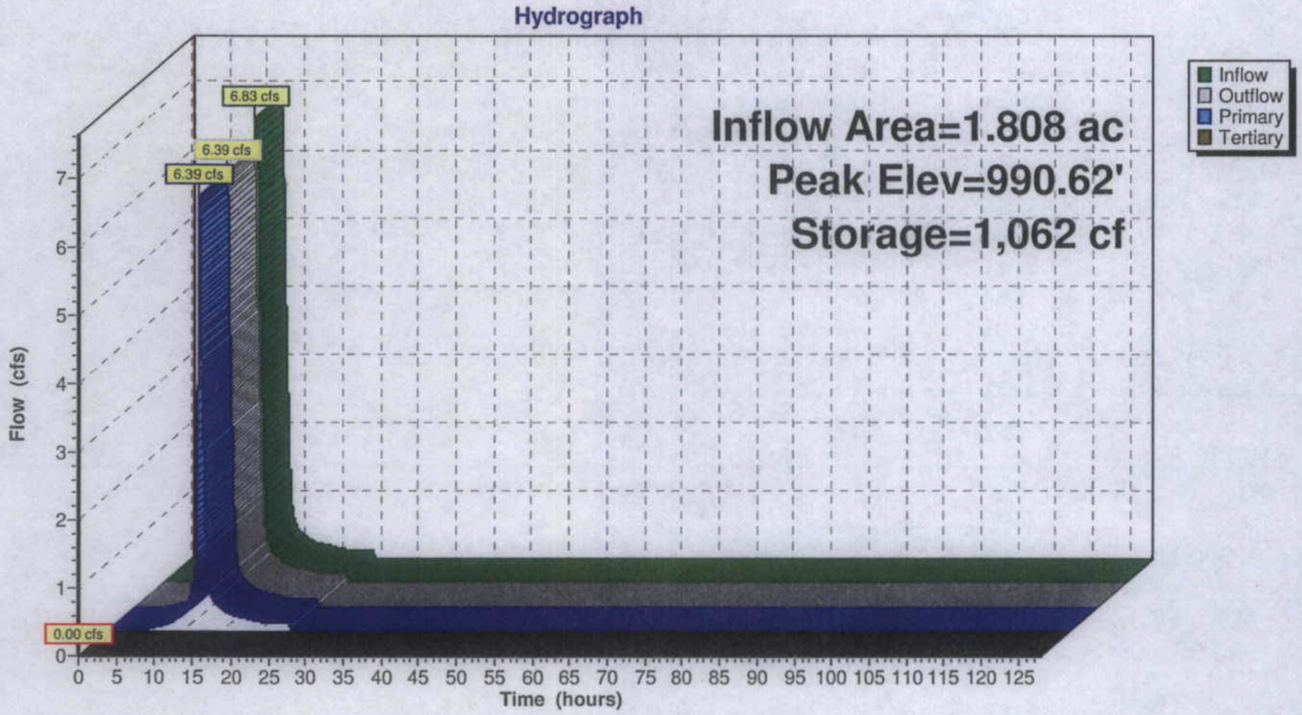
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 99.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.19' / 982.00' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=6.38 cfs @ 12.08 hrs HW=990.62' TW=982.19' (Dynamic Tailwater)
└─**1=Culvert** (Passes 6.38 cfs of 29.34 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 6.38 cfs @ 2.13 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=979.99' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: CB SW


Hydrograph
6.83 cfs
6.39 cfs
6.39 cfs
0.00 cfs
Inflow Area=1.808 ac
Peak Elev=990.62'
Storage=1,062 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
0
1
2
3
4
5
6
7
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 10P: CB Pump

Inflow Area = 1.662 ac, 0.00% Impervious, Inflow Depth = 5.05" for 100-yr event
Inflow = 5.94 cfs @ 12.08 hrs, Volume= 0.700 af
Outflow = 5.94 cfs @ 12.08 hrs, Volume= 0.700 af, Atten= 0%, Lag= 0.0 min
Primary = 5.94 cfs @ 12.08 hrs, Volume= 0.700 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

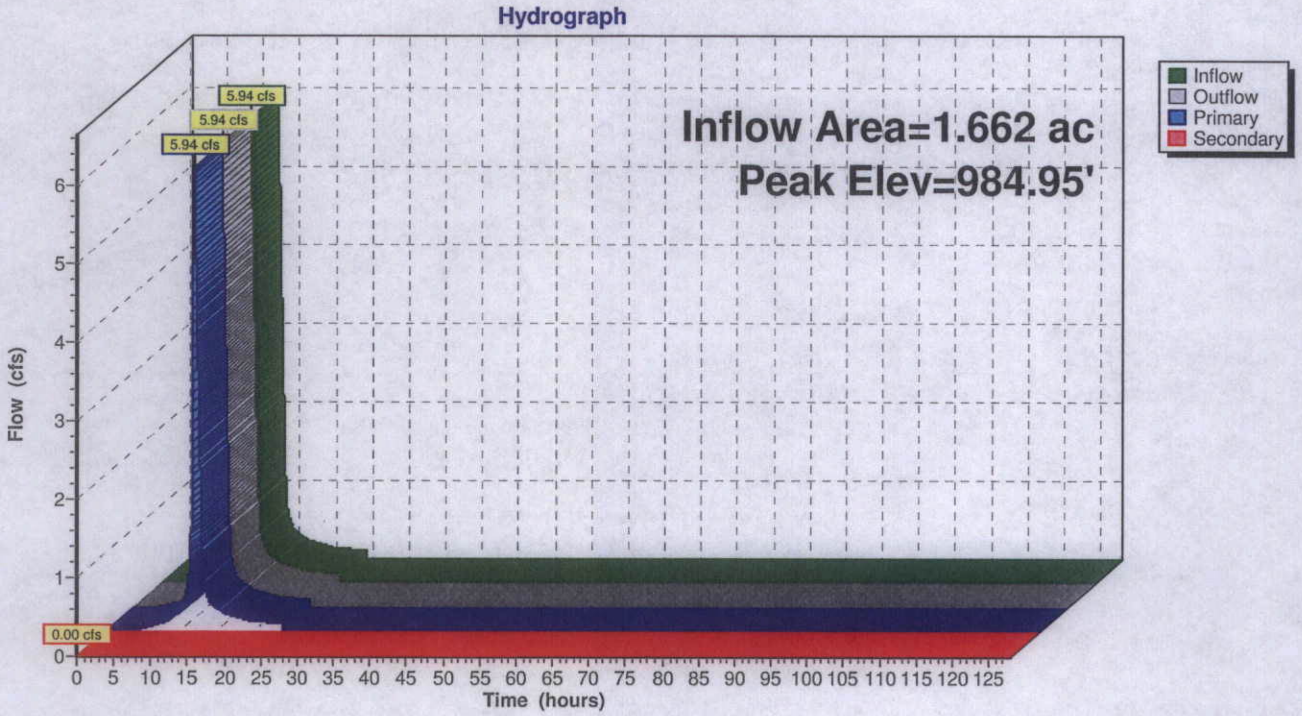
Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 984.95' @ 24.50 hrs
Flood Elev= 990.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	982.00'	**21.0" Round Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 982.00' / 982.00' S= 0.0000 '/' Cc= 0.900 n= 0.013
#2	Secondary	990.95'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=5.94 cfs @ 12.08 hrs HW=983.54' TW=982.18' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 5.94 cfs @ 3.51 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=982.00' TW=979.99' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 10P: CB Pump



Summary for Pond P-N: North Basin

Inflow Area = 1.555 ac, 10.60% Impervious, Inflow Depth = 4.99" for 100-yr event
Inflow = 11.15 cfs @ 12.01 hrs, Volume= 0.647 af
Outflow = 1.56 cfs @ 12.36 hrs, Volume= 0.645 af, Atten= 86%, Lag= 20.7 min
Primary = 1.56 cfs @ 12.36 hrs, Volume= 0.645 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 988.84' @ 12.36 hrs Surf.Area= 8,148 sf Storage= 12,593 cf
Flood Elev= 993.00' Surf.Area= 12,166 sf Storage= 34,171 cf

Plug-Flow detention time= 124.3 min calculated for 0.645 af (100% of inflow)
Center-of-Mass det. time= 122.5 min (906.8 - 784.3)

Volume	Invert	Avail.Storage	Storage Description
#1	982.00'	34,171 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

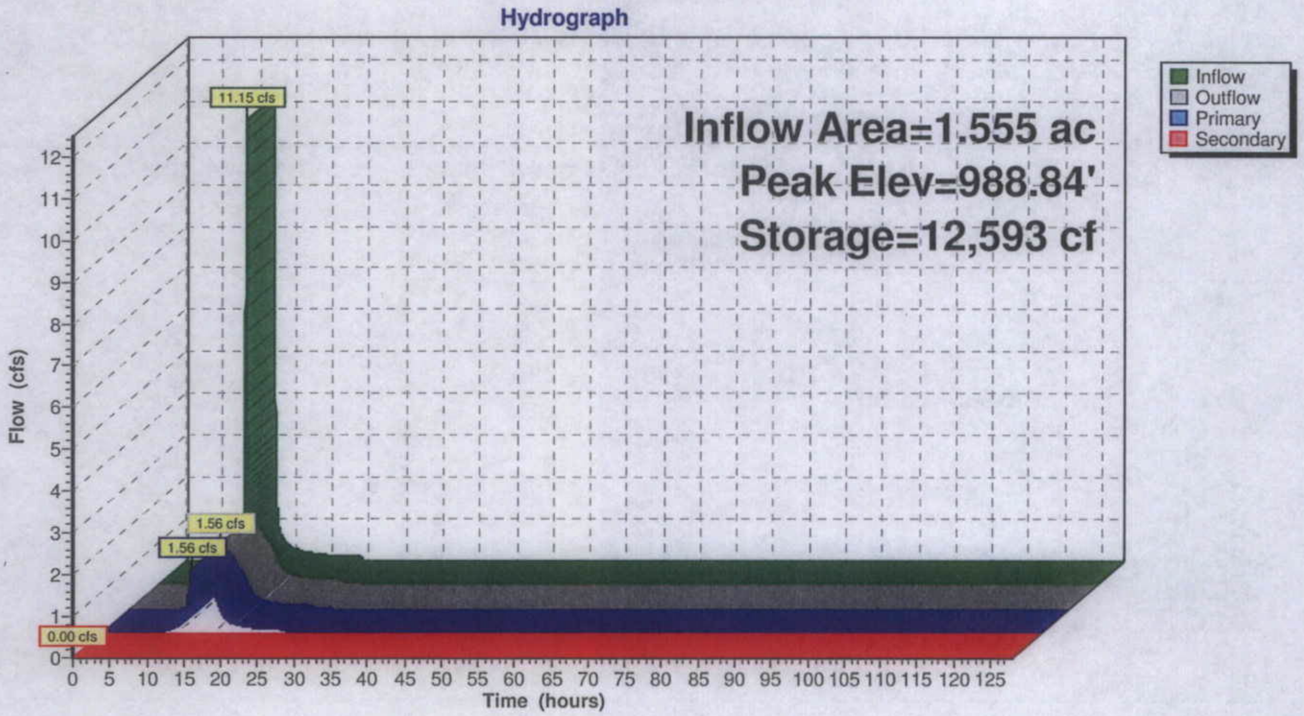
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
982.00	443	0.0	0	0
983.00	812	0.0	0	0
984.00	1,293	0.0	0	0
985.00	1,886	0.0	0	0
986.00	2,589	0.0	0	0
986.99	5,543	0.0	0	0
987.00	5,543	100.0	55	55
988.00	6,914	100.0	6,229	6,284
989.00	8,387	100.0	7,651	13,934
990.00	9,960	100.0	9,174	23,108
991.00	12,166	100.0	11,063	34,171

Device	Routing	Invert	Outlet Devices
#1	Primary	987.00'	**4.0" Round Culvert X 3.00** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 987.00' / 986.80' S= 0.0100 '/' Cc= 0.900 n= 0.010
#2	Device 1	987.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	990.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	990.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" Grate Limited to weir flow at low heads
#5	Secondary	991.00'	**20.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=1.56 cfs @ 12.36 hrs HW=988.84' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.56 cfs @ 5.94 fps)
  ├─**2=Orifice/Grate** (Passes 1.56 cfs of 2.06 cfs potential flow)
  ├─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=982.00' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P-N: North Basin



Summary for Pond P-S: South Basin

Inflow Area = 6.308 ac, 5.65% Impervious, Inflow Depth = 4.86" for 100-yr event
Inflow = 26.12 cfs @ 12.04 hrs, Volume= 2.553 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 984.95' @ 24.64 hrs Surf.Area= 29,592 sf Storage= 111,189 cf
Flood Elev= 990.50' Surf.Area= 57,219 sf Storage= 362,790 cf

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

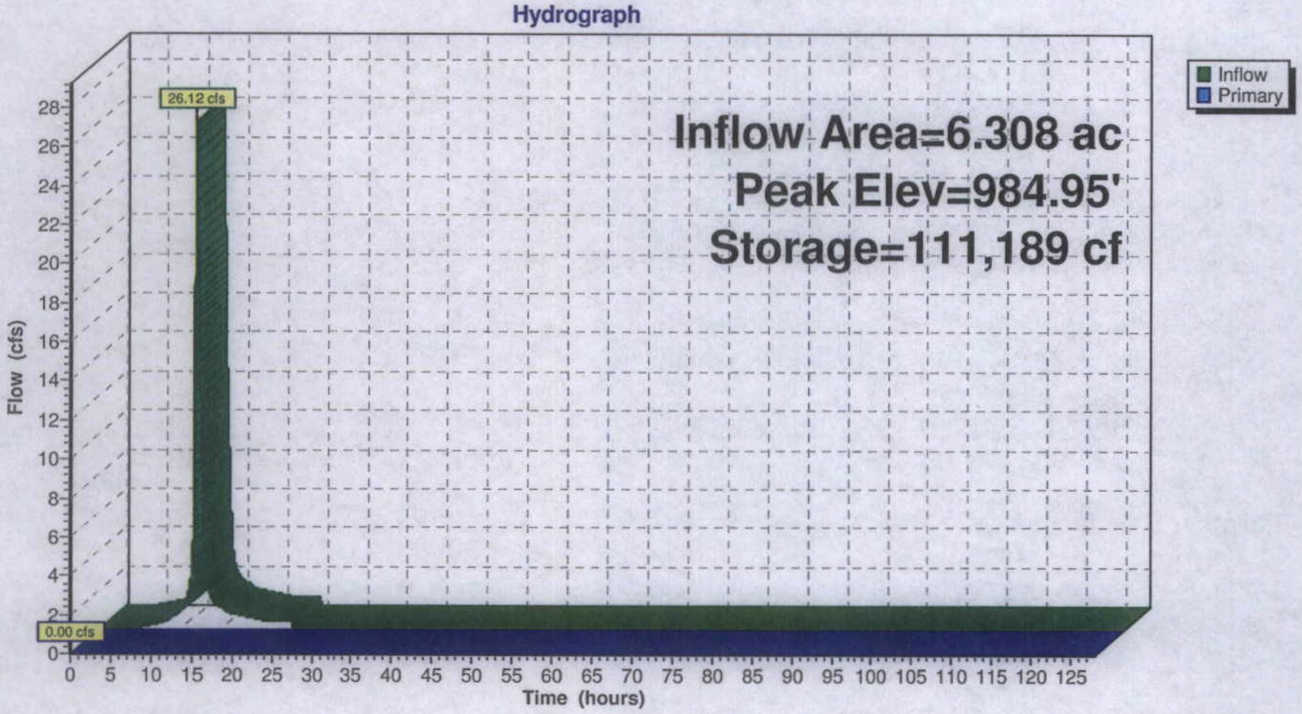
Volume	Invert	Avail.Storage	Storage Description
#1	979.99'	362,790 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
979.99	15,521	0.0	0	0
980.00	15,521	100.0	155	155
981.00	18,219	100.0	16,870	17,025
982.00	20,989	100.0	19,604	36,629
983.00	23,830	100.0	22,410	59,039
984.00	26,744	100.0	25,287	84,326
985.00	29,730	100.0	28,237	112,563
986.00	40,204	100.0	34,967	147,530
987.00	43,493	100.0	41,849	189,378
988.00	46,840	100.0	45,167	234,545
989.00	50,243	100.0	48,542	283,086
990.00	53,703	100.0	51,973	335,059
990.50	57,219	100.0	27,731	362,790

Device	Routing	Invert	Outlet Devices
#1	Primary	990.50'	**150.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=979.99' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P-S: South Basin

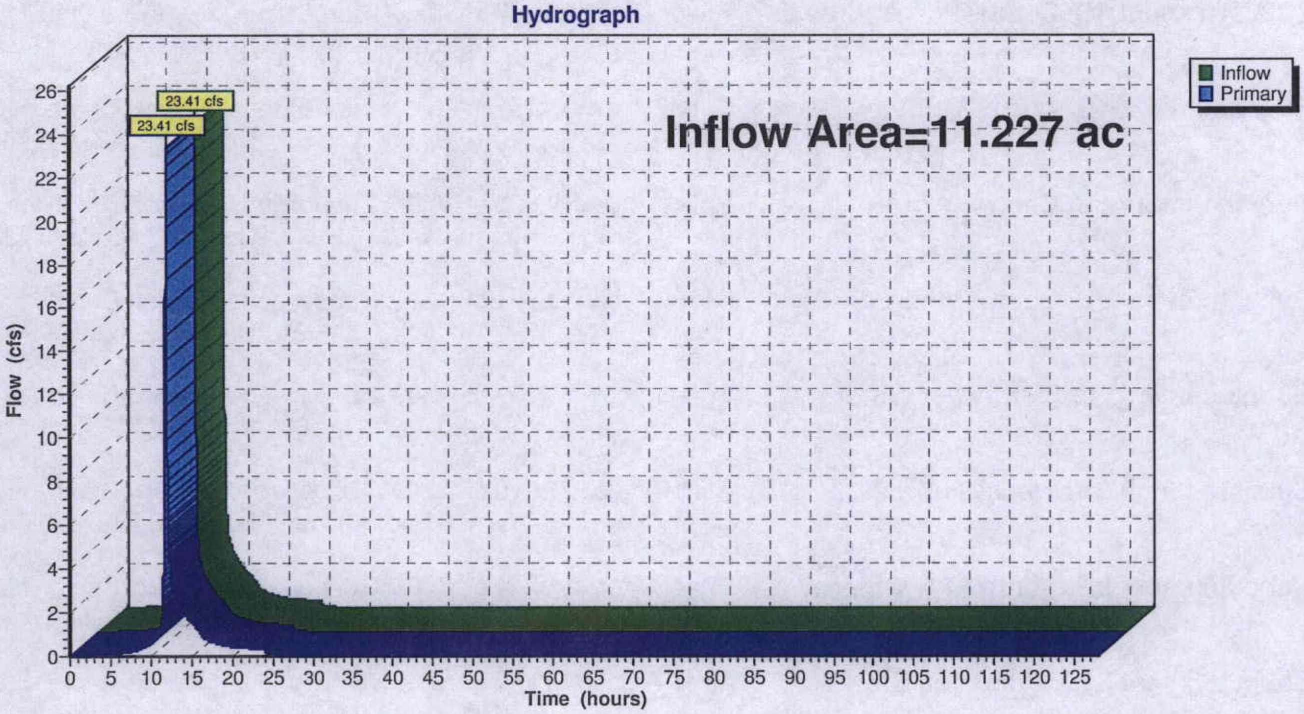


Summary for Link PROP: Total

Inflow Area =	11.227 ac,	12.41% Impervious,	Inflow Depth = 2.06"	for 100-yr event
Inflow =	23.41 cfs @	12.01 hrs, Volume=	1.930 af	
Primary =	23.41 cfs @	12.01 hrs, Volume=	1.930 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs

Link PROP: Total



Time span=0.00-128.00 hrs, dt=0.01 hrs, 12801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Northeast Windrow Runoff Area=25,745 sf 0.00% Impervious Runoff Depth=10.80"
Tc=10.0 min CN=88 Runoff=4.51 cfs 0.532 af

Subcatchment 2S: East Windrow Runoff Area=19,347 sf 0.00% Impervious Runoff Depth=11.19"
Tc=10.0 min CN=91 Runoff=3.41 cfs 0.414 af

Subcatchment 3S: Southeast Windrow Runoff Area=19,357 sf 0.00% Impervious Runoff Depth=11.19"
Tc=10.0 min CN=91 Runoff=3.42 cfs 0.414 af

Subcatchment 4S: North Windrow Runoff Area=33,157 sf 0.00% Impervious Runoff Depth=11.06"
Tc=10.0 min CN=90 Runoff=5.84 cfs 0.702 af

Subcatchment 5S: Central Windrow Runoff Area=19,622 sf 0.00% Impervious Runoff Depth=11.19"
Tc=10.0 min CN=91 Runoff=3.46 cfs 0.420 af

Subcatchment 6S: South Windrow Runoff Area=19,624 sf 0.00% Impervious Runoff Depth=11.19"
Tc=10.0 min CN=91 Runoff=3.46 cfs 0.420 af

Subcatchment 7S: Northwest Windrow Runoff Area=36,257 sf 0.00% Impervious Runoff Depth=10.80"
Tc=10.0 min CN=88 Runoff=6.35 cfs 0.749 af

Subcatchment 8S: West Windrow Runoff Area=21,248 sf 0.00% Impervious Runoff Depth=11.06"
Tc=10.0 min CN=90 Runoff=3.74 cfs 0.450 af

Subcatchment 9S: Southwest Windrow Runoff Area=21,244 sf 0.00% Impervious Runoff Depth=11.06"
Tc=10.0 min CN=90 Runoff=3.74 cfs 0.450 af

Subcatchment 11S: Pond and Storage Runoff Area=67,737 sf 10.60% Impervious Runoff Depth=11.06"
Tc=10.0 min CN=90 Runoff=11.93 cfs 1.433 af

Subcatchment 12S: Pond Area Runoff Area=59,175 sf 26.23% Impervious Runoff Depth=10.41"
Tc=10.0 min CN=85 Runoff=10.26 cfs 1.178 af

Subcatchment DE-P: Drive Entrance Runoff Area=18,545 sf 0.00% Impervious Runoff Depth=11.19"
Tc=10.0 min CN=91 Runoff=3.27 cfs 0.397 af

Subcatchment PRM: Perimeter Runoff Runoff Area=90,004 sf 0.00% Impervious Runoff Depth=9.74"
Flow Length=60' Tc=10.0 min CN=80 Runoff=15.26 cfs 1.677 af

Subcatchment ROOF: Roof Runoff Area=37,980 sf 100.00% Impervious Runoff Depth=12.06"
Tc=10.0 min CN=98 Runoff=6.76 cfs 0.876 af

Pond 1P: CB NE Peak Elev=990.88' Storage=2,691 cf Inflow=4.51 cfs 0.532 af
Primary=1.96 cfs 0.532 af Secondary=0.00 cfs 0.000 af Outflow=1.96 cfs 0.532 af

Pond 2P: CB E Peak Elev=990.73' Storage=1,676 cf Inflow=4.95 cfs 0.946 af
Primary=3.77 cfs 0.946 af Tertiary=0.00 cfs 0.000 af Outflow=3.77 cfs 0.946 af

Pond 3P: CB SE Peak Elev=990.61' Storage=1,009 cf Inflow=6.57 cfs 1.360 af
Primary=6.15 cfs 1.360 af Tertiary=0.00 cfs 0.000 af Outflow=6.15 cfs 1.360 af

Pond 4P: CB N Peak Elev=991.16' Storage=3,320 cf Inflow=5.84 cfs 0.702 af
Primary=2.92 cfs 0.695 af Secondary=2.69 cfs 0.006 af Outflow=5.61 cfs 0.702 af

Pond 5P: CB Central Peak Elev=990.82' Storage=2,253 cf Inflow=8.04 cfs 1.122 af
Primary=4.16 cfs 1.122 af Tertiary=0.00 cfs 0.000 af Outflow=4.16 cfs 1.122 af

Pond 6P: CB S Peak Elev=990.62' Storage=1,029 cf Inflow=6.66 cfs 1.542 af
Primary=6.24 cfs 1.542 af Tertiary=0.00 cfs 0.000 af Outflow=6.24 cfs 1.542 af

Pond 7P: CB NW Peak Elev=991.25' Storage=3,319 cf Inflow=6.35 cfs 0.749 af
Primary=3.27 cfs 0.731 af Secondary=4.64 cfs 0.018 af Outflow=7.92 cfs 0.749 af

Pond 8P: CB W Peak Elev=990.86' Storage=2,581 cf Inflow=11.16 cfs 1.199 af
Primary=4.84 cfs 1.199 af Tertiary=0.00 cfs 0.000 af Outflow=4.84 cfs 1.199 af

Pond 9P: CB SW Peak Elev=990.65' Storage=1,199 cf Inflow=7.33 cfs 1.648 af
Primary=7.00 cfs 1.648 af Tertiary=0.00 cfs 0.000 af Outflow=7.00 cfs 1.648 af

Pond 10P: CB Pump Peak Elev=988.32' Inflow=6.24 cfs 1.542 af
Primary=6.24 cfs 1.542 af Secondary=0.00 cfs 0.000 af Outflow=6.24 cfs 1.542 af

Pond P-N: North Basin Peak Elev=989.01' Storage=13,980 cf Inflow=11.93 cfs 1.433 af
Primary=1.63 cfs 1.431 af Secondary=0.00 cfs 0.000 af Outflow=1.63 cfs 1.431 af

Pond P-S: South Basin Peak Elev=988.32' Storage=249,545 cf Inflow=28.34 cfs 5.729 af
Outflow=0.00 cfs 0.000 af

Link PROP: Total Inflow=26.66 cfs 4.381 af
Primary=26.66 cfs 4.381 af

Total Runoff Area = 11.227 ac Runoff Volume = 10.112 af Average Runoff Depth = 10.81"
87.59% Pervious = 9.834 ac 12.41% Impervious = 1.393 ac

Summary for Subcatchment 1S: Northeast Windrow

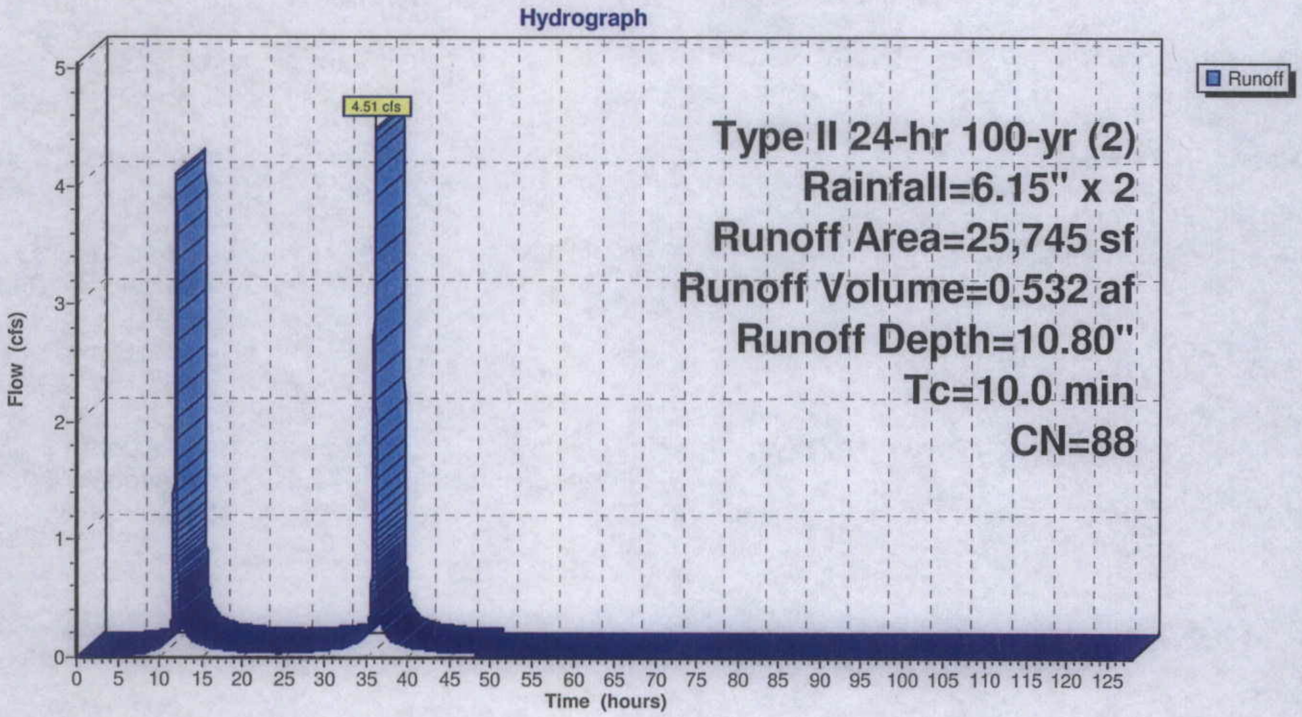
Runoff = 4.51 cfs @ 36.01 hrs, Volume= 0.532 af, Depth=10.80"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

	Area (sf)	CN	Description
*	19,012	91	Gravel pads, HSG D
	6,733	80	>75% Grass cover, Good, HSG D
	25,745	88	Weighted Average
	25,745		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: Northeast Windrow



Summary for Subcatchment 2S: East Windrow

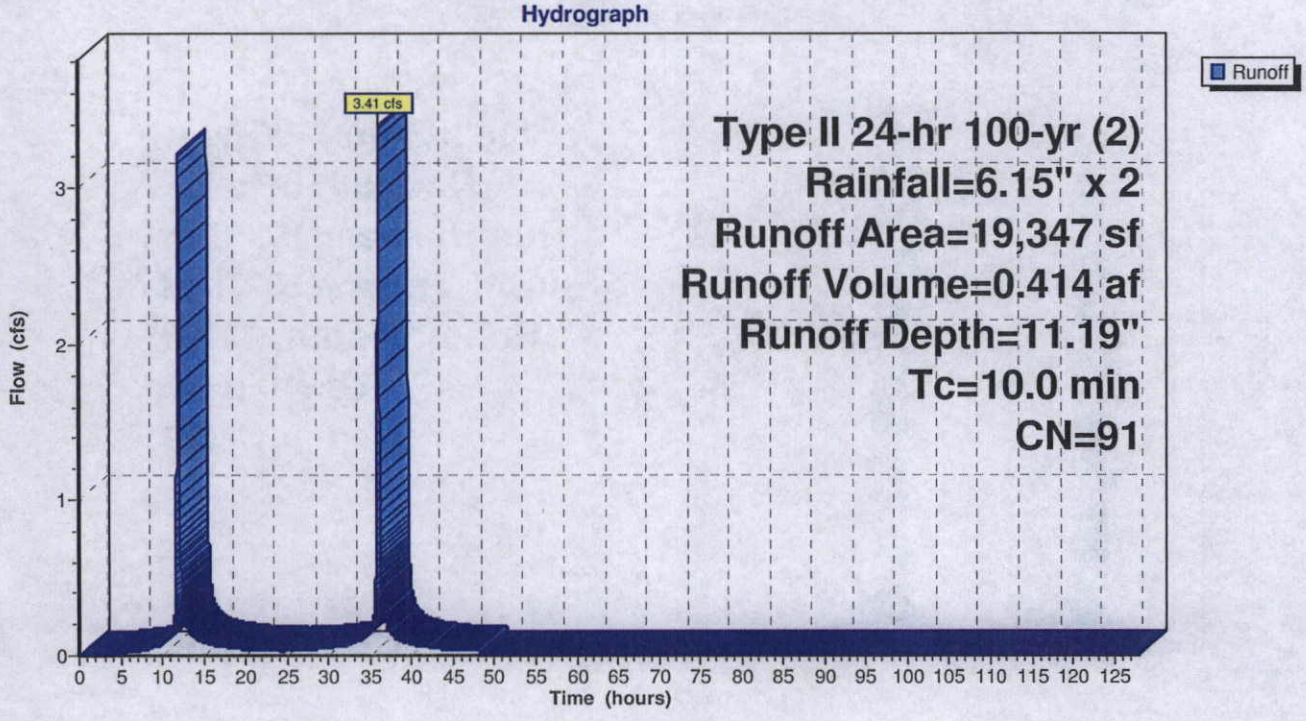
Runoff = 3.41 cfs @ 36.01 hrs, Volume= 0.414 af, Depth=11.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

	Area (sf)	CN	Description
*	19,347	91	Gravel pads, HSG D
	19,347		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2S: East Windrow



Summary for Subcatchment 3S: Southeast Windrow

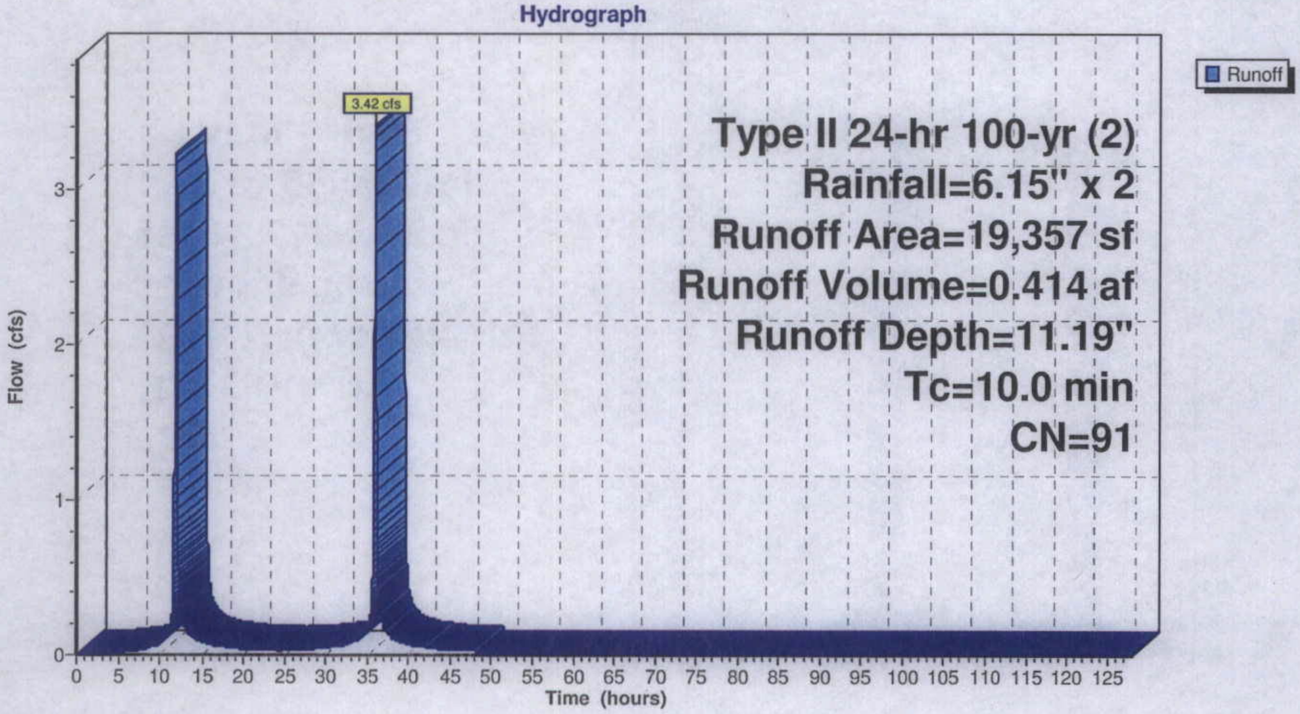
Runoff = 3.42 cfs @ 36.01 hrs, Volume= 0.414 af, Depth=11.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

	Area (sf)	CN	Description
*	19,357	91	Gravel paths, HSG D
	19,357		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 3S: Southeast Windrow



Summary for Subcatchment 4S: North Windrow

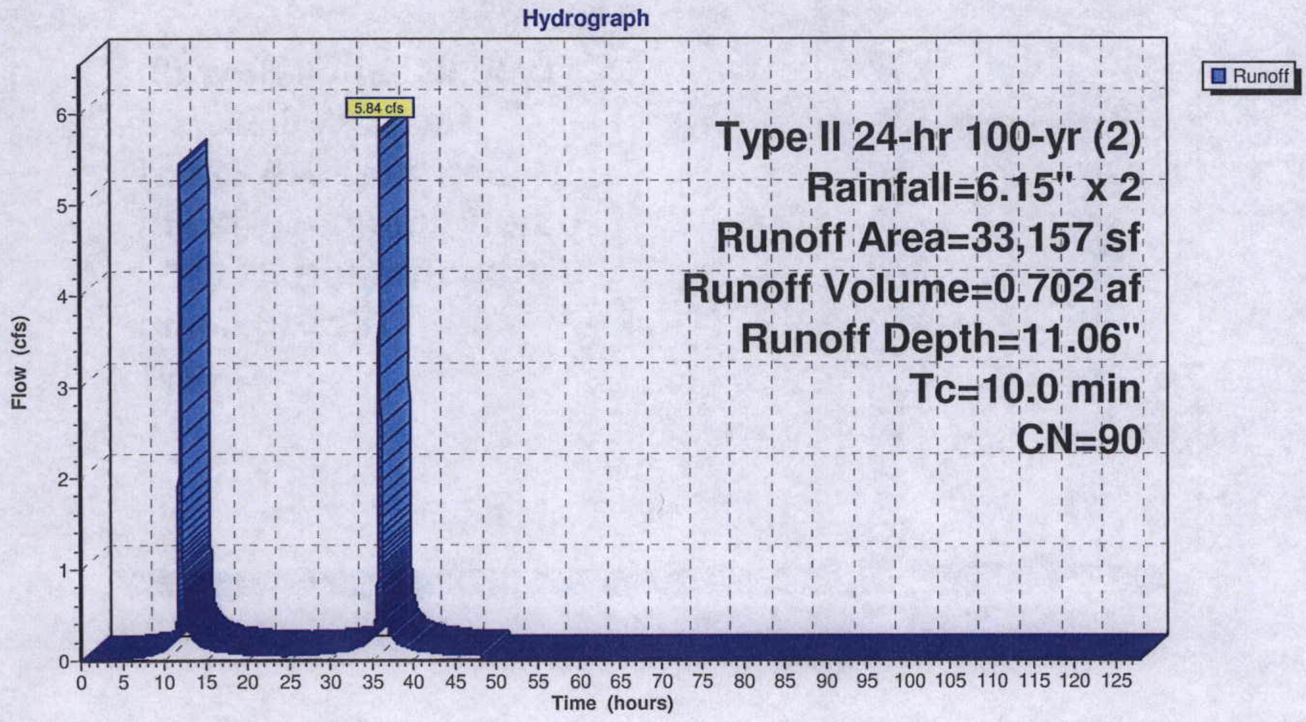
Runoff = 5.84 cfs @ 36.01 hrs, Volume= 0.702 af, Depth=11.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

	Area (sf)	CN	Description
*	29,932	91	Gravel paths, HSG D
	3,225	80	>75% Grass cover, Good, HSG D
	33,157	90	Weighted Average
	33,157		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 4S: North Windrow



Summary for Subcatchment 5S: Central Windrow

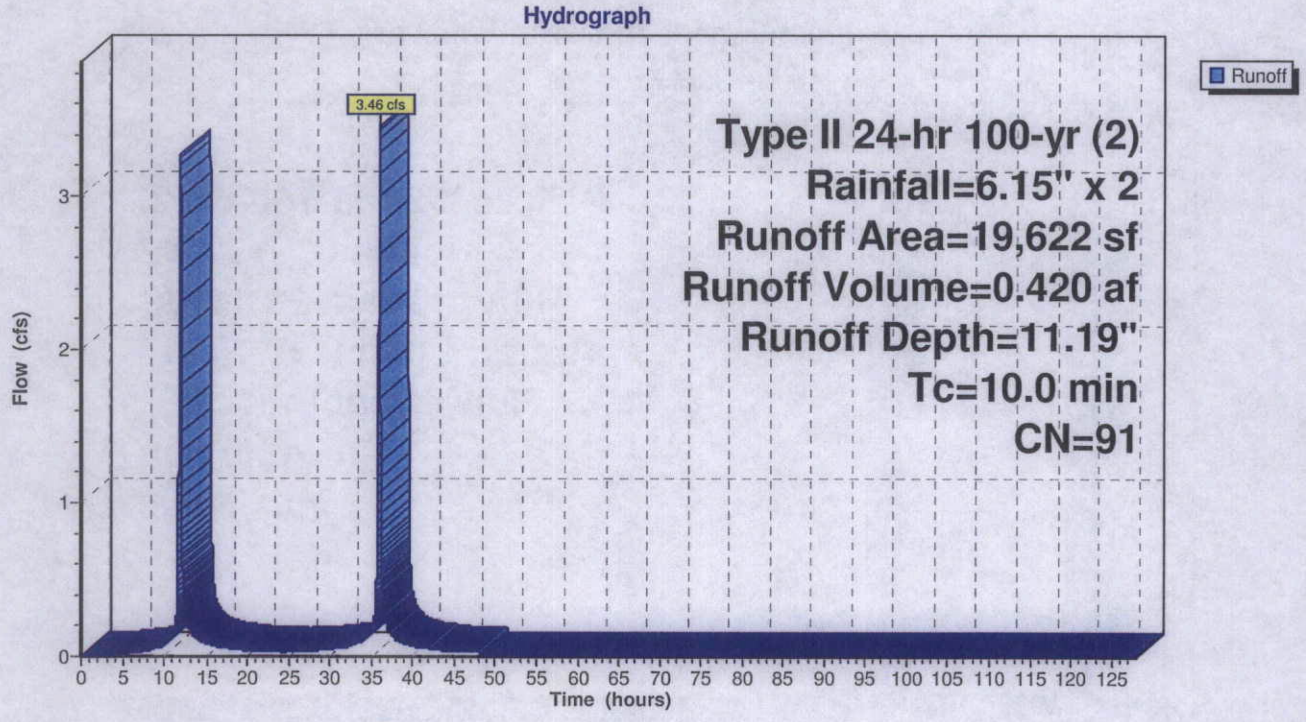
Runoff = 3.46 cfs @ 36.01 hrs, Volume= 0.420 af, Depth=11.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

	Area (sf)	CN	Description
*	19,622	91	Gravel paths, HSG D
	19,622		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 5S: Central Windrow



Summary for Subcatchment 6S: South Windrow

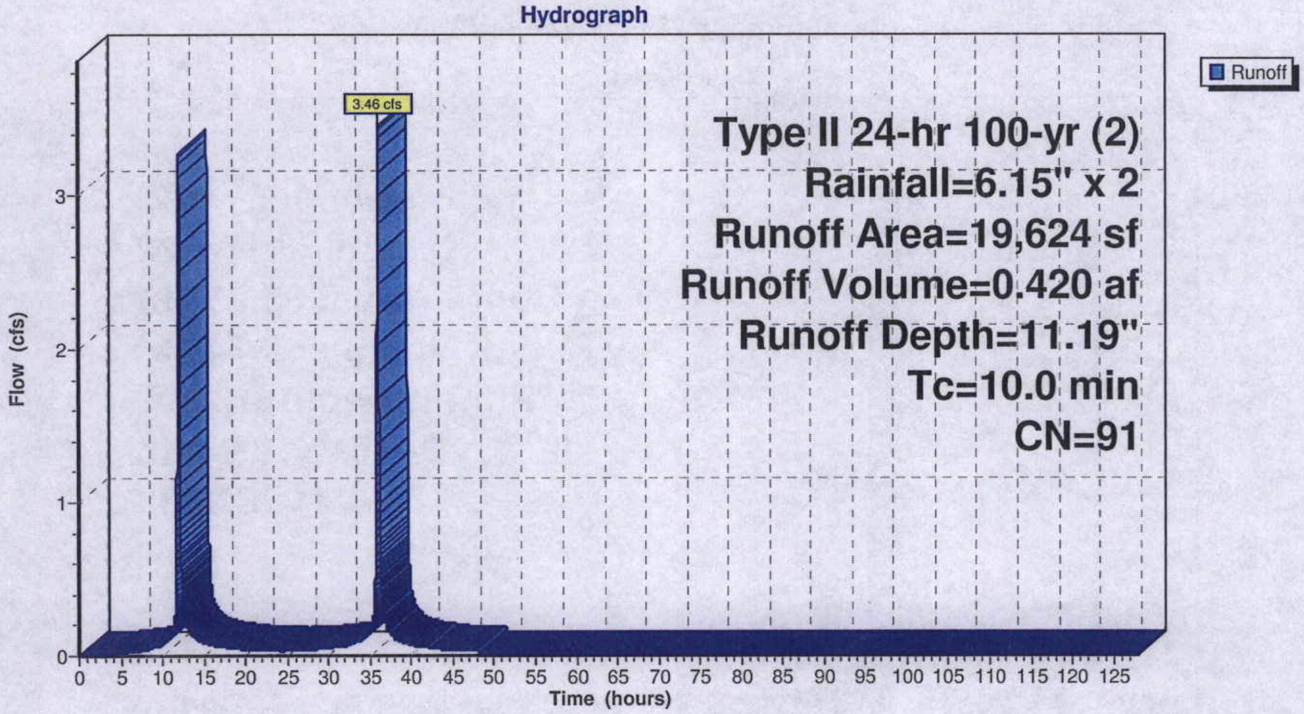
Runoff = 3.46 cfs @ 36.01 hrs, Volume= 0.420 af, Depth=11.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

	Area (sf)	CN	Description
*	19,624	91	Gravel paths, HSG D
	19,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 6S: South Windrow



Summary for Subcatchment 7S: Northwest Windrow

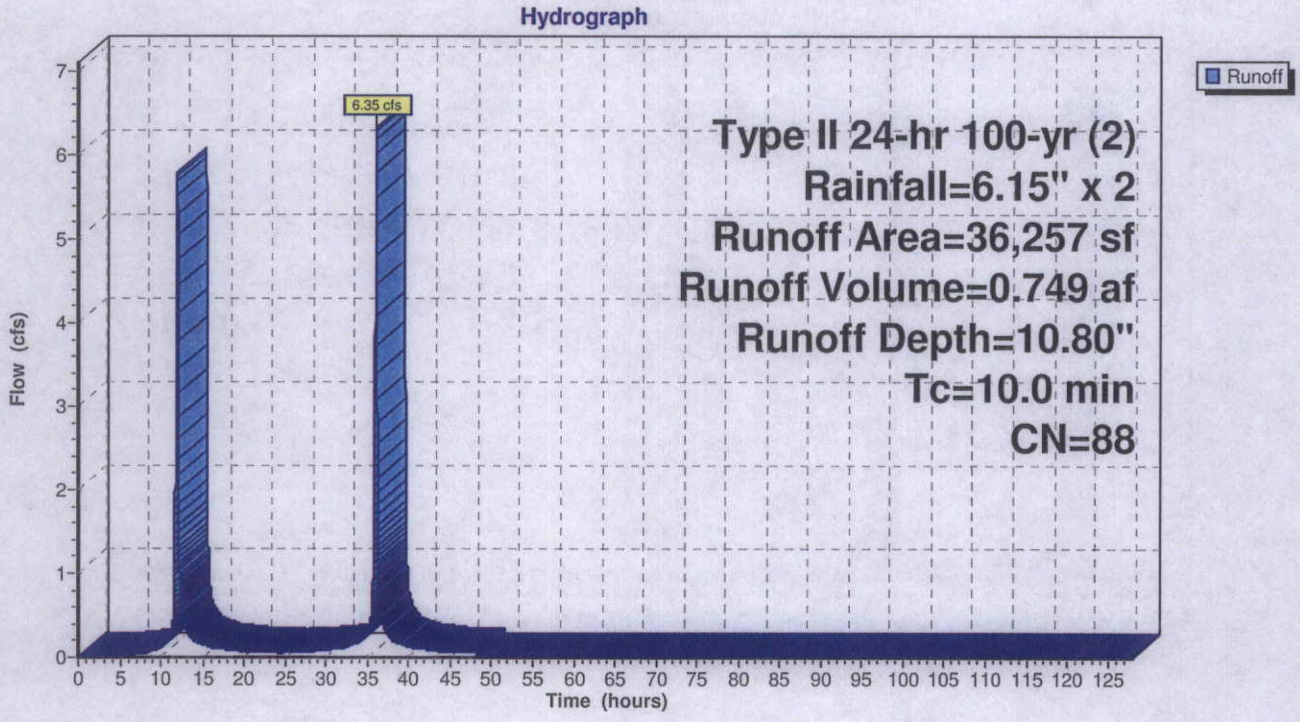
Runoff = 6.35 cfs @ 36.01 hrs, Volume= 0.749 af, Depth=10.80"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

	Area (sf)	CN	Description
*	27,075	91	Gravel paths, HSG D
	9,182	80	>75% Grass cover, Good, HSG D
	36,257	88	Weighted Average
	36,257		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 7S: Northwest Windrow



Summary for Subcatchment 8S: West Windrow

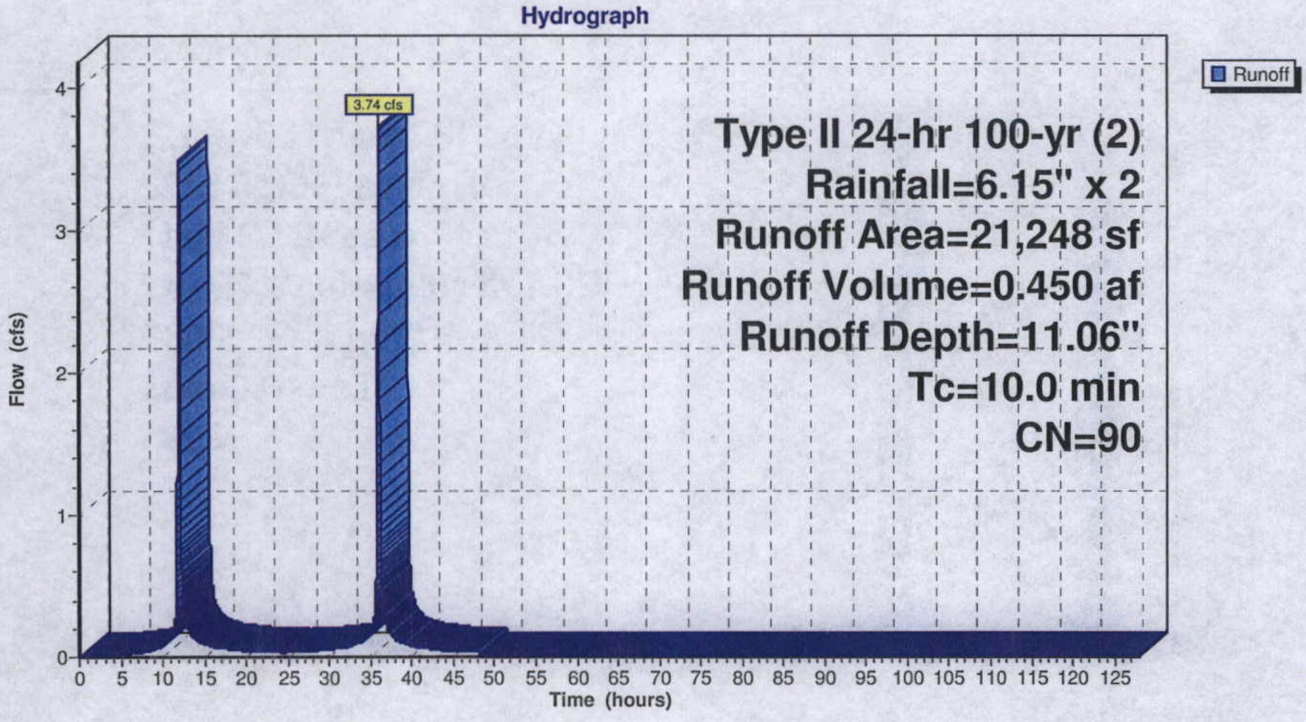
Runoff = 3.74 cfs @ 36.01 hrs, Volume= 0.450 af, Depth=11.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

Area (sf)	CN	Description
19,338	91	Gravel roads, HSG D
1,910	80	>75% Grass cover, Good, HSG D
21,248	90	Weighted Average
21,248		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 8S: West Windrow



Summary for Subcatchment 9S: Southwest Windrow

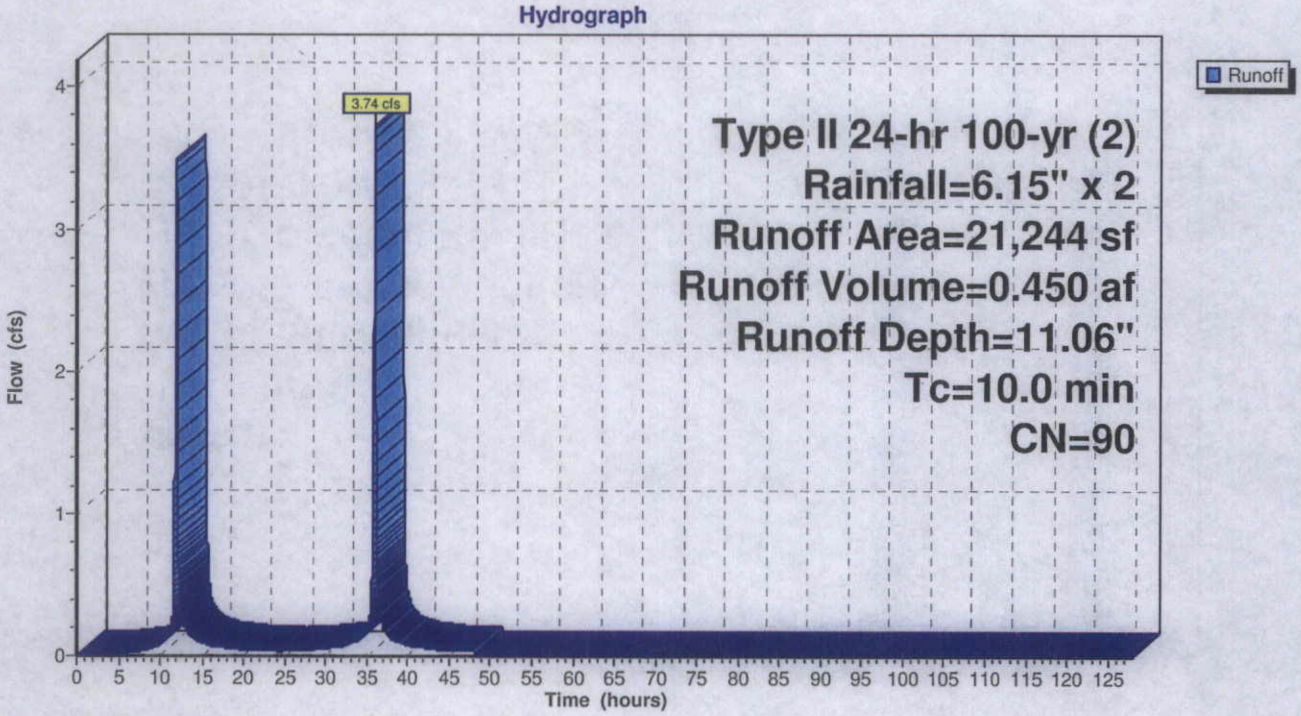
Runoff = 3.74 cfs @ 36.01 hrs, Volume= 0.450 af, Depth=11.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

Area (sf)	CN	Description
19,289	91	Gravel roads, HSG D
1,955	80	>75% Grass cover, Good, HSG D
21,244	90	Weighted Average
21,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 9S: Southwest Windrow



Summary for Subcatchment 11S: Pond and Storage Area

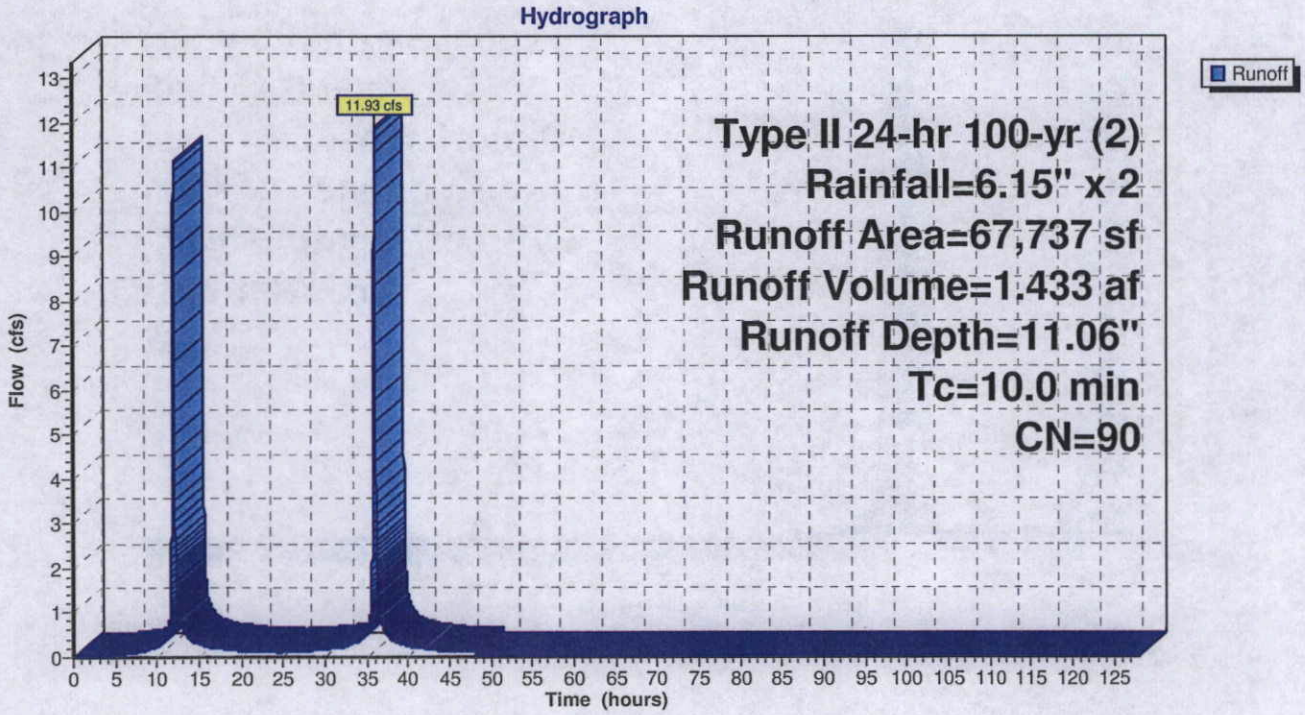
Runoff = 11.93 cfs @ 36.01 hrs, Volume= 1.433 af, Depth=11.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

Area (sf)	CN	Description
11,601	80	>75% Grass cover, Good, HSG D
48,954	91	Gravel roads, HSG D
1,639	98	Unconnected pavement, HSG D
5,543	98	Water Surface, HSG D
67,737	90	Weighted Average
60,555		89.40% Pervious Area
7,182		10.60% Impervious Area
1,639		22.82% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Pond and Storage Area



Summary for Subcatchment 12S: Pond Area

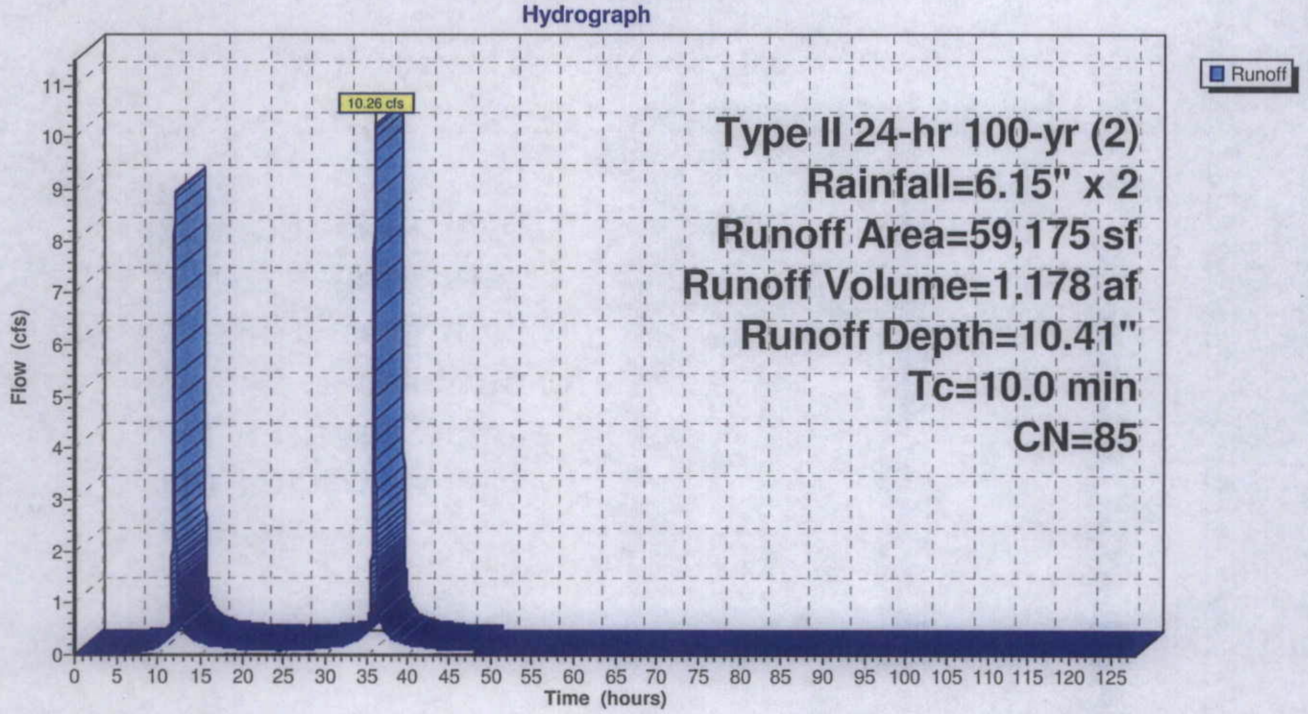
Runoff = 10.26 cfs @ 36.01 hrs, Volume= 1.178 af, Depth=10.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

Area (sf)	CN	Description
43,654	80	>75% Grass cover, Good, HSG D
15,521	98	Water Surface, HSG D
59,175	85	Weighted Average
43,654		73.77% Pervious Area
15,521		26.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 12S: Pond Area



Summary for Subcatchment DE-P: Drive Entrance

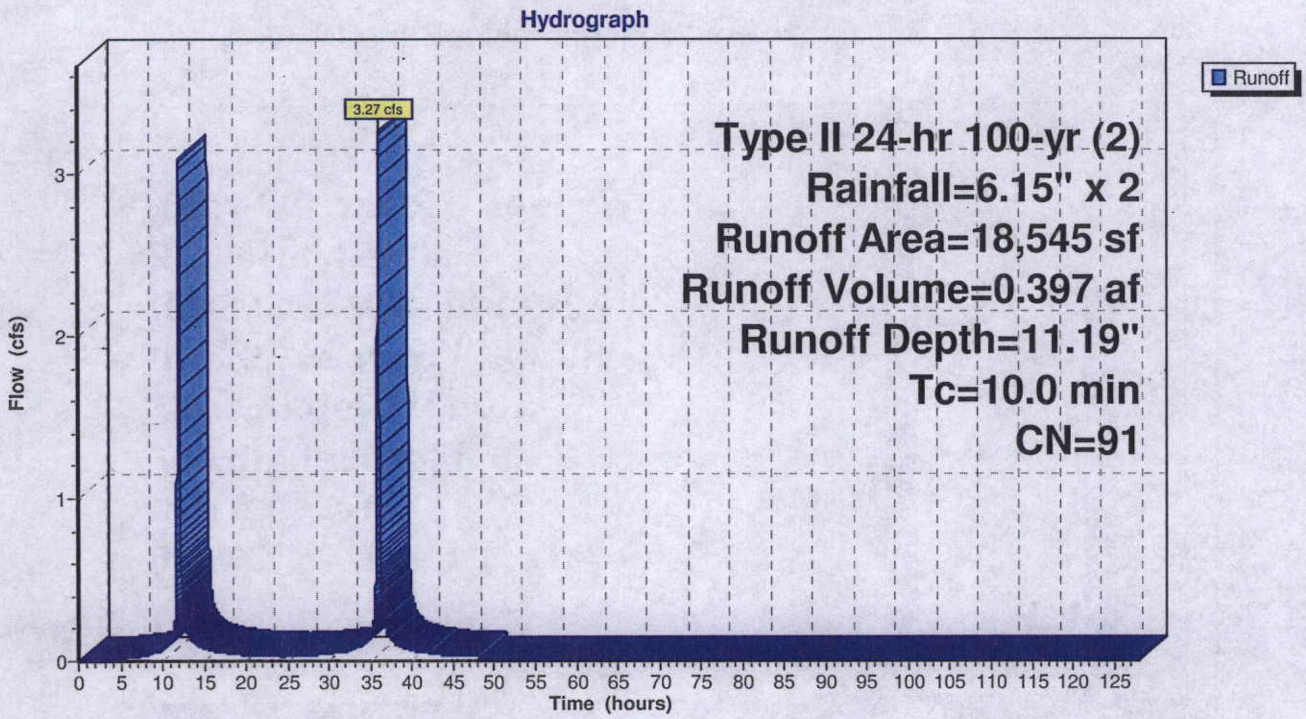
Runoff = 3.27 cfs @ 36.01 hrs, Volume= 0.397 af, Depth=11.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

Area (sf)	CN	Description
18,545	91	Gravel roads, HSG D
18,545		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment DE-P: Drive Entrance



Summary for Subcatchment PRM: Perimeter Runoff

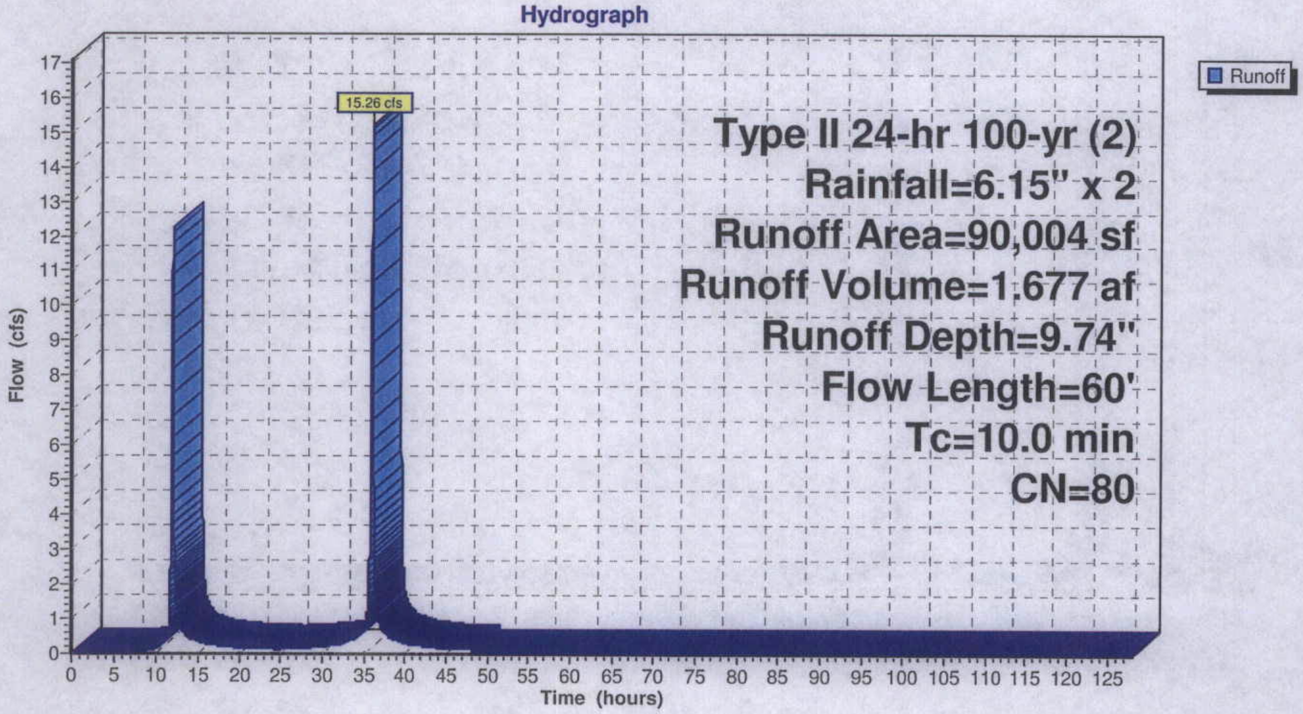
Runoff = 15.26 cfs @ 36.01 hrs, Volume= 1.677 af, Depth= 9.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

Area (sf)	CN	Description
87,582	80	>75% Grass cover, Good, HSG D
2,422	91	Gravel roads, HSG D
90,004	80	Weighted Average
90,004		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	60		0.10		**Direct Entry,**

Subcatchment PRM: Perimeter Runoff



Summary for Subcatchment ROOF: Roof

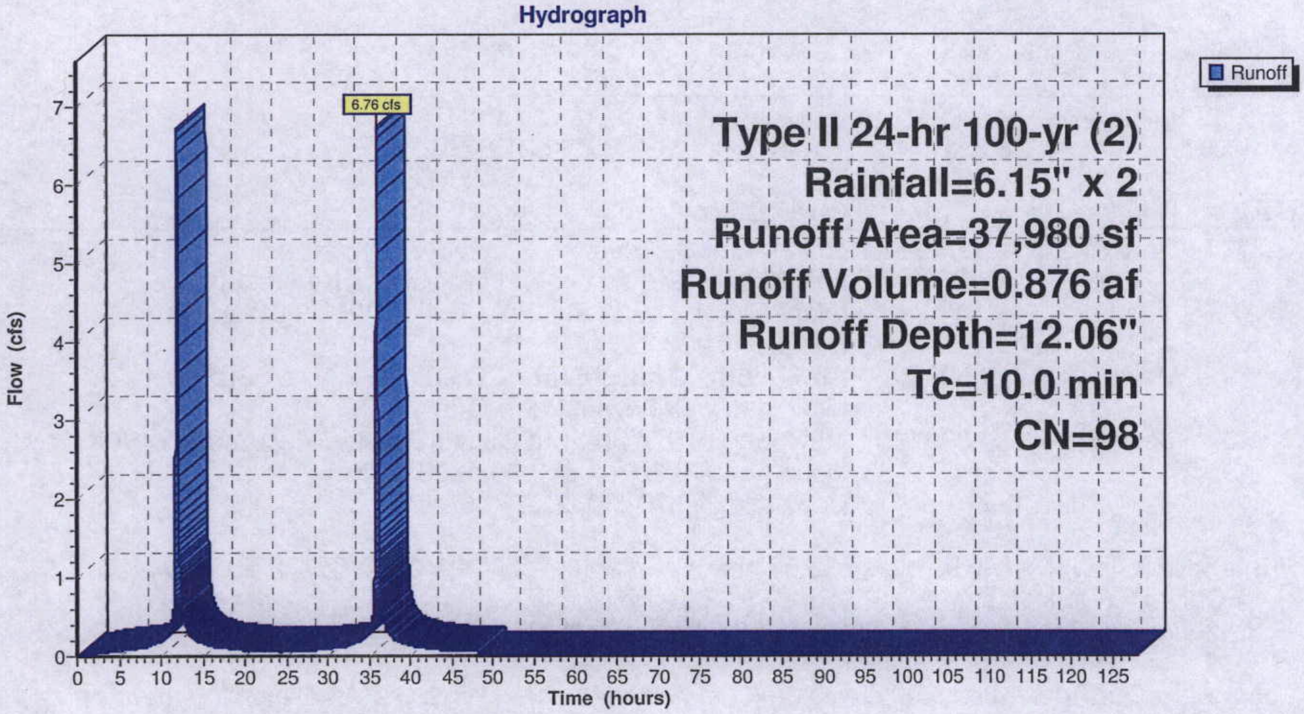
Runoff = 6.76 cfs @ 36.01 hrs, Volume= 0.876 af, Depth=12.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr (2) Rainfall=6.15" x 2

	Area (sf)	CN	Description
*	37,980	98	Roof
	37,980		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment ROOF: Roof



Summary for Pond 1P: CB NE

Inflow Area = 0.591 ac, 0.00% Impervious, Inflow Depth = 10.80" for 100-yr (2) event
Inflow = 4.51 cfs @ 36.01 hrs, Volume= 0.532 af
Outflow = 1.96 cfs @ 36.31 hrs, Volume= 0.532 af, Atten= 57%, Lag= 18.2 min
Primary = 1.96 cfs @ 36.31 hrs, Volume= 0.532 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.88' @ 36.15 hrs Surf.Area= 7,970 sf Storage= 2,691 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 9.3 min calculated for 0.532 af (100% of inflow)
Center-of-Mass det. time= 9.3 min (1,568.3 - 1,559.0)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

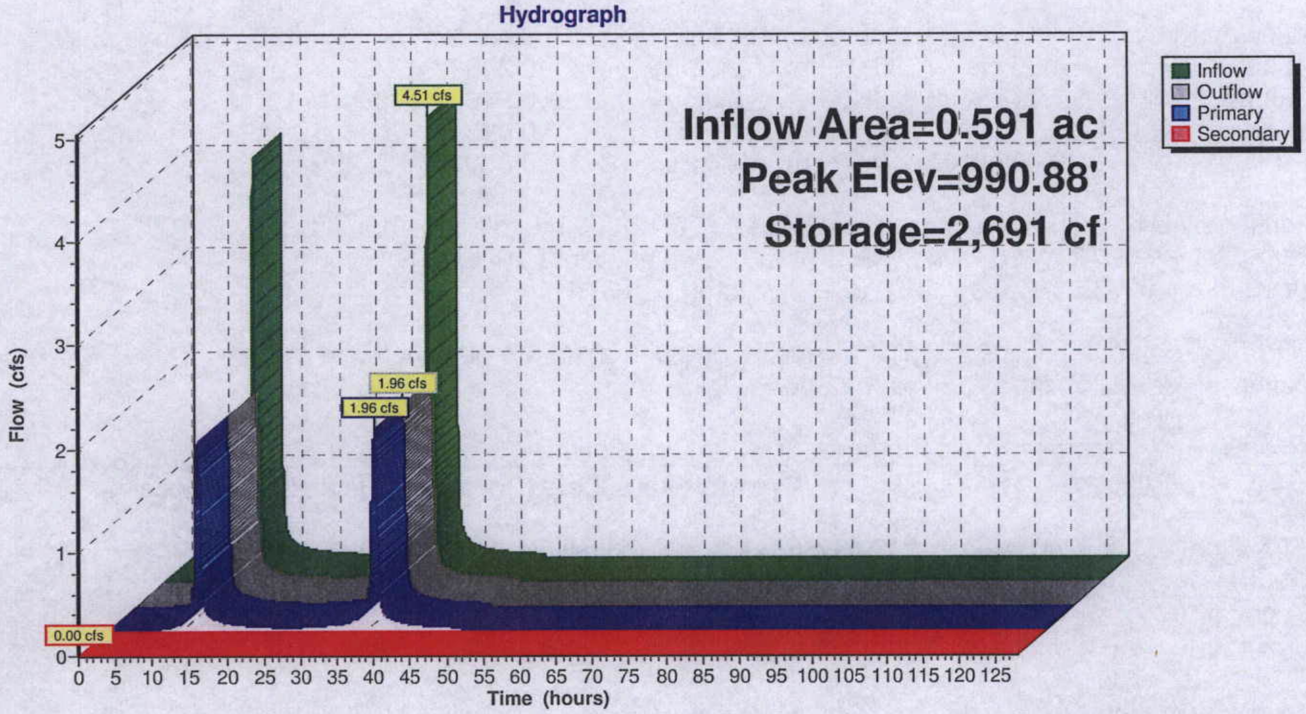
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.99 cfs @ 36.31 hrs HW=990.81' TW=990.63' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.99 cfs @ 1.63 fps)
  └─**2=Orifice/Grate** (Passes 1.99 cfs of 7.84 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: CB NE


Hydrograph
4.51 cfs
1.96 cfs
1.96 cfs
0.00 cfs
Inflow Area=0.591 ac
Peak Elev=990.88'
Storage=2,691 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0
1
2
3
4
5
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 2P: CB E

Inflow Area =	1.035 ac,	0.00% Impervious,	Inflow Depth = 10.97"	for 100-yr (2) event
Inflow =	4.95 cfs @	36.01 hrs, Volume=	0.946 af	
Outflow =	3.77 cfs @	36.17 hrs, Volume=	0.946 af,	Atten= 24%, Lag= 9.2 min
Primary =	3.77 cfs @	36.17 hrs, Volume=	0.946 af	
Tertiary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.73' @ 36.11 hrs Surf.Area= 6,289 sf Storage= 1,676 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 3.5 min calculated for 0.946 af (100% of inflow)
Center-of-Mass det. time= 3.5 min (1,556.7 - 1,553.2)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

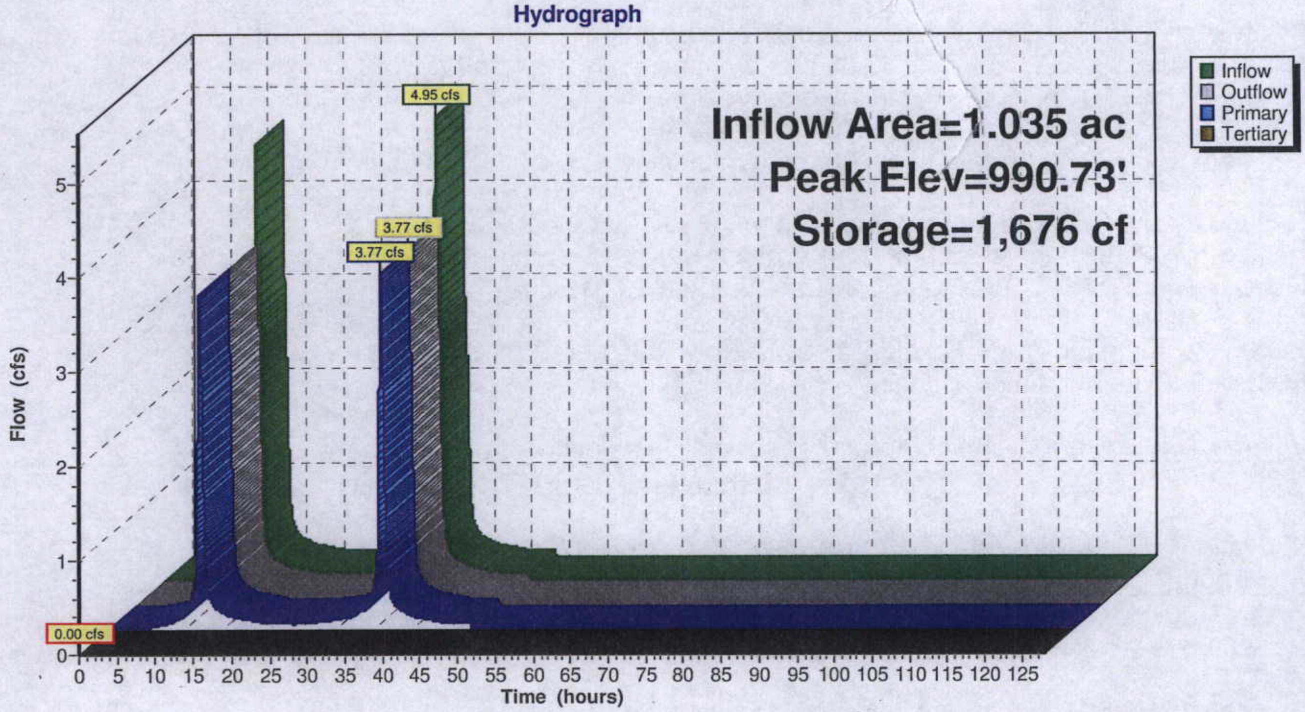
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.84 cfs @ 36.17 hrs HW=990.72' TW=990.59' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 3.84 cfs @ 1.60 fps)
  └─**2=Orifice/Grate** (Passes 3.84 cfs of 5.82 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: CB E


Hydrograph
4.95 cfs
3.77 cfs
3.77 cfs
0.00 cfs
Inflow Area=1.035 ac
Peak Elev=990.73'
Storage=1,676 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
0
1
2
3
4
5
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 3P: CB SE

Inflow Area = 1.480 ac, 0.00% Impervious, Inflow Depth = 11.03" for 100-yr (2) event
Inflow = 6.57 cfs @ 36.03 hrs, Volume= 1.360 af
Outflow = 6.15 cfs @ 36.08 hrs, Volume= 1.360 af, Atten= 6%, Lag= 3.0 min
Primary = 6.15 cfs @ 36.08 hrs, Volume= 1.360 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.61' @ 36.08 hrs Surf.Area= 4,881 sf Storage= 1,009 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.6 min calculated for 1.360 af (100% of inflow)
Center-of-Mass det. time= 1.6 min (1,551.3 - 1,549.7)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

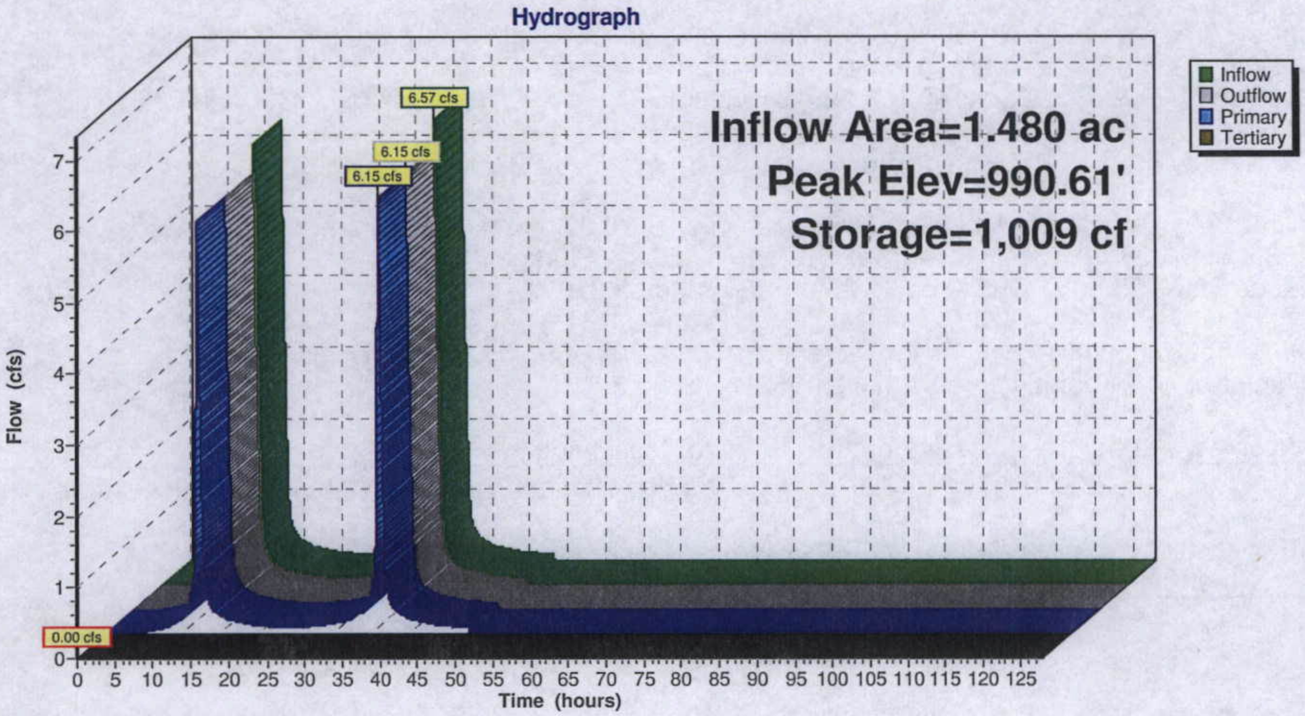
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 99.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.19' / 982.00' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=6.15 cfs @ 36.08 hrs HW=990.61' TW=986.65' (Dynamic Tailwater)
1=Culvert (Passes 6.15 cfs of 22.28 cfs potential flow)
2=Orifice/Grate (Weir Controls 6.15 cfs @ 2.10 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=979.99' (Dynamic Tailwater)
3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 3P: CB SE


Hydrograph
6.57 cfs
6.15 cfs
6.15 cfs
0.00 cfs
Inflow Area=1.480 ac
Peak Elev=990.61'
Storage=1,009 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
7
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 4P: CB N

Inflow Area = 0.761 ac, 0.00% Impervious, Inflow Depth = 11.06" for 100-yr (2) event
Inflow = 5.84 cfs @ 36.01 hrs, Volume= 0.702 af
Outflow = 5.61 cfs @ 36.09 hrs, Volume= 0.702 af, Atten= 4%, Lag= 4.8 min
Primary = 2.92 cfs @ 36.09 hrs, Volume= 0.695 af
Secondary = 2.69 cfs @ 36.09 hrs, Volume= 0.006 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 991.16' @ 36.09 hrs Surf.Area= 8,853 sf Storage= 3,320 cf
Flood Elev= 990.95' Surf.Area= 8,853 sf Storage= 3,320 cf

Plug-Flow detention time= 10.1 min calculated for 0.702 af (100% of inflow)
Center-of-Mass det. time= 10.1 min (1,552.4 - 1,542.3)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

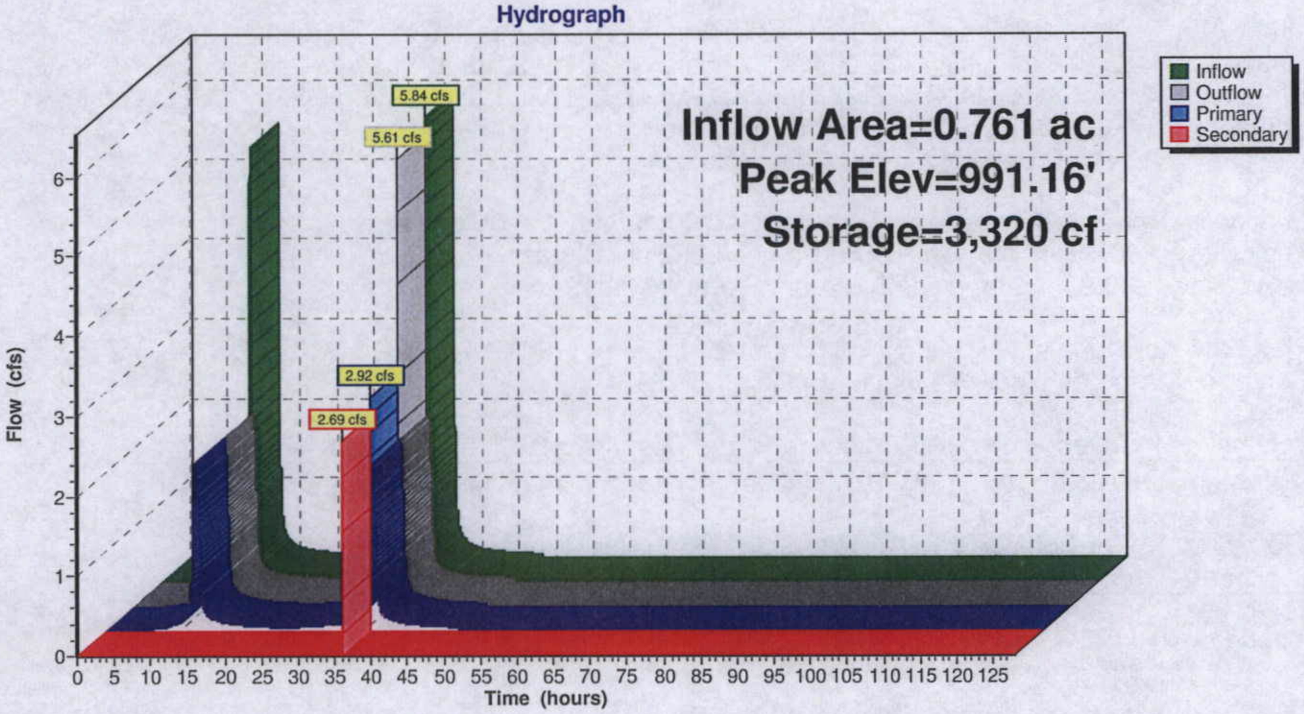
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,853	3,320	3,320

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.85 cfs @ 36.09 hrs HW=991.16' TW=990.79' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 2.85 cfs @ 2.32 fps)
  └─**2=Orifice/Grate** (Passes 2.85 cfs of 11.65 cfs potential flow)

Secondary OutFlow Max=2.64 cfs @ 36.09 hrs HW=991.16' TW=990.79' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Weir Controls 2.64 cfs @ 1.28 fps)

Pond 4P: CB N


Hydrograph
5.84 cfs
5.61 cfs
2.92 cfs
2.69 cfs
Inflow Area=0.761 ac
Peak Elev=991.16'
Storage=3,320 cf
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0
1
2
3
4
5
6
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
Time (hours)

Summary for Pond 5P: CB Central

Inflow Area = 1.212 ac, 0.00% Impervious, Inflow Depth = 11.11" for 100-yr (2) event
Inflow = 8.04 cfs @ 36.09 hrs, Volume= 1.122 af
Outflow = 4.16 cfs @ 36.16 hrs, Volume= 1.122 af, Atten= 48%, Lag= 4.1 min
Primary = 4.16 cfs @ 36.16 hrs, Volume= 1.122 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.82' @ 36.14 hrs Surf.Area= 7,292 sf Storage= 2,253 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 3.9 min calculated for 1.121 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (1,549.3 - 1,545.4)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

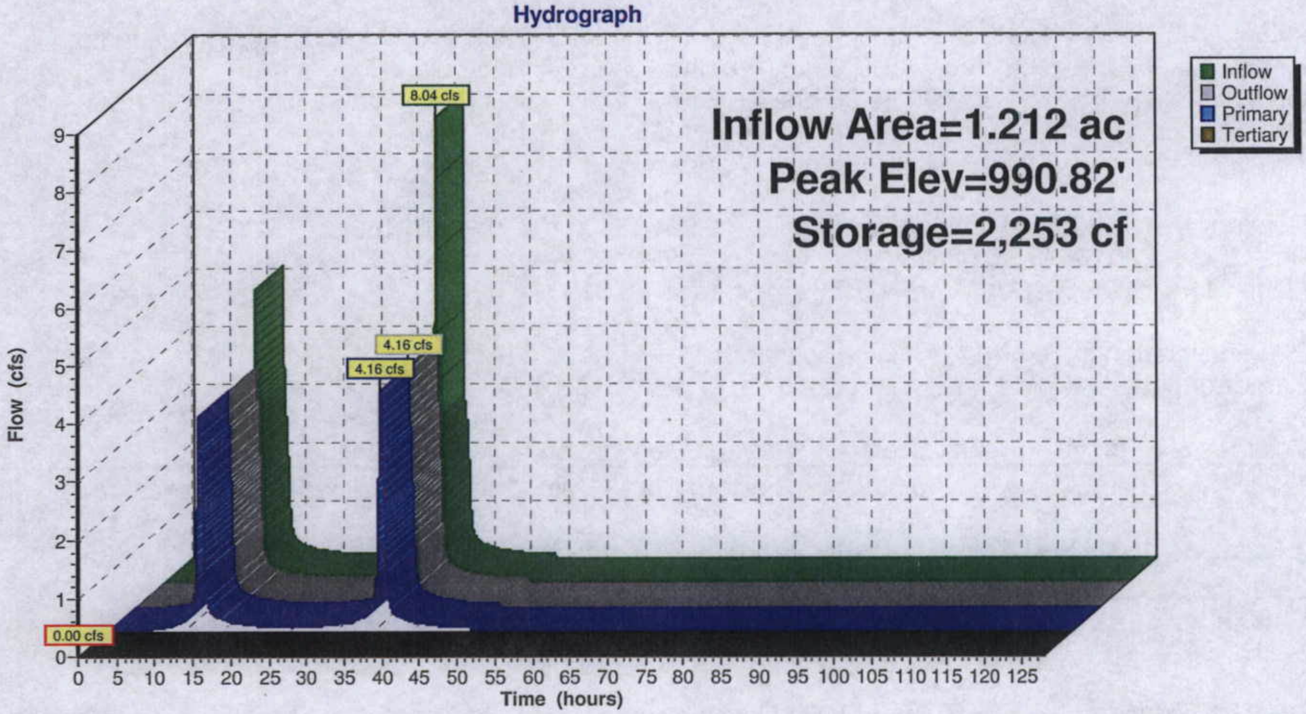
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.19 cfs @ 36.16 hrs HW=990.81' TW=990.60' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 4.19 cfs @ 1.74 fps)
  └─**2=Orifice/Grate** (Passes 4.19 cfs of 8.29 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 5P: CB Central



Summary for Pond 6P: CB S

Inflow Area =	1.662 ac,	0.00% Impervious,	Inflow Depth = 11.13"	for 100-yr (2) event
Inflow =	6.66 cfs @	36.03 hrs, Volume=	1.542 af	
Outflow =	6.24 cfs @	36.08 hrs, Volume=	1.542 af,	Atten= 6%, Lag= 3.1 min
Primary =	6.24 cfs @	36.08 hrs, Volume=	1.542 af	
Tertiary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.62' @ 36.08 hrs Surf.Area= 4,928 sf Storage= 1,029 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.7 min calculated for 1.541 af (100% of inflow)
Center-of-Mass det. time= 1.7 min (1,546.8 - 1,545.1)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

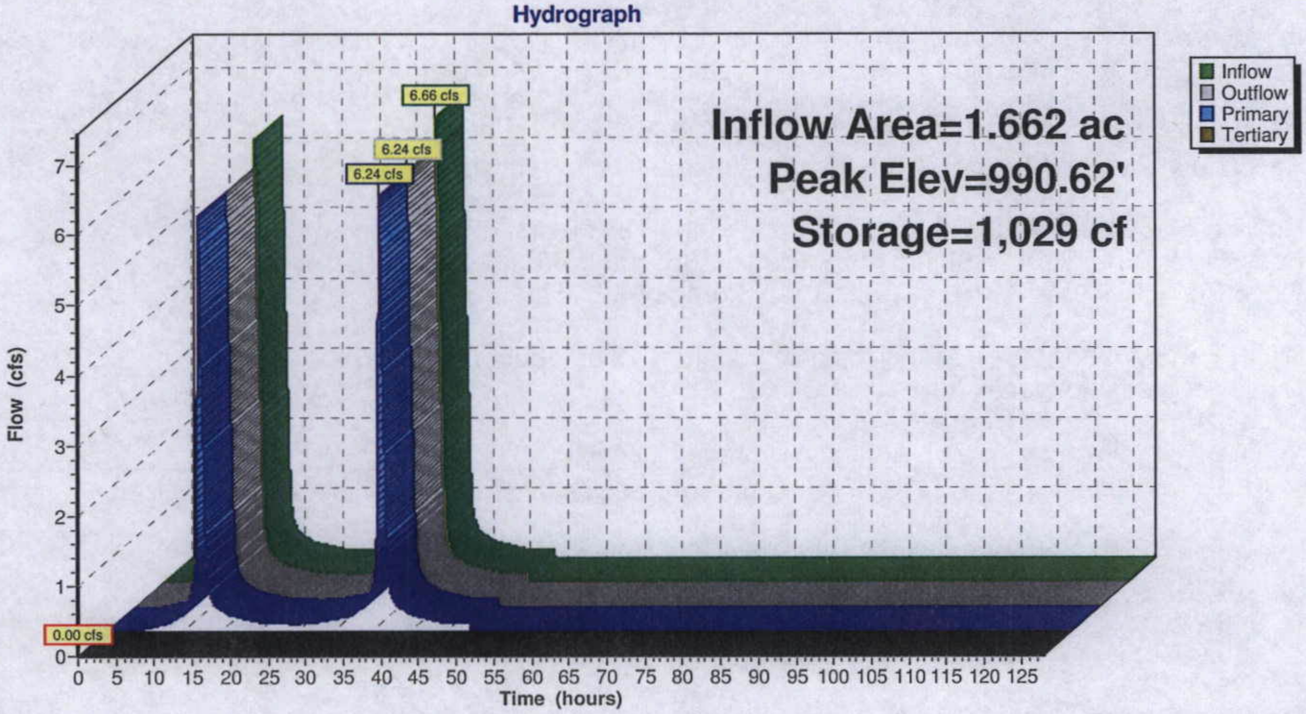
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 57.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 983.19' / 982.50' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=6.24 cfs @ 36.08 hrs HW=990.62' TW=986.92' (Dynamic Tailwater)
└─**1=Culvert** (Passes 6.24 cfs of 17.58 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 6.24 cfs @ 2.11 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=982.00' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: CB S


Hydrograph
6.66 cfs
6.24 cfs
6.24 cfs
0.00 cfs
Inflow Area=1.662 ac
Peak Elev=990.62'
Storage=1,029 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
7
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 7P: CB NW

Inflow Area =	0.832 ac,	0.00% Impervious,	Inflow Depth = 10.80"	for 100-yr (2) event
Inflow =	6.35 cfs @	36.01 hrs, Volume=	0.749 af	
Outflow =	7.92 cfs @	36.06 hrs, Volume=	0.749 af,	Atten= 0%, Lag= 3.1 min
Primary =	3.27 cfs @	36.06 hrs, Volume=	0.731 af	
Secondary =	4.64 cfs @	36.06 hrs, Volume=	0.018 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 991.25' @ 36.06 hrs Surf.Area= 8,851 sf Storage= 3,319 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 9.9 min calculated for 0.749 af (100% of inflow)
Center-of-Mass det. time= 9.9 min (1,568.9 - 1,559.0)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

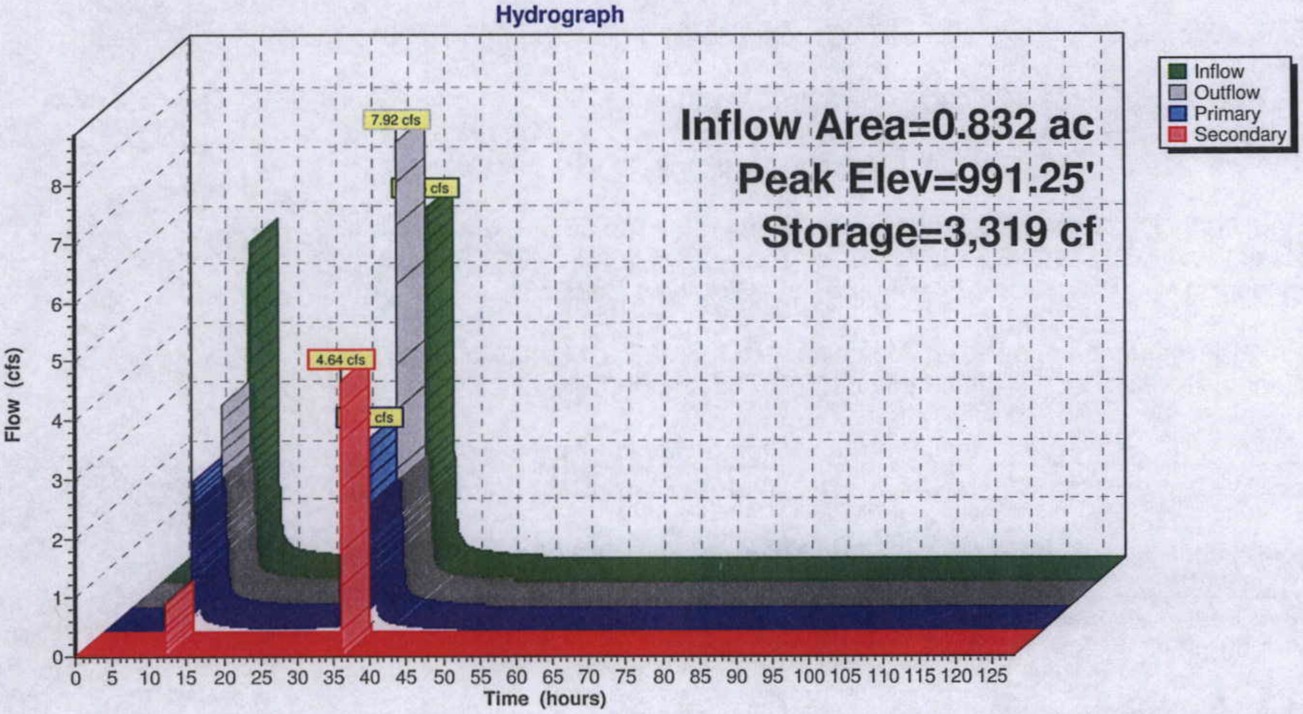
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	986.20'	**15.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 986.20' / 984.70' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Secondary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.15 cfs @ 36.06 hrs HW=991.24' TW=990.78' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 3.15 cfs @ 2.57 fps)
  └─**2=Orifice/Grate** (Passes 3.15 cfs of 12.88 cfs potential flow)

Secondary OutFlow Max=4.48 cfs @ 36.06 hrs HW=991.24' TW=990.78' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Weir Controls 4.48 cfs @ 1.54 fps)

Pond 7P: CB NW


Hydrograph
Inflow
Outflow
Primary
Secondary
Inflow Area=0.832 ac
Peak Elev=991.25'
Storage=3,319 cf
7.92 cfs
cfs
4.64 cfs
cfs
Flow (cfs)
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
0 1 2 3 4 5 6 7 8

Summary for Pond 8P: CB W

Inflow Area = 1.320 ac, 0.00% Impervious, Inflow Depth = 10.90" for 100-yr (2) event
Inflow = 11.16 cfs @ 36.06 hrs, Volume= 1.199 af
Outflow = 4.84 cfs @ 36.13 hrs, Volume= 1.199 af, Atten= 57%, Lag= 4.2 min
Primary = 4.84 cfs @ 36.13 hrs, Volume= 1.199 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.86' @ 36.13 hrs Surf.Area= 7,805 sf Storage= 2,581 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 3.8 min calculated for 1.199 af (100% of inflow)
Center-of-Mass det. time= 3.8 min (1,562.8 - 1,558.9)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

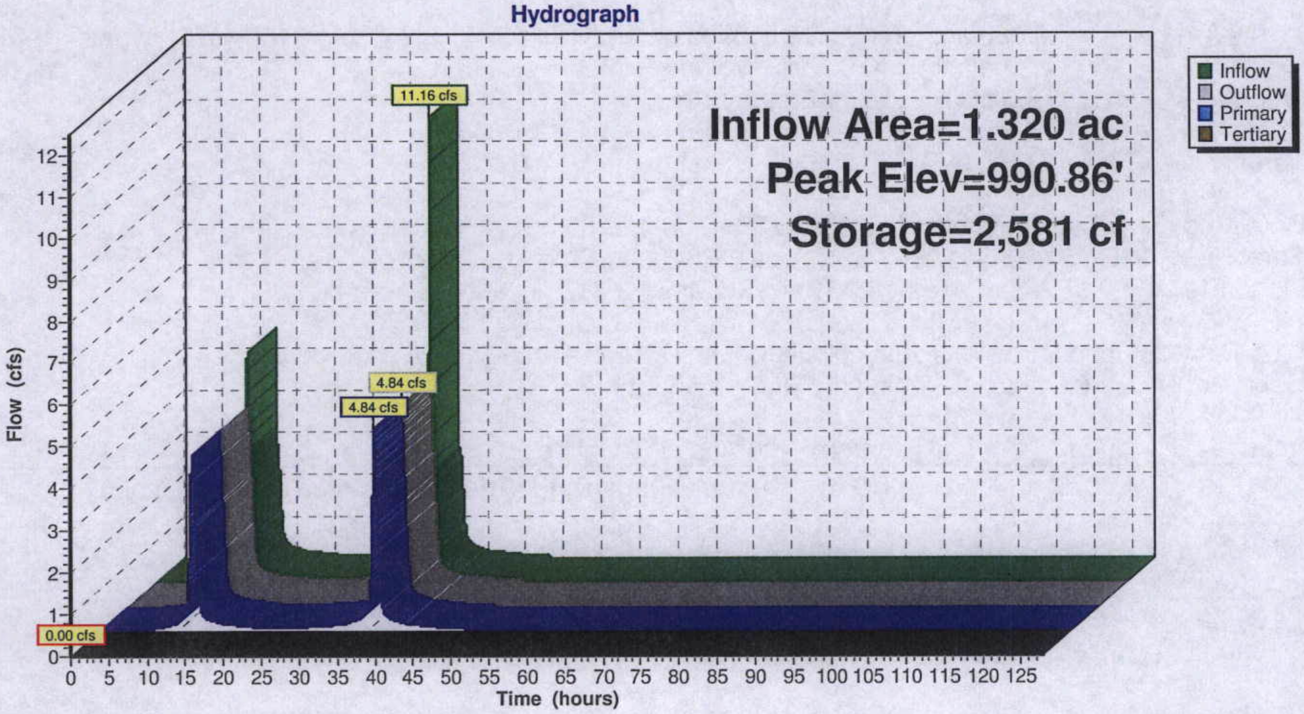
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	984.70'	**21.0" Round Culvert** L= 125.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 984.70' / 983.19' S= 0.0121 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.86 cfs @ 36.13 hrs HW=990.86' TW=990.65' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 4.86 cfs @ 2.02 fps)
↑—**2=Orifice/Grate** (Passes 4.86 cfs of 8.83 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=990.20' (Dynamic Tailwater)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 8P: CB W


Hydrograph
11.16 cfs
4.84 cfs
4.84 cfs
0.00 cfs
Inflow Area=1.320 ac
Peak Elev=990.86'
Storage=2,581 cf
Inflow
Outflow
Primary
Tertiary
Flow (cfs)
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125
0 1 2 3 4 5 6 7 8 9 10 11 12

Summary for Pond 9P: CB SW

Inflow Area = 1.808 ac, 0.00% Impervious, Inflow Depth = 10.94" for 100-yr (2) event
Inflow = 7.33 cfs @ 36.07 hrs, Volume= 1.648 af
Outflow = 7.00 cfs @ 36.11 hrs, Volume= 1.648 af, Atten= 5%, Lag= 2.2 min
Primary = 7.00 cfs @ 36.11 hrs, Volume= 1.648 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 990.65' @ 36.11 hrs Surf.Area= 5,320 sf Storage= 1,199 cf
Flood Elev= 990.95' Surf.Area= 8,851 sf Storage= 3,319 cf

Plug-Flow detention time= 1.7 min calculated for 1.648 af (100% of inflow)
Center-of-Mass det. time= 1.7 min (1,558.9 - 1,557.2)

Volume	Invert	Avail.Storage	Storage Description
#1	990.20'	3,319 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

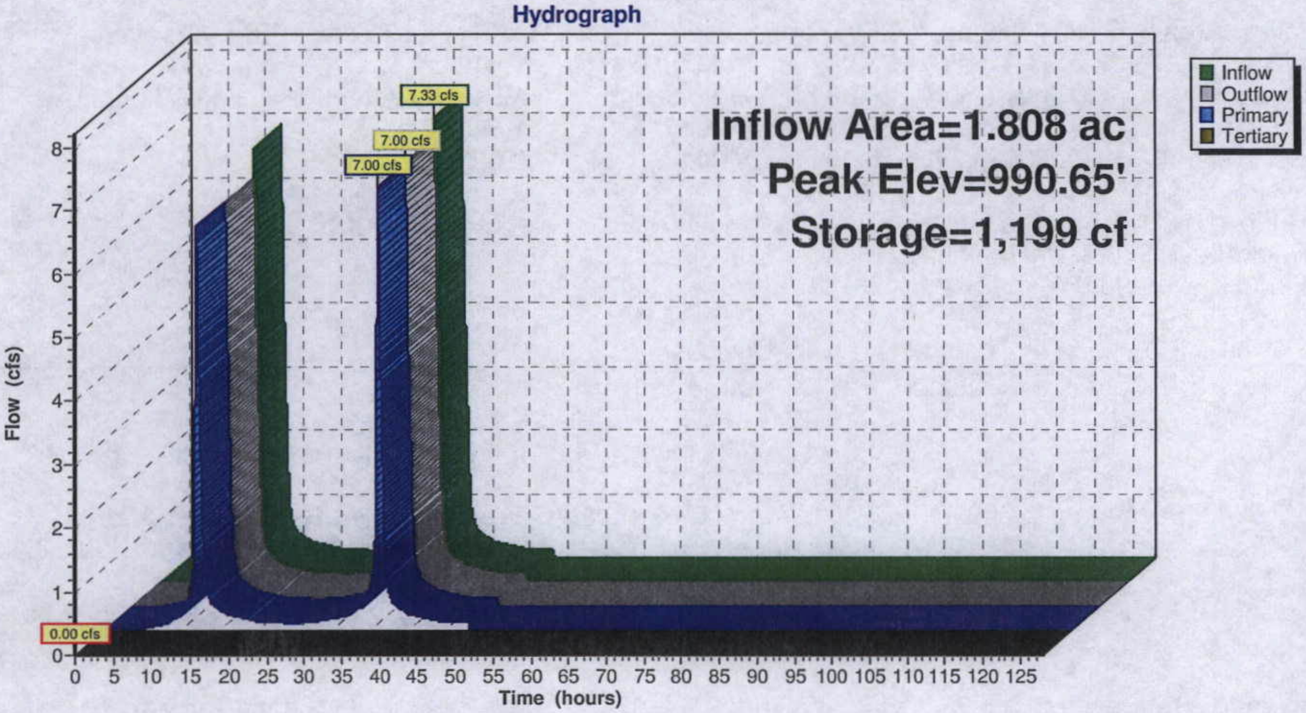
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
990.20	0	0	0
990.95	8,851	3,319	3,319

Device	Routing	Invert	Outlet Devices
#1	Primary	983.19'	**21.0" Round Culvert** L= 99.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 983.19' / 982.00' S= 0.0120 '/' Cc= 0.900 n= 0.013
#2	Device 1	990.20'	**27.0" Horiz. Orifice/Grate** C= 0.600 in 27.0" Grate Limited to weir flow at low heads
#3	Tertiary	990.95'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=6.99 cfs @ 36.11 hrs HW=990.65' TW=986.72' (Dynamic Tailwater)
└─**1=Culvert** (Passes 6.99 cfs of 22.20 cfs potential flow)
  └─**2=Orifice/Grate** (Weir Controls 6.99 cfs @ 2.20 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=990.20' TW=979.99' (Dynamic Tailwater)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: CB SW


Hydrograph
Inflow
Outflow
Primary
Tertiary
Inflow Area=1.808 ac
Peak Elev=990.65'
Storage=1,199 cf
7.33 cfs
7.00 cfs
7.00 cfs
0.00 cfs
Flow (cfs)
0
1
2
3
4
5
6
7
8
Time (hours)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125

Summary for Pond 10P: CB Pump

Inflow Area =	1.662 ac, 0.00% Impervious, Inflow Depth = 11.13"	for 100-yr (2) event
Inflow =	6.24 cfs @ 36.08 hrs, Volume=	1.542 af
Outflow =	6.24 cfs @ 36.08 hrs, Volume=	1.542 af, Atten= 0%, Lag= 0.0 min
Primary =	6.24 cfs @ 36.08 hrs, Volume=	1.542 af
Secondary =	0.00 cfs @ 0.00 hrs, Volume=	0.000 af

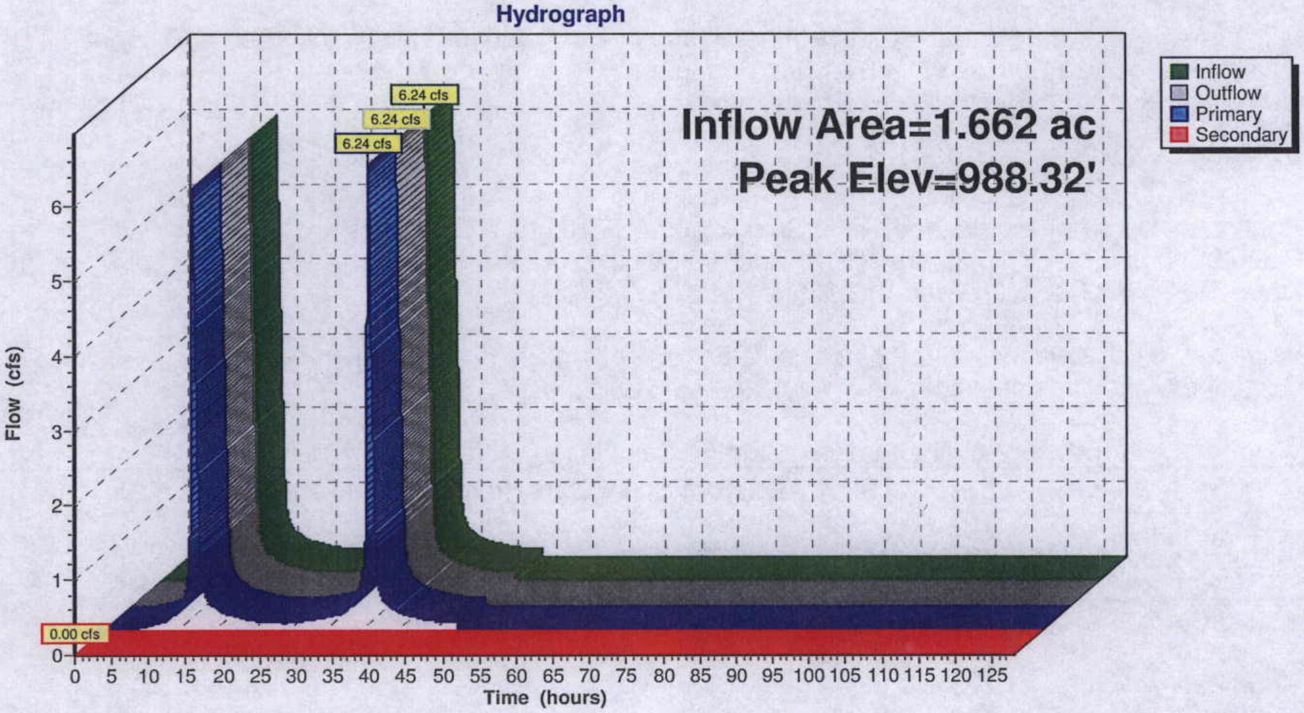
Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 988.32' @ 48.23 hrs
Flood Elev= 990.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	982.00'	**21.0" Round Culvert** L= 42.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 982.00' / 982.00' S= 0.0000 '/' Cc= 0.900 n= 0.013
#2	Secondary	990.95'	**20.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=5.98 cfs @ 36.08 hrs HW=986.92' TW=986.65' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 5.98 cfs @ 2.49 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=982.00' TW=979.99' (Dynamic Tailwater)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 10P: CB Pump



Summary for Pond P-N: North Basin

Inflow Area = 1.555 ac, 10.60% Impervious, Inflow Depth = 11.06" for 100-yr (2) event
Inflow = 11.93 cfs @ 36.01 hrs, Volume= 1.433 af
Outflow = 1.63 cfs @ 36.35 hrs, Volume= 1.431 af, Atten= 86%, Lag= 20.6 min
Primary = 1.63 cfs @ 36.35 hrs, Volume= 1.431 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 989.01' @ 36.35 hrs Surf.Area= 8,396 sf Storage= 13,980 cf
Flood Elev= 993.00' Surf.Area= 12,166 sf Storage= 34,171 cf

Plug-Flow detention time= 119.2 min calculated for 1.431 af (100% of inflow)
Center-of-Mass det. time= 117.4 min (1,659.6 - 1,542.3)

Volume	Invert	Avail.Storage	Storage Description
#1	982.00'	34,171 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

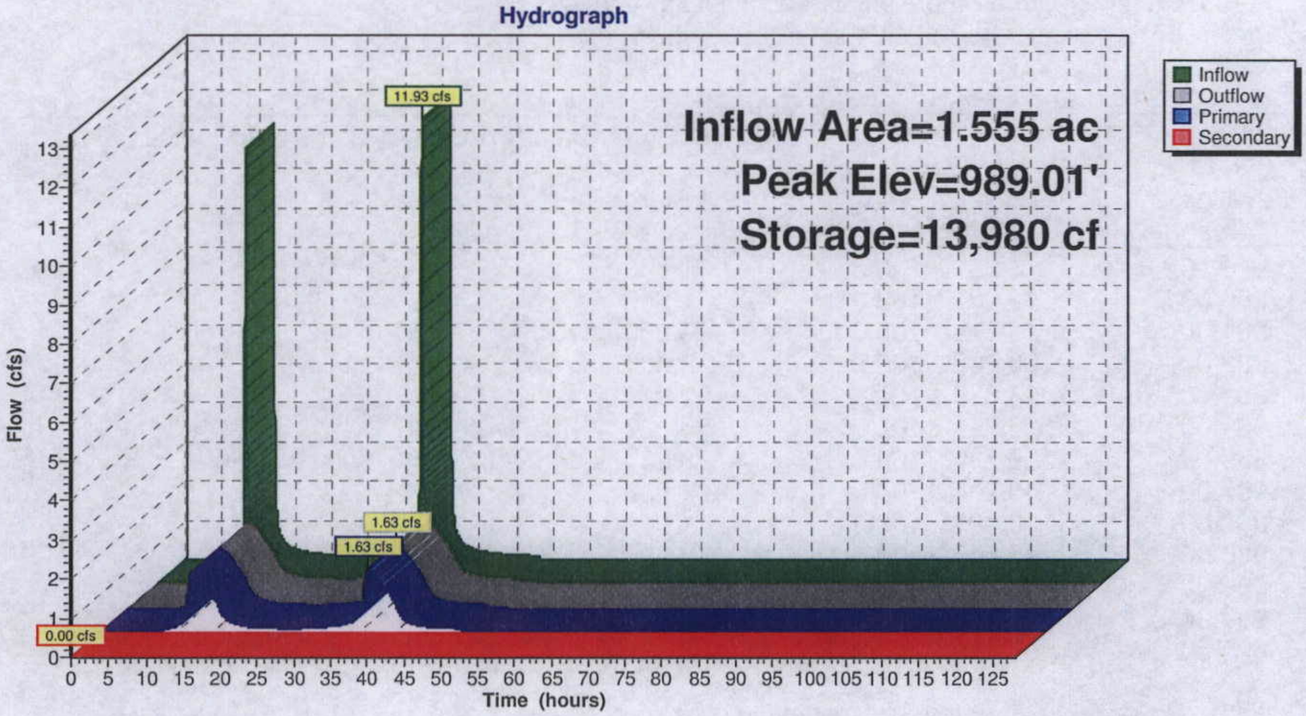
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
982.00	443	0.0	0	0
983.00	812	0.0	0	0
984.00	1,293	0.0	0	0
985.00	1,886	0.0	0	0
986.00	2,589	0.0	0	0
986.99	5,543	0.0	0	0
987.00	5,543	100.0	55	55
988.00	6,914	100.0	6,229	6,284
989.00	8,387	100.0	7,651	13,934
990.00	9,960	100.0	9,174	23,108
991.00	12,166	100.0	11,063	34,171

Device	Routing	Invert	Outlet Devices
#1	Primary	987.00'	**4.0" Round Culvert X 3.00** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 987.00' / 986.80' S= 0.0100 '/' Cc= 0.900 n= 0.010
#2	Device 1	987.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	990.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Device 1	990.50'	**48.0" Horiz. Orifice/Grate** C= 0.600 in 48.0" Grate Limited to weir flow at low heads
#5	Secondary	991.00'	**20.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=1.63 cfs @ 36.35 hrs HW=989.01' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.63 cfs @ 6.23 fps)
  ├─**2=Orifice/Grate** (Passes 1.63 cfs of 2.17 cfs potential flow)
  ├─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=982.00' TW=0.00' (Dynamic Tailwater)
└─**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P-N: North Basin



Summary for Pond P-S: South Basin

Inflow Area = 6.308 ac, 5.65% Impervious, Inflow Depth = 10.90" for 100-yr (2) event
Inflow = 28.34 cfs @ 36.04 hrs, Volume= 5.729 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs
Peak Elev= 988.32' @ 48.62 hrs Surf.Area= 47,917 sf Storage= 249,545 cf
Flood Elev= 990.50' Surf.Area= 57,219 sf Storage= 362,790 cf

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

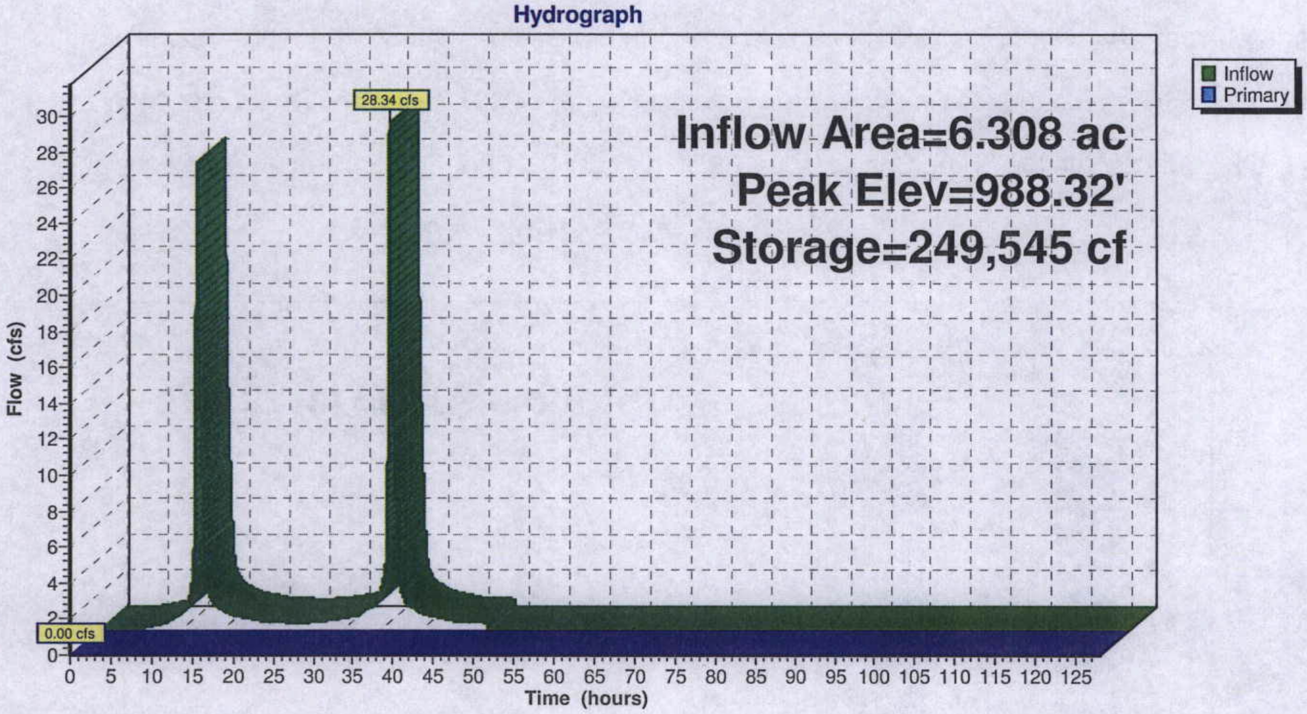
Volume	Invert	Avail.Storage	Storage Description
#1	979.99'	362,790 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
979.99	15,521	0.0	0	0
980.00	15,521	100.0	155	155
981.00	18,219	100.0	16,870	17,025
982.00	20,989	100.0	19,604	36,629
983.00	23,830	100.0	22,410	59,039
984.00	26,744	100.0	25,287	84,326
985.00	29,730	100.0	28,237	112,563
986.00	40,204	100.0	34,967	147,530
987.00	43,493	100.0	41,849	189,378
988.00	46,840	100.0	45,167	234,545
989.00	50,243	100.0	48,542	283,086
990.00	53,703	100.0	51,973	335,059
990.50	57,219	100.0	27,731	362,790

Device	Routing	Invert	Outlet Devices
#1	Primary	990.50'	**150.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=979.99' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P-S: South Basin

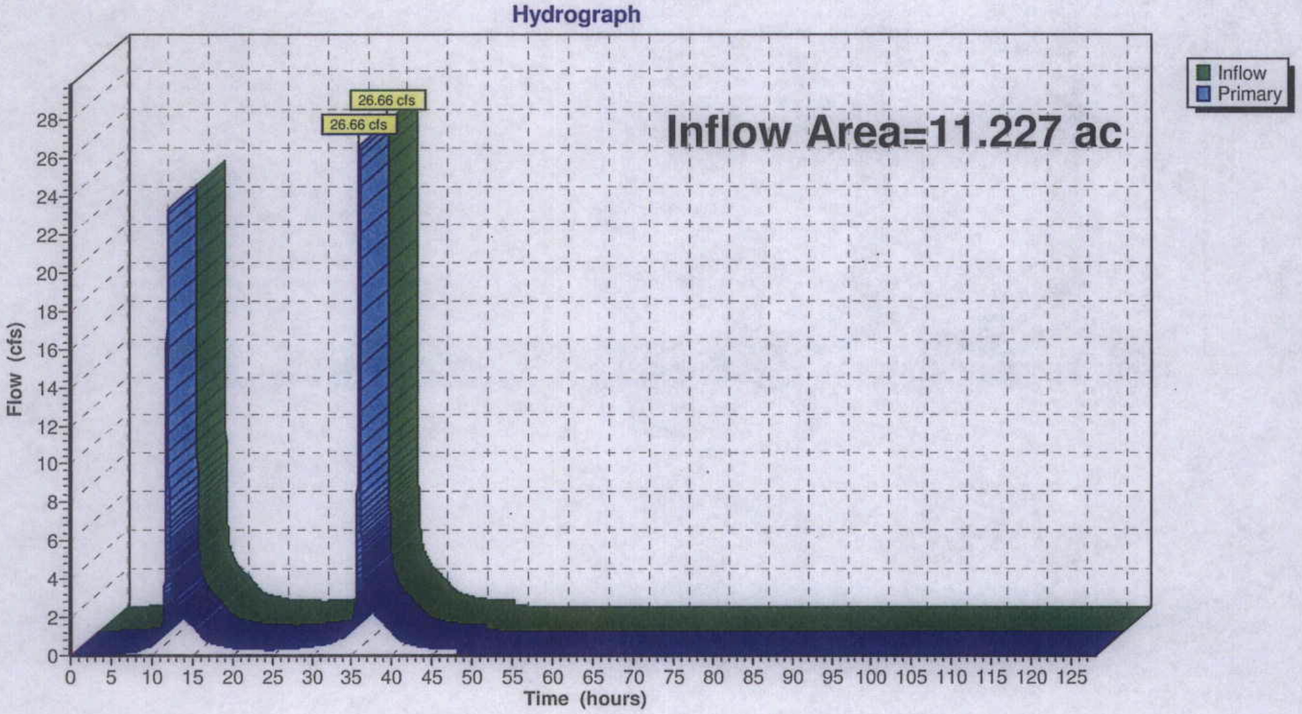


Summary for Link PROP: Total

Inflow Area = 11.227 ac, 12.41% Impervious, Inflow Depth = 4.68" for 100-yr (2) event
Inflow = 26.66 cfs @ 36.01 hrs, Volume= 4.381 af
Primary = 26.66 cfs @ 36.01 hrs, Volume= 4.381 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-128.00 hrs, dt= 0.01 hrs

Link PROP: Total



Appendix C

Geotechnical Report

AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
• ENVIRONMENTAL
• GEOTECHNICAL
• MATERIALS
• FORENSICS

PRELIMINARY REPORT OF GEOTECHNICAL EXPLORATION AND REVIEW

Full Circle Organics Compost Site
56437 164th Street
Good Thunder, Minnesota

Report No. 22-00941

Date:

December 8, 2011

Prepared for:

MFS Farms, LLC
c/o MFRA, Inc.
14800 28th Avenue North, Suite 140
Plymouth, Minnesota 55447

www.amengtest.com

AMERICAN ENGINEERING TESTING, INC.

CONSULTANTS
• ENVIRONMENTAL
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• MATERIALS
• FORENSICS

December 8, 2011

MFS Farms, LLC
c/o MFRA, Inc.
14800 28th Avenue North, Suite 140
Plymouth, Minnesota 55447

Attn: Mr. Michael C. Brandt, P.E.

RE: Preliminary Geotechnical Exploration and Review
Full Circle Organics Compost Site
56437 164th Street
Good Thunder, Minnesota 56037
Report No. 22-00941

Dear Mr. Brandt:

American Engineering Testing, Inc. (AET) is pleased to present the results of our subsurface exploration program and geotechnical engineering review for the Full Circle Organics Compost Site project in Good Thunder, Minnesota. These services were performed according to our proposal to you dated August 11, 2011.

We are submitting two hard copies and one electronic copy of the report to you.

Please contact me if you have any questions about the report. I can also be contacted for arranging construction observation and testing services during the earthwork phase.

Sincerely,
American Engineering Testing, Inc.

Derek S. Van Heuveln, P.E.
Staff Engineer II
Phone: (651) 789-4656
Fax: (651) 659-1379
dvanheuveln@amengtest.com

550 Cleveland Avenue North | St. Paul, MN 55114
Phone 651-659-9001 | Toll Free 800-972-6364 | Fax 651-659-1379 | www.amengtest.com | AA/EEO

SIGNATURE PAGE

Prepared for:

MFS Farms, Inc.
c/o MFRA, Inc.
14800 28th Avenue North, Suite 140
Plymouth, Minnesota 55447

Attn: Mr. Michael C. Brandt, P.E.

Prepared by:

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Minnesota 55114
(651) 659-9001/www.amengtest.com

Authored by:

Derek S. Van Heuveln, P.E.
Staff Engineer II

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 Minnesota Statute Section 326.02 to 326.15

Date: 12/8/2011 **License #: 45922**

Reviewed by:

Thomas P. Venema, P.E., LEED AP
Principal Engineer/Vice President

TABLE OF CONTENTS

TABLE OF CONTENTS

1.0 INTRODUCTION

You are designing a new compost facility for MFS Farms, Inc. at a site near Good Thunder, Minnesota. To assist planning and design, you have authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site, conduct soil laboratory testing, and perform a geotechnical engineering review for the project. This report presents the results of the above services, and provides our engineering recommendations based on this data.

2.0 SCOPE OF SERVICES

AET's services were performed according to our proposal to you dated August 11, 2011, which was authorized by Mr. Kevin FitzSimmons with MFS Farms, Inc. on August 12, 2011. The authorized scope consists of the following:

- 16 standard penetration test borings to depths ranging from 8 to 15 feet.
- Soil laboratory testing, which included water content tests, two sieve/hydrometer tests, two flexible wall permeability tests, and two Atterberg Limit tests.
- Geotechnical engineering analysis based on the gained data and preparation of this report.

These services are intended for geotechnical purposes. The scope is not intended to explore for the presence or extent of environmental contamination.

3.0 PROJECT INFORMATION

MFS Farms, Inc. is planning to develop approximately 10 acres of farmland into a composting site for Full Circle Organics. The site is located primarily in the northwest quarter of the southwest quarter of the northwest quarter of Section 1, Township 106N (Lyra Township), Range 27W. This is located along the east side of 563rd Avenue approximately ½ to ¾ mile south of 164th Street. The site will consist of a one-story building, a scale and scale house, access driveway and drive areas, three windrow areas, a "Final Product Storage" area, three stormwater ponds, and a filtration basin. Based on the plans, grades across the site will be raised 2 to 5 feet for the project; cuts of up to 4 to 7 feet are anticipated in the pond areas.

The 37,980 square foot building will have steel frame walls with the roof extending approximately 16 to 20 feet high. The building, which will have a finished floor elevation of 996.6, is being designed as an unheated structure at this time. The storage building will be set at the northeast corner of the site and will be connected to 563rd Avenue by a gravel driveway. The gravel driveway will consist of 8 inches of crushed rock aggregate base. A concrete truck dock will be located at the southeast corner of the building. The concrete pavement section will consist of 6 inches of concrete over 8 inches of crushed rock aggregate base. A truck scale will be installed near the entrance of the gravel driveway; the scale building will be a portable structure (e.g., trailer) that will not be permanently founded into the ground.

The composting windrow areas and "Final Product Storage" area will be located to the west and south of the building. The section in these areas will consist of 8 inches of Mn/DOT Class 5 aggregate base over 24 inches of compacted clay with a permeability of no greater than 1×10^{-7} centimeters per second (cm/sec); the intent of the clay is to restrict infiltration. These areas will be open air. The windrow area west of the mixing area will measure approximately 230 feet square; the twin windrow areas and "Final Product Storage" area to the south of the driveway will cover an area approximately 468 feet wide (east-west) by 326 feet long (north-south).

Pond Nos. 1 and 3, as well as the filtration basin, are located along the west edge of the site adjacent to 563rd Avenue. Pond No. 2 is located just north of the 'Final Product Storage' area.

Our foundation design assumptions include a minimum factor of safety of 3 with respect to localized shear or base failure of the foundations. We assume the structure will be able to tolerate total settlements of up to 1 inch, and differential settlements over a 30 foot distance of up to ½ inch.

The above stated information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 Field Exploration Program

The subsurface exploration program conducted for the project consisted of 16 standard penetration test borings. The logs of the borings and details of the methods used appear in Appendix A. The logs contain information concerning soil layering, soil classification, geologic description, and moisture condition. Relative density or consistency is also noted for the natural soils, which is based on the standard penetration resistance (N-value).

The boring locations are shown on Figure 1 in Appendix A. The borings were located in the field by MFRA personnel based on recommendations by AET. Surface elevations were also measured in the field by MFRA personnel.

4.2 Laboratory Testing

The laboratory test program included 103 water content tests, 10 organic content tests, 2 sieve/hydrometer tests, 2 flexible wall permeability tests, and 2 Atterberg Limit tests. The test results appear in Appendix A on the individual boring logs adjacent to the samples upon which they were performed, or on the data sheets following the logs.

5.0 SITE CONDITIONS

5.1 Surface Observations

The project site was a recently harvested cornfield at the time of our borings. The topography slopes up from the southeast corner to the northwest corner; the surface elevation at our boring locations varies from a low of 990.0 at Boring SB-15 to a high of 995.4 at Boring SB-1.

5.2 Subsurface Soils/Geology

The general site geology consists of a surficial zone of mixed plow zone soils at a depth of 2 to 5 feet below grade. The plowed zone soils are native to the site but have been disturbed by agricultural activities; these soils are noted as "Fill" on our boring logs. The plowed zone fill soils are underlain by fine alluvium or weathered glacial till and glacial till soils to the boring termination depths. The fine alluvium or weathered till soils were not encountered in Boring No. SB-4.

5.3 Ground Water

Ground water was measured in boring SB-3 at a depth of 15.2 feet below grade (elevation 977); ground water was not observed in any of the remaining 15 borings. Considering the majority of the soils consist of slow draining clays and sandy clays, it often takes several hours or even days for the hydrostatic ground water level to stabilize in an open borehole. More accurate ground water readings are obtained using temporary piezometers and obtaining readings for an extended period of time. Our scope of services did not allow for long-term monitoring of the water levels. We caution that ground water can become trapped or perched within layers of sands and silty sands above or surrounded by slower draining clays and clayey sands.

Ground water levels fluctuate due to varying seasonal and annual rainfall and snow melt amounts, as well as other factors.

5.4 Review of Soil Properties

5.4.1 Strength/Stability

The plowed zone fill soils are judged to have moderate strength and poor to moderate stability unless disturbed. The naturally-deposited fine alluvial and weathered till soils are judged to have moderate to moderately high strength and moderate to high stability. The glacial till sandy lean clay and lean clay are judged to have moderate to high strength and moderate to high stability. When exposed to moisture and disturbed by traffic, the fill, fine alluvium and till have relatively low strength and poor stability.

5.4.2 Compressibility

The plowed zone fill soils are judged to be at least moderately compressible under the anticipated fill and foundation loads. The naturally-deposited fine alluvial, weathered till, and till soils are judged to have a low compressibility potential.

5.4.3 Subgrade Drainage

The soils encountered at this site, both plowed zone fill and naturally-deposited soils, are clayey and have poor drainage properties. Water can be expected to be trapped within the upper subgrade. This can result in increased periods of subgrade saturation, which leads to increased detrimental frost effects and subgrade weakening.

5.4.4 Frost Susceptibility

The fill and naturally-deposited soils encountered at the project are considered to be highly frost susceptible.

6.0 RECOMMENDATIONS

6.1 Approach Discussion

It should be possible to support the proposed building addition on conventional spread footings, after some corrective grading operations. It is our opinion that relying on the existing plowed zone fill soils to support the footings of the building will result in some risks to the Owner. These risks are associated with the high organic content of the upper plowed zone fill soils, which could lead to excess differential settlement of the building under the additional fill and foundations loadings. The naturally deposited glacial till and alluvial soils would also be suitable for support of the building foundations and floor slab.

However, the building is planned as an unheated building, and freeze-thaw related movement of the highly frost susceptible subgrade and concrete slab should be considered. These frost related movements may affect the performance of the slab. In our opinion, these issues would also affect the truck scale. For the building slab and truck scale, we recommend constructing a subgrade of non-frost susceptible (NFS) sand.

In our opinion, the existing fill soils would generally be suitable to support the planned gravel drives, windrow areas, and "Final Product Storage" area after stripping the upper, more highly organic portion of these soils. This would consist of approximately 2 feet of stripping in the driveway areas, based on our organic content test results. Organic contents over 5% are considered high, and the organic content test results in the upper 2 feet of the subgrade generally varied from 5 to 8%; below 2 feet, the organic contents were generally less than 5%, primarily around 2 to 3%. However, if more than 3 feet of new subgrade fill will be placed, the existing plowed zone fill soils can be left in place after stripping the upper vegetative mat; the new fill soils would act to bridge over the more highly organic native soils.

In our opinion, the proposed 8-inch thick aggregate base section of the driveway and windrow areas is not sufficient to support truck and heavy machinery traffic. The clayey subgrade soils are considered poor from a frost and drainage standpoint. These conditions results in accelerated subgrade and aggregate base weakening, particularly during the spring when the subgrade soils are at the lowest strength when coming out of the freeze-thaw cycle. We recommend increasing the aggregate base section to a minimum of 12 inches. As an alternative in the driveway areas, a 12-inch thick sand subbase could be installed as the upper subgrade to better control infiltrating water and the associated frost movements. The aggregate base section could remain at the 8-inches in the drive areas if a 1-foot sand subbase is incorporated into the design. However, there is an increased cost with increasing the aggregate base section and installing a sand subbase. The Owner must consider the cost versus performance expectations when evaluating each option.

6.2 Site Grading

6.2.1 Excavation

To prepare the building area for foundation and slab support, we recommend complete excavation of the plow zone fill (black fat clay) within the building pad, thereby exposing the naturally-deposited brown and gray lean clay and sandy lean clay soils. In the scale area, we also recommend excavating the plow zone fill to the underlying naturally-deposited lean clay soils. For the remainder of the site, we recommend stripping the upper portion of the plowed zone fill soils, which are more highly organic in the upper 2 feet based on our organic content tests. However, if more than 3 feet of new subgrade fill will be placed, the upper plowed zone fill soils can remain in place after stripping the upper vegetative mat. This would result in excavation depths at the boring locations as shown in Table A.

Table A – Recommended Excavation Depths

Boring Number	Location	Surface Elevation (ft)	Excavation Depth (ft)	Approximate Excavation Elevation (ft)
1	Site	995.4	2*	995
2	Building	993.8	2½	991½
3	Building	992.9	4	989
4	Site	993.8	2*	993
5	Building	993.0	3	990
6	Building	993.0	4	989
7	Site	993.1	2*	992½
8	Site	992.2	2*	991½
9	Scale	992.5	2	990½
10	Site	991.8	2*	991
11	Site	991.6	2*	991
12	Site	991.0	2*	990½
13	Site	992.1	2*	991½
14	Site	991.0	2*	989
15	Site	990.0	2*	988
16	Site	990.1	2*	988

*Depth of excavation can be reduced to stripping the vegetative mat if more than 3 feet of new subgrade fill will be placed, based on final site grades.

The depth/elevation indicated in Table A is based on the soil condition at the specific boring location. Since conditions will vary away from the boring location, it is recommended that AET geotechnical personnel observe and confirm the competency of the soils in the entire excavation bottom prior to new fill or footing placement.

Where the excavation extends below foundation grade, the excavation bottom and resultant engineered fill system must be oversized laterally beyond the planned outside edges of the foundations to properly support the lateral loads exerted by that foundation. This excavation/engineered fill lateral extension should at least be equal to the vertical depth of fill needed to attain foundation grade at that location (i.e., 1:1 lateral oversize).

6.2.2 Building Slab and Scale Subgrade

A floor slab subgrade consisting of the cohesive engineered fill over the naturally-deposited lean clay and sandy lean clay soils would be susceptible to freeze-thaw related movements, which would affect the performance of the slab. These issues would also affect the proposed truck scale. For these building slab and truck scale, we recommend constructing a subgrade of non-frost susceptible (NFS) sand. This would require excavating the plowed zone fill and naturally-deposited alluvial and till soils to a depth of at least 4 feet below bottom of the new interior building slab and scale, or to the depths recommended in Table A, whichever is greater. Any other soft or unsuitable material encountered should also be excavated. The base soils of this excavation should be engineered fill or naturally-deposited fine alluvial or glacial till soils. The NFS soils should have no more than 35% (by weight) passing the No. 40 sieve and no more than 5% (by weight) passing the No. 200% sieve. The NFS sand soils should be placed in lifts and compacted to at least 95% of the maximum Standard Proctor dry density (ASTM D 698), extending to a distance of at least 2 feet horizontally beyond the outside edges of the scale slab.

Where the excavation abuts existing structures or site elements that are not founded on frost footings or do not have an NFS subgrade, such as the gravel driveway, the sand subbase should be sloped at a 4:1 (H:V) ratio to prevent creating an abrupt differential frost heave during winter conditions.

The NFS sand will need to be drained. This is typically performed by installing drainpipes at the base of the sand subbase excavation which are outletted to a lower area, such as the proposed ponds. If the sand subbase is not drained, it will accumulate infiltrating water and create a bathtub effect, where the water will pool in the sand subbase before it infiltrates into the underlying slower draining lean clay and sandy lean clay soils. This would increase the likelihood of frost heave and freeze thaw weakening of the sand subbase, and frost related movements of the building slab and scale.

6.2.3Fill Placement and Compaction

Fill placed to attain grade for foundation support should be compacted in thin lifts, such that the entire lift achieves a minimum compaction level of 98% of the standard maximum dry unit weight per ASTM:D698 (Standard Proctor test). Fill placed which supports the floor slab of the building only (outside of the 1:1 oversize zone below footings) or for general site grading in the windrow and 'Final Product Storage' areas can have a reduced minimum compaction level of 95% of the standard maximum dry unit weight.

In our opinion, the onsite sandy lean clay and lean clay soils can be used as engineered fill provided they are carefully segregated from the more organic upper portions of the plowed zone fill. The onsite fat clays should not be used as engineered fill. If additional fill is required, we recommend importing clay fill similar to the onsite soils (lean clays and sandy lean clays). Granular fill can be imported; however, it should not be used in the windrow areas or in areas where it cannot be drained and water can become trapped between the cohesive soil layers. We recommend that the contractor submit a sample of the proposed fill material to our laboratory for testing and review by a Geotechnical Engineer.

Sandy lean clays and lean clays are more difficult to work with than silty sands and sands. The lean clays and sandy lean clays are moisture sensitive, and should be compacted at water contents within 2% to 3% of their respective optimum water contents (based on the Standard Proctor test). The majority of the onsite clayey soils were above optimum, with some being significantly above the optimum moisture content, based on the Standard proctor test. For reuse of the onsite soils, it should be anticipated that significant moisture conditioning (e.g., drying) of the clayey soils would be required to reduce the water content into the proper range for compaction. The lean clays and sandy lean clays are more susceptible to freeze-thaw movements when exposed to freezing temperatures. Refer to the standard sheet "Freezing Weather Effects on Building Construction" at the end of this report for concerns about frost-related movements and precautions.

If there are areas where fill is placed on slopes, we recommend benching the sloped surface (benches cut parallel to the slope contour) prior to placing the fill. Benching is recommended where slopes are steeper than 4:1 (H: V).

Our borings indicate variable depths of fill at the boring locations. We cannot determine the volume of fill that can be considered reusable; this must be determined at the time of excavation when full view of the fill is available.

6.3 Foundation Design

The storage building structure can be supported on conventional spread foundations placed on naturally-deposited fine alluvial or glacial till soils or engineered fill. We recommend foundations for unheated building space (such as the storage building) extend to a minimum of 60 inches below exterior grade. We recommend perimeter foundations is placed such that the bottom is a minimum of 42 inches below exterior grade if the building is heated. There should be a 'bond break' placed against the exterior of the building foundation wall, such as rigid foam insulation, so that frozen soil does not grip the foundation walls (adfreezing) and heave the structure.

Based on the conditions encountered, it is our opinion the building foundations can be designed based on a net maximum allowable soil bearing pressure of 3,000 psf. It is our judgment this design pressure will have a factor of safety of at least 3 against localized shear or base failure. We judge that total settlements under this loading should not exceed 1 inch. We also judge that differential settlements of conditions depicted by the borings should not exceed ½ inch.

6.4 Floor Slab Design

After successful completion of this grading, it is our opinion that the floor slabs can be supported on grade by the compacted fill. Assuming the recommended 4 feet of NFS sand is used as the subgrade, a modulus of subgrade reaction of 200 pci can be used to design the slab. If the floor slabs of the new building are supported by the sandy lean clay or lean clay fill, we recommend they be designed using a Modulus of Subgrade Reaction (k-value) of 150 pci. These are ultimate values; therefore, a factor of safety of 1.5 should be applied.

For recommendations pertaining to moisture and vapor protection of interior floor slabs, if required, we refer you to the standard sheet entitled "Floor Slab Moisture/Vapor Protection" at the end of this report.

6.5 Exterior Building Backfilling

Fill that is placed below sidewalks, stoops, and exterior slabs should be compacted to a minimum of 95% of the Standard Proctor maximum dry density. Fill placed in landscaped areas should be compacted to a minimum of 90% of the Standard Proctor maximum dry density. Because the majority of the soils at this site are fat clays, sandy lean clays, and lean clays, it is important that precautions are taken to prepare for frost-related slab movements outside the building during freezing temperatures, and after the soils thaw. We refer you to the sheet entitled "Freezing Weather Effects on Building Construction" at the end of this report for details concerning protection against freeze-thaw related movements.

6.6 Windrow and Final Product Storage Areas

6.7.1 Clay Liner Permeability Comments

Based on our discussions with you and our review of the project drawings, the clay liner for the windrow and 'Final Product Storage' areas will consist of 2 feet of imported clay with a permeability of no greater than 1×10^{-7} cm/sec. The average hydraulic conductivity of the samples that we tested was 1.25×10^{-6} cm/sec in SB-2 in the sample from 4 to 6 feet below grade and 1.05×10^{-7} cm/sec in SB-15 in the sample from 4 to 6 feet below grade. Based on the results of the flexible wall permeability tests performed on the soils retained from the project site, additional testing is recommended potential borrow areas to determine if onsite soils are available that meet the project requirements for the clay liner.

6.7 Pavements – Gravel and Concrete

6.7.1 Definitions

Italicized words used in this section have a specific definition or are a Mn/DOT reference. The definitions are presented on the attached standard sheet entitled "Definitions Relating to Pavement Construction", or are defined in an ASTM standard or a Mn/DOT specification.

6.7.2 Pavement Section Comments

In our opinion, the proposed 8-inch thick aggregate base section of the driveway and windrow areas is not sufficient to support truck and heavy machinery traffic. The clayey subgrade soils are considered poor from a frost and drainage standpoint. These conditions results in accelerated subgrade and aggregate base weakening, particularly during the spring when the subgrade soils are at the lowest strength when coming out of the freeze-thaw cycle. We recommend increasing the aggregate base section to a minimum of 12 inches. As an alternative in the driveway areas, a 12-inch thick *sand subbase* could be installed as the upper subgrade to better control infiltrating water and the associated frost movements. The aggregate base section could remain at the 8-inches in the drive areas if a 1-foot *sand subbase* is incorporated into the design. However, there is an increased cost with increasing the aggregate base section and installing a *sand subbase*. The Owner must consider the cost versus performance expectations when evaluating each option.

6.7.3 Frost/Drainage Improvement

The clayey subgrade soils are considered poor from a frost and drainage standpoint. These conditions result in accelerated subgrade and aggregate base/surfacing. Long-term performance in fine grained soils can be improved by placing a *sand subbase* layer as the top of subgrade to better control infiltrating water and the associated frost movements. The thickness of the *sand subbase* recommended is usually dependent on soil stability conditions, the road function, and cost versus performance expectations. At this site, the underlying soils are relatively stable, and because of this, it is our opinion the *sand subbase* thickness should be at least 1-foot thick.

Sand subbase layers are typically comprised of *Select Granular Material.* This specification allows for the possibility of a fine grained sand material approaching a silty sand classification. This type of material does not drain as fast as a cleaner sand material, and the stability can be affected by the presence of excess water. Therefore, the use of *Modified Select Granular Material* can further improve performance, if your budget allows.

Where there is a need to vary the thickness of the *sand subbase*, we recommend the thickness have a taper of no steeper than 10:1 (H:V). The subcut and sand layer placement should extend slightly beyond the outer edge of the curb to maintain frost uniformity.

The *sand subbase* should be provided with proper subsurface drainage to prevent build-up of water within the sand. This can be accomplished by placing properly engineered drainage lines along the length of the roadway which are connected to the onsite ponds or outfall into ditch areas.

A Type V geotextile fabric can be used to maintain separation between the clayey subgrade soils and the *sand subbase*, although the need for separation is not judged necessary when the native subgrade is stable beneath the *sand subbase*.

6.7.4 Subgrade Preparation

We recommend removing the fill as described in Table A, and any organic soils and soft clays which exist within the upper 3 feet of the pavement subgrade (*critical subgrade zone*). After removal of the materials as recommended above, we recommend scarifying the exposed subgrade soils to a depth of about 12 inches and then compacting the soils with a large, self-propelled sheepsfoot compactor to at least 100% of the *standard maximum dry unit weight* defined in ASTM: D698 (Standard Proctor test); or 95% if the grade is more than 3 feet below final subgrade elevation.

6.7.3 Fill Placement and Compaction

All fill placed to re-establish subgrade elevation should be compacted per the requirements of Mn/DOT Specification 2105.3F1 (Specified Density Method). This specification requires soils placed within the *critical subgrade zone* be compacted to a minimum of 100% of the *standard* *maximum dry unit weight* defined in ASTM: D698 (Standard Proctor test), at a water content 65% to 102% of the *standard optimum water content.* If fill is needed below the upper 3 feet of the *critical subgrade zone*, this fill can be compacted to a reduced level of 95% of the Standard Proctor maximum dry density.

6.7.4 Subgrade Stability and Test Roll

Subgrade stability within the *critical subgrade zone* of the new pavements is important for pavement support, construction, and performance. Stability of the subgrade soils in the *critical subgrade zone* should be evaluated using the *test roll* procedure before placement of the aggregate surfacing layer or aggregate base layers for the concrete pavements.

After establishing subgrade elevations, but before placement of the *sand subbase,* aggregate surfacing, or base layers, we recommend the subgrade soils be subjected to a *test roll* procedure using a loaded, tandem-axle dump truck. The *test roll* will help to delineate any *unstable soils* that will not be acceptable as pavement subgrade soils. These *unstable soils* should be removed and replaced; or be aerated, dried and recompacted back into place as recommended by AET geotechnical personnel. After the subgrade soils pass a test roll procedure, fill and the aggregate surfacing or base layer can be placed and compacted. The aggregate surfacing and base layers should be compacted to at least 100% of the Standard Proctor density.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Potential Difficulties

7.1.1 Runoff Water in Excavation

Water can be expected to collect in the excavation bottom during times of inclement weather or snow melt. To allow observation of the excavation bottom, to reduce the potential for soil disturbance, and to facilitate filling operations, we recommend water be removed from within the excavation during construction. Based on the soils encountered, we anticipate the ground water can be handled with conventional sump pumping.

7.1.2 Disturbance of Soils

The on-site soils can become disturbed under construction traffic, especially if the soils are wet. If soils become disturbed, they should be subcut to the underlying undisturbed soils. The subcut soils can then be dried and recompacted back into place, or they should be removed and replaced with drier imported fill.

7.2 Excavation Backsloping

If excavation faces are not retained, the excavations should maintain maximum allowable slopes in accordance with *OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations"* (can be found on www.osha.gov). Even with the required OSHA sloping, water seepage or surface runoff can potentially induce sideslope erosion or running which could require slope maintenance.

7.3 Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observation by a geotechnical engineer/technician during construction to evaluate these potential changes. Soil density testing should also be performed on new fill placed in order to document that project specifications for compaction have been satisfied.

8.0 LIMITATIONS

Within the limitations of scope, budget, and schedule, our services have been conducted according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, either expressed or implied, is intended.

Important information regarding risk management and proper use of this report is given in Appendix B entitled "Geotechnical Report Limitations and Guidelines for Use".

FLOOR SLAB MOISTURE/VAPOR PROTECTION

Floor slab design relative to moisture/vapor protection should consider the type and location of two elements, a granular layer and a vapor membrane (vapor retarder, water resistant barrier or vapor barrier). In the following sections, the pros and cons of the possible options regarding these elements will be presented, such that you and your specifier can make an engineering decision based on the benefits and costs of the choices.

GRANULAR LAYER

In American Concrete Institute (ACI) 302.1R-04, a "base material" is recommended over the vapor membrane, rather than the conventional clean "sand cushion" material. The base layer should be a minimum of 4 inches (100 mm) thick, trimmable, compactable, granular fill (not sand), a so-called crusher-run material. Usually graded from 1½ inches to 2 inches (38 to 50 mm) down to rock dust is suitable. Following compaction, the surface can be choked off with a fine-grade material. We refer you to ACI 302.1R-04 for additional details regarding the requirements for the base material.

In cases where potential static water levels or significant perched water sources appear near or above the floor slab, an under floor drainage system may be needed wherein a draintile system is placed within a thicker clean sand or gravel layer. Such a system should be properly engineered depending on subgrade soil types and rate/head of water inflow.

VAPOR MEMBRANE

The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. Your decision will then relate to whether to use the ACI base material or a conventional sand cushion layer. However, if any of the above sensitivity issues apply, placement of a vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) require installation of a vapor membrane to limit the slab moisture content as a condition of their warranty.

VAPOR MEMBRANE/GRANULAR LAYER PLACEMENT

A number of issues should be considered when deciding whether to place the vapor membrane above or below the granular layer. The benefits of placing the slab on a granular layer, with the vapor membrane placed **below** the granular layer, include **reduction** of the following:

- Slab curling during the curing and drying process.
- Time of bleeding, which allows for quicker finishing.
- Vapor membrane puncturing.
- Surface blistering or delamination caused by an extended bleeding period.
- Cracking caused by plastic or drying shrinkage.

The benefits of placing the vapor membrane over the granular layer include the following:

- A lower moisture emission rate is achieved faster.
- Eliminates a potential water reservoir within the granular layer above the membrane.
- Provides a "slip surface", thereby reducing slab restraint and the associated random cracking.

If a membrane is to be used in conjunction with a granular layer, the approach recommended depends on slab usage and the construction schedule. The vapor membrane should be placed above the granular layer when:

- Vapor sensitive floor covering systems are used or vapor sensitive items will be directly placed on the slab.
- The area will be humidity controlled, but the slab will be placed before the building is enclosed and sealed from rain.
- Required by a floor covering manufacturer's system warranty.

The vapor membrane should be placed below the granular layer when:

- Used in humidity controlled areas (without vapor sensitive coverings/stored items), with the roof membrane in place, and the building enclosed to the point where precipitation will not intrude into the slab area. Consideration should be given to slight sloping of the membrane to edges where draintile or other disposal methods can alleviate potential water sources, such as pipe or roof leaks, foundation wall damp proofing failure, fire sprinkler system activation, etc.

There may be cases where membrane placement may have a detrimental effect on the subgrade support system (e.g., expansive soils). In these cases, your decision will need to weigh the cost of subgrade options and the performance risks.

BASEMENT/RETAINING WALL BACKFILL AND WATER CONTROL

DRAINAGE

Below-grade basements should include a perimeter backfill drainage system on the exterior side of the wall. The exception may be where basements lie within free draining sands where water will not perch in the backfill. Drainage systems should consist of perforated or slotted PVC drainage pipes located at the bottom of the backfill trench, lower than the interior floor grade. The drain pipe should be surrounded by properly graded filter rock. A filter fabric should then envelope the filter rock. The drain pipe should be connected to a suitable means of disposal, such as a sump basket or a gravity outfall. A storm sewer gravity outfall would be preferred over exterior gravity drainage, as the latter may freeze during winter. For non-building, exterior retaining walls, weep holes at the base of the wall can be substituted for a drain pipe.

BACKFILLING

Prior to backfilling, dampproofing or waterproofing should be applied on perimeter basement walls. The backfill materials placed against basement walls will exert lateral loadings. To reduce this loading by allowing for drainage, we recommend using free draining sands for backfill. The zone of sand backfill should extend outward from the wall at least 2 feet, and then extend upward and outward from the wall at a 30 degree or greater angle from vertical. As a minimum, the sands used on this project should contain no greater than 7% of the particles (by weight) finer than the #200 sieve and no more than 40% of the particles (by weight) finer than the #40 sieve. The sand backfill should be placed in lifts and compacted with portable compaction equipment. This compaction should be to the specified levels if slabs or pavements are placed above. Where slabs or pavements are not above, we recommend capping the sand backfill with a layer of clayey soil to minimize surface water infiltration. Positive surface drainage away from the building should also be maintained. If surface capping or positive surface drainage cannot be maintained, then the trench should be filled with more permeable soils, such as the Fine Filter or Coarse Filter Aggregates defined in MnDOT *Specification* 3149. You should recognize that if the backfill soils are not properly compacted, settlements may occur which may affect surface drainage away from the building.

Backfilling with silty or clayey soil is possible but not preferred. These soils can build-up water which increases lateral pressures and results in wet wall conditions and possible water infiltration into the basement. If you elect to place silty or clayey soils as backfill, we recommend you place a prefabricated drainage composite against the wall which is hydraulically connected to a drainage pipe at the base of the backfill trench. High plasticity clays should be avoided as backfill due to their swelling potential.

LATERAL PRESSURES

Lateral earth pressures on below-grade walls vary, depending on backfill soil classification, backfill compaction, and slope of the backfill surface. Static or dynamic surcharge loads near the wall will also increase lateral wall pressure. For design, we recommend the following ultimate lateral earth pressure values (given in equivalent fluid pressure values) for a drained soil compacted to 95% of the Standard Proctor density and a level ground surface.

	Equivalent Fluid Density	
Soil Type	**Active Pressure (pcf)**	**At-Rest Pressure (pcf)**
Sands (SP or SP-SM)	35	50
Silty Sands (SM	45	65
Fine Grained Soils (SC, CL or ML)	70	90

Basement walls are normally restrained at the top which restricts movement. In this case, the design lateral pressures should be the "at-rest" pressure situation. Retaining walls which are free to rotate or deflect should be designed using the active case. Lateral earth pressures will be significantly higher than that shown if the backfill soils are not drained and become saturated.

EXCAVATION AND REFILLING FOR STRUCTURAL SUPPORT

EXCAVATION

Excavations for structural support at soil boring locations should be taken to depths recommended in the geotechnical report. Since conditions can vary, recommended excavation depths between and beyond the boring locations should be evaluated by geotechnical field personnel. If ground water is present, the excavation should be dewatered to avoid the risk of unobservable poor soils being left in-place. Excavation base soils may become disturbed due to construction traffic, ground water or other reasons. Such soils should be subcut to underlying undisturbed soils. Where the excavation base slopes steeper than 4:1, the excavation bottom should be benched across the slope parallel to the excavation contour.

Soil stresses under footings spread out with depth. Therefore, the excavation bottom and subsequent fill system should be laterally oversized beyond footing edges to support the footing stresses. A lateral oversize equal to the depth of fill below the footing (i.e., 1:1 oversize) is usually recommended. The lateral oversize is usually increased to 1.5:1 where compressible organic soils are exposed on the excavation sides. Variations in oversize requirements may be recommended in the geotechnical report or can be evaluated by the geotechnical field personnel.

Unless the excavation is retained, the backslopes should be maintained in accordance with OSHA Regulations (Standards - 29 CFR), Part 1926, Subpart P, "Excavations" (found on www.osha.gov). Even with the required OSHA sloping, ground water can induce sideslope raveling or running which could require that flatter slopes or other approaches be used.

FILLING

Filling should proceed only after the excavation bottom has been approved by the geotechnical engineer/technician. Approved fill material should be uniformly compacted in thin lifts to the compaction levels specified in the geotechnical report. The lift thickness should be thin enough to achieve specified compaction through the full lift thickness with the compaction equipment utilized. Typical thicknesses are 6" to 9" for clays and 12" to 18" for sands. Fine grained soils are moisture sensitive and are often wet (water content exceeds the "optimum moisture content" defined by a Proctor test). In this case, the soils should be scarified and dried to achieve a water content suitable for compaction. This drying process can be time consuming, labor intensive, and requires favorable weather.

Select fill material may be needed where the excavation bottom is sensitive to disturbance or where standing water is present. Sands (SP) which are medium to coarse grained are preferred, and can be compacted in thicker lift thicknesses than finer grained soils.

Filling operations for structural support should be closely monitored for fill type and compaction by a geotechnical technician. Monitoring should be on a full-time basis in cases where vertical fill placement is rapid; during freezing weather conditions; where ground water is present; or where sensitive bottom conditions are present.

EXCAVATION/REFILLING DURING FREEZING TEMPERATURES

Soils that freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density loss depends on the soil type and moisture condition; and is most pronounced in clays and silts. Foundations, slabs, and other improvements should be protected from frost intrusion during freezing weather. For earthwork during freezing weather, the areas to be filled should be stripped of frozen soil, snow and ice prior to new fill placement. In addition, new fill should not be allowed to freeze during or after placement. For this reason, it may be preferable to do earthwork operations in small plan areas so grade can be quickly attained instead of large areas where much frost stripping may be needed.

FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION

GENERAL

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/strength loss depends on the soil type and moisture condition. Heave is greater in soils with higher percentages of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about 1/4" to 3/8" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

DESIGN CONSIDERATIONS

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 12% passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

Adfreezing can occur on exterior piers (such as deck, fence or other similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where soils become saturated. Additional footing embedment and/or widened footings below the frost zones (which include tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

CONSTRUCTION CONSIDERATIONS

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

DEFINITIONS RELATING TO PAVEMENT CONSTRUCTION

TOP OF SUBGRADE
Grade which contacts the bottom of the aggregate base layer.

SAND SUBBASE
Uniform thickness sand layer placed as the top of subgrade which is intended to improve the frost and drainage characteristics of the pavement system by better draining excess water in the base/subbase, by reducing and "bridging" frost heaving and by reducing spring thaw weakening effects.

CRITICAL SUBGRADE ZONE
The subgrade portion beneath and within three vertical feet of the top of subgrade. A sand subbase, if placed, would be considered the upper portion of the critical subgrade zone.

GRANULAR BORROW
Soils meeting Mn/DOT Specification 3149.2B1. This refers to granular soils which, of the portion passing the 1" sieve, contain less than 20% by weight passing the #200 sieve.

SELECT GRANULAR BORROW
Soils meeting Mn/DOT Specification 3149.2B2. This refers to granular soils which, of the portion passing the 1" sieve, contain less than 12% by weight passing the #200 sieve.

MODIFIED SELECT GRANULAR BORROW
Clean, medium grained sands which, of the portion passing the 1" sieve, contain less than 5% by weight passing the #200 sieve and less than 40% by weight passing the #40 sieve.

GEOTEXTILE STABILIZATION FABRIC
Geotextile meeting Type V requirements defined in Mn/DOT Specification 3733. When using fabric, installation should also meet the requirements outlined in Mn/DOT Specification 3733.

COMPACTION SUBCUT
Construction of a uniform thickness subcut below a designated grade to provide uniformity and compaction within the subcut zone. Replacement fill can be the materials subcut, although the reused soils should be blended to a uniform soil condition and recompacted per the Specified Density Method (Mn/DOT Specification 2105.3F1).

TEST ROLL
A means of evaluating the near-surface stability of subgrade soils (usually non-granular). Suitability is determined by the depth of rutting or deflection caused by passage of heavy rubber-tired construction equipment, such as a loaded dump truck, over the test area. Yielding of less than 1" is normally considered acceptable, although engineering judgment may be applied depending on equipment used, soil conditions present, and/or pavement performance expectations.

UNSTABLE SOILS
Subgrade soils which do not pass a test roll. Unstable soils typically have water content exceeding the "standard optimum water content" defined in ASTM:D698 (Standard Proctor test).

ORGANIC SOILS
Soils which have sufficient organic content such that engineering properties/stability are affected. These soils are usually black to dark brown in color.

Appendix A

Geotechnical Field Exploration and Testing
Boring Log Notes
Unified Soil Classification System
Figure 1 – Boring Locations
Subsurface Boring Logs
Results of Sieve/Hydrometer Analysis Tests
Results of Organic Content Tests
Results of Flexible Wall Permeability Tests

Appendix A
Geotechnical Field Exploration and Testing
Report No. 22-00941

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling 16 standard penetration test borings. The locations of the borings appear on Figure 1, preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS) - Calibrated to N_{60} Values

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586 with one primary modification. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value. Our method uses a modified hammer weight, which is determined by measuring the system energy using a Pile Driving Analyzer (PDA) and an instrumented rod.

In the past, standard penetration N-value tests were performed using a rope and cathead for the lift and drop system. The energy transferred to the split-spoon sampler was typically limited to about 60% of its potential energy due to the friction inherent in this system. This converted energy then provides what is known as an N_{60} blow count.

The most recent drill rigs incorporate an automatic hammer lift and drop system, which has higher energy efficiency and subsequently results in lower N-values than the traditional N_{60} values. By using the PDA energy measurement equipment, we are able to determine actual energy generated by the drop hammer. With the various hammer systems available, we have found highly variable energies ranging from 55% to over 100%. Therefore, the intent of AET's hammer calibrations is to vary the hammer weight such that hammer energies lie within about 60% to 65% of the theoretical energy of a 140-pound weight falling 30 inches. The current ASTM procedure acknowledges the wide variation in N-values, stating that N-values of 100% or more have been observed. Although we have not yet determined the statistical measurement uncertainty of our calibrated method to date, we can state that the accuracy deviation of the N-values using this method is significantly better than the standard ASTM Method.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as "DS" or "SU" on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of "topsoil" layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

Visual-manual judgment of the AASHTO Soil Group is also noted as a part of the soil description. A chart presenting details of the AASHTO Soil Classification System is also attached.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests
Conducted per AET Procedure 01-LAB-010, which is performed in general accordance with ASTM: D2216 and AASHTO: T265.

A.5.2 Atterberg Limits Tests
Conducted per AET Procedure 01-LAB-030, which is performed in general accordance with ASTM: D4318 and AASHTO: T89, T90.

A.5.3 Sieve Analysis of Soils (thru #200 Sieve)
Conducted per AET Procedure 01-LAB-040, which is performed in general conformance with ASTM: D6913, Method A.

A.5.4 Particle Size Analysis of Soils (with hydrometer)
Conducted per AET Procedure 01-LAB-050, which is performed in general accordance with ASTM: D422 and AASHTO: T88.

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
AR:	Sample of material obtained from cuttings blown out the top of the borehole during air rotary procedure.
B, H, N:	Size of flush-joint casing
CAS:	Pipe casing, number indicates nominal diameter in inches
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
DP:	Direct push drilling; a 2.125 inch OD outer casing with an inner 1½ inch ID plastic tube is driven continuously into the ground.
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RDA:	Rotary drilling with compressed air and roller or drag bit.
RDF:	Rotary drilling with drilling fluid and roller or drag bit
REC:	In split-spoon (see notes), direct push and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
SS:	Standard split-spoon sampler (steel; 1.5" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
$\underline{\nabla}$:	Water level directly measured in boring
$\underline{\nabla}$:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (<u>approximate</u>)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remolded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES
(Calibrated Hammer Weight)

The standard penetration test consists of driving a split-spoon sampler with a drop hammer (calibrated weight varies to provide N_{60} values) and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM: D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM: D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

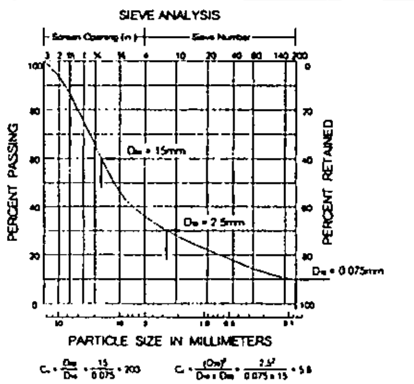
Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]	GW	Well graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3$[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3$[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OL	Organic clay[K,L,M,N] Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OH	Organic clay[K,L,M,P] Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]

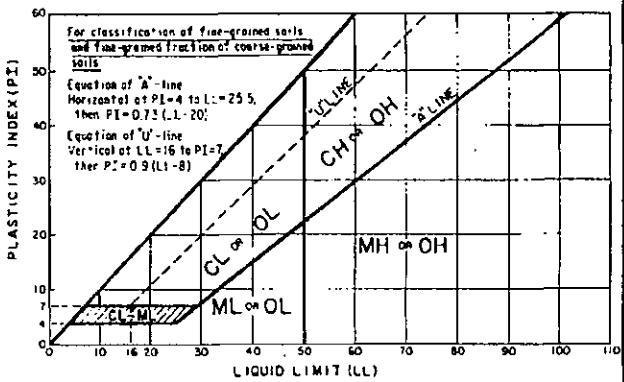
Notes

[A] Based on the material passing the 3-in (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
[D] Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains $\geq$15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.
[K] If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.
[L] If soil contains $\geq$30% plus No. 200, predominantly sand, add "sandy" to group name.
[M] If soil contains $\geq$30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI$\geq$4 and plots on or above "A" line.
[O] PI<4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.
[R] Fiber Content description shown below.





Plasticity Chart

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition (MC Column)

D (Dry):	Absense of moisture, dusty, dry to touch.
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").
W (Wet/ Waterbearing):	Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.
F (Frozen):	Soil frozen

Layering Notes

Laminations:	Layers less than ½" thick of differing material or color.
Lenses:	Pockets or layers greater than ½" thick of differing material or color.

Peat Description

Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. *Slightly organic* used for borderline cases.

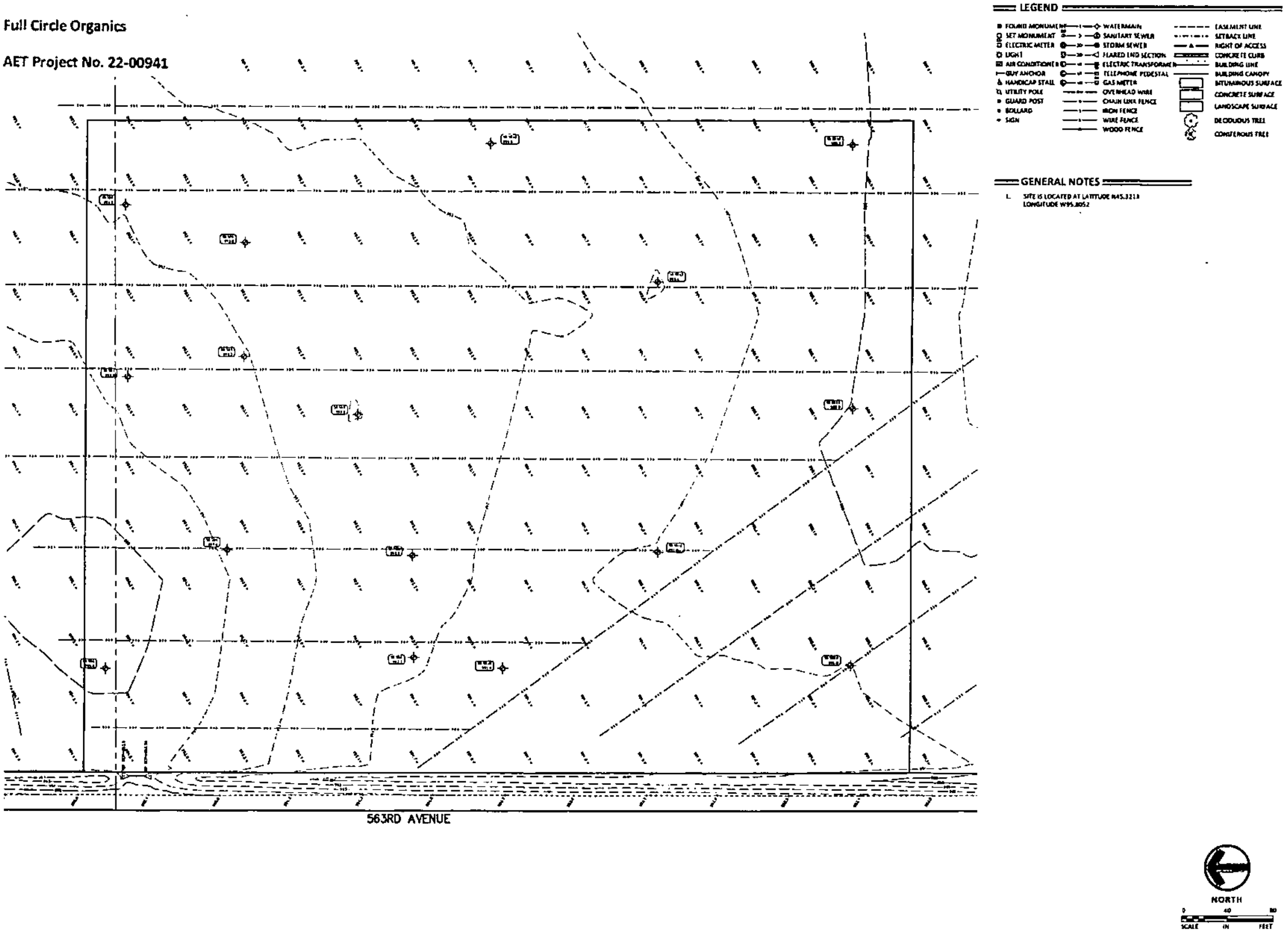
Root Inclusions

With roots:	Judged to have sufficient quantity of roots to influence the soil properties.
Trace roots:	Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.

Figure 1 – Soil Boring Locations

Full Circle Organics

AET Project No. 22-00941



mfra

Client
MFS FARMS LLC & FULL CIRCLE ORGANICS

Project
FULL CIRCLE ORGANICS - GOOD THUNDER COMPOSTING FACILITY

Location
LYRA TOWNSHIP
BLUE EARTH COUNTY, MN

Certification

PRELIMINARY

Summary

Revision History
No. Date By Submittal / Revision

Sheet Title
EXISTING CONDITIONS

Sheet No. Revision
C2.01

Project No. MFS19051

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-1 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 995.4 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–3	FILL, mixture of lean clay and fat clay, trace roots, dark brown and brownish gray, a little black (plowed zone)	FILL	9	M	SS	4	28				
			9	M	SS	8	24				
3–6.5	LEAN CLAY, gray and brown mottled, a little light gray, stiff, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL					29				
			11	M	SS	14	20				
6.5–14	SANDY LEAN CLAY, a little gravel, light brownish gray, a little brown, stiff to very stiff, laminations of fine silty sand (CL)	TILL	13	M	SS	16	22				
			16	M	SS	18	22				
			15	M	SS	18	22				
14–16	SANDY LEAN CLAY, a little gravel, grayish brown, a little brown, very stiff, laminations of sand (CL)		21	M	SS	18	20				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	3.25" HSA	11/7/11	2:25	16.0	14.5	16.0		None

BORING COMPLETED: **11/7/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-2 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 993.8 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, trace roots, black (plowed zone)	FILL	8	M	SS	10	28				
2–2.5	FILL, mixture of lean clay and fat clay, a little sand, trace roots, gray and black (plowed zone)		9	M	SS	12	24 33				
2.5–5	LEAN CLAY, gray and brown mottled, a little light gray, stiff, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL			TW	24			62	21	87
5–16	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff to very stiff, laminations of fine silty sand (CL)	TILL	9	M	SS	16					
			16	M	SS	16	22				
			15	M	SS	18	22				
			23	M	SS	16	20				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-14½'	3.25" HSA

BORING COMPLETED: 11/7/11

DR: JM LG: JMM Rig: 68C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/7/11	5:06	16.0	14.5	16.0		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-3 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: 992.3

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2.5	FILL, mostly fat clay, trace roots, black (plowed zone)	FILL	8	M	SS	4	27				
2.5–4	FILL, mixture of lean clay and fat clay, gray and black (plowed zone)		9	M	SS	6	27				
4–6.5	LEAN CLAY, gray and brown mottled, a little light gray, firm, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	8	M	SS	12	32				
6.5–11.5	SANDY LEAN CLAY, a little gravel, light brownish gray, a little brown, stiff to very stiff, laminations of fine silty sand (CL)	TILL	10	M	SS	16	22				
			12	M	SS	16	21				
11.5–14	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, very stiff, laminations of fine silty sand and sand (CL)		23	M	SS	18	20				
14–16	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of medium waterbearing sand and fine silty sand (CL)		14	M-W	SS	16	25				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	3.25" HSA							
		11/7/11	4:10	11.0	9.5	11.0		None
		11/7/11	4:18	16.0	14.5	15.3		15.2
BORING COMPLETED: 11/7/11		11/7/11	4:25	16.0	14.5	15.4		None
DR: JM LG: JMM Rig: 68C								

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-4 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 993.8 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, dark brown (plowed zone)	FILL	9	M	SS	6	23				
2–4	FILL, mostly fat clay, trace roots, gray and black (plowed zone)		10	M	SS	6	25 33				
4–6.5	LEAN CLAY, trace roots, brown and gray mottled, stiff, laminations of silt (CL)	TILL	10	M	SS	10	39				
6.5–11	SANDY LEAN CLAY, a little gravel, light brownish gray, a little brown to brownish gray, a little brown, firm to stiff, laminations of fine silty sand (CL)		8	M	SS	18	30				
			15	M	SS	16	24				
11	**END OF BORING**										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-9½'	3.25" HSA	11/7/11	2:56	11.0	9.5	10.9		None

BORING COMPLETED: **11/7/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-5 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **993.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–3	FILL, mixture of fat clay, slightly organic and lean clay, trace roots, black and brownish gray (plowed zone)	FILL	7	M	SS	4	25				
			9	M	SS	6	27				
3–4	LEAN CLAY, gray, a little black and light gray, stiff laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL					29				
4–6.5	LEAN CLAY WITH SAND, gray, a little brown, firm, laminations of sandy silt (CL)	TILL	8	M	SS	16	29				
6.5–8.5	SANDY LEAN CLAY, a little gravel, grayish brown, a little brown, stiff, laminations of fine silty sand (CL)		11	M	SS	18	23				
	END OF BORING										

DEPTH:	DRILLING METHOD
0-7'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/7/11	3:20	8.5	7.0	8.5		None

BORING COMPLETED: **11/7/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-6 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **992.9**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	7	M	SS	10	28				
2–4	FILL, mostly lean clay, a little fat clay, gray, a little black (plowed zone)		9	M	SS	2	31				
4–6.5	LEAN CLAY, gray and brown mottled, a little light gray, stiff, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	9	M	SS	18	42				
6.5–8.5	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)	TILL	12	M	SS	14	22				
	END OF BORING										

DEPTH:	DRILLING METHOD
0-7'	3.25" HSA

BORING COMPLETED: **11/7/11**

DR: **JM** LG: **JMM** Rig: **68C**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/7/11	3:40	8.5	7.0	8.5		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-7 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **993.1**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	10	M	SS	4	24				
2–4	FAT CLAY, brownish gray, firm (CH)	FINE ALLUVIUM	7	M	SS	6	29				
4–9	LEAN CLAY, gray and brown mottled, stiff, laminations of silt (CL)		9	M	SS	8	36				
			9	M	SS	12	32				
9–16	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff to very stiff, laminations of fine silty sand (CL)	TILL	11	M	SS	16	26				
			14	M	SS	18	23				
			18	M	SS	14	21				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	3.25" HSA	11/8/11	10:07	16.0	14.5	15.8		None

BORING COMPLETED: 11/8/11

DR: JM LG: JMM Rig: 68C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-8 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 992.3 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–3	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	9	M	SS	2	20				
			9	M	SS	8	26				
3–4	LEAN CLAY, gray, a little light gray, stiff, laminations of silt (CL)	FINE ALLUVIUM					30				
4–9	LEAN CLAY, gray and brown mottled, firm, laminations of sandy silt (CL)		6	M	SS	12	31				
			7	M	SS	14	35				
9–11.5	LEAN CLAY, brownish gray, a little brown, stiff, laminations of sandy silt (CL)		13	M	SS	16	33				
11.5–13.5	LEAN CLAY, gray, stiff, laminations of fine sand (CL)		10	M	SS	16	30				
	END OF BORING										

DEPTH:	DRILLING METHOD
0-12'	3.25" HSA

BORING COMPLETED: 11/8/11

DR: JM LG: JMM Rig: 68C

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/8/11	8:10	13.5	12.0	13.4		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 22-00941 LOG OF BORING NO. SB-9 (p. 1 of 1)

PROJECT: Full Circle Organics; Good Thunder, MN

SURFACE ELEVATION: 992.5

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	9	M	SS	4	24				
2–4	FAT CLAY, gray, a little light gray, firm, laminations of silt (CH)	FINE ALLUVIUM OR WEATHERED TILL	8	M	SS	4	29				
4–9	LEAN CLAY, gray and brown mottled, firm, laminations of sandy silt (CL)		8	M	SS	8	38				
			8	M	SS	14	26				
9–13.5	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)		12	M	SS	16	23				
			14	M	SS	16	23				
	END OF BORING										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-12'	3.25" HSA	11/8/11	9:32	13.5	12.0	13.5		None

WATER LEVEL MEASUREMENTS

BORING COMPLETED: 11/8/11

DR: JM LG: JMM Rig: 68C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-10 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: 991.8

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–4	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	7	M	SS	10	22				
			9	M	SS	2	22				
4–6.5	LEAN CLAY, gray and brown mottled, firm, laminations of sandy silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	6	M	SS	12	40				
6.5–9	LEAN CLAY, a little gravel, gray and brown mottled, firm, laminations of sandy silt (CL)		8	M	SS	14	33				
9–11.5	LEAN CLAY WITH SAND, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)	TILL	11	M	SS	14	30				
11.5–14	LEAN CLAY WITH SAND, gray, stiff (CL)		11	M	SS	18	29				
14–18	SANDY LEAN CLAY, a little gravel, gray, firm (CL)		7	M	SS	18	25				
18–21	SANDY LEAN CLAY, a little gravel, gray, stiff, laminations of fine sand (CL)		12	M	SS	16	20				
21	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-19½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/8/11	8:56	21.0	19.5	21.0		None

BORING COMPLETED: 11/8/11

DR: JM LG: JMM Rig: 68C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-11 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **991.6**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	10	M	SS	3	23				
2–3	FILL, mostly fat clay, slightly organic, a little fat clay, trace roots, black, a little brownish gray (plowed zone)		10	M	SS	8	28 31				
3–4	LEAN CLAY, gray mottled, a little brown and light gray, stiff, laminations of sandy silt and silt (CL)	FINE ALLUVIUM OR WEATHERED TILL									
5–6	SANDY LEAN CLAY, a little gravel, brown, a little gray, firm, laminations of sandy silt (CL)	TILL	8	M	SS	18	26				
6–9	LEAN CLAY WITH SAND, gray, a little brown,stiff, laminations of sandy silt (CL)		9	M	SS	16	34				
9–16	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)		12	M	SS	20	25				
			14	M	SS	16	18				
			13	M	SS	16	21				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	**3.25" HSA**	**11/8/11**	**10:46**	**16.0**	**14.5**	**15.9**		**None**

BORING COMPLETED: **11/8/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-12 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **991.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	8	M	SS	3	29				
2–4	LEAN CLAY, trace roots, gray and brown mottled, a little light gray, stiff, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	10	M	SS	3	28				
4–6.5	LEAN CLAY, gray and brown mottled, stiff, laminations of silt (CL)	TILL	9	M	SS	8	38				
6.5–9	SANDY LEAN CLAY, brown, a little gray, stiff (CL)		9	M	SS	16	25				
9–11	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)		15	M	SS	16	25				
11	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-9½'	3.25" HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/8/11	12:02	11.0	9.5	11.0		None

BORING COMPLETED: **11/8/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-13 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 992.1 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	7	M	SS	4	26				
2–4	FILL, mostly fat clay, slightly organic, trace roots, gray and black (plowed zone)		9	M	SS	4	29				
4–6.5	LEAN CLAY, brown and gray mottled, firm, laminations of sandy silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	7	M	SS	8	39				
6.5–9	SANDY LEAN CLAY, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)	TILL	10	M	SS	16	27				
9–11	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown, stiff, laminations of fine silty sand (CL)		15	M	SS	14	22				
	END OF BORING										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-9½'	3.25" HSA	11/8/11	11:15	11.0	9.5	11.0		None

WATER LEVEL MEASUREMENTS

BORING COMPLETED: 11/8/11

DR: JM LG: JMM Rig: 68C

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-14 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **991.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	11	M	SS	10	25				
2–4	FILL, mixture of fat clay and fat clay, slightly organic, trace roots, gray and black (plowed zone)		10	M	SS	4	28				
4–9	LEAN CLAY, brown and gray mottled, firm, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	8	M	SS	12	39				
			8	M	SS	14	38				
9–14	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown to brownish gray, a little brown, stiff, laminations of fine silty sand (CL)	TILL	12	M	SS	16	25				
			13	M	SS	18	31				
14–16	SANDY LEAN CLAY, a little gravel, gray, a little brown, very stiff, laminations of fine silty sand (CL)		17	M	SS	14	20				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	3.25" HSA	11/8/11	12:38	16.0	14.5	16.0		None

BORING COMPLETED: **11/8/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-15 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

SURFACE ELEVATION: **990.0**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0–2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	6	M	SS	8	29				
2–5	FILL, mixture of fat clay, slightly organic and fat clay, trace roots, black and gray (plowed zone)		8	M	SS	4	29				
5–9	LEAN CLAY, brown and gray mottled, firm, laminations of sandy silt (CL)	FINE ALLUVIUM OR WEATHERED TILL		M	TW	18			55	29	98
			8	M	SS	18	33				
9–11.5	LEAN CLAY WITH SAND,brownish gray, a little brown, stiff, laminations of fine silty sand (CL)	TILL	10	M	SS	20	29				
11.5–14	SANDY LEAN CLAY, a little gravel, gray, a little brown, stiff, laminations of fine silty sand (CL)		13	M	SS	16	21				
14–16	SANDY LEAN CLAY, a little gravel, gray, stiff (CL)		15	M	SS	16	20				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-14½'	**3.25" HSA**

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/8/11	1:17	16.0	14.5	15.8		None

BORING COMPLETED: **11/8/11**

DR: **JM** LG: **JMM** Rig: **68C**

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11

AMERICAN ENGINEERING TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: **22-00941** LOG OF BORING NO. **SB-16 (p. 1 of 1)**

PROJECT: **Full Circle Organics; Good Thunder, MN**

DEPTH IN FEET	SURFACE ELEVATION: 990.1 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	WC	DEN	LL	PL	%-#200
0-2	FILL, mostly fat clay, slightly organic, trace roots, black (plowed zone)	FILL	8	M	SS	4	28				
2-4	FILL, mixture of fat clay, slightly organic, and fat clay, trace roots, black and brownish gray (plowed zone)		9	M	SS	6	24				
4-6.5	LEAN CLAY, brown and gray mottled, stiff, laminations of silt (CL)	FINE ALLUVIUM OR WEATHERED TILL	10	M	SS	14	38				
6.5-9	SANDY LEAN CLAY, a little gravel, light grayish brown, a little brown, stiff, laminations of fine silty sand (CL)	TILL	9	M	SS	18	28				
9-16	SANDY LEAN CLAY, a little gravel, brownish gray, a little brown to gray, a little brown, stiff, laminations of fine silty sand (CL)		14	M	SS	16	26				
			12	M	SS	16	21				
			15	M	SS	16	23				
16	**END OF BORING**										

DEPTH:	DRILLING METHOD
0-14½'	3.25" HSA

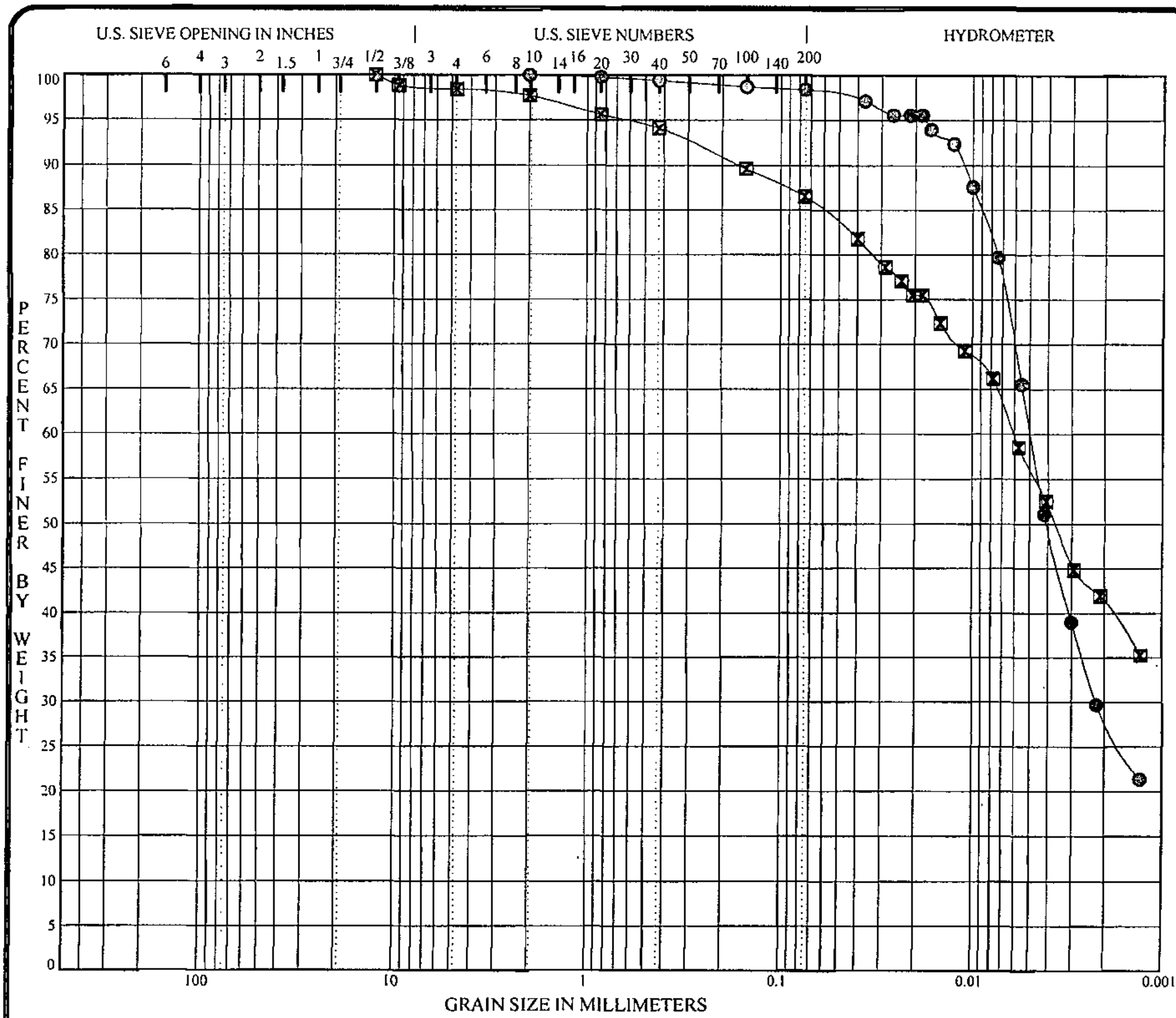
BORING COMPLETED: 11/8/11

DR: JM LG: JMM Rig: 68C

WATER LEVEL MEASUREMENTS						
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
11/8/11	1:56	16.0	14.5	16.0		None

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP 22-00941.GPJ AET+CPT+WELL.GDT 12/8/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
⊙ SB-15	4.0'	**FAT CLAY**		**55**	**29**	**26**		
⊠ SB-2	4.0'	**FAT CLAY**		**62**	**21**	**41**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
○ SB-15	4.0'	**2.00**	**0.00**	**0.002**		**0.0**	**1.6**	**38.0**	**60.4**
⊠ SB-2	4.0'	**12.50**	**0.01**			**1.6**	**11.9**	**30.4**	**56.1**

PROJECT **Full Circle Organics Cornfield;**

AET JOB NO. **22-00941**
DATE **11/7/11**

AMERICAN
ENGINEERING
TESTING, INC.

GRADATION CURVES

REPORT OF TEST ORGANIC CONTENT

PROJECT:
FULL CIRCLE ORGANICS
COMPOST SITE
56437 164TH STREET
GOOD THUNDER, MINNESOTA 56037

REPORTED TO:
MFS FARMS, LLC
C/O MCCOMBS FRANKS ROOS ASSOC.
14800 28TH AVENUE N, SUITE 140
PLYMOUTH, MN 55447
ATTN: MICHAEL C. BRANDT,

AET PROJECT NO: 22-00941 **DATE:** NOVEMBER 23, 2011

RESULTS:

BORING NUMBER (DEPTH)	SB-2 (0-2 FEET)	
Organic Content, %	4.955	ASTM: D2974
BORING NUMBER (DEPTH)	SB-3 (0-2 FEET)	
Organic Content, %	6.58	ASTM: D2974
BORING NUMBER (DEPTH)	SB-4 (0-2 FEET)	
Organic Content, %	7.755	ASTM: D2974
BORING NUMBER (DEPTH)	SB-5 (0-2 FEET)	
Organic Content, %	5.584	ASTM: D2974
BORING NUMBER (DEPTH)	SB-5 (2-3 FEET)	
Organic Content, %	5.203	ASTM: D2974
BORING NUMBER (DEPTH)	SB-5 (3-3.5 FEET)	
Organic Content, %	2.151	ASTM: D2974
BORING NUMBER (DEPTH)	SB-6 (0-2 FEET)	
Organic Content, %	7.008	ASTM: D2974
BORING NUMBER (DEPTH)	SB-6 (2-3.5 FEET)	
Organic Content, %	2.572	ASTM: D2974
BORING NUMBER (DEPTH)	SB-10 (0-2 FEET)	
Organic Content, %	6.173	ASTM: D2974
BORING NUMBER (DEPTH)	SB-13 (0-2 FEET)	
Organic Content, %	8.327	ASTM: D2974

REMARKS: The samples were submitted to our laboratory on November 21, 2011 by Derek Van Heuveln of American Engineering Testing, Inc.

Report Prepared and Reviewed By:
American Engineering Testing, Inc.

Derek Van Heuveln
Staff Engineer II

AMERICAN ENGINEERING TESTING, INC.

AET, Inc
American Engineering Testing
550 Cleveland Ave. North
St. Paul, MN 55114
651-659-9001

Hydraulic Conductivity/Permeability

ASTM D 5084

AET Project No.: 22-00941 Project Name: Full Circle Organics Cornfield

Project Location: Good Thunder, MN Engineer: DVH

Date Submitted: 11/18/2011 By: DVH Date Tested: 11/23/2011 Tested By: BAP

Sample Description: Gray/Brown Mottled Lean Clay (CL)

Boring Number: SB-2 Sample No.: P-1 Depth: 4'-6'

Initial Sample		Final Sample			
Sample Wt: (g)	1039.03	Sample Wt: (g)	1056.43	Specific Gravity:	2.65
Length: (in)	5.160	Length: (in)	5.176	Assumed/Tested:	Assumed
Diameter: (in)	2.846	Diameter: (in)	2.854		
Area: (in^2)	6.361	Area: (in^2)	6.398	Permeant Liquid:	Deaired Tap Water
Volume: (cf)	0.0190	Volume: (cf)	0.0192	Cell Pressure: (psi)	80
MC: (%)	27.71	MC: (%)	29.84	Consolidation Stress: (psi)	4.0
Dry Unit Wt: (pcf)	94.49	Dry Unit Wt: (pcf)	93.62	Burette Area: (cm)	1.00
Saturation: (%)	97.90	Saturation: (%)	103.20		

Average Hydraulic Conductivity at 20 oC: 1.25E-06 cm/sec

3.55E-03 ft/day

Reviewed By: DL S. V Haan

AMERICAN ENGINEERING TESTING, INC.

AET, Inc
American Engineering Testing
550 Cleveland Ave. North
St. Paul, MN 55114
651-659-9001

Hydraulic Conductivity/Permeability
ASTM D 5084

AET Project No.: 22-00941 Project Name: Full Circle Organics Cornfield

Project Location: Good Thunder, MN Engineer: DVH

Date Submitted: 11/18/2011 By: DVH Date Tested: 11/23/2011 Tested By: BAP

Sample Description: Gray/Brown Mottled Lean Clay (CL)

Boring Number: SB-15 Sample No.: P-2 Depth: 4'-6'

Initial Sample		Final Sample			
Sample Wt: (g)	969.94	Sample Wt: (g)	975.92	Specific Gravity:	2.65
Length: (in)	5.170	Length: (in)	5.172	Assumed/Tested:	Assumed
Diameter: (in)	2.832	Diameter: (in)	2.847		
Area: (in^2)	6.299	Area: (in^2)	6.364	Permeant Liquid:	Deaired Tap Water
Volume: (cf)	0.0188	Volume: (cf)	0.0190	Cell Pressure: (psi)	80
MC: (%)	40.22	MC: (%)	41.08	Consolidation Stress: (psi)	4.0
Dry Unit Wt: (pcf)	80.98	Dry Unit Wt: (pcf)	80.08	Burette Area: (cm)	1.00
Saturation: (%)	102.28	Saturation: (%)	102.24		

Average Hydraulic Conductivity at 20 oC: 1.05E-07 cm/sec

2.98E-04 ft/day

Reviewed By:

Appendix B

Geotechnical Report Limitations and Guidelines for Use

Appendix B
Geotechnical Report Limitations and Guidelines for Use
Report No. 22-00941

B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by ASFE[1], of which, we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Geotechnical Services are Performed for Specific Purposes, Persons, and Projects
Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. And no one, not even you, should apply the report for any purpose or project except the one originally contemplated.

B.2.2 Read the Full Report
Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

B.2.3 A Geotechnical Engineering Report is Based on A Unique Set of Project-Specific Factors
Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typically factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes, even minor ones, and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

B.2.4 Subsurface Conditions Can Change
A geotechnical engineering report is based on conditions that existed at the time the study was performed. Do not rely on a geotechnical engineering report whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

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1 ASFE, 8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733: www.asfe.org

B.2.5 Most Geotechnical Findings Are Professional Opinions
Site exploration identified subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

B.2.6 A Report's Recommendations Are Not Final
Do not overrely on the construction recommendations included in your report. Those recommendations are not final, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

B.2.7 A Geotechnical Engineering Report Is Subject to Misinterpretation
Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

B.2.8 Do Not Redraw the Engineer's Logs
Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognizes that separating logs from the report can elevate risk.

B.2.9 Give Contractors a Complete Report and Guidance
Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In the letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

B.2.10 Read Responsibility Provisions Closely
Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their report. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.11 Geoenvironmental Concerns Are Not Covered
The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. Do not rely on an environmental report prepared for someone else.

Appendix J

MPCA Permit Application

RECEIVED
MAY 1 6 2012
BY:

80

Minnesota Pollution Control Agency
520 Lafayette Road
St.Paul, MN 55155-4194

Permit Application for Construction and Operation

Solid Waste Permit Program

Doc Type: Permit Application 12-SW-2224

MPCA Public Notice Number: 11-SW-2224

Print or type application: Before submitting, make a photocopy for your records. The Minnesota Pollution Control Agency (MPCA) will review the application for completeness and provide an official response to the permittees within 30 business days of receipt of the application.

Permit Application Assembly: To expedite the processing and review of your application, **put this form at the beginning** of your submittal package. Please place all checklists directly behind this application form in order by the number found on the bottom left hand corner of each checklist. **Do not place forms and checklist in an appendix** as this makes it difficult and time consuming for staff to locate them.

Completeness instructions: Without properly completed forms, an application cannot be processed and will be determined to be incomplete. All sections of this form must be completed. If portions do not apply to this facility, please indicate so with "n/a".

The completed form is to be returned to: Beckie Olson
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Facility name: Full Circle Organics - Good Thunder Composting Facility Permit No.: SW- 662

Application is for (check appropriately):
- ☒ New permit
- ☐ Permit reissuance
- ☐ Major modification
- ☐ Minor modification
- ☐ Resubmittal of 'Incomplete' application originally submitted on: ______ (mm/dd/yyyy)

Variance request(s) included (check appropriately): ☐ Yes ☒ No

If yes, please describe:

Checklists Required (Please check all that are included with this application.)

All applicable checklists must be completed and submitted with this application. The MPCA will not process an application that does not include all of the required checklists. All checklists can be found at: http://www.pca.state.mn.us/enzq8a9.

All Solid Waste Facilities
- ☒ Solid Waste Facility Application Checklist

Mixed Municipal Solid Waste (MSW) Landfill
- ☐ MSW Landfill Application Checklist

MSW Combustor Ash Landfill
- ☐ MSW Combustor Ash Landfill Application Checklist

Demolition Debris Landfill
- ☐ Demolition Debris Landfill Application Checklist

Industrial Solid Waste Landfill
- ☐ Industrial Solid Waste Landfill Application Checklist

Transfer Station
- ☐ Solid Waste Transfer Station Application Checklist

Solid Waste Compost Facility
- ☒ Solid Waste Compost Facility Application Checklist

Refuse-Derived Fuel Processing Facility
- ☐ Refuse-Derived Fuel Processing Facilities Application Checklist

I. Local Acknowledgment/Permission for

Other Solid Waste Facilities

This section is primarily meant to notify the county and local authorities of the applicant's intent so that all county and local ordinances and plans can be met. It is intended to validate that counties and local authorities were properly notified of this permit application for construction and operation. Signature by the county or local authority is not meant to imply approval.

A. County Acknowledgment/Permission (to be completed by County Solid Waste Administrator or County Zoning Administrator)

Signature: [signature] Date: 12-08-2011

Print name: Dave Kronlokken Phone: 507-304-4381

Title: Waste and Recycling Supervisor Fax: 507-304-4431

E-mail: dave.kronlokken@co.blue-earth.mn.us

Organization: Blue Earth County Enviormental Services

Address: 410 South 5th St, PO Box 3566

City: Mankato State: MN Zip: 56002

B. Local Acknowledgment/Permission (to be completed by local building or zoning office)

Signature: [signature] Date: 12-08-11

Print name: George Leary Phone: 507-304-4495

Title: Zoning Administrator Fax: 507-304-4431

E-mail: George.Leary@co.blue-earth.mn.us

Organization: Blue Earth County Enviormental Services

Address: 410 South 5th St, PO Box 3566

City: Mankato State: MN Zip: 56002

In lieu of completion of this part of the application, the applicant may submit documentation that the applicant has sent appropriate notification to the county and local authorities. Documentation must consist of copies of letters sent to the county and local authorities via certified mail, return receipt requested and copies of the signed return receipt.

Solid Waste Transfer Facilities

If this application is for a transfer facility, the applicant must attach copies of all required municipal licenses/approvals. The MPCA will not process an application without these approvals. See Minn. R. 7001.3075, subp. C, for more details. If no municipal approvals are required the owner or operator must sign the statement below stating that no municipal approvals are required.

Have all local licenses/approvals been acquired? ☐ Yes ☐ No

If yes, please list all approvals, include issuances and expiration dates (please include copies of the approvals in the permit application:

N/A

If no, please sign the following line confirming no municipal approvals are required:

Signature: ______ Date: ______

Print name: ______ Title: ______

II. Facility Information

A. General Information

Facility name: Full Circle Organics - Good Thunder Composting Facility

Permit number (for modification/ reissuances only): ______

Address: 56437 164th Street

City: Good Thunder State: MN Zip: 56037

MPCA Region (check one): ☐ Brainerd ☐ Detroit Lakes ☐ Duluth ☐ Marshall/Willmar ☐ Metro ☒ Rochester

B. Legal description of property (acreage includes the entire area of the facility)

10. Acres ____ ¼ ____ ¼ ____ ¼ NW ¼ Section 01 T 106 N R 27 W

Township name: Lyra MN Legislative District: 24B

County: Blue Earth

Latitude: ____ Deg ____ Min ____ Sec North

Longitude: ____ Deg ____ Min ____ Sec West

1. Directions to the facility (physical location): 56437 164th Street, Good Thunder, MN. 56037

2. Current land use: Agriculture

3. Current zoning designation of the site and the surrounding areas within a quarter mile radius: Agriculture

4. Describe the key topographic features at and around the facility: Open Fields
   Plantings are prominent during the growing season

5. Environmental Assessment Worksheet (EAW) or Environmental Impact Statement (EIS) required? ☐ Yes ☒ No
   Explain:

C. Identify the following features within a one mile radius of the site

Feature	Name of feature	Distance
Current and former water supply or monitoring wells	MFS Farms	.5 miles
Airports	None	
Lakes or ponds	None	
Rivers, streams or springs	None	
Wetlands	None	
Floodplains	None	
Karst features (sinkholes, caves)	None	
Parks or wildlife refuges	None	
Present or proposed access and major haul roads, and their weight restrictions	563rd Ave 7 ton(spring)	0.05 miles
Easements or right-of-way	563rd Ave	0.05 miles
Recreational areas	None	
Historical or archeological areas	None Known	

III. Waste Activity Information

A. Type(s) of Waste Activity(s) to occur at the facility (check all boxes that apply)

Disposal activity

- ☐ Mixed Municipal Solid Waste
- ☐ Industrial Solid Waste
- ☐ Demolition Debris
- ☐ Municipal Solid Waste Combustor Ash
- ☐ Other:

Processing activity

- ☐ Solid Waste Composting
- ☐ Solid Waste Transfer Station
- ☐ Solid Waste Recycling
- ☐ Solid Waste Processing (prior to mass burn)
- ☐ Solid Waste Storage
- ☐ Refuse-Derived-Fuel (RDF)
- ☒ Other: Separated Organic Solid Waste Composting

B. Describe the capacity of each waste activity area and the total facility capacity in the tables below. Provide information for each type of activity selected above.

Disposal activity areas

	Capacity (yd^3)				
Disposal area	Ultimate/design capacity	Proposed/ additional capacity	Current in-place volume	Remaining permitted capacity	Certificate of Need (MSW only)
Mixed Municipal Solid Waste (MSW)	NA	NA	NA	NA	
Industrial Waste	NA	NA	NA	NA	
Demolition Debris	NA	NA	NA	NA	
Municipal Solid Waste Combustor Ash	NA	NA	NA	NA	
Other: Source Seperated Organic waste	1600	0	1600	0	
Total					

Processing activity areas

Processing area	Proposed capacity		Permitted capacity		Design capacity	
	tons/year	tons/day	tons/year	tons/day	tons/year	tons/day
Solid Waste Composting	25,000	80	25000	80	25000	80
Solid Waste Transfer Station	NA	NA	NA	NA	NA	NA
Solid Waste Recycling	NA	NA	NA	NA	NA	NA
Solid Waste Processing (prior to mass burn)	NA	NA	NA	NA	NA	NA
Solid Waste Storage	NA	NA	NA	NA	NA	NA
Refuse-Derived-Fuel (RDF)	NA	NA	NA	NA	NA	NA
Other:						
Total						

IV. Operational Information

A. List the solid waste and waste by-products to be managed at the facility according to the waste type, quantity, and management method (collect, transfer, store, process, convert, compost, treat, or disposal).

Waste Type	Quantity	Unit (tons, tons/day, tons/year, cubic yards, PTE's, items)	Management Method
Municipal Solid Waste	None	0	N/A
MSW Combustor Ash	None	0	N/A
Demolition Debris	None	0	N/A
Industrial Waste	None	0	N/A
Asbestos	None	0	N/A
Appliances	None	0	N/A
Electronics	None	0	N/A
Yard Waste	16	tons/day	Composting
Tires	None	0	N/A
Household Hazardous Waste	None	0	N/A
Recyclables (list)	None	0	N/A
Other: Organic waste	80	Tons/Day	Composting
Other:			

B. The facility will have capacity to receive 20 vehicles per day and expects to receive an average of 15 vehicles per day. List the vehicle types (i.e., packer trucks, roll-off boxes, private citizen vehicles) using the facility including those that transport special wastes, such as tires or white goods.

Vehicle Type	Vehicle Capacity	Waste Type Transported
Semi	15 tons	Separated organic waste
tandam truck	10 to 20 cubic yards	Yard Waste and Separated Organic Waste
Refuse Hauler	25 cubic yards	Separated organic waste

C. Describe the equipment to be located and used on site at the facility, or the availability and arrangement for use of equipment kept off-site, managing the waste:

Front End Loader - Conventional front-end loaders will be used to move tipped waste loads, charge the grinder, load the mixer truck, and move finished product.

Water Truck - Water needed to control dust on interior and exterior haul routes will be applied with a rubber tired sprayer. The water truck can also be used to add moisture to stockpliled wastes that need increased moisture content

Compost Turner - The turner will be used to turn the windrows until material is at the acceptable stage.

V. Signature and Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Engineer (Consultant)

Signature: [signature] Date: 2-21-12

Print name: Michael Brandt License Number: 42661

Title: Project Manager State licensed: MN

E-mail: mbrandt@mfra.com

Organization: MFRA, Inc

Address: 14800 28th Avenue N., Suite 140

City: Plymouth State: MN Zip: 55447

Phone: 763-476-6010 Fax: 763-476-8532

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

I further certify that the construction and operation of the above described facility will be in accordance with the plans, specifications, reports and related communications accepted by the Minnesota Pollution Control Agency (MPCA) and on file in its office; and in accordance with conditions imposed in the permit issued by the MPCA.

I certify that the facility is consistent with local solid waste management plans. I am aware an MPCA permit must be obtained before construction or operation of the facility may begin and all local permits, licenses or other government approval must be obtained before an MPCA permit can be issued.

I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment.

Landowner

Signature: Kevin FitzSimmons — Date: 11/18/11

Print name: Kevin Fitzsimmons — Phone: 507 317 0746

Title: Property Owner — Fax: 507 278 3795

Email: mfitz@myclearwave.net

Organization: MFS Farms

Address: 56437 164th Street

City: Good Thunder — State: MN — Zip: 56037

Phone: — Fax:

Owner (Applicant)

Signature: — Date: 11-18-11

Print name: Max Milinkovich — Phone: (612) 282-9383

Title: Owner — Fax:

E-mail: fullcircleorganics@yahoo.com

Organization: Full Circle Organics

Address: 5029 13th Avenue S.

City: Minneapolis — State: MN — Zip: 55417

Operator*

Signature: — Date: 11-18-11

Print name: Max Milinkovich — Certification No:

Title: Owner — Expiration Date:

E-mail: fullcircleorganics@yahoo.com — Phone: (612) 282-938

Organization: Full Circle Organics — Fax:

Address: 5029 13th Avenue S.

City: Minneapolis — State: MN — Zip: 55417

Provide the same information for other certified operators.

VI. Solid Waste Annual Report Contact

Print name: Max Milinkovich — Phone: (612) 282-938

Title: Owner — Fax:

E-mail: Max@fullcircle-organics.com

Organization: Full Circle Organics

Address: 5029 13th Street S.

City: Minneapolis — State: MN — Zip: 55417

Appendix K

MPCA Permit Application Checklist

Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Solid Waste Facility Application Checklist

Solid Waste Permit Program

Doc Type: Permit Application

Purpose: This checklist has been developed as a guide for permit application preparers and reviewers in order to assist with the submittal of a substantially complete permit application. Thoroughly review all applicable rules, statutes and guidance documents for further details and requirements. Minnesota Rules can be found at: https://www.revisor.mn.gov/rules/. All guidance documents can be found on the Minnesota Pollution Control Agency (MPCA) Solid Waste Publications webpage at: http://www.pca.state.mn.us/lupg880.

Many items listed below must be discussed in depth within the permit application submittal package. Be sure to include the most recently updated information, drawings and plans. Previously submitted documents **cannot** be referenced; all necessary documents must be included in this package. The permit application submittals should discuss all applicable MPCA Guidance Documents; include justification if the facility does not follow the guidance provided.

Instructions for permit application preparers: The following checklist must be completed and included with a permit application for all solid waste facilities. In the table below, indicate in the far left column the name and page number(s) of the document where the specified rule requirement is addressed. If the rule requirement does not apply, please indicate with "n/a" for not applicable. **The permit application will be determined to be incomplete if there are any blank spaces in this column.**

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
Permit Application Report (PAR) Section 1.2	7001.0050, item A Name, address, and telephone number of the owner of the facility for which the application is submitted and identification of the status of the owner as a federal, state, public, private, or other entity			
PAR Section 1.2	7001.0050, item B If the operator of the facility for which the application is submitted is different from the owner, the name, address, and telephone number of the operator and identification of the status of the operator as a federal, state, public, private, or other entity			
PAR Section 1.2	7001.0050, item C Name, address, and telephone number of the person who prepared the application			
PAR Sections 1.1 &, 2.1 and 2.1.2,	7001.0050, item D Description including the location of the business, plant, system, facility, or activity for which the permit is sought			
PAR Section 2.5 and 2.7	7001.0050, item E General description of the materials handled, processed, stored, or disposed of by the applicant; and a statement of the nature and quantity of the materials proposed to be stored, processed, discharged, emitted, or disposed of during the period of the required permit, and proposed methods for control of these materials			

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
Permit Application Report (PAR) Appendix J	7001.0060, item A For a corporation, the permit application must be signed by a principal executive officer of at least the level of vice-president or the duly authorized representative or agent of the executive officer if the representative or agent is responsible for the overall operation of the facility that is the subject of the permit application			
N/A	7001.0060, item B For a partnership or sole proprietorship, the permit application must be signed by a general partner or the proprietor, respectively			
N/A	7001.0060, item C For a municipality, state, federal, or other public agency, the permit application must be signed by either a principal executive officer or ranking elected official			
PAR Appendix J	7001.0060, item D If the operator of the facility for which the application is submitted is different from the owner, the permit application must be signed by both the owner according to items A through C above			
NA	7001.0060, item E For solid waste management facilities, the permit application must be signed by the facility owner and landowner under items A to C if the landowner is different from the owner of the facility for which the application is submitted			
PAR Appendix J	7001.0060, item F For a firm preparing the necessary reports and plans for a solid waste management facility permit application, the permit application must be signed by an engineer registered in Minnesota			
PAR Appendix J	7001.0070 A person who signs a permit application shall make the following certification: "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information. The information is, to the best of my knowledge and belief, true, accurate, and complete."			

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
Permit Application Report (PAR) Section Appendix J	7001.3150 A person who signs a permit application or any portion of it, or any report required by a permit to be submitted to the commissioner or agency must make the certification required by part 7001.0070 and shall make the following additional certification: "I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment." An engineer registered in Minnesota must certify all technical documents, such as design drawings and specifications, engineering reports, and hydrogeologic studies, required to be submitted as part of a permit application or by a permit condition. The hydrogeologic report and all related groundwater and surface water monitoring reports must be signed by a person knowledgeable in the field of hydrogeology. This person must certify the quality of work performed and must have been responsible for the gathering and interpretation of the hydrogeologic data and the preparation of the reports.			
PAR Section 2.1	7001.3300, item A General description of the facility			
N/A	7001.3300, item B Industrial solid waste management plan in accordance with 7035.2535			
PAR Section 2.1.4 & 2.4.2	7001.3300, item C Description of security procedures and equipment			
PAR Section 2.4.3 and Section 4.0	7001.3300, item D Inspection schedule			
PAR Section 6	7001.3300, item E Contingency action plan			
PAR Section 2.11, 2.15 &2.16	7001.3300, item F(1) Description of procedures, structures or equipment to prevent operational hazards			
PAR Section 2.14	7001.3300, item F(2) Description of procedures, structures or equipment to prevent run-off, run-on			
PAR Section 2.14 and Section 3	7001.3300, item F(3) Description of procedures, structures or equipment to prevent ground and surface water contamination			
PAR Section 5	7001.3300, item F(4) Description of procedures, structures or equipment to mitigate effects of equipment failure			
PAR Section 5	7001.3300, item G Description of precautions to prevent			

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
	ignition or explosions and emergency response plan			
Permit Application Report (PAR) Section 2.4.1	7001.3300, item H Traffic patterns and control			
PAR Section 2.7 and 2.10	7001.3300, item I Storage descriptions			
PAR Section 5	7001.3300, item J Closure and Postclosure Plan			
Submission to follow Blue Earth County review	7001.3300, item K Closure cost estimates and evidence of financial assurance			
N/A	7001.3300, item L Postclosure cost estimates and evidence of financial assurance			
Submitted to County	7001.3300, item M Corrective action cost estimates and evidence of financial assurance			
PAR Appendix H	7001.3300, item N(1 to 18) Topographic and development map			
PAR Section 1.4 & Appendix B	7001.3300, item O Geologic and location information			
PAR Section 2	7001.3300, item P(1 to 9) Operations and maintenance manual			
PAR Section 3 and Appendix H	7001.3300, item Q Construction QA/QC plan			
PAR Section 6.2 and 2.8	7001.3300, item R Household hazardous waste management plan			
Attached	7001.3300, item S Full size copies of all engineering plan sheets			
PAR Appendix H	7001.3300, item S Reduced copies of all engineering plan sheets (11" x 17")			
Will Be supplied upon request.	7001.3300, item S Address labels for all adjacent properties owners and interested parties			
Appendix H	7001.3300, item S Plan sheet with adjacent land owner information			
N/A	7001.3300, item S Discussion of all previously granted variances			
N/A	7001.3300, item S Variance application according to Minn. R. 7000.7000 for all new requests			
PAR Section 1 & 2	7001.3300, item S Description of how and why the facility does or does not operate according to all applicable MPCA Guidance Documents			

PAR Appendix D	7001.3300, item S Inspection Form			

Minnesota Pollution Control Agency

520 Lafayette Road North
St. Paul, MN 55155-4194

Solid Waste Compost Facility Application Checklist

Solid Waste Permit Program

Mixed Municipal Solid Waste (MSW)

Doc Type: Permit Application

Purpose: This checklist has been developed as a guide for permit application preparers and reviewers in order to assist with the submittal of a substantially complete permit application. Thoroughly review all applicable rules, statutes and guidance documents for further details and requirements. Minnesota Rules can be found at: https://www.revisor.mn.gov/rules/. All guidance documents can be found on the Minnesota Pollution Control Agency (MPCA) Solid Waste Publications webpage at: http://www.pca.state.mn.us/lupg880.

Many items listed below must be discussed in depth within the permit application submittal package. Be sure to include the most recently updated information, drawings and plans. Previously submitted documents **cannot** be referenced; all necessary documents must be included in this package. The permit application submittals should discuss all applicable MPCA Guidance Documents; include justification if the facility does not follow the guidance provided.

Instructions for permit application preparers: The following checklist must be completed and included with a permit application for all solid waste compost facilities. In the table below, indicate in the far left column the name and page number(s) of the document where the specified rule requirement is addressed. If the rule requirement does not apply, please indicate with "n/a" for not applicable. **The permit application will be determined to be incomplete if there are any blank spaces in this column.**

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
Permit Application Report (PAR) Section 2.7.1	7001.3375, item A Description of area for each stage of the composting process			
PAR Section 2.14, 2.14.1 and 2.14.2	7001.3375, item B Description of design and features of the facility, including run-off, run-on, and leachate control systems			
PAR Section 2.5	7001.3375, item C Description of material(s) to be composted			
PAR Section 2.8	7001.3375, item D Description of the residue's composition			
PAR Section 2.8	7001.3375, item E Description of residue disposal method			
PAR Section 2.13.4	7001.3375, item F Design of odor control system			
PAR Section 2.5, 2.7, 2.10 & 2.14	7001.3375, item G Design and performance specifications			
PAR Section 2.7	7001.3375, item H Description of composting method, including retention time, temperature, number of turns and air flow design			
PAR Section 2	7001.3375, item I Operating plan and waste analysis plan			
PAR Section 2.7.3	7001.3375, item J Description of the proposed uses for the compost			
PAR Section 2	7035.2836, subp. 4(A) Site preparations specifications			

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
Permit Application Report (PAR) Section 2.4	7035.2836, subp. 4(B) Facility access plan			
PAR Section 2.14	7035.2836, subp. 4(C) Surface water management			
PAR Section 2.5 & 2.7	7035.2836, subp. 4(D) The composting, curing, and storage area liners			
PAR Section : 2.14	7035.2836, subp. 4(E) Leachate collection and treatment system			
PAR Section 2.8	7035.2836, subp. 4(F) Residual management			
PAR Section 2.12.4	7035.2836, subp. 4(G) Odor control design			
PAR Section 2.4.2	7035.2836, subp. 5(A) Secured access			
PAR Section 2.16	7035.2836, subp. 5(B) Personnel training program			
PAR Section 2.7	7035.2836, subp. 5(C) Designated delivery area			
PAR Section 2.8	7035.2836, subp. 5(D) Recyclable materials management			
PAR Section 2.8	7035.2836, subp. 5(E) Residuals management			
PAR Section 2.14 & 4.3	7035.2836, subp. 5(F) Leachate management			
PAR Section 2.13.4	7035.2836, subp. 5(G) Odor control			
PAR Section 2.13.1	7035.2836, subp. 5(H) Wind control			
PAR Section 4.2	7035.2836, subp. 5(I) PFRP method			
PAR Section 2.7.1 & 4.2	7035.2836, subp. 5(J)(1) Testing plan for compost maturity			
PAR Section 4.2	7035.2836, subp. 5(J)(2) Metals analysis			
PAR Section 4.2	7035.2836, subp. 5(J)(3) Percent inert material analysis			
PAR Section 4.2	7035.2836, subp. 5(J)(4) Testing plan for pH, moisture content, particle size, NPK ratio, and soluble salt content			
PAR Section 2.16	7035.2836, subp. 5(J)(5)(a) Training and experience of person collecting samples			
PAR Section 2.11	7035.2836, subp. 5(J)(5)(b) Equipment used to collect, process and store samples			

Permit Application Report (PAR) Section 2.11	7035.2836, subp. 5(J)(5)(c) Equipment cleaning procedures			

Document and page number	Minn. R. citation	MPCA use only		
		Completeness review		Comments
		Admin	Technical	
PAR Section 4.2	7035.2836, subp. 5(J)(5)(d) Sample collection locations			
PAR Section 4.2	7035.2836, subp. 5(J)(5)(e) Grab sample procedures			
PAR Section 4.2	7035.2836, subp. 5(J)(5)(f) Composite sample procedures			
PAR Section 2.7.1	7035.2836, subp. 5(J)(5)(g) Chain-of-custody and storage procedures			
PAR Section 4.2	7035.2836, subp. 5(J)(5)(h) Sampling QA/QC			
PAR Section 4.2	7035.2836, subp. 6 Compost classification and description of how results will determine distribution			
PAR Appendix N	7035.2836, subp. 7(A) Registration with MN Department of Agriculture			
PAR Section 2.7.3	7035.2836, subp. 7(B) Allowable end uses			
PAR Section 2.7 & 2.10	7035.2836, subp. 7(C) Compost distribution			

Appendix L

Blue Earth County Application

Blue Earth County

Solid Waste

Source Separated Organics Facility License
Application and Checklist.

Facility Name:	Full Circle Organics
Facility Owner:	MFS Farms / Full Circle Organics
Facility Location:	56437 164th St., Good Thunder, MN 56037
Facility Legal Description:	Lot 2, Block 1, MFA Farms Addition
Facility Address:	563rd Avenue, Good Thunder, MN 56037
MPCA SW Permit Number:	

Item Location:	License application must include: (county code of ordinances 16-13.1):
PAR 2.2	1) Schedule of daily operations
Appendix H	2) Schedule of litter cleanup on designated routes leading to facility
PAR 2.3	3) Schedule of charges to be levied at facility.
Attached	4) Three sets of plans and specs prepared by registered professional engineer
PAR App E	5) Current map or aerial photo showing:
PAR App. C	a) Land use and zoning within ¼ mile
PAR App. E	b) Homes, buildings,
N/A	c) Lakes, ponds, watercourses, wetlands, dry runs
PAR App. C	d) Rock outcroppings, roads
PAR App. H	e) Topography with contours and drainage patterns.
PAR App. M	f) Wells
PAR App. H	6) Plot plan including legal description of site and adjacent area showing:
App. H	a) Dimensions
App. B	b) Locations of borings
	c) Present and planned pertinent features, including:
App. H	i) Roads,
App. H	ii) Fencing,
NA	iii) Cover stockpiles,
App. H	iv) Progressive development plan, including excavation and fill areas

Blue Earth County

Solid Waste

Source Separated Organics Facility License
Application and Checklist.

NA	7) Ultimate land use plan, including intermediate stages.
PAR 2.7.3	7a) Plan for use of Compost Generated
PAR 2.13.3	7b) Plan for control of vectors, vermin and odors 8) A Report including:
PAR 2.1.3	a) Population and areas to be served by the operation
Appendix B	b) Geology and groundwater elevations
	to a depth of at least ten feet below proposed excavation or lowest level
	of operation,
App. B & H	c) Lowest elevation of operation, and high water table elevation
NA	d) Cover material source, character, and location.
PAR S2.11	e) List of equipment to be present at site for operations.
PAR 1.2	f) Area of operation in acres
PAR 1.2	g) Owner of operation, including contact information.
PAR 1.2	h) Persons responsible for operation and maintenance, including contact infc
PAR S2.7	i) Operating procedures
PAR S2.16	j) Provision for training and periodic retraining of personnel
PAR 5.4	k) Local government notification
N/A	l) Applicable zoning approval, or current CUP
PAR S2.10	m) Maximum capacity of unfinished product
PAR S2.10	n) Maximum capacity of finished product 9) Certificate of liability insurance documenting required coverage levels.
PAR App. J	10) MPCA Solid Waste Facility Permit Application.

Application Instructions

~~ Complete the top of the license application with facility location and address information.
~~ For each required item in the checklist, record its location in the MPCA Permit application documents-page #
~~ For items not included in the MPCA Permit Application documents, or related submissions, attach documents, or necessary materials to meet the item requirements.
~~ Include a copy of the MPCA Permit application documents, if they have not already been submitted.

License Information: ***The following items will be charged once a license has been granted.***
~~ An annual license fee of $1000.
~~ A closure/post-closure contingency fund and/or bond for operation (amount dependent on maximum capacity).
NA ~~ Pursuant to MN Statute 115A.919, a fee on incoming waste per yard of permitted capacity.

Notice and Signature:

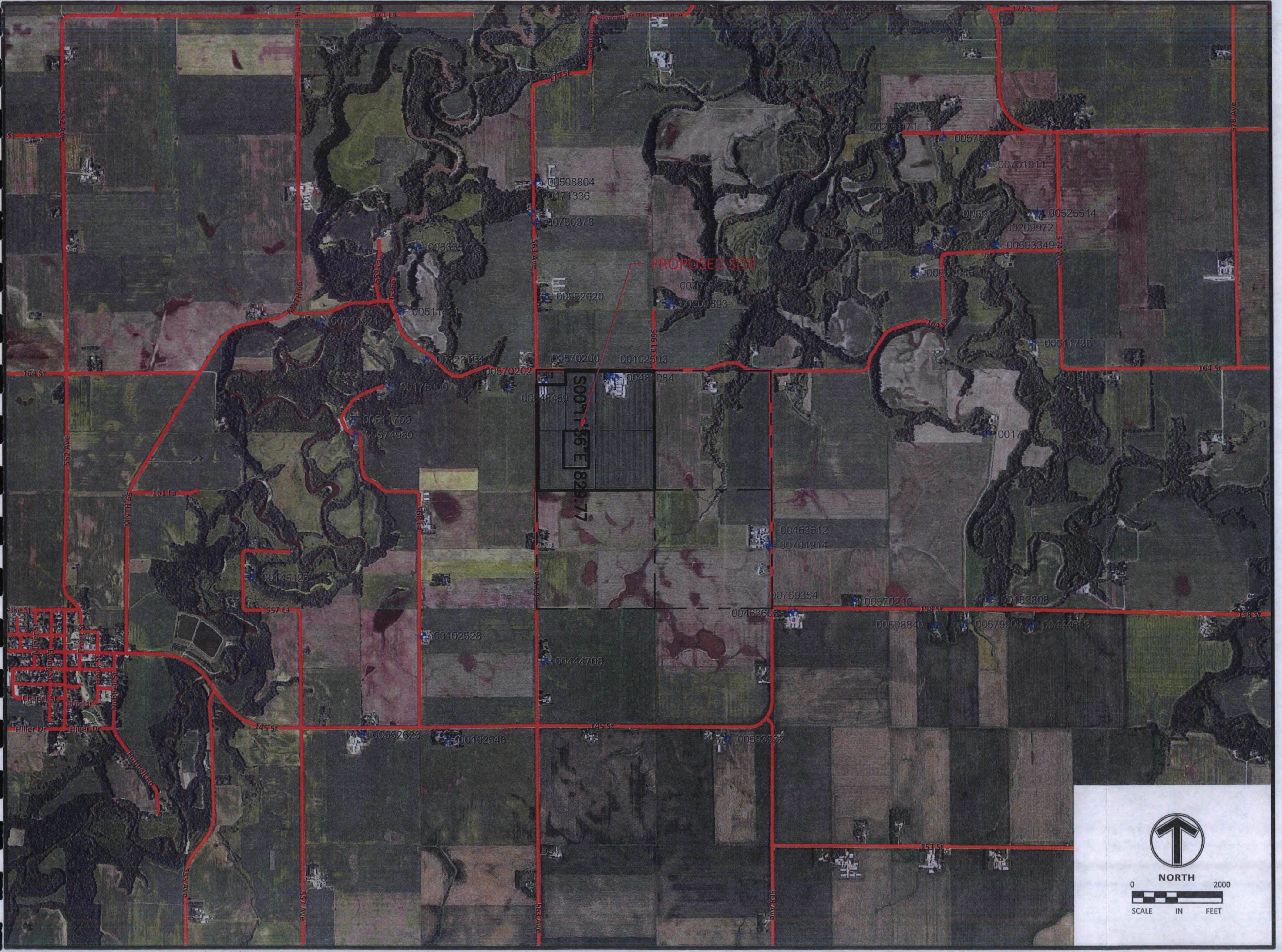
I, ______________________ the undersigned, hereby apply for a license to establish, operate and maintain a Solid Waste Facility in Blue Earth County. In support of this application, all data and information required by the Blue Earth County Code of Ordinances, Chapter 16, has been submitted in the documents referenced above. I declare that the above information and all referenced documents are true and correct and that the above mentioned solid waste facility will be operated in accordance with Blue Earth County Code of Ordinances and all laws and ordinances in effect or which hereinafter be adopted by and for Blue Earth County or the State of Minnesota.

Applicant Signature *Title* *Date*

).

Appendix M

Well Logs



mfra
engineering surveying planning energy
14800 28th Ave. N, Ste 140
Plymouth, Minnesota 55447
(763) 476.6010 telephone
(763) 476.8532 facsimile
www.mfra.com

Client
FULL CIRCLE ORGANICS, LLC.

Project
COMPOSTING SITE

Location
LYRA TOWNSHIP

Certification

Summary
Approved: MCB Drawn: ERW

Revision History
No. Date By Submittal / Rev.

Sheet Title
WELL LOG EXHIBIT

Sheet No. Revision
EX-D

Project No. MFS19051

Minnesota Unique Well No.

102503

County Blue Earth
Quad Good Thunder
Quad ID 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/17/1997
Update Date 06/29/1997
Received Date

Well Name FITZSIMMONS, MIKE

Township	Range	Dir	Section	Subsections	Elevation	
106	27	W	1	BABABC	Elevation Method	998 ft. 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
90 ft.	90 ft.	05/20/1975

Drilling Method Cable Tool

Well Address
RR 3
GOOD THUNDER MN 56037

Drilling Fluid
--

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
SOIL	BLACK	SOFT	0	5
CLAY	YELLOW	SOFT	5	20
CLAY	BLUE	SOFT	20	60
SAND	GRAY		60	90

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☑ Yes ☐ No Above/Below 2 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 85 ft.	lbs./ft.	

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
0	18	4	85 ft. and 90 ft.

Static Water Level
60 ft. from Land surface Date Measured 05/20/1975

PUMPING LEVEL (below land surface)
75 ft. after 40 hrs. pumping 20 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☐ Yes ☑ No

Located by: Minnesota Geological Survey
Method: Digitized - scale 1:24,000 or larger (Digitizing Table)
Unique Number Verification: Information from owner
Input Date: 01/01/1990
System: *UTM - Nad83, Zone15, Meters* X: 418072 Y: 4874781

Nearest Known Source of Contamination
100 feet E direction Barnyard type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 05/25/1975
Manufacturer's name DEMING Model number __ HP 0.75 Volts 230
Length of drop Pipe 80 ft. Capacity 20 g.p.m
Type Submersible Material Galvanized

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Denn Well Co.	07120	DENN, L.

First Bedrock
Last Strat . sand-gray
Aquifer Quat. Buried Unconf. Aquife
Depth to Bedrock ft.

County Well Index Online Report

102503

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

102528

County	Blue Earth
Quad	Good Thunder
Quad ID	56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date	06/17/1997
Update Date	06/29/1997
Received Date	

Well Name BUNDE, EUNICE

Township	Range	Dir	Section	Subsections	Elevation	995 ft.
106	27	W	11	ABBCCC	Elevation Method	7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
198 ft.	198 ft.	02/07/1979

Drilling Method Cable Tool

Well Address

GOOD THUNDER MN 56037

Drilling Fluid --

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
SOIL	BLACK	SOFT	0	4
CLAY	YELLOW	SOFT	4	28
CLAY	BLUE	SOFT	28	90
SAND	GRAY	HARD	90	110
CLAY	BLUE	SOFT	110	132
SAND	GRAY	SOFT	132	170
CLAY	YELLOW	SOFT	170	185
ROCK	GRAY	HARD	185	198

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☑ Yes ☐ No Above/Below 1.5 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 185 ft.	lbs./ft.	

Open Hole from 185 ft. to 198 ft.

Screen NO Make Type

Diameter	Slot/Gauze	Length	Set Between

Static Water Level
60 ft. from Land surface Date Measured 02/07/1979

PUMPING LEVEL (below land surface)
70 ft. after 4 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☐ Yes ☑ No

Located by: Minnesota Geological Survey

Method: Digitized - scale 1:24,000 or larger (Digitizing Table)

Unique Number Verification: Name on mailbox

Input Date: 01/01/1990

System: *UTM - Nad83, Zone15, Meters*

X: 416771 Y: 4873040

Nearest Known Source of Contamination
300 feet N direction Barnyard type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 00/00/1979
Manufacturer's name GOULDS Model number 10EJ HP 0.75 Volts 230
Length of drop Pipe 80 ft. Capacity 15 g.p.m
Type Submersible Material Galvanized

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

First Bedrock Jordan-St.Lawrence
Last Strat Jordan-St.Lawrence

Aquifer Jordan-St.Lawrence
Depth to Bedrock 185 ft.

Well Contractor Certification

Denn Well Co.	07120	DENN, L.
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report

102528

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

171336

County: Blue Earth
Quad: Good Thunder
Quad ID: 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/17/1997
Update Date 07/15/1997
Received Date

Well Name SCHWANTES, LONNIE

Township	Range	Dir	Section	Subsections	Elevation
107	27	W	35	ADADAD	992 ft.

Elevation Method: 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
150 ft.	150 ft.	06/04/1986

Drilling Method Cable Tool

Drilling Fluid --

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☑ Yes ☐ No Above/Below 2 ft.

Geological Material	Color	Hardness	From	To
TOPSOIL	BLACK	SOFT	0	3
CLAY	YELLOW	SOFT	3	30
CLAY	BLUE	SOFT	30	60
CLAY	GRAY		60	80
SANDY CLAY	GRAY		80	90
SAND	GRAY		90	95
CLAY	GRAY		95	120
SAND	BROWN		120	122
CLAY & SAND	BROWN	SOFT	122	130
CLAY	WHITE		130	140
SAND	BROWN		140	150

Casing Diameter	Weight	Hole Diameter
5 in. to 145 ft.	lbs./ft.	

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
4	10	5	145 ft. and 150 ft.

Static Water Level
100 ft. from Land surface Date Measured 06/04/1986

PUMPING LEVEL (below land surface)
120 ft. after 10 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☐ No

NO REMARKS

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)
Unique Number Verification: Information from neighbor
Input Date: 02/07/2003
System: *UTM - Nad83, Zone15, Meters*
X: 417564 Y: 4875894

Nearest Known Source of Contamination
100 feet North West direction Septic tank/drain field type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 06/04/1986
Manufacturer's name GOULDS Model number 10EJ HP 0.75 Volts 230
Length of drop Pipe 120 ft. Capacity 20 g.p.m
Type Submersible Material Plastic

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Denn Well Co.	07120	DENN, L.

First Bedrock
Last Strat sand-brown
Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report

171336

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

175000

County Blue Earth
Quad Good Thunder
Quad ID 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/17/1997
Update Date 06/29/1997
Received Date

Well Name PONGRATES, BOB

Township Range Dir Section Subsections Elevation 912 ft.

106 27 W 2 BAACBB Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
232 ft.	232 ft.	08/16/1984

Drilling Method Non-specified Rotary

Well Address

GOOD THUNDER MN 56037

Drilling Fluid
--

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
CLAY			0	73
SAND			73	152
CLAY			152	158
LAYER			158	165
SAND			165	180
RED ROCK			180	200
SANDSTONE			200	232

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☐ Yes ☐ No Above/Below 0 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 180 ft.	lbs./ft.	

Open Hole from 180 ft. to 232 ft.

Screen NO Make Type

Diameter	Slot/Gauze	Length	Set Between

Static Water Level
ft. from Date Measured

PUMPING LEVEL (below land surface)
ft. after hrs. pumping g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☐ Yes ☐ No

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)
Unique Number Verification: Information from neighbor
Input Date: 06/28/2004
System: *UTM - Nad83, Zone15, Meters*
X: 416574 Y: 4874730

Nearest Known Source of Contamination
_feet _direction _type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name Model number __ HP 0 Volts
Length of drop Pipe _ft. Capacity _g.p.m Type Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

First Bedrock St.Lawrence
Aquifer Multiple
Last Strat St.Lawrence-Franconia
Depth to Bedrock 180 ft.

Well Contractor Certification
Seppmann Well Co. 07160
License Business Name Lic. Or Reg. No. Name of Driller

County Well Index Online Report

175000

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

209893

County: Blue Earth
Quad: Good Thunder
Quad ID: 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 1031

Entry Date: 06/17/1997
Update Date: 06/02/2004
Received Date:

Well Name BUSSE, ARNOLD

Township	Range	Dir	Section	Subsections	Elevation	
107	27	W	36	DBCCAD	992 ft.	Elevation Method: 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
268 ft.	268 ft.	00/00/1958

Drilling Method Cable Tool

Well Address

GOOD THUNDER MN 56037

Drilling Fluid --

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
DRIFT			0	207
LIMEROCK			207	268

Casing Type Steel (black or low carbon) Joint No Information Drive Shoe? ☐ Yes ☐ No Above/Below 0 ft.

Casing Diameter	Weight	Hole Diameter
0 in. to 207 ft.	lbs./ft.	

Open Hole from 207 ft. to 268 ft.

Screen NO Make Type

Diameter	Slot/Gauze	Length	Set Between

Static Water Level
50 ft. from Land surface Date Measured 1958

PUMPING LEVEL (below land surface)
ft. after hrs. pumping g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
NURE SAMPLE NO. 601157.

Located by: Minnesota Geological Survey
Method: Digitized - scale 1:24,000 or larger (Digitizing Table)

Unique Number Verification: Information from owner
Input Date: 01/01/1990

System: *UTM - Nad83, Zone15, Meters* X: 418495 Y: 4875263

Grouting Information Well Grouted? ☐ Yes ☐ No

Nearest Known Source of Contamination
_feet _direction _type

Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 08/00/1969
Manufacturer's name Model number __ HP 0 Volts
Length of drop Pipe _ ft. Capacity _ g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

First Bedrock Jordan-St.Lawrence
Aquifer Jordan-St.Lawrence
Last Strat Jordan-St.Lawrence
Depth to Bedrock 207 ft.

Well Contractor Certification

United States Geological Survey	USGS	HENRIKSEN
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report

209893

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

444708

County Blue Earth
Quad Good Thunder
Quad ID 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/17/1997
Update Date 06/30/1997
Received Date

Well Name SOMBKE ESTATE

Township	Range	Dir	Section	Subsections	Elevation	1005 ft.
106	27	W	12	BBCCCA	Elevation Method	7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
115 ft.	115 ft.	03/22/1989

Drilling Method Cable Tool

Well Address
RR 1 BOX 74
GOOD THUNDER MN 56037

Drilling Fluid
--

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
TOP SOIL	BLACK	SOFT	0	3
CLAY	YELLOW	SOFT	3	30
CLAY	BLUE	SOFT	30	70
SANDY CLAY	GRAY		70	85
SAND	GRAY	HARD	85	88
CLAY	BLUE		88	100
CLAY	BLUE	SOFT	100	105
SAND	BROWN	HARD	105	115

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☐ Yes ☐ No Above/Below 0 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 110 ft.	lbs./ft.	5 in. to 115 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
4	12	5	110 ft. and 115 ft.

Static Water Level
50 ft. from Land surface Date Measured 03/22/1989

PUMPING LEVEL (below land surface)
60 ft. after 8 hrs. pumping 35 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model 6P556
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☐ Yes ☑ No

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)

Unique Number Verification: Other, note in remarks
Input Date: 06/28/2004

System: *UTM - Nad83, Zone15, Meters* X: 417603 Y: 4872854

Nearest Known Source of Contamination
60 feet N direction Septic tank/drain field type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 03/23/1989
Manufacturer's name GOULDS Model number 13EK07412
HP 0.75 Volts 230
Length of drop Pipe 60 ft. Capacity 15 g.p.m
Type Submersible Material Plastic

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Denn Well Co.	07120	DENN, L.

First Bedrock
Aquifer Quat. Buried Artes. Aquifer
Last Strat sand-brown
Depth to Bedrock ft.

Minnesota Unique Well No.

463606

County Blue Earth
Quad Good Thunder
Quad ID 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/17/1997
Update Date 06/29/1997
Received Date

Well Name SOHRE, DEAN

Township Range Dir Section Subsections Elevation 1001 ft.

106 26 W 7 BBBABC Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
114 ft.	114 ft.	06/04/1990

Drilling Method Cable Tool

Well Address
RR 2
GOOD THUNDER MN 56037

Drilling Fluid --

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
TOP SOIL	BLACK	SOFT	0	2
CLAY	YELLOW	SOFT	2	20
CLAY	BLUE	SOFT	20	90
CLAY-SAND	BLUE		90	104
SAND	GRY/BRN	HARD	104	114

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☑ Yes ☐ No Above/Below 2 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 110 ft.	lbs./ft.	5 in. to 114 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
4	12	4	110 ft. and 114 ft.

Static Water Level
40 ft. from Land surface Date Measured 06/04/1990

PUMPING LEVEL (below land surface)
60 ft. after 4 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model 6PS56
☐ Casing Protection 1 ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☐ Yes ☑ No

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)

Unique Number Verification: Name on mailbox
Input Date: 06/28/2004

System: *UTM - Nad83, Zone15, Meters* X: 419283 Y: 4873155

Nearest Known Source of Contamination
300 feet S direction Barnyard type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 06/14/1990
Manufacturer's name GOULDS Model number BEM10412 HP 1 Volts 230
Length of drop Pipe 60 ft. Capacity 25 g.p.m
Type Submersible Material Plastic

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

Denn Well Co.	07120	DENN, R.
License Business Name	Lic. Or Reg. No.	Name of Driller

First Bedrock
Aquifer Quat. Buried Artes. Aquifer
Last Strat sand
Depth to Bedrock ft.

County Well Index Online Report

463606

Minnesota Unique Well No.

463612

County Blue Earth
Quad Good Thunder
Quad ID 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/17/1997
Update Date 06/29/1997
Received Date

Well Name SOMBKE, MARLIN

Township Range Dir Section Subsections Elevation 999 ft.

106 27 W 1 DADDDD Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
115 ft.	115 ft.	10/04/1990

Drilling Method Cable Tool

Well Address
RR 2
GOOD THUNDER MN 56037

Drilling Fluid
--

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
TOPSOIL	BLACK	SOFT	0	3
CLAY	YELLOW	SOFT	3	30
SAND	YELLOW	HARD	30	32
CLAY	BLUE	SOFT	32	105
SAND	BROWN	HARD	105	115

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☑ Yes ☐ No Above/Below 2 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 111 ft.	lbs./ft.	5 in. to 115 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
4	10	5	111 ft. and 115 ft.

Static Water Level
70 ft. from Land surface Date Measured 10/05/1990

PUMPING LEVEL (below land surface)
80 ft. after 10 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model 65PC
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☐ Yes ☑ No

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)

Unique Number Verification: Address verification
Input Date: 01/14/2003

System: *UTM - Nad83, Zone15, Meters*
X: 419153 Y: 4873607

Nearest Known Source of Contamination
80 feet W direction Septic tank/drain field type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 10/10/1990
Manufacturer's name GOULDS Model number 18EL10 HP 1 Volts 230
Length of drop Pipe 80 ft. Capacity 20 g.p.m
Type Submersible Material Plastic

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

Denn Well Co.	07120	DENN, R.
License Business Name	Lic. Or Reg. No.	Name of Driller

First Bedrock
Aquifer Quat. Buried Artes. Aquifer
Last Strat sand-brown
Depth to Bedrock ft.

County Well Index Online Report

463612

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

481084

County Blue Earth
Quad Good Thunder
Quad ID 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/17/1997
Update Date 06/29/1997
Received Date

Well Name FITZSIMMONS, MIKE & SONS

Township Range Dir Section Subsections Elevation 998 ft.

106 27 W 1 BABABD Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth 206 ft. | Depth Completed 206 ft. | Date Well Completed 06/10/1992

Drilling Method Cable Tool

Well Address
RR 3 BOX 78
GOOD THUNDER MN 56037

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
TOP SOIL	BLACK	SOFT	0	3
CLAY	YELLOW	SOFT	3	20
CLAY	BLUE	SOFT	20	40
SAND	GRAY	HARD	40	43
SAND CLAY	GRAY	HARD	43	160
CLAY	BLUE	SOFT	160	190
SAND	GRAY	HARD	190	200
GRAVEL	VARIED	HARD	200	206

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☑ Yes ☐ No Above/Below 0 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 205 ft.	lbs./ft.	5 in. to 206 ft.

Open Hole from 205 ft. to 206 ft.

Screen NO Make Type

Diameter	Slot/Gauze	Length	Set Between

Static Water Level
100 ft. from Land surface Date Measured 06/11/1992

PUMPING LEVEL (below land surface)
140 ft. after 3 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
NEAREST POLLUTION SOURCE IS HOG BUILDINGS

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)
Unique Number Verification: Name on mailbox
Input Date: 06/28/2004
System: *UTM - Nad83, Zone15, Meters*
X: 418116 Y: 4874769

Grouting Information Well Grouted? ☑ Yes ☐ No

Nearest Known Source of Contamination
130 feet W direction Barnyard type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 06/17/1992
Manufacturer's name GOULD Model number 25EL25 HP 1.5 Volts 230
Length of drop Pipe 140 ft. Capacity 25 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

Denn Well Co.	07120	DENN, G.
License Business Name	Lic. Or Reg. No.	Name of Driller

First Bedrock
Aquifer Quat. Buried Artes. Aquifer
Last Strat gravel (+larger)
Depth to Bedrock ft.

County Well Index Online Report **481084**

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

511431

County Blue Earth
Quad Good Thunder
Quad ID 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/17/1997
Update Date 12/23/2003
Received Date

Well Name HOPP, RON

Township Range Dir Section Subsections Elevation 921 ft.

107 27 W 35 CADCDD Elevation Method 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
117 ft.	117 ft.	08/01/1989

Drilling Method Non-specified Rotary

Well Address
55952 IVY RD
GOOD THUNDER MN

Geological Material	Color	Hardness	From	To
CLAY	YELLOW	SOFT	0	3
SAND	BROWN	SOFT	3	10
CLAY	BLUE	SOFT	10	108
SANDROCK	WHITE	.	108	117

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Casing Type Plastic Joint No Information Drive Shoe? ☐ Yes ☑ No Above/Below 1 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 112 ft.	lbs./ft.	9 in. to 117 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
5	15	7.6	112 ft. and 117 ft.

Static Water Level
10 ft. from Land surface Date Measured 08/01/1989

PUMPING LEVEL (below land surface)
ft. after hrs. pumping 40 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
NO NITRATES. PERMIT # BE151WX.

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)

Unique Number Verification: Address verification
Input Date: 11/14/2003

System: *UTM - Nad83, Zone15, Meters* X: 416659 Y: 4875239

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Neat Cement from 0 to 30 ft. 1 yrds.

Nearest Known Source of Contamination
78 feet E direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☑ Not Installed Date Installed 08/03/1989
Manufacturer's name AEROMOTOR Model number A12B50
HP 0.5 Volts 230
Length of drop Pipe 40 ft. Capacity 12 g.p.m
Type Submersible Material Plastic

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

Searles Well Co.	08258	VOLK, J.
License Business Name	Lic. Or Reg. No.	Name of Driller

First Bedrock Jordan
Last Strat Jordan
Aquifer Jordan
Depth to Bedrock 108 ft.

Minnesota Unique Well No.

533577

County: Blue Earth
Quad: Good Thunder
Quad ID: 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date: 06/17/1997
Update Date: 12/23/2003
Received Date:

Well Name KERKHOFF, DON

Township	Range	Dir	Section	Subsections	Elevation	
107	27	W	35	ACCCCB	921 ft.	Elevation Method: 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
120 ft.	120 ft.	12/17/1993

Drilling Method: Non-specified Rotary

Well Address
55940 IVY RD
GOOD THUNDER MN

Drilling Fluid: Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use: Domestic

Geological Material	Color	Hardness	From	To
SOIL	BLACK	SOFT	0	2
SAND & GRAVEL	BROWN	SOFT	2	11
CLAY	BLUE		11	83
ROCK	YELLOW	HARD	83	103
SAND	GREEN	SOFT	103	106
ROCK	YELLOW	HARD	106	110
SAND	WHITE	SOFT	110	114
ROCK	YELLOW	HARD	114	116
SAND	WHITE	SOFT	116	120

Casing Type: Steel (black or low carbon) Joint: Threaded Drive Shoe? ☑ Yes ☐ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 87 ft.	15 lbs./ft.	9 in. to 87 ft.

Open Hole from 87 ft. to 120 ft.

Screen NO Make Type

Diameter	Slot/Gauze	Length	Set Between

Static Water Level
26 ft. from Land surface Date Measured 12/17/1993

PUMPING LEVEL (below land surface)
26 ft. after 1 hrs. pumping 15 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
CERTIFICATION NO. 027-013-221

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Well grouted, type unknown from 0 to 40 ft. 2 bags

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)

Unique Number Verification: Address verification
Input Date: 11/14/2003

System: *UTM - Nad83, Zone15, Meters* X: 416776 Y: 4875674

Nearest Known Source of Contamination
65 feet North East direction Septic tank/drain field type

Well disinfected upon completion? ☑ Yes ☐ No

Pump ☑ Not Installed Date Installed 12/20/1993
Manufacturer's name AEROMOTOR Model number A12B50
HP 0.5 Volts 230
Length of drop Pipe 40 ft. Capacity 38 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Searles Well Co.	08258	SCHAEFER, J.

First Bedrock: Prairie Du Chien Group
Aquifer: Prairie Du Chien-Jordan
Last Strat: Jordan
Depth to Bedrock 83 ft.

Minnesota Unique Well No.

552620

County Blue Earth
Quad Good Thunder
Quad ID 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 06/17/1997
Update Date 01/07/2009
Received Date

Well Name BRINDLEY, JOHN

Township	Range	Dir	Section	Subsections	Elevation
107	27	W	36	CBCCAB	1005 ft.

Elevation Method: 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
230 ft.	230 ft.	09/24/1994

Drilling Method Cable Tool

Well Address
RR 1 BOX 101
GOOD THUNDER MN 56037

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
TOP SOIL	BLACK	SOFT	0	2
CLAY	YELLOW	SOFT	2	25
CLAY	GRAY	SOFT	25	120
SAND	BROWN	SOFT	120	128
CLAY	GRAY	SOFT	128	140
SAND	BROWN	SOFT	140	165
CLAY	YELLOW	SOFT	165	184
SAND	GRAY	HARD	184	215
SANDSTONE	WHITE	HARD	215	230

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☑ Yes ☐ No Above/Below 0 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 220 ft.	lbs./ft.	5 in. to 230 ft.

Open Hole from 220 ft. to 230 ft.

Screen NO Make Type

Diameter	Slot/Gauze	Length	Set Between

Static Water Level
110 ft. from Land surface Date Measured 09/24/1994

PUMPING LEVEL (below land surface)
120 ft. after 4 hrs. pumping 60 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Bentonite from 0 to ft. 6 bags

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)
Unique Number Verification: Name on mailbox
Input Date: 06/28/2004
System: *UTM - Nad83, Zone15, Meters* X: 417648 Y: 4875326

Nearest Known Source of Contamination
65 feet South East direction Barnyard type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 09/26/1994
Manufacturer's name GOULDS Model number 25EL15 HP 1.5 Volts 230
Length of drop Pipe 120 ft. Capacity 25 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

First Bedrock Jordan
Last Strat Jordan
Aquifer Jordan
Depth to Bedrock 215 ft.

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Denn Well Service	07647	DENN, G.

County Well Index Online Report

552620

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

570202

County: Blue Earth
Quad: Good Thunder
Quad ID: 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date: 06/17/1997
Update Date: 09/29/2005
Received Date:

Well Name TISCHU, ELNA

Township	Range	Dir	Section	Subsections	Elevation	
106	27	W	2	AACBB	1005 ft.	Elevation Method: 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
220 ft.	220 ft.	07/11/1996

Drilling Method: Cable Tool

Well Address
RR 1 BOX 99
GOOD THUNDER MN 56037

Drilling Fluid: Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use: Domestic

Geological Material	Color	Hardness	From	To
TOP SOIL	BLACK	SOFT	0	2
CLAY	YELLOW	SOFT	2	20
SAND-CLAY	GRAY	SOFT	20	130
SAND	GRAY	SOFT	130	134
SAND-CLAY	GRAY	SOFT	134	215
SAND	GRAY	SOFT	215	220

Casing Type: Steel (black or low carbon) Joint: Threaded Drive Shoe? ☑ Yes ☐ No Above/Below 0 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 215 ft.	lbs./ft.	5 in. to 215 ft.
		4 in. to 220 ft.

Open Hole from ft. to ft.

Screen: YES Make: COOK Type: stainless steel

Diameter	Slot/Gauze	Length	Set Between
4	12	5	215 ft. and 220 ft.

Static Water Level
90 ft. from Land surface Date Measured 07/11/1996

PUMPING LEVEL (below land surface)
95 ft. after 4 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer: MONITOR Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information: Well Grouted? ☑ Yes ☐ No

Grout Material: Bentonite from 0 to 215 ft. 6 bags

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)
Unique Number Verification: Tag on well
Input Date: 06/28/2004
System: *UTM - Nad83, Zone15, Meters* X: 417381 Y: 4874709

Nearest Known Source of Contamination
80 feet N direction Septic tank/drain field type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 07/12/1996
Manufacturer's name GOULDS Model number 10EJ07 HP 0.75 Volts 230
Length of drop Pipe 100 ft. Capacity 15 g.p.m Type Submersible Material

Abandoned Wells: Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance: Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Denn Well Service	07647	DENN, G.

First Bedrock
Aquifer: Quat. Buried Artes. Aquifer
Last Strat: sand-gray
Depth to Bedrock ft.

County Well Index Online Report

570202

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

570215

County: Blue Earth
Quad: Good Thunder
Quad ID: 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date: 06/17/1997
Update Date: 06/29/1997
Received Date:

Well Name BORR, MARK

Township Range Dir Section Subsections Elevation 1002 ft.

106 26 W 6 CDCDCA **Elevation Method** 7.5 minute topographic map (+/- 5 feet)

Well Depth 285 ft. **Depth Completed** 285 ft. **Date Well Completed** 09/14/1996

Drilling Method Cable Tool

Well Address
RR 3 BOX 149
GOOD THUNDER MN 56037

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☐ No From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
TOP SOIL	BLACK	SOFT	0	2
CLAY	YEL/GRN	SOFT	2	110
SAND-CLAY	BRN/YEL	SOFT	110	120
CLAY	GRAY	SOFT	120	145
SAND	GRAY	SOFT	145	148
CLAY	GRAY	SOFT	148	249
GRAVEL	BROWN	SOFT	249	251
SANDSTONE	GRAY	HARD	251	285

Casing Type Steel (black or low carbon) **Joint** Threaded **Drive Shoe?** ☑ Yes ☐ No **Above/Below** 0 ft.

Casing Diameter 5 in. to 252 ft. **Weight** lbs./ft. **Hole Diameter** 5 in. to 285 ft.

Open Hole from 252 ft. to 285 ft.

Screen NO **Make** **Type**

Diameter **Slot/Gauze** **Length** **Set Between**

Static Water Level
60 ft. from Land surface Date Measured 09/14/1996

PUMPING LEVEL (below land surface)
65 ft. after 4 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Bentonite from 0 to 252 ft. 8 bags

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)
Unique Number Verification: Tag on well
Input Date: 06/28/2004
System: *UTM - Nad83, Zone15, Meters* X: 419717 Y: 4873226

Nearest Known Source of Contamination
70 feet S direction Septic tank/drain field type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☑ Not Installed Date Installed 09/16/1996
Manufacturer's name GOULDS Model number 106505 HP 0.5 Volts 23
Length of drop Pipe 80 ft. Capacity 15 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Denn Well Service	07647	DENN, G.

First Bedrock Jordan **Aquifer** Jordan
Last Strat Jordan **Depth to Bedrock** 251 ft.

County Well Index Online Report **570215**

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

574980

County: Blue Earth
Quad: Good Thunder
Quad ID: 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date: 06/17/1997
Update Date: 12/12/2003
Received Date:

Well Name SURDY, THEODORE & NANCY

Township Range Dir Section Subsections Elevation: 985 ft.

106 27 W 2 BCAAAC Elevation Method: 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
245 ft.	245 ft.	12/28/1995

Drilling Method Non-specified Rotary

Well Address
16200 560TH LA
GOOD THUNDER MN

Drilling Fluid: Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
SOIL	BLACK	SOFT	0	2
CLAY	YELLOW	SOFT	2	20
CLAY	BLUE	SOFT	20	60
SAND	BROWN	SOFT	60	80
CLAY	BLUE	SOFT	80	110
MUDDY SAND	BROWN	SOFT	110	124
CLAY	BLUE	SOFT	124	238
ROCK	GRAY	HARD	238	241
SAND	BROWN	SOFT	241	245

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☑ Yes ☐ No Above/Below 0 ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 240 ft.	15 lbs./ft.	9 in. to 240 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
5	15	8	240 ft. and 245 ft.

Static Water Level
140 ft. from Land surface Date Measured 12/28/1995

PUMPING LEVEL (below land surface)
ft. after hrs. pumping 20 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Bentonite from 0 to 30 ft. 3 bags

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)

Unique Number Verification: Tag on well
Input Date: 11/14/2003

System: *UTM - Nad83, Zone15, Meters* X: 416329 Y: 4874407

Nearest Known Source of Contamination
35 feet South East direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name Model number __ HP _ Volts
Length of drop Pipe _ ft. Capacity _ g.p.m Type Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

First Bedrock
Aquifer Quat. Buried Artes. Aquifer
Last Strat sand-brown
Depth to Bedrock ft.

Well Contractor Certification

Searles Well Co.	08258	VOLK, J.
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report

574980

Minnesota Unique Well No.

611709

County: Blue Earth
Quad: Good Thunder
Quad ID: 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date: 11/02/1999
Update Date: 03/02/2009
Received Date:

Well Name BRIAR, MARC

Township	Range	Dir	Section	Subsections	Elevation	983 ft.
106	27	W	2	BBDDAB	Elevation Method	CALC FROM 2-FOOT COUNTY DEM

Well Depth	Depth Completed	Date Well Completed
250 ft.	250 ft.	08/20/1998

Drilling Method Non-specified Rotary

Well Address
RR 2 BOX 725
GOOD THUNDER MN 56037

Drilling Fluid Bentonite

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Casing Type Plastic Joint Welded Drive Shoe? ☐ Yes ☑ No Above/Below ft.

Geological Material	Color	Hardness	From	To
TOP SOIL	BLACK	SOFT	0	2
CLAY		SOFT	2	37
CLAY	LT. GRY	MEDIUM	37	76
GRAVEL		SOFT	76	79
CLAY	BLUE	MED-HRD	79	100
CLAY	GRAY	V.HARD	100	155
GRAVEL		SOFT	155	157
CLAY	GRAY	HARD	157	238
SAND	WHITE	SOFT	238	250

Casing Diameter	Weight	Hole Diameter
5 in. to 240 ft.	lbs./ft.	10 in. to 25 ft.
		8.8 in. to 250 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
5	18	10	240 ft. and 250 ft.

Static Water Level
140 ft. from Land surface Date Measured 08/20/1998

PUMPING LEVEL (below land surface)
ft. after 5 hrs. pumping 50 g.p.m.

Well Head Completion
Pitless adapter manufacturer BAKER Model MONITOR
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Bentonite from 0 to 35 ft. 8 bags

Located by: Blue Earth Cty.

Method: Digitization (Screen) - Map (1:12,000)

Unique Number Verification: Site Plan

Input Date: 02/11/2009

System: *UTM - Nad83, Zone15, Meters*

X: 416314 Y: 4874511

Nearest Known Source of Contamination
65 feet E direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 08/24/1998
Manufacturer's name STA-RITE Model number HP 0.75 Volts
Length of drop Pipe 120 ft. Capacity g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

Corey Seppmann Well Drilling Co.	07478	SEPPMAN, C.
License Business Name	Lic. Or Reg. No.	Name of Driller

First Bedrock
Last Strat sand-white

Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report

611709

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

623194

County: Blue Earth
Quad: Good Thunder
Quad ID: 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date: 01/09/2001
Update Date: 03/11/2005
Received Date:

Well Name FITZSIMMONS, MIKE & SO

Township Range Dir Section Subsections Elevation: 925 ft.

107 27 W 35 DCCCBA Elevation Method: 7.5 minute topographic map (+/- 5 feet)

Well Depth	Depth Completed	Date Well Completed
148 ft.	148 ft.	01/22/2000

Drilling Method Cable Tool

Well Address
RR 1 BOX 97
GOOD THUNDER MN 56037

Drilling Fluid: Water

Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use: Domestic

Geological Material	Color	Hardness	From	To
TOP SOIL	BLACK	SOFT	0	3
CLAY & SAND	BROWN	SOFT	3	12
CLAY	GRAY	SOFT	12	105
SAND	GRAY	SOFT	105	125
SAND & CLAY	GRAY	SOFT	125	140
SAND	BROWN	SOFT	140	148

Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? ☑ Yes ☐ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 143 ft.	15 lbs./ft.	5 in. to 148 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
4	12	5	143 ft. and 148 ft.

Static Water Level
15 ft. from Land surface Date Measured 01/24/1999

PUMPING LEVEL (below land surface)
27 ft. after 3 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model BULL DOG
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
BE-00-03 - DENN WELL SERVICE

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Bentonite from 0 to 143 ft. 4 bags.

Located by: Minnesota Geological Survey
Method: Digitization (Screen) - Map (1:24,000)
Unique Number Verification: N/A
Input Date: 11/14/2003
System: *UTM - Nad83, Zone15, Meters* X: 416819 Y: 4874912

Nearest Known Source of Contamination
80 feet North West direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 01/25/1999
Manufacturer's name GOULDS Model number 10GS07 HP 0.75 Volts 230
Length of drop Pipe 40 ft. Capacity 15 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Denn Well Service	07647	DENN, G. & R.

First Bedrock
Aquifer Quat. Buried Artes. Aquifer
Last Strat sand-brown
Depth to Bedrock ft.

County Well Index Online Report 623194

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

648459

County: Blue Earth
Quad: Good Thunder
Quad ID: 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date: 01/09/2001
Update Date: 03/02/2009
Received Date: 11/20/2000

Well Name FITZSIMMONS, KEVIN

Township Range Dir Section Subsections Elevation 1005 ft.

106 27 W 1 BBBBDC **Elevation Method** CALC FROM 2-FOOT COUNTY DEM

Well Depth	Depth Completed	Date Well Completed
240 ft.	240 ft.	08/16/2000

Drilling Method Cable Tool

Well Address
16333 563 AV
GOOD THUNDER MN 56037

Drilling Fluid Water

Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
TOP SOIL	BLACK	SOFT	0	2
CLAY	YELLOW	SOFT	2	30
CLAY & SAND	GRAY	SFT-HRD	30	195
SAND	GRAY	SOFT	195	198
SAND & CLAY	GRAY	SOFT	198	215
SANDROCK_ FIRM	GRY/WHT		215	240

Casing Type Steel (black or low carbon) **Joint** Threaded **Drive Shoe?** ☑ Yes ☐ No **Above/Below** ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 215 ft.	15 lbs./ft.	5 in. to 240 ft.

Open Hole from 215 ft. to 240 ft.

Screen NO **Make** **Type**

Diameter	Slot/Gauze	Length	Set Between

Static Water Level
100 ft. from Land surface Date Measured 08/16/2000

PUMPING LEVEL (below land surface)
110 ft. after 3 hrs. pumping 30 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model THEADED
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

REMARKS
BE-00-54 - DENN WELL SERVICE

Located by: Blue Earth Cty.
Method: Digitization (Screen) - Map (1:12,000)
Unique Number Verification: Site Plan
Input Date: 02/11/2009
System: *UTM - Nad83, Zone15, Meters*
X: 417634 Y: 4874751

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Bentonite from 0 to 215 ft. 8 bags

Nearest Known Source of Contamination
110 feet S direction Barnyard type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 08/21/2000
Manufacturer's name GOULDS Model number 18GS10412 HP 1 Volts 230
Length of drop Pipe 120 ft. Capacity 20 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

First Bedrock Jordan
Last Strat Jordan
Aquifer Jordan
Depth to Bedrock 215 ft.

Well Contractor Certification

Denn Well Service	07647	DENN, R. & G.
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report

648459

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

701921

County Blue Earth
Quad Good Thunder
Quad ID 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 02/07/2005
Update Date 03/24/2009
Received Date 11/03/2004

Well Name FRANK, DAREN & JENNY

Township	Range	Dir	Section	Subsections	Elevation	
107	27	W	35	CCBACA	1001 ft.	Elevation Method: CALC FROM 2-FOOT COUNTY DEM

Well Depth	Depth Completed	Date Well Completed
220 ft.	220 ft.	06/25/2004

Drilling Method Cable Tool

Well Address
RR
GOOD THUNDER MN 56037

Drilling Fluid Water

Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
TOPSOIL	BLACK	SOFT	0	2
CLAY	YELLOW	SOFT	2	40
CLAY/SAND	GRAY	SOFT	40	55
SAND	GRAY	SFT-HRD	55	57
CLAY/SAND	GRAY	SOFT	57	210
FINE SAND	GRAY	SOFT	210	215
SAND	BROWN	SOFT	215	220

Casing Type Steel (black or low carbon) **Joint** Threaded **Drive Shoe?** ☑ Yes ☐ No **Above/Below** ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 215 ft.	15 lbs./ft.	5 in. to 220 ft.

Open Hole from ft. to ft.

Screen YES **Make** JOHNSON **Type** stainless steel

Diameter	Slot/Gauze	Length	Set Between
4	12	5	215 ft. and 220 ft.

Static Water Level
100 ft. from Land surface Date Measured 06/25/2004

PUMPING LEVEL (below land surface)
110 ft. after 4 hrs. pumping 20 g.p.m.

Well Head Completion
Pitless adapter manufacturer MONITOR Model THREADED
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Bentonite from to 215 ft. 8 bags

Located by:
Unique Number Verification: N/A
System: *UTM - Nad83, Zone15, Meters*

Method: GPS SA Off (averaged)
Input Date: 08/12/2008
X: 416111 Y: 4875182

Nearest Known Source of Contamination
80 feet E direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 07/09/2004
Manufacturer's name GOULDS Model number 10GS07 HP 0.75 Volts 230
Length of drop Pipe 120 ft. Capacity 15 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

Well Contractor Certification

License Business Name	Lic. Or Reg. No.	Name of Driller
Denn Well Service	07647	DENN, G/R

First Bedrock
Last Strat sand-brown

Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

County Well Index Online Report

701921

Printed 12/9/2011
HE-01205-07

Minnesota Unique Well No.

750378

County Blue Earth
Quad Good Thunder
Quad ID 56D

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date
Update Date 03/24/2009
Received Date 02/08/2007

Well Name SCHWANTES, LONNIE

Township Range Dir Section Subsections Elevation 993 **ft.**

107 27 W 36 BCCBBB **Elevation Method** CALC FROM 2-FOOT COUNTY DEM

Well Depth 140 ft. **Depth Completed** 140 ft. **Date Well Completed** 01/09/2007

Drilling Method Cable Tool

Well Address
16677 563RD AV
GOOD THUNDER MN 56037

Drilling Fluid Water

Well Hydrofractured? ☐ Yes ☑ No
From Ft. to Ft.

Use Domestic

Geological Material	Color	Hardness	From	To
TOPSOIL	BLACK	SOFT	0	3
CLAY	YELLOW	SOFT	3	30
CLAY	GRAY	SOFT	30	120
SAND	BROWN	SFT-HRD	120	135
SANDSTONE	BROWN	HARD	135	140

Casing Type Steel (black or low carbon) **Joint** Threaded **Drive Shoe?** ☑ Yes ☐ No **Above/Below** ft.

Casing Diameter	Weight	Hole Diameter
5 in. to 135 ft.	15 lbs./ft.	5 in. to 135 ft.

Open Hole from 135 ft. to 140 ft.

Screen NO **Make** **Type**

Diameter **Slot/Gauze** **Length** **Set Between**

Static Water Level
100 ft. from Land surface Date Measured 01/09/2007

PUMPING LEVEL (below land surface)
110 ft. after 4 hrs. pumping 15 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☑ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Bentonite from to 135 ft. 7 bags

Located by: Blue Earth Cty.

Method: Digitization (Screen) - Map (1:12,000)

Unique Number Verification: Site Plan

Input Date: 02/11/2009

System: *UTM - Nad83, Zone15, Meters*

X: 417590 **Y:** 4875831

Nearest Known Source of Contamination
80 feet E direction Sewer type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed 01/09/2007
Manufacturer's name GOULDS Model number 10GS07 HP 0.75 Volts 230
Length of drop Pipe 120 ft. Capacity 15 g.p.m Type Submersible Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☑ No

First Bedrock

Last Strat boulder or boulders-brown

Aquifer Quat. Buried Artes. Aquifer
Depth to Bedrock ft.

Well Contractor Certification

Denn Well Service, Inc.	1699	DENN, G.
License Business Name	Lic. Or Reg. No.	Name of Driller

County Well Index Online Report

750378

Printed 12/9/2011
HE-01205-07

Appendix N

Department of Agriculture Application

MINNESOTA DEPARTMENT OF AGRICULTURE | 625 Robert St. N., St. Paul, MN 55155-2538
www.mda.state.mn.us

Pesticide & Fertilizer Management Division Ph. 651-201-6379, Fax 651-201-6117 **NEW LICENSE NUMBER:**

2012 APPLICATION FOR SOIL/PLANT AMENDMENT PRODUCT REGISTRATION IN MINNESOTA

Minn. Stat. Sec. 18C.411

Do you currently hold a Minnesota Soil/Plant Amendment Product License Number: ☒ No ☐ Yes If yes, MN Lic. No:

GUARANTOR AS LABELED IN MINNESOTA (Complete below):			REGISTRANT OR AGENT (Complete if different from Guarantor):		
FULL CIRCLE ORGANICS, LLC					
Legal Name Max Milinkovich - Owner FULL CIRCLE ORGANICS, LLC			Legal Name		
DBA (If different)			DBA (If different)		
Street Address 5029 13th Street S.			Mailing Address		
City Minneapolis	State MN	Zip Code 55417	City	State	Zip Code
Company Telephone 612-282-9383			Company Telephone		

ITEM NO.	COMPLETE BRAND NAME OF SOIL AND PLANT AMENDMENT Product registration WILL NOT be granted until product label/label facsimile and material used in promoting the sale of each product is submitted with application.
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Application Fees:

No. of New Products _______ x $200.00 each $ __________ **(323810)**

Return this form with your check made payable to:
Minnesota Department of Agriculture
Cashier, 625 Robert Street North, Saint Paul, MN 55155-2538

TOTAL DUE: $ __________

I hereby certify that the information contained in and submitted with this application is true and correct.

Signature: ______________________ Date: ______________

Name (Please print): ______________________ Title: ______________

Contact Telephone: ______________ Fax Number: ______________

E-mail Address: ______________________

For Office Use Only

AG-00890 (10/09)

Preferred ID: ~~SW-580~~ SW-662

02/17/2012
final site
Development
plans

NOTICE

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For access to these items, please see the original file.

X	Document Type	Description (Include date, subject/topic/title, etc.)
	~~Photo/Video Files/Audio Files~~ ~~(Includes Audio cassette tapes, or videotapes)~~	1. coversheet 2. Existing conditions 3. site plan 4. site plan
X 14	Plans/Specifications/Maps (Includes Maps, blueprints or plan sheets)	5. grading plan 6. grading plan 7. Erosion control plan 8. Erosion control plan
	Site Photos ~~(Includes slides and negatives)~~	9. Erosion control Details 10. utility plan 11. overall utility plan
	~~Diskette(s)/Floppy Disk(s)~~ ~~(Please list appropriate doc type i.e. – Monitoring Report, Remedial Investigation, etc.)~~	12. Draintile Removal plan 13. construction Details 14. construction Details
	Other	