APPLICATION FOR SITE PLAN REVIEW

140 Tihonet Road PV+ES Project

140 Tihonet Road (aka 0 & 169 Tihonet Road)
Wareham, Massachusetts

Prepared for:

Borrego Solar Systems, Inc.
55 Technology Dr. #102
Lowell, MA 01851

Prepared by:

BEALS + THOMAS
BEALS AND THOMAS, INC.
32 Court Street
Plymouth, Massachusetts
02360-3866

Submitted in Compliance with the Zoning By-laws of the Town of Wareham, Massachusetts

June 2, 2020

1833112PT001

June 2, 2020

Mr. George Barrett, Chair
Wareham Planning Board
c/o Mr. Kenneth Buckland, Town Planner
54 Marion Road
Wareham, Massachusetts 02571

Via: FedEx and Email to *sraposo@wareham.ma.us*

Reference: Application for Site Plan Review
140 Tihonet Road PV+ES Project
Wareham, Massachusetts
B+T Project No. 1833.112

Dear Planning Board Members:

On behalf of the Applicant, Borrego Solar Systems, Inc. (BSSI), Beals and Thomas, Inc. (B+T) respectfully submits this Application for Site Plan Review for the construction, installation, and operation of a proposed large ground-mounted solar energy facility at 140 Tihonet Road in Wareham, Massachusetts (the Project). The Project is designed to comply with applicable zoning criteria in the October 2019 revision to the Zoning By-laws of the Town of Wareham, Massachusetts (the Zoning By-laws), including Section 590: Solar Energy Generation Facilities.

The proposed Project consists of an approximately ±5 megawatt (MW) AC/±21 MW DC solar array and energy storage system including site access and interconnection to the electrical grid. The Project is proposed within a ±76.5-acre area (the Site) on a portion of a larger area of land (the Property) owned by A D Makepeace Co (aka A.D. Makepeace Company, ADM). The Property can be further identified as Wareham Assessor's Map 111 Lot 1000-F, Map 111 Parcel 1000-G , Map 111 Lot 1000-H, Map 111 Parcel R-1, and Map 112 Lot 1000 (address indicated as 0 Tihonet Road and 169 Tihonet Road in Assessors' database). More specifically, the Site is located to the southwest of the previously-approved 160 Tihonet Road Wareham PV+ES (aka Tihonet East Solar) Project, immediately south of an existing electrical easement, and east of Tihonet Pond and Tihonet Road.

B+T is pleased to participate in the approval process for another renewable/sustainable energy project in the Town of Wareham, following the successful review of multiple other BSSI solar projects on ADM land in recent years. BSSI is currently also proposing a separate solar project north across the electric easement, as well as one off Charge Pond Road, which will be submitted to the Planning Board for review.

Enclosed are three hard copies of the Site Plan Review application package, plus a complete electronic copy on a USB drive. We understand that the Planning Office will coordinate with the Town Clerk to confirm receipt of these materials pursuant to Section 17(b)(i) of Chapter 53 of the Acts of 2020, and will forward one of the hard copies to the peer review consultant. The following information is included for your review:

Section 1.0: Site Plan Application Forms
Section 2.0: Project Narrative*
Section 3.0: Parties in Interest
Section 4.0: Stormwater Management Information
Section 5.0: Solar Documentation
Section 6.0: Plans*

Please note that a waiver from Section 1531.11, photographs of the site at size of 8” by 10” is requested. Photographs are included in Section 2, but do not meet the specified size due to their orientation. Additionally, waivers are requested from Section 1531.10: “All contiguous land owned by the applicant or by the owner of the property.” It is not practical to depict all contiguous parcels, due to the extent of the surrounding land owned by ADM. Furthermore, Subsection 1532: “Existing Features” requires that plans be at a scale of 1” = 20’, 40’, or 100’ where practical and appropriate. Plans have been submitted at various scales appropriate to the Project Site. Finally, a waiver is requested from Section 1532.1 “Existing Natural Features” 2. “Individual trees 18” dbh or over.” Due to the size of the Property and the character of the Project, it is infeasible to locate all trees greater than 18 inches.

Enclosed is a check payable to the Town of Wareham in the amount of $750.00 for the appropriate filing fee as required by the Zoning By-laws. An additional check in the amount of $34.20 to cover abutter notification expenses has been forwarded to the Town under separate cover. We understand that the Planning Board will be responsible for notification to abutters via Certified Mail. We further understand that the Planning Board will be responsible for publishing the notice of public hearing in the Wareham Week, for which an additional $80.00 check is included. Lastly, a check in the amount of $200.00 payable to the Wareham Fire Department is enclosed to facilitate its review.

Should you have any questions regarding this matter or require additional information, please contact us at (508) 366-0560. We thank you for your consideration of this request and look forward to meeting with the Board at the next available public hearing.

Very truly yours,

BEALS AND THOMAS, INC.

Stacy H. Minihane

Jeffrey R. Murphy

Stacy H. Minihane, PWS
Senior Associate

Jeffrey R. Murphy, PE
Civil Engineer

Enclosures

cc: Borrego Solar Systems, Inc. (via Box upload)
A.D. Makepeace Company, James Kane (1 copy via US Mail w/o Stormwater Report and with reduced plans; full copy via email)
Charles L. Rowley PE, PLS (via email)

MKS/shm/jrm/cmv/1833112PT001

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Map 111, Lot 1000

PLANNING BOARD
TAX VERIFICATION FORM

This verifies that Borrego Solar Systems, Inc. (name of applicant) is up-to-date on the taxes for the property(ies) he/she owns in Wareham. If the applicant is not the current owner of the property that the application addresses, the current owner A D Makepeace Co (name of property owner) is up-to-date on taxes and on all properties he/she owns in the Town of Wareham.

John Foster, Tax Collector

Map 112, Lot 1000

PLANNING BOARD
TAX VERIFICATION FORM

This verifies that Borrego Solar Systems, Inc. (name of applicant) is up-to-date on the taxes for the property(ies) he/she owns in Wareham. If the applicant is not the current owner of the property that the application addresses, the current owner A D Makepeace Co (name of property owner) is up-to-date on taxes and on all properties he/she owns in the Town of Wareham.

John Foster, Tax Collector

APPLICATION FOR SITE PLAN REVIEW

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Applicant: Name: Borrego Solar Systems, Inc.

Mailing address: 55 Technology Drive, #102, Lowell, MA 01851

Telephone: (888) 898-6273

Project: Street & Number: 140 Tihonet Road (aka 0 and 169 Tihonet Road per Assessor's database)

Assessor's Map: 111; 112 Lot(s) 1000-F, 1000-G, 1000-H, R-1; 1000

Dwelling Units # None

Parking Spaces # None

Acres: 76.5 Square Feet Commercial Space: 0

Briefly describe project: Construction, installation, and operation of a large-scale ground-mounted solar energy facility

Date: 06/02/2020

Signature of Applicant: ____________________

APPLICATION FOR SITE PLAN REVIEW

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List of abutters:

Please list the names of all abutters, owners of land directly opposite on any public or private street or way, and abutters to the abutters within three hundred feet of the property line of the petitioner as they appear on the most recent applicable tax list.

See list enclosed in Section 3.0

SITE PLAN REVIEW CHECKLIST

Plans shall be prepared by a registered architect, landscape architect, or Professional Engineer. 14 complete sets are required with the following information included:

1. GENERAL INFORMATION

__X__ Developer name, address, telephone number

__X__ Property owner name, address, telephone number, legal relationship between developer and property owner

__X__ Date of application

__X__ Statement briefly describing project

__X__ Locus map (1" = 2,000')

__X__ Location of property to surrounding area (this plan shall show at a scale of not less than 1" = 100' the general characteristics of all lands within 200' of the proposed site and shall include structures, parking areas, driveways, pedestrian ways and natural characteristics)

__X__ Zoning district (square feet within each district if more than one district)

__X__ Total area of project in square feet to include wetland and 100 year flood plain (both in square feet)

______ All contiguous land owned by the applicant or by the owner of the property. At the discretion of the Planning Board photographs of the site at size 8" x 10"

2. EXISTING FEATURES

Plans shall be accurately drawn to a scale of 1" = 20, 1" = 40', or 1" = 100' where practical and appropriate to the size of the proposal and shall show all existing natural, manmade, and legal features of the site. Such plans are to include but not be limited to the following:

__X__ Tree line of wooded area

______ Individual trees 18" dbh or over

__X__ Bogs or agricultural areas

x ______ All wetlands protected under CMR 10.02 (1) (a-d)

x ______ Flood plain (100 years) with base flood elevation data

x (1') ______ Contour lines (2' intervals)

x ______ General soil types

2b. EXISTING MANMADE FEATURES

x ______ Vehicle accommodation areas

x ______ Street, roads, private ways, walkways

N/A ______ Curbs, gutters, curb cuts, drainage grates

N/A ______ Storm drainage facilities, including manholes

x ______ Utility lines, including water, sewer, electric, telephone, gas, cable TV

N/A ______ Fire hydrants and location of dumpsters

N/A ______ Building, structures, and signs (free standing), including dimensions of each

N/A ______ Existing light fixtures

2C. EXISTING LEGAL FEATURES

x ______ Zoning of property (district lines)

x ______ Property lines (with dimensions identified)

x ______ Street right of way lines

x ______ Utility or other easement lines

x ______ Monuments

3. THE DEVELOPMENT PLAN

The development plan shall show proposed changes in the (a) existing natural features; (b) existing man made features and (c) existing legal features.

The Development Plan shall include:

N/A	Square feet in every new lot
x	Lot dimensions
N/A	Location and dimensions of all buildings and free standing signs as well as the distances from all buildings to lot lines, streets, or street right of way
N/A	Building elevations (side, front, and back for a typical unit) showing building height and any proposed wall signs
N/A	Location, dimensions, and designated use for all recreation areas
N/A	Location and dimension of all open space; indicate whether open space is to be dedicated to public use or to remain private
N/A	Streets (including street names) which conform to the design standards of the Planning Board's Rules and Regulations Governing the Subdivision of Land
N/A	Curbs and gutters, curb cuts, drainage grates
x	Drainage facilities including manholes, pipes, drainage ditches, and retention ponds
N/A	Sidewalks and walkways showing widths and materials
x	Outdoor illumination with lighting fixture size and type identified
x	Utilities; water, sewer, electric, telephone, gas, cable TV
N/A	Fire hydrant location
N/A	Dumpster (trash collection facilities)
x	New contour lines resulting from earth movement (at 2' intervals) and indications of types of ground cover and other precautions to stabilize slopes
N/A	Vehicle parking, loading, and circulation areas showing dimensions
x	Proposed new plantings by size and location or construction of other devices to comply with screening and shading requirements

4. IMPACT STATEMENT

In order to evaluate the impact of the proposed development to Town services and the welfare of the community, there shall be submitted an impact statement in two parts.

X ______ All applicable Town services including but not limited to schools, sewer services, water systems, parks, fire, and police.

X ______ The roads in the immediate vicinity of the proposed development (including an estimate of both peak and average daily counts)

X ______ The ecology of the area within the site and any significant off-site impacts

Part Two shall describe what actions have been taken to mitigate the impacts described in Part One

This application constitutes the applicant's willingness to work under the Town of Wareham's Zoning Bylaws. Any errors or omissions from this checklist or the Zoning Bylaw may result in the application not being placed on a Planning Board Agenda or denial of the Site Plan.

Site Plan Review Application Checklist

Note to Applicant(s): The following checklist serves as an instrument to help ensure that all necessary information and materials are submitted with the application for Site Plan Review. Please verify that all related items listed below have been accounted for in your submission. (Refer to Article 15 of the Zoning By-Law of the Town of Wareham, Massachusetts, adopted October 2004).

Name of site: 140 Tihonet Road PV+ES Date: June 2, 2020
Owner(s): A D Makepeace Co
Address: 158 Tihonet Road, Wareham, MA 02571
Telephone Number: (508) 295-1000 Cell Phone: __________

Developer(s): Borrego Solar Systems, Inc.
Address: 55 Technology Drive, #102, Lowell, MA 01851
Telephone Number: (888) 898-6273 Cell Phone: __________

Relationship between Developer & Property Owner: Owner is leasing development rights to Applicant

Surveyor: Northeast Survey Consultants
Engineer: Beals and Thomas, Inc.
Architect: Not Applicable
Landscape Architect: Not Applicable

ITEM	Complete
Application for Site Plan Review – Special Permit filed with Planning Board	Yes
(14 copies of application and supplementary materials)	Yes
Application for Special Permit – Residential Cluster Development filed with Planning Board	N/A
(11copies of application and supplementary materials)	N/A
Copies filed with Town Clerk	Yes
Filing Fees	Yes
GENERAL INFORMATION	
Developer Name, address, telephone number	Yes
Property Owner Name, address, telephone number	Yes
Date of Application	Yes
Statement briefly describing project	Yes
Locus Map (1” = 2,000’)	Yes
Location of property to surrounding area (scale should be no less than 1” = 100’) and general characteristics of all lands within 200’ of the proposed site including structures, parking areas, driveways, pedestrian ways, and natural characteristics	Yes

Zoning district (sq. feet within each district if more than one)	Yes
Total area of project to include wetland and 100 year floodplain (both in sq. feet)	N/A
All contiguous land owned by the applicant or by owner of property	Waiver
Photographs of site (8” by 10”) – at discretion of Permitting Authority	Waiver
List of abutters, certified by Board of Assessors	Yes
Number of dwellings which could be constructed by means of a conventional development plan, considering the whole tract, exclusive of water bodies and land prohibited from development by legally enforceable restrictions, easements, or covenants. This includes: • Any bank, freshwater wetland, coastal wetland, beach, dune, flat, marsh, or swamp bordering the ocean, any estuary, creek, river, stream, pond, or lake • Lake under any of the water bodies listed above; • Land subject to tidal action • Land subject to coastal storm flowage or slopes in excess of fifteen (15) percent are not to be counted in figuring the number of permissible units of conventional development.	N/A
EXISTING FEATURES	
(Scale 1” = 20’, 1” = 40’,or 1” = 100’ where practical and appropriate to the size of the proposal) Must include a minimum of the following:	Waiver
1. Existing Natural Features a. Tree line of natural area; b. Individual trees 18” dbh or over; c. Bogs or agricultural areas; d. All wetlands protected under 310 CMR 10.01 (1) (a-d); floodplain (100 year) with base flood elevation data; e. Contour lines (2’ intervals); f. General soil types.	Yes, as applicable, except b.
2. Existing Man-Made Features a. Vehicle accommodation areas; streets, roads, private ways, walkways; b. Curbs, gutters, curb cuts, drainage grates; c. Storm drainage facilities including manholes; d. Utility lines including water, sewer, electric, telephone, gas, cable TV; e. Fire hydrants and location of dumpsters; f. Buildings, structures, and signs (free standing) including dimensions of each; g. Exterior lighting features.	Yes, as applicable
3. Existing Legal Features a. Zoning of property (district lines); b. Property lines (with dimensions identified); c. Street right-of-way lines; d. Utility or other easement lines; e. Monuments.	Yes

DEVELOPMENT PLAN	
Proposed changes to existing natural features, existing man-made features, and existing legal features including the following;	Yes, As Applicable
• Area of each new lot in square feet;	N/A
• Lot dimensions;	Yes
• Location and dimensions of all buildings and freestanding signs as well as the distances from all buildings to lot lines, streets, or street;	N/A
• Location, dimension, and designated use for all recreation areas;	N/A
• Location and dimension of all open space (indicate whether such open space is to be dedicated to public use or remain private);	N/A
• Streets (including street names) which conform to the design standards of the Planning Board's Rules and Regulations Governing the Subdivision of Land;	N/A
• Curbs and gutters, curb cuts, drainage grates;	N/A
• Drainage facilities including manholes, pipes, drainage ditches, and retention ponds;	Yes
• Sidewalks and walkways showing widths and materials;	N/A
• Outdoor illumination with lighting fixture size and type identified;	Yes
• Utilities – Water, sewer, electric, telephone, gas, cable TV;	Yes
• Fire hydrant locations;	N/A
• Dumpster (trash collection facilities);	N/A
• New contour lines resulting from earth movement (2' intervals) and indications of types of ground cover and other precautions to stabilize slopes;	Yes
• Vehicle parking, loading, and circulation areas showing dimensions and layout of parking spaces, travel lanes, aisles, and driveways;	N/A
• Proposed new plantings by size and location or construction of other devices to comply with screening and shading requirements.	Yes
IMPACT STATEMENT	
Part One: Description of neighborhood and impact of proposed development on all applicable town services including but not limited to schools, sewer service, water system, parks, fire, and police protection;	Yes
Traffic report of existing and future traffic within and adjacent to proposed development. (Include estimate of both peak and average daily traffic count);	N/A
Analysis of site in regards to wetlands, coastal wetlands, slopes, soil conditions, 100 year flood plain, and other natural features as Planning Board may request;	Yes
Environmental Impact Assessment Report relating to proposed plan and copy of environmental impact report if otherwise required in order to illustrate the ecology of the area within the site and any significant off-site impacts;	N/A
Evaluation of open land proposed within cluster, with respect to size, shape, location, natural resource value, and accessibility by residents of the Town or of the cluster;	N/A

Part Two: Description of actions that have been taken to mitigate the impacts described in Part One.	Yes

TOWN OF WAREHAM
ANR/SUBIDIVISION/SITE PLAN REVIEW FORM

Check one: ANR ______ Form B ______ Form C ______ Site Plan Review __X__

Date stamped in __________________ Date decision in due ___________________

Applicant's name(s) Borrego Solar Systems, Inc.

Applicant's address 55 Technology Drive, #102, Lowell, MA 01851

Telephone number (888) 898-6273

Address of property 140 Tihonet Road (aka 0 and 169 Tihonet Road per Assessors' database)

Landowner's name A D Makepeace Co

Owner's address 158 Tihonet Road, Wareham, MA 02571

Telephone number (508) 295-1000

Contact person Stacy H. Minihane, PWS, B+T Telephone (508) 366-0560

Map # 111; 112 Lot # 1000-F, 1000-G, 1000-H, R-1; 1000 Zone R-60

Date Approved ___________________________ Date Denied ___________________________

Comments (state reasons for denial or stipulations of approval)

Conditions for:

RECORD OF PLANNING BOARD PROCEEDINGS AND DECISIONS
Town of Wareham Planning Board

Name of Subdivision or Project: 140 Tihonet Road PV+ES Project____________________

____

APPLICATION: FORM A _________ FORM B _________ FORM C _________
SITE PLAN REVIEW ___X_____ OTHER __________

DATE SUBMITTED: ____

DATE DECISION IS DUE: ____

DATE OF PUBLIC HEARING(S): ____

DECISION DATE: ____

DATE DECISION SENT TO TOWN CLERK: ____

DATE APPEALS PERIOD BEGINS _______________________ ENDS _________________________

PLANNING BOARD DECISIONS: (yes or no or abstention) if abstaining, appropriate recusal form should accompany decision.

FORM A:
M. Baptiste __________ G. Barrett _________ M. Fitzgerald ________ B. Reed __________
J. Cronan __________ A. Slavin __________

FORM B:
M. Baptiste __________ G. Barrett _________ M. Fitzgerald ________ B. Reed __________
J. Cronan __________ A. Slavin __________

FORM C:
M. Baptiste __________ G. Barrett _________ M. Fitzgerald ________ B. Reed __________
J. Cronan __________ A. Slavin __________

SITE PLAN:
M. Baptiste __________ G. Barrett _________ M. Fitzgerald ________ B. Reed __________
J. Cronan __________ A. Slavin __________

COMMENTS OR STIPULATIONS ON DECISION: ____

____

____

STREET NAME PROPOSED AND ACCEPTED: ____

____

Conditions for: ____

____

____

____

____

____

TOWN OF WAREHAM
PLANNING BOARD
54 Marion Road
Wareham, Massachusetts 02571

NOTICE OF PUBLIC HEARING

In accordance with the provisions of Chapter 40-A, Section 5, Massachusetts General Laws, the Planning Board will hold a public hearing on January 25, 2010, at 7:00 p.m. in the Lower Level Cafeteria of Wareham Town Hall, 54 Marion Road, Wareham, MA to consider the following proposed revisions to the Subdivision Rules and Regulations;

SECTION VII FILING FEES – effective 01/26/10

A. APPROVAL NOT REQUIRED PLANS

Filing fee: $150.00 per plan sheet + $50.00 each newly-created lot

B. PRELIMINARY PLAN

Filing fee: $500.00 + $100.00 per lot + $80.00 advertising fee

C. DEFINITIVE PLAN

Filing fee:
$750.00 + $75.00 per lot if Form B has been submitted, plus $1.00 per linear foot of road + $80.00 advertising fee.
$1,500.00 + $50.00 per lot if Form B has not been submitted, plus $1.00 per linear foot of road + $80.00 advertising fee.

COVENANT RELEASE/BOND RELEASE

Filing fee: $100.00 per request

Subdivision Modifications

Filing fees for subdivision modifications shall be the same as listed above for an original application. Review Fees shall also be the same.

D. REVIEW FEES REQUIRED

Where specific conditions arising from the land or the nature of the proposal necessitates the assistance of planning, engineering, legal, traffic, soils, hydrologic or other consultants, the Planning Board may engage such consultant services to assist the Board in analyzing the project to ensure compliance with all relevant laws, by-laws, regulations, good design principles and best available practices. In these instances the Board will require the applicant to pay a review fee consisting of the reasonable costs to be incurred by the Board for these services (The provisions for this language, MLG Ch. 44, Sec. 53G, were adopted at the October 22, 2002 Town Meeting).

Funds received by the Board pursuant to this section shall be deposited with the Town Treasurer who shall establish a special individual account for this purpose. Expenditures from this special account may be made at the direction of the Board. Expenditure from this account shall be made only in connection with the review of a specific project or projects for which a review fee has been, or will be collected, from the applicant. Failure of an applicant to pay all review fees shall be grounds for denial of the application or permit.

Review fees may only be spent for services rendered in connection with the specific project for which they were collected. Accrued interest may also be spent for this purpose. At the completion of a Board's review of a project, any excess amount of funds in the account, including any interest, attributable to a specific project, shall be repaid to the applicant or the applicant's successor in interest. The applicant must submit a written request for these funds. Upon request, a final report for said account shall be made available to the applicant, or the applicant's successor in interest. For the purpose of this regulation, any person or entity claiming to be an applicant's successor in interest shall provide the Board with the documentation establishing such succession in interest.

Any applicant may take an administrative appeal from the selection of the outside consultant to the Board of Selectmen, providing that such appeal is taken within 14 days of notification of the Board's appointment to the consultant. The grounds for such an appeal shall be limited to the claims that the selected consultant has a conflict of interest or does not possess the minimum required qualifications as may be set by the Board. The minimum qualifications shall consist of a licensed professional in a related field. The required time limit for action upon an application by the Board shall be extended by the duration of the administrative appeal. In the event that no decision is made by the Board of Selectmen within one month following the filing of the appeal, the selection made by the Board will stand.

***Amended 01/25/10 by majority vote; The Board may waive fees if deemed modification is to be minor. The Board, in its discretion, may waive or adjust the fees if it deems the modification to be a minor modification.**

OTHER COST AND EXPENSES

All expenses for professional services, ancillary report reviews, supplemental studies, advertising, publication of notices, postage and mailings and all other expenses in connection with the proposed subdivision, including without limitation sampling and/or testing, shall be borne by the applicant. Re-inspection fees shall be the reasonable costs to be incurred to observe and inspect the construction of the proposed improvements and shall be based on an estimate provided by the Town's engineer.

The Planning Board shall not accept an application or schedule a public hearing for any application without receipt of a dollar deposit as listed in the Consulting Fee Schedule to be used only for payment of engineering, legal and other consulting services related to the proposed project.

The Planning Board may request supplemental payments, as needed, which shall be due and payable within fourteen (14) days of the request. Failure to pay the deposit amount or any supplemental payment shall be grounds for denial of the application. Any person interested or wishing to be heard on the proposed revisions to the Subdivision Rules and Regulations should appear at the time and place designated.

George T. Barrett
Chairman

NOTICE PUBLICATION DATES:
First Notice: January 7, 2010
Second Notice: January 14, 2010

Section 2.0

Project Narrative

2.0 PROJECT NARRATIVE

2.1 Introduction

The proposed 140 Tihonet Road PV+ES Project (the Project) is located off Tihonet Road proximate to and northeasterly of the corporate offices of the landowner, A D Makepeace Co (aka A.D. Makepeace Company, ADM). The Site can be further identified as a 76.5-acre portion of Map 111 Lot 1000-F, Map 111 Lot 1000-G, Map 111 Lot 1000-H, Map 111 Parcel R-1, and Map 112 Lot 1000. These assessor's parcels are collectively referred to herein as the Property. More specifically, the Site is located to the southwest of the previously-approved 160 Tihonet Road Wareham PV+ES (aka Tihonet East Solar) Project, immediately south of an existing electrical easement, and east of Tihonet Pond and Tihonet Road. Refer to the Locus and Aerial Maps enclosed in Section 6.0.

The Site is located in the R-60 District as indicated on the Town of Wareham Zoning Map. According to Section 320: Table of Principal Use Regulations, large ground mounted solar energy projects are allowed by Site Plan Review from the Permit Granting Authority. Accordingly, Site Plan Approval from the Planning Board is requested pursuant to Section 590 of the Zoning By-laws.

Aerial Photograph. The proposed solar array will be located north of the existing cranberry bogs and south of the existing utility easement, as depicted in the above aerial photograph. Also refer to the Locus and Aerial Maps included in Section 6.0.

As defined in Article 16 of the Zoning By-laws, Large Ground-Mounted Solar Photovoltaic Installations (LGMSPI) are arrays that generate a minimum capacity of 250 kW and are structurally mounted on the ground. The proposed system size is a ±5 MW AC (±21 MW DC) facility with panels installed on a racking system within existing upland areas at 140 Tihonet Road. Laydown areas and supporting utility structures (inverters, batteries, etc.) also are located within existing upland areas.

2.2 Existing Conditions

The overall Property is part of the land holdings of ADM, and contains wooded areas, active cranberry bogs and associated sand track agricultural roads. The Property is bisected by a utility easement held by New Bedford Gas and Edison Light Co. This electric easement lies immediately north of the area of the proposed array (the Site), which lies east of Tihonet Pond and Tihonet Road, and consists of forested pine uplands typical of this region. The Property and Site can be accessed via Tihonet Road, an existing sand track agricultural road. Utility poles are present along Tihonet Road.

A Notice of Intent (NOI) is being filed with the Wareham Conservation Commission for work proposed within the 100-foot buffer zone to wetland resource areas.

The Site is not located within areas identified by the Natural Heritage and Endangered Species Program (NHESP) as Priority Habitats of Rare Species or Estimated Habitats of Rare Wildlife.

Typical view of the Site. Photograph taken May 30, 2019.

View along utility easement. Photograph taken April 10, 2020.

2.3 Proposed Conditions

The Project includes the construction, installation, and operation of a large ground-mounted solar array and energy storage facility, including site access and interconnection to the electrical grid. The fenced area surrounding the ±5 MW AC (±21 MW DC) solar array will occupy approximately ±66 acres of upland area. The proposed array is comprised of approximately 51,921 solar modules, which is subject to change and will be finalized upon issuance of construction drawings prior to issuance of building and electrical permits. The system will include appurtenant inverters and battery storage structures, as described in Section 5.0 and depicted on the plans enclosed in Section 6.0. The Site will be enclosed by a security fence as detailed in the accompanying plan set.

The interconnection to the electrical grid is proposed at the adjacent easement. Existing agricultural roads on the Property will utilized and improved for emergency access as necessary as indicated on the plans. The new access roads will be located entirely within the limits of the proposed security fence, which will be secured with knox boxes and gates.

Disturbed areas will be stabilized with herbaceous species following construction. In addition, erosion and sedimentation controls will surround the work area where needed during construction as depicted on the plans in Section 6.0.

The proposed Project will not result in the development impacts generally associated with typical residential, commercial, or industrial development. The Project will not generate water or sewer demands, increase traffic, create greenhouse gas (GHG) emissions, or contribute to acid rain or smog. In fact, the Project will create a source of renewable energy consistent with the Commonwealth's net-zero emissions goal for 2050.

2.4 Compliance with the Zoning By-laws of the Town of Wareham

BSSI proposes this Project in accordance with M.G.L. c. 40A, s. 3 of the Massachusetts Zoning law, which states that no zoning ordinance or by-law shall prohibit or unreasonably regulate solar energy systems except where necessary to protect public health, safety, or welfare. The Project is sited appropriately and complies with applicable zoning criteria and does not endanger public health, safety or welfare. The Project further complies with the local Zoning By-laws as follows:

2.4.1 Section 590: Solar Energy Generation Facilities

Proposed large ground-mounted solar energy facilities are required to undergo Site Plan Review under the authority of the Planning Board pursuant to Section 592.3 of the Zoning By-laws. The Project complies with the applicable requirements of Section 590 as follows:

Section 593: Application for Site Plan Review

Compliance with Article 15: Site Plan Review of the Zoning By-laws is addressed in Section 2.4.2 herein. We have provided below the list of requested information pursuant to Section 593 of the Zoning By-laws:

593.1 Landscape plan including sizes, types and numbers of plantings and details. Existing vegetation and other unique land features shall be preserved where feasible.

Landscape information has been included on the plan set, including the location of existing treed areas and details regarding the proposed seed mix. Additional plantings are not proposed given the nature of the Project.

The array and energy storage area will have been cleared of vegetation and roughly graded in association with the landowner's existing agricultural operations on the Property. This work will occur prior to installation of the solar modules, transformers, and inverters. Siting the Project at this location therefore minimizes overall disturbances. The Project limits earthwork and vegetation clearing to the extent feasible; however, an area of clearing beyond the arrays is required to accommodate stormwater facilities, and also to avoid shading impacts to the arrays, as well as to maintain a fall hazard safety zone around the array. Clearing outside of the array area is limited to the minimum necessary, and the area will be allowed to re-vegetate.

593.2 Plans of the large ground-mounted solar energy facilities signed by a Professional Engineer licensed to practice in the Commonwealth of Massachusetts showing the proposed layout of the system and any potential shading from nearby structures.

Plans stamped by a Massachusetts Professional Engineer depicting the system layout are enclosed in Section 6.0. Potential shading from nearby structures is not depicted as there are no existing structures that would shade the arrays.

593.3 Proposed changes to the landscape of the site, grading, vegetation clearing and planting, exterior lighting, screening vegetation or structures.

These items are depicted on the plans enclosed in Section 6.0.

593.4 A stormwater management plan detailing the existing environmental and hydrological conditions of the site, proposed alterations of the site and all proposed components of the drainage system and any measures for the detention, retention, or infiltration of water, for the protection of water quality and protection from flooding.

A Stormwater Management Report is enclosed in Section 4.0.

593.5 A description of the solar energy facility and the technical, economic and other reasons for the proposed location and design shall be prepared and signed by a registered professional engineer.

The technical and other reasons for the proposed location largely consist of the availability of interconnection. After evaluating various available sites, BSSI and ADM identified solar and energy storage as the highest and best use of this site.

593.6 Confirmation prepared and signed by a registered professional engineer that the large ground-mounted solar energy facilities comply with all applicable Federal and State standards.

The facility will comply with applicable federal and state standards.

593.7 One or three line electrical diagram detailing the solar photovoltaic installation, associated components, and electrical interconnection methods, with all National Electrical Code compliant disconnects and over current devices.

AC single line diagrams are enclosed in Section 5.0: Solar Documentation.

593.8 Documentation of the major system components to be used, including the photovoltaic panels, mounting system, inverters.

Typical rack cross-sections/elevations are depicted on the plans enclosed in Section 6.0. It is not feasible to commit to specific equipment now, given the time that will pass before construction begins with associated potential technology advances and/or geotechnical or other evaluations that may be undertaken, including coordination with Eversource for interconnection. However, anticipated equipment information (for solar modules, inverters, etc.) is included in Section 5.0: Solar Documentation.

593.9 Documentation of the sound generated by equipment used in the production of electrical energy, including any proprietary documentation.

Generally, sound levels are in the <79-decibel range for inverters and up to 76 decibels for some of the energy storage equipment; however, sound levels reduce to ambient within 200 feet. Additional information regarding sound levels is enclosed in Section 5.0: Solar Documentation.

593.10 An operation and maintenance plan (see also section 595 on decommissioning)

An operation and maintenance plan is included in Section 5.0: Solar Documentation.

593.11 The Planning Board may require the proponent to pay for professional services to evaluate the proposal.

BSSI acknowledges this requirement.

Section 594: Design Standards

The proposed large ground-mounted solar energy facility and appurtenant structures will comply as applicable with the standards detailed in Section 594.1, which generally addresses minimum lot size, yard depth, fencing, operation and maintenance plan, and utility company notification (evidence of notification to the utility company is included in Section 5.0: Solar Documentation). The proposed solar panels and associated equipment adhere to the required property line setbacks. Although the limit of work extends into the 50-foot zoning setback, as with previous projects, this area will be vegetated upon completion of construction. Agricultural roads used for site access lie within the 50-foot zoning setback, (e.g. the easterly access road), but these are existing features. Disturbance of the 50-foot zoning setback for site access is allowed under Section 594.3.7. Property lines will be adjusted as needed to meet zoning setbacks. Both existing and proposed future property lines are depicted on the enclosed plans. The proposed property lines will be confirmed through a separate Approval Not Required process.

Section 594.2 does not apply to the Project, as it relates to on-site solar energy facilities as an accessory use.

The Project will comply as applicable with the provisions of 594.3, which generally addresses appurtenant structures, lighting, signage, utility connections, sound, and clear-cutting of trees. Additional discussion is provided elsewhere herein for sound, visual, and tree clearing provisions.

Section 595: Abandonment or Decommissioning

The proposed Project will comply with the abandonment and decommissioning requirements as described in Section 595. Decommissioning information and cost estimates are included in Section 5.0: Solar Documentation. This plan also includes information regarding disposal of refuse.

2.4.2 Article 15: Site Plan Review

The Project has been prepared with consideration of the purposes of Site Plan Review outlined in Section 1510 of the Bylaw, including: protection against detrimental uses; convenience and safety of vehicular and pedestrian movement; disposal of refuse; protection of environmental features; arrangement of structures; adequacy of vehicular and pedestrian access, drainage, water supply, sewage disposal, lighting, landscaping, wetlands, water courses, buildings and other features that support the neighborhood; and compliance with applicable sections of the Zoning By-Laws. The requirements of Article 15 address conformance with the purposes listed above (with the exception of refuse, which is addressed by the decommissioning plan noted above), and therefore the applicable sections of Article 15 are discussed in additional detail below.

Section 1530: Information Required

Section 1531: General Information, Section 1532: Existing Features, and Section 1533: The Development Plan

The plans enclosed in Section 6.0 provide the applicable information noted in these sections. Please also refer to the Site Plan Review Checklist enclosed in Section 1.0 for additional detail. Please note that waivers from the photograph size, plan scale, and certain existing feature requirements are requested; refer to Section 2.5 for additional detail.

Section 1534: Impact Statement
Part 1: Impact of the Proposed Development on…

All applicable town services including but not limited to schools, sewer service, water systems, parks, fire, and police protection

The Project is not anticipated to have an adverse impact to municipal services such as schools, sewer service, water systems, parks, or fire/police protection. The Project is a large ground-mounted solar energy facility, which will generate clean, renewable energy. The Project will not generate school-age children, does not require connection to water or wastewater systems, and will require minimal, if any, fire and/or police protection. Fire and/or police protection will only be necessary should there be an emergency situation.

The roads in the immediate vicinity of the proposed development

The Project is not anticipated to have an adverse impact on the roadways in the vicinity of the Site. The Project is not anticipated to generate regular vehicle trips outside of the construction period. The Site will have an emergency/maintenance access roadway connecting to Tihonet Road; however, this will only be used for maintenance or emergency situations.

The ecology of the area within the site and any significant off-site impacts

The Site is not located within areas identified by NHESP as Priority Habitats of Rare Species or Estimated Habitats of Rare Wildlife.

Work within areas subject to Conservation Commission jurisdiction is limited to the 100-foot buffer zone associated with an agricultural canal to the south, Tihonet Pond to the west, and two isolated vegetated wetlands in the western portion of the Site. A minimum 50-foot setback has been maintained from vegetated wetland, and a minimum 100-foot setback has been maintained from a potential vernal pool, in accordance with the Wareham Wetland Protective By-Law. A waiver from said By-Law will be requested for work within the 50-foot No Activity Zone for improvements to an existing agricultural access road. A Notice of Intent is being filed with the Wareham Conservation Commission for the Project.

No off-site impacts to the ecology of the area are anticipated from the Project.

Part 2: Proposed Mitigation

Mitigation is not proposed, as the overall anticipated impacts of this renewable energy project are minimal. The Project will provide benefits of its own.

Section 1540: Evaluation Standards
Pursuant to Section 1540, an evaluation of the listed objectives is provided for the Planning Board's consideration.

Section 1541: Natural Features

The solar facility will contain natural features to the maximum extent feasible. Although tree clearing is necessary to accommodate the array, the area within the fence will be vegetated with an herbaceous seed mix, and the area exterior to the fence will be cleared.

<u>“Reduce the volume of cut and fill”</u>
The proposed volume of cut and fill associated with the solar Project has been reduced to the extent practicable by siting it in an area that will be utilized in association with the existing agricultural operations.

<u>“Reduce the number of removed trees”</u>
Clearing outside of the array area is limited to the minimum necessary, and the area will be allowed to re-vegetate. Tree trimming along access roads will also be undertaken if needed.

<u>“Reduce the pollutants reaching the water table”</u>
Vehicular traffic will not be regularly occurring and, therefore, will not increase the potential for pollutants on the Site. Sanding and salting of the access roads are not proposed.

The materials within the solar arrays are inert and, therefore, are not potential pollutants. Some inverters and batteries are solid-state with no internal fluids and will be properly housed per electric code standards so as to avoid potential pollution. The central inverters will contain biodegradable coolant, and will be housed with appropriate oil containment measures.

There is no sewage disposal system proposed or required for the Site.

<u>“Reduce the area of wetland vegetation displaced”</u>
No wetland vegetation will be displaced. The project has maintained appropriate buffer zones to wetland resource areas such that wetlands will not be impacted.

“Reduce soil erosion”
Soil erosion will be addressed both during the construction of the project and after it is complete. During construction, the Site will be managed in accordance with the Stormwater Pollution Prevention Plan included in the Stormwater Management Report in Section 4.0. Additionally, rip-rap check dams are proposed in swales. Disturbed areas of the Site will be revegetated with an herbaceous seed mix which will help hold soils in place and reduce erosion. The pile base to support the array structures will be hydraulically advanced into the ground to reduce the excavation and exposure of soil associated with normal construction practices.

In addition, sedimentation controls will be implemented to protect adjacent resource areas and existing infrastructure features during construction. Please refer to the Stormwater Management Report enclosed in Section 4.0 for detailed information regarding the best management practices to be used to control soil erosion and sedimentation required by the National Pollutant Discharge Elimination System (NPDES) construction permitting program.

“Reduce the area of impervious surface”
The amount of impervious surface has been minimized by limiting impervious areas to concrete pads for the required inverters and energy storage equipment. The remainder of the Project will be pervious, and vegetated with low-growing herbaceous species, with the exception of gravel access roadways.

“Reduce the amount of stormwater runoff from the site”
Refer to Section 4.0 of this Application for a detailed plan to manage stormwater runoff.

Section 1542: Relation of Buildings to Environment

This section is not directly applicable to the Project, as no buildings are proposed as part of this work. The proposed solar use is in harmony with the adjacent agricultural uses and sustainable practices in general on the larger land holdings of ADM. In addition, the Project will not be generally visible from public ways and will not visually impact neighborhoods due to its distance from residences and generally low height profile.

Section 1543: Vehicular Circulation

The Project will not result in an increase in traffic trips to or from the Site outside of the construction period. An estimated 4 to 5 maximum truck trips are anticipated per day over the course of construction of the solar facility. The Project will be accessed from Tihonet Road, and will not require the construction of any new streets or access ways or the paving of existing ways on private property.

The proposed Site circulation considers input from the Wareham Fire Department on prior similar projects, and includes 20-foot wide perimeter gravel access roads. Portions of the perimeter emergency access will utilize existing sand track roads, which will be improved if necessary to meet Wareham Fire Standards. In areas where perimeter access does not exist, new 20-foot wide roads will be constructed inside the proposed fence to provide perimeter access to remaining areas surrounding the arrays. Electrical equipment pads will also be readily accessible via 20-foot wide access roads. Knox boxes will be provided at the gates to facilitate emergency access.

Subsection 1544: Pedestrian Circulation

This section is not applicable, as the Site is not intended to be accessible to pedestrians or to the general public at large.

Section 1545: Parking

This section is not applicable, as the proposed use does not require parking spaces. There is adequate space provided on the Site for the occasional vehicle to service the facility.

Section 1546: Landscaping

This subsection indicates that all site plans are subject to the requirements of the Zoning By-laws. Article 10: "Landscaping", applies to all new non-residential development, pursuant to Section 1020. Pursuant to Section 1030, the Planning Board is responsible for determining acceptable landscaping standards where not otherwise provided in Article 10.

Landscaping information has been included on the plan sets, including the location of existing treed areas and details regarding the proposed seed mix. Additional plantings are not proposed given the nature of the Project.

2.5 Waiver Request

Please note that the Applicant respectfully requests the following waivers:

- A waiver from Section 1531.11, photographs of the site at size of 8” by 10” is requested. Photographs are included in Section 2, but do not meet the specified size due to their orientation.
- A waiver is requested from Section 1531.10: “All contiguous land owned by the applicant or by the owner of the property.” It is not practical to depict all contiguous parcels, due to the extent of the surrounding land owned by ADM.

- A waiver is requested from the provisions of Subsection 1532: “Existing Features” that require that plans be at a scale of 1” = 20’, 40’, or 100’ where practical and appropriate. Plans have been submitted at various scales appropriate to the Project Site.
- A waiver is requested from Section 1532.1 “Existing Natural Features” 2. “Individual trees 18” dbh or over.” Due to the size of the Property and the character of the Project, it is infeasible to locate all trees greater than 18 inches.

Section 3.0
Parties in Interest

List of Abutting Town Planning Boards

Certified List of Abutters

3.0 PARTIES IN INTEREST

In accordance with the requirements of M.G.L. Chapter 40A, a list of the addresses of Planning Boards in municipalities within the Commonwealth that abut Wareham is as follows:

Bourne Planning Board
Bourne Town Hall
24 Perry Avenue - Room 201
Buzzards Bay, MA 02532-3441

Carver Planning Board
Carver Town Hall
108 Main Street
Carver MA 02330

Marion Planning Board
2 Spring Street
Marion Town House
Marion, MA 02738

Middleborough Planning Board
Town Hall Annex
20 Center Street
Middleborough, MA 02346

Plymouth Planning Board
26 Court Street
Plymouth, MA 02360

Rochester Planning Board
Town Hall Annex
37 Marion Road
Rochester, MA 02770

TOWN OF WAREHAM ABUTTERS LIST

140 Tihonet Rd Project Site includes

Map	**Lot**
112	**1000**
111	**1000-F**
111	**1000-H**
111	**R-1**
111	**1000-G**

OWNER: A D MAKEPEACE CO.

300' LIST/100' LIST

MAP-LOT	**OWNER**	**CO-OWNER**	**MAIL ADDRESS**	**TOWN**	**ST**	**ZIP CODE**
111/1000-B	MAKEPEACE CO A D		158 TIHONET RD	WAREHAM	MA	02571
113/1018	TWEEDY & BARNES CO		31 HOME DEPOT DR #228	PLYMOUTH	MA	02360
112-1000	MAKEPEACE CO A D		158 TIHONET ROAD	WAREHAM	MA	02571
113-1020	OCONNOR DANIEL F TRUSTEE		168 CHARGE POND RD	WAREHAM	MA	02571
114-1000	MAKEPEACE CO A D		158 TIHONET RD	WAREHAM	MA	02571

CERTIFIED ABUTTERS LIST AS THEY APPEAR ON OUR TAX ROLLS AS OF 5/26/2020

Prepared by Jacqui Nichols based on plans submitted by Beals and Thomas and GAF

ASSESSORS OFFICE

Section 4.0
Stormwater Management Information

Stormwater Management Report
(Under Separate Cover)

Stormwater Management Report

140 Tihonet Road PV+ES Project

140 Tihonet Road (aka 0 & 169 Tihonet Road)
Wareham, Massachusetts

Prepared for:

BORREGO SOLAR

Borrego Solar Systems, Inc.
55 Technology Drive, Suite 102
Lowell, MA 01851

Prepared by:

BEALS + THOMAS

BEALS AND THOMAS, INC.
32 Court Street
Plymouth, MA 02360

June 2, 2020

Calculated by: **Nathaniel B. Bautz, EIT**

Checked by: **Jeffrey R. Murphy, PE**

Approved by:

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED
PROFESSIONAL ENGINEER

6/2/20

Jeffrey R. Murphy, PE

1833112RP001

TABLE OF CONTENTS

LIST OF ATTACHMENTS

1.0 INTRODUCTION

The proposed project includes a stormwater management system designed to mitigate potential impacts the proposed project could have on the existing watershed. Stormwater controls are proposed to control peak runoff rates, provide water quality, promote groundwater recharge and sediment removal. The proposed system has been designed to comply with:

- The 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Handbook,
- The Massachusetts Wetland Protection Act (310 CMR 10.00), and
- Town of Wareham Zoning Bylaw

The pre- and post-development hydrologic conditions were modeled using HydroCAD™ version 10.00 to demonstrate that post-development stormwater runoff rates will be less than or equal to the pre-development rates. Watershed maps with soil types as well as detailed analysis of the model results are also included. The following table summarizes the peak runoff rates for the pre- and post-development conditions.

Table 1: Pre- & Post-development Peak Runoff Rate Comparison, units are in cubic feet per second (cfs).

Storm Event	2 Year		10 Year		100 Year	
	Pre	Post	*Pre*	Post	*Pre*	Post
Design Point 1	*0.00*	0.00	*0.00*	0.00	*0.26*	0.20
Design Point 2	*0.00*	0.00	*0.07*	0.04	*1.90*	1.11
Design Point 3	*0.00*	0.00	*0.04*	0.00	*1.03*	0.14
Design Point 4	*0.00*	0.00	*0.02*	0.01	*0.68*	0.11
Design Point 5	*0.00*	0.00	*0.00*	0.00	*0.39*	0.18

2.0 PRE-DEVELOPMENT CONDITIONS

2.1 Site Conditions

The site is accessed by the unpaved portion of Tihonet Road behind the A.D. Makepeace Company headquarters. The site is currently undeveloped and is primarily wooded with an existing gravel cart path to the south and east. Runoff from the site drains radially outward from the existing hilltop ridge. Flows to the west go towards Tihonet Road and Tihonet Pond. Flows to the southwest are directed to an existing agricultural channel that flows southeast from Tihonet Pond into existing bogs south of the proposed array. Runoff also flows to existing bogs both on-site as well as off-site to the southeast, and easterly to an existing wetland system. North of the proposed solar array, there is an existing cleared utility transmission easement.

The site does not contain, nor is it tributary to any Critical Areas.

The site does not discharge to a surface water with a TMDL or draft TMDL.

2.2 Soil Description

The Natural Resources Conservation Service (NRCS) lists the on-site soils types as predominantly hydrologic soil class A. These soil groups include Poquonock sand, Plymouth-Carver complex, Carver loamy coarse sand, and Hinckley loamy sand, and Gloucester-Canton complex. A small area of hydrologic soil class D soils is present at the southwestern corner of the proposed project locus, which is classified as Udipsamments-wet substratum.

Poquonock sand is a well-drained soil comprised of sandy eolian or glaciofluvial deposits over coarse-loamy lodgment till. Generally, this soil is in areas with drumlins, ground moraines, and till plains and has a sand layer that extends to about 30 inches below the surface followed by a gravelly sandy loam layer which extends to about 70 inches below the surface. Plymouth-Carver complex is an excessively drained soil that is characterized by sandy gravelly glaciofluvial deposits. Carver loamy coarse sand and Hinckley loamy sand and Gloucester-Canton complex are also excessively drained sandy glaciofluvial outwash soil types. Udipsamments-wet substratum are defined as sandy human transported material over sandy and gravelly glaciofluvial deposits.

2.3 Hydrologic Analysis

Sub-catchment areas were delineated based on existing runoff patterns and topographic information. This information is shown on the *Pre-Development Conditions Hydrologic Areas Map* included in Attachment 2. Summaries of each area with respect to Curve Number and Time of Concentration calculations can be found in the model results also in Attachment 2.

3.0 POST-DEVELOPMENT CONDITIONS

3.1 Design Strategy

During the design phase of the site layout, consideration was given to conserving environmentally sensitive features and minimizing impact on the existing hydrology. To achieve this, the proposed grading endeavored to match the existing drainage patterns where feasible.

Wetlands in the vicinity of the site were excluded from the development envelope and will not be altered by the proposed project. The hydrology analysis considers these wetlands in order to maintain their existing hydrology.

The proposed solar panels are raised above the ground with the leading edge tilted to the south. Stormwater that lands on the panels will sheet down off the front edge to the pervious sandy ground below, which will be vegetated with an herbaceous seed mix.

There will be several concrete pads associated with the utility equipment that will produce a negligible amount of runoff which will flow to adjacent pervious soils. These have been accounted for in the stormwater design and analysis.

3.2 Hydrologic Analysis Methodology

The established design points used in the pre-development conditions analysis were used in the post-development analysis for direct comparison. The tributary areas and flow paths were modified to reflect post-development conditions. See Attachment 3 for the *Post-Development Conditions Hydrologic Areas Map*. Summaries of each area with respect to Curve Number and Time of Concentration calculations can be found in the model results in Attachment 3.

3.3 Compliance with MassDEP Stormwater Management Standards

The proposed stormwater management system was designed in compliance with the ten (10) MassDEP Stormwater Management Standards. The following summary provides key information related to the design approach and mitigation measures for stormwater.

STANDARD 1: No new stormwater conveyance (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

There will be no direct discharge of untreated stormwater from the site. Erosion control barriers will be installed as depicted on the plans and will remain in place throughout construction and until the site is stabilized with vegetation.

STANDARD 2: Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

The proposed stormwater management system will effectively maintain the post-development peak discharge rates for the 2-, 10-, and 100-year, 24-hour storms. Refer to Section 1.0 Introduction for a summary of the peak runoff rates.

STANDARD 3: Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater management practices and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil types. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The proposed solar panels, while covering a large footprint, will allow water to sheet flow to the ground below where it can be absorbed into the sandy on-site soils. Other minimal areas of impervious (i.e. concrete pads) as well as the proposed changes in vegetative cover have been accounted for in the design. Proposed infiltration basins will provide the required recharge based on the footprint of the impervious concrete pads. Therefore, recharge of groundwater will be maintained under the post-development condition.

STANDARD 4: **Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).**

The proposed project does not include any proposed impervious surfaces requiring treatment for water quality. Therefore, the 80% TSS removal requirement does not apply.

STANDARD 5: **For land uses with higher potential pollutant loads (LUHPPLs), source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.**

The proposed project is not associated with stormwater discharges from land uses with higher potential pollutant loads.

STANDARD 6: **Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas. Critical areas are Outstanding Resource Waters, shellfish beds, swimming beaches, coldwater fisheries and recharge areas for public water supplies.**

There are no stormwater discharges to critical areas associated with this project.

STANDARD 7: **Redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. However, if it is not practicable to meet all the Standards, new (retrofitted or expanded) stormwater management systems must be designed to improve existing conditions.**

The proposed project is new development, and therefore this standard does not apply.

STANDARD 8: **A plan to control construction-related impacts during erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.**

Since the project will disturb greater than 1 acre, a DRAFT Stormwater Pollution Prevention Plan (SWPPP) has been developed and is included in Attachment 5. The SWPPP will be finalized prior to construction to comply with Section 3 of the NPDES Construction General Permit for Stormwater Discharges; therefore the requirements of Standard 8 are fulfilled.

STANDARD 9: **A Long-Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.**

The Site Owner's Manual complies with the Long-Term Pollution Prevention Plan (Standard 4) and the Long-Term Operation and Maintenance Plan (Standard 9) requirements of the 2008 MassDEP Stormwater Management Standards. The Manual outlines source control and pollution prevention measures and maintenance requirements associated with the proposed development.

STANDARD 10: **All illicit discharges to the stormwater management system are prohibited.**

There will be no illicit discharges to the proposed stormwater management system associated with the proposed project. An Illicit Discharge Compliance Statement is provided on the following page.

3.5 Illicit Discharge Compliance Statement

An illicit discharge is any discharge to a stormwater management system that is not comprised entirely of stormwater, discharges from fire-fighting activities, and certain non-designated non-stormwater discharges.

To the best of my knowledge, no detectable illicit discharge exists on site. The site plans included with this report detail the storm sewers that convey stormwater on the site and demonstrate that these systems do not include the entry of an illicit discharge. A Site Owner's Manual is included, which contains the Long Term Pollution Prevention Plan that outlines measures to prevent future illicit discharges. As the Site Owner, I will ultimately be responsible for implementing the Long Term Pollution Prevention Plan.

Signature: ____________________________________
Owner's Name

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED
PROFESSIONAL ENGINEER

Jeffrey R Murphy 6/2/2020
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☒ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): ______________________

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

  ☐ is within the Zone II or Interim Wellhead Protection Area

  ☐ is near or to other critical areas

  ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

  ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☒ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

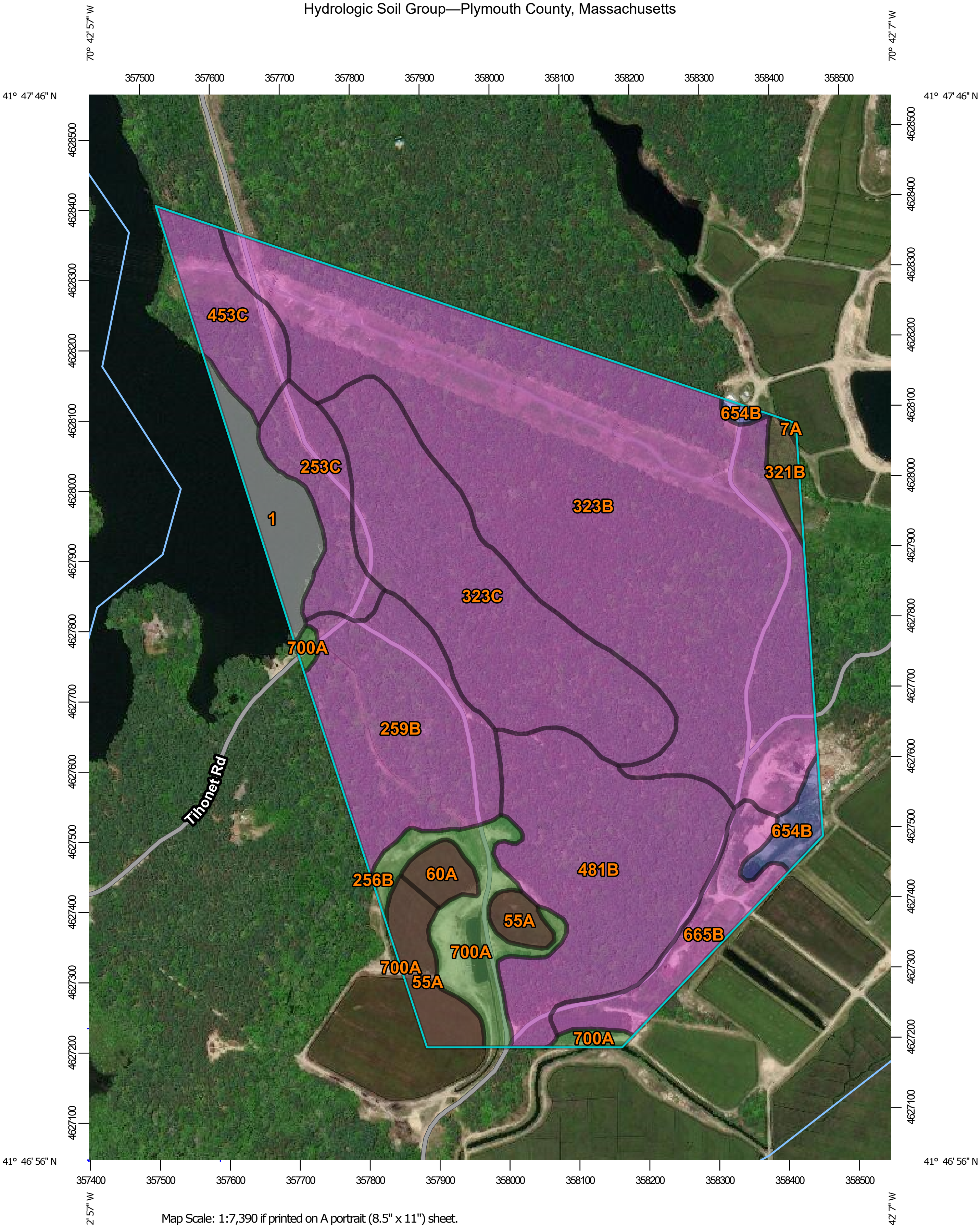
Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Attachment 1
Soil Data



Map Scale: 1:7,390 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 100, 200, 400, 600

Feet: 0, 350, 700, 1400, 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 12, Sep 12, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Jul 3, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		5.1	2.9%
7A	Rainberry coarse sand, 0 to 3 percent slopes, sanded surface	A/D	0.1	0.0%
55A	Freetown coarse sand, 0 to 3 percent slopes, sanded surface	B/D	5.0	2.9%
60A	Swansea coarse sand, 0 to 2 percent slopes	B/D	1.6	0.9%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	6.4	3.7%
256B	Deerfield loamy fine sand, 3 to 8 percent slopes	A	0.0	0.0%
259B	Carver loamy coarse sand, 3 to 8 percent slopes	A	17.0	9.7%
321B	Birchwood sand, 3 to 8 percent slopes, very stony	B/D	1.4	0.8%
323B	Poquonock sand, 3 to 8 percent slopes, very stony	A	67.2	38.5%
323C	Poquonock sand, 8 to 15 percent slopes, very stony	A	24.3	13.9%
453C	Gloucester - Canton complex, 8 to 15 percent slopes, extremely bouldery	A	6.6	3.8%
481B	Plymouth - Carver complex, 3 to 8 percent slopes, bouldery	A	23.3	13.3%
654B	Udorthents, loamy, 0 to 8 percent slopes	B	2.3	1.3%
665B	Udipsamments, 0 to 8 percent slopes	A	6.4	3.7%
700A	Udipsamments, wet substratum, 0 to 3 percent slopes	A/D	8.1	4.7%
Totals for Area of Interest			**174.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Plymouth County, Massachusetts

253C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svm9
Elevation: 0 to 1,480 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash plains, moraines, outwash deltas, eskers, outwash terraces, kames, kame terraces
Landform position (two-dimensional): Shoulder, toeslope, footslope, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Convex, linear, concave
Across-slope shape: Linear, convex, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent
Landform: Moraines, outwash plains, eskers, outwash terraces, kames
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, crest, head slope, nose slope, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Outwash plains, outwash deltas, moraines, outwash terraces, eskers, kames, kame terraces
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Convex, linear, concave
Across-slope shape: Linear, convex, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Moraines, outwash deltas, outwash terraces, kame terraces, outwash plains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Data Source Information

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 12, Sep 12, 2019

Plymouth County, Massachusetts

259B—Carver loamy coarse sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2y07t
Elevation: 0 to 240 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Carver, loamy coarse sand, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Carver, Loamy Coarse Sand

Setting

Landform: Outwash plains, moraines
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 3 inches: moderately decomposed plant material
A - 3 to 7 inches: loamy coarse sand
E - 7 to 10 inches: coarse sand
Bw1 - 10 to 15 inches: coarse sand
Bw2 - 15 to 28 inches: coarse sand
BC - 28 to 32 inches: coarse sand
C - 32 to 67 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: Dry Outwash (F149BY005MA)
Hydric soil rating: No

Minor Components

Deerfield

Percent of map unit: 10 percent
Landform: Outwash plains, outwash terraces, outwash deltas, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Moraines, kames, outwash terraces, eskers, kame terraces, outwash plains, outwash deltas
Landform position (two-dimensional): Summit, toeslope, shoulder, backslope, footslope
Landform position (three-dimensional): Side slope, crest, head slope, nose slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Merrimac

Percent of map unit: 3 percent
Landform: Outwash terraces, outwash deltas, kame terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Mashpee

Percent of map unit: 2 percent
Landform: Terraces, drainageways, depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 12, Sep 12, 2019

Plymouth County, Massachusetts

323B—Poquonock sand, 3 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: bcz7
Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Poquonock, very stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Poquonock, Very Stony

Setting

Landform: Drumlins, ground moraines, till plains
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy eolian deposits and/or glaciofluvial deposits over coarse-loamy lodgment till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oe - 1 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: sand
E - 4 to 5 inches: sand
Bs - 5 to 7 inches: loamy sand
Bw - 7 to 26 inches: sand
BC - 26 to 35 inches: loamy sand
2Cd1 - 35 to 49 inches: gravelly sandy loam
2Cd2 - 49 to 71 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 22 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Birchwood, very stony

Percent of map unit: 8 percent
Landform: Drumlins, ground moraines, till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Mattapoisett, extremely stony

Percent of map unit: 7 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Montauk, very stony

Percent of map unit: 3 percent
Landform: Drumlins, ground moraines, till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Scituate, very stony

Percent of map unit: 2 percent
Landform: Ridges, drumlins
Landform position (two-dimensional): Footslope, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Data Source Information

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 12, Sep 12, 2019

Plymouth County, Massachusetts

323C—Poquonock sand, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: bcz6
Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Poquonock, very stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Poquonock, Very Stony

Setting

Landform: Drumlins, ground moraines, till plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Sandy eolian deposits and/or glaciofluvial deposits over coarse-loamy lodgment till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oe - 1 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: sand
E - 4 to 5 inches: sand
Bs - 5 to 7 inches: loamy sand
Bw - 7 to 26 inches: sand
BC - 26 to 35 inches: loamy sand
2Cd1 - 35 to 49 inches: gravelly sandy loam
2Cd2 - 49 to 71 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Percent of area covered with surface fragments: 1.5 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 22 to 35 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Birchwood, very stony

Percent of map unit: 10 percent
Landform: Ground moraines, till plains, drumlins
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Scituate, very stony

Percent of map unit: 5 percent
Landform: Drumlins, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Montauk, very stony

Percent of map unit: 5 percent
Landform: Till plains, drumlins, ground moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 12, Sep 12, 2019

Plymouth County, Massachusetts

481B—Plymouth - Carver complex, 3 to 8 percent slopes, bouldery

Map Unit Setting

National map unit symbol: bcz2
Elevation: 0 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Plymouth, bouldery, and similar soils: 45 percent
Carver, bouldery, and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth, Bouldery

Setting

Landform: Outwash plains, moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly supraglacial meltout till over sandy and gravelly glaciofluvial deposits

Typical profile

Oi - 0 to 4 inches: slightly decomposed plant material
Oe - 4 to 6 inches: moderately decomposed plant material
A - 6 to 7 inches: loamy coarse sand
E - 7 to 11 inches: coarse sand
Bs - 11 to 15 inches: loamy coarse sand
Bw - 15 to 20 inches: coarse sand
BC - 20 to 29 inches: coarse sand
C - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 0.1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Carver, Bouldery

Setting

Landform: Outwash plains, moraines, pitted outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy glaciofluvial deposits

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 3 inches: moderately decomposed plant material
A - 3 to 7 inches: coarse sand
E - 7 to 10 inches: coarse sand
Bw1 - 10 to 15 inches: coarse sand
Bw2 - 15 to 28 inches: coarse sand
BC - 28 to 32 inches: coarse sand
C - 32 to 67 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 0.1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Barnstable, bouldery

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve

Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Poquonock, bouldery

Percent of map unit: 5 percent
Landform: Drumlins, ground moraines, till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, kames
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 12, Sep 12, 2019

Attachment 2
Pre-Development Hydrologic Analysis

BEALS + THOMAS
BEALS AND THOMAS, INC.
Reservoir Corporate Center
144 Turnpike Road
Southborough, MA 01772-2104

CALCULATION SUMMARY

T 508.366.0560
F 508.366.4391
www.bealsandthomas.com
Regional Office: Plymouth, MA

JOB NO./LOCATION:

1833.112
Wareham, MA

CLIENT/PROJECT:

Borrego Solar Systems, Inc.
140 Tihonet Road PV+ES Project

SUBJECT/TITLE:

Pre-Development Hydrologic Calculations

OBJECTIVE OF CALCULATION:

- To determine the pre-development peak rates of runoff from the site for the 2, 10, & 100-year storm events at design points DP-1 through 5.

CALCULATION METHOD(S):

- Runoff curve numbers (CN), time-of-concentration (Tc), and runoff rates were calculated based on TR-55 methodology.
- Autodesk Civil 3D 2019 computer program was utilized for digitizing ground cover areas.
- Peak runoff rates were computed using HydroCAD version 10.00.

ASSUMPTIONS:

- The ground cover types were determined using MassGIS aerial imagery and hydrologic soil groups based on United States Department of Agriculture, NRCS Soil Survey map information.
- Watershed boundaries have been estimated based upon contour information depicted on the Existing Conditions Plan as well as MassGIS contours in offsite areas outside limits of those shown on the existing conditions plan.
- Wetland systems were not included in the hydrologic analysis.

SOURCES OF DATA/EQUATIONS:

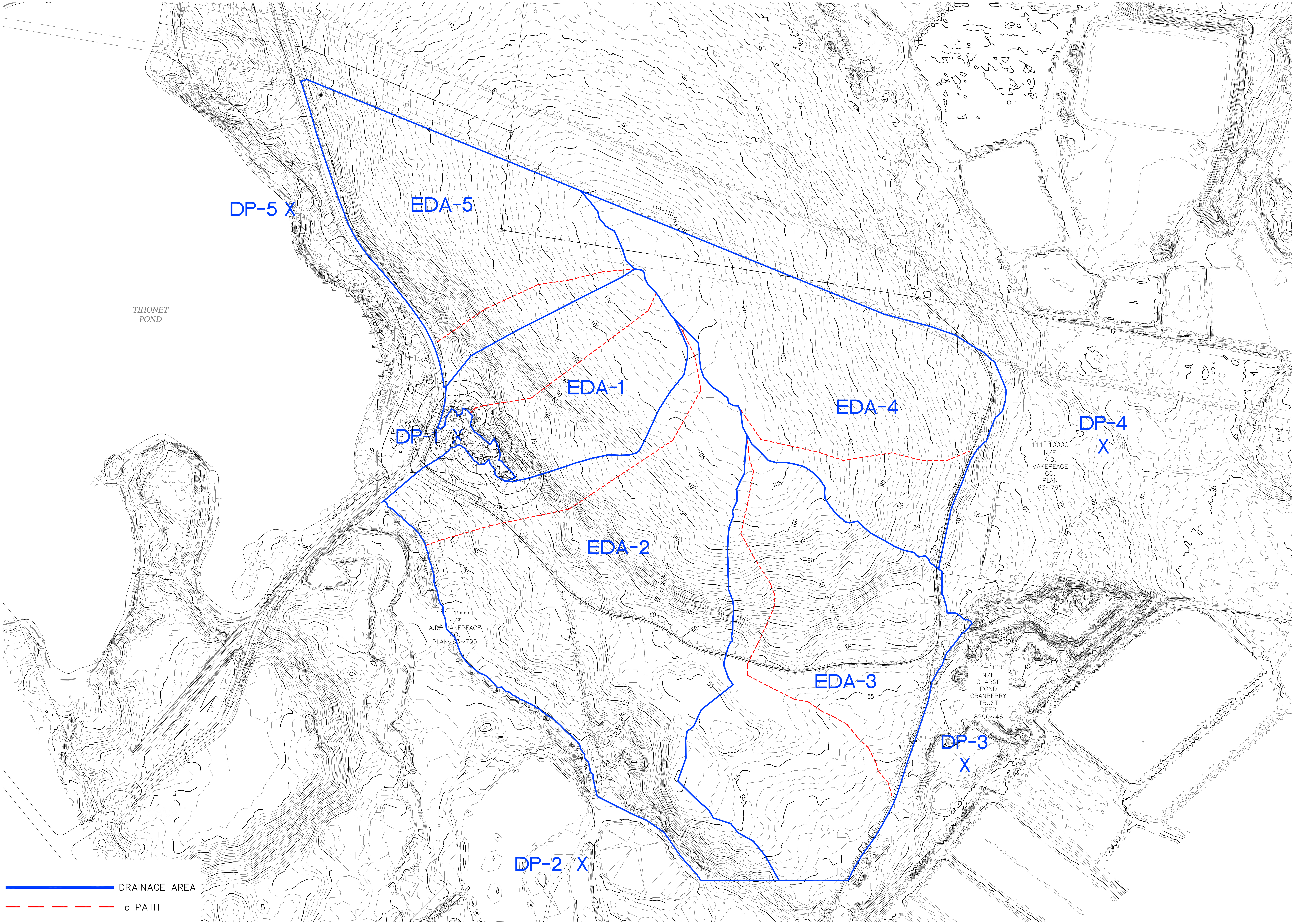
- Pre-Development Conditions Hydrologic Areas Map prepared by Beals and Thomas, Inc. File No. 1833112P593A-001.
- NRCS Soil Survey for Plymouth County, hydrologic soil group report, downloaded from Web Soil Survey on 3/12/2020.
- TR-55 urban Hydrology for Small Watersheds, SCS, 1986.
- Massachusetts DEP Stormwater Management Handbook, February 2008.

REV	CALC. BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
0	N. Bautz	05/31/2020	J. Murphy	6/1/2020	J. Murphy	6/1/2020

CONCLUSIONS:

Storm Event	2-Year	10-Year	100-Year
DP-1 (cfs)	0.00	0.00	0.26
DP-2 (cfs)	0.00	0.07	1.90
DP-3 (cfs)	0.00	0.04	1.03
DP-4 (cfs)	0.00	0.02	0.68
DP-5 (cfs)	0.00	0.00	0.39

REV	CALC. BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
0	N. Bautz	05/31/2020	J. Murphy	6/1/2020	J. Murphy	6/1/2020



Pre-Development Conditions
Hydrologic Areas Map
Figure Number 001

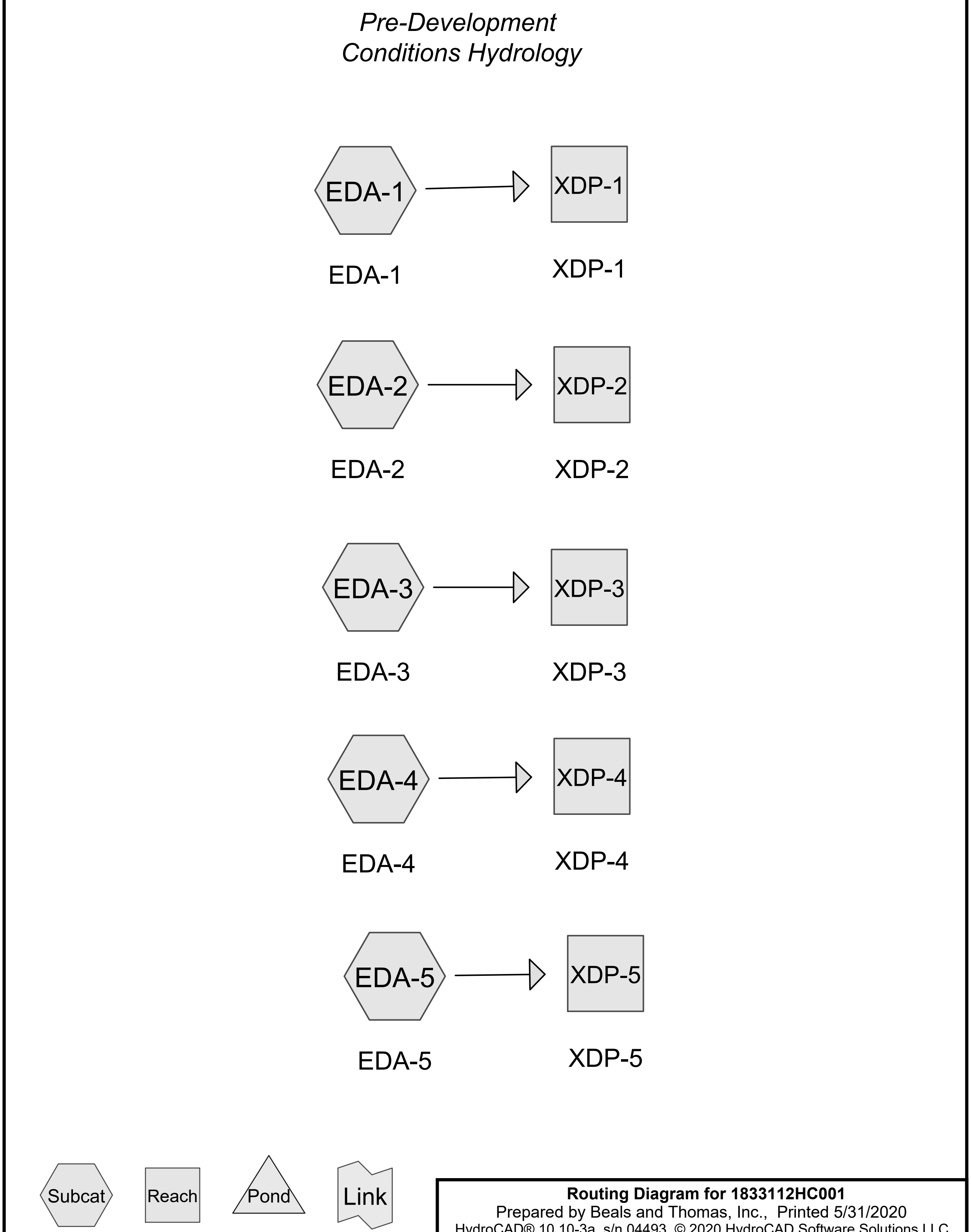
Scale: 1" = 150'
Date: 06/01/2020

Plan 1833112P593A-001
B+T Project No. 1833.112

140 Tihonet Road PV+ES Project
Wareham, Massachusetts

Borrego Solar Systems, Inc.
55 Technology Drive, Suite 102
Lowell, Massachusetts

North Arrow
NORTH



Routing Diagram for 1833112HC001
Prepared by Beals and Thomas, Inc., Printed 5/31/2020
HydroCAD® 10.10-3a s/n 04493 © 2020 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.585	39	>75% Grass cover, Good, HSG A (EDA-4, EDA-5)
1.235	96	Gravel surface, HSG A (EDA-2, EDA-3, EDA-4)
0.190	96	Gravel surface, HSG D (EDA-2)
88.289	30	Woods, Good, HSG A (EDA-1, EDA-2, EDA-3, EDA-4, EDA-5)
0.569	77	Woods, Good, HSG D (EDA-2)
90.868	**31**	**TOTAL AREA**

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA-1: EDA-1 Runoff Area=9.142 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=820' Tc=22.5 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment EDA-2: EDA-2 Runoff Area=27.900 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=1,436' Tc=39.1 min CN=33 Runoff=0.00 cfs 0.000 af

Subcatchment EDA-3: EDA-3 Runoff Area=21.829 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=1,626' Tc=46.8 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment EDA-4: EDA-4 Runoff Area=18.259 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=916' Tc=31.3 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment EDA-5: EDA-5 Runoff Area=13.738 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=768' Tc=21.0 min CN=30 Runoff=0.00 cfs 0.000 af

Reach XDP-1: XDP-1 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach XDP-2: XDP-2 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach XDP-3: XDP-3 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach XDP-4: XDP-4 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach XDP-5: XDP-5 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 90.868 ac Runoff Volume = 0.000 af Average Runoff Depth = 0.00"
100.00% Pervious = 90.868 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EDA-1: EDA-1

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
9.142	30	Woods, Good, HSG A
9.142		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0200	0.07		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
5.6	327	0.0380	0.97		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
1.6	131	0.0760	1.38		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
0.7	83	0.1690	2.06		**Shallow Concentrated Flow, Tc-4** Woodland Kv= 5.0 fps
1.4	101	0.0590	1.21		**Shallow Concentrated Flow, Tc-5** Woodland Kv= 5.0 fps
0.5	66	0.2270	2.38		**Shallow Concentrated Flow, Tc-6** Woodland Kv= 5.0 fps
0.5	34	0.0590	1.21		**Shallow Concentrated Flow, Tc-7** Woodland Kv= 5.0 fps
0.2	28	0.2500	2.50		**Shallow Concentrated Flow, Tc-8** Woodland Kv= 5.0 fps
22.5	820	Total			

Summary for Subcatchment EDA-2: EDA-2

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
26.629	30	Woods, Good, HSG A
0.569	77	Woods, Good, HSG D
0.512	96	Gravel surface, HSG A
0.190	96	Gravel surface, HSG D
27.900	33	Weighted Average
27.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
5.6	204	0.0150	0.61		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
4.4	206	0.0240	0.77		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
4.9	344	0.0550	1.17		**Shallow Concentrated Flow, Tc-4** Woodland Kv= 5.0 fps
1.8	203	0.1430	1.89		**Shallow Concentrated Flow, Tc-5** Woodland Kv= 5.0 fps
6.6	429	0.0470	1.08		**Shallow Concentrated Flow, Tc-6** Woodland Kv= 5.0 fps
39.1	1,436	Total			

Summary for Subcatchment EDA-3: EDA-3

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
21.330	30	Woods, Good, HSG A
0.499	96	Gravel surface, HSG A
21.829	32	Weighted Average
21.829		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
6.0	308	0.0290	0.85		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
5.0	439	0.0840	1.45		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
20.0	829	0.0190	0.69		**Shallow Concentrated Flow, Tc-4** Woodland Kv= 5.0 fps
46.8	1,626	Total			

Summary for Subcatchment EDA-4: EDA-4

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
17.906	30	Woods, Good, HSG A
0.129	39	>75% Grass cover, Good, HSG A
0.224	96	Gravel surface, HSG A
18.259	31	Weighted Average
18.259		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
5.9	208	0.0140	0.59		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
9.6	658	0.0520	1.14		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
31.3	916	Total			

Summary for Subcatchment EDA-5: EDA-5

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
13.282	30	Woods, Good, HSG A
0.456	39	>75% Grass cover, Good, HSG A
13.738	30	Weighted Average
13.738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0200	0.07		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
7.3	510	0.0540	1.16		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
1.7	208	0.1680	2.05		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
21.0	768	Total			

Summary for Reach XDP-1: XDP-1

Inflow Area = 9.142 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-2: XDP-2

Inflow Area =	27.900 ac,	0.00% Impervious, Inflow Depth = 0.00"	for 2-Year event	
Inflow =	0.00 cfs @	5.00 hrs, Volume=	0.000 af	
Outflow =	0.00 cfs @	5.00 hrs, Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-3: XDP-3

Inflow Area =	21.829 ac,	0.00% Impervious, Inflow Depth = 0.00"	for 2-Year event	
Inflow =	0.00 cfs @	5.00 hrs, Volume=	0.000 af	
Outflow =	0.00 cfs @	5.00 hrs, Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-4: XDP-4

Inflow Area =	18.259 ac,	0.00% Impervious, Inflow Depth = 0.00"	for 2-Year event	
Inflow =	0.00 cfs @	5.00 hrs, Volume=	0.000 af	
Outflow =	0.00 cfs @	5.00 hrs, Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-5: XDP-5

Inflow Area =	13.738 ac,	0.00% Impervious, Inflow Depth = 0.00"	for 2-Year event	
Inflow =	0.00 cfs @	5.00 hrs, Volume=	0.000 af	
Outflow =	0.00 cfs @	5.00 hrs, Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA-1: EDA-1 Runoff Area=9.142 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=820' Tc=22.5 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment EDA-2: EDA-2 Runoff Area=27.900 ac 0.00% Impervious Runoff Depth=0.02"
Flow Length=1,436' Tc=39.1 min CN=33 Runoff=0.07 cfs 0.045 af

Subcatchment EDA-3: EDA-3 Runoff Area=21.829 ac 0.00% Impervious Runoff Depth=0.01"
Flow Length=1,626' Tc=46.8 min CN=32 Runoff=0.04 cfs 0.017 af

Subcatchment EDA-4: EDA-4 Runoff Area=18.259 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=916' Tc=31.3 min CN=31 Runoff=0.02 cfs 0.004 af

Subcatchment EDA-5: EDA-5 Runoff Area=13.738 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=768' Tc=21.0 min CN=30 Runoff=0.00 cfs 0.000 af

Reach XDP-1: XDP-1 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach XDP-2: XDP-2 Inflow=0.07 cfs 0.045 af
Outflow=0.07 cfs 0.045 af

Reach XDP-3: XDP-3 Inflow=0.04 cfs 0.017 af
Outflow=0.04 cfs 0.017 af

Reach XDP-4: XDP-4 Inflow=0.02 cfs 0.004 af
Outflow=0.02 cfs 0.004 af

Reach XDP-5: XDP-5 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 90.868 ac Runoff Volume = 0.067 af Average Runoff Depth = 0.01"
100.00% Pervious = 90.868 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EDA-1: EDA-1

Runoff = 0.00 cfs @ 24.13 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
9.142	30	Woods, Good, HSG A
9.142		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0200	0.07		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
5.6	327	0.0380	0.97		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
1.6	131	0.0760	1.38		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
0.7	83	0.1690	2.06		**Shallow Concentrated Flow, Tc-4** Woodland Kv= 5.0 fps
1.4	101	0.0590	1.21		**Shallow Concentrated Flow, Tc-5** Woodland Kv= 5.0 fps
0.5	66	0.2270	2.38		**Shallow Concentrated Flow, Tc-6** Woodland Kv= 5.0 fps
0.5	34	0.0590	1.21		**Shallow Concentrated Flow, Tc-7** Woodland Kv= 5.0 fps
0.2	28	0.2500	2.50		**Shallow Concentrated Flow, Tc-8** Woodland Kv= 5.0 fps
22.5	820	Total			

Summary for Subcatchment EDA-2: EDA-2

Runoff = 0.07 cfs @ 22.09 hrs, Volume= 0.045 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
26.629	30	Woods, Good, HSG A
0.569	77	Woods, Good, HSG D
0.512	96	Gravel surface, HSG A
0.190	96	Gravel surface, HSG D
27.900	33	Weighted Average
27.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
5.6	204	0.0150	0.61		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
4.4	206	0.0240	0.77		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
4.9	344	0.0550	1.17		**Shallow Concentrated Flow, Tc-4** Woodland Kv= 5.0 fps
1.8	203	0.1430	1.89		**Shallow Concentrated Flow, Tc-5** Woodland Kv= 5.0 fps
6.6	429	0.0470	1.08		**Shallow Concentrated Flow, Tc-6** Woodland Kv= 5.0 fps
39.1	1,436	Total			

Summary for Subcatchment EDA-3: EDA-3

Runoff = 0.04 cfs @ 23.45 hrs, Volume= 0.017 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
21.330	30	Woods, Good, HSG A
0.499	96	Gravel surface, HSG A
21.829	32	Weighted Average
21.829		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
6.0	308	0.0290	0.85		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
5.0	439	0.0840	1.45		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
20.0	829	0.0190	0.69		**Shallow Concentrated Flow, Tc-4** Woodland Kv= 5.0 fps
46.8	1,626	Total			

Summary for Subcatchment EDA-4: EDA-4

Runoff = 0.02 cfs @ 24.05 hrs, Volume= 0.004 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
17.906	30	Woods, Good, HSG A
0.129	39	>75% Grass cover, Good, HSG A
0.224	96	Gravel surface, HSG A
18.259	31	Weighted Average
18.259		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
5.9	208	0.0140	0.59		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
9.6	658	0.0520	1.14		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
31.3	916	Total			

Summary for Subcatchment EDA-5: EDA-5

Runoff = 0.00 cfs @ 24.12 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
13.282	30	Woods, Good, HSG A
0.456	39	>75% Grass cover, Good, HSG A
13.738	30	Weighted Average
13.738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0200	0.07		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
7.3	510	0.0540	1.16		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
1.7	208	0.1680	2.05		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
21.0	768	Total			

Summary for Reach XDP-1: XDP-1

Inflow Area = 9.142 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 24.13 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 24.13 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-2: XDP-2

Inflow Area = 27.900 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-Year event
Inflow = 0.07 cfs @ 22.09 hrs, Volume= 0.045 af
Outflow = 0.07 cfs @ 22.09 hrs, Volume= 0.045 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-3: XDP-3

Inflow Area = 21.829 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.04 cfs @ 23.45 hrs, Volume= 0.017 af
Outflow = 0.04 cfs @ 23.45 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-4: XDP-4

Inflow Area = 18.259 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.02 cfs @ 24.05 hrs, Volume= 0.004 af
Outflow = 0.02 cfs @ 24.05 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-5: XDP-5

Inflow Area = 13.738 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 24.12 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 24.12 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA-1: EDA-1 Runoff Area=9.142 ac 0.00% Impervious Runoff Depth=0.21"
Flow Length=820' Tc=22.5 min CN=30 Runoff=0.26 cfs 0.162 af

Subcatchment EDA-2: EDA-2 Runoff Area=27.900 ac 0.00% Impervious Runoff Depth=0.37"
Flow Length=1,436' Tc=39.1 min CN=33 Runoff=1.90 cfs 0.864 af

Subcatchment EDA-3: EDA-3 Runoff Area=21.829 ac 0.00% Impervious Runoff Depth=0.32"
Flow Length=1,626' Tc=46.8 min CN=32 Runoff=1.03 cfs 0.573 af

Subcatchment EDA-4: EDA-4 Runoff Area=18.259 ac 0.00% Impervious Runoff Depth=0.26"
Flow Length=916' Tc=31.3 min CN=31 Runoff=0.68 cfs 0.398 af

Subcatchment EDA-5: EDA-5 Runoff Area=13.738 ac 0.00% Impervious Runoff Depth=0.21"
Flow Length=768' Tc=21.0 min CN=30 Runoff=0.39 cfs 0.243 af

Reach XDP-1: XDP-1 Inflow=0.26 cfs 0.162 af
Outflow=0.26 cfs 0.162 af

Reach XDP-2: XDP-2 Inflow=1.90 cfs 0.864 af
Outflow=1.90 cfs 0.864 af

Reach XDP-3: XDP-3 Inflow=1.03 cfs 0.573 af
Outflow=1.03 cfs 0.573 af

Reach XDP-4: XDP-4 Inflow=0.68 cfs 0.398 af
Outflow=0.68 cfs 0.398 af

Reach XDP-5: XDP-5 Inflow=0.39 cfs 0.243 af
Outflow=0.39 cfs 0.243 af

Total Runoff Area = 90.868 ac Runoff Volume = 2.240 af Average Runoff Depth = 0.30"
100.00% Pervious = 90.868 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EDA-1: EDA-1

Runoff = 0.26 cfs @ 14.03 hrs, Volume= 0.162 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
9.142	30	Woods, Good, HSG A
9.142		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0200	0.07		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
5.6	327	0.0380	0.97		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
1.6	131	0.0760	1.38		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
0.7	83	0.1690	2.06		**Shallow Concentrated Flow, Tc-4** Woodland Kv= 5.0 fps
1.4	101	0.0590	1.21		**Shallow Concentrated Flow, Tc-5** Woodland Kv= 5.0 fps
0.5	66	0.2270	2.38		**Shallow Concentrated Flow, Tc-6** Woodland Kv= 5.0 fps
0.5	34	0.0590	1.21		**Shallow Concentrated Flow, Tc-7** Woodland Kv= 5.0 fps
0.2	28	0.2500	2.50		**Shallow Concentrated Flow, Tc-8** Woodland Kv= 5.0 fps
22.5	820	Total			

Summary for Subcatchment EDA-2: EDA-2

Runoff = 1.90 cfs @ 13.00 hrs, Volume= 0.864 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
26.629	30	Woods, Good, HSG A
0.569	77	Woods, Good, HSG D
0.512	96	Gravel surface, HSG A
0.190	96	Gravel surface, HSG D
27.900	33	Weighted Average
27.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
5.6	204	0.0150	0.61		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
4.4	206	0.0240	0.77		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
4.9	344	0.0550	1.17		**Shallow Concentrated Flow, Tc-4** Woodland Kv= 5.0 fps
1.8	203	0.1430	1.89		**Shallow Concentrated Flow, Tc-5** Woodland Kv= 5.0 fps
6.6	429	0.0470	1.08		**Shallow Concentrated Flow, Tc-6** Woodland Kv= 5.0 fps
39.1	1,436	Total			

Summary for Subcatchment EDA-3: EDA-3

Runoff = 1.03 cfs @ 13.44 hrs, Volume= 0.573 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
21.330	30	Woods, Good, HSG A
0.499	96	Gravel surface, HSG A
21.829	32	Weighted Average
21.829		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
6.0	308	0.0290	0.85		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
5.0	439	0.0840	1.45		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
20.0	829	0.0190	0.69		**Shallow Concentrated Flow, Tc-4** Woodland Kv= 5.0 fps
46.8	1,626	Total			

Summary for Subcatchment EDA-4: EDA-4

Runoff = 0.68 cfs @ 13.94 hrs, Volume= 0.398 af, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
17.906	30	Woods, Good, HSG A
0.129	39	>75% Grass cover, Good, HSG A
0.224	96	Gravel surface, HSG A
18.259	31	Weighted Average
18.259		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
5.9	208	0.0140	0.59		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
9.6	658	0.0520	1.14		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
31.3	916	Total			

Summary for Subcatchment EDA-5: EDA-5

Runoff = 0.39 cfs @ 14.00 hrs, Volume= 0.243 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
13.282	30	Woods, Good, HSG A
0.456	39	>75% Grass cover, Good, HSG A
13.738	30	Weighted Average
13.738		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.0	50	0.0200	0.07		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
7.3	510	0.0540	1.16		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
1.7	208	0.1680	2.05		**Shallow Concentrated Flow, Tc-3** Woodland Kv= 5.0 fps
21.0	768	Total			

Summary for Reach XDP-1: XDP-1

Inflow Area = 9.142 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-Year event
Inflow = 0.26 cfs @ 14.03 hrs, Volume= 0.162 af
Outflow = 0.26 cfs @ 14.03 hrs, Volume= 0.162 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-2: XDP-2

Inflow Area =	27.900 ac,	0.00% Impervious,	Inflow Depth = 0.37"	for 100-Year event	
Inflow =	1.90 cfs @	13.00 hrs,	Volume=	0.864 af	
Outflow =	1.90 cfs @	13.00 hrs,	Volume=	0.864 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-3: XDP-3

Inflow Area =	21.829 ac,	0.00% Impervious,	Inflow Depth = 0.32"	for 100-Year event	
Inflow =	1.03 cfs @	13.44 hrs,	Volume=	0.573 af	
Outflow =	1.03 cfs @	13.44 hrs,	Volume=	0.573 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-4: XDP-4

Inflow Area =	18.259 ac,	0.00% Impervious,	Inflow Depth = 0.26"	for 100-Year event	
Inflow =	0.68 cfs @	13.94 hrs,	Volume=	0.398 af	
Outflow =	0.68 cfs @	13.94 hrs,	Volume=	0.398 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach XDP-5: XDP-5

Inflow Area =	13.738 ac,	0.00% Impervious,	Inflow Depth = 0.21"	for 100-Year event	
Inflow =	0.39 cfs @	14.00 hrs,	Volume=	0.243 af	
Outflow =	0.39 cfs @	14.00 hrs,	Volume=	0.243 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Attachment 3
Post-Development Hydrologic Analysis

BEALS + THOMAS
BEALS AND THOMAS, INC.
Reservoir Corporate Center
144 Turnpike Road
Southborough, MA 01772-2104

CALCULATION SUMMARY

T 508.366.0560
F 508.366.4391
www.bealsandthomas.com
Regional Office: Plymouth, MA

JOB NO./LOCATION:

1833.112
Wareham, MA

CLIENT/PROJECT:

Borrego Solar Systems, Inc.
140 Tihonet Road PV+ES Project

SUBJECT/TITLE:

Post Development Hydrologic Calculations

OBJECTIVE OF CALCULATION:

- To determine the pre-development peak rates of runoff from the site for the 2, 10, & 100-year storm events at design points DP-1 through 5.

CALCULATION METHOD(S):

- Runoff curve numbers (CN), time-of-concentration (Tc), and runoff rates were calculated based on TR-55 methodology.
- Autodesk Civil 3D 2019 computer program was utilized for digitizing ground cover areas.
- Peak runoff rates were computed using HydroCAD version 10.00.

ASSUMPTIONS:

- The ground cover types were determined using MassGIS aerial imagery and hydrologic soil groups based on United States Department of Agriculture, NRCS Soil Survey map information.
- Watershed boundaries have been estimated based upon contour information depicted on the Existing Conditions Plan as well as MassGIS contours in offsite areas outside limits of those shown on the existing conditions plan.
- Wetland systems were not included in the hydrologic analysis.

SOURCES OF DATA/EQUATIONS:

- Post-Development Conditions Hydrologic Areas Map prepared by Beals and Thomas, Inc. File No. 1833112P593A-002.
- 140 Tihonet Road PV+ES Project Grading and Drainage Plans, prepared by Borrego Solar Systems, Inc., plan numbers C-4.0 – C4.4.
- NRCS Soil Survey for Plymouth County, hydrologic soil group report, downloaded from Web Soil Survey on 3/12/2020.
- TR-55 urban Hydrology for Small Watersheds, SCS, 1986.
- Massachusetts DEP Stormwater Management Handbook, February 2008

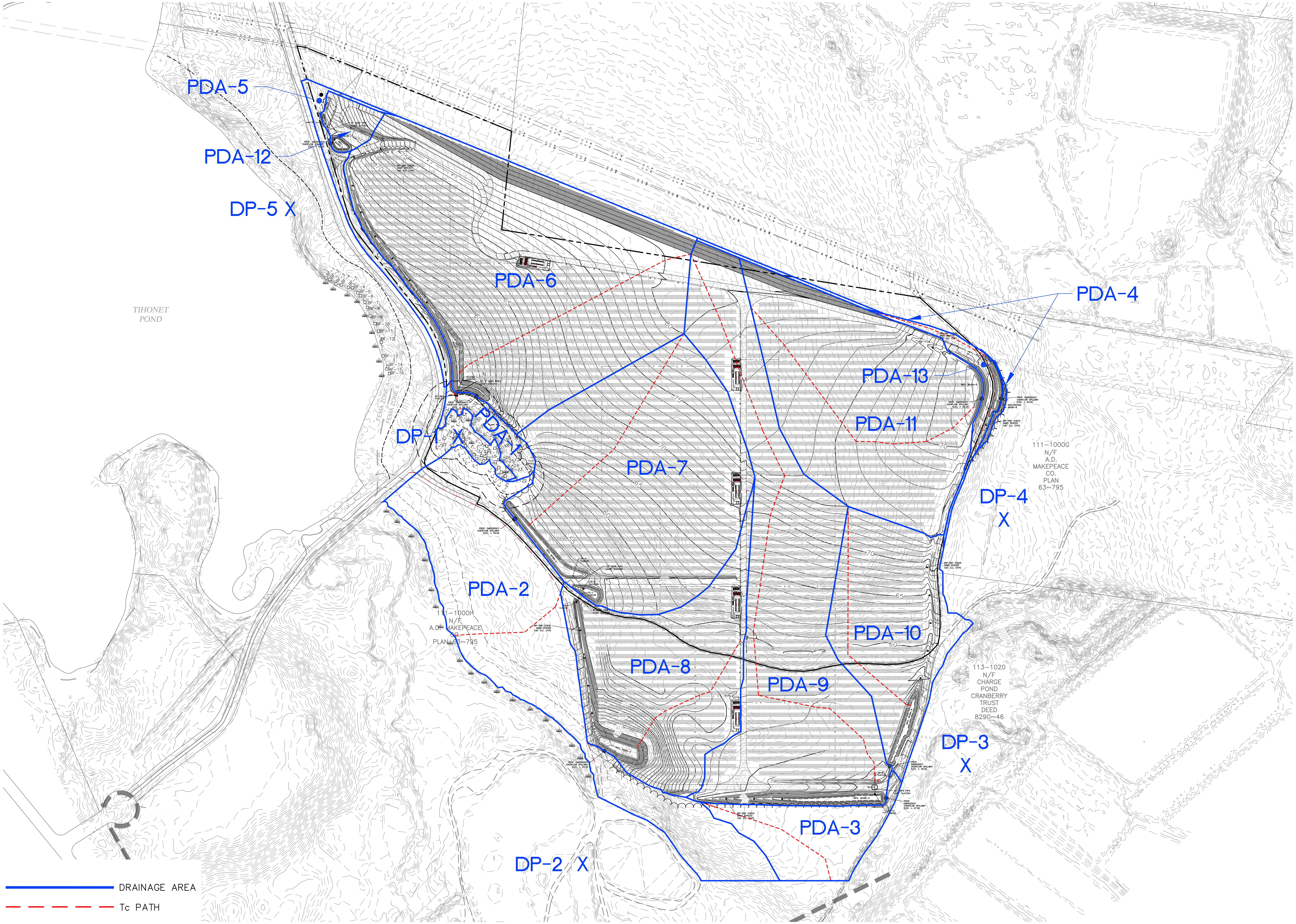
REV	CALC. BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
0	N. Bautz	05/31/2020	J. Murphy	06/01/2020	J. Murphy	06/01/2020

CONCLUSIONS:

Storm Event	2-Year	10-Year	100-Year
DP-1 (cfs)	0.00	0.00	0.20
DP-2 (cfs)	0.00	0.04	1.11
DP-3 (cfs)	0.00	0.00	0.14
DP-4 (cfs)	0.00	0.01	0.11
DP-5 (cfs)	0.00	0.00	0.18

- Post-development peak runoff rates are less than or equal to pre-development rates in accordance with the Mass DEP Stormwater Handbook.

REV	CALC. BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
0	N. Bautz	05/31/2020	J. Murphy	06/01/2020	J. Murphy	06/01/2020



Post-Development Conditions
Hydrologic Areas Map
Figure Number 002

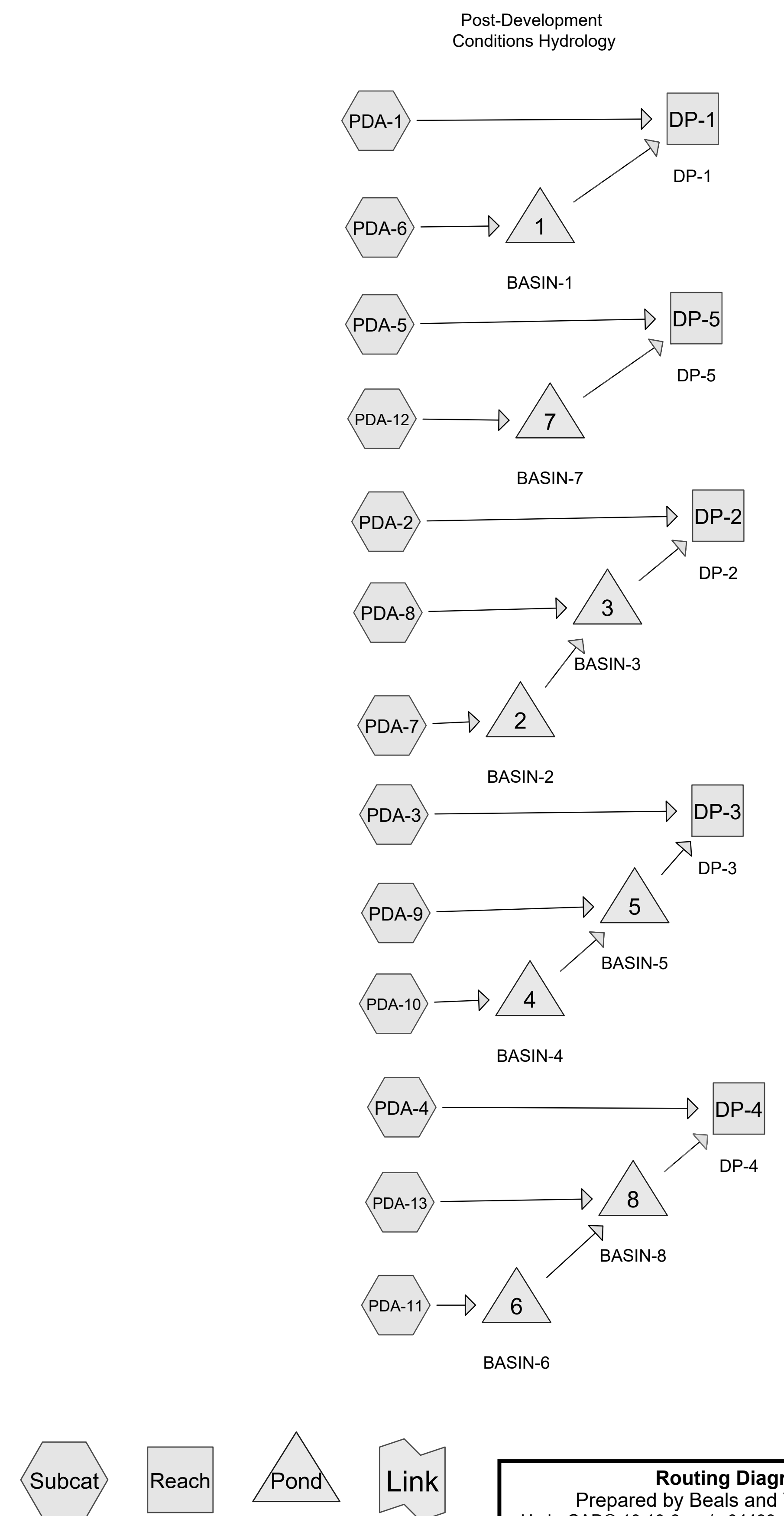
Scale: 1" = 150'
Date: 06/01/2020
Plan 1833112P593A-002
B+T Project No. 1833.112

140 Tihonet Road PV+ES Project
Wareham, Massachusetts

Borrego Solar Systems, Inc.
55 Technology Drive, Suite 102
Lowell, Massachusetts

North Arrow
NORTH

BEALS AND THOMAS, INC.



Routing Diagram for 1833112HC002
Prepared by Beals and Thomas, Inc., Printed 6/1/2020
HydroCAD® 10.10-3a s/n 04493 © 2020 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
69.659	39	>75% Grass cover, Good, HSG A (PDA-10, PDA-11, PDA-12, PDA-13, PDA-4, PDA-6, PDA-7, PDA-8, PDA-9)
0.336	80	>75% Grass cover, Good, HSG D (PDA-8)
1.697	30	Brush, Good, HSG A (PDA-1, PDA-2, PDA-3, PDA-5)
0.012	73	Brush, Good, HSG D (PDA-2)
0.146	98	Equipment Pad Area, HSG A (PDA-6, PDA-7, PDA-8, PDA-9)
0.929	96	Existing Gravel surface, HSG A (PDA-10, PDA-11, PDA-13, PDA-2, PDA-3, PDA-8, PDA-9)
0.149	96	Existing Gravel surface, HSG D (PDA-2, PDA-8)
4.338	96	Gravel surface, HSG A (PDA-10, PDA-11, PDA-12, PDA-13, PDA-2, PDA-3, PDA-5, PDA-6, PDA-7, PDA-8, PDA-9)
0.008	96	Gravel surface, HSG D (PDA-2, PDA-8)
13.341	30	Woods, Good, HSG A (PDA-1, PDA-10, PDA-2, PDA-3, PDA-7, PDA-8)
0.253	77	Woods, Good, HSG D (PDA-2)
90.868	**41**	**TOTAL AREA**

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA-1: Runoff Area=0.865 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=122' Tc=8.9 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment PDA-10: Runoff Area=6.302 ac 0.00% Impervious Runoff Depth=0.04"
Flow Length=823' Tc=15.5 min CN=43 Runoff=0.03 cfs 0.021 af

Subcatchment PDA-11: Runoff Area=11.606 ac 0.00% Impervious Runoff Depth=0.02"
Flow Length=1,075' Tc=30.3 min CN=41 Runoff=0.03 cfs 0.018 af

Subcatchment PDA-12: Runoff Area=0.696 ac 0.00% Impervious Runoff Depth=0.41"
Tc=6.0 min CN=58 Runoff=0.18 cfs 0.024 af

Subcatchment PDA-13: Runoff Area=0.854 ac 0.00% Impervious Runoff Depth=0.38"
Flow Length=460' Tc=8.4 min CN=57 Runoff=0.17 cfs 0.027 af

Subcatchment PDA-2: Runoff Area=10.773 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=449' Tc=29.8 min CN=34 Runoff=0.00 cfs 0.000 af

Subcatchment PDA-3: Runoff Area=2.836 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=577' Tc=43.5 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment PDA-4: Runoff Area=0.260 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment PDA-5: Runoff Area=1.227 ac 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=34 Runoff=0.00 cfs 0.000 af

Subcatchment PDA-6: Runoff Area=18.529 ac 0.16% Impervious Runoff Depth=0.03"
Flow Length=939' Tc=19.5 min CN=42 Runoff=0.06 cfs 0.044 af

Subcatchment PDA-7: Runoff Area=13.769 ac 0.21% Impervious Runoff Depth=0.02"
Flow Length=894' Tc=16.3 min CN=41 Runoff=0.03 cfs 0.021 af

Subcatchment PDA-8: Runoff Area=8.568 ac 0.69% Impervious Runoff Depth=0.09"
Flow Length=559' Tc=18.5 min CN=46 Runoff=0.10 cfs 0.062 af

Subcatchment PDA-9: Runoff Area=14.583 ac 0.20% Impervious Runoff Depth=0.04"
Flow Length=2,248' Tc=60.8 min CN=43 Runoff=0.07 cfs 0.049 af

Reach DP-1: DP-1 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP-2: DP-2 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP-3: DP-3 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP-4: DP-4 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP-5: DP-5 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 1: BASIN-1 Peak Elev=50.02' Storage=53 cf Inflow=0.06 cfs 0.044 af
Discarded=0.06 cfs 0.044 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.06 cfs 0.044 af

Pond 2: BASIN-2 Peak Elev=47.02' Storage=19 cf Inflow=0.03 cfs 0.021 af
Discarded=0.03 cfs 0.021 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.021 af

Pond 3: BASIN-3 Peak Elev=28.02' Storage=88 cf Inflow=0.10 cfs 0.062 af
Discarded=0.10 cfs 0.062 af Primary=0.00 cfs 0.000 af Outflow=0.10 cfs 0.062 af

Pond 4: BASIN-4 Peak Elev=46.51' Storage=19 cf Inflow=0.03 cfs 0.021 af
Discarded=0.03 cfs 0.021 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.021 af

Pond 5: BASIN-5 Peak Elev=43.51' Storage=55 cf Inflow=0.07 cfs 0.049 af
Discarded=0.07 cfs 0.049 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.049 af

Pond 6: BASIN-6 Peak Elev=67.01' Storage=13 cf Inflow=0.03 cfs 0.018 af
Discarded=0.03 cfs 0.018 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.018 af

Pond 7: BASIN-7 Peak Elev=60.12' Storage=146 cf Inflow=0.18 cfs 0.024 af
Discarded=0.07 cfs 0.024 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.024 af

Pond 8: BASIN-8 Peak Elev=62.23' Storage=199 cf Inflow=0.17 cfs 0.027 af
Discarded=0.05 cfs 0.027 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.027 af

Total Runoff Area = 90.868 ac Runoff Volume = 0.265 af Average Runoff Depth = 0.03"
99.84% Pervious = 90.722 ac 0.16% Impervious = 0.146 ac

Summary for Subcatchment PDA-1:

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
	0.627	30	Woods, Good, HSG A
	0.238	30	Brush, Good, HSG A
	0.865	30	Weighted Average
	0.865		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
1.7	72	0.0210	0.72		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
8.9	122	Total			

Summary for Subcatchment PDA-10:

Runoff = 0.03 cfs @ 15.67 hrs, Volume= 0.021 af, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
	0.244	30	Woods, Good, HSG A
	5.609	39	>75% Grass cover, Good, HSG A
	0.179	96	Gravel surface, HSG A
*	0.270	96	Existing Gravel surface, HSG A
	6.302	43	Weighted Average
	6.302		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
6.2	448	0.0300	1.21		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
4.6	305	0.0250	1.11		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
0.1	20	0.3330	4.04		**Shallow Concentrated Flow, Tc-4** Short Grass Pasture Kv= 7.0 fps
15.5	823	Total			

Summary for Subcatchment PDA-11:

Runoff = 0.03 cfs @ 21.45 hrs, Volume= 0.018 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
	11.109	39	>75% Grass cover, Good, HSG A
	0.456	96	Gravel surface, HSG A
*	0.041	96	Existing Gravel surface, HSG A
	11.606	41	Weighted Average
	11.606		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
14.0	559	0.0090	0.66		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
9.1	466	0.0150	0.86		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
30.3	1,075	Total			

Summary for Subcatchment PDA-12:

Runoff = 0.18 cfs @ 12.15 hrs, Volume= 0.024 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.458	39	>75% Grass cover, Good, HSG A
0.238	96	Gravel surface, HSG A
0.696	58	Weighted Average
0.696		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Summary for Subcatchment PDA-13:

Runoff = 0.17 cfs @ 12.22 hrs, Volume= 0.027 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
	0.579	39	>75% Grass cover, Good, HSG A
	0.125	96	Gravel surface, HSG A
*	0.150	96	Existing Gravel surface, HSG A
	0.854	57	Weighted Average
	0.854		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0600	0.24		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
4.9	410	0.0390	1.38		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
8.4	460	Total			

Summary for Subcatchment PDA-2:

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
	9.872	30	Woods, Good, HSG A
	0.253	77	Woods, Good, HSG D
	0.119	30	Brush, Good, HSG A
	0.012	73	Brush, Good, HSG D
	0.106	96	Gravel surface, HSG A
	0.004	96	Gravel surface, HSG D
*	0.265	96	Existing Gravel surface, HSG A
*	0.142	96	Existing Gravel surface, HSG D
	10.773	34	Weighted Average
	10.773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
14.0	399	0.0090	0.47		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
29.8	449	Total			

Summary for Subcatchment PDA-3:

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
	2.548	30	Woods, Good, HSG A
	0.182	30	Brush, Good, HSG A
	0.019	96	Gravel surface, HSG A
*	0.087	96	Existing Gravel surface, HSG A
	2.836	32	Weighted Average
	2.836		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	50	0.0050	0.04		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
22.7	527	0.0060	0.39		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
43.5	577	Total			

Summary for Subcatchment PDA-4:

Runoff = 0.00 cfs @ 23.42 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.260	39	>75% Grass cover, Good, HSG A
0.260		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Summary for Subcatchment PDA-5:

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
1.158	30	Brush, Good, HSG A
0.069	96	Gravel surface, HSG A
1.227	34	Weighted Average
1.227		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Summary for Subcatchment PDA-6:

Runoff = 0.06 cfs @ 17.12 hrs, Volume= 0.044 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
	17.489	39	>75% Grass cover, Good, HSG A
	1.011	96	Gravel surface, HSG A
*	0.029	98	Equipment Pad Area, HSG A
	18.529	42	Weighted Average
	18.500		99.84% Pervious Area
	0.029		0.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
12.3	883	0.0290	1.19		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
0.0	6	0.3330	4.04		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
19.5	939	Total			

Summary for Subcatchment PDA-7:

Runoff = 0.03 cfs @ 21.16 hrs, Volume= 0.021 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.002	30	Woods, Good, HSG A
13.303	39	>75% Grass cover, Good, HSG A
0.435	96	Gravel surface, HSG A
0.029	98	Equipment Pad Area, HSG A
13.769	41	Weighted Average
13.740		99.79% Pervious Area
0.029		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
10.8	835	0.0340	1.29		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.3330	4.04		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
16.3	894	Total			

Summary for Subcatchment PDA-8:

Runoff = 0.10 cfs @ 14.85 hrs, Volume= 0.062 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
	0.048	30	Woods, Good, HSG A
	7.327	39	>75% Grass cover, Good, HSG A
	0.336	80	>75% Grass cover, Good, HSG D
	0.673	96	Gravel surface, HSG A
	0.004	96	Gravel surface, HSG D
	0.059	98	Equipment Pad Area, HSG A
*	0.114	96	Existing Gravel surface, HSG A
*	0.007	96	Existing Gravel surface, HSG D
	8.568	46	Weighted Average
	8.509		99.31% Pervious Area
	0.059		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
8.3	384	0.0120	0.77		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
0.6	92	0.1200	2.42		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
0.1	33	0.3330	4.04		**Shallow Concentrated Flow, Tc-4** Short Grass Pasture Kv= 7.0 fps
18.5	559	Total			

Summary for Subcatchment PDA-9:

Runoff = 0.07 cfs @ 16.54 hrs, Volume= 0.049 af, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

	Area (ac)	CN	Description
	13.525	39	>75% Grass cover, Good, HSG A
	1.027	96	Gravel surface, HSG A
	0.029	98	Equipment Pad Area, HSG A
*	0.002	96	Existing Gravel surface, HSG A
	14.583	43	Weighted Average
	14.554		99.80% Pervious Area
	0.029		0.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
24.9	810	0.0060	0.54		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
8.1	572	0.0280	1.17		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
5.7	228	0.0090	0.66		**Shallow Concentrated Flow, Tc-4** Short Grass Pasture Kv= 7.0 fps
12.6	579	0.0120	0.77		**Shallow Concentrated Flow, Tc-5** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.3330	4.04		**Shallow Concentrated Flow, Tc-6** Short Grass Pasture Kv= 7.0 fps
60.8	2,248	Total			

Summary for Reach DP-1: DP-1

Inflow Area = 19.394 ac, 0.15% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2: DP-2

Inflow Area = 33.110 ac, 0.27% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-3: DP-3

Inflow Area = 23.721 ac, 0.12% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-4: DP-4

Inflow Area = 12.720 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 23.42 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 23.42 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-5: DP-5

Inflow Area = 1.923 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 1: BASIN-1

Inflow Area = 18.529 ac, 0.16% Impervious, Inflow Depth = 0.03" for 2-Year event
Inflow = 0.06 cfs @ 17.12 hrs, Volume= 0.044 af
Outflow = 0.06 cfs @ 17.35 hrs, Volume= 0.044 af, Atten= 0%, Lag= 13.5 min
Discarded = 0.06 cfs @ 17.35 hrs, Volume= 0.044 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 50.02' @ 17.35 hrs Surf.Area= 3,205 sf Storage= 53 cf

Plug-Flow detention time= 14.6 min calculated for 0.043 af (100% of inflow)
Center-of-Mass det. time= 14.7 min (1,180.0 - 1,165.3)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	49,872 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
50.00	3,167	0	0
51.00	5,415	4,291	4,291
52.00	8,082	6,749	11,040
53.00	11,128	9,605	20,645
54.00	14,526	12,827	33,472
55.00	18,274	16,400	49,872

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Secondary	54.15'	**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
#3	Primary	53.75'	**3.0" Round Culvert X 2.00** L= 18.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 53.75' / 53.50' S= 0.0139 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.18 cfs @ 17.35 hrs HW=50.02' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=50.00' (Free Discharge)
└─**3=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=50.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2: BASIN-2

Inflow Area = 13.769 ac, 0.21% Impervious, Inflow Depth = 0.02" for 2-Year event
Inflow = 0.03 cfs @ 21.16 hrs, Volume= 0.021 af
Outflow = 0.03 cfs @ 21.35 hrs, Volume= 0.021 af, Atten= 0%, Lag= 11.4 min
Discarded = 0.03 cfs @ 21.35 hrs, Volume= 0.021 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 47.02' @ 21.35 hrs Surf.Area= 1,214 sf Storage= 19 cf

Plug-Flow detention time= 10.9 min calculated for 0.021 af (100% of inflow)
Center-of-Mass det. time= 11.0 min (1,211.2 - 1,200.2)

Volume	Invert	Avail.Storage	Storage Description
#1	47.00'	37,897 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
47.00	1,122	0	0
48.00	6,637	3,880	3,880
49.00	9,684	8,161	12,040
50.00	12,900	11,292	23,332
51.00	16,230	14,565	37,897

Device	Routing	Invert	Outlet Devices
#1	Discarded	47.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	50.00'	**6.0" Round Culvert** L= 34.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 50.00' / 47.00' S= 0.0882 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.07 cfs @ 21.35 hrs HW=47.02' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=47.00' (Free Discharge)
└─**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 3: BASIN-3

Inflow Area =	22.337 ac,	0.39% Impervious,	Inflow Depth = 0.03"	for 2-Year event
Inflow =	0.10 cfs @	14.85 hrs, Volume=	0.062 af	
Outflow =	0.10 cfs @	15.09 hrs, Volume=	0.062 af,	Atten= 1%, Lag= 14.2 min
Discarded =	0.10 cfs @	15.09 hrs, Volume=	0.062 af	
Primary =	0.00 cfs @	5.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 28.02' @ 15.09 hrs Surf.Area= 4,385 sf Storage= 88 cf

Plug-Flow detention time= 15.1 min calculated for 0.062 af (100% of inflow)
Center-of-Mass det. time= 14.8 min (1,077.1 - 1,062.2)

Volume	Invert	Avail.Storage	Storage Description
#1	28.00'	36,352 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.00	4,364	0	0
29.00	5,408	4,886	4,886
30.00	6,566	5,987	10,873
31.00	7,801	7,184	18,057
32.00	9,130	8,466	26,522
33.00	10,529	9,830	36,352

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	32.00'	**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

Discarded OutFlow Max=0.24 cfs @ 15.09 hrs HW=28.02' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=28.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4: BASIN-4

Inflow Area =	6.302 ac,	0.00% Impervious,	Inflow Depth = 0.04"	for 2-Year event
Inflow =	0.03 cfs @	15.67 hrs, Volume=	0.021 af	
Outflow =	0.03 cfs @	15.85 hrs, Volume=	0.021 af,	Atten= 1%, Lag= 10.3 min
Discarded =	0.03 cfs @	15.85 hrs, Volume=	0.021 af	
Primary =	0.00 cfs @	5.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 46.51' @ 15.85 hrs Surf.Area= 2,891 sf Storage= 19 cf

Plug-Flow detention time= 10.3 min calculated for 0.021 af (100% of inflow)

Center-of-Mass det. time= 10.4 min (1,140.3 - 1,130.0)

Volume	Invert	Avail.Storage	Storage Description
#1	46.50'	20,301 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
46.50	2,880	0	0
47.00	3,674	1,639	1,639
48.00	5,333	4,504	6,142
49.00	7,058	6,196	12,338
50.00	8,869	7,964	20,301

Device	Routing	Invert	Outlet Devices
#1	Discarded	46.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	49.00'	**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

Discarded OutFlow Max=0.16 cfs @ 15.85 hrs HW=46.51' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=46.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 5: BASIN-5

Inflow Area =	20.885 ac,	0.14% Impervious, Inflow Depth = 0.03"	for 2-Year event	
Inflow =	0.07 cfs @	16.54 hrs, Volume=	0.049 af	
Outflow =	0.07 cfs @	16.84 hrs, Volume=	0.049 af,	Atten= 1%, Lag= 18.0 min
Discarded =	0.07 cfs @	16.84 hrs, Volume=	0.049 af	
Primary =	0.00 cfs @	5.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 43.51' @ 16.84 hrs Surf.Area= 4,267 sf Storage= 55 cf

Plug-Flow detention time= 13.3 min calculated for 0.049 af (100% of inflow)
Center-of-Mass det. time= 13.3 min (1,185.3 - 1,172.0)

Volume	Invert	Avail.Storage	Storage Description
#1	43.50'	45,119 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.50	4,237	0	0
44.00	5,396	2,408	2,408
45.00	7,877	6,637	9,045
46.00	10,550	9,214	18,258
47.00	13,384	11,967	30,225
48.00	16,403	14,894	45,119

Device	Routing	Invert	Outlet Devices
#1	Discarded	43.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	47.00'	**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

Discarded OutFlow Max=0.24 cfs @ 16.84 hrs HW=43.51' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=43.50' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 6: BASIN-6

Inflow Area = 11.606 ac, 0.00% Impervious, Inflow Depth = 0.02" for 2-Year event
Inflow = 0.03 cfs @ 21.45 hrs, Volume= 0.018 af
Outflow = 0.03 cfs @ 21.51 hrs, Volume= 0.018 af, Atten= 0%, Lag= 3.9 min
Discarded = 0.03 cfs @ 21.51 hrs, Volume= 0.018 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 67.01' @ 21.51 hrs Surf.Area= 1,560 sf Storage= 13 cf

Plug-Flow detention time= 8.4 min calculated for 0.018 af (100% of inflow)
Center-of-Mass det. time= 8.5 min (1,221.6 - 1,213.2)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	50,094 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
67.00	1,507	0	0
68.00	7,940	4,724	4,724
69.00	20,020	13,980	18,704
70.00	42,760	31,390	50,094

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	69.00'	**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

Discarded OutFlow Max=0.09 cfs @ 21.51 hrs HW=67.01' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=67.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 7: BASIN-7

Inflow Area = 0.696 ac, 0.00% Impervious, Inflow Depth = 0.41" for 2-Year event
Inflow = 0.18 cfs @ 12.15 hrs, Volume= 0.024 af
Outflow = 0.07 cfs @ 12.61 hrs, Volume= 0.024 af, Atten= 62%, Lag= 27.5 min
Discarded = 0.07 cfs @ 12.61 hrs, Volume= 0.024 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 60.12' @ 12.61 hrs Surf.Area= 1,211 sf Storage= 146 cf

Plug-Flow detention time= 16.2 min calculated for 0.024 af (100% of inflow)
Center-of-Mass det. time= 16.0 min (939.5 - 923.5)

Volume	Invert	Avail.Storage	Storage Description
#1	60.00'	6,142 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.00	1,154	0	0
61.00	1,612	1,383	1,383
61.50	1,960	893	2,276
62.00	2,351	1,078	3,354
63.00	3,226	2,789	6,142

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	62.00'	**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

Discarded OutFlow Max=0.07 cfs @ 12.61 hrs HW=60.12' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=60.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 8: BASIN-8

Inflow Area = 12.460 ac, 0.00% Impervious, Inflow Depth = 0.03" for 2-Year event
Inflow = 0.17 cfs @ 12.22 hrs, Volume= 0.027 af
Outflow = 0.05 cfs @ 13.01 hrs, Volume= 0.027 af, Atten= 68%, Lag= 47.6 min
Discarded = 0.05 cfs @ 13.01 hrs, Volume= 0.027 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 62.23' @ 13.01 hrs Surf.Area= 978 sf Storage= 199 cf

Plug-Flow detention time= 31.7 min calculated for 0.027 af (100% of inflow)
Center-of-Mass det. time= 31.5 min (963.4 - 931.9)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	7,173 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	739	0	0
63.00	1,770	1,255	1,255
64.00	2,858	2,314	3,569
65.00	4,351	3,605	7,173

Device	Routing	Invert	Outlet Devices
#1	Discarded	62.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	64.00'	**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

Discarded OutFlow Max=0.05 cfs @ 13.01 hrs HW=62.23' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=62.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA-1: Runoff Area=0.865 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=122' Tc=8.9 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment PDA-10: Runoff Area=6.302 ac 0.00% Impervious Runoff Depth=0.27"
Flow Length=823' Tc=15.5 min CN=43 Runoff=0.48 cfs 0.144 af

Subcatchment PDA-11: Runoff Area=11.606 ac 0.00% Impervious Runoff Depth=0.20"
Flow Length=1,075' Tc=30.3 min CN=41 Runoff=0.37 cfs 0.198 af

Subcatchment PDA-12: Runoff Area=0.696 ac 0.00% Impervious Runoff Depth=1.01"
Tc=6.0 min CN=58 Runoff=0.68 cfs 0.058 af

Subcatchment PDA-13: Runoff Area=0.854 ac 0.00% Impervious Runoff Depth=0.95"
Flow Length=460' Tc=8.4 min CN=57 Runoff=0.69 cfs 0.068 af

Subcatchment PDA-2: Runoff Area=10.773 ac 0.00% Impervious Runoff Depth=0.03"
Flow Length=449' Tc=29.8 min CN=34 Runoff=0.04 cfs 0.030 af

Subcatchment PDA-3: Runoff Area=2.836 ac 0.00% Impervious Runoff Depth=0.01"
Flow Length=577' Tc=43.5 min CN=32 Runoff=0.00 cfs 0.002 af

Subcatchment PDA-4: Runoff Area=0.260 ac 0.00% Impervious Runoff Depth=0.14"
Tc=6.0 min CN=39 Runoff=0.01 cfs 0.003 af

Subcatchment PDA-5: Runoff Area=1.227 ac 0.00% Impervious Runoff Depth=0.03"
Tc=6.0 min CN=34 Runoff=0.00 cfs 0.003 af

Subcatchment PDA-6: Runoff Area=18.529 ac 0.16% Impervious Runoff Depth=0.24"
Flow Length=939' Tc=19.5 min CN=42 Runoff=0.96 cfs 0.368 af

Subcatchment PDA-7: Runoff Area=13.769 ac 0.21% Impervious Runoff Depth=0.20"
Flow Length=894' Tc=16.3 min CN=41 Runoff=0.51 cfs 0.235 af

Subcatchment PDA-8: Runoff Area=8.568 ac 0.69% Impervious Runoff Depth=0.39"
Flow Length=559' Tc=18.5 min CN=46 Runoff=1.26 cfs 0.280 af

Subcatchment PDA-9: Runoff Area=14.583 ac 0.20% Impervious Runoff Depth=0.27"
Flow Length=2,248' Tc=60.8 min CN=43 Runoff=0.69 cfs 0.333 af

Reach DP-1: DP-1 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP-2: DP-2 Inflow=0.04 cfs 0.030 af
Outflow=0.04 cfs 0.030 af

Reach DP-3: DP-3 Inflow=0.00 cfs 0.002 af
Outflow=0.00 cfs 0.002 af

Reach DP-4: DP-4 Inflow=0.01 cfs 0.003 af
Outflow=0.01 cfs 0.003 af

Reach DP-5: DP-5 Inflow=0.00 cfs 0.003 af
Outflow=0.00 cfs 0.003 af

Pond 1: BASIN-1 Peak Elev=51.14' Storage=5,082 cf Inflow=0.96 cfs 0.368 af
Discarded=0.32 cfs 0.368 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.32 cfs 0.368 af

Pond 2: BASIN-2 Peak Elev=47.70' Storage=2,123 cf Inflow=0.51 cfs 0.235 af
Discarded=0.28 cfs 0.235 af Primary=0.00 cfs 0.000 af Outflow=0.28 cfs 0.235 af

Pond 3: BASIN-3 Peak Elev=28.74' Storage=3,540 cf Inflow=1.26 cfs 0.280 af
Discarded=0.29 cfs 0.280 af Primary=0.00 cfs 0.000 af Outflow=0.29 cfs 0.280 af

Pond 4: BASIN-4 Peak Elev=46.82' Storage=1,009 cf Inflow=0.48 cfs 0.144 af
Discarded=0.19 cfs 0.144 af Primary=0.00 cfs 0.000 af Outflow=0.19 cfs 0.144 af

Pond 5: BASIN-5 Peak Elev=44.22' Storage=3,651 cf Inflow=0.69 cfs 0.333 af
Discarded=0.33 cfs 0.333 af Primary=0.00 cfs 0.000 af Outflow=0.33 cfs 0.333 af

Pond 6: BASIN-6 Peak Elev=67.47' Storage=1,433 cf Inflow=0.37 cfs 0.198 af
Discarded=0.25 cfs 0.198 af Primary=0.00 cfs 0.000 af Outflow=0.25 cfs 0.198 af

Pond 7: BASIN-7 Peak Elev=60.65' Storage=848 cf Inflow=0.68 cfs 0.058 af
Discarded=0.08 cfs 0.058 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.058 af

Pond 8: BASIN-8 Peak Elev=62.86' Storage=1,010 cf Inflow=0.69 cfs 0.068 af
Discarded=0.09 cfs 0.068 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.068 af

Total Runoff Area = 90.868 ac Runoff Volume = 1.723 af Average Runoff Depth = 0.23"
99.84% Pervious = 90.722 ac 0.16% Impervious = 0.146 ac

Summary for Subcatchment PDA-1:

Runoff = 0.00 cfs @ 24.03 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (ac)	CN	Description
	0.627	30	Woods, Good, HSG A
	0.238	30	Brush, Good, HSG A
	0.865	30	Weighted Average
	0.865		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
1.7	72	0.0210	0.72		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
8.9	122	Total			

Summary for Subcatchment PDA-10:

Runoff = 0.48 cfs @ 12.54 hrs, Volume= 0.144 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (ac)	CN	Description
	0.244	30	Woods, Good, HSG A
	5.609	39	>75% Grass cover, Good, HSG A
	0.179	96	Gravel surface, HSG A
*	0.270	96	Existing Gravel surface, HSG A
	6.302	43	Weighted Average
	6.302		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
6.2	448	0.0300	1.21		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
4.6	305	0.0250	1.11		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
0.1	20	0.3330	4.04		**Shallow Concentrated Flow, Tc-4** Short Grass Pasture Kv= 7.0 fps
15.5	823	Total			

Summary for Subcatchment PDA-11:

Runoff = 0.37 cfs @ 13.05 hrs, Volume= 0.198 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (ac)	CN	Description
	11.109	39	>75% Grass cover, Good, HSG A
	0.456	96	Gravel surface, HSG A
*	0.041	96	Existing Gravel surface, HSG A
	11.606	41	Weighted Average
	11.606		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
14.0	559	0.0090	0.66		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
9.1	466	0.0150	0.86		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
30.3	1,075	Total			

Summary for Subcatchment PDA-12:

Runoff = 0.68 cfs @ 12.11 hrs, Volume= 0.058 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
0.458	39	>75% Grass cover, Good, HSG A
0.238	96	Gravel surface, HSG A
0.696	58	Weighted Average
0.696		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Summary for Subcatchment PDA-13:

Runoff = 0.69 cfs @ 12.15 hrs, Volume= 0.068 af, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (ac)	CN	Description
	0.579	39	>75% Grass cover, Good, HSG A
	0.125	96	Gravel surface, HSG A
*	0.150	96	Existing Gravel surface, HSG A
	0.854	57	Weighted Average
	0.854		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0600	0.24		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
4.9	410	0.0390	1.38		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
8.4	460	Total			

Summary for Subcatchment PDA-2:

Runoff = 0.04 cfs @ 17.48 hrs, Volume= 0.030 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (ac)	CN	Description
	9.872	30	Woods, Good, HSG A
	0.253	77	Woods, Good, HSG D
	0.119	30	Brush, Good, HSG A
	0.012	73	Brush, Good, HSG D
	0.106	96	Gravel surface, HSG A
	0.004	96	Gravel surface, HSG D
*	0.265	96	Existing Gravel surface, HSG A
*	0.142	96	Existing Gravel surface, HSG D
	10.773	34	Weighted Average
	10.773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
14.0	399	0.0090	0.47		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
29.8	449	Total			

Summary for Subcatchment PDA-3:

Runoff = 0.00 cfs @ 23.45 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (ac)	CN	Description
	2.548	30	Woods, Good, HSG A
	0.182	30	Brush, Good, HSG A
	0.019	96	Gravel surface, HSG A
*	0.087	96	Existing Gravel surface, HSG A
	2.836	32	Weighted Average
	2.836		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	50	0.0050	0.04		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
22.7	527	0.0060	0.39		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
43.5	577	Total			

Summary for Subcatchment PDA-4:

Runoff = 0.01 cfs @ 13.76 hrs, Volume= 0.003 af, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
0.260	39	>75% Grass cover, Good, HSG A
0.260		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Summary for Subcatchment PDA-5:

Runoff = 0.00 cfs @ 17.13 hrs, Volume= 0.003 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
1.158	30	Brush, Good, HSG A
0.069	96	Gravel surface, HSG A
1.227	34	Weighted Average
1.227		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Summary for Subcatchment PDA-6:

Runoff = 0.96 cfs @ 12.63 hrs, Volume= 0.368 af, Depth= 0.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (ac)	CN	Description
	17.489	39	>75% Grass cover, Good, HSG A
	1.011	96	Gravel surface, HSG A
*	0.029	98	Equipment Pad Area, HSG A
	18.529	42	Weighted Average
	18.500		99.84% Pervious Area
	0.029		0.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
12.3	883	0.0290	1.19		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
0.0	6	0.3330	4.04		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
19.5	939	Total			

Summary for Subcatchment PDA-7:

Runoff = 0.51 cfs @ 12.62 hrs, Volume= 0.235 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
0.002	30	Woods, Good, HSG A
13.303	39	>75% Grass cover, Good, HSG A
0.435	96	Gravel surface, HSG A
0.029	98	Equipment Pad Area, HSG A
13.769	41	Weighted Average
13.740		99.79% Pervious Area
0.029		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
10.8	835	0.0340	1.29		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.3330	4.04		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
16.3	894	Total			

Summary for Subcatchment PDA-8:

Runoff = 1.26 cfs @ 12.51 hrs, Volume= 0.280 af, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (ac)	CN	Description
	0.048	30	Woods, Good, HSG A
	7.327	39	>75% Grass cover, Good, HSG A
	0.336	80	>75% Grass cover, Good, HSG D
	0.673	96	Gravel surface, HSG A
	0.004	96	Gravel surface, HSG D
	0.059	98	Equipment Pad Area, HSG A
*	0.114	96	Existing Gravel surface, HSG A
*	0.007	96	Existing Gravel surface, HSG D
	8.568	46	Weighted Average
	8.509		99.31% Pervious Area
	0.059		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
8.3	384	0.0120	0.77		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
0.6	92	0.1200	2.42		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
0.1	33	0.3330	4.04		**Shallow Concentrated Flow, Tc-4** Short Grass Pasture Kv= 7.0 fps
18.5	559	Total			

Summary for Subcatchment PDA-9:

Runoff = 0.69 cfs @ 13.37 hrs, Volume= 0.333 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

	Area (ac)	CN	Description
	13.525	39	>75% Grass cover, Good, HSG A
	1.027	96	Gravel surface, HSG A
	0.029	98	Equipment Pad Area, HSG A
*	0.002	96	Existing Gravel surface, HSG A
	14.583	43	Weighted Average
	14.554		99.80% Pervious Area
	0.029		0.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
24.9	810	0.0060	0.54		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
8.1	572	0.0280	1.17		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
5.7	228	0.0090	0.66		**Shallow Concentrated Flow, Tc-4** Short Grass Pasture Kv= 7.0 fps
12.6	579	0.0120	0.77		**Shallow Concentrated Flow, Tc-5** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.3330	4.04		**Shallow Concentrated Flow, Tc-6** Short Grass Pasture Kv= 7.0 fps
60.8	2,248	Total			

Summary for Reach DP-1: DP-1

Inflow Area = 19.394 ac, 0.15% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 24.03 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 24.03 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2: DP-2

Inflow Area = 33.110 ac, 0.27% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.04 cfs @ 17.48 hrs, Volume= 0.030 af
Outflow = 0.04 cfs @ 17.48 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-3: DP-3

Inflow Area = 23.721 ac, 0.12% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 23.45 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 23.45 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-4: DP-4

Inflow Area = 12.720 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.01 cfs @ 13.76 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 13.76 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-5: DP-5

Inflow Area =	1.923 ac,	0.00% Impervious, Inflow Depth = 0.02"	for 10-Year event
Inflow =	0.00 cfs @	17.13 hrs, Volume=	0.003 af
Outflow =	0.00 cfs @	17.13 hrs, Volume=	0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 1: BASIN-1

Inflow Area =	18.529 ac,	0.16% Impervious, Inflow Depth = 0.24"	for 10-Year event
Inflow =	0.96 cfs @	12.63 hrs, Volume=	0.368 af
Outflow =	0.32 cfs @	17.65 hrs, Volume=	0.368 af, Atten= 66%, Lag= 301.1 min
Discarded =	0.32 cfs @	17.65 hrs, Volume=	0.368 af
Primary =	0.00 cfs @	5.00 hrs, Volume=	0.000 af
Secondary =	0.00 cfs @	5.00 hrs, Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 51.14' @ 17.65 hrs Surf.Area= 5,791 sf Storage= 5,082 cf

Plug-Flow detention time= 203.4 min calculated for 0.368 af (100% of inflow)
Center-of-Mass det. time= 203.4 min (1,206.0 - 1,002.6)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	49,872 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
50.00	3,167	0	0
51.00	5,415	4,291	4,291
52.00	8,082	6,749	11,040
53.00	11,128	9,605	20,645
54.00	14,526	12,827	33,472
55.00	18,274	16,400	49,872

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Secondary	54.15'	**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
#3	Primary	53.75'	**3.0" Round Culvert X 2.00** L= 18.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 53.75' / 53.50' S= 0.0139 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.32 cfs @ 17.65 hrs HW=51.14' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=50.00' (Free Discharge)
└─**3=Culvert** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=50.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2: BASIN-2

Inflow Area = 13.769 ac, 0.21% Impervious, Inflow Depth = 0.20" for 10-Year event
Inflow = 0.51 cfs @ 12.62 hrs, Volume= 0.235 af
Outflow = 0.28 cfs @ 16.15 hrs, Volume= 0.235 af, Atten= 46%, Lag= 211.4 min
Discarded = 0.28 cfs @ 16.15 hrs, Volume= 0.235 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 47.70' @ 16.15 hrs Surf.Area= 4,967 sf Storage= 2,123 cf

Plug-Flow detention time= 100.9 min calculated for 0.235 af (100% of inflow)
Center-of-Mass det. time= 100.7 min (1,113.2 - 1,012.6)

Volume	Invert	Avail.Storage	Storage Description
#1	47.00'	37,897 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
47.00	1,122	0	0
48.00	6,637	3,880	3,880
49.00	9,684	8,161	12,040
50.00	12,900	11,292	23,332
51.00	16,230	14,565	37,897

Device	Routing	Invert	Outlet Devices
#1	Discarded	47.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	50.00'	**6.0" Round Culvert** L= 34.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 50.00' / 47.00' S= 0.0882 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.28 cfs @ 16.15 hrs HW=47.70' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=47.00' (Free Discharge)
└─**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 3: BASIN-3

Inflow Area = 22.337 ac, 0.39% Impervious, Inflow Depth = 0.15" for 10-Year event
Inflow = 1.26 cfs @ 12.51 hrs, Volume= 0.280 af
Outflow = 0.29 cfs @ 16.06 hrs, Volume= 0.280 af, Atten= 77%, Lag= 212.7 min
Discarded = 0.29 cfs @ 16.06 hrs, Volume= 0.280 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 28.74' @ 16.06 hrs Surf.Area= 5,142 sf Storage= 3,540 cf

Plug-Flow detention time= 140.7 min calculated for 0.280 af (100% of inflow)
Center-of-Mass det. time= 140.5 min (1,102.7 - 962.2)

Volume	Invert	Avail.Storage	Storage Description
#1	28.00'	36,352 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.00	4,364	0	0
29.00	5,408	4,886	4,886
30.00	6,566	5,987	10,873
31.00	7,801	7,184	18,057
32.00	9,130	8,466	26,522
33.00	10,529	9,830	36,352

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	32.00'	**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

Discarded OutFlow Max=0.29 cfs @ 16.06 hrs HW=28.74' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.29 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=28.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4: BASIN-4

Inflow Area = 6.302 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-Year event
Inflow = 0.48 cfs @ 12.54 hrs, Volume= 0.144 af
Outflow = 0.19 cfs @ 15.48 hrs, Volume= 0.144 af, Atten= 61%, Lag= 176.4 min
Discarded = 0.19 cfs @ 15.48 hrs, Volume= 0.144 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 46.82' @ 15.48 hrs Surf.Area= 3,391 sf Storage= 1,009 cf

Plug-Flow detention time= 52.9 min calculated for 0.144 af (100% of inflow)

Center-of-Mass det. time= 52.9 min (1,040.3 - 987.4)

Volume	Invert	Avail.Storage	Storage Description
#1	46.50'	20,301 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
46.50	2,880	0	0
47.00	3,674	1,639	1,639
48.00	5,333	4,504	6,142
49.00	7,058	6,196	12,338
50.00	8,869	7,964	20,301

Device	Routing	Invert	Outlet Devices
#1	Discarded	46.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	49.00'	**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

Discarded OutFlow Max=0.19 cfs @ 15.48 hrs HW=46.82' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=46.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 5: BASIN-5

Inflow Area = 20.885 ac, 0.14% Impervious, Inflow Depth = 0.19" for 10-Year event
Inflow = 0.69 cfs @ 13.37 hrs, Volume= 0.333 af
Outflow = 0.33 cfs @ 17.39 hrs, Volume= 0.333 af, Atten= 52%, Lag= 241.6 min
Discarded = 0.33 cfs @ 17.39 hrs, Volume= 0.333 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 44.22' @ 17.39 hrs Surf.Area= 5,940 sf Storage= 3,651 cf

Plug-Flow detention time= 130.7 min calculated for 0.333 af (100% of inflow)
Center-of-Mass det. time= 130.6 min (1,160.0 - 1,029.4)

Volume	Invert	Avail.Storage	Storage Description
#1	43.50'	45,119 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.50	4,237	0	0
44.00	5,396	2,408	2,408
45.00	7,877	6,637	9,045
46.00	10,550	9,214	18,258
47.00	13,384	11,967	30,225
48.00	16,403	14,894	45,119

Device	Routing	Invert	Outlet Devices
#1	Discarded	43.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	47.00'	**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

Discarded OutFlow Max=0.33 cfs @ 17.39 hrs HW=44.22' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.33 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=43.50' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 6: BASIN-6

Inflow Area = 11.606 ac, 0.00% Impervious, Inflow Depth = 0.20" for 10-Year event
Inflow = 0.37 cfs @ 13.05 hrs, Volume= 0.198 af
Outflow = 0.25 cfs @ 16.08 hrs, Volume= 0.198 af, Atten= 32%, Lag= 181.5 min
Discarded = 0.25 cfs @ 16.08 hrs, Volume= 0.198 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 67.47' @ 16.08 hrs Surf.Area= 4,551 sf Storage= 1,433 cf

Plug-Flow detention time= 69.3 min calculated for 0.198 af (100% of inflow)
Center-of-Mass det. time= 69.2 min (1,094.7 - 1,025.5)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	50,094 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
67.00	1,507	0	0
68.00	7,940	4,724	4,724
69.00	20,020	13,980	18,704
70.00	42,760	31,390	50,094

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	69.00'	**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

Discarded OutFlow Max=0.25 cfs @ 16.08 hrs HW=67.47' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=67.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 7: BASIN-7

Inflow Area = 0.696 ac, 0.00% Impervious, Inflow Depth = 1.01" for 10-Year event
Inflow = 0.68 cfs @ 12.11 hrs, Volume= 0.058 af
Outflow = 0.08 cfs @ 13.69 hrs, Volume= 0.058 af, Atten= 88%, Lag= 95.2 min
Discarded = 0.08 cfs @ 13.69 hrs, Volume= 0.058 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 60.65' @ 13.69 hrs Surf.Area= 1,452 sf Storage= 848 cf

Plug-Flow detention time= 108.3 min calculated for 0.058 af (100% of inflow)
Center-of-Mass det. time= 108.1 min (995.2 - 887.1)

Volume	Invert	Avail.Storage	Storage Description
#1	60.00'	6,142 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.00	1,154	0	0
61.00	1,612	1,383	1,383
61.50	1,960	893	2,276
62.00	2,351	1,078	3,354
63.00	3,226	2,789	6,142

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	62.00'	**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

Discarded OutFlow Max=0.08 cfs @ 13.69 hrs HW=60.65' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=60.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 8: BASIN-8

Inflow Area = 12.460 ac, 0.00% Impervious, Inflow Depth = 0.07" for 10-Year event
Inflow = 0.69 cfs @ 12.15 hrs, Volume= 0.068 af
Outflow = 0.09 cfs @ 13.87 hrs, Volume= 0.068 af, Atten= 87%, Lag= 103.6 min
Discarded = 0.09 cfs @ 13.87 hrs, Volume= 0.068 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 62.86' @ 13.87 hrs Surf.Area= 1,621 sf Storage= 1,010 cf

Plug-Flow detention time= 129.9 min calculated for 0.067 af (100% of inflow)
Center-of-Mass det. time= 129.7 min (1,022.7 - 893.1)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	7,173 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	739	0	0
63.00	1,770	1,255	1,255
64.00	2,858	2,314	3,569
65.00	4,351	3,605	7,173

Device	Routing	Invert	Outlet Devices
#1	Discarded	62.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	64.00'	**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

Discarded OutFlow Max=0.09 cfs @ 13.87 hrs HW=62.86' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=62.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA-1: Runoff Area=0.865 ac 0.00% Impervious Runoff Depth=0.21"
Flow Length=122' Tc=8.9 min CN=30 Runoff=0.02 cfs 0.015 af

Subcatchment PDA-10: Runoff Area=6.302 ac 0.00% Impervious Runoff Depth=1.07"
Flow Length=823' Tc=15.5 min CN=43 Runoff=4.03 cfs 0.564 af

Subcatchment PDA-11: Runoff Area=11.606 ac 0.00% Impervious Runoff Depth=0.92"
Flow Length=1,075' Tc=30.3 min CN=41 Runoff=4.63 cfs 0.888 af

Subcatchment PDA-12: Runoff Area=0.696 ac 0.00% Impervious Runoff Depth=2.41"
Tc=6.0 min CN=58 Runoff=1.85 cfs 0.140 af

Subcatchment PDA-13: Runoff Area=0.854 ac 0.00% Impervious Runoff Depth=2.31"
Flow Length=460' Tc=8.4 min CN=57 Runoff=1.98 cfs 0.165 af

Subcatchment PDA-2: Runoff Area=10.773 ac 0.00% Impervious Runoff Depth=0.43"
Flow Length=449' Tc=29.8 min CN=34 Runoff=1.11 cfs 0.387 af

Subcatchment PDA-3: Runoff Area=2.836 ac 0.00% Impervious Runoff Depth=0.32"
Flow Length=577' Tc=43.5 min CN=32 Runoff=0.14 cfs 0.074 af

Subcatchment PDA-4: Runoff Area=0.260 ac 0.00% Impervious Runoff Depth=0.77"
Tc=6.0 min CN=39 Runoff=0.11 cfs 0.017 af

Subcatchment PDA-5: Runoff Area=1.227 ac 0.00% Impervious Runoff Depth=0.43"
Tc=6.0 min CN=34 Runoff=0.18 cfs 0.044 af

Subcatchment PDA-6: Runoff Area=18.529 ac 0.16% Impervious Runoff Depth=1.00"
Flow Length=939' Tc=19.5 min CN=42 Runoff=9.76 cfs 1.537 af

Subcatchment PDA-7: Runoff Area=13.769 ac 0.21% Impervious Runoff Depth=0.92"
Flow Length=894' Tc=16.3 min CN=41 Runoff=6.65 cfs 1.053 af

Subcatchment PDA-8: Runoff Area=8.568 ac 0.69% Impervious Runoff Depth=1.32"
Flow Length=559' Tc=18.5 min CN=46 Runoff=7.18 cfs 0.943 af

Subcatchment PDA-9: Runoff Area=14.583 ac 0.20% Impervious Runoff Depth=1.07"
Flow Length=2,248' Tc=60.8 min CN=43 Runoff=5.15 cfs 1.306 af

Reach DP-1: DP-1 Inflow=0.20 cfs 0.102 af
Outflow=0.20 cfs 0.102 af

Reach DP-2: DP-2 Inflow=1.11 cfs 0.387 af
Outflow=1.11 cfs 0.387 af

Reach DP-3: DP-3 Inflow=0.14 cfs 0.076 af
Outflow=0.14 cfs 0.076 af

Reach DP-4: DP-4 Inflow=0.11 cfs 0.017 af
Outflow=0.11 cfs 0.017 af

Reach DP-5: DP-5 Inflow=0.18 cfs 0.044 af
Outflow=0.18 cfs 0.044 af

Pond 1: BASIN-1 Peak Elev=54.12' Storage=35,276 cf Inflow=9.76 cfs 1.537 af
Discarded=0.84 cfs 1.080 af Primary=0.19 cfs 0.086 af Secondary=0.00 cfs 0.000 af Outflow=1.02 cfs 1.167 af

Pond 2: BASIN-2 Peak Elev=49.93' Storage=22,387 cf Inflow=6.65 cfs 1.053 af
Discarded=0.71 cfs 0.909 af Primary=0.00 cfs 0.000 af Outflow=0.71 cfs 0.909 af

Pond 3: BASIN-3 Peak Elev=31.68' Storage=23,639 cf Inflow=7.18 cfs 0.943 af
Discarded=0.49 cfs 0.665 af Primary=0.00 cfs 0.000 af Outflow=0.49 cfs 0.665 af

Pond 4: BASIN-4 Peak Elev=48.95' Storage=12,005 cf Inflow=4.03 cfs 0.564 af
Discarded=0.39 cfs 0.501 af Primary=0.00 cfs 0.000 af Outflow=0.39 cfs 0.501 af

Pond 5: BASIN-5 Peak Elev=47.01' Storage=30,315 cf Inflow=5.15 cfs 1.306 af
Discarded=0.75 cfs 0.970 af Primary=0.02 cfs 0.001 af Outflow=0.77 cfs 0.971 af

Pond 6: BASIN-6 Peak Elev=68.74' Storage=13,984 cf Inflow=4.63 cfs 0.888 af
Discarded=0.94 cfs 0.888 af Primary=0.00 cfs 0.000 af Outflow=0.94 cfs 0.888 af

Pond 7: BASIN-7 Peak Elev=61.81' Storage=2,923 cf Inflow=1.85 cfs 0.140 af
Discarded=0.12 cfs 0.140 af Primary=0.00 cfs 0.000 af Outflow=0.12 cfs 0.140 af

Pond 8: BASIN-8 Peak Elev=63.93' Storage=3,380 cf Inflow=1.98 cfs 0.165 af
Discarded=0.16 cfs 0.165 af Primary=0.00 cfs 0.000 af Outflow=0.16 cfs 0.165 af

Total Runoff Area = 90.868 ac Runoff Volume = 7.132 af Average Runoff Depth = 0.94"
99.84% Pervious = 90.722 ac 0.16% Impervious = 0.146 ac

Summary for Subcatchment PDA-1:

Runoff = 0.02 cfs @ 13.81 hrs, Volume= 0.015 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.627	30	Woods, Good, HSG A
0.238	30	Brush, Good, HSG A
0.865	30	Weighted Average
0.865		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
1.7	72	0.0210	0.72		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
8.9	122	Total			

Summary for Subcatchment PDA-10:

Runoff = 4.03 cfs @ 12.30 hrs, Volume= 0.564 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

	Area (ac)	CN	Description
	0.244	30	Woods, Good, HSG A
	5.609	39	>75% Grass cover, Good, HSG A
	0.179	96	Gravel surface, HSG A
*	0.270	96	Existing Gravel surface, HSG A
	6.302	43	Weighted Average
	6.302		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0300	0.18		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
6.2	448	0.0300	1.21		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
4.6	305	0.0250	1.11		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
0.1	20	0.3330	4.04		**Shallow Concentrated Flow, Tc-4** Short Grass Pasture Kv= 7.0 fps
15.5	823	Total			

Summary for Subcatchment PDA-11:

Runoff = 4.63 cfs @ 12.58 hrs, Volume= 0.888 af, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

	Area (ac)	CN	Description
	11.109	39	>75% Grass cover, Good, HSG A
	0.456	96	Gravel surface, HSG A
*	0.041	96	Existing Gravel surface, HSG A
	11.606	41	Weighted Average
	11.606		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
14.0	559	0.0090	0.66		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
9.1	466	0.0150	0.86		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
30.3	1,075	Total			

Summary for Subcatchment PDA-12:

Runoff = 1.85 cfs @ 12.10 hrs, Volume= 0.140 af, Depth= 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.458	39	>75% Grass cover, Good, HSG A
0.238	96	Gravel surface, HSG A
0.696	58	Weighted Average
0.696		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Summary for Subcatchment PDA-13:

Runoff = 1.98 cfs @ 12.13 hrs, Volume= 0.165 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

	Area (ac)	CN	Description
	0.579	39	>75% Grass cover, Good, HSG A
	0.125	96	Gravel surface, HSG A
*	0.150	96	Existing Gravel surface, HSG A
	0.854	57	Weighted Average
	0.854		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0600	0.24		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
4.9	410	0.0390	1.38		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
8.4	460	Total			

Summary for Subcatchment PDA-2:

Runoff = 1.11 cfs @ 12.75 hrs, Volume= 0.387 af, Depth= 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

	Area (ac)	CN	Description
	9.872	30	Woods, Good, HSG A
	0.253	77	Woods, Good, HSG D
	0.119	30	Brush, Good, HSG A
	0.012	73	Brush, Good, HSG D
	0.106	96	Gravel surface, HSG A
	0.004	96	Gravel surface, HSG D
*	0.265	96	Existing Gravel surface, HSG A
*	0.142	96	Existing Gravel surface, HSG D
	10.773	34	Weighted Average
	10.773		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0100	0.05		**Sheet Flow, Tc-1** Woods: Light underbrush n= 0.400 P2= 3.40"
14.0	399	0.0090	0.47		**Shallow Concentrated Flow, Tc-2** Woodland Kv= 5.0 fps
29.8	449	Total			

Summary for Subcatchment PDA-3:

Runoff = 0.14 cfs @ 13.31 hrs, Volume= 0.074 af, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

	Area (ac)	CN	Description
	2.548	30	Woods, Good, HSG A
	0.182	30	Brush, Good, HSG A
	0.019	96	Gravel surface, HSG A
*	0.087	96	Existing Gravel surface, HSG A
	2.836	32	Weighted Average
	2.836		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.8	50	0.0050	0.04		**Sheet Flow, Tc-1**
					Woods: Light underbrush n= 0.400 P2= 3.40"
22.7	527	0.0060	0.39		**Shallow Concentrated Flow, Tc-2**
					Woodland Kv= 5.0 fps
43.5	577	Total			

Summary for Subcatchment PDA-4:

Runoff = 0.11 cfs @ 12.16 hrs, Volume= 0.017 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.260	39	>75% Grass cover, Good, HSG A
0.260		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Summary for Subcatchment PDA-5:

Runoff = 0.18 cfs @ 12.38 hrs, Volume= 0.044 af, Depth= 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
1.158	30	Brush, Good, HSG A
0.069	96	Gravel surface, HSG A
1.227	34	Weighted Average
1.227		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Summary for Subcatchment PDA-6:

Runoff = 9.76 cfs @ 12.39 hrs, Volume= 1.537 af, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

	Area (ac)	CN	Description
	17.489	39	>75% Grass cover, Good, HSG A
	1.011	96	Gravel surface, HSG A
*	0.029	98	Equipment Pad Area, HSG A
	18.529	42	Weighted Average
	18.500		99.84% Pervious Area
	0.029		0.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0100	0.12		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
12.3	883	0.0290	1.19		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
0.0	6	0.3330	4.04		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
19.5	939	Total			

Summary for Subcatchment PDA-7:

Runoff = 6.65 cfs @ 12.35 hrs, Volume= 1.053 af, Depth= 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
0.002	30	Woods, Good, HSG A
13.303	39	>75% Grass cover, Good, HSG A
0.435	96	Gravel surface, HSG A
0.029	98	Equipment Pad Area, HSG A
13.769	41	Weighted Average
13.740		99.79% Pervious Area
0.029		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	50	0.0200	0.15		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
10.8	835	0.0340	1.29		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.3330	4.04		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
16.3	894	Total			

Summary for Subcatchment PDA-8:

Runoff = 7.18 cfs @ 12.32 hrs, Volume= 0.943 af, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

	Area (ac)	CN	Description
	0.048	30	Woods, Good, HSG A
	7.327	39	>75% Grass cover, Good, HSG A
	0.336	80	>75% Grass cover, Good, HSG D
	0.673	96	Gravel surface, HSG A
	0.004	96	Gravel surface, HSG D
	0.059	98	Equipment Pad Area, HSG A
*	0.114	96	Existing Gravel surface, HSG A
*	0.007	96	Existing Gravel surface, HSG D
	8.568	46	Weighted Average
	8.509		99.31% Pervious Area
	0.059		0.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
8.3	384	0.0120	0.77		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
0.6	92	0.1200	2.42		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
0.1	33	0.3330	4.04		**Shallow Concentrated Flow, Tc-4** Short Grass Pasture Kv= 7.0 fps
18.5	559	Total			

Summary for Subcatchment PDA-9:

Runoff = 5.15 cfs @ 13.01 hrs, Volume= 1.306 af, Depth= 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

	Area (ac)	CN	Description
	13.525	39	>75% Grass cover, Good, HSG A
	1.027	96	Gravel surface, HSG A
	0.029	98	Equipment Pad Area, HSG A
*	0.002	96	Existing Gravel surface, HSG A
	14.583	43	Weighted Average
	14.554		99.80% Pervious Area
	0.029		0.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow, Tc-1** Grass: Short n= 0.150 P2= 3.40"
24.9	810	0.0060	0.54		**Shallow Concentrated Flow, Tc-2** Short Grass Pasture Kv= 7.0 fps
8.1	572	0.0280	1.17		**Shallow Concentrated Flow, Tc-3** Short Grass Pasture Kv= 7.0 fps
5.7	228	0.0090	0.66		**Shallow Concentrated Flow, Tc-4** Short Grass Pasture Kv= 7.0 fps
12.6	579	0.0120	0.77		**Shallow Concentrated Flow, Tc-5** Short Grass Pasture Kv= 7.0 fps
0.0	9	0.3330	4.04		**Shallow Concentrated Flow, Tc-6** Short Grass Pasture Kv= 7.0 fps
60.8	2,248	Total			

Summary for Reach DP-1: DP-1

Inflow Area = 19.394 ac, 0.15% Impervious, Inflow Depth = 0.06" for 100-Year event
Inflow = 0.20 cfs @ 17.15 hrs, Volume= 0.102 af
Outflow = 0.20 cfs @ 17.15 hrs, Volume= 0.102 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-2: DP-2

Inflow Area = 33.110 ac, 0.27% Impervious, Inflow Depth = 0.14" for 100-Year event
Inflow = 1.11 cfs @ 12.75 hrs, Volume= 0.387 af
Outflow = 1.11 cfs @ 12.75 hrs, Volume= 0.387 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-3: DP-3

Inflow Area = 23.721 ac, 0.12% Impervious, Inflow Depth = 0.04" for 100-Year event
Inflow = 0.14 cfs @ 13.31 hrs, Volume= 0.076 af
Outflow = 0.14 cfs @ 13.31 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-4: DP-4

Inflow Area = 12.720 ac, 0.00% Impervious, Inflow Depth = 0.02" for 100-Year event
Inflow = 0.11 cfs @ 12.16 hrs, Volume= 0.017 af
Outflow = 0.11 cfs @ 12.16 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP-5: DP-5

Inflow Area = 1.923 ac, 0.00% Impervious, Inflow Depth = 0.28" for 100-Year event
Inflow = 0.18 cfs @ 12.38 hrs, Volume= 0.044 af
Outflow = 0.18 cfs @ 12.38 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 1: BASIN-1

Inflow Area = 18.529 ac, 0.16% Impervious, Inflow Depth = 1.00" for 100-Year event
Inflow = 9.76 cfs @ 12.39 hrs, Volume= 1.537 af
Outflow = 1.02 cfs @ 17.29 hrs, Volume= 1.167 af, Atten= 90%, Lag= 294.2 min
Discarded = 0.84 cfs @ 17.29 hrs, Volume= 1.080 af
Primary = 0.19 cfs @ 17.29 hrs, Volume= 0.086 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 54.12' @ 17.29 hrs Surf.Area= 14,984 sf Storage= 35,276 cf

Plug-Flow detention time= 411.2 min calculated for 1.167 af (76% of inflow)
Center-of-Mass det. time= 314.3 min (1,239.9 - 925.7)

Volume	Invert	Avail.Storage	Storage Description
#1	50.00'	49,872 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
50.00	3,167	0	0
51.00	5,415	4,291	4,291
52.00	8,082	6,749	11,040
53.00	11,128	9,605	20,645
54.00	14,526	12,827	33,472
55.00	18,274	16,400	49,872

Device	Routing	Invert	Outlet Devices
#1	Discarded	50.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Secondary	54.15'	**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
#3	Primary	53.75'	**3.0" Round Culvert X 2.00** L= 18.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 53.75' / 53.50' S= 0.0139 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.05 sf

Discarded OutFlow Max=0.84 cfs @ 17.29 hrs HW=54.12' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.84 cfs)

Primary OutFlow Max=0.19 cfs @ 17.29 hrs HW=54.12' (Free Discharge)
└─**3=Culvert** (Inlet Controls 0.19 cfs @ 1.89 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=50.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2: BASIN-2

Inflow Area =	13.769 ac,	0.21% Impervious,	Inflow Depth = 0.92"	for 100-Year event	
Inflow =	6.65 cfs @	12.35 hrs,	Volume=	1.053 af	
Outflow =	0.71 cfs @	17.33 hrs,	Volume=	0.909 af,	Atten= 89%, Lag= 299.0 min
Discarded =	0.71 cfs @	17.33 hrs,	Volume=	0.909 af	
Primary =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 49.93' @ 17.33 hrs Surf.Area= 12,662 sf Storage= 22,387 cf

Plug-Flow detention time= 376.0 min calculated for 0.907 af (86% of inflow)
Center-of-Mass det. time= 314.6 min (1,242.7 - 928.1)

Volume	Invert	Avail.Storage	Storage Description
#1	47.00'	37,897 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
47.00	1,122	0	0
48.00	6,637	3,880	3,880
49.00	9,684	8,161	12,040
50.00	12,900	11,292	23,332
51.00	16,230	14,565	37,897

Device	Routing	Invert	Outlet Devices
#1	Discarded	47.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	50.00'	**6.0" Round Culvert** L= 34.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 50.00' / 47.00' S= 0.0882 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.71 cfs @ 17.33 hrs HW=49.93' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.71 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=47.00' (Free Discharge)
└─**2=Culvert** (Controls 0.00 cfs)

Summary for Pond 3: BASIN-3

Inflow Area = 22.337 ac, 0.39% Impervious, Inflow Depth = 0.51" for 100-Year event
Inflow = 7.18 cfs @ 12.32 hrs, Volume= 0.943 af
Outflow = 0.49 cfs @ 17.93 hrs, Volume= 0.665 af, Atten= 93%, Lag= 336.5 min
Discarded = 0.49 cfs @ 17.93 hrs, Volume= 0.665 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 31.68' @ 17.93 hrs Surf.Area= 8,700 sf Storage= 23,639 cf

Plug-Flow detention time= 458.5 min calculated for 0.665 af (71% of inflow)
Center-of-Mass det. time= 349.1 min (1,255.8 - 906.6)

Volume	Invert	Avail.Storage	Storage Description
#1	28.00'	36,352 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
28.00	4,364	0	0
29.00	5,408	4,886	4,886
30.00	6,566	5,987	10,873
31.00	7,801	7,184	18,057
32.00	9,130	8,466	26,522
33.00	10,529	9,830	36,352

Device	Routing	Invert	Outlet Devices
#1	Discarded	28.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	32.00'	**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

Discarded OutFlow Max=0.49 cfs @ 17.93 hrs HW=31.68' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.49 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=28.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 4: BASIN-4

Inflow Area = 6.302 ac, 0.00% Impervious, Inflow Depth = 1.07" for 100-Year event
Inflow = 4.03 cfs @ 12.30 hrs, Volume= 0.564 af
Outflow = 0.39 cfs @ 16.91 hrs, Volume= 0.501 af, Atten= 90%, Lag= 276.8 min
Discarded = 0.39 cfs @ 16.91 hrs, Volume= 0.501 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 48.95' @ 16.91 hrs Surf.Area= 6,976 sf Storage= 12,005 cf

Plug-Flow detention time= 370.8 min calculated for 0.500 af (89% of inflow)

Center-of-Mass det. time= 318.9 min (1,235.9 - 917.0)

Volume	Invert	Avail.Storage	Storage Description
#1	46.50'	20,301 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
46.50	2,880	0	0
47.00	3,674	1,639	1,639
48.00	5,333	4,504	6,142
49.00	7,058	6,196	12,338
50.00	8,869	7,964	20,301

Device	Routing	Invert	Outlet Devices
#1	Discarded	46.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	49.00'	**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

Discarded OutFlow Max=0.39 cfs @ 16.91 hrs HW=48.95' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.39 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=46.50' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 5: BASIN-5

Inflow Area = 20.885 ac, 0.14% Impervious, Inflow Depth = 0.75" for 100-Year event
Inflow = 5.15 cfs @ 13.01 hrs, Volume= 1.306 af
Outflow = 0.77 cfs @ 18.36 hrs, Volume= 0.971 af, Atten= 85%, Lag= 320.9 min
Discarded = 0.75 cfs @ 18.36 hrs, Volume= 0.970 af
Primary = 0.02 cfs @ 18.36 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 47.01' @ 18.36 hrs Surf.Area= 13,404 sf Storage= 30,315 cf

Plug-Flow detention time= 413.1 min calculated for 0.971 af (74% of inflow)
Center-of-Mass det. time= 311.7 min (1,270.7 - 959.0)

Volume	Invert	Avail.Storage	Storage Description
#1	43.50'	45,119 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.50	4,237	0	0
44.00	5,396	2,408	2,408
45.00	7,877	6,637	9,045
46.00	10,550	9,214	18,258
47.00	13,384	11,967	30,225
48.00	16,403	14,894	45,119

Device	Routing	Invert	Outlet Devices
#1	Discarded	43.50'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	47.00'	**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

Discarded OutFlow Max=0.75 cfs @ 18.36 hrs HW=47.01' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.75 cfs)

Primary OutFlow Max=0.02 cfs @ 18.36 hrs HW=47.01' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.23 fps)

Summary for Pond 6: BASIN-6

Inflow Area =	11.606 ac,	0.00% Impervious,	Inflow Depth = 0.92"	for 100-Year event
Inflow =	4.63 cfs @	12.58 hrs,	Volume=	0.888 af
Outflow =	0.94 cfs @	15.66 hrs,	Volume=	0.888 af, Atten= 80%, Lag= 184.8 min
Discarded =	0.94 cfs @	15.66 hrs,	Volume=	0.888 af
Primary =	0.00 cfs @	5.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 68.74' @ 15.66 hrs Surf.Area= 16,935 sf Storage= 13,984 cf

Plug-Flow detention time= 207.4 min calculated for 0.886 af (100% of inflow)
Center-of-Mass det. time= 207.6 min (1,148.6 - 941.1)

Volume	Invert	Avail.Storage	Storage Description
#1	67.00'	50,094 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
67.00	1,507	0	0
68.00	7,940	4,724	4,724
69.00	20,020	13,980	18,704
70.00	42,760	31,390	50,094

Device	Routing	Invert	Outlet Devices
#1	Discarded	67.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	69.00'	**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

Discarded OutFlow Max=0.94 cfs @ 15.66 hrs HW=68.74' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.94 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=67.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 7: BASIN-7

Inflow Area = 0.696 ac, 0.00% Impervious, Inflow Depth = 2.41" for 100-Year event
Inflow = 1.85 cfs @ 12.10 hrs, Volume= 0.140 af
Outflow = 0.12 cfs @ 14.83 hrs, Volume= 0.140 af, Atten= 93%, Lag= 163.7 min
Discarded = 0.12 cfs @ 14.83 hrs, Volume= 0.140 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 61.81' @ 14.83 hrs Surf.Area= 2,203 sf Storage= 2,923 cf

Plug-Flow detention time= 291.2 min calculated for 0.139 af (100% of inflow)
Center-of-Mass det. time= 291.2 min (1,149.6 - 858.4)

Volume	Invert	Avail.Storage	Storage Description
#1	60.00'	6,142 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
60.00	1,154	0	0
61.00	1,612	1,383	1,383
61.50	1,960	893	2,276
62.00	2,351	1,078	3,354
63.00	3,226	2,789	6,142

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	62.00'	**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

Discarded OutFlow Max=0.12 cfs @ 14.83 hrs HW=61.81' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=60.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 8: BASIN-8

Inflow Area = 12.460 ac, 0.00% Impervious, Inflow Depth = 0.16" for 100-Year event
Inflow = 1.98 cfs @ 12.13 hrs, Volume= 0.165 af
Outflow = 0.16 cfs @ 14.63 hrs, Volume= 0.165 af, Atten= 92%, Lag= 150.0 min
Discarded = 0.16 cfs @ 14.63 hrs, Volume= 0.165 af
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 63.93' @ 14.63 hrs Surf.Area= 2,785 sf Storage= 3,380 cf

Plug-Flow detention time= 275.3 min calculated for 0.165 af (100% of inflow)
Center-of-Mass det. time= 275.2 min (1,138.4 - 863.1)

Volume	Invert	Avail.Storage	Storage Description
#1	62.00'	7,173 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
62.00	739	0	0
63.00	1,770	1,255	1,255
64.00	2,858	2,314	3,569
65.00	4,351	3,605	7,173

Device	Routing	Invert	Outlet Devices
#1	Discarded	62.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	64.00'	**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

Discarded OutFlow Max=0.16 cfs @ 14.63 hrs HW=63.93' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=62.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Attachment 4
Hydraulic Analysis

CALCULATION SUMMARY

JOB NO./LOCATION:

1833.112
Wareham, MA

CLIENT/PROJECT:

Borrego Solar Systems, Inc.
140 Tihonet Road PV+ES Project

SUBJECT/TITLE:

Hydraulic Calculations

OBJECTIVE OF CALCULATION:

- To size culvert pipes to adequately convey flows from the proposed project and to meet the design standards of the Massachusetts DEP Stormwater Handbook for inlet capacity, pipe flow, and scour.

CALCULATION METHOD(S):

- Culverts are designed using the Rational Formula, based on a 50-year storm event for the Town of Barnstable (see attached IDF curve).

ASSUMPTIONS:

- Runoff coefficient C=0.3 for pervious areas and C=0.9 for impervious areas.
- Manning's n=0.012 for HDPE pipe.
- The times of concentration for contributing subcatchments are approximately 60 minutes for flows to FE-9.
- The minimum full-flow (scour) velocity is 2 feet per second.
- The maximum full-flow (scour) velocity is 10 feet per second.

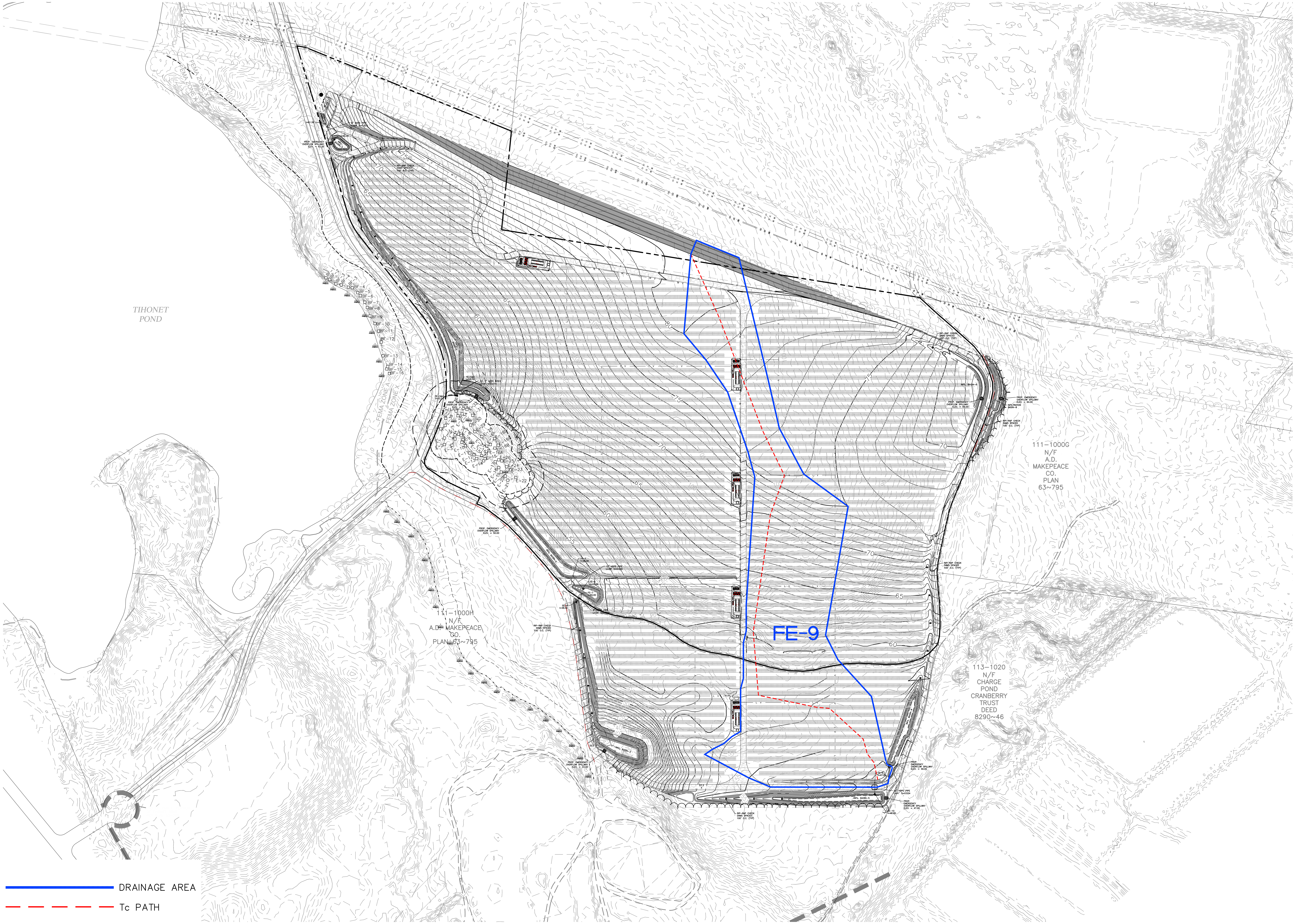
SOURCES OF DATA/EQUATIONS:

- 140 Tihonet Road PV+ES Project Grading and Drainage Plans, prepared by Borrego Solar Systems, Inc., plan numbers C-4.0 – C4.4.
- Rational Method (Q=CiA) was used to calculate peak runoff rates tributary to FE-9.
- Manning's Equation was used to determine pipe capacities.
- 50-year storm intensity obtained from the Intensity/Duration rainfall curve for Plymouth, MA in S.C.S Technical Report No. 40.
- Massachusetts DEP Stormwater Management Handbook, February 2008.

CONCLUSIONS:

- The proposed culvert pipes will adequately convey the 50-year storm event runoff rates.
- The proposed stormwater management design has been reviewed for compliance with the stormwater management standards described in the Massachusetts DEP Stormwater Management Handbook.

REV	CALC. BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
0	N. Bautz	05/31/2020	J. Murphy	06/01/2020	J. Murphy	06/01/2020



Hydraulic Areas Map

Figure Number 003

Scale: 1" = 150'

Date: 06/01/2020

Plan 1833112P593A-003

B+T Project No. 1833.112

140 Tihonet Road PV+ES Project

Wareham, Massachusetts

Borrego Solar Systems, Inc.

55 Technology Drive, Suite 102
Lowell, Massachusetts

North Arrow

NORTH

BEALS + THOMAS

Hydraulic Drainage Areas & Corresponding Rational Method Flows

Using the Rational Method:

$$Q = CIA$$

Where:

Q = flow (cfs)

C = Runoff Coefficient (0.9 for impervious areas)

I = Rainfall Intensity, 50-year storm (in/hr) (from Barnstable IDF curve, see attache

A = Contributing Area (acres)

Assumptions: - Coefficient of runoff for Gravel Surfaces = 0.9

- Coefficient of runoff for Pervious Surfaces = 0.3

Inlet	Contributing Area (Acres)	Weighted Average Rational Coefficients	Rainfall Intensity for Barnstable (in/hr)	Contributing Flow (cfs)
FE-9	13.271	0.30	2.50	9.95

JOB NO.	1833.112	COMPUTED BY	NBB
FILE	140 Tihonet Road PV+ES Project		5/30/2020
		CHECKED BY	JRM
		DATE	6/1/2020

B E A L S + T H O M A S

Hydraulic Pipe Sizing Calculations

Using the Manning Equation to Verify Pipe Capacities Versus Pipe Flows:

$$Q = \frac{1.49}{n} A\, R^{\frac{2}{3}}\, S^{\frac{1}{2}}$$

Where:

Q = flow (cfs)
n = Manning's roughness coefficient
A = Cross Sectional Area (sf)
R = Hydraulic Radius (ft)
S = Pipe Slope

Assumptions: n = 0.012 for HDPE pipe
Pipe velocity shall be between 2.0 ft/sec and 10 ft/sec

Pipe Connection	Contributing Flow-50 Year Storm(cfs)	Proposed Pipe Size and Material	Proposed Pipe Slope (rise/run)	Full-Flow Capacity of Pipe from Manning Equation (cfs)	Adequate	Full Flow Velocity (ft/sec)
FE-9 to FE-10	9.95	15" HDPE	0.024	10.87	OK	8.9

JOB NO.	1833.112	COMPUTED BY	NBB	CHECKED BY	JRM
FILE	140 Tihonet Road PV+ES Project	DATE	5/30/2020	DATE	6/1/2020

Storm Data Detailed Report: Barnstable Rainfall

Element Details

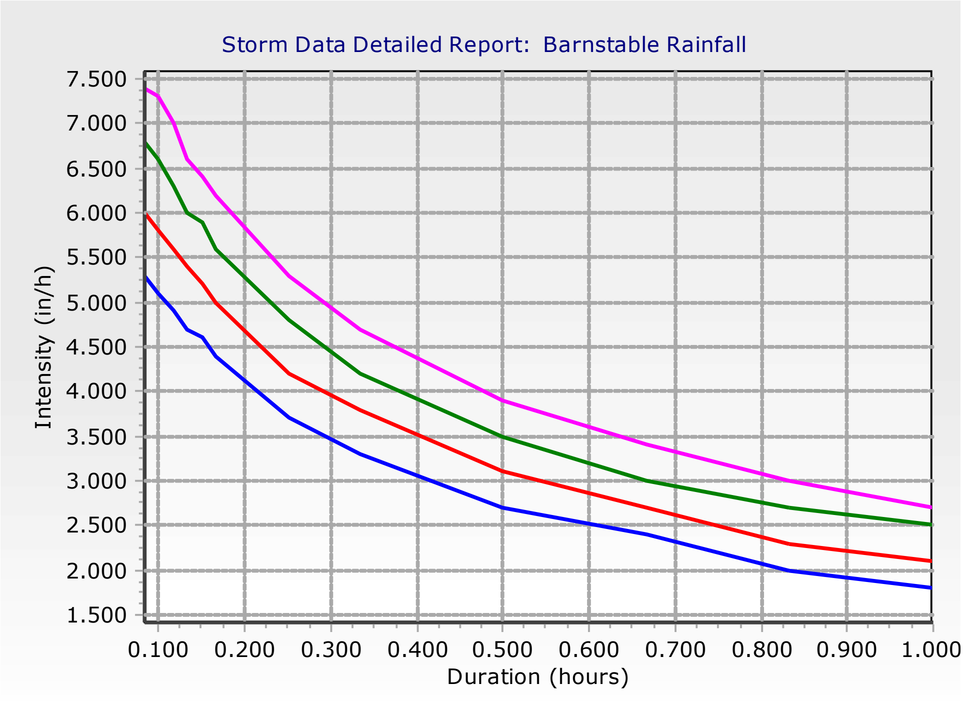
ID	30	Notes	
Label	Barnstable Rainfall		

Duration (hours)	10 Year (in/h)	25 Year (in/h)	50 Year (in/h)	100 Year (in/h)
0.083	5.300	6.000	6.800	7.400
0.100	5.100	5.800	6.600	7.300
0.117	4.900	5.600	6.300	7.000
0.133	4.700	5.400	6.000	6.600
0.150	4.600	5.200	5.900	6.400
0.167	4.400	5.000	5.600	6.200
0.250	3.700	4.200	4.800	5.300
0.333	3.300	3.800	4.200	4.700
0.500	2.700	3.100	3.500	3.900
0.667	2.400	2.700	3.000	3.400
0.833	2.000	2.300	2.700	3.000
1.000	1.800	2.100	2.500	2.700

Library Status Summary

	Synchronization Details
ID	30
Label	Barnstable Rainfall
Modified Date	3/11/2020 4:13:38 PM
Library Source	G:\Corp-Data\Qags\StormCAD\8 XM\Rainfall .xml
Library Modified Date	10/16/2008 3:19:18 PM
Synchronization Status	Synchronize to Library
Engineering Reference Guid	686ed606-a18a-4e03-9cab-f4a1ec6f02ac

Storm Data Detailed Report: Barnstable Rainfall



Attachment 5
Drawdown and Groundwater Recharge Calculations

B E A L S + T H O M A S

Standard 3: Drawdown

$$\textbf{Drawdown Time} = \frac{\textbf{Rv}}{\textbf{(K) (Bottom Area)}}$$

where:

Rv = Storage Volume Below Outlet [Ac-ft]

K= Infiltration Rate [in/hr]

Bottom Area= Bottom Area of Recharge System [Ac]

Infiltration Basin-1

Rv =	0.687	Ac-ft	
K =	2.410	in/hr	
Bottom Area =	0.073	Acres	
Drawdown Time =	**46.860**	**Hours**	*< 72 Hours, Design is in compliance with the standard.*

Infiltration Basin-2 (North)

Rv =	0.339	Ac-ft	
K =	2.410	in/hr	
Bottom Area =	0.114	Acres	
Drawdown Time =	**14.807**	**Hours**	*< 72 Hours, Design is in compliance with the standard.*

Infiltration Basin-2 (South)

Rv =	0.139	Ac-ft	
K =	2.410	in/hr	
Bottom Area =	0.026	Acres	
Drawdown Time =	**26.620**	**Hours**	*< 72 Hours, Design is in compliance with the standard.*

Infiltration Basin-3

Rv =	0.609	Ac-ft	
K =	2.410	in/hr	
Bottom Area =	0.100	Acres	
Drawdown Time =	**30.324**	**Hours**	*< 72 Hours, Design is in compliance with the standard.*

Infiltration Basin-4

Rv =	0.283	Ac-ft	
K =	2.410	in/hr	
Bottom Area =	0.067	Acres	
Drawdown Time =	**21.032**	**Hours**	*< 72 Hours, Design is in compliance with the standard.*

Infiltration Basin-5

Rv =	0.694	Ac-ft	
K =	2.410	in/hr	
Bottom Area =	0.097	Acres	
Drawdown Time =	**35.625**	**Hours**	*< 72 Hours, Design is in compliance with the standard.*

Infiltration Basin-6

Rv =	0.430	Ac-ft	
K =	2.410	in/hr	
Bottom Area =	0.035	Acres	
Drawdown Time =	**61.174**	**Hours**	*< 72 Hours, Design is in compliance with the standard.*

Infiltration Basin-7

Rv =	0.077	Ac-ft	
K =	2.410	in/hr	
Bottom Area =	0.026	Acres	
Drawdown Time =	**14.746**	**Hours**	*< 72 Hours, Design is in compliance with the standard.*

Infiltration Basin-8

Rv =	0.082	Ac-ft	
K =	2.410	in/hr	
Bottom Area =	0.017	Acres	
Drawdown Time =	**24.018**	**Hours**	*< 72 Hours, Design is in compliance with the standard.*

Note:

1. The infiltration BMPs have been designed to fully drain within 72 hours, therefore the proposed stormwater management design is in compliance with Standard 3 .

2. Infiltration Rate based on Volume 3, Chapter 1, Table 2.3.3 *Rawls Rates* from the 2008 MA DEP Stormwater Management Handbook.

JOB NO.	1833.112	COMPUTED BY:	NBB	CHECKED BY:	JRM
JOB:	140 Tihonet Road PV+ES Project	DATE:	5/30/2020	DATE:	6/1/2020

Stage-Area-Storage for Pond 1: BASIN-1

Elevation (feet)	Surface (acres)	Storage (acre-feet)	Elevation (feet)	Surface (acres)	Storage (acre-feet)
50.00	0.073	0.000	52.65	0.231	0.389
50.05	0.075	0.004	52.70	0.234	0.400
50.10	0.078	0.008	52.75	0.238	0.412
50.15	0.080	0.011	52.80	0.241	0.424
50.20	0.083	0.016	52.85	0.245	0.436
50.25	0.086	0.020	52.90	0.248	0.449
50.30	0.088	0.024	52.95	0.252	0.461
50.35	0.091	0.029	53.00	0.255	0.474
50.40	0.093	0.033	53.05	0.259	0.487
50.45	0.096	0.038	53.10	0.263	0.500
50.50	0.099	0.043	53.15	0.267	0.513
50.55	0.101	0.048	53.20	0.271	0.527
50.60	0.104	0.053	53.25	0.275	0.540
50.65	0.106	0.058	53.30	0.279	0.554
50.70	0.109	0.064	53.35	0.283	0.568
50.75	0.111	0.069	53.40	0.287	0.582
50.80	0.114	0.075	53.45	0.291	0.597
50.85	0.117	0.080	53.50	0.294	0.611
50.90	0.119	0.086	53.55	0.298	0.626
50.95	0.122	0.092	53.60	0.302	0.641
51.00	0.124	0.099	53.65	0.306	0.656
51.05	0.127	0.105	53.70	0.310	0.672
51.10	0.130	0.111	53.75	0.314	0.687
51.15	0.133	0.118	53.80	0.318	0.703
51.20	0.137	0.125	53.85	0.322	0.719
51.25	0.140	0.131	53.90	0.326	0.735
51.30	0.143	0.139	53.95	0.330	0.752
51.35	0.146	0.146	54.00	0.333	0.768
51.40	0.149	0.153	54.05	0.338	0.785
51.45	0.152	0.161	54.10	0.342	0.802
51.50	0.155	0.168	54.15	0.346	0.819
51.55	0.158	0.176	54.20	0.351	0.837
51.60	0.161	0.184	54.25	0.355	0.854
51.65	0.164	0.192	54.30	0.359	0.872
51.70	0.167	0.201	54.35	0.364	0.890
51.75	0.170	0.209	54.40	0.368	0.909
51.80	0.173	0.218	54.45	0.372	0.927
51.85	0.176	0.226	54.50	0.376	0.946
51.90	0.179	0.235	54.55	0.381	0.965
51.95	0.182	0.244	54.60	0.385	0.984
52.00	0.186	0.253	54.65	0.389	1.003
52.05	0.189	0.263	54.70	0.394	1.023
52.10	0.193	0.272	54.75	0.398	1.043
52.15	0.196	0.282	54.80	0.402	1.063
52.20	0.200	0.292	54.85	0.407	1.083
52.25	0.203	0.302	54.90	0.411	1.103
52.30	0.207	0.312	54.95	0.415	1.124
52.35	0.210	0.323	55.00	**0.420**	**1.145**
52.40	0.214	0.333			
52.45	0.217	0.344			
52.50	0.221	0.355			
52.55	0.224	0.366			
52.60	0.227	0.377			

Stage-Area-Storage for Pond 2N: BASIN-2 (NORTH)

Elevation (feet)	Surface (acres)	Storage (acre-feet)
48.00	0.114	0.000
48.05	0.117	0.006
48.10	0.120	0.012
48.15	0.122	0.018
48.20	0.125	0.024
48.25	0.128	0.030
48.30	0.131	0.037
48.35	0.133	0.043
48.40	0.136	0.050
48.45	0.139	0.057
48.50	0.142	0.064
48.55	0.144	0.071
48.60	0.147	0.078
48.65	0.150	0.086
48.70	0.153	0.093
48.75	0.155	0.101
48.80	0.158	0.109
48.85	0.161	0.117
48.90	0.164	0.125
48.95	0.166	0.133
49.00	0.169	0.142
49.05	0.172	0.150
49.10	0.175	0.159
49.15	0.178	0.168
49.20	0.181	0.177
49.25	0.184	0.186
49.30	0.186	0.195
49.35	0.189	0.204
49.40	0.192	0.214
49.45	0.195	0.224
49.50	0.198	0.233
49.55	0.201	0.243
49.60	0.204	0.253
49.65	0.206	0.264
49.70	0.209	0.274
49.75	0.212	0.285
49.80	0.215	0.295
49.85	0.218	0.306
49.90	0.221	0.317
49.95	0.224	0.328
50.00	0.226	0.339
50.05	0.229	0.351
50.10	0.232	0.362
50.15	0.235	0.374
50.20	0.238	0.386
50.25	0.241	0.398
50.30	0.244	0.410
50.35	0.247	0.422
50.40	0.250	0.435
50.45	0.253	0.447
50.50	0.256	0.460
50.55	0.259	0.473
50.60	0.262	0.486
50.65	0.265	0.499
50.70	0.268	0.512
50.75	0.270	0.526
50.80	0.273	0.539
50.85	0.276	0.553
50.90	0.279	0.567
50.95	0.282	0.581
51.00	**0.285**	**0.595**

Stage-Area-Storage for Pond 2S: BASIN-2 (SOUTH)

Elevation (feet)	Surface (acres)	Storage (acre-feet)	Elevation (feet)	Surface (acres)	Storage (acre-feet)
47.00	0.026	0.000	49.65	0.064	0.116
47.05	0.026	0.001	49.70	0.065	0.119
47.10	0.027	0.003	49.75	0.066	0.122
47.15	0.028	0.004	49.80	0.066	0.126
47.20	0.028	0.005	49.85	0.067	0.129
47.25	0.029	0.007	49.90	0.068	0.132
47.30	0.030	0.008	49.95	0.069	0.136
47.35	0.030	0.010	50.00	0.070	0.139
47.40	0.031	0.011	50.05	0.071	0.143
47.45	0.031	0.013	50.10	0.071	0.146
47.50	0.032	0.014	50.15	0.072	0.150
47.55	0.033	0.016	50.20	0.073	0.153
47.60	0.033	0.018	50.25	0.074	0.157
47.65	0.034	0.019	50.30	0.075	0.161
47.70	0.035	0.021	50.35	0.076	0.165
47.75	0.035	0.023	50.40	0.077	0.168
47.80	0.036	0.025	50.45	0.078	0.172
47.85	0.036	0.026	50.50	0.079	0.176
47.90	0.037	0.028	50.55	0.079	0.180
47.95	0.038	0.030	50.60	0.080	0.184
48.00	0.038	0.032	50.65	0.081	0.188
48.05	0.039	0.034	50.70	0.082	0.192
48.10	0.040	0.036	50.75	0.083	0.196
48.15	0.041	0.038	50.80	0.084	0.201
48.20	0.041	0.040	50.85	0.085	0.205
48.25	0.042	0.042	50.90	0.086	0.209
48.30	0.043	0.044	50.95	0.087	0.213
48.35	0.044	0.046	51.00	**0.087**	**0.218**
48.40	0.044	0.049			
48.45	0.045	0.051			
48.50	0.046	0.053			
48.55	0.046	0.055			
48.60	0.047	0.058			
48.65	0.048	0.060			
48.70	0.049	0.063			
48.75	0.049	0.065			
48.80	0.050	0.067			
48.85	0.051	0.070			
48.90	0.052	0.073			
48.95	0.052	0.075			
49.00	0.053	0.078			
49.05	0.054	0.080			
49.10	0.055	0.083			
49.15	0.056	0.086			
49.20	0.056	0.089			
49.25	0.057	0.092			
49.30	0.058	0.094			
49.35	0.059	0.097			
49.40	0.060	0.100			
49.45	0.061	0.103			
49.50	0.061	0.106			
49.55	0.062	0.109			
49.60	0.063	0.113			

Stage-Area-Storage for Pond 3: BASIN-3

Elevation (feet)	Surface (acres)	Storage (acre-feet)	Elevation (feet)	Surface (acres)	Storage (acre-feet)
28.00	0.100	0.000	30.65	0.169	0.354
28.05	0.101	0.005	30.70	0.171	0.362
28.10	0.103	0.010	30.75	0.172	0.371
28.15	0.104	0.015	30.80	0.173	0.379
28.20	0.105	0.021	30.85	0.175	0.388
28.25	0.106	0.026	30.90	0.176	0.397
28.30	0.107	0.031	30.95	0.178	0.406
28.35	0.109	0.037	31.00	0.179	0.415
28.40	0.110	0.042	31.05	0.181	0.424
28.45	0.111	0.048	31.10	0.182	0.433
28.50	0.112	0.053	31.15	0.184	0.442
28.55	0.113	0.059	31.20	0.185	0.451
28.60	0.115	0.064	31.25	0.187	0.460
28.65	0.116	0.070	31.30	0.188	0.470
28.70	0.117	0.076	31.35	0.190	0.479
28.75	0.118	0.082	31.40	0.191	0.489
28.80	0.119	0.088	31.45	0.193	0.498
28.85	0.121	0.094	31.50	0.194	0.508
28.90	0.122	0.100	31.55	0.196	0.518
28.95	0.123	0.106	31.60	0.197	0.527
29.00	0.124	0.112	31.65	0.199	0.537
29.05	0.125	0.118	31.70	0.200	0.547
29.10	0.127	0.125	31.75	0.202	0.557
29.15	0.128	0.131	31.80	0.203	0.568
29.20	0.129	0.138	31.85	0.205	0.578
29.25	0.131	0.144	31.90	0.207	0.588
29.30	0.132	0.151	31.95	0.208	0.598
29.35	0.133	0.157	32.00	0.210	0.609
29.40	0.135	0.164	32.05	0.211	0.619
29.45	0.136	0.171	32.10	0.213	0.630
29.50	0.137	0.178	32.15	0.214	0.641
29.55	0.139	0.184	32.20	0.216	0.651
29.60	0.140	0.191	32.25	0.218	0.662
29.65	0.141	0.198	32.30	0.219	0.673
29.70	0.143	0.206	32.35	0.221	0.684
29.75	0.144	0.213	32.40	0.222	0.695
29.80	0.145	0.220	32.45	0.224	0.706
29.85	0.147	0.227	32.50	0.226	0.718
29.90	0.148	0.235	32.55	0.227	0.729
29.95	0.149	0.242	32.60	0.229	0.740
30.00	0.151	0.250	32.65	0.230	0.752
30.05	0.152	0.257	32.70	0.232	0.763
30.10	0.154	0.265	32.75	0.234	0.775
30.15	0.155	0.273	32.80	0.235	0.787
30.20	0.156	0.280	32.85	0.237	0.799
30.25	0.158	0.288	32.90	0.239	0.811
30.30	0.159	0.296	32.95	0.240	0.822
30.35	0.161	0.304	33.00	**0.242**	**0.835**
30.40	0.162	0.312			
30.45	0.163	0.320			
30.50	0.165	0.329			
30.55	0.166	0.337			
30.60	0.168	0.345			

Stage-Area-Storage for Pond 4: BASIN-4

Elevation (feet)	Surface (acres)	Storage (acre-feet)
46.50	0.066	0.000
46.55	0.068	0.003
46.60	0.070	0.007
46.65	0.072	0.010
46.70	0.073	0.014
46.75	0.075	0.018
46.80	0.077	0.021
46.85	0.079	0.025
46.90	0.081	0.029
46.95	0.083	0.033
47.00	0.084	0.038
47.05	0.086	0.042
47.10	0.088	0.046
47.15	0.090	0.051
47.20	0.092	0.055
47.25	0.094	0.060
47.30	0.096	0.065
47.35	0.098	0.069
47.40	0.100	0.074
47.45	0.101	0.079
47.50	0.103	0.085
47.55	0.105	0.090
47.60	0.107	0.095
47.65	0.109	0.100
47.70	0.111	0.106
47.75	0.113	0.112
47.80	0.115	0.117
47.85	0.117	0.123
47.90	0.119	0.129
47.95	0.121	0.135
48.00	0.122	0.141
48.05	0.124	0.147
48.10	0.126	0.153
48.15	0.128	0.160
48.20	0.130	0.166
48.25	0.132	0.173
48.30	0.134	0.180
48.35	0.136	0.186
48.40	0.138	0.193
48.45	0.140	0.200
48.50	0.142	0.207
48.55	0.144	0.214
48.60	0.146	0.222
48.65	0.148	0.229
48.70	0.150	0.236
48.75	0.152	0.244
48.80	0.154	0.252
48.85	0.156	0.259
48.90	0.158	0.267
48.95	0.160	0.275
49.00	0.162	0.283
49.05	0.164	0.291
49.10	0.166	0.300
49.15	0.168	0.308
49.20	0.170	0.316
49.25	0.172	0.325
49.30	0.175	0.334
49.35	0.177	0.342
49.40	0.179	0.351
49.45	0.181	0.360
49.50	0.183	0.369
49.55	0.185	0.379
49.60	0.187	0.388
49.65	0.189	0.397
49.70	0.191	0.407
49.75	0.193	0.416
49.80	0.195	0.426
49.85	0.197	0.436
49.90	0.199	0.446
49.95	0.202	0.456
50.00	**0.204**	**0.466**

Stage-Area-Storage for Pond 5: BASIN-5

Elevation (feet)	Surface (acres)	Storage (acre-feet)	Elevation (feet)	Surface (acres)	Storage (acre-feet)
43.50	0.097	0.000	46.15	0.252	0.456
43.55	0.100	0.005	46.20	0.255	0.469
43.60	0.102	0.010	46.25	0.258	0.482
43.65	0.105	0.015	46.30	0.261	0.495
43.70	0.108	0.020	46.35	0.265	0.508
43.75	0.111	0.026	46.40	0.268	0.521
43.80	0.113	0.032	46.45	0.271	0.535
43.85	0.116	0.037	46.50	0.275	0.548
43.90	0.119	0.043	46.55	0.278	0.562
43.95	0.121	0.049	46.60	0.281	0.576
44.00	0.124	0.055	46.65	0.284	0.590
44.05	0.127	0.062	46.70	0.288	0.605
44.10	0.130	0.068	46.75	0.291	0.619
44.15	0.133	0.074	46.80	0.294	0.634
44.20	0.135	0.081	46.85	0.297	0.648
44.25	0.138	0.088	46.90	0.300	0.663
44.30	0.141	0.095	46.95	0.304	0.678
44.35	0.144	0.102	47.00	0.307	0.694
44.40	0.147	0.109	47.05	0.310	0.709
44.45	0.150	0.117	47.10	0.314	0.725
44.50	0.152	0.124	47.15	0.317	0.741
44.55	0.155	0.132	47.20	0.321	0.757
44.60	0.158	0.140	47.25	0.324	0.773
44.65	0.161	0.148	47.30	0.328	0.789
44.70	0.164	0.156	47.35	0.332	0.805
44.75	0.167	0.164	47.40	0.335	0.822
44.80	0.170	0.173	47.45	0.339	0.839
44.85	0.172	0.181	47.50	0.342	0.856
44.90	0.175	0.190	47.55	0.345	0.873
44.95	0.178	0.199	47.60	0.349	0.891
45.00	0.181	0.208	47.65	0.352	0.908
45.05	0.184	0.217	47.70	0.356	0.926
45.10	0.187	0.226	47.75	0.359	0.944
45.15	0.190	0.236	47.80	0.363	0.962
45.20	0.193	0.245	47.85	0.367	0.980
45.25	0.196	0.255	47.90	0.370	0.998
45.30	0.199	0.265	47.95	0.374	1.017
45.35	0.202	0.275	48.00	**0.377**	**1.036**
45.40	0.205	0.285			
45.45	0.208	0.295			
45.50	0.212	0.306			
45.55	0.215	0.317			
45.60	0.218	0.327			
45.65	0.221	0.338			
45.70	0.224	0.349			
45.75	0.227	0.361			
45.80	0.230	0.372			
45.85	0.233	0.384			
45.90	0.236	0.395			
45.95	0.239	0.407			
46.00	0.242	0.419			
46.05	0.245	0.431			
46.10	0.249	0.444			

Stage-Area-Storage for Pond 6: BASIN-6

Elevation (feet)	Surface (acres)	Storage (acre-feet)	Elevation (feet)	Surface (acres)	Storage (acre-feet)
67.00	0.035	0.000	69.65	0.799	0.839
67.05	0.042	0.002	69.70	0.825	0.879
67.10	0.050	0.004	69.75	0.851	0.921
67.15	0.057	0.007	69.80	0.878	0.965
67.20	0.064	0.010	69.85	0.904	1.009
67.25	0.072	0.013	69.90	0.930	1.055
67.30	0.079	0.017	69.95	0.956	1.102
67.35	0.086	0.021	70.00	**0.982**	**1.151**
67.40	0.094	0.026			
67.45	0.101	0.031			
67.50	0.109	0.036			
67.55	0.116	0.041			
67.60	0.123	0.047			
67.65	0.131	0.054			
67.70	0.138	0.061			
67.75	0.145	0.068			
67.80	0.153	0.075			
67.85	0.160	0.083			
67.90	0.167	0.091			
67.95	0.175	0.100			
68.00	0.182	0.109			
68.05	0.196	0.118			
68.10	0.210	0.128			
68.15	0.224	0.139			
68.20	0.238	0.150			
68.25	0.251	0.163			
68.30	0.265	0.176			
68.35	0.279	0.189			
68.40	0.293	0.204			
68.45	0.307	0.219			
68.50	0.321	0.234			
68.55	0.335	0.251			
68.60	0.349	0.268			
68.65	0.363	0.286			
68.70	0.377	0.304			
68.75	0.390	0.323			
68.80	0.404	0.343			
68.85	0.418	0.364			
68.90	0.432	0.385			
68.95	0.446	0.407			
69.00	0.460	0.430			
69.05	0.486	0.453			
69.10	0.512	0.478			
69.15	0.538	0.504			
69.20	0.564	0.532			
69.25	0.590	0.561			
69.30	0.617	0.591			
69.35	0.643	0.622			
69.40	0.669	0.655			
69.45	0.695	0.689			
69.50	0.721	0.725			
69.55	0.747	0.761			
69.60	0.773	0.799			

Stage-Area-Storage for Pond 7: BASIN-7

Elevation (feet)	Surface (acres)	Storage (acre-feet)	Elevation (feet)	Surface (acres)	Storage (acre-feet)
60.00	0.026	0.000	62.65	0.067	0.116
60.05	0.027	0.001	62.70	0.068	0.120
60.10	0.028	0.003	62.75	0.069	0.123
60.15	0.028	0.004	62.80	0.070	0.127
60.20	0.029	0.006	62.85	0.071	0.130
60.25	0.029	0.007	62.90	0.072	0.134
60.30	0.030	0.008	62.95	0.073	0.137
60.35	0.030	0.010	63.00	**0.074**	**0.141**
60.40	0.031	0.011			
60.45	0.031	0.013			
60.50	0.032	0.015			
60.55	0.032	0.016			
60.60	0.033	0.018			
60.65	0.033	0.019			
60.70	0.034	0.021			
60.75	0.034	0.023			
60.80	0.035	0.025			
60.85	0.035	0.026			
60.90	0.036	0.028			
60.95	0.036	0.030			
61.00	0.037	0.032			
61.05	0.038	0.034			
61.10	0.039	0.036			
61.15	0.039	0.037			
61.20	0.040	0.039			
61.25	0.041	0.042			
61.30	0.042	0.044			
61.35	0.043	0.046			
61.40	0.043	0.048			
61.45	0.044	0.050			
61.50	0.045	0.052			
61.55	0.046	0.055			
61.60	0.047	0.057			
61.65	0.048	0.059			
61.70	0.049	0.062			
61.75	0.049	0.064			
61.80	0.050	0.067			
61.85	0.051	0.069			
61.90	0.052	0.072			
61.95	0.053	0.074			
62.00	0.054	0.077			
62.05	0.055	0.080			
62.10	0.056	0.082			
62.15	0.057	0.085			
62.20	0.058	0.088			
62.25	0.059	0.091			
62.30	0.060	0.094			
62.35	0.061	0.097			
62.40	0.062	0.100			
62.45	0.063	0.103			
62.50	0.064	0.106			
62.55	0.065	0.110			
62.60	0.066	0.113			

Stage-Area-Storage for Pond 8: BASIN-8

Elevation (feet)	Surface (acres)	Storage (acre-feet)
62.00	0.017	0.000
62.05	0.018	0.001
62.10	0.019	0.002
62.15	0.021	0.003
62.20	0.022	0.004
62.25	0.023	0.005
62.30	0.024	0.006
62.35	0.025	0.007
62.40	0.026	0.009
62.45	0.028	0.010
62.50	0.029	0.011
62.55	0.030	0.013
62.60	0.031	0.014
62.65	0.032	0.016
62.70	0.034	0.018
62.75	0.035	0.019
62.80	0.036	0.021
62.85	0.037	0.023
62.90	0.038	0.025
62.95	0.039	0.027
63.00	0.041	0.029
63.05	0.042	0.031
63.10	0.043	0.033
63.15	0.044	0.035
63.20	0.046	0.037
63.25	0.047	0.040
63.30	0.048	0.042
63.35	0.049	0.045
63.40	0.051	0.047
63.45	0.052	0.050
63.50	0.053	0.052
63.55	0.054	0.055
63.60	0.056	0.058
63.65	0.057	0.060
63.70	0.058	0.063
63.75	0.059	0.066
63.80	0.061	0.069
63.85	0.062	0.072
63.90	0.063	0.075
63.95	0.064	0.079
64.00	0.066	0.082
64.05	0.067	0.085
64.10	0.069	0.089
64.15	0.071	0.092
64.20	0.072	0.096
64.25	0.074	0.099
64.30	0.076	0.103
64.35	0.078	0.107
64.40	0.079	0.111
64.45	0.081	0.115
64.50	0.083	0.119
64.55	0.084	0.123
64.60	0.086	0.127
64.65	0.088	0.132
64.70	0.090	0.136
64.75	0.091	0.141
64.80	0.093	0.145
64.85	0.095	0.150
64.90	0.096	0.155
64.95	0.098	0.160
65.00	**0.100**	**0.165**

BEALS + THOMAS
Standard 3: Groundwater Recharge

Groundwater Recharge Volume Required:

Rv = F x Impervious Area, where:

Rv = Required Recharge Volume [Ac-ft]

F = Target Depth Factor associated with each Hydrologic Soil Group (HSG) [in]

Impervious Area = Total Impervious Area under Post-development Conditions [Ac] (equipment pads)

			Impervious Area [Acres]	Required Recharge Volume [Ac-ft]
HSG "A", use F =	0.6	in	0.146	0.007
HSG "B", use F =	0.35	in	0.000	0.000
HSG "C", use F =	0.25	in	0.000	0.000
HSG "D", use F =	0.1	in	0.000	0.000
Total Required Recharge Volume (Rv) =				**0.007 Ac-ft**

Capture Area Adjustment: (Ref: DEP Handbook V.3 Ch.1 P.27-28)

Total Site Impervious Area (Total)=	0.146	Acres
Impervious Area Draining to Infiltrative BMPs (infil) =	0.146	Acres
Percent Imp. Area Draining to Infiltrative BMPs =	100.0%	
Capture Area Adjustment Factor = (Total)/(Infil) = Ca =	1.00	
Adjusted Required Recharge Volume = Ca x Rv	**0.007**	**Ac-ft**

Groundwater Recharge Volume Provided :

BMP	Provided Recharge Volume [Ac-ft] (Below Lowest Basin Outlet)
Infiltration Basin 1 =	0.687
Infiltration Basin 2 =	0.478
Infiltration Basin 3 =	0.609
Infiltration Basin 4 =	0.283
Infiltration Basin 5 =	0.694
Infiltration Basin 6 =	0.430
Infiltration Basin 7=	0.077
Infiltration Basin 8 =	0.082
Total Provided Recharge Volume =	**3.340 Ac-ft**

PROVIDED GROUNDWATER RECHARGE VOLUME IS GREATER THAN OR EQUAL TO THE REQUIRED RECHARGE VOLUME, THEREFORE PROPOSED STORMWATER MANAGEMENT DESIGN IS IN COMPLIANCE WITH STANDARD 3.

JOB NO.	1833.112	COMPUTED BY:	NBB	CHECKED BY:	JRM
JOB:	140 Tihonet Road PV+ES Project	DATE:	05/30/20	DATE:	6/1/2020

Attachment 6
Site Owner's Manual

Site Owner’s Manual

140 Tihonet Road PV+ES Project

140 Tihonet Road (aka 0 & 169 Tihonet Road)
Wareham, Massachusetts

Prepared for:

Borrego Solar Systems, Inc.
55 Technology Drive, Suite 102
Lowell, MA 01851

Prepared by:

BEALS + THOMAS
BEALS AND THOMAS, INC.
32 Court Street
Plymouth, MA 02360

June 2, 2020

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1.0 INTRODUCTION

The Site Owner's Manual complies with the Long-Term Pollution Prevention Plan (Standard 4) and the Long-Term Operation and Maintenance Plan (Standard 9) requirements of the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook. The Manual outlines source control and pollution prevention measures and maintenance requirements of stormwater best management practices (BMPs) associated with the proposed development.

2.0 SITE OWNER'S AGREEMENT

2.1 Operation and Maintenance Compliance Statement

Site Owner: Borrego Solar Systems, Inc.
55 Technology Drive, Suite 102
Lowell, MA 01851

Responsible Party: Borrego Solar Systems, Inc.

Borrego Solar Systems, Inc. or their successors shall maintain ownership of the on-site stormwater management system as well as the responsibility for operation and maintenance during the post-development stages of the project. The site has been inspected for erosion and appropriate measures have been taken to permanently stabilize any eroded areas. All aspects of stormwater best management practices (BMPs) have been inspected for damage, wear and malfunction, and appropriate steps have been taken to repair or replace the system or portions of the system so that the stormwater at the site may be managed in accordance with the Stormwater Management Standards. Future responsible parties shall be notified of their continuing legal responsibility to operate and maintain the BMPs. The operation and maintenance plan for the stormwater BMPs is being implemented.

______________________________ ____________
Responsible Party Signature Date

2.2 Stormwater Maintenance Easements

The Site Owner will have access to all stormwater practices for inspection and maintenance, including direct maintenance access by heavy equipment to structures requiring regular maintenance.

2.3 Record Keeping

The Site Owner shall maintain a rolling log in which all inspections and maintenance activities for the past three years shall be recorded. The Operation and Maintenance Log includes information pertaining to inspections, repairs, and disposal relevant to the project's stormwater management system. The Log is located in Appendix A.

The Operation and Maintenance Log shall be made available to the Conservation Commission and the DEP upon request. The Conservation Commission and the DEP shall be allowed to enter and inspect the premises to evaluate and ensure that the responsible party complies with the maintenance requirements for each BMP.

2.4 Training

Employees involved in grounds maintenance and emergency response will be educated on the general concepts of stormwater management and groundwater protection. The Site Owner’s Manual will be reviewed with the maintenance staff. The staff will be trained on the proper course of action for specific events expected to be incurred during routine maintenance or emergency situations.

3.0 LONG-TERM POLLUTION PREVENTION PLAN

In compliance with Standard 4 of the 2008 DEP Stormwater Management Handbook, this section outlines source control and pollution prevention measures to be employed on-site after construction.

3.1 Storage of Materials and Waste

The site shall be kept clear of trash and debris at all times. Certain materials and waste products shall be stored inside or outside upon an impervious surface and covered, as required by local and state regulations.

3.2 Vehicle Washing

No commercial vehicle washing shall take place on-site.

3.3 Routine Inspections and Maintenance of Stormwater BMPs

See Section 4.0 Long-Term Operation and Maintenance Plan, for routine inspection and maintenance requirements for all proposed stormwater BMPs.

3.4 Spill Prevention and Response

A contingency plan shall be implemented to address the spill or release of petroleum products and hazardous materials and will include the following measures:

1. Equipment necessary to quickly attend to inadvertent spills or leaks shall be stored on-site in a secure but accessible location. Such equipment shall include but not be limited to the following: safety goggles, chemically resistant gloves and overshoe boots, water and chemical fire extinguishers, sand and shovels, suitable absorbent materials, storage containers and first aid equipment (i.e. Indian Valley Industries, Inc. 55-gallon Spill Containment kit or approved equivalent).

2. Spills or leaks shall be treated properly according to material type, volume of spillage and location of spill. Mitigation shall include preventing further spillage, containing the spilled material in the smallest practical area, removing spilled material in a safe and environmentally-friendly manner, and remediation of any damage to the environment.

3. For large spills, MassDEP Hazardous Waste Incident Response Group shall be notified immediately at 888-304-1133 and an emergency response contractor shall be consulted.

3.5 Maintenance of Grassed Areas

Grassed areas shall be maintained regularly by the facility operator. Vegetated and landscaped BMPs will be maintained as outlined in Section 4.0.

3.6 Snow and Deicing Chemical Management

Snow removal at the site shall comply with the following requirements:

- Plowed snow shall not be placed in wetland resource areas or associated buffer zones. The following maintenance measures shall be undertaken at all snow disposal sites:
  - Debris shall be cleared from an area prior to using it for snow disposal.
  - Debris and accumulated sediments shall be cleared from the site and properly disposed of at the end of the snow season and no later than May 15.
- The use of deicing materials and sand shall not be used at the proposed project site to protect off-site areas.

4.0 LONG-TERM OPERATION AND MAINTENANCE PLAN

This section outlines the general maintenance activities for the stormwater best management practices (BMPs) associated with the proposed stormwater management system and identifies the long-term inspection and maintenance requirements for each BMP.

4.1 Stormwater Management System Components

The following table outlines the type and quantity of the BMPs and their general location. Please reference the site plan(s) provided in the Figures section for exact location.

BMP Type	Quantity	Location
Infiltration Basin	8	Throughout the site

4.2 Inspection and Maintenance Schedules

4.2.1 Infiltration Basins

Infiltration basins shall be inspected and maintained after major storm events (rainfall totals greater than 2.5 inches in 24 hours) during the first three months of operation and twice a year and when there are discharges through the outlet control structure thereafter. Additionally, all pretreatment BMPs shall be inspected in accordance with the minimal requirements specified for those practices and after all major storm events. Inspections shall include the following measures:

- During and after major storm events, the length of time standing water remains in the basin shall be recorded.
    - If the time is greater than 72 hours, thoroughly inspect the basin for signs of clogging.
    - A corrective action plan shall be developed by a qualified professional to restore infiltrative function. The Site Owner shall take immediate action to implement these corrective measures.
- Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than the design velocity.
- Identify areas of sediment accumulation, differential settlement, cracking, and erosion within the basin.
- Inspect embankments for leakage and tree growth.
- Examine the health of the vegetation within the basin and on the embankments.

Corrective measures shall be taken immediately as warranted by the inspections. If any evidence of hydrocarbons is found during inspection, the material shall be immediately removed using absorbent pads or other suitable measures and legally disposed.

Preventative maintenance shall include the following activities:

- Mow the buffer area and basin bottom and side slopes, if vegetated.
- Remove trash, debris, and accumulated organic matter.
- Remove clippings after mowing.

4.2.2 Stormwater Outfalls

Flared end sections and associated riprap aprons, and overflow spillways shall be inspected at least once per year and after major storm events (rainfall totals greater than 2.5 inches in 24 hours) to ensure that the stability of the outlet area is maintained. The outfall area shall be kept clear of debris such as trash, branches, and sediment. Repairs shall be made immediately if riprap displacement or downstream channel scour is observed.

4.3 Estimated Operation and Maintenance Budget

An operations and maintenance budget was prepared to approximate the annual cost of the inspections required in compliance with the DEP Stormwater Management Policy. The table below estimates the annual cost to inspect and maintain each proposed BMP, based on the requirements in Section 4.2.

BMP Type	# of BMPS	Annual O&M Cost (per BMP)[1]	Total Cost
Infiltration Basin	8	$50-$100	$400-$800
Riprap Spillway/Flared Ends	8	$200-$400	$1600-$3200
		Total	$2000-$4000

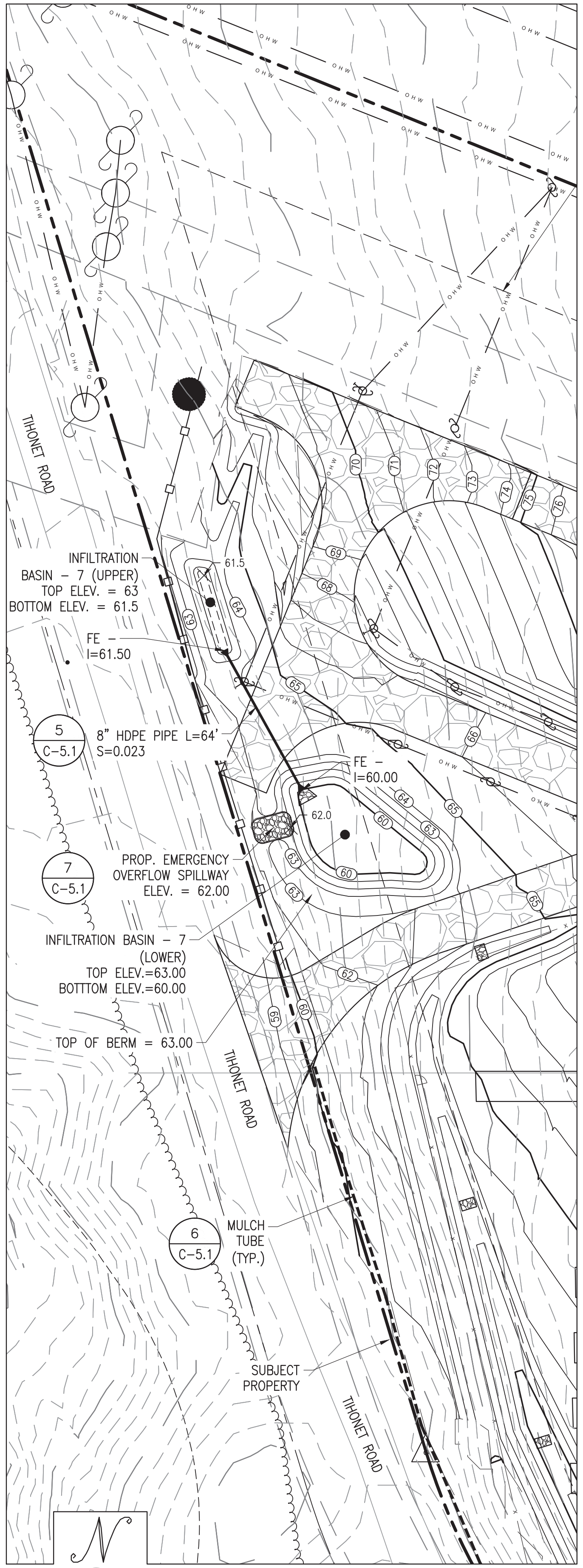
4.4 Public Safety Features

The site is not open to the public. A locked vehicle gate will be located at the entrance to the gravel access driveway. In addition, a 7' chain-link-fence will surround the array. Operation and maintenance of the facility will be conducted in accordance with the safety requirements of the facility operator and applicable OSHA regulations.

[1] Annual maintenance cost is based on estimate of the cost to complete all inspection and maintenance measures outlined in Section 4.2. For BMPs that require sediment removal at regular intervals (i.e. every 5 or 10 years), the annual cost includes the annual percentage of that cost.

Figures

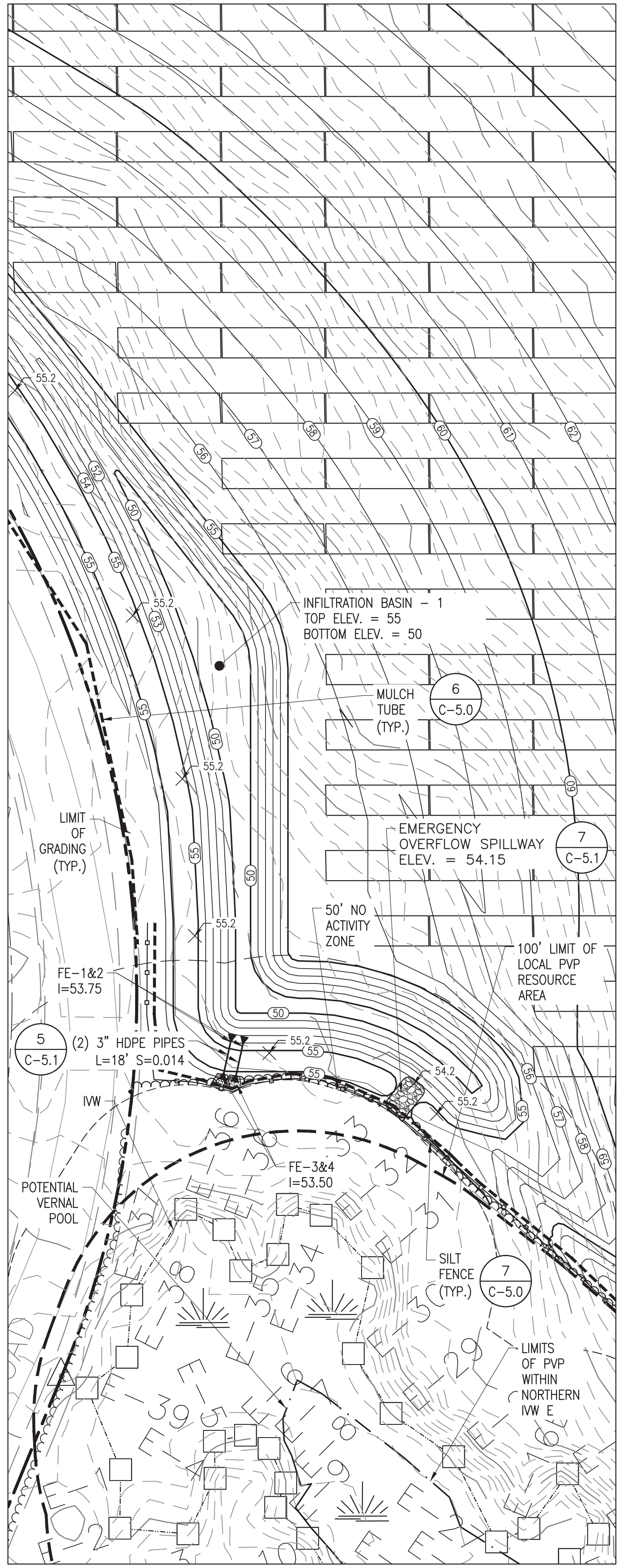
Figure 1: Site Plan



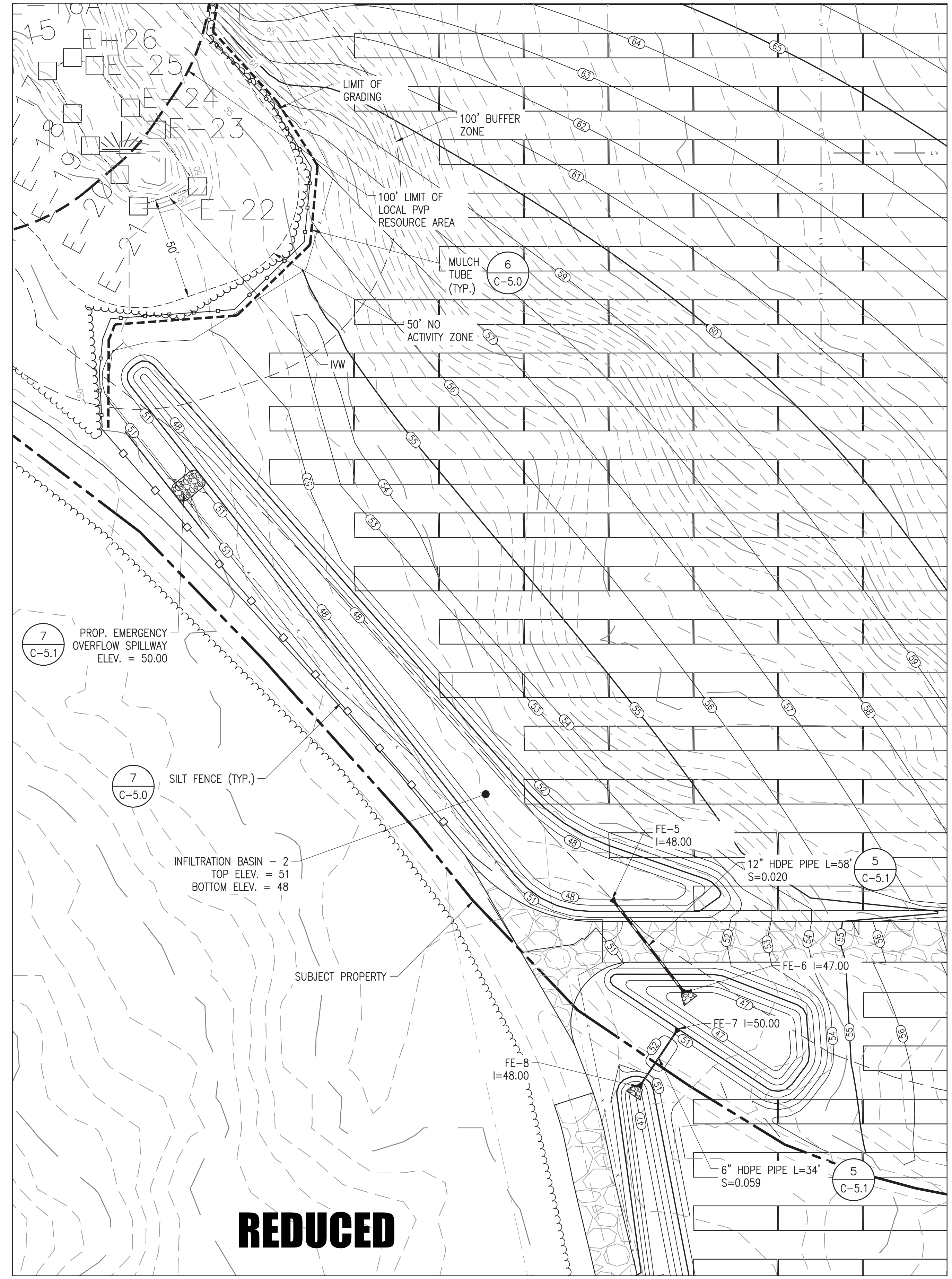
BASINS 7, 9

SCALE: 1" = 30'

0 30' 60'



BASIN 1



BASIN 2

BORREGO SOLAR
55 TECHNOLOGY DRIVE, SUITE 102
LOWELL, MA 01851
PHONE: (888) 898-6273
FAX: (888) 843-6778
WWW.BORREGOSOLAR.COM

NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED PROFESSIONAL ENGINEER
6/2/2020

SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

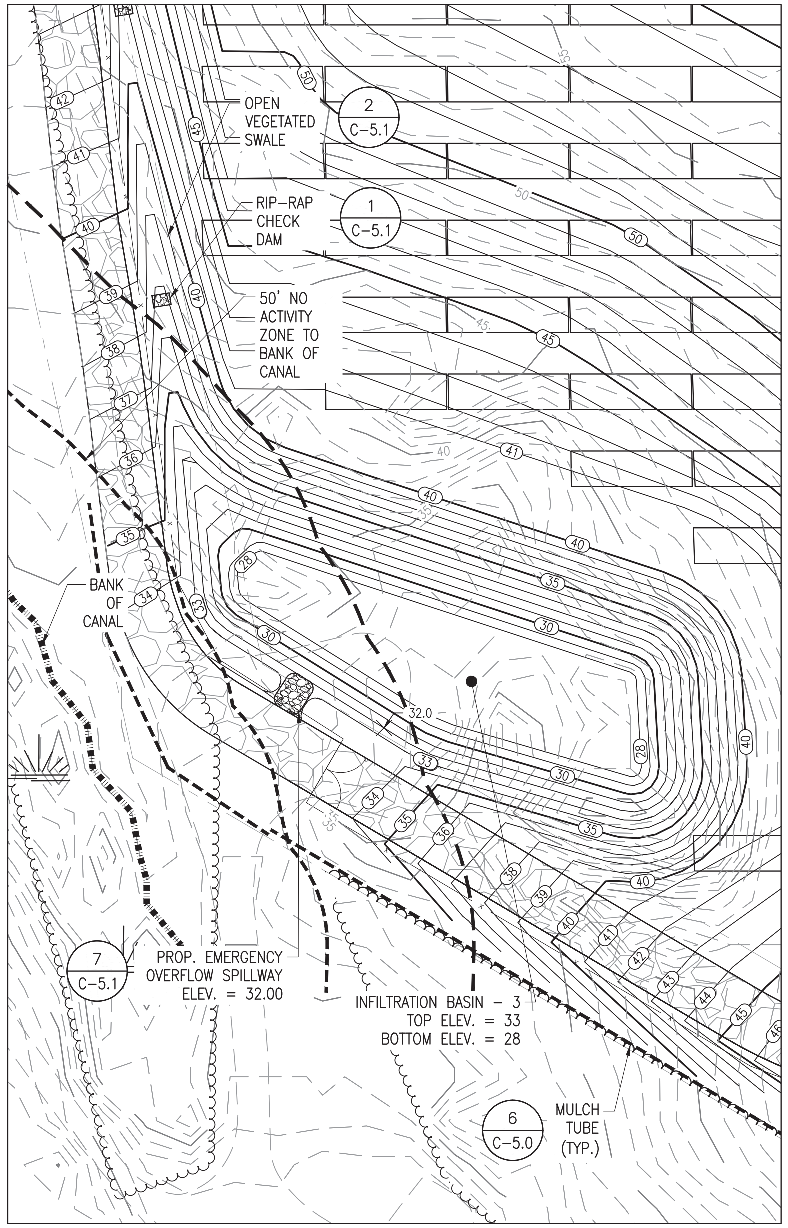
PROJECT NUMBER: 905-2708

REV	DATE	DRAWN	CHECKED	RELEASE LEVEL
	03/26/20	WS	CDS	SUP SET CREATION
	05/07/20	WS	CDS	REVISIONS PER NEW FIELD DATA
	06/01/20	LBD	CDS	UPDATED SET TO MATCH DESIGN CHANGES
	06/02/20	WS	CDS	ISSUED FOR LOCAL PERMITTING

SCALES STATED ON DRAWINGS ARE VALID ONLY WHEN PLOTTED ARCH D 24" X 36"

C-4.4

GRADING AND EROSION CONTROL PLAN - NORTH



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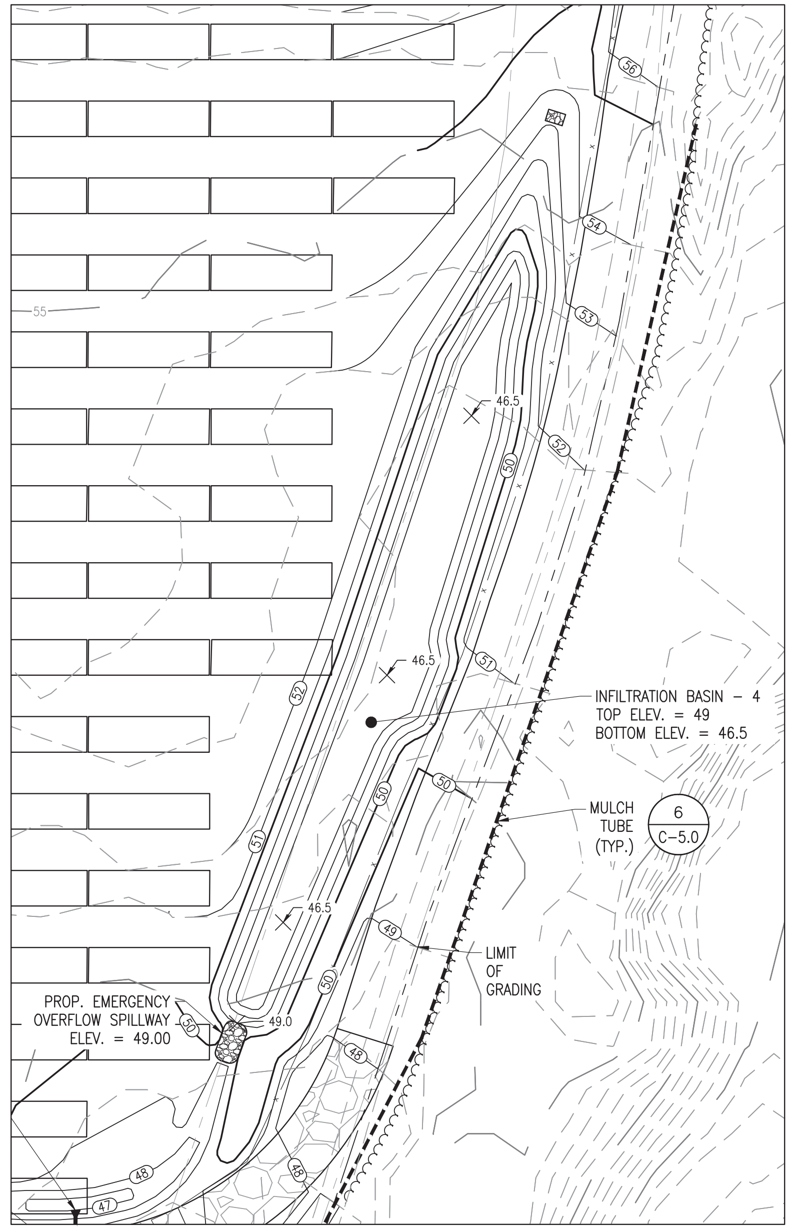

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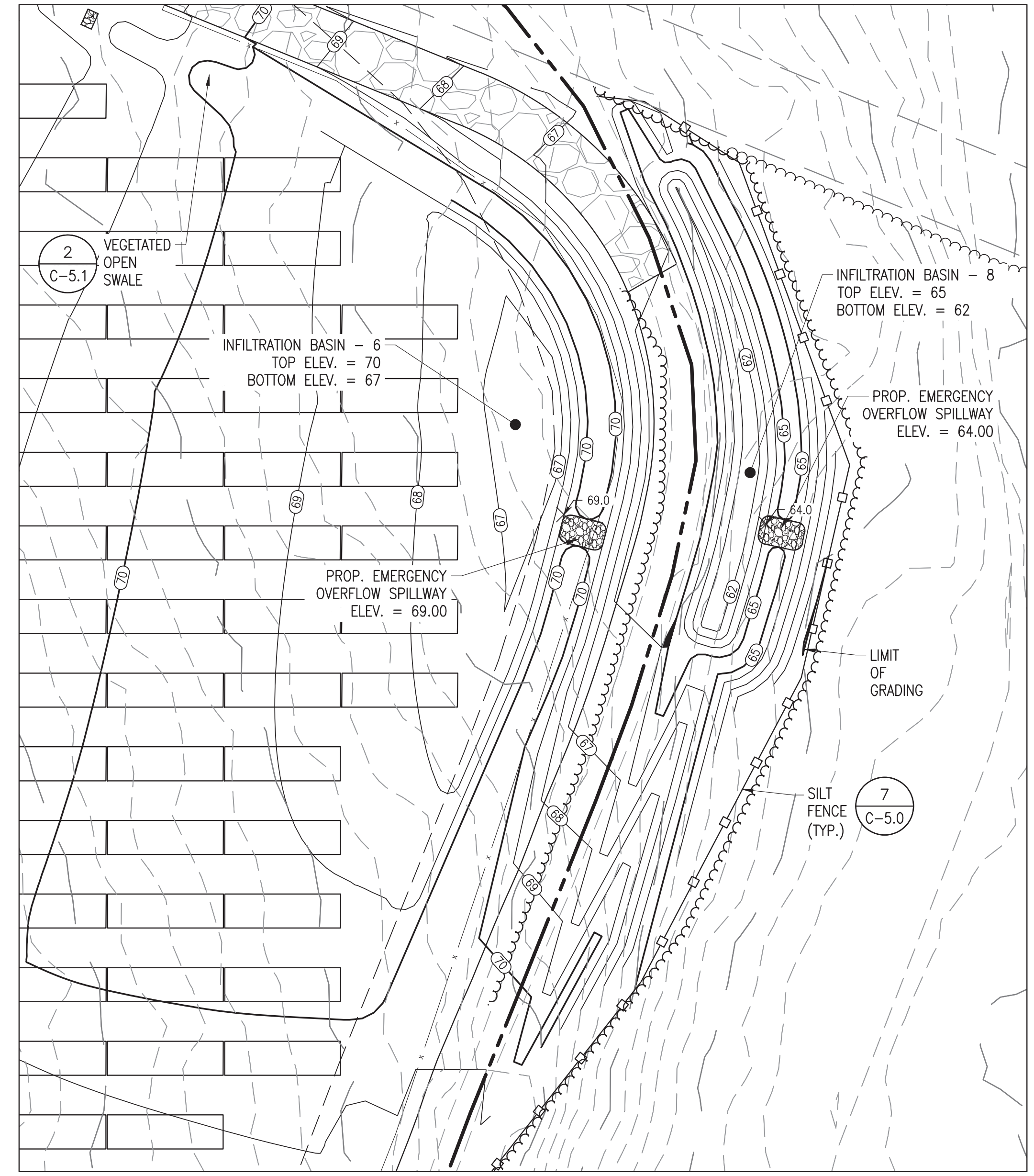
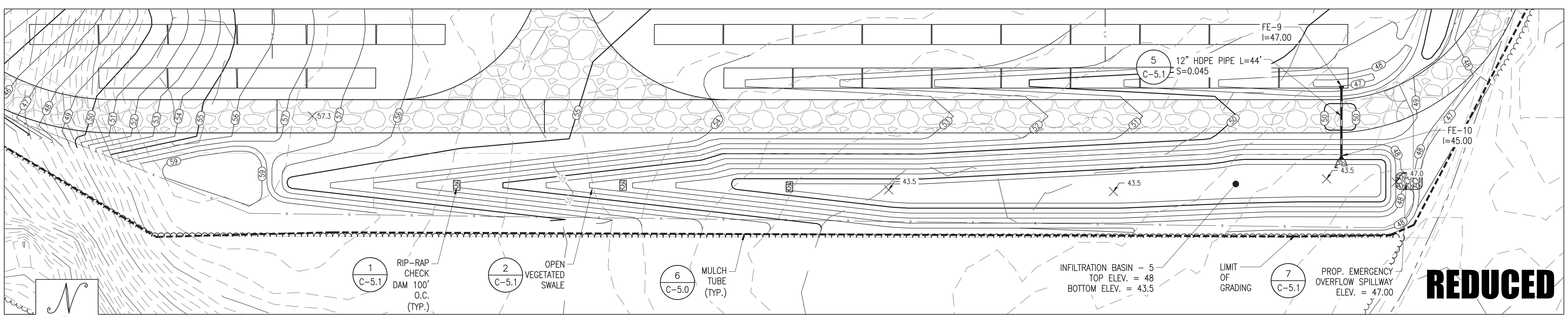
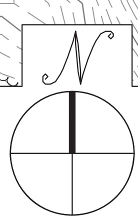


BASINS 6, 8



REDUCED



BASIN 5

SCALE: 1" = 30'

0 30' 60'

BORREGO SOLAR
55 TECHNOLOGY DRIVE, SUITE 102
LOWELL, MA 01851
PHONE: (888) 898-6273
FAX: (888) 843-6778
WWW.BORREGOSOLAR.COM

NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS JEFFREY R. MURPHY CIVIL No. 51800 REGISTERED PROFESSIONAL ENGINEER
6/2/2020

SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

PROJECT NUMBER: 905-2708

REV	DATE	DRAWN	CHECKED	RELEASE LEVEL
	03/26/20	WS	CDS	SUP SET CREATION
	05/07/20	WS	CDS	REVISIONS PER NEW FIELD DATA
	06/01/20	LBD	CDS	UPDATED SET TO MATCH DESIGN CHANGES
	06/02/20	WS	CDS	ISSUED FOR LOCAL PERMITTING

SCALES STATED ON DRAWINGS ARE VALID ONLY WHEN PLOTTED ARCH D 24" X 36"

C-4.3

GRADING AND EROSION CONTROL PLAN - NORTH

Appendices

Appendix A

Operation and Maintenance Log

OPERATION AND MAINTENANCE LOG

This template is intended to comply with the operation and maintenance log requirements of the 2008 MassDEP Stormwater Management Handbook. Copies of this log should be made for all inspections and kept on file for three years from the inspection date.

Name/Company of Inspector:
Date/Time of Inspection:
Weather Conditions: (Note current weather and any recent precipitation events)

Stormwater BMP	Inspection Observations	Actions Required

Appendix B

List of Emergency Contacts

List of Emergency Contacts

MassDEP Hazardous Waste Incident Response Group
(617) 792-7653

Town of Wareham Municipal Maintenance
95 Charge Pond Road
Wareham, MA 02571
(508) 295-5300

Town of Wareham Fire Department
20 Church Street
Wareham, MA 02571
(508) 295-2973

Town of Wareham Police Department
2515 Cranberry Highway
Wareham, MA 02571
(508) 295-1212

Attachment 7
Draft Stormwater Pollution Prevention Plan

Draft Stormwater Pollution Prevention Plan

140 Tihonet Road PV+ES Project

140 Tihonet Road (aka 0 & 169 Tihonet Road)
Wareham, Massachusetts

Prepared for:

Borrego Solar Systems, Inc.
55 Technology Drive, Suite 102
Lowell, MA 01851

Prepared by:

BEALS AND THOMAS, INC.
32 Court Street
Plymouth, MA 02360

June 2, 2020

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LIST OF APPENDICES

1.0 CONTACT INFORMATION/RESPONSIBLE PARTIES

1.1 OPERATOR(S)/ SUBCONTRACTORS

Operator(s)

Company:	Borrego Solar Systems, Inc.				
Name:					
Address:					
City:		State:		ZIP Code:	
Telephone:		Email:			

Company:	TBD				
Name:					
Address:					
City:		State:		ZIP Code:	
Telephone:		Email:			

Subcontractor(s)

Company:	TBD				
Name:					
Address:					
City:		State:		ZIP Code:	
Telephone:		Email:			
Area of Control:		Site Work Contractor			

24-Hour Emergency Contact

Company:	TBD
Name:	
Telephone:	

1.2 STORMWATER TEAM

SWPPP Preparer

Company:	Beals and Thomas, Inc.				
Name:	Nathaniel Bautz, EIT				
Address:	144 Turnpike Road				
City:	Southborough	State:	MA	ZIP Code:	01772
Telephone:	508-366-0560	Email:			

Personnel Responsible for Installation & Maintenance of Stormwater BMPs

Company:	TBD				
Name:					
Address:					
City:		State:		ZIP Code:	
Telephone:		Email:			

Inspection Personnel

Company:	TBD				
Name:					
Address:					
City:		State:		ZIP Code:	
Telephone:		Email:			

Personnel Responsible for Taking Corrective Actions

Company:	TBD				
Name:					
Address:					
City:		State:		ZIP Code:	
Telephone:		Email:			

2.0 SITE EVALUATION, ASSESSMENT AND PLANNING

2.1 PROJECT/SITE INFORMATION

Project/Site Name:	140 Tihonet Road PV+ES Project				
Project Street/Location:	140 Tihonet Road (aka 0 & 169 Tihonet Road)				
City:	Wareham	State:	MA	ZIP Code:	02571
County or Similar Subdivision:		Plymouth			

Latitude:	41°47’23” N	Longitude:	70°42’29”W

Method for Determining Latitude/Longitude:
- ☐ USGS Topographic Map (specify scale: __________)
- ☐ EPA Website
- ☐ GPS
- ☒ Other (please specify): Google Earth

Horizontal Reference Datum:
- ☐ NAD 27 ☐ WGS 84
- ☒ NAD 83 ☐ Unknown

Is the project located on Indian country lands, or located on a property of religious of cultural significance to an Indian tribe? ☐ Yes ☒ No

If yes, provide the name of the Indian tribe associated with the area of Indian country (including the name of Indian reservation if applicable), or if not in Indian country, provide the name of the Indian tribe associated with the property:

____

Is this project considered a federal facility? ☐ Yes ☒ No

Are you applying for permit coverage as a “federal operator” as defined in Appendix A of the 2017 CGP? ☐ Yes ☒ No

NPDES project or permit tracking number: TBD

2.1.1 Emergency-Related Projects

Is this project in response to a public emergency? ☐ Yes ☒ No

If yes, document the cause of the public emergency *(e.g., natural disaster, extreme flooding conditions)*, information substantiating its occurrence *(e.g., state disaster declaration)*, and a description of the construction necessary to reestablish effective public services:

2.2 NATURE AND SEQUENCE OF CONSTRUCTION ACTIVITY

2.2.1 Function of the Construction Activity

Function of the construction activity:

☐ Single-Family Residential
☐ Multi-Family Residential
☐ Institutional
☐ Utility
☐ Commercial
☐ Industrial
☐ Highway or Road Construction
☒ Other (please specify): Renew. Energy

2.2.2 Building Demolition

Will there be demolition of any structure built or renovated before January 1, 1980? ☐ Yes ☒ No

If yes, do any of the structures being demolished have at least 10,000 square feet of floor space? ☐ Yes ☒ No

2.2.3 Agricultural Land

Was the pre-development land use used for agriculture? ☐ Yes ☒ No

2.2.4 Estimated Project Dates

Estimated Project Start Date: TBD
Estimated Project Completion Date: TBD

Estimated Timeline of Activity	Construction Activity and BMP Descriptions
TBD	***Before any site grading activities begin*** 1. Stake Limit of Construction. Workers shall be informed that no construction activity is to occur beyond this limit at any time. 2. Install sediment controls as shown on the plans. An adequate stockpile of erosion control materials shall be on site at all times for emergency or routine replacement and shall include materials to repair silt fences, compost mulch tubes, or any other devices planned for use during construction. 3. Construct stabilized construction exits. 4. Construct staging and materials storage area. 5. Install temporary sanitary facilities and dumpsters.
TBD	***Site grading*** 1. Begin overall site grading. 2. Establish topsoil stockpile. 3. Install silt fences around stockpile. 4. Build stormwater basins and complete overall site grading. 5. Disturbed areas where construction will cease for more than 14 days shall be stabilized with erosion controls.
TBD	***Infrastructure (utilities, solar panels, etc.)*** 1. Construct temporary concrete washout area. 2. Install utilities, solar panels.
TBD	***Final stabilization and landscaping*** 1. Finalize grading activities. 2. Remove all temporary erosion control BMPs and stabilize any areas disturbed by their removal with erosion controls. 3. Monitor stabilized areas until final stabilization is reached.

2.3 SOILS, SLOPES, VEGETATION, AND CURRENT DRAINAGE PATTERNS

Soil type(s): The Natural Resources Conservation Service (NRCS) lists the on-site soils types as predominantly hydrologic soil class A. These soil groups include Poquonock sand, Plymouth-Carver complex, Carver loamy coarse sand, and Hinckley loamy sand, and Gloucester-Canton complex. A small area of hydrologic soil class D soils is present at the southwestern corner of the proposed project locus, which is classified as Udipsamments-wet substratum.

Slopes: 1-30%

Drainage Patterns: Runoff from the site drains to the south, east, and west.

Vegetation: The existing site is comprised of woodland area.

2.4 CONSTRUCTION SITE ESTIMATES

Total construction site area to be disturbed:	±76.5 acres
Maximum area to be disturbed at one time:	±76.5 acres
Percentage impervious area before construction:	<1%
Runoff curve number before construction:	31
Percentage impervious area after construction:	<1%
Runoff coefficient after construction:	40

2.5 DISCHARGE INFORMATION

2.5.1 Description of Receiving Storm Sewer Systems

Does your project/site discharge stormwater into a Municipal Separate Storm Sewer System (MS4)? ☐ Yes ☒ No

2.5.2 Receiving Waters

Runoff from the site drains to Tihonet Pond to the west, and to existing cranberry bogs to the south which eventually flow to Parker Mills Pond. Runoff also flows east to an off-site wetland that drains to off-site cranberry bogs that drain to Harlow Brook.

2.5.3 Impaired Waters/ TMDLs

Has the surface water been listed as "impaired?" ☐ Yes ☒ No

If yes, list the pollutant(s) causing the impairment: N/A

Describe the method(s) used to determine whether or not your project site discharges to an impaired water:

Has a TMDL been completed? ☐ Yes ☒ No

If yes, list the title of the TMDL document: N/A

List the pollutant(s) for which there is a TMDL: N/A

2.5.4 Tier 2, 2.5, or 3 Waters

Is this surface water designated as a Tier 2, 2.5 or 3 water? ☐ Yes ☐ No

If yes specify which Tier the surface water is designated as:
☐ Tier 2 ☐ Tier 2.5 ☐ Tier 3

2.6 UNIQUE SITE FEATURES AND SENSITIVE AREAS

The site contain wetlands and a potential vernal pool; these features will not be impacted by the project. The hydrology of these areas is maintained by the proposed stormwater design. Additionally, they will be protected by sediment control barriers as needed to avoid potential sedimentation.

2.7 CONSTRUCTION SUPPORT ACTIVITIES

Construction support activities are not required for the project.

2.8 POTENTIAL SOURCES OF POLLUTION

2.8.1 Potential Sources of Sediment

- Grading and site excavation operations
- Vehicle tracking
- Soil stripping and stockpiling

2.8.2 Potential Sources of Non-Sediment Pollutants

- Combined Staging Area — small fueling activities, minor equipment maintenance, sanitary facilities, and hazardous waste storage.
- Materials Storage Area — general building materials, solvents, adhesives, paints, aggregates, trash, and so on.
- Construction Activity — concrete pouring, and array construction
- Concrete Washout Area

Material/ Chemical	Physical Description	Stormwater Pollutants	Location[1]
[2]Fertilizer	Liquid or solid grains	Nitrogen, phosphorous	Newly seeded areas
Cleaning solvents	Colorless, blue, or yellow-green liquid	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates	No equipment cleaning allowed in project limits
Curing compounds	Creamy white liquid	Naphtha	Concrete Equipment Pads
Hydraulic oil/fluids	Brown oily petroleum hydrocarbon	Mineral oil	Leaks or broken hoses from equipment
Gasoline	Colorless, pale brown or pink petroleum hydrocarbon	Benzene, ethyl benzene, toluene, xylene, MTBE	Contractor staging area
Diesel Fuel	Clear, blue-green to yellow liquid	Petroleum distillate, oil & grease, naphthalene, xylenes	Contractor staging area
Kerosene	Pale yellow liquid petroleum hydrocarbon	Coal oil, petroleum distillates	Contractor staging area
Antifreeze/ coolant	Clear green/yellow liquid	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)	Leaks or broken hoses from equipment
Sanitary toilets	Various colored liquid	Bacteria, parasites, and viruses	Staging area

[1] Area where material/chemical is used on-site.
[2] Use of fertilizers containing nitrogen and/or phosphorus in ratios greater than recommended by the manufacture must be documented.

2.9 SITE PLANS

The Existing Conditions Plan shows the undeveloped site and its current features. The Site Plans show the developed site.

These Site Plans include:

- ☐ Delineation of construction phasing, if applicable
- ☒ Areas of soil disturbance and areas that will not be disturbed
- ☒ Direction(s) of stormwater flow and approximate slopes before and after major grading activities
- ☒ Natural features to be preserved
- ☒ Locations of major structural and non-structural BMPs identified in the SWPPP
- ☐ Location(s) of sediment, soil or other construction materials will be stockpiled
- ☐ Locations of stabilization measures
- ☐ Locations of off-site material, waste, borrow, or equipment storage areas
- ☒ Location of all waters of the U.S., including wetlands on or near the site. Indicate if water bodies are listed as impaired, or are identified as Tier 2, 2.5 or 3 waters.
- ☒ Boundary lines of any natural buffers,
- ☒ Locations of stormwater discharges and/ or locations where authorized non-stormwater will be discharged to surface water(s)
- ☒ Locations of storm drain inlets and stormwater control measures on the site and in the immediate vicinity of the site
- ☐ Locations of all pollutant-generating activities
- ☐ Locations where polymers, flocculants, or other treatment chemicals will be used and stored
- ☐ Areas of federally listed critical habitat for endangered or threatened species

See Appendix B: Site Plans

3.0 COMPLIANCE WITH APPLICABLE FEDERAL & STATE REQUIREMENTS

3.1 ENDANGERED SPECIES CERTIFICATION

Are endangered or threatened species and critical habitats on or near the project area?
☐ Yes ☐ No

Describe how this determination was made:
PLACEHOLDER LANGUAGE PENDING SITE SPECIFIC REVIEW: A project review package was submitted to USFWS on DATE, addressing Northern Long-Eared Bat (NLEB) and Plymouth Red-Belly Turtle. In summary:

A habitat assessment for Northern Long-Eared Bat was performed on DATE by GZA GeoEnvironmental, Inc. (GZA) and concluded that the project site does not provide important habitat for NLEB, and hibernacula or maternity roosting tree habitat are not known within ¼ mile of the site. The assessment also indicates that the closest location of documented overwintering for this species is located ># miles from the site, and further, that summer forage habitat is not present within the proposed work area.

GZA also performed a Plymouth Red-Belly Turtle assessment of the site, dated DATE. The assessment found that the project site does not occur within mapped Critical Habitat for the turtle, and a general habitat assessment and limited site survey found that the project site has low to moderate potential to support this species and no individual turtles were found. Accordingly, a "may affect, but is unlikely to adversely affect" concurrence letter was issued by USFWS on April 10, 2019.

If yes, describe the species and/or critical habitat:

If yes, describe or refer to documentation that determines the likelihood of an impact on the identified species and/or habitat and the steps taken to address that impact.

3.2 HISTORIC PRESERVATION

Step 1
Will stormwater controls that require subsurface earth disturbance be installed on the site?

☒ Yes ☐ No

Step 2
If you answered yes in Step 1, have prior surveys or evaluations conducted on the site already determined that historic properties do not exist, or that prior disturbances at the site have precluded the existence of historic properties?

☐ Yes ☐ No

Step 3
If you answered no in Step 2, has it been determined that the installation of subsurface earth-disturbing stormwater controls will have no effect on historic properties?

☐ Yes ☐ No

PLACEHOLDER LANGUAGE PENDING SITE SPECIFIC REVIEW: Historic sites are not present. See Appendix M: Historic Preservation Documentation.

Step 4
If you answered no in Step 3, did the State Historic Preservation Officer (SHPO), Tribal Historic Preservation Office (THPO), or other tribal representative (whichever applies) respond within 15 calendar days to indicate whether the subsurface earth disturbances caused by the installation of stormwater controls affect historic properties?

☐ Yes ☐ No

If no, no further documentation is required. If yes, describe the nature of their response and include documentation in the Appendix:

☐ Written indication that adverse effects to historic properties from the installation of stormwater controls can be mitigated by agreed upon actions.

☐ No agreement has been reached regarding measures to mitigate effects to historic properties from the installation of stormwater controls.

☐ Other:

3.3 SAFE DRINKING WATER ACT UNDERGROUND INJECTION CONTROL REQUIREMENTS

Do you plan to install any of the following controls?

☐ Infiltration trenches (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)

☐ Commercially manufactured pre-cast or pre-built proprietary subsurface detention vaults, chambers, or other devices designed to capture and infiltrate stormwater flow

☐ Drywells, seepage pits, or improved sinkholes (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)

If yes, attach documentation of contact between you and the applicable state agency or EPA Regional Office responsible for implementing the requirements for underground injection wells in the Safe Drinking Water Act and EPA's implementing regulations at 40 CFR Parts 144-147.

3.4 APPLICABLE STATE OR LOCAL PROGRAMS

This SWPPP complies with the requirements of Standard 8 of the Massachusetts Department of Environmental Protection Stormwater Handbook, which states:

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plans) shall be developed and implemented.

4.0 EROSION AND SEDIMENT CONTROL BMPS

This SWPPP contains a listing of the erosion and sediment control best management practices (BMPs) that will be implemented to control pollutants in stormwater discharges. The BMPs are categorized under one of the areas of BMP activity as described below:

- Natural Buffers or Equivalent Sediment Controls
- Phased construction activity
- Control stormwater flowing onto and through the project
- Stabilize soils
- Protect slopes
- Protect storm drain inlets
- Establish perimeter controls and sediment barriers
- Retain sediment on-site and control dewatering practices
- Establish stabilized construction exits

4.1 NATURAL BUFFERS OR EQUIVALENT SEDIMENT CONTROLS

Are there any surface waters located within 50 feet of your construction disturbances that receive stormwater discharges from the site? ☐ Yes ☒ No

4.2 PHASED CONSTRUCTION ACTIVITY

Phased construction is not proposed. To minimize erosion during grading activities, grading and site work shall be conducted after snowmelt and during periods of predicted dry weather. The areas of the site that will remain vegetated after construction shall be stabilized with hydromulch or seeding immediately after grading activities are completed. All other areas of the construction site shall be stabilized if site work is not planned for more than 14 days. Disturbed areas shall be stabilized immediately after construction but no later than 14 days after construction ceases. Areas graded shall be stabilized with hydromulch immediately after construction but no later than 14 days after construction ceases.

4.3 STABILIZE SOIL

4.3.1 Temporary Stabilization

Description:	Initiation of temporary vegetative cover shall occur immediately where construction will cease for more than 7 days. Temporary vegetative cover shall be established using hydroseeding for areas of exposed soil (including stockpiles).
Installation Schedule:	Temporary stabilization measures shall be initiated immediately where construction activities will temporarily cease for more than 14 days. Stabilization will be completed as soon as practicable, but no later than 7 calendar days after stabilization has been initiated.
Maintenance and Inspection:	Stabilized areas shall be inspected weekly and after storm events until a dense cover of vegetation has become established. If failure is noticed at the seeded area, the area shall be reseeded, fertilized, and mulched immediately.

4.3.2 Hydromulching

Description:	Hydromulching shall provide immediate protection to exposed soils during short periods of disturbance. Hydromulch shall also be applied in areas that have been seeded for temporary or permanent stabilization.
Installation Schedule:	Hydromulch shall be applied to soil exposed temporarily for >14 days during construction.
Maintenance and Inspection:	Hydromulched areas shall be inspected weekly and after storm events to check for movement of mulch or erosion. If washout, breakage, or erosion occurs, the surface shall be repaired, and new hydromulch shall be applied to the damaged area.

4.3.3 Permanent Stabilization

Description:	Initiation of permanent stabilization measures shall occur immediately after the final design grades are achieved and earth moving activities cease. Vegetative cover shall be established on exposed soils. Permanent stabilization shall be completed in accordance with the procedures outlined in Section 6.0 Final Stabilization.
Installation Schedule:	Portions of the site where construction activities have permanently ceased shall be stabilized as soon as possible, but no later than 7 calendar days after stabilization has been initiated.
Maintenance and Inspection:	All seeded areas shall be inspected weekly during construction activities and after storm events until a dense cover of vegetation has been established. If failure is noticed at the seeded area, the area shall be reseeded in accordance with the plans. Care shall be taken to avoid compacting newly placed topsoil. After construction is completed at the site, permanently stabilized areas shall be monitored until final stabilization is reached.

4.3.4 Dust Control

Description:	Dust from the site shall be controlled by using a mobile pressure-type distributor truck to apply water to disturbed areas. The mobile unit shall apply water at a maximum rate of 300 gallons per acre and minimized as necessary to prevent runoff and ponding.
Installation Schedule:	Dust control shall be implemented as needed once site grading has been initiated and during windy conditions (forecasted or actual wind conditions of 20 mph or greater) while site grading is occurring. Spraying of water shall be performed no more than three times a day during the months of May–September and once per day during the months of October–April or whenever the dryness of the soil warrants it.
Maintenance and Inspection:	At least one mobile unit shall be available at all times to distribute water to control dust on the site. Each mobile unit shall be equipped with a positive shutoff valve to prevent over watering of the disturbed area.

4.4 ESTABLISH PERIMETER CONTROLS AND SEDIMENT BARRIERS

4.4.1 Sediment Control Barrier

☐ Permanent ☒ Temporary

Description:	A sediment control barrier, consisting of silt fence and compost mulch tube shall be installed along the down-gradient side of the proposed project to decrease the velocity of sheet flows and intercept and detain small amounts of sediment from disturbed areas.
Installation Schedule:	Sediment Control Barrier shall be installed prior to clearing and grubbing.
Maintenance and Inspection:	Sediment Control Barrier shall be inspected weekly, following storms, and daily during rainy periods. Damaged fencing or tubes shall be replaced. Concentrated flows shall be intercepted and rerouted. Sediment accumulations shall be removed when reaching a depth of 6-inches, or one-half of the above ground height of the barrier, whichever is less. Deteriorated sediment control material shall be replaced. Used mulch tubes and fencing shall be properly disposed of.

4.5 ESTABLISH STABILIZED CONSTRUCTION ENTRANCE/EXIT

☐ Permanent ☒ Temporary

Description:	Temporary gravel or crushed stone construction entrance/exit or other means shall be used to minimize off-site movement of soil with vehicles. Construction access points shall be maintained to minimize tracking of soil onto public roads. If the rock entrance is not working to keep streets clean, then install wheel wash, sweep streets, or wash streets if wash water can be collected.
Installation Schedule:	Stabilized construction entrance shall be installed prior to earthmoving activities.
Maintenance and Inspection:	Stabilized construction entrances shall be inspected daily. Gravel or crushed stone shall be added if the pad is no longer in accordance with the specifications. If the rock entrance is not working to keep public streets clean, then install wheel wash, sweep streets, or wash streets if wash water can be collected. When sediment has been tracked off of the site onto public roads, it shall be removed by the end of the same working day, or by the end of the next working day if track-out occurs on a non-work day. Remove sediment by sweeping, shoveling or vacuuming public roadways were sediment has been tracked-out.

4.6 DEWATERING PRACTICES

Description:	All groundwater or stormwater discharged from excavations, trenches, or other similar points shall be treated by sediment basins, sediment traps, sediment socks, dewatering tanks, tube settlers or filtration systems specifically designed to remove sediment from the excavations. All dewatering practices shall conform to the following: • Visible floating solids or foam shall not be discharged; • An oil-water separator or suitable filtration device (such as a cartridge filter) that is designed to remove oil, grease, or other products if dewatering water is found to contain these materials shall be used; • To the extent feasible, utilize vegetated, upland areas of the site to infiltrate dewatering water before discharge. In no case will surface waters be considered part of the treatment area; • Velocity dissipaters shall be installed at all points where dewatering activities are discharged to the surface. • With backwash water, either haul it away for disposal or return it to the beginning of the treatment process; and • Replace and clean the filter media used in dewatering devices when the pressure differential equals or exceeds the manufacturer's specifications.
Installation Schedule:	Install settling or filtration methods prior to commencing dewatering. Engineer is required to approve settling of filtration method design prior to installation.
Maintenance and Inspection:	Settling of filtration controls shall be inspected weekly and following storms. Sediment shall be removed when it reaches a depth of one foot, or half the design capacity whichever is less.

5.0 GOOD HOUSEKEEPING BMPS

This SWPPP contains a listing of the good housekeeping best management practices (BMPs) that shall be implemented to control pollutants in stormwater discharges during construction-related work. The BMPs are categorized below:

- Material Handling and Waste Management
- Establish Proper Building Material Staging Areas
- Designate Washout Areas
- Establish Proper Equipment/Vehicle Fueling and Maintenance Practices
- Allowable Non-Stormwater Discharges and Control Equipment/Vehicle Washing
- Spill Prevention and Control Plan

5.1 MATERIAL HANDLING AND WASTE MANAGEMENT

Several management procedures and practices are proposed to prevent and/or reduce the discharge of pollutants to stormwater from solid or liquid wastes that will be generated at the site. These measures are grouped into the following categories: (1) solid or construction waste disposal, (2) recycling, (3) sanitary and septic waste, and (4) hazardous materials.

5.1.1 Solid or Construction Waste Disposal

Description:	All waste materials shall be collected and disposed of into metal trash dumpsters or enclosed trash containers in the materials storage area. Dumpsters shall have a secure watertight lid, be placed away from stormwater conveyances and drains, and meet all federal, state, and municipal regulations. Only trash and construction debris from the site shall be deposited in the dumpster. No construction materials shall be buried on-site unless authorized by a program for recycling/beneficial use. All personnel shall be instructed regarding the correct disposal of trash and construction debris. Notices that state these practices shall be posted in the office trailer and the individual who manages day-to-day site operations shall be responsible for seeing that these practices are followed.
Installation Schedule:	Trash dumpsters shall be installed once the materials storage area has been established.
Maintenance and Inspection:	The dumpsters shall be inspected weekly and immediately after storm events. The dumpsters shall be emptied weekly and taken to an approved landfill or recycling facility. If trash and construction debris are exceeding the dumpsters' capacity, the dumpsters shall be emptied more frequently. Waste container lids shall be closed when not in use and at the end of the business day. For waste containers that do not have lids, provide cover or a similarly effective means to minimize the discharge of pollutants.

5.1.2 Recycling

Description:	Wood pallets, cardboard boxes, and other recyclable construction scraps shall be disposed of in a designated dumpster for recycling. The dumpster shall have a secure watertight lid, be placed away from stormwater conveyances and drains and meet all local and state solid-waste management regulations. Only solid recyclable construction scraps from the site shall be deposited in the dumpster. All personnel shall be instructed regarding the correct procedure for disposal of recyclable construction scraps. Notices that state these procedures shall be posted in the office trailer, and the individual who manages day-to-day site operations shall be responsible for seeing that these procedures are followed.
Installation Schedule:	Designated recycling dumpsters shall be installed when building materials arrive on-site.
Maintenance and Inspection:	The recycling dumpster shall be inspected weekly and immediately after storm events. The recycling dumpster shall be emptied weekly and taken to an approved recycling center. If recyclable construction wastes are exceeding the dumpsters' capacity, the dumpsters shall be emptied more frequently.

5.1.3 Sanitary and Septic Waste

Description:	Temporary sanitary facilities (portable toilets) shall be provided at the site throughout the construction phase. The portable toilets shall be located in the staging area, away from concentrated flow paths and traffic flow.
Installation Schedule:	The portable toilets shall be brought to the site once the staging area has been established.
Maintenance and Inspection:	All sanitary waste shall be collected from the portable facilities on a regular basis. The portable toilets shall be inspected weekly for evidence of leaking holding tanks. Toilets with leaking holding tanks shall be removed from the site and replaced with new portable toilets.

5.1.4 Hazardous Materials and Waste

Description:	All hazardous waste materials such as oil filters, petroleum products, paint, and equipment maintenance fluids shall be stored in structurally sound and sealed shipping containers, within the hazardous materials storage area. Hazardous waste materials shall be stored in appropriate and clearly marked containers and segregated from other non-waste materials. Secondary containment shall be provided for all waste materials in the hazardous materials storage area and shall consist of commercially available spill pallets. Additionally, all hazardous waste materials shall be disposed of in accordance with federal, state, and municipal regulations. Hazardous waste materials shall not be disposed of into the on-site dumpsters. All personnel shall be instructed regarding proper procedures for hazardous waste disposal. Notices that state these procedures shall be posted in the office trailer and the individual who manages day-to-day site operations shall be responsible for seeing that these procedures are followed.
Installation Schedule:	Shipping containers used to store hazardous waste materials shall be installed once such materials arrive on-site.
Maintenance and Inspection:	The hazardous waste material storage areas shall be inspected weekly and after storm events. The storage areas shall be kept clean, well-organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Material safety data sheets, material inventory, and emergency contact numbers shall be maintained in the office trailer.

5.2 ESTABLISH PROPER BUILDING MATERIAL STAGING AREAS

Description:	Construction equipment and maintenance materials shall be stored at the combined staging area and materials storage areas. A watertight shipping container shall be used to store hand tools, small parts, and other construction materials. Nonhazardous building materials such as packaging material (wood, plastic, and glass), and construction scrap material (steel, metal scraps, and pipe cuttings) shall be stored in a separate covered storage facility adjacent to the shipping container. All hazardous-waste materials such as oil filters, petroleum products, paint, and equipment maintenance fluids shall be stored in structurally sound and sealed containers under cover within the storage area. Very large items, shall be stored in the open in the materials storage area. Such materials shall be elevated on blocks to minimize contact with runoff.

Installation Schedule:	The materials storage area shall be installed after grading and before any infrastructure is constructed at the site.
Maintenance and Inspection:	The storage area shall be inspected weekly and after storm events. The storage area shall be kept clean, well-organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.

5.3 DESIGNATE WASHOUT AREAS

5.3.1 Concrete Washout

Description:	A designated temporary, above-grade concrete washout area shall be constructed. The temporary concrete washout area shall be constructed with a recommended minimum length and minimum width of 10 feet, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations. The washout area shall be lined with plastic sheeting at least 10 mils thick and free of any holes or tears. Signs shall be posted marking the location of the washout area to ensure that concrete equipment operators use the proper facility. Concrete pours shall not be conducted during or before an anticipated storm event. Concrete mixer trucks and chutes shall be washed in the designated area or concrete wastes shall be properly disposed of off-site. When the temporary washout area is no longer needed for the construction project, the hardened concrete and materials used to construct the area shall be removed and disposed of according to the maintenance section below, and the area shall be stabilized.
Installation Schedule:	The washout area shall be constructed before concrete pours occur at the site.
Maintenance and Inspection:	The washout areas shall be inspected daily to ensure that all concrete washing is being discharged into the washout area, no leaks or tears are present, and to identify when concrete wastes need to be removed. The washout areas shall be cleaned out once the area is filled to 75 percent of the holding capacity. Once 75% of the area's holding capacity has been reached, the concrete wastes shall be allowed to harden; the concrete shall be broken up, removed, and taken to an approved landfill for disposal or recycled on-site or off-site in accordance with applicable laws. The plastic sheeting shall be replaced if tears occur during removal of concrete wastes from the washout area.

Design Specifications:

1. Temporary concrete washout type Above Grade shall be constructed as detailed above.
2. The washout shall be a minimum of 50 feet from storm drain inlets.
3. Plastic lining shall be free of holes, tears, or other defects that compromise the impermeability of the material.

5.4 ESTABLISH PROPER EQUIPMENT/VEHICLE FUELING AND MAINTENANCE PRACTICES

Description:	Several types of vehicles and equipment will likely be used on-site throughout the project, including graders, scrapers, excavators, loaders, rollers, trucks and trailers, backhoes, and forklifts. All major equipment/vehicle fueling and maintenance shall be performed outside of wetland resource areas and associated buffer zones. When vehicle fueling must occur on-site, the fueling activity shall occur in the staging area. Only minor equipment maintenance shall occur on-site. All equipment fluids generated from maintenance activities shall be disposed of into designated drums stored on spill pallets in accordance with the Material Handling and Waste Management Section 5.1. Absorbent, spill-cleanup materials and spill kits shall be available at the combined staging and materials storage area. Drip pans shall be placed under all equipment receiving maintenance and vehicles and equipment parked overnight.
Installation Schedule:	BMPs implemented for equipment and vehicle maintenance and fueling activities shall begin at the start of the project.
Maintenance and Inspection:	Inspect equipment/vehicle storage areas weekly and after storm events. Vehicles and equipment shall be inspected on each day of use. Leaks shall be repaired immediately, using dry cleanup measures where possible and eliminating the source of the discharge. Problem vehicle(s) or equipment shall be removed from the project site. Keep ample supply of spill-cleanup materials on-site and immediately clean up spills and dispose of materials properly. Do not clean surfaces by hosing-down the area.

5.5 ALLOWABLE NON-STORMWATER DISCHARGES AND CONTROL EQUIPMENT / VEHICLE WASHING

Description:	All equipment and vehicle washing shall be performed off-site, except as required for wheel washes and concrete washout areas.
Installation Schedule:	N/A
Maintenance and Inspection:	N/A

5.6 SPILL PREVENTION AND CONTROL PLAN

Description:	i. Employee Training: All employees shall be trained as detailed in the Inspection and Maintenance Section 8.0 of this report. ii. Vehicle Maintenance: Vehicles and equipment shall be maintained off-site, except for minor maintenance as needed. All vehicles and equipment including subcontractor vehicles shall be checked for leaking oil and fluids. Vehicles leaking fluids shall not be allowed on-site. iii. Hazardous Material Storage: Hazardous materials shall be stored in accordance with this report and applicable regulations. iv. Spill Kits: Spill kits shall be kept within the materials storage area. Spills: All spills shall be cleaned up immediately upon discovery. Spent absorbent materials and rags shall be hauled off-site immediately after the spill is cleaned up for disposal at an approved landfill. Spills shall be reported to the National Response Center at 1-800-424-8802 and MassDEP at 888-304-1133 as applicable in accordance with state and federal requirements. v. Material safety data sheets: A material inventory and emergency contact information shall be maintained at the on-site project trailer.
Installation Schedule:	The spill prevention and control procedures shall be implemented once construction begins on-site.
Maintenance and Inspection:	All personnel shall be instructed on the correct procedures for spill prevention and control. Notices that state these practices shall be posted in the office trailer, and the individual who manages day-to-day site operations shall be responsible for seeing that these procedures are followed.

5.7 FERTILIZER DISCHARGE RESTRICTIONS

Description:	Discharges from fertilizers containing nitrogen and phosphorus shall be minimized. Fertilizers shall be applied at rates and amounts consistent with the manufacture's specification, and shall at no time exceed local, state, or federal specifications. See project landscape specifications for acceptable fertilizers that can be used for the project.
Installation Schedule:	Fertilizers shall be applied at an appropriate time of year, timed to coincide as closely as possible to the period of maximum vegetation uptake and growth. Avoid applying fertilizers before heavy rains. Do not apply fertilizers to frozen ground or stormwater conveyance channels flowing with water.
Maintenance and Inspection:	N/A

5.8 ALLOWABLE NON-STORMWATER DISCHARGE MANAGEMENT

Any changes in construction activities that produce other allowable non-stormwater discharges shall be identified, and the SWPPP shall be amended and the appropriate erosion and sediment control shall be implemented.

The following is a list of allowable non-stormwater discharges:

- Water Used to Control Dust
- Uncontaminated Excavation Dewatering
- Firefighting
- Non-Detergent Laden Vehicle Wash Water

Except for water used to control dust and irrigation water, the above discharges shall not be routed to areas of exposed soil.

6.0 FINAL STABILIZATION

In compliance with the Construction General Permit, soil stabilization measures must be implemented immediately whenever earth-disturbing activities are temporarily or permanently ceased on any portion of the site. Earth-disturbing activities are temporarily ceased when clearing, grading, and excavation within any area of a site that will not include a permanent structure will not resume for a period of 7 or more calendar days, but such activities will resume in the future.

In the context of this provision, "immediately" means as soon as practicable, but no later than the end of the next work day, following the day when the earth-disturbing activities have temporarily or permanently ceased. The following activities constitute the initiation of stabilization:

- Preparing the soil for vegetative or non-vegetative stabilization;
- Applying mulch or other non-vegetative product to the exposed area;
- Seeding or planting the exposed area;
- Starting any of the activities in listed above on a portion of the area to be stabilized, but not on the entire area; and
- Finalizing arrangements to have stabilization product fully installed in compliance with the applicable deadline for completing stabilization.

As soon as practicable, but no later than 7 calendar days after the initiation of soil stabilization measures the following activities are required to be completed:

- For vegetative stabilization, all activities necessary to initially seed or plant the area to be stabilized; and/or
- For non-vegetative stabilization, the installation or application of all such non-vegetative measures.

The following sections detail the management practices proposed to achieve final stabilization of the site.

6.1 PERMANENT SEEDING

Description:	Permanent seeding shall be applied immediately after the final design grades are achieved on portions of the site but no later than 7 days after construction activities have permanently ceased. After the entire site is stabilized, any sediment that has accumulated shall be removed and hauled off-site for disposal at an approved landfill. Construction debris, trash and temporary BMPs (including sedimentation controls, material storage areas, sanitary toilets, and inlet protection) shall also be removed and any areas disturbed during removal shall be seeded immediately. Seeding shall be performed in accordance to the Site Plans and Landscape Specifications for the project.
Installation Schedule:	Seeding shall occur at portions of the site where construction activities have permanently ceased shall be stabilized, as soon as possible but no later than 7 days after construction ceases.
Maintenance and Inspection:	All seeded areas shall be inspected weekly during construction activities for failure and after storm events until a dense cover of vegetation has been established. If failure is noticed at the seeded area, the area shall be reseeded in accordance with the plans. After construction is completed at the site, permanently stabilized areas shall be monitored until final stabilization is achieved.

7.0 INSPECTIONS AND MAINTENANCE

7.1 INSPECTIONS

7.1.1 Inspection Schedule and Procedures

Inspections of the site will be performed once every 7 days and within 24 hours of the end of a storm event of 0.25-inch) or greater unless otherwise specified. The inspections will verify that all BMPs required are implemented, maintained, and effectively minimizing erosion and preventing stormwater contamination from construction materials.

To determine if a storm event of 0.25 inches or greater has occurred on the site, either a properly maintained rain gauge will be kept on the site or the storm event information will be obtained from a weather station that is representative of the location. If an inspection is conducted because of rainfall measuring 0.25 inches or greater, the applicable rain gauge or weather station readings that triggered the inspection will be noted in the inspection report.

Inspections shall include all areas of the site disturbed by construction activity and areas used for storage of materials that are exposed to precipitation. Inspectors shall look for evidence of, or the potential for, pollutants entering the storm water conveyance system. Sedimentation and erosion control measures identified in the SWPPP shall be observed to ensure proper operation. Discharge locations shall be inspected to ascertain whether sediment and erosion control measures are effective in preventing significant impacts to waters of the United States, where accessible. Where discharge locations are inaccessible, nearby downstream location shall be inspected to the extent that such inspections are practicable. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site sediment tracking.

For detailed inspection procedures, see Sections 4 and 5.

All inspections shall be coordinated with a representative from Owner Company. An Owner Company representative shall accompany the Inspector, when possible, during inspections.

Inspection reports are required to be completed within 24-hours of an inspection. If corrective actions are identified by the Inspector during the inspection, he/she shall notify and submit a copy of the inspection report to the Operator(s). For corrective actions identified, the Site Owner/Site Operator shall be responsible for initiating the corrective action within 24 hours of the report and completing maintenance as soon as possible or before the next storm event. For any corrective actions requiring a SWPPP amendment or change to a stormwater conveyance or control design, the

Site Owner/Site Operator shall notify Owner, as soon as possible, before initiating the corrective action.

The business days for the project construction are ***7:00 am to 5:00 pm***, ***Monday through Friday***.

For a copy of the inspection report template, see Appendix E.

7.2 REDUCTIONS IN INSPECTION FREQUENCY

Once an area is stabilized, inspections may be reduced to twice per month for the first month, no more than 14 calendar days apart, then once per month. If construction resumes at the stabilized area the inspection frequency shall increase as outlined in Section 7.1.

If earth-disturbing activities are suspended due to frozen conditions inspections can be temporarily suspended until a thaw occurs.

7.3 CORRECTIVE ACTION LOG

The corrective action log describes repairs, replacements, and maintenance of BMPs undertaken as a result of the inspections and maintenance procedures. Additionally, remedies of permit violations and clean and proper disposal of spills, releases other deposits should be recorded.

If it is determined the stormwater controls have not been installed as required, or that they are not functioning adequately corrective action is required within 7 calendar days.

The operator will document the completion of the corrective action within 24 hours.

See Appendix F – Corrective Action Log.

8.0 RECORDKEEPING AND TRAINING

8.1 RECORDKEEPING

A copy of the SWPPP, along with all inspection reports and corrective action logs are required to be stored at an accessible location at the site or other location easily accessible during normal business hours, and shall be made available upon request of the EPA, or state or local agency approving stormwater management plans.

The following records shall be kept at the project site and shall be available for inspectors to review. These records shall be retained for a minimum period of at least 3 years after the permit is terminated.

Date(s) when major grading activities occur:
See Appendix I – Grading and Stabilization Activities Log

Date(s) when construction activities temporarily or permanently cease on a portion of the site:
See Appendix I – Grading and Stabilization Activities Log

Date(s) when an area is either temporarily or permanently stabilized:
See Appendix I – Grading and Stabilization Activities Log

8.2 LOG OF CHANGES TO THE SWPPP

The log of changes to the SWPPP is maintained in Appendix G and includes additions of new BMPs, replacement of failed BMPs, significant changes in the activities or their timing on the project, changes in personnel, changes in inspection and maintenance procedures and updates to site plans.

8.3 TRAINING

Prior to the commencement of earth-disturbing activities or pollutant-generating activities, whichever occurs first, training on the pollution prevention measures outlined in this SWPPP shall be provided to staff and subcontractors.

8.3.1 Individual(s) Responsible for Training

Company/Organization: TBD

Name: TBD

8.3.2 Description of Training Conducted

Informal training shall be conducted for all staff, including subcontractors, on the site. The training shall be conducted primarily via tailgate sessions and shall focus on avoiding damage to stormwater BMPs and preventing illicit discharges. The tailgate sessions shall be conducted biweekly and shall address the following topics: Erosion Control BMPs, Sediment Control BMPs, Non-Stormwater BMPs, Waste Management and Materials Storage BMPs, and Emergency Procedures specific to the construction site. (See Appendix J – Training Log)

Formal training shall be provided to all staff and subcontractors with specific stormwater responsibilities, such as installing and maintaining BMPs. The formal training shall cover all design and construction specifications for installing the BMPs and proper procedures for maintaining each BMP. Training shall also cover inspection schedules and procedures for personnel whose job duties are related to inspections. Formal training shall occur before any BMPs are installed on the site. (See Appendix J – Training Log)

9.0 CERTIFICATION AND NOTIFICATION

9.1 SIGNATURE, PLAN REVIEW, AND MAKING PLANS AVAILABLE

A copy of the SWPPP (including a copy of the Construction General Permit, NOI, and acknowledgement letter from EPA) shall be retained at the construction site (or other location easily accessible during normal business hours to EPA, a state, tribal or local agency approving sediment and erosion plans, grading plans, or storm water management plans; local government officials; the operator of a municipal separate storm sewer receiving discharges from the site; and representatives of the U.S. Fish and Wildlife Service or the National Marine Fisheries Service) from the date of commencement of construction activities to the date of final stabilization. A copy of the SWPPP shall be available at a central location on-site for the use of all those identified as having responsibilities under the SWPPP. If an on-site location is unavailable to store the SWPPP when no personnel are present, notice of the plan's location shall be posted near the main entrance at the construction site.

9.2 NOTICE OF PERMIT COVERAGE

A sign must be posted at a safe, publicly accessible location in close proximity to the construction site detailing the permit coverage. The notice must be located so that it is visible from the public road that is nearest to the active part of the construction site, and it must use a font large enough to be readily viewed from a public right-of-way. At a minimum, the notice must include:

- The NPDES Permit Tracking Number,
- A contact name and phone number for obtaining additional construction site information,
- The Uniform Resource Locator (URL) for the SWPPP (if available), or the following statement: "If you would like to obtain a copy of the Stormwater Pollution Prevention Plan (SWPPP) for this site, contact the EPA Regional 1 Office at (617) 918-1038,
- The following statement "If you observe indicators of stormwater pollutants in the discharge or in the receiving waterbody, contact the EPA through the following website: https://www.epa.gov/enforcement/report-environmental-violations."

9.3 OWNER 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 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:_________________________________ Title:______________________

Signature:______________________________ Date:______________________

9.4 OPERATOR 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 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:_________________________________ Title:______________________

Signature:______________________________ Date:______________________

APPENDICES

Appendix A

General Location Map

Appendix B

Site Plans

Appendix C

Construction General Permit

https://www.epa.gov/sites/production/files/2017-02/documents/2017_cgp_final_permit_508.pdf

Appendix D

NOI and Acknowledgement Letter from EPA

Appendix E

Inspection Reports

Inspections under this SWPPP shall be conducted in accordance with each installed BMPs recommended maintenance requirements. This inspection frequency may be reduced to at least once every month if: a) the entire site is temporarily stabilized, b) runoff is unlikely due to winter conditions (e.g. site is covered with snow, ice, or the ground is frozen), or c) construction is occurring during seasonal arid periods in arid areas and semi-arid areas. If an inspection report is filed according to this modified schedule it shall be noted at the end of the report under the "NOTES" section.

The following pages should be copied and completed for each inspection. All inspection forms should be compiled in a binder to prove compliance with this SWPPP.

Stormwater Pollution Prevention Plan: Inspection Checklist

General Information			
Project Name			
NPDES Tracking No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approx. Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	
	❑Yes ❑No	❑Yes ❑No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	
Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	

BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"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."

Print name and title:

____

Signature:____

Date:____________________

Appendix F

Corrective Action Log

Corrective Action Log

Use this form to note the date and activity for accurate record keeping (make additional copies as necessary). Examples include the restaking or reinforcement of the erosion control barrier, site watering to prevent dust erosion, street sweeping, equipment and machinery repair, etc.

Date	Activity Description	Additional Action Items

Appendix G

SWPPP Amendment Log

The SWPPP, including the site plans, shall be amended whenever there is a change in design, construction, operation, or maintenance at the construction site that has or could have a significant effect on the discharge of pollutants to the waters of the United States that has not been previously addressed in the SWPPP.

The SWPPP shall be amended if during inspections or investigations by site staff, or by local, state, tribal or federal officials, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in storm water discharges from the construction site.

Based on the results of an inspection, the SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven (7) calendar days following the inspection. Implementation of these additional or modified BMPs shall be accomplished as described in Subpart 3.6B of the Construction General Permit (located in Appendix C).

SWPPP Amendment Log

Amendment No.	Description of the Amendment	Date of Amendment	Amendment Prepared by (Name(s) and Title)

Appendix H

Subcontractor Certifications/Agreements

Sample 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 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 I

Grading and Stabilization Activities Log

Site Plans in Appendix B should be annotated to indicate areas where final stabilization has been accomplished and no further construction-phase permit requirements apply.

The following records are to be kept by each Site Operator throughout the construction period and maintained in the SWPPP. Insert additional documentation for record keeping as necessary.

Grading and Stabilization Activities Log

Date	Location on Property	Description

Appendix J

Training Log

Training Log

Date	Training Topic	Attendee	Signature of Training Coordinator

Appendix K

Delegation of Authority

Sample Delegation of Authority Form

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 Appendix I of EPA's Construction General Permit (CGP), and that the designee above meets the definition of a "duly authorized representative" as set forth in Appendix I.

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 L

Endangered Species Documentation

DRAFT

Appendix M

Historic Preservation Documentation

Section 5.0
Solar Documentation

Operation and Maintenance Plan

Decommissioning Plan

Proof of Notification to Utility Company

Documentation of Major System Components

One-Line Electrical Diagram

5.0 SOLAR DOCUMENTATION

Standard Operation and Maintenance Procedures

Item	Preventative Maintenance Service Description	Frequency/Months Assigned
1	Visual inspection of general site conditions, PV arrays, electrical equipment, mounting structure, fence, gate, shading, vegetation, animal damage, erosion, corrosion, and discolored panels.	Bi-Annually
2	Visual inspection and correction of facility for loose electrical connections and ground connections.	Bi-Annually
3	Visual inspection of all medium voltage transformers, including meters, oil gage, and temperature gauge.	Annually
4	String level open circuit voltage, DC operating current tests, and I-V curve traces on 10% of strings.	Annually
5	Switches and disconnects test to ensure they are not jammed.	Bi-Annually
6	Infrared scans on all combiner and re-combiner boxes; tighten connections; report broken terminal blocks.	Bi-Annually
7	Sensors and meters, including pyranometers, anemometers, and tilt sensors.	Annually
8	Inverter preventative maintenance for inverters per manufacturer's operating guidelines.	Bi-Annually
9	PV array module maintenance.	See below
10	Wash all panels with clear water.	Bi-Annually
11	Perform infrared scan of 10% of modules indicated above for two types of circuitry connections: cells on the front and junction boxes on the back.	Annually
12	Vegetation mitigation within facility area, as applicable.	Annually
13	Written preventative maintenance report.	Bi-Annually
14	Inspect screening trees, as applicable. Replace as necessary.	Annually
15	Snow removal on access road.	6"+ accumulation

Decommissioning Estimate

Date: 04/09/20

150 Tihonet Road
Wareham, MA

This Decommissioning Estimate has been prepared by Borrego Solar in an attempt to predict the cost associated with the removal of the proposed solar facility. Key assumptions used include the fact that the fencing, electrical cabinetry, solar racks, solar panels, wiring and all other equipment are all one hundred percent recyclable, therefore, the primary cost of decommissioning is the labor to dismantle and load as well as the cost of trucking. No salvage values have been assumed in these calculations. The concrete pads will be broken up at the site and hauled to the nearest transfer station where it will be accepted without a charge.

The following values were used in this Decommissioning Estimate:

System Specifications	
Number of Modules	51,921
Number of Racks	2,163
Number of Inverters	2
Number of Transformers	5
Electrical Wiring Length (ft)	9,928
Number of Foundation Screws	8,654
Length of Perimeter Fence (ft)	7,019
Number of Power Poles	5
Access Rd Material Volume (YD)	3,456
Total Disturbed Area (SF)	97,817
Total Fence Weight (lbs)	4,983
Total Racking Weight (lbs)	1,838,869
Total Foundation Screw Weight (lbs)	346,140

Equipment & Material Removal Rates	
Module Removal Rate (min/module)	1
Rack Wiring Rem. Rate (min/mod)	0.5
Racking Dismantling Rate (min/rack)	30
Inverter Removal Rate (units/hr)	1
Transformer Removal Rate (units/hr)	0.5
Rack Loading Rate (min/Rack)	15
Elect. Wiring Removal Rate (min/LF)	0.5
Screw Rem. Rate (screws/day)	500
Fence Removal Rate (min/LF)	0.5
Days req. to break up concrete pads	4
Days req. with Rough Grader	2
Days req. with Fine Grader	3
Total Truckloads Required	135
Round-Trip Dist. to Trans. Sta.(miles)	10.6
Round-Trip Time to Trans. Sta. (hr)	0.5

Labor and Equipment Costs		
Labor Rate ($/hr)	$	25.00
Bobcat Cost ($/hr)	$	50.00
Front End Loader Cost ($/Day)	$	1,000.00
Excavator Cost ($/Day)	$	1,000.00
Trucking Cost ($/hr)	$	120.00
Backhoe Cost ($/hr)	$	245.00
Power Pole Removal Cost ($/pole)	$	1,500.00
Grader Cost ($/day)	$	1,800.00
Gravel Export Cost ($/YD)	$	10.00
Loam Import Cost ($/YD)	$	25.00
Seeding Cost ($/SF)	$	0.08
Fuel Cost ($/mile)	$	0.25

Energy Storage Decommissioning		
Number of Energy Storage Units		5
Battery Disposal Fee	$	2,000.00
Battery Loading Prep Time (hr)		32
Battery Loading Time (hr)		8

160 Tihonet Road
Wareham, MA

Labor, Material, and Equipment Costs

1. **Remove Modules**
   The solar modules are fastened to racking with clamps. They slide in a track. A laborer needs only unclamp the module and reach over and slide the module out of the track.

   Module Removal Rate • Total Number of Solar Modules • Labor Rate = Module Removal Cost

   Total = $ 21,633.75

2. **Remove Rack Wiring**
   The modules are plugged together in the same manner as an electrical cord from a light is plugged into a wall socket. The string wires are in a tray. A laborer needs only unplug the module, reach into the tray and remove the strands of wire.

   Wire Removal Rate • Total Number of Solar Modules • Labor Rate = Rack Wiring Removal Cost

   Total = $ 10,816.88

3. **Dismantle Racks**
   The racking is supported by screw foundations. The racking will be disconnected from the foundation and removed seperately.

   Number of Racks • Rack Dismantling Rate • Labor Rate = Rack Dismantling Cost

   Total = $ 27,042.19

4. **Remove and Load Electrical Equipment**
   Electrical equipment includes transformers and inverters.

   (Number of Inverters • Inverter Removal Rate + Number of Transformers • Transformer Removal Rate) • (Labor Rate + Bobcat Cost) = Electrical Equipment Removal Cost

   Total = $ 337.50

5. **Break Up Concrete Pads**
   Concrede pads are broken up using an excavator and jackhammer.

   Number of Demolition Days • (Excavator Cost + Labor Cost) = Total Concrete Pad Removal

   Total = $ 4,800.00

160 Tihonet Road
Wareham, MA

6. Load Racks

Once the racks have been dismantled, they will be loaded onto trucks for removal from the site. The trucking cost associated with this line item represents the additional time a truck will be needed during loading. Please see item # 13 for additional trucking costs.

Number of Racks • Rack Loading Rate • (Labor Cost + Front End Loader Cost + Trucking Cost) = Total Rack Removal Cost

Total = $ 105,464.53

7. Remove Electrical Wiring

Electrical wiring will be removed from all underground conduits.

Cable Length • Cable Removal Rate • (Labor Cost + Backhoe Cost) = Total Cable Removal Cost

Total = $ 22,338.00

8. Remove Foundation Screws

Foundation screws will be backed out of the ground and loaded onto a truck to be removed from site.

(Total Number of Screws / Daily Screw Removal Rate) • (Labor Rate + Excavator Cost) = Total Screw Removal Cost

Total = $ 20,768.40

9. Remove Fencing

Fencing posts, mesh, and foundations will be loaded onto a truck and removed from site. Trucking costs included in this line item are for the removal process. Trucking to a recycling facility are included in item #13.

(Total Length of Fence • Fence Removal Rate) • (Labor Rate + Bobcat Cost + Trucking Cost) =

Total = $ 11,405.88

10. Remove Power Poles

Power poles will be removed and shipped off site.

Number of Power Poles • Pole Removal cost = Total Power Pole Removal Cost

Total = $ 7,500.00

160 Tihonet Road
Wareham, MA

11. Seed Disturbed Areas

Seeding cost includes labor and materials for reseeding all disturbed areas including the reclaimed gravel road area, former electrical areas, and areas disturbed by racking foundation removal.

Seeding Cost • Disturbed Area =
Total Seeding Cost

Total = $ 7,825.35

12. Truck to Transfer Station

All material will be trucked to the nearest Transfer station that accepts construction material. The nearest transfer station is Wareham Town Recycling

(Total Truckloads • Roundtrip Distance • Fuel Cost) + (Total Truckloads • Round Trip Time • Trucking Cost) =
Total Trucking Cost to Transfer Station

Total = $ 8,457.75

13. Remove and Dispose of Energy Storage Equipment

The battery units will be prepared for shipment and loaded onto a truck. A disposal fee will also be required for the disposal company to accept the batteries.

Number of Battery Units • ((Loading Prep Time • Labor Cost) + Loading Time • (Labor Rate + Bobcat Cost + Trucking Cost) + Disposal Fee) =
Total Energy Storage Removal and Disposal Cost

Total = $ 21,800.00

160 Tihonet Road
Wareham, MA

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160 Tihonet Road
Wareham, MA

Summary of Decommissioning Costs

Line Item	Task	Cost
1	Module Removal	$ 21,633.75
2	Rack Wiring Removal	$ 10,816.88
3	Rack Dismantling	$ 27,042.19
4	Electrical Equipment Loading and Removal	$ 337.50
5	Break Up Concrete Pads	$ 4,800.00
6	Load Racks	$ 105,464.53
7	Electrical Wiring Removal	$ 22,338.00
8	Foundation Screw Removal	$ 20,768.40
9	Fence Removal	$ 11,405.88
10	Power Pole Removal	$ 7,500.00
11	Seed Disturbed Areas	$ 7,825.35
12	Trucking to Transfer Station	$ 8,457.75
13	Energy Storage System Removal	$ 21,800.00
	Subtotal =	$ 270,190.22

Present Value Total = $ 270,190.22

Total after 20 years @ 1.5% Inflation

Present Value • (1+ Inflation Rate)^Number of Years = Future Value

Grand Total = $363,907.06

EVERSOURCE

Generating Facility Expedited/Standard Process

Interconnection Application

Contact Information: Date Prepared: 5/13/19

Legal Name and address of Interconnecting Customer

Interconnecting Customer (print): 510 PV Project Development, LLC Contact Person: Brendan Neagle

Mailing Address: 360 22nd St, Suite 600

City: Oakland State: CA Zip Code: 94612

Telephone (Daytime): 978-513-2613 (Evening): ______

Facsimile Number: 888-843-6778 E-Mail Address: bneagle@BorregoSolar.com

Customer name (if Customer is not Interconnecting Customer) ______

Customer email: ______ Customer telephone: ______

Customer Mailing Address: ______
City: ______ State: ______ Zip Code: ______

Landowner name (if neither Interconnecting Customer nor Customer) ______

Landowner email: ______ Landowner telephone: ______

Landowner Mailing Address: ______
City: ______ State: ______ Zip Code: ______

EVERSOURCE

Alternative Contact Information
(e.g., system installation contractor or coordinating company, if appropriate):

Name: Borrego Solar Systems, Inc. - Contact Person: Christian Bain

Mailing Address: 55 Technology Dr. Suite 102

City: Lowell State: MA Zip Code: 01851

Telephone (Daytime): 617-517-6349 (Evening): ______

Facsimile Number: 888-843-6778 E-Mail Address: intx-ma@borregosolar.com

Ownership (include % ownership by any electric utility): 100

Site Control? (Y/N) Y

Will Facility be constructed on a single parcel of land? (Y/N) Y

Authorized/Proposed generation capacity already exists (check all that apply):

☐ On Current Account ☐ On Same Legal Parcel of Land ☐ In Same Building/Structure

If any apply, include existing generation capacity on design diagrams, and provide Application Number(s): ______

Confidentiality Statement: "I agree to allow information regarding the processing of my application (without my name and address) to be reviewed by the Massachusetts DG Working Group that is exploring ways to further expedite future interconnections." Yes ☒ No ☐

Group Study Agreement: "I understand and agree if my project becomes part of a Group Study, the Company is authorized to share my contact information and project details with other parties that are also involved in the Group Study."

Generating Facility Information

Please provide all Pre-Application Reports (either mandatory or optional) as attachments. This is mandatory for systems greater than or equal to 500 kW.

Address of Facility: 140 TIHONET ROAD

City: WAREHAM State: MA Zip Code: 02571

Electric Distribution Company: Eversource

Account Number: ______

Meter Number: ______

EVERSOURCE

System Design Capacity: Nominal 5000 (kW) 5000 (kVA)

Maximum 5000 (kW) 5000 (kVA)

For Solar PV provide the DC-STC rating: 19956.375 (kW_{DC})

Type of Generating Unit: Synchronous _____ Induction _____ Inverter x

Manufacturer: Power Electronics________________________ Model: HEMK FS2125K________

Prime Mover: ☐ Fuel Cell ☐ Reciprocating Engine ☐ Gas Turbine ☐ Steam Turbine

☐ Microturbine ☒ Photovoltaic Other Energy Storage_______________________

Energy Source: ☒Solar ☐ Wind ☐Hydro ☐ Diesel ☐ Natural Gas ☐ Fuel Oil

Other Li-ion______________________ (Please Specify)

For Solar PV provide the DC-STC rating: 19956.375 (kW)

IEEE 1547.1 (UL 1741) Listed? Yes ☒___________ No ☐___________

1) Generating Unit Type 1

Manufacturer: Power Elecronics____ Model Name and Number: HEMK FS2125K_ Quantity: 5

Single ☐ or Three ☒ Phase

AC Rating: Nominal: 1000 (kW) 1000 (kVA) 600 (AC Volts)

Maximum: 1000 (kW) 1000 (kVA) 600 (AC Volts)

2) Generating Unit Type 2 (if applicable)

Manufacturer: ______________________ Model Name and Number: ______ Quantity: _____

Single ☐ or Three ☐ Phase

AC Rating: Nominal: _____ (kW) _____ (kVA) _____ (AC Volts)

Maximum: _____ (kW) _____ (kVA) _____ (AC Volts)

EVERSOURCE

3) Generating Unit Type 3 (if applicable)

Manufacturer: _______ Model Name and Number: ______________________ Quantity: _____

Single ☐ or Three ☐ Phase

AC Rating: Nominal: _____ (kW) _____ (kVA) _____ (AC Volts)

Maximum: _____ (kW) _____ (kVA) _____ (AC Volts)

Need an air quality permit from DEP? Yes ☐ No ☒ Not Sure ☐

If "yes", have you applied for it? Yes ☐ No ☐

Planning to Export Power? Yes ☐ No ☐ A Cogeneration Facility? Yes☐ No ☒

Anticipated Export Power Purchaser: EVERSOURCE ___________________________________

Export Form? Simultaneous Purchase/Sale ☐ Net Purchase/Sale ☐ Net Metering ☒

Other (Specify) ____

If net metering, please refer to Schedule Z of the Standards for Interconnection of Distributed Generation.Please note that if under the public cap, all off-takers must be a Municipality or Other Governmental Entity (as defined in 220 C.M.R. 18.02) and therefore be certified by the DPU.

Est. Install Date: 8/29/19___ Est. In-Service Date: 10/29/19__ Agreement Needed By: 6/29/19 ___

Application Process

I am opting to forego the Expedited Process. Please review this application under the Standard Process. Yes ☐ No ☒

I hereby certify that, to the best of my knowledge, all of the information provided in this application is true:

Interconnecting Customer

Signature: _________________________ Title: ________________ Date: __________________

The information provided in this application is complete:

Company

Signature: ________________________ Title: _________________ Date: __________________

EVERSOURCE

Generating Facility Technical Detail

Information on components of the generating facility that are currently Listed

	Equipment Type	Manufacturer	Model	National Standard
1.	Modules	LG	LG405N2T-J5	UL1703
2.	Inverters	Power Electronics	FS2125K	UL1741
3.	GSU Transformers	Cooper Power	Padmount	ANSI C57
4.	Protective Relay	Schweitzer	SEL-651R	ANSI C37.90,C37.90.1
5.				
6.				

Total Number of Generating Units in Facility? 5

Generator Unit Power Factor Rating: >99%

Max Adjustable Leading Power Factor? 0.5 Max Adjustable Lagging Power Factor? 0.5

Generator Characteristic Data (for all inverter-based machines)

Max Design Fault Contribution Current? 12702 Instantaneous ☐ or RMS? ☒

Harmonics Characteristics: <3%

Start-up power requirements: 8kVA

Generator Characteristic Data (for all rotating machines)

Rotating Frequency: _____ (rpm)   Neutral Grounding Resistor (If Applicable): _____

Additional Information for Synchronous Generating Units

Synchronous Reactance, Xd:	_____ (PU)	Transient Reactance, X'd:	_____ (PU)
Subtransient Reactance, X'd:	_____ (PU)	Neg Sequence Reactance, X2:	_____ (PU)
Zero Sequence Reactance, Xo:	_____ (PU)	kVA Base:	_____
Field Voltage:	_____ (Volts)	Field Current:	_____ (Amps)

Additional information for Induction Generating Units

Rotor Resistance, Rr:	_____	Stator Resistance, Rs:	_____
Rotor Reactance, Xr:	_____	Stator Reactance, Xs:	_____
Magnetizing Reactance, Xm:	_____	Short Circuit Reactance, Xd":	_____
Exciting Current:	_____	Temperature Rise:	_____
Frame Size:	_____		
Total Rotating Inertia, H:	_____	Per Unit on kVA Base:	_____

Reactive Power Required In Vars (No Load): _____

Reactive Power Required In Vars (Full Load): _____

Additional information for Induction Generating Units that are started by motoring

Motoring Power: _____ (kW)   Design Letter: _____

Interconnection Equipment Technical Detail   Date:_____

Will a transformer be used between the generator and the point of interconnection?
Yes ☐   No ☐

Will the transformer be provided by Interconnecting Customer?   Yes ☐   No ☐

Transformer Data (if applicable, for Interconnecting Customer-Owned Transformer):

Nameplate Rating: _____ (kVA)   Single ☐ or Three ☐ Phase

Transformer Impedance: _____ (%) on a _____ kVA Base

If Three Phase:

Transformer Primary: _____ (Volts) ☐ Delta ☐ Wye ☐ Wye-Grounded _____ Other
Transformer Secondary: _____ (Volts) ☐ Delta ☐ Wye ☐ Wye-Grounded _____ Other
PCS Secondary: _____ (Volts) ☐ Delta ☐ Wye ☐ Wye-Grounded _____ Other

EVERSOURCE

Transformer Fuse Data (if applicable, for Interconnecting Customer-Owned Fuse):
(Attach copy of fuse manufacturer's Minimum Melt & Total Clearing Time-Current Curves)

Manufacturer: _____ Type: _____ Size: _____ Speed: _____

Interconnecting Circuit Breaker (if applicable):

Manufacturer: _____________ Type: ______________ Load Rating: _____ (Amps)

Interrupting Rating: _____ (Amps) Trip Speed: _____ (Cycles)

Interconnection Protective Relays (if applicable):
(If microprocessor-controlled)

List of Functions and Adjustable Setpoints for the protective equipment or software:

	Setpoint Function	Minimum	Maximum
1.	Under Frequency	57.0Hz (0.16 sec)	58.5 Hz (100 sec)
2.	Over Frequency	60.5 Hz (0.16 sec)	65.0 Hz (inst)
3.	Under Voltage	50% nom (0.16 sec)	88% nom (2 sec)
4.	Over Voltage	110% nom (1 sec)	120% nom (0.16 sec)
5.			
6.			

(If discrete components)

(Enclose copy of any proposed Time-Overcurrent Coordination Curves)

Manufacturer: ________ Type: _______ Style/Catalog No.: ______ Proposed Setting: _____

Manufacturer: ________ Type: _______ Style/Catalog No.: ______ Proposed Setting: _____

Manufacturer: ________ Type: _______ Style/Catalog No.: ______ Proposed Setting: _____

Manufacturer: ________ Type: _______ Style/Catalog No.: ______ Proposed Setting: _____

Manufacturer: ________ Type: _______ Style/Catalog No.: ______ Proposed Setting: _____

Manufacturer: ________ Type: _______ Style/Catalog No.: ______ Proposed Setting: _____

Current Transformer Data (if applicable):

(Enclose copy of Manufacturer's Excitation & Ratio Correction Curves)

Manufacturer: _______ Type: ______ Accuracy Class: _____

Proposed Ratio Connection: _____

Manufacturer: _______ Type: ______ Accuracy Class: _____

Proposed Ratio Connection: _____

Potential Transformer Data (if applicable):

Manufacturer: ________ Type: _______ Accuracy Class: ______

Proposed Ratio Connection: ____

Manufacturer: _______ Type: ______ Accuracy Class: _____

Proposed Ratio Connection: _____

EVERSOURCE

General Technical Detail Date: _____

Enclose 3 copies, or send 1 electronic copy, of site electrical One-Line Diagram showing the configuration of all generating facility equipment, current and potential circuits, and protection and control schemes with a Massachusetts registered professional engineer (PE) stamp. Enclose 3 copies, or send 1 electronic copy, of any applicable site documentation that indicates the precise physical location of the proposed generating facility (e.g., USGS topographic map or other diagram or documentation).

Proposed Location of Protective Interface Equipment on Property:
(Include Address if Different from Application Address)

See Site Layout ____

____

Enclose copy of any applicable site documentation that describes and details the operation of the protection and control schemes.

Enclose copies of applicable schematic drawings for all protection and control circuits, relay current circuits, relay potential circuits, and alarm/monitoring circuits (if applicable).

When mailing application fee checks, please enclose a copy of this signed interconnection application form with the payment.Please enclose any other information pertinent to this Facility.

TECHNICAL CHARACTERISTICS HEMK 690V

		FRAME 1	FRAME 2
REFERENCE		**FS2445K**	**FS3670K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2445	3670
	AC Output Power(kVA/kW) @40°C [1]	2530	3800
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	690V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	976V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645 / 5000 optional	3970 / 6000 optional
	Max. DC short circuit current (A) [4]	4000 / 10000 optional	6000 / 12000 optional
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.9% (preliminary)	
	Euroeta (η)	98.5% (preliminary)	98.7% (preliminary)
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS

HEMK 660V

		FRAME 1	FRAME 2
REFERENCE		**FS2340K**	**FS3510K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2340	3510
	AC Output Power(kVA/kW) @40°C [1]	2420	3630
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	660V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	934V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645 / 5000 optional	3970 / 6000 optional
	Max. DC short circuit current (A) [4]	4000 / 10000 optional	6000 / 12000 optional
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.8% (preliminary)	98.9% (preliminary)
	Euroeta (η)	98.5% (preliminary)	98.6% (preliminary)
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS HEMK 645V

		FRAME 1	FRAME 2
REFERENCE		**FS2285K**	**FS3430K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2285	3430
	AC Output Power(kVA/kW) @40°C [1]	2365	3550
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	645V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	913V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645 / 5000 optional	3970 / 6000 optional
	Max. DC short circuit current (A) [4]	4000 / 10000 optional	6000 / 12000 optional
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.8% (preliminary)	98.9% (preliminary)
	Euroeta (η)	98.4% (preliminary)	98.6% (preliminary)
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS

HEMK 630V

		FRAME 1	FRAME 2
REFERENCE		**FS2235K**	**FS3350K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2235	3350
	AC Output Power(kVA/kW) @40°C [1]	2310	3465
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	630V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	891V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645 / 5000 optional	3970 / 6000 optional
	Max. DC short circuit current (A) [4]	4000 / 10000 optional	6000 / 12000 optional
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.8% (preliminary)	
	Euroeta (η)	98.4% (preliminary)	98.6% (preliminary)
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.

[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS

HEMK 615V

		FRAME 1	FRAME 2
REFERENCE		**FS2180K**	**FS3270K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2180	3270
	AC Output Power(kVA/kW) @40°C [1]	2255	3380
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	615V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	870V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645 / 5000 optional	3970 / 6000 optional
	Max. DC short circuit current (A) [4]	4000 / 10000 optional	6000 / 12000 optional
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.8% (preliminary)	
	Euroeta (η)	98.4% (preliminary)	98.6% (preliminary)
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

TECHNICAL CHARACTERISTICS

HEMK 600V

		FRAME 1	FRAME 2
REFERENCE		**FS2125K**	**FS3190K**
OUTPUT	AC Output Power(kVA/kW) @50°C [1]	2125	3190
	AC Output Power(kVA/kW) @40°C [1]	2200	3300
	Max. AC Output Current (A) @40°C	2117	3175
	Operating Grid Voltage(VAC) [2]	600V ±10%	
	Operating Grid Frequency(Hz)	50Hz/60Hz	
	Current Harmonic Distortion (THDi)	< 3% per IEEE519	
	Power Factor (cosine phi) [3]	0.5 leading … 0.5 lagging adjustable / Reactive Power injection at night	
INPUT	MPPt @full power (VDC)	849V-1310V	
	Maximum DC voltage	1500V	
	Number of PV inputs [2]	Up to 36	
	Number of Freemaq DC/DC inputs [4]	Up to 6	
	Max. DC continuous current (A) [4]	2645 / 5000 optional	3970 / 6000 optional
	Max. DC short circuit current (A) [4]	4000 / 10000 optional	6000 / 12000 optional
EFFICIENCY & AUXILIARY SUPPLY	Efficiency (Max) (η)	98.8% (preliminary)	
	Euroeta (η)	98.4% (preliminary)	98.6% (preliminary)
	Max. Power Consumption (KVA)	8	10
CABINET	Dimensions [WxDxH] (ft)	12 x 7 x 7	
	Dimensions [WxDxH] (m)	3.7 x 2.2 x 2.2	
	Weight (lb)	12125	12677
	Weight (kg)	5500	5750
	Type of ventilation	Forced air cooling	
ENVIRONMENT	Degree of protection	NEMA 3R - IP54	
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating	
	Relative Humidity	4% to 100% non condensing	
	Max. Altitude (above sea level)	2000m; >2000m power derating (Max. 4000m)	
	Noise level [5]	< 79 dBA	
CONTROL INTERFACE	Interface	Graphic Display	
	Communication protocol	Modbus TCP	
	Plant Controller Communication	Optional	
	Keyed ON/OFF switch	Standard	
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device	
	General AC Protection	Circuit Breaker	
	General DC Protection	Fuses	
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2	
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16, UL62109-1, IEC62109-1, IEC62109-2	
	Compliance	NEC 2017 / IEC	
	Utility interconnect	EEE 1547.1-2005 / UL1741SA-Feb. 2018 / IEC62116:2014	

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[4] Consult Power Electronics for Freemaq DC/DC connection configurations.
[5] Readings taken 1 meter from the back of the unit.

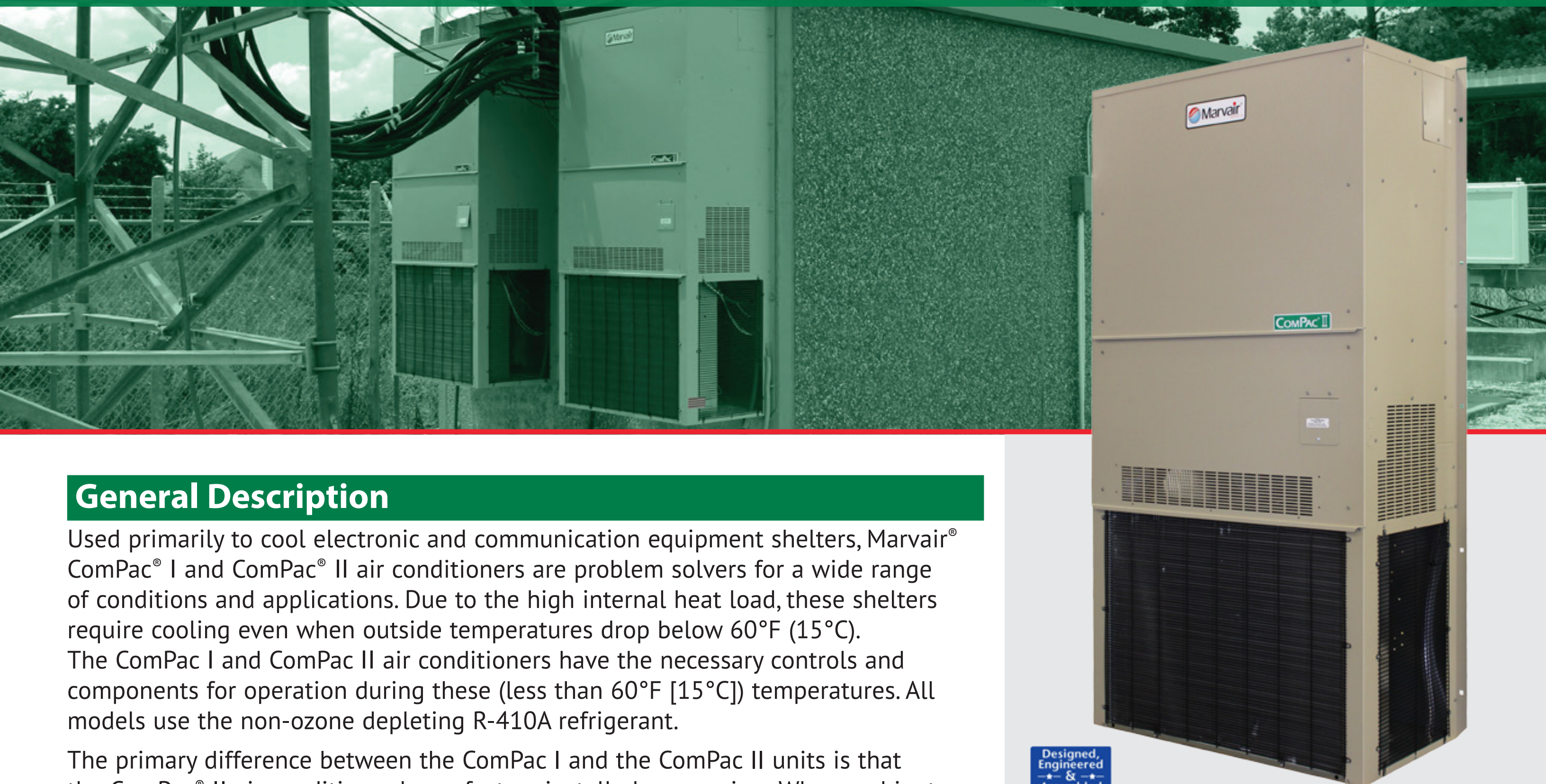
Marvair® AIRXCEL®

ComPac® I ComPac® II

PRODUCT DATA SHEET

1 to 6 Ton Vertical Wall Mount Air Conditioners

Models AVPA12-20-24-30-36-42-48-60-72 (Single Stage Compressor)
Models AVHA20-24-30-36-42-48-60-72 (Single Stage Compressor)
Models HVEA24-30-36-42-49-60 (Single Stage Compressor)
Models HVESA36-42-49-60 (2-Stage Compressor)



Designed, Engineered & Assembled In the USA

AVPA36ACA-100C

AHRI CERTIFIED® www.ahridirectory.org · CE · Intertek · NSF Registered to ISO 9001

General Description

Used primarily to cool electronic and communication equipment shelters, Marvair® ComPac® I and ComPac® II air conditioners are problem solvers for a wide range of conditions and applications. Due to the high internal heat load, these shelters require cooling even when outside temperatures drop below 60°F (15°C). The ComPac I and ComPac II air conditioners have the necessary controls and components for operation during these (less than 60°F [15°C]) temperatures. All models use the non-ozone depleting R-410A refrigerant.

The primary difference between the ComPac I and the ComPac II units is that the ComPac® II air conditioner has a factory installed economizer. When ambient conditions are cool and dry, the economizer uses outside air to cool the shelter. The economizer provides temperature control, energy cost savings, and increased reliability by decreasing the operating hours of the compressor and the condenser fan. To insure proper operation and optimum performance, all economizers are non-removable, factory installed and tested. In addition, factory and field installed accessories can be used to meet specific requirements.

➤ Standard Efficiency Models

AVPA: Marvair's most popular model with an Energy Efficiency Ratio (EER) of 9.0 to 10.0. The ComPac AVPA is available in cooling capacities of 1, 1.5, 2, 2.5, 3, 3.5, 4, 5 and 6 tons (12,000 BTUH to 72,000 BTUH).

➤ High Efficiency Models

HVEA: Marvair's most efficient wall mount air conditioners. Electronically commutated indoor fan motors combined with highly efficient scroll compressors result in Energy Efficiency Ratios (EER's) of up to 11.75.

AVHA: ComPac models with an EER of 10.0. The AVPA72 is also rated 10 EER.

➤ 2-Stage Compressor Models

HVESA: ComPac models 36-42-49-60 have a 2-stage compressor with first stage cooling approximately 65% of the total cooling capacity. The 2-stage compressor provides lower start-up amps which can be critical when operating with a generator. The two stage compressor can also reduce energy costs and is able to more precisely match the cooling capacity of the air conditioner with the heat load in the shelter. *Both ComPac I and ComPac II units are available with 2 stage compressors.*

Features and Benefits

Built-In Energy Savings

- *Optional Factory Installed Economizer*
- *Three Model Lines to Meet Any Budget and Efficiency Requirements*
- *Available EER of up to 11.75*
- *Available 2-Stage Compressor on HVESA Models*

R-410A Refrigerant

- *Efficient Heat Release*
- *Non-Ozone Depleting Refrigerant*
- *Synthetic Lubricant*
- *Reduced Compressor Wear*

High Efficiency and Reliability

- *High Efficiency Compressor and Lanced Coil Fins*
- *High/Low Pressure Switches with Lockout & Short Cycle Protection*

Ease of Installation and Service

- *Side Access Panels for Power Connections*
- *Built-In Mounting Flanges and Iternal Disconnect*
- *Standard Access Valves and Filters, Status LEDs*

Safety Listed and Energy Certified

All ComPac air conditioners are built to UL standard 1995, 4th edition and CAN/CSA C22.2, No. 236-11. For energy efficiency and performance, the units are tested and rated in accordance to the ANSI/ARI (Air-Conditioning and Refrigeration Institute) Standard 390- 2003 (Single Package Vertical Units). All units meet or exceed the efficiency requirements of ANSI/ASHRAE/IESNA 90.1.2010. The ComPac I and ComPac II air conditioners are commercial units and are not intended for use in residential applications.

Standard Features

➤ **Designed for Operation in Low Ambient Conditions**

- Low ambient control cycles condenser fan to maintain proper refrigerant pressures. Allows operation in mechanical cooling (compressor) of our standard air conditioners down to 20°F (-7°C). With the Extreme Duty option, the units will operate down to 0°F (-18°C). Note: low temperature operation is affected by ambient conditions, e.g. wind and humidity.
- Three minute by-pass of the low pressure switch for start-up of compressor when outdoor temperatures are below 55°F (13°C).
- Factory built-in economizer.*

➤ **High Efficiency**

- High efficiency compressor.
- Lanced fins standard on all evaporator and condenser coils.

➤ **Built-in Reliability**

- High pressure switch and low pressure switch with lockout protects refrigerant circuit.
- Adjustable .03 to ten minute delay on make for short cycle protection.

➤ **Remote Alarm Capability**

- Dry contacts can be used for remote alarm or notification upon air conditioner lockout.

➤ **Ease of Service**

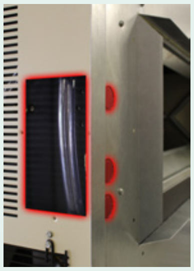
- Service access valves are standard.
- Standard 2" (50 mm) pleated filter with a MERV rating of 8 changeable from outside.
- All major components are readily accessible.
- Front Control Panel allows easy access and complies with NEC clearance codes on redundant side-by-side systems.
- LEDs indicate operational status and fault conditions.
- Foil backed insulation on the indoor air path.
- A minimum position potentiometer that can be adjusted to prevent the economizer damper from closing completely. This control ensures that whenever the evaporator fan is operating, fresh air is being introduced into the building.

➤ **Rugged Construction**

- Copper tube, aluminum fin evaporator & condenser coils.
- Field or factory installed heaters on discharge side of evaporator coil (optional)
- Baked on neutral beige finish over galvanneal steel for maximum cabinet life. (Other finishes are available.)

➤ **Ease of Installation**

- Sloped top with flashing eliminates need of rainhood.
- Built-in mounting flanges facilitate installation and minimize chance of water leaks.
- Supply and return openings exactly match previous models.
- Factory installed disconnect on all units.
- Single Point Power Entry complies with latest edition of U.L. Standard 1995.
- Side access panels for easy access to electrical connections.



*ComPac® II air conditioner only

A Marvair® First – Factory Installed Economizer

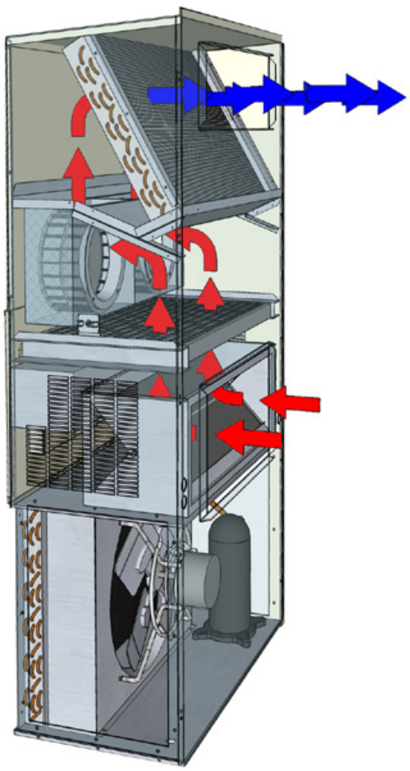
Marvair's ComPac® II air conditioner has been the industry standard since its introduction in 1986. Tens of thousands of ComPac II air conditioners are in operation from the metropolitan areas of North America to the deserts of the Mid-East to the Siberian tundra. Here's how the economizer works:

On a signal from the wall mounted indoor thermostat that cooling is required, either mechanical cooling with the compressor or free cooling with the economizer is provided. A factory installed enthalpy controller determines whether the outside air is sufficiently cool and dry to be used for cooling. If suitable, the compressor is locked out and the economizer damper opens to bring in outside air. Integral pressure relief allows the interior air to exit the shelter, permitting outside air to enter the shelter. The temperature at which the economizer opens is adjustable from 63°F (17°C) at 50% Relative Humidity to 73°F (23°C) at 50% Relative Humidity.

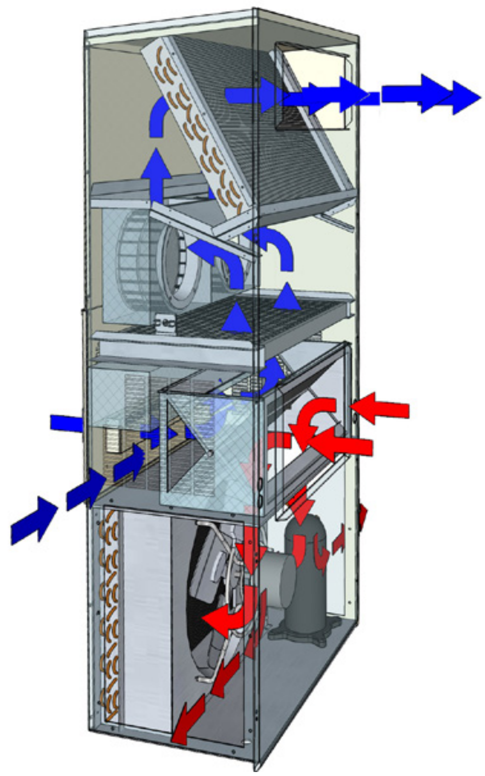
After the enthalpy control has activated and outside air is being brought into the building, the mixed air sensor measures the temperature of the air entering the indoor blower and then modulates the economizer damper to mix the right proportion of cool outside air with warm indoor air to maintain 50-63°F (10 - 17°C) air being delivered to the building. This prevents shocking the electronic components with cold outside air. The compressor is not permitted to operate when the economizer is functioning.

If the outside air becomes too hot or humid, the economizer damper closes completely, or to a field selectable minimum open position, and mechanical cooling is activated.

In all ComPac II air conditioners, the supply air flow in the economizer mode is the same or greater than the rated air flow. (The rated air flow is the AHRI certified air flow when the unit is in mechanical cooling.) The “full flow” economizer reduces electrical costs by maximizing the use of outside air for cooling.



100% Mechanical Cooling



100% Economizer Cooling

Note: *This graphical representation is for illustrative purposes only. The actual appearance of internal components may vary depending on the model, installed options and configuration.*

Savings with an Economizer

The following table shows the annual electrical cost of cooling a 10 ft. x 20 ft. x 9 ft. (3m x 6m x 2.7m) shelter in twelve cities in the US. Costs are shown for an air conditioner without an economizer (ComPac I units), for an air conditioner with an economizer (ComPac II units) and the savings. The savings do not include any demand charges. The savings are based on the electrical usage of a five ton air conditioner and an electric rate of $.10 per kilowatt-hour, the approximate average commercial rate in the US.

Hours of Operation	Atlanta, GA	Boston, MA	Chicago, IL	Dallas, TX	Denver, CO	Houston, TX
Annual Compressor & Condenser Motor Run Time without Economizer (Hrs.)	6,531	6,348	6,361	6,628	6,472	6,655
Annual Compressor & Condenser Motor Run Time with Economizer (Hrs.)	3,841	2,153	2,424	3,798	750	4,970
Run Time Savings with the Economizer (Hrs.)	2,690	4,195	3,937	2,830	5,722	1,685
Estimated Annual Costs Saving ($) of 9.0 EER unit with an Economizer (ComPac II)						
Annual Operating Cost 9.0 EER Unit without Economizer ($)	$4,100.00	$3,985.00	$4,792.00	$4,161.00	$3,657.00	$4,178.00
Annual Operating Cost 9.0 EER with Economizer	$2,685.00	$1,784.00	$2,315.00	$2,671.00	$940.00	$3,291.00
Annual Savings using 9.0 EER Unit with Economizer	$1,415.00	$2,201.00	$2,477.00	$1,490.00	$2,717.00	$887.00

Hours of Operation	Los Angeles, CA	Miami, FL	Phoenix, AZ	Pittsburgh, PA	Seattle, WA	St. Louis, MO
Annual Compressor & Condenser Motor Run Time without Economizer (Hrs.)	6,467	6,779	6,765	6,386	6,465	6,472
Annual Compressor & Condenser Motor Run Time with Economizer (Hrs.)	3,862	6,391	3,106	1,929	1,654	2,716
Run Time Savings with the Economizer (Hrs.)	2,605	388	3,659	4,457	4,811	3,756
Estimated Annual Costs Saving ($) of 9.0 EER unit with an Economizer (ComPac II)						
Annual Operating Cost 9.0 EER Unit without Economizer ($)	$4,060.00	$4,255.00	$4,247.00	$4,009.00	$3,653.00	$4,063.00
Annual Operating Cost 9.0 EER with Economizer	$2,686.00	$4,051.00	$2,315.00	$1,667.00	$1,368.00	$2,090.00
Annual Savings using 9.0 EER Unit with Economizer	$1,374.00	$204.00	$1,932.00	$2,342.00	$2,285.00	$1,973.00

Shelter Metrics:
•10’ x 20’ x 9’ building
•Internal heat gain (electronics load): 12,000 watts.
•Building surface area (excluding floor area): 740 ft²
•R-Value of walls and ceiling: R-12
•Internal shelter temperature (Thermostat set point): 75ºF

Air Conditioner Metrics:
•ComPac II Economizer setting: 57ºF (dry bulb or enthalpy sensor)
•A/C unit capacity: 60,000 BTUH (5 tons) with 1-stage compressor
•Nominal EER (unit efficiency): 9.0 (models AVPA)
•Cost of power: $.10 per KWH

Operation of the 2-Stage Compressor Air Conditioners with a CommStat 4™ or CommStat 6 Lead/Lag Thermostat Controller

Marvair's HVESA air conditioners have 2-stage compressors. These units can provide substantial energy savings and better control of temperature and humidity by matching the cooling requirement with the performance of the air conditioner. First stage is typically 65% of the total (2-stage) capacity of the air conditioner. When operated from power supplied by a generator, starting the air conditioner in 1-stage means lower start-up amps.

- **CommStat™ 4 Controller:** When two, 2-stage air conditioners are controlled by a CommStat 4 lead/lag controller in a redundant application, one of the air conditioners is the lead unit and the second is the lag unit. On a call for cooling, the lead unit starts operation in the 1-stage (low capacity). If the temperature in the building continues to rise above the set point temperature, the 1-stage (low capacity) of the lag unit will be initiated. When the temperature in the building drops to the set point, the air conditioners will turn off. On a subsequent call for cooling the process will repeat.

  If the set point temperature is not reached with 1-stage capacity operation of both air conditioners, the lead air conditioner will commence operation in 2-stage (full capacity). If the temperature in the building continues to rise past the setpoint, the lag unit will switch to 2-stage cooling operation. At that time, both air conditioners are operating in maximum capacity.

- **CommStat™ 6 Controller:** When two, 2-stage air conditioners are controlled by a CommStat 6 lead/lag controller in a redundant application, one of the air conditioners is the lead unit and the second is the lag unit. On a call for cooling, the lead unit starts operation in the 1st-stage (LOW capacity). If the temperature in the building continues to rise above the set point temperature, the 2nd-stage (FULL capacity) of the LEAD unit will be initiated. When the temperature in the building drops to the set point, the unit will turn off. On a subsequent call for cooling the process will repeat.

  If the set point temperature is not reached with 2nd-stage capacity operation of the LEAD air conditioner, the LAG air conditioner will commence operation in 1st-stage (LOW capacity). If the temperature in the building continues to rise past the setpoint, the lag unit will switch to 2-stage cooling operation. At that time, both air conditioners are operating in maximum capacity

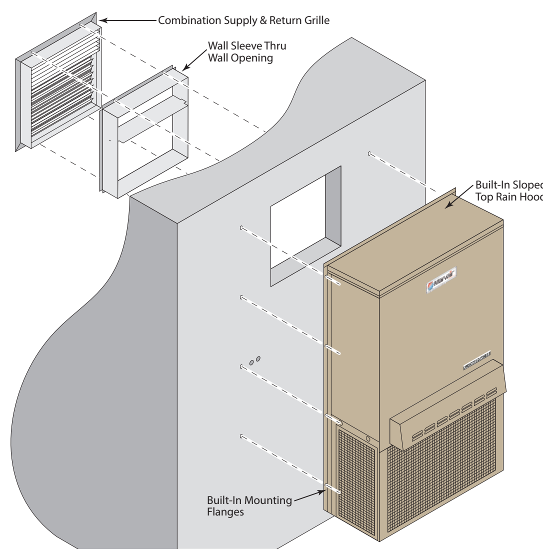
When the temperature in the building is satisfied with either controller, both units will turn off.

If the units have economizers (ComPac II air conditioners), the enthalpy sensor determines whether to use outside air or use mechanical cooling. When the economizer is used, the compressors do not operate.

Marvair's AVPA12 One Ton Air Conditioner

Ideal Replacement for Old Window Air Conditioners or New Construction

The electronic/communication shelter requires cooling virtually year-round because of the heat load generated by the internal electronic equipment (i.e., switching and transmission gear). Residential window room air conditioners are not designed to operate when outside air temperatures are moderate to cold, i.e., below 65°F (18°C). Typical problems are freezing of the coil, diminished capacity and compressor damage which all contribute to high maintenance and short operating life.



The Marvair® One Ton ComPac® I and ComPac® II air conditioners are designed for the electronic/ communication shelter to provide a commercial grade air conditioner for years of operation. The Marvair One Ton is built to operate continuously and efficiently in a variety of outside conditions. For existing shelters with window air conditioners, upgrading to the commercial grade Marvair air conditioners is made easy by the design of the One Ton ComPac II unit with the factory installed economizer. The back panel is designed for either a 19" x 19" (483 mm x 483 mm) or 28" x 19" (711 mm x 483 mm) opening, standard opening sizes for many window units. The unit is shipped from the factory for mounting on a 19" x 19" (483 mm x 483 mm) opening, but can be easily changed at site to fit in a 28" x 19" (711 mm x 483 mm) opening. With the built-in mounting flanges, the air conditioner mounts quickly and simply to the exterior of the building. The single piece supply and return grille attaches easily to the wall sleeve to complete the installation. The ComPac I (non-economizer) unit has separate supply and return grilles. (See the Accessories section for the part numbers of the grilles and wall sleeves). Factory installed electric heat is available in the Marvair One Ton Air Conditioner thus eliminating baseboard heat and a second power source.

Controllers and Thermostats

➤ Controllers

CommStat 6 2/4 Telecom HVAC Controller NEW! .... *P/N 70705*
CommStat 6 4/8 Telecom HVAC Controller NEW! .... *P/N S/12087-04*
CommStat 6 6/12 Telecom HVAC Controller NEW! .... *P/N S/12087-06*

The CommStat 6 is an HVAC controller, is available in three configurations, and is designed specifically for controlling up to six redundant air conditioners with two stage compressors in a telecommunications shelter or enclosure. The **CommStat 6 2/4** controls up to two single or 2-stage air conditioners (4 Stages max.), the **CommStat 6 4/8** controls up to four single or 2-stage air conditioners (8 Stages max.) and the **CommStat 6 6/12** controls up to six single or 2-stage air conditioners (12 Stages max.)

In addition to the control of the air conditioners, the CommStat 6 has multiple configurable outputs for remote alarms or notification. The CommStat 6 is factory programmed with standard industry set points, but can be configured on site. Settings are retained indefinitely in the event of a power loss.

CommStat 4 Telecom HVAC Controller .... P/N *S/7846*

The CommStat 4 HVAC controller is designed specifically for controlling two redundant air conditioners or heat pumps with single or 2-stage compressors. The CommStat 4 has seven outputs for remote alarms or notification. Status LED's indicate HEAT, COOL, POWER and the LEAD unit. When a fault is detected, an alarm LED flashes and the LCD screen displays the fault.

The CommStat 4 uses RS-485 communications via a RJ11 jack. It can be daisy chained with a second CommStat 4 controllers for controlling up to four air conditioners in one shelter. When two CommStat 4 controllers are daisy chained together, one is the MASTER and the other controller is the SLAVE. Any settings to the MASTER unit immediately take effect on the SLAVE unit. See the CommStat 4 Product Data Sheet for complete details.

CommStat3™ Lead/Lag Microprocessor Controller .... *P/N S/04581*

Solid state controller designed to operate a fully or partially redundant air conditioning system. Ensures equal wear on both air conditioners while allowing the lag unit to assist upon demand. Lead/ lag changeover is factory set at 7 days, but is field programmable in 1/2 day increments from 1/2 to 7 days. The CommStat 3™ Controller has LED's to indicate status & function, digital display of temperature, a comfort override button for energy savings, five alarm relays, a built in temperature sensor and is fully programmable. See CommStat 3™ Controller Product Data Sheet for details on operation & installation.

➤ Thermostats & Thermostat Guards

Note: *All air conditioners with 2-stage compressors (models HVESA) require a 2-stage cooling thermostat.*

Thermostat .... *P/N 50123*
Digital thermostat. 1-stage heat, 1-stage cooling. 7 day programmable. Fan switch: Auto & On. Auto-change over. Keypad lockout. Non-volatile program memory.

Thermostat .... *P/N 50107*
Digital thermostat. 2-stage heat, 2-stage cooling. 7 day programmable. Fan switch: Auto & On. Auto-change over. Status LED's. Backlit display. Programmable fan. Non-volatile program memory.

Thermostat Guard .... *P/N 50092*
Thermostat guard for use with the 50123 and 50107 thermostats.

Thermostat .... *P/N 50218*
Digital, non-programmable thermostat. 1-stage cooling and 1-stage heat. Auto-changeover.

Digital Humidistat .... *P/N 50254*
To be used with units with hot gas or electric reheat. Programmable dehumidistat and ventilation controller. Permanent memory retention of set points.Humidity sensor can be field calibrated. High & low dehumidification set points. Outdoor temperature and humidity sensor included. °F or °C selectable.

Thermostat .... *P/N 50252*
Non-programmable digital thermostat with backlit display. 2 stage heat and 2-stage cooling. Auto changeover.

Accessories

➤ Supply Grilles

For AVPA20/24 .... P/N 80674
20" x 8" (508 mm x 203 mm)
For AVPA/AVHA20,24,30,36 and HVEA24 .... P/N 80675
28" x 8" (711 mm x 203 mm)
For AVPA/AVHA42,48,60, AVPA72 and HVEA30,36,42,49,60 .... P/N 80676
30" x 10" (762 mm x 254 mm)

➤ Return Grilles

For AVPA20/24 .... P/N 80677
20" x 12" (508 mm x 305 mm)
For AVPA/AVHA20,24,30,36 and HVEA24 .... P/N 80678
28" x 14" (711 mm x 356 mm)
For AVPA/AVHA42,48,60, AVPA72 and HVEA30,36,42,49,60 .... P/N 80679
30" x 16" (762 mm x 406 mm)

➤ Return Filter Grilles

Used when filter must be changed from the interior. Not recommended for ComPac® II air conditioner.
Note: Filter used in Return Filter Grille is 1" (25 mm) thick.

For AVPA20/24 .... P/N 80671
20" x 12" (508 mm x 305 mm)
For AVPA/AVHA20,24,30,36 and HVEA24 .... P/N 80672
28" x 14" (711 mm x 356 mm)
For AVPA/AVHA42,48,60, AVPA72 and HVEA30, 36, 42, 49, 60 .... P/N 80673
30" x 16" (762 mm x 406 mm)

➤ AVPA12 Grilles and Wall Sleeves

For AVPA12 ComPac I (non-economizer) .... P/N 80682
Supply Grille 17" x 5" (432 mm x 127 mm)
Return Air Grilles For AVPA12 (non-economizer unit) .... P/N 92352
17" x 10" (432 mm x 25)
AVPA12 ComPac I (non-economizer) unit Return Air Filter Grille .... P/N 80683
17" x 10" (432 mm x 25)
AVPA12 ComPac I (non-economizer) Special Combination Supply/Return Air Grille .... P/N 80669
26" x 17" (660 mm x 432 mm)

➤ For AVPA12 ComPac II with Factory Installed Economizer

<u>Combination Supply and Return Air Grille and Wall Sleeve for 19" x 19" Opening</u>
Wall Sleeve for 19" x 19" (483 mm x 483 mm) opening .... P/N S/09392
Combination Supply and Return Air Grille for 19" x 19" (483 mm x 483 mm) opening .... P/N 92379
Note: *Grille is 17" x 17" (432 mm x 432 mm)*
<u>Combination Supply and Return Air Grille and Wall Sleeve for 28" x 19" Opening</u>
Wall Sleeve for 28" x 19" (711 mm x 483 mm) opening .... P/N S/01784
Combination Supply and Return Air Grille for 28" x 19" (711 mm x 483 mm) opening .... P/N 80681
Note: Grille is 26" x 17" (660 mm x 432 mm)

Options

The ComPac® I and ComPac® II air conditioners were designed and are built to stringent requirements of the communications/electronic shelter. Applications occur that have special requirements. Numerous options are available for the ComPac I and ComPac II air conditioners that meet these special needs.

➤ Hard Start Kit

Used on single phase equipment to give the compressor higher starting torque under low voltage conditions. (Field installed only) (Note: Not recommended for use on scroll compressors.)

➤ Dehumidification

ComPac® I and ComPac® II A/C – Allows the electric heat to operate simultaneously with cooling. See Dehumidification Application Bulletin for details. Note: The electrical characteristics and requirements of air conditioners with the dehumidification option are different from standard air conditioners. Refer to the appropriate Summary Rating Charts for the electrical characteristics of units with Electric Reheat. Available on all units except the AVPA12. Units with reheat require a thermostat and a dehumidistat for proper operation.

➤ Protective Coating Packages

Typically, only the ComPac I is used in corrosive environments, but the ComPac II air conditioner is also available with corrosion protection. Two corrosion protection packages are offered - one for the condenser section (Coastal Environmental Package) and the other for the entire unit (Coat-All Package).

The Coastal Environmental Package includes:

- Corrosion resistant fasteners
- Sealed or partially sealed condenser fan motor
- Protective coating applied to all exposed internal copper and metal in the condenser section
- Protective coating on the condenser coil (Luvata Insitu®) contains ES2 (embedded stainless steel pigment) technology.

The Coat all Package includes all of the above, plus:

- Protective coating on the evaporator coil (Luvata Insitu®) contains ES2 (embedded stainless steel pigment) technology
- Protective coating on exterior and interior components and sheet metal. (***Note:*** the internal sheet metal which is insulated and the internal control box are not coated)

Note: The AVPA12 is available with the protective coatings and corrosion resistant fasteners, but does not have a sealed condenser fan motor.

➤ Protective Coil Coatings

The Condenser Coil or the Evaporator Coil or Both can be coated. Coating the Evaporator Coil in not common. For harsh conditions, e.g., power plants, paper mills or sites where the unit will be exposed to salt water, the coils should be protected by a protective coating.

Note: Cooling capacity may be reduced by up to 5% on units with coated coils.

➤ External Low Noise Blower (ELNB)

ComPac® I and ComPac® II A/C – A field installed kit that consists of a condenser air hood, centrifugal blowers, controls and a compressor jacket to reduce the sound level by up to 6 dbA of Marvair ComPac air conditioners. Available for models AVPA30-60. See External Low Noise Blower Product Data Sheet for details.

➤ ComPac® II Air Conditioner Transition Curb

ComPac II A/C only – A sheet metal curb that enables AVPA42/48/60 ComPac II air conditioner to replace an AVPA30/36 ComPac II unit. Curb transitions supply and return openings of the 3-1/2, 4 and 5 ton units to the smaller openings.

➤ Hot Gas By-Pass

ComPac® I A/C Only – Used in specialty applications; i.e., Magnetic Resonance Imaging (MRI) buildings, to prevent magnetic voltage disturbance caused by compressor cycling. Hot gas by-pass option packages are available to allow operation to 20°F (-7°C). Please refer to Hot Gas By-pass Application Bulletin for details. Not available on the AVPA12, 20 & 24.

➤ High Filtration

Selected units are built with larger blowers/motors for use with higher efficiency filters with MERV ratings of 11, 13 and 14 when tested to ASHRAE 52.2. Units with economizers have a prefilter on the outside air. Not available on the AVPA12. Contact your Marvair representative for specific models.

➤ Color

ComPac® I and ComPac® II air conditioners are available in five different cabinet colors -the standard Marvair® beige, white, gray, brown and dark bronze. The standard cabinet's sides, top and front panels are constructed of 20 gauge painted steel. As an option, these panels can be built of 16 gauge steel in beige & gray or .050 stucco aluminum. When the 16 gauge painted steel or the aluminum is used, only the side, top and front panels are 16 gauge or aluminum. Contact your Marvair representative for color chips. The cabinet can also be constructed of type 316 stainless steel. Two stainless steel cabinet constructions are available- the complete cabinet, including most internal sheet metal or only the exterior sheet metal.

➤ Extended Warranty

A first-year labor (Silver), and a two-year labor (Gold) are available. See *www.marvair.com* for optional warranty details.

➤ Dirty Filter Indicator

A factory installed option that measures the difference in pressure across the internal filter and illuminates a LED when the pressure exceeds the desired difference. Not available on the AVPA12.

➤ **Phase Monitor**
Continuously measures the voltage of each of the three phases. The monitor separately senses low and high voltage, voltage unbalance including phase loss and phase reversal. A red LED glows to indicate a fault. When all voltages are acceptable, a green LED glows. Automatically resets when voltages and phases are within operating tolerances.
Note: Not required on 1ø units.

➤ **Thermal Expansion Valve**
Available on all ComPac air conditioners. Improves performance in hot ambient temperatures.

➤ **Sealed Condenser Fan Motors**
Recommended on units to be installed in corrosive sites, e.g., near the ocean and in deserts with blowing sand. Available on all units except the AVPA12.

➤ **Compressor Sound Jacket**
To reduce sound of compressor. Available on all units except the AVPA12

➤ **Extreme Duty Package** *(Not Available on AVPA12)*
Allows Marvair® air conditioners to operate in extremely cold and hot ambient conditions. The Extreme Duty Kit is always factory installed and is available on all air conditioners. ComPac I units without an economizer will operate from 0°F to 130°F (-18° to 54°C). ComPac II units with an economizer will operate from -40°F to 130°F (-40° to 54°C).

The Extreme Duty Package includes a suction line accumulator, thermal expansion valve (TXV), crankcase heater, hard start kit, an auto reset high pressure switch and an outdoor thermostat and fan cycle switch. The fan cycle control is standard on all ComPac air conditioners and operates based upon the liquid line pressure. The outside thermostat opens whenever the outside temperature is below 50°F (10°C) and closes when the outside temperature is 50°F (10°C) or higher. When the temperature is below 50°F (10°C), the fan cycle switch is in the circuit; when temperatures are 50°F (10°C) or higher, the fan cycle switch is not in the circuit. The outdoor thermostat is used with a TXV to prevent excessive cycling or "hunting" of the TXV.

➤ **Lockable Disconnect Access Cover Plate**
The access plate to the service disconnect switch can be equipped with a lockable cover.

➤ **Desert Duty Package (Not available on the AVPA12)**
Our standard air conditioners will operate in outside ambient temperatures up to 120°F (48.9°C) The Desert Duty package is a factory installed package of components and cabinet modifications to allow operation in ambient temperatures up 130°F (54°C). Standard features of the Desert Duty package include a thermal expansion valve and a sealed condenser fan motor. Cabinet modifications include a slotted panel in the base pan that improves condenser air flow and also provides access to the compressor and condenser fan motor. To prevent sand and dust infiltration, the electrical control box is sealed. A closed loop design on the ComPac I unit insures that no outside air is introduced into the shelter. Note: the ComPac II unit with the economizer may be ordered with the Desert Duty Package. If the ComPac II air conditioner is required with the Desert Duty Package, sand intrusion into the shelter should be considered.

➤ **Washable Filter**
Spun aluminum construction allows cleaning of filters with water.

➤ **Hot Gas Reheat (HGR)**
A Hot Gas Reheat coil and controls allow the indoor humidity of the controlled environment to be maintained at or below a certain humidity set point. These units do not have the ability to add humidity to the room. Dehumidification is achieved by operating mechanical cooling in conjunction with a hot gas reheat coil.

➤ **Right & Left Side Compressor Location**
The air conditioners can be built with the compressor on the opposite side to facilitate service access when two units are installed side by side. In the AVPA20-24-30-36 & AVHA30/36, the standard location for the compressor is on the right hand side. In the AVPA12 and the AVPA42-48-60 & AVHA42-48-60, the standard location for the compressor is on the left hand side. In the 72, the compressor is accessed from the front of the unit and an opposing configuration is not required.

➤ Marvair Coil Cop® Theft Deterrent System

The Marvair Coil Cop® is a factory installed, multi-layered theft deterrent system designed for use in Marvair wall mounted air conditioners and heat pumps. It provides visual and audio warnings and remote notification in the event of an attempted theft or vandalism of the unit. It is especially useful for air conditioners located in remote or unsupervised locations, e.g., many cell sites, and can eliminate bulky and expensive cages. For a complete description of the components and operation of the Coil Cop system, please see the Coil Cop brochure (available for download at *www.marvair.com*).

Two variations of the Coil Cop theft deterrent system are available:

- **Coil Cop Variation T1** is the complete Coil Cop Package. Includes stainless steel channels to secure both the condenser and evaporator coils, warning labels, a speaker, tamper resistant fasteners, loss of charge switch, tri-axis accelerometer and operator panel with status lights.
- **Coil Cop Variation T2** includes stainless steel channels to secure the condenser coil, warning labels, a speaker, tamper resistant fasteners, loss of charge switch, tri-axis accelerometer and operator panel with status lights. Variation T2 does not include stainless steel channel on the evaporator coil.

Remote Access Data Points

Through the Ethernet connection, the network operations center can monitor and change various data points in the HVAC system and the shelter.

Data Points which can be monitored **and** changed:

- First Stage Cooling Set Point Temperature
- Second Stage Cooling Set Point Differential Temperature
- First Stage Heating Set Point Temperature
- Second Stage Heating Set Point Differential Temperature

Data points which can only be monitored:

- Inside Temperature - Current
- Outside Temperature - Current
- Outside Humidity - Current
- Dew point - Current
- Inside Temperature - Average Last Hour
- Outside Temperature - Average Last Hour
- Outside Humidity - Average Last Hour
- Dew point - Average Last Hour
- Unit 1 & Unit 2 Mechanical Cooling Time - Last Hour
- Unit 1 & Unit 2 Mechanical Cooling Requests - Last Hour
- Unit 1 & Unit 2 Free Air Cooling Time - Last Hour
- Unit 1 & Unit 2 Free Air Cooling Requests - Last Hour
- Unit 1 & Unit 2 Heating Time - Last Hour
- Unit 1 & Unit 2 Heating Requests - Last Hour

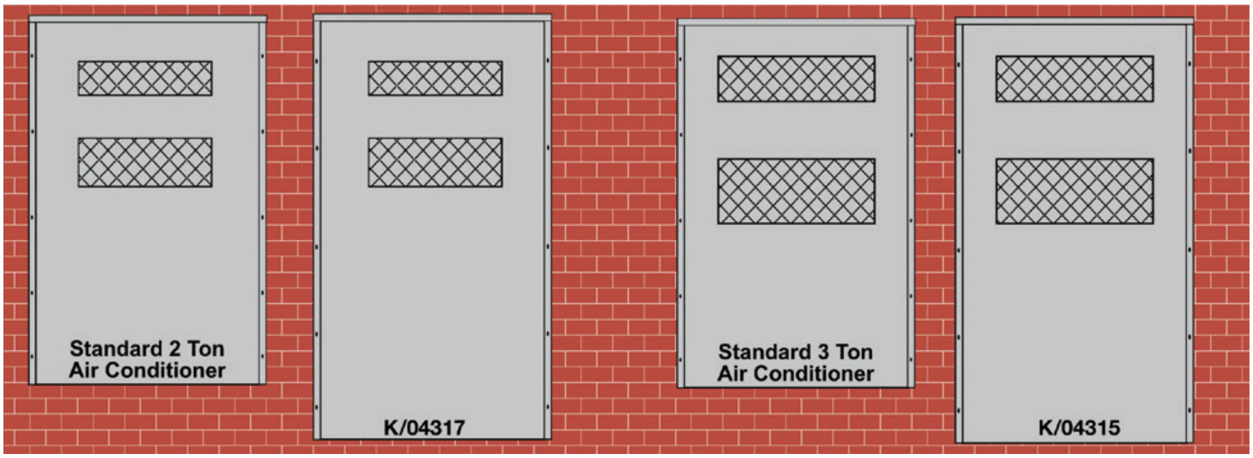
Dry Contacts Alarm Outputs

A dry contact is provided for each HVAC unit to indicate HVAC unit failure to the shelter alarm block. Unit failure is defined as 1) a high pressure lockout or 2) a low pressure lockout or 3) a loss of landline power. This dry contact is a normally open contact.

Back Panel Adapters for AVPA60 & AVHA60 Air Conditioners

These back panel adapters are factory installed on the AVPA60 & AVHA60 ComPac I air conditioners and to match the supply and return air openings on Marvair 2 and 3 ton air conditioners. This allows the AVPA60 & AVHA60 to be quickly and easily installed. No cutting or sawing of the shelter is required. The back panel, K/04317 has supply and return openings that match the openings of AVP24 & AVPA24 wall mounted air conditioners. The back panel, K/04315, has supply and return openings that match the openings of Marvair's AVP36 & AVPA36 air conditioners. In addition to matching the openings of Marvair units, the back panels will also match the openings of other brands.

When the K/04317 back panel adapter is used, a return filter grille, p/n 80671, must be used. When the K/04315 back panel adapter is used, a return filter grille, p/n 80672, must be used.



Control Box

The internal control board in the ComPac® air conditioners simplifies wiring, consolidates several of the electrical functions onto one device and improves the reliability of the air conditioner. In addition, the control board has LED's that indicate operational status and fault conditions.

➤ LED Indicator Lights

COLOR	TYPE	STATUS	DESCRIPTION
Green	Power	Constant On	24 VAC power has been applied
Red	Status	Constant On	Normal operation
		1 Blink	High pressure switch has opened twice
		2 Blinks	Low pressure switch has opened twice
		3 Blinks	Freeze stat (optional) - indoor coil temperature is below 35°F (1°C)

➤ Modes of Operation

Normal Start-up: On a call for cooling, and the with the high pressure switch closed, the cooling system (compressor, indoor blower motor and outdoor fan motor) will be energized. (Note: See the Delay on Make feature). The cooling system will remain energized during the three minute low pressure switch bypass cycle. If the low pressure is closed, the cooling system will continue to operate after the three-minute bypass. If the low pressure switch is open after the three-minute bypass, the cooling system will be de-energized.

Lockout Mode: If either the high or low pressure switch opens twice on the same call for cooling, the control board enters into and indicates the lockout mode. In the lockout mode, the compressor is turned off, the alarm output is energized and the status LED's will blink to indicate which fault has occurred. If there is a call for air flow, the indoor blower will remain energized. When the lockout condition has cleared, the unit will reset if the demand of the thermostat is removed or when power is reset. The lockout circuit is factory wired for normally open contacts. The user can select either normally closed or normally open remote alarm dry contacts.

Delay on Make: On initial power up or on resumption of power, the air conditioner will wait .03 to 10 minutes from a call for cooling before allowing the contactor to energize.

Model Identification

●●● S A ●● AC ● ●●● ● ● A5 ●●●

AVP
AVH
HVE

2-Stage Compressor

Refrigerant
A = R410A

System Type
Air Conditioner

Nominal Cooling
12 = 11,000 BTUH
20 = 20,000 BTUH
24 = 24,000 BTUH
30 = 30,000 BTUH
36 = 36,000 BTUH
42 = 42,000 BTUH
48/49 = 48,000 BTUH
60 = 60,000 BTUH
72 = 72,000 BTUH

Power Supply
A = 208/230V,1ø,60Hz
C = 208/230V,3ø,60Hz
D = 460V,3ø,60Hz **(3 wire)**
Z = 575V,3ø,60Hz

Electric Heat – kW
000 = No Heat
022 = 2.2 kW
036 = 3.6 kW
040 = 4 kW
050 = 5 kW
060 = 6 kW
080 = 8 kW
090 = 9 kW
100 = 10 kW
120 = 12 kW
150 = 15 kW

Configuration
N = ComPac® I A/C
C = ComPac® II A/C

Special Option Code
R = Electric Reheat
U = Scroll Compressor
X = Hot Gas Bypass
O = Opposite side compressor
E = Extreme Duty
D = Desert Duty
G = Hot Gas Reheat

A5 = Built in compliance with UL 1995, 4th edition

Cabinet Color
100 = Beige
200 = Gray
400 = White
500 = Stainless Steel (Exterior Only)
SS-500 = Stainless Steel
700 = Aluminum Stucco

ComPac I & ComPac II Ambient Temperature Operating Ranges

Basic Model	Special Option	AVPA	AVHA/HVEA/HVESA
ComPac I	Standard Unit (N)	20ºF - 120ºF (7ºC - 48.9ºC)	20ºF - 120ºF (7ºC - 48.9ºC)
	Desert Duty (ND)	20ºF - 130ºF (7ºC - 54ºC)	20ºF - 130ºF (7ºC - 54ºC)
	Extreme Duty Kit (NE)	0ºF - 130ºF (18ºC - 54ºC)	0ºF - 130ºF (18ºC - 54ºC)
ComPac II	Standard Unit (C)	-40ºF - 120ºF (-40ºC - 48.9ºC)	-40ºF - 120ºF (-29ºC - 48.9ºC)
	Desert Duty (CD)	-40ºF - 130ºF (-40ºF - 54ºC)	-40ºF - 130ºF (-29ºC - 54ºC)
	Extreme Duty Kit (CE)	-40ºF - 130ºF (-40ºF - 54ºC)	-40ºF - 130ºF (-29ºC - 54ºC)

EER Comparison by Model

Nominal Cooling Capacity (BTUH)	Basic Model	EER
12,000	AVPA12	9.00
20,000	AVPA20	9.00
	AVHA20	10.00
24,000	AVPA24	9.25
	AVHA24	10.00
	HVEA24	10.75
30,000	AVPA30	9.25
	AVHA30	10.00
	HVEA30	11.75
36,000	AVPA36	9.25
	AVHA36	10.00
	HVEA36	11.25
	HVESA36	11.25
42,000	AVPA42	9.25
	AVHA42	10.00
	HVEA42	10.50
	HVESA42	10.50

Nominal Cooling Capacity (BTUH)	Basic Model	EER
48,000	AVPA48	9.50
	AVHA48	10.00
	HVEA49	11.50
	HVESA49	11.50
60,000	AVPA60	9.25
	AVHA60	10.00
	HVEA60	10.50
	HVESA60	10.50
72,000	AVPA72	10.00

Note: HVESA models have 2-stage compressors.

ComPac® AVPA/AVHA Standard Efficiency Air Conditioners

Certified Efficiency and Capacity Ratings at ANSI/AHRI Standard 390 - AVPA/AVHA Air Conditioners

Model Number	AVPA12	AVPA20	AVPA24	AVPA30	AVPA36	AVPA42	AVPA48	AVPA60	AVPA72	
	ACA	ACA	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA	ACC ACD ACZ
Cooling BTUH[1]	10,800	19,600	24,000	29,000	35,000	42,000	46,000	54,500	62,000	70,000
EER[2]	9.00	9.00	9.25	9.25	9.25	9.25	9.50	9.25	10.00	10.00
Rated Air Flow (CFM[3])	400	755	840	1,000	1,100	1,575	1,725	1,850	1,925	1,925

Model Number	AVHA20	AVHA24	AVHA30	AVHA36	AVHA42	AVHA48	AVHA60
	ACA	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ
Cooling BTUH[1]	19,600	24,000	29,000	33,000	42,000	46,000	54,000
EER[2]	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Rated Air Flow (CFM[3])	755	840	1,000	1,100	1,575	1,725	1,850

[1]Cooling rated at 95°F (35°C) outdoor and 80°F DB/67° WB (26.5°C DB/19.5°C WB) return air. [2]EER=Energy Efficiency Ratio [3]CFM=Cubic Feet per Minute
Ratings are with no outside air. Performance will be affected by altitude.
Ratings are at 230 volts for 208/230 volt units ("A" & "C" models) and 460 volts for "D" models. Operation of units at a different voltage from that of the rating point will affect performance and air flow.

Sensible Total Heat Ratio @ 95°F (35°C) Outside Air Dry Bulb - AVPA/AVHA Air Conditioners

Model Number	AVPA12	AVPA20	AVPA24	AVPA30	AVPA36	AVPA42	AVPA48	AVPA60	AVPA72	
	ACA	ACA	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA	ACC ACD ACZ
Total Capacity	10,800	19,600	24,000	29,000	35,000	42,000	46,000	54,500	62,000	70,000
Sensible Heat Ratio	0.74	0.76	0.75	0.75	0.69	0.76	0.76	0.73	0.71	0.67
Sensible Capacity	8,000	14,800	18,000	21,740	24,155	31,900	34,940	39,800	43,815	46,800
Rated Air Flow (CFM[1])	400	755	840	1,000	1,100	1,575	1,725	1,850	1,925	1,925

Model Number	AVHA20	AVHA24	AVHA30	AVHA36	AVHA42	AVHA48	AVHA60
	ACA	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ	ACA ACC ACD ACZ
Total Capacity	19,600	24,000	29,000	33,000	42,000	46,000	54,000
Sensible Heat Ratio	0.76	0.75	0.75	0.74	0.74	0.76	0.72
Sensible Capacity	14,800	18,000	21,700	24,500	31,000	35,000	39,000
Rated Air Flow (CFM[1])	755	840	1,000	1,100	1,575	1,725	1,850

[1]CFM=Cubic Feet per Minute. Sensible heat ratios based upon ANSI/AHRI std. 390 outdoor air conditions of 95°F (35°C) and 80°F DB/67° WB (26.5°C DB/19.5°C WB) return air.

Cooling Performance (BTUH) at Various Outdoor Temperatures - AVPA/AVHA Air Conditioners

Model Number	Outdoor Temperature											
	75ºF / 24ºC	80ºF / 26.5ºC	85ºF / 29ºC	90ºF / 32ºC	95ºF / 35ºC	100ºF / 38ºC	105ºF / 40.5ºC	110ºF / 43.3ºC	115ºF / 46ºC	120ºF / 48.9ºC	125ºF / 51.7ºC	130ºF / 54.4ºC
AVPA12AC	12,525	12,095	11,660	11,230	10,800	10,365	9,9935	9,500	9,285	8,640	8,205	7,775
AVPA20AC	22,735	21,950	21,165	20,380	19,600	18,815	18,030	17,245	16,855	15,680	14,895	14,110
AVPA24AC	27,840	26,880	25,920	24,960	24,000	23,040	22,080	21,120	20,640	19,200	18,240	17,280
AVPA30AC	33,640	32,480	31,320	30,160	29,000	27,840	26,680	25,520	24,940	23,200	22,040	20,880
AVPA36AC	40,600	39,200	37,800	36,400	35,000	33,600	32,200	30,800	30,100	28,000	26,600	25,200
AVPA42AC	48,720	47,040	45,360	43,680	42,000	40,320	38,640	36,960	36,120	33,600	31,920	30,240
AVPA48AC	53,360	51,520	49,680	47,840	46,000	44,160	42,320	40,480	39,560	36,800	34,960	33,120
AVPA60AC	63,220	61,040	58,860	56,680	54,500	52,320	50,140	47,960	46,870	43,600	41,420	39,240
AVPA72ACA	71,920	69,440	66,960	64,480	62,000	59,520	57,040	54,560	53,320	49,600	47,120	44,640
AVPA72ACC, ACD, ACZ	81,200	78,400	75,600	72,800	70,000	67,200	64,400	61,600	60,200	56,000	53,200	50,400
AVHA20AC	22,735	21,950	21,165	20,380	19,600	18,815	18,030	17,245	16,855	15,680	14,895	14,110
AVHA24AC	27,840	26,880	25,920	24,960	24,000	23,040	22,080	21,120	20,640	19,200	18,240	17,280
AVHA30AC	33,640	32,480	31,320	30,160	29,000	27,840	26,680	25,520	24,940	23,200	22,040	20,880
AVHA36AC	38,280	36,960	35,640	34,320	33,000	31,680	30,360	29,040	28,380	26,400	25,080	23,760
AVHA42AC	48,720	47,040	45,360	43,680	42,000	40,320	38,640	36,960	36,120	33,600	31,920	30,240
AVHA48AC	53,360	51,520	49,680	47,840	46,000	44,160	42,320	40,480	39,560	36,800	34,960	33,120
AVHA60AC	63,220	61,040	58,860	56,680	54,500	52,320	50,140	47,960	46,870	43,600	41,420	39,240

Based upon ANSI/AHRI std. 390 return air conditions of 80°F DB/67° WB (26.5°C DB/19.5°C WB) at various outdoor temperatures.
Note: Operation of units above 120°F (48.9°C) requires the Desert Duty package.

Electrical Characteristics - Compressor, Fan & Blower Motors - AVPA/AVHA Air Conditioner

BASIC MODEL	COMPRESSOR				OUTDOOR FAN & INDOOR BLOWER MOTORS	OUTDOOR FAN MOTOR			INDOOR BLOWER MOTOR		
	TYPE	VOLTS / HZ / PH	RLA[1]	LRA[2]	VOLTS / HZ / PH	RPM[3]	FLA[4]	HP[5]	RPM[3]	FLA[4]	HP[5]
AVPA12ACA	ROTARY	208/230-60-1	4.7	25.0	208/230-60-1	1630	0.65	1/6	1650	0.85	1/5
AVPA/AVHA20ACA	RECIPROCATING	208/230-60-1	8.3	43.0	208/230-60-1	1075	1.5	1/5	1075	1.5	1/5
AVPA/AVHA24ACA		208/230-60-1	10.6	54.0	208/230-60-1	1075	1.5	1/5	1075	1.5	1/5
AVPA30ACA		208/230-60-1	13.1	74.0	208/230-60-1	1075	1.8	1/4	1075	2.5	1/4
AVPA36ACA		208/230-60-1	14.7	84.0	208/230-60-1	1075	1.8	1/4	1075	2.5	1/4
AVPA42ACA		208/230-60-1	15.7	84.0	208/230-60-1	825	2.8	1/3	1075	3.1	1/2
AVPA48ACA		208/230-60-1	18.6	102.0	208/230-60-1	825	2.8	1/3	1075	3.1	1/2
AVPA60ACA		208/230-60-1	23.0	130.0	208/230-60-1	825	2.8	1/3	1075	5.2	3/4
AVPA/AVHA24ACA	SCROLL	208/230-60-1	12.8	64.0	208/230-60-1	1075	1.5	1/5	1075	1.5	1/5
AVPA/AVHA30ACA		208/230-60-1	14.1	77.0	208/230-60-1	1075	1.8	1/4	1075	2.5	1/4
AVPA/AVHA36ACA		208/230-60-1	17.9	112.0	208/230-60-1	1075	1.8	1/4	1075	2.5	1/4
AVPA/AVHA42ACA		208/230-60-1	19.8	109.0	208/230-60-1	825	2.8	1/3	1075	3.1	1/2
AVPA/AVHA48ACA		208/230-60-1	21.8	117.0	208/230-60-1	825	2.8	1/3	1075	3.1	1/2
AVPA/AVHA60ACA		208/230-60-1	26.2	134.0	208/230-60-1	825	2.8	1/3	1075	5.2	3/4
AVPA72ACA		208/230-60-1	30.1	158.0	208/230-60-1	825	2.9	1/2	1075	5.2	3/4
AVPA/AVHA24ACC	SCROLL	208/230-60-3	8.3	61.0	208/230-60-1	1075	1.5	1/5	1075	1.5	1/5
AVPA/AVHA30ACC		208/230-60-3	9.0	71.0	208/230-60-1	1075	1.8	1/4	1075	2.5	1/4
AVPA/AVHA36ACC		208/230-60-3	13.2	88.0	208/230-60-1	1075	1.8	1/4	1075	2.5	1/4
AVPA/AVHA42ACC		208/230-60-3	13.6	83.1	208/230-60-1	825	2.8	1/3	1075	3.1	1/2
AVPA/AVHA48ACC		208/230-60-3	13.7	83.1	208/230-60-1	825	2.8	1/3	1075	3.1	1/2
AVPA/AVHA60ACC		208/230-60-3	15.6	111.0	208/230-60-1	825	2.8	1/3	1075	5.2	3/4
AVPA72ACC		208/230-60-3	22.4	149.0	208/230-60-1	825	2.9	1/2	1075	5.2	3/4
AVPA/AVHA24ACD	SCROLL	460-60-3	5.1	28.0	208/230-60-1	1075	1.5	1/5	1075	1.5	1/5
AVPA/AVHA30ACD		460-60-3	5.6	38.0	208/230-60-1	1075	1.8	1/4	1075	2.5	1/4
AVPA/AVHA36ACD		460-60-3	6.0	44.0	208/230-60-1	1075	1.8	1/4	1075	2.5	1/4
AVPA/AVHA42ACD		460-60-3	6.1	41.0	208/230-60-1	825	2.8	1/3	1075	3.1	1/2
AVPA/AVHA48ACD		460-60-3	6.2	41.0	208/230-60-1	825	2.8	1/3	1075	3.1	1/2
AVPA/AVHA60ACD		460-60-3	7.7	52.0	208/230-60-1	825	2.8	1/3	1075	5.2	3/4
AVPA72ACD		460-60-3	10.6	75.0	208/230-60-1	825	2.9	1/2	1075	5.2	3/4
AVPA/AVHA24ACZ	SCROLL	575-60-3	3.3	23.7	208/230-60-1	1075	1.5	1/5	1075	1.5	1/5
AVPA/AVHA30ACZ		575-60-3	3.8	36.5	208/230-60-1	1075	1.5	1/5	1075	1.5	1/4
AVPA/AVHA36ACZ		575-60-3	4.2	30.0	208/230-60-1	1075	1.8	1/4	1075	2.5	1/4
AVPA/AVHA42ACZ		575-60-3	4.2	33.0	208/230-60-1	1075	1.8	1/4	1075	2.5	1/2
AVPA/AVHA48ACZ		575-60-3	4.8	33.0	208/230-60-1	825	2.8	1/3	1075	3.1	1/2
AVPA/AVHA60ACZ		575-60-3	5.8	38.9	208/230-60-1	825	2.8	1/3	1075	3.1	3/4
AVPA72ACZ		575-60-3	7.7	54.0	208/230-60-1	825	2.8	1/3	1075	5.2	3/4

[1]RLA = Rated Load Amps [2]LRA = Locked Rotor Amps [3]RPM = Revolutions per Minute [4]FLA = Full Load Amps [5]HP = Horsepower
The 460 volt (ACD) units will have a step down transformer for the 230 volt motors.

Summary Electrical Ratings (Wire and Circuit Breaker Sizing) - *AVPA/AVHA Air Conditioners with Ventilation Configurations: Manual Damper, up to 15% Outside Air ("N"), Economizer, Outside Air with Pressure Relief ("C")*

ELECTRIC HEAT		000 = None		022 = 2.2 kw		036 = 3.6 kw		040 = 4 kw		050 = 5 kw		060 = 6 kw		080 = 8 kw		090 = 9 kw		100 = 10 kw		120 = 12 kw		150 = 15 kw	
BASIC MODEL	VOLTAGE PHASE / HZ	SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]	
		MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]
AVPA12ACA	208/230-1-60	7.4	15	12.4	15	19.7	20			26.9	30												
AVPA/AVHA20ACA	208/230-1-60	13.4	20					22.4	25	27.5	30	32.8	35	43.1	45			53.6	60				
AVPA/AVHA24ACA	208/230-1-60	19.0	30					22.4	30	27.5	30	32.8	35	43.1	45			53.6	60				
AVPA/AVHA30ACA	208/230-1-60	21.9	35					23.4	35	28.5	35	33.8	35	44.1	45			54.6	60	65.0	70	80.6	90
AVPA/AVHA36ACA	208/230-1-60	26.7	40					26.7	40	28.5	40	33.8	40	44.1	45			54.6	60	65.0	70	80.6	90
AVPA/AVHA42ACA	208/230-1-60	30.7	50							30.7	50							55.2	60	65.6	70	81.2	90
AVPA/AVHA48ACA	208/230-1-60	33.2	50							33.2	50							55.2	60	65.6	70	81.2	90
AVPA/AVHA60ACA	208/230-1-60	40.8	60							40.8	60							57.3	60	67.7	70	83.3	90
AVPA72ACA	208/230-1-60	45.6	60							45.6	60							57.3	60	67.7	70	83.3	90
AVPA/AVHA24ACC	208/230-3-60	13.4	20									19.5	20			28.6	30			37.6	40		
AVPA/AVHA30ACC	208/230-3-60	15.6	20									20.5	25			29.6	30			38.6	40	47.6	50
AVPA/AVHA36ACC	208/230-3-60	20.8	30									20.8	30			29.6	30			38.6	40	47.6	50
AVPA/AVHA42ACC	208/230-3-60	22.9	35									22.9	35			30.2	35			39.1	40	48.1	50
AVPA/AVHA48ACC	208/230-3-60	23.0	35									23.0	35			30.2	35			39.1	40	48.1	50
AVPA/AVHA60ACC	208/230-3-60	27.5	40									27.5	40			32.3	40			41.3	45	50.2	60
AVPA72ACC	208/230-3-60	36.1	50									36.1	50			36.1	50			41.3	50	50.2	60
AVPA/AVHA24ACD	460-3-60	7.9	15									9.8	15			14.3	15			18.8	20	23.3	25
AVPA/AVHA30ACD	460-3-60	9.2	15									10.3	15			14.8	15			19.3	20	23.8	25
AVPA/AVHA36ACD	460-3-60	9.7	15									10.3	15			14.8	15			19.3	20	23.8	25
AVPA/AVHA42ACD	460-3-60	10.6	15									10.9	15			15.1	20			19.6	20	24.1	25
AVPA/AVHA48ACD	460-3-60	10.7	15									10.9	15			15.1	20			19.6	20	24.1	25
AVPA/AVHA60ACD	460-3-60	13.6	20									13.6	20			16.1	20			20.6	25	25.1	30
AVPA72ACD	460-3-60	17.3	25									17.3	25			17.3	25			20.6	25	25.1	30
AVPA/AVHA24ACZ	575-3-60	5.3	16									7.9	16			11.5	16			15.0	16		
AVPA/AVHA30ACZ	575-3-60	6.5	16									8.3	16			11.5	16			15.4	20	19.0	20
AVPA/AVHA36ACZ	575-3-60	7.0	16									8.3	16			11.9	16			15.4	20	19.0	20
AVPA/AVHA42ACZ	575-3-60	7.6	16									8.5	16			12.1	16			16.6	20	19.2	20
AVPA/AVHA48ACZ	575-3-60	8.4	16									8.5	16			12.1	16			16.6	20	19.2	20
AVPA/AVHA60ACZ	575-3-60	10.5	16									10.5	16			13.0	16			16.5	20	20.1	25
AVPA/AVHA72ACZ	575-3-60	12.8	20									12.8	20			13.0	20			16.5	20	20.1	25

[1]MCA = Minimum Circuit Ampacity (Wiring Size Amps) [2]MFS = Maximum Fuse or HACR Breaker Size [3]SPPE = Single Point Power Entry
MCA & MFS are calculated at 230 volts on the ACA & ACC models. The 460 volts ACD models are calculated at 460 volts. This chart should only be used as a guideline for estimating conductor size and overcurrent protection. For the requirements of specific units, always refer to the data label on the unit.

Summary Electrical Ratings (Wire and Circuit Breaker Sizing) -
AVPA/AVHA Air Conditioners with Elec. Reheat ("R") and Ventilation Configurations: Manual Damper, up to 15% Outside Air ("N"), Economizer, Outside Air with Pressure Relief ("C")

ELECTRIC HEAT		000 = None		022 = 2.2 kw		036 = 3.6 kw		040 = 4 kw		050 = 5 kw		060 = 6 kw		080 = 8 kw		090 = 9 kw		100 = 10 kw		120 = 12 kw		150 = 15 kw	
BASIC MODEL	VOLTAGE PHASE / HZ	SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]	
		MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]
AVPA12ACA	208/230-1-60	7.4	15	18.9	20	26.2	30			33.4	35												
AVPA/AVHA20ACA	208/230-1-60	13.4	20					34.3	35	39.4	40	44.7	45					65.5	70				
AVPA/AVHA24ACA	208/230-1-60	19.0	30					39.9	40	45	45	50.3	60					71.1	80				
AVPA/AVHA30ACA	208/230-1-60	21.9	35					42.8	45	47.9	50	53.2	60					74	80	84.8	90	100	100
AVPA/AVHA36ACA	208/230-1-60	26.7	40					47.6	50	52.7	60	58	60					78.8	80	89.2	90	104.8	110
AVPA/AVHA42ACA	208/230-1-60	30.7	50							56.7	60							82.8	90	93.2	100	108.8	110
AVPA/AVHA48ACA	208/230-1-60	33.2	50							59.2	60							85.3	90	95.7	100	111.3	120
AVPA/AVHA60ACA	208/230-1-60	40.8	60							66.8	70							92.9	100	103.3	110	118.9	120
AVPA72ACA	208/230-1-60	45.6	60							71.6	80							97.7	100	108.1	110	123.7	130
AVPA/AVHA24ACC	208/230-3-60	13.4	20									31.4	35			40.5	45			49.5	50	58.5	60
AVPA/AVHA30ACC	208/230-3-60	15.6	20									33.6	35			42.7	45			51.7	60	60.7	70
AVPA/AVHA36ACC	208/230-3-60	20.8	30									38.8	40			47.9	50			56.9	60	65.9	70
AVPA/AVHA42ACC	208/230-3-60	22.9	35									40.9	45			50.0	50			59.0	60	68.0	70
AVPA/AVHA48ACC	208/230-3-60	23.0	35									41.0	45			50.1	60			59.1	60	68.1	70
AVPA/AVHA60ACC	208/230-3-60	27.5	40									45.5	50			54.6	60			63.6	70	72.6	80
AVPA72ACC	208/230-3-60	36.1	50									54.1	60			63.2	70			72.2	80	81.2	90
AVPA/AVHA24ACD	460-3-60	7.9	15									16.9	20			21.4	25			25.9	30	30.4	35
AVPA/AVHA30ACD	460-3-60	9.2	15									18.2	20			22.7	25			27.2	30	31.7	35
AVPA/AVHA36ACD	460-3-60	9.7	15									18.7	20			23.2	25			27.7	30	32.2	35
AVPA/AVHA42ACD	460-3-60	10.6	15									19.6	20			24.1	25			28.6	30	33.1	35
AVPA/AVHA48ACD	460-3-60	10.7	15									19.7	20			24.2	25			28.7	30	33.2	35
AVPA/AVHA60ACD	460-3-60	13.6	20									22.6	25			27.1	30			31.6	35	36.1	40
AVPA72ACD	460-3-60	17.3	25									26.3	30			30.8	35			35.3	40	39.8	40
AVPA/AVHA24ACZ	575-3-60	5.3	16									12.6	16			16.2	20			19.7	20		
AVPA/AVHA30ACZ	575-3-60	6.5	16									13.7	16			17.3	20			20.8	25	24.5	25
AVPA/AVHA36ACZ	575-3-60	7.0	16									14.2	16			17.8	20			21.3	25	25.0	25
AVPA/AVHA42ACZ	575-3-60	7.6	16									14.9	16			18.5	20			22.0	25	25.6	30
AVPA/AVHA48ACZ	575-3-60	8.4	16									15.6	20			19.2	20			22.7	25	26.4	30
AVPA/AVHA60ACZ	575-3-60	10.5	16									17.7	20			21.3	25			24.8	25	28.5	30
AVPA72ACZ	575-3-60	12.8	20									20.1	25			23.7	25			27.2	30	30.8	35

[1]MCA = Minimum Circuit Ampacity (Wiring Size Amps) [2]2MFS = Maximum Fuse or HACR Breaker Size [3]SPPE = Single Point Power Entry
MCA & MFS are calculated at 230 volts on the ACA & ACC models. The 460 volts ACD models are calculated at 460 volts. This chart should only be used as a guideline for estimating conductor size and overcurrent protection. For the requirements of specific units, always refer to the data label on the unit.

Unit Load Amps - *AVPA/AVHA Air Conditioners with Ventilation Configurations: Manual Damper, up to 15% Outside Air ("N") Economizer, Outside Air with Pressure Relief ("C")*

BASIC MODEL NUMBER	VOLTAGE PHASE / HZ	CUR-RENT AMPS		LOAD OF RESISTIVE HEATING - ELEMENTS ONLY (AMPS) (1) ALL HEATING ELEMENTS ARE ON A SEPARATE CIRCUIT (2) SHADED VALUES (12 & 15 kW) UTILIZE TWO CIRCUITS										TOTAL MAXIMUM HEATING AMPS INCLUDES AMPS FROM MOTOR(S) THAT ARE LOCATED ON AN ELECTRICAL CIRCUIT THAT DOES NOT HAVE HEATERS									
		AC[1]	IBM[2]	2.2 kW	3.6 kW	04 kW	05 kW	06 kW	08 kW	09 kW	10 kW	12 kW	15 kW	2.2 kW	3.6 kW	04 kW	05 kW	06 kW	08 kW	09 kW	10 kW	12 kW	15 kW
AVPA12ACA	208/230-1-60	6.1	0.85	9.2	15.0		20.8							10.1	15.0		21.7						
AVPA/AVHA20ACA	208/230-1-60	11.3	1.5			16.7	20.8	25.0	33.3		41.7					18.2	22.3	26.5	34.8		43.2		
AVPA/AVHA24ACA	208/230-1-60	15.8	1.5			16.7	20.8	25.0	33.3		41.7					18.2	22.3	26.5	34.8		43.2		
AVPA/AVHA30ACA	208/230-1-60	18.4	2.5			16.7	20.8	25.0	33.3		41.7	50.0	62.5			19.2	23.3	27.5	35.8		44.2	52.5	65.0
AVPA/AVHA36ACA	208/230-1-60	22.2	2.5			16.7	20.8	25.0	33.3		41.7	50.0	62.5			19.2	23.3	27.5	35.8		44.2	52.5	65.0
AVPA/AVHA42ACA	208/230-1-60	25.7	3.1				20.8				41.7	50.0	62.5				23.9				44.8	53.1	65.6
AVPA/AVHA48ACA	208/230-1-60	27.7	3.1				20.8				41.7	50.0	62.5				23.9				44.8	53.1	65.6
AVPA/AVHA60ACA	208/230-1-60	34.2	5.2				20.8				41.7	50.0	62.5				26.0				46.9	55.2	67.7
AVPA72ACA	208/230-1-60	38.2	5.2				20.8				41.7	50.0	62.5				26.0				46.9	55.2	67.7
AVPA/AVHA24ACC	208/230-3-60	11.2	1.5					14.4		21.7		28.9	36.1					15.9		23.2		30.4	37.6
AVPA/AVHA30ACC	208/230-3-60	13.3	2.5					14.4		21.7		28.9	36.1					16.9		24.2		31.4	38.6
AVPA/AVHA36ACC	208/230-3-60	17.5	2.5					14.4		21.7		28.9	36.1					16.9		24.2		31.4	38.6
AVPA/AVHA42ACC	208/230-3-60	19.5	3.1					14.4		21.7		28.9	36.1					17.5		24.8		32.0	39.2
AVPA/AVHA48ACC	208/230-3-60	19.6	3.1					14.4		21.7		28.9	36.1					17.5		24.8		32.0	39.2
AVPA/AVHA60ACC	208/230-3-60	23.6	5.2					14.4		21.7		28.9	36.1					19.6		26.9		34.1	41.3
AVPA72ACC	208/230-3-60	30.5	5.2					14.4		21.7		28.9	36.1					19.6		26.9		34.1	41.3
AVPA24/AVHAACD	460-3-60	6.6	0.8					7.2		10.8		14.4	18.0					8.0		11.6		15.2	18.8
AVPA/AVHA30ACD	460-3-60	7.8	1.3					7.2		10.8		14.4	18.0					8.5		12.1		15.7	19.3
AVPA/AVHA36ACD	460-3-60	8.2	1.3					7.2		10.8		14.4	18.0					8.5		12.1		15.7	19.3
AVPA/AVHA42ACD	460-3-60	9.1	1.6					7.2		10.8		14.4	18.0					8.8		12.4		16.0	19.6
AVPA/AVHA48ACD	460-3-60	9.2	1.6					7.2		10.8		14.4	18.0					8.8		12.4		16.0	19.6
AVPA/AVHA60ACD	460-3-60	11.7	2.6					7.2		10.8		14.4	18.0					9.8		13.4		17.0	20.6
AVPA72ACD	460-3-60	14.7	2.6					7.2		10.8		14.4	18.0					9.8		13.4		17.0	20.6
AVPA/AVHA24ACZ	575-3-60	4.5	0.6					5.8		8.7		11.5						6.4		9.3		12.1	
AVPA/AVHA30ACZ	575-3-60	5.5	1.0					5.8		8.7		11.5	14.4					6.8		9.7		12.5	15.4
AVPA/AVHA36ACZ	575-3-60	5.9	1.0					5.8		8.7		11.5	14.4					6.8		9.7		12.5	15.4
AVPA/AVHA42ACZ	575-3-60	6.6	1.2					5.8		8.7		11.5	14.4					7.0		9.9		12.7	15.6
AVPA/AVHA48ACZ	575-3-60	7.2	1.2					5.8		8.7		11.5	14.4					7.0		9.9		12.7	15.6
AVPA/AVHA60ACZ	575-3-60	9.0	2.1					5.8		8.7		11.5	14.4					7.9		10.8		13.6	16.5
AVPA/AVHA72ACZ	575-3-60	10.9	2.1					5.8		8.7		11.5	14.4					7.9		10.8		13.6	16.5

[1]AC = Air Conditioner Unit Amps [2]IBM = Indoor Blower Motor

Heating kW is rated at 240 volts on the ACA & ACC models. Derate heater output by 25% for operation at 208 volts. Heating kW is rated at 480 volts on the ACD models. Total heating and cooling amps includes all motors. Three phase models contain single phase motor loads. Loads are not equally balanced on each phase and values shown are maximum phase loads.

ComPac® HVEA High Efficiency Air Conditioners

Certified Efficiency and Capacity Ratings at ANSI/AHRI Standard 390 for HVEA Air Conditioners with Single Stage Compressor

Model Number	HVEA24			HVEA30			HVEA36			HVEA42			HVEA49			HVEA60		
	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD
Cooling BTUH[1]	23,600			29,000			35,600			40,000			49,000			58,000		
EER[2]	10.75			11.75			11.25			10.50			11.50			10.50		
Rated Air Flow (CFM[3])	800			1,000			1,300			1,400			1,750			1,900		

[1]Cooling rated at 95°F (35°C) outdoor and 80°F DB/67° WB (26.5°C DB/19.5°C WB) return air [2]EER=Energy Efficiency Ratio [3]CFM=Cubic Feet per Minute
Ratings are with no outside air. Performance will be affected by altitude.
Ratings are at 230 volts for 208/230 volt units ("A" & "C" models) and 460 volts for "D" models. Operation of units at a different voltage from that of the rating point will affect performance and air flow.

Sensible Total Heat Ratio @ 95°F (35°C) Outside Air Dry Bulb - HVEA Air Conditioners with Single Stage Compressor

Model Number	HVEA24			HVEA30			HVEA36			HVEA42			HVEA49			HVEA60		
	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD
Total Capacity	23,600			29,000			35,600			40,000			49,000			58,000		
Sensible Heat Ratio	0.74			0.76			0.76			0.73			0.74			0.73		
Sensible Capacity	17,435			22,020			26,945			29,270			36,175			42,505		
Rated Air Flow (CFM[1])	800			1,000			1,300			1,400			1,750			1,900		

[1]CFM=Cubic Feet per Minute
Sensible heat ratios based upon ANSI/AHRI std. 390 outdoor air conditions of 95°F (35°C) and 80°F DB/67° WB (26.5°C DB/19.5°C WB) return air.

Cooling Performance (BTUH) at Various Outdoor Temperatures for HVEA Air Conditioners with Single Stage Compressor

Model Number	Outdoor Temperature											
	75ºF / 24ºC	80ºF / 26.5ºC	85ºF / 29ºC	90ºF / 32ºC	95ºF / 35ºC	100ºF / 38ºC	105ºF / 40.5ºC	110ºF / 43.3ºC	115ºF / 46.1ºC	120ºF / 48.9ºC	125ºF / 51.7ºC	130ºF / 54.4ºC
HVEA24AC	27,375	26,430	25,490	24,545	23,600	22,655	21,710	20,770	20,295	19,870	19,445	19,020
HVEA30AC	33,640	32,480	31,320	30,160	29,000	27,840	26,680	25,520	24,940	24,420	23,895	23,375
HVEA36AC	41,295	39,870	38,450	37,025	35,600	34,175	32,750	31,320	30,615	29,975	29,335	28,695
HVEA42AC	46,400	44,800	43,200	41,600	40,000	38,400	36,800	35,200	34,400	33,680	32,960	32,240
HVEA49AC	56,840	54,880	52,920	50,960	49,000	47,040	45,080	43,120	42,140	41,260	40,375	39,495
HVEA60AC	67,280	64,960	62,640	60,320	58,000	55,680	53,360	51,040	49,880	48,835	47,790	46,745

Based upon ANSI/AHRI std. 390 return air conditions of 80°F DB/67° WB (26.5°C DB/19.5°C WB) at various outdoor temperatures.

Electrical Characteristics - Compressor, Fan & Blower Motors - HVEA Air Conditioner with Single Stage Compressor

BASIC MODEL	COMPRESSOR				OUTDOOR FAN MOTOR				INDOOR FAN MOTOR (ECM)			
	Type	VOLTS-HZ-PH	RLA[1]	LRA[2]	VOLTS-HZ-PH	RPM[3]	FLA[4]	HP[5]	VOLTS-HZ-PH	RPM[3]	FLA[4]	HP[5]
HVEA24ACA	SCROLL	208/230-60-1	12.8	58.3	208/230-60-1	1075	1.8	1/4	208/230-60-1	1500	2.8	1/3
HVEA30ACA		208/230-60-1	12.8	64.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVEA36ACA		208/230-60-1	16.6	79.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVEA42ACA		208/230-60-1	19.8	109.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVEA49ACA		208/230-60-1	21.8	117.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4
HVEA60ACA		208/230-60-1	26.4	134.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4
HVEA24ACC	SCROLL	208/230-60-3	7.7	55.4	208/230-60-1	1075	1.8	1/4	208/230-60-1	1500	2.8	1/3
HVEA30ACC		208/230-60-3	8.3	61.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVEA36ACC		208/230-60-3	10.4	88.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVEA42ACC		208/230-60-3	13.6	83.1	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVEA49ACC		208/230-60-3	13.7	83.1	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4
HVEA60ACC		208/230-60-3	15.9	111.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4
HVEA24ACD	SCROLL	460-60-3	4.0	28.0	208/230-60-1	1075	1.8	1/4	208/230-60-1	1500	2.8	1/3
HVEA30ACD		460-60-3	5.1	28.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVEA36ACD		460-60-3	5.8	38.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVEA42ACD		460-60-3	6.1	41.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVEA49ACD		460-60-3	6.2	41.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4
HVEA60ACD		460-60-3	7.7	52.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4

[1]RLA = Rated Load Amps [2]LRA = Locked Rotor Amps [3]RPM = Revolutions per Minute [4]FLA = Full Load Amps [5]HP = Horsepower
The 460 volt units will have a step down transformer for the 230 volt motors.

Summary Electrical Ratings (Wire and Circuit Breaker Sizing) - *HVEA Air Conditioners with Single stage Compressors & Ventilation Configurations: Manual Damper, up to 15% Outside Air ("N") Economizer, Outside Air with Pressure Relief ("C")*

ELECTRIC HEAT		000 = None		040 = 4 kw		050 = 5 kw		060 = 6 kw		080 = 8 kw		090 = 9 kw		100 = 10 kw		120 = 12 kw		150 = 15 kw	
BASIC MODEL	VOLTAGE PHASE / HZ	SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]	
		MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]
HVEA24ACA	208/230-1-60	20.6	30	23.1	30	28.8	30	34.1	35	44.4	45			54.9	60				
HVEA30ACA	208/230-1-60	21.6	30	23.1	30	28.8	30	34.1	35	44.4	45			54.9	60	65.3	70	80.9	90
HVEA36ACA	208/230-1-60	26.4	40	26.4	40	28.8	40	34.1	35	44.4	45			54.9	60	65.3	70	80.9	90
HVEA42ACA	208/230-1-60	30.4	50			30.4	50							54.9	60	65.3	70	80.9	90
HVEA49ACA	208/230-1-60	34.4	50			34.4	50							56.4	60	66.8	70	82.4	90
HVEA60ACA	208/230-1-60	40.1	60			40.1	60							56.4	60	66.8	70	82.4	90
HVEA24ACC	208/230-3-60	14.2	20					20.8	25			29.9	30			38.9	40		
HVEA30ACC	208/230-3-60	16.0	20					20.8	25			29.9	30			38.9	40	47.9	50
HVEA36ACC	208/230-3-60	18.6	25					20.8	25			29.9	30			38.9	40	47.9	50
HVEA42ACC	208/230-3-60	22.6	35					22.6	35			29.9	35			38.9	40	47.9	50
HVEA49ACC	208/230-3-60	24.2	35					24.2	35			31.4	35			40.4	50	49.4	50
HVEA60ACC	208/230-3-60	27.0	40					27.0	40			31.4	40			40.4	50	49.4	50
HVEA24ACD	460-3-60	7.3	15					10.4	15			14.9	15			19.4	20	23.9	25
HVEA30ACD	460-3-60	9.2	15					10.4	15			14.9	15			19.4	20	23.9	25
HVEA36ACD	460-3-60	10.1	15					10.4	15			14.9	15			19.4	20	23.9	25
HVEA42ACD	460-3-60	10.4	15					10.4	15			14.9	15			19.4	20	23.9	25
HVEA49ACD	460-3-60	11.3	15					11.3	15			15.7	20			20.2	25	24.7	25
HVEA60ACD	460-3-60	13.2	20					13.2	20			15.7	20			20.2	25	24.7	25

[1]MCA = Minimum Circuit Ampacity (Wiring Size Amps) [2]MFS = Maximum Fuse or HACR Breaker Size [3]SPPE = Single Point Power Entry
MCA & MFS are calculated at 230 volts on the ACA & ACC models. he 460 volts ACD models are calculated at 460 volts. This chart should only be used as a guideline for estimating conductor size and overcurrent protection. For the requirements of specific units, always refer to the data label on the unit.

Summary Electrical Ratings (Wire and Circuit Breaker Sizing) -
HVEA Air Conditioners with Electric Reheat ("R") with Single stage Compressors and Ventilation Configurations:
Manual Damper, up to 15% Outside Air ("N")
Economizer, Outside Air with Pressure Relief ("C")

ELECTRIC HEAT		000 = None		040 = 4 kw		050 = 5 kw		060 = 6 kw		080 = 8 kw		090 = 9 kw		100 = 10 kw		120 = 12 kw		150 = 15 kw	
BASIC MODEL	VOLTAGE PHASE / HZ	SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]	
		MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]
HVEA24ACA	208/230-1-60	20.6	30	41.5	45	46.6	50	51.9	60					72.7	80				
HVEA30ACA	208/230-1-60	21.6	30	42.5	45	47.6	50	52.9	60					73.7	80	84.1	90	99.7	100
HVEA36ACA	208/230-1-60	26.4	40	47.3	50	52.4	60	57.7	60					78.5	80	88.9	90	104.5	110
HVEA42ACA	208/230-1-60	30.4	50			56.4	60							82.5	90	92.9	100	108.5	110
HVEA49ACA	208/230-1-60	34.4	50			60.4	70							86.5	90	96.9	100	112.5	120
HVEA60ACA	208/230-1-60	40.1	60			66.1	70							92.2	100	102.6	110	118.2	120
HVEA24ACC	208/230-3-60	14.2	20					32.2	35			41.3	45			50.3	60	59.3	60
HVEA30ACC	208/230-3-60	16.0	20					34.0	35			43.1	45			52.1	60	61.1	70
HVEA36ACC	208/230-3-60	18.6	25					36.6	40			45.7	50			54.7	60	63.7	70
HVEA42ACC	208/230-3-60	22.6	35					40.6	45			49.7	50			58.7	60	67.7	70
HVEA49ACC	208/230-3-60	24.2	35					42.2	45			51.3	60			60.3	70	69.3	70
HVEA60ACC	208/230-3-60	27.0	40					45.0	45			54.1	60			63.1	70	72.1	80
HVEA24ACD	460-3-60	7.3	15					16.3	20			20.8	25			25.3	30	29.8	30
HVEA30ACD	460-3-60	9.2	15					18.2	20			22.7	25			27.2	30	31.7	35
HVEA36ACD	460-3-60	10.1	15					19.1	20			23.6	25			28.1	30	32.6	35
HVEA42ACD	460-3-60	10.4	15					19.4	20			23.9	25			28.4	30	32.9	35
HVEA49ACD	460-3-60	11.3	15					20.3	25			24.8	25			29.3	30	33.8	35
HVEA60ACD	460-3-60	13.2	20					22.2	25			26.7	30			31.2	35	35.7	40

[1]MCA = Minimum Circuit Ampacity (Wiring Size Amps) [2]2MFS = Maximum Fuse or HACR Breaker Size [3]3SPPE = Single Point Power Entry

MCA & MFS are calculated at 230 volts on the ACA & ACC models. The 460 volts ACD models are calculated at 460 volts. This chart should only be used as a guideline for estimating conductor size and overcurrent protection. For the requirements of specific units, always refer to the data label on the unit.

Unit Load Amps -
HVEA Air Conditioners with with Single stage Compressors and Ventilation Configurations:
Manual Damper, up to 15% Outside Air ("N")
Economizer, Outside Air with Pressure Relief ("C")

BASIC MODEL NUMBER	VOLTAGE PHASE / HZ	CURRENT AMPS		LOAD OF RESISTIVE HEATING - ELEMENTS ONLY (AMPS) *(1) ALL HEATING ELEMENTS ARE ON A SEPARATE CIRCUIT (2) SHADED VALUES (12 & 15 kW) UTILIZE TWO CIRCUITS*								TOTAL MAXIMUM HEATING AMPS *INCLUDES AMPS FROM MOTOR(S) THAT ARE LOCATED ON AN ELECTRICAL CIRCUIT THAT DOES NOT HAVE HEATERS*							
		AC[1]	IBM[2]	04 kW	05 kW	06 kW	08 kW	09 kW	10 kW	12 kW	15 kW	04 Kw	05 Kw	06 Kw	08 Kw	09 Kw	10 Kw	12 Kw	15 Kw
HVEA24ACA	208/230-1-60	17.4	2.8	16.7	20.8	25.0	33.3		41.7			19.5	23.6	27.8	36.1		44.5		
HVEA30ACA	208/230-1-60	18.4	2.8	16.7	20.8	25.0	33.3		41.7	50.0	62.5	19.5	23.6	27.8	36.1		44.5	52.8	65.3
HVEA36ACA	208/230-1-60	22.2	2.8	16.7	20.8	25.0	33.3		41.7	50.0	62.5	19.5	23.6	27.8	36.1		44.5	52.8	65.3
HVEA42ACA	208/230-1-60	25.4	2.8		20.8				41.7	50.0	62.5		23.6				44.5	52.8	65.3
HVEA49ACA	208/230-1-60	28.9	4.3		20.8				41.7	50.0	62.5		25.1				46.0	54.3	66.8
HVEA60ACA	208/230-1-60	33.5	4.3		20.8				41.7	50.0	62.5		25.1				46.0	54.3	66.8
HVEA24ACC	208/230-3-60	12.3	2.8			14.4		21.7		28.9	36.1			17.2		24.5		31.7	38.9
HVEA30ACC	208/230-3-60	13.9	2.8			14.4		21.7		28.9	36.1			17.2		24.5		31.7	38.9
HVEA36ACC	208/230-3-60	16.0	2.8			14.4		21.7		28.9	36.1			17.2		24.5		31.7	38.9
HVEA42ACC	208/230-3-60	19.2	2.8			14.4		21.7		28.9	36.1			17.2		24.5		31.7	38.9
HVEA49ACC	208/230-3-60	20.8	4.3			14.4		21.7		28.9	36.1			18.7		26.0		33.2	40.4
HVEA60ACC	208/230-3-60	23.0	4.3			14.4		21.7		28.9	36.1			18.7		26.0		33.2	40.4
HVEA24ACD	460-3-60	6.3	1.4			7.2		10.8		14.4	18.0			8.6		12.2		15.8	19.4
HVEA30ACD	460-3-60	7.9	1.4			7.2		10.8		14.4	18.0			8.6		12.2		15.8	19.4
HVEA36ACD	460-3-60	8.6	1.4			7.2		10.8		14.4	18.0			8.6		12.2		15.8	19.4
HVEA42ACD	460-3-60	8.9	1.4			7.2		10.8		14.4	18.0			8.6		12.2		15.8	19.4
HVEA49ACD	460-3-60	9.8	2.2			7.2		10.8		14.4	18.0			9.4		13.0		16.6	20.2
HVEA60ACD	460-3-60	11.3	2.2			7.2		10.8		14.4	18.0			9.4		13.0		16.6	20.2

[1]AC = Air Conditioner Unit Amps [2]IBM = Indoor Blower Motor

Heating kW is rated at 240 volts on the ACA & ACC models. Derate heater output by 25% for operation at 208 volts. Heating kW is rated at 480 volts on the ACD models.

Total heating and cooling amps includes all motors. Three phase models contain single phase motor loads. Loads are not equally balanced on each phase and values shown are maximum phase loads.

ComPac® HVESA Air Conditioners with 2-Stage Compressor

Certified Efficiency and Capacity Ratings at ANSI/AHRI Standard 390 for HVESA Air Conditioners with 2-Stage Compressors

Model Number	HVESA36			HVESA42			HVESA49			HVESA60		
	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD
Cooling BTUH[1] - 2nd Stage	35,000			39,000			47,000			56,000		
EER[2] - 2nd Stage	11.00			10.50			11.75			10.50		
Integrated Part Load Value[3]	16.0			14.1			16.0			14.8		
Rated Air Flow (CFM[4])	1,300			1,400			1,750			1,900		

[1]Cooling rated at 95°F (35°C) outdoor and 80°F DB/67° WB (26.5°C DB/19.5°C WB) return air. [2]EER=Energy Efficiency Ratio
[3]Integrated Part Load Value is an integrated efficiency measure from 1st and 2nd stage capacity modulation. [4]CFM=Cubic Feet per Minute
Ratings are with no outside air. Performance will be affected by altitude.
Ratings are at 230 volts for 208/230 volt units ("A" & "C" models) and 460 volts for "D" models. Operation of units at a different voltage from that of the rating point will affect performance and air flow.

Sensible Total Heat Ratio @ 95°F (35°C) Outside Air Dry Bulb - HVESA Air Conditioners with 2-Stage Compressors

Model Number	HVESA36			HVESA42			HVESA49			HVESA60		
	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD	ACA	ACC	ACD
Total Capacity	35,000			39,000			47,000			56,000		
Sensible Heat Ratio	0.70			0.71			0.79			0.77		
Sensible Capacity	24,445			27,590			36,920			43,235		
Rated Air Flow (CFM[1])	1,300			1,400			1,750			1,900		

[1]CFM=Cubic Feet per Minute
Sensible heat ratios based upon ANSI/AHRI std. 390 outdoor air conditions of 95°F (35°C) and 80°F DB/67° WB (26.5°C DB/19.5°C WB) return air.

Stage 2 Cooling Performance (BTUH) at Various Outdoor Temperatures

Model Number	Outdoor Temperature				
	75ºF / 24ºC	80ºF / 26.5ºC	85ºF / 29ºC	90ºF / 32ºC	95ºF / 35ºC
HVESA36AC	40,600	39,200	37,800	36,400	35,000
HVESA42AC	45,240	43,680	42,120	40,560	39,000
HVESA49AC	54,520	52,640	50,760	48,880	47,000
HVESA60AC	64,960	62,720	60,480	58,240	56,000

Based upon ANSI/AHRI std. 390 return air conditions of 80°F DB/67° WB (26.5°C DB/19.5°C WB) at various outdoor temperatures.

Stage 1 Cooling Performance (BTUH) at Various Outdoor Temperatures

Model Number	Outdoor Temperature				
	75ºF / 24ºC	80ºF / 26.5ºC	85ºF / 29ºC	90ºF / 32ºC	95ºF / 35ºC
HVESA36AC	30,856	29,792	28,728	27,664	26,600
HVESA42AC	34,336	33,152	31,968	30,784	29,600
HVESA49AC	44,080	42,560	41,040	39,520	38,000
HVESA60AC	51,040	49,280	47,520	45,760	44,000

Based upon ANSI/AHRI std. 390 return air conditions of 80°F DB/67° WB (26.5°C DB/19.5°C WB) at various outdoor temperatures.

Electrical Characteristics - Compressor, Fan & Blower Motors - HVESA Air Conditioner with 2-Stage Compressor

BASIC MODEL	Type	COMPRESSOR			OUTDOOR FAN MOTOR				INDOOR FAN MOTOR (ECM[6])			
		VOLTS-HZ-PH	RLA[1]	LRA[2]	VOLTS-HZ-PH	RPM[3]	FLA[4]	HP[5]	VOLTS-HZ-PH	RPM[3]	FLA[4]	HP[5]
HVESA36ACA	SCROLL	208/230-60-1	16.6	82.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVESA42ACA		208/230-60-1	16.6	96.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVESA49ACA		208/230-60-1	21.1	96.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4
HVESA60ACA		208/230-60-1	25.6	118.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4
HVESA36ACC	SCROLL	208/230-60-3	11.1	58.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVESA42ACC		208/230-60-3	13.4	88.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVESA49ACC		208/230-60-3	13.4	88.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4
HVESA60ACC		208/230-60-3	17.6	123.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4
HVESA36ACD	SCROLL	460-60-3	4.5	29.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVESA42ACD		460-60-3	6.1	44.0	208/230-60-1	825	2.8	1/3	208/230-60-1	1500	2.8	1/2
HVESA49ACD		460-60-3	6.4	41.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4
HVESA60ACD		460-60-3	9.0	62.0	208/230-60-1	825	2.8	1/2	208/230-60-1	1500	4.3	3/4

[1]RLA = Rated Load Amps [2]LRA = Locked Rotor Amps [3]RPM = Revolutions per Minute [4]FLA = Full Load Amps [5]HP = Horsepower [6]ECM = Electronically Commutated Motor
The 460 volt units have a step down transformer for the 230 volt motors.

Summary Electrical Ratings (Wire and Circuit Breaker Sizing) - *HVESA Air Conditioners with Two Stage Compressor and Ventilation Configurations: Manual Damper, up to 15% Outside Air ("N") Economizer, Outside Air with Pressure Relief ("C")*

ELECTRIC HEAT		000 = None		040 = 4 kw		050 = 5 kw		060 = 6 kw		080 = 8 kw		090 = 9 kw		100 = 10 kw		120 = 12 kw		150 = 15 kw	
BASIC MODEL	VOLTAGE PHASE / HZ	SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]	
		MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]
HVESA36ACA	208/230-1-60	24.6	35	24.6	35	28.8	35	34.1	35	44.4	45			54.9	60	65.3	70	80.9	90
HVESA42ACA	208/230-1-60	28.0	45			28.8	45							54.9	60	65.3	70	80.9	90
HVESA49ACA	208/230-1-60	33.5	50			33.5	50							56.4	60	66.8	70	82.4	90
HVESA60ACA	208/230-1-60	41.0	60			41.0	60							56.4	60	66.8	70	82.4	90
HVESA36ACC	208/230-3-60	20.1	30					20.8	25			29.9	30			38.9	40	47.9	50
HVESA42ACC	208/230-3-60	23.2	35					23.2	35			29.9	35			38.9	40	47.9	50
HVESA49ACC	208/230-3-60	24.6	35					24.6	35			31.4	35			40.4	50	49.4	50
HVESA60ACC	208/230-3-60	27.7	40					27.7	40			31.4	40			40.4	50	49.4	50
HVESA36ACD	460-3-60	9.9	15					10.4	15			14.9	15			19.4	20	23.9	25
HVESA42ACD	460-3-60	10.6	15					10.6	15			14.9	15			19.4	20	23.9	25
HVESA49ACD	460-3-60	11.6	15					11.6	15			15.7	20			20.2	25	24.7	25
HVESA60ACD	460-3-60	12.6	15					12.6	20			15.7	20			20.2	25	24.7	25

[1]MCA = Minimum Circuit Ampacity (Wiring Size Amps) [2]2MFS = Maximum Fuse or HACR Breaker Size [3]3SPPE = Single Point Power Entry
MCA & MFS are calculated at 230 volts on the ACA & ACC models. The 460 volts ACD models are calculated at 460 volts. This chart should only be used as a guideline for estimating conductor size and overcurrent protection. For the requirements of specific units, always refer to the data label on the unit.

Summary Electrical Ratings (Wire and Circuit Breaker Sizing) - *HVESA Air Conditioners with Two Stage Compressor, Electric Reheat (“R”) and Ventilation Configurations: Manual Damper, up to 15% Outside Air (“N”) Economizer, Outside Air with Pressure Relief (“C”)*

ELECTRIC HEAT		000 = None		040 = 4 kw		050 = 5 kw		060 = 6 kw		080 = 8 kw		090 = 9 kw		100 = 10 kw		120 = 12 kw		150 = 15 kw	
BASIC MODEL	VOLTAGE PHASE / HZ	SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]		SPPE[3]	
		MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]	MCA[1]	MFS[2]
HVESA36ACA	208/230-1-60	24.6	35	45.5	50	50.6	60	55.9	60					76.7	80	87.1	90	102.7	110
HVESA42ACA	208/230-1-60	28.0	45			54.0	60							80.1	90	90.5	100	106.1	110
HVESA49ACA	208/230-1-60	33.5	50			59.5	60							85.6	90	96.0	100	111.6	120
HVESA60ACA	208/230-1-60	41.0	60			67.0	70							93.1	100	103.5	110	119.1	120
HVESA36ACC	208/230-3-60	20.1	30					38.1	40			47.2	50			56.2	60	65.2	70
HVESA42ACC	208/230-3-60	23.2	35					41.2	45			50.3	60			59.3	60	68.3	70
HVESA49ACC	208/230-3-60	24.6	35					42.6	45			51.7	60			60.7	70	69.7	70
HVESA60ACC	208/230-3-60	27.7	40					45.7	50			54.8	60			63.8	70	72.8	80
HVESA36ACD	460-3-60	9.9	15					18.9	20			23.4	25			27.9	30	32.4	35
HVESA42ACD	460-3-60	10.6	15					19.6	20			24.1	25			28.6	30	33.1	35
HVESA49ACD	460-3-60	11.6	15					20.6	25			25.1	30			29.6	30	34.1	35
HVESA60ACD	460-3-60	12.6	15					21.6	25			26.1	30			30.6	35	35.1	40

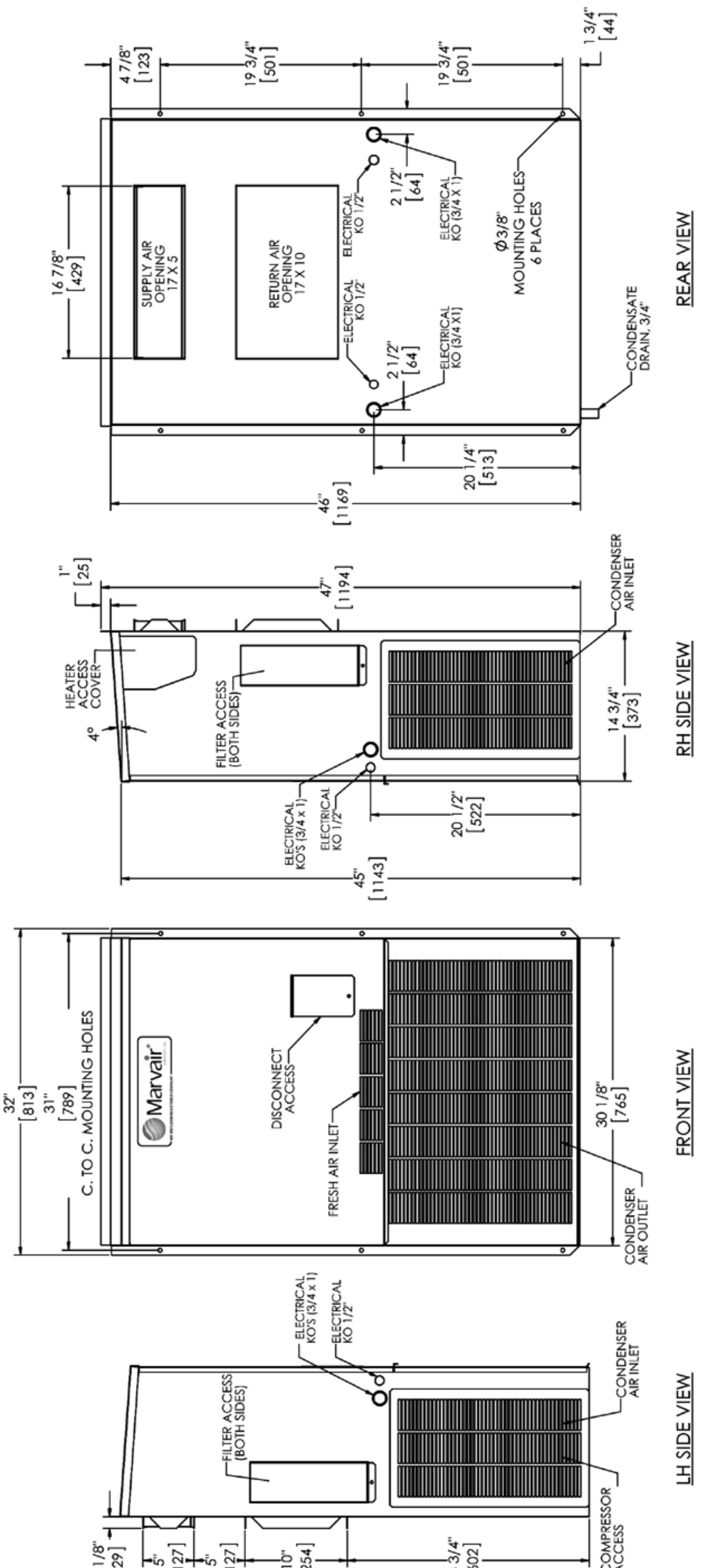
[1]MCA = Minimum Circuit Ampacity (Wiring Size Amps) [2]2MFS = Maximum Fuse or HACR Breaker Size [3]3SPPE = Single Point Power Entry
MCA & MFS are calculated at 230 volts on the ACA & ACC models. The 460 volts ACD models are calculated at 460 volts. This chart should only be used as a guideline for estimating conductor size and overcurrent protection. For the requirements of specific units, always refer to the data label on the unit.

Unit Load Amps - *HVESA Air Conditioners with Two Stage Compressor and Ventilation Configurations: Manual Damper, up to 15% Outside Air (“N”) Economizer,Outside Air with Pressure Relief (“C”)*

BASIC MODEL NUMBER	VOLTAGE PHASE / HZ	CURRENT AMPS		LOAD OF RESISTIVE HEATING - ELEMENTS ONLY (AMPS) *(1) ALL HEATING ELEMENTS ARE ON A SEPARATE CIRCUIT (2) SHADED VALUES (12 & 15 kW) UTILIZE TWO CIRCUITS*								TOTAL MAXIMUM HEATING AMPS *INCLUDES AMPS FROM MOTOR(S) THAT ARE LOCATED ON AN ELECTRICAL CIRCUIT THAT DOES NOT HAVE HEATERS*							
		AC[1]	IBM[2]	04 kW	05 kW	06 kW	08 kW	09 kW	10 kW	12 kW	15 kW	04 Kw	05 Kw	06 Kw	08 Kw	09 Kw	10 Kw	12 Kw	15 Kw
HVESA36ACA	208/230-1-60	20.8	2.8	16.7	20.8	25.0	33.3		41.7	50.0	62.5	19.5	23.6	27.8	36.1		44.5	52.8	65.3
HVESA42ACA	208/230-1-60	23.5	2.8		20.8				41.7	50.0	62.5		23.6				44.5	52.8	65.3
HVESA49ACA	208/230-1-60	28.2	4.3		20.8				41.7	50.0	62.5		25.1				46.0	54.3	66.8
HVESA60ACA	208/230-1-60	34.2	4.3		20.8				41.7	50.0	62.5		25.1				46.0	54.3	66.8
HVESA36ACC	208/230-3-60	17.2	2.8			14.4		21.7		28.9	36.1			17.2		24.5		31.7	38.9
HVESA42ACC	208/230-3-60	19.7	2.8			14.4		21.7		28.9	36.1			17.2		24.5		31.7	38.9
HVESA49ACC	208/230-3-60	21.1	4.3			14.4		21.7		28.9	36.1			18.7		26.0		33.2	40.4
HVESA60ACC	208/230-3-60	23.6	4.3			14.4		21.7		28.9	36.1			18.7		26.0		33.2	40.4
HVESA36ACD	460-3-60	8.5	1.4			7.2		10.8		14.4	18.0			8.6		12.2		15.8	19.4
HVESA42ACD	460-3-60	9.0	1.4			7.2		10.8		14.4	18.0			8.6		12.2		15.8	19.4
HVESA49ACD	460-3-60	9.2	2.2			7.2		10.8		14.4	18.0			9.4		13.0		16.6	20.2
HVESA60ACD	460-3-60	10.0	2.2			7.2		10.8		14.4	18.0			9.4		13.0		16.6	20.2

[1]AC = Air Conditioner Unit Amps [2]IBM = Indoor Blower Motor
Heating kW is rated at 240 volts on the ACA & ACC models. Derate heater output by 25% for operation at 208 volts. Heating kW is rated at 480 volts on the ACD models.
Total heating and cooling amps includes all motors. Three phase models contain single phase motor loads. Loads are not equally balanced on each phase and values shown are maximum phase loads.

Dimensional Data - AVPA12 ComPac® I Air Conditioners



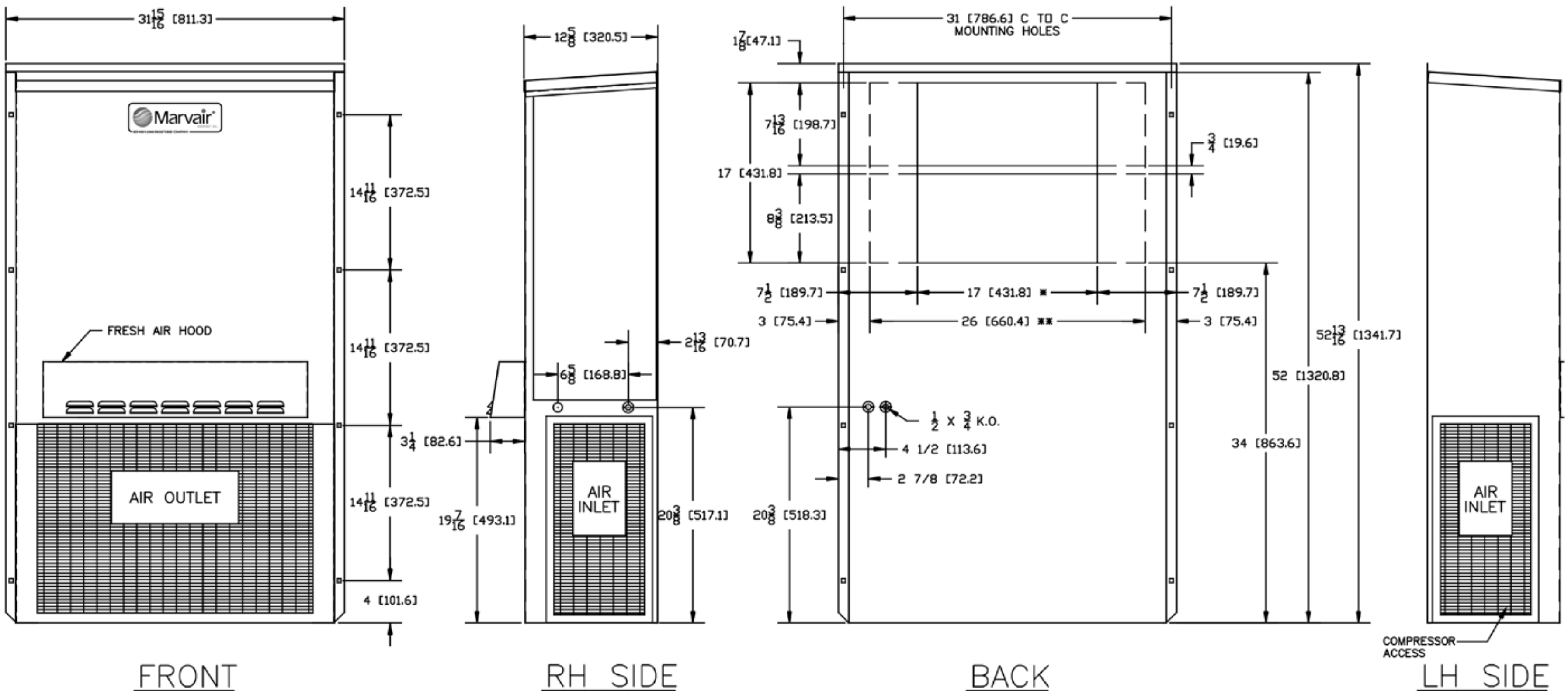
Shipping Weight (pounds/kilograms)

AVPA12	LBS/KGS
COMPAC I	185/84

Filter Size

AVPA12	INCHES	MILLIMETERS	PART NUMBER	FILTERS PER UNIT	MERV RATING
RETURN AIR FILTER	10" x 20" x 2"	254 x 508 x 52	91974	1	7

Dimensional Data - AVPA12 ComPac® II Air Conditioners



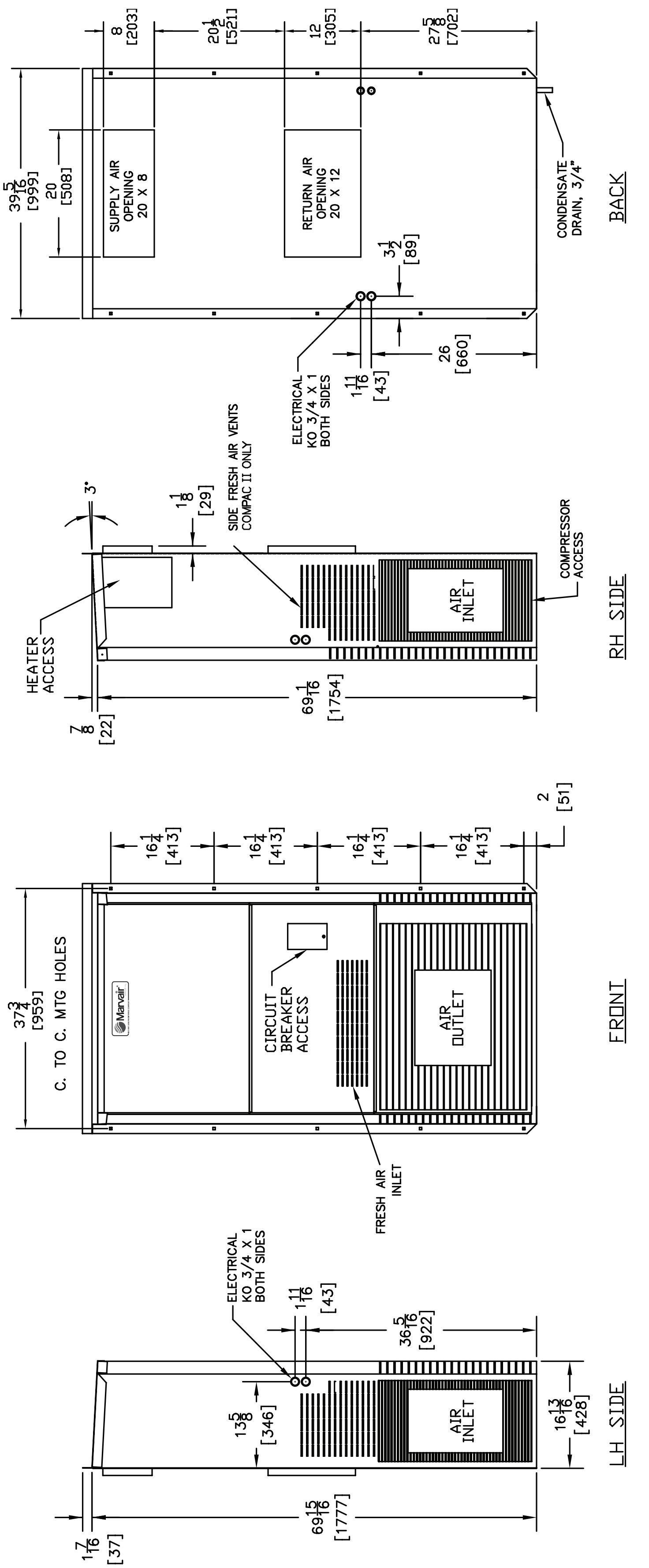
Shipping Weight (pounds/kilograms)

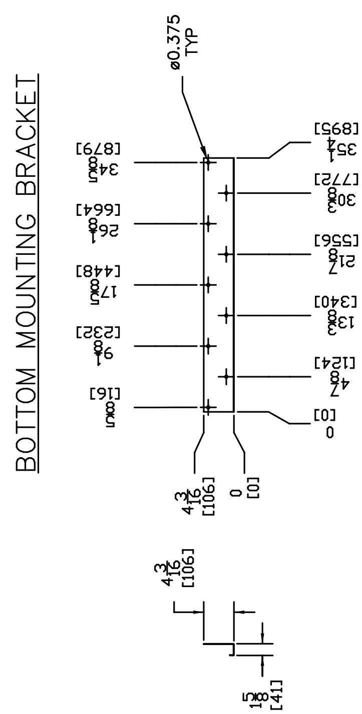
AVPA12	LBS/KGS
COMPAC II	194/88

Filter Size

AVPA12	INCHES	MILLIMETERS	PART NUMBER	FILTERS PER UNIT	MERV RATING
RETURN AIR FILTER	6¼″ x 22¼″ x 2″	159 x 565 x 52	80172	1	7

Dimensional Data - AVPA/AVHA20/24 ComPac® I & II Air Conditioners





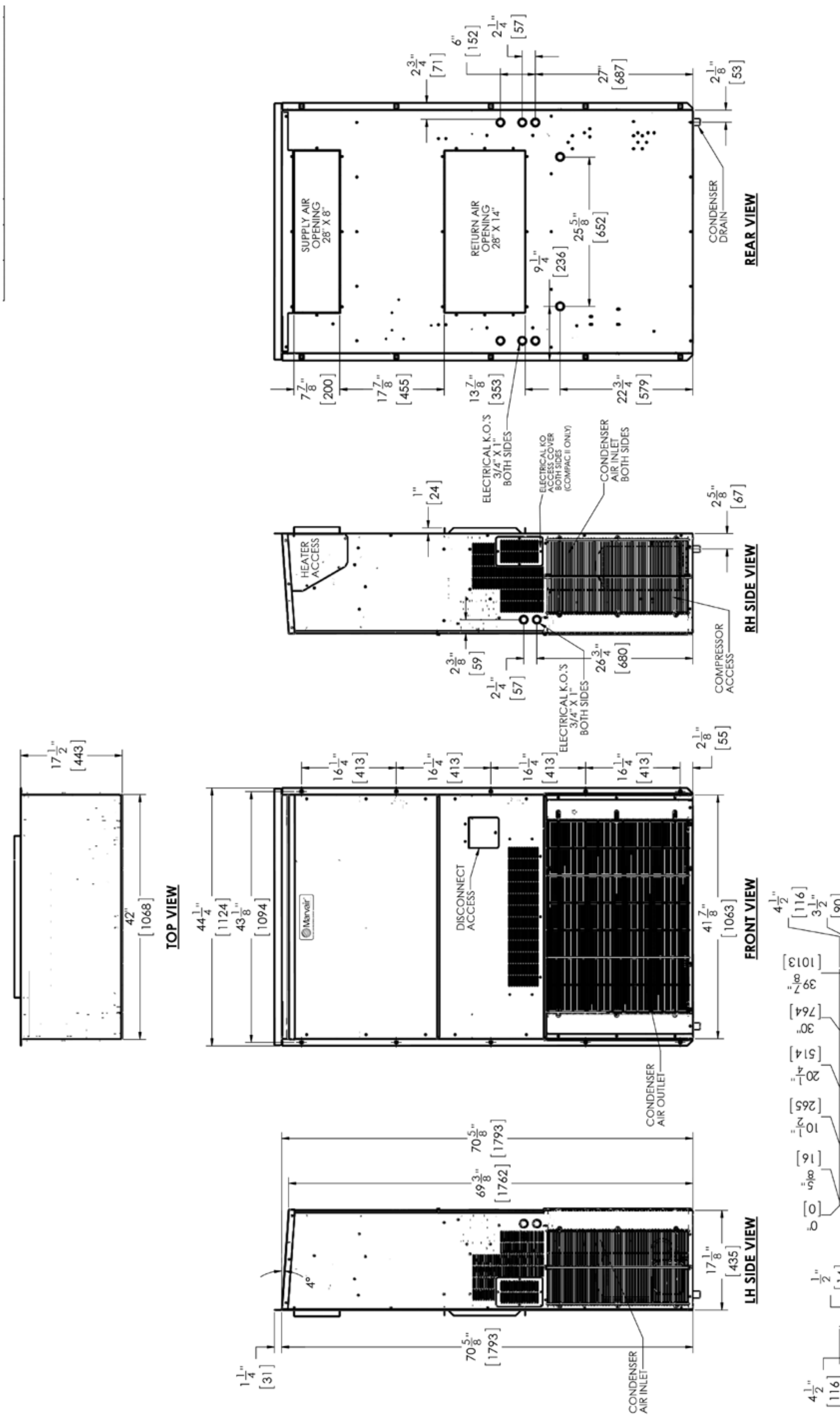
Shipping Weight (pounds/kilograms)

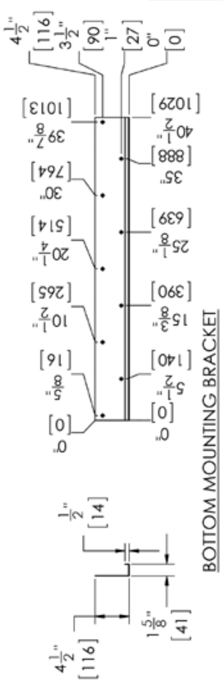
AVPA/AVHA20/24	LBS/KGS
COMPAC I	350/159
COMPAC II	375/170.5

Filter Size

AVPA/AVHA20/24	INCHES	MILLIMETERS	PART NUMBER	FILTERS PER UNIT	MERV RATING
RETURN AIR FILTER	25" x 16" x 2"	635 x 406 x 51	80137	1	7

Dimensional Data - AVPA/AVHA30/36, and HVEA24 ComPac® I & II Air Conditioners





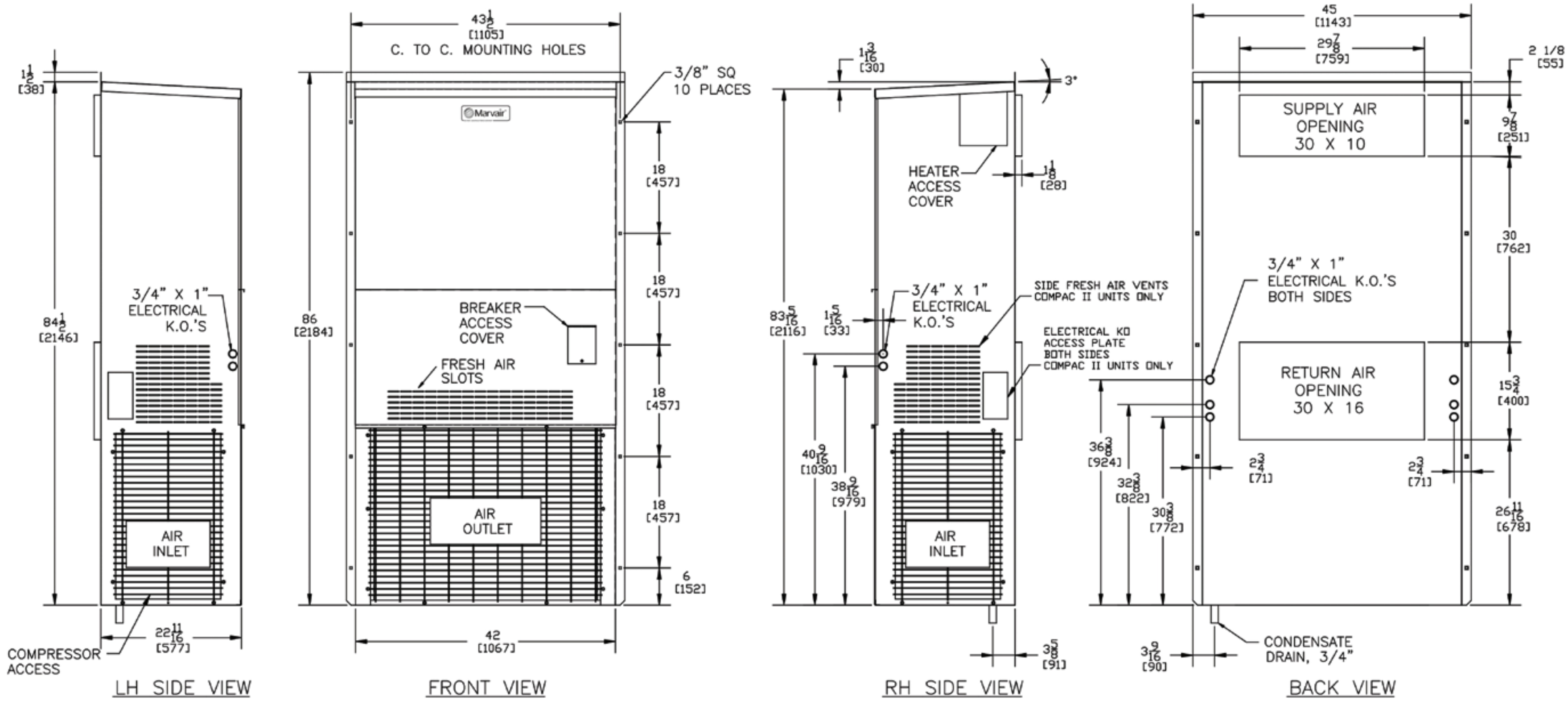
Shipping Weight (pounds/kilograms)

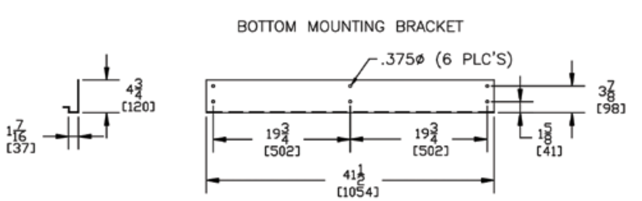
AVPA/AVHA30/36 & HVEA24	LBS/KGS
COMPAC I	420/191
COMPAC II	445/202.5

Filter Size

AVPA/AVHA30/36 & HVEA24	INCHES	MILLIMETERS	PART NUMBER	FILTERS PER UNIT	MERV RATING
RETURN AIR FILTER	30 x 16 x 2	762 x 406 x 51	80138	1	7

Dimensional Data - AVPA/AVHA42/48/60, and HVEA30/36/42, HVESA30/36/42 ComPac® I & II Air Conditioners





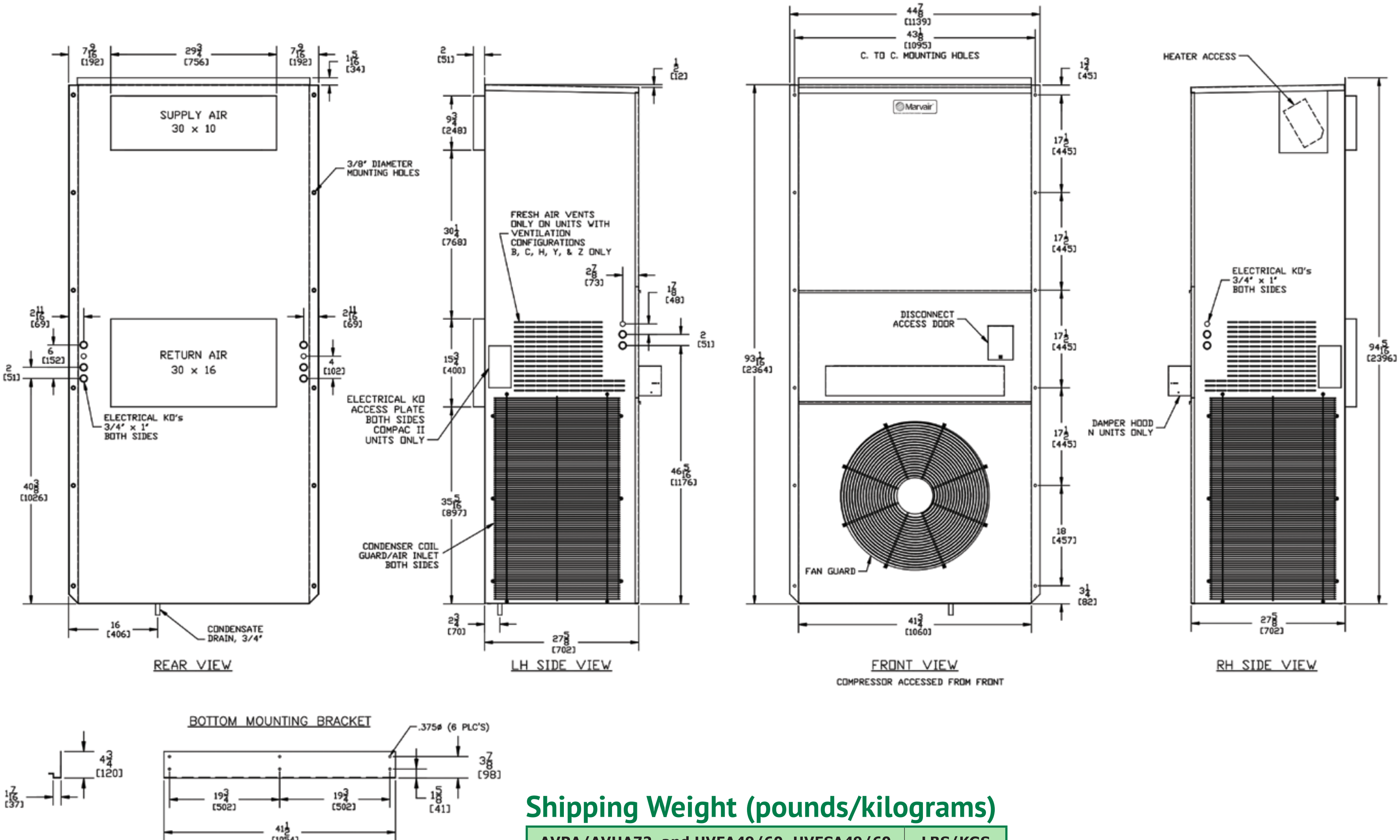
Shipping Weight (pounds/kilograms)

AVPA/AVHA42/48/60 and HVEA30/36/42, HVESA30/36/42	LBS/KGS
COMPAC I	540/245.5
COMPAC II	565/257

Filter Size

AVPA/AVHA42/48/60, HVEA30/36/42, & HVESA30/36/42	INCHES	MILLIMETERS	PART NUMBER	FILTERS PER UNIT	MERV RATING
RETURN AIR FILTER	36½ x 22 x 2	927 x 559 x 51	80162	1	8

Dimensional Data - AVPA72, and HVEA49/60, HVESA49/60 ComPac® I & ComPac® II Air Conditioners



Shipping Weight (pounds/kilograms)

AVPA/AVHA72, and HVEA49/60, HVESA49/60	LBS/KGS
COMPAC I	680/309
COMPAC II	705/320.5

Filter Size

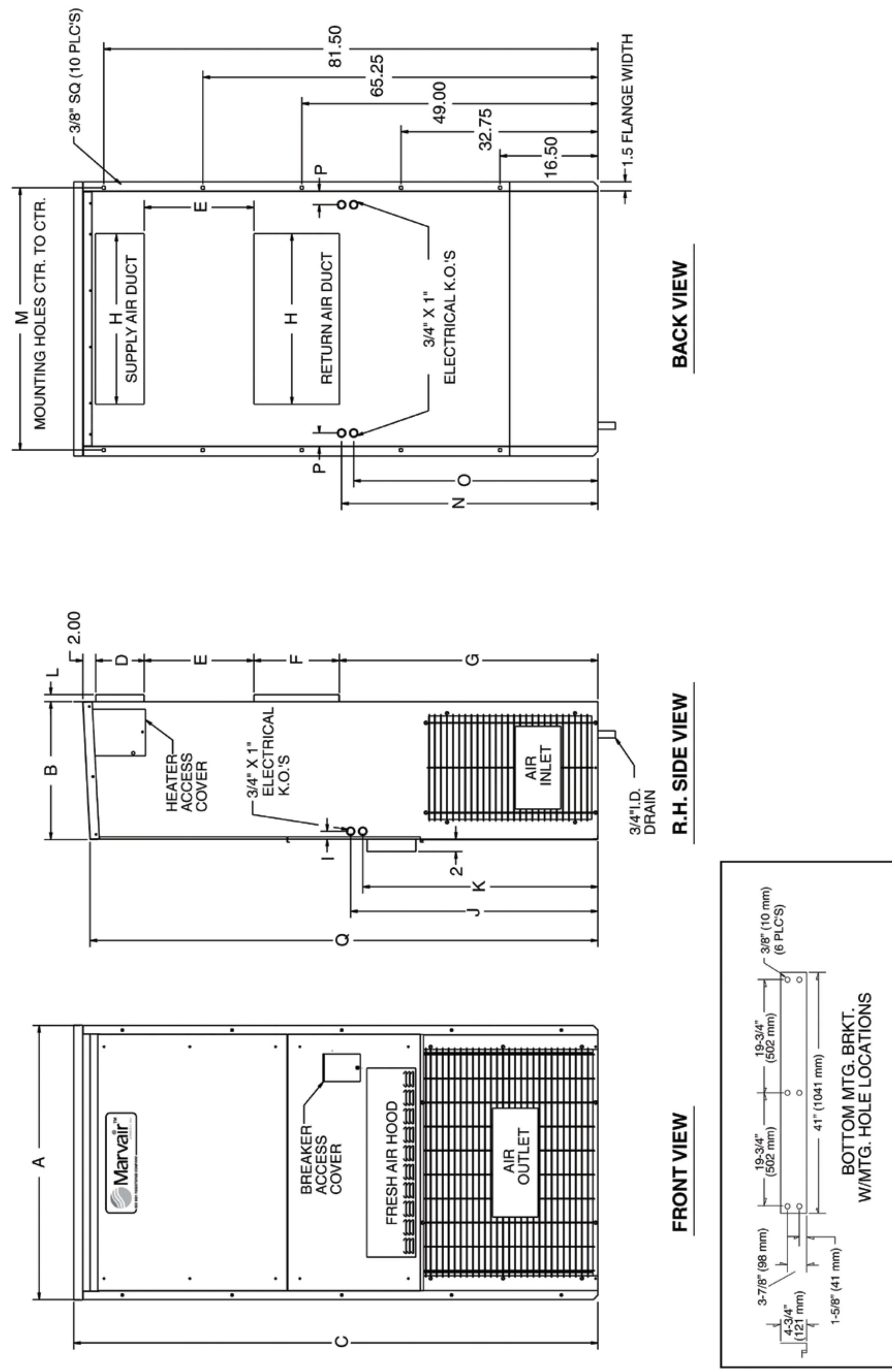
AVPA/AVHA72, HVEA49/60 & HVESA49/60	INCHES	MILLIMETERS	PART NUMBER	FILTERS PER UNIT	MERV RATING
RETURN AIR FILTER	18 x 24 x 2	457 x 610 x 51	81257	2	7

Dimensional Data - AVPA60/AVHA60 with K/04315 Back Panel - ComPac I Only

For matching existing AVP36 wall opening with new AVPA60/AVHA60
For ComPac I Only. For ComPac II use transition curb in Options section.

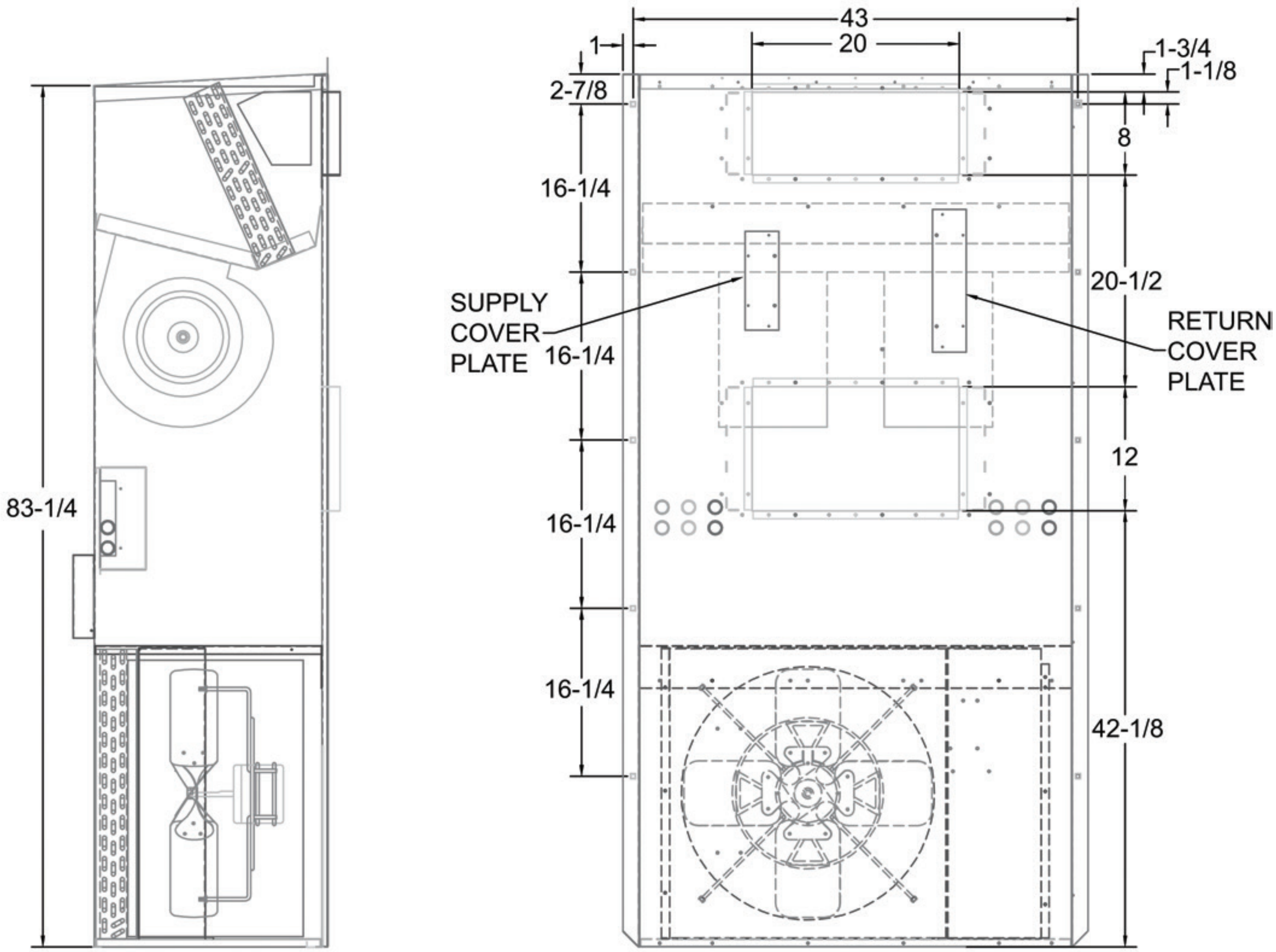
MODEL	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
60 (inches)	45	22-5/8	86	8	18	14	42-1/2	28	1-5/16	40-9/16	38-9/16	1-1/8	43-1/8	42-3/16	40-1/2	2-1/4	83-5/16
60 (mm)	1143	575	2184	203	457	356	1080	711	33	1030	980	29	1095	1072	1029	57	2116

NOTE: Dimensional tolerance ± 1/16" (2 mm)



Dimensional Data - AVPA60 with K/04317 Back Panel - ComPac I Only

For matching existing AVP24 wall opening with new AVPA60/AVHA60
For ComPac I Only. For ComPac II use transition curb in Options section.



NOTES:
UNIT IS SHIPPED FROM THE FACTORY WITH SUPPLY AND RETURN LINES CENTERED LEFT TO RIGHT ON BACK PANEL. RETURN AND SUPPLY OPENINGS MAY BE SHIFTED 2-9/16" LEFT OR RIGHT TO ALLOW FOR A BETTER FIT. A SLOTTED HOLE PATTERN IS PROVIDED TO ASSIST WITH CUT OUT OF OPENINGS AND COVER PLATES ARE ALSO PROVIDED TO COVER EXCESSIVE HOLES LEFT IN BACK PANEL AFTER MAKING CUT OUTS.

P.O. Box 400 • Cordele, GA 31010
156 Seedling Drive • Cordele, GA 31015
Ph: 229-273-3636 • Fax: 229-273-5154
Email: marvair@airxcel.com • Internet: www.marvair.com

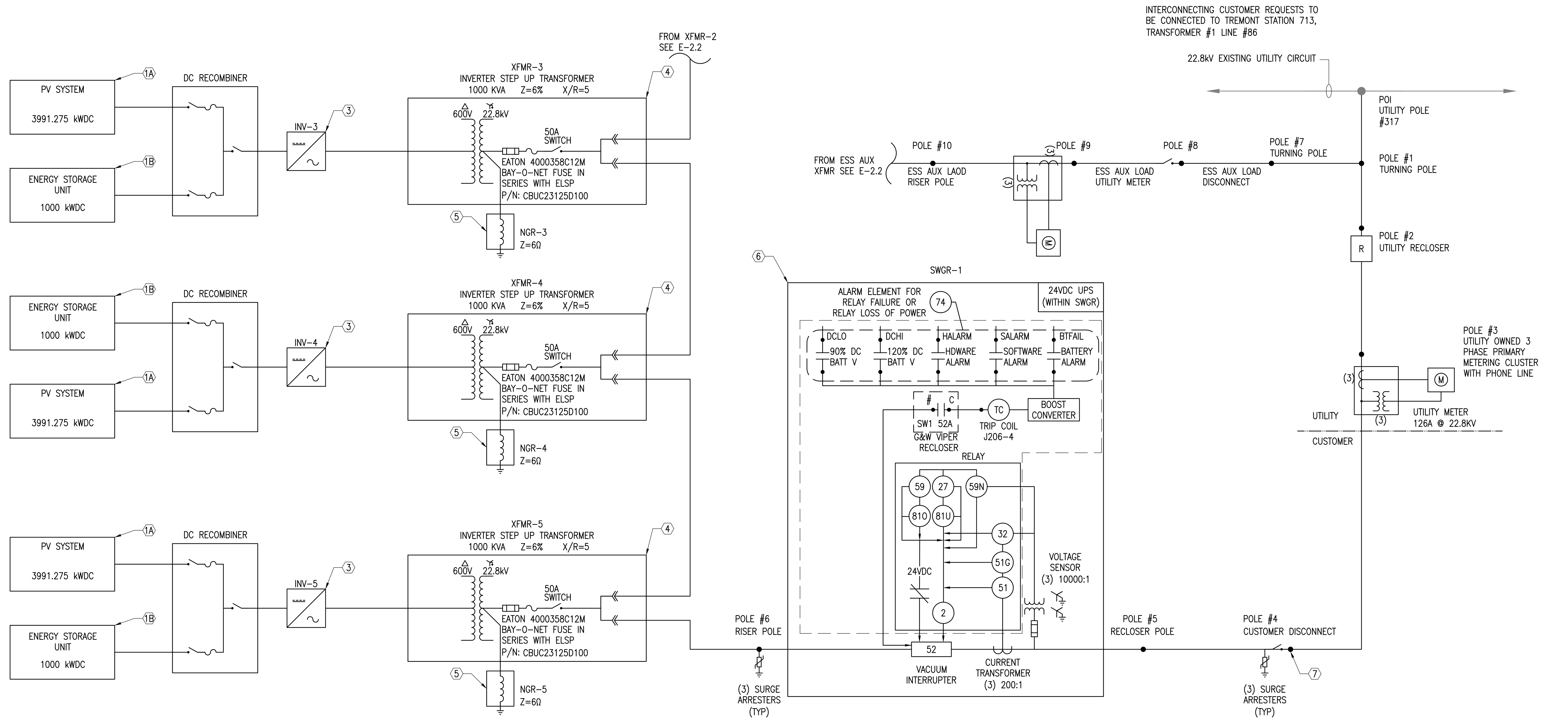
TECHNICAL CHARACTERISTICS

REFERENCE		FD0500
DC INPUT & OUTPUT	DC Rated Power (kW) @50ºC	500
	DC PV Voltage Range (Vdc)	700 to 1500
	DC ESS Voltage Range (Vdc)	700 to 1500
	Maximum DC PV Input Voltage (Vdc)	1500
	DC Voltage Ripple	<3%
	Maximum DC output current (A)	600
	Battery Technology	Compatible with all battery technologies
EFFICIENCY	Efficiency (Max)	98,9%
	Max. Standby Consumption	< approx. 50W
CABINET	Dimensions (mm)	1215 x 970 x 2250
	Cooling	Forced air
	Enclosure Rating	NEMA 3R / IP54
CONNECTIONS	Number of connections	3 positive / 3 negative
	Terminals	Lugs Rated 90ºC
	Max. positive and negative input wire size	400kcmil / 185mm^2
ENVIRONMENT	Operating Temperature range [1]	-35ºC to 50ºC
	Relative Humidity	4% to 100% non condensing
	Max. Altitude	4000m; >2000m power derating
	Audible Noise level	<79 dBA
CONTROL INTERFACE	Interfaces	Emergency pushbutton and indicator lights
		USB, RJ45 and RS 485
		Freesun App
	Communications Protocol	Modbus TCP, Modbus RTU
PROTECTIONS	Ground Fault Detection	Insulation monitoring device
	PV disconnection & protection	Switch + Fuses
	BESS disconnection & protection	Contactors + Fuses
CERTIFICATIONS	Safety Certification	UL-1741

[1] Heating resistors kit option below -20ºC.

Table 2
AUDIBLE SOUND LEVELS FOR LIQUID-IMMERSED NETWORK TRANSFORMERS AND STEP-VOLTAGE REGULATORS

Equivalent Two-Winding kVA	Average Sound Level Decibels
0-50	48
51-100	51
101-300	55
301-500	56
501-750	57
751-1000	58
1001-1500	60
1501-2000	61
2001-2500	62
2501-3000	63



PROPOSED RELAY SETTINGS

DEVICE	SECONDARY PICKUP	PRIMARY PICKUP	UNIT	TIME DELAY	TOTAL CLEARING TIME	DESCRIPTION
27-1	24.68	6582	V	1.05 SEC	1.1 SEC	UNDER VOLTAGE
27-2	43.44	11584	V	1.95 SEC	2 SEC	
59-1	54.30	14480	V	1.95 SEC	2 SEC	OVER VOLTAGE
59-2	59.24	15797	V	0.11 SEC	0.16 SEC	
81U-1	56.5		HZ	0.11 SEC	0.16 SEC	UNDER FREQUENCY
81U-2	58.5		HZ	299.95 SEC	300 SEC	
81O-1	61.2		HZ	299.95 SEC	300 SEC	OVER FREQUENCY
81O-2	62		HZ	0.11 SEC	0.16 SEC	
59N	100		V	1.95 SEC	2 SEC	GROUND OVER VOLTAGE
32	<5000		kW	4.95 SEC	5 SEC	DIRECTIONAL POWER
51	0.950	190	A	TD: 2.0 CURVE: U4		EXTREMELY INVERSE OVER CURRENT
51G	0.475	95	A	TD: 1.5 CURVE: U4		EXTREMELY INVERSE GROUND OVER CURRENT
2	0.95	1.05	MIN/MAX VOLT PU	300 S DELAY		EQUIVALENT 2 – HEALTHY UTILITY RESTORATION DELAY
	59.50	60.50	MIN/MAX HZ			
EQUIVALENT 74: SEE DETAILS IN SCHEMATICS						

1. SETTINGS ASSUME 3 CYCLE CONTACTOR/BREAKER TIMING
2. NOTE: THE RATIO OF THE VOLTAGE SENSOR IS 10000. THAT MAKES THE INPUT NOMINAL VOLTAGE EQUAL TO 1.32V(13164/10000). TO ADJUST THAT TO 300V BASE MULTIPLY BY 37.5(300V BASE TO 8V BASE). THE Vnom SET IN THE RELAY IS 49.37V WHICH IS WHAT THE RELAY WILL SEE FOR PROTECTION. EFFECTIVE PTR = 10000*8/300 = 266.67

ELECTRICAL EQUIPMENT SCHEDULE

REF. #	TOTAL	DESCRIPTION
1A	49,275	LG405N2T-J5 MODULES (27 MODULES PER STRING)
1B	5	ENERGY STORAGE UNIT, 1000kW/4000kWH
3	5	HEMK FS2125K (LIMITED TO 1000kVA, 1000kW), 600VAC
4A	5	1000KVA TRANSFORMER, 3 PHASE, 22.8kV DELTA PRIMARY, 600V GWYE SECONDARY
4B	5	112.5KVA TRANSFORMER, 3 PHASE, 22.8kV DELTA PRIMARY, 208V GWYE SECONDARY
5	5	NEUTRAL GROUNDING REACTOR, 25kV CLASS, Z = 6 OHMS
6	1	G&W POLE MOUNTED RECLOSER, VACUUM INTERRUPTER, WITH INTEGRATED SEL 651R MULTIFUNCTION RELAY
7	2	25kV POLE MOUNTED, 900A, 65KAIC, DISCONNECT LOAD BREAK SWITCH, GANG OPERATED, LOCKABLE, 24/7 UTILITY ACCESSIBLE

PROPOSED INVERTER SETTINGS

DEVICE	PICKUP	UNITS	TIME DELAY	DESCRIPTION
27-1	300	Volts	1.1	UNDERVOLTAGE RELAY
27-2	528	Volts	2	
59-1	660	Volts	2	OVERVOLTAGE RELAY
59-2	720	Volts	0.16	
81U-1	56.5	Hz	0.16	UNDERFREQUENCY
81U-2	58.5	Hz	300	
81O-1	61.2	Hz	300	OVERFREQUENCY
81O-2	62	Hz	0.16	

AC SINGLE LINE DIAGRAM

SCALE: NTS

BORREGO SOLAR
55 TECHNOLOGY DRIVE, SUITE 102
LOWELL, MA 01851
PHONE: (888) 898-6273
FAX: (888) 843-6778
WWW.BORREGOSOLAR.COM

NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS
AHARON N. WRIGHT
ELECTRICAL
No. 54113
REGISTERED PROFESSIONAL ENGINEER
03/24/2020

UTILITY SUBMISSION
140 TIHONET ROAD
140 TIHONET ROAD, WAREHAM, MA 02571

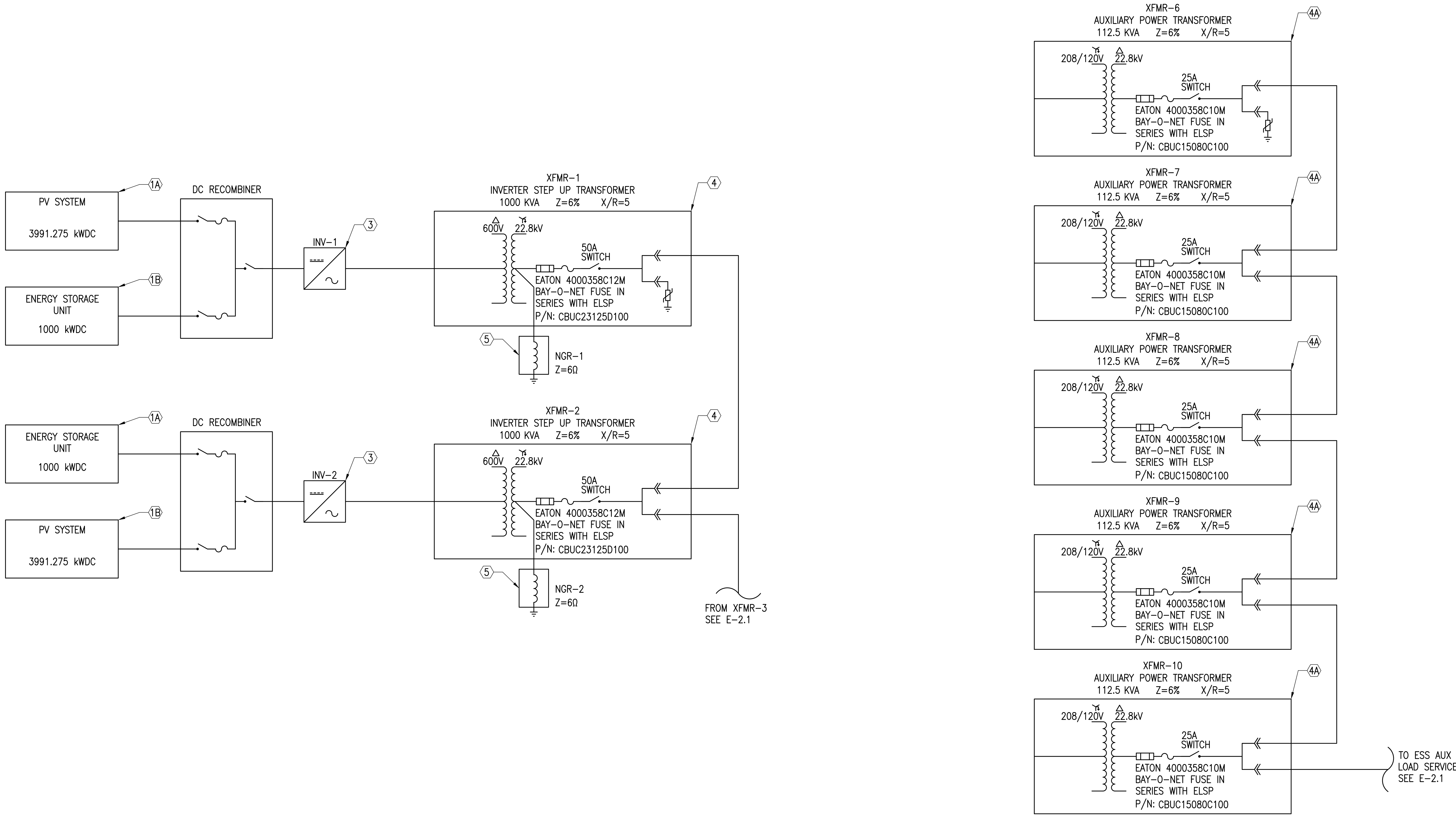
PROJECT NUMBER: 905-2708

REV	DATE	DRAWN	CHECKED	RELEASE LEVEL
	5/13/19	CC		INTX APPLICATION
	03/18/20	NEH	MK	INTX APPLICATION

SCALES STATED ON DRAWINGS ARE VALID ONLY WHEN PLOTTED ARCH D 24" X 36"

E-2.1

AC SINGLE LINE DIAGRAM



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SCALE: NTS

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SCALES STATED ON DRAWINGS ARE VALID ONLY WHEN PLOTTED ARCH D 24" X 36"

E-2.2

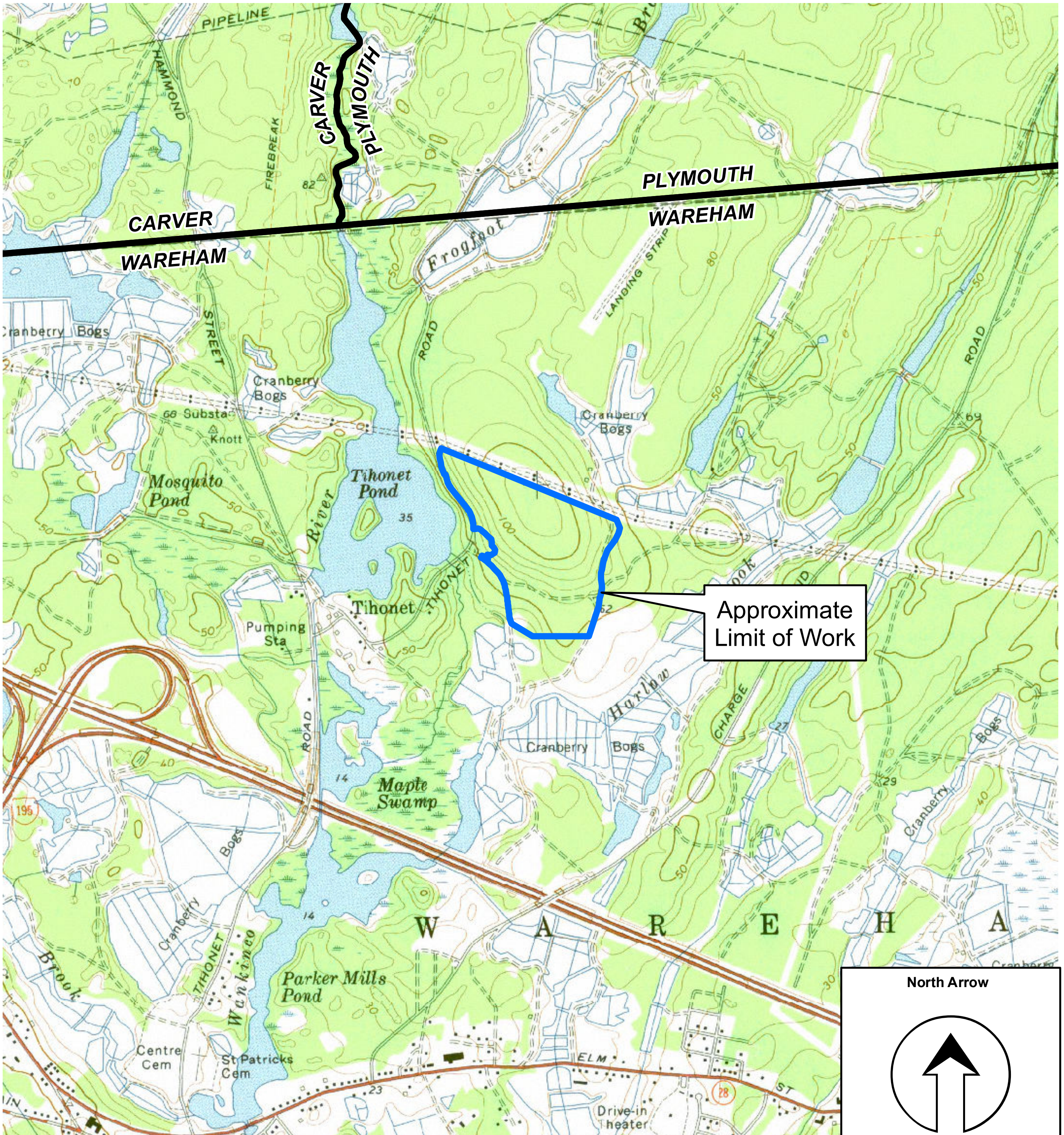
AC SINGLE LINE DIAGRAM

Section 6.0
Plans

Locus Map

Aerial Map

Entitled "Site Use Plan Submission, 140 Tihonet Road, Wareham, MA 02571, Solar Photovoltaic and Energy Storage Electric System"
Prepared by Borrego Solar Systems, Inc. and Beals and Thomas, Inc.
In 13 Sheets
Last Revised June 2, 2020



Digital USGS Map of Wareham, MA, dated 1972, provided by the Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services.

0 1,000 2,000 4,000
FEET

PROJECT:

140 Tihonet Road PV+ES Project

Wareham, Massachusetts

PREPARED FOR:

Borrego Solar Systems, Inc.

55 Technology Dr. #102
Lowell, MA 01851

Locus Map

Figure 1

Scale: 1" = 2,000'

Date: 06/1/2020

Source File 1833112P595A.mxd

B+T Project No. 1833.112

BEALS+THOMAS

Digital orthophotograph, dated 2019, provided by the Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology and Security Services.

0 250 500 1,000
FEET

PROJECT:
140 Tihonet Road
PV+ES Project
Wareham, Massachusetts

PREPARED FOR:
Borrego Solar Systems, Inc.
55 Technology Dr. #102
Lowell, MA 01851

Aerial Map
Figure 2

Scale: 1" = 500' **Date: 06/1/2020**

Source File 1833112P595A.mxd

B+T Project No. 1833.112

SITE USE PLAN SUBMISSION

140 TIHONET ROAD, WAREHAM, MA 02571

SOLAR PHOTOVOLTAIC AND ENERGY STORAGE ELECTRIC SYSTEM

GENERAL NOTES

1. AS CONTAINED HEREIN, "CONTRACTOR" IS ASSUMED TO BE THE EPC PROVIDER HIRED BY THE SYSTEM/PROJECT OWNER.THESE NOTES SET MINIMUM STANDARDS FOR CONSTRUCTION. THE DRAWINGS GOVERN OVER THESE NOTES TO THE EXTENT SHOWN.
2. WHEN THERE IS A CONFLICT BETWEEN THESE GENERAL NOTES AND THE DRAWINGS, THE DRAWINGS SHALL GOVERN.EXCEPTIONS TO THE CONTRACT DOCUMENTS ARE PERMITTED ONLY WITH THE APPROVAL OF BORREGO.
3. ALL WORK SHALL CONFORM TO THE MINIMUM STANDARDS OF THE FOLLOWING: LOCAL BUILDING CODE, LOCAL ELECTRICAL CODE, ANY OTHER REGULATING AGENCIES WHICH HAVE AUTHORITY OVER ANY PORTION OF THE WORK AND THOSE CODES AND STANDARDS LISTED IN THESE DRAWINGS.
4. THESE DRAWINGS SHALL NOT BE USED FOR CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DEVELOPING A CONSTRUCTION LEVEL DESIGN AND ASSOCIATED DRAWINGS AND DETAILS.
5. COORDINATE THESE DRAWINGS WITH SPECIFICATIONS AND MANUFACTURER INSTALLATION AND OPERATION MANUALS.
6. UNLESS OTHERWISE NOTED, THE DESIGN REPRESENTED ON THESE PLANS IS BASED ON THE INFORMATION AND CRITERIA LISTED IN THE "BASIS OF DESIGN" SECTION. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY SUCH INFORMATION IN PREPARATION OF THE CONSTRUCTION DESIGN.
7. THE EXISTING CONDITIONS REPRESENTED ON THESE PLANS ARE BASED ON PUBLICLY AVAILABLE INFORMATION AND THE SITE DISCOVERY SUMMARIZED IN THESE DRAWINGS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE ACCURACY OF SUCH INFORMATION AND SUPPLEMENT WITH ANY ADDITIONAL REQUIRED INFORMATION.
8. UNLESS INDICATED AS EXISTING (E), ALL PROPOSED MATERIALS AND EQUIPMENT SHALL BE CONSIDERED TO BE NEW.
9. ALL EQUIPMENT AND COMPONENTS SHALL BE MOUNTED IN COMPLIANCE WITH THE MANUFACTURER'S REQUIREMENTS, CONSTRUCTION DETAILS, AND/OR PRUDENT INDUSTRY STANDARDS.
10. TO THE EXTENT THAT TRESS AND OTHER FEATURES AFFECT THE SYSTEM'S PRODUCTION, SUCH PRODUCTION MODELING IS BASED ON THE EXISTING APPROXIMATE HEIGHTS AND LOCATIONS RELATIVE TO THE SYSTEM AND MAY BE IMPACTED AS TREES GROW AND OTHER FEATURES CHANGE.

PROJECT SCOPE

THIS PROJECT CONSISTS OF THE INSTALLATION OF SOLAR MODULES PER THE SYSTEM DESCRIPTION, BELOW. THE MODULES WILL BE INSTALLED ON A GROUND MOUNTED RACKING SYSTEM. THE MODULES WILL BE WIRED IN SERIES STRINGS AND CONNECTED IN PARALLEL TO THE INVERTERS, WHICH CONVERT THE PHOTOVOLTAIC OUTPUT POWER FROM DC TO AC. THE SOLAR ELECTRIC SYSTEM WILL BE INTERCONNECTED WITH THE EXISTING SITE ELECTRICAL SYSTEM IN ACCORDANCE WITH THE APPLICABLE ELECTRIC CODE AND EVERSOURCE REQUIREMENTS.

THIS PROJECT CONSISTS OF THE INSTALLATION OF ENERGY STORAGE EQUIPMENT, PER THE SYSTEM DESCRIPTION, BELOW. THE ENERGY STORAGE MODULES WILL BE INSTALLED IN A PURPOSE BUILT UNIT(S), AND FIRE SUPPRESSION SYSTEMS. THE ENERGY STORAGE MODULES WILL BE WIRED IN SERIES STRINGS AND CONNECTED THROUGH DC/DC CONVERTERS, WHICH WILL CONVERT DC TO AC WHILE THE BATTERIES ARE DISCHARGING

PV SYSTEM DESCRIPTION

APPROXIMATE SYSTEM SIZE (DC)	21,028.005 KW	SYSTEM SIZE (AC)	4,995 KW
MODULES	(51,921) LG405N2T-J5	INVERTER(S)	(5) POWER ELECTRONICS HEMK FS2125 POWER LIMITED TO 999kW
STC RATING	405	CEC EFFICIENCY	98.8%
RACKING	TERRASMART TGP	AZIMUTH	180° (SOUTH = 180°)
TILT ANGLE	25°		

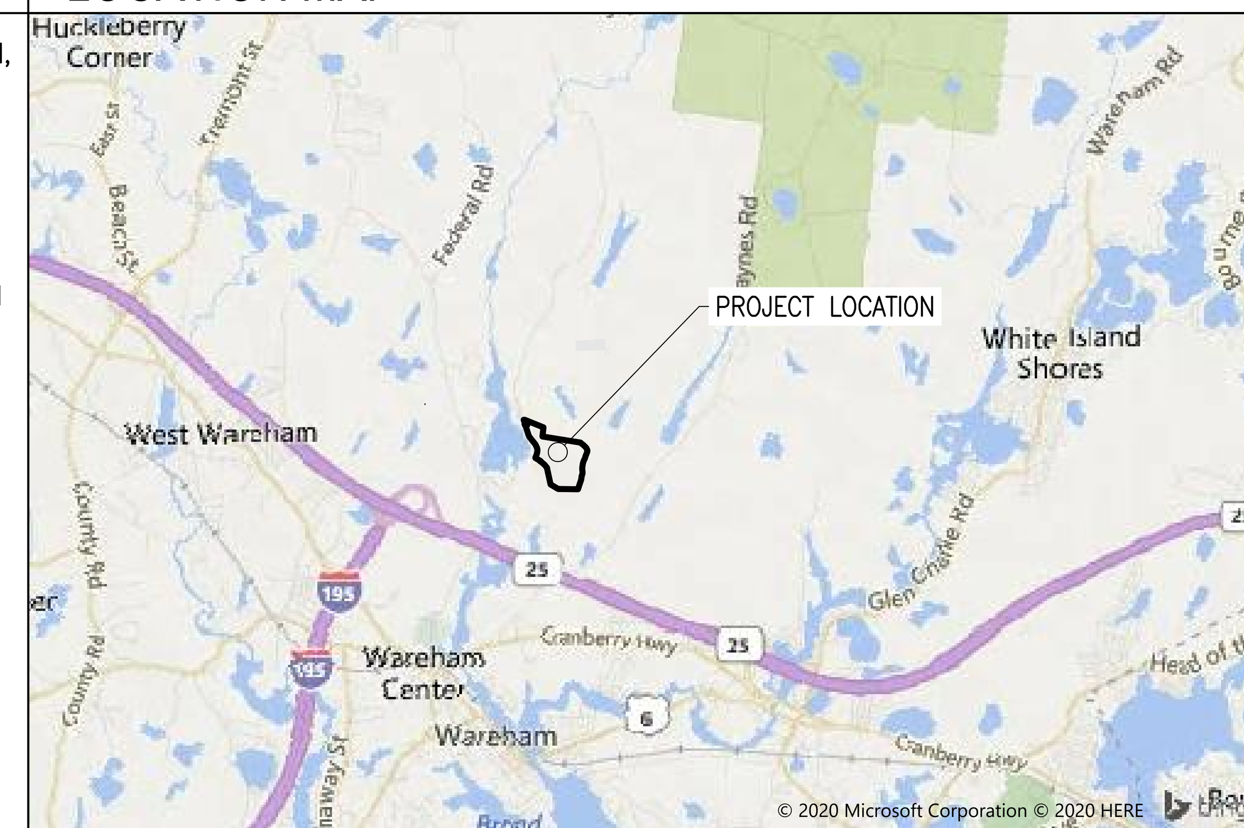
ENERGY STORAGE SYSTEM DESCRIPTION

SYSTEM POWER CAPACITY	4995kW
USABLE ENERGY CAPACITY	6 HOURS AT RATED POWER CAPACITY
POWER CONVERSION SYSTEM	SAME AS ABOVE
DC/DC CONVERTER	POWER ELECTRONICS FREEMAQ FD0500 DC/DC CONVERTER 500kW

TOTAL SYSTEM DESCRIPTION

TOTAL PV+STORAGE POWER CAPACITY	4,995kWAC
MAXIMUM EXPORT TO UTILITY	4,995kWAC
STORAGE CHARGING MODE	SOLAR ONLY

LOCATION MAP



AERIAL VIEW

DRAWING LIST

APPLICABLE CODES AND STANDARDS

2020 MASSACHUSETTS ELECTRICAL CODE 527 CMR12.00
MASSACHUSETTS BUILDING CODE 9TH EDITION
UL-1703 – SOLAR MODULES
UL-1741 – INVERTERS, COMBINER BOXES
UL-2703 – RACKING MOUNTING SYSTEMS AND CLAMPING DEVICES FOR PV MODULES
UL-1642 – STANDARD FOR LITHIUM BATTERIES
UL-1973 – STANDARD FOR BATTERIES FOR USE IN LIGHT ELECTRIC RAIL (LER) APPLICATIONS AND STATIONARY APPLICATIONS
UL-9540 – STANDARD FOR ENERGY STORAGE SYSTEMS AND EQUIPMENT

PROJECT DIRECTORY

SYSTEM / PROJECT OWNER
TBD

LAND OWNER / HOST
A.D. MAKEPEACE COMPANY
158 TIHONET ROAD
WAREHAM, MA 02571

AUTHORITY HAVING JURISDICTION
TOWN OF WAREHAM
54 MARION ROAD
WAREHAM, MA 02571

UTILITY
EVERSOURCE

CIVIL ENGINEER
BEALS AND THOMAS, INC.
32 COURT STREET
PLYMOUTH, MA 02360

CIVIL ENGINEER
FIRM: BEALS AND THOMAS, INC.
CONTACT: JEFFREY R. MURPHY, P.E.
PHONE: (508)-366-0560

FIRM: BORREGO SOLAR SYSTEMS, INC.
CONTACT: DEAN SMITH, P.E.
PHONE: (978)-221-3103

ELECTRICAL ENGINEER
FIRM: BORREGO SOLAR SYSTEMS, INC.
CONTACT: AHARON WRIGHT, P.E.
PHONE: (978)-726-3496

DESIGN ENGINEER
FIRM: BORREGO SOLAR SYSTEMS, INC.
CONTACT: NORMAN HALLISSEY
PHONE: (978)-207-3926

GENERAL ABBREVIATIONS

(E)	EXISTING	NS	NORTH-SOUTH
AHJ	AUTHORITY HAVING JURISDICTION	NTS	NOT TO SCALE
AL	ALUMINUM	OAE	OR APPROVED EQUAL
APPROX	APPROXIMATE	OC	ON CENTER
ARY	ARRAY	OD	OUTSIDE DIAMETER
BLDG	BUILDING	OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
BSS	BORREGO SOLAR SYSTEM		
CL	CENTERLINE	PV	PHOTOVOLTAIC
DAS	DATA ACQUISITION SYSTEM	PVC	POLY VINYL CHLORIDE
DIA	DIAMETER	SCH	SCHEDULE
DO	DITTO	SS	STAINLESS STEEL
EW	EAST-WEST	SSS	SOLAR SUPPORT STRUCTURE
FBO	FURNISHED BY OTHERS	STC	STANDARD TEST CONDITIONS
FF	FORWARD FACING	TBD	TO BE DETERMINED
GALV	GALVANIZED	TP	TAMPER PROOF
HDG	HOT DIP GALVANIZED	TYP	TYPICAL
HVAC	HEATING VENTILATION AND AIR CONDITIONING	UON	UNLESS OTHERWISE NOTED
ID	INSIDE DIAMETER	VIF	VERIFY IN FIELD
MFR	MANUFACTURER	WP	WEATHER PROOF
MOD	SOLAR MODULE		

REV 1.0

BORREGO SOLAR
55 TECHNOLOGY DRIVE, SUITE 102
LOWELL, MA 01851
PHONE: (888) 898-6273
FAX: (888) 843-6778
WWW.BORREGOSOLAR.COM

NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED PROFESSIONAL ENGINEER
6/2/2020

SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

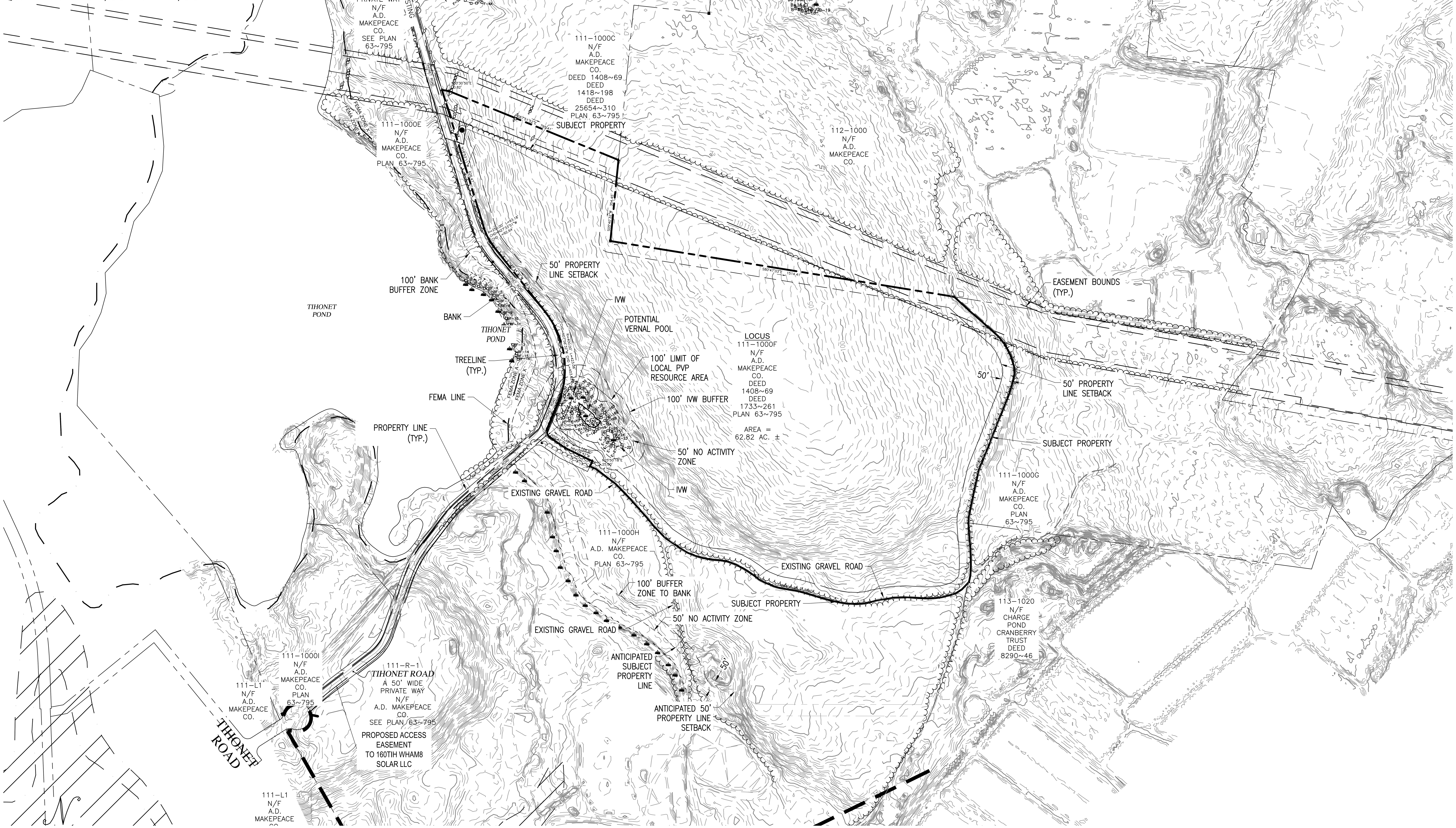
PROJECT NUMBER:
905-2708

REV	DATE	DRAWN	CHECKED	RELEASE LEVEL
	03/26/20	WS	CDS	SUP SET CREATION
	05/07/20	WS	CDS	REVISIONS PER NEW FIELD DATA
	06/01/20	LBD	CDS	UPDATED SET TO MATCH DESIGN CHANGES
	06/02/20	WS	CDS	ISSUED FOR LOCAL PERMITTING

SCALES STATED ON DRAWINGS ARE VALID ONLY WHEN PLOTTED ARCH D 24" X 36"

T-1
TITLE PAGE

NOTES:
1. ALL FLAGS BEGINNING WITH "BF" ARE BANK FLAGS. ALL OTHERS ARE WETLAND FLAGS
2. THIS PLAN IS PREPARED BASED ON THE LIMITED ALTA/NSPS LAND TITLE SURVEY PREPARED BY NORTHEAST SURVEY CONSULTANTS AND STAMPED MARCH 5, 2020. WITH FIELD WORK COMPLETED ON MARCH 4, 2020.
3. SOME SUPPLEMENTAL INFORMATION HAS BEEN ADDED TO THE PLAN.
4. WETLAND RESOURCE AREAS WERE DELINEATED BY BEALS AND THOMAS, INC. ON APRIL 10 2020, APRIL 14, 2020 AND APRIL 17, 2020, WITH INVESTIGATIONS OF POTENTIAL VERNAL POOLS OCCURRING ON APRIL 17, 2020 AND MAY 11, 2020.



EXISTING CONDITIONS PLAN

SCALE: 1" = 200'

0 200' 400'

BORREGO SOLAR
55 TECHNOLOGY DRIVE, SUITE 102
LOWELL, MA 01851
PHONE: (888) 898-6273
FAX: (888) 843-6778
WWW.BORREGOSOLAR.COM

NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS
CHARLES D. SMITH
CIVIL
No. 52136
REGISTERED PROFESSIONAL ENGINEER

Charles D Smith
6/2/20

SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

PROJECT NUMBER:
905-2708

REV	DATE	DRAWN	CHECKED	RELEASE LEVEL
	03/26/20	WS	CDS	SUP SET CREATION
	05/07/20	WS	CDS	REVISIONS PER NEW FIELD DATA
	06/01/20	LBD	CDS	UPDATED SET TO MATCH DESIGN CHANGES
	06/02/20	WS	CDS	ISSUED FOR LOCAL PERMITTING

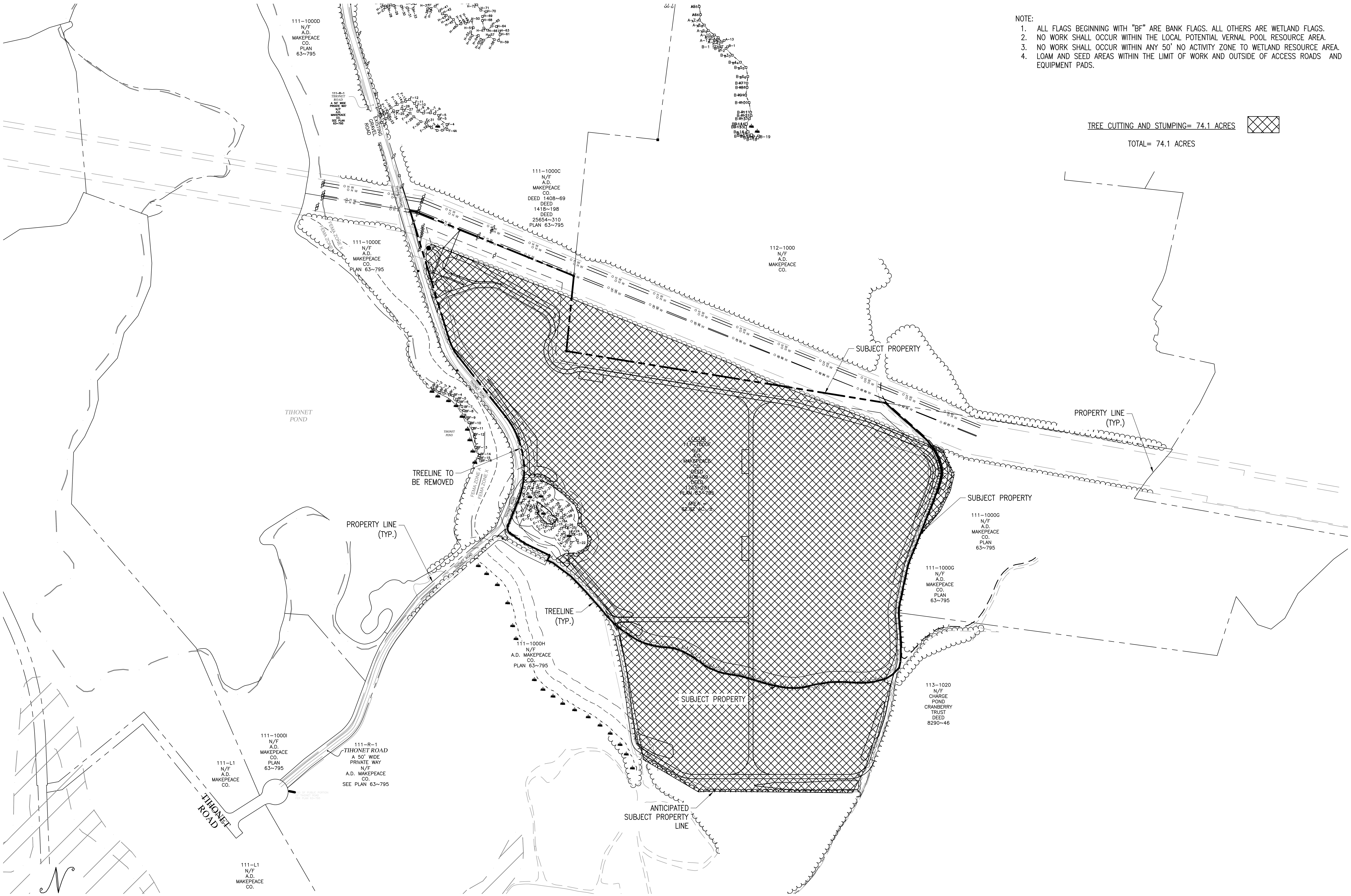
SCALES STATED ON DRAWINGS ARE VALID ONLY WHEN PLOTTED ARCH D 24" X 36"

C-1.0
EXISTING CONDITIONS PLAN

NOTE:
1. ALL FLAGS BEGINNING WITH "BF" ARE BANK FLAGS. ALL OTHERS ARE WETLAND FLAGS.
2. NO WORK SHALL OCCUR WITHIN THE LOCAL POTENTIAL VERNAL POOL RESOURCE AREA.
3. NO WORK SHALL OCCUR WITHIN ANY 50' NO ACTIVITY ZONE TO WETLAND RESOURCE AREA.
4. LOAM AND SEED AREAS WITHIN THE LIMIT OF WORK AND OUTSIDE OF ACCESS ROADS AND EQUIPMENT PADS.

TREE CUTTING AND STUMPING= 74.1 ACRES

TOTAL= 74.1 ACRES



TREE CLEARING PLAN

SCALE: 1" = 200'

0 200' 400'

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55 TECHNOLOGY DRIVE, SUITE 102
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NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED
PROFESSIONAL ENGINEER
6/2/2020

SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

PROJECT NUMBER:
905–2708

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C-2.0
TREE CLEARING PLAN

OVERALL LAYOUT AND MATERIALS PLAN

SCALE: 1" = 200'

0 200' 400'

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COMMONWEALTH OF MASSACHUSETTS
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SITE USE PLAN
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C-3.0
OVERALL LAYOUT AND MATERIALS PLAN

ZONING TABLE	
ZONING DISTRICT – RESIDENTIAL R-60 DISTRICT	
	NON RESIDENTIAL USE REQUIREMENTS
MINIMUM LOT AREA	130,680 SF
MINIMUM FRONTAGE	180 FT
MINIMUM FRONT SETBACK	50 FT
MINIMUM SIDE SETBACK	50 FT
MINIMUM REAR SETBACK	50 FT
MAXIMUM HEIGHT	35 FT
MAXIMUM BUILDING COVERAGE	–
MAXIMUM IMPERVIOUS SURFACE	–

NOTE:
1. ALL FLAGS BEGINNING WITH "BF" ARE BANK FLAGS. ALL OTHERS ARE WETLAND FLAGS.
2. THE PROPOSED ARRAY IS COMPRISED OF APPROX. 51921 MODULES, AND IS SUBJECT TO CHANGE. FINAL NUMBER OF MODULES WILL BE SHOWN ON CONSTRUCTION DRAWINGS PRIOR TO ISSUANCE OF BUILDING AND ELECTRICAL PERMITS.
3. THE PROPOSED PROJECT LIMIT OF WORK INCLUDING IS APPROXIMATELY 76.5 ACRES.
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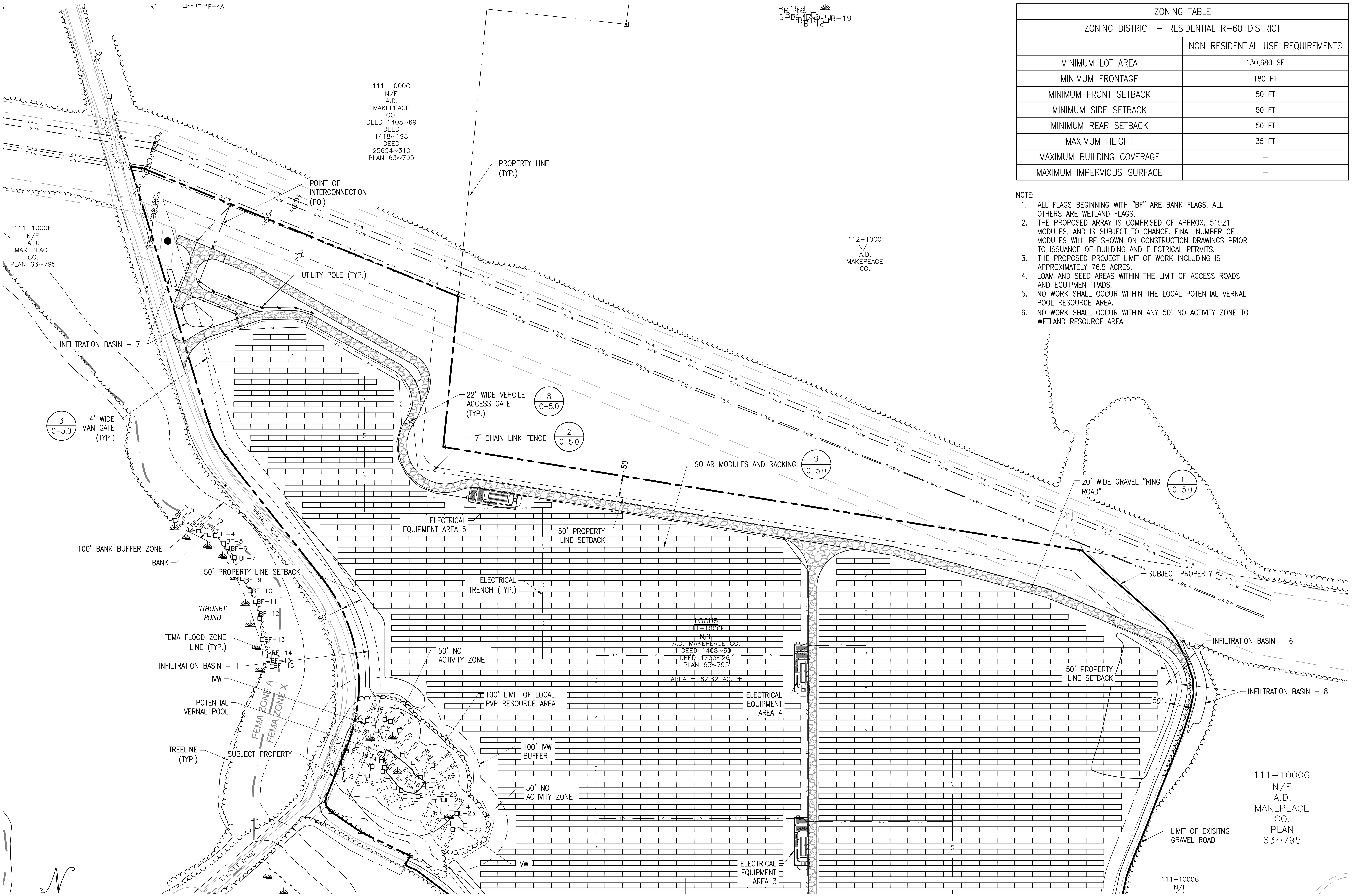

LAYOUT AND MATERIALS - NORTH

SCALE: 1" = 100'

0 100' 200'

BORREGO SOLAR
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COMMONWEALTH OF MASSACHUSETTS JEFFREY R. MURPHY CIVIL No. 51800 REGISTERED PROFESSIONAL ENGINEER
6/2/2020

SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

PROJECT NUMBER: 905-2708

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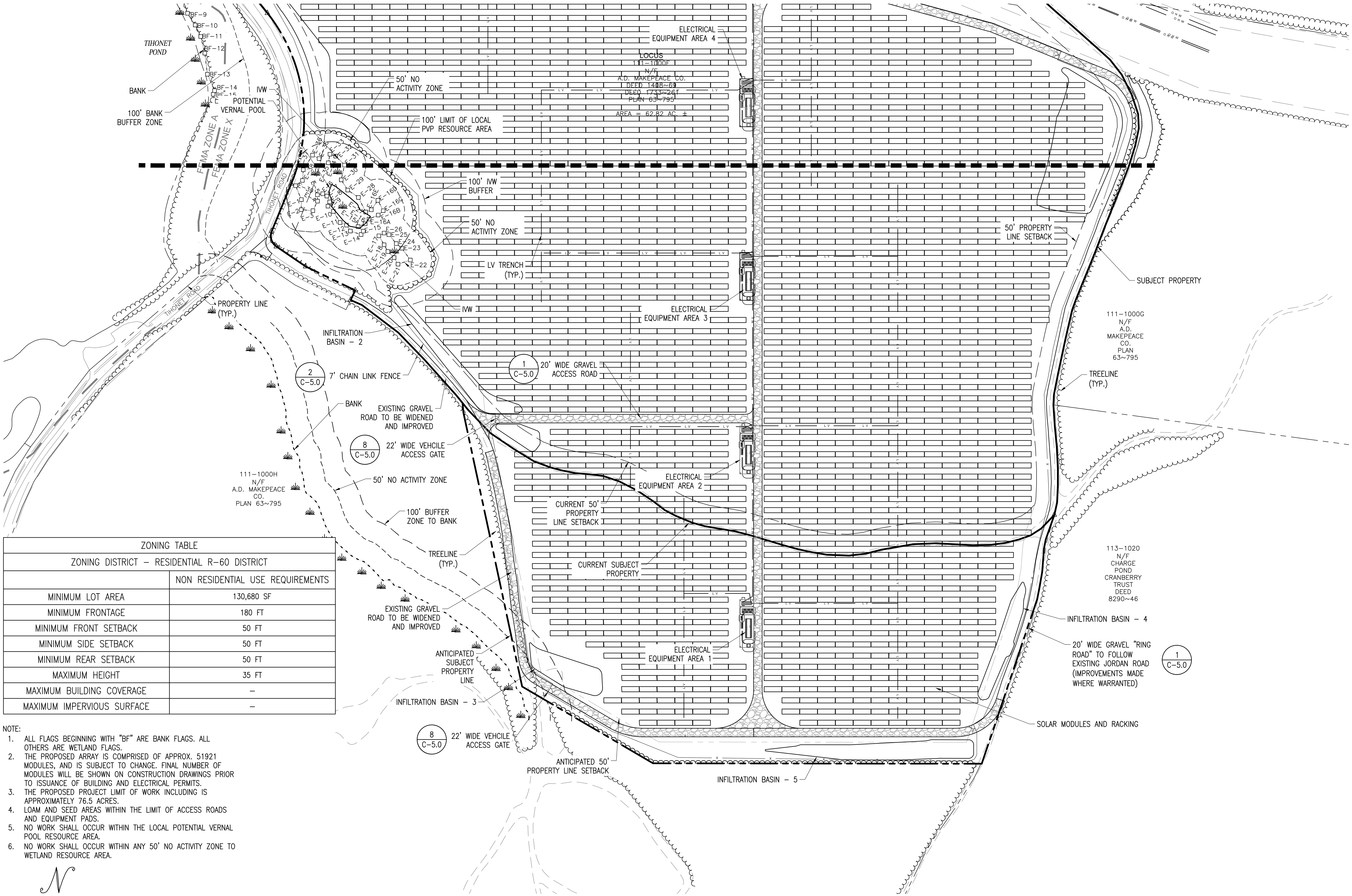
C-3.1

LAYOUT AND MATERIALS - NORTH



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N

LAYOUT AND MATERIALS - SOUTH

SCALE: 1" = 100'

0 100' 200'

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NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS
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CIVIL
No. 51800
REGISTERED
PROFESSIONAL ENGINEER
Jeffrey R. Murphy
6/2/2020

SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

PROJECT NUMBER: 905-2708

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C-3.2

LAYOUT AND MATERIALS - SOUTH

OVERALL GRADING AND EROSION CONTROL PLAN

SCALE: 1" = 200'

0 200' 400'

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COMMONWEALTH OF MASSACHUSETTS
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6/2/2020

SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

PROJECT NUMBER:
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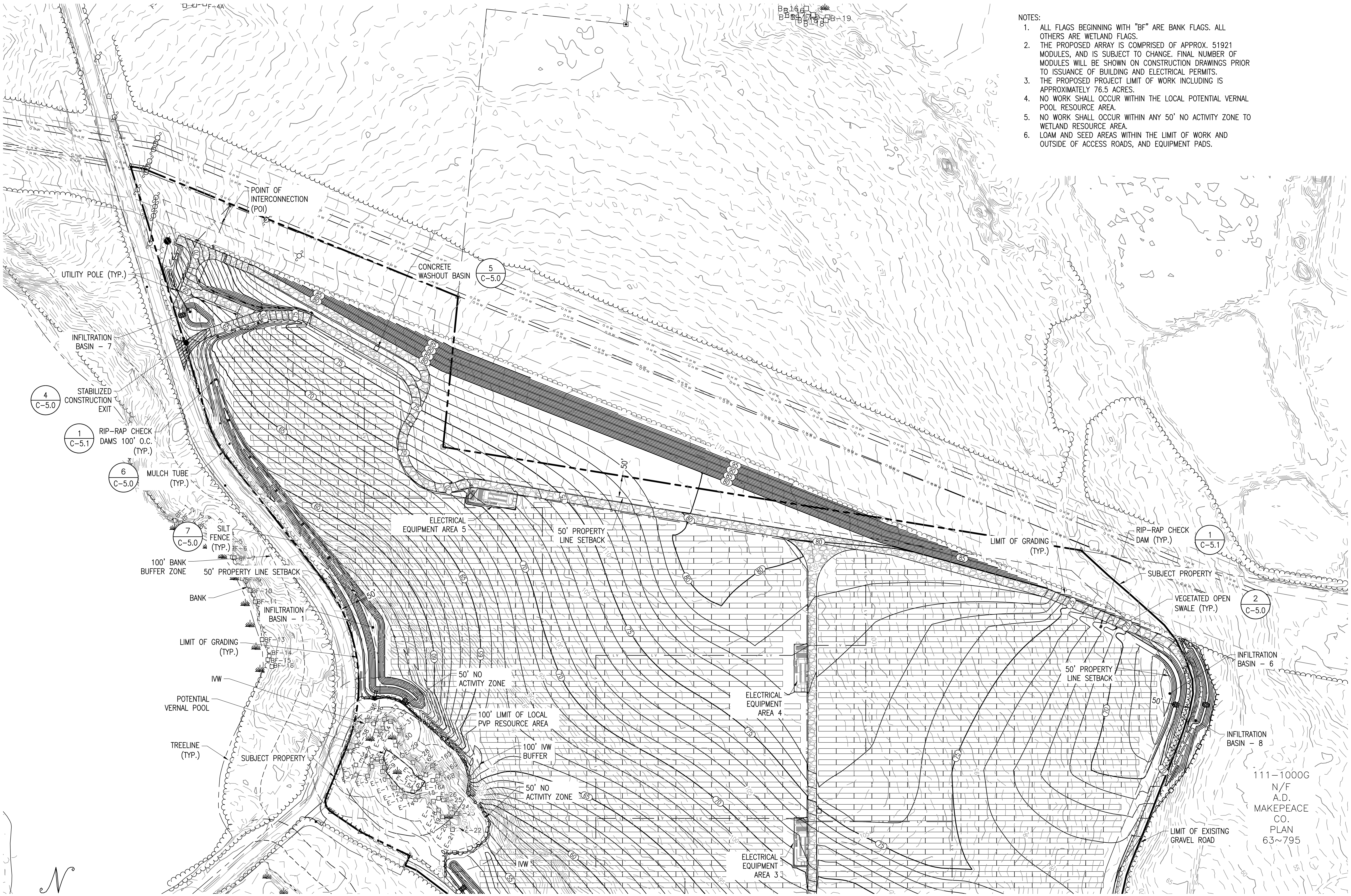
C-4.0

OVERALL GRADING AND EROSION CONTROL PLAN



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N

GRADING AND EROSION CONTROL PLAN - NORTH

SCALE: 1" = 100'

0 100' 200'

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COMMONWEALTH OF MASSACHUSETTS
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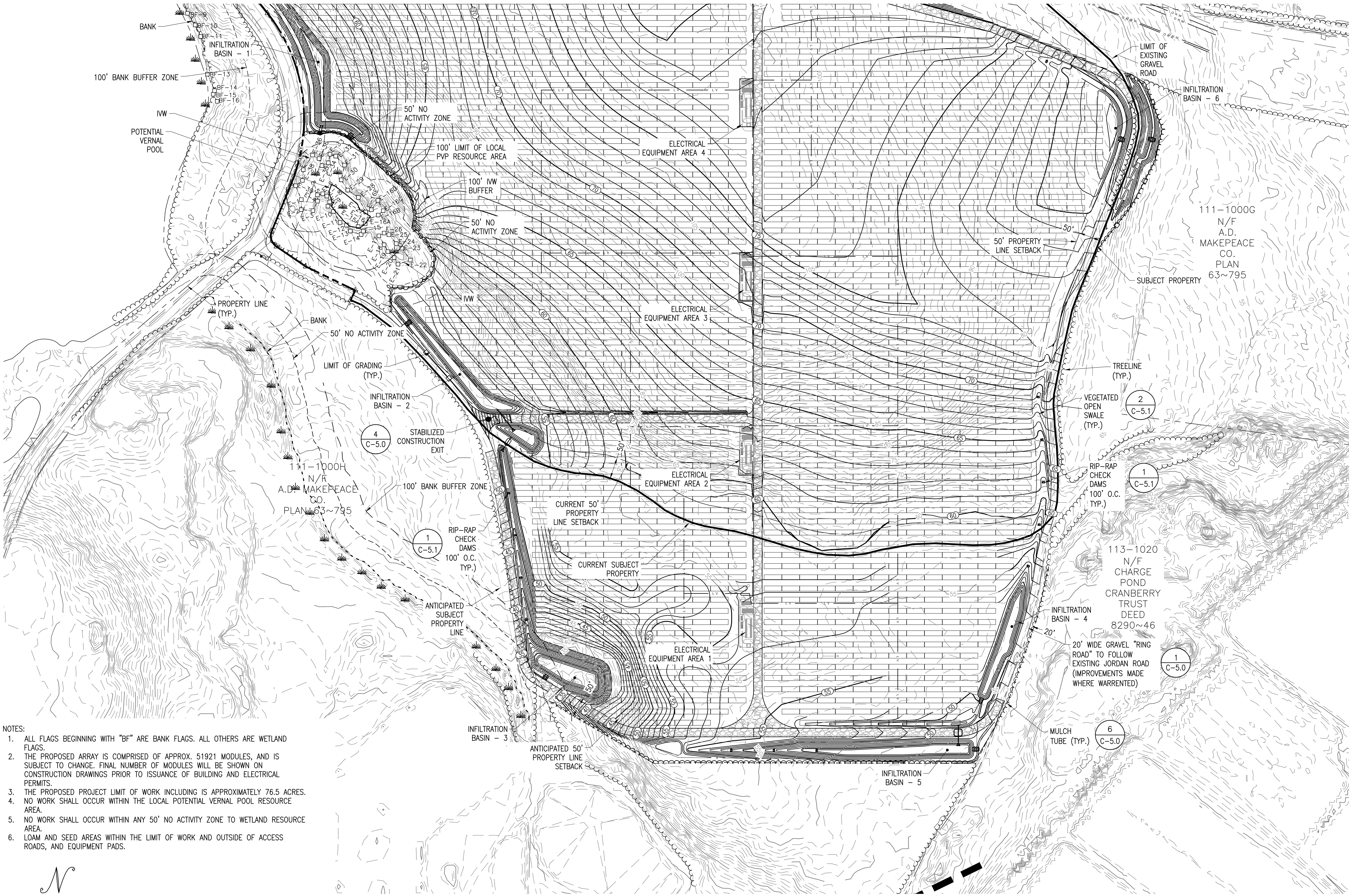
C-4.1

GRADING AND EROSION CONTROL PLAN - NORTH



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GRADING AND EROSION CONTROL PLAN - SOUTH

SCALE: 1" = 100'

0 100' 200'

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55 TECHNOLOGY DRIVE, SUITE 102
LOWELL, MA 01851
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NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED PROFESSIONAL ENGINEER
6/2/2020

SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

PROJECT NUMBER: 905–2708

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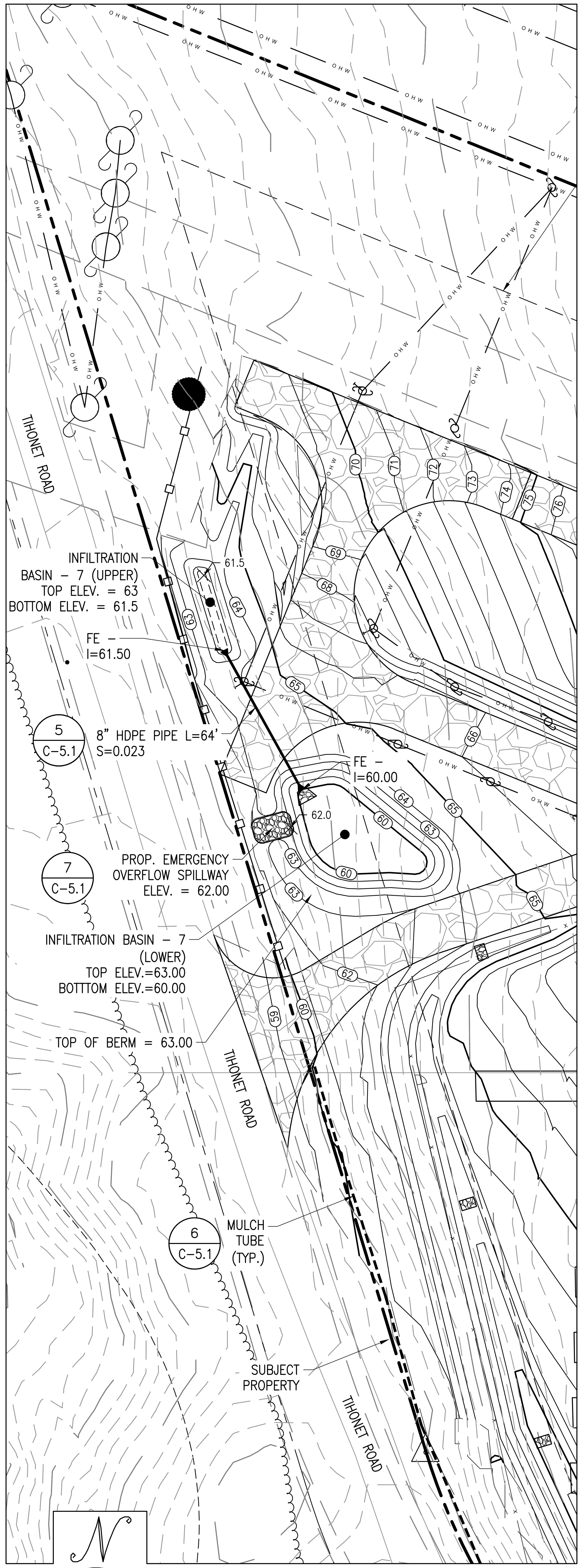
C-4.2

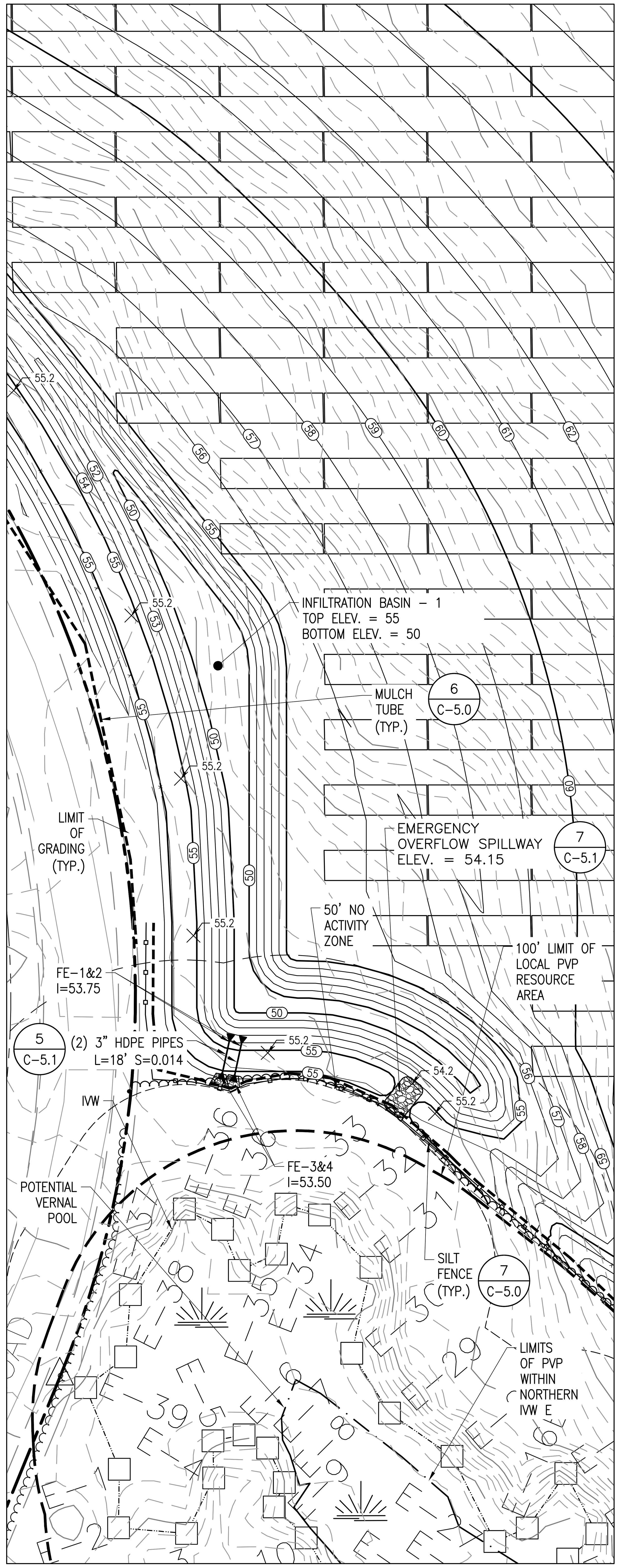
GRADING AND EROSION CONTROL PLAN - SOUTH



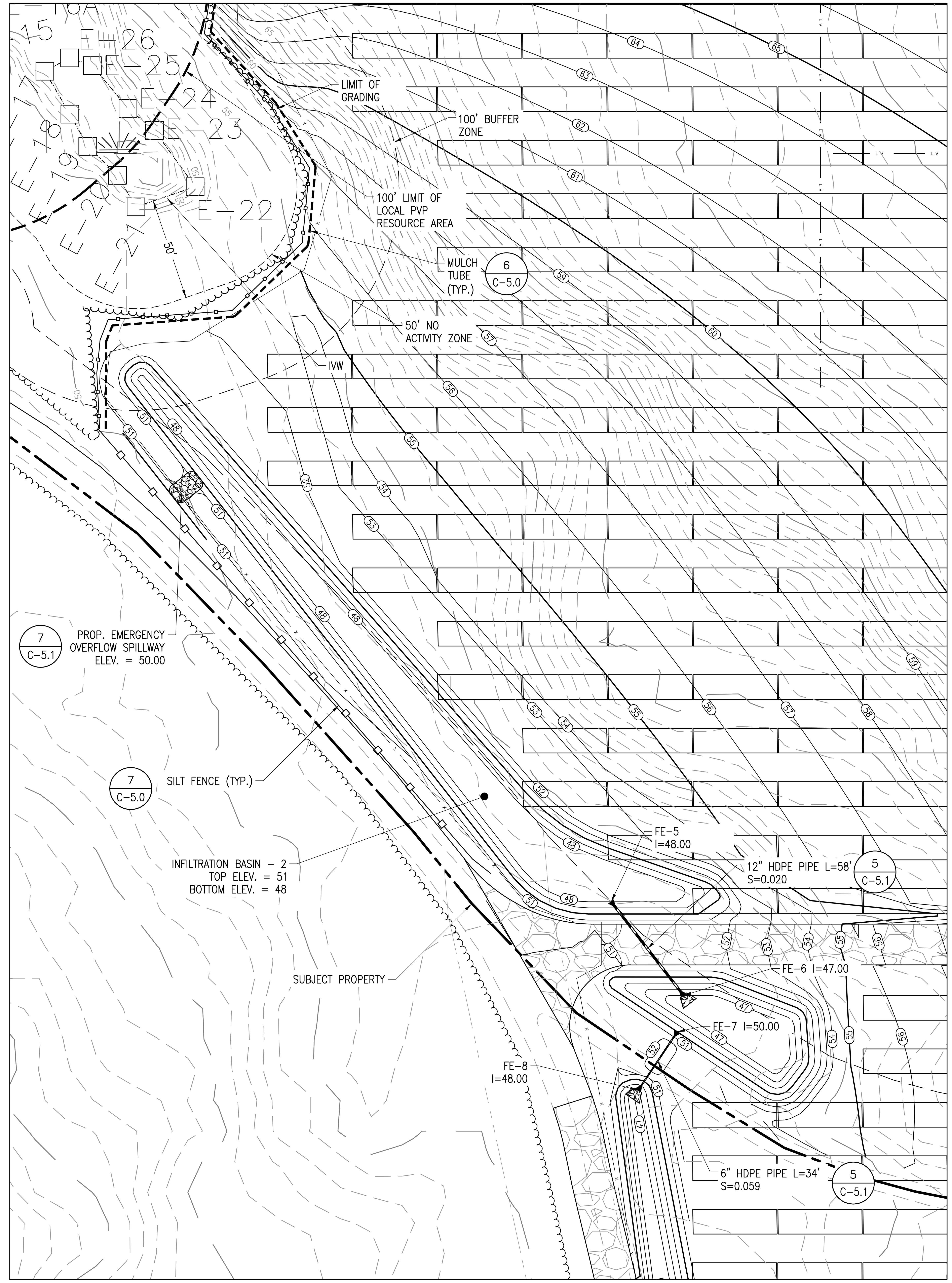
BASINS 7, 9

SCALE: 1" = 30'

0 30' 60'



BASIN 1



BASIN 2

BORREGO SOLAR
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COMMONWEALTH OF MASSACHUSETTS
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SITE USE PLAN
140 TIHONET ROAD
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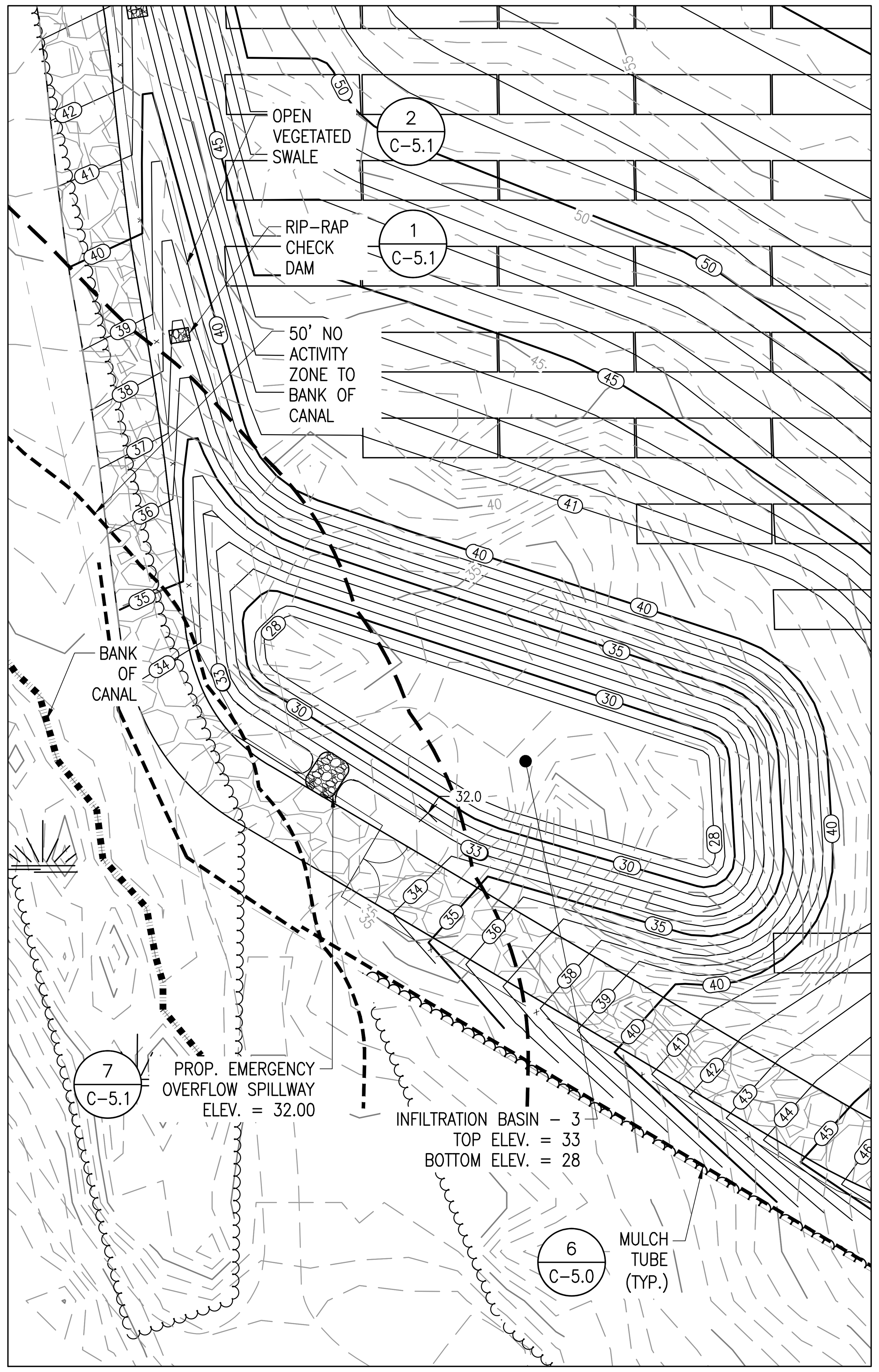
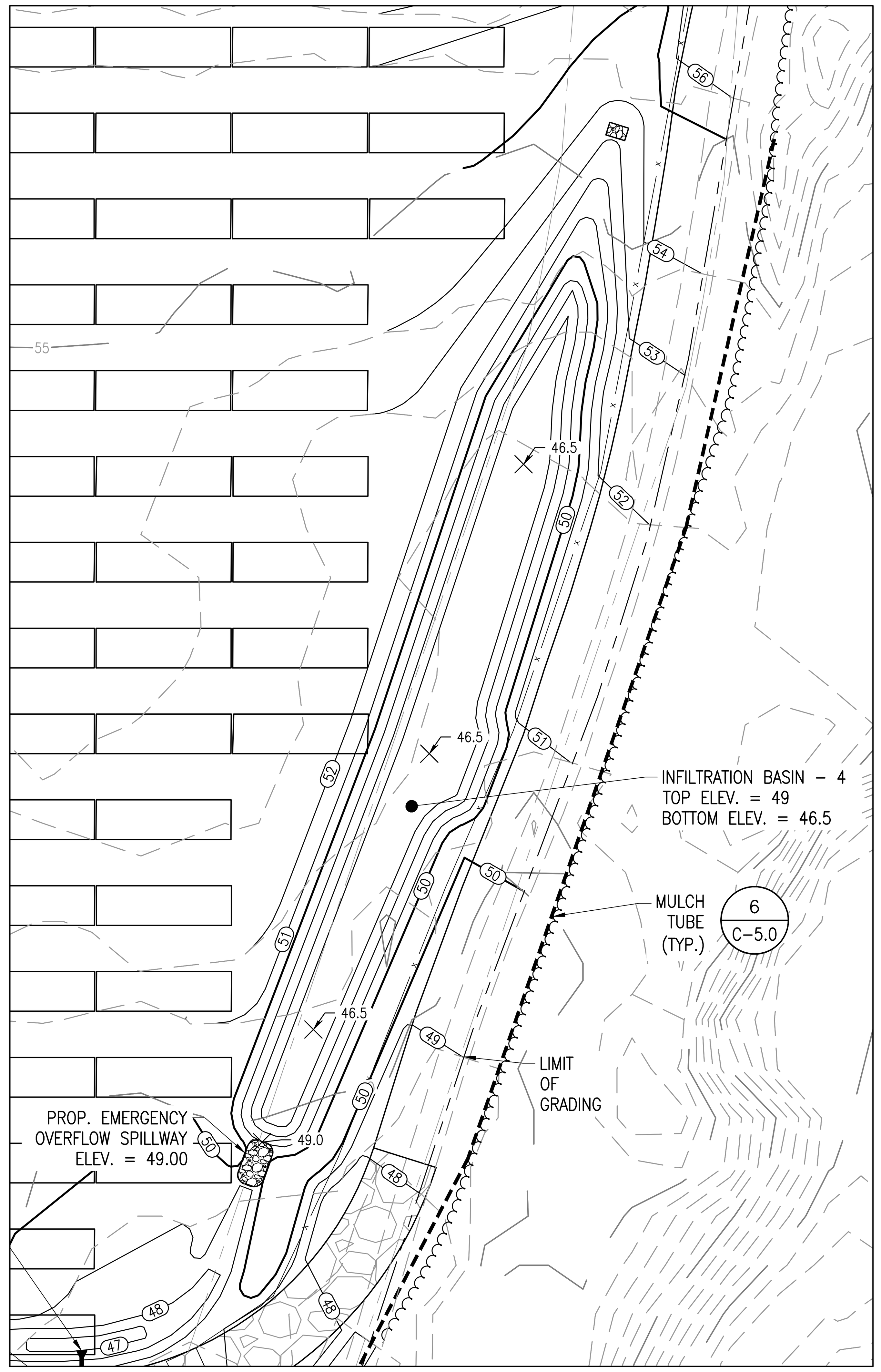
C-4.4

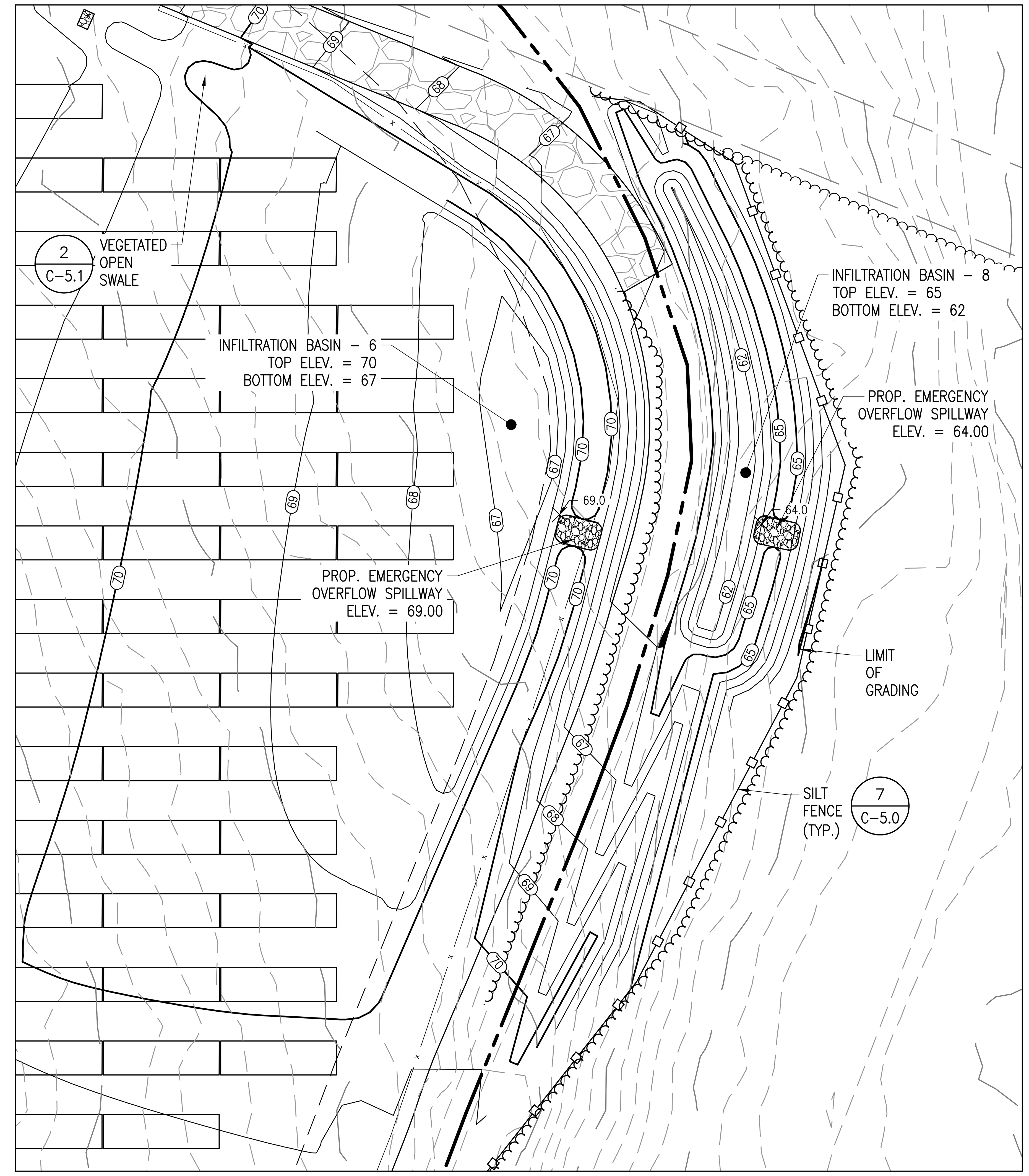
GRADING AND EROSION CONTROL PLAN - NORTH



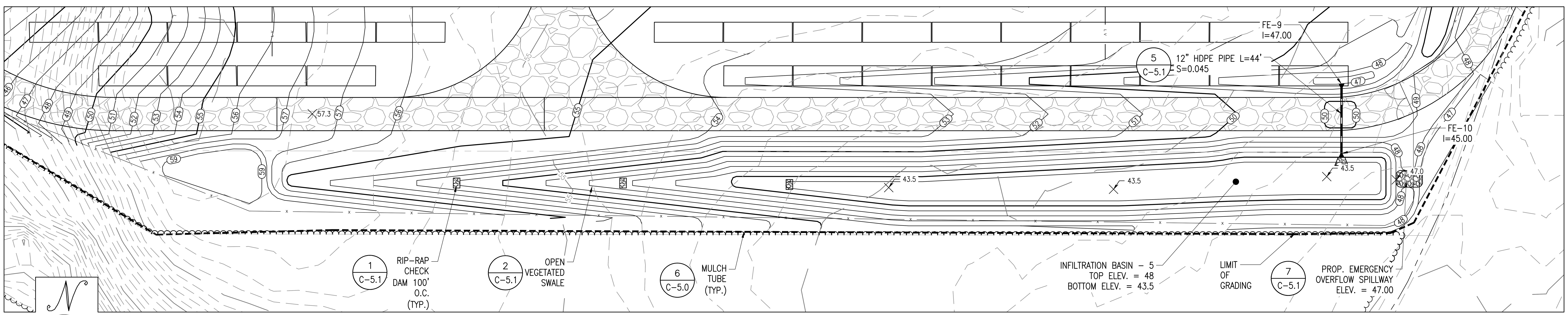
BASIN 3



BASIN 4



BASINS 6, 8



N

BASIN 5

SCALE: 1" = 30'

0 30' 60'

BORREGO SOLAR

55 TECHNOLOGY DRIVE, SUITE 102
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COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
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No. 51800
REGISTERED PROFESSIONAL ENGINEER
Jeffrey R. Murphy
6/2/2020

SITE USE PLAN
140 TIHONET ROAD
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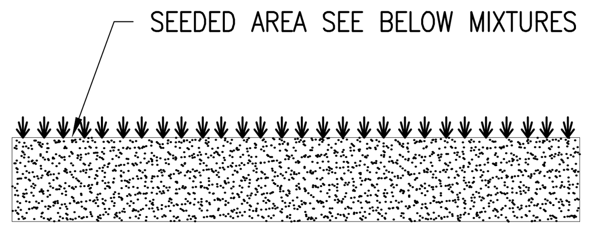
C-4.3

GRADING AND EROSION CONTROL PLAN - NORTH



ADM SANDY MIXTURE

CONTAINS	PURE SEED	GERM	ORIGIN
HARD FESCUE*	24.64%	85.00%	OREGON
PENNLAWN CREEPING RED FESCUE	24.61%	85.00%	OREGON
BOREAL CREEPING RED FESCUE	24.51%	85.00%	CANADA
AZURE SHEEPS FESCUE	24.50%	85.00%	OREGON

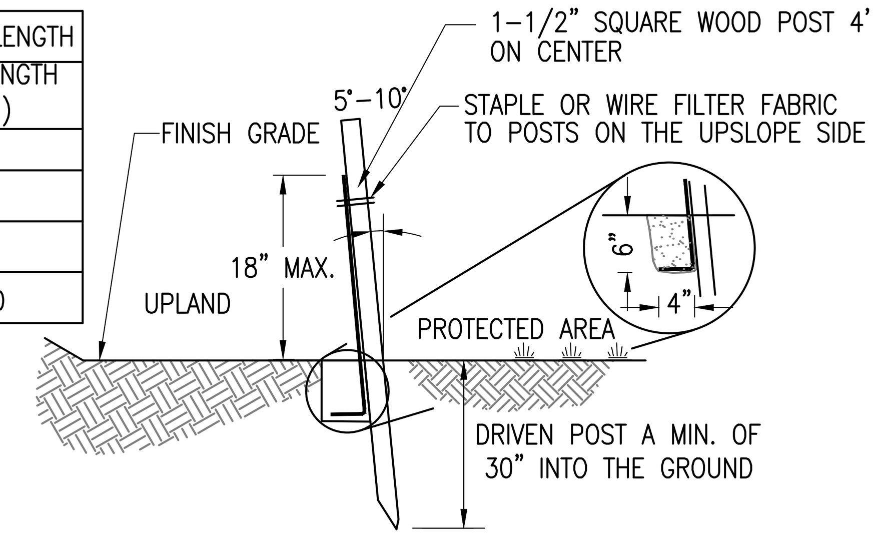
OTHER CROP SEEDS: 0.16%
INERT MATTER: 1.49%
WEED SEEDS: 0.09%
NOXIOUS WEED SEEDS NONE FOUND
* VARIETY NOT STATED

PROVIDED BY: VALLEY GREEN, 14 COPPERBEECH DR., KINGSTON, MA 02364

10 SEED DETAIL

SCALE: NTS

MAX ALLOWABLE SLOPE LENGTH	
STEEPNESS	MAX LENGTH (FT.)
2:1	25
3:1	50
4:1	75
5+:1	100

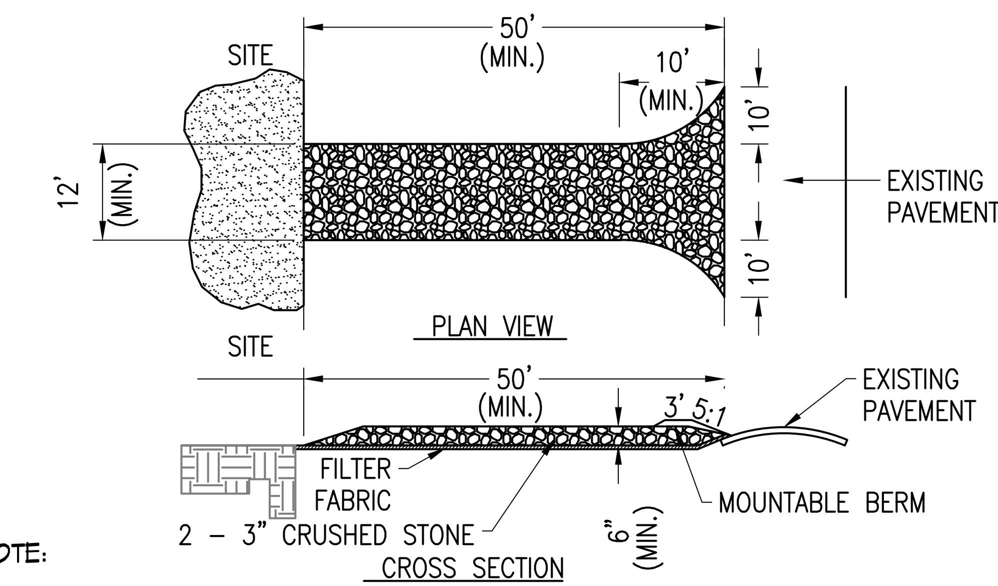


NOTES:

1. MAX DRAINAGE AREA FOR OVERLAND FLOW SHALL NOT EXCEED 1/4 ACRE-FOOT PER 100 FEET OF FENCE.
2. FILTER FABRIC TO BE FASTENED SECURELY TO FENCE POST WITH WIRE TIES OR STAPLES. POST SHALL BE STEEL EITHER "T" OR "U" SHAPED OR HARDWOOD.
3. FILTER CLOTH SHALL BE FASTENED SECURELY WITH TIES SPACED EVERY 24" AT TOP AND MID-SECTION.
4. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY 6 INCHES AND FOLDED. FILTER CLOTH SHALL BE FILTER X, MIRAFI 100X, STABILENKA T140N, OR APPROVED EQUAL.
5. PREFABRICATED UNITS SHALL BE GEOFAB, ENVIROFENCE, OR APPROVED EQUAL.
6. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SEDIMENT FENCE.

7 SILT FENCE

SCALE: NTS
XD_CIVIL_EROSION_SILT FENCE_P 2014-10-17

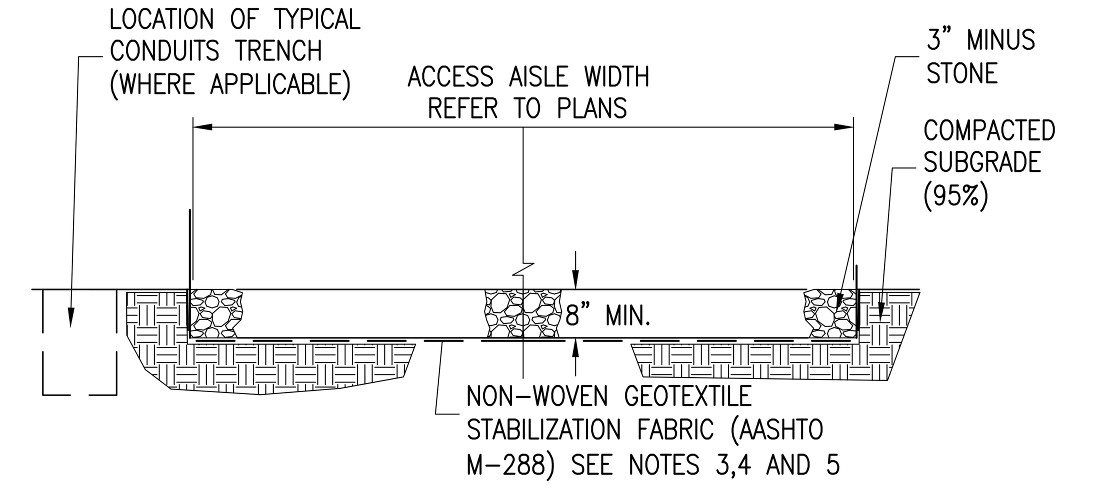


NOTE:

1. ENTRANCE WIDTH SHALL BE A TWENTY-FOUR (24) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
2. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH SHALL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY. BERM SHALL BE PERMITTED. PERIODIC INSPECTION AND MAINTENANCE SHALL BE PROVIDED AS NEEDED.

4 STABILIZED CONSTRUCTION EXIT

SCALE: NTS
XD_CIVIL_TEMPORARY CONSTRUCTION_STABILIZED CONSTRUCTION EXIT 06-10-2016

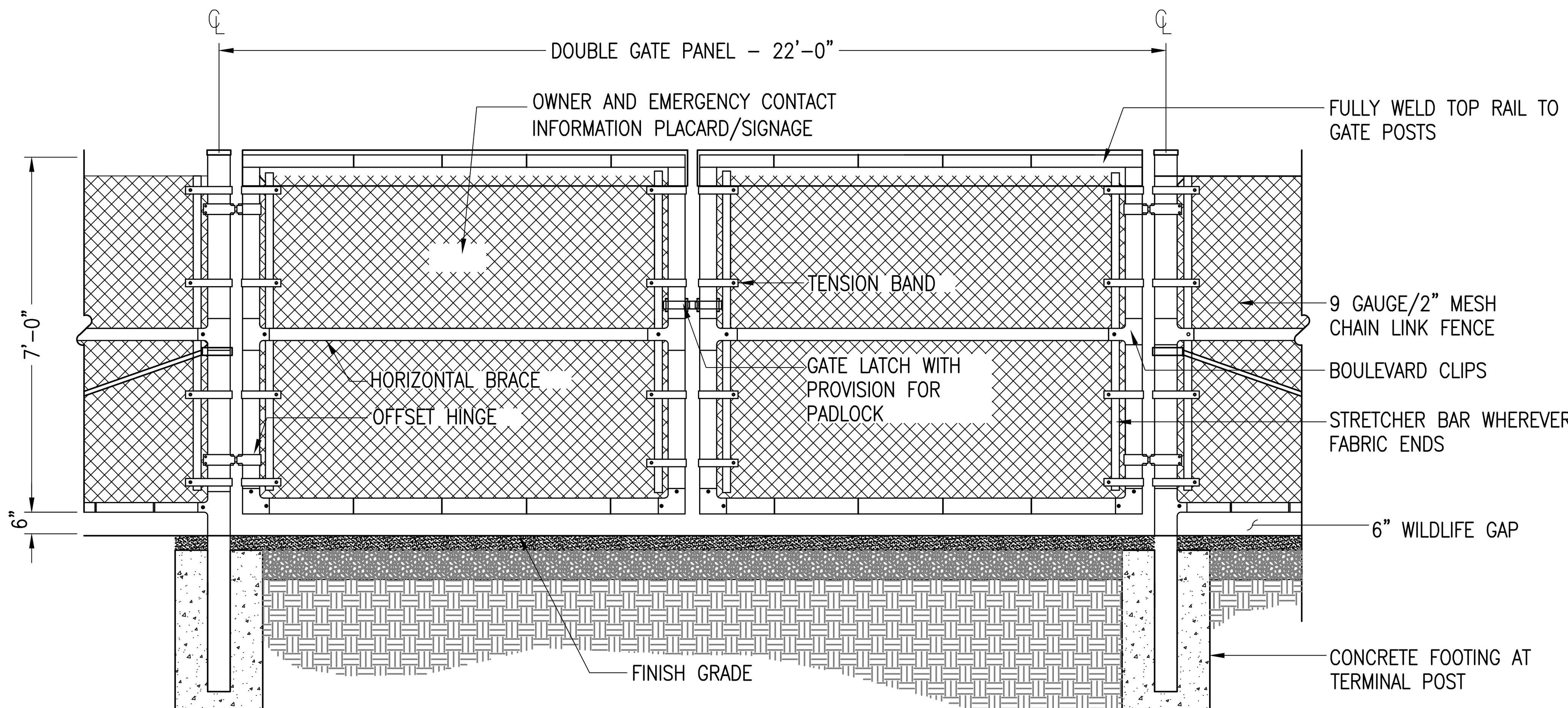


NOTES:

1. SUBCONTRACTOR SHALL EXCAVATE TO SUITABLE MATERIAL FOR SUBGRADE.
2. SUBCONTRACTOR SHALL COMPACT SUBGRADE TO PROVIDE SUITABLE SURFACE TO PLACE ROAD.
3. GEOTEXTILE FABRIC SHALL MEET THE FOLLOWING REQUIREMENTS:
   - TENSILE STRENGTH: 150 LB MIN.
   - ELONGATION: 50%
   - CBR PUNCTURE: 400 LB MIN.
   - MINIMUM WATER FLOW RATE: 120 GPM / FT^2
4. SUBCONTRACTOR SHALL FOLLOW GEOTEXTILE FABRIC MANUFACTURER INSTALLATION PROCEDURES.
5. WHERE OVERLAPPING OF GEOTEXTILE FABRIC IS REQUIRED, SUBCONTRACTOR SHALL OVERLAP A MINIMUM OF 24".
6. SUBCONTRACTOR SHALL REMOVE TEMPORARY CONSTRUCTION ACCESS ROADS, AND RESTORE TO PRE-CONSTRUCTION CONDITIONS TO THE SATISFACTION OF THE CEOR AND THE GOVERNING AGENCIES.

1 GRAVEL ACCESS ROAD

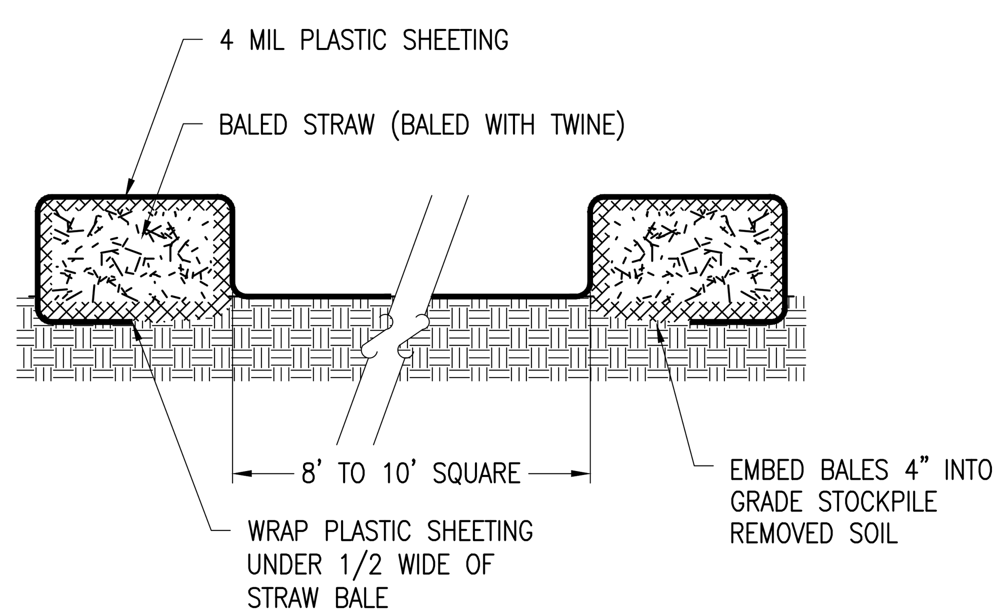
SCALE: NTS
XD_CIVIL_GRAVEL_ROAD 07-24-2017



NOTE:
1. FENCE GATE SHALL BE EQUIPPED WITH FIRE DEPARTMENT KNOX BOX FOR EMERGENCY ACCESS.

8 VEHICLE GATE - WILDLIFE GAP

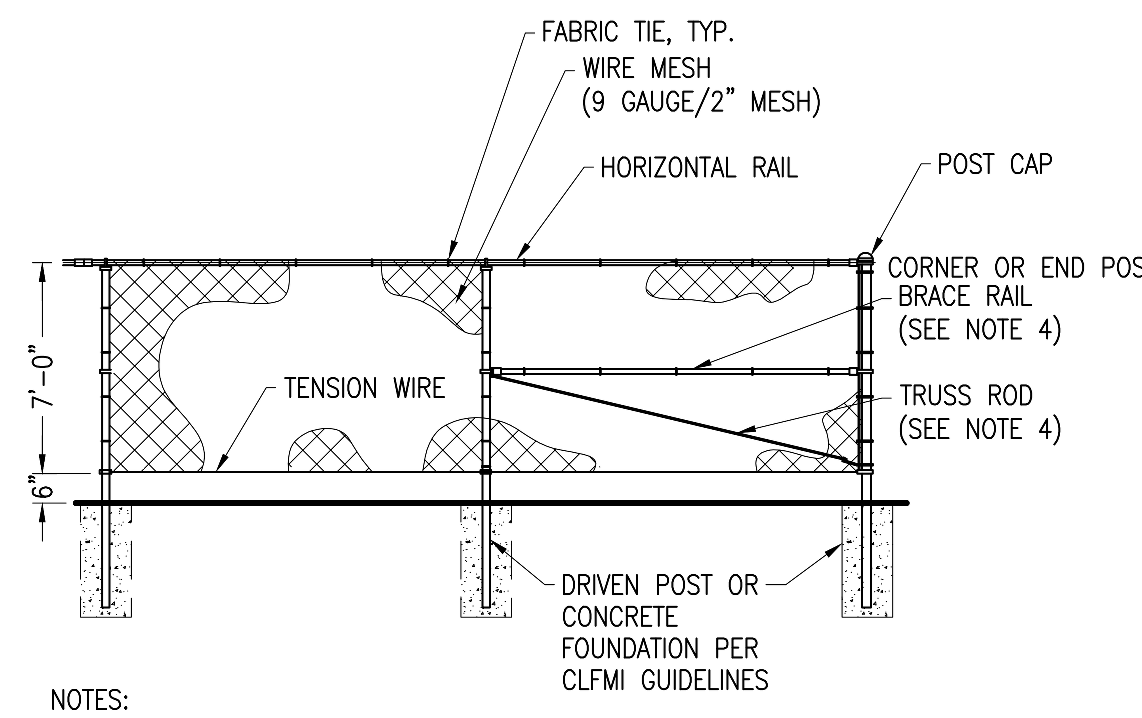
SCALE: NTS
XD_CIVIL_FENCE_VEHICLE GATE_7' 10-23-2018



NOTE: PLASTIC SHEETING SHALL BE FREE OF TEARS OR HOLES. AFTER BASIN IS USED, WASHWATER FROM WASHOUT BASIN SHALL EVAPORATE OR BE VACUUMED OUT. REMOVE REMAINING HARDENED SOLIDS. REPLACE PLASTIC SHEETING AND STRAWBALES AS REQUIRED.

5 CONCRETE WASHOUT BASINS

SCALE: NTS
XD_CIVIL_CONCRETE WASHOUT BASINS 07-24-2017



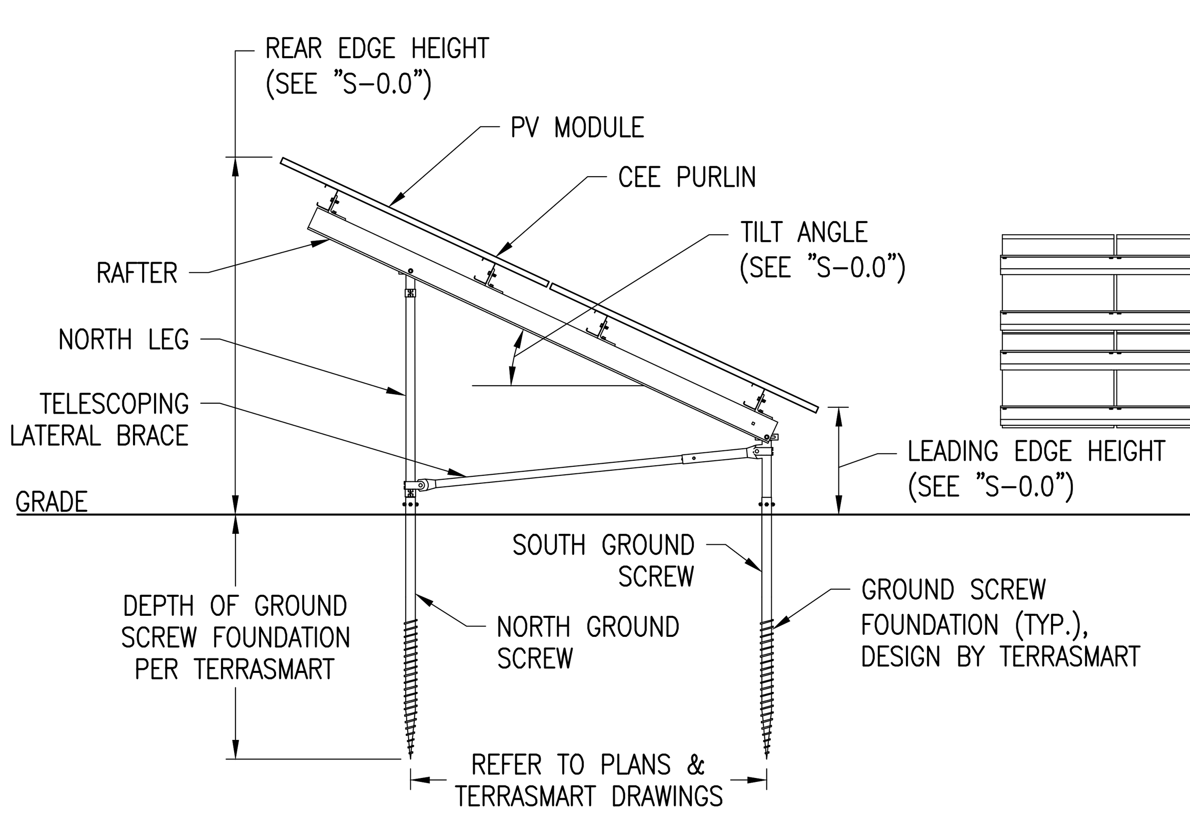
NOTES:

1. THE FENCE SHALL MEET OR EXCEED THE CHAIN LINK FENCE MANUFACTURER INSTITUTE (CLFMI) GUIDELINES AND RELATED FEDERAL SPECIFICATIONS FOR SECURITY CHAIN LINK FENCE MATERIALS AND INSTALLATION.
2. FENCE MATERIAL AND COMPONENTS SHALL BE GALVANIZED, UNLESS OTHERWISE NOTED.
3. THIS DETAIL NOT APPLICABLE FOR PRIVACY FENCE OR FENCE WITH SLATS.
4. ADJUSTABLE TRUSS ROD AND BRACE RAIL AT CORNER OR END POSTS ONLY, IF REQUIRED BY CLFMI GUIDELINES.

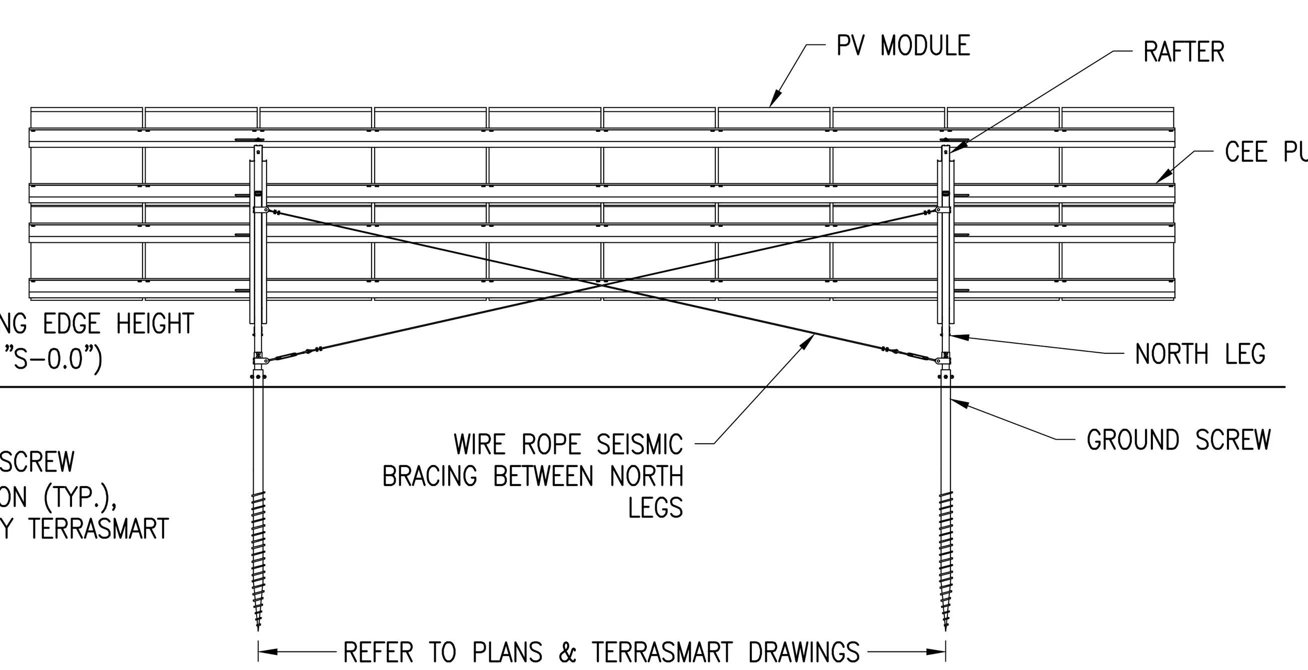
2 CHAIN LINK FENCE - WILDLIFE GAP

SCALE: NTS
XD_CIVIL_FENCE_7'_CHAIN_LINK_WILDLIFE_GAP 06-27-2016

NOTE: THE "TERRAFARM" RACKING AND GROUND SCREW FOUNDATIONS ARE DESIGNED BY TERRASMART AND WILL BE A SUBMITTAL TO BORREGO. THE INFORMATION SHOWN HERE IS FOR GENERAL REFERENCE ONLY. 2x10 RACKING CONFIGURATION SHOWN IN THIS DETAIL AS REFERENCE. ACTUAL RACK SIZE FOR THIS PROJECT MAY VARY.



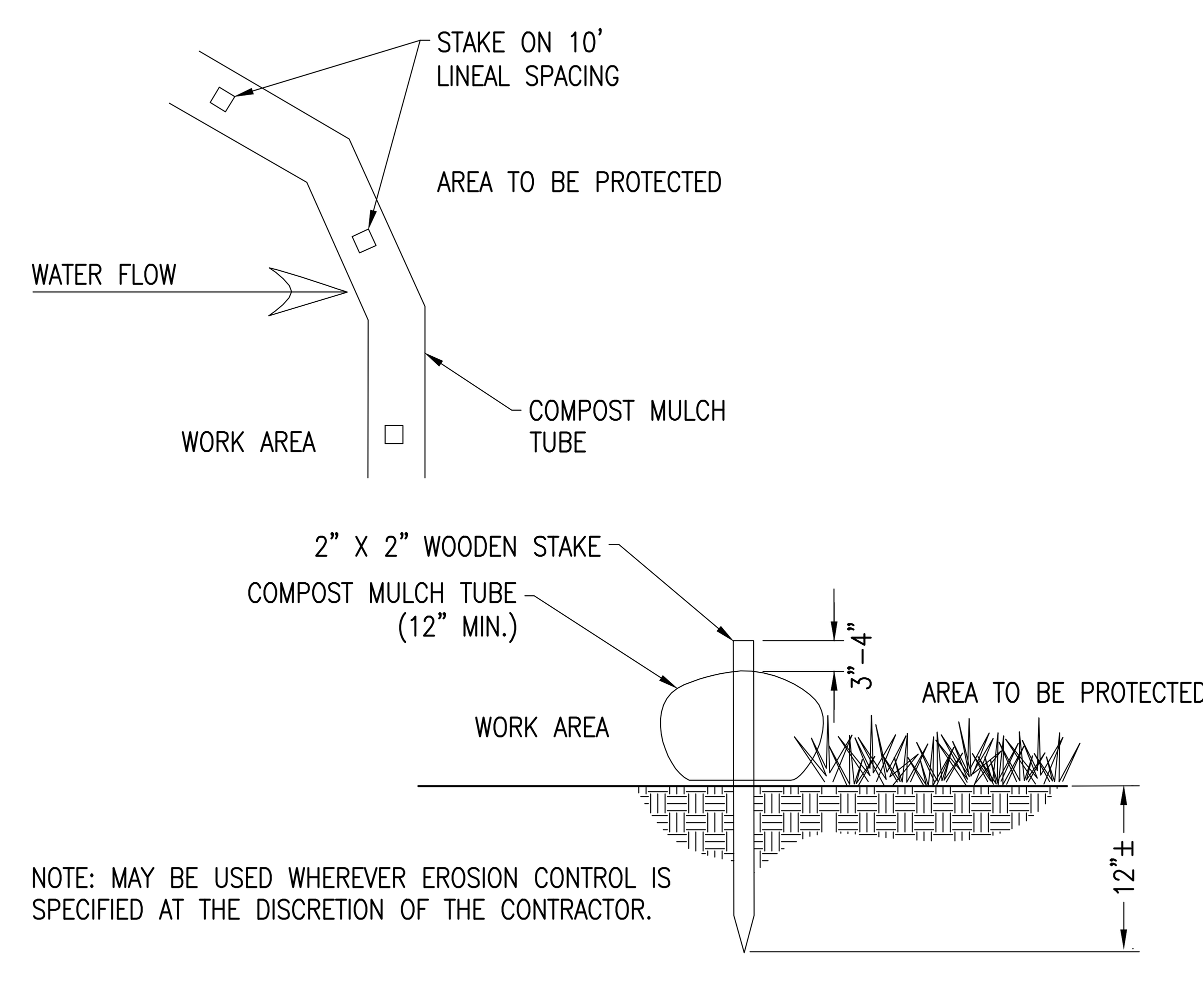
SECTION



REAR ELEVATION

9 TYPICAL RACK SECTION & REAR ELEVATION

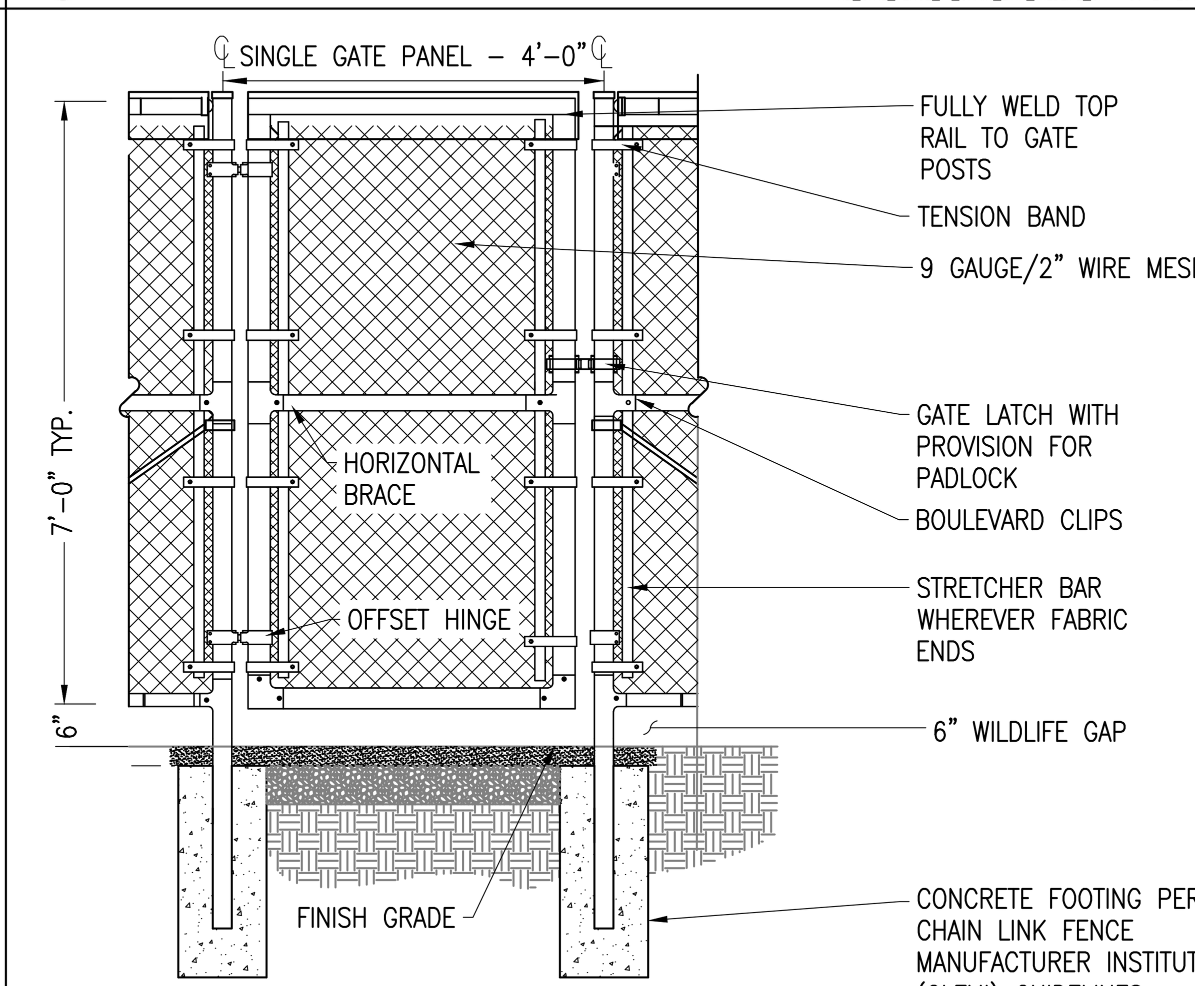
TERRASMART TF2P
SCALE: NTS
XD_STRUC_TERRASMART_TF2P_RACK SECT & REAR ELEV 2017-12-04



NOTE: MAY BE USED WHEREVER EROSION CONTROL IS SPECIFIED AT THE DISCRETION OF THE CONTRACTOR.

6 MULCH TUBE

SCALE: NTS
XD_CIVIL_FILTREXX_FILTER_SOCK 03-29-2016



NOTE: FABRIC SHALL BE GALVANIZED

3 4' MAN GATE - WILDLIFE GAP

SCALE: NTS
XD_CIVIL_SITE CONSTRUCTION_4' WALK THROUGH GATE 07-25-2017

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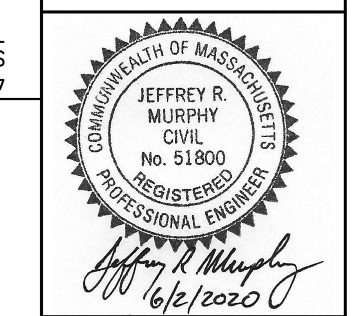
LOWELL, MA 01851
PHONE: (888) 898-6273
FAX: (888) 843-6778
WWW.BORREGOSOLAR.COM

NOT FOR CONSTRUCTION



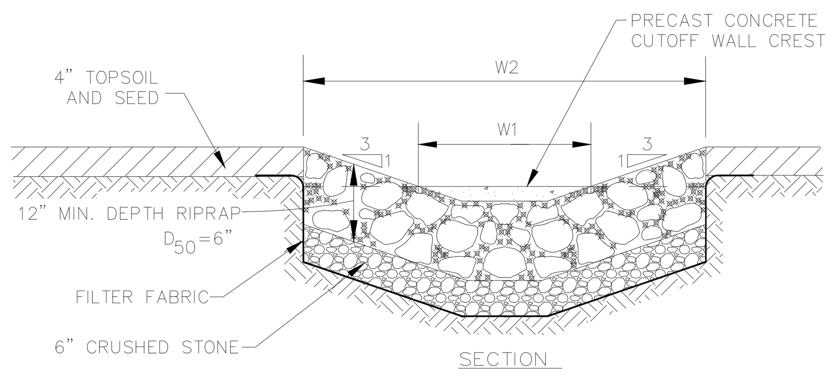
SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

PROJECT NUMBER: 905-2708

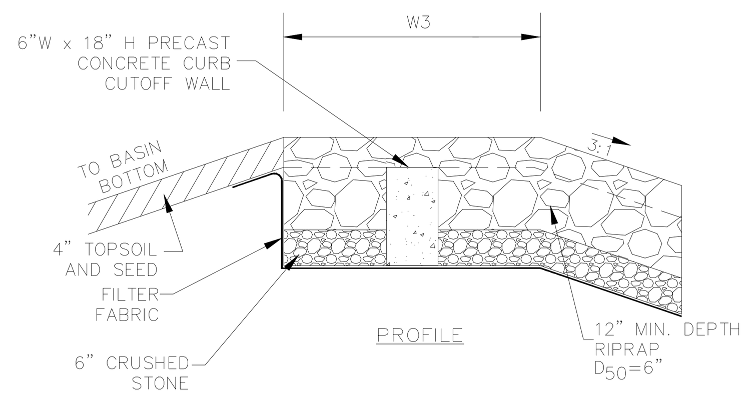
REV	DATE	DRAWN	CHECKED	RELEASE LEVEL
	03/26/20	WS	CDS	SUP SET CREATION
	05/07/20	WS	CDS	REVISIONS PER NEW FIELD DATA
	06/01/20	LBD	CDS	UPDATED SET TO MATCH DESIGN CHANGES
	06/02/20	WS	CDS	ISSUED FOR LOCAL PERMITTING

SCALES STATED ON DRAWINGS ARE VALID ONLY WHEN PLOTTED ARCH D 24" X 36"

C-5.0
CIVIL DETAILS



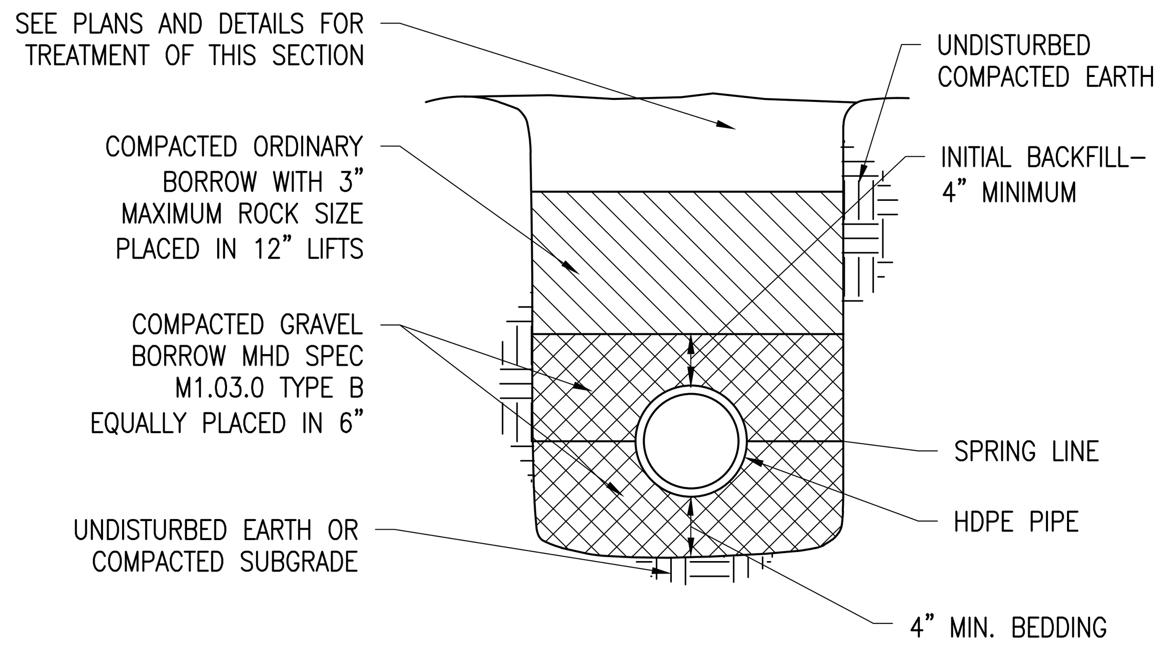
CREST ELEV.	W1 (FT)	W2 (FT)	W3 (FT)
SEE PLAN	4	10	SEE PLAN



NOTES:
1. RIPRAP SHALL MEET M2.02.3–STONE FOR PIPE ENDS.
2. CRUSHED STONE SHALL MEET M2.01.4 3/4" SPEC.

EMERGENCY OVERFLOW SPILLWAY
NOT TO SCALE

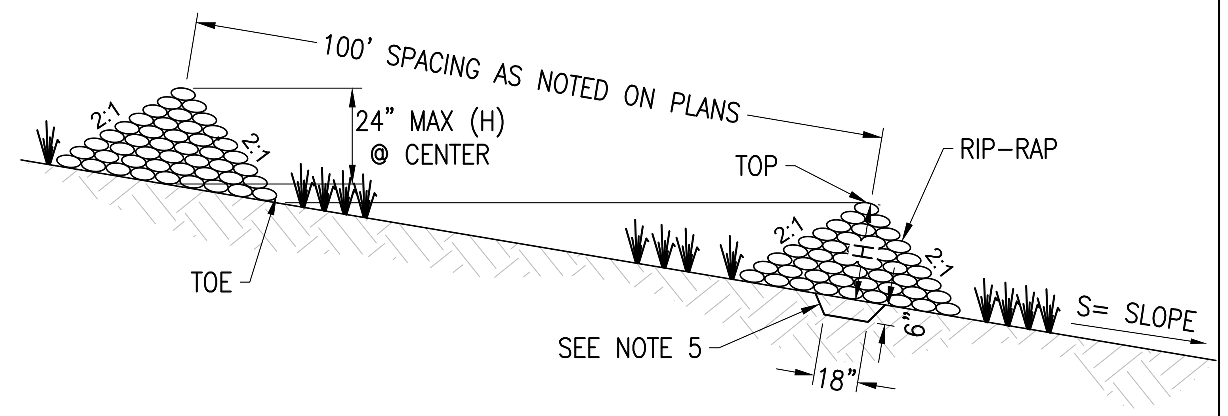
7



NOTES:
1. TRENCH EXCAVATION WIDTH TO ALLOW FOR FREE TRAVEL OF COMPACTION EQUIPMENT.
2. ALL COMPACTION TO A MINIMUM 95 PERCENT DRY DENSITY DETERMINED BY ASTM D1557 SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

5 HDPE DRAIN PIPE BEDDING

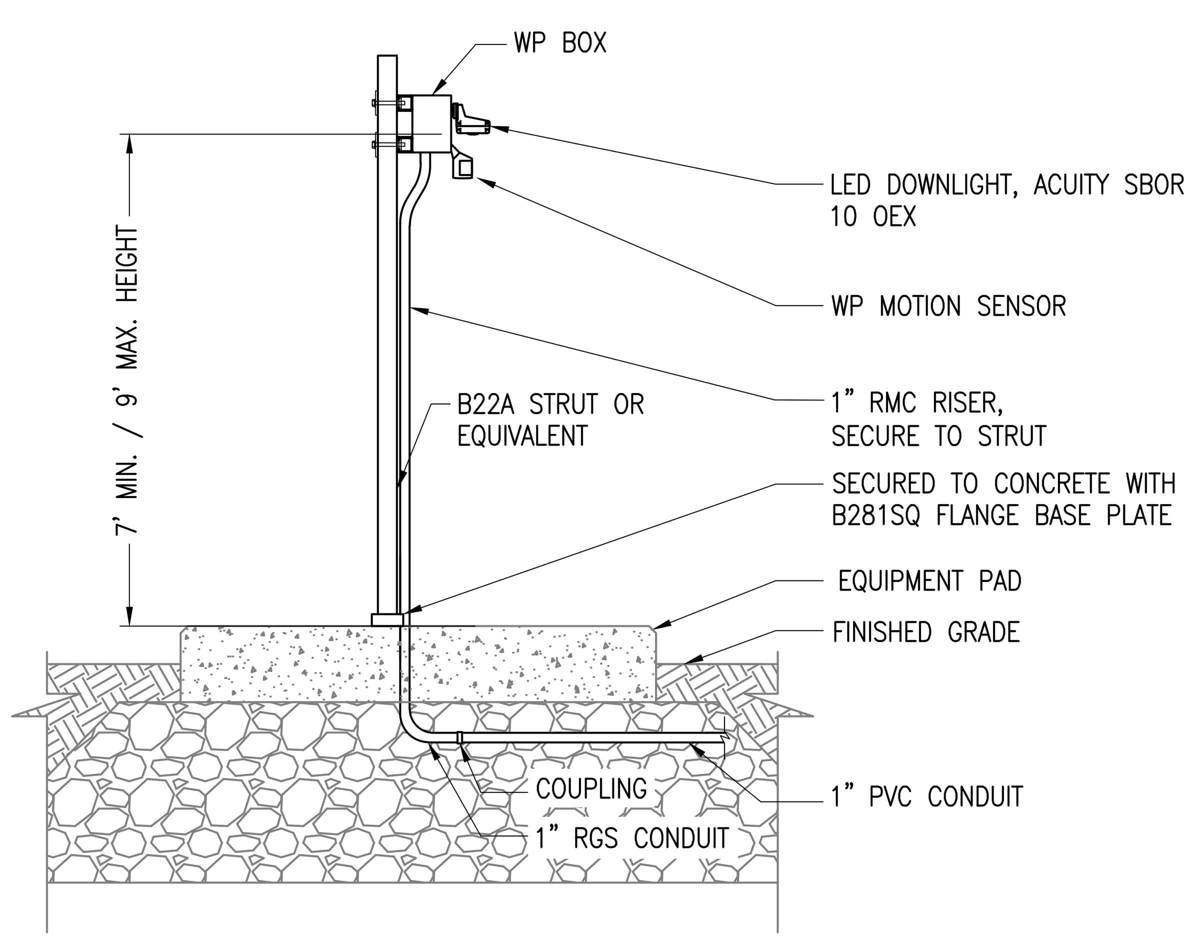
SCALE: NTS
XD_CIVIL_D_HDPE DRAIN PIPE BEDDING 06-28-2016



NOTES:
1. MAXIMUM DRAINAGE AREA ≤ 2 ACRES
2. USE 6" RIP-RAP
3. H=24" MAX @ CENTER
4. RIP-RAP SHALL BE PLACED ON A FILTER FABRIC FOUNDATION
5. INSTALL 6" DEEP CUT-OFF TRENCH BELOW
6. EXTEND THE STONE A MINIMUM OF 1.5' BEYOND THE DITCH BANKS TO PREVENT CUTTING AROUND THE DAM

1 RIP-RAP CHECK DAM

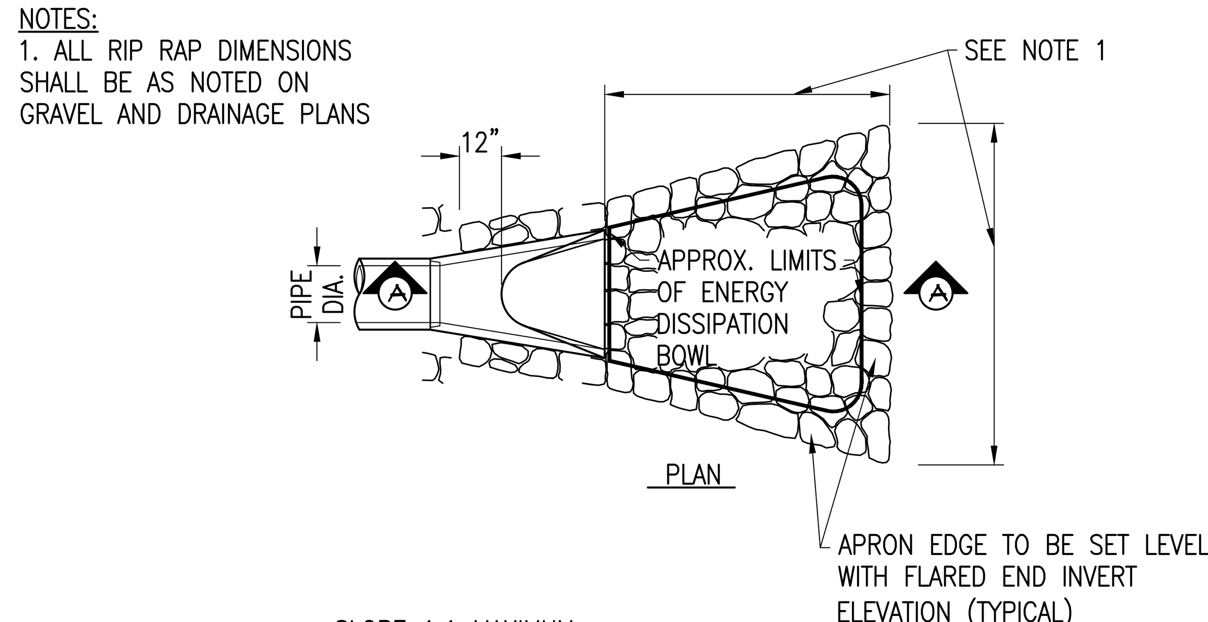
SCALE: N.T.S.
XD_CIVIL_CHECK DAM 08-15-2016

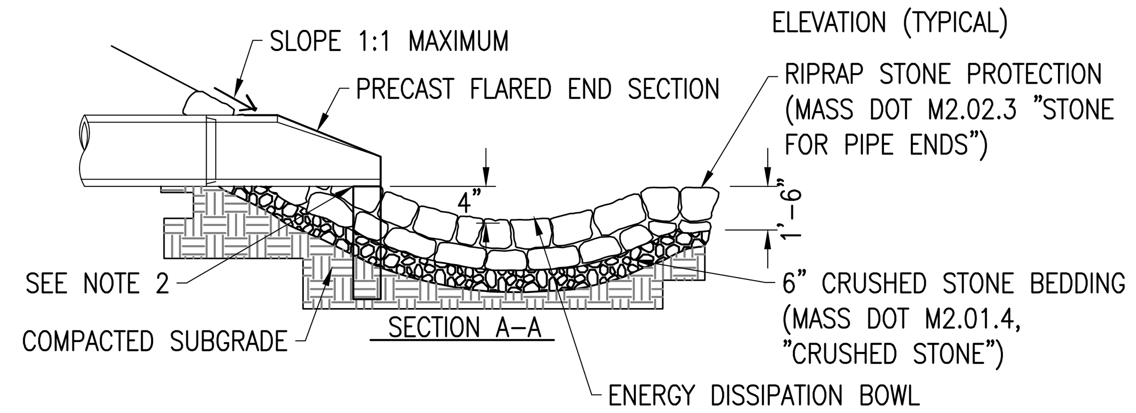


8 LIGHTING MOUNTING - DOWNLIGHT

SCALE: NTS
XD_ELEC_ LIGHT MOUNTING-DOWNLIGHT 2018-06-22 JPL

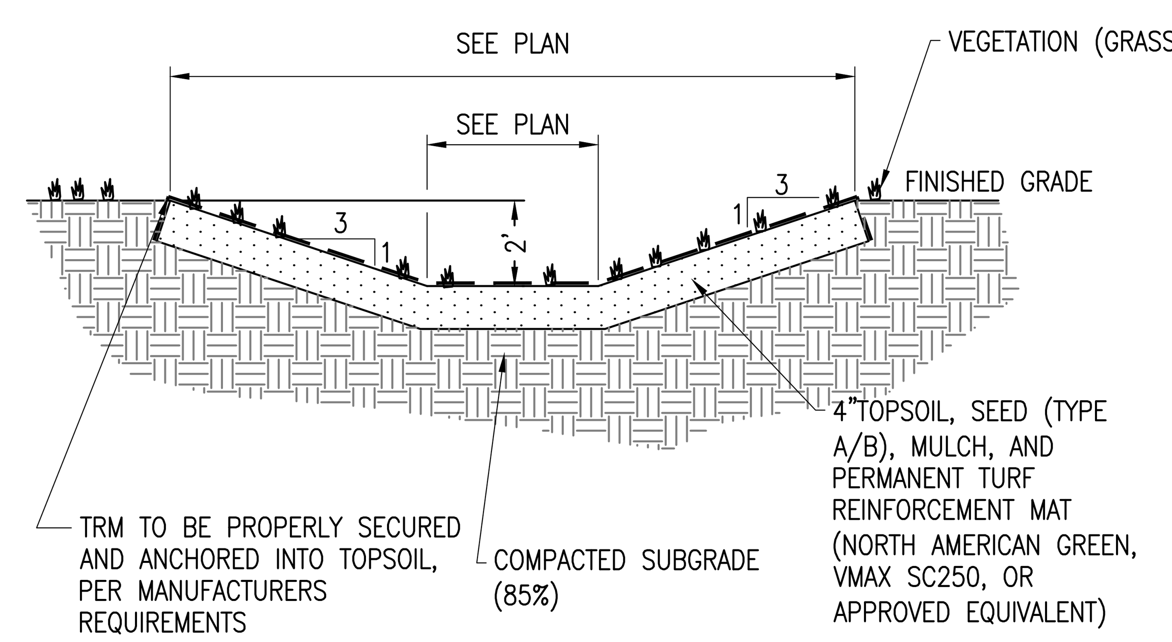
NOTES:
1. ALL RIP RAP DIMENSIONS SHALL BE AS NOTED ON GRAVEL AND DRAINAGE PLANS





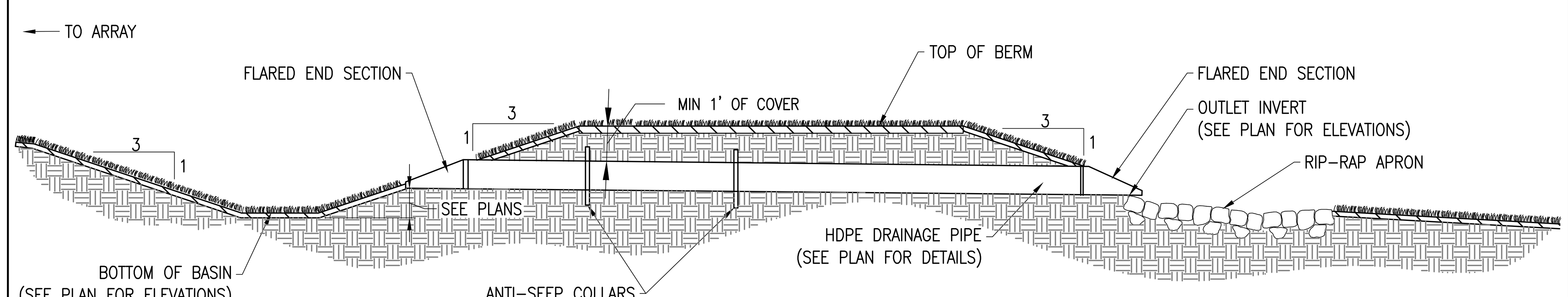
4 FLARED END SECTION/RIP-RAP APRON

SCALE: NTS
XD_CIVIL_DRAINAGE_FLARED END SECTION RIP-RAP APRON 2016-08-15



2 VEGETATED OPEN SWALE

SCALE: NTS
XD_CIVIL_DRAINAGE_ROCK-LINED_SWALE 06-27-2016



3 INFILTRATION BASIN OUTLET

SCALE: NTS
XD_CIVIL_DRAINAGE_DETENTION BASIN WITH RISER 08-16-2018

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NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS
JEFFREY R. MURPHY
CIVIL
No. 51800
REGISTERED PROFESSIONAL ENGINEER
Jeffrey R Murphy
6/2/2020

SITE USE PLAN
140 TIHONET ROAD
WAREHAM, MA 02571

PROJECT NUMBER: 905-2708

REV	DATE	DRAWN	CHECKED	RELEASE LEVEL
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	05/07/20	WS	CDS	REVISIONS PER NEW FIELD DATA
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C-5.1
CIVIL DETAILS