CHASE ESTATES 3.9.22 SUBMITTAL PACKAGE

- Cover Letter to Bourne Zoning Board of Appeals
- Site plan set “Chase Estates” dated March 9, 2022
- Requested Waivers
- Drainage report “Chase Estates” dated March 9, 2022

Outback Engineering Incorporated

www.Outback-Eng.com

March 9, 2022

Bourne Zoning Board of Appeals
c/o James E. Beyer, Chairman
24 Perry Avenue
Bourne, MA 02532

RE: Revised Plans
Chase Estates at 230 Sandwich Road, MGL Ch. 40B Modification of Comp Permit No. 08-18

Dear Chairman Beyer and Board Members,

On behalf of the applicant, Chase Developers, we are submitting revised site plans for a 24-unit condominium with duplex homes and a common area with a pool, along with corresponding Drainage Report, and a waiver list all dated March 9, 2017; 10 sets of site plans and waiver list are attached, with 3 copies of the drainage report (PDF's will be provided electronically).

The revised plans have evolved from the January 18, 2022 Concept Condominium Plan that we discussed with the Board on January 19, and incorporate the following:

- Comments from Town Engineer Tim Lydon in a January 19, 2022 email and follow up from our meeting with him on February 1, 2022.
- Multiple discussions with MassDOT and the Fire Department culminating in the resolution of the road design to accommodate the ladder truck's turning movement onto Sandwich Road from the site driveway.

To address Mr. Lydon's comments, the plans include details as follows:
1. Demonstrate compliance for breakout elevations for the septic leaching area at existing house where we are planning to remove the existing house foundation and surrounding disturbed soils to create a flat area, and then install system for 4 units. Refer to detail sheet 11 for a septic system profile showing the breakout elevations as well as other system details.

2. Sediment and Erosion Control Plan during construction has been updated to include:
a. detailed Construction Sequence notes are provided on sheet 2 (see Part 2) and referenced on the Sediment & Erosion Control Plan (sheet 7) where additional ESC notes are provided (see note 9, where cut slope along station 2+0 to 5+0 approx. are to be stabilized within 14 days; jute mesh or coconut fiber rolls on 2:1 cut slopes are specified to stabilize soils quickly).
b. a Construction Period Operation and Maintenance Plan is included in the Drainage Report, Appendix J (this is in lieu of a Stormwater Pollution Prevention Plan where this site is all upland with no stormwater discharges to waters of the U.S. – no EPA NPDES permit required).
c. As a condition of approval, an Erosion Control Monitor could be hired by the developer to provide periodic inspections prior to heavy rains and otherwise as needed during construction.

3. Water main connection through the site to connect between Sandwich Road and Bosun's Lane will not provide any driveway connectivity to residents of Bosun's.

4. Where an 11% road grade is proposed from approximate station 1+50 to 4+50 to minimize more severe cuts on the existing slopes, safety improvements were added to the plans include posting "Caution Steep Grade" sign at the top of the hill, a guardrail is provided along the left driveway shoulder between station 0+50 and 2+75, and a larger centerline road radius (R= 200') was incorporated for the curve at approximate station 1+50 to 2+50 to make the downgrade transition easier.

5. We discussed the proposed 20' roadway pavement with 12" Cape Cod berms and 1 sidewalk at 4' wide with no grass strip would be sufficient with the additional measures outlined above, and including resolution of the Fire Department turning radius issue.

To resolve the emergency vehicle turning radius onto Sandwich Road, we had a number of discussions with MassDOT explaining the requirements that the Fire Department was requesting per 527 CMR fire regulations. However, it became apparent that they would not issue a MassDOT access permit for any entrance configuration other than a maximum 24' wide road and R=30' radii. These dimensions did not allow the Fire Department's largest vehicle (a ladder truck) to make the northbound turn out of the site driveway onto Sandwich Road without crossing into the proposed left-hand turn lane which was in conflict with the Fire Department regulations at 527 CMR. Therefore, MassDOT suggested that the left-hand turn lane they previously suggested could be eliminated, and that the existing striped median could remain so that the Fire truck will not cross into an opposing lane of travel (there will be a break in the median where vehicles cross Sandwich Road to exit the site heading southbound, and turn into the site from the southbound travel lane). The plans have been updated to reflect this change, where the site driveway will intersect Sandwich Road with a 24' width that tapers down to 20' wide at approximate station 2+80.

We look forward to meeting again with the Board on March 16, 2022. Should you have any comments or questions in the meantime, please contact me at (508) 946-9231 or email jpavlik@outback-eng.com.

Sincerely,
OUTBACK ENGINEERING, INC.

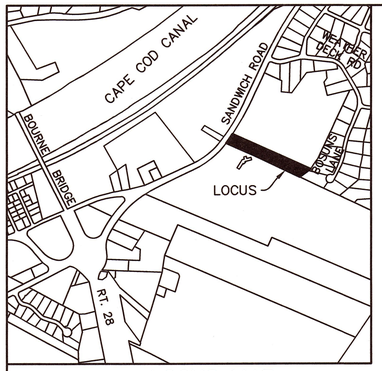
James A. Pavlik

James A. Pavlik, P.E.
Project Manager, Principal

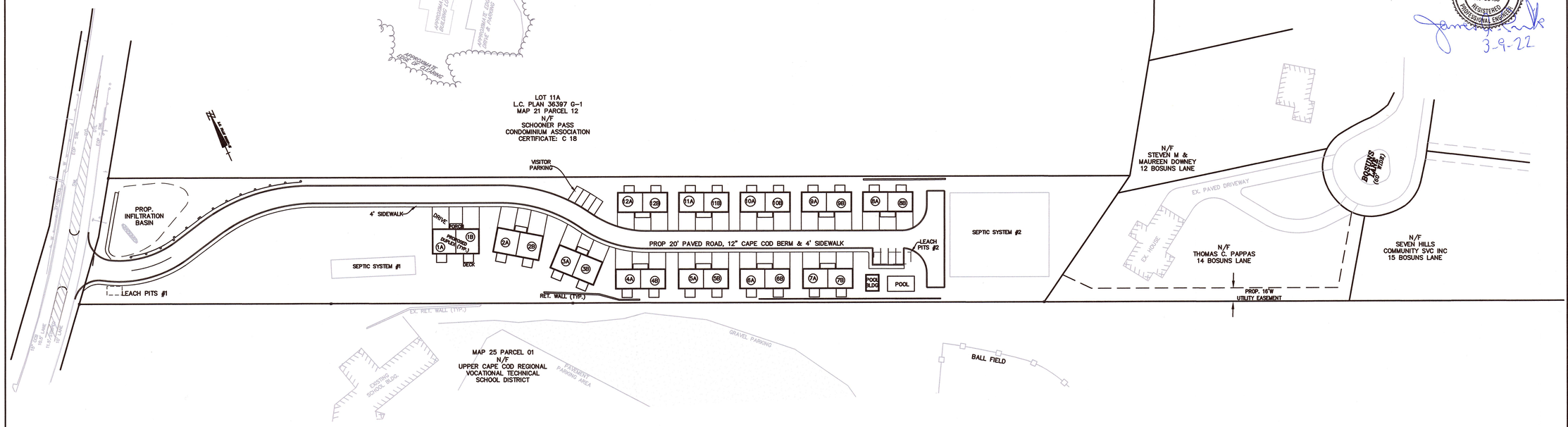
cc : Tom Pappas, Chase Developers
Drew Hoyt
Tim Lydon. Town Engineer
Dave Pelonzi, Bourne Fire

" CHASE ESTATES "

A PROPOSED RESIDENTIAL SUBDIVISION IN BOURNE, MASSACHUSETTS



LOCUS MAP
SCALE: 1" = 1000'



PROJECT SUMMARY

PROPOSED USE: 24 CONDOMINIUM HOMES (24 DUPLEX BUILDINGS, PERMITTED THROUGH MGL CH. 40B, SECTION 20-23
PARKING SUMMARY: 24 HOMES W/ 2-CAR GARAGES + 2 DRIVEWAY SPACES = 96 SPACES
VISITOR PARKING SPACES = 8 SPACES
TOTAL PARKING PROVIDED = 104 SPACES (ALL SPACES 9'X19' MIN, EXCEPT UNITS 8B AND 12A HAVE 1 DRIVEWAY SPACE 9'X16')

WATER AND SEWAGE DESIGN FLOW PER TITLE 5
24 DUPLEX UNITS X 3 BEDROOMS X 110 GPD/BEDROOM = 7,920 GPD

BOURNE TOWN GOVERNMENT/ UTILITY CONTACTS

POLICE DEPT. 35 ARMORY RD P: 508-759-4420 F: 508-759-4454	BUILDING DEPARTMENT 24 PERRY AVE P: 508-759-0615 F: 508-759-0679	CONSERVATION COMMISSION 24 PERRY AVE P: 508-759-0615 F: 508-759-0679
FIRE DEPT. 51 MEETINGHOUSE LANE P: 508-759-4412 F: 508-759-4411	DEPARTMENT OF PUBLIC WORKS 35 ERNEST VALERI RD. P: 508-759-0600 F: 508-759-0617	PLANNING BOARD 24 PERRY AVE P: 508-759-0600 F: 508-759-0679
BOURNE WATER DISTRICT 211 BARLOWS LANDING RD. P: 508-563-2294	BOARD OF HEALTH 24 PERRY AVE P: 508-759-0615 F: 508-759-0679	ZONING BOARD OF APPEALS 24 PERRY AVE P: 508-759-0600 EXT. 1342

PLAN INDEX

SHEET	DESCRIPTION
1	INDEX SITE PLAN
2	LEGEND & GENERAL NOTES
3	EXISTING CONDITIONS
4	GRADING & DRAINAGE PLAN
5	UTILITY PLAN & ROAD PROFILE
6	LAYOUT & MATERIALS PLAN
7	EROSION SEDIMENTATION & CONTROL PLAN
8	EMERGENCY VEHICLE TURNING MOVEMENT PLAN
9-11	CONSTRUCTION DETAILS

FOR REGISTRY USE ONLY

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

COMMONWEALTH OF MASSACHUSETTS — JEFFREY D. YOUNGQUIST — No. 37742 — PROFESSIONAL LAND SURVEYOR

3-9-22
DATE PROFESSIONAL LAND SURVEYOR

COMMONWEALTH OF MASSACHUSETTS — JAMES A. PAVLIK — CIVIL — No. 38488 — REGISTERED PROFESSIONAL ENGINEER

3-9-22

APPROVED SUBJECT TO TERMS AND CONDITIONS OF A COMPREHENSIVE PERMIT PER ZONING BOARD OF APPEALS DECISION AS AUTHORIZED BY CHAPTER 40B OF THE MASSACHUSETTS GENERAL LAWS, SECTION 20-23

DATE: _____

BOURNE ZONING BOARD

I CERTIFY THAT 20 DAYS HAVE ELAPSED SINCE ZONING BOARD APPROVAL, AND THAT NO APPEAL HAS BEEN FILED AT THIS OFFICE.

TOWN CLERK – TOWN OF BOURNE

REVISIONS

NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

APPLICANT
CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

SITE PLAN
"CHASE ESTATES"
SUBDIVISION
AT
230 SANDWICH ROAD
IN
BOURNE
MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
www.outback-eng.com

DATE: MARCH 9, 2022
DRAWN BY: KAD | CHECKED BY: JAP
SCALE: 1"=60' | SHEET 1 OF 11

0' 60' 120' 180'

OE-3294A

GENERAL NOTES

PART 1 – TOPOGRAPHIC AND PROPERTY LINE INFORMATION

A. PROPERTY LINE & TOPOGRAPHIC SURVEY REFERENCES:
1. "CHASE ESTATES 40B SITE PLAN SUBMISSION" AT 230 SANDWICH ROAD BOURNE, MA. PREPARED BY HIGHPOINT ENGINEERING INC. FOR CHASE DEVELOPERS, INC.
2. THE TOPOGRAPHY SHOWN HEREON IS BASED ON FIELD SURVEY BY OUTBACK ENGINEERING IN JANUARY 2021.
3. VERTICAL ELEVATIONS ARE BASED ON NAVD88. HORIZONTAL DATUM IS BASED ON NAD83.

B. THE SITE IS LOCATED WITHIN AN AREA OF MINIMAL FLOOD HAZARD ZONE X, DEPICTED ON FIRM MAP 25001C0502J AND 25023C0237K, EFFECTIVE DATE JULY 16, 2014.

C. SITE IS NOT LOCATED WITHIN A ZONE II OR IWPA GROUNDWATER RESOURCE PROTECTION AREA. SITE IS NOT LOCATED WITHIN A ZONE A, B, OR C SURFACE WATER PROTECTION AREA.

D. THE SITE IS NOT LOCATED WITHIN A NATURAL HERITAGE AND ENDANGERED SPECIES PROGRAM (NHESP) PRIORITY HABITAT OF RARE SPECIES OR WITHIN AN NHESP ESTIMATED HABITAT OF RARE WILDLIFE PER THE LATEST ON-LINE MASSGIS MAPPING INFORMATION.

E. THE SITE IS NOT LOCATED WITHIN A STATE DESIGNATED AREA OF CRITICAL ENVIRONMENTAL CONCERN.

F. EXISTING UTILITIES DEPICTED HEREON ARE A COMPILATION OF THE FIELD SURVEY AND BEST AVAILABLE INFORMATION AND IS NOT WARRANTED TO BE CORRECT OR THAT ALL UTILITIES ARE SHOWN. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO NOTIFY ALL UTILITY COMPANIES AND AGENCIES PRIOR TO CONSTRUCTION FOR THE LOCATION OF UNDERGROUND UTILITIES. CONTRACTOR SHALL NOTIFY DIGSAFE (811) AT LEAST 72 HOURS PRIOR TO THE ONSET OF ANY CONSTRUCTION TO HAVE ALL EXISTING UTILITIES LOCATED AND CLEARLY MARKED.

G. THIS PLAN IS THE SUBJECT OF A COMPREHENSIVE PERMIT UNDER M.G.L. C.40B, SECTIONS 20-23.

H. NO KNOWN PUBLIC OR COMMUNITY WATER SUPPLY WELLS ARE WITHIN 100' OF THE SUBJECT PROPERTY.

I. SITE HAS TOWN WATER, ELECTRIC, CABLE & GAS SERVICE AVAILABLE IN SANDWICH ROAD. ALL UTILITIES FOR THE PROJECT SHALL BE INSTALLED UNDERGROUND.

PART 2 – EXECUTION

2.1 – DEMOLITION, SEDIMENTATION, AND EROSION CONTROL

A. THE FIRST STAGE INVOLVES ACTIVITIES NEEDED TO ADDRESS STORMWATER MANAGEMENT, EXCAVATING MATERIAL DESIGNATED FOR OFF-SITE REMOVAL OR ON-SITE RELOCATION AND FENCING SELECTED AREAS. STAGE ONE WILL PREPARE SITE FOR CONVENTIONAL CONSTRUCTION.

B. THE SECOND STAGE WILL CONSIST OF ROUTINE CONSTRUCTION INVOLVING ROADWAY CONSTRUCTION, UTILITY INSTALLATION, BUILDING, AND LANDSCAPING.

C. THERE ARE GENERAL PHASES OF CONSTRUCTION. IN EACH PHASE OF CONSTRUCTION, IMPLEMENT STANDARD EROSION AND SEDIMENT CONTROL PRACTICES PRIOR TO INITIATING EARTH DISTURBING ACTIVITIES, AND MAINTAIN THESE PRACTICES THROUGHOUT THE COURSE OF CONSTRUCTION.

D. DURING DEMOLITION, EXCAVATIONS AS MUCH AS 15 FEET MAY BE REQUIRED FOR THE INSTALLATION OF FOUNDATIONS AND UTILITIES. EXCAVATIONS SHALL BE CUT TO A STABLE SLOPE OR BE TEMPORARILY BRACED, DEPENDING ON THE EXCAVATION DEPTHS AND THE ENCOUNTERED SUBSURFACE CONDITIONS. THE CONTRACTOR MAY BE REQUIRED TO SUBMIT EXCAVATION AND SLOPE STABILIZATION METHODS PRIOR TO THE START OF CONSTRUCTION TO THE ENGINEER FOR REVIEW.

E. BASED ON THE COMPOSITION OF SOILS ENCOUNTERED DURING THE EXPLORATION PROGRAM, SITE SOILS ARE GENERALLY CLASSIFIED AS TYPE A SOILS AS DEFINED BY USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS). TEMPORARY CONSTRUCTION SLOPES SHOULD BE DESIGNED IN STRICT COMPLIANCE WITH THE MOST RECENT GOVERNING REGULATIONS. STOCKPILES SHOULD BE PLACED WELL AWAY FROM THE EDGE OF THE EXCAVATION AND THEIR HEIGHT SHOULD BE CONTROLLED TO PREVENT SURCHARGE TO THE SIDES OF THE EXCAVATION. SURFACE DRAINAGE SHOULD BE CONTROLLED TO AVOID FLOW OF SURFACE WATER INTO THE EXCAVATIONS.

F. CONSTRUCTION SLOPES SHOULD BE REVIEWED FOR MASS MOVEMENT. IF POTENTIAL STABILITY PROBLEMS ARE OBSERVED, WORK SHOULD CEASE AND A GEOTECHNICAL ENGINEER SHOULD BE CONTACTED IMMEDIATELY. THE RESPONSIBILITY FOR EXCAVATION SAFETY AND STABILITY OF TEMPORARY CONSTRUCTION SLOPES SHOULD LIE SOLELY WITH THE CONTRACTOR.

G. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION AND MAINTENANCE OF EROSION CONTROL MEASURES SHOWN ON THIS PLAN AND ANY ADDITIONAL MEASURES AS MAY BE NECESSARY OR REQUIRED THROUGHOUT CONSTRUCTION, UNTIL FINAL SURFACE FINISHES HAVE BEEN ESTABLISHED AND ACCEPTED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTROL EROSION AND SEDIMENTATION. IT IS INTENDED THAT THE IMPLEMENTATION OF THE MEASURES SHOWN ON THESE PLANS WILL MEET THIS GOAL. WHEN IT IS CLEAR TO THE DESIGNER THAT EROSION AND SEDIMENTATION HAVE BEEN ADEQUATELY CONTROLLED WITHOUT THE IMPLEMENTATION OF EVERY MEASURE, ADDITIONAL MEASURES NEED NOT BE IMPLEMENTED. ALTERNATIVELY, IF ALL OF THE MEASURES HAVE BEEN IMPLEMENTED AND THE CONTROL OF EROSION AND SEDIMENTATION IS INADEQUATE, THE CONTRACTOR MUST EMPLOY SUFFICIENT SUPPLEMENTAL MEASURES BEYOND THE SCOPE OF THIS PLAN.

H. REFER TO THE EROSION AND SEDIMENT CONTROL PLAN THAT IS PART OF THIS PLAN SET. THE GENERAL CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR PERIODIC INSPECTIONS AND MAINTENANCE OF THE INSTALLED EROSION CONTROL MEASURES, AND SHALL DOCUMENT THE INSPECTIONS AND REMEDIAL MEASURES THAT MAY BE REQUIRED FROM TIME TO TIME USING A CONSTRUCTION PERIOD OPERATION AND MAINTENANCE LOG FORM (SEE DRAINAGE REPORT, APPENDIX J).

2.2 – TYPICAL PRACTICES TO BE APPLIED TO THE SITE INCLUDE THE FOLLOWING (SEE ESC PLAN ALSO):

A. PRIOR TO EARTH DISTURBANCE IN ANY WORK AREA, INSTALL EROSION CONTROL BARRIERS BETWEEN THE WORK AREA AND THE SURFACE WATER RESOURCE TO WHICH IT DRAINS, IF PRESENT, OR TO PROTECT OFF-SITE AREAS.

B. DISCHARGE WATER FROM DEWATERING OPERATIONS TO A TEMPORARY SILTATION TRAP OR SEDIMENTATION BASIN.

C. PROVIDE TEMPORARY BERMS AND SWALES TO DIVERT SURFACE WATER AWAY FROM THE AREAS THAT WILL BE EXPOSED BY CONSTRUCTION ACTIVITY TO MINIMIZE THE AMOUNT OF SURFACE WATER COMING INTO CONTACT WITH EXPOSED SOILS. PROVIDE STABLE OUTLETS FOR THESE DEVICES, AND LINE OR VEGETATE THESE DIVERSIONS TO PROVIDE FOR THEIR STABILITY DURING CONSTRUCTION.

D. LIMIT THE EXTENT OF EXPOSED SOILS TO AREAS THAT CAN BE WORKED AND RESTABILIZED WITHIN THE CONSTRUCTION SEASON AND DURING THE SPECIFIC CONSTRUCTION PHASE.

E. WHEN EARTHWORK CONSTRUCTION ACTIVITY IN AN AREA IS COMPLETE, STABILIZE THE AREA WITH A SUITABLE SURFACE AS DESCRIBED BELOW.

F. IN ADDITION TO THESE PRACTICES, FOLLOW THE SPECIAL PRACTICES DESCRIBED BELOW. COMPLY WITH THE DIRECTIONS OF THE APPLICANT'S REPRESENTATIVE TO ADDRESS EROSION AND SEDIMENTATION CONDITIONS THAT MAY ARISE ON A CASE BY CASE BASIS DURING CONSTRUCTION.

G. THE FOLLOWING IS A DESCRIPTION OF MINIMUM CONSTRUCTION REQUIREMENTS AND DOES NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITIES WITH REGARD TO DETERMINING THE ADEQUACY OF MEANS AND METHODS OF CONSTRUCTION.

2.3 – CONSTRUCTION SEQUENCING

A. SEQUENCING SHALL BE AS SHOWN ON THE PLAN AND AS DICTATED BY THE REQUIREMENTS OF CONSTRUCTION.

B. THE FOLLOWING ARE GENERAL GUIDELINES FOR CONTRACTOR TO FOLLOW. REFER TO EROSION AND SEDIMENT CONTROL PLAN AND COMPREHENSIVE PERMIT FOR OTHER SPECIFIC REQUIREMENTS.

1.) CLEAR TREES TO LIMIT OF WORK SHOWN.
2.) INSTALL EROSION CONTROL BARRIER (ECB) AROUND WORK AREA AS SHOWN.
- CLEAR AND GRUB THE SITE.
- INSTALL STONE ENTRANCE PAD (SEE DETAIL)
- INSTALL STRAW WATTLES ACROSS STONE ENTRANCE PAD AT NIGHT AND PRIOR TO RAIN EVENTS
- INSTALL ECB AND SEDIMENT TRAPS PER PLANS. PRIOR TO EARTH DISTURBANCE IN ANY WORK AREA, INSTALL ECB BETWEEN THE WORK AREA AND THE SURFACE WATER RESOURCE AREA (IF PRESENT) OR DOWNGRADIENT AREAS.

3.) WHEN WORK SITE IS GRADED TOWARDS ROADWAY AND/OR PROPERTY LINES, ECB ARE TO BE PLACED AT PAVEMENT EDGE/PROPERTY LINE, AS NECESSARY DURING CONSTRUCTION.
- MAINTAIN ALL EROSION CONTROL BARRIERS DURING CONSTRUCTION, UNTIL SOILS ARE STABILIZED.
- DUE TO THE PRESENCE OF RELATIVELY STEEP 2:1 SLOPES ON THE SOUTH SIDE OF THE PROPOSED ROAD UP TO STATION 4+0 APPROXIMATELY (i.e. WEST OF BUILDING #1), CONTRACTOR SHALL BE REQUIRED TO STABILIZE THE CUT SLOPE ALONG THE ROAD SHOULDER WITHIN 14 DAYS OF COMMENCING EARTHWORK ACTIVITIES AS SHOWN ON THE LANDSCAPE PLAN AND EROSION AND SEDIMENT CONTROL PLAN.

4.) CONTRACTOR TO USE STREWN STRAW OR STUMP GRINDINGS ATOP BARE SOILS AS NECESSARY TO MINIMIZE POTENTIAL EROSION, AS NECESSARY DURING CONSTRUCTION.
5.) CONTRACTOR MAY UTILIZE ADDITIONAL EROSION CONTROL MEASURES AS NECESSARY, SUCH AS BUT NOT LIMITED TO HAY BALES, STRAW WATTLES, CRUSHED STONE, EARTHEN BERMS, AND ADDITIONAL SEDIMENT TRAPS TO CONTAIN SOILS ON SITE. MODIFICATIONS MAY BE IMPLEMENTED AS CONSTRUCTION PROGRESSES, AS NECESSARY DURING CONSTRUCTION.
6.) CONTRACTOR TO DEMOLISH EXISTING STRUCTURES, AND CONSTRUCT ROADWAY, PARKING, UTILITIES AND OTHER INFRASTRUCTURE PER SCHEDULE BY OWNER. CONSTRUCTION OF ROADWAY SHALL FOLLOW BOURNE SUBDIVISION REGULATION 361.a-e, PERTAINING TO SCHEDULE OF WORK.
7.) DEVELOPER TO CONSTRUCT DUPLEX HOMES WITH INDIVIDUAL SEPTIC SYSTEMS ON LOTS 1-12.
8.) COMPLETE LANDSCAPING, FINISH GRADING AND ROADWAY. CLEAN UP SITE AND STABILIZE ALL DISTURBED AREAS.
9.) CONTRACTOR SHALL MAINTAIN ALL EROSION CONTROL MEASURES DURING CONSTRUCTION UNTIL SITE IS FINISH LANDSCAPED AND SOILS ARE STABILIZED.

2.4 – MAINTENANCE

A. DURING THE PERIOD OF CONSTRUCTION AND/OR UNTIL LONG TERM VEGETATION IS ESTABLISHED, SEEDED AREAS WILL BE FERTILIZED AND RESEEDED AS NECESSARY TO INSURE VEGETATION ESTABLISHMENT.

B. TEMPORARY SEDIMENTATION TRAPS WILL BE CHECKED AFTER EACH SIGNIFICANT RAINFALL AND CLEANED AS NEEDED TO RETAIN STORAGE CAPACITY.

C. TEMPORARY DRAINAGE SWALES AND BERMS WILL BE CHECKED WEEKLY AND REPAIRED WHEN NECESSARY.

D. THE EROSION CONTROL BARRIERS AND OTHER EROSION AND SEDIMENT CONTROL MEASURES/DEVICES SHALL BE INSPECTED, CLEANED, REPLACED AND/OR REPAIRED AS NECESSARY, PERIODICALLY AND AFTER EACH SIGNIFICANT RAINFALL.

E. SWEEP ON-SITE PAVED AREAS AND OFF-SITE STREETS AS NECESSARY TO PREVENT SILT AND DEBRIS ORIGINATING ON-SITE FROM ENTERING CLOSED DRAINAGE SYSTEMS AND/OR ENVIRONMENTALLY SENSITIVE AREAS. WHEN NECESSARY UTILIZE WATER SPRAYING, SURFACE ROUGHENING AND/OR APPLY POLYMERS, SPRAY-ON TACKIFIERS, CHLORIDES AND BARRIERS FOR DUST CONTROL.

F. THE OPERATION AND MAINTENANCE (O&M) SCHEDULE DURING THE CONSTRUCTION PHASE IS THE RESPONSIBILITY OF THE OWNER AND/OR SITE CONTRACTOR. THE OUTLINE BELOW SHALL BE ADHERED TO AS CLOSELY AS POSSIBLE TO ENSURE THE PROPER CONSTRUCTION AND FUNCTION OF THE DRAINAGE SYSTEM. CONTRACTOR SHALL BE REQUIRED TO INSPECT EROSION CONTROLS PERIODICALLY AND TO DOCUMENT COMPLIANCE BY COMPLETING CONSTRUCTION PERIOD O&M LOG FORMS (SEE DRAINAGE REPORT, APPENDIX j).

1. PRIOR TO CONSTRUCTION, EROSION CONTROLS (ECB) SHALL BE INSTALLED PER THE APPROVED PLANS. ECB SHALL BE INSPECTED PRIOR TO A LARGE STORM EVENT TO ENSURE THAT THE EROSION CONTROL WILL FUNCTION AS REQUIRED AND FOLLOWING A STORM TO INSPECT FOR DAMAGE TO THE EROSION CONTROL ELEMENTS. ANY DAMAGE OR IMPROPER INSTALLATION THAT IS NOTICED PRIOR TO OR FOLLOWING A STORM EVENT SHALL BE PROMPTLY REPLACED OR REPAIRED IN A SATISFACTORY MANNER SO AS TO PREVENT SEDIMENT FROM BYPASSING THE EROSION CONTROL BARRIER.
2. IN CONJUNCTION WITH THE SITE CONSTRUCTION, ALL DRAINAGE STRUCTURES INCLUDING CATCH BASIN, WATER QUALITY INLET, SUBSURFACE INFILTRATION STRUCTURES, AND THE INFILTRATION BASIN SHALL BE CONSTRUCTED AND STABILIZED AS SOON AS POSSIBLE. CATCH BASINS SHALL BE PROTECTED WITH SILT SACKS AS SHOWN.
3. THE CATCH BASINS AND WATER QUALITY TANK SHALL BE INSPECTED WEEKLY DURING CONSTRUCTION. ANY SEDIMENT BUILDUP OF EIGHT (8) INCH DEPTH IN ANY OF THE STRUCTURES SHALL BE PROMPTLY REMOVED BY HAND OR MECHANICAL METHODS AND ALL DEBRIS REMOVED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS.
   - PROTECT CATCH BASIN AND WATER QUALITY TANK INLETS FROM RECEIVING SEDIMENT-LADEN STORM RUNOFF THAT MAY CLOG UNDERGROUND LEACHING SYSTEMS BY GRADING GRAVEL SUBBASE AWAY FROM THESE INLETS PRIOR TO PAVING.
4. THE SITE SHALL BE INSPECTED WEEKLY OR AFTER ALL RAINFALL EVENTS GREATER THAN 1/2 INCH, WHICHEVER OCCURS SOONER. ANY EROSION SHALL BE FILLED AND RESTABILIZED IN A MANNER TO PREVENT FUTURE EROSION.

2.5 – GENERAL

A. ALL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE CONSTRUCTED IN ACCORDANCE WITH MASSACHUSETTS GUIDELINES AND ALL LOCAL, COUNTY AND MUNICIPAL REGULATIONS.

B. EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE IN PLACE PRIOR TO THE COMMENCEMENT OF ANY SITE WORK OR EARTHWORK OPERATIONS, SHALL BE MAINTAINED DURING CONSTRUCTION, AND SHALL REMAIN IN PLACE UNTIL ALL SITE WORK IS COMPLETE AND GROUNDCOVER IS ESTABLISHED.

C. ALL WORK SHALL BE IN ACCORDANCE WITH THE PERMITS AND APPROVALS ISSUED AND THE CONSTRUCTION SPECIFICATIONS. BLASTING IS PROHIBITED ON THE PROJECT SITE.

D. STOCKPILES SHALL BE SURROUNDED ON THEIR PERIMETERS WITH STAKED STRAW WATTLES AND/OR SILTATION FENCES TO PREVENT AND/OR CONTROL SILTATION AND EROSION.

E. TOPS OF STOCKPILES SHOULD BE COVERED IN SUCH A MANNER THAT STORMWATER DOES NOT INFILTRATE THE MATERIALS AND THEREBY RENDER THE SAME UNSUITABLE FOR FILL USE.

F. ALL DISTURBED OR EXPOSED AREAS SHALL BE PERMANENTLY STABILIZED WITHIN FIVE (5) BUSINESS DAYS OF COMPLETION OF CONSTRUCTION OF A GIVEN AREA. EXPOSED AREAS WHERE NO WORK HAS OCCURRED FOR FOURTEEN (14) DAYS SHALL BE TEMPORARILY STABILIZED WITH HYDROSEED OR OTHER APPROVED METHOD.

G. THE LOCATION OF TEMPORARY DRAINAGE SWALES AND SEDIMENTATION TRAPS ARE APPROXIMATE ONLY AND SHALL BE RELOCATED AS REQUIRED AS CONSTRUCTION PROGRESSES.

H. HAYBALE DIKES SHALL BE CONSTRUCTED AT ALL EXISTING & PROPOSED CATCH BASINS LOCATED IN FILL AREAS & SUBJECT TO STORMWATER RUN-OFF FROM PROPOSED FILL AREAS DURING CONSTRUCTION, OR AS DIRECTED BY THE OWNER'S REPRESENTATIVE. NO SEDIMENTS SHALL ENTER THE ON-SITE OR OFF-SITE DRAINAGE SYSTEMS AT ANY TIME.

I. CULVERT/PIPE INLETS AND OUTFALLS SHALL BE PROTECTED BY STRAW WATTLE FILTERS UNTIL DISTURBED AREAS ARE PERMANENTLY STABILIZED.

J. EROSION CONTROLS SHALL BE PERIODICALLY INSPECTED AND REPLACED AS REQUIRED.

K. ALL PROPOSED NON-RIPRAP SLOPES STEEPER THAN 3:1 SHALL BE STABILIZED WITH EXCELSIOR BLANKETS OR OTHER EROSION CONTROL COVERINGS AND PROTECTED FROM EROSION.

L. THE CONTRACTOR SHALL KEEP ON SITE AT ALL TIMES ADDITIONAL STRAW WATTLES AND EXTRA SILTATION FENCING FOR INSTALLATION AT THE DIRECTION OF THE OWNER'S REPRESENTATIVE OR LOCAL OFFICIALS TO MITIGATE ANY EMERGENCY CONDITION.

M. DISPOSAL OF ALL DEMOLISHED MATERIALS IS THE RESPONSIBILITY OF THE CONTRACTOR AND MUST BE HAULED OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL MUNICIPAL REQUIREMENTS.

N. THE CONTRACTOR SHALL PROTECT AND/OR CAP OFF ALL EXISTING ON-SITE UTILITY SERVICES DESIGNATED AS SUCH ON THESE DRAWINGS.

O. THE LIMIT OF WORK LINE FOR THE AREA TO BE CLEARED AND GRUBBED SHALL BE THE SAME AS THE LIMIT OF WORK LINE NECESSARY FOR GRADING PURPOSES, (I.E., THE GRADING LIMITS AROUND THE PERIMETER OF THE PROJECT AREA).

P. THE AREA OR AREAS OF ENTRANCE AND EXIT TO AND FROM THE SITE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY.

Q. FOLLOWING THE ADDITION OF A BINDER COURSE, THE CONTRACTOR SHALL SWEEP ALL ON-SITE PAVEMENT, IF NECESSARY, UNTIL ALL SITE CONSTRUCTION IS COMPLETED.

R. THE MATERIALS AND METHODS USED IN THE CONSTRUCTION OF ROADWAYS SHALL CONFORM TO THE REQUIREMENTS OF "TOWN OF BOURNE CONSTRUCTION STANDARDS AND SPECIFICATIONS", AS MAY BEWAIVED BY THE COMPREHENSIVE PERMIT. WHEN NO CITY SPECIFICATION IS PROVIDED THE MATERIALS AND METHODS USED IN THE CONSTRUCTION OF ROADWAYS SHALL CONFORM TO THE REQUIREMENTS OF "THE COMMONWEALTH OF MASSACHUSETTS, DEPARTMENT OF PUBLIC WORKS, STANDARDS & SPECIFICATIONS FOR HIGHWAYS & BRIDGES," LATEST EDITION.

PART 3 – STORM DRAINS

A. STORM DRAIN PIPING (INDICATED BY LETTER "D") SHALL BE CONCRETE UNLESS ADS PLASTIC PIPE PROTECTED IS APPROVED BY THE BOARD. MINIMUM COVER FOR DRAINS SHALL BE 24". PIPING WITH 24" TO 36" COVER SHALL BE REINFORCED CONCRETE

B. ANY CATCHBASINS AND MANHOLES SHALL BE AT LEAST FOUR FEET INSIDE DIAMETER, WHERE CB's SHALL HAVE A 4 FT. OR GREATER SUMP BELOW PIPE INVERT. THEY SHALL BE CONSTRUCTED OF PRECAST CONCRETE UNITS, WITH A CONCRETE BASE OF AT LEAST 4" THICKNESS, PRECAST SEGMENTS OR POURED IN PLACE. ALL CATCHBASINS MUST BE HOODED. A CATCHBASIN TO MANHOLE CONFIGURATION SHALL BE USED. LEACHING CATCHBASINS WILL NOT NORMALLY BE ALLOWED. MANHOLE COVERS AND GRATES SHALL BE IN CONFORMANCE WITH MASSDOT SPECIFICATIONS, DESIGNED AND PLACED SO AS TO CAUSE NO HAZARD TO BICYCLES. NO STORM SEWER SHALL HAVE LESS THAN A 12" INSIDE DIAMETER.

C. COORDINATES OF MANHOLES REFER TO CENTERS OF STRUCTURES AND CATCH BASINS REFER TO THE CENTER BACK OF THE FRAME AND GRATE.

E. FLARED END SECTIONS (FES) SHALL BE RCP OR CORRUGATED POLYETHYLENE PIPE (HDPE) AS INDICATED, PER AASHTO M170 MANUFACTURED TO MEET ASTM C76, ADS N-12 OR APPROVED EQUAL

PART 4 – UTILITIES

4.1 – WATER DISTRIBUTION AND FIRE PROTECTION

A. ALL WATER MAIN APPURTENANCES, MATERIALS, AND METHODS OF INSTALLATION SHALL MEET OR EXCEED ALL LOCAL MUNICIPAL REQUIREMENTS OF THE BOURNE WATER DISTRICT (BWD)

B. GENERALLY, WATER MAIN FITTINGS IDENTIFIED ON THIS DRAWING ARE SHOWN FOR INSTALLATION LOCATION PURPOSES. THE CONTRACTOR IS ADVISED THAT NOT ALL FITTINGS AND SUPPLY LINES ARE NOTED, SHOWN, OR INDICATED.

C. WATER MAINS 3" DIA. AND LARGER SHALL HAVE 4'-6" MINIMUM COVER AND SHALL BE EITHER PLASTIC C900 OR CEMENT LINED DUCTILE IRON (CLDI), CLASS 52 MINIMUM, CONFORMING TO AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) A21.50, A21.4, A21.10 AND A21.51. JOINTS AT FITTINGS, VALVES AND HYDRANT LATERALS SHALL BE MECHANICAL JOINT PER ANSI A21.11, WITH GASKETS. JOINTS AT OTHER LOCATIONS SHALL BE PUSH-ON TYPE WITH GASKETS PER ANSI A21.11. ALL FITTINGS, VALVES, HYDRANTS AND CAPS SHALL BE CLASS 350 PROVIDED WITH THRUST RESTRAINTS (THRUST BLOCKS AND RETAINING RODS) IN CONFORMANCE WITH THE DETAILS.

D. ALL HYDRANTS SHALL BE INSTALLED WITH A 6" CLDI LATERAL AND SHALL BE INSTALLED WITH A 6" GATE VALVE, BOX, AND TEE FITTING. ALL HYDRANTS SHALL MEET AND BE INSTALLED IN ACCORDANCE WITH ALL LOCAL MUNICIPAL STANDARDS.

E. PRESSURE AND LEAKAGE TEST, DISINFECTION AND FLUSHING SHALL BE IN ACCORDANCE WITH ALL LOCAL MUNICIPAL STANDARDS AND REQUIREMENTS. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS IN CONNECTIONS WITH UTILITY TESTS, FLUSHING, AND INSPECTIONS AS REQUIRED BY THE LOCAL MUNICIPALITY.

F. EXISTING SERVICES SHALL BE CUT AND A WATERTIGHT PLUG SHALL BE INSTALLED. EXISTING GATE VALVES TO BE ABANDONED SHALL BE PERMANENTLY CLOSED AND CAPPED, AND WATER SERVICES SHOULD BE SHUT OFF AT THE MAIN CORPORATION.

4.2 – UTILITY SEPARATION

A. A MINIMUM 10 FEET CLEAR HORIZONTAL DISTANCE SHALL BE MAINTAINED BETWEEN SANITARY SEWER MAINS AND WATER MAINS. WHENEVER CONDITIONS PREVENT A LATERAL SEPARATION OF 10 FEET, THE WATER MAIN SHALL BE LAID IN A SEPARATE TRENCH AND THE ELEVATION OF THE CROWN OF THE SEWER SHALL BE AT LEAST 18 INCHES BELOW THE INVERT OF THE WATER MAIN.

B. A MINIMUM OF 18" VERTICAL CLEARANCE SHALL BE MAINTAINED WHERE WATER MAINS CROSS STORM DRAIN LINES, OR AS MAY BE APPROVED BY TOWN DPW AND BWD.

C. WHERE SANITARY SEWERS CROSS WATER MAINS, THE SEWER SHALL BE LAID AT SUCH AN ELEVATION THAT THE CROWN OF THE SEWER IS AT LEAST 18" BELOW THE INVERT OF THE WATER MAIN. IF THE ELEVATION OF THE SEWER CANNOT BE VARIED TO MEET THIS REQUIREMENT, THE CONTRACTOR SHALL DO THE FOLLOWING:

THE WATER MAIN SHALL BE RELOCATED TO PROVIDE THIS SEPARATION OR CONSTRUCTED WITH MECHANICAL-JOINT PIPE FOR A DISTANCE OF TEN FEET ON EACH SIDE OF THE SEWER. ONE FULL LENGTH OF WATER MAIN SHALL BE CENTERED OVER THE SEWER SO THAT BOTH JOINTS WILL BE AS FAR FROM THE SEWER AS POSSIBLE. IN ADDITION, THE WATER MAIN SHALL BE ENCASED IN CONCRETE.

D. PRIMARY ELECTRICAL ENCASED CONDUIT MUST BE SEPARATED FROM GAS BY 3' MIN. AND FROM OTHER UTILITIES BY 2' MINIMUM, OR AS REQUIRED BY THE LOCAL UTILITY COMPANY.

E. TELEPHONE AND FIRE ALARM WHICH SHARE THE SAME TRENCH MUST HAVE A 1' VERTICAL SEPARATION.

F. GAS MAINS MUST BE SEPARATED FROM OTHER UTILITIES BY 2' MINIMUM.

4.3 – ELECTRIC AND COMMUNICATIONS

A. INSTALLATION OF COMMUNICATIONS (TELEPHONE, CABLE AND FIRE ALARM) SYSTEMS SHALL BE COORDINATED AND SCHEDULED BY THE CONTRACTOR WITH THE APPROPRIATE UTILITY COMPANY SERVICING THE PROJECT SITE.

B. COORDINATES REFER TO THE CENTER OF STRUCTURES UNLESS OTHERWISE NOTED OR DETAILED. CONTRACTOR SHALL COORDINATE LIGHT BASE LOCATIONS WITH PROPOSED CURBING AND PARKING LOT STRIPING.

C. CONTRACTOR IS RESPONSIBLE FOR VERIFYING ELECTRICAL SERVICE PRIOR TO ORDERING ANY EQUIPMENT.

PART 5 – PAVEMENT AND CURBING

A. JOINTS BETWEEN NEW BITUMINOUS CONCRETE PAVEMENT AND SAWCUT EXISTING PAVEMENT SHALL BE SEALED WITH BITUMEN AND BACKSANDED.

B. CURBING SHALL BE INSTALLED AS FOLLOWS:

BITUMINOUS MODIFIED CAPE COD BERM ALONG ROADWAY.

C. DIMENSIONS REFER TO FACE OF CURB UNLESS NOTED OTHERWISE.

D. ALL LIMITS OF PAVING SHALL BE CURBED UNLESS NOTED OR DETAILED OTHERWISE.

PART 6 – TRAFFIC CONTROL

A. INCLUDING, BUT NOT LIMITED TO, ALL CROSSWALKS, STOP LINES AND LEGENDS.

- LEGENDS SHALL BE PREFORMED PERMANENT PLASTIC. PAVEMENT MARKINGS SHALL BE THERMO PLASTIC (ALKYD). THE MARKINGS, LEGENDS SHALL BE INSTALLED IN ACCORDANCE WITH THE THE RELEVANT PORTIONS OF MASSACHUSETTS HIGHWAY DEPARTMENT (MHD) STANDARD SPECIFICATIONS. THE CONTRACTOR'S ATTENTION ALSO IS DIRECTED TO THE STANDARD SPECIFICATIONS, FOR REQUIREMENTS REGARDING THE AMBIENT AIR TEMPERATURE AT THE TIME OF APPLICATION.

PART 7 – QUALITY ASSURANCE

A. COMPLY WITH GOVERNING CODES AND REGULATIONS. PROVIDE PRODUCTS FROM ACCEPTABLE MANUFACTURERS. USE EXPERIENCED INSTALLERS. DELIVER, HANDLE, AND STORE MATERIALS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

B. CONFORM TO CONDITIONS OF APPROVAL ISSUED BY REGULATORY AGENCIES INCLUDING, BUT NOT NECESSARILY LIMITED TO, LOCAL PLANNING BOARD, CONSERVATION COMMISSION, CITY COUNCIL, BOARD OF HEALTH, PUBLIC WORKS / HIGHWAY DEPARTMENT, STATE ENVIRONMENTAL PROTECTION DEPARTMENT, AND U.S. GOVERNMENT, ENVIRONMENTAL PROTECTION AGENCY. WHERE CONDITIONS OF REGULATORY APPROVAL DIFFER FROM REQUIREMENTS CONTAINED HEREIN OR ON THE DRAWINGS, COMPLY WITH THE MORE STRINGENT REQUIREMENT.

PART 8 – INSPECTION AND MAINTENANCE

BITUMINOUS CONCRETE

A. INSPECT ALL CATCH BASINS (CB) AND MANHOLES AT LOCATIONS SHOWN ON SITE PLANS. LOOK FOR SETTLING OF PAVEMENT, REPAIR AS REQUIRED. LOOK AT LEVEL OF SAND, SILT IN SUMPS. HAVE SUMPS CLEANED IF OUTLET PIPE IS BLOCKED. VERIFY THAT ELBOW (OIL TRAP) ON PIPE OUTLET IS SECURELY IN PLACE. CLEAN ALL LEAVES, TRASH, AND PINE NEEDLES FROM CB GRATE.

B. LOOK FOR SIGNS OF CRACKING & POTHOLES, REPAIR AS REQUIRED.

C. LOOK FOR SIGNS OF EROSION AT EDGES OF ROADWAY. INSPECT FOR BROKEN CURB. SEVERE EROSION MAY BE CAUSED BY PIPE BLOCKAGE AND RESULTING OVERFLOWS OUT OF CATCH BASINS. REMOVE DRAIN MANHOLE COVERS AND CB GRATES IN AREA AND LOOK FOR BLOCKAGES WHERE SURFACE EROSION IS EVIDENT.

LAWNS

A. INSPECT AFTER EACH SIGNIFICANT RAINFALL (½" OR MORE) FOR FIRST 6 MONTHS AFTER CONSTRUCTION TO ENSURE SURFACE VEGETATION IS HEALTHY, DISCHARGE DEVICES ARE NOT BLOCKED AND BANKS ARE NOT ERODING. CHECK ALL COMPONENTS AFTER EACH MAJOR STORM (MORE THAN 2" RAINFALL IN 24 HOURS). CLEAN/REPAIR AS REQUIRED.

PART 8 – CONTINUED

LANDSCAPING

A. INSPECT FOR DISEASED/DYING TREES, SHRUBS, GROUND COVER, & GRASS; REPLACE AS REQUIRED.

B. INSPECT MULCH BEDS. SUPPLEMENT AS REQUIRED TO PROVIDE THE SPECIFIED MINIMUM DEPTH (LOOSE MEASURE).

RIP RAP (STONE) SLOPE PROTECTION

A. INSPECT STONE SLOPE PROTECTION, CUT EMERGING YOUNG TREES GROWING IN STONES. INSPECT STONE AT PIPE OUTLETS. REMOVE DEBRIS. REPAIR AS REQUIRED.

PART 9 – POST CONSTRUCTION OPERATION AND MAINTENANCE SCHEDULE

A. ONCE CONSTRUCTION IS COMPLETED, THE OWNER SHALL BE RESPONSIBLE FOR MAINTENANCE OF ROADWAYS AND UTILITY INFRASTRUCTURE, OR ONCE THE CONDOMINIUM ASSOCIATION (CA) ASSUMES RESPONSIBILITY FOR MAINTENANCE. REFER TO THE LONG TERM STORMWATER OPERATION AND MAINTENANCE PLAN & POLLUTION PREVENTION PLAN PREPARED FOR THIS PROJECT FOR ADDITIONAL DETAILS (SEE DRAINAGE REPORT, APPENDIX K).

B. TRASH AND RECYCLING FROM HOMES SHALL BE BY PRIVATE TRASH REMOVAL COMPANY CONTRACTED BY THE CONDOMINIUM ASSOCIATION.

C. OPERATION AND MAINTENANCE OF ON SITE SEPTIC SYSTEMS:

1. SEPTIC SYSTEMS SHALL BE THE RESPONSIBILITY OF THE CONDOMINIUM ASSOCIATION.

D. SNOW STORAGE/REMOVAL:

1. SNOW REMOVAL FROM THE ROADWAY AND VISITOR PARKING AREAS SHALL BE AT THE EXPENSE OF THE CONDOMINIUM ASSOCIATION, SIMILAR TO LANDSCAPING AND OVERALL MAINTENANCE OF THE DEVELOPMENT.
2. SNOW STORAGE AREAS SHALL BE UTILIZED AS DEPICTED ON THIS PLAN OR IN OTHER AREAS NOT WITHIN RESOURCE AREAS ON THE SITE.

LEGEND

	EXISTING	PROPOSED
SPOT ELEVATION	100x0	100x0
MAJOR CONTOUR	80	80
MINOR CONTOUR	82	82
WATER	W	W
WATER GATE		
HYDRANT		
WATER SERVICE	WS	WS
GAS GATE		
SEWER	S	S
SEWER MANHOLE	Ⓢ	Ⓢ
DRAIN	D	D
DRAIN MANHOLE	Ⓓ	Ⓓ
ELECTRIC	E	E
ELEC/TEL/CABLE	ETC	ETC
GAS MAIN	G	G
CATCH BASIN		
UTILITY POLE		
OVERHEAD WIRE	OHW	
STOCKADE FENCE		
EROSION CONTROL BARRIER		
CONCRETE BOUND		
TREELINE		
PERMEAMETER TEST (BY OTHERS)	TPD TPD6	
DRAINAGE TEST PITS (BY OTHERS)	TP #2 3/11/08	

COMMONWEALTH OF MASSACHUSETTS JAMES A. PAVLIK CIVIL No 36489 REGISTERED PROFESSIONAL ENGINEER

3-9-22

FOR REGISTRY USE ONLY

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

COMMONWEALTH OF MASSACHUSETTS JEFFREY D. YOUNGQUIST No. 37742 PROFESSIONAL LAND SURVEYOR

3-9-22

DATE PROFESSIONAL LAND SURVEYOR

APPROVED SUBJECT TO TERMS AND CONDITIONS OF A COMPREHENSIVE PERMIT PER ZONING BOARD OF APPEALS DECISION AS AUTHORIZED BY CHAPTER 40B OF THE MASSACHUSETTS GENERAL LAWS, SECTION 20-23

DATE:

BOURNE ZONING BOARD

I CERTIFY THAT 20 DAYS HAVE ELAPSED SINCE ZONING BOARD APPROVAL, AND THAT NO APPEAL HAS BEEN FILED AT THIS OFFICE.

TOWN CLERK – TOWN OF BOURNE

REVISIONS

NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

APPLICANT
CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

LEGEND & GENERAL NOTES

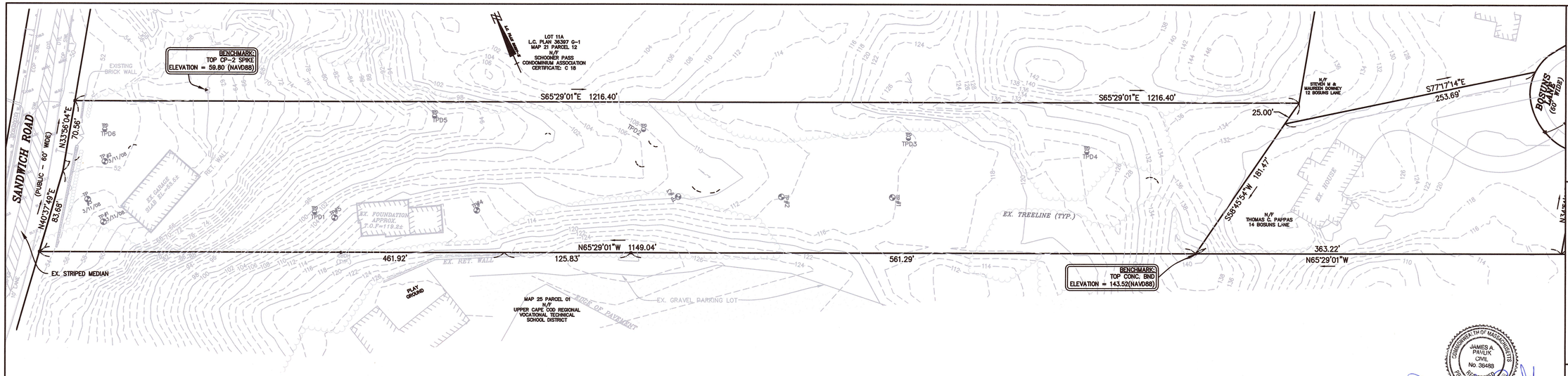
"CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
FAX: (508)-947-8873
www.outback-eng.com

DATE: MARCH 9, 2022	
DRAWN BY: KAD	CHECKED BY: JAP
SCALE: 1"=40'	SHEET 2 OF 11

0' 40' 80' 120'

OE-3294A

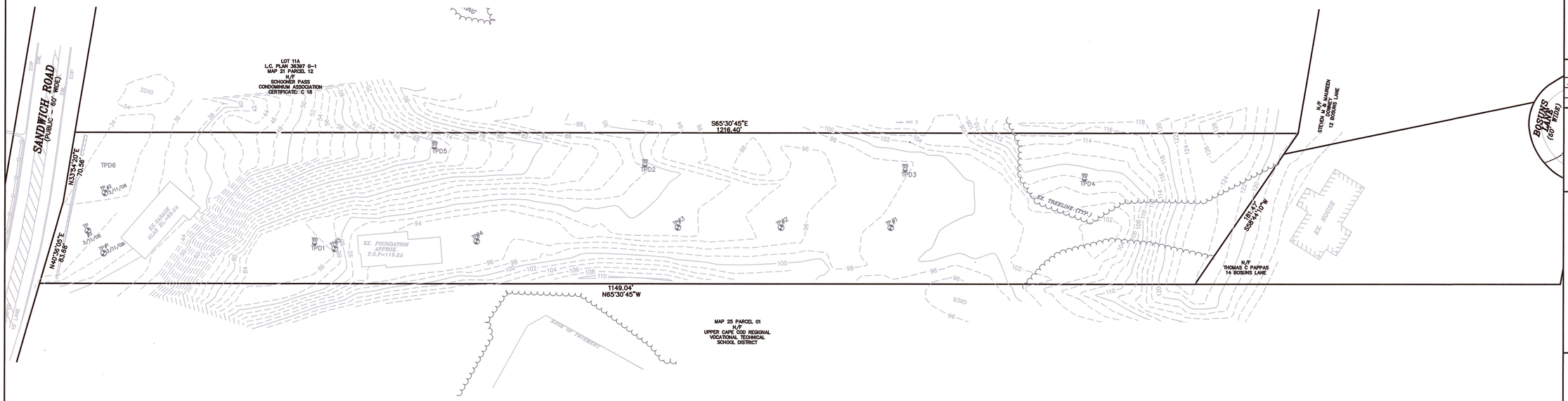


OUTBACK ENGINEERING SURVEY

(JANUARY 2021 SURVEY)

NOTES:

- EXISTING CONDITIONS TOPOGRAPHY SHOWN BASED ON A SURVEY PERFORMED BY OUTBACK ENGINEERING INC, IN JANUARY 2021.
- ELEVATIONS SHOWN ON NAVD88 DATUM.



NOTES:

- EXISTING CONDITIONS TOPOGRAPHY SHOWN BASED ON PLANS PREPARED BY HOLMES AND McGRATH, INC. ENTITLED "SITE PLAN PREPARED FOR CHASE DEVELOPERS, INC. IN BOURNE, MA DATED JULY 30, 2007 AND LAST REVISED JANUARY 19, 2010.
- ELEVATIONS SHOWN BASED ON AN ASSUMED DATUM.
- THIS PLAN DOCUMENTS FIELD CONDITIONS PRIOR TO FILING COMPREHENSIVE PERMIT

HOLMES AND McGRATH, INC SURVEY

(JULY 2007 SURVEY)

FOR REGISTRY USE ONLY

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

COMMONWEALTH OF MASSACHUSETTS
JEFFREY D YOUNGQUIST
No. 37742
REGISTERED PROFESSIONAL LAND SURVEYOR

3-9-22
DATE PROFESSIONAL LAND SURVEYOR

COMMONWEALTH OF MASSACHUSETTS
JAMES A. PAVLIK
CIVIL
No. 36488
REGISTERED PROFESSIONAL ENGINEER

3-1-22

APPROVED SUBJECT TO TERMS AND CONDITIONS OF A COMPREHENSIVE PERMIT PER ZONING BOARD OF APPEALS DECISION AS AUTHORIZED BY CHAPTER 40B OF THE MASSACHUSETTS GENERAL LAWS, SECTION 20-23

DATE: _____

BOURNE ZONING BOARD

I CERTIFY THAT 20 DAYS HAVE ELAPSED SINCE ZONING BOARD APPROVAL, AND THAT NO APPEAL HAS BEEN FILED AT THIS OFFICE.

TOWN CLERK – TOWN OF BOURNE

REVISIONS

NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

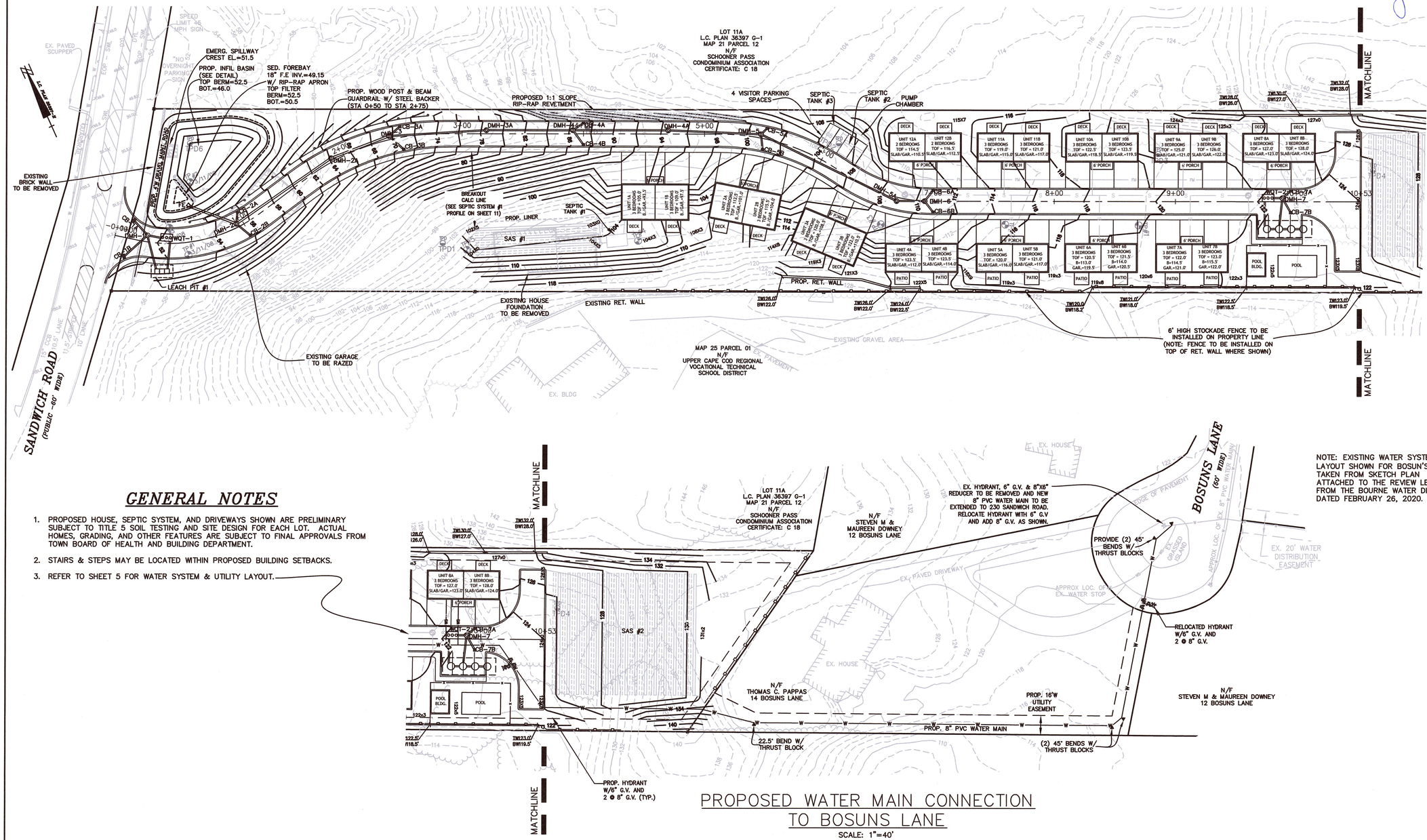
APPLICANT
CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

EXISTING CONDITIONS PLAN "CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
www.outback-eng.com

DATE: MARCH 9, 2022
DRAWN BY: KAD | CHECKED BY: JAP
SCALE: 1"=50' | SHEET 3 OF 11
0' 50' 100' 150'

OE-3294A



PROPOSED WATER MAIN CONNECTION TO BOSUNS LANE

SCALE: 1"=40'

NOTE: EXISTING WATER SYSTEM LAYOUT SHOWN FOR BOSUN'S LANE TAKEN FROM SKETCH PLAN ATTACHED TO THE REVIEW LETTER FROM THE BOURNE WATER DISTRICT DATED FEBRUARY 26, 2020.

GENERAL NOTES

1. PROPOSED HOUSE, SEPTIC SYSTEM, AND DRIVEWAYS SHOWN ARE PRELIMINARY SUBJECT TO TITLE 5 SOIL TESTING AND SITE DESIGN FOR EACH LOT. ACTUAL HOMES, GRADING, AND OTHER FEATURES ARE SUBJECT TO FINAL APPROVALS FROM TOWN BOARD OF HEALTH AND BUILDING DEPARTMENT.
2. STAIRS & STEPS MAY BE LOCATED WITHIN PROPOSED BUILDING SETBACKS.
3. REFER TO SHEET 5 FOR WATER SYSTEM & UTILITY LAYOUT.

COMMONWEALTH OF MASSACHUSETTS
JAMES A. PAVLIK
CIVIL
No. 38488
REGISTERED PROFESSIONAL ENGINEER
3-9-22

FOR REGISTRY USE ONLY

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

COMMONWEALTH OF MASSACHUSETTS
JEFFREY D YOUNGQUIST
No. 37742
REGISTERED PROFESSIONAL LAND SURVEYOR
3-9-22
DATE PROFESSIONAL LAND SURVEYOR

APPROVED SUBJECT TO TERMS AND CONDITIONS OF A COMPREHENSIVE PERMIT PER ZONING BOARD OF APPEALS DECISION AS AUTHORIZED BY CHAPTER 40B OF THE MASSACHUSETTS GENERAL LAWS, SECTION 20-23

DATE: _____

BOURNE ZONING BOARD

I CERTIFY THAT 20 DAYS HAVE ELAPSED SINCE ZONING BOARD APPROVAL, AND THAT NO APPEAL HAS BEEN FILED AT THIS OFFICE.

TOWN CLERK – TOWN OF BOURNE

REVISIONS

NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

APPLICANT
CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

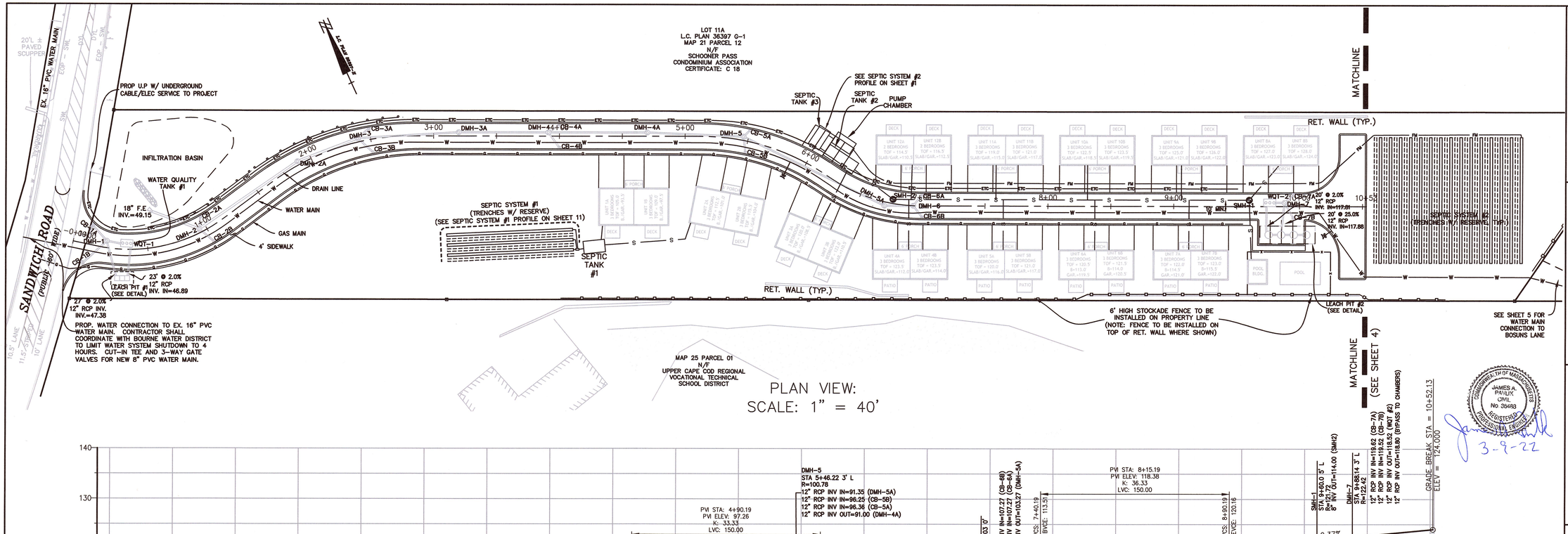
GRADING & DRAINAGE PLAN "CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
www.outback-eng.com

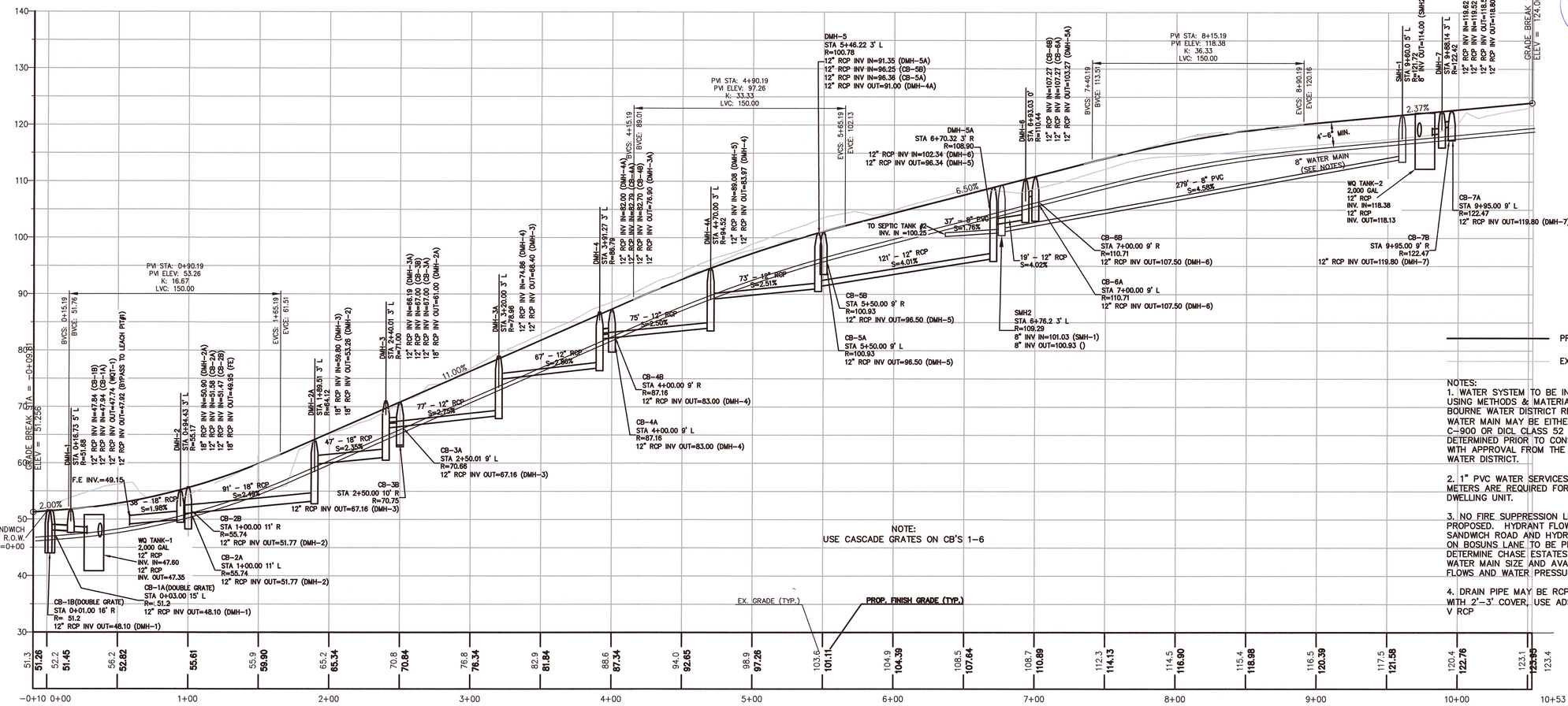
DATE: MARCH 9, 2022
DRAWN BY: KAD | CHECKED BY: JAP
SCALE: 1"=40' | SHEET 4 OF 11

0' 40' 80' 120'

OE-3294A



PLAN VIEW:
SCALE: 1" = 40'



PROFILE VIEW:
SCALE: H 1"=40', V 1"=10'

PROP. CL GRADE

EX. CL GRADE

NOTE:
USE CASCADE GRATES ON CB'S 1–6

NOTES:
1. WATER SYSTEM TO BE INSTALLED USING METHODS & MATERIALS PER BOURNE WATER DISTRICT REQUIREMENTS. WATER MAIN MAY BE EITHER 8" PVC C-900 OR DICL CLASS 52 PIPE. TO BE DETERMINED PRIOR TO CONSTRUCTION WITH APPROVAL FROM THE BOURNE WATER DISTRICT.

2. 1" PVC WATER SERVICES AND METERS ARE REQUIRED FOR EACH DWELLING UNIT.

3. NO FIRE SUPPRESSION LINES ARE PROPOSED. HYDRANT FLOW TESTS AT SANDWICH ROAD AND HYDRANT #870 ON BOSUNS LANE TO BE PERFORMED TO DETERMINE CHASE ESTATES PROJECT WATER MAIN SIZE AND AVAILABLE FIRE FLOWS AND WATER PRESSURES.

4. DRAIN PIPE MAY BE RCP OR ADS WITH 2'–3' COVER. USE ADS OR CLASS V RCP

FOR REGISTRY USE ONLY

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

COMMONWEALTH OF MASSACHUSETTS
JEFFREY T. YOUNGQUIST No. 37742 REGISTERED PROFESSIONAL LAND SURVEYOR

3-9-22
DATE PROFESSIONAL LAND SURVEYOR

APPROVED SUBJECT TO TERMS AND CONDITIONS OF A COMPREHENSIVE PERMIT PER ZONING BOARD OF APPEALS DECISION AS AUTHORIZED BY CHAPTER 40B OF THE MASSACHUSETTS GENERAL LAWS, SECTION 20–23

COMMONWEALTH OF MASSACHUSETTS
JAMES A. PAYLIS CIVIL No. 39493 REGISTERED PROFESSIONAL ENGINEER

3-9-22

DATE:

BOURNE ZONING BOARD

I CERTIFY THAT 20 DAYS HAVE ELAPSED SINCE ZONING BOARD APPROVAL, AND THAT NO APPEAL HAS BEEN FILED AT THIS OFFICE.

TOWN CLERK – TOWN OF BOURNE

REVISIONS

NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

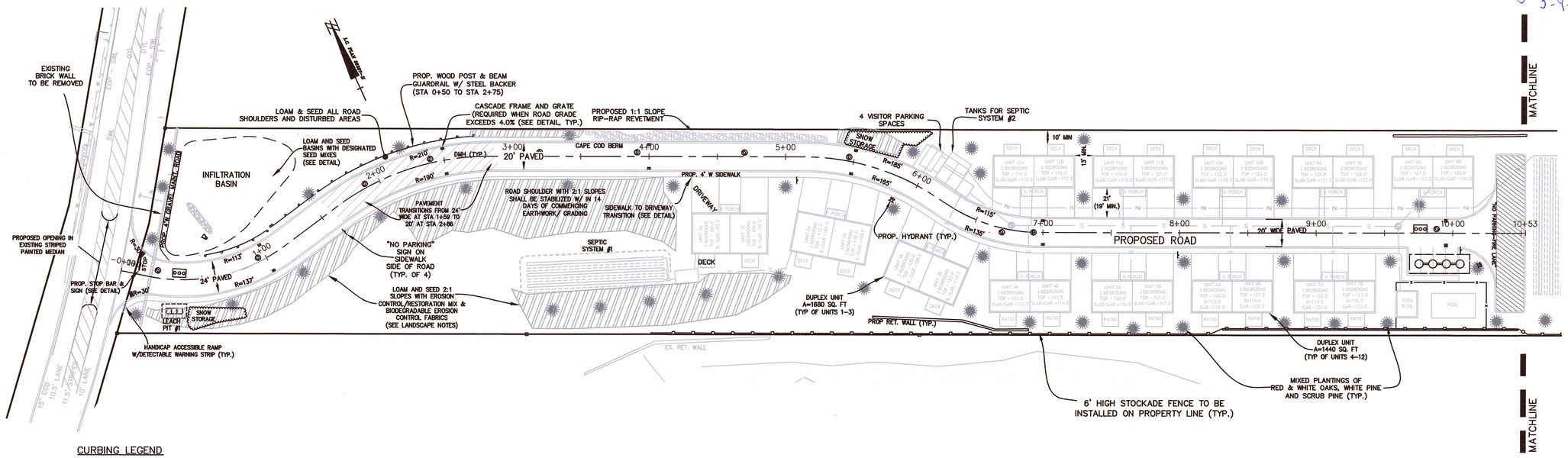
APPLICANT
CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

UTILITY PLAN & ROAD PROFILE "CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)–946–9231
www.outback–eng.com

DATE: MARCH 9, 2022
DRAWN BY: KAD | CHECKED BY: JAP
SCALE: 1"=40' | SHEET 5 OF 11
0' 40' 80' 120'

OE–3294A



CURBING LEGEND

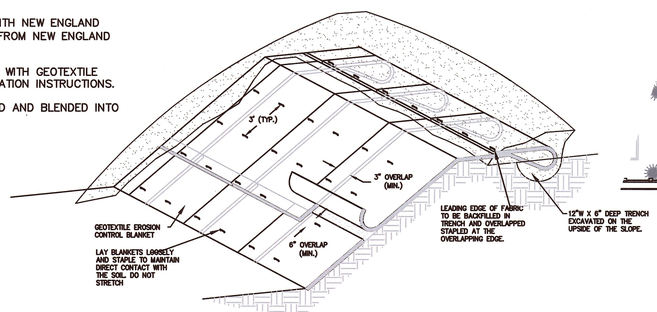
CAPE COD BERM (WHERE SHOWN)

GENERAL NOTES

1. FOUNDATION PLANTINGS SHALL BE PROVIDED AT FRONT OF EACH HOME CONSISTING OF NATIVE SHRUBS AND FLOWERS.
2. LOCATIONS OF RETAINING WALLS BETWEEN AND IN FRONT OF HOMES ARE NOT ALL SHOWN AND SHALL BE SUBJECT TO SPECIFIC HOME STYLE DEPENDING ON BUYER PREFERENCES. NO WALLS SHALL EXCEED 6 FEET IN HEIGHT WITHOUT BUILDING INSPECTOR APPROVAL.
3. SPECIES OF SHADE TREES ALONG THE SITE DRIVEWAY SHALL BE FROM TOWN APPROVED LIST.
4. PROPOSED HOUSE, SEPTIC SYSTEMS, AND DRIVEWAYS SHOWN ARE PRELIMINARY SUBJECT TO TITLE 5 SOIL TESTING AND SITE DESIGN FOR EACH LOT. ACTUAL HOMES, GRADING, AND OTHER FEATURES ARE SUBJECT TO FINAL APPROVALS FROM TOWN BOARD OF HEALTH AND BUILDING DEPARTMENT.

LANDSCAPE NOTES

1. LAWN AREAS TO BE SEEDED WITH SUN/SHADE SEED WITH 34% PERENNIAL RYEGRASS, 33% FINE FESCUE AND 33% KENTUCKY BLUEGRASS MIXTURE OR AN APPROVED EQUAL.
2. SLOPES STEEPER THAN 3 TO 1 ARE TO BE SEEDED WITH NEW ENGLAND EROSION CONTROL/RESTORATION MIX FOR DRY SITES FROM NEW ENGLAND WETLAND PLANTS OR APPROVED EQUAL.
3. SLOPES OF 2 TO 1 OR STEEPER ARE TO BE COVERED WITH GEOTEXTILE EROSION CONTROL BLANKET. SEE DETAIL FOR INSTALLATION INSTRUCTIONS.
4. ALL DISTURBED AREAS SHALL BE LOAMED AND SEEDED AND BLENDED INTO THE EXISTING GRADE AND CONDITIONS.

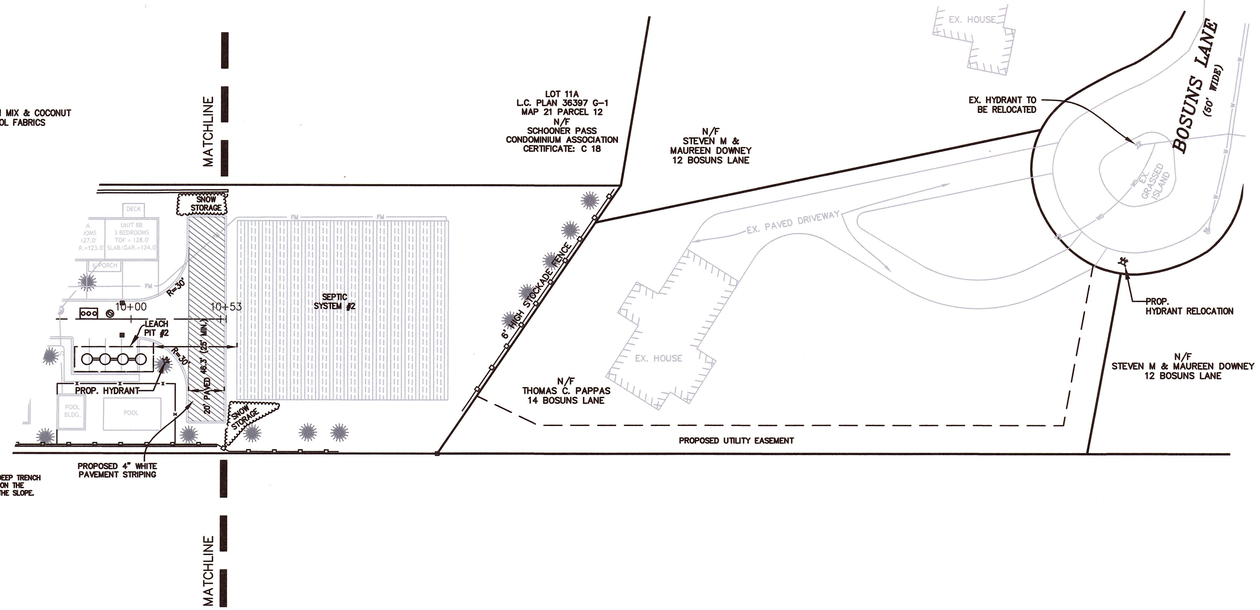


GEOTEXTILE EROSION CONTROL BLANKET

NOT TO SCALE

PROPOSED 1:1 SLOPE RIP-RAP REVETMENT

2:1 SLOPES WITH EROSION CONTROL/RESTORATION MIX & COCONUT FIBER OR OTHER BIODEGRADABLE EROSION CONTROL FABRICS



COMMONWEALTH OF MASSACHUSETTS
JAMES A. PAVLIK
No. 36488
REGISTERED PROFESSIONAL ENGINEER
3-9-22

FOR REGISTRY USE ONLY

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

COMMONWEALTH OF MASSACHUSETTS
JEFFREY D. YOUNGQUIST
No. 37742
PROFESSIONAL LAND SURVEYOR
3-9-22

DATE PROFESSIONAL LAND SURVEYOR

APPROVED SUBJECT TO TERMS AND CONDITIONS OF A COMPREHENSIVE PERMIT PER ZONING BOARD OF APPEALS DECISION AS AUTHORIZED BY CHAPTER 40B OF THE MASSACHUSETTS GENERAL LAWS, SECTION 20-23

DATE: _____

BOURNE ZONING BOARD

I CERTIFY THAT 20 DAYS HAVE ELAPSED SINCE ZONING BOARD APPROVAL, AND THAT NO APPEAL HAS BEEN FILED AT THIS OFFICE.

TOWN CLERK – TOWN OF BOURNE

REVISIONS

NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

APPLICANT
CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

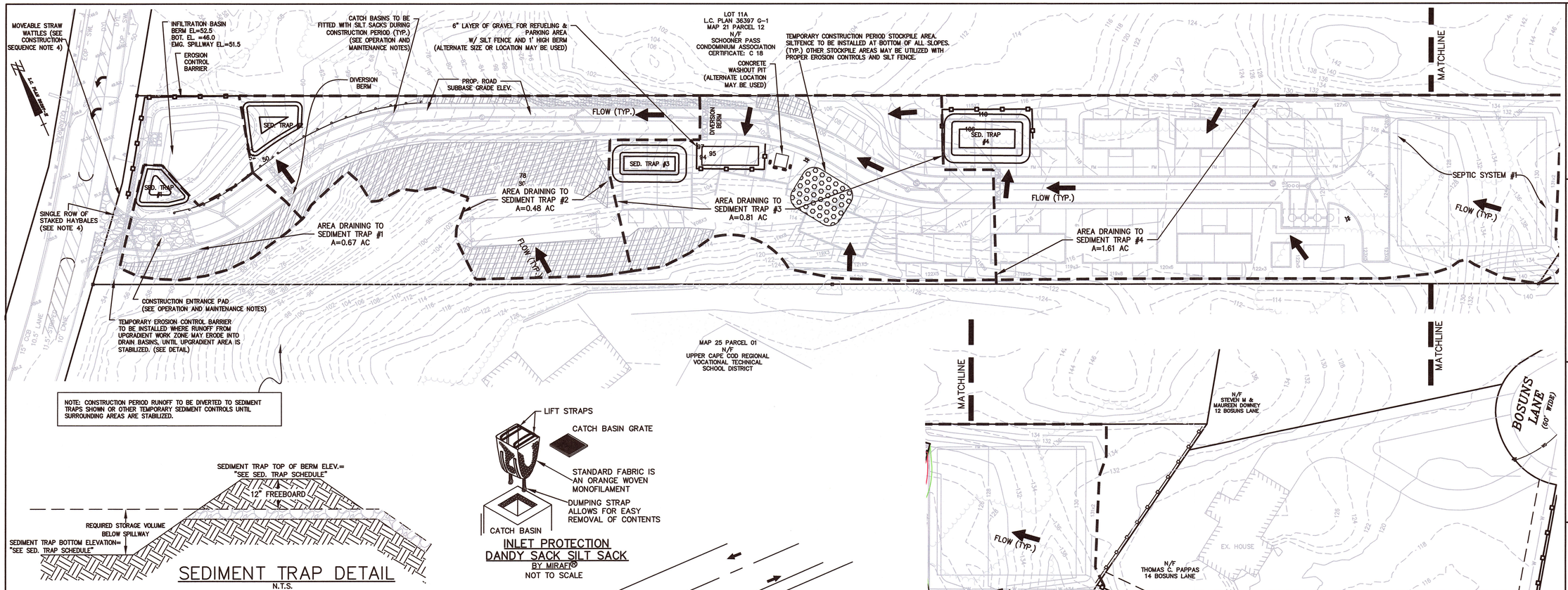
LAYOUT & MATERIALS PLAN "CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
www.outback-eng.com

DATE: MARCH 9, 2022

DRAWN BY: KAD	CHECKED BY: JAP
SCALE: 1"=40'	SHEET 6 OF 11

OE-3294A



NOTE: CONSTRUCTION PERIOD RUNOFF TO BE DIVERTED TO SEDIMENT TRAPS SHOWN OR OTHER TEMPORARY SEDIMENT CONTROLS UNTIL SURROUNDING AREAS ARE STABILIZED.

SEDIMENT TRAP DETAIL

N.T.S.

SEDIMENT TRAP SCHEDULE

TRAP #	DRAINED AREA TO TRAP (AC.)	SED. TRAP REQ. VOLUME (FT³)*	BOT EL.	BOT. AREA (S.F)	SPILLWAY EL.	SPILLWAY AREA (S.F)	TRAP VOLUME PROVIDED(FT³)*
1	0.22	792	48	167	51	994	1568
2	0.72	2592	55	142	59	1446	2722
3	0.81	2907	92	464	95	1671	3203
4	1.61	5796	106	651	110	2585	6472

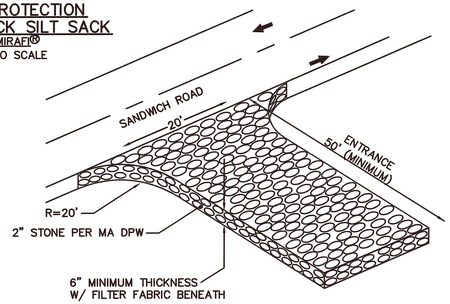
*SEDIMENT TRAPS MUST BE SIZED TO PROVIDE 3,600 FT³ OF STORAGE PER ACRE DRAINED PER THE MASSACHUSETTS EROSION AND SEDIMENTATION CONTROL GUIDELINES.

NOTE: TRAP LOCATIONS AND ELEVATIONS SHOWN MAY BE FIELD ADJUSTED BY CONTRACTOR AS CONSTRUCTION PROGRESSES.

INLET PROTECTION DANDY SACK SILT SACK

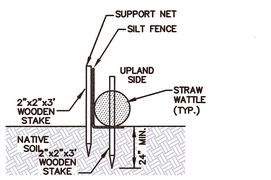
BY MIRAFI®

NOT TO SCALE



STABILIZED CONSTRUCTION ENTRANCE PAD

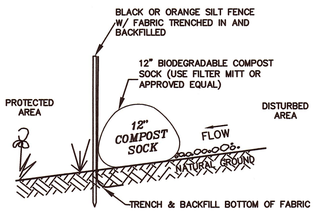
N.T.S.



NOTE: THE PROPOSED SILT FENCE SHALL NOT BE BURIED. THE PROPOSED STRAW WATTLE SHALL LAY DIRECTLY ATOP THE SILT FENCE

STRAW WATTLE WITH SILT FENCING

(NOT TO SCALE)



NOTE: A SINGLE SILT FENCE OR COMPOST SOCK MAY BE USED.

EROSION CONTROL BARRIER

N.T.S.

EROSION & SEDIMENT CONTROL NOTES

SEE SHEET 2 ALSO FOR PART 2.3 CONSTRUCTION SEQUENCING NOTES AND OTHER REQUIREMENTS FOR THE CONDUCT OF WORK ON SITE.

1. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION AND MAINTENANCE OF EROSION CONTROL MEASURES SHOWN ON THIS PLAN AND ANY ADDITIONAL MEASURES AS MAY BE NECESSARY OR REQUIRED THROUGHOUT CONSTRUCTION, UNTIL FINAL SURFACE FINISHES HAVE BEEN ESTABLISHED AND ACCEPTED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTROL EROSION AND SEDIMENTATION. IT IS INTENDED THAT THE IMPLEMENTATION OF THE FOLLOWING MEASURES WILL MEET THIS GOAL. WHEN IT IS CLEAR TO THE DESIGNER THAT EROSION AND SEDIMENTATION HAVE BEEN ADEQUATELY CONTROLLED WITHOUT THE IMPLEMENTATION OF EVERY MEASURE, ADDITIONAL MEASURES NEED NOT BE IMPLEMENTED. ALTERNATIVELY, IF ALL OF THE FOLLOWING MEASURES HAVE BEEN IMPLEMENTED AND THE CONTROL OF EROSION AND SEDIMENTATION IS INADEQUATE, THE CONTRACTOR MUST EMPLOY SUFFICIENT SUPPLEMENTAL MEASURES BEYOND THE SCOPE OF THIS PLAN.
2. ALTHOUGH NOT SHOWN HEREON, CONTRACTOR MAY UTILIZE ADDITIONAL EROSION CONTROL MEASURES SUCH AS, BUT NOT LIMITED TO SEDIMENT TRAPS AND EROSION CONTROL BLANKETS.
3. EROSION CONTROL MEASURES SHALL BE IN ACCORDANCE WITH THE STANDARDS OF THE MOST CURRENT VERSION OF THE "MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS," THE STANDARDS OF THE TOWN OF BOURNE, AND AS SHOWN ON THESE PLANS, WHICHEVER IS THE MOST STRINGENT.
4. EROSION CONTROLS MUST BE INSTALLED PRIOR TO THE START OF ANY CONSTRUCTION ACTIVITIES. LIMITED CLEARING (BUT NO GRUBBING) AND SITE DISTURBANCE IS ALLOWED IN ORDER TO FACILITATE INSTALLATION OF EROSION CONTROLS.
5. WHERE SEVERAL TYPES OF EROSION CONTROL DEVICES ARE CALLED OUT ON THE PLAN, THE CONTRACTOR MAY SELECT FROM THOSE DETAILED FOR INDIVIDUAL AREAS THAT MAY BEST FIT HIS CONSTRUCTION OPERATIONS WHILE STILL MAINTAINING PROTECTIONS THAT MEET ALL CONTRACT AND REGULATORY REQUIREMENTS.
6. ALL AREAS DISTURBED BY CONSTRUCTION ACTIVITIES, WHETHER INSIDE THE CONTRACT LIMIT LINE OR BEYOND, NOT COVERED BY BUILDINGS OR PAVEMENTS, SHALL BE TOP SOILED AND SEEDED AS LAWN.
7. THE CONTRACTOR SHALL MONITOR ALL NEW AND MODIFIED DRAINAGE STRUCTURE SUMPS WITHIN THE CONTRACT LIMITS AND SHALL PUMP SUMPS CLEAN OF SILT AND DEBRIS WHEN MORE THAN ¼ FULL AND/OR IMMEDIATELY PRIOR TO FINAL ACCEPTANCE.
8. AREAS THAT ARE NOT THE LOCATION OF ACTIVE CONSTRUCTION WHICH ARE TO BE LEFT BARE FOR OVER ONE MONTH BEFORE FINISHED GRADING AND SEEDING IS ACHIEVED, SHALL BE MULCHED OR RECEIVE TEMPORARY STABILIZATION SUCH AS JUTE NETTING OR SHALL RECEIVE A TEMPORARY SEEDING OF PERENNIAL RYEGRASS APPLIED AT A RATE OF 2 LBS./1,000 SQ. FT. LIMESTONE (EQUIVALENT TO BE 50 PERCENT CALCIUM PLUS MAGNESIUM OXIDE) SHALL BE APPLIED AS SEEDBED PREPARATION AT A RATE OF 90 LBS./1,000 SQ. FT. PLANTING SEASONS SHALL BE APRIL 1 TO JUNE 1 AND AUGUST 1 TO OCTOBER 1. AREAS TO BE LEFT BARE BEFORE FINISH GRADING AND SEEDING OUTSIDE OF PLANTING SEASONS SHALL RECEIVE AN AIR-DRIED WOOD CHIP MULCH, FREE OF COARSE MATTER.
9. STABILIZATION OF SLOPES IN CUT AREAS (USING MULCH OR GRASS) AND THE INSTALLATION OF CONTROL LINE (STRAWBALE CHECK OR FILTER FABRIC) AT THE TOE OF SLOPE SHALL BE INITIATED WITHIN FOURTEEN (14) DAYS OF COMPLETION.
   - BETWEEN STATION 0+00 AND APPROXIMATELY 4+00, THE SOUTHERLY SLOPE SHOWN AS 2:1 MUST BE LOAMED AND SEEDED AND EROSION CONTROL BLANKET INSTALLED (SEE SHEET 6) WITHIN 14 DAYS OF COMMENCING THE EARTHWORK.
10. SEDIMENT REMOVED FROM CONTROL STRUCTURES WILL BE DISPOSED IN A MANNER WHICH IS CONSISTENT WITH THE INTENT OF THE PLAN. ALL LINEAR EROSION CONTROLS RETAINING SEDIMENT OVER 1/2 THEIR HEIGHT SHALL HAVE THE SEDIMENT REMOVED AND ALL DAMAGED EROSION CONTROLS SHALL BE REPAIRED OR REPLACED.
11. THE CONTRACTOR WILL BE ASSIGNED THE RESPONSIBILITY FOR IMPLEMENTING THIS EROSION AND SEDIMENT CONTROL PLAN. THIS RESPONSIBILITY INCLUDES THE INSTALLATION AND MAINTENANCE OF CONTROL MEASURES, INFORMING ALL PARTIES ENGAGED ON THE CONSTRUCTION SITE OF THE REQUIREMENTS AND OBJECTIVES OF THE PLAN.
12. STOCKPILES OF SOIL SHALL BE SURROUNDED BY A SEDIMENT BARRIER. SOIL STOCKPILES TO BE LEFT BARE FOR MORE THAN FOURTEEN (14) DAYS SHALL BE STABILIZED WITH TEMPORARY VEGETATION OR MULCH. IF SOIL STOCKPILES ARE TO REMAIN FOR MORE THAN SIXTY (60) DAYS, FILTER FABRIC SHALL BE USED IN PLACE OF STRAWBALES. SIDE SLOPES SHALL NOT EXCEED 2:1.
13. THE CONTRACTOR SHALL BE RESPONSIBLE TO CONTROL DUST AND WIND EROSION THROUGHOUT THE LIFE OF THEIR CONTRACT. DUST CONTROL SHALL INCLUDE, BUT IS NOT LIMITED TO SPRINKLING OF WATER ON EXPOSED SOILS AND HAUL ROADS. CONTRACTOR SHALL CONTROL DUST TO PREVENT A HAZARD TO TRAFFIC.
14. IF FINAL GRADING IS TO BE DELAYED FOR MORE THAN FOURTEEN (14) DAYS AFTER LAND DISTURBANCES CEASE, TEMPORARY VEGETATION OR MULCH SHALL BE USED TO STABILIZE SOILS.

FOR REGISTRY USE ONLY

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

COMMONWEALTH OF MASSACHUSETTS JEFFREY D YOUNGQUIST No. 37742 REGISTERED PROFESSIONAL LAND SURVEYOR

3-9-22

DATE PROFESSIONAL LAND SURVEYOR

APPROVED SUBJECT TO TERMS AND CONDITIONS OF A COMPREHENSIVE PERMIT PER ZONING BOARD OF APPEALS DECISION AS AUTHORIZED BY CHAPTER 40B OF THE MASSACHUSETTS GENERAL LAWS, SECTION 20-23

DATE: _____

BOURNE ZONING BOARD

I CERTIFY THAT 20 DAYS HAVE ELAPSED SINCE ZONING BOARD APPROVAL, AND THAT NO APPEAL HAS BEEN FILED AT THIS OFFICE.

TOWN CLERK – TOWN OF BOURNE

REVISIONS

NO.	DATE	DESCRIPTION

OWNER

230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

APPLICANT

CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

COMMONWEALTH OF MASSACHUSETTS JAMES A. PAVLIK CIVIL No. 38498 REGISTERED PROFESSIONAL ENGINEER

3.9.22

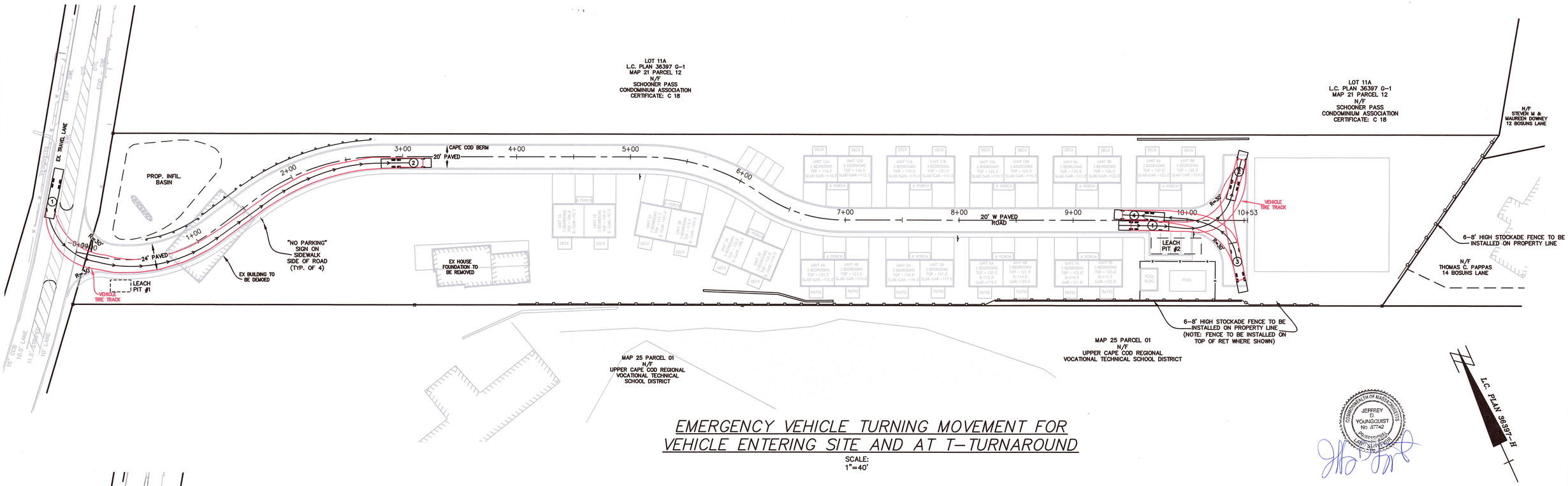
SEDIMENT & EROSION CONTROL PLAN "CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
www.outback-eng.com

DATE: MARCH 9, 2022
DRAWN BY: KAD | CHECKED BY: JAP
SCALE: 1"=40' | SHEET 7 OF 11

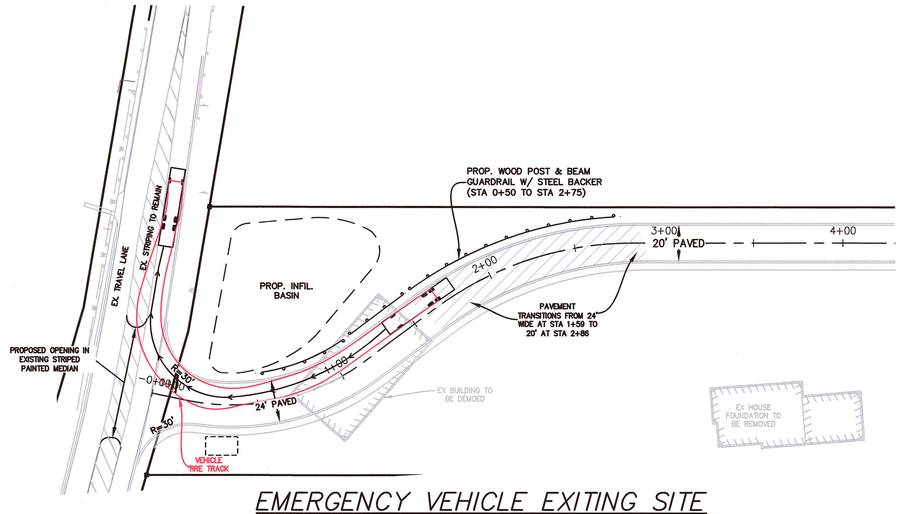
0' 40' 80' 120'

OE-3294A



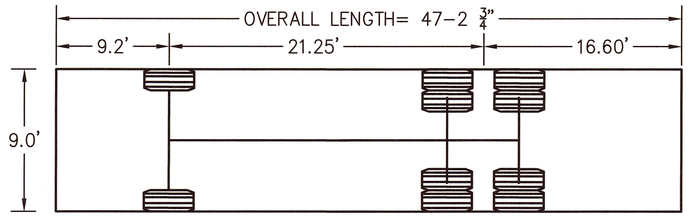
EMERGENCY VEHICLE TURNING MOVEMENT FOR VEHICLE ENTERING SITE AND AT T-TURNAROUND

SCALE:
1"=40'



EMERGENCY VEHICLE EXITING SITE

SCALE:
1"=40'



VEHICLE DIMENSIONS USED FOR TURNING MOVEMENT SHOWN
(2006 AMERICAN LaFRANCE/LTI 100' AERIAL TOWER LADDER TRUCK)

NOTE DIMENSIONS TAKEN FROM TRUCK 126 SPECIFICATIONS, TOWN OF BOURNE FIRE/RESCUE & EMERGENCY VEHICLES LETTER

NOTE:
THE PURPOSE OF THIS PLAN IS TO DEMONSTRATE THAT THE BOURNE LADDER TRUCK CAN MANEUVER THE PROPOSED SUBDIVISION ROAD

COMMONWEALTH OF MASSACHUSETTS
JEFFREY C. YOUNGQUIST
No. 37742
REGISTERED PROFESSIONAL ENGINEER
LAND SURVEYOR

COMMONWEALTH OF MASSACHUSETTS
JAMES A. PAVLIK
CIVIL
No. 36493
REGISTERED PROFESSIONAL ENGINEER
3-9-22

REVISIONS		
NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

APPLICANT
CHASE DEVELOPERS INC.

EMERGENCY VEHICLE TURNING MOVEMENT PLAN

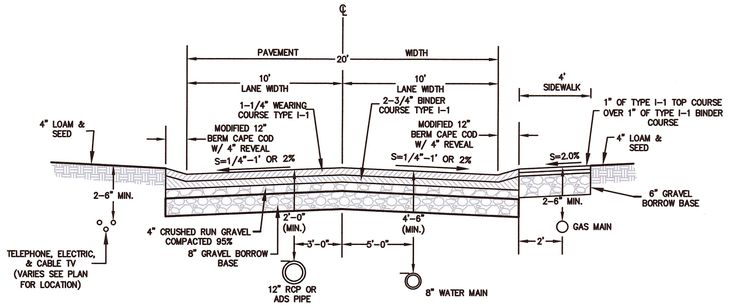
"CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
www.outback-eng.com

DATE: MARCH 9, 2022
DRAWN BY: CJV | CHECKED BY: JAP
SHEET 8 OF 11

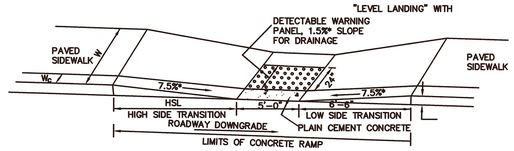
SCALE AS NOTED

OE-3294A



TYPICAL ROADWAY CROSS SECTION

NOT TO SCALE



WHEELCHAIR RAMP DETAIL

NOT TO SCALE

ROADWAY PROFILE GRADE		HIGH SIDE TRANSITION LENGTH ROUNDED LENGTH (4")
%	G	ENGLISH UNITS
0	0.00	6'-6"
1	0.01	7'-8"
2	0.02	9'-0"
3	0.03	11'-0"
4	0.04	14'-0"
>4	>0.04	15'-0" (MAX.)

LEGEND

HSL=HIGH SIDE TRANSITION LENGTH (SEE M/E 107.9.0)

W=SIDEWALK LENGTH

W =CURB WIDTH

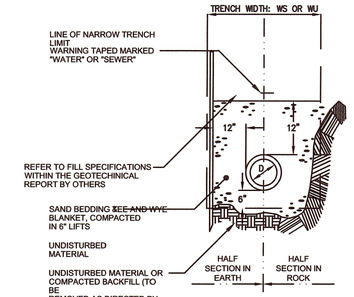
*=TOLERANCE FOR CONSTRUCTION ±0.5%

USABLE SIDEWALK WIDTH PER AAB=W-W

USABLE SIDEWALK WIDTH PER AAB IS NOT TO BE LESS THAN 4'-0"

SEE M/E 107.6.5R FOR DETAILS OF DETECTABLE WARNING PANEL

CURB TRANSITION LENGTH FOR WHEELCHAIR RAMPS



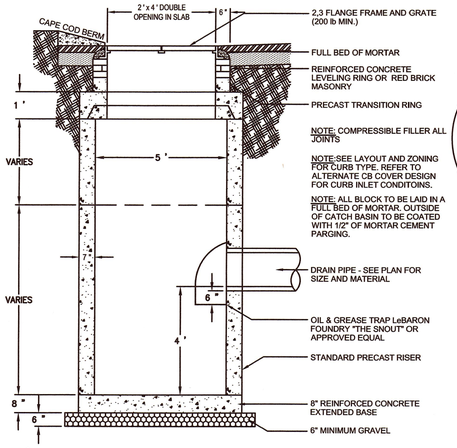
WATER TRENCH

NOTE:
BRONZE WEDGES AT ALL WATERMAIN PIPE JOINTS, 2 MIN. PER JOINTS AT ALL LOCATIONS.

NOTE: THRUST BLOCKS TO BE PER TOWN OF BOURNE STANDARDS

WATER TRENCH

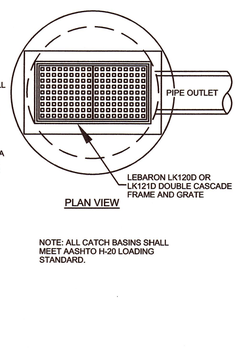
NOT TO SCALE



5' DIAMETER DOUBLE GRATE CATCH BASIN

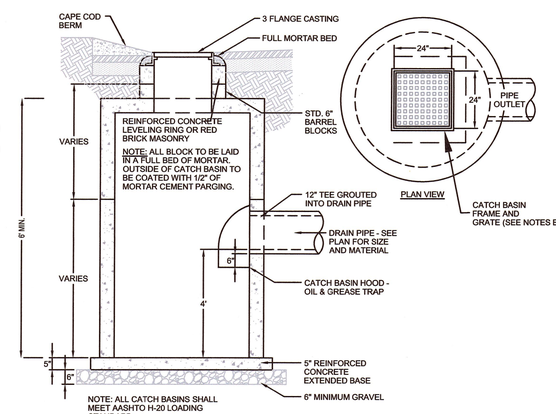
NOT TO SCALE

NOTE:
CB'S 1A AND 1B SHALL HAVE DOUBLE CASCADE GRATES



PLAN VIEW

NOTE: ALL CATCH BASINS SHALL MEET AASHTO H-20 LOADING STANDARD.

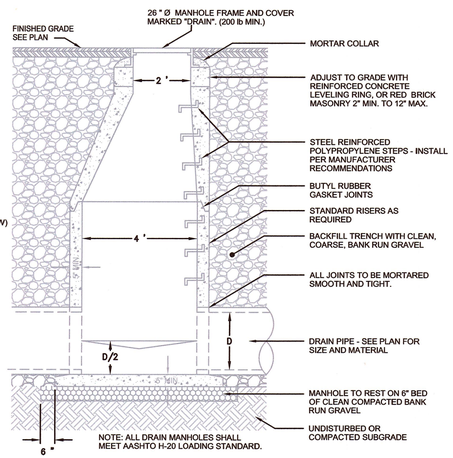


PLAN VIEW

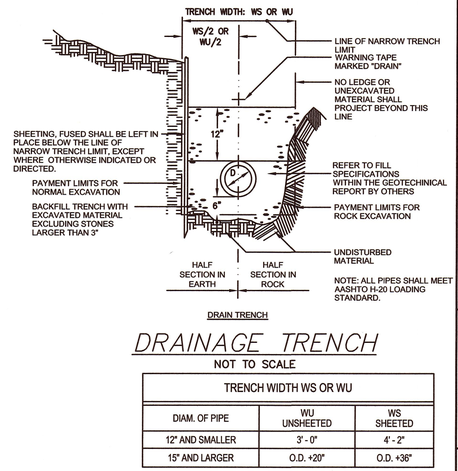
SINGLE GRATE CATCH BASIN

NOTES: NOT TO SCALE

1. CASCADE GRATE (LEBARON LK120D OR LK121D) REQUIRED WHEN ROAD GRADES EXCEED 6%.
2. CB'S 2A, 2B, 3A, 3B, 4A AND 4B SHALL HAVE CASCADE GRATES. CB'S 1A AND 1B SHALL HAVE DOUBLE CASCADE GRATES



PRECAST DRAIN MANHOLE



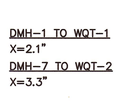
DRAIN TRENCH

NOTE: ALL PIPES SHALL MEET AASHTO H-20 LOADING STANDARD.

DRAINAGE TRENCH

NOT TO SCALE

TRENCH WIDTH WS OR WU		
DIAM. OF PIPE	WU UNSHEETED	WS SHEETED
12" AND SMALLER	3' - 0"	4' - 2"
15" AND LARGER	O.D. +20"	O.D. +36"



END VIEW

DMH-1 TO WQT-1
X=2.1"

DMH-7 TO WQT-2
X=3.3"

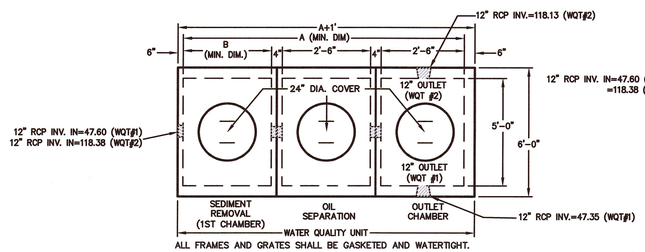
ATTACH END CAP TO 12" RCP OUTLET FROM SPLITTER MANHOLE. THEN CUT END CAP TO SPECIFIED HEIGHT FROM INVERT IN ORDER TO LIMIT FLOW TO WATER QUALITY INLET.

OUTLET FROM DMH-1 & DMH-2 TO WATER QUALITY TANK DETAIL

N.T.S.

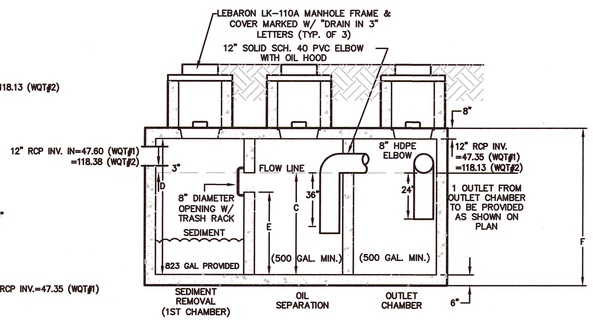
	WQT-1	WQT-2
A (MIN. DIM.)	9'-8"	9'-8"
B (MIN. DIM.)	4'-0"	4'-0"
C	5'-6"	5'-6"
D	7'-0"	7'-0"
E	5'-0"	5'-0"
F	8'-0"	8'-0"
1ST CHAMBER GAL. REQUIRED	283	441
1ST CHAMBER GAL. PROVIDED	823	823
MIN. CAPACITY REQUIRED*	1,263 GAL.	1,441 GAL.

*INTERIOR VOLUME TO FLOW LINE IS SHOWN. SELECT TANK SIZE TO PROVIDE THIS MINIMUM VOLUME. USE SHEA PRECAST CONCRETE TANKS (MODIFIED AS SHOWN), OR EQUIVALENT.



ALL FRAMES AND GRATES SHALL BE GASKETED AND WATERTIGHT.

TANK SHALL BE INSTALLED, WATERPROOFED, AND BACKFILLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS.



WATER QUALITY TANK DETAIL (H-20)

NOT TO SCALE

FOR REGISTRY USE ONLY

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

COMMONWEALTH OF MASSACHUSETTS JEFFREY D. YOUNGQUIST No. 37742 REGISTERED PROFESSIONAL LAND SURVEYOR

3-9-22

DATE PROFESSIONAL LAND SURVEYOR

APPROVED SUBJECT TO TERMS AND CONDITIONS OF A COMPREHENSIVE PERMIT PER ZONING BOARD OF APPEALS DECISION AS AUTHORIZED BY CHAPTER 40B OF THE MASSACHUSETTS GENERAL LAWS, SECTION 20-23

DATE: _____

BOURNE ZONING BOARD

I CERTIFY THAT 20 DAYS HAVE ELAPSED SINCE ZONING BOARD APPROVAL, AND THAT NO APPEAL HAS BEEN FILED AT THIS OFFICE.

TOWN CLERK – TOWN OF BOURNE

REVISIONS

NO.	DATE	DESCRIPTION

COMMONWEALTH OF MASSACHUSETTS JAMES A. PAVLIK CIVIL No. 38483 REGISTERED PROFESSIONAL ENGINEER

3-9-22

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

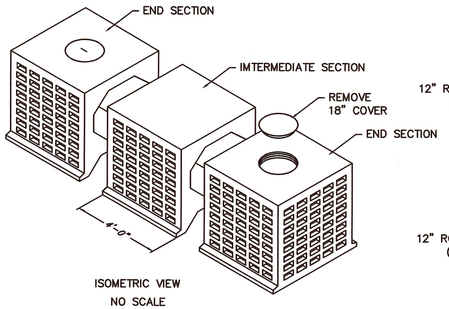
APPLICANT
CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

CONSTRUCTION DETAIL SHEET
"CHASE ESTATES"
SUBDIVISION
AT
230 SANDWICH ROAD
IN
BOURNE
MASSACHUSETTS

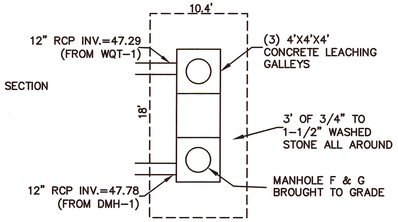
Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
www.outback-eng.com

DRAWN BY: KAD	CHECKED BY: JAP
SCALE: AS NOTED	SHEET 9 OF 11

OE-3294A

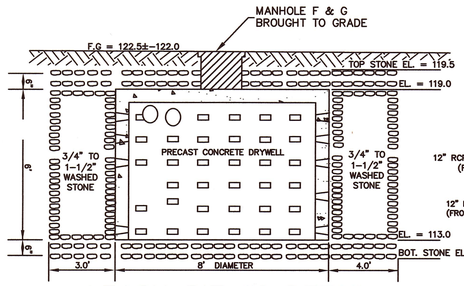


ISOMETRIC VIEW
NO SCALE



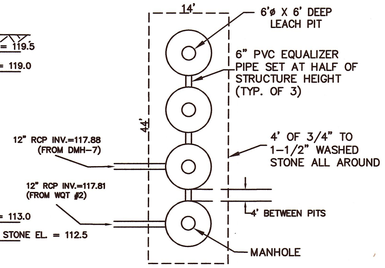
LEACH PIT #1 PLAN VIEW

NOT TO SCALE



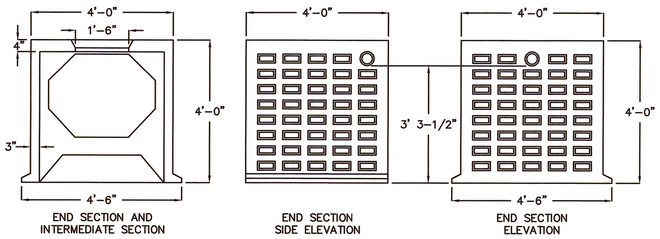
LEACH PIT #2 DETAIL

NOT TO SCALE



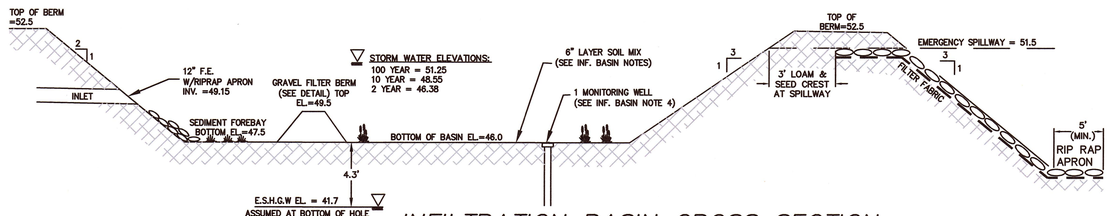
LEACH PIT #2 PLAN VIEW

NOT TO SCALE



PRECAST CONCRETE LEACHING GALLEY (LEACH PIT #1)

NOT TO SCALE

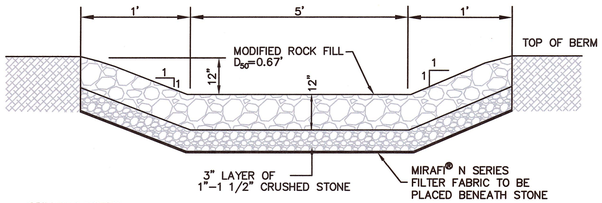


INFILTRATION BASIN CROSS SECTION

NOT TO SCALE

INFILTRATION BASIN NOTES

1. EXISTING TOPSOIL, SUBSOIL, AND ANY UNSUITABLE SOILS BENEATH INFILTRATION BASIN (EXCLUDING SEDIMENT FOREBAY) TO BE REMOVED TO A DEPTH OF NATURALLY OCCURRING PERVIOUS SOIL. USE LIGHT EARTH-MOVING EQUIPMENT TO EXCAVATE BASIN BECAUSE HEAVY EQUIPMENT COMPACTS THE SOILS AND MAY REDUCE INFILTRATION CAPACITY. IF NECESSARY TO OBTAIN REQUIRED SUBGRADE, PLACE CLEAN WASHED SAND OR TITLE 5 SAND TO THE DEPTH REQUIRED. CONTRACTOR MUST NOTIFY DESIGN ENGINEER AND TOWN REPRESENTATIVE TO INSPECT OPEN HOLE 48 HOURS PRIOR TO PLACEMENT OF SAND AND 6" LAYER SOIL MIX.
2. BASIN BOTTOM AND INTERIOR SIDE SLOPES TO RECEIVE A 6" LAYER OF PERMEABLE SOIL MIX, CONSISTING OF AGED COMPOST MIXED WITH 50/50 LOAM/SAND (OR COMPOST MIXED W/REMOVED TOPSOIL/SUBSOIL).
3. SEED MIXES TO BE USED:
   BOTTOM:NEW ENGLAND EROSION CONTROL/RESTORATION MIX FOR DETENTION BASINS AND MOIST SITES.
   SIDE SLOPES: NEW ENGLAND CONSERVATION/WILDLIFE MIX.
4. INSTALL 1 MONITORING WELL PER 5,000 S.F. BASIN FLOOR AREA, USING A 4" PERF. PIPE PLACED VERTICALLY DOWN INTO THE NATURALLY OCCURRING SOIL TO A DEPTH OF 10' OR LIMITING SOIL LAYER SUCH AS BEDROCK OR SILTY LOAM. THE PIPE SHALL BE WRAPPED W/MIRAFI N-SERIES FILTER FABRIC AND CAPPED W/A SCREW TYPE CAP ACCESSIBLE AT FINISH GRADE (USE IRRIGATION VALVE BOX). INSTALLER TO CAREFULLY BACKFILL TO ENSURE PIPE REMAINS VERTICAL.

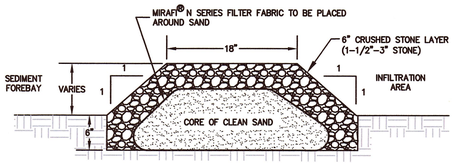


SPILLWAY NOTES:

1. A WELL GRADED MIXTURE OF ROCK SIZES SHALL BE USED FOR THE STONE. FIFTY PERCENT BY WEIGHT OF THE STONE MIXTURE SHALL BE SMALLER THEN THE MEDIAN SIZE STONE (d50). THE LARGEST STONE SIZE IN THE MIXTURE SHALL BE 1.5 TIMES THE d50 SIZE (12").
2. STONES FOR RIP RAP SHALL BE ANGULAR OR SUBANGULAR. THE STONES SHALL BE SHAPED SO THAT THE LEAST DIMENSION OF THE STONE FRAGMENT SHALL NOT BE LESS THAN ONE- THIRD OF THE GREATEST DIMENSION OF THE FRAGMENT. FLAT ROCKS SHALL NOT BE USED FOR RIP RAP.
3. STONE FOR THE RIP RAP MAY BE PLACED BY EQUIPMENT AND SHALL BE CONSTRUCTED TO THE FULL LAYER THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO PREVENT DISPLACEMENT OF THE UNDERLYING MATERIALS. HAND PLACEMENT MAY BE REQUIRED TO PREVENT DAMAGE TO ANY PERMANENT STRUCTURES.
4. VOIDS IN THE ROCK RIP RAP SHOULD BE FILLED WITH SPALLS AND SMALLER ROCKS.

EMERGENCY SPILLWAY

NOT TO SCALE



GRAVEL FILTER BERM

PERMEAMETER TESTS BY HOLMES AND McGRATH, INC

TP#	INFIL. RATE (IN/HR)
TPD1	22.16
TPD2	62.24
TPD3	55.15
TPD4	22.77
TPD5	100.89
TPD6	98.34

T.P.# 1 (7-22-08)

DEPTH	ELEV.
0	115.9
	C HORIZON MEDIUM SAND 7.5Y 6/6
120"	105.9
	NO MOTTLES
	NO WATER

PERC. RATE : OBSERVATION
DATE OF TEST : 7/22/08
WITNESSED BY : CINDY COFFIN
SOIL EVALUATOR: RAUL LIZARDI-RIVERA

T.P.# 2 (7-22-08)

DEPTH	ELEV.
0	114.0
	FILL
13"	112.9
	C HORIZON MEDIUM SAND 7.5Y 6/6
120"	104.0
	NO MOTTLES
	NO WATER

PERC. RATE : <2 MPI
DATE OF TEST : 7/22/08
WITNESSED BY : CINDY COFFIN
SOIL EVALUATOR: RAUL LIZARDI-RIVERA

T.P.# 3 (7-22-08)

DEPTH	ELEV.
0	109.3
	C1 HORIZON MED/COARSE SAND 5YR 6/6
72"	103.3
	C2 HORIZON MED/FINE SAND 7.5Y 7/4
120"	99.3
	NO MOTTLES
	NO WATER

PERC. RATE : OBSERVATION
DATE OF TEST : 7/22/08
WITNESSED BY : CINDY COFFIN
SOIL EVALUATOR: RAUL LIZARDI-RIVERA

T.P.# 4 (7-22-08)

DEPTH	ELEV.
0	116.0
	FILL
30"	113.5
	B HORIZON MEDIUM SAND 7.5YR 5/4
66"	110.5
	C HORIZON MEDIUM SAND 7.5YR 7/4
124"	105.7
	NO MOTTLES
	NO WATER

PERC. RATE : <2 MPI
DATE OF TEST : 7/22/08
WITNESSED BY : CINDY COFFIN
SOIL EVALUATOR: RAUL LIZARDI-RIVERA

T.P.# 5 (7-22-08)

DEPTH	ELEV.
0	107.5
	FILL
84"	100.5
	C HORIZON MEDIUM SAND 7.5YR 5/4
120"	97.5
	NO MOTTLES
	NO WATER

PERC. RATE : OBSERVATION
DATE OF TEST : 7/22/08
WITNESSED BY : CINDY COFFIN
SOIL EVALUATOR: RAUL LIZARDI-RIVERA

T.P.# 1 (3-11-08)

DEPTH	ELEV.
0	57.5
	FILL
66"	52.0
	C HORIZON MEDIUM SAND 7.5Y 6/6
114"	48.0
	NO MOTTLES
	NO WATER

PERC. RATE : OBSERVATION
DATE OF TEST : 3/11/08
WITNESSED BY : CINDY COFFIN
SOIL EVALUATOR: RAUL LIZARDI-RIVERA

T.P.# 2 (3-11-08)

DEPTH	ELEV.
0	51.7
	FILL
13"	50.6
	C HORIZON MEDIUM SAND 7.5Y 6/6
120"	41.7
	NO MOTTLES
	NO WATER

PERC. RATE : <2 MPI
DATE OF TEST : 3/11/08
WITNESSED BY : CINDY COFFIN
SOIL EVALUATOR: RAUL LIZARDI-RIVERA

T.P.# 3 (3-11-08)

DEPTH	ELEV.
0	54.5
	FILL
19"	52.9
	B HORIZON SANDY LOAM 7.5Y 6/6
35"	51.6
	C HORIZON MEDIUM SAND 7.5Y 6/6
114"	45.0
	NO MOTTLES
	NO WATER

PERC. RATE : OBSERVATION
DATE OF TEST : 3/11/08
WITNESSED BY : CINDY COFFIN
SOIL EVALUATOR: RAUL LIZARDI-RIVERA

NOTE: ALL SOIL LOGS SHOWN WERE COMPLETED BY HOLMES AND McGRATH

TEST PIT LOGS

NOT TO SCALE

FOR REGISTRY USE ONLY

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

COMMONWEALTH OF MASSACHUSETTS JEFFREY D YOUNGQUIST No. 37742 REGISTERED PROFESSIONAL LAND SURVEYOR

3-9-22
DATE PROFESSIONAL LAND SURVEYOR

COMMONWEALTH OF MASSACHUSETTS JAMES A PATLIN CIVIL No. 38488 REGISTERED PROFESSIONAL ENGINEER

3-9-22

APPROVED SUBJECT TO TERMS AND CONDITIONS OF A COMPREHENSIVE PERMIT PER ZONING BOARD OF APPEALS DECISION AS AUTHORIZED BY CHAPTER 40B OF THE MASSACHUSETTS GENERAL LAWS, SECTION 20-23

DATE: _____

BOURNE ZONING BOARD

I CERTIFY THAT 20 DAYS HAVE ELAPSED SINCE ZONING BOARD APPROVAL, AND THAT NO APPEAL HAS BEEN FILED AT THIS OFFICE.

TOWN CLERK – TOWN OF BOURNE

REVISIONS

NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

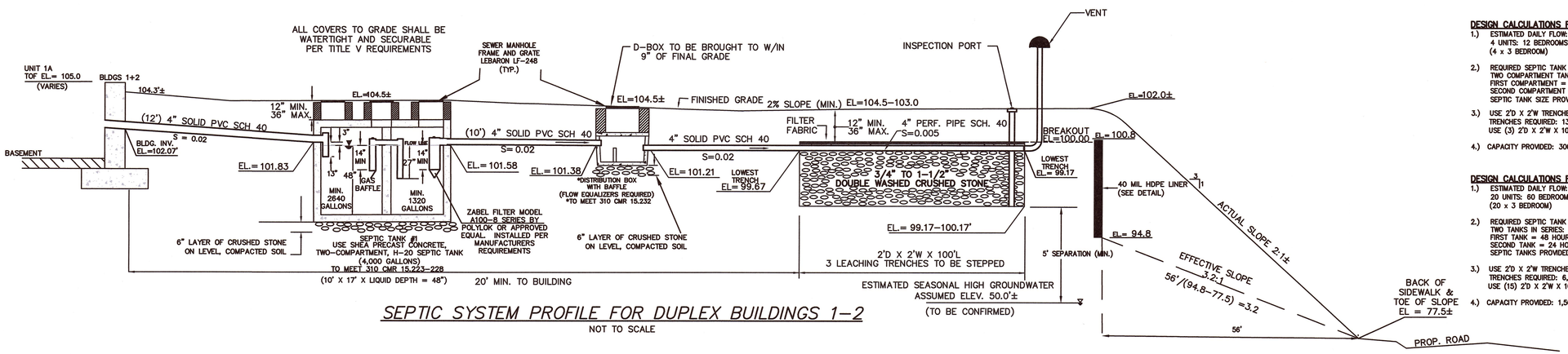
APPLICANT
CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

CONSTRUCTION DETAIL SHEET
"CHASE ESTATES"
SUBDIVISION
AT
230 SANDWICH ROAD
IN
BOURNE
MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
www.outback-eng.com

DATE: MARCH 9, 2022
DRAWN BY: KAD | CHECKED BY: JAP
SCALE: AS NOTED | SHEET 10 OF 11

OE-3294A



SEPTIC SYSTEM PROFILE FOR DUPLEX BUILDINGS 1–2

NOT TO SCALE

DESIGN CALCULATIONS FOR BUILDINGS 1–2:

1.) ESTIMATED DAILY FLOW:
4 UNITS: 12 BEDROOMS X 110 GPD/BEDROOM = 1,320 GPD
(4 x 3 BEDROOM)

2.) REQUIRED SEPTIC TANK CAPACITY: (PER TITLE 5)
TWO COMPARTMENT TANK:
FIRST COMPARTMENT = 48 HOUR DETENTION X 1,320 GPD = 2,640 GAL
SECOND COMPARTMENT = 24 HOUR DETENTION X 1,320 GPD = 1,320 GAL
SEPTIC TANK SIZE PROVIDED (2-COMPARTMENT TANK) = 4,000 GAL

3.) USE 2'D X 2'W TRENCHES AND <5 MPI PERC RATE = 0.74 GPD/SF
TRENCHES REQUIRED: 1320 GPD / 0.74 = 1784 S.F. / 6 S.F./L.F. = 297 LF.
USE (3) 2'D X 2'W X 100'L TRENCHES = 300 LF.

4.) CAPACITY PROVIDED: 300 LF X 6 S.F/LF X 0.74 GPD/SF = 1,332 GPD

DESIGN CALCULATIONS FOR BUILDINGS 3–12:

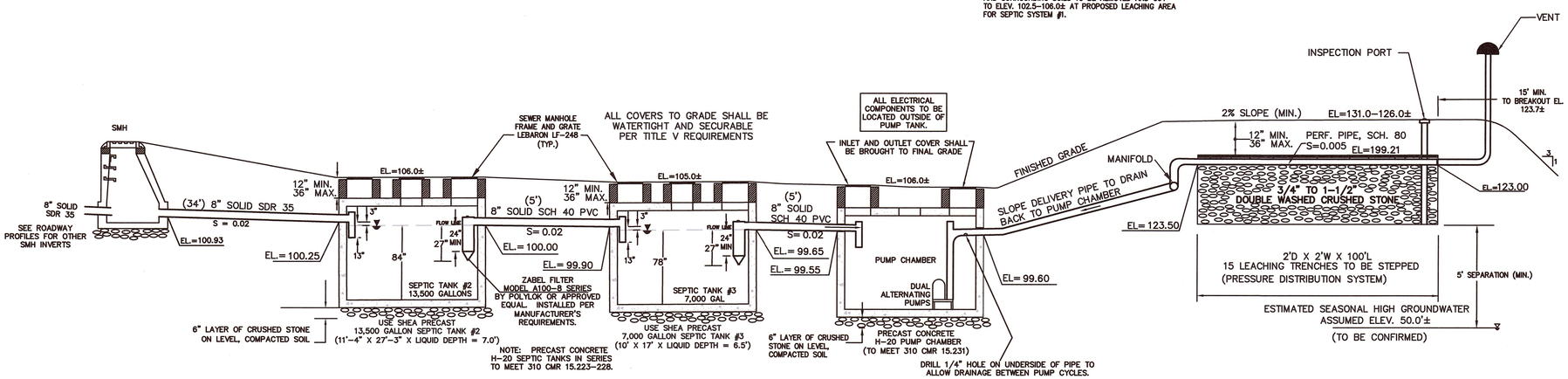
1.) ESTIMATED DAILY FLOW:
20 UNITS: 60 BEDROOMS X 110 GPD/BEDROOM = 6,600 GPD
(20 x 3 BEDROOM)

2.) REQUIRED SEPTIC TANK CAPACITY: (PER TITLE 5)
TWO TANKS IN SERIES:
FIRST TANK = 48 HOUR DETENTION X 6,600 GPD = 13,200 GAL
SECOND TANK = 24 HOUR DETENTION X 6,600 GPD = 6,600 GAL
SEPTIC TANKS PROVIDED = 13,545 GAL + 7,000 GAL

3.) USE 2'D X 2'W TRENCHES AND 0.74 GPD/SF
TRENCHES REQUIRED: 6,600 GPD / 0.74 = 8,919 S.F. / 6 S.F./L.F. = 1,486.5 LF.
USE (15) 2'D X 2'W X 100'L TRENCHES = 1,500 LF.

4.) CAPACITY PROVIDED: 1,500 LF X 6 S.F/LF X 0.74 GPD/SF = 6,660 GPD

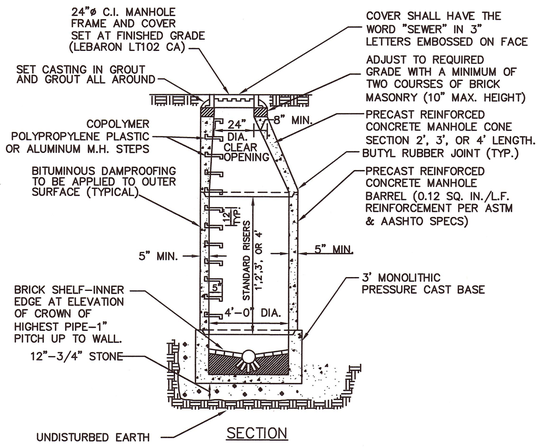
NOTE:
EXISTING HOUSE FOUNDATION (TOF ELEV. =119.2±) AND SURROUNDING SOILS TO BE REMOVED AND CUT TO ELEV. 102.5–106.0± AT PROPOSED LEACHING AREA FOR SEPTIC SYSTEM #1.



SEPTIC SYSTEM PROFILE FOR DUPLEX BUILDINGS 3–12

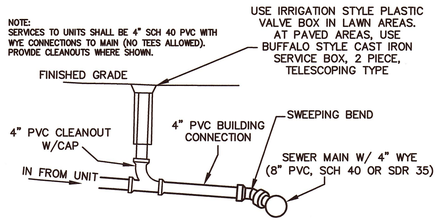
NOT TO SCALE

SEPTIC SYSTEM NOTES:
SYSTEM DETAILS SHOWN HERE ARE SCHEMATIC ONLY TO DEMONSTRATE LOCATION AND SIZING OF THE SYSTEM COMPONENTS. MORE DETAILED DESIGN PLANS PER TITLE 5 REQUIREMENTS SHALL BE PREPARED FOLLOWING ISSUANCE OF A COMPREHENSIVE PERMIT FOR THE SITE LAYOUT PROPOSED HEREON. SEPTIC SYSTEM DESIGN SHALL BE SUBJECT TO THE APPROVAL OF THE BOARD OF HEALTH.



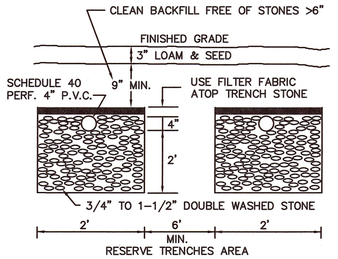
STANDARD SEWER MANHOLE SECTION

NOT TO SCALE



TYPICAL SEWER CONNECTION W/ CLEANOUT

NOT TO SCALE



TYPICAL LEACHING TRENCHES

NOT TO SCALE

FOR REGISTRY USE ONLY

I CERTIFY THAT THIS PLAN HAS BEEN PREPARED IN CONFORMANCE WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS.

COMMONWEALTH OF MASSACHUSETTS JEFFREY D YOUNGQUIST No. 37742 PROFESSIONAL LAND SURVEYOR

3-9-22

DATE PROFESSIONAL LAND SURVEYOR

APPROVED SUBJECT TO TERMS AND CONDITIONS OF A COMPREHENSIVE PERMIT PER ZONING BOARD OF APPEALS DECISION AS AUTHORIZED BY CHAPTER 40B OF THE MASSACHUSETTS GENERAL LAWS, SECTION 20–23

DATE: _____

BOURNE ZONING BOARD

I CERTIFY THAT 20 DAYS HAVE ELAPSED SINCE ZONING BOARD APPROVAL, AND THAT NO APPEAL HAS BEEN FILED AT THIS OFFICE.

TOWN CLERK – TOWN OF BOURNE

REVISIONS

NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

APPLICANT
CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

CONSTRUCTION DETAIL SHEET

"CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
www.outback-eng.com

DATE: MARCH 9, 2022
DRAWN BY: AJP | CHECKED BY: JAP
SCALE: AS NOTED | SHEET 11 OF 11

OE-3294A

Chase Estates
Town of Bourne Comprehensive Permit #08-10
Notice of Project Change

Chase Developers, Inc.

Requested Waivers – March 9, 2022

The Applicant requests waivers of the following local bylaws and regulations:

Bourne Zoning Bylaw

Section 1230. Site Plan - Special Permit Approval.

Section 2200. Use Regulations.

Section 2440. Dimensional Regulations – Two or more principal buildings where this is a condominium development.

Section 2500. Intensity of Use Schedule.

Section 2600. Development Scheduling.

Section 3300. Parking Requirements.

Section 3340. Egress Standards.

Section 3492.A-C. Submission Requirement for Local Stormwater permits

Section 3493.G.1.(b) ii Stormwater Management Standards for Local Stormwater Permits Regulation requires 90% TSS removal; MA Stormwater Handbook requires 80%, and proposed BMPs will achieve 80% minimum TSS removal (85% proposed)

Section 3496. Inspection and Site Supervision

Section 3498. Performance Bond

Section 4400. Earth Removal.

Project construction may result in removal of more than 50 yards of material (e.g., spoils, rocks, surplus soil).

Bourne General Bylaw

Section 3.7. Wetland and Natural Resource Protection

Section 3.13. Development Mitigation

Bourne Wetland Regulations

Board of Health Regulations

Bedroom Definition Regulation

Bourne Subdivision Regulations – review of road construction standards, condominium propose.

Section 223-Standards of access

Min. right-of-way width: 50 feet required; condominium driveway proposed (no right of way)

Surface width: 24 feet required; 20 feet proposed, except entrance onto Sandwich Road will be 24’ wide tapering down to 20 ft. at approximately station 2+80.

Maximum grade: 10% required; 11% max. proposed

Section 261-Application Procedure

(a)(5). Cross-sections at 1”=4’ scale

(a)(6). Form C Application

(b)(3) Environmental Information Report

(b)(4) Procedure for abutter notification

Section 263-Application Procedure

Plans submitted for review are not formatted exactly as specified (e.g., 1”=4’ vertical scale required; 1”=10’ vertical scale provided; (b) right and left sidelines not) shown in profile plan; (c) 25’ stations required for vertical curves; 50’ stations provided; (e) street light locations not shown); Final Plans will provided all requested information.

Section 264-Environmental Information Report

Section 265 - Plan Processing

Plan to be reviewed & approved by ZBA, not by Planning Board as specified in regulation.

Section 266 - Performance Guaranty

Draft comprensive permit provides for performance guaranty.

Section 267(c) - Ownership of Ways and Easements (15% security retainer)

Draft comprensive permit provides for performance guaranty.

Section 322.b-Pavement widths

24 feet required for minor street; 24 ft. proposed at entrance and tapering down to 20 ft. at station 2+80.

Section 323-Grade

10% required; 11% proposed

Section 323(f)

Reg 2:1 minimum cut slope required; 1:1 cut proposed in one limited area of the site driveway.

Section 325-Dead End streets

Regulation requires 500 ft. max; 1053 feet proposed

327 - Curbs

(b) Regulation provides for granite or concrete curb inlets at catch basins when required by Board; modified Cape Cod Berm with 4" reveal proposed.

Section 331-Sidewalk location

Regulation requires 5-foot sidewalks; one 4-foot sidewalk proposed

Section 352 Stormwater Management

D. 1. Standard 4 – Water Quality: 1.7" water quality depth required with 44% pretreatment. 1" water quality volume and 44% pretreatment is proposed per DEP Stormwater Management Regulations.

D.3. Prohibited Practices: below grade infiltration structures for treatment and/or control of road runoff for new subdivision roads. Underground leaching pits are proposed at 2 locations along the condominium driveway (with catch basins and water quality tanks provided for pretreatment).

Section 365 - Spoil Lots

Regulation requires spoil lot; applicant will dispose of spoils off-site

Section 366-Reflective markers

Regulation requires 30” reflective markers; markers not proposed (road will remain private and will be privately plowed).

DRAINAGE REPORT

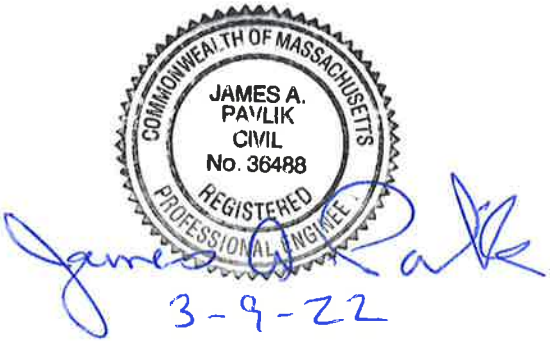
"CHASE ESTATES"
MGL Ch. 40B RESIDENTIAL CONDOMINIUM
in
BOURNE, MASSACHUSETTS

March 9, 2022

Prepared for:
Chase Developers Inc.
14 Bosuns Lane
Bourne, Massachusetts

Prepared by:

165 East Grove Street
Middleborough, MA 02346
Tel# 508-946-9231 www.outback-eng.com



DRAINAGE REPORT
"CHASE ESTATES"
BOURNE, MASSACHUSETTS

Sections

Figures

Appendices

DRAINAGE REPORT
"CHASE ESTATES"
BOURNE, MASSACHUSETTS

Section 1.0: Introduction

Chase Estates is a proposed 24-unit, residential condominium with duplex homes, permitted under a Comprehensive Permit per MGL Ch. 40B. Located at 230 Sandwich Road, the development will have a privately maintained driveway that ends at the back of the site with a T-style turnaround. The main driveway is approximately 1,053 ft. long with a sidewalk on one side, with underground utilities consisting of water, gas, cable & electric utilities, and 2 common Title 5 septic systems. There are no wetlands on site or in the immediate vicinity of the property, and soils are very permeable sand based on test pits conducted by others and a review of available soil maps. The March 9, 2022 site plans show proposed drainage facilities to control stormwater runoff, and the calculations herein document that stormwater runoff from the site can be appropriately controlled for design storms up to the 100-year storm. Catch basins will be used in the proposed roadway, piped to several infiltration systems. Although DEP Stormwater Management Regulations do not apply to this site because there are no stormwater discharges to any wetlands, many of the best management practices (BMPs) prescribed in these regulations have been incorporated into the site design, including pretreatment devices, infiltration BMPs, erosion control plans during construction, and long-term stormwater operation and maintenance plans upon completion of the development.

Section 2.0: Existing Conditions

Consisting of 4.3 acres, the Chase Estates site is located on the east side of Sandwich Road, bounded by the Schooner Pass condominium to the north, homes on Bosuns Lane to the east, and Upper Cape Cod Regional Technical High School to the south. The site was mostly cleared approximately 15 years ago when a 6-car garage was constructed at the front of the site, and a house foundation was constructed in the central area; these structures will be demolished as part of this project. The property is generally rectangular shaped, with topography ranging from elevation 50 ft. at Sandwich Road, rising eastward up to elevation 140 ft. at the hilltop at the back, southeast corner of the site (see Figure 1, USGS Locus Map). The majority of the site slopes towards Sandwich Road, with small portions at the back of the site flowing south towards the school and east toward Bosuns Lane. There are no wetlands on site or in the immediate vicinity of the property; Sandwich Road has no catch basins, and stormwater runoff appears to be directed to a paved scupper on the west side of this state highway in the immediate vicinity of the site frontage.

Soils on-site have been identified by the USDA NRCS as primarily Plymouth loamy coarse sand soils consisting of loamy coarse sand with a small portion of the site within pits, sand and gravel; all soil types fall within Hydrologic Soil Group A (Refer to Appendix A for NRCS soils map information). Test pits were previously done by Holmes and McGrath in 2008 as shown on the plan set. Additional soil test pits will be needed to document soil conditions at the 2 leach pits (refer to the site plans for test pit locations and soil logs). Soils in these test pits consisted of medium sand. Groundwater was not identified in any of these test pits.

The site is not located within any mapped environmentally sensitive areas based on review of MassGIS data (no vernal pools, no endangered species habitat, and no areas prone to flooding; refer to Figures 2 and 3). The site is not located within any state-designated Outstanding Resource Waters, Zone II of public water supply wells, or Zone A of public water supplies (see Figure 4).

For drainage design purposes, the site was delineated into 3 sub-catchment areas based on field investigations and review of the topography, and runoff conditions were calculated at 3 design discharge points, representing stormwater runoff flow to the following areas (please refer to Appendix

D-1 for Existing Hydrology Calculations representing pre-development conditions, and Appendix L for the Pre-Development Drainage Map):

- DP1: Runoff to Sandwich Road
- DP2: Flow to off-site school property
- DP3: Flow off-site to the east towards Bosuns Lane (N/F Thomas Pappas).

Section 3.0: Proposed Development

Chase Estates will have 12 duplex homes for a total of 24 dwelling units in the condominium. The main driveway will be 1,053 ft. long, with 20-ft. wide pavement, Cape Cod berms and a 4' wide sidewalk on one side; to better accommodate the turning movements of the Bourne Fire Department's ladder truck, the entrance driveway will be 24 ft. wide for approximately 150 ft. into the site, tapering down to 20 ft. wide at approximately station 2+80. Underground utilities consisting of water, gas, cable & electric utilities, and 2 common Title 5 septic systems are proposed (these septic systems are shown schematically to be further designed and permitted through the Board of Health after the Comprehensive Permit is modified, and prior to construction.). As shown on the Site Plans, the driveway shoulders and development will be graded using 3:1 fill slopes and 2:1 cut slopes per town requirements, and retaining walls may be 4 ft. high or less where necessary to accommodate siting some of the homes. A 6-ft. high stockade fence is proposed along a stretch of the southern and eastern property lines to screen the site from abutters and to prevent trespass.

Stormwater runoff from the proposed driveway and developed area of the site will be controlled using catch basins piped to infiltration BMPs; CBs are spaced at 150-ft. intervals along the roadway where centerline grades exceed 6% as was required in the prior Comprehensive Permit. The site is designed to mitigate stormwater impacts and to reduce offsite stormwater runoff conditions from existing conditions as required in the town regulations (refer to waivers list). Although DEP Stormwater Management Regulations do not apply to this site, many of the BMPs prescribed in these regulations have been incorporated into the site design, including pretreatment devices, infiltration BMPs, erosion control plans during construction, and long-term stormwater operation and maintenance plans upon completion of the development (see appendices). The site design and stormwater management system utilizes several low impact development techniques and BMPs as outlined in DEP's Stormwater Management Handbook:

- Narrower roadways and short driveways to reduce impervious area.
- One stormwater infiltration basin and two underground leaching systems are proposed with pretreatment systems to capture runoff from the roadway, recharge the runoff to groundwater, and completely contain all runoff in the infiltration systems for the 100-year storm.

These BMPS are sited at appropriate locations based on the soils, grades of the roadway and setbacks required from the on-site septic systems, and are sized to contain and infiltrate the 100-year design storm. It is anticipated that the site driveway and drainage system will be owned by a condominium association that will be responsible for maintenance, along with other common areas.

Refer to Appendix D-2 for the post-development hydrology calculations and Appendix L for the post-development watershed map. Pipe calculations sized for the 25-year storm per town of Bourne requirements are provided in Appendix H. Roadway Gutter Flow Calculations are provided in Appendix I, demonstrating that the modified Cape Cod berm sufficiently controls stormwater runoff within the roadway.

Section 4.0: Drainage Design Methodology

To determine changes in stormwater runoff for the proposed project, the HydroCAD Stormwater Modeling System software was used. This software closely approximates the USDA Soil Conservation Service (SCS) TR-20 methodology for calculating runoff. The calculations determined the change in the existing and post-development runoff rates to each drainage design point for each of the 2, 10, and 100-year storm events. All storm events analyzed comply with Technical Paper-40 Rainfall Data (*Rainfall Frequency Atlas of the United States*), as currently prescribed by DEP. Infiltration rates used to size the recharge BMPs are based on the soil types found in test pits and Rawl's rates per DEP (please note soils at the site were tested by Holmes and McGrath and found to have even higher infiltration rates, however, the more conservative Rawl's rates were used in our calculations).

Much of the stormwater design complies with the DEP Stormwater Management Regulations, incorporating a number of BMPs for water quality, recharge and runoff control (refer to Section 6 and Appendix B for the DEP Stormwater Checklist). The calculations herein document compliance with rate and volume control, sizing of the infiltration systems, as well as pretreatment, water quality and recharge volumes, and discharge velocities. To ensure long-term viability of these drainage systems and to prevent pollution and degradation of the environment, the Long-Term Stormwater Operation & Maintenance Plan and Pollution Prevention Plan in Appendix K was prepared. Please note that this project is not subject to a NPDES General Construction Permit and a Storm Water Pollution Prevention Plan is not required because there are no discharges to any wetlands or other waters of the U.S. during construction. Construction-period erosion and sediment control guidelines are shown on the Erosion and Sedimentation Control plans to provide guidance for the site contractor to maintain erosion controls and other good housekeeping practices during construction (see Sheet 8 of the site plans, and Appendix J for the Construction Period Operation and Maintenance Log Form).

Section 5.0: Summary of Results

In accordance with DEP requirements, the storm water design controls runoff for the 2, 10, and 100-year storm events below existing conditions. There are 3 design points analyzed with a summary of runoff rates and volumes tabulated below (please note all stormwater runoff towards Sandwich Road in the post-development condition is captured on site and within the infiltration basin).

Comparison of Pre- & Post-Development Runoff Rates
Design Point 1P -Runoff to Sandwich Road

	Pre development (EDA 1)	Post development
	Rate/Volume	Rate/Volume
2 Year Storm (3.50")		
• To Design Point DP1	0.01 cfs 0.006 af	0.00 cfs 0.000 af
10 Year Storm (4.85")		
• To Design Point DP1	0.17 cfs 0.075 af	0.00 cfs 0.000 af
100 Year Storm (7.10")		
• To Design Point DP1	2.15 cfs 0.326 af	0.00 cfs 0.00 af

Design Point 2 – Flow off-site to school

	Pre development (EDA 2) Rate	Post development (PDA 7) Rate
2 Year Storm (3.50") • To Design Point DP2	0.00 cfs 0.00 af	0.00 cfs 0.00 af
10 Year Storm (4.85") • To Design Point DP2	0.00 cfs 0.001 af	0.00 cfs 0.001 af
100 Year Storm (7.10") • To Design Point DP2	0.04 cfs 0.008 af	0.03 cfs 0.004 af

Design Point 3 – Flow off-site to East (N/F Pappas)

	Pre development (EDA 3) Rate	Post development (PDA 4) Rate
2 Year Storm (3.50") • To Design Point DP3	0.00 cfs 0.002 af	0.00 cfs 0.001 af
10 Year Storm (4.85") • To Design Point DP3	0.05 cfs 0.011 af	0.03 cfs 0.007 af
100 Year Storm (7.10") • To Design Point DP3	0.32 cfs 0.036 af	0.23 cfs 0.022 af

Section 6.0: Compliance with DEP Stormwater Management Standards

This section documents project compliance with DEP's 10 Stormwater Management Standards, as summarized below. Refer to Appendix B for the DEP Checklist for Stormwater Report.

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

   There are no wetlands onsite or within close proximity to the site, and virtually all stormwater runoff is contained onsite. DEP Stormwater Management Regulations do not apply because there are no stormwater discharges to any wetlands. However, many of the BMPs prescribed in the DEP Stormwater regulations have been incorporated into the site design, including pretreatment devices, infiltration BMPs, erosion control plans during construction, and long-term stormwater operation and maintenance plans upon completion of the development. A riprap apron is proposed at the inlet to the infiltration basin to prevent erosion (see Appendix C for maximum discharge velocities).

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

   To prevent storm damage and downstream and off-site flooding, Standard 2 requires that the post-development peak discharge rate is equal to or less than the pre-development rate from the 2-year and the 10-year 24-hour storms. BMPs that slow runoff rates through storage and gradual release, such as LID techniques, extended dry detention basins, and wet basins, must be

provided to meet Standard 2. Where an area is within the 100-year coastal flood plain or land subject to coastal storm flowage, the control of peak discharge rates is usually unnecessary and may be waived.

For projects subject to jurisdiction under the Wetlands Protection Act, the issuing authority relies on TR-20 and TR-55 which are guides for estimating the effects of land use changes on runoff volume and peak rates of discharge published by Natural Resource Conservation Service (NRCS). Applicants must calculate runoff rates from pre-existing and post-development conditions. Measurement of peak discharge rates is calculated at a design point, typically the lowest point of discharge at the downgradient property boundary. The topography of the site may require evaluation at more than one design point, if flow leaves the property in more than one direction. An applicant may demonstrate that a feature beyond the property boundary (e.g. culvert) is more appropriate as a design point.
Proponents must also evaluate the impact of peak discharges from the 100-year 24-hour storm. If this evaluation shows that increased off-site flooding will result from peak discharges from the 100-year 24-hour storms, BMPs must also be provided to attenuate these discharges.

One infiltration basin and 2 leach pits have been incorporated into the stormwater design to control runoff rates for the 2- and 10-year storm events as required by DEP; runoff volumes were also evaluated for each design point for the 100-year storm to ensure there will be no risk of increased off-site flooding. Three design points have been analyzed and runoff controlled at each as summarized in Section 5 (refer to HydroCAD calculations in Appendices D-1 and D-2 also).

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best 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 type. 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 Infiltration Basin and two Leach Pits have been designed to recharge more than eight (8) times the required recharge volume of storm water for the site. The required recharge volume has been calculated using the simple dynamic method. Infiltration systems are sited at all locations with at least 4-ft. separation to the water table based on groundwater conditions observed in test pits. These calculations as well as drawdown calculations for all infiltration BMPs have been provided in Appendix E.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:*
   a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
   b. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and
   c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

   The storm water management system for this project has been designed to remove a minimum of 80% of the average annual post construction load of TSS in accordance with this standard. This standard has been met as noted below.

(a) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan (see Appendix J).
(b) The structural BMP treatment trains utilized will capture the required water quality volume determined per the Massachusetts Stormwater Handbook (see Appendix F-1).
(c) Pretreatment is provided at each infiltration system in accordance with the Handbook using deep sump catch basins, a sediment forebay at the infiltration basin, and water quality tanks at the 2 Leach Pits (see Appendices F-2 to F-4).

5. *For land uses with higher potential pollutant loads, 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. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

   The site is not a source of higher pollutant loads. This standard is not applicable.

6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area (IWPA) of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.*

   The site is not located within or near any Zone I or II, IWPA, ORW/SRW or other critical area as defined in the Handbook. This standard is not applicable.

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

   The project site is not a redevelopment project. This standard is not applicable.

8. *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 plan) shall be developed and implemented.*

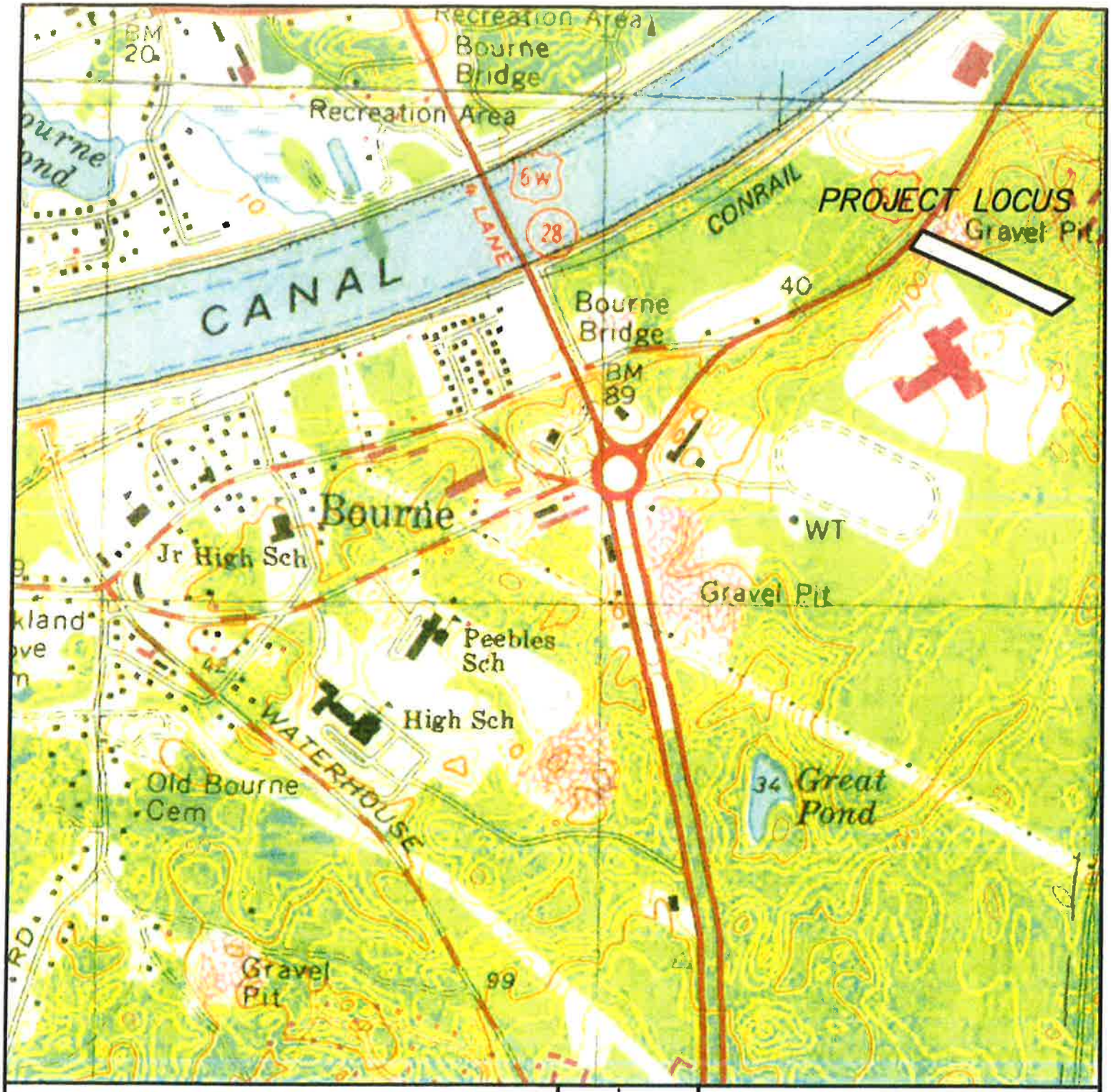
Where this site has a large area flowing towards Sandwich Road with some steep slopes that will require special attention during construction to prevent washouts and off-site sediment transport. Detailed construction sequence notes and erosion control requirements are shown on the Erosion and Sedimentation Control (ESC) plan within the Site Plan set. Appendix J includes a Construction Period Operation and Maintenance log forms for the site contractor and owner to follow to prevent issues during construction, to keep sediment contained onsite. Temporary sediment traps have been sized according to DEP Guidance on Erosion Controls. This standard has been met.

9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

   Long-term O&M requirements for the stormwater system are incorporated into the "Long-Term Stormwater O&M Plan and Pollution Prevention Plan" in Appendix K. This document describes inspection and maintenance schedules for each drainage BMP with an O&M Log Sheet. It also provides good housekeeping guidelines to prevent pollution of the environment as noted above for Standard #4. Standard #9 has been met.

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

    Appendix G contains a PE-signed Illicit Discharge Statement. This standard has been met.



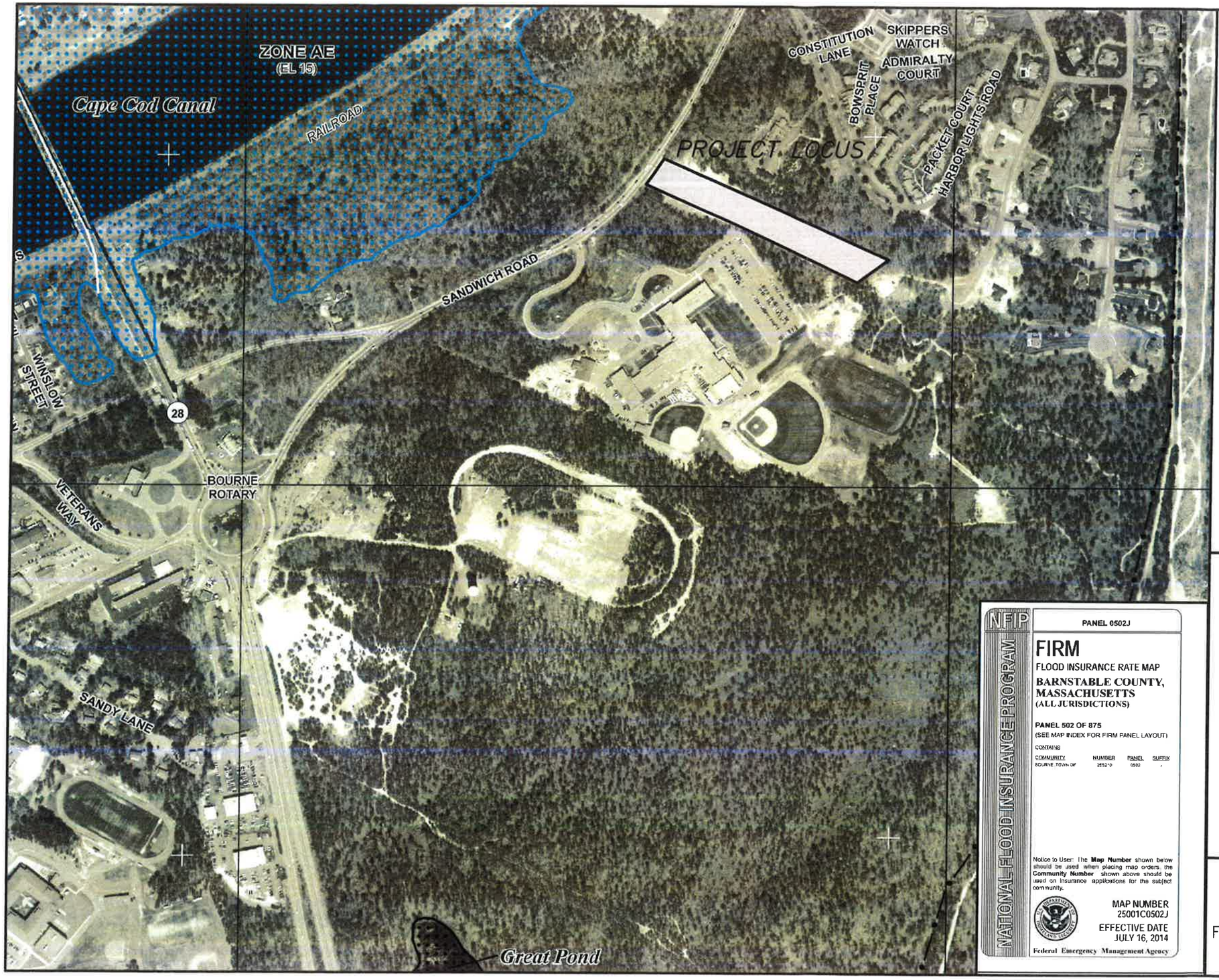
USGS LOCUS MAP
"230 SANDWICH ROAD"
SANDWICH, MASS.
SOURCE: USGS MAP

FEET 0 1000 2000 3000

SCALE: 1"=1000'

Outback Engineering Incorporated

165 EAST GROVE STREET
MIDDLEBOROUGH, MASS. 02346
TEL 508-946-9231



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0502J

FIRM

FLOOD INSURANCE RATE MAP

BARNSTABLE COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 502 OF 875
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
BOURNE, TOWN OF	2552*0	0502	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25001C0502J
EFFECTIVE DATE
JULY 16, 2014

Federal Emergency Management Agency

MAGNETIC

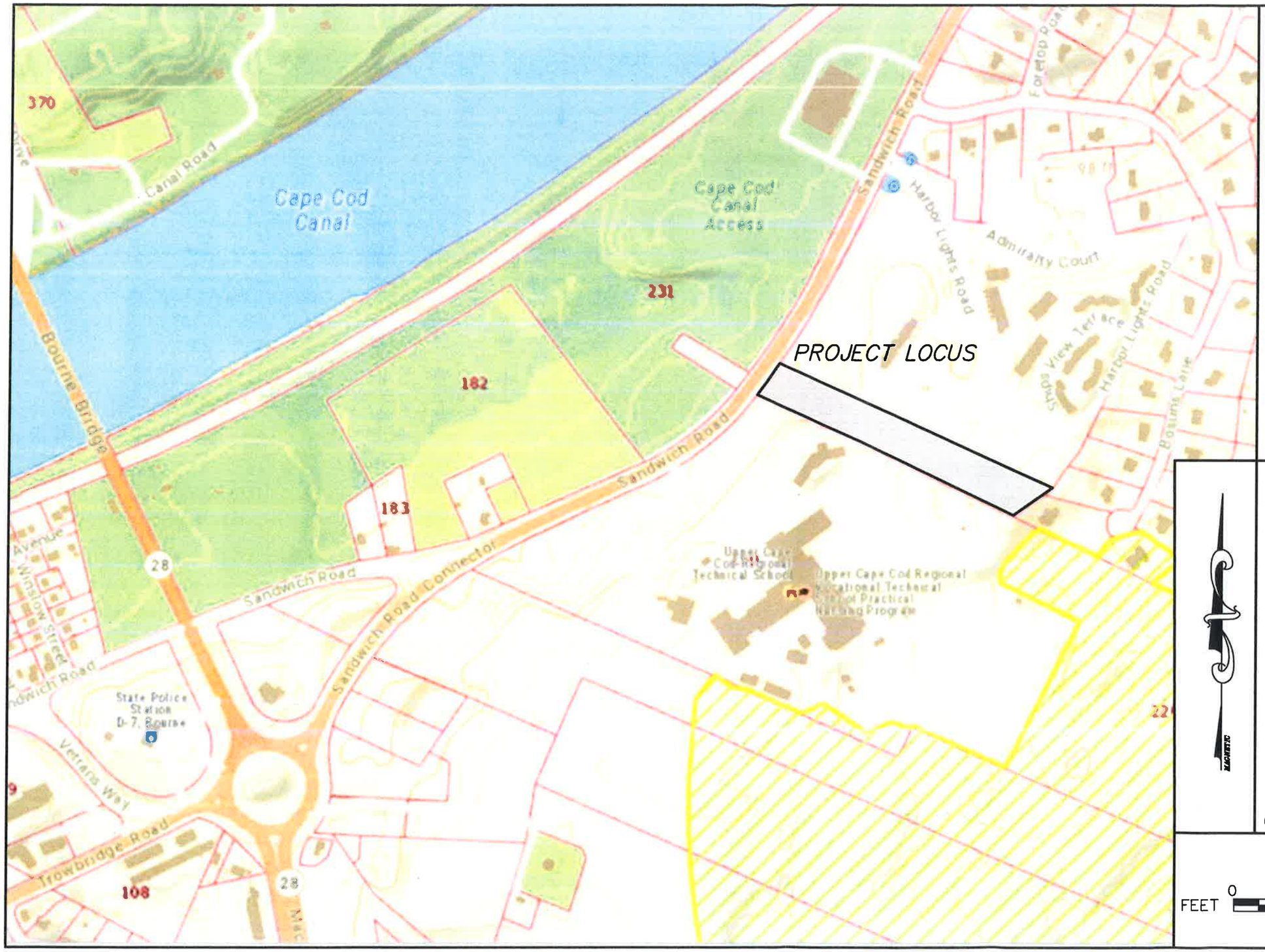
Outback Engineering Incorporated

165 EAST GROVE STREET
MIDDLEBOROUGH, MASS. 02346
TEL 508-946-9231

FLOOD MAP
"230 SANDWICH ROAD"
SANDWICH, MASS.
SOURCE: FEMA

FEET 0 500 1000 1500

SCALE: 1"=500'



LEGEND

NHESP Estimated Habitats of Rare Wildlife

NHESP Priority Habitats of Rare Species

Potential Vernal Pools

NHESP Certified Vernal Pools

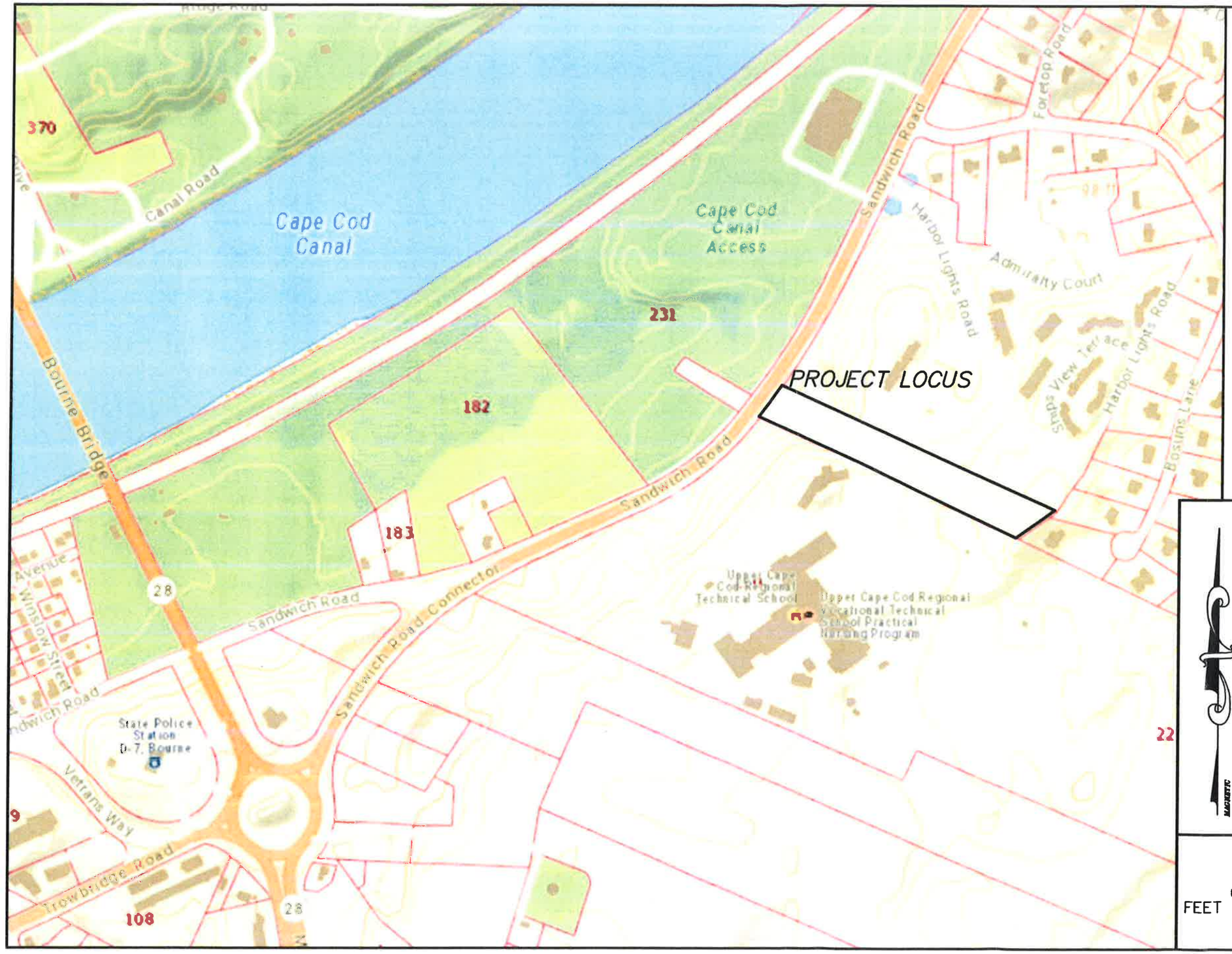
Outback Engineering Incorporated

165 EAST GROVE STREET
MIDDLEBOROUGH, MASS. 02346
TEL 508-946-9231

NATURAL HERITAGE MAP
"LAKELAND HILLS"
SANDWICH, MASS.
SOURCE: 2008 MAPPING BY NHESP OF THE MASSACHUSETTS DIVISIONS OF FISHERIES AND WILDLIFE

FEET 0 400 800 1200

SCALE: 1"=400'



LEGEND

Outstanding Resource Waters
- ACEC
- Cape Cod National Seashore
- Protected Shoreline
- Public Water Supply Watershed
- Retired Public Water Supply
- Scenic/Protected River
- Wildlife Refuge

Zone Is

Zone IIs

Tax Parcels for Query

Outback Engineering Incorporated

165 EAST GROVE STREET
MIDDLEBOROUGH, MASS. 02346
TEL 508-946-9231

CRITICAL AREAS MAP
"230 SANDWICH ROAD"
SANDWICH, MASS.
SOURCE: MASSGIS

MAGNETIC

FEET 0 400 800 1200

SCALE: 1"=400'

Appendix A

NRCS Soil characteristics for on-site soils

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Barnstable County, Massachusetts

January 26, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

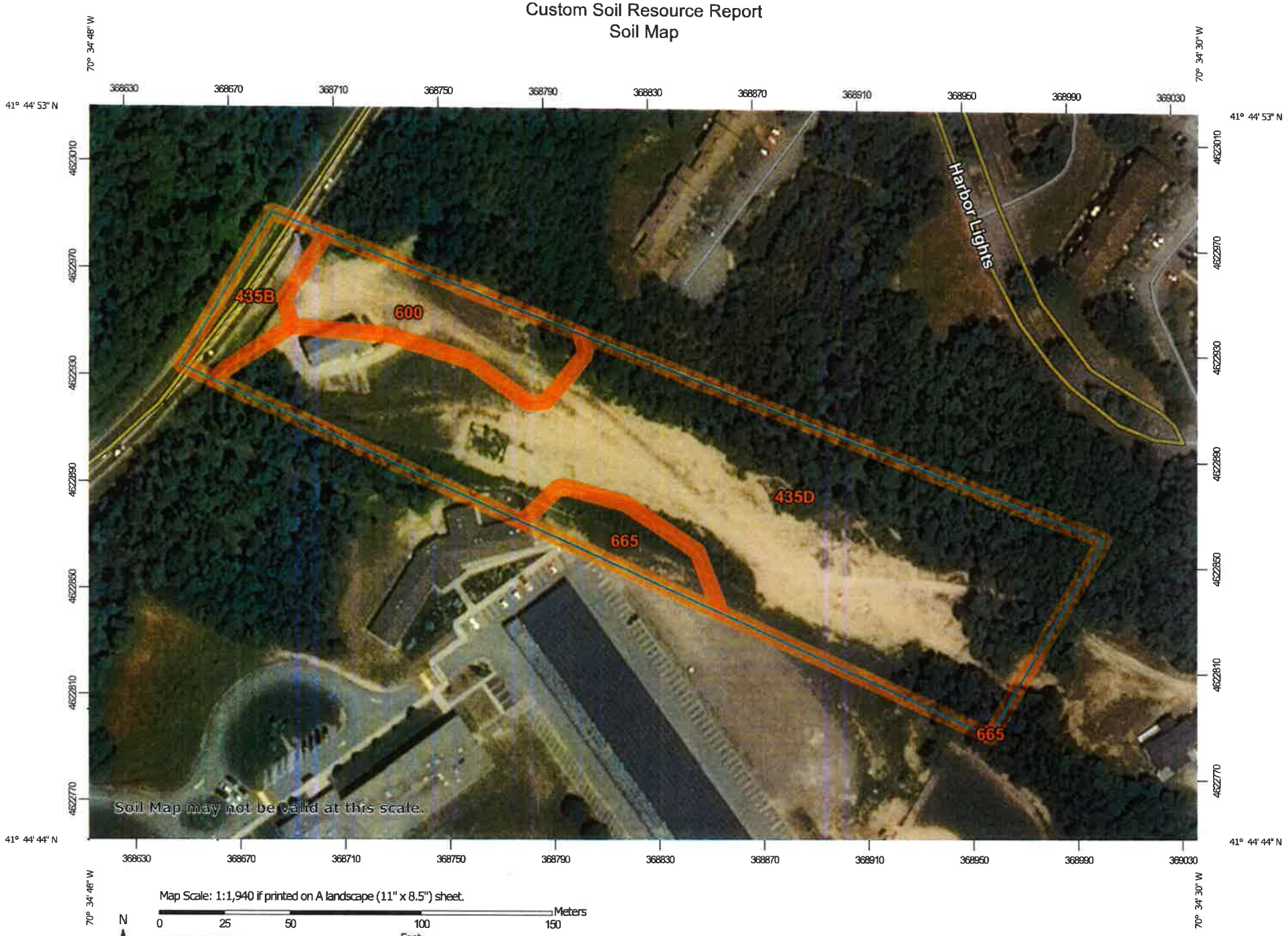
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Barnstable County, Massachusetts
Survey Area Data: Version 17, Jun 9, 2020

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

Date(s) aerial images were photographed: Jul 10, 2018—Nov 17, 2018

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
435B	Plymouth loamy coarse sand, 3 to 8 percent slopes	0.4	5.7%
435D	Plymouth loamy coarse sand, 15 to 35 percent slopes	4.9	76.6%
600	Pits, sand and gravel	0.8	12.2%
665	Udipsamments, smoothed	0.3	5.4%
Totals for Area of Interest		**6.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Barnstable County, Massachusetts

435B—Plymouth loamy coarse sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 98rs
Elevation: 0 to 1,000 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Plymouth and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth

Setting

Landform: Outwash plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits and/or loose sandy ablation till; loose sandy ablation till and/or loose sandy glaciofluvial deposits; loose sandy ablation till and/or loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 3 inches: loamy coarse sand
H2 - 3 to 29 inches: gravelly loamy coarse sand
H3 - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

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

Minor Components

Hinckley
Percent of map unit: 8 percent
Hydric soil rating: No

Carver
Percent of map unit: 8 percent
Hydric soil rating: No

Barnstable
Percent of map unit: 6 percent
Hydric soil rating: No

Nantucket
Percent of map unit: 6 percent
Hydric soil rating: No

Merrimac
Percent of map unit: 2 percent
Hydric soil rating: No

435D—Plymouth loamy coarse sand, 15 to 35 percent slopes

Map Unit Setting
National map unit symbol: 98rv
Elevation: 0 to 1,000 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Plymouth and similar soils: 65 percent
Minor components: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth

Setting
Landform: Ice-contact slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits and/or loose sandy ablation till; loose sandy glaciofluvial deposits and/or loose sandy ablation till

Typical profile
H1 - 0 to 3 inches: loamy coarse sand
H2 - 3 to 29 inches: gravelly loamy coarse sand

H3 - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Minor Components

Carver

Percent of map unit: 15 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 10 percent
Hydric soil rating: No

Barnstable

Percent of map unit: 5 percent
Hydric soil rating: No

Nantucket

Percent of map unit: 5 percent
Hydric soil rating: No

600—Pits, sand and gravel

Map Unit Setting

National map unit symbol: 98rq
Frost-free period: 120 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Pits: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Setting

Parent material: Loose sandy and gravelly glaciofluvial deposits

665—Udipsamments, smoothed

Map Unit Setting

National map unit symbol: 98s6
Elevation: 0 to 230 feet
Mean annual precipitation: 41 to 48 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udipsamments and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udipsamments

Setting

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy excavated or filled land

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix B

DEP Checklist for Stormwater Report

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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.

Checklist for Stormwater Report

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.

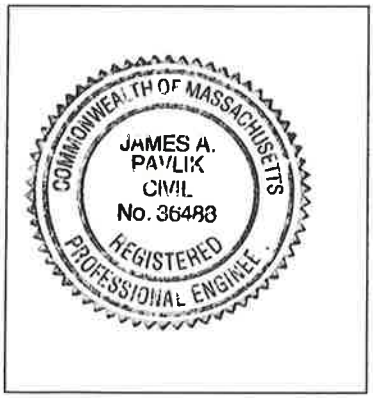
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



James A. Pavlik 3-9-22

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): Leaching Drywells

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 for Stormwater Report

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 for Stormwater Report

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 for 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 for 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.

Appendix C

Maximum Discharge Velocities (Standard #1)

Outback Engineering Incorporated

165 East Grove Street
Middleborough, MA 02346

Tel: 508-946-9231 Fax: 508-947-8873

www.outback-eng.com

JOB #: OE-3294 CALC BY: CJV DATE: 3/4/22
JOB NAME: 230 Sandwich Road CHECK BY: J.A.P DATE: 3/4/22
TOWN: Bourne

STANDARD 1: NO UNTREATED DISCHARGE OR EROSION TO WETLANDS

No new untreated discharge:
Computations required to demonstrate compliance with Standards 4 through 6 may be used to demonstrate that all new discharges are adequately treated.

Maximum Discharge Velocity & Ability of Ground Surface to Resist Erosion:

Discharge Outlet	Max. Discharge Velocity (ft/s)*	Receiving Groundcover	Receiving Slope	Permissible Velocity (ft/s)**	Suitability
Broad-crested weir Infil. Basin	0	Lawn	3%	5	O.K.

* Maximum discharge velocity obtained from post-development hydrology calculation (see Appendix D-2)

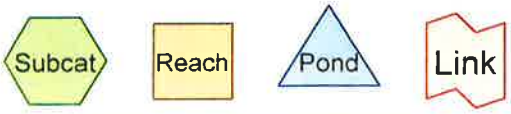
Appendix D-1

Existing Hydrology Calculations (Standard #2)

Runoff to Sandwich Road

Flow off site to East (N/F Pappas)

Flow to depression off-site on school property



Routing Diagram for PRE Hydrocad
Prepared by Microsoft, Printed 3/8/2022

Summary for Subcatchment EDA 1: Runoff to Sandwich Road

Runoff = 0.01 cfs @ 21.41 hrs, Volume= 0.006 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.50"

	Area (sf)	CN	Description
*	3,023	98	Existing Garage,, & Brick Walls, HSG A
	127,867	30	Woods, Good, HSG A
	49,608	49	50-75% Grass cover, Fair, HSG A
	13,159	96	Gravel surface, HSG A
	193,657	40	Weighted Average
	190,634		98.44% Pervious Area
	3,023		1.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.0900	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
4.4	1,180	0.0760	4.44		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.9	1,230	Total			

Summary for Subcatchment EDA2: Flow to depression off-site on school property

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to nonexistent node 2R

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.50"

Area (sf)	CN	Description
5,204	30	Woods, Good, HSG A
2,150	49	50-75% Grass cover, Fair, HSG A
7,354	36	Weighted Average
7,354		100.00% Pervious Area

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

Summary for Subcatchment EDA3: Flow off site to East (N/F Pappas)

Runoff = 0.00 cfs @ 14.81 hrs, Volume= 0.002 af, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.50"

Area (sf)	CN	Description
2,792	30	Woods, Good, HSG A
12,046	49	50-75% Grass cover, Fair, HSG A
14,838	45	Weighted Average
14,838		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**
4.7	50	0.2000	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
0.2	60	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.9	110	Total			

Summary for Subcatchment EDA 1: Runoff to Sandwich Road

Runoff = 0.17 cfs @ 12.55 hrs, Volume= 0.075 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.85"

	Area (sf)	CN	Description
*	3,023	98	Existing Garage,, & Brick Walls, HSG A
	127,867	30	Woods, Good, HSG A
	49,608	49	50-75% Grass cover, Fair, HSG A
	13,159	96	Gravel surface, HSG A
	193,657	40	Weighted Average
	190,634		98.44% Pervious Area
	3,023		1.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.0900	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
4.4	1,180	0.0760	4.44		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.9	1,230	Total			

Summary for Subcatchment EDA2: Flow to depression off-site on school property

Runoff = 0.00 cfs @ 15.05 hrs, Volume= 0.001 af, Depth= 0.09"
Routed to nonexistent node 2R

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.85"

Area (sf)	CN	Description
5,204	30	Woods, Good, HSG A
2,150	49	50-75% Grass cover, Fair, HSG A
7,354	36	Weighted Average
7,354		100.00% Pervious Area

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

Summary for Subcatchment EDA3: Flow off site to East (N/F Pappas)

Runoff = 0.05 cfs @ 12.40 hrs, Volume= 0.011 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.85"

Area (sf)	CN	Description
2,792	30	Woods, Good, HSG A
12,046	49	50-75% Grass cover, Fair, HSG A
14,838	45	Weighted Average
14,838		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**
4.7	50	0.2000	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
0.2	60	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.9	110	Total			

Summary for Subcatchment EDA 1: Runoff to Sandwich Road

Runoff = 2.15 cfs @ 12.25 hrs, Volume= 0.326 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.10"

	Area (sf)	CN	Description
*	3,023	98	Existing Garage,, & Brick Walls, HSG A
	127,867	30	Woods, Good, HSG A
	49,608	49	50-75% Grass cover, Fair, HSG A
	13,159	96	Gravel surface, HSG A
	193,657	40	Weighted Average
	190,634		98.44% Pervious Area
	3,023		1.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.0900	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
4.4	1,180	0.0760	4.44		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.9	1,230	Total			

Summary for Subcatchment EDA2: Flow to depression off-site on school property

Runoff = 0.04 cfs @ 12.32 hrs, Volume= 0.008 af, Depth= 0.59"
Routed to nonexistent node 2R

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.10"

Area (sf)	CN	Description
5,204	30	Woods, Good, HSG A
2,150	49	50-75% Grass cover, Fair, HSG A
7,354	36	Weighted Average
7,354		100.00% Pervious Area

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

Summary for Subcatchment EDA3: Flow off site to East (N/F Pappas)

Runoff = 0.32 cfs @ 12.19 hrs, Volume= 0.036 af, Depth= 1.28"

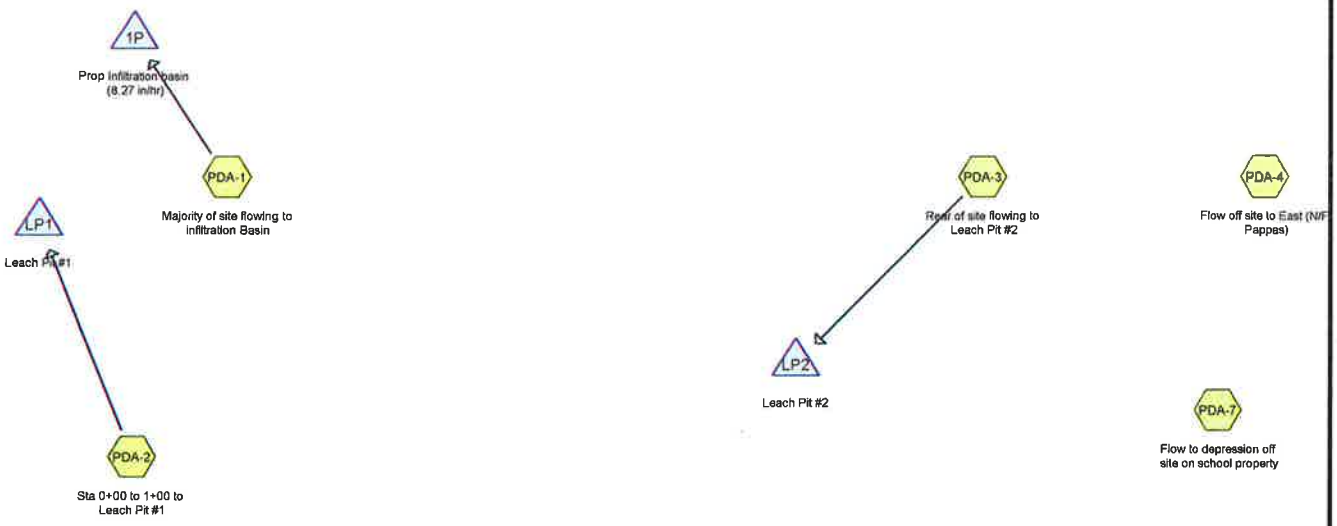
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.10"

Area (sf)	CN	Description
2,792	30	Woods, Good, HSG A
12,046	49	50-75% Grass cover, Fair, HSG A
14,838	45	Weighted Average
14,838		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**
4.7	50	0.2000	0.18		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
0.2	60	0.1000	5.09		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
10.9	110	Total			

Appendix D-2

Post-Development Hydrology Calculations (Standard #2)



Subcat Reach Pond Link

Routing Diagram for Hydrocad - (3-9-22 24 Unit Layout)
Prepared by Microsoft, Printed 3/8/2022

Summary for Subcatchment PDA-1: Majority of site flowing to infiltration Basin

Runoff = 1.10 cfs @ 12.14 hrs, Volume= 0.139 af, Depth= 0.45"
Routed to Pond 1P : Prop Infiltration basin (8.27 in/hr)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.50"

	Area (sf)	CN	Description
*	10,022	98	driveways, HSG A
*	18,000	98	roof area, HSG A
*	24,359	98	road/ sidewalk, HSG A
	82,106	39	>75% Grass cover, Good, HSG A
	19,503	30	Woods, Good, HSG A
*	1,300	98	Unconnected roofs, HSG A (porches)
	3,595	39	>75% Grass cover, Good, HSG A
	236	30	Woods, Good, HSG A
*	1,139	98	Half of pool area, HSG A
	160,260	58	Weighted Average
	105,440		65.79% Pervious Area
	54,820		34.21% Impervious Area
	1,300		2.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.1300	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
0.3	196	0.3500	9.52		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	73	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.1	319	Total			

Summary for Subcatchment PDA-2: Sta 0+00 to 1+00 to Leach Pit #1

Runoff = 0.00 cfs @ 15.62 hrs, Volume= 0.001 af, Depth= 0.04"
Routed to Pond LP1 : Leach Pit #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.50"

Area (sf)	CN	Adj	Description
3,579	39		>75% Grass cover, Good, HSG A
3,145	98		Unconnected pavement, HSG A
5,306	30		Woods, Good, HSG A
12,030	50	42	Weighted Average, UI Adjusted
8,885			73.86% Pervious Area
3,145			26.14% Impervious Area
3,145			100.00% Unconnected

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

Summary for Subcatchment PDA-3: Rear of site flowing to Leach Pit #2

Runoff = 0.03 cfs @ 12.45 hrs, Volume= 0.010 af, Depth= 0.17"
Routed to Pond LP2 : Leach Pit #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.50"

	Area (sf)	CN	Description
*	3,945	98	Road/ driveway, HSG A
	720	98	Unconnected roofs, HSG A
	1,530	30	Woods, Good, HSG A
	24,876	39	>75% Grass cover, Good, HSG A
*	1,139	98	Half of Pool area, HSG A
	32,210	49	Weighted Average
	26,406		81.98% Pervious Area
	5,804		18.02% Impervious Area
	720		12.41% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
0.3	105	0.1500	6.24		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	65	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.8	220	Total			

Summary for Subcatchment PDA-4: Flow off site to East (N/F Pappas)

Runoff = 0.00 cfs @ 14.74 hrs, Volume= 0.001 af, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.50"

Area (sf)	CN	Description
1,696	30	Woods, Good, HSG A
550	39	>75% Grass cover, Good, HSG A
6,646	49	50-75% Grass cover, Fair, HSG A
8,892	45	Weighted Average
8,892		100.00% Pervious Area

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

Summary for Subcatchment PDA-7: Flow to depression off site on school property

Runoff = 0.00 cfs @ 22.55 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.50"

Area (sf)	CN	Description
2,445	39	>75% Grass cover, Good, HSG A
2,445		100.00% Pervious Area

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

Summary for Pond 1P: Prop Infiltration basin (8.27 in/hr)

Inflow Area = 3.679 ac, 34.21% Impervious, Inflow Depth = 0.45" for 2 Year event
Inflow = 1.10 cfs @ 12.14 hrs, Volume= 0.139 af
Outflow = 0.24 cfs @ 13.22 hrs, Volume= 0.139 af, Atten= 78%, Lag= 64.8 min
Discarded = 0.24 cfs @ 13.22 hrs, Volume= 0.139 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 46.38' @ 13.22 hrs Surf.Area= 1,261 sf Storage= 1,358 cf

Plug-Flow detention time= 56.5 min calculated for 0.139 af (100% of inflow)
Center-of-Mass det. time= 56.5 min (976.0 - 919.5)

Volume	Invert	Avail.Storage	Storage Description
#1	45.00'	21,052 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
45.00	719	118.0	0	0	719
46.00	1,110	142.0	907	907	1,232
48.00	2,012	182.0	3,078	3,985	2,313
50.00	3,621	245.0	5,555	9,540	4,496
52.00	5,221	285.0	8,793	18,333	6,265
52.50	5,656	294.0	2,719	21,052	6,704

Device	Routing	Invert	Outlet Devices
#1	Discarded	45.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	51.50'	**10.0' long x 15.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.24 cfs @ 13.22 hrs HW=46.38' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=45.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond LP1: Leach Pit #1

Inflow Area = 0.276 ac, 26.14% Impervious, Inflow Depth = 0.04" for 2 Year event
Inflow = 0.00 cfs @ 15.62 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 15.65 hrs, Volume= 0.001 af, Atten= 0%, Lag= 1.8 min
Discarded = 0.00 cfs @ 15.65 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 44.50' @ 15.65 hrs Surf.Area= 0.004 ac Storage= 0.000 af

Plug-Flow detention time= 1.8 min calculated for 0.001 af (100% of inflow)
Center-of-Mass det. time= 1.7 min (1,131.6 - 1,129.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	44.50'	0.007 af	**10.40'W x 18.00'L x 5.00'H Field A** 0.021 af Overall - 0.004 af Embedded = 0.017 af x 40.0% Voids
#2A	45.00'	0.003 af	**Concrete Galley 4x4x4** x 3 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf
		0.010 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	44.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 15.65 hrs HW=44.50' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Summary for Pond LP2: Leach Pit #2

Inflow Area = 0.739 ac, 18.02% Impervious, Inflow Depth = 0.17" for 2 Year event
Inflow = 0.03 cfs @ 12.45 hrs, Volume= 0.010 af
Outflow = 0.03 cfs @ 12.49 hrs, Volume= 0.010 af, Atten= 3%, Lag= 2.6 min
Discarded = 0.03 cfs @ 12.49 hrs, Volume= 0.010 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 112.52' @ 12.49 hrs Surf.Area= 0.014 ac Storage= 0.000 af

Plug-Flow detention time= 2.5 min calculated for 0.010 af (100% of inflow)
Center-of-Mass det. time= 2.4 min (996.9 - 994.5)

Volume	Invert	Avail.Storage	Storage Description
#1	113.00'	0.016 af	**6.00'D x 6.00'H Vertical Cone/Cylinder** x 4 Inside #2 0.021 af Overall - 6.0" Wall Thickness = 0.016 af
#2	112.50'	0.031 af	**14.00'W x 44.00'L x 7.00'H Prismatoid** 0.099 af Overall - 0.021 af Embedded = 0.078 af x 40.0% Voids
		0.047 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	112.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.12 cfs @ 12.49 hrs HW=112.52' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Summary for Subcatchment PDA-1: Majority of site flowing to infiltration Basin

Runoff = 3.92 cfs @ 12.11 hrs, Volume= 0.333 af, Depth= 1.09"
Routed to Pond 1P : Prop Infiltration basin (8.27 in/hr)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.85"

	Area (sf)	CN	Description
*	10,022	98	driveways, HSG A
*	18,000	98	roof area, HSG A
*	24,359	98	road/ sidewalk, HSG A
	82,106	39	>75% Grass cover, Good, HSG A
	19,503	30	Woods, Good, HSG A
*	1,300	98	Unconnected roofs, HSG A (porches)
	3,595	39	>75% Grass cover, Good, HSG A
	236	30	Woods, Good, HSG A
*	1,139	98	Half of pool area, HSG A
	160,260	58	Weighted Average
	105,440		65.79% Pervious Area
	54,820		34.21% Impervious Area
	1,300		2.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.1300	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
0.3	196	0.3500	9.52		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	73	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.1	319	Total			

Summary for Subcatchment PDA-2: Sta 0+00 to 1+00 to Leach Pit #1

Runoff = 0.02 cfs @ 12.40 hrs, Volume= 0.006 af, Depth= 0.27"
Routed to Pond LP1 : Leach Pit #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.85"

Area (sf)	CN	Adj	Description
3,579	39		>75% Grass cover, Good, HSG A
3,145	98		Unconnected pavement, HSG A
5,306	30		Woods, Good, HSG A
12,030	50	42	Weighted Average, UI Adjusted
8,885			73.86% Pervious Area
3,145			26.14% Impervious Area
3,145			100.00% Unconnected

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

Summary for Subcatchment PDA-3: Rear of site flowing to Leach Pit #2

Runoff = 0.26 cfs @ 12.16 hrs, Volume= 0.036 af, Depth= 0.58"
Routed to Pond LP2 : Leach Pit #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.85"

	Area (sf)	CN	Description
*	3,945	98	Road/ driveway, HSG A
	720	98	Unconnected roofs, HSG A
	1,530	30	Woods, Good, HSG A
	24,876	39	>75% Grass cover, Good, HSG A
*	1,139	98	Half of Pool area, HSG A
	32,210	49	Weighted Average
	26,406		81.98% Pervious Area
	5,804		18.02% Impervious Area
	720		12.41% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
0.3	105	0.1500	6.24		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	65	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.8	220	Total			

Summary for Subcatchment PDA-4: Flow off site to East (N/F Pappas)

Runoff = 0.03 cfs @ 12.32 hrs, Volume= 0.007 af, Depth= 0.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.85"

Area (sf)	CN	Description
1,696	30	Woods, Good, HSG A
550	39	>75% Grass cover, Good, HSG A
6,646	49	50-75% Grass cover, Fair, HSG A
8,892	45	Weighted Average
8,892		100.00% Pervious Area

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

Summary for Subcatchment PDA-7: Flow to depression off site on school property

Runoff = 0.00 cfs @ 13.63 hrs, Volume= 0.001 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.85"

Area (sf)	CN	Description
2,445	39	>75% Grass cover, Good, HSG A
2,445		100.00% Pervious Area

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

Summary for Pond 1P: Prop Infiltration basin (8.27 in/hr)

Inflow Area = 3.679 ac, 34.21% Impervious, Inflow Depth = 1.09" for 10 Year event
Inflow = 3.92 cfs @ 12.11 hrs, Volume= 0.333 af
Outflow = 0.46 cfs @ 13.67 hrs, Volume= 0.333 af, Atten= 88%, Lag= 93.6 min
Discarded = 0.46 cfs @ 13.67 hrs, Volume= 0.333 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 48.55' @ 13.67 hrs Surf.Area= 2,409 sf Storage= 5,202 cf

Plug-Flow detention time= 143.9 min calculated for 0.333 af (100% of inflow)
Center-of-Mass det. time= 143.8 min (1,028.3 - 884.5)

Volume	Invert	Avail.Storage	Storage Description
#1	45.00'	21,052 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
45.00	719	118.0	0	0	719
46.00	1,110	142.0	907	907	1,232
48.00	2,012	182.0	3,078	3,985	2,313
50.00	3,621	245.0	5,555	9,540	4,496
52.00	5,221	285.0	8,793	18,333	6,265
52.50	5,656	294.0	2,719	21,052	6,704

Device	Routing	Invert	Outlet Devices
#1	Discarded	45.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	51.50'	**10.0' long x 15.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.46 cfs @ 13.67 hrs HW=48.55' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.46 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=45.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond LP1: Leach Pit #1

Inflow Area = 0.276 ac, 26.14% Impervious, Inflow Depth = 0.27" for 10 Year event
Inflow = 0.02 cfs @ 12.40 hrs, Volume= 0.006 af
Outflow = 0.02 cfs @ 12.43 hrs, Volume= 0.006 af, Atten= 1%, Lag= 1.8 min
Discarded = 0.02 cfs @ 12.43 hrs, Volume= 0.006 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 44.53' @ 12.43 hrs Surf.Area= 0.004 ac Storage= 0.000 af

Plug-Flow detention time= 1.7 min calculated for 0.006 af (100% of inflow)
Center-of-Mass det. time= 1.7 min (982.9 - 981.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	44.50'	0.007 af	**10.40'W x 18.00'L x 5.00'H Field A** 0.021 af Overall - 0.004 af Embedded = 0.017 af x 40.0% Voids
#2A	45.00'	0.003 af	**Concrete Galley 4x4x4** x 3 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf
		0.010 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	44.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 12.43 hrs HW=44.53' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Summary for Pond LP2: Leach Pit #2

Inflow Area = 0.739 ac, 18.02% Impervious, Inflow Depth = 0.58" for 10 Year event
Inflow = 0.26 cfs @ 12.16 hrs, Volume= 0.036 af
Outflow = 0.12 cfs @ 12.10 hrs, Volume= 0.036 af, Atten= 55%, Lag= 0.0 min
Discarded = 0.12 cfs @ 12.10 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 113.14' @ 12.57 hrs Surf.Area= 0.014 ac Storage= 0.004 af

Plug-Flow detention time= 7.2 min calculated for 0.036 af (100% of inflow)
Center-of-Mass det. time= 7.2 min (932.5 - 925.4)

Volume	Invert	Avail.Storage	Storage Description
#1	113.00'	0.016 af	**6.00'D x 6.00'H Vertical Cone/Cylinder** x 4 Inside #2 0.021 af Overall - 6.0" Wall Thickness = 0.016 af
#2	112.50'	0.031 af	**14.00'W x 44.00'L x 7.00'H Prismatoid** 0.099 af Overall - 0.021 af Embedded = 0.078 af x 40.0% Voids
		0.047 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	112.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.12 cfs @ 12.10 hrs HW=112.58' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Summary for Subcatchment PDA-1: Majority of site flowing to infiltration Basin

Runoff = 10.07 cfs @ 12.10 hrs, Volume= 0.760 af, Depth= 2.48"
Routed to Pond 1P : Prop Infiltration basin (8.27 in/hr)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.10"

	Area (sf)	CN	Description
*	10,022	98	driveways, HSG A
*	18,000	98	roof area, HSG A
*	24,359	98	road/ sidewalk, HSG A
	82,106	39	>75% Grass cover, Good, HSG A
	19,503	30	Woods, Good, HSG A
*	1,300	98	Unconnected roofs, HSG A (porches)
	3,595	39	>75% Grass cover, Good, HSG A
	236	30	Woods, Good, HSG A
*	1,139	98	Half of pool area, HSG A
	160,260	58	Weighted Average
	105,440		65.79% Pervious Area
	54,820		34.21% Impervious Area
	1,300		2.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.1300	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
0.3	196	0.3500	9.52		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	73	0.0900	6.09		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.1	319	Total			

Summary for Subcatchment PDA-2: Sta 0+00 to 1+00 to Leach Pit #1

Runoff = 0.22 cfs @ 12.12 hrs, Volume= 0.024 af, Depth= 1.04"
Routed to Pond LP1 : Leach Pit #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.10"

Area (sf)	CN	Adj	Description
3,579	39		>75% Grass cover, Good, HSG A
3,145	98		Unconnected pavement, HSG A
5,306	30		Woods, Good, HSG A
12,030	50	42	Weighted Average, UI Adjusted
8,885			73.86% Pervious Area
3,145			26.14% Impervious Area
3,145			100.00% Unconnected

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

Summary for Subcatchment PDA-3: Rear of site flowing to Leach Pit #2

Runoff = 1.17 cfs @ 12.12 hrs, Volume= 0.101 af, Depth= 1.63"
Routed to Pond LP2 : Leach Pit #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.10"

	Area (sf)	CN	Description
*	3,945	98	Road/ driveway, HSG A
	720	98	Unconnected roofs, HSG A
	1,530	30	Woods, Good, HSG A
	24,876	39	>75% Grass cover, Good, HSG A
*	1,139	98	Half of Pool area, HSG A
	32,210	49	Weighted Average
	26,406		81.98% Pervious Area
	5,804		18.02% Impervious Area
	720		12.41% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.50"
0.3	105	0.1500	6.24		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	65	0.0400	4.06		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.8	220	Total			

Summary for Subcatchment PDA-4: Flow off site to East (N/F Pappas)

Runoff = 0.23 cfs @ 12.11 hrs, Volume= 0.022 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.10"

Area (sf)	CN	Description
1,696	30	Woods, Good, HSG A
550	39	>75% Grass cover, Good, HSG A
6,646	49	50-75% Grass cover, Fair, HSG A
8,892	45	Weighted Average
8,892		100.00% Pervious Area

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

Summary for Subcatchment PDA-7: Flow to depression off site on school property

Runoff = 0.03 cfs @ 12.16 hrs, Volume= 0.004 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.10"

Area (sf)	CN	Description
2,445	39	>75% Grass cover, Good, HSG A
2,445		100.00% Pervious Area

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

Summary for Pond 1P: Prop Infiltration basin (8.27 in/hr)

Inflow Area = 3.679 ac, 34.21% Impervious, Inflow Depth = 2.48" for 100 Year event
Inflow = 10.07 cfs @ 12.10 hrs, Volume= 0.760 af
Outflow = 0.88 cfs @ 13.82 hrs, Volume= 0.760 af, Atten= 91%, Lag= 103.3 min
Discarded = 0.88 cfs @ 13.82 hrs, Volume= 0.760 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 51.25' @ 13.82 hrs Surf.Area= 4,585 sf Storage= 14,649 cf

Plug-Flow detention time= 220.9 min calculated for 0.760 af (100% of inflow)
Center-of-Mass det. time= 220.8 min (1,078.5 - 857.6)

Volume	Invert	Avail.Storage	Storage Description
#1	45.00'	21,052 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
45.00	719	118.0	0	0	719
46.00	1,110	142.0	907	907	1,232
48.00	2,012	182.0	3,078	3,985	2,313
50.00	3,621	245.0	5,555	9,540	4,496
52.00	5,221	285.0	8,793	18,333	6,265
52.50	5,656	294.0	2,719	21,052	6,704

Device	Routing	Invert	Outlet Devices
#1	Discarded	45.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	51.50'	**10.0' long x 15.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.88 cfs @ 13.82 hrs HW=51.25' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.88 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=45.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond LP1: Leach Pit #1

Inflow Area = 0.276 ac, 26.14% Impervious, Inflow Depth = 1.04" for 100 Year event
Inflow = 0.22 cfs @ 12.12 hrs, Volume= 0.024 af
Outflow = 0.04 cfs @ 12.05 hrs, Volume= 0.024 af, Atten= 84%, Lag= 0.0 min
Discarded = 0.04 cfs @ 12.05 hrs, Volume= 0.024 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 47.40' @ 13.72 hrs Surf.Area= 0.004 ac Storage= 0.006 af

Plug-Flow detention time= 68.4 min calculated for 0.024 af (100% of inflow)
Center-of-Mass det. time= 68.3 min (979.7 - 911.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	44.50'	0.007 af	**10.40'W x 18.00'L x 5.00'H Field A** 0.021 af Overall - 0.004 af Embedded = 0.017 af x 40.0% Voids
#2A	45.00'	0.003 af	**Concrete Galley 4x4x4** x 3 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf
		0.010 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	44.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 12.05 hrs HW=44.69' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Summary for Pond LP2: Leach Pit #2

Inflow Area = 0.739 ac, 18.02% Impervious, Inflow Depth = 1.63" for 100 Year event
Inflow = 1.17 cfs @ 12.12 hrs, Volume= 0.101 af
Outflow = 0.12 cfs @ 11.90 hrs, Volume= 0.101 af, Atten= 90%, Lag= 0.0 min
Discarded = 0.12 cfs @ 11.90 hrs, Volume= 0.101 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 117.90' @ 14.12 hrs Surf.Area= 0.014 ac Storage= 0.036 af

Plug-Flow detention time= 135.9 min calculated for 0.101 af (100% of inflow)
Center-of-Mass det. time= 135.8 min (1,019.5 - 883.6)

Volume	Invert	Avail.Storage	Storage Description
#1	113.00'	0.016 af	**6.00'D x 6.00'H Vertical Cone/Cylinder** x 4 Inside #2 0.021 af Overall - 6.0" Wall Thickness = 0.016 af
#2	112.50'	0.031 af	**14.00'W x 44.00'L x 7.00'H Prismatoid** 0.099 af Overall - 0.021 af Embedded = 0.078 af x 40.0% Voids
		0.047 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	112.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.12 cfs @ 11.90 hrs HW=112.61' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Appendix E

Groundwater Recharge and Basin Drawdown Calculations (Standard #3)

DRAWDOWN WITHIN 72 HOURS

DRAWDOWN TIME = (Rv)(1/IR)(12 inches/ 1 foot)(1/BA)
WHERE,
Rv = RECHARGE VOLUME IN CUBIC FEET
IR = DESIGN INFILTRATION RATE IN INCHES PER HOUR
BA = BOTTOM AREA IN SQUARE FEET

INFILTRATION BASIN

DRAWDOWN TIME = 15,835 X $\frac{1}{8.27}$ X $\frac{12}{1}$ X $\frac{1}{1,109}$ = **20.72** Hours

Leach Pits #1)

DRAWDOWN TIME = 350 X $\frac{1}{8.27}$ X $\frac{12}{1}$ X $\frac{1}{145}$ = **3.50** Hours

Leach Pits #2

DRAWDOWN TIME = 1,786 X $\frac{1}{8.27}$ X $\frac{12}{1}$ X $\frac{1}{476}$ = **5.44** Hours

Outback Engineering Incorporated
165 East Grove Street
Middleborough, MA 02346
Tel: 508-946-9231
www.outback-eng.com
Fax: 508-947-8873

JOB #: OE-3294
JOB NAME: 230 Sandwich Road
TOWN: Bourne

CALC BY: CJV **DATE:** 3/4/22
CHECK BY: J.A.P. **DATE:** 3/4/22

STANDARD 3: GROUNDWATER RECHARGE CALCULATIONS

Required Recharge Volume
Rv = F x impervious area (including green roofs & porous pavement)
where F = Target Depth Factor

Total Impervious Area*= 63,436 S.F. = 1.46 ACRES

	HSG A	HSG B	HSG C	HSG D
Impervious Area (sf)	63,436	0	0	0
Target Depth Factor (in.)	0.6	0.35	0.25	1
Annual Recharge Volume (cf)	3172	0	0	0

Total required volume to recharge = 3,172 **c.f.**

CAPTURE AREA ADJUSTMENT:

Total Site Impervious Area	=	1.46	ACRES				
Total Impervious Area Directed to Infiltration BMPs	=	1.46	ACRES				
Adjustment Ratio	=	1.46	/	1.46	=	1.00	
Adjusted Required Recharge Volume	=	**3,172**	x	1.00	=	3,172	**c.f.**
	=	**3,172**	/	43,560	=	0.073	**a.f.**

SIMPLE DYNAMIC METHOD:
Recharge Provided through exfiltration in Infiltration Basin, Leaching Pits at entrance and Leaching Pits at turnaround
1.29" rainfall event required to produce *adjusted* required recharge volume
*Storm start time of 11 hours and end time of 13 hours (see attached hydrograph and drain summary)
Required Storage Volume, assuming exfiltration rate of 8.27 in/hr = 1,550 **cf**

Volume provided in Infiltration Basin (below lowest outlet at 51.5):
Cumulative Vol. at 51.50 = 15,835 c.f.

Volume provided in Leaching Pits @ entrance(cum. Of 2)
Cumulative Vol. at 49.50 = 350 c.f.

Volume provided in Leaching Pits @ turnaround(cum. Of 3)
Cumulative Vol. at 120.50 = 1,786 c.f.

Volume provided in Roof Drain (per roof drain)
Cumulative Vol. at 108.50 = 261 c.f.

STORAGE VOLUME PROVIDED

Infiltration BMP	TOTAL VOLUME (C.F.)	BOTTOM AREA (S.F.)
Infiltration basin	15,835	1,109
Leaching Pits at entrance (2)	350	145
Leaching Pits @ turnaround (3)	1,786	476
Roof Drains	522	154
TOTAL	**18,493**	1,884

Impervious Area

Recharge Volume

Subcat Reach Pond Link

Routing Diagram for Appendix E - Groundwater Recharge
Prepared by Microsoft, Printed 3/8/2022

Summary for Subcatchment S: Impervious Area

Runoff = 1.69 cfs @ 12.09 hrs, Volume= 0.073 af, Depth> 0.60"
Routed to Pond P : Recharge Volume

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.05 hrs
Type III 24-hr Recharge Rainfall=1.29"

	Area (sf)	CN	Description
*	63,436	98	Impervious
	63,436		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Pond P: Recharge Volume

Inflow Area = 1.456 ac,100.00% Impervious, Inflow Depth > 0.60" for Recharge event
Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.073 af
Outflow = 0.30 cfs @ 11.75 hrs, Volume= 0.042 af, Atten= 82%, Lag= 0.0 min
Discarded = 0.30 cfs @ 11.75 hrs, Volume= 0.042 af

Routing by Dyn-Stor-Ind method, Time Span= 11.00-13.00 hrs, dt= 0.05 hrs
Peak Elev= 100.97' @ 12.55 hrs Surf.Area= 1,550 sf Storage= 1,499 cf

Plug-Flow detention time= 17.7 min calculated for 0.042 af (58% of inflow)
Center-of-Mass det. time= 3.4 min (728.3 - 724.9)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	1,550 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	1,550	0	0
101.00	1,550	1,550	1,550

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.30 cfs @ 11.75 hrs HW=100.01' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.30 cfs)

Appendix F-1

Water Quality Volume Calculations (Standard #4)

Outback Engineering Incorporated

165 East Grove Street
Middleborough, MA 02346
Tel: 508-946-9231 Fax: 508-947-8873
www.outback-eng.com

JOB #: OE-3294 CALC BY: CJV DATE: 3/4/22
JOB NAME: 230 Sandwich Road CHECK BY: JAP DATE: 3/4/22
TOWN: Bourne

STANDARD 4: WATER QUALITY

WATER QUALITY VOLUME:
V(WQ) = D(WQ) X (12 IN. / FT) X A(IMP)
WHERE,
V(WQ) = REQUIRED WATER QUALITY TREATMENT VOLUME IN CUBIC FEET
D(WQ) = WATER QUALITY DEPTH (0.5 INCH OR 1 INCH)
A(IMP) = IMPERVIOUS AREA IN S.F.

WATER QUALITY VOLUME AT INFILTRATION BASIN
CONTRIBUTING IMPERVIOUS AREA = 53,140 S.F.

V(WQ)	=	1	IN.	X	1 FT/ 12 IN.	X	53,140	S.F.	=	4,428	C.F.

61,769

VOLUME PROVIDED FROM DEEP SUMP HOODED CATCH BASINS

(3.14 x (2ft)^2 x 4ft)	X	10	CATCH BASINS	=	503	C.F.
VOLUME PROVIDED FROM SEDIMENT FOREBAY						
(See Sediment Forebay Calculations)				=	458	C.F.
VOLUME PROVIDED AT BASIN (BELOW LOWEST OUTLET)						
(See Groundwater Recharge Calculations)				=	15,835	C.F.
			TOTAL	=	16,796	C.F.

WATER QUALITY VOLUME AT LEACHING PITS #1
CONTRIBUTING IMPERVIOUS AREA = 3,145 S.F.

V(WQ)	=	1	IN.	X	1 FT/ 12 IN.	X	3,145	S.F.	=	262	C.F.

VOLUME PROVIDED FROM DEEP SUMP HOODED CATCH BASINS

(3.14 x (2ft)^2 x 4ft)	X	2	CATCH BASINS	=	101	C.F.
VOLUME PROVIDED FROM WATER QUALITY TANK= 110 ft^3						
(See Water Quality Tank Sizing Calcs)				=	110	C.F.
VOLUME PROVIDED IN DRYWELLS (BELOW LOWEST OUTLET)						
(See Groundwater Recharge Calculations)				=	350	C.F.
			TOTAL	=	561	C.F.

WATER QUALITY VOLUME AT LEACHING PITS #2
CONTRIBUTING IMPERVIOUS AREA = 5,484 S.F.

V(WQ)	=	1	IN.	X	1 FT/ 12 IN.	X	5,484	S.F.	=	457	C.F.

VOLUME PROVIDED FROM DEEP SUMP HOODED CATCH BASINS

(3.14 x (2ft)^2 x 4ft)	X	2	CATCH BASINS	=	101	C.F.
VOLUME PROVIDED FROM WATER QUALITY TANK= 110 ft^3						
(See Water Quality Tank Sizing Calcs)				=	110	C.F.
VOLUME PROVIDED IN DRYWELLS (BELOW LOWEST OUTLET)						
(See Groundwater Recharge Calculations)				=	1,786	C.F.
			TOTAL	=	1,997	C.F.

Appendix F-2
TSS Removal Calculations (Standard #4)

Outback Engineering Incorporated

165 East Grove Street
Middleborough, MA 02346
Tel: 508-946-9231 Fax: 508-947-8873
www.outback-eng.com

JOB #: OE-3294
JOB NAME: 230 Sandwich Road
TOWN: Bourne

CALC BY: CJV DATE: 3/4/22
CHECK BY: JAP DATE: 3/4/22

PRETREATMENT TSS REMOVAL CALCULATIONS FOR INFILTRATION BASINS WITH RAPID INFILTRATION

INFILTRATION BASIN

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BXC)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1.00	0.25	0.75
Sediment Forebay	25%	0.75	0.19	0.56
		Total TSS Removal=	0.44	

LEACHING PITS @ ENTRANCE

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BXC)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1.00	0.25	0.75
Water Quality tank	25%	0.75	0.19	0.56
		Total TSS Removal=	0.44	

LEACHING PITS @ TURNAROUND

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BXC)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1.00	0.25	0.75
Water Quality tank	25%	0.75	0.19	0.56
		Total TSS Removal=	0.44	

TSS REMOVALS FOR EACH DISCHARGE

TREATMENT OF INFILTRATION BASIN

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BXC)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1	0.25	0.75
Infiltration Basin (with Sediment Forebay)	80%	0.75	0.6	0.15
		Total TSS Removal=	0.85	

Outback Engineering Incorporated

165 East Grove Street
Middleborough, MA 02346
Tel: 508-946-9231 Fax: 508-947-8873
www.outback-eng.com

JOB #: OE-3294
JOB NAME: 230 Sandwich Road
TOWN: Bourne

CALC BY: CJV DATE: 3/4/22
CHECK BY: JAP DATE: 3/4/22

TREATMENT OF LEACHING PITS @ ENTRANCE

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BXC)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1	0.25	0.75
Leaching Chambers (with Pre-Treatment WQ tank)	80%	0.75	0.6	0.15
		Total TSS Removal=	0.85	

TREATMENT OF LEACHING PITS @ TURNAROUND

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BXC)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1	0.25	0.75
Leaching Chambers (with Pre-Treatment WQ tank)	80%	0.75	0.6	0.15
		Total TSS Removal=	0.85	

Appendix F-3
Sediment Forebay Calculations (Standard #4)

Outback Engineering Incorporated

165 East Grove Street
Middleborough, MA 02346
Tel: 508-946-9231 Fax: 508-947-8873
www.outback-eng.com

JOB #: OE-3294 CALC BY: K.A.D. DATE: 03/04/22
JOB NAME: Sandwich Road CHECK BY: J.A.P. DATE: 03/04/22
TOWN: Bourne

SEDIMENT FOREBAY SIZING CALCULATION FOR INFIL. BASIN #1

TOTAL CONTRIBUTING IMPERVIOUS AREA TO FOREBAY

= 53,140 s.f.

REQUIRED VOLUME OF SEDIMENT FOREBAY = VOLUME PRODUCED BY 0.1" RUNOFF/IMPERVIOUS ACRE

REQ'D SED. FOREBAY VOLUME = 0.1" INCHES X $\frac{1\ FT}{12\ IN}$ X 53,140 S.F.

= 443 C.F.

PROVIDED VOLUME OF SEDIMENT FOREBAY

BOTTOM FOREBAY EL. = 47.50 AREA = 86 S.F.
FOREBAY BERM EL. = 49.50 AREA = 372 S.F.

VOLUME PROVIDED = 458 C.F.

Appendix F-4
Water Quality Inlet Calculations

Outback Engineering Incorporated

165 East Grove Street
Middleborough, MA 02346
Tel: 508-946-9231 Fax: 508-947-8873

JOB #: OE-3294 CALC BY: CJV DATE: 3/4/22
JOB NAME: 230 Sandwich Road CHECK BY: J.A.P. DATE: 3/4/22

WATER QUALITY INLET CALCULATIONS (Flow to Leach Pit #1)

Contributing Impervious Area = 3,145 s.f.

First Chamber (400 c.f. / contributing impervious acre)

= 3,145 s.f. x $\frac{1 \text{ Acre}}{43{,}560 \text{ s.f.}}$ = 0.07 Acres

= $\frac{400 \text{ c.f.}}{\text{acre}}$ x 0.07 Acres = 29 c.f.

= $\frac{7.48 \text{ gal}}{\text{c.f.}}$ x 29 c.f. = 216 Gallons (Min.)

Second Chamber

= 500 Gallons (Min.)

ThirdChamber

= 500 Gallons (Min)

Use a 2000 Gallon Tank

WATER QUALITY INLET CALCULATIONS (Flow to Leach Pit #2)

Contributing Impervious Area = 5,804 s.f.

First Chamber (400 c.f. / contributing impervious acre)

= 5,804 s.f. x $\frac{1 \text{ Acre}}{43{,}560 \text{ s.f.}}$ = 0.13 Acres

= $\frac{400 \text{ c.f.}}{\text{acre}}$ x 0.13 Acres = 53 c.f.

= $\frac{7.48 \text{ gal}}{\text{c.f.}}$ x 53 c.f. = 399 Gallons (Min.)

Second Chamber

= 500 Gallons (Min.)

ThirdChamber

= 500 Gallons (Min)

Use a 2000 Gallon Tank

Outback Engineering Incorporated

165 East Grove Street
Middleborough, MA 02346

Tel: 508-946-9231 Fax: 508-947-8873

JOB #: OE-3294
JOB NAME: 230 Sandwich Road
TOWN: Bourne
Des. Storm: 2 year

CALC BY: CJV **DATE:** 3/4/22
CHECK BY: J.A.P. **DATE:** 3/4/22

WATER QUALITY TANK BYPASS CALCULATION

Per the Stormwater Management Regulations, water quality tanks must be designed offline, pass the 2-year 24-hour storm without interference, and must have a bypass for larger storms to prevent resuspension of solids. This calculation provides the required elevation difference between the two outlets in the required flow splitter drain manhole (highlighted in yellow). The bypass pipe must be set at this relative height above the outlet to the water quality tank. Also see detail for flow limiter on sheet 9 of the Final Plans.

WATER QUALITY TANK 1

(DMH-1 acts as the flow splitter manhole for WQ Tank-1)

PIPE DESCRIPTION				DRAINAGE AREA (acres)	IMPERV. AREA (acres)	PERV. AREA (acres)	C perv.= 0.30 imp.=0.90	CA	TIME OF CONC. (min.)			I (in./hr)	Qc=CIA (cfs)
LENGTH #	DA #	FROM	TO						Inlet (min.)	Drain (min.)	Total (min.)		
1	1	CB-1A	DMH-1	0.04	0.03	0.01	0.76	0.03	10	0.11	10.11	3.2	0.09
2	1	CB-1B	DMH-1	0.23	0.04	0.19	0.41	0.09	10	0.12	10.12	3.2	0.30
3	1	DMH-1	WQT-1	0.27	0.07	0.19	0.46	0.12	10	0.05	10.05	3.2	0.39

LENGTH #	PIPE DIAMETER (in.)	PIPE MATERIAL (n-value)	SLOPE (ft./ft.)	LENGTH (ft)	FULL FLOW		CURRENT FLOW				
					Vf (ft/sec)	Qf (cfs)	Vc (ft/sec)	Qc (cfs)	Qc/Qf	d/D (in.)	Depth of flow in pipe (in)
1	12	0.012	0.02	17	6.95	5.46	2.50	0.09	0.02	0.1	1.0
2	12	0.012	0.02	26	6.95	5.46	3.71	0.30	0.06	0.2	1.8
3	12	0.012	0.02	11	6.95	5.46	4.07	0.39	0.07	0.2	2.1

WATER QUALITY TANK 2

(DMH-7 acts as the flow splitter manhole for WQ Tank-2)

PIPE DESCRIPTION				DRAINAGE AREA (acres)	IMPERV. AREA (acres)	PERV. AREA (acres)	C perv.= 0.30 imp.=0.90	CA	TIME OF CONC. (min.)			I (in./hr)	Qc=CIA (cfs)
LENGTH #	DA #	FROM	TO						Inlet (min.)	Drain (min.)	Total (min.)		
1	1	CB-7A	DMH-7	0.43	0.05	0.38	0.37	0.16	10	0.07	10.07	3.2	0.50
2	1	CB-7B	DMH-7	0.28	0.06	0.22	0.42	0.12	10	0.07	10.07	3.2	0.38
3	1	DMH-7	WQT-2	0.71	0.11	0.60	0.39	0.28	10	0.08	10.08	3.2	0.88

LENGTH #	PIPE DIAMETER (in.)	PIPE MATERIAL (n-value)	SLOPE (ft./ft.)	LENGTH (ft)	FULL FLOW		CURRENT FLOW				
					Vf (ft/sec)	Qf (cfs)	Vc (ft/sec)	Qc (cfs)	Qc/Qf	d/D (in.)	Depth of flow in pipe (in)
1	12	0.012	0.02	19	6.95	5.46	4.42	0.50	0.09	0.2	2.4
2	12	0.012	0.02	18	6.95	5.46	4.03	0.38	0.07	0.2	2.1
3	12	0.012	0.02	26	6.95	5.46	5.28	0.88	0.16	0.3	3.3

PIPE CHARACTERISTICS

	Vel	Q	n	DIA	DIA FT	A	Pw	R
1	49.1	38.6	0.012	12	1	0.785	3.1416	0.25
2	49.1	38.6	0.012	12	1	0.785	3.1416	0.25
3	49.1	38.6	0.012	12	1	0.785	3.1416	0.25

	Vel	Q	n	DIA	DIA FT	A	Pw	R
1	49.1	38.6	0.012	12	1	0.785	3.1416	0.25
2	49.1	38.6	0.012	12	1	0.785	3.1416	0.25
3	49.1	38.6	0.012	12	1	0.785	3.1416	0.25

Appendix G

Illicit Discharge Statement (Standard #10)

The project does not have any illicit discharges to any of the stormwater management facilities as shown on the Final Plans.

James A. Pavlik, P.E.
Project Manager

Appendix H
Pipe Calculations

Tel: 508-946-9231 Fax: 508-947-8873

JOB #: OE-3294
JOB NAME: 230 Sandwich Road
TOWN: Bourne
Des. Storm: 25 year

CALC BY: C.J.V DATE: 3/4/22
CHECK BY: J.A.P. DATE: 3/4/22

PIPE CAPACITY CALCULATIONS

MIN VELOCITY: 2 ft./sec. MAX VELOCITY: 10 ft./sec.

PIPE NETWORK TO INFILTRATION BASIN

PIPE DESCRIPTION									TIME OF CONC. (min.)				
LENGTH #	DA #	FROM	TO	DRAINAGE AREA (acres)	IMPERV. AREA (acres)	PERV. AREA (acres)	C perv.= 0.30 imp.=0.90	CA	Inlet (min.)	Drain (min.)	Total (min.)	I (in./hr)	Qc=CIA (cfs)
1	1	CB-6A	DMH-6	0.53	0.30	0.23	0.64	0.34	10	0.03	10.03	5	1.68
2	1	CB-6B	DMH-6	0.52	0.33	0.19	0.68	0.36	10	0.04	10.04	5	1.79
3	1	DMH-6	DMH-5A	1.05	0.63	0.42	0.66	0.69	10	0.03	10.03	5	3.46
4	1	DMH-5A	DMH-5	1.05	0.63	0.42	0.66	0.69	10	0.21	10.21	5	3.46
5	1	CB-5A	DMH-5	0.20	0.10	0.10	0.61	0.12	10	0.04	10.04	5	0.60
6	1	CB-5B	DMH-5	0.34	0.17	0.17	0.60	0.20	10	0.05	10.05	5	1.02
7	1	DMH-5	DMH-4A	1.58	0.90	0.68	0.64	1.02	10	0.14	10.14	5	5.08
8	1	DMH-4A	DMH-4	1.58	0.90	0.68	0.64	1.02	10	0.14	10.14	5	5.08
9	1	CB-4A	DMH-4	0.13	0.04	0.09	0.48	0.06	10	0.04	10.04	5	0.30
10	1	CB-4B	DMH-4	0.47	0.13	0.34	0.47	0.22	10	0.03	10.03	5	1.10
11	1	DMH-4	DMH-3A	2.18	1.07	1.11	0.59	1.30	10	0.13	10.13	5	6.49
12	1	DMH-3A	DMH-3	2.18	1.07	1.11	0.59	1.30	10	0.13	10.13	5	6.49
13	1	CB-3A	DMH-3	0.11	0.04	0.08	0.50	0.06	10	0.05	10.05	5	0.28
14	1	CB-3B	DMH-3	0.46	0.05	0.41	0.37	0.17	10	0.04	10.04	5	0.85
15	1	DMH-3	DMH-2A	2.76	1.16	1.60	0.55	1.52	10	0.08	10.08	5	7.62
16	1	DMH-2A	DMH-2	2.76	1.16	1.60	0.55	1.52	10	0.15	10.15	5	7.62
17	1	CB-2A	DMH-2	0.05	0.04	0.01	0.77	0.04	10	0.05	10.05	5	0.21
18	1	CB-2B	DMH-2	0.60	0.06	0.55	0.36	0.22	10	0.04	10.04	5	1.08
19	1	DMH-2	FE	3.42	1.26	2.16	0.52	1.78	10	0.07	10.07	5	8.90

LENGTH #	PIPE DIAMETER (in.)	PIPE MATERIAL (n-value)	SLOPE (ft./ft.)	LENGTH (ft)	FULL FLOW		CURRENT FLOW					
					Vf (ft/sec)	Qf (cfs)	Vc (ft/sec)	Qc (cfs)	Qc/Qf	d/D (in.)	Depth of flow in pipe (in)	
1	12	0.012	0.02	12	6.95	5.46	6.25	1.68	0.31	0.4	4.5	OK!
2	12	0.012	0.02	16	6.95	5.46	6.35	1.79	0.33	0.4	4.6	OK!
3	12	0.012	0.04	19	9.83	7.72	9.77	3.46	0.45	0.5	5.5	OK!
4	12	0.012	0.04	121	9.83	7.72	9.77	3.46	0.45	0.5	5.5	OK!
5	12	0.012	0.02	12	6.95	5.46	4.70	0.60	0.11	0.2	2.7	OK!
6	12	0.012	0.02	16	6.95	5.46	5.49	1.02	0.19	0.3	3.5	OK!
7	12	0.012	0.025	73	7.77	6.10	8.87	5.08	0.83	0.7	8.1	OK!
8	12	0.012	0.025	75	7.77	6.10	8.87	5.08	0.83	0.7	8.1	OK!
9	12	0.012	0.02	10	6.95	5.46	3.70	0.30	0.06	0.2	1.8	OK!
10	12	0.012	0.02	10	6.95	5.46	5.62	1.10	0.20	0.3	3.7	OK!
11	12	0.012	0.0286	67	8.31	6.53	9.79	6.49	0.99	0.8	9.5	OK!
12	12	0.012	0.0275	77	8.15	6.40	9.62	6.49	1.01	0.8	9.7	OK!
13	12	0.012	0.02	10	6.95	5.46	3.62	0.28	0.05	0.1	1.8	OK!
14	12	0.012	0.02	12	6.95	5.46	5.22	0.85	0.16	0.3	3.2	OK!
15	18	0.012	0.024	47	9.98	17.63	9.81	7.62	0.43	0.4	8.0	OK!
16	18	0.012	0.025	91	10.18	17.99	9.96	7.62	0.42	0.4	7.9	OK!
17	12	0.012	0.02	10	6.95	5.46	3.25	0.21	0.04	0.1	1.5	OK!
18	12	0.012	0.02	13	6.95	5.46	5.58	1.08	0.20	0.3	3.6	OK!
19	18	0.012	0.02	38	9.11	16.09	9.57	8.90	0.55	0.5	9.4	OK!

NOTE: Refer to Appendix F-4 for pipe calcs associated with CB's 1A,1B, 7A, and 7B.

Appendix I

Gutter Flow Calculations

The following calculations were prepared in accordance with Bourne Subdivision Regulations, Section 352.A.4 and 352.A.5 (Road Drainage) and in response to comment 22 from the December 11, 2020 comment letter from Drew Hoyt.

Gutter Flow calculation methodology

The equation below was used to calculate the top width of flow into the travel lane:

$$T=\frac{(1.79Qn)^{3/8}}{S_x^{5/8}S^{3/16}}$$

Where: Q = flow rate in gutter (ft^3/s)

N = Manning's n

S_x = road cross slope, ft/ft

S = longitudinal (direction of flow) slope, ft/ft

T = spread, top width flow (ft)

From this calculation the height of flow was calculated knowing the roadway cross slope and using simple triangle formulas. With the width and height of flow now known the velocity (ft/s) was calculated using the formula of V = Q/A, where A = cross-sectional area of flow over catch basins.

Outback Engineering Incorporated

165 East Grove Street
Middleborough, MA 02346

Tel: 508-946-9231 Fax: 508-947-8873

JOB #: OE-3294
JOB NAME: 230 Sandwich Road
TOWN: Bourne

CALC BY: C.J.V DATE: 3/4/22
CHECK BY: J.A.P. DATE: 3/4/22

GUTTER FLOW CALCULATIONS

	GUTTER FLOW CALCS				
Flow to	Q (cfs)*	*Impedence into roadway (feet)*	height of flow (ft)	Velocity (ft/s)	Velocity check (See Note)
CB-6A	1.68	6.59	0.13	3.86	OK
CB-6B	1.79	6.75	0.14	3.92	OK
CB-5A	0.60	4.49	0.09	2.99	OK
CB-5B	1.02	4.49	0.09	5.03	OK
CB-4A	1.10	2.67	0.05	4.22	OK
CB-4B	6.49	4.35	0.09	5.84	OK
CB-3A	0.28	2.61	0.05	4.16	OK
CB-3B	0.85	3.94	0.08	5.47	OK
CB-2A	0.21	2.32	0.05	3.85	OK
CB-2B	1.08	4.31	0.09	5.81	OK

*Flow rates taken from Pipe calcs from Appendix H

Note: Per Bourne Subdivision Regulations Section 352.A.5, water velocities shall between 2 and 10 ft/s in pipes and gutters

Appendix J

Construction Period Operation and Maintenance Log Form

(Standard #8)

Construction Period Erosion & Sediment Control Plan – O&M Log Form
Chase Estates, 230 Sandwich Road, Bourne, MA

The site shall be inspected weekly during construction and earth disturbing activities, and after rainfall events greater than ½ inch, whichever occurs sooner.

Inspected by:_____ **Date:** _____ **Weather:**_____

CONSTRUCTION PERIOD CONTROLS

CONTROL	BMP Installed (Yes or No)	BMP Maintenance Required (Yes or No)	IF SEDIMENT BUILDUP OR OTHER MITIGATION REQUIRED, DATE CLEANED. LIST OTHER REMEDIAL MEASURES IMPLEMENTED.
Stabilized construction entrance pad			
Sandwich Road pavement - street sweeping			
Perimeter erosion control barriers			
Temporary construction parking & staging area			
Concrete washout area			
Temporary soil stockpile area			
Dumpster & sanitary facilities			
Individual building construction parking and staging area			
Sediment Trap #1			
Sediment Trap #2			
Sediment Trap #3			
Sediment Trap #4			
Storm drain inlets at Catch Basins			
Erosion Control Barrier at Infil. Basin			
Sediment Forebay at Infil. Basin			
Final stabilized Infil. Basin #1			
Water Quality Tank #1			
Water Quality Tank #2			
Leaching Pit #1			
Leaching Pit #2			

REQUIRED MAINTENANCE NOTES:

_____

_____

_____

_____

_____

_____

_____

TO BE PERFORMED BY:_____ON OR BEFORE:_____

Appendix K

Long-Term Stormwater Operation & Maintenance Plan and Pollution Prevention Plan
(Standards #4 & #9)

Long-Term
Stormwater Operation & Maintenance Plan
&
Pollution Prevention Plan

Chase Estates
Bourne, Massachusetts

March 9, 2022

Prepared for:
Chase Developers Inc.
14 Bosuns Lane
Bourne, Massachusetts

Prepared by:

165 East Grove Street
Middleborough, MA 02346
Tel # 508-946-9231 www.outback-eng.com

Long-Term Stormwater Operation & Maintenance Plan & Pollution Prevention Plan
Chase Estates
Bourne, Massachusetts

Sections

Appendices

Section 1.0: Introduction & Responsible Parties

This operation and maintenance plan has been prepared for the Chase Estates subdivision in compliance with the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Regulations, Standards #4 and #9, to ensure long-term functioning of the drainage systems, and to provide suitable practices for source control and pollution prevention, including a snow management program. Chase Estates is a proposed 24-unit, residential condominium permitted under a Comprehensive Permit per MGL Ch. 40B. The project will have a 1,053-ft. long road (24-ft. wide at the entrance and tapering down to 20-ft. wide at station 2+80) with Cape Cod berms and a 4' sidewalk on one side, with town water, gas, underground cable utilities, and 2 Title 5 septic systems. Stormwater runoff will be controlled using catch basins piped to an infiltration basin and 2 underground leaching systems as shown on the site plans.

This O&M plan identifies the responsible party to perform maintenance tasks on the stormwater systems after construction is completed, as was intended per the design and as required by the Comprehensive Permit; good housekeeping practices are also outlined to prevent pollution and degradation of the environment. Initially, all maintenance tasks on the roadway and common areas will be undertaken by the developer as homes are built and sold. A condominium association will then be established by the developer as the project nears completion, and the Condo Association shall then be responsible for maintaining the drainage systems, driveway, and common areas per this O&M Plan. The roadway and drainage systems will not be accepted by the town of Bourne, and all maintenance tasks are the responsibility of the Condominium Association.

Developer/Owner: 230 Sandwich Road Realty Trust
14 Bosuns Lane
Bourne, Massachusetts

Responsible Party for maintenance of site driveway, stormwater infrastructure & common areas:
Condominium Association to be established by the developer.

Section 2.0: Operation & Maintenance Schedule - Stormwater System

The Chase Estates drainage systems for the site are generally shown on the "Stormwater Infrastructure Plan" (see attached); also reference the approved Site Plans showing the condominium layout and the Drainage Report for detailed information on the overall site design and stormwater management system description and calculations.

2.1 O&M for Roadway Drainage Infrastructure

Once construction is completed, the following tasks shall be the responsibility of the Condominium Association (refer to O&M Log Form in Appendix A), including maintenance of all catch basins and water quality tanks within the roadway that are piped to the infiltration basin, Leaching Pit #1 at roadway station 0+25, and Leaching Pit #2 at sta 9+80.

1. There are 7 pairs of catch basins to collect runoff within the site driveway. Inspect or clean catch basins four times annually (quarterly), including at the end of the foliage (Autumn) and snow removal (Spring) seasons. Sediments must be removed four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. Cleaning may be done by either clamshell bucket or vacuum truck. All sediment and hydrocarbons should be properly handled and disposed of by a qualified contractor in accordance with local, state, and federal guidelines and regulations.

2. There are two water quality tanks (WQT) at roadway station 0+25 and 9+80, where stormwater from the catch basins runs through a flow-splitting manhole to divert the "first flush" to the WQT, and bypass larger storms directly to the underground leaching chambers. Inspect these WQTs after every major storm for the first year, and clean at least two times per year thereafter. Cleaning includes removing grease and oil floating on top of the water, as well as sediment that settles at the bottom of the tank, using a vacuum truck. These WQTs are designed to prevent sediment and hydrocarbons in stormwater runoff from entering into the underground leaching chamber system that may prematurely cause the underground leaching chambers to clog; they also prevent oil/grease and other stormwater runoff pollutants from entering into the chambers that may cause pollution of soil and groundwater.

2.2 O&M for Infiltration Basin & Leaching Pits #1 and #2

There are 3 infiltration systems for this project located adjacent to the proposed road where catch basins discharge stormwater, as shown on the "Stormwater Infrastructure Plan" (see Appendix B). The following tasks shall be the sole responsibility of the Condominium Association (refer to O&M Log Form in Appendix A).

1. Leaching Pit #1 consists of underground, stone-embedded, leaching galleys on the south side of road at station 0+25. This leaching pit receives stormwater runoff from approximately the first 100 ft. of entrance roadway and upgradient overland areas. Catch basins and a WQT are piped to it. It is designed to infiltrate stormwater runoff within 72 hours following a rain event.

   Maintenance: Leach pit #1 shall be inspected after every major storm during the first few months after construction to ensure proper stabilization and function. Thereafter, inspections are required once yearly. The water depth should be measured in the observation well at 24 and 48 hours after a storm. The clearance rate can be calculated based on the drop in depth divided by the elapsed time. If the clearance rate has been significantly reduced, or if water is found to be ponding within the chamber bed for much longer than 72 hours, repair or replacement may be necessary. The exterior of the stone bed can be checked by excavating a section and replacing stone with filter fabric as needed. The overflow pipe and its outlet rip rap should also be inspected yearly to check for scour; the overflow will only be required in

the event of extremely large storm events or multiple storms that occur back to back in a short time period of 2 or 3 days. Maintenance of the water quality tank (see Section 2.1, #2) is important to keep sediment from entering the chamber bed and clogging the system.

2. An underground stone-embedded drywell system (leach pit #2) under parking spaces for the proposed pool at sta 9+80. This stone-embedded drywell receives stormwater runoff from the emergency vehicle turnaround and overland flow where one of the proposed septic systems are, with its catch basins and water quality tank piped to it. It is designed to infiltrate the stormwater runoff, and dry out in 72 hours following a rain event.

   Maintenance: Leach pit #2 shall be inspected after every major storm during the first few months after construction to ensure proper stabilization and function. Thereafter, inspections are required once yearly. The water depth should be measured in the observation well at 24 and 48 hours after a storm. The clearance rate can be calculated based on the drop in depth divided by the elapsed time. If the clearance rate has been significantly reduced, or if water is found to be ponding within the chamber bed for much longer than 72 hours, repair or replacement may be necessary. The exterior of the stone bed can be checked by excavating a section and replacing stone with filter fabric as needed. The overflow pipe and its outlet rip rap should also be inspected yearly to check for scour; the overflow will only be required in the event of extremely large storm events or multiple storms that occur back to back in a short time period of 2 or 3 days. Maintenance of the water quality tank (see Section 2.1, #2) is important to keep sediment from entering the chamber bed and clogging the system.

3. The infiltration basin receives stormwater runoff from the roadway and the catch basins that are piped to them. The infiltration basin is designed to fully capture and recharge the 100-year storm through the underlying soils at the bottom of the basin. The basin will have a sediment forebay that require maintenance, and emergency overflow structures that should rarely if ever require maintenance except in the event of the basin clogging/failure that may lead to runoff spilling out and causing erosion.

   Maintenance: The infiltration basin should be inspected after every major storm for the first three months after construction and twice per year thereafter. If the infiltration rate has been significantly reduced such that standing water persists for more than 3 days, the infiltrative capacity of the soil should be restored by scarifying the bottom of the basin, or removing and replacing the bottom soil layer with fresh loam/sand mix and reseeding as necessary.

   Mow the buffer area, side slopes, and bottom area twice per year. Remove grass clippings and accumulated organic matter.

   Inspect sediment forebay after every major storm during the first few months after construction to ensure proper stabilization and function. Cleaning of sediments should take place four times per year thereafter. After cleaning, damaged vegetation should be restored using loam as necessary and reseeding or using sod.
   Inspect and clean basin emergency overflow outlet structures and rip rap aprons at least twice per year. Check for scour and repair eroded areas immediately upon discovery with additional riprap and/or loam and seed as necessary.

Section 3.0: Post-development Operation and Maintenance Budget

The following is an estimated annual budget for Operation & Maintenance of the different drainage systems:

- Catch Basin cleaning: 14 catch basins x 4 times per year @ $60 each = $3360.
- Sediment Forebay cleaning: 1 forebays x 4 times per year @ $75 each = $300.
- Water Quality Tank cleaning: 2 tanks x 2 time per year @ $150 each = $600.
- Leach Pits 1 and 2: 2 structures x 2 times per year x $50 each = $200.
- Infiltration Basin cleaning & mowing: 1 basin x 2 times per year @ $100 each = $200.

Total Estimated Annual Stormwater System O&M Budget: $4,660

Section 4.0: Pollution Prevention Plan w/ Snow Management

1. **Good housekeeping measures** shall be used in the day-to-day operation of the development site. This includes keeping the homesites and common areas in a neat and orderly state, limiting use of fertilizers and pesticides, and using professional companies to maintain common areas and to dispose of waste materials.

2. **Snow Management Guidelines:**

   General:

   Calcium chloride and/or sand should be used sparingly for deicing purposes. During and following snowstorms, snow shall be plowed from the paved site driveway, sidewalk, and visitor parking by the Condo Association's contractor. The Condominium Association may choose to have individual driveways plowed also, or this responsibility may be the individual unit owners. The town's DPW shall not be responsible for plowing the development roadway and sidewalk. Snow plow trucks will perform this snow removal by furrowing snow along the edges of the road and driveways. It is anticipated that most smaller snowstorms will not generate enough snow requiring removal. In the event of an extremely large snowfall, heavy equipment, such as front-end loaders, may be required to remove snow from the roadway; this snow may be disposed in the areas shown on the Stormwater Infrastructure Plan. These potentially larger snowfalls that result in large accumulations across the site shall be disposed per the guidelines below.

   Site Selection:

   The snow stockpile areas shall be utilized (or snow may be trucked offsite by contractors). These onsite areas were selected because of their location on pervious surfaces in upland areas (there are no wetlands on site). Snow will be compacted and reduced in volume when stockpiled.

   The following areas must be avoided for snow disposal (refer to Stormwater Infrastructure Plan for signage associated with prohibited dumping areas):

   *Avoid dumping snow in the infiltration basin or atop the septic system leaching areas. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Site Preparation and Maintenance:

The following maintenance measures should be undertaken for the snow disposal site:

* Snow disposal sites are to be in areas with stabilized groundcover such as lawn or mulched areas.

*A siltfence should be placed securely on the downgradient side of the snow disposal site.

*Debris should be cleared from the site prior to using the site for snow disposal each winter season.

*At the end of the snow season, debris and accumulated sediment should be cleared from the site and properly disposed of no later than May 15.

3. **Mosquito Control Guidelines:**
   The stormwater basins do not rely on a standing pool of water, and are designed to dewater within 72 hours after precipitation. If evidence of mosquitos is found in any of the sediment forebays and/or basins, larvicide (i.e. Bacillus sphaericus (Bs)) may be applied by a licensed pesticide applicator in compliance with all pesticide label requirements (Bs is to be hand-broadcast).

4. **Pet Waste Management:**
   Pet waste management involves using a combination of pet waste collection programs, pet awareness and education, to alert residents to the proper disposal techniques for pet droppings. The condominium association will establish rules requiring individual home owners to properly collect and dispose of pet waste.

5. **Spill Prevention**: The homeowners association shall be aware of, educate home owners, and enforce the following spill prevention measures:

   Good Housekeeping

   The following good housekeeping practices will be followed by individual homeowners:
   - An effort will be made to store only enough product required to do the job.
   - All materials stored on-site will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other structure.
   - Products wills be kept in their original containers with the original manufacturer's label.
   - Substances will not be mixed with one another unless recommended by the manufacturer.
   - Whenever possible, all of a product will be used up before disposing of the container.
   - Manufacturer's recommendations for proper use and disposal will be followed.

   Hazardous Products

   These practices are used to reduce the risks associated with hazardous materials:
   - Exterior storage of deicing chemicals, fertilizers, herbicides, pesticides, or other hazardous materials shall be prohibited.
   - Products will be kept in original containers unless they are not resealable.
   - Original labels and material safety data will be retained.
   - If surplus product must be disposed of, manufacturer's or local/State recommended methods will be followed.

Petroleum Products

All vehicles should be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage. Small quantities of petroleum products for individual homeowners use may be stored in tightly sealed containers which are clearly labeled.

Pesticides, Herbicides, Fungicides and Fertilizers

Pesticides, fungicides and herbicides shall be used sparingly or not at all within jurisdictional areas. Regular use of fertilizers within jurisdictional areas is also not recommended by the Conservation Commission. If used, fertilizers will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. Storage will be in a covered enclosure. The contents of any partially used bags will be transferred to a sealable plastic bin to avoid spills.

Paints

All containers will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewer system but will be properly disposed of according to manufacturers' instructions or State and local regulations.

Spill Control Practices

In addition to the management practices listed above the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage area on-site. Equipment and materials will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate State or local government agency, protective clothing, regardless of the size.
- The spill prevention plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.

Accidental Spill and Emergency Response Plan

In the event of an accident within the boundaries of the site, where significant gasoline or other petroleum products or other hazardous materials are released, the following procedure shall be followed in the order noted.

- As quickly as possible, attempt to block the nearest stormwater catch basins if on a roadway, or if in proximity to wetlands, create a berm of soil downslope of the spill.
- Immediately, and while the containment measures are implemented as described above, notify the following government entities and inform them of the type of spill that occurred:
    - Bourne Fire Department at 911 (emergencies). Regular business calls: 508-759-4412
    - Bourne Board of Health at 508-759-0615
    - Bourne Conservation Commission at 508-759-0615

- Mass. Department of Environmental Protection (DEP) Central Region at 508-792-7650
- National Response Center (NRC) at 800-424-8802 (for spills that require such notification pursuant to 40 CFR Part 110, 40 CFR Part 117, and 40 CFR Part 302)

- Once the various emergency response teams have arrived at the site and if the spill occurs on a lot, the owner shall follow the instructions of the various government entities, which may include the following:
  - A clean up firm may need to be immediately contacted.
  - If the hazardous materials have entered the stormwater system, portions of it may need to be cleaned and restored per the DEP.

Appendix A
Long-Term Stormwater Operation & Maintenance Log Forms

Stormwater Operation & Maintenance Log Form
Chase Estates- Roadway

PRETREATMENT STRUCTURAL CONTROLS

CONTROL	DATE INSPECTED	SEDIMENT BUILDUP (YES/NO)	IF SEDIMENT BUILDUP, DATE CLEANED
CB-1A			
CB-1B			
Water Quality Tank #1			
CB-2A			
CB-2B			
CB-3A			
CB-3B			
CB-4A			
CB-4B			
CB-5A			
CB-5B			
CB-6A			
CB-6B			
CB-7A			
CB-7B			
Water Quality Tank #2			

Note: Sediment to be removed from catch basins and Water Quality Tanks when depth reaches 24". Water Quality Inlet tanks and the other three compartments in the WQT are to be inspected and cleaned annually.

REQUIRED MAINTENANCE NOTES:

_____

_____

_____

_____

_____

_____

_____

TO BE PERFORMED BY:_____ON OR BEFORE:_____

NOTE: This log form to be used by HOA, until roadway is accepted by town of Bourne.

Stormwater Operation & Maintenance Log Form
Chase Estates– Infiltration Basin, Leaching Drywells

SEDIMENT/PRETREATMENT STRUCTURAL CONTROLS

CONTROL	DATE INSPECTED	SEDIMENT BUILDUP (YES/NO)	STATEMENT OF GENERAL CONDITION, REQUIRED MAINT., DATE OF SEDIMENT REMOVAL
Sed. Forebay to Infil. Basin			

RUNOFF STRUCTURAL CONTROLS

CONTROL	DATE INSPECTED	STATEMENT OF GENERAL CONDITION & REQUIRED MAINTENANCE IF ANY
Infiltration Basin		
Leach Pits #1 @ sta 0+25		
Leach Pits #2 @ sta 9+80		

REQUIRED MAINTENANCE:

_____

_____

_____

_____

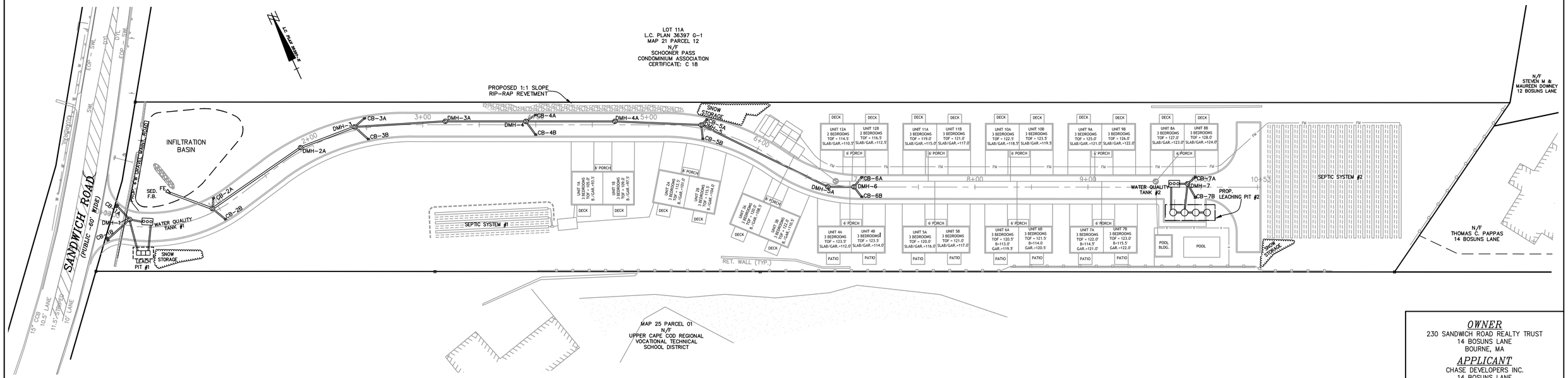
_____

_____

TO BE PERFORMED BY:_____ ON OR BEFORE:_____

NOTE: This log form to be used by Condominium Association.

Appendix B
Stormwater Infrastructure Plans



SNOW DISPOSAL NOTES

- REFER TO OPERATION AND MAINTENANCE PLAN FOR FULL SNOW DISPOSAL REQUIREMENTS
- FURROW SNOW ALONG ROAD SHOULDERS
- AVOID DUMPING SNOW ON/IN CATCH BASINS, FOREBAY, INFILTRATION BASIN, LEACHING PITS, AND SEPTIC SYSTEMS

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

APPLICANT
CHASE DEVELOPERS INC.
14 BOSUNS LANE
BOURNE, MA

STORMWATER INFRASTRUCTURE PLAN "CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)-946-9231
FAX: (508)-947-8873
www.outback-eng.com

DATE: MARCH 9, 2022
DRAWN BY: CJV | CHECKED BY: JAP
SCALE: 1"=40'
0' 40' 80' 120'

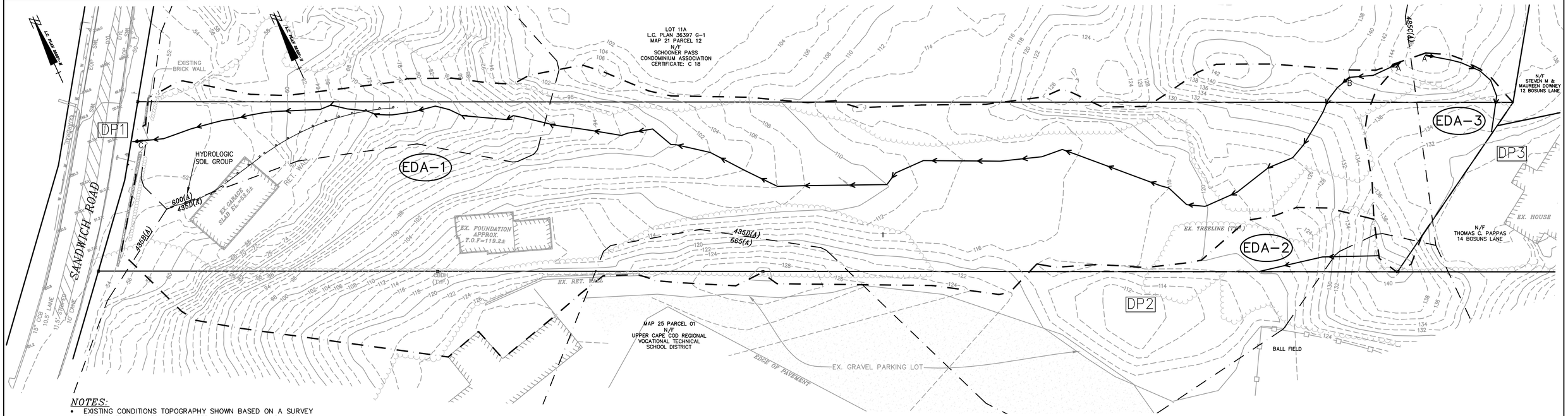
OE-3294

Appendix L

Pre- and Post-Development Drainage Maps

LEGEND

DESCRIPTION	SYMBOL
POST DRAIN BOUNDARY	
POST Tc FLOW PATH	
POST DRAIN AREA	EDA–2
SOIL BOUNDARY	435D(A)
DESIGN POINT	DP1



NOTES:

- EXISTING CONDITIONS TOPOGRAPHY SHOWN BASED ON A SURVEY PERFORMED BY OUTBACK ENGINEERING INC, IN JANUARY 2021.
- ELEVATIONS SHOWN ON NAVD88 DATUM.

NOTES:
1. EDA–1 FLOWS SANDWICH ROAD
2. EDA–2 FLOWS TO DEPRESSION OFF–SITE ON N/F UPPER CAPE COD REGIONAL VOCATIONAL TECHNICAL SCHOOL DISTRICT
3. EDA–3 FLOWS OFF–SITE TO N/F PAPPAS

REVISIONS

NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

APPLICANT
CHASE DEVELOPERS INC.

PRE DRAINAGE MAP "CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering Incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)–946–9231
www.outback–eng.com

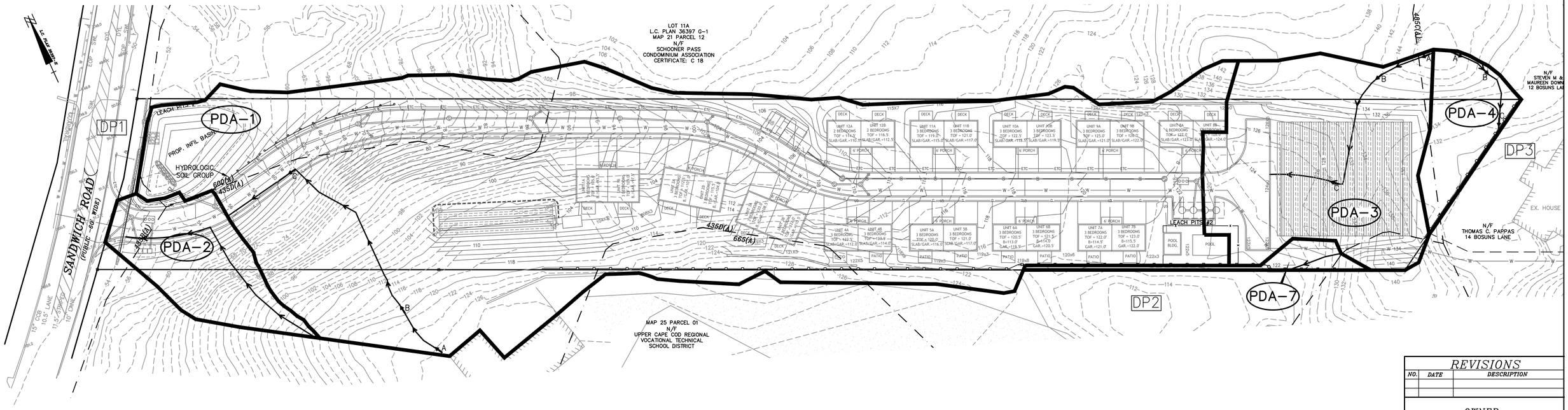
DATE: MARCH 9, 2022
DRAWN BY: CJV | CHECKED BY: JAP
SCALE: 1"=40' | SHEET 1 OF 1

0' 40' 80' 120'

OE–3294A

LEGEND

DESCRIPTION	SYMBOL
POST DRAIN BOUNDARY	▬▬
POST Tc FLOW PATH	——→
POST DRAIN AREA	PDA–1
SOIL BOUNDARY	435D(A)
DESIGN POINT	DP1



NOTES:
1. PDA–1 FLOWS TO INFILTRATION BASIN .
2. PDA–2 FLOWS TO LEACH PITS #1.
3. PDA–3 FLOWS TO LEACH PITS #2
4. PDA–4 FLOWS OFF SITE TO EAST N/F PAPPAS

REVISIONS		
NO.	DATE	DESCRIPTION

OWNER
230 SANDWICH ROAD REALTY TRUST
14 BOSUNS LANE
BOURNE, MA

APPLICANT
CHASE DEVELOPERS INC.

POST DRAINAGE MAP "CHASE ESTATES" SUBDIVISION AT 230 SANDWICH ROAD IN BOURNE MASSACHUSETTS

Outback Engineering incorporated
165 EAST GROVE STREET
MIDDLEBOROUGH, MA 02346
TEL: (508)–946–9231
www.outback–eng.com

DATE: MARCH 9, 2022
DRAWN BY: CJV | CHECKED BY: JAP
SCALE: 1"=40' | SHEET 1 OF 1
0' 40' 80' 120'

OE–3294A