ENT 68998:2024 PG 1 of 96
ANDREA ALLEN
UTAH COUNTY RECORDER
2024 Oct 7 12:54 PM FEE 0.00 BY MG
RECORDED FOR AMERICAN FORK CITY

STORM WATER FACILITY AGREEMENT

THIS AGREEMENT, is made and entered into this 25 day of JULY, 2024, by and between ELEVATE APARTMENTS AT 620, LLC (hereinafter referred to as "Owner", and American Fork City (hereinafter referred to as the "City"), a Municipal Corporation.

RECITALS

WHEREAS, the Owner desires to improve, develop or redevelop real property located at approximately 742 E 620 S in American Fork City, Utah County, State of Utah (hereinafter referred to as the "Property"), which is more particularly described in Exhibit A attached hereto;

WHEREAS, said development requires the installation and maintenance of storm water facilities (hereinafter referred to as "Facilities") to be constructed according to designs and plans approved by the City;

WHEREAS, the Owner, for and in behalf of its administrators, executors, successors, heirs, or assigns, including any homeowners association, recognizes and agrees that the health, safety, and welfare of the citizens of the City require that the Facilities be constructed and adequately maintained on the Property throughout the life of the development; and

NOW, THEREFORE, in consideration of the foregoing, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

SECTION 1
FACILITIES

Facilities include all storm water detention and control structures, flood control devices, or other improvements, which may include, but is not limited to all pipes, channels, or other structures and infrastructure built to convey storm water to the Facilities, as well as all structures, improvements, and vegetation provided to control the quantity and quality of the storm water which are required by the City in the site plan attached hereto as Exhibit B.

SECTION 2
FACILITIES CONSTRUCTION

The Owner shall, at its sole cost and expense, construct the Facilities in accordance with the plans and specifications for the development approved by the City. Owner understands and agrees that modifications may be needed to make the system work properly after the Facilities are installed and agrees to make modifications and adjustments as may be necessary and required by the City.

Approved as to form:
Attorney for American Fork City

SECTION 3
MAINTENANCE

The Owner shall, at its sole cost and expense, adequately maintain the Facilities in good working condition acceptable to the City and in accordance with the schedule of long term maintenance activities agreed to by the parties and attached hereto as Exhibit C. Adequate maintenance is herein defined as follows: 1) keeping the Facilities in good working condition so that the Facilities are performing their design functions, 2) performing facility inspections and repairs as may be needed, and 3) replacing and/or modifying portions, or all of the system, as may be needed to maintain the intended function of the facility.

SECTION 4
EASEMENT

The Owner hereby grants permission to the City, its authorized agents, and employees to enter upon the Property and to inspect the Facilities whenever the City deems it necessary. Whenever possible, the City shall provide notice prior to entry. Inspections by the City shall be conducted in a reasonable manner and at reasonable times, as determined appropriate by the City. The purpose of the inspection shall be to determine and ensure that the Facilities are being adequately maintained, are continuing to perform in an adequate manner, and are in compliance with all laws, regulations, and approved plans and specifications. The Owner hereby grants a twenty-five (25) foot access easement in favor of the City with the midpoint of the easement lying over the midpoint of the Facilities identified in the attached plan. This easement shall be limited in scope to allow only those actions which are necessary to allow the City to inspect, ensure adequate maintenance, and to cause any repairs to be made that the City deems necessary. This easement shall include, but is not be limited to, prohibiting the construction of structures or improvements that would impact or obstruct the intended purposes of the Facilities or restrict the ability of the Owner or the City to inspect, maintain, or repair the Facilities.

SECTION 5
FAILURE TO MAINTAIN FACILITIES

In the event the Owner fails to maintain the Facilities in good working order acceptable to the City and in accordance with the maintenance schedule incorporated in this Agreement, the City, in addition to any other remedies provided by State or City code, may, with due notice as provided in Section 6, enter the property and take whatever steps it deems necessary to return the Facilities to good working order. This provision shall not be construed to allow the City to erect any structure of a permanent nature on the property that is not included in the plans and specifications for the development, or other agreement between the parties. It is expressly understood and agreed that the City is under no obligation to maintain or repair the Facilities. The decision to maintain or repair the Facilities shall be at the City's sole discretion and in no event shall this Agreement be construed to impose any such obligation on the City or to create any liability for the City refusing to undertake such a duty.

Approved as to form:
Attorney for American Fork City

SECTION 6
NOTICE OF DEFICIENCIES

If the City finds that the Facilities contain any defects or are not being maintained adequately, the City shall provide Owner written notice of the defects or deficiencies and provide Owner with a reasonable time, as determined by the City, to cure such defects or deficiencies.

SECTION 7
RECOUPMENT OF COSTS

In the event the City performs work of any nature pursuant to the Agreement, or expends any funds in the performance of said work for labor, use of equipment, supplies, materials, and the like, the Owner shall reimburse the City within thirty (30) days of receipt thereof for all the costs incurred by the City. If not paid within the prescribed time period, the City shall be entitled to record a lien against the real property in the amount of such costs. The actions described in this section are in addition to and not in lieu of any and all legal remedies available to the City as a result of the Owner's failure to maintain the Facilities.

SECTION 8
LIMITATION OF LIABILITIES

It is the sole intent of this Agreement to insure the proper construction and maintenance of the Facilities by the Owner. As the Facilities are not part of the City's Storm Water Collection System, this agreement does not create or extend any rights to immunity or liability protections provided by law to municipalities. This Agreement shall not be deemed to create or affect any additional liability of any party for damage alleged to result from or caused by storm water runoff, or to constitute a waiver of any immunity provided to the City through the Utah State Code or Constitution.

SECTION 9
SEDIMENT ACCUMULATION

Adequate maintenance shall include control of sediment accumulation resulting from the normal operation of the Facilities. The Owner will make accommodations for the removal and appropriate disposal of all accumulated sediments.

SECTION 10
REQUIREMENTS AND STANDARDS

The Parties agree to follow and comply with all requirements applicable to storm water detention and control facilities as by the Utah Department of Environmental Quality, Division of Water Quality, including the Small MS4 General UPDES Permit requirements, and by the City ordinances and Storm Water Management Plan as existing at the time of executing this agreement and as may be amended from time to time. The parties agree that these requirements and regulations are incorporated herein by this reference and that this agreement shall be deemed

Approved as to form:
Attorney for American Fork City

automatically amended to incorporate any and all changes and amendments made thereto after the signing of this agreement.

SECTION 11
INSPECTIONS

The Owner shall perform an annual inspection of the Facilities. The City may require more frequent inspections should it have reason to believe that such inspections are necessary. All inspections shall be conducted by a qualified inspector and the results shall be reported to the City. The purpose of the inspection and reporting is to assure safe and proper functioning of the Facilities, including but not limited to, the structural improvements, berms, outlet structure, pond areas, access roads, vegetation, landscaping, etc. All annual inspection reports shall be submitted to the City Public Works Department no later than September 1 of any given year and shall be on the Maintenance Inspection Report attached hereto as Exhibit D.

SECTION 12
INDEMNITY

The Owner indemnifies and holds harmless the City and its authorized agents and employees for any and all damages, accidents, casualties, occurrences or claims which might arise or be asserted against the City from the construction, presence, existence or maintenance of the facility or facilities by the Owner. In the event a claim is asserted against the City, its authorized agents or employees, the City shall promptly notify the Owner and the Owner shall defend at its own expense any suit based on such claim. If any judgment or claims against the City, its authorized agents or employees shall be allowed, the Owner shall pay for all costs and expenses in connection herewith.

SECTION 13
COVENANT RUNNING WITH THE LAND

This Agreement shall be recorded at the Utah County Recorder's Office and shall constitute a covenant running with the land and shall be binding on the Owner, its administrators, executors, heirs, assigns and any other successors in interest, including any homeowners association.

SECTION 14
REMEDIES

This Agreement may be enforced by proceedings at law or in equity by or against the parties hereto and their respective successors in interest. Any rights or remedies contained in this Agreement shall be in addition, and non-exclusive, to any rights existing under the Utah Code or that may exist under the common law.

Approved as to form:
Attorney for American Fork City

SECTION 15
ATTORNEYS FEES

If any party retains, consults, or uses an attorney because of any breach, default, or failure to perform as required by this Agreement, the non-breaching/defaulting party shall be entitled to reasonable attorney's fees incurred before litigation is filed. In the event that any litigation is commenced to enforce or interpret this Agreement the prevailing party shall be entitled to its attorneys fees, expert witness expenses, and litigation related expenses, including but not limited to court costs.

SECTION 16
THIRD PARTY BENEFICIARIES

This Agreement shall be binding upon and inure solely to the benefit of the parties herein and is not intended to create contractual rights in any third party.

SECTION 17
NO PARTNERSHIP

Nothing contained in this Agreement shall be deemed to create any form of a partnership or joint-venture between the City and Owner.

SECTION 18
UTAH LAW AND VENUE

This Agreement shall be interpreted pursuant to the laws of the State of Utah. Any and all suits for any claims or for any and every breach or dispute arising out of this Agreement shall be maintained in the appropriate court of competent jurisdiction in Utah County, Utah.

SECTION 19
INTEGRATED AGREEMENT

This Agreement sets forth the entire agreement of the parties and supersedes all prior agreements, whether written or oral, that exists between the parties regarding the subject matter of this Agreement.

SECTION 20
SEVERABILITY

The provisions of this agreement shall be severable and if any phrase, clause, sentence or provision is declared unconstitutional, or the applicability thereof to the, its successors and assigns, is held invalid, the remainder of this Covenant shall not be affected thereby.

Approved as to form:
Attorney for American Fork City

SECTION 21
AMENDMENTS

Except as expressly provided elsewhere in this Agreement, no provision of this Agreement may not be modified except in writing agreed to by both parties.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the dates set forth below.

OWNER

Date: July 25, 2024.

By: Greg Rindlisbacher
Its: Owner / Managing Member

NOTARIZATION

STATE OF UTAH)
) :ss
COUNTY OF UTAH)

The above Agreement was executed on this 25 day of JULY, 2024 by GREG RINDLISBACHER, for and on behalf of ELEVATE APARTMENTS AT WDR LLC the Owner identified in the above signed Agreement. In executing this Agreement, the signer did swear before me that he is duly authorized to sign the agreement on behalf of the Owner.

NOTARY PUBLIC
NIC ABBOTT
731978
MY COMMISSION EXPIRES
JULY 05, 2027
STATE OF UTAH

NOTARY PUBLIC

AMERICAN FORK CITY

Date: 8-12-~~2024~~ MW, 2024.

Director of Public Works Sam Kelly

State of Utah
County of Utah
The foregoing instrument was acknowledged before me this 12th day of August 2024, by Sam Kelly.

ATTEST:

MELISSA WHITE
NOTARY PUBLIC - STATE OF UTAH
COMMISSION # 735790
Comm. Expires: 02-27-2028

Approved as to form:
Attorney for American Fork City

Exhibit "A"

Beginning at a point that is located on a boundary and represented by a survey Surveying Associates, on file within Utah County Survey records as File #91-65, which point is located North 89° 35' 45" West 132.32 feet along section line and North 60.73 feet from the Southeast corner of Section 24, Township 5 South, Range 1 East, Salt Lake Base and Meridian (Said corner is retraced via Witness monument and county survey record. Basis of Bering is the AND 83 State Plane Coordinate - System, Central Zone); thence along said survey boundary South 82°14'24" West a distance 89.20 feet thence North 89°26'51" West whose course is also is along the Utah Valley Business Park Plat "L" Subdivision a distance of 588.50 feet, thence North 89°47'54" West along said Utah Valley Business Park Plat "F" a distance of 150.04 feet, thence North 00°26'49" East along said Utah Business Park Plat "F" a distance of 44.96 feet thence to and along the Easterly Bounds of Harrington Hollow Amended Subdivision, the following 2 courses: North 00°47'06" East a distance of 143.49 feet, thence North 00°29'08" East a distance of 343.65 feet to the bounds of a R.O.W. Known as 620 South Street of the Best Road Dedication via Dedication Plat of Utah County Recorder's Office, Thence South 88°56'00" East a distance of 604.99 feet to the beginning of a curve bears to the right through an angle of 08°30'17", having a radius of 1200.00 feet along the arc distance of 178.12, and whose long chard bears South 84°40'52" East a distance of 177.96 feet, thence South 80°25'43" East a distance 122.13 feet, leaving said R.O.W. Thence South 09°35'42" West a distance of 484.96 feet to the point of beginning.

EXHIBIT B

ENT 68998:2024 PG 8 of 96

Stormwater System Operations and Maintenance Plan

for:

Bach Apartments
742 E 620 S St
American Fork, UT, 84003

Elevate Apartments at 620, LLC
742 E 620 S
American Fork, UT, 84003
801-972-0505
info@live-elevate.com

Ashlee Potts, Erin McMullen, Ashlee Potts, NA
Phone Number: 801-972-0505
Email: manager@live-elevate.com

PURPOSE AND RESPONSIBILTY

The Clean Water Act regulates development to protect water resources.
The resulting American Fork Municipal Separate Storm Sewer Systems (MS4) Permit regulates development to design with water quality approaches and to show maintenance adequately contains and controls pollution generated on the property.

The Utah Stormwater Advisory Committee formed to support the Utah Department of Environmental Quality, Division of Water Quality CWA obligations, recommends the Stormwater System Operations and Maintenance Plan program to achieve the MS4 obligations and to foster uniformity across municipalities.

The Stormwater System Operations and Maintenance Plan prepared by the designers of this property is intended to help site staff and service contractors understand the property's flood and water quality control system and why adequate maintenance is necessary for sufficient flood control protection and to prevent pollutants in the runoff from affecting the environment. Ultimately, good maintenance helps improve the quality of life in our communities where we live and visit.

This Stormwater System Operations and Maintenance Plan describes the systems, operations and the minimum operating procedures necessary to manage pollutants on this property. Any activities or site operations on this property that contaminate water entering the City's stormwater system and results in loose litter must be prohibited.

The Stormwater System Operations and Maintenance Plan is aimed at preventing impairments to the McArthur Ditch and subsequently Utah Lake. The required TMDLs (303d list) for Utah Lake are Eutrophication, PCBs in Fish Tissue, E. coli, Harmful Algal Blooms, Phosphorus, Total Dissolved Solids (TDS).

CONTENTS

SECTION 1: SITE DESCRIPTION, USE AND IMPACT

By living in urban communities, every property has runoff that can potentially affect the quality of water that drains to waterways and the ground. To manage flooding, control water pollution and manage cost, it is vital we understand how our flood and water quality system works.
Our site infrastructure is limited at controlling and containing pollutants. If our property and operations are managed improperly, we will contaminate local water resources. This Stormwater System Operations and Maintenance Plan includes Standard Operations procedures (SOPs) intended to help us responsibly manage our grounds. Standard Operations Procedures are filed in appendix B.

Parking, Sidewalk and Pavements

The site includes a combination of parking, sidewalk, and pavement to serve a large apartment building and townhomes.

Any sediment, leaves, debris, spilt fluids or other waste that collects on our parking areas, sidewalks and other pavements, will be carried by runoff to our flood and water quality control system. Any solids will fill in our system requiring removal and cleaning.
Any solid material, dissolved solids and liquids mixed with runoff can contaminate surface water and potentially groundwater for which we are responsible.

Maintenance involves regular sweeping, but it can also involve pavement washing to remove stains, slip spots, and improve appearance when necessary. The Pavement Sweeping and Pavement Washing SOPs are used to manage the pollutants associated with our pavements.

Landscaping

Landscaping on the site includes, but is not limited to, tress, perennial plats, and shrubs. Our landscape operations can result in grass clippings, sticks, branches, dirt, mulch, fertilizers, herbicides, and pesticides to fall or be left on our paved areas. When left on pavements, these solids will fill in our flood and water quality system requiring removal and cleaning.
Any dissolved solids and liquids mixing with runoff can contaminate surface water and potentially groundwater for which we are responsible.
Therefore, it is vital that the paved areas remain clean of landscape debris. The Landscape Maintenance SOP is written to control and manage this potential pollution source.

Flood and Water Quality Control System

Our flood and water quality control system collects runoff directly from pavements with inlets and pipes. The pipes carry runoff and anything washed off our pavement directly to our manufactured treatment device and to our underground chamber retention/detention system designed to retain and infiltrate the first 1.83" of runoff. Our manufactured treatment devices include an isolator row from the StormTech® MC-3500 and a Barracuda® C3 Stormwater Separator. The isolator row lined with a filter fabric will retain the collected

sediment and can be subsequently extracted at a later time. The Barracuda® C3 Stormwater Separator removes total suspended solids and can be implemented into precast manhole locations. Pollution that dissolves in water is not treated and anything else that can bypass runoff events will drain into the ground. The runoff in excess of the retention volume is released to the City system at 2.078 cfs. The entire system is designed to manage the peak volume runoff for the 100-year storm event.

Treating and infiltrating runoff from our property is required by the Clean Water Act intended to protect streams, rivers and groundwater. It is important we regularly maintain our system and diligently follow our standard operations procedures to manage and prevent pollution with potential to dissolve and mix with runoff, damaging surface and subsurface water resources for which we are responsible.

Also, anything we allow to reach our surface low impact system, manufactured treatment device and underground chamber system will fill it with sediment and debris increasing maintenance cost. It is important to follow our standard operations procedures to help manage site maintenance cost and ensure our system is working properly. The StormTech® MC-3500 Chamber Maintenance SOP is written to manage maintenance for the storm drain system and to ensure it is functioning properly.

ENT 68998:2024 PG 12 of 96

Waste Management

Good waste management systems, if managed improperly, can become the source of the very pollution it was intended to manage. Closing the lids of our dumpster and trash receptacles on site are necessary to prevent light weight trash carried off by wind and precipitation exposure preventing liquids that can leak on to our pavement and from haul trucks. In addition, our dumpster pad slopes toward our pavement and any leaks can leach into runoff, staining our pavement, increasing odors and increasing risk to water resources. The Waste Management SOP is written to control and manage the waste we generate.

Utility System

Our roof top or side yard utility systems are exposed to our roof drains and overland flow, which drain to our pavements. These heating and air conditioner units contain oils and other chemicals that can harm surface and groundwater if allowed to reach our flood and water quality system. Liquids and other waste generated by maintenance of this system can be appropriately managed by the Spill Control SOP.

Snow and Ice Removal Management

Salt is a necessary pollutant and is vital to ensuring a safe parking and pedestrian walkway. However, salt and other ice management chemicals, when improperly managed will unnecessarily increase our salt impact to our own vegetation and local water resources. In addition, we need to minimize salt to maintain healthy root systems needed for optimum infiltration rates. The Snow and Ice Management SOP is written to manage snow removal operations properly and to ensure a healthy root system to help maintain optimum infiltration rates.

Equipment / Outside Storage

None

ENT 68998:2024 PG 13 of 96

SECTION 2: TRAINING

Ensure that all employees and maintenance contractors know and understand the standard operations procedures specifically written to manage and maintain the property. Maintenance contractors must use the stronger of their Company and the Stormwater System Operations and Maintenance Plan standard operations procedures. File all training records in Appendix C.

SECTION 3: RECORDKEEPING

Maintain records of operation and maintenance activities in accordance with standard operations procedures.
Mail a copy of the record to American Fork annually.

SECTION 4: APPENDICES

Appendix A- Site Drawings and Details

1. Final Grading and Drainage Plan Sheets

Appendix B- Standard Operation Procedures SOPs

1. Pavement Sweeping SOP
2. Landscape Maintenance SOP
3. Waste Management SOP
4. Flood and Water Quality System SOP
5. Pavement Washing SOP
6. Snow and Ice Removal Management SOP
7. General Construction Maintenance SOP
8. Spill Control SOP

Appendix C- Recordkeeping Documents

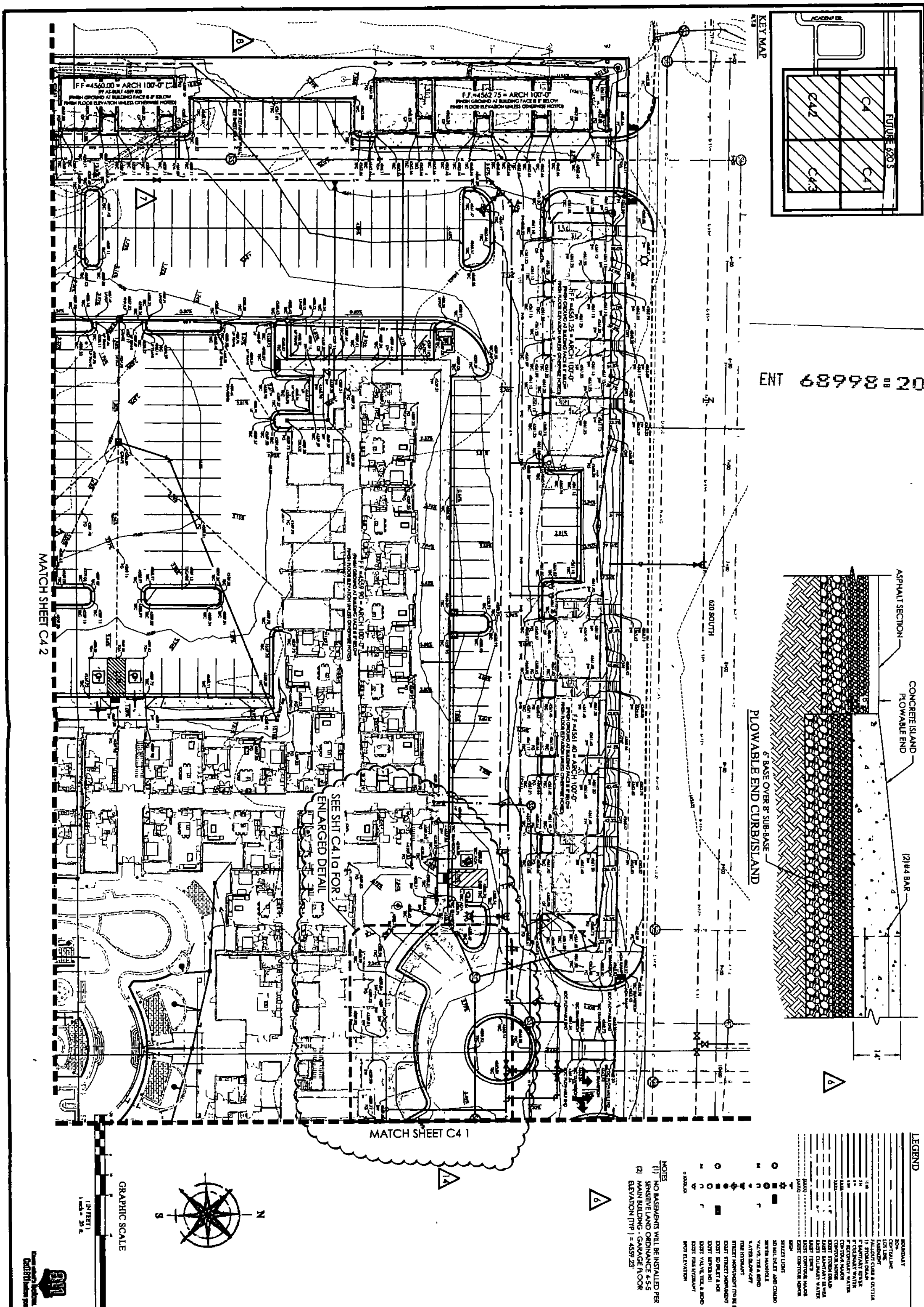
1. Maintenance/Inspection Schedule
2. Maintenance Log
3. Annual SOP Training Log per Section 2

Appendix D- Drainage and Geotechnical Reports, UIC Registration

1. Storm Drain Report
2. 100-Year Storm Drain Calculations
3. Geotechnical Study

APPENDIX A – SITE DRAWINGS AND DETAILS

ENT 68998:2024 PG 17 of 96



REVISION BLOCK		
#	DATE	DESCRIPTION
14	5/29/24	FIRE ACCESS REVISIONS
4	12/22/21	—
5	08/07/22	ADDED FRENCH DRAIN
6	10/28/22	ADA RAMP & CURB REVISION
7	2/13/23	GRADING AND DRAINAGE REV'D
8	07/13/23	REVISIONS PER BACH

BACH APARTMENTS

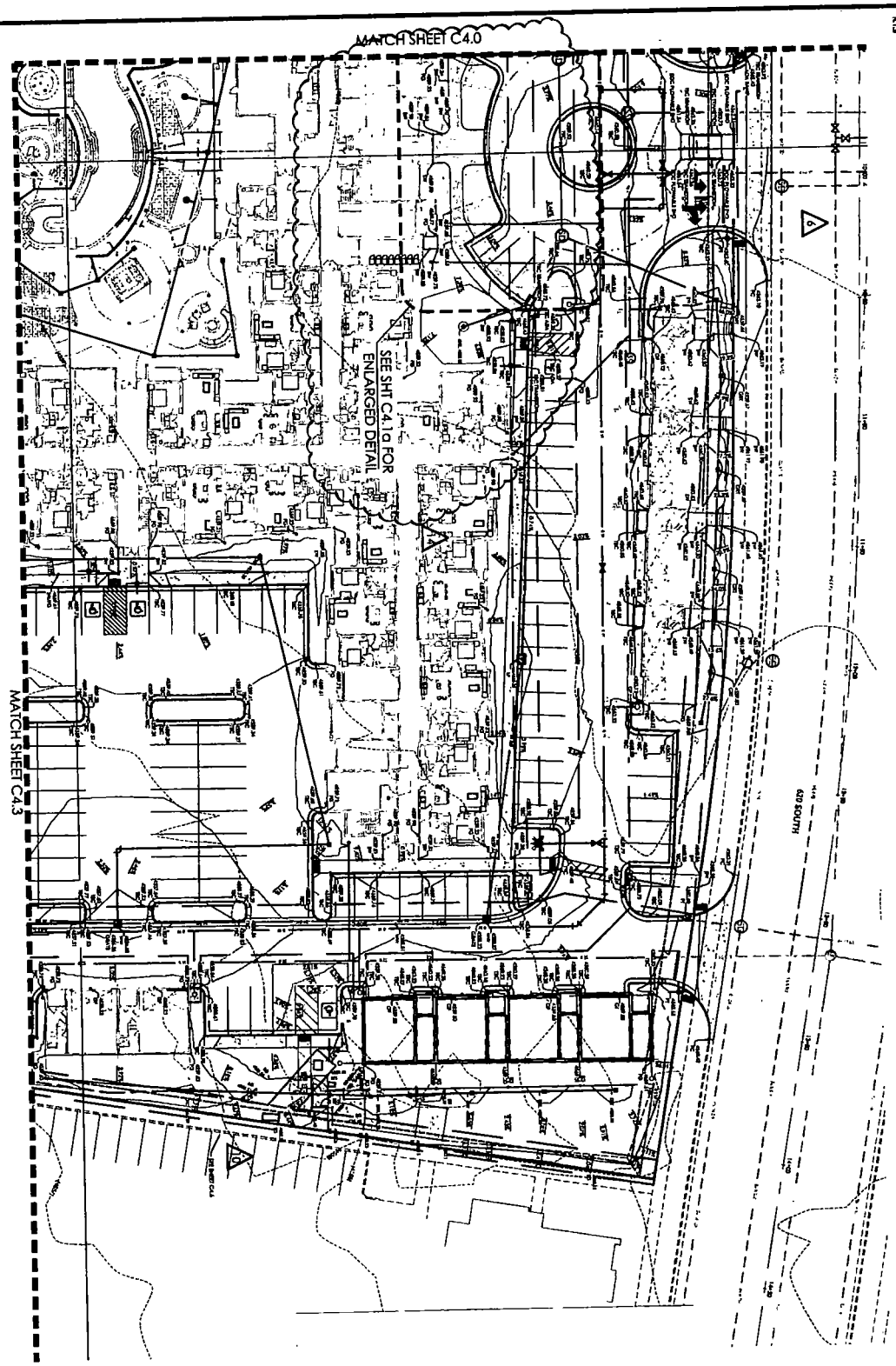
AMERICAN FORK, UT

GRADING PLAN

FOCUS ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH (801) 352-0075
www.focusutah.com

GRADING PLAN

C4.0



GRAPHIC SCALE

NOTES:
(1) NO BASEMENTS WILL BE INSTALLED PER SENSITIVE LAND ORDINANCE 4-5-5.
(2) MAIN BUILDING - GARAGE FLOOR ELEVATION (FF) = 4537.25

LEGEND

REVISION BLOCK		
#	DATE	DESCRIPTION
14	3/29/24	FIRE ACCESS REVISIONS
3	09/23/21	SEWER LATERAL REVISIONS
2	10/7/21	DRAINAGE REVISION
1	12/23/21	---
5	09/07/22	ADDED FRENCH DRAIN
6	10/28/22	ADA RAMP & CURB REVISION

C4.1 GRADING PLAN

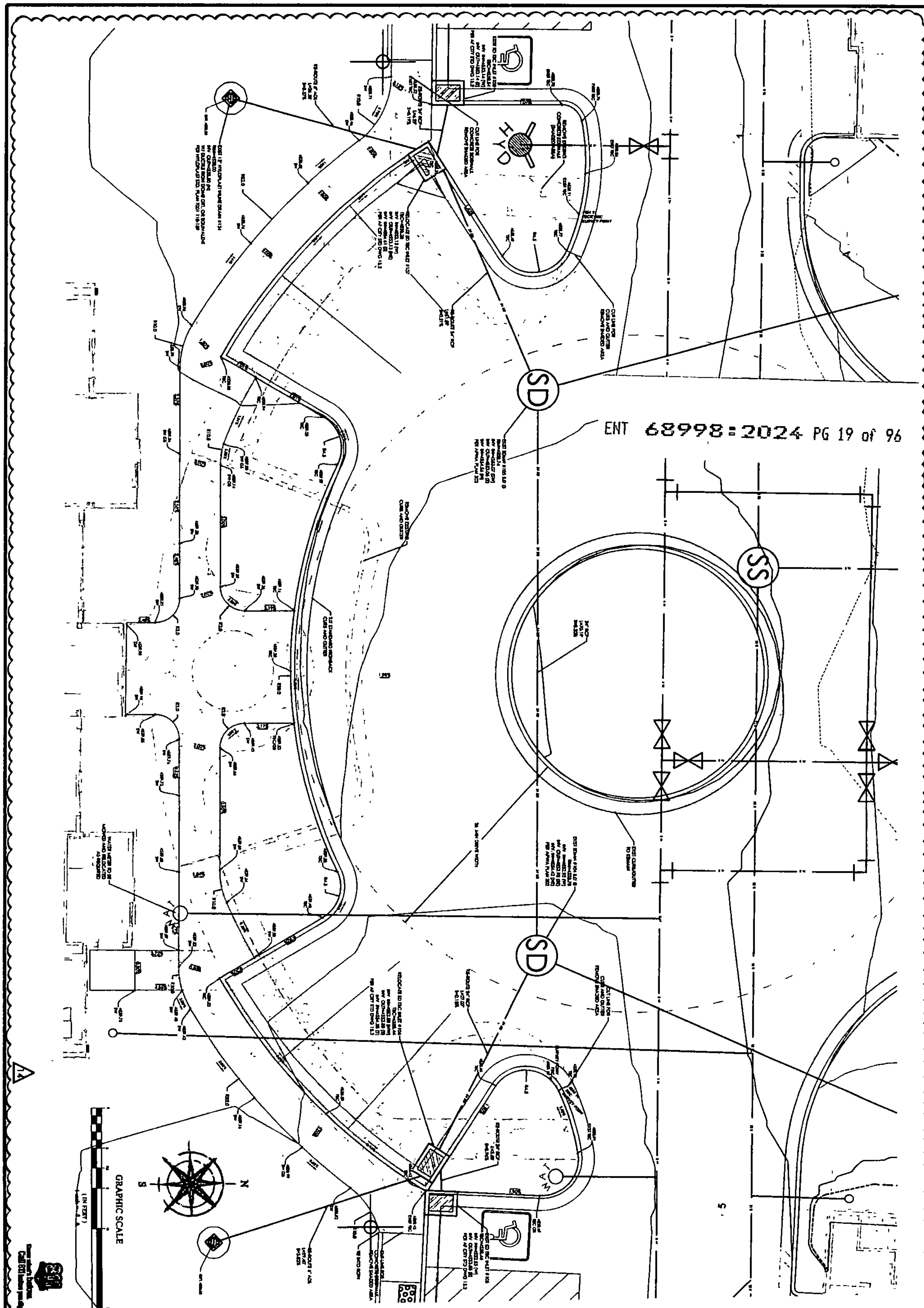
BACH APARTMENTS

AMERICAN FORK, UT

GRADING PLAN

FOCUS
ENGINEERING AND SURVEYING, LLC
6949 S HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH: (801) 352-0075
www.focusutah.com

ENT 68998:2024 PG 19 of 96



REVISION BLOCK		
#	DATE	DESCRIPTION
14	5/29/24	FIRE ACCESS REVISIONS

BACH APARTMENTS

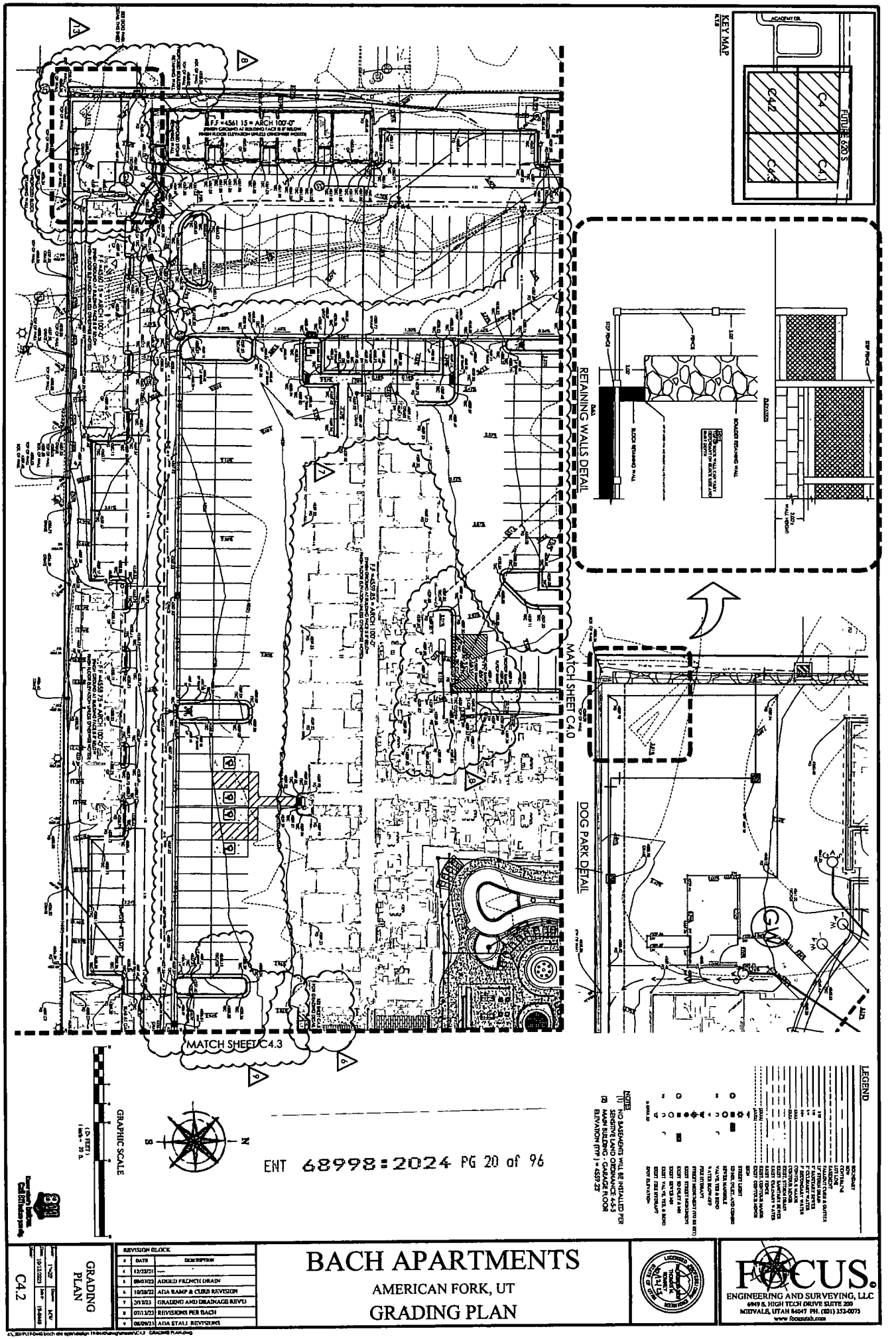
AMERICAN FORK, UT

GRADING & DRAINAGE PLAN

FOCUS ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH: (801) 352-0075

GRADING & DRAINAGE PLAN

C4.1a



REVISION BLOCK		
#	DATE	DESCRIPTION
4	12/22/21	---
5	09/03/22	ADDED FRENCH DRAIN
6	10/28/22	ADA RAMP & CURB REVISION
7	2/13/23	GRADING AND DRAINAGE REVI
8	07/13/23	REVISIONS PER BACH
9	08/09/23	ADA STALL REVISIONS

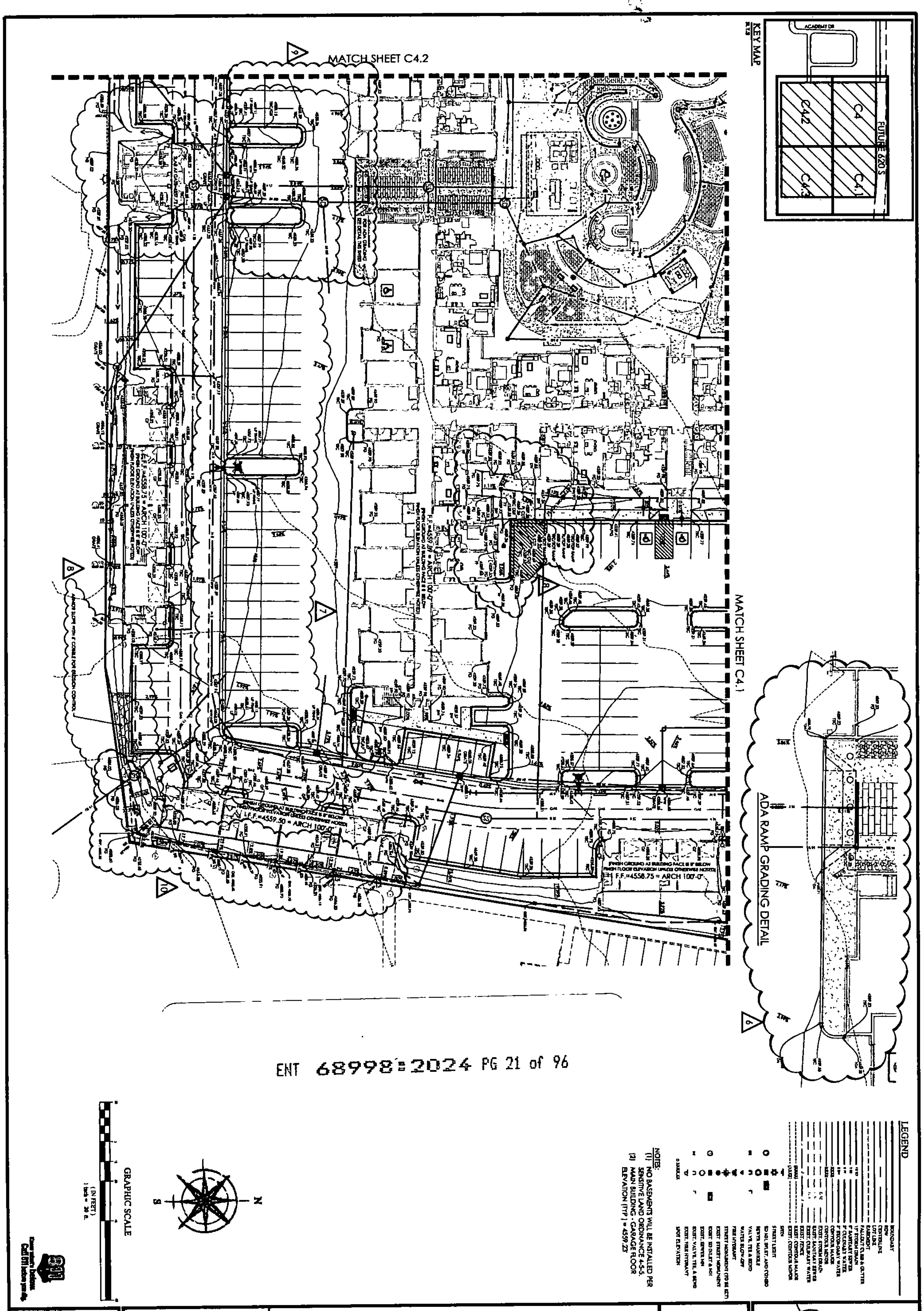
C4.2 — GRADING PLAN

BACH APARTMENTS

AMERICAN FORK, UT

GRADING PLAN

FOCUS.
ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH. (801) 352-0075
www.focusutah.com



REVISION BLOCK		
#	DATE	DESCRIPTION
5	08/07/22	ADDED FRENCH DRAIN
6	10/28/22	ADA RAMP & CURB REVISION
7	2/17/23	GRADING AND DRAINAGE REVD
8	07/13/23	REVISIONS PER BACH
9	02/09/23	ADA STALL REVISIONS
10	3/8/24	DRAINAGE AT BLDG 15 (RFI 442)

BACH APARTMENTS

AMERICAN FORK, UT

GRADING PLAN

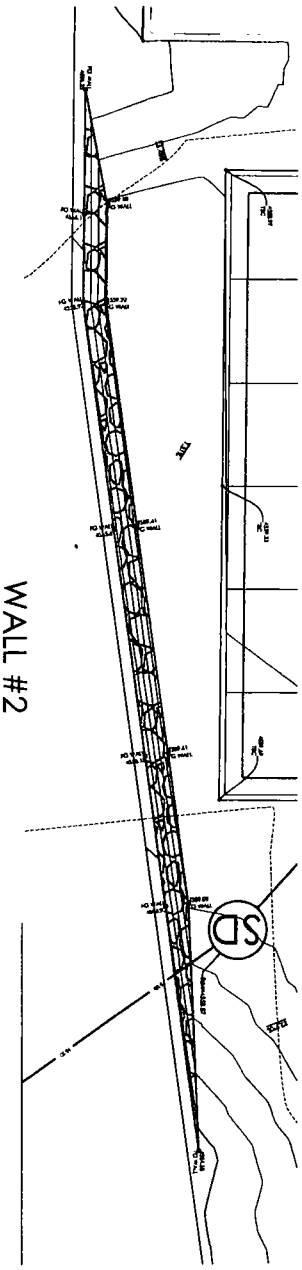
GRADING PLAN

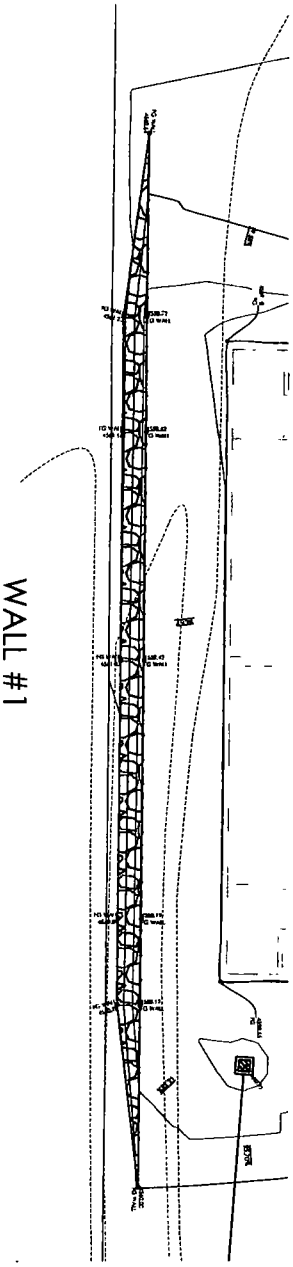
Scale: 1"=20' | Drawn: MW | Date: 3/8/24 | Job #: 19-0440

Sheet: C4.3

FOCUS ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH: (801) 352-0075
www.focusutah.com

F:_2019\19-0440 Bach AFC Apts\design 19-0440\dwg\sheets\C4.3 - GRADING PLAN.dwg





GRAPHIC SCALE

LEGEND

REVISION BLOCK		
#	DATE	DESCRIPTION
-		
1		
2		
3		
4		
5		
6		

C4.4

RETAINING WALL PLAN

BACH APARTMENTS

AMERICAN FORK, UT

RETAINING WALL PLAN

FOR REVIEW ONLY

FOCUS
ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH: (801) 352-0075
www.focusutah.com

REVISION BLOCK		
#	DATE	DESCRIPTION
7	2/17/23	GRADING AND DRAINAGE REVD
11	09/20/23	PLANTER DRAINS COURTYARD
13	4/23/24	PLANTER LOCATIONS & GRADING

BACH APARTMENTS

AMERICAN FORK

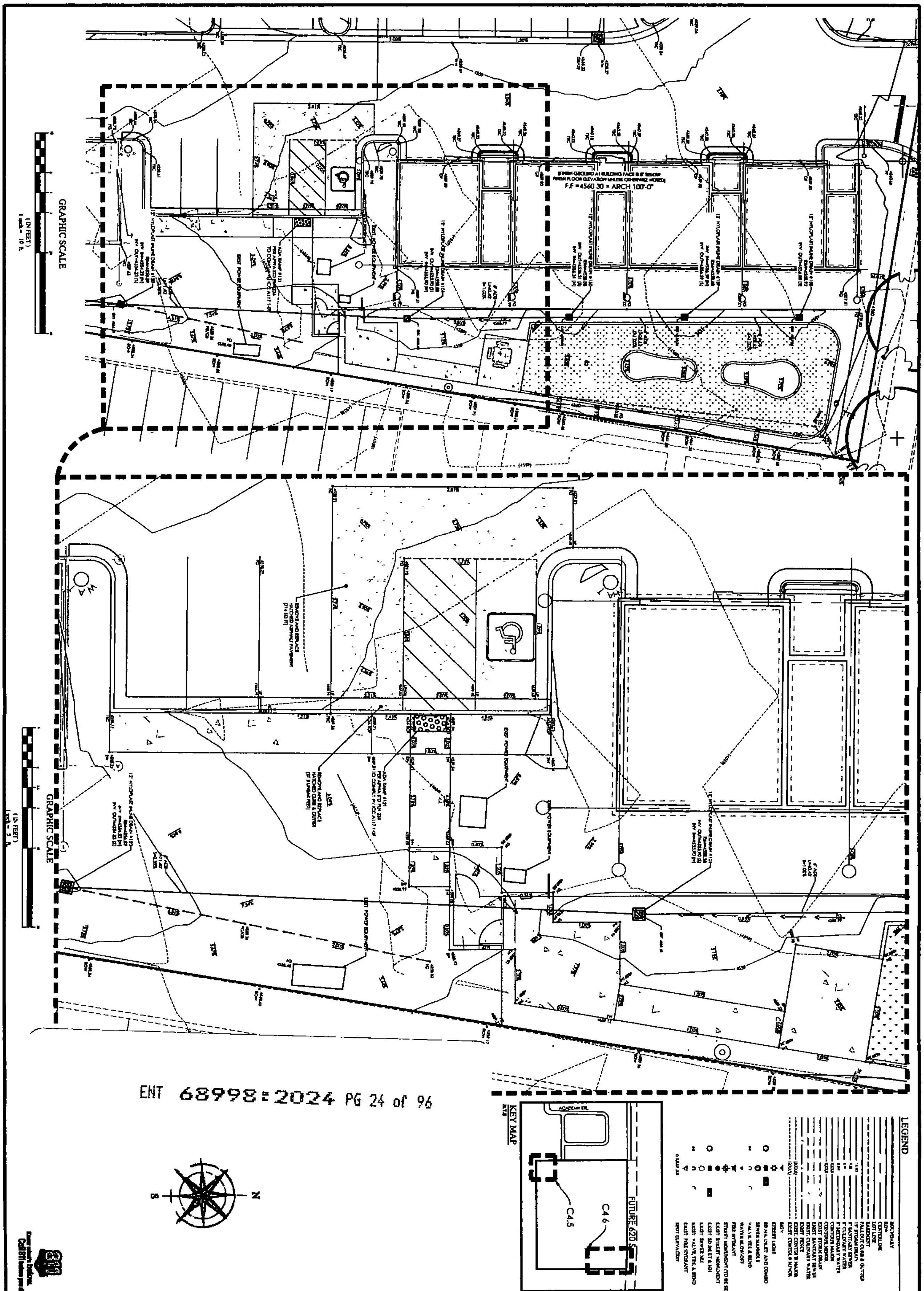
POOL & DECK GRADING PLAN

FOR REVIEW ONLY

FOCUS
ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH (801) 352-0075
www.focuseng.com

POOL & DECK GRADING PLAN

C4.5



ENT 68998:2024 PG 24 of 96

BACH APARTMENTS

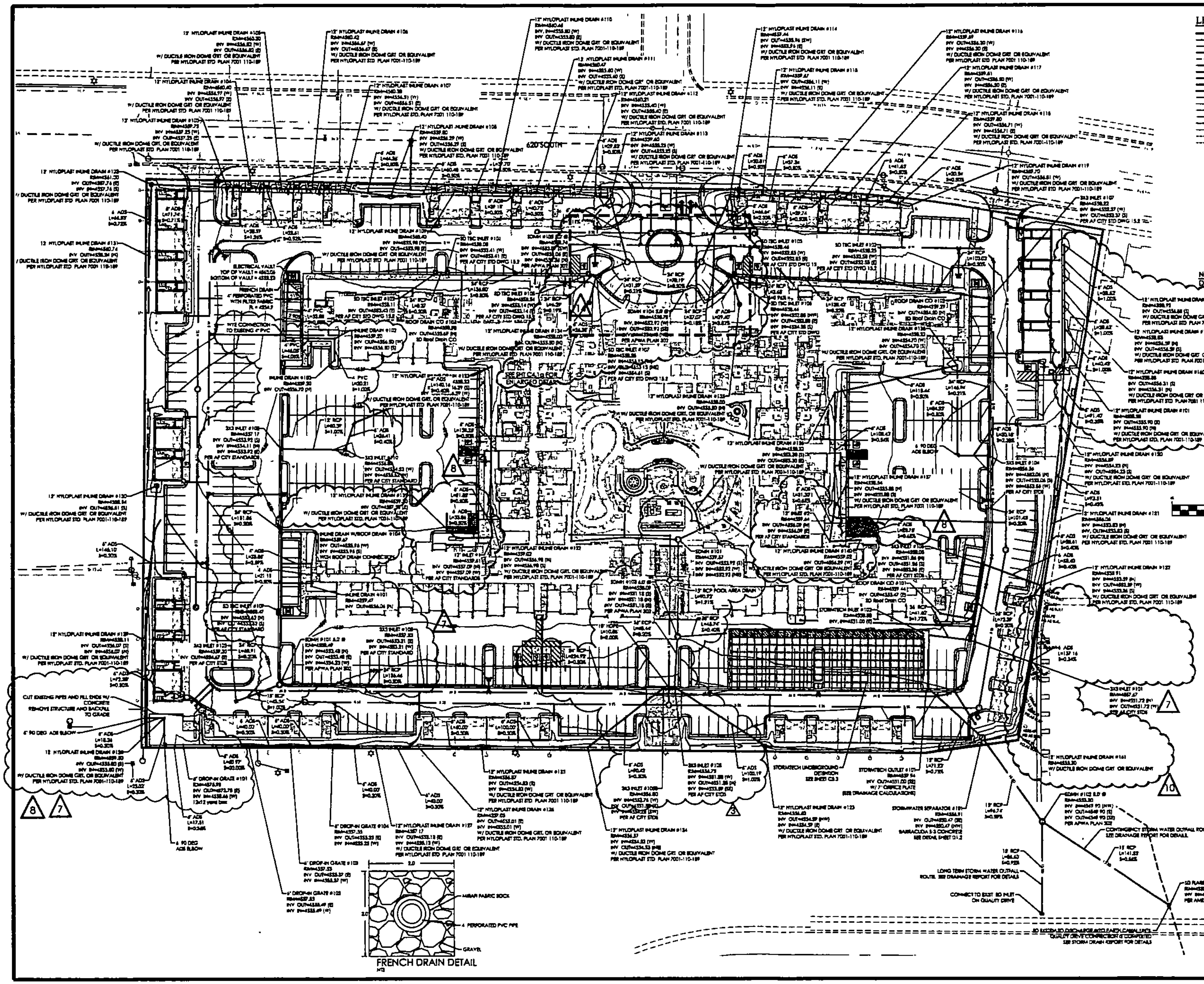
AMERICAN FORK, UT

DOG PARK EXHIBIT

FOCUS ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH (801) 352-0075
www.focusutah.com

DOG PARK EXHIBIT

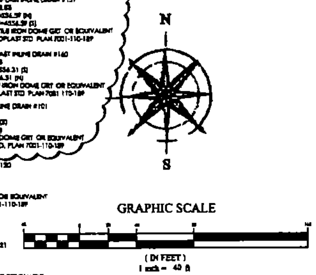
C4.6



LEGEND

- BOUNDARY
- ROW
- CENTERLINE
- LOT LINE
- EASEMENT
- FALLOUT CURB & GUTTER
- 15" STORM DRAIN
- 8" SANITARY SEWER
- 8" CULINARY WATER
- 8" SECONDARY WATER
- CONTOUR MAJOR
- CONTOUR MINOR
- EXIST STORM DRAIN
- EXIST SANITARY SEWER
- EXIST CULINARY WATER
- EXIST FENCE
- EXIST CONTOUR MAJOR
- EXIST CONTOUR MINOR
- SIGN
- STREET LIGHT
- SD MH, INLET, AND COMBO
- SEWER MANHOLE
- VALVE, TEE & BEND
- WATER BLOW-OFF
- FIRE HYDRANT
- STREET MONUMENT (TO BE SET)
- EXIST STREET MONUMENT
- EXIST SD INLET & MH
- EXIST SEWER MH
- EXIST VALVE, TEE, & BEND
- EXIST FIRE HYDRANT
- SPOT ELEVATION

NOTE: FLOWLINE ARROWS INDICATE SURFACE FLOW DIRECTION NOT PIPE FLOW



NOTE TO CONTRACTOR:

TIMING OF THE CONSTRUCTION AND SERVICEABILITY OF QUALITY DRIVE IS UNKNOWN. THE ENGINEER OF RECORD MUST BE CONTACTED PRIOR TO THE START OF CONSTRUCTION TO ENSURE EITHER

A QUALITY DRIVE IS CONSTRUCTED, SERVICEABLE, AND ABLE TO RECEIVE STORM WATER OUTFALL OR

B PLANS AND CALCULATIONS HAVE BEEN SUBMITTED TO AND APPROVED BY AF CITY FOR DISCHARGE INTO EXISTING IRRIGATION DITCH.

811 Know what's below. Call 811 before you dig.

FOCUS ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH (801) 352-0075
www.focusutah.com

BACH APARTMENTS

AMERICAN FORK, UT

DRAINAGE PLAN

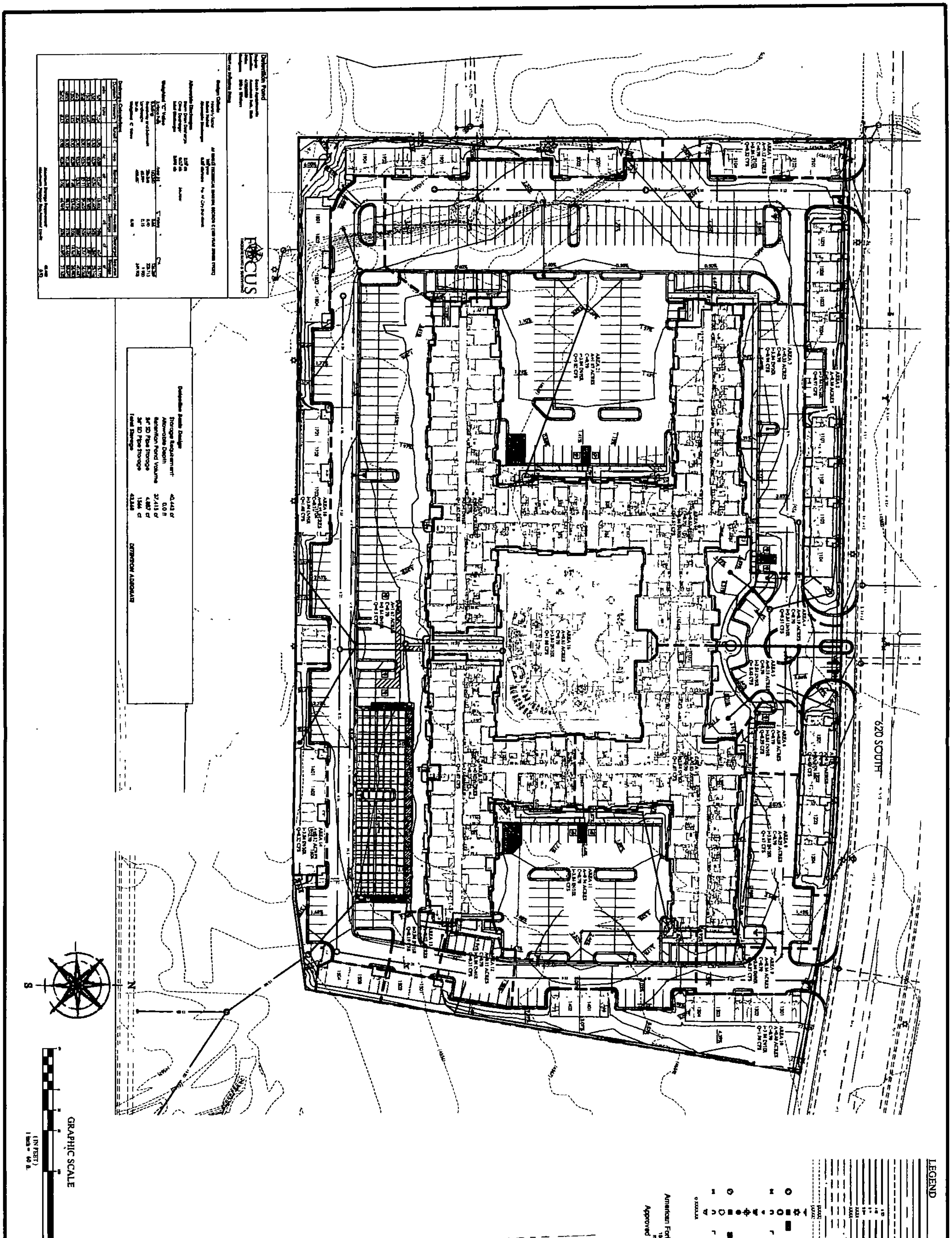
REVISION BLOCK

#	DATE	DESCRIPTION
[illegible]	05/29/24	FIRE ACCESS REVISIONS
6	10/28/22	ADA RAMP & CURB REVISION
7	2/17/23	GRADING AND DRAINAGE REV'D
8	07/13/23	REVISIONS PER BACH
9	1/8/24	EAST DOG PARK DRAINAGE
10	3/8/24	DRAINAGE AT BLDG 13 (RFT 442)

DRAINAGE PLAN

Scale: 1"=40' | Drawn: MW
Date: 05/29/2024 | Job #: 19-0440
Sheet: C5.0

ENT 68998:2024 PG 25 of 96



FOCUS ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 300
MIDVALE, UTAH 84047 PH (801) 352-0075
www.focusutah.com

FOR REVIEW ONLY

BACH APARTMENTS

AMERICAN FORK, UT

OVERALL DRAINAGE PLAN

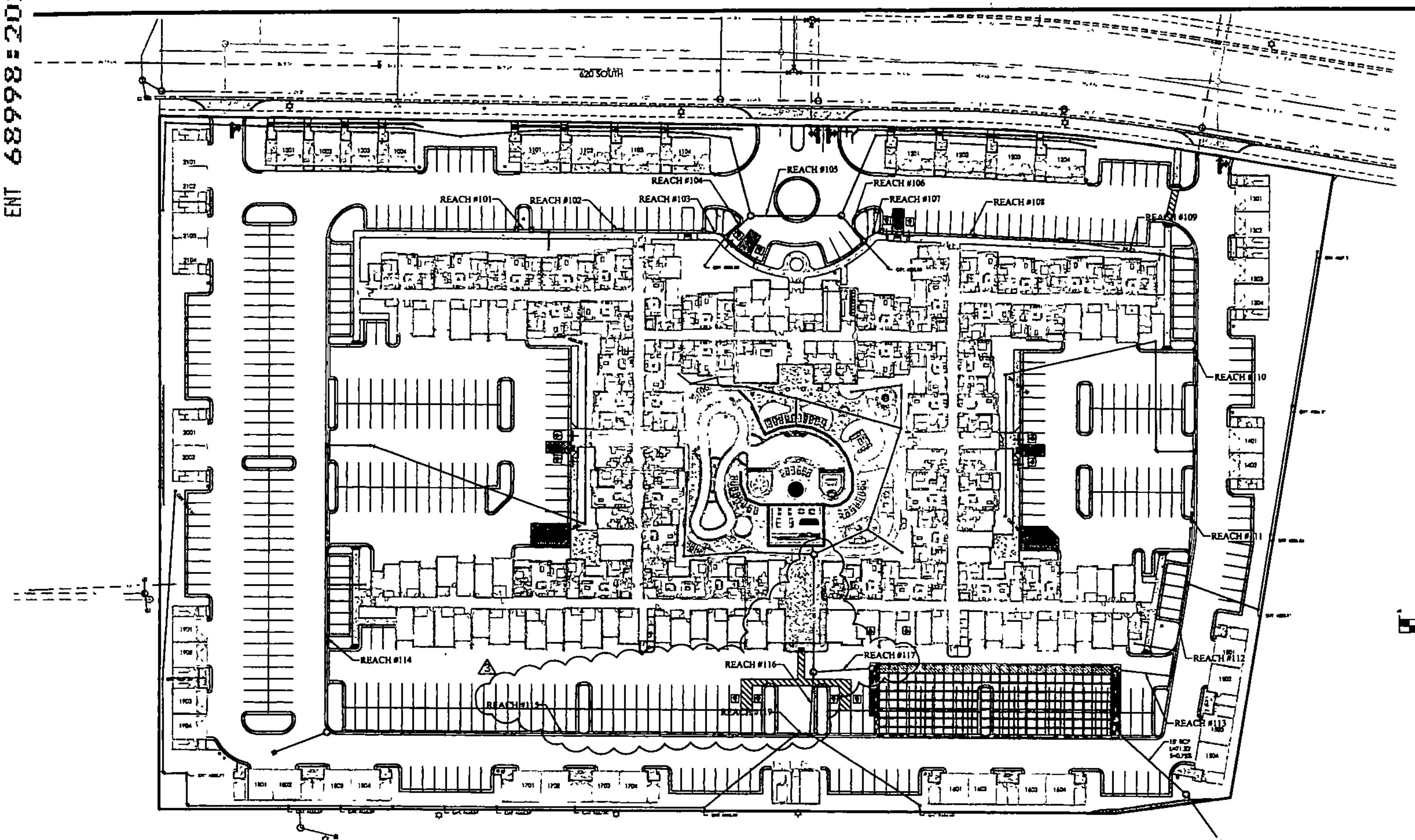
REVISION BLOCK

#	DATE	DESCRIPTION
1		
2		
3		
4		
5		
6		

OVERALL DRAINAGE PLAN

Scale: 1"=60'
Date: 06/29/2020
Job #: 19-0440

C5.1



LEGEND

- BOUNDARY
- ROW
- CENTERLINE
- LOT LINE
- EASEMENT
- FALLOUT CURB & GUTTER
- 15" STORM DRAIN
- 8" SANITARY SEWER
- 8" CULINARY WATER
- 8" SECONDARY WATER
- CONTOUR MAJOR
- CONTOUR MINOR
- EXIST. STORM DRAIN
- EXIST. SANITARY SEWER
- EXIST. CULINARY WATER
- EXIST. FENCE
- EXIST. CONTOUR MAJOR
- EXIST. CONTOUR MINOR
- SIGN
- STREET LIGHT
- SD MH, INLET, AND COMBO
- SEWER MANHOLE
- VALVE, TEE & BEND
- WATER BLOW-OFF
- FIRE HYDRANT
- STREET MONUMENT (TO BE SET)
- EXIST. STREET MONUMENT
- EXIST. SD INLET & MH
- EXIST. SEWER MH
- EXIST. VALVE, TEE, & BEND
- EXIST. FIRE HYDRANT
- SPOT ELEVATION

GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

PIPE CAPACITY TABLE (BASED ON MANNING'S EQUATION)

Pipe Name	Size (Inches)	Length (Feet)	Slope (%)	C-VALUE	Intensity (In/Hr)	Tc (Min.)	Qcap (CFS)	Q10 (CFS)
REACH #101	24	8	0.30%	0.7	3.84	5	10.1	0.940
REACH #102	24	136	0.30%	0.7	3.84	5	10.1	0.940
REACH #103	24	16	0.30%	0.7	3.84	5	10.1	0.940
REACH #104	24	23	0.30%	0.7	3.84	5	10.1	1.430
REACH #105	24	78	0.30%	0.7	3.84	5	10.1	2.740
REACH #106	24	24	0.30%	0.7	3.84	5	10.1	3.300
REACH #107	24	15	0.30%	0.7	3.84	5	10.1	3.480
REACH #108	24	130	0.30%	0.7	3.84	5	10.1	3.970
REACH #109	24	103	0.30%	0.7	3.84	5	10.1	4.640
REACH #110	24	147	0.31%	0.7	3.84	5	10.3	5.010
REACH #111	24	101	0.30%	0.7	3.84	5	10.1	8.690
REACH #112	36	72	0.50%	0.7	3.84	5	29.9	10.030
REACH #113	36	42	1.72%	0.7	3.84	5	87.7	11.910
REACH #114	24	221	0.30%	0.7	3.84	5	10.1	4.700
REACH #115	24	361	0.30%	0.7	3.84	5	10.1	6.700
REACH #116	36	40	0.50%	0.7	3.84	5	29.9	12.700
REACH #117	36	46	0.40%	0.7	3.84	5	42.3	14.350
REACH #118	18	77	0.7[illegible]	0.7	3.84	5	7.6	[illegible]
REACH #119	18	11	2.00%	0.7	3.84	5	14.9	12.700

NOTE: ALL PIPES CONNECTING 12" NYLOPLAST DRAIN BASINS TO BE 6" ADS

25 Year Storm

Project: Bach Apartments
Location: American Fork, Utah
Date: 4/08/2020
Designer: Mike Winters

25-YEAR PIPE SIZING PER AF STORM WATER TECHNICAL MANUAL

FOCUS ENGINEERING & SURVEYING

Design Criteria

Intensity Table: AF STORM WATER TECH MANUAL SECTION C (Table 2-25 Year Storm Event)
Return Period: 25 year
Allowable Discharge: 0.20 cfs/acre Per AF City Standards

Allowable Discharges

Storm Drain Discharge: 2.08 cfs
Other Discharge: 0.60 cfs Source:
Total Discharge: 2.68 cfs

Weighted "C" Value

Surface Type	Area (sf)	"C" Value	C*A
Building	163,340	0.85	138,839
Roadway and Sidewalk	226,348	0.90	203,713
Landscape	65,999	0.15	9,900
Totals	452,687		349,903
Weighted "C" Value		0.78	

Drainage Calculations

Duration	Intensity	Runoff C	Area	Rainfall	Accumulated Flow	Allowable Discharge	Discharge	Required Storage
min.	in/hr		Ac	cfs	cf	cfs	cf	cf
5.0	3.84	0.70	10.39	27.93	8,380	2.08	624	7,757
10.0	2.96	0.70	10.39	21.39	12,835	2.08	1,247	11,588
15.0	2.48	0.70	10.39	18.04	16,237	2.08	1,871	14,866
30.0	1.72	0.70	10.39	12.51	22,502	2.08	3,741	18,761
60.0	1.07	0.70	10.39	7.73	28,545	2.08	7,482	21,063
120.0	0.62	0.70	10.39	4.51	32,474	2.08	14,963	17,509
180.0	0.46	0.70	10.39	3.37	36,364	2.08	22,447	12,909
360.0	0.26	0.70	10.39	1.89	40,854	2.08	44,893	-4,041

Know what's below. Call 811 before you dig.

FOCUS ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH (801) 352-0075
www.focusutah.com

LICENSED PROFESSIONAL ENGINEER
THOMAS M. ROMNEY
STATE OF UTAH

BACH APARTMENTS

AMERICAN FORK, UT

PIPE SIZING PLAN

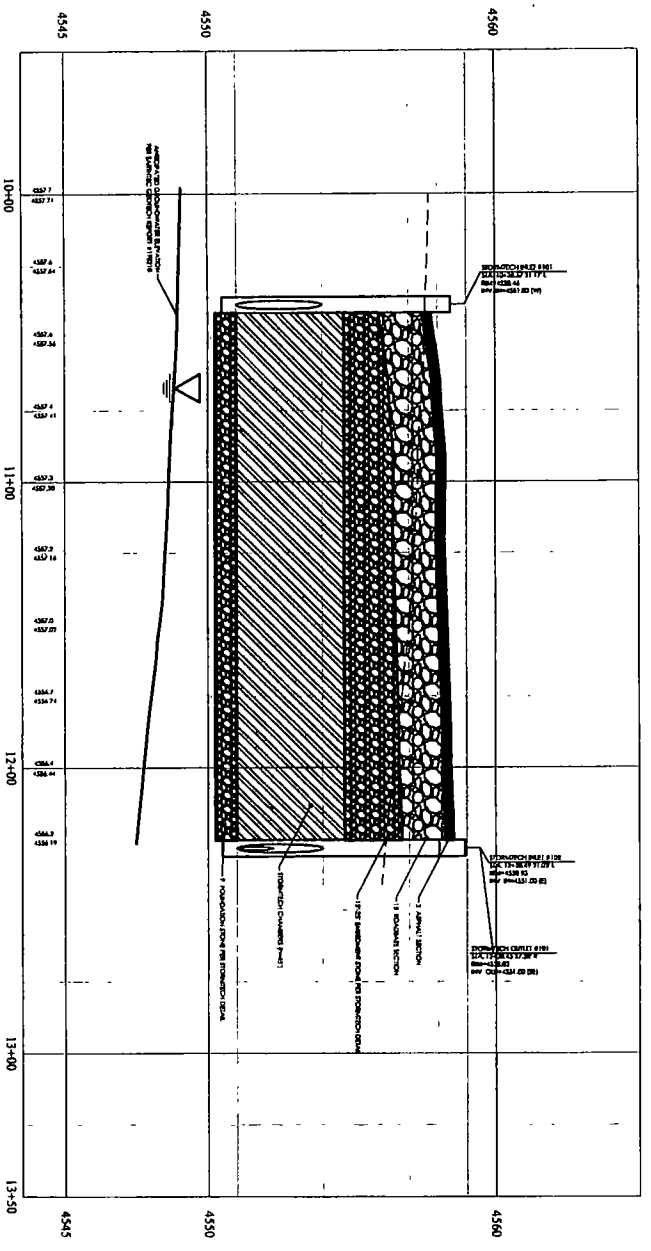
REVISION BLOCK

#	DATE	DESCRIPTION
1	11/05/20	PLUMBING COORDINATION
2	09/22/21	SEWER LATERAL REVISIONS
3	10/7/21	DRAINAGE REVISION
4	—	—
5	—	—

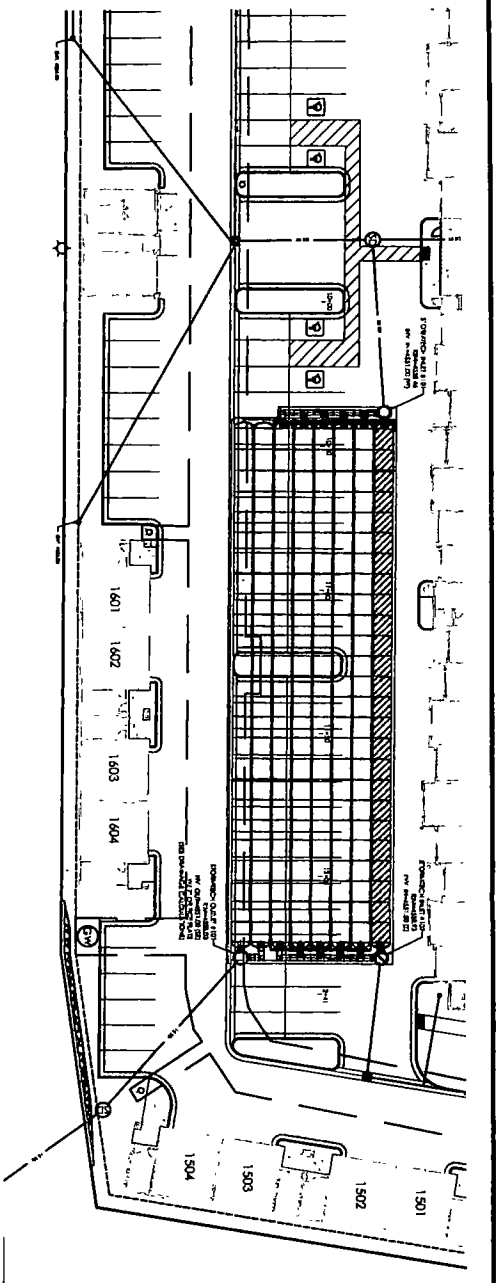
PIPE SIZING PLAN

Scale: 1"=40'	Drawn: MW
Date: 03/04/2021	Job #: 19-0440

Sheet: C5.2



STORMTECH PROFILE



LEGEND

GRAPHIC SCALE

American Fork City Engineering
Approved for Construction

REVISION BLOCK		
#	DATE	DESCRIPTION
-		
-		
-		
-		
-		

BACH APARTMENTS

AMERICAN FORK, UT

STORM WATER STORAGE

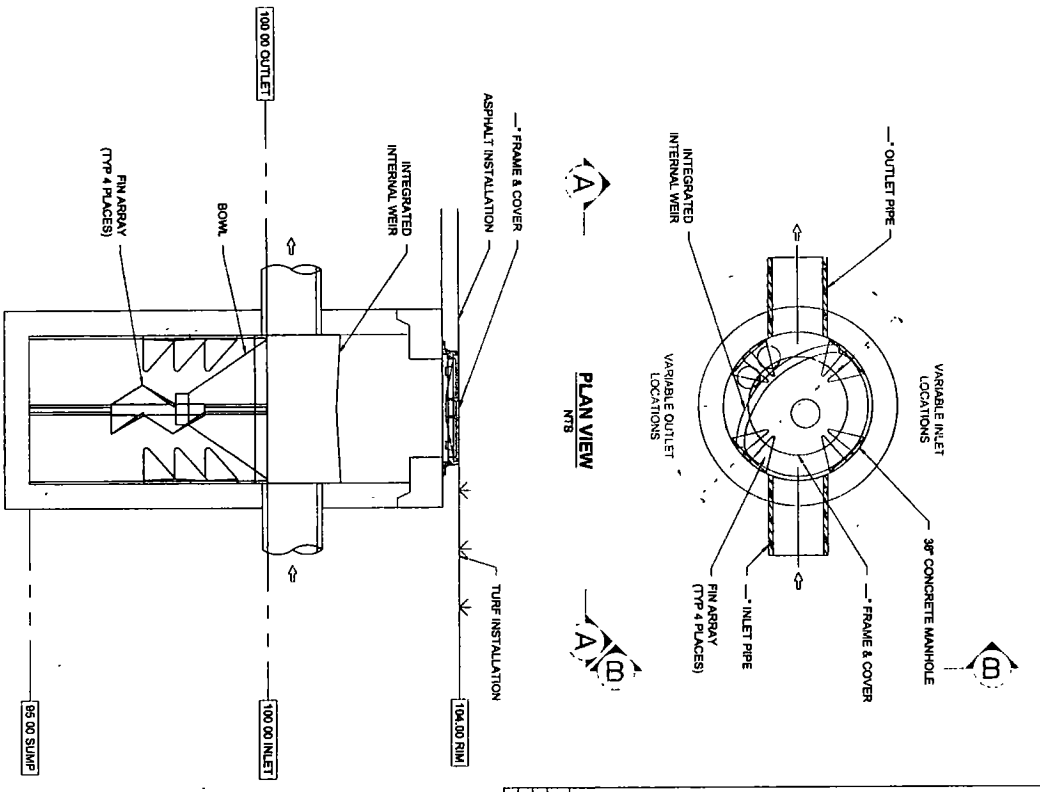
FOR REVIEW ONLY

FOCUS.
ENGINEERING AND SURVEYING, LLC
6949 S HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH: (801) 352-0075
www.focusutah.com

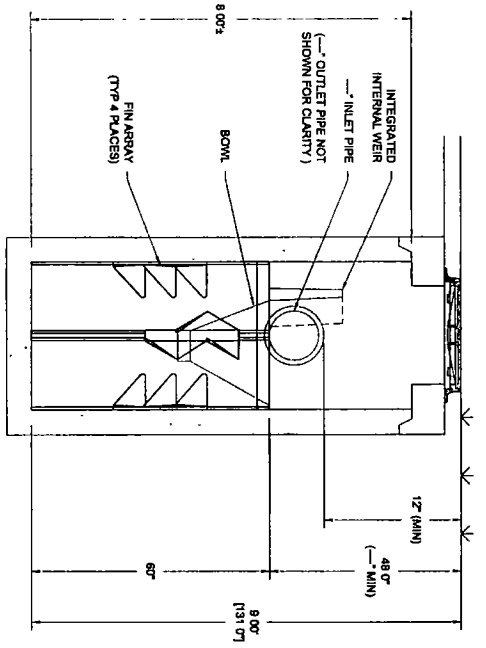
STORM WATER STORAGE

C5.3

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS
NOTES:
BACH MC3500 3558CF
AM FORK, UT
American Fork City Engineering
Approved for Construction
BACH APARTMENTS
AMERICAN FORK, UT
STORMTECH DETAILS
FOCUS.
ENGINEERING AND SURVEYING, LLC
6949 S. HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH. (801) 352-0075
www.focuscos.com
D1.2
STORMTECH DETAILS



UNIT ID	BARRACUDA S3
PEAK FLOW RATE (CFS)	
TREATMENT FLOW RATE (CFS)	



American Fork City Engineering
Approved for Construction

ADS ADVANCED DRAINAGE SYSTEMS, INC.	4640 TRUEMAN BLVD HILLIARD, OH 43026	Barracuda	1030 Deer Hollow Drive Mount Airy, MD 21771 1-800-BAYSAVER 1-800-229-7283	REV / DWN / CKD / DESCRIPTION	BARRACUDA S3 STANDARD DETAIL
SHEET 1 OF 1	NOT TO SCALE				DATE 3/22/19 DRAWN EKH PROJECT # CHECKED

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

HYDRODYNAMIC SEPARATOR DETAILS

D1.3

REVISION BLOCK		
#	DATE	DESCRIPTION
1		
2		
3		
4		
5		
6		

BACH APARTMENTS

AMERICAN FORK, UT

HYDRODYNAMIC SEPARATOR DETAILS

FOCUS ENGINEERING AND SURVEYING, LLC
6949 S HIGH TECH DRIVE SUITE 200
MIDVALE, UTAH 84047 PH (801) 352-0075
www.focusutah.com

APPENDIX B – Standard Operation Procedures (SOPs)

Pavement Sweeping

General:
These SOPs are not expected to cover all necessary procedure actions. Operators are allowed to adapt SOPs to unique site conditions in good judgment when it is necessary for safety, and the proper, and effective containment of pollutants. However, any changes of routine operations must be amended in these SOPs.

1. Purpose:

a) One of the primary contaminates in the McArthur Ditch is organic material.
b) Any sediment, leaves, debris, spilt fluids or other waste that collects on our parking areas and sidewalks will fill in our low impact drainage system, retention/detention storage, manufactured treatment device and underground retention/detention infiltration system increasing our maintenance cost. Removing this debris after it has washed to our flood and water quality system is very expensive.

2. Regular Procedure:

a) Remain aware of minor sediment/debris and hand sweep or remove material by other means as needed. Significant deposits will likely collect in autumn with leaf fall and early spring after winter thaw. Usually sweeping machinery is the best tool for this application.
b) Regularly manage outside activities that spread fugitive debris on our pavements. This involves outside functions including but not limited to: Yard sales, yard storage, fund raisers, etc.
c) Do not allow car wash fund raiser or other related activities. Detergents will damage water resources and washed pollutants will fill our storm drain system and drain into the ground which we are responsible.

4. Disposal Procedure:

a) Dispose of hand collected material in dumpster.
b) Use licensed facilities when haul off is necessary.

5. Training:

a) Annually and at hire.
b) Inform staff and service contractors when incorrect SOP implementation is observed.

Landscape Maintenance

ENT 68998:2024 PG 33 of 96

General:
This SOP is not expected to cover all necessary procedure actions. Operators are allowed to adapt SOPs to unique site conditions in good judgment when it is necessary for safety, and the proper, and effective containment of pollutants. However, any changes of routine operations must be amended in this SOP.

1. Purpose:

a) One of the primary contaminates in the McArthur Ditch is organic material.
b) Grass clippings, sticks, branches, dirt, mulch, fertilizers, pesticides and other pollutants will fill our low impact drainage system, retention/detention storage, manufactured treatment device and underground retention/detention infiltration system increasing our maintenance cost. Removing this debris after it has washed to our flood and water quality system is very expensive.

2. Maintenance Procedure:

a) Maintain healthy vegetation root systems. Healthy root systems will help improve permeable soils maintaining more desirable infiltration rates of our landscape areas receiving runoff from our pavements.
b) Grooming
   - Lawn Mowing – Immediately following operation, sweep or blow clippings onto vegetated ground.
   - Fertilizer Operation – Prevent overspray. Sweep or blow granular fertilizer onto vegetated ground immediately following operation.
   - Herbicide Operation – Prevent overspray. Sweep or blow granular herbicide onto vegetated ground immediately following operation.
   - Trash and Debris – Remove trash and debris collecting within landscaping.
c) Remove or contain all erodible or loose material prior to forecast wind and precipitation events, before any non-stormwater will pass through the property and at the end of the work period. Light weight debris and landscape materials can require immediate attention when wind or rain is expected.
d) Landscape project materials and waste can usually be contained or controlled by operational best management practices.
   - Operational; including but not limited to:
     - Strategic staging of materials eliminating exposure, such as not staging on pavement
     - Avoiding multiple day staging of landscaping backfill and spoil on pavements

- ➢ Haul off spoil as generated and daily
- ➢ Scheduling work when weather forecast is clear.

e) Cleanup:

- Use dry cleanup methods, e.g. square nose shovel and broom. Conditions are usually sufficient when no more material can be swept onto the square nosed shovel.
- Power blowing tools

3. Waste Disposal:

a) Dispose of waste according to General Waste Management SOP, unless superseded by specific SOPs for the operation.

4. Equipment:

a) Tools sufficient for proper containment of pollutants and removal.

5. Training:

a) Annually and at hire.
b) Inform staff and service contractors when incorrect SOP implementation is observed.
c) Landscape Service Contractors must use equal or better SOPs.

Waste Management

General:
This SOP is not expected to cover all necessary procedure actions. Operators are allowed to adapt SOPs to unique site conditions in good judgment when it is necessary for safety, and the proper, and effective containment of pollutants. However, any changes of routine operations must be amended in this SOP.

1. Purpose:

a) Trash can easily blow out of our dumpster and trash receptacles.
b) Liquids can leak from our dumpster polluting waterways, subsurface soils, leak from haul trucks, stain pavements and increase odors.

2. Procedure:

a) Remain aware of the lids and keep them closed.
b) Remain aware of leaking and fix. Minimize allowing disposal of liquids in our receptacles and dumpster.
c) Beware of dumpster capacity. Solve capacity issues. Leaving bags outside of dumpster is not acceptable.

3. Waste Disposal Restrictions for all waste Scheduled for the North Pointe Solid Waste District:

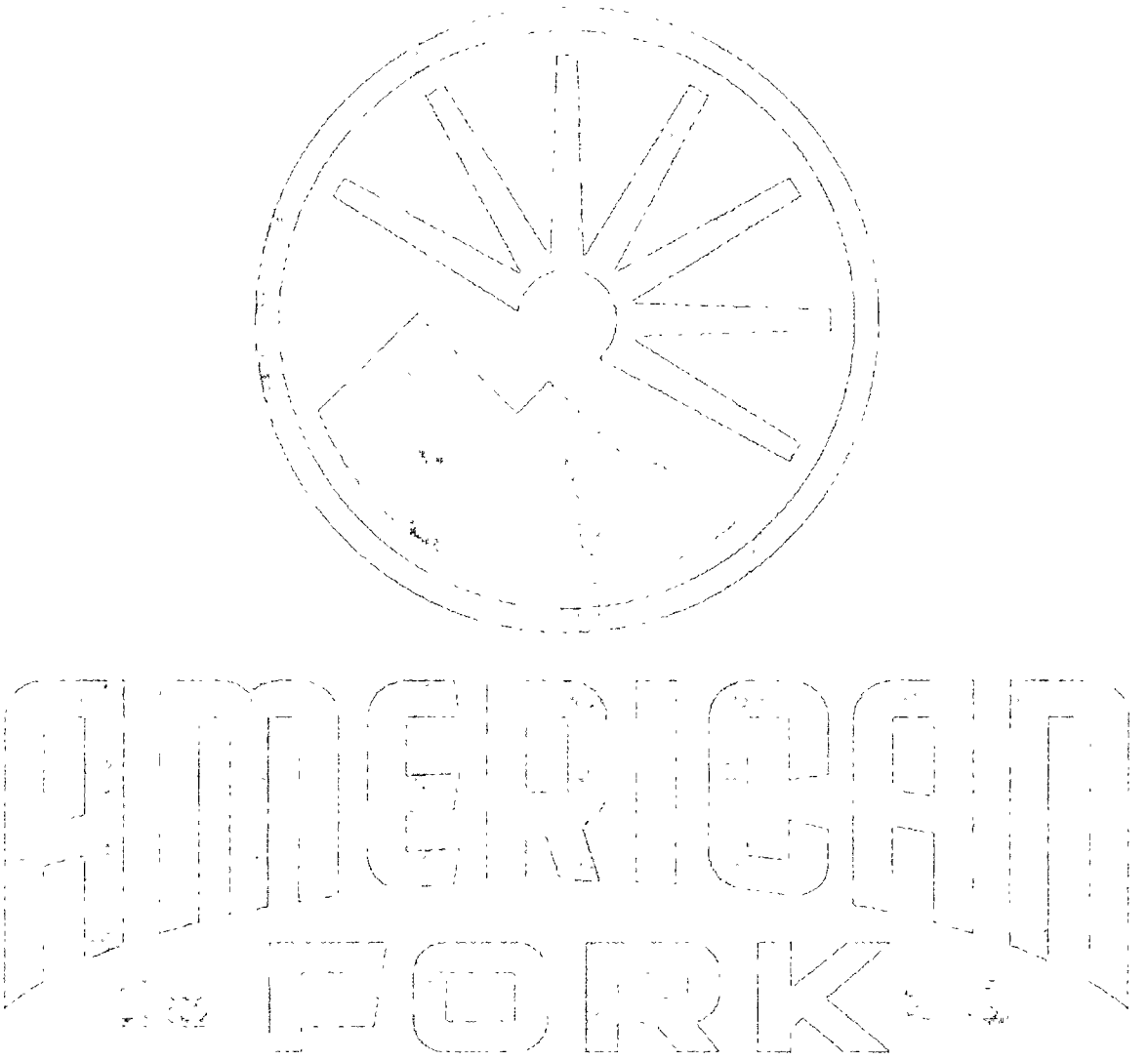
a) Generally, most waste generated at this property, and waste from spill and cleanup operations can be disposed in our dumpsters, unless specific disposal requirements are identified by the product SDS or otherwise specified in other SOPs. Contact the North Pointe Solid Waste District for specific waste that may not be disposed of in our dumpsters.
b) Know the facility disposal requirements and restrictions. It should not be assumed that all waste disposed in collection devices will be disposed at the North Pointe Solid Waste District.
c) Review North Pointe Solid Waste District regulations for additional restrictions and understand what waste is prohibited in the North Pointe Solid Waste District. Ensure the SDS and North Pointe Solid Waste District regulations are not contradictory.

Contact the North Pointe Solid Wate District for local landfill prohibitions.
North Pointe Solid Waste District –801-225-8538

4. Training:

a) Annually and at hire.

b) Inform staff and service contractors when incorrect SOP implementation is observed.



Flood and Water Quality System

General:
These SOPs are not expected to cover all necessary procedure actions. Operators are allowed to adapt SOPs to unique site conditions in good judgment when it is necessary for safety, and the proper, and effective containment of pollutants. However, any changes of routine operations must be amended in these SOPs.

1. Purpose:

a) Our flood and water quality system will collect anything we leave in the way of runoff which will fill in our low impact drainage system, retention/detention storage, manufactured treatment device and underground retention/detention infiltration system increasing our maintenance cost. Removing this debris after it has washed to our flood and water quality system is very expensive.
b) Any liquids or dissolved pollutants can increase the risk for contaminating groundwater for which we are responsible.
c) During very intense storm events pollutants in excess runoff can bypass our system increasing risk of contaminating groundwater and the McArthur Ditch and subsequently Utah Lake.

2. Inspections:

a) Inspect Manufactured Treatment Device. Remove any floating trash at each inspection interval with rake or other means. Remove oil sheen with absorbent materials. Remove sediments with accumulations 6" and more. This will usually require hydro-vacuum machinery.
b) Inspect Manufactured Treatment Device for mosquito larvae. Contact the Utah County Mosquito Abatement District when necessary.
c) Inspect underground retention/detention infiltration system for liquid or solid pollutants that can pollute subsurface soils. Find sources and prevent. There is no vegetation, and less soil biology to break down harmful chemicals at these depths.
d) Inspect underground retention/detention infiltration system for sediment and debris accumulations. Follow the StormTech® MC-3500 Chamber Maintenance SOP to remove and clean sediment and debris in the system.
e) Inspect sediment accumulations in above ground detention/retention infrastructure. Remove sediment accumulation when volume capacities drop below 90%.
f) Regularly remove trash and debris from landscaping areas and above ground low impact flood control systems with regular grooming operations. Inspect sediment accumulations in low impact flood control systems. Remove

accumulations when volumes within the swales, rain gardens and landscape areas drop below 90%.

g) Inspect low impact flood control system for adequate drainage and vegetation coverage. Poor drainage can be improved by maintaining healthy plant root systems.

h) Inspect flood design and retention system high water levels following significant storm events. The retention and detention depths should not exceed the depths shown on the plans for the respective storm event volumes. Contact an engineer when high water depths shown with plans are not consistent with the storm event.

i) Inspect surface water ponding. Water should not remain for more than 48 hours. Contact an engineer when the system is not draining. We should reduce site irrigation overspray as this could keep our pond wet all the time.

3. Disposal Procedure:

a) Remove and dispose sediment and debris at licensed facilities. Also, dry waste can be disposed in our dumpster as permitted by the North Pointe Solid Waste District.

b) Disposal of hazardous waste

1. Dispose of hazardous waste at regulated disposal facilities. Follow SDS Sheets. Also see Waste Management and Spill Control SOP.

4. Training:

a) Annually and at hire.

b) Inform staff and service contractors when incorrect SOP implementation is observed.

Pavement Washing

These SOPs are not expected to cover all necessary procedure actions. Operators are allowed to adapt SOPs to unique site conditions in good judgment when it is necessary for safety, and the proper, and effective containment of pollutants. However, any changes of routine operations must be amended in these SOPs.

1. Purpose:

a) Pavement washing involving detergents can potentially contaminate groundwater with phosphates and with whatever we are washing from pavements.

b) Pavement washing can fill our low impact drainage system, retention/detention storage, manufactured treatment device and underground retention/detention infiltration system increasing our maintenance cost. Removing this debris after it has washed to our flood and water quality system is very expensive.

2. Procedure:

a) Prevent waste fluids and any detergents if used from entering storm drain system. The following methods are acceptable for this operation.

- Dam the inlet using a boom material that seals itself to the pavement and pick up the wastewater with shop-vacuum or absorbent materials.
- Collect wastewater with shop-vacuum simultaneous with the washing operation.
- Collect wastewater with vacuum truck or trailer simultaneous with the washing operation.

b) This procedure must not be used to clean the initial spills. First apply the Spill Containment and cleanup SOP following by pavement washing when desired or necessary.

3. Disposal Procedure:

a) Small volumes of diluted washing waste can usually be drained to the local sanitary sewer. Contact the Timpanogos Special Service District.

b) Large volumes must be disposed at regulated facilities.

4. Pavement Cleaning Frequency:

a) There is no regular pavement washing regimen. Pavement washing is determined by conditions that warrant it, including but not limited to: prevention of slick or other hazardous conditions or restore acceptable appearance of pavements.

5. Training:

a) Annually and at hire

b) Inform staff and service contractors when incorrect SOP implementation is observed.

Snow and Ice Removal Management

General:
This SOP is not expected to cover all necessary procedure actions. Operators are allowed to adapt SOPs to unique site conditions in good judgment when it is necessary for safety, and the proper, and effective containment of pollutants. However, any changes of routine operations must be amended in this SOP.

1. Purpose:

a) Salt and other ice management chemicals if improperly managed will unnecessarily increase our salt impact to our own vegetation and local water resources.
b) We need to maintain healthy root systems to help maintain optimum infiltration rates.

2. De-Icing Procedure:

a) Do not store or allow salt or equivalent to be stored on outside paved surfaces.
b) Minimize salt use by varying salt amounts relative to hazard potential.
c) Sweep excessive piles left by the spreader.
d) Watch forecast and adjust salt amounts when temperatures are expected to increase the same day.

3. Training:

a) Annually and at hire.
b) Require snow and ice service contractors to follow the stronger of this SOP and their company SOPs.

General Construction Maintenance

General:
This SOP is not expected to cover all necessary procedure actions. Operators are allowed to adapt SOPs to unique site conditions in good judgment when it is necessary for safety, and the proper, and effective containment of pollutants. However, any changes of routine operations must be amended in this SOP.

1. Purpose:

a) Any sediment, debris, or construction waste will fill our low impact drainage system, retention/detention storage, manufactured treatment device and underground retention/detention infiltration system increasing our maintenance cost. Removing this debris after it has washed to our flood and water quality system is very expensive.

2. Construction Procedure:

a) Remove or contain all erodible or loose material prior to forecasted wind and precipitation events or before non-stormwater will pass through the project site. For light weight debris, maintenance can require immediate attention for wind and runoff events. Many times, daily maintenance is necessary or as needed for precipitation or non-stormwater events.

b) Project materials and waste can be contained or controlled by operational or structural best management practices.

- Operational; including but not limited to:
  - Strategic staging of materials eliminating exposure, such as not staging on pavement
  - Avoiding multiple day staging of backfill and spoil
  - Haul off spoil as generated or daily
  - Schedule work during clear forecast
- Structural; including but not limited to:
  - Inlet protection, e.g. wattles, filter fabric, drop inlet bags, temporary covers
  - Gutter dams, e.g. wattles, sandbags, dirt dams
  - Boundary containment, e.g. wattles, silt fence
  - Dust control, e.g. water hose,
  - Waste control, e.g. construction solid or liquid waste containment, dumpster, receptacles

c) Inspect often to insure the structural best management practices are in good operating condition and at least prior to the workday end. Promptly repair damaged best management practices achieving effective containment.

d) Cleanup:

- Use dry cleanup methods, e.g. square nose shovel and broom.
- Wet methods are allowed if wastewater is prevented from entering the stormwater system, e.g. wet/dry vacuum, disposal to our landscaped areas.

e) Cleanup Standard:
- When a broom and a square nosed shovel cannot pick any appreciable amount of material.

3. Waste Disposal:

a) Dispose of waste according to General Waste Management SOP, unless superseded by specific SOPs for the operation.
b) Never discharge waste material to storm drains.

4. Equipment:

a) Tools sufficient for proper containment of pollutants and cleanup.
b) Push broom and square blade shovel should be a minimum.

5. Training:

a) Annually and at hire.
b) Require snow and ice service contractors to follow the stronger of this SOP and their company SOPs.

Spill Control

General:

This SOP is not expected to cover all necessary procedure actions. Operators are allowed to adapt SOPs to unique site conditions in good judgment when it is necessary for safety, and the proper, and effective containment of pollutants. However, any changes of routine operations must be amended in this SOP.

1. Purpose:

a) Spilt liquids and solids will reach our retention/detention storage system potentially contaminating groundwater which we are responsible.
b) It is vital we contain all spills on the surface. Spills reaching waterways and permeable surfaces can result in expensive spill mitigation, including waterway restoration and potential tear out and replacement permeable drainage systems.

2. Containment Procedure:

a) Priority is to dam and contain flowing spills.
b) Use spill kits booms if available or any material available to stop flowing liquids; including but not limited to, nearby sand, dirt, landscaping materials, etc.
c) Hazardous or unknown waste material spills
   1. Critical Emergency constitutes large quantities of flowing uncontained liquid that people are at risk or reach storm drain systems. Generally, burst or tipped tanks and containment is still critical. Call HAZMAT, DWQ, Utah County Health Department, and City.
      Also report spills to DWQ of quantities of 25 gallons and more and when the spill of lesser quantity causes a sheen on downstream water bodies.
   2. Minor Emergency constitutes a spill that is no longer flowing but has reached a storm drain and adequate cleanup is still critical. Call Utah County Health Department and City.
   3. Spills that are contained on the surface, typically do not meet the criteria for Critical and Minor Emergencies and may be managed by the responsible implementation of this SOP.
   4. Contact Numbers:
      NATIONAL RESPONSE CENTER (NRC) 800-424-8802
      HAZMAT - 911
      DWQ HOTLINE –801-536-4123, 801-231-1769, 801-536-4300
      Utah County Health Department –801-851-7331
      City – American Fork –801-763-3000

3. Cleanup Procedure:

a) NEVER WASH SPILLS TO THE STORM DRAIN SYSTEMS.

b) Clean per SDS requirements but generally most spills can be cleaned up according to the following:
   - Absorb liquid spills with spill kit absorbent material, sand or dirt until liquid is sufficiently converted to solid material.
   - Remove immediately using dry cleanup methods, e.g. broom and shovel, or vacuum operations.
   - Cleanup with water and detergents may also be necessary depending on the spilled material. However, the waste from this operation must be vacuumed or effectively picked up by dry methods or vacuum machinery. See Pavement Washing SOP.
   - Repeat process when residue material remains.

4. DISPOSAL:

a) Follow SDS requirements but usually most spills can be disposed per the following b. & c.
b) Generally, most spills absorbed into solid forms can be disposed to the dumpster and receptacles. Follow Waste Management SOP.
c) Generally, liquid waste from surface cleansing processes may be disposed to the sanitary sewer system after the following conditions have been met:
   - Dry cleanup methods have been used to remove the bulk of the spill and disposed per the Waste Management SOP.
   - The liquid waste amounts are small and diluted with water. This is intended for spill cleanup waste only and never for the disposal of unused or spent liquids.

5. Documentation:

a) Document all spills in Appendix C.

6. SDS sheets:

a) SDS Manual is filed in break room.

7. Materials:

a) Generally, sand or dirt will work for most cleanup operations and for containment. However, it is the responsibility of the owner to select the absorbent materials and cleanup methods required by the SDS Manuals for chemicals used by the company.

8. Training:

a) Annually and at hire.
b) Require snow and ice service contractors to follow the stronger of this SOP and their company SOPs.

StormTech® MC-3500 Chamber & Barracuda® C3 Stormwater Separator Maintenance

General:
These SOPs are not expected to cover all necessary procedure actions. Operators are allowed to adapt SOPs to unique site conditions in good judgment when it is necessary for safety, and the proper, and effective containment of pollutants. However, any changes of routine operations must be amended in these SOPs.

1. Purpose:

a) One of the primary contaminates in the McArthur Ditch is organic material.
b) Any sediment, leaves, debris, spilt fluids or other waste that collects on our parking areas and sidewalks will fill in our low impact drainage system, retention/detention storage, manufactured treatment device and underground retention/detention infiltration system increasing. Removing sediment in the system regularly is necessary to maintain the integrity of the system and keep pollutants out of the McArthur Ditch and subsequently Utah Lake.

2. Regular Procedure for StormTech® MC-3500 Chamber:

a) At a minimum, StormTech® recommends annual inspections. Initially, the Isolator Row Plus should be inspected every six months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition. If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3" throughout the length of the Isolator Row Plus, clean-out should be performed.
b) Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency.
c) When finished, replace all caps, lids and covers. Record observations and actions.
d) Inspect and clean catch basins and manholes upstream of the StormTech® system.
e) For further detail and recommended nozzle see Isolator® Row Plus O&M Manual.

3. Regular Procedure for Barracuda® C3 Stormwater Separator:

a) Periodic inspection is needed to determine the need and frequency of maintenance. Inspection should begin as soon as construction is complete and then on an annual basis. Typically, the system needs to be cleaned every 1-3 years. Excessive oils, fuels, or sediments may reduce the maintenance cycle. Periodic inspection is important.

b) Sediment depth will determine when to clean the system. Use the instructions and Storage Capacity Chart in the Barracuda® Maintenance Guide to determine when to clean the system.

c) Follow the Maintenance Instructions in the Barracuda® Maintenance Guide to properly clean the system.

4. Disposal Procedure:

a) Remove and dispose sediment and debris at licensed facilities. Also, dry waste can be disposed in your dumpster as permitted by the North Pointe Solid Waste District.

b) Disposal of hazardous waste

1. Dispose of hazardous waste at regulated disposal facilities. Follow SDS Sheets. Also see Waste Management and Spill Control SOP.

5. Equipment:

a) Stadia rod for inspection of sediment depth.

b) JetVac combination vehicle for removing sediment when necessary.

c) High pressure nozzle best fit for the specific StormTech® System. See Isolator Row Plus O&M Manual for further detail.

6. Training:

a) Annually and at hire.

b) Inform staff and service contractors when incorrect SOP implementation is observed.

APPENDIX C – PLAN RECORDKEEPING DOCUMENTS

MAINTENANCE/INSPECTION SCHEDULE

Frequency	Site Infrastructure
A/S	Private Roadways
A/S	Private Shared Parking Area
A/S	Private Sidewalks
A/S	Landscaping Areas
A/S	Private Parking Lot
U	Any roof top or side yard utility units will be inspected if a spill or leak is noticed with the annual inspection of the landscaping, sidewalks, or roadways.
A/S	StormTech® MC-3500 Chamber will need to be inspected to ensure that the isolation chamber does not need to be cleaned. This isolation should be maintained per ADS recommendations. The isolation chamber should be cleaned using a vac truck on an as needed basis based on the inspections.
U	Private residence dumpster receptacle should be inspected if it appears that there is an impact to the parking during the annual parking inspection.

Inspection Frequency Key: A=annual, Q=Quarterly, M=monthly, W=weekly, S=following appreciable storm event, U=Unique infrastructure specific (specify)

RECORD INSPECTIONS IN THE MAINTENANCE LOG

Inspection Means: Either; Traditional walk through, Awareness/Observation, and during regular maintenance operations while noting efficiencies/inefficiencies/concerns found, etc.

MAINTENANCE LOG

Date	Maintenance Performed/Spill Events. Perform Maintenance per SOPs	Observation Notes, including but not limited to; Inspection results, Observations, System Performance (effectiveness/inefficiencies), SOP Usefulness, Concerns, Necessary Changes...	Initials

Annual Summary of operations and maintenance effectiveness, inefficiencies, problems, necessary changes etc.

*You may create your own form that provides this same information or request a word copy of this document.

Annual SOP Training Log per Section 2

SOP	Trainer	Employee Name / Maintenance Contractor Co.	Date

*You may create your own form that provides this same information or request a word copy of this document.

APPENDIX D – Support Design Reports and Documents

BACH APARTMENTS

07/29/20

Prepared for:

Bach Homes

Prepared by:

Mike Winters

FOCUS
ENGINEERING & SURVEYING

6949 S HIGHTECH DR #200
MIDVALE, UT 84047
Phone: 801-352-0075
Web: www.focusutah.com

Table of Contents

APPENDICES

I. GENERAL LOCATION AND DESCRIPTION

The proposed project is located at 620 S and 600 E in American Fork and is 10.39 acres, with approximately 100% being disturbed with construction. The current use is an empty field and the proposed use will be an apartment complex. The property slopes from west to east at approximately 1%-2%

A soils report has been prepared by Earthtec Engineering dated 05/08/19 and the soil consists of predominantly lean clay and silt soils.

II. DRAINAGE BASIN

There is currently no existing storm drain infrastructure on the property, and all surface storm water runs off site to an existing irrigation ditch south east of the site.

The property resides in flood zone X per FEMA FIRM panel number 4955170105B.

III. PROPOSED DRAINAGE PLAN

A drainage plan has been developed per American Fork City standards. The onsite detention/retention system will utilize an underground Stormtech® MC-3500 chamber to detain/retain both a 25-year and 100-year storm event with a discharge rate of approximately 0.20 cfs/acre. An underground system located beneath the parking area will maximize the lot area to be developed for commercial and residential purposes. The ease of implementation and storage of the construction materials makes the Stormtech® MC-3500 an ideal choice for an underground drainage solution.

The Stormtech® MC-3500 consists of several rows of long chambers that will facilitate the controlled discharge of stormwater back into the surrounding environment. The first row is called the isolator row and is lined with a filter fabric which will filter out the collected sediment. This ensures that the successive chambers will not have reduced percolation rates due to sediment reducing void spaces. The next few chambers will then

detain stormwater until levels reach the designed outlet elevation, wherein the stormwater will be discharged to a Barracuda®® C3 Stormwater Separator. Simultaneously, water can percolate through the soil beneath the chambers. A percolation rate of 20 min/inch was established below the location of the proposed Stormtech system, see appendix ix. for complete details.

There is currently no outlet for the storm drain system to gravity drain into, so instead the system will be connected to storm drain cap south east of the site, pending development from a project by a separate developer.

The TR-55 method was used to determine runoff values for sizing the detention system, along with calculations using the rational method to verify proper storage requirements for the site.

Details for the Stormtech® MC-3500 can be found in Appendix iv.

IV. CONTINGENCY DRAINAGE PLAN

As stated previously, and per the exhibit created for American Fork City which presents an alternative to the Storm Drain Master Plan (appendix vii.), the proposed discharge location of outfall storm water from the Bach Apartments is the storm drain inlet directly to the south (from the southeast corner) of the Bach Apartments property. Because the design and construction of the Bach Apartments' storm drain system is dependent on the approval and successful construction of Quality Drive, it is important to have a contingency plan for storm water discharge in the event that the Bach Apartments begin construction prior to Quality Drive being serviceable. Efforts by the American Fork Engineering Department have allowed the following contingency plan to become an effective alternative should it be required:

1. In the event that the Bach Apartments are to begin construction prior to completion of Quality Drive, storm water will be discharged at a rate of 2.78 CFS into the irrigation ditch approx. 210.0' from the southeast property corner.

2. Prior to this connection being acceptable, FOCUS engineering will demonstrate that the existing ditch has the capacity to handle this flow rate and will present data to AF city. If the existing ditch proves inadequate in-situ to handle this flow rate, the existing ditch will be enlarged to a suitable cross-sectional area that will allow this rate to pass.

3. The existing ditch travels a distance of approx. 1350.0' southeasterly until it is picked up by an existing 24" pipe. By inspection of AF City Engineers, this pipe has been subjected to partial blockage due to sediment and debris build-up. It will be the responsibility of the developer to ensure this pipe is clear of all residual sediment and debris build-up, and will provide evidence that this has been accomplished prior to approval of this contingency plan. See appendix vii for contingency drainage plan exhibit.

V. STORMWATER QUALITY

The stormwater quality management will be conducted using the isolator row from the Stormtech® MC-3500 as well as the Barracuda® C3 Stormwater Separator. The isolator row lined with a filter fabric will retain the collected sediment and can be subsequently extracted at a later time. The Barracuda® C3 Stormwater Separator removes total suspended solids and can be implemented into precast manhole locations. Stormwater will then be discharged afterwards.

Details for the Barracuda® C3 Stormwater Separator can be found in Appendix v.

VI. ANALYSIS - HYDROLOGY

The design storms required are for the 100-year event, though a 25-year storm was also considered. The rainfall depth information was obtained from the American Fork Water Technical Manual. The post development stormwater runoff discharge cannot exceed that of 0.20 cfs/acre (2.078 cfs) per AF City Standards.

The TR-55 method was used to determine storm drain runoff flows and Autodesk Storm and Sanitary Analysis was used to model the storm drain system. The 25-year design maximum storage requirement is 21,063 cf, while the 100-year design maximum storage requirement is 40,443 cf. The underground detention/retention pond was sized with a Farmer Fletcher rainfall distribution and the project area of 10.39 acres. Using a weighted C value of 0.70 and a total converted area of 452,687 sf, the runoff calculations resulted in a maximum detention volume of 40,443 cubic feet.

The detention system is sized to detain the 100-year event with a discharge rate of 2.078 cfs. The maximum storage requirement for detention on this site is 40,521 cubic feet and all 40,521 cubic feet are provided. This number does not include storage provided by proposed storm drain piping, storm sewer inlets, manholes, etc.

Volume of storage provided by the 24" storm drain pipes (see following section for sizing method) equates to 4,887 cf. The maximum storage requirement for the 100-year event including storage provided by the proposed storm drain piping is 35,556 cf.

Details for calculating storage requirements can be found in Appendix ii.

VII. ANALYSIS - HYDRAULICS

The design storm required is the 100-year event for pipe capacity. The pipes were sized using Manning's equation for uniform flow $Q = VA = \left(\frac{1.49}{n}\right) AR^{\frac{2}{3}}S^{\frac{1}{2}}$ with a Manning's n value of 0.013, resulting in a diameter of 24". The exit orifice size of 7.3 inches for the Stormtech® MC-3500 was determined using the flow through an orifice equation $Q = CA(2gh)^{\frac{1}{2}}$ with an h value of 2.2 ft, C value of 0.6, and A value of 0.291 sf.

Storm drain inlets have been placed at all low points in the parking lot and drive aisles. Inlets have also been spaced no more than 400 feet apart for ease of maintenance.

Details for calculating hydraulic components can be found in Appendix ii.

VIII. OVERLAND FLOOD RUNOFF

The inlets and pipes in the system have been designed to convey the runoff from the 100-year storm (1.83 inches/hr per American Fork standards). An emergency overflow on the east side of the pond will allow storm water in excess of the 100-year storm to travel down to 4190 West.

IX. GEOTECHNICAL ASPECT

The Stormtech® MC-3500 system should be developed with the groundwater table in mind. Failure to do so will result in an inefficient detention/retention system due to infiltration of the groundwater table into the chambers, minimizing available volume to accommodate stormwater runoff.

Using depth sensor data from the geotechnical report prepared by Earthtec Engineering, bore sites B-6 and B-9 served as estimates for the site location. The groundwater table is at a depth of approximately 12 feet and the Stormtech® MC-3500 chambers (including 9 inches of foundation stone) will be constructed above that elevation.

X. CONCLUSION

It is concluded that the project is in compliance with city standards and design guidelines. "I hereby certify that this report for the onsite drainage of this development was prepared by me (or under my direct supervision) in accordance with the provisions of the City of American Fork Standard Specifications and Drawings, and was designed to comply with the provisions thereof. I understand that the city assumes no responsibility or liability whatsoever for this report."

Sincerely,

Thomas Romney, P.E.
Project Manager
FOCUS Engineering & Surveying

Detention Pond

Project: Bach Apartments
Location American Fork, Utah
Date: 4/20/2020
Designer: Mike Winters

FOCUS ENGINEERING & SURVEYING

100-Year Detention Sizing

Design Criteria

Intensity Table: **AF WATER TECHNICAL MANUAL SECTION C (100 YEAR STORM EVENT)**
Return Period: **100 year**
Allowable Discharge: **0.20 cfs/acre** Per AF City Standards

Allowable Discharges

Storm Drain Discharge: 2.08 cfs
Other Discharge: 0.00 cfs Source:
Total Discharge: **2.078 cfs**

Weighted "C" Value

Surface Type	*Area (sf)*	*"C" Value*	*C*A*
Building	160,340	0.85	136,289
Roadway and Sidewalk	226,348	0.90	203,713
Landscape	65,999	0.15	9,900
Totals	452,687		349,902
Weighted "C" Value		**0.70**	

Drainage Calculations

Duration	Intensity	Runoff C	Area	Rainfall	Accumulated Flow	Allowable Discharge	Discharge	Required Storage
min	*in/hr*		*Ac*	*cfs*	*cf*	*cfs*	*cf*	*cf*
5.0	7.24	0.70	10.39	52.67	15,800	2.08	624	15,177
10.0	5.60	0.70	10.39	40.74	24,443	2.08	1,247	23,196
15.0	4.61	0.70	10.39	33.54	30,182	2.08	1,871	28,312
30.0	3.04	0.70	10.39	22.11	39,807	2.08	3,741	36,065
60.0	1.83	0.70	10.39	13.31	47,925	2.08	7,482	40,443
120.0	1.03	0.70	10.39	7.49	53,948	2.08	14,965	38,983
180.0	0.74	0.70	10.39	5.38	58,138	2.08	22,447	35,691
360.0	0.42	0.70	10.39	3.06	65,995	2.08	44,895	21,100

Maximum Storage Requirement: ***40,443***
Maximum Storage Requirement (ac-ft): 0.93

Detention Basin Design

Storage Requirement: 40,443 *cf*
Allowable Depth: 0.0 *ft*
Retention Pond Volume: 0 *cf*
24" SD Pipe Storage 4,887 *cf*

Total Storage **4,887** ***INCREASE DETENTION***

Orifice Design

Restriction Rate 0.20 CFS/ACRE
Allowable Outfall Rate Q (2.08

Orifice Sizing: h = xx ft
C = 0.6
A = #VALUE! sf
dia. = #VALUE! inches

Orifice Size= **#VALUE!** **inch**

GSH

REPORT
GEOTECHNICAL STUDY
PROPOSED VEST PROPERTY – AMERICAN FORK APARTMENTS
NEAR THE INTERSECTION OF 620 SOUTH AND 600 EAST
AMERICAN FORK, UTAH

Submitted To:

Bach Homes
116500 South State Street, Suite 300
Draper, Utah 84020

Submitted By:

GSH Geotechnical, Inc.
473 West 4800 South
Salt Lake City, Utah 84123

July 25, 2020

Job No. 1726-020-20

July 25, 2020
Job No. 1726-020-20

Mr. Brian Carlisle
Bach Homes
116500 South State Street, Suite 300
Draper, Utah 84020

Mr. Carlisle:

Re: Report
Geotechnical Study
Proposed Vest Property – American Fork Apartments
Near the Intersection of 620 South and 600 East
American Fork, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our geotechnical study performed at the site of the proposed Vest Property – American Fork Apartments to be located near the intersection of 620 South and 600 East in American Fork, Utah. The general location of the site with respect to existing roadways, as of 2020, is presented on Figure 1, Vicinity Map. A more detailed layout of the site showing proposed facilities and borings drilled in conjunction with this study is presented on Figure 2, Site Plan.

1.2 OBJECTIVES AND SCOPE

The objectives and scope of the study were planned in discussions between Mr. Brian Carlisle of Bach Homes and Mr. Alan Spilker of GSH Geotechnical, Inc. (GSH).

In general, the objectives of this study were to:

1. Define and evaluate the subsurface soil and groundwater conditions across the site.

2. Provide appropriate foundation, earthwork, pavement, and geoseismic recommendations to be utilized in the design and construction of the proposed facilities.

In accomplishing these objectives, our scope has included the following:

1. A field program consisting of the drilling, logging, and sampling of 10 exploration borings, as well as a site-specific shear wave velocity test.

2. A laboratory testing program.

3. An office program consisting of the correlation of available data, engineering analysis, and the preparation of this summary report.

1.3 AUTHORIZATION

Authorization was provided by returning a signed copy of the Professional Services Agreement No. 20-0651 dated June 22, 2020.

1.4 PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration borings, projected groundwater conditions, and the layout and design data discussed in Section 2, Proposed Construction. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, GSH must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings developed, and our recommendations prepared in accordance with generally accepted engineering principles and practices in this area at this time.

2. PROPOSED CONSTRUCTION

The project is to consist of the construction of a residential apartment structure with an associated pool area and surrounding pavements. The structure is anticipated to be 3 to 4 stories, placed slab on grade, and supported upon conventional spread and continuous wall footings.

Maximum real column and wall loads are anticipated to be on the order of up to 200 kips and up to 7 kips per lineal foot, respectively. Real loads are defined as the total of all dead plus frequently applied (reduced) live loads.

Paved parking areas and drive lanes are planned around the structure. Projected traffic in the parking areas is anticipated to consist of a light volume of automobiles and light trucks, occasional medium-weight trucks, and no heavyweight trucks. Projected traffic in the drive lanes is anticipated to consist of a moderate volume of automobiles and light trucks, a light volume of medium-weight trucks, and occasional heavyweight trucks (garbage trucks).

Site development will require some earthwork in the form of minor cutting and filling. At this time, we anticipate that maximum site grading cuts and fills, excluding utilities, will be on the order of 1 to 3 feet.

3. SITE INVESTIGATIONS

3.1 GENERAL

Subsurface conditions in unexplored locations or at other times may vary from those encountered at specific boring locations. If such variations are noted during construction or if project development plans are changed, GSH must review the changes and amend our recommendations, if necessary.

Boring locations were established by estimating distances and angles from site landmarks. If increased accuracy is desired by the client, we recommend that the boring locations and elevations be surveyed.

3.2 FIELD PROGRAM

To define and evaluate the subsurface soil and groundwater conditions across the site, 10 borings were drilled within the accessible areas. These borings were completed to depths ranging from 11 to 46 feet with a truck-mounted drill rig equipped with hollow-stem augers. The approximate locations of the borings are presented on Figure 2.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the drilling operations, a continuous log of the subsurface conditions encountered was maintained. In addition, samples of the typical soils encountered were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications were supplemented by subsequent inspection and testing in our laboratory. Graphical representation of the subsurface conditions encountered is presented on Figures 3A through 3J, Boring Logs. Soils were classified in accordance with the nomenclature described on Figure 4, Key to Boring Log (USCS).

A 3.0-inch outside diameter, 2.42-inch inside diameter drive sampler (Dames & Moore) and a 2.0-inch outside diameter, 1.38-inch inside diameter drive sampler (SPT) were utilized at select locations and depths. The blow counts recorded on the boring logs were those required to drive the sampler 12 inches with a 140-pound hammer dropping 30 inches.

Following completion of excavation operations, 1.25-inch diameter slotted PVC pipe was installed in each boring to provide a means of monitoring the groundwater fluctuations. The borings were backfilled with auger cuttings.

3.3 LABORATORY TESTING

3.3.1 General

To provide data necessary for our engineering analysis, a laboratory testing program was performed. This program included moisture, density, partial gradation, Atterberg limits, consolidation, and chemical tests. The following paragraphs describe the tests and summarize the test data.

3.3.2 Moisture and Density Tests

To provide index parameters and to correlate other test data, moisture and density tests were performed on selected samples. The results of these tests are presented on the boring logs, Figures 3A through 3J.

3.3.3 Partial Gradation Tests

To aid in classifying the granular soils, partial gradation tests were performed. Results of the tests are tabulated below and presented on the boring logs, Figures 3A through 3J.

Boring No.	Depth (feet)	Percent Passing No. 200 Sieve	Moisture Content Percent	Soil Classification
B-7	5.0	45.1	27.6	*SM/SC
B-7	10.0	32.2	24.0	*SM/SC
B-7	15.0	81.9	28.7	ML
B-7	20.0	58.1	24.4	ML
B-10	10.0	36.3	14.3	SM/SC

* Sample contained multiple clay layers

3.3.4 Atterberg Limits Test

To aid in classifying the soils, an Atterberg limits test was performed on a sample of the fine-grained cohesive soils. Results of the test are tabulated below and presented on the boring logs, Figures 3A through 3J:

Boring No.	Depth (feet)	Liquid Limit (percent)	Plastic Limit (percent)	Plasticity Index (percent)	Soil Classification
B-7	30.0	40	26	14	ML

3.3.5 Consolidation Tests

To provide data necessary for our settlement analysis, consolidation testing was performed on 3 representative samples of the natural fine-grained clay soils encountered at the site. The results of these tests indicate that the samples tested were moderately over-consolidated and will exhibit moderate strength and compressibility characteristics under the anticipated loading. Detailed results of the tests are maintained within our files and can be transmitted to you, upon your request.

3.3.6 Chemical Tests

To determine if the site soils will react detrimentally with concrete, chemical tests were performed on a representative sample of the near-surface soil encountered at the site. The results of the chemical tests are tabulated below:

Boring No.	Depth (feet)	Soil Classification	pH	Total Water Soluble Sulfate (mg/kg-dry)
B-3	2.5	CL	8.40	48.5

4. SITE CONDITIONS

4.1 SURFACE

The site is located near the intersection of 620 South and 600 East in American Fork, Utah. The site is currently vacant/undeveloped brush/grass land previously used for agricultural purposes. Review of historic aerial imagery indicates that an irrigation ditch previously existed in the northern portion of the site running from east to west. The topography of the site is relatively flat, grading down to the south with a total relief of approximately 9 to 11 feet. Site vegetation consists of various weeds and brush/grass throughout.

The site is bounded to the north by similar vacant/undeveloped brush/grass land followed by single-family residential structures; to the east by similar vacant/undeveloped brush/grass land along with a single-family residential structure followed by 4850 South Street; to the south by residential and commercial structures along with 700 South Street; and to the west by single-family residential structures followed by 620 East Street.

4.2 SUBSURFACE SOIL

The following paragraphs provide generalized descriptions of the subsurface profiles and soil conditions encountered within the borings conducted during this study. As previously noted, soil conditions may vary in unexplored locations.

The borings were drilled to depths ranging from 11 to 46 feet. The soil conditions encountered in each of the borings, to the depths penetrated, were generally similar across the boring locations.

- Approximately 4 to 6 inches of topsoil was encountered in each boring. Topsoil thickness is frequently erratic and thicker zones of topsoil should be anticipated.

- Non-engineered fill soils were encountered in each boring except Borings B-3, B-5, and B-6, to depths ranging from 1.5 to 6.5 feet beneath the existing ground surface. The non-engineered fill soils primarily consisted of sand with varying clay, silt, and gravel content, and gravel with varying silt, sand, and cobble content.

- Natural soils were encountered below the non-engineered fill or the ground surface in each boring. The natural soils consisted primarily of clay with varying silt, sand, and gravel content, silt with varying clay and sand content, and sand with varying clay, silt, and gravel content.

The natural clay/silt soils were very soft to very stiff, slightly moist to saturated, gray, brownish-gray, brownish-yellow, and brown in color, and moderately over-consolidated. The natural clay soils are anticipated to exhibit moderate strength and compressibility characteristics under the anticipated loading.

The natural sand soils were very loose to dense, slightly moist to saturated, and gray and brown in color. The natural sand soils are anticipated to exhibit moderately high strength and moderately low compressibility characteristics under the anticipated load range.

For a more descriptive interpretation of subsurface conditions, please refer to Figures 3A through 3J, Boring Logs. The lines designating the interface between soil types on the boring logs generally represent approximate boundaries. In situ, the transition between soil types may be gradual.

4.3 GROUNDWATER

On July 10, 2020 (8 days following drilling), groundwater was measured within the PVC pipes installed as tabulated below:

Boring No.	Groundwater Depth (feet)
	July 10, 2020
B-1	5.2
B-2	6.8
B-3	10.3
B-4	7.2
B-5	8.4
B-6	9.5

Boring No.	Groundwater Depth (feet)
	July 10, 2020
B-7	7.1
B-8	7.0
B-9	6.1
B-10	7.0

Groundwater levels vary with changes in season and rainfall, construction activity, irrigation, snow melt, surface water run-off, and other site-specific factors.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

The proposed structures may be supported upon conventional spread and continuous wall foundations supported upon suitable natural soils and/or structural fill extending to suitable natural soils.

The most significant geotechnical aspects at the site are:

1. The existing non-engineered fills across much of the site.
2. The relatively shallow depth to groundwater.
3. The potentially liquefiable sand layers encountered in Boring B-7.

Prior to proceeding with construction, removal of the existing debris, surface vegetation, root systems, topsoil, non-engineered fill, and any deleterious materials from beneath an area extending out at least 5 feet from the perimeter of the proposed structure footprint and 3 feet beyond rigid pavements and exterior flatwork areas will be required. All existing utility locations should be reviewed to assess their impact on the proposed construction and abandoned and/or relocated as appropriate.

Due to the developed nature of this site and the surrounding area, additional non-engineered fills may exist in unexplored areas of the site. Based on our experience, non-engineered fills are frequently erratic in composition and consistency. All surficial loose/disturbed soils and non-engineered fills must be removed below all footings, floor slabs, and rigid pavements. The in situ, non-engineered fills may remain below flexible pavements if free of any deleterious materials, of limited thickness, and if properly prepared, as discussed later in this report.

On-site non-engineered fill soils encountered were primarily granular. On-site granular soils, including existing non-engineered fills, may be re-utilized as structural site grading fill if they meet the criteria for such, as stated later in this report.

Groundwater was measured as shallow as 5.1 feet below the ground surface. GSH recommends placing floor slabs no closer than 4 feet from the highest groundwater elevation. Site grading fill may be utilized to raise the overall grade to achieve the required separation between the floor slab and the highest groundwater elevation.

Proof rolling of the natural clay subgrade must not be completed if cuts extend to within 1 foot of the groundwater surface. In areas where cuts are to extend to within 1 foot of the groundwater surface, stabilization must be anticipated.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

A very loose, saturated sand layer was encountered in Boring B-7. Due to liquefiable soils being present, the site has been determined to be Site Class F (in accordance with Section 20.3.1, Site Class F of ASCE 7-16). According to ASCE 7-16, a site-specific response analysis is required. Section 20.3.1 of ASCE 7-16 provides exception to this requirement under certain conditions. These options will need to be reviewed and evaluated by the project structural engineer. If needed, GSH can provide additional information and analysis, including a complete site-specific response analysis.

Detailed discussions pertaining to earthwork, foundations, pavements, and the geoseismic setting of the site are presented in the following sections.

5.2 EARTHWORK

5.2.1 Site Preparation

Initial site preparation will consist of the removal of the existing debris, non-engineered fills, surface vegetation, root systems, topsoil, and any deleterious materials from beneath an area extending out at least 5 feet from the perimeter of the proposed structure footprint and 3 feet beyond rigid pavements and exterior flatwork areas. All existing utility locations should be reviewed to assess their impact on the proposed construction and abandoned and/or relocated as appropriate.

In situ, non-engineered fills may remain below flexible pavements if free of debris and deleterious materials, less than 3 feet in thickness, and if properly prepared. Proper preparation below pavements will consist of the scarification of the upper 12 inches below asphalt concrete (flexible pavement), followed by moisture preparation and re-compaction to the requirements of structural fill. Even with proper preparation, pavements established overlying non-engineered fills may encounter some long-term movements unless the non-engineered fills are completely removed.

It must be noted that from a handling and compaction standpoint, soils containing high amounts of fines (silts and clays) are inherently more difficult to rework and are very sensitive to changes in moisture content, requiring very close moisture control during placement and compaction. This will be very difficult, if not impossible, during wet and cold periods of the year. Additionally, the on-site soils are likely above optimum moisture content for compacting at present and would require some drying prior to re-compacting.

Subsequent to stripping and prior to the placement of floor slabs, foundations, structural site grading fills, exterior flatwork, and pavements, the exposed subgrade must be proof rolled by passing moderate-weight rubber tire-mounted construction equipment over the surface at least twice. If excessively soft or otherwise unsuitable soils are encountered beneath footings, they must be completely removed. If removal depth required is greater than 2 feet below footings, GSH must be notified to provide further recommendations. In pavement, floor slab, and outside flatwork areas, unsuitable natural soils should be removed to a maximum depth of 2 feet and replaced with compacted granular structural fill.

Subgrade preparation as described must be completed prior to placing overlying structural site grading fills.

Due to the relatively high groundwater, site grading cuts should be kept to a minimum. Cuts extending to within 1 foot of the groundwater elevation will likely disturb the natural clay soils and proof rolling must not be completed. Stabilization must be anticipated in areas where cuts are to extend to within 1 foot of the groundwater surface.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

GSH must be notified prior to the placement of structural site grading fills, floor slabs, footings, and pavements to verify that all loose/disturbed soils and non-engineered fills have been completely removed and/or properly prepared.

5.2.2 Temporary Excavations

Temporary excavations up to 8 feet deep in fine-grained cohesive soils, above or below the water table, may be constructed with sideslopes no steeper than one-half horizontal to one vertical (0.5H:1.0V). Excavations deeper than 8 feet are not anticipated at the site.

For granular (cohesionless) soils, construction excavations above the water table, not exceeding 4 feet, should be no steeper than one-half horizontal to one vertical (0.5H:1.0V). For excavations up to 8 feet, in granular soils and above the water table, the slopes should be no steeper than one horizontal to one vertical (1H:1V). Excavations encountering saturated cohesionless soils will be very difficult and will require very flat sideslopes and/or shoring, bracing, and dewatering.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

The static groundwater table was encountered as shallow as 5.1 feet below the existing surface and may be shallower with seasonal fluctuations. Consideration for dewatering of utility trenches, excavations for the removal of non-engineered fill, and other excavations below this level should be incorporated into the design and bidding process.

All excavations must be inspected periodically by qualified personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated.

5.2.3 Structural Fill

Structural fill is defined as all fill which will ultimately be subjected to structural loadings, such as imposed by footings, floor slabs, pavements, etc. Structural fill will be required as backfill over foundations and utilities, as site grading fill, and as replacement fill below footings. All structural fill must be free of surface vegetation, root systems, rubbish, topsoil, frozen soil, and other deleterious materials.

Structural site grading fill is defined as structural fill placed over relatively large open areas to raise the overall grade. For structural site grading fill, the maximum particle size shall not exceed 4 inches; although, occasional larger particles, not exceeding 8 inches in diameter, may be incorporated if placed randomly in a manner such that "honeycombing" does not occur and the desired degree of compaction can be achieved. The maximum particle size within structural fill placed within confined areas shall be restricted to 2 inches.

On-site soils, including existing non-engineered fills, may be re-utilized as structural site grading fill if they do not contain construction debris or deleterious material and meet the requirements of structural fill. Fine-grained soils will require very close moisture control and may be very difficult, if not impossible, to properly place and compact during wet and cold periods of the year.

Imported structural fill below foundations and floor slabs shall consist of a well graded sand and gravel mixture with less than 30 percent retained on the three-quarter-inch sieve and less than 20 percent passing the No. 200 Sieve (clays and silts).

To stabilize soft subgrade conditions (if encountered) or where structural fill is required to be placed closer than 2.0 feet above the water table at the time of construction, a mixture of coarse angular gravels and cobbles and/or 1.5- to 2.0-inch gravel (stabilizing fill) should be utilized. It may also help to utilize a stabilization fabric, such as Mirafi 600X or equivalent, placed on the natural ground if 1.5- to 2.0-inch gravel is used as stabilizing fill.

5.2.4 Fill Placement and Compaction

All structural fill shall be placed in lifts not exceeding 8 inches in loose thickness. Structural fills shall be compacted in accordance with the percent of the maximum dry density as determined by the AASHTO[1] T180 (ASTM[2] D1557) compaction criteria in accordance with the following table:

Location	Total Fill Thickness (feet)	Minimum Percentage of Maximum Dry Density
Beneath an area extending at least 5 feet beyond the perimeter of the structure	0 to 10	95
Site grading fills outside area defined above	0 to 5	90
Site grading fills outside area defined above	5 to 10	95
Utility trenches within structural areas	--	96
Road base	--	96

Structural fills greater than 10 feet thick are not anticipated at the site.

Subsequent to stripping and prior to the placement of structural site grading fill, the subgrade shall be prepared as discussed in Section 5.2.1, Site Preparation, of this report. In confined areas, subgrade preparation should consist of the removal of all loose or disturbed soils.

Coarse angular gravel and cobble mixtures (stabilizing fill), if utilized, shall be end dumped, spread to a maximum loose lift thickness of 15 inches, and compacted by dropping a backhoe bucket onto the surface continuously at least twice. As an alternative, the stabilizing fill may be compacted by passing moderately heavy construction equipment or large self-propelled compaction equipment at least twice. Subsequent fill material placed over the coarse gravels and cobbles shall be adequately compacted so that the "fines" are "worked into" the voids in the underlying coarser gravels and cobbles. Where soil fill materials are to be placed directly over more than about 18 inches of clean gravel, a separation geofabric, such as Mirafi 140N or equivalent, is recommended to be placed between the gravel and subsequent soil fills.

Non-structural fill may be placed in lifts not exceeding 12 inches in loose thickness and compacted by passing construction, spreading, or hauling equipment over the surface at least twice.

---

1 American Association of State Highway and Transportation Officials
2 American Society for Testing and Materials

5.2.5 Utility Trenches

All utility trench backfill material below structurally loaded facilities (footings, floor slabs, flatwork, pavements, etc.) shall be placed at the same density requirements established for structural fill. If the surface of the backfill becomes disturbed during the course of construction, the backfill shall be proof rolled and/or properly compacted prior to the construction of any exterior flatwork over a backfilled trench. Proof rolling shall be performed by passing moderately loaded rubber tire-mounted construction equipment uniformly over the surface at least twice. If excessively loose or soft areas are encountered during proof rolling, they shall be removed to a maximum depth of 2 feet below design finish grade and replaced with structural fill.

Many utility companies and City-County governments are now requiring that Type A-1a or A-1b (AASHTO Designation – granular soils with limited fines) soils be used as backfill over utilities. These organizations are also requiring that in public roadways, the backfill over major utilities be compacted over the full depth of fill to at least 96 percent of the maximum dry density as determined by the AASHTO T180 (ASTM D1557) method of compaction. GSH recommends that as the major utilities continue onto the site that these compaction specifications are followed.

Fine-grained soils, such as silts and clays, are not recommended for utility trench backfill in structural areas.

The static groundwater table was encountered as shallow as 5.1 feet below the existing surface and may be shallower with seasonal fluctuations. Dewatering of utility trenches and other excavations below this level should be anticipated.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

5.3 GROUNDWATER

On July 10, 2020 (8 days following drilling), groundwater was measured within the PVC pipes installed as tabulated below:

Boring No.	Groundwater Depth (feet)
	July 10, 2020
B-1	5.2
B-2	6.8
B-3	10.3
B-4	7.2

Boring No.	Groundwater Depth (feet)
	July 10, 2020
B-5	8.4
B-6	9.5
B-7	7.1
B-8	7.0
B-9	6.1
B-10	7.0

Based on the anticipated cuts necessary to reach design subgrades, we anticipate temporary and permanent dewatering may be necessary. Floor slabs must be placed a minimum of 4 feet from the stabilized groundwater elevation. Site grading fill may be utilized to raise the overall grade to achieve the required separation between the floor slab and the highest groundwater elevation.

The groundwater measurements presented are conditions at the time of the field exploration and may not be representative of other times or locations. Groundwater levels may vary seasonally and with precipitation, as well as other factors including irrigation. Evaluation of these factors is beyond the scope of this study. Groundwater levels may, therefore, be at shallower or deeper depths than those measured during this study, including during construction and over the life of the structure.

The extent and nature of any dewatering required during construction will be dependent on the actual groundwater conditions prevalent at the time of construction and the effectiveness of construction drainage to prevent run-off into open excavations.

5.4 SPREAD AND CONTINUOUS WALL FOUNDATIONS

5.4.1 Design Data

The results of our analysis indicate that the proposed structures may be supported upon conventional spread and continuous wall foundations established upon suitable natural soils and/or structural fill extending to suitable natural soils. Under no circumstances shall foundations be established over non-engineered fills, loose or disturbed soils, topsoil, surface vegetation, root systems, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. More heavily loaded footings will require a certain amount of granular structural replacement fill as specified in Section 5.4.3, Settlements, of this report. For design, the parameters on the following page are provided.

Minimum Recommended Depth of Embedment for Frost Protection	- 30 inches
Minimum Recommended Depth of Embedment for Non-frost Conditions	- 15 inches
Recommended Minimum Width for Continuous Wall Footings	- 18 inches
Minimum Recommended Width for Isolated Spread Footings	- 24 inches
Recommended Net Bearing Capacity for Real Load Conditions	- 2,500 pounds per square foot
Bearing Capacity Increase for Seismic Loading	- 50 percent

The term "net bearing capacity" refers to the allowable pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and backfill to lowest adjacent final grade need not be considered. Real loads are defined as the total of all dead plus frequently applied live loads. Total load includes all dead and live loads, including seismic and wind.

5.4.2 Installation

Under no circumstances shall the footings be installed upon non-engineered fills, loose or disturbed soils, topsoil, surface vegetation, root systems, rubbish, construction debris, or other deleterious materials. If unsuitable soils are encountered, they must be removed and replaced with compacted granular fill. If granular soils become loose or disturbed, they must be recompacted prior to pouring the concrete.

The width of structural replacement fill below footings should be equal to the width of the footing plus one foot for each foot of fill thickness.

5.4.3 Settlements

Granular structural replacement fill will be required under more heavily loaded footings. For the required amount, refer to the table on the following page.

Foundations	Loading	Minimum Thickness of Replacement Structural Granular Fill (feet)
Wall	Up to 7 kips per lineal foot	0
Spread	Up to 125 kips	0
	125 kips to 200 kips	1.0

Based on column loadings, soil bearing capacities, and the foundation recommendations as discussed above, we expect primary total settlement beneath individual foundations to be less than one inch.

The amount of differential settlement is difficult to predict because the subsurface and foundation loading conditions can vary considerably across the site. However, we anticipate differential settlement between adjacent foundations could vary from 0.5 to 0.75 inch. The final deflected shape of the structure will be dependent on actual foundation locations and loading.

5.5 LATERAL RESISTANCE

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining frictional resistance, a coefficient of friction of 0.35 may be utilized for the footing interface with the in situ natural clay soils and 0.40 for footing interface with natural granular soils or granular structural fill. Passive resistance provided by properly placed and compacted granular structural fill above the water table may be considered equivalent to a fluid with a density of 300 pounds per cubic foot. Below the water table, this granular soil should be considered equivalent to a fluid with a density of 150 pounds per cubic foot.

A combination of passive earth resistance and friction may be utilized provided that the friction component of the total is divided by 1.5.

5.6 FLOOR SLABS

Floor slabs may be established upon suitable natural subgrade soils or structural fill extending to suitable natural soils. Under no circumstances shall floor slabs be established directly over non-engineered fills, loose or disturbed soils, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water.

Additionally, GSH recommends that floor slabs be constructed a minimum of 4.0 feet from the stabilized groundwater elevation. Site grading fill may be utilized to raise the overall grade to achieve the required separation between the floor slab and the highest groundwater elevation.

To facilitate curing of the concrete and to provide a capillary moisture break, it is recommended that floor slabs be directly underlain by at least 4 inches of "free-draining" fill, such as "pea" gravel or three-quarters to one-inch minus clean gap-graded gravel.

Settlement of lightly loaded floor slabs designed according to previous recommendations (average uniform pressure of 200 pounds per square foot or less) is anticipated to be less than one-quarter of an inch.

5.7 PAVEMENTS

The natural clay soils and non-engineered fills will exhibit poor pavement support characteristics when saturated. All pavement areas must be prepared as previously discussed (see Section 5.2.1, Site Preparation). Under no circumstances shall pavements be established over unprepared non-engineered fills, loose or disturbed soils, topsoil, surface vegetation, root systems, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. With the subgrade soils and the projected traffic as discussed in Section 2, Proposed Construction, the following pavement sections are recommended:

Parking Areas

(Light Volume of Automobiles and Light Trucks,
Occasional Medium-Weight Trucks,
and No Heavyweight Trucks)
[1-3 equivalent 18-kip axle loads per day]

Flexible Pavements:
(Asphalt Concrete)

3.0 inches	Asphalt concrete
8.0 inches	Aggregate base
Over	Properly prepared fills, stabilized natural subgrade soils, and/or structural site grading fill extending to properly prepared fills and/or stabilized natural subgrade soils

Rigid Pavements:
(Non-reinforced Concrete)

5.0 inches	Portland cement concrete (non-reinforced)

5.0 inches	Aggregate base
Over	Properly prepared and stabilized natural subgrade soils, and/or structural site grading fill extending to properly prepared and stabilized natural subgrade soils

Roadways

(Moderate Volume of Automobiles and Light Trucks,
Light Volume of Medium-Weight Trucks,
and Occasional Heavyweight Trucks)
[6 equivalent 18-kip axle loads per day]

Flexible Pavements:
(Asphalt Concrete)

3.0 inches	Asphalt concrete
9.0 inches	Aggregate base
Over	Properly prepared fills, stabilized natural subgrade soils, and/or structural site grading fill extending to properly prepared fills and/or stabilized natural subgrade soils

Rigid Pavements:
(Non-reinforced Concrete)

6.0 inches	Portland cement concrete (non-reinforced)
6.0 inches	Aggregate base
Over	Properly prepared and stabilized natural subgrade soils, and/or structural site grading fill extending to properly prepared and stabilized natural subgrade soils

For dumpster pads, we recommend a pavement section consisting of 7.0 inches of Portland cement concrete, 12.0 inches of aggregate base, over properly prepared natural subgrade or site grading

structural fills. Dumpster pads should not be constructed overlying non-engineered fills under any circumstances.

These above rigid pavement sections are for non-reinforced Portland cement concrete. Concrete should be designed in accordance with the American Concrete Institute (ACI) and joint details should conform to the Portland Cement Association (PCA) guidelines. The concrete should have a minimum 28-day unconfined compressive strength of 4,000 pounds per square inch and contain 6 percent ±1 percent air-entrainment.

The crushed stone should conform to applicable sections of the current Utah Department of Transportation (UDOT) Standard Specifications. All asphalt material and paving operations should meet applicable specifications of the Asphalt Institute and UDOT. A GSH technician shall observe placement and perform density testing of the base course material and asphalt.

Please note that the recommended pavement section is based on estimated post-construction traffic loading. If the pavement is to be constructed and utilized by construction traffic, the above pavement section may prove insufficient for heavy truck traffic, such as concrete trucks or tractor-trailers used for construction delivery. Unexpected distress, reduced pavement life, and/or premature failure of the pavement section could result if subjected to heavy construction traffic and the owner should be made aware of this risk. If the estimated traffic loading stated herein is not correct, GSH must review actual pavement loading conditions to determine if revisions to these recommendations are warranted.

5.8 CEMENT TYPES

The laboratory tests indicate that the natural soils tested contain a negligible amount of water soluble sulfates. Based on our test results, concrete in contact with the on-site soil will have a low potential for sulfate reaction (ACI 318, Table 4.3.1). Therefore, all concrete which will be in contact with the site soils may be prepared using Type I or IA cement.

5.9 GEOSEISMIC SETTING

5.9.1 General

Utah municipalities have adopted the International Building Code (IBC) 2018. The IBC 2018 code refers to ASCE 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7-16) determines the seismic hazard for a site based upon mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class. The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points).

5.9.2 Faulting

Based on our review of available literature, no active faults pass through or immediately adjacent to the site. The nearest active mapped fault consists of the Utah Lake Faults, located about 2.1 miles to the southeast of the site.

5.9.3 Soil Class

Due to liquefiable soils being present, the site has been determined to be Site Class F (in accordance with Section 20.3.1, Site Class F of ASCE 7-16). According to ASCE 7-16, a site-specific response analysis is required. Section 20.3.1 of ASCE 7-16 provides exception to this requirement under certain conditions. These options will need to be reviewed and evaluated by the project structural engineer. If needed, GSH can provide additional information and analysis including a complete site-specific response analysis.

5.9.4 Ground Motions

The IBC 2018 code is based on USGS mapping, which provides values of short and long period accelerations for average bedrock values for the Western United States and must be corrected for local soil conditions. The following table summarizes the peak ground and short and long period accelerations for the MCE event and incorporates the appropriate soil amplification factor for a Site Class D – Default Profile. Based on the site latitude and longitude (40.3636 degrees north and 111.7789 degrees west, respectively), the values for this site are tabulated below:

Spectral Acceleration Value, T	Bedrock Boundary [mapped values] (% g)	Site Coefficient	Site Class * [adjusted for site class effects] (% g)	Design Values* (% g)
Peak Ground Acceleration	*	F_a = *	*	*
0.2 Seconds (Short Period Acceleration)	S_S = *	F_a = *	S_{MS} = *	S_{DS} = *
1.0 Second (Long Period Acceleration)	S_1 = *	F_v = *	S_{M1} = *	S_{D1} = *

* See Section 5.9.3, Soil Class.

5.9.5 Liquefaction

The site is located in an area that has been identified by the Utah Geological Survey (UGS) as being a "high" liquefaction potential zone. Liquefaction is defined as the condition when saturated, loose, granular soils lose their support capabilities because of excessive pore water pressure, which

develops during a seismic event. Clayey soils, even if saturated, will generally not liquefy during a major seismic event.

Calculations were performed using the procedures described in the 2008 Soil Liquefaction During Earthquakes Monograph by Idriss and Boulanger[3]. Our calculations indicate the very loose, saturated sand layer encountered in Boring B-1 could liquefy during the design seismic event. Calculated settlement associated with the liquefaction of each layer within the borings was less than 2.2 inches. This magnitude of settlement should be tolerable to design for life safety. Additionally, lateral spread and ground rupture are unlikely to occur.

5.10 SITE VISITS

GSH must verify that all topsoil/disturbed soils and any other unsuitable soils have been removed, that non-engineered fills have been removed and/or properly prepared, and that suitable soils have been encountered prior to placing site grading fills, footings, slabs, and pavements. Additionally, GSH must observe fill placement and verify in-place moisture content and density of fill materials placed at the site.

[3] Idriss, I. M., and Boulanger, R. W. (2008), Soil liquefaction during earthquakes: Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261 pp.

5.11 CLOSURE

If you have any questions or would like to discuss these items further, please feel free to contact us at (801) 685-9190.

Respectfully submitted,

GSH Geotechnical, Inc.

Robert A. Gifford
Staff Engineer/Geologist

Reviewed by:

Alan D. Spilker, P.E.
State of Utah No. 334228
President/Senior Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
No. 334228
ALAN D. SPILKER
STATE OF UTAH

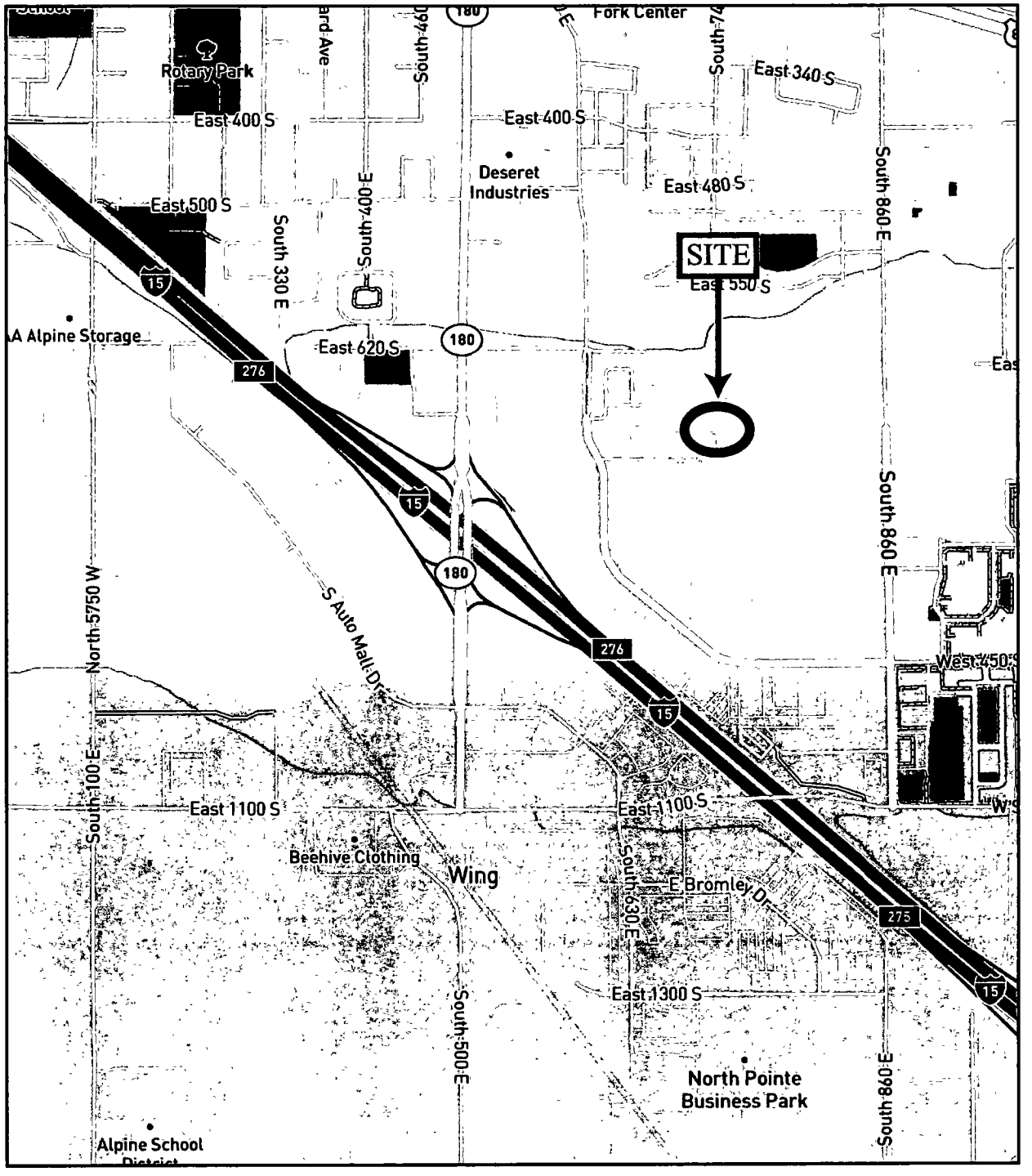
RAG/ADS:jlh

Encl. Figure 1, Vicinity Map
Figure 2, Site Plan
Figures 3A through 3J, Log of Borings
Figure 4, Key to Boring Log (USCS)

Addressee (email)

cc: Mr. James McLaughlin (email)
Back Homes

BACH HOMES
JOB NO. 1726-020-20



200 0 200 400 600 800 M

0.2 0 0.2 MI 0.4

FIGURE 1
VICINITY MAP

REFERENCE:
ALL TRAILS - NATIONAL GEOGRAPHIC TERRAIN
DATED 2020

GSH

BACH HOMES
JOB NO 1726-020-20

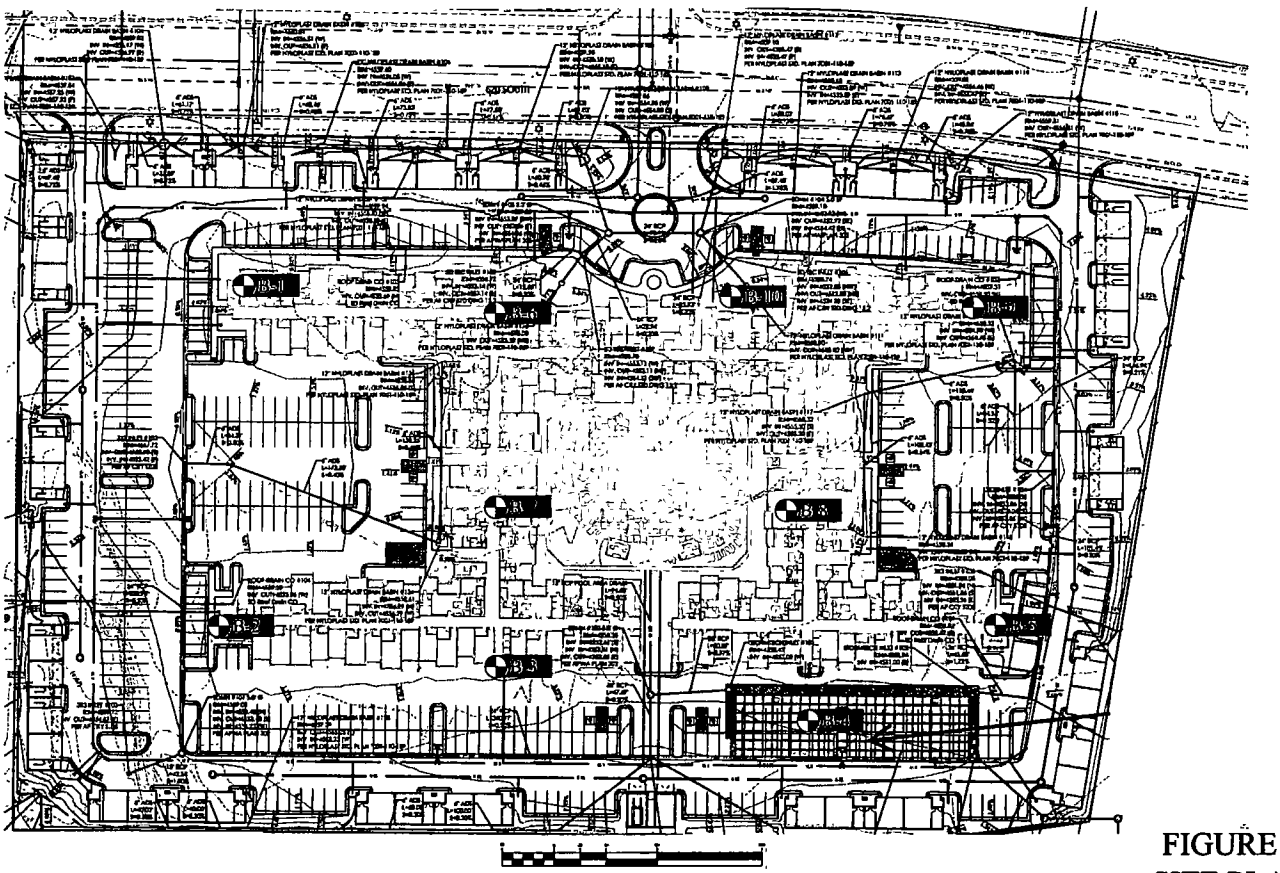


FIGURE 2
SITE PLAN

REFERENCE.
ADAPTED FROM DRAWING ENTITLED
"BACH APARTMENTS, SHEET C5 0" BY FOCUS
DATED 05/05/2020

GSH

GSH BORING LOG

Page: 1 of 1

BORING: B-1

CLIENT: Bach Homes — PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments — DATE STARTED: 7/1/20 — DATE FINISHED: 7/1/20

LOCATION: Near Intersection of 620 South 600 East, American Fork, Utah — GSH FIELD REP.: HB

DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger — HAMMER: Automatic — WEIGHT: 140 lbs — DROP: 30"

GROUNDWATER DEPTH: 5.2' (7/10/20) — ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	SM/SC FILL	SILTY/CLAYEY FINE TO MEDIUM SAND, FILL with some fine gravel; major roots (topsoil) to 6"; brown		34							slightly moist medium dense
	CL	SILTY CLAY with fine sand and occasional layers of silty fine sand up to 1/2" thick; organics; gray									slightly moist stiff
▼			5	10							saturated
		grades brown	10	17							very stiff
	SM/SC	SILTY FINE TO MEDIUM SAND with some clay and layers of clay up to 2" thick; brown									saturated loose
			15	16		27.0	98				
		End of Exploration at 16.0'. No groundwater encountered at time of drilling. Installed 1.25" diameter slotted PVC pipe to 16.0'.	20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3A

GSH BORING LOG

Page: 1 of 1

BORING: B-2

CLIENT: Bach Homes | PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments | DATE STARTED: 7/1/20 | DATE FINISHED: 7/1/20

LOCATION: Near Intersection of 620 South 600 East, American Fork, Utah | GSH FIELD REP.: HB

DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger | HAMMER: Automatic | WEIGHT: 140 lbs | DROP: 30"

GROUNDWATER DEPTH: 6.8' (7/10/20) | ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	SM/SC FILL	SILTY FINE TO COARSE SAND, FILL with some clay and trace fine and coarse gravel; major roots (topsoil) to 4"; brown									slightly moist very loose
	SM/SC	SILTY FINE TO COARSE SAND with some clay and trace fine and coarse gravel; brown		6	X	25.4	95				slightly moist very loose
			5	18	X	20.7	104				medium dense
▼											saturated
	CL	SILTY CLAY with silty fine sand; roots; brownish gray	10	0	X	30.7	92				saturated very soft
		End of Exploration at 11.0'. Installed 1.25" diameter slotted PVC pipe to 11.0'.	15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3B

GSH BORING LOG

Page: 1 of 1

BORING: B-3

CLIENT: Bach Homes — PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments — DATE STARTED: 7/1/20 — DATE FINISHED: 7/1/20

LOCATION: Near Intersection of 620 South 600 East, American Fork, Utah — GSH FIELD REP.: HB

DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger — HAMMER: Automatic — WEIGHT: 140 lbs — DROP: 30"

GROUNDWATER DEPTH: 10.3' (7/10/20) — ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	CL	SILTY CLAY with fine sand; major roots (topsoil) to 6"; brown									slightly moist stiff
				17							
			5								
				10							moist stiff
▼		grades fine sandy clay with silt and occasional layers of silty fine sand up to 2" thick; brown	10								medium stiff saturated
				7		30.8	94				
		End of Exploration at 13.0'. Installed 1.25" diameter slotted PVC pipe to 13.0'.	15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3C

GSH BORING LOG

Page: 1 of 1

BORING: B-4

CLIENT: Bach Homes — PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments — DATE STARTED: 7/1/20 — DATE FINISHED: 7/1/20

LOCATION: Near Intersection of 620 South 600 East, American Fork, Utah — GSH FIELD REP.: HB

DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger — HAMMER: Automatic — WEIGHT: 140 lbs — DROP: 30"

GROUNDWATER DEPTH: 7.2' (7/10/20) — ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	GP/GM FILL	FINE AND COARSE GRAVEL, FILL with fine to medium sand and silt; major roots (topsoil) to 6"; brown		34		5.4	110				dry-slightly moist medium dense
	GP FILL	FINE AND COARSE GRAVEL, FILL with fine to coarse sand; brown and gray	5	20							slightly moist medium dense
▼	CL	SILTY CLAY with trace fine sand; organics; gray	10	4							moist medium stiff saturated
	SM/SC	SILTY FINE TO MEDIUM SAND with clay; gray	15	12							saturated loose
		End of Exploration at 16.0'. Installed 1.25" diameter slotted PVC pipe to 16.0'.	20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3D

GSH

BORING LOG

Page: 1 of 1

BORING: B-5

CLIENT: Bach Homes — PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments — DATE STARTED: 7/1/20 — DATE FINISHED: 7/1/20

LOCATION: Near Intersection of 620 South 600 East, American Fork, Utah — GSH FIELD REP.: HB

DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger — HAMMER: Automatic — WEIGHT: 140 lbs — DROP: 30"

GROUNDWATER DEPTH: 8.4' (7/10/20) — ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	CL	FINE SANDY CLAY with silt and some fine gravel; major roots (topsoil) to 6"; brown									slightly moist medium stiff
				8							
			5								
		grades with occasional layers of silty fine sand up to 2" thick; gray		7		19.3	113				
▼											saturated
			10								
		grades with layers of fine to medium sand up to 3" thick									moist stiff
				12							
		End of Exploration at 13.0'. No groundwater encountered at time of drilling. Installed 1.25" diameter slotted PVC pipe to 13.0'.	15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3E

GSH BORING LOG

Page: 1 of 1

BORING: B-6

CLIENT: Bach Homes — PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments — DATE STARTED: 7/1/20 — DATE FINISHED: 7/1/20

LOCATION: Near Intersection of 620 South 600 East, American Fork, Utah — GSH FIELD REP.: HB

DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger — HAMMER: Automatic — WEIGHT: 140 lbs — DROP: 30"

GROUNDWATER DEPTH: 9.5' (7/10/20) — ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	CL	SILTY CLAY with fine sand; major roots (topsoil) to 4"; brown									dry stiff
				15							slightly moist
		grades fine sandy clay with silt and organics; layers of silty fine sand up to 2" thick	5	16		20.4	108				moist
▼		grades silty clay with trace fine sand; brownish-yellow	10	17							saturated
		End of Exploration at 11.0'. Installed 1.25" diameter slotted PVC pipe to 11.0'.	15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3F

GSH

BORING LOG

Page: 1 of 2

BORING: B-7

CLIENT: Bach Homes | PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments | DATE STARTED: 7/2/20 | DATE FINISHED: 7/2/20

LOCATION: Near Intersection of 620 South 600 East, American Fork, Utah | GSH FIELD REP.: HB

DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger | HAMMER: Automatic | WEIGHT: 140 lbs | DROP: 30"

GROUNDWATER DEPTH: 7.1' (7/10/20) | ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	GM FILL	FINE AND COARSE GRAVEL, FILL with fine to coarse sand and cobbles; major roots (topsoil) to 4"; gray									dry very dense
				50/5"							
	SM/ SC	SILTY/CLAYEY FINE TO MEDIUM SAND with some fine gravel and occasional layers of silty clay up to 2" thick; brown									slightly moist loose
			5	10		27.6	99	45.1			
▼											saturated
		grades silty/clayey fine to coarse sand with layers of clay up to 2"	10	2		24.0		32.2			very loose
	ML	FINE SANDY SILT brown									saturated medium stiff
			15	7		28.7		81.9			
			20	14		24.4		58.1			stiff
			25	11							

See Subsurface Conditions section in the report for additional information.

FIGURE 3G

GSH	BORING LOG Page: 2 of 2	BORING: B-7

CLIENT: Bach Homes — PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments — DATE STARTED: 7/2/20 — DATE FINISHED: 7/2/20

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
			25	11							
		grades gray									
		grades with layers of fine to coarse sand up to 1" thick	30	12					40	14	
	SP/ SM	FINE TO COARSE SAND with some silt and trace fine gravel; gray									saturated dense
			35	38							
		grades with occasional layers of fine silty clay up to 3" thick	40	32							
			45	29							medium dense
		End of Exploration at 46.0'. Installed 1.25" diameter slotted PVC pipe to 46.0'.	50								

See Subsurface Conditions section in the report for additional information.

FIGURE 3G
(continued)

GSH

BORING LOG

Page: 1 of 1

BORING: B-8

CLIENT: Bach Homes | PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments | DATE STARTED: 7/2/20 | DATE FINISHED: 7/2/20

LOCATION: Near Intersection of 620 South 600 East, American Fork, Utah | GSH FIELD REP.: HB

DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger | HAMMER: Automatic | WEIGHT: 140 lbs | DROP: 30"

GROUNDWATER DEPTH: 7.0' (7/10/20) | ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	GP/GM FILL	FINE AND COARSE GRAVEL, FILL with fine sand and silt; major roots (topsoil) to 6"; brown									slightly moist medium dense
			5	12							
▼	CL	SILTY CLAY with fine sand; organics; gray									moist medium stiff saturated
			10	4		19.2	102				
		grades fine sandy clay with layers of silty fine sand up to 1" thick	15	13							stiff
		End of Exploration at 16.0'. No groundwater encountered at time of drilling. Installed 1.25" diameter slotted PVC pipe to 16.0'.	20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3H

GSH BORING LOG

Page: 1 of 1

BORING: B-9

CLIENT: Bach Homes | PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments | DATE STARTED: 7/2/20 | DATE FINISHED: 7/2/20

LOCATION: Near Intersection of 620 South 600 East, American Fork, Utah | GSH FIELD REP.: HB

DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger | HAMMER: Automatic | WEIGHT: 140 lbs | DROP: 30"

GROUNDWATER DEPTH: 6.1' (7/10/20) | ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	GP/GM FILL	FINE AND COARSE GRAVEL, FILL with fine to coarse sand; major roots (topsoil) to 4"; brown									slightly moist loose
				13							
	CL	FINE SANDY CLAY with silt; organics; gray	5								moist medium stiff
▼											saturated
				7		35.9	84				
			10								
		grades with layers of silty fine sand up to 3" thick; gray and brown		10							stiff
		End of Exploration at 13.0'. Installed 1.25" diameter slotted PVC pipe to 13.0'.	15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 31

GSH BORING LOG

Page: 1 of 1

BORING: B-10

CLIENT: Bach Homes | PROJECT NUMBER: 1726-020-20

PROJECT: Proposed Vest Property - American Fork Apartments | DATE STARTED: 7/2/20 | DATE FINISHED: 7/2/20

LOCATION: Near Intersection of 620 South 600 East, American Fork, Utah | GSH FIELD REP.: HB

DRILLING METHOD/EQUIPMENT: 3-3/4" ID Hollow-Stem Auger | HAMMER: Automatic | WEIGHT: 140 lbs | DROP: 30"

GROUNDWATER DEPTH: 7.0' (7/10/20) | ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	GM FILL	FINE AND COARSE GRAVEL, FILL with fine to coarse sand; major roots (topsoil) to 4"; brown									dry medium dense
				40							
	SM/ SC	SILTY/CLAYEY FINE TO MEDIUM SAND gray and brown									slightly moist loose
			5	17							
▼											saturated
		grades with fine and coarse gravel; medium sand grades out; brown	10	7		14.3		36.3			
		End of Exploration at 11.0'. No groundwater encountered at time of drilling. Installed 1.25" diameter slotted PVC pipe to 11.0'.	15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3J

CLIENT: Bach Homes
PROJECT: Proposed Vest Property - American Fork Apartments
PROJECT NUMBER: 1726-020-20

KEY TO BORING LOG

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫

COLUMN DESCRIPTIONS

① **Water Level:** Depth to measured groundwater table. See symbol below.

② **USCS:** (Unified Soil Classification System) Description of soils encountered; typical symbols are explained below.

③ **Description:** Description of material encountered; may include color, moisture, grain size, density/consistency,

④ **Depth (ft.):** Depth in feet below the ground surface.

⑤ **Blow Count:** Number of blows to advance sampler 12" beyond first 6", using a 140-lb hammer with 30" drop.

⑥ **Sample Symbol:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

⑦ **Moisture (%):** Water content of soil sample measured in laboratory; expressed as percentage of dryweight of

⑧ **Dry Density (pcf):** The density of a soil measured in laboratory; expressed in pounds per cubic foot.

⑨ **% Passing 200:** Fines content of soils sample passing a No. 200 sieve; expressed as a percentage.

⑩ **Liquid Limit (%):** Water content at which a soil changes from plastic to liquid behavior.

⑪ **Plasticity Index (%):** Range of water content at which a soil exhibits plastic properties.

⑫ **Remarks:** Comments and observations regarding drilling or sampling made by driller or field personnel. May include other field and laboratory test results using the following abbreviations:

CEMENTATION:	MODIFIERS:	MOISTURE CONTENT (FIELD TEST):
Weakly: Crumbles or breaks with handling or slight finger pressure.	**Trace** <5%	**Dry:** Absence of moisture, dusty, dry to the touch.
Moderately: Crumbles or breaks with considerable finger pressure	**Some** 5-12%	**Moist:** Damp but no visible water
Strongly: Will not crumble or break with finger pressure.	**With** > 12%	**Saturated:** Visible water, usually soil below water table

Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results Descriptions on the logs apply only at the specific boring locations and at the time the borings were advanced, they are not warranted to be representative of subsurface conditions at other locations or times

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS SYMBOLS	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS More than 50% of material is larger than No. 200 sieve size.	GRAVELS More than 50% of coarse fraction retained on No 4 sieve.	CLEAN GRAVELS (little or no fines)	GW	Well-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
			GP	Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
		GRAVELS WITH FINES (appreciable amount of fines)	GM	Silty Gravels, Gravel-Sand-Silt Mixtures
			GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
	SANDS More than 50% of coarse fraction passing through No 4 sieve.	CLEAN SANDS (little or no fines)	SW	Well-Graded Sands, Gravelly Sands, Little or No Fines
			SP	Poorly-Graded Sands, Gravelly Sands, Little or No Fines
		SANDS WITH FINES (appreciable amount of fines)	SM	Silty Sands, Sand-Silt Mixtures
			SC	Clayey Sands, Sand-Clay Mixtures
FINE-GRAINED SOILS More than 50% of material is smaller than No. 200 sieve size.	SILTS AND CLAYS Liquid Limit less than 50%		ML	Inorganic Silts and Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL	Organic Silts and Organic Silty Clays o f Low Plasticity
	SILTS AND CLAYS Liquid Limit greater than 50%		MH	Inorganic Silts, Micacious or Diatomacious Fine Sand or Silty Soils
			CH	Inorganic Clays of High Plasticity, Fat Clays
			OH	Organic Silts and Organic Clays of Medium to High Plasticity
HIGHLY ORGANIC SOILS			PT	Peat, Humus, Swamp Soils with High Organic Contents

Note: Dual Symbols are used to indicate borderline soil classifications.

STRATIFICATION:

DESCRIPTION	THICKNESS
Seam	up to 1/8"
Layer	1/8" to 12"
Occasional: One or less per 6" of thickness	
Numerous; More than one per 6" of thickness	

TYPICAL SAMPLER GRAPHIC SYMBOLS

- Bulk/Bag Sample
- Standard Penetration Split Spoon Sampler
- Rock Core
- No Recovery
- 3 25" OD, 2 42" ID D&M Sampler
- 3 0" OD, 2.42" ID D&M Sampler
- California Sampler
- Thin Wall

WATER SYMBOL

- Water Level

FIGURE 4

GSH