

Cover Sheet

Document Title:	Final Compliant WQMP Report
Prepared By:	San Bernardino County
Date:	08/15/2024
Version:	Permit WQMP-2021-000153
Project Name:	PPHCSD Civic Center Phase 1
Client/Stakeholder:	PPHCSD
Confidentiality:	[Public/Internal/Confidential]

Document Overview

This specification document outlines the requirements, standards, and key details for the project or product described above. The cover sheet provides a summary of essential information to identify and track the document throughout its lifecycle.

Contact Information

- Preparer David W Larson, P.E., 801-331-8900, david@rbcea.com
- Steeno Design Studio Inc, 760-244-5001, sophie@steenodesign.com

Revision History

Version	Date	Description	Author

MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

PHELAN COMMUNITY PARK

APN: 3066-251-18, & 3066-261-10

WQMP-2021-00153

Prepared for:

PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT

4176 Warbler Road

Phelan, CA 92371

Tel: 760-868-1212

Prepared by:



RED BRICK CONSULTING
ENGINEERS & ARCHITECTS

2829 S Kollman In
Saratoga Springs, UT 84045

661-816-5179

Submittal Date: August 2, 2023

Revision No. and Date: OCT 6, 2023

Revision No. and Date: DEC 18, 2023

Revision No. and Date: APRIL 25, 2024

Revision No. and Date: July 11, 2024

Revision No. and Date: _____

Final Approval Date: _____

**County of San Bernardino
NPDES**

THE PLANS & DETAILS HAVE BEEN

**REVIEWED
FOR COMPLIANCE**

THE APPROVAL OF THESE PLANS SHALL NOT
BE CONSTRUED TO BE A PERMIT FOR ANY
VIOLATION OF ANY CODE OR ORDINANCE OF
THIS COUNTY

By Jonathan Dillon

Date 08/15/2024

THESE PLANS SHALL BE ON THE JOB FOR
ALL REQUESTED INSPECTIONS

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Phelan Pinon Hills Community Services District by Red Brick Solution. The WQMP is intended to comply with the requirements of the County of San Bernardino and the Phase II Small MS4 General Permit for the Mojave River Watershed. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the Phase II Small MS4 Permit and the intent of San Bernardino County (unincorporated areas of Phelan, Oak Hills, Spring Valley Lake and Victorville) and the incorporated cities of Hesperia and Victorville and the Town of Apple Valley. Once the undersigned transfers its interest in the property, its successors in interest and the city/county/town shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):	PRAA-2021-00040 WQMP-2021-00153	Grading Permit Number(s):	GRAD-2021-00235
Tract/Parcel Map Number(s):	APN 3066-251-18, & 3066-261-10	Building Permit Number(s):	NEWNR-2021-0230
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3066-251-18, & 3066-261-10
Owner's Signature			
Owner Name: Don Bartz			
Title	General Manager		
Company	Phelan Pinon Hills Community Services District		
Address	4176 Warbler Road, Phelan, CA 92371		
Email	dbartz@pphcsd.org		
Telephone #	760-868-1212		
Signature		Date	April 30, 2024

Preparer's Certification

Project Data			
Permit/Application Number(s):	PRAA-2021-0040 WQMP-2021-00153	Grading Permit Number(s):	GRAD-2021-00235
Tract/Parcel Map Number(s):	APN 3066-251-18, & 3066-261-10	Building Permit Number(s):	NEWNR-2021-0230
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3066-251-18, & 3066-261-10

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of the California State Water Resources Control Board Order No. 2013-0001-DWQ.


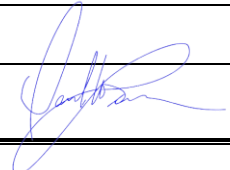
Engineer: David W. Larson		<p>PE Stamp Below</p> 
Title	Principal	
Company	Red Brick Solution	
Address	331 South Rio Grande Street, #203, Salt Lake City, UT 84101	
Email	david@redbricksolution.com	
Telephone #	801-224-5335	
Signature		
Date		

Table of Contents

Section I	Introduction	1-1
Section 1	Discretionary Permits.....	1-2
Section 2	Project Description.....	2-1
2.1	Project Information	2-1
2.1.1	Project Sizing Categorization Information.....	2-1
2.2	Property Ownership/ Management.....	2-2
2.3	Potential Stormwater Pollutants.....	2-3
Section 3	Site and Watershed Description.....	3-1
Section 4	Best Management Practices	4-1
4.1	Source Control and Site Design BMPs	4-1
4.1.1	Source Control BMPs.....	4-1
4.1.2	Site Design BMPs	4-7
4.2	Treatment BMPs	4-8
4.2.1	Project Specific Hydrology Characterization	4-8
4.3	BMP Selection And Sizing	4-13
4.3.1	Exceptions to Requirements for Bioretention Faculty.....	4-14
4.3.2	Site Design BMP	4-17
4.3.3	Infiltration BMPs.....	4-18
4.3.3.1	Allowed Variations for Special Site Conditions	4-18
4.3.4	Biotreatment BMP.....	4-20
4.3.5	Conformance Summary.....	4-24
4.3.6	Hydromodification Control BMP	4-25
4.4	Alternative Compliance Plan (if applicable).....	4-26
Section 5	Inspection & Maintenance Responsibility Post Construction BMPs.....	5-1
Section 6	Site Plan and Drainage Plan	6-1
6.1.	Site Plan and Drainage Plan	6-1
6.2	Electronic Data Submittal	6-1

Forms

Form 1-1	Project Information	1-2
Form 2.1-1	Description of Proposed Project	2-1
Form 2.2-1	Property Ownership/Management.....	2-2
Form 2.3-1	Pollutants of Concern	2-3
Form 3-1	Site Location and Hydrologic Features	3-1
Form 3-2	Existing Hydrologic Characteristics for Drainage Area 1	3-2
Form 3-3	Watershed Description	3-3

Form 4.1-1 Non-Structural Source Control	4-2
Form 4.1-2 Structural SourceControl BMP	4-4
Form 4.1-2 Structural Source Control BMPs Con't.....	4-5
Form 4.1-3 Site Design Practices Checklist.....	4-6
Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume	4-9
Form 4.2-2 Summary of Hydromodification Assessment	4-9
Form 4.2-3 Hydromodification Assessment for Runoff Volume.....	4-10
Form 4.2-4 Hydromodification Assessment for Time of Concentration	4-11
Form 4.2-5 Hydromodification Assessment for Peak Runoff (DA1)	4-12
Form 4.3-1 Infiltration BMPs Feasibility	4-15
Form 4.3-2 Site Design BMP (DA 1)	4-16
1 Form 4.3-2 cont. Site Design BMPs (DA)	4-17
Form 4.3-3 Infiltration LID BMP	4-19
Form 4.3-4 Selection and Evaluation of Biotreatment BMP	4-20
Form 4.3-5 Volume Based Biotreatment – Bioretention and Planter Boxes w/Undrains	4-21
Form 4.3-6 Volume Based Biotreatment- Constructed Wetlands and Extended Detention	4-22
Form 4.3-7 Flow Based Biotreatment.....	4-23
Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate	4-24
Form 4.3-9 Hydromodification Control BMP	4-25
Form 5-1 BMP Inspection and Maintenance.....	5-1

Project location	EXHIBIT A
Site boundary	EXHIBIT B
Land uses and land covers, as applicable	EXHIBIT C & D
Suitability/feasibility constraints	ATTACHED
Structural Source Control BMP locations	EXHIBIT C
Site Design Hydrologic Source Control BMP locations	SEE EROSION CONTROL PLANS ATTACHED
LID BMP details	ATTACHED
Drainage delineations and flow information	SEE GRADING PLANS ATTACHED
Drainage connections	SEE GRADING PLANS ATTACHED

Section I – Introduction

This WQMP template has been prepared specifically for the Phase II Small MS4 General Permit in the Mojave River Watershed. This location is within the jurisdiction of the Lahontan Regional Water Quality Control Board (LRWQCB). This document should not be confused with the WQMP template for the Santa Ana Phase I area of San Bernardino County.

WQMP preparers must refer to the MS4 Permit for the Mojave Watershed WQMP template and Technical Guidance (TGD) document found at: <http://cms.sbcounty.gov/dpw/Land/NPDES.aspx> to find pertinent arid region and Mojave River Watershed specific references and requirements.

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name		Phelan Community Park			
Project Owner Contact Name:		Don Bartz - Phelan Pinon Hills Community Services District			
Mailing Address:	4176 Warbler Road, Phelan, CA 92371	E-mail Address:	dbartz@pphcsd.org	Telephone:	760-868-1212
Permit/Application Number(s):		PRAA-2021-00040 WQMP 2021-00153	Tract/Parcel Map Number(s):	PAPN: 3066-251-18, & 3066-261-10	
Additional Information/ Comments:		<p>Exhibit D1 shows the overall site is bounded by Sheep Creek Road on the West, Commercial Development and School fields on the North, residential homes on the East and Warbler Road on the South; the project consists of Class A soils (see Exhibit C) with Poor Cover consisting Annual grass CN 67 (see Exhibit I) and Barren graded land CN 78. Gravel and Decomposed Granite are to be considered 20-percent impervious CN 98 and 80-percent Commercial Landscaping CN 32. The overall project will expand the existing 3.11-acre PPHCS site into a 23.96-acre development comprised of APN 3066-261-10 that encompasses the existing 3.11 acre site, and the northerly 5.02-acre commercial site; APN 3066-251-18 a proposed 14.60-acre park; a quick claim of the southern 0.42-acre portion of Sahara Road; the easterly 0.72-acre extension of Warbler Road; a 0.49-acre reciprocal access road on the north; and the removal of the 0.40-acre dedication of Sheep Creek Road. Total project acreage is then $3.11+5.02+14.60+0.42+0.72+0.49-0.40=23.96$ acres.</p>			
Description of Project:		<p>Overall project site WQMP report:</p> <p>EXHIBIT D2 shows the pre-developed site has one drainage Area (DA1) with three (3) Drainage Management Areas (DMA's). DMA-A consists of the existing 3.11-acre commercial site, The northerly 11.40-acre (DMA-B) barren graded contractor yard (CN 78), and the 9.45-acre (DMA-C) annually grass cover undisturbed future park (CN 67) area as shown on Exhibit D2, a portion of which contains protected vegetation. Storm flows follow the natural topography from the Southwest to the Northeast corner of the site. The 3.11-acre commercial site has 38,924 sf of impermeable hardscape, 29,729 sf of Landscape, and 66,590 sf of gravel beds. Since 20% of gravel is considered impermeable the total impermeable area becomes 52,242 sf and 83,001 sf permeable. $((52,242+83,001)/43560)+11.4+9.45=23.96$</p> <p>Exhibit E1 shows that the overall Post-developed site has one (1) Drainage Area (DA1) with five (5) Drainage Management Areas (DMA's) and an infiltration basin located at the northeast corner of the site as shown on Exhibit K. The First DMA-A consists of the existing 3.11-acre commercial site comprised of 38,924 sf impermeable hardscape, 29,729 sf of landscape, and 66,590 sf of gravel and approximately 40% flows into DMA-B and 60% flow into DMA-C. (total 52,242 impermeable 83,001 permeable).</p> <p>The Second (DMA-B1) consists of a 14,034 sf Community Building on 2.88-acre site and the Third (DMA-B2) consisting of a 17,284 sf Community Center Gymnasium on a 2.03-acre site with associated landscape and parking on a combined 4.91-acre site which is comprised of 170,643 sf of hardscape, 43,597 sf of gravel landscaping (8,719 sf impermeable and 34,877 sf permeable) for a total of 179,362 sf of impermeable and 34,877 sf permeable area.</p> <p>The Fourth (DMA-C) & Fifth (DMA-D) consist of 9.43 acres and 6.51 acres, respectively, for an overall 15.93-acre park site containing 210,504 sf impermeable hardscape, 345,501 gravel, and 138,050 sf of grass playfields. (total 279,604 impermeable 414,451 permeable.)</p> <p>An on-site basin is proposed at the northeast corner of the project located within DMA-C and it is designed to mitigate the Delta Q and the overall infiltration requirement for the entire developed site.</p> <p>Off-site flows tributary to the site are 549 CFS. These flows will be captured along Warbler Road and conveyed east to the eastern property line of the park site where these flows will be redirected north via an earthen channel along the eastern property line to the northeast corner of the site that bypasses the proposed basin to confluence with the mitigated flows exiting the park site basin.</p> <p>The project will be Phased into at least four (4) phases. The 1st Phase will be attached as Addendum-1 to this report and will consist of the existing 3.11-acre site and the westerly 2.88-acre site to the North. Including the overall basin.</p> <p>Subsequent phasing may tentatively be as follows: Phase II, the easterly 2.03-acre project, Phase III the westerly 6.80-acre park site improvements, and Phase IV the easterly 6.51-acre park grading and improvements.</p> <p>This overall analysis assumes that all construction will be completed and will have a common onsite infiltration basin in DMA-C. Subsequent Addendums will address the Phases of construction and the interim conveyances to the overall infiltration basin established in this report.</p>			
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.		<p>The 4.41-acre site is being utilized as a staging area for construction equipment and supplies as shown. No WQMP conditions are being employed. Typical drainage is currently to the northeast corner of the overall 23.96-acre development</p>			

Section 2 Project Description

2.1 Project Information

The WQMP shall provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

2.1.1 Project Sizing Categorization

If the Project is greater than 5,000 square feet, and not on the excluded list as found on Section 1.4 of the TGD, the Project is a Regulated Development Project.

If the Project is creating and/or replacing greater than 2,500 square feet but less than 5,000 square feet of impervious surface area, then it is considered a Site Design Only project. This criterion is applicable to all development types including detached single family homes that create and/or replace greater than 2,500 square feet of impervious area and are not part of a larger plan of development.

Form 2.1-1 Description of Proposed Project					
1 Regulated Development Project Category (Select all that apply):					
<input checked="" type="checkbox"/> #1 New development involving the creation of 5,000 ft ² or more of impervious surface collectively over entire site	<input checked="" type="checkbox"/> #2 Significant re-development involving the addition or replacement of 5,000 ft ² or more of impervious surface on an already developed site	<input type="checkbox"/> #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface	<input type="checkbox"/> #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface		
<input type="checkbox"/> Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) Will require source control Site Design Measures. Use the "PCMP" Template. Do not use this WQMP Template.					
2 Project Area (ft ²):	23.96 ac= 1,043,537 sf	3 Number of Dwelling Units:	N/A	4 SIC Code:	7999 / 8641
5 Is Project going to be phased? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.					

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:

The property will be owned and operated by Pheland Pinon Hills Community Service District, and they will be the responsible party. Currently the responsible party will be Don Bartz the general manager representative and property owner association representative.

Name: Don Bartz

Title: General Manager (GMR)

Phone: 760-868-1212

Address: 4176 Warbler Road Phelan, CA 9237

DBartz@pphcsd.org

No other property owner's association will be formed for this project.

2.3 Potential Stormwater Pollutants

Best Management Practices (BMP) measures for pollutant generating activities and sources shall be designed consistent with recommendations from the CASQA Stormwater BMP Handbook for New Development and Redevelopment (or an equivalent manual). Pollutant generating activities must be considered when determining the overall pollutants of concern for the Project as presented in Form 2.3-1.

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-2 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Trash, Human wastes and Petroleum Hydrocarbons
Nutrients - Phosphorous	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Liquid Fertilizers
Nutrients - Nitrogen	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Landscape fertilizers
Noxious Aquatic Plants	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	nuisance water
Sediment	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Landscaping
Metals	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Parking Area
Oil and Grease	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Parking Area
Trash/Debris	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Parking and Trash Containers
Pesticides / Herbicides	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Landscaping
Organic Compounds	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Landscaping
Other: Fluoride	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Mojave River
Other:	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed Drainage Management Areas (DMAs)) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. ***If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet. A map presenting the DMAs must be included as an appendix to the WQMP document.***

Form 3-1 Site Location and Hydrologic Features			
Site coordinates take GPS measurement at approximate center of site	Latitude 34.423056 N	Longitude 117.571419 W	Thomas Bros Map page
1 San Bernardino County climatic region: <input checked="" type="checkbox"/> Desert			
2 Does the site have more than one drainage area (DA): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached</i>			
Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA		
DA1 DMA-A TO DMA-B1 TO DMA-B2 TO DMA-C TO BASIN PLUS DMA-D TO BASIN TO OUTLET	The 3.11-acre (DMA-A) PPHCSD will convey flows north to the 4.91-acre (DMA-B) Community Center and Parking Lot, where they will be collected on site into a storm drain system that is released on to the 9.43-acre (DMA-C) easterly park site's play-field where it is conveyed northeasterly via graded channels graded to a slope varying from 10:1 slopes to 0.50% to the access road along the northerly property line where it is collected and conveyed down the concrete access road into the 1.07-ac-ft infiltration basin that also receives an additional 6.51-acre (DMA-D) future park site down a rip rap lined drainage conveyance prior to out letting these flows to the northeast into their natural historic conveyance channel.		

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	SEE EXHIBIT D3	
1 DMA drainage area (ft ²)	542,073	501,464		
2 Existing site impervious area (ft ²)	52,242	0		
3 Antecedent moisture condition <i>For desert areas, use</i> http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf	II	II		
4 Hydrologic soil group <i>Refer to County Hydrology Manual Addendum for Arid Regions –</i> http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf	A	A		
5 Longest flowpath length (ft)	1,807	1,262		
6 Longest flowpath slope (ft/ft)	0.0304	0.0357		
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Com	Barren-graded		
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover</i> <i>good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>		Poor		

Form 3-3 Watershed Description for Drainage Area	
Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Regional Board: 6V / Lahontan/Mojave River (below Lower Narrows)
Applicable TMDLs http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	N/A.
303(d) listed impairments http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	N/A
Environmentally Sensitive Areas (ESA) Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP	DESERT TORTOISE HABITAT CAT 3
Hydromodification Assessment	<input checked="" type="checkbox"/> Yes Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal <input type="checkbox"/> No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

The information and data in this section are required for both Regulated Development and Site Design Only Projects. Source Control BMPs and Site Design BMP Measures are the basis of site-specific pollution management.

4.1.1 Source Control BMPs

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

The identified list of source control BMPs correspond to the CASQA Stormwater BMP Handbook for New Development and Redevelopment.

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owners shall walk-thru of the site where treatment BMPs are located and restrictions., and Within 2 days for new hires. Within 2 months, a signed acknowledgement of site policies and restrictions. Educational materials available from the San Bernardino Stormwater Program and can be downloaded at: http://www.sbcountystormwater.org/gov_out.html http:// www.mojaveriver.org/
N2	Activity Restrictions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Conditions, covenants and restrictions (CCRs) will be prepared by the developer restricting dumping waste down catch basins for the purpose of surface water quality protection . Pesticides shall be applied by a licensed applicator.
N3	Landscape Management BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CC&R's will be prepared limiting fertilizer and/or pesticide usage. At a minimum, pesticides shall be placed by a licensed applicator. Owner/site operator(s) shall ensure landscaping/Groundskeeping Service providers do not blow or sweep debris, cutting, leaves, etc., into treatment BMPs and/or City maintained right of ways. All landscape maintenance contractors will be required to sweep up all landscape cuttings, mowing and fertilizer materials off paved areas weekly and dispose of properly.
N4	BMP Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Property owner shall be responsible for the maintenance of all site BMP's. The RPIC will also schedule cleaning and/or maintenance of all structural BMP facilities. When BMP replacement(s) is required, the Owner shall order and provide materials to assigned personnel/staff.
N5	Title 22 CCR Compliance (How development will comply)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Project will obtain MDS reports on materials stored on site and review hazards prior to using said materials in a safety meeting
N6	Local Water Quality Ordinances	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All local water quality ordinances shall be followed through implementation of WQMP.
N7	Spill Contingency Plan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No fueling or Hazardous materials on-site

Form 4.1-1 Non-Structural Source Control BMPs				
N8	Underground Storage Tank Compliance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Underground septic storage tank compliance proposed. Septic system shall be kept a minimum 50 feet from infiltration system.
N9	Hazardous Materials Disclosure Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No hazardous materials

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No hazardous waste proposed
N11	Litter/Debris Control Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner to ensure lids are secure, lidded, and consistent with County Ordinances on a daily basis. In addition, the owner will contract weekly with Landscaping/Groundskeeping services including perimeter fencing and wind-blown debris. The owner/POA will contract trash removal through local city services.
N12	Employee Training	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner/POA training manual will be provided and training of staff and residence will occur bi-annually and with new occupant.
N13	Housekeeping of Loading Docks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	NO LOADING DOCKS PROPOSED
N14	Catch Basin Inspection Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The Owner will clean in the late summer/early fall prior to the start of the rainy season at least 80% of drainage facilities inspected, and clean and maintain on annual basis 100% every two-year period using an outside agency.
N15	Vacuum Sweeping of Private Streets and Parking Lots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	VACUUM sweep Streets and parking lots shall be swept at a minimum in late summer or early fall, prior to the start of the rainy season or equivalent, as required by the governing jurisdiction.
N16	Other Non-structural Measures for Public Agency Projects	<input checked="" type="checkbox"/>	<input type="checkbox"/>	As a partially Federally funded site additional non-structural measures for public agency projects may be required and will be implemented such as 1) Protect Sensitive / Special Value Features 2)Reduce Parking Imperviousness All non-playfields, including hills, elevation changes and parking areas will be constructed with gravel or DG surfaces.
N17	Comply with all other applicable NPDES permits	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The owner/POA will comply with the State General Construction Permit and develop a SWPPP.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Storm drain inlets and catch basins will be labeled with no less than 2" letters stating "No Dumping" and will maintain legibility of stencils and signs.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No outdoor storage planned on site.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The enclosure area will be paved with an impervious surface and provide solid roof or awning to prevent exposure to direct precipitation.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All landscaped areas will be designed based on efficient irrigation systems such as timing and application methods and group plans with similar water requirements to minimize the runoff of excess irrigation water.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All landscape pockets, fingers, setback areas, parkway strips, street medians shall be finish-graded at a min of 1-2 inches below top of curb or sidewalk for increased retention/infiltration of stormwater and irrigation water.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Storm Drain Channel Slope Protection will be concrete lining with velocity dissipation drop structures and rip-rap.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No dock proposed.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No maintenance bays with proposed.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No car washing proposed on site.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No outdoor processing proposed.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No equipment washing proposed.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No fueling proposed.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No hillside landscaping proposed.
S14	Wash water control for food preparation areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No outdoor food preparation is planned for this site. All food preparation will be indoors, wash water for food preparation areas will drain to sanitary sewer.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No community car wash racks proposed.

4.1.2 Site Design BMPs

As part of the planning phase of a project, the site design practices associated with new LID requirements in the Phase II Small MS4 Permit must be considered. Site design BMP measures can result in smaller Design Capture Volume (DCV) to be managed by both LID and hydromodification control BMPs by reducing runoff generation.

As is stated in the Permit, it is necessary to evaluate site conditions such as soil type(s), existing vegetation and flow paths will influence the overall site design.

Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Site Design Practices Checklist
Site Design Practices <i>If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets</i>
Minimize impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: The 23.96-acre site will be developed such that impervious areas are isolated to the existing 3.11-acre and northwesterly 4.41-acre site, while the remaining park site will be landscaped using gravel and DG that is considered 20% impermeable limiting the total imperviousness to 48.9%.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: All drainage channels and playfields are designed as pervious conveyances on the park site as flows travel to the infiltration basin.
Preserve existing drainage patterns and time of concentration: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Off-site flows will be directed to the eastern property line, then north to exit the site as historic native flows, and on-site predeveloped flows will be retained to preserve existing TCs and exit the site at historic conveyance points.
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Developed flows on the center site will be directed to the neighboring parks site into the infiltration Basin
Use of Porous Pavement.: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Desert area is unsuitable for the porous pavement.
Protect existing vegetation and sensitive areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Joshua trees will be protected in a 40-foot radius zone per San Bernardino County LandUse Services Building and Safety Division Information Bulletin No. IB-0016, Sec. 4.1 along with desert tortoise fencing installed around disturbance areas.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: All non-playfields, including hills, elevation changes and parking areas will be constructed with gravel or DG surfaces.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Infiltration basin is outside the construction limits required for paving and building construction.

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: GRASS OR DG SWALES ALONG PLAY FIELDS AND ROCK LINED SWALES DOWN TRANSITION SLOPES SEE EXHIBIT E1
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: All landscape areas will be staked to minimize compaction.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: A retention/detention infiltration basin will be used as an alternative.
Stream Setbacks. Includes a specified distance from an adjacent stream: : Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: No stream beds are located in the project site.

It is noted that, in the Phase II Small MS4 Permit, site design elements for green roofs and vegetative swales are required. Due to the local climatology in the Mojave River Watershed, proactive measures are taken to maximize the amount of drought tolerant vegetation. It is not practical in this region to have green roofs or vegetative swales. As part of site design the project proponent should utilize locally recommended vegetation types for landscaping. Typical landscaping recommendations are found in following local references:

San Bernardino County Special Districts:

Guide to High Desert Landscaping -

<http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795>

Recommended High-Desert Plants -

<http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553>

Mojave Water Agency:

Desert Ranch: <http://www.mojavewater.org/files/desertranchgardenprototype.pdf>

Summertree: <http://www.mojavewater.org/files/Summertree-Native-Plant-Brochure.pdf>

Thornless Garden: <http://www.mojavewater.org/files/thornlessgardenprototype.pdf>

Mediterranean Garden: <http://www.mojavewater.org/files/mediterraneangardenprototype.pdf>

Lush and Efficient Garden: <http://www.mojavewater.org/files/lushandefficientgardenprototype.pdf>

Alliance for Water Awareness and Conservation (AWAC) outdoor tips – <http://hdawac.org/save-outdoors.html>

4.2 Treatment BMPs

After implementation and design of both Source Control BMPs and Site Design BMP measures, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, evapotranspire, and/or bioretain the amount of runoff specified in Permit Section E.12.e (ii)(c) Numeric Sizing Criteria for Storm Water Retention and Treatment.

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.

It is noted that in the Phase II Small MS4 Permit jurisdictions, the LID BMP Design Capture Volume criteria is based on the 2-year rain event. The hydromodification performance criterion is based on the 10-year rain event.

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), San Bernardino County requires use of the P_6 method (Form 4.2-1) For pre- and post-development hydrologic calculation, San Bernardino County requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi²), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for hydromodification performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
¹ Project area DA 1 (ft²): 1,043,537	² Imperviousness after applying preventative site design practices (Imp%): 0.4899	³ Runoff Coefficient (Rc): 0.3328 $R_c = 0.858(\text{Imp}\%)^{1/3} - 0.78(\text{Imp}\%)^{1/2} + 0.774(\text{Imp}\%) + 0.04$
⁴ Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr}-1\text{hr}}$ (in): 0.405 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
⁵ Compute P_6, Mean 6-hr Precipitation (inches): 0.501 $P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)		
⁶ Drawdown Rate Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
⁷ Compute design capture volume, DCV (ft³): 28,468 $\text{DCV} = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2		

Form 4.2-2 Summary of Hydromodification Assessment (DA 1)			
Is the change in post- and pre- condition flows captured on-site? : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If "Yes", then complete Hydromodification assessment of site hydrology for 10yr storm event using Forms 4.2-3 through 4.2-5 and insert results below (Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual- Addendum 1) If "No," then proceed to Section 4.3 BMP Selection and Sizing			
Condition	Runoff Volume (ft ³)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	¹ 80,046 Form 4.2-3 Item 12	² 15.55 Form 4.2-4 Item 13	³ 17.39 Form 4.2-5 Item 10
Post-developed	⁴ 52,710 Form 4.2-3 Item 13	⁵ 14.81 Form 4.2-4 Item 14	⁶ 17.10 Form 4.2-5 Item 14
Difference	⁷ (27,336) Item 4 – Item 1	⁸ 0.74 Item 2 – Item 5	⁹ (0.30) Item 6 – Item 3
Difference (as % of pre-developed)	¹⁰ (34%) Item 7 / Item 1	¹¹ 5% Item 8 / Item 2	¹² (2%) Item 9 / Item 3

Form 4.2-3 Hydromodification Assessment for Runoff Volume (DA 1)

Weighted Curve Number Determination for: Pre-developed DA	DMA A1	DMA A2	DMA B	DMA C	SEE EXHIBIT D2			
1a Land Cover type	COM	LANDSCAPE	BARREN	A-GRASS-POOR				
2a Hydrologic Soil Group (HSG)	A	A	A	A				
3a DMA Area, ft ² <i>sum of areas of DMA should equal area of DA</i>	52,242	83,001	496,697	411,597				
4a Curve Number (CN) <i>use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>	98	32	78	67				
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	SEE EXHIBIT E1					
1b Land Cover type	COM	LANDSC						
2b Hydrologic Soil Group (HSG)	A	A						
3b DMA Area, ft ² <i>sum of areas of DMA should equal area of DA</i>	511,209	532,329						
4b Curve Number (CN) <i>use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>	98	32						
5 Pre-Developed area-weighted CN: 71	7 Pre-developed soil storage capacity, S (in): 4.08 $S = (1000 / \text{Item 5}) - 10$				9 Initial abstraction, I _a (in): 0.82 $I_a = 0.2 * \text{Item 7}$			
6 Post-Developed area-weighted CN: 64	8 Post-developed soil storage capacity, S (in): 5.54 $S = (1000 / \text{Item 6}) - 10$				10 Initial abstraction, I _a (in): 1.11 $I_a = 0.2 * \text{Item 8}$			
11 Precipitation for 10 yr, 24 hr storm (in): 3.27 Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html								
12 Pre-developed Volume (ft ³): 80,046 $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 9})^2 / ((\text{Item 11} - \text{Item 9} + \text{Item 7}))]$								
13 Post-developed Volume (ft ³): 52,710 $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 10})^2 / ((\text{Item 11} - \text{Item 10} + \text{Item 8}))]$								
14 Volume Reduction needed to meet hydromodification requirement, (ft ³): (29,971) $V_{hydro} = (\text{Item 13} * 0.95) - \text{Item 12}$								

Form 4.2-4 Hydromodification Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA (For projects using the Hydrology Manual complete the form below)

Variables	Pre-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>				Post-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>			
	DMA A	DMA B	SEE EXHIBIT D3		DMA A	DMA B	SEE EXHIBIT E1	
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>	533	405			533	761		
2 Change in elevation (ft)	13	18			13	33		
3 Slope (ft/ft), $S_o = \text{Item 2} / \text{Item 1}$	0.0244	0.0444			0.0244	0.0434		
4 Land cover	com	u-poor			COM	Landsc		
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>	13.5	10			13.5	13.5		
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>	1,274 42 FT S=0.0330	857 8 FT S=0.0201			1533 35 FT S=0.0228	448 5 FT S=0.0112		
7 Cross-sectional area of channel (ft ²)	27	27			27	27		
8 Wetted perimeter of channel (ft)	20	20			20	20		
9 Manning's roughness of channel (n)	0.03	0.03			0.03	0.04		
10 Channel flow velocity (ft/sec) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7} / \text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$	11.02	15.78			9.17	4.81		
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$	1.93	0.42			2.79	1.55		
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$	15.43	10.42			16.29	15.05		
13 Pre-developed time of concentration (min): 10.42 <i>Minimum of Item 12 pre-developed DMA</i>								
14 Post-developed time of concentration (min): 15.05 <i>Minimum of Item 12 post-developed DMA</i>								
15 Additional time of concentration needed to meet hydromodification requirement (min): (5.15) $T_{C-Hydro} = (\text{Item 13} * 0.95) - \text{Item 14}$								

Form 4.2-5 Hydromodification Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet (Use additional forms if more than 3 DMA)			Post-developed DA to Project Outlet (Use additional forms if more than 3 DMA)								
	DMA A	DMA B		DMA A	DMA B							
1 Rainfall Intensity for storm duration equal to time of concentration $I_{peak} = 10^{(LOG \text{ Form 4.2-1 Item 4} - 0.7 LOG \text{ Form 4.2-4 Item 5} / 60)}$	1.15	1.42	SEE EXHIBIT D3	1.15	1.15	SEE EXHIBIT E1						
2 Drainage Area of each DMA (Acres) <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>	12.44	11.52		11.74	12.22							
3 Ratio of pervious area to total area <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>	0.90	0.99		0.51	0.51							
4 Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>	0.54	0.54		0.64	0.64							
5 Maximum loss rate (in/hr) $F_m = \text{Item 3} * \text{Item 4}$ <i>Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>	0.488	0.535		0.3265	0.3265							
6 Peak Flow from DMA (cfs) $Q_p = \text{Item 2} * 0.9 * (\text{Item 1} - \text{Item 5})$	7.42	9.17		8.70	9.06							
7 Time of concentration adjustment factor for other DMA to site discharge point <i>Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)</i>	DMA A	n/a	0.676	n/a	0.924	0						
	DMA B	1	n/a	1	n/a	0						
	DMA C			n/a		n/a						
8 Pre-developed Q_p at T_c for DMA A: 11.73 $Q_p = \text{Item } 6_{DMAA} + [\text{Item } 6_{DMAB} * (\text{Item } 1_{DMAA} - \text{Item } 5_{DMAB}) / (\text{Item } 1_{DMAB} - \text{Item } 5_{DMAB}) * \text{Item } 7_{DMAA/2}] + [\text{Item } 6_{DMAC} * (\text{Item } 1_{DMAA} - \text{Item } 5_{DMAC}) / (\text{Item } 1_{DMAC} - \text{Item } 5_{DMAC}) * \text{Item } 7_{DMAA/3}]$	9 Pre-developed Q_p at T_c for DMA B: 11.73 $Q_p = \text{Item } 6_{DMAB} + [\text{Item } 6_{DMAA} * (\text{Item } 1_{DMAB} - \text{Item } 5_{DMAA}) / (\text{Item } 1_{DMAA} - \text{Item } 5_{DMAA}) * \text{Item } 7_{DMAB/1}] + [\text{Item } 6_{DMAC} * (\text{Item } 1_{DMAB} - \text{Item } 5_{DMAC}) / (\text{Item } 1_{DMAC} - \text{Item } 5_{DMAC}) * \text{Item } 7_{DMAB/3}]$			10 Pre-developed Q_p at T_c for DMA C: 0.00 $Q_p = \text{Item } 6_{DMAC} + [\text{Item } 6_{DMAA} * (\text{Item } 1_{DMAC} - \text{Item } 5_{DMAA}) / (\text{Item } 1_{DMAA} - \text{Item } 5_{DMAA}) * \text{Item } 7_{DMAC/1}] + [\text{Item } 6_{DMAB} * (\text{Item } 1_{DMAC} - \text{Item } 5_{DMAB}) / (\text{Item } 1_{DMAB} - \text{Item } 5_{DMAB}) * \text{Item } 7_{DMAC/2}]$								
10 Peak runoff from pre-developed condition confluence analysis (cfs): 11.73 <i>Maximum of Item 8, 9, and 10 (including additional forms as needed)</i>												
11 Post-developed Q_p at T_c for DMA A: 17.08 <i>Same as Item 8 for post-developed values</i>	12 Post-developed Q_p at T_c for DMA B: 17.08 <i>Same as Item 9 for post-developed values</i>			13 Post-developed Q_p at T_c for DMA C: 0.00 <i>Same as Item 10 for post-developed values</i>								
14 Peak runoff from post-developed condition confluence analysis (cfs): 17.08 <i>Maximum of Item 11, 12, and 13 (including additional forms as needed)</i>												
15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): 4.50 $Q_{p-hydro} = (\text{Item } 14 * 0.95) - \text{Item } 10$												

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretenention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design Measures (Form 4.3-2)
- Retention and Infiltration BMPs (Form 4.3-3) or
- Biotreatment BMPs (Form 4.3-4).

Please note that the selected BMPs may also be used as dual purpose for on-site, hydromodification mitigation and management.

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is “Yes,” provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Form 4.3-2 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable Site Design BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of site design, retention and/or infiltration BMPs is unable to mitigate the entire DCV, then the remainder of the volume-based performance criteria that cannot be achieved with site design, retention and/or infiltration BMPs must be managed through biotreatment BMPs. If biotreatment BMPs are used, then they must be sized to provide equivalent effectiveness based on Template Section 4.3.4.

4.3.1 Exceptions to Requirements for Bioretention Facilities

Contingent on a demonstration that use of bioretention or a facility of equivalent effectiveness is infeasible, other types of biotreatment or media filters (such as tree-box-type biofilters or in-vault media filters) may be used for the following categories of Regulated Projects:

- 1) Projects creating or replacing an acre or less of impervious area, and located in a designated pedestrian-oriented commercial district (i.e., smart growth projects), and having at least 85% of the entire project site covered by permanent structures;
- 2) Facilities receiving runoff solely from existing (pre-project) impervious areas; and
- 3) Historic sites, structures or landscapes that cannot alter their original configuration in order to maintain their historic integrity.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)	
Feasibility Criterion – Complete evaluation for each DA on the Project Site	
¹ Would infiltration BMP pose significant risk for groundwater related concerns? <i>Refer to Section 5.3.2.1 of the TGD for WQMP</i>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
² Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<ul style="list-style-type: none"> • The location is less than 50 feet away from slopes steeper than 15 percent • The location is less than ten feet from building foundations or an alternative setback. • A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards. 	
If Yes, Provide basis: (attach)	
³ Would infiltration of runoff on a Project site violate downstream water rights?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
⁴ Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
⁵ Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
⁶ Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? <i>See Section 3.5 of the TGD for WQMP and WAP</i>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
⁷ Any answer from Item 1 through Item 3 is “Yes”: <i>If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Selection and Evaluation of Biotreatment BMP.</i> <i>If no, then proceed to Item 8 below.</i>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
⁸ Any answer from Item 4 through Item 6 is “Yes”: <i>If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Site Design BMP.</i> <i>If no, then proceed to Item 9, below.</i>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
⁹ All answers to Item 1 through Item 6 are “No”: <i>Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.</i> <i>Proceed to Form 4.3-2, Site Design BMPs.</i>	

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that

either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, complete Items 2-5; If no, proceed to Item 6	DA 1 DMA C BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
2 Total impervious area draining to pervious area (ft ²)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft ³) $V = \text{Item 2} * \text{Item 3} * (0.5/12)$, assuming retention of 0.5 inches of runoff			
5 Sum of retention volume achieved from impervious area dispersion (ft ³): $V_{\text{retention}} = \text{Sum of Item 4 for all BMPs}$			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
7 Ponding surface area (ft ²)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft ²)			
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft ³) $V_{\text{retention}} = (\text{Item 7} * \text{Item 8}) + (\text{Item 9} * \text{Item 10} * \text{Item 11})$			
13 Runoff volume retention from on-lot infiltration (ft ³): $V_{\text{retention}} = \text{Sum of Item 12 for all BMPs}$			

Form 4.3-2 Site Design BMPs (DA 1)			
Form 4.3-2 cont. Site Design BMPs (DA 1)			
14 Implementation of Street Trees: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 14-18. If no, proceed to Item 19</i>	DA 1 BMP Type	DMA 1 BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft ²)			
17 Runoff volume retention from street trees (ft ³) <i>$V_{\text{retention}} = \text{Item 15} * \text{Item 16} * (0.05/12)$ assume runoff retention of 0.05 inches</i>			
18 Runoff volume retention from street tree BMPs (ft ³): 0 <i>$V_{\text{retention}} = \text{Sum of Item 17 for all BMPs}$</i>			
19 Total Retention Volume from Site Design BMPs: 0 <i>Sum of Items 5, 13 and 18</i>			

4.3.3 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix C of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

4.3.3.1 Allowed Variations for Special Site Conditions

The bioretention system design parameters of this Section may be adjusted for the following special site conditions:

- 1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.
- 2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a “flow-through planter”).
- 3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.
- 4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide adequate pretreatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with no chance of spill migration.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)

1 Remaining LID DCV not met by site design BMP (ft³): 28468 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 19}$

BMP Type Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs	DA 1 DMA C BMP Type Basin	DA 1 DMA C BMP Type channel	DA DMA BMP Type (Use additional forms for more BMPs)
2 Infiltration rate of underlying soils (in/hr) See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods	8.3		
3 Infiltration safety factor See TGD Section 5.4.2 and Appendix D	3.44		
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	2.41		
5 Ponded water drawdown time (hr) Copy Item 6 in Form 4.2-1	48		
6 Maximum ponding depth (ft) BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details	6.5		SEE EXHIBIT K RETENTION DEPTH
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	6.5		
8 Infiltrating surface area, SA_{BMP} (ft ²) the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP	7874		SEE EXHIBIT K SF @ AVG. 3.25 FT DEPTH
9 Amended soil depth, d_{media} (ft) Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details	0		
10 Amended soil porosity	0		
11 Gravel depth, d_{media} (ft) Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details	0		
12 Gravel porosity	0		
13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs	3		
14 Above Ground Retention Volume (ft ³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$	55,927		
15 Underground Retention Volume (ft ³) Volume determined using manufacturer's specifications and calculations	0		
16 Total Retention Volume from LID Infiltration BMPs: 55,927 (Sum of Items 14 and 15 for all infiltration BMP included in plan)			
17 Fraction of DCV achieved with infiltration BMP: 196% $\text{Retention\%} = \text{Item 16} / \text{Form 4.2-1 Item 7}$			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.			

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

- Use Form 4.3-5 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-6 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-7 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-4 Selection and Evaluation of Biotreatment BMP (DA 1)		
1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft ³): 0 <i>Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16</i>		List pollutants of concern <i>Copy from Form 2.3-1.</i> Nutrients, Noxious Aquatic Plants, Metals, Oil and Grease, Trash/Debris, Pesticide, Organic Compounds
2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i>	Volume-based biotreatment <i>Use Forms 4.3-5 and 4.3-6 to compute treated volume</i>	Flow-based biotreatment <i>Use Form 4.3-7 to compute treated flow</i>
	<input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention	<input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input type="checkbox"/> Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft ³): 0.00 <i>Form 4.3-5 Item 15 + Form 4.3-6 Item 13</i>	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft ³): 0 <i>Item 1 – Item 3</i>	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 1% <i>Item 4 / Item 1</i>
6 Flow-based biotreatment BMP capacity provided (cfs): 0.00 <i>Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)</i>		
7 Metrics for MEP determination: <ul style="list-style-type: none"> • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input checked="" type="checkbox"/> <i>If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.</i> 		

Form 4.3-5 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type (Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>			
2 Amended soil infiltration rate <i>Typical ~ 5.0</i>			
3 Amended soil infiltration safety factor <i>Typical ~ 2.0</i>			
4 Amended soil design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$			
5 Ponded water drawdown time (hr) <i>Copy Item 6 from Form 4.2-1</i>			
6 Maximum ponding depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	.33		
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$			
8 Amended soil surface area (ft ²)			
9 Amended soil depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
10 Amended soil porosity, n			
11 Gravel depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
12 Gravel porosity, n			
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>			
14 Biotreated Volume (ft ³) $V_{biotreated} = \text{Item 8} * [(\text{Item 7} / 2) + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: <i>Sum of Item 14 for all volume-based BMPs included in this form</i>			

Form 4.3-6 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type <i>Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (E.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.</i>	DA DMA BMP Type		DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft ²) $A_{bottom} = \text{Item 2} * \text{Item 3}$				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft ²) $A_{surface} = (\text{Item 2} + (2 * \text{Item 5} * \text{Item 6})) * (\text{Item 3} + (2 * \text{Item 5} * \text{Item 6}))$				
8 Storage volume (ft ³) <i>For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i> $V = \text{Item 6} / 3 * [\text{Item 4} + \text{Item 7} + (\text{Item 4} * \text{Item 7})^{0.5}]$				
9 Drawdown Time (hrs) <i>Copy Item 6 from Form 2.1</i>				
10 Outflow rate (cfs) $Q_{BMP} = (\text{Item 8}_{forebay} + \text{Item 8}_{basin}) / (\text{Item 9} * 3600)$				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft ³) $V_{biotreated} = (\text{Item 8}_{forebay} + \text{Item 8}_{basin}) * (\text{Item 10} * \text{Item 11} * 3600)$				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : <i>(Sum of Item 12 for all BMP included in plan)</i>				

Form 4.3-7 Flow Based Biotreatment (DA 1)			
Biotreatment BMP Type <i>Vegetated swale, vegetated filter strip, or other comparable proprietary BMP</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5</i>			
2 Flow depth for water quality treatment (ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
3 Bed slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
4 Manning's roughness coefficient			
5 Bottom width (ft) $b_w = (\text{Form 4.3-5 Item 6} * \text{Item 4}) / (1.49 * \text{Item 2}^{1.67} * \text{Item 3}^{0.5})$			
6 Side Slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
7 Cross sectional area (ft ²) $A = (\text{Item 5} * \text{Item 2}) + (\text{Item 6} * \text{Item 2}^2)$			
8 Water quality flow velocity (ft/sec) $V = \text{Form 4.3-5 Item 6} / \text{Item 7}$			
9 Hydraulic residence time (min) <i>Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
10 Length of flow based BMP (ft) $L = \text{Item 8} * \text{Item 9} * 60$			
11 Water surface area at water quality flow depth (ft ²) $SA_{top} = (\text{Item 5} + (2 * \text{Item 2} * \text{Item 6})) * \text{Item 10}$			

4.3.5 Conformance Summary

Complete Form 4.3-8 to demonstrate how on-site LID DCV is met with proposed site design, infiltration, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)	
1	Total LID DCV for the Project DA-1 (ft ³): 28,468 <i>Copy Item 7 in Form 4.2-1</i>
2	On-site retention with site design BMP (ft ³): 0.00 <i>Copy Item 18 in Form 4.3-2</i>
3	On-site retention with LID infiltration BMP (ft ³): 31,431 <i>Copy Item 16 in Form 4.3-3</i>
4	On-site biotreatment with volume based biotreatment BMP (ft ³): 0.00 <i>Copy Item 3 in Form 4.3-4</i>
5	Flow capacity provided by flow based biotreatment BMP (cfs): 0.00 <i>Copy Item 6 in Form 4.3-4</i>
6	<p>LID BMP performance criteria are achieved if answer to any of the following is "Yes":</p> <ul style="list-style-type: none"> Full retention of LID DCV with site design or infiltration BMP: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, sum of Items 2, 3, and 4 is greater than Item 1</i> Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3-5 Item 6 and Items 2, 3 and 4 are maximized</i> On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i>
7	<p>If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:</p> <ul style="list-style-type: none"> Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: <input type="checkbox"/> <i>Checked yes if Form 4.3-4 Item 7 is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$</i> Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated: <ul style="list-style-type: none"> 1) Equal or greater amount of runoff infiltrated or evapotranspired; <input type="checkbox"/> 2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; <input type="checkbox"/> 3) Equal or greater protection against shock loadings and spills; <input type="checkbox"/> 4) Equal or greater accessibility and ease of inspection and maintenance. <input type="checkbox"/>

4.3.6 Hydromodification Control BMP

Use Form 4.3-9 to compute the remaining runoff volume retention, after Site Design BMPs are implemented, needed to address hydromodification, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential hydromodification. Describe the proposed hydromodification treatment control BMP. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-9 Hydromodification Control BMPs (DA 1)	
1 Volume reduction needed for hydromodification performance criteria (ft ³): (29,971) <i>(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</i>	2 On-site retention with site design and infiltration, BMP (ft ³): 55,927 <i>Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction</i>
3 Remaining volume for hydromodification volume capture (ft ³): (85,899) <i>Item 1 – Item 2</i>	4 Volume capture provided by incorporating additional on-site BMPs (ft ³): 0.00
5 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:</i> <ul style="list-style-type: none"> Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP <input type="checkbox"/> Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities <input type="checkbox"/> 	
6 Form 4.2-2 Item 12 less than or equal to 5%: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:</i> <ul style="list-style-type: none"> Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs <input type="checkbox"/> 	

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance.

Alternative Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:

- 1) Equal or greater amount of runoff infiltrated or evapotranspired;
- 2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment;
- 3) Equal or greater protection against shock loadings and spills;
- 4) Equal or greater accessibility and ease of inspection and maintenance.

The Project Proponent will need to obtain written approval for an alternative design from the Lahontan Regional Water Board Executive Officer (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMPs included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and a Maintenance Agreement. The Maintenance Agreement must also be attached to the WQMP.

Note that at time of Project construction completion, the Maintenance Agreement must be completed, signed, notarized and submitted to the County Stormwater Department

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
In-filtration Channel	PPHCSD GM	Inspect channel and remove any visible debris.	Bi-annually
In-filtration Basin	PPHCSD GM	Inspect Basin and remove any visible debris.	Bi-annually
SD-12 Efficient Irrigation	PPHCSD GM	Owner shall inspect or hire landscape maintenance company to inspect irrigation systems and control systems to ensure they are operating efficiently in order to minimize water usage.	Monthly
SD-13 Storm Drain Signs	PPHCSD GM	Owner shall inspect and maintain the legibility of all stencils, markings and signs.	Bi-annually
SD-32 Trash Enclosure	PPHCSD GM	The owner shall inspect and maintain screens, covers, signs for legibility and all trash enclosures and bins for leakage and deterioration of underline pavement.	Bi-monthly
BG-40 Landscape	PPHCSD GM	Allow leaf drop to become part of the mulch layer in tree shrub, and ground cover areas, keep lawn mower blades sharp, grass dash cycle	Bi-monthly

MOJAVE RIVER WATERSHED Water Quality Management Plan (WQMP)

Inspection and O&M		collect lawn and garden clippings, perform soils analysis seasonally, apply chemical furnace wisers only as needed by a certified applicator, prune plants sparingly.	
BG-30 Food prep inspection and O&M	PPHCSD GM	cleaning of equipment, grease handling and disposal, spills, surface cleaning, cooling and refrigeration equipment maintenance, landscaping and grounds maintenance, dumpster, loading area, parking lots, inspection of food preparation areas	Daily
WM-4 spill kit inspection and O&M	PPHCSD GM	absorbent spill clean up materials and spill kit shall be available on site and used on small spills instead of hosing down or burying techniques. Spill kit materials should be disposed of after use	verify weekly that spill control cleanup materials are present
MP-52 CATCH BASIN	PPHCSD GM	INSPECT FOR TRASH AND DEBRIS AND DAMAGE	MONTHLY
N11 LITTER AND DEBRIS	PPHCSD GM	INSPECT FOR TRASH AND DEBRIS AND DAMAGE. IMPLEMENT TRASH MANAGEMENT PROCEDURES IN COMMON AREAS	WEEKLY
SC-43 VACUUM SWEEPING	PPHCSD GM	INSPECT PARKING AREAS FOR DEBRIS ACCUMULATION	ANNUALLY PRIOR TO OCT 1ST
RIP-RAP	PPHCSD GM	INSPECT FOR TRASH AND DEBRIS AND REPLACE DAMAGED STONES	MONTHLY
VEGETATED SWALE	PPHCSD GM	INSPECT FOR TRASH AND DEBRIS AND DAMAGE	MONTHLY

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C,C&R's & Lease Agreements

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C,C&R's & Lease Agreements

LOCATION / LAND USE MAP

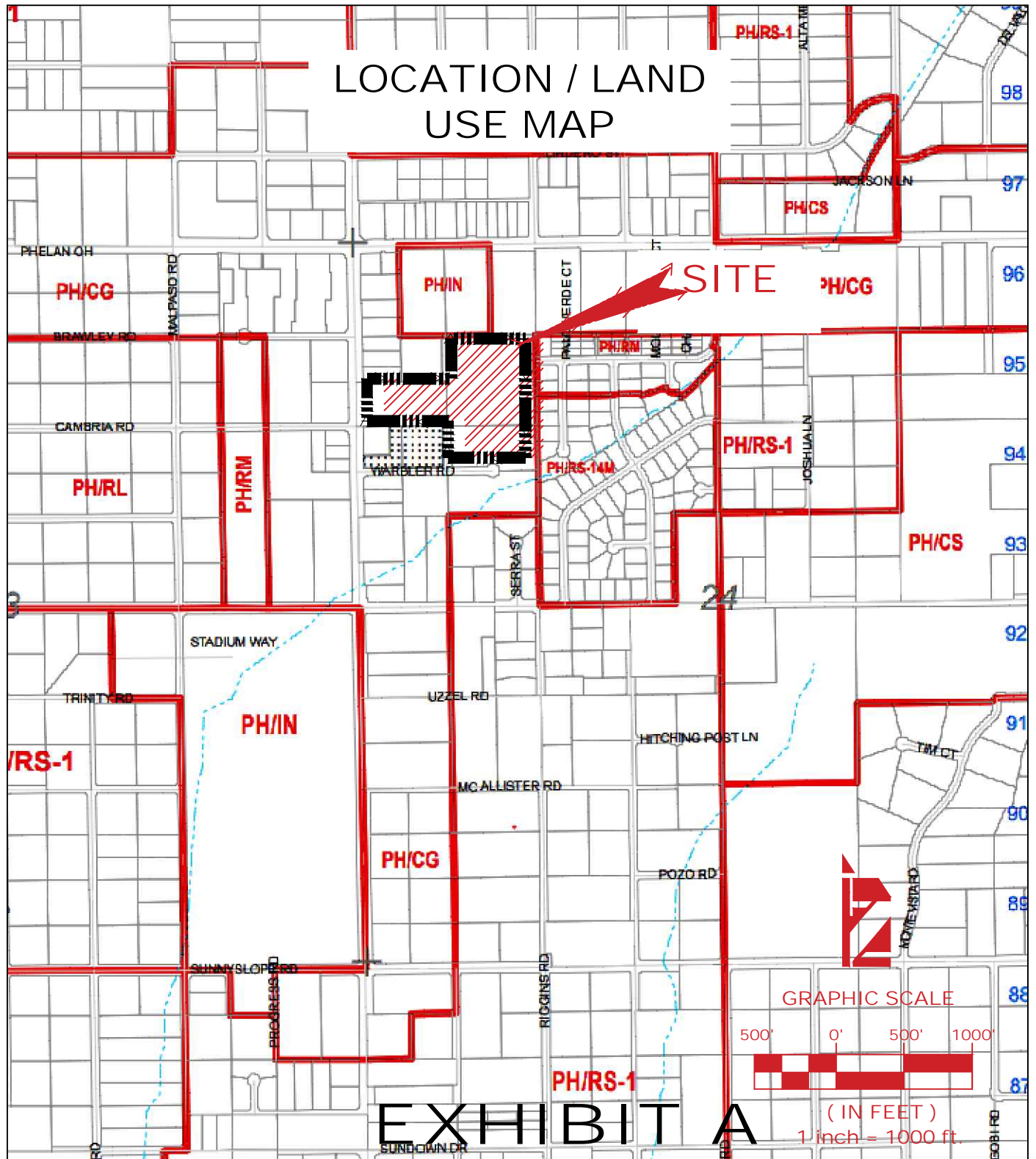


EXHIBIT A

DATE: 07/14/2023

DRAWN BY: DWL

CHECKED BY: DWL

SCALE: NTS

LOCATION

PPHCSD-COMMUNITY CENTER
PHELAN - SAN BERNARDINO, CA
COUNTY, CA
APN: 3066-251-18, &
3066-261-10





POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.083 (0.069-0.101)	0.118 (0.098-0.144)	0.167 (0.138-0.205)	0.209 (0.171-0.259)	0.270 (0.214-0.345)	0.320 (0.248-0.417)	0.373 (0.282-0.498)	0.430 (0.316-0.591)	0.510 (0.360-0.732)	0.576 (0.392-0.855)
10-min	0.119 (0.099-0.145)	0.170 (0.140-0.207)	0.240 (0.198-0.294)	0.300 (0.246-0.371)	0.388 (0.307-0.495)	0.459 (0.355-0.598)	0.534 (0.404-0.714)	0.616 (0.452-0.847)	0.732 (0.515-1.05)	0.826 (0.562-1.23)
15-min	0.144 (0.120-0.176)	0.205 (0.170-0.250)	0.290 (0.239-0.355)	0.363 (0.297-0.448)	0.469 (0.371-0.598)	0.555 (0.430-0.723)	0.646 (0.488-0.864)	0.745 (0.547-1.02)	0.885 (0.623-1.27)	0.998 (0.679-1.48)
30-min	0.207 (0.172-0.252)	0.294 (0.243-0.359)	0.416 (0.343-0.509)	0.521 (0.426-0.643)	0.672 (0.532-0.858)	0.796 (0.616-1.04)	0.927 (0.701-1.24)	1.07 (0.785-1.47)	1.27 (0.894-1.82)	1.43 (0.974-2.13)
60-min	0.285 (0.236-0.348)	0.405 (0.335-0.495)	0.574 (0.473-0.702)	0.718 (0.587-0.886)	0.927 (0.733-1.18)	1.10 (0.849-1.43)	1.28 (0.966-1.71)	1.47 (1.08-2.02)	1.75 (1.23-2.51)	1.97 (1.34-2.93)
2-hr	0.420 (0.348-0.512)	0.576 (0.476-0.703)	0.791 (0.653-0.969)	0.975 (0.798-1.20)	1.24 (0.980-1.58)	1.45 (1.13-1.89)	1.68 (1.27-2.24)	1.92 (1.41-2.64)	2.26 (1.59-3.24)	2.53 (1.72-3.75)
3-hr	0.523 (0.433-0.637)	0.707 (0.585-0.863)	0.960 (0.792-1.18)	1.18 (0.962-1.45)	1.48 (1.17-1.89)	1.73 (1.34-2.26)	1.99 (1.51-2.66)	2.27 (1.67-3.12)	2.66 (1.88-3.82)	2.97 (2.02-4.41)
6-hr	0.750 (0.621-0.914)	1.00 (0.832-1.23)	1.35 (1.12-1.66)	1.65 (1.35-2.03)	2.06 (1.63-2.63)	2.39 (1.86-3.12)	2.74 (2.07-3.66)	3.11 (2.29-4.28)	3.63 (2.55-5.20)	4.04 (2.75-5.99)
12-hr	0.997 (0.826-1.22)	1.38 (1.14-1.68)	1.90 (1.56-2.32)	2.32 (1.90-2.87)	2.92 (2.31-3.73)	3.39 (2.63-4.42)	3.88 (2.93-5.19)	4.39 (3.23-6.04)	5.09 (3.59-7.30)	5.65 (3.84-8.39)
24-hr	1.30 (1.15-1.49)	1.87 (1.66-2.16)	2.64 (2.33-3.05)	3.27 (2.86-3.81)	4.14 (3.51-4.99)	4.83 (4.01-5.94)	5.53 (4.48-6.97)	6.27 (4.94-8.12)	7.29 (5.51-9.84)	8.08 (5.90-11.3)
2-day	1.53 (1.35-1.76)	2.23 (1.97-2.57)	3.17 (2.80-3.67)	3.96 (3.47-4.61)	5.05 (4.28-6.08)	5.90 (4.90-7.26)	6.79 (5.50-8.56)	7.72 (6.08-10.0)	9.01 (6.81-12.2)	10.0 (7.32-14.0)
3-day	1.65 (1.46-1.90)	2.42 (2.14-2.79)	3.47 (3.06-4.01)	4.35 (3.81-5.06)	5.56 (4.72-6.70)	6.53 (5.42-8.03)	7.53 (6.10-9.49)	8.59 (6.77-11.1)	10.1 (7.61-13.6)	11.2 (8.21-15.7)
4-day	1.75 (1.55-2.02)	2.58 (2.29-2.98)	3.72 (3.29-4.30)	4.68 (4.10-5.45)	6.02 (5.10-7.25)	7.08 (5.88-8.71)	8.20 (6.64-10.3)	9.38 (7.39-12.1)	11.0 (8.34-14.9)	12.3 (9.02-17.2)
7-day	1.93 (1.71-2.22)	2.86 (2.53-3.30)	4.17 (3.68-4.82)	5.29 (4.63-6.16)	6.88 (5.83-8.29)	8.16 (6.77-10.0)	9.51 (7.70-12.0)	11.0 (8.63-14.2)	13.0 (9.83-17.6)	14.6 (10.7-20.5)
10-day	1.99 (1.76-2.29)	2.97 (2.63-3.42)	4.36 (3.85-5.04)	5.56 (4.87-6.48)	7.30 (6.19-8.79)	8.71 (7.23-10.7)	10.2 (8.27-12.9)	11.8 (9.32-15.3)	14.1 (10.7-19.1)	16.0 (11.7-22.4)
20-day	2.30 (2.04-2.65)	3.49 (3.09-4.02)	5.21 (4.60-6.03)	6.73 (5.90-7.85)	8.99 (7.61-10.8)	10.9 (9.01-13.3)	12.9 (10.4-16.2)	15.1 (11.9-19.5)	18.2 (13.8-24.6)	20.8 (15.2-29.1)
30-day	2.67 (2.37-3.07)	4.04 (3.58-4.66)	6.07 (5.36-7.02)	7.89 (6.90-9.19)	10.6 (8.98-12.8)	12.9 (10.7-15.8)	15.3 (12.4-19.3)	18.0 (14.2-23.3)	21.9 (16.6-29.6)	25.2 (18.4-35.2)
45-day	3.15 (2.79-3.63)	4.73 (4.19-5.46)	7.09 (6.26-8.20)	9.22 (8.07-10.7)	12.4 (10.5-15.0)	15.2 (12.6-18.7)	18.2 (14.7-22.9)	21.4 (16.9-27.7)	26.2 (19.8-35.4)	30.1 (22.0-42.1)
60-day	3.51 (3.11-4.04)	5.20 (4.60-5.99)	7.75 (6.84-8.96)	10.1 (8.82-11.7)	13.6 (11.5-16.4)	16.6 (13.8-20.4)	19.9 (16.1-25.1)	23.5 (18.5-30.4)	28.8 (21.7-38.8)	33.1 (24.2-46.3)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

EXHIBIT C



United States
Department of
Agriculture

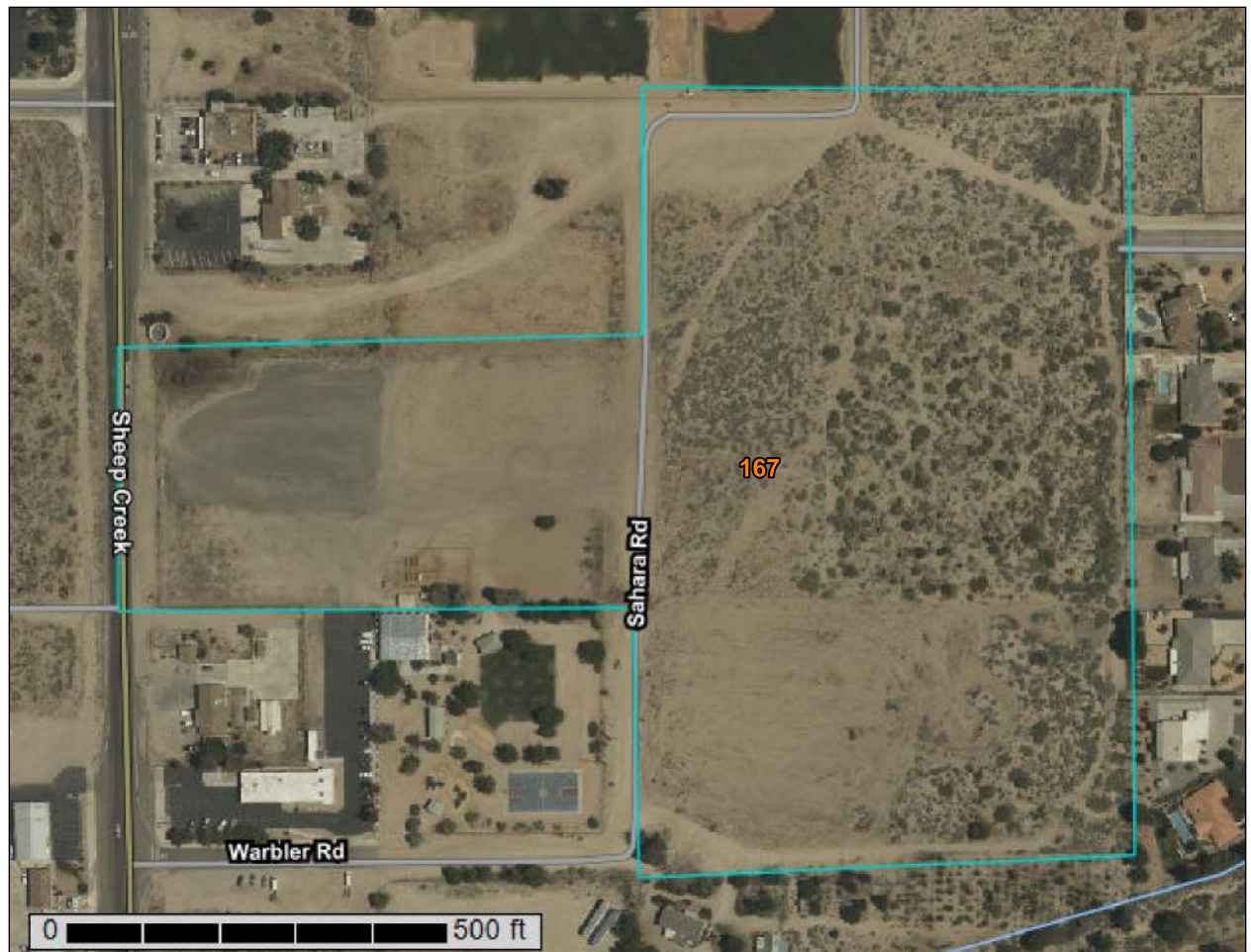
NRCS

Natural
Resources
Conservation
Service

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

Custom Soil Resource Report for San Bernardino County, California, Mojave River Area

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
167	TUJUNGA SAND, COOL, 2 TO 9 PERCENT SLOPES	20.7	100.0%
Totals for Area of Interest		20.7	100.0%



San Bernardino County, California, Mojave River Area

167—TUJUNGA SAND, COOL, 2 TO 9 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkt9
Elevation: 2,700 to 4,300 feet
Mean annual precipitation: 6 to 9 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 150 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Tujunga

Setting

Landform: Fan aprons
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 14 inches: sand
H2 - 14 to 60 inches: stratified gravelly sand to gravelly loamy sand

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: NoneOccasional
Frequency of ponding: None
Available water capacity: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R030XE006CA - COARSE LOAMY
Hydric soil rating: No

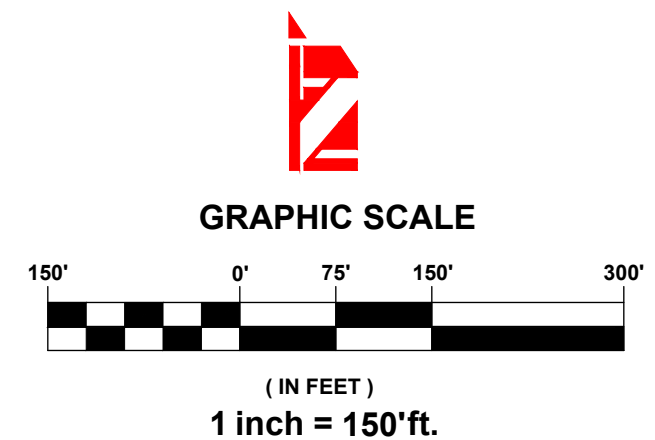
Minor Components

Soboba

Percent of map unit: 4 percent

Hanford

Percent of map unit: 4 percent



WATER QUALITY MANAGEMENT PLAN

WQMP AREAS ADDED TO SITE

FOR:
PPHCSD

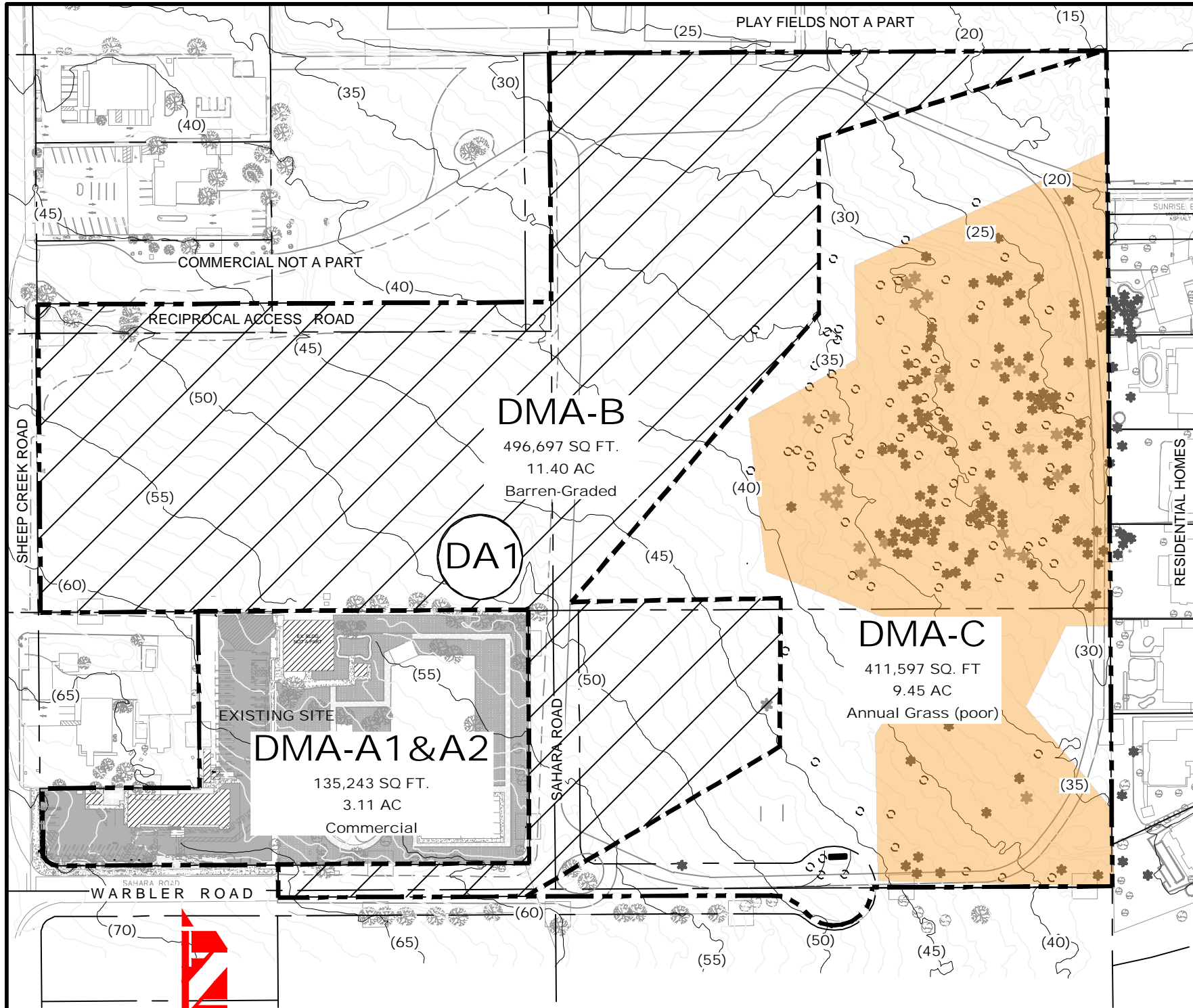
IN
**PHELAND
SAN BERNARDINO
COUNTY, CA**

APN:
**3066-261-10
3066-251-18**

RED BRICK SOLUTION

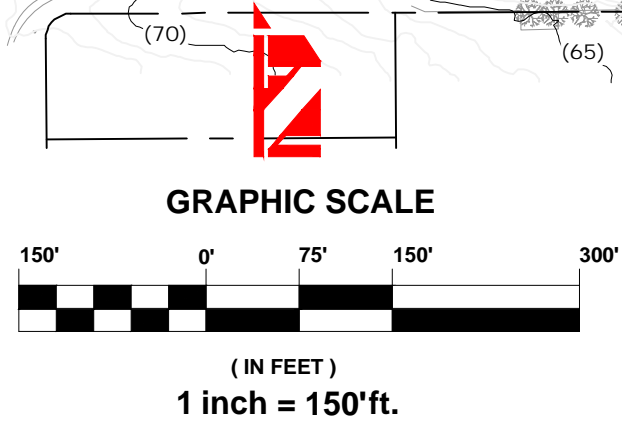
CONSULTING ENGINEERS
& ARCHITECTS

EXHIBIT D1



LEGEND:

- DA1 DRAINAGE AREA
- DMA-A DRAINAGE MANAGEMENT AREA - A
- ## NODE #
- XX.XX SPOT ELEVATION
- OVERALL BOUNDARY
- DMA BOUNDARY
- SUBAREA FLOWLINE
- EG EXISTING GRADE
- FG FINISH GRADE
- FS FINISH SURFACE
- FF FINISH FLOOR
- IE INVERTELEVATION
- BARREN - GRADED
- PROTECTED VEGETATION



ADD 4100 TO ELEVATION CALLOUTS

WQMP

ON-SITE
TRIBUTARY
WATERSHED AREA

FOR:
PPHCSD

IN
PHELAN
SAN BERNARDINO
COUNTY, CA

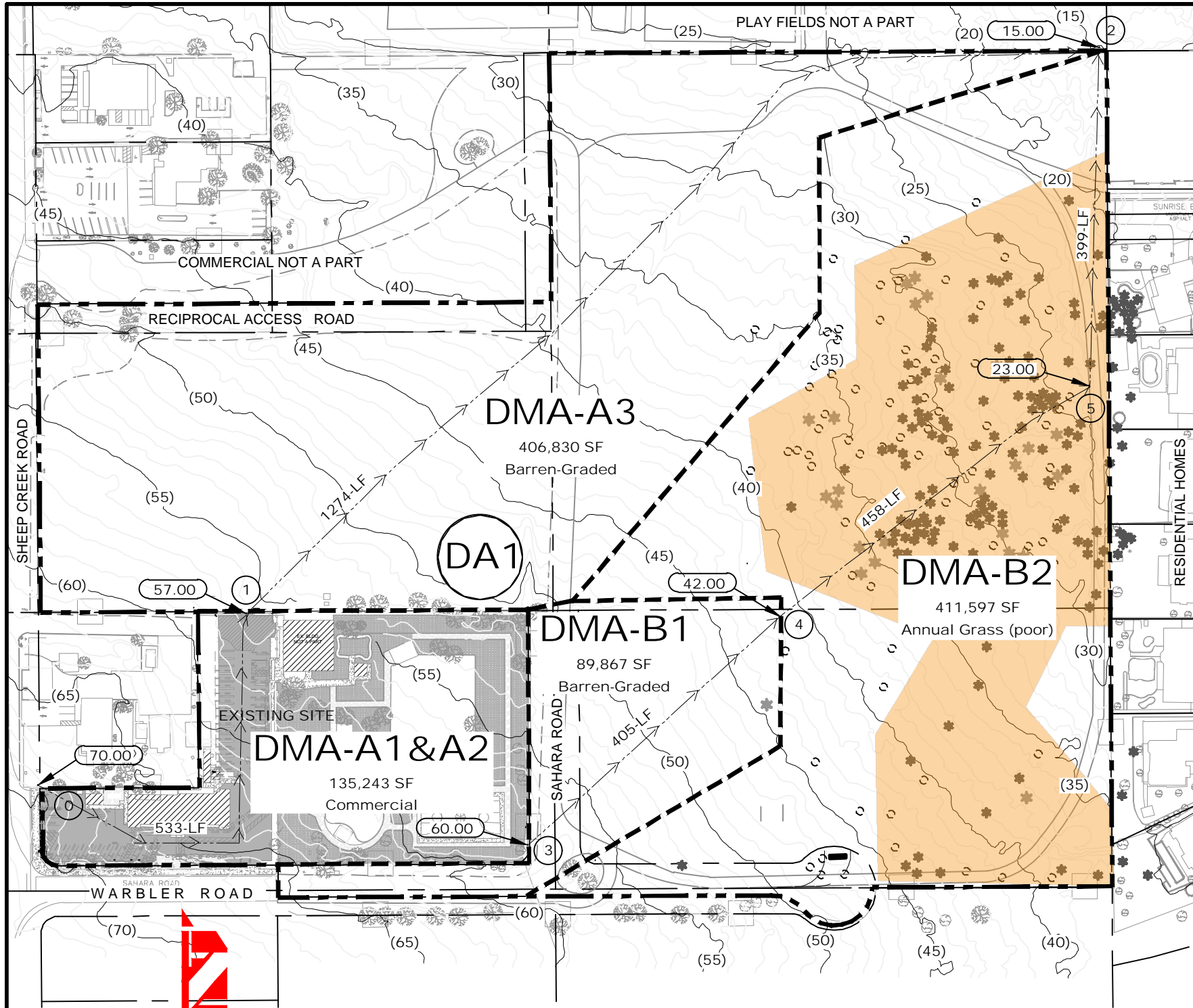
APN:
3066-251-18, &
3066-261-10

SOIL CLASS
LAND COVER

RED
BRICK
SOLUTION

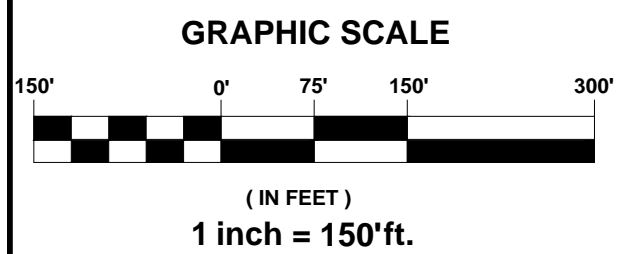
CONSULTING ENGINEERS
& ARCHITECTS

EXHIBIT D2



LEGEND:

- DA1 DRAINAGE AREA
- DMA-A DRAINAGE MANAGEMENT AREA - A
- ## NODE #
- XX.XX SPOT ELEVATION
- OVERALL BOUNDARY
- DMA BOUNDARY
- SUBAREA FLOWLINE
- EG EXISTING GRADE
- FG FINISH GRADE
- FS FINISH SURFACE
- FF FINISH FLOOR
- IE INVERTELEVATION
- PROTECTED VEGETATION



ADD 4100 TO ELEVATION CALLOUTS

WQMP

ON-SITE
TRIBUTARY
WATERSHED AREA

FOR:
PPHCSD

IN
PHELAN
SAN BERNARDINO
COUNTY, CA

APN:
3066-251-18, &
3066-261-10

PRE-DEVELOPED
LAND USE

RED
BRICK
SOLUTION

CONSULTING ENGINEERS
& ARCHITECTS

EXHIBIT D3

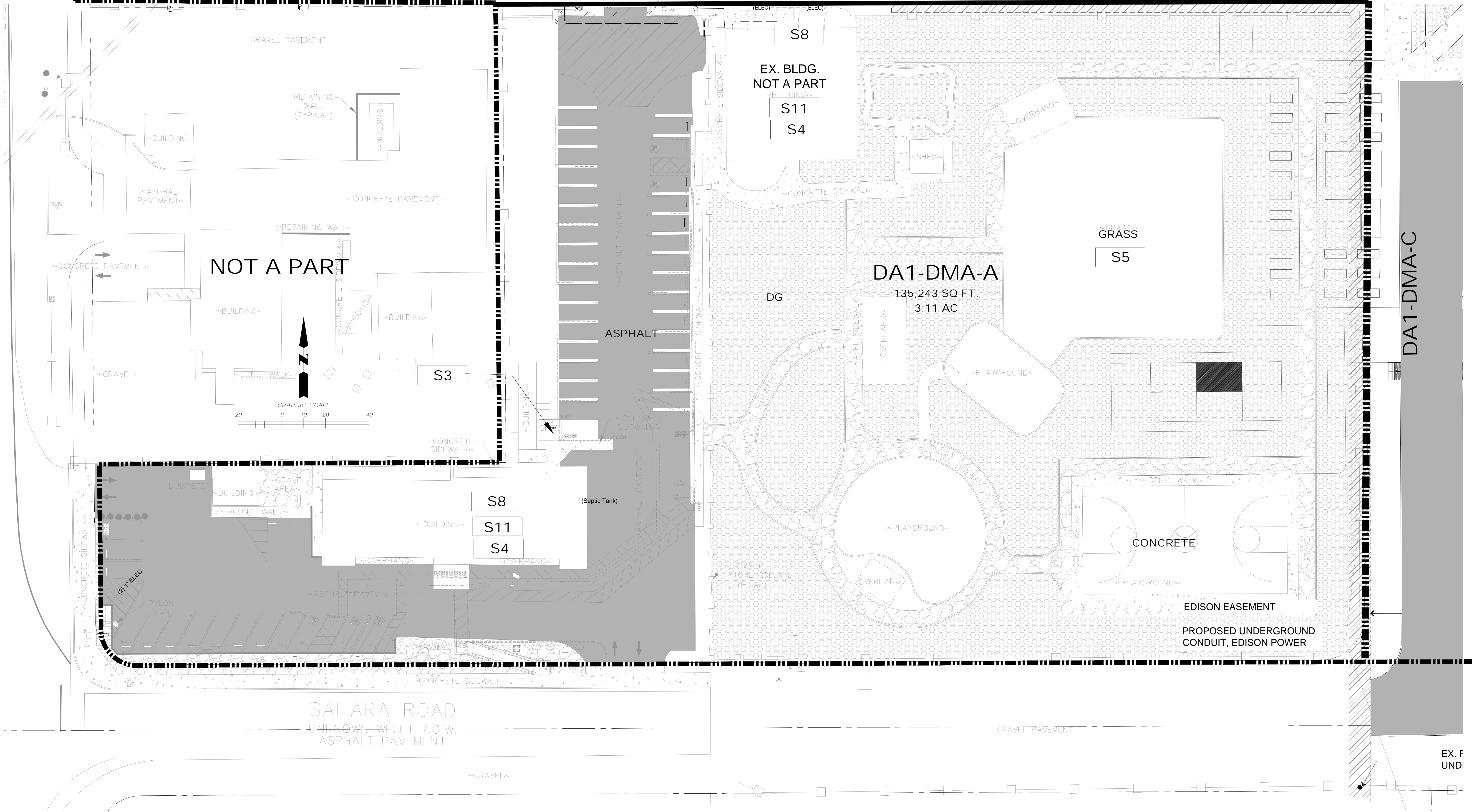


		Areas	imp	per
DMA-A	hardscape	38924	38924	
	Gravel	66590	13318	53272
	Landscape	29729		29729
	Total	135243	52242	83001
DMA-B1&B2	Hardscape	170643	170643	
	Gravel	43597	8719	34877
		214240	179363	34877
	Total			
DMA-C & D	hardscape	210504	210504	
	Gravel	345501	69100	276401
	Landscape	138050		138050
	Total	694055	279604	414451
Project Total		sf	511209	5332939
			48.99%	51.01%

[View all posts by](#) [David Mervin](#)

C:\Users\Owner\OneDrive - Red Brick Consulting Engineers and Architects\Documents - Projects\2020\200039.1 - Phase 1 Civic Center WQMP\PPH\12-WQMP\200039 exhibits.dwg

DA1-DMA-B1&B2



IMPERVIOUS AREAS:

DMA-A	hardscape	Areas	imp	per
	Gravel	38924	38924	53272
	Landscape	29,729.00		29729
	Total	135243	52242	83001

NON-STRUCTURAL SOURCE CONTROL BMPS

- N1 EDUCATION OF PROPERTY OWNERS, TENANTS, AND OCCUPANTS ON STORMWATER BMPS
- N3 LANDSCAPE MANAGEMENT BMPS
- N4 BMP MAINTENANCE
- N6 LOCAL WATER QUALITY ORDINANCES
- N12 EMPLOYEE TRAINING
- N15 VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS

STRUCTURAL SOURCE CONTROL BMPS

- S1 CATCH BASIN OPERATION AND MAINTENANCE
- S2 INFILTRATION BASIN
- S3 TRASH STORAGE AREAS
- S4 EFFICIENT IRRIGATION SYSTEMS
- S5 FINISH GRADE OF LANDSCAPE AREAS AT A MINIMUM 2" BELOW ADJACENT TOP OF CURB, SIDEWALK, OR PAVEMENT. SEE DETAIL HEREON
- S6 STORM DRAIN SIGNAGE
- S7 RIPRAP INSPECTION OPERATION AND MAINTENANCE
- S8 LANDSCAPE INSPECTION OPERATION AND MAINTENANCE
- S9 FOOD PREPARATION AREAS
- S11 SPILL KIT INSPECTION OPERATION AND MAINTENANCE



PLANS PREPARED BY:
RED BRICK SOLUTION,LLC
CONSULTING ENGINEERS
& ARCHITECTS
331 S. RIO GRANDE STREET
SUITE 203
SALT LAKE CITY, UTAH 84101
7801.224.5335
888.812.1179
05/20/2023
AND W. LARSON RCE C52991 DATE

WQMP BMP SITE PLAN
ENLARGED AREA

EXHIBIT E2

SCALE: 1" = 50'
DESIGNED BY: DWL
DRAWN BY: DWL
CHECKED BY: DWL
SHEET
OF



Know what's below.
Call before you dig.

C:\Users\Owner\OneDrive - Red Brick Consulting Engineers and Architects Documents - Projects\2020\200039.1 - Phase 1 Civic Center WQMP\PPH\12-WQMP\200039 exhibits.dwg

SHEEP CREEK ROAD

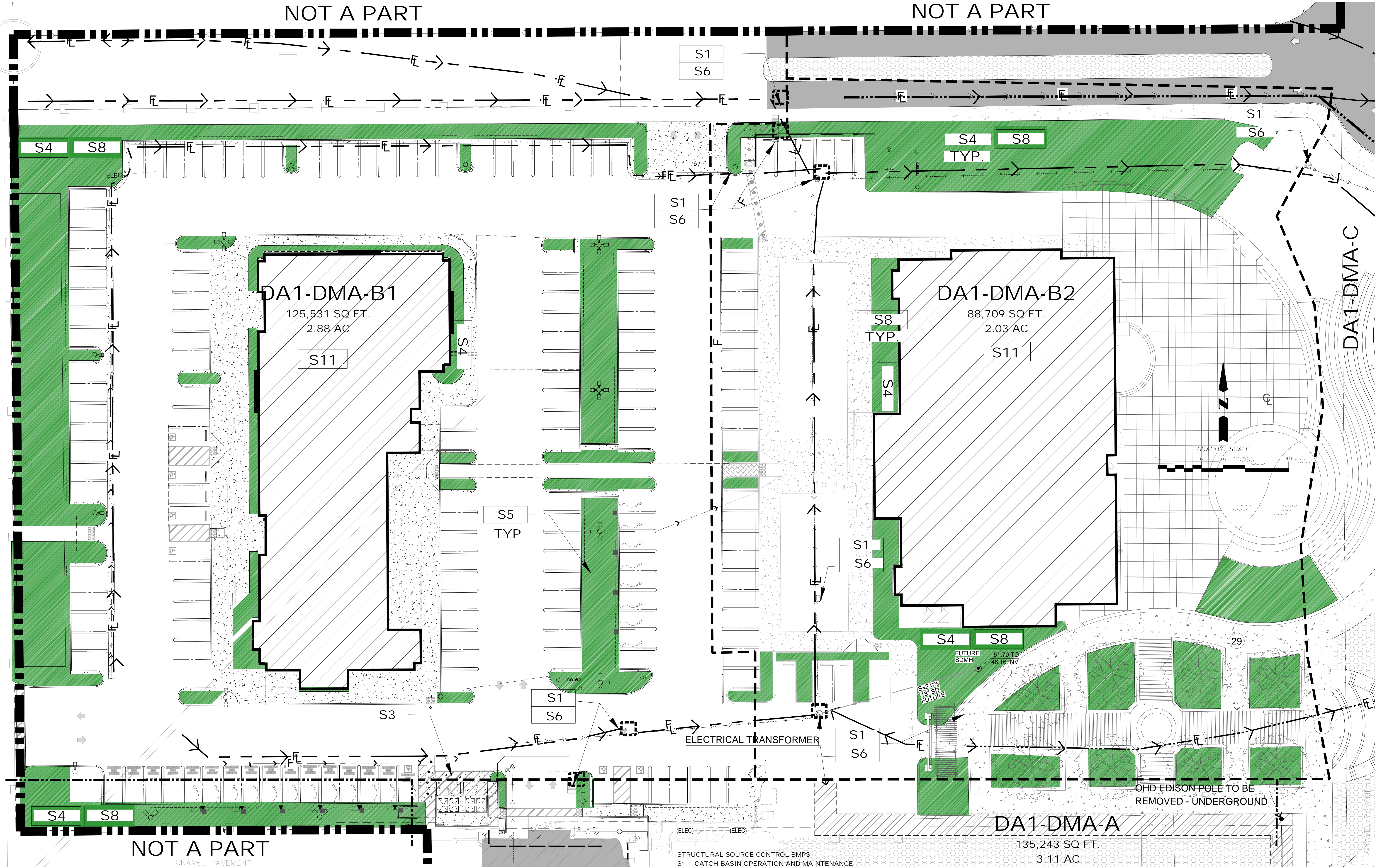
4 V. M. E. N. I



Know what's below.
Call before you dig.

NOT A PART

NOT A PART



IMPERVIOUS AREAS:		IMP	PERV
DMA-B1 & B2	Hardscape	170,643.00	170643
	Gravel	43,596.54	8719.3072 34877.2288
	Total	214239.536	179362.307 34877.2288
		4.92	AC.

NON-STRUCTURAL SOURCE CONTROL BMPs

- N1 EDUCATION OF PROPERTY OWNERS, TENANTS, AND OCCUPANTS ON STORMWATER BMPs
- N3 LANDSCAPE MANAGEMENT BMPs
- N4 BMP MAINTENANCE
- N6 LOCAL WATER QUALITY ORDINANCES
- N12 EMPLOYEE TRAINING
- N15 VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS

STRUCTURAL SOURCE CONTROL BMPs

- S1 CATCH BASIN OPERATION AND MAINTENANCE
- S2 INFILTRATION BASIN
- S3 TRASH STORAGE AREAS
- S4 EFFICIENT IRRIGATION SYSTEMS
- S5 FINISH GRADE OF LANDSCAPE AREAS AT A MINIMUM 2" BELOW ADJACENT TOP OF CURB, SIDEWALK, OR PAVEMENT. SEE DETAIL HEREON
- S6 STORM DRAIN SIGNAGE
- S7 RIPRAP INSPECTION OPERATION AND MAINTENANCE
- S8 LANDSCAPE INSPECTION OPERATION AND MAINTENANCE
- S9 FOOD PREPARATION AREAS
- S11 SPILL KIT INSPECTION OPERATION AND MAINTENANCE



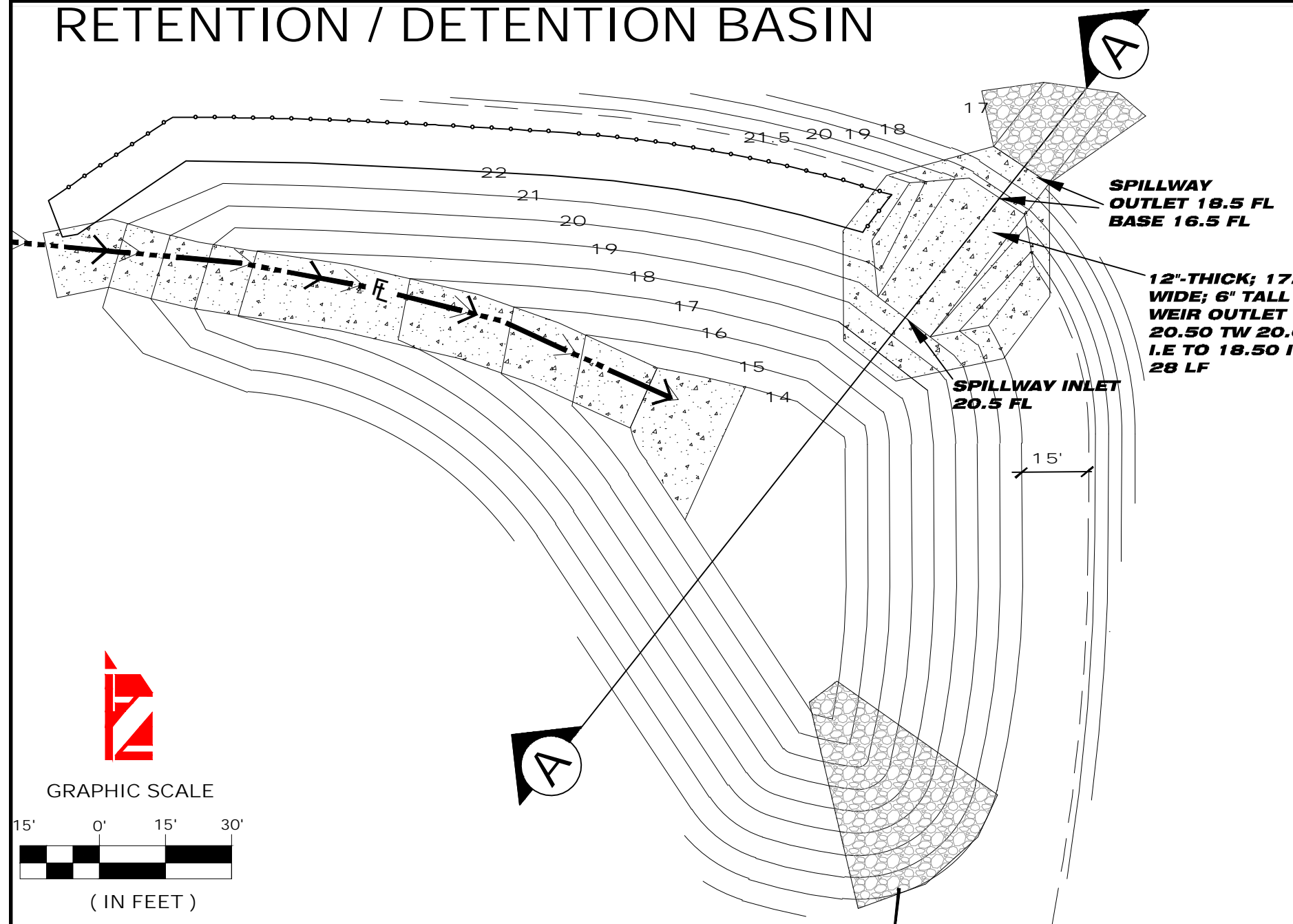
PLANS PREPARED BY:
RED BRICK SOLUTION, LLC
CONSULTING ENGINEERS
& ARCHITECTS
331 S. RIO GRANDE STREET
SUITE 203
SALT LAKE CITY, UTAH 84101
7801.224.5335
888.811.1179
05/20/2023
W. LARSON RCE C52991 DATE

WQMP BMP SITE PLAN
ENLARGED AREA

EXHIBIT E3

SCALE: 1" = 50'
DESIGNED BY: DWL
DRAWN BY: DWL
CHECKED BY: DWL
SHEET
OF

RETENTION / DETENTION BASIN



BASIN DATA:

BOTTOM ELEV= 4114.0
RIM ELEV = 4122.0

**100-YEAR STORM
WSE = 4120.50**

OUTLET ELEV = 4120.50
RETENTION V = 1.260 AC-FT
REQ'D DCV = 28,467 CF
= 0.65 AC-FT < 1.26

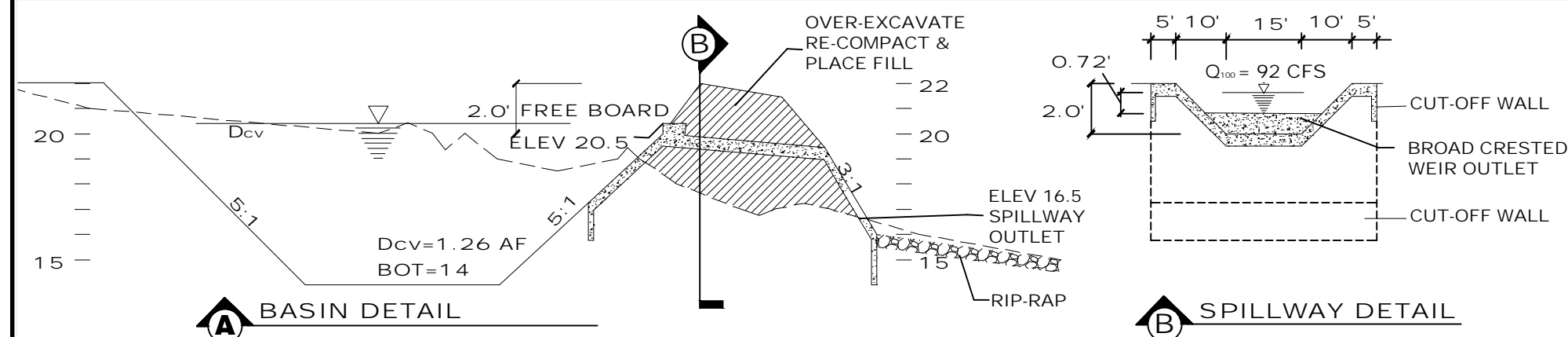
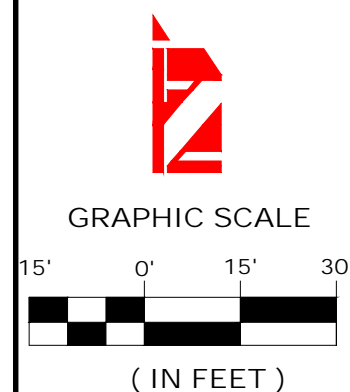
DRAWDOWN TIME:
REQ'D < 48 HRS

INFILTRATION RATE = 8.30 IN/HR
FS = 2.41 = 3.44 IN/HR

DEPTH = 4120.5 - 4114.0 = 6.5 FT
= 6.5' * 12 = 78 IN

DRAWDOWN = 78 / 2.12 = 36.8 HR
< 48 OK

FT/ELEV		BASIN VOLUME/ FT ELEVATION			
		Area SF	Area Ac.	Vol Ac/ft per ft	Acc. Vol Ac.-Ft
21.5	7.5	19698.307	0.452211	0.216254	1.914440
21	7	17981.786	0.412805	0.378924	1.698186
20	6	15030.083	0.345043	0.313908	1.319262
19	5	12317.552	0.282772	0.253706	1.005354
18	4	9785.288	0.224639	0.195384	0.751649
17.5	3.5	8510.934	0.195384	0.094035	0.556264
17.25	3.25	7873.757	0.180757	0.150456	0.462229
17	3	7236.580	0.166129	0.143142	0.311773
16	2	5233.984	0.120156	0.101456	0.168631
15	1	3604.855	0.082756	0.067175	0.067175
14	0	2247.407	0.051593		



HYDROLOGY
STUDY

ON-SITE
TRIBUTARY
WATERSHED AREA

FOR:
PPHCSD

IN
PHELAN
SAN BERNARDINO
COUNTY, CA

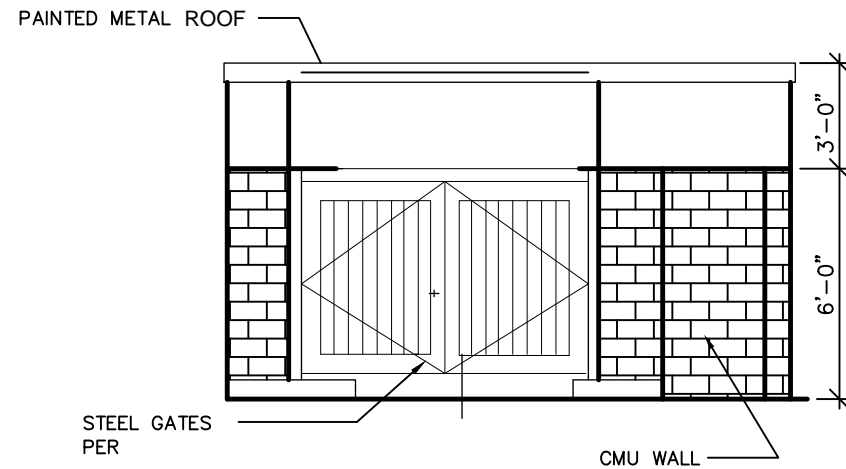
APN:
3066-251-18, &
3066-261-10

RETENTION/
DETENTION BASIN

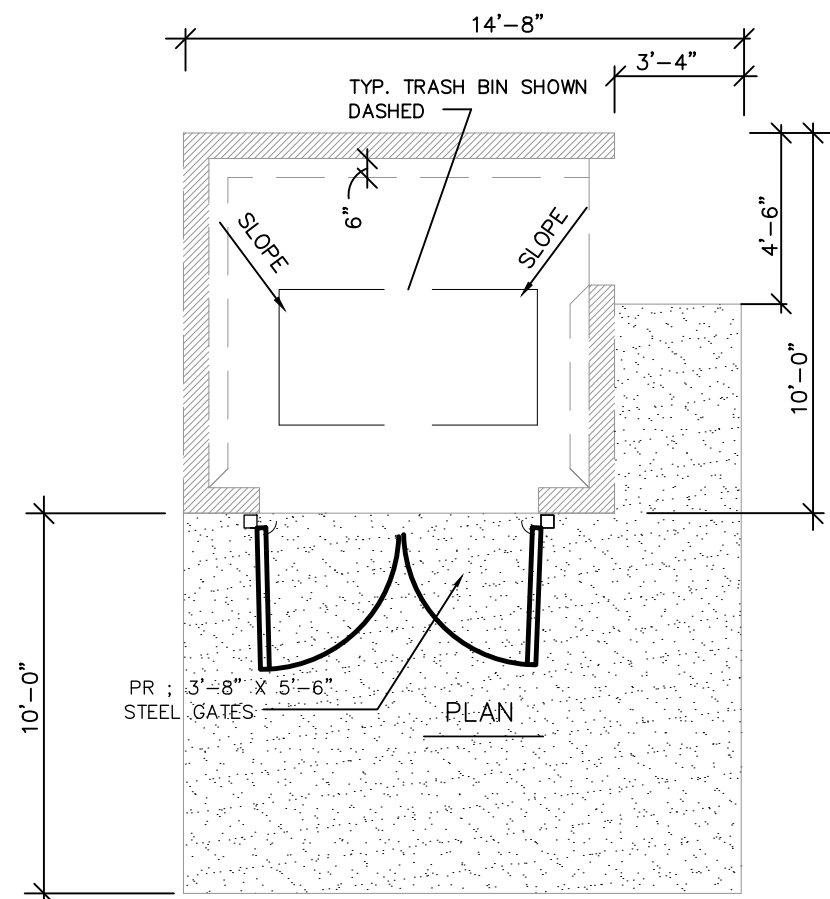
**RED
BRICK
SOLUTION**

CONSULTING ENGINEERS
& ARCHITECTS

EXHIBIT K



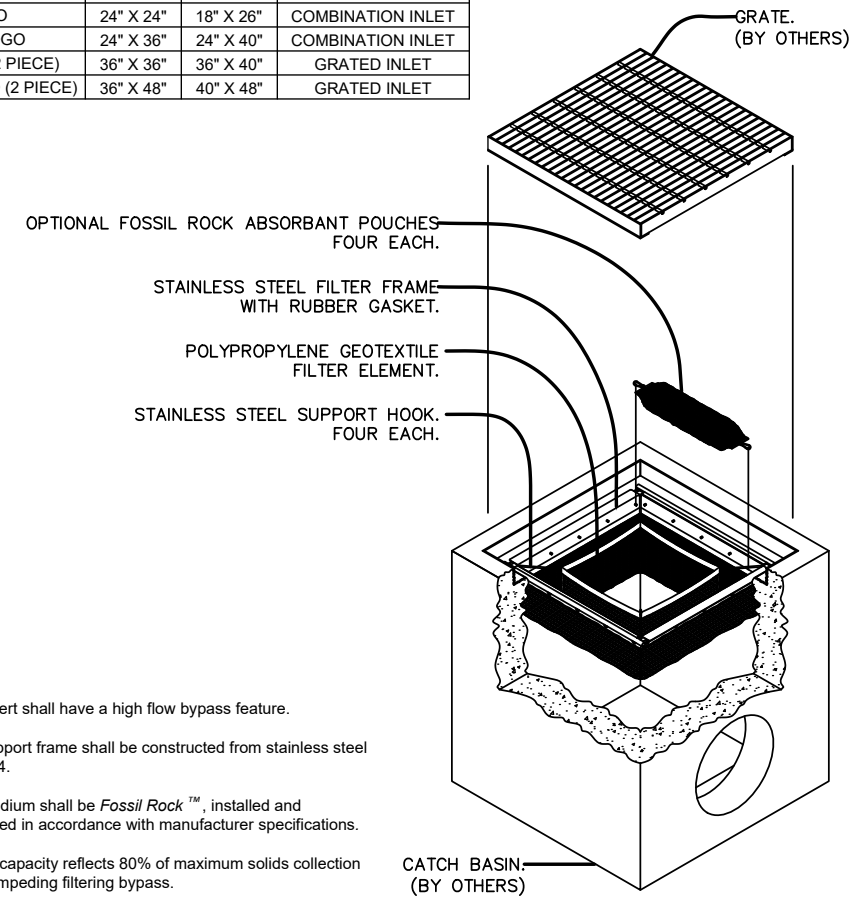
ELEVATION



TRASH ENCLOSURE DETAIL

SCALE 1"=5'

SPECIFIER CHART			
MODEL	INLET ID	GRATE OD	COMMENTS
FF-12D	12" X 12"	15" X 15"	GRATED INLET
FF-16D	16" X 16"	18" X 18"	GRATED INLET
FF-18D	18" X 18"	20" X 20"	GRATED INLET
FF-1836SD	18" X 36"	18" X 40"	GRATED INLET
FF-1836DGO	18" X 36"	18" X 40"	COMBINATION INLET
FF-24D	24" X 24"	26" X 26"	GRATED INLET
FF-2436SD	24" X 36"	24" X 40"	GRATED INLET
FF-24DGO	24" X 24"	18" X 26"	COMBINATION INLET
FF-2436DGO	24" X 36"	24" X 40"	COMBINATION INLET
FF-36D (2 PIECE)	36" X 36"	36" X 40"	GRATED INLET
FF-3648D (2 PIECE)	36" X 48"	40" X 48"	GRATED INLET



NOTES:

- Filter insert shall have a high flow bypass feature.
- Filter support frame shall be constructed from stainless steel Type 304.
- Filter medium shall be *Fossil Rock™*, installed and maintained in accordance with manufacturer specifications.
- Storage capacity reflects 80% of maximum solids collection prior to impeding filtering bypass.

NO DUMPING

DRAINS TO RIVER

STENCIL DETAIL

SCALE

WQMP

ON-SITE SOURCE CONTROLS

**FOR:
PPHCSD**

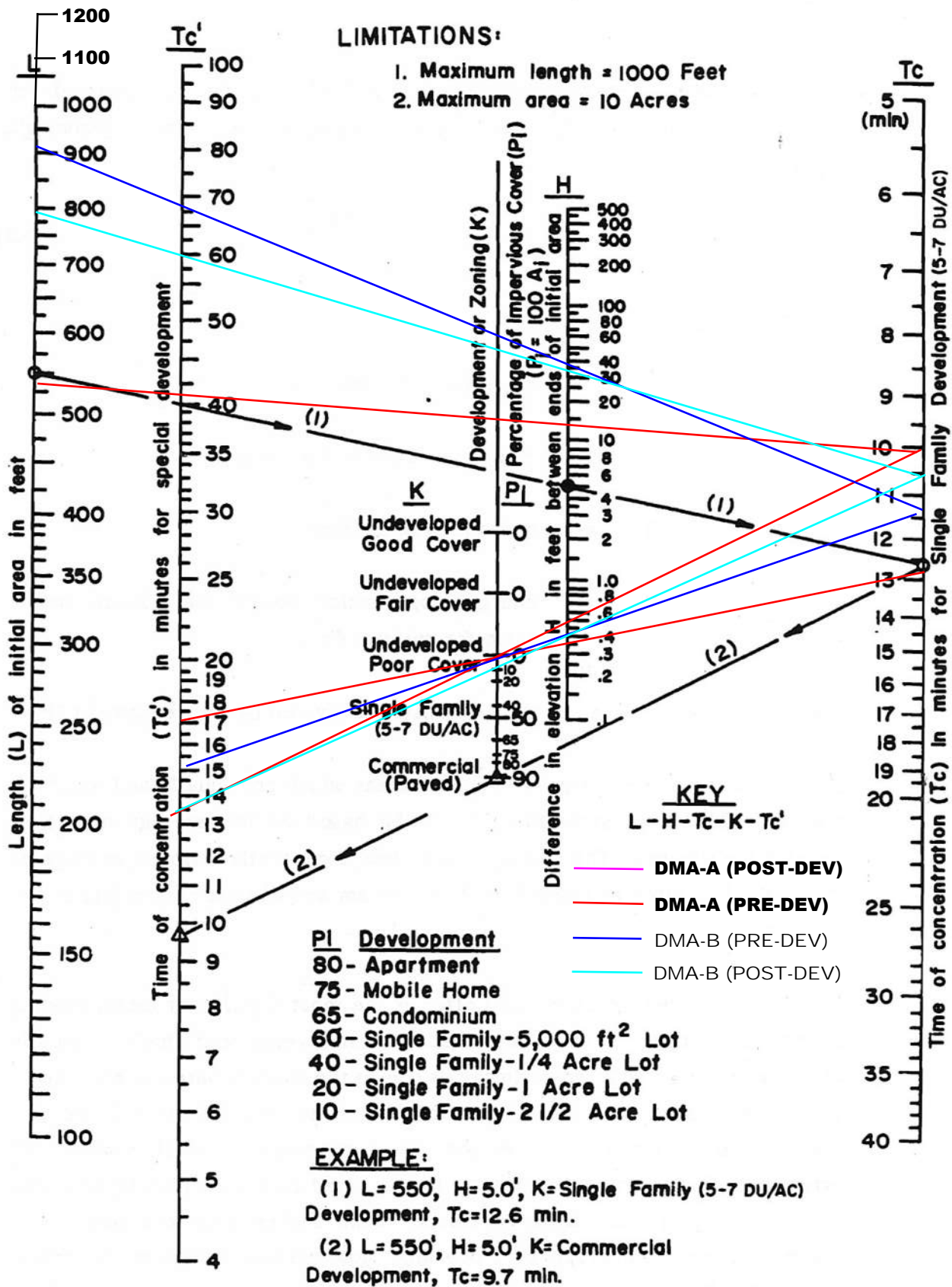
**IN
PHELAND
SAN BERNARDINO
COUNTY, CA**

**APN:
3066-261-08,10
3066-251-14**

**RED
BRICK
SOLUTION**

CONSULTING ENGINEERS
& ARCHITECTS

EXHIBIT G



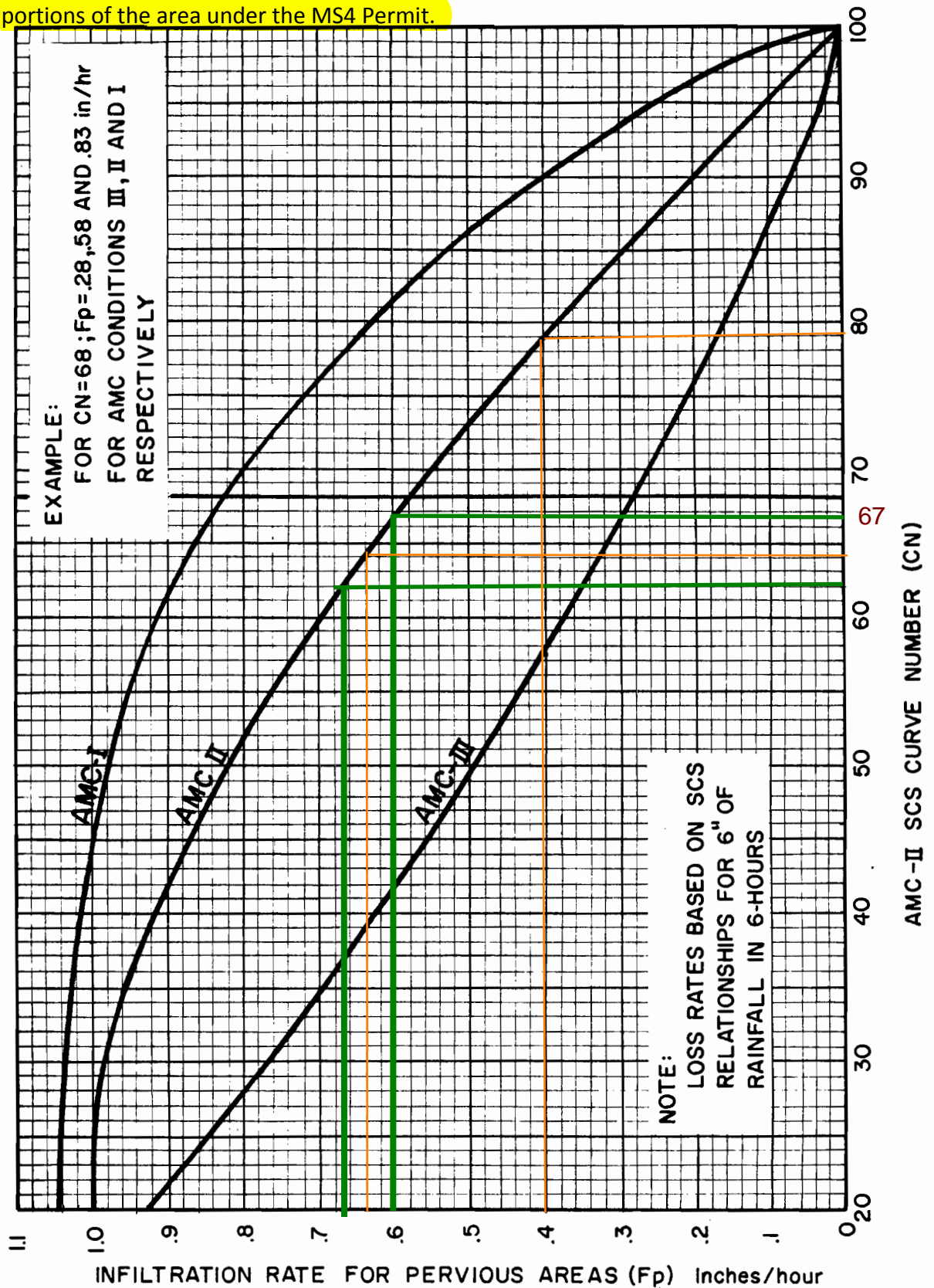
SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

**TIME OF CONCENTRATION
NOMOGRAPH
FOR INITIAL SUBAREA**

EXHIBIT J

Curve (I) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II					
Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
<u>NATURAL COVERS -</u>					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
<u>URBAN COVERS -</u>					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Impervious areas shall be assigned a CN of 98. It is noted that for ultimately developed conditions, the CN for urban landscaping (turf) is provided in Figure C-3.					
SAN BERNARDINO COUNTY		CURVE NUMBERS FOR PERVIOUS AREAS			
HYDROLOGY MANUAL					

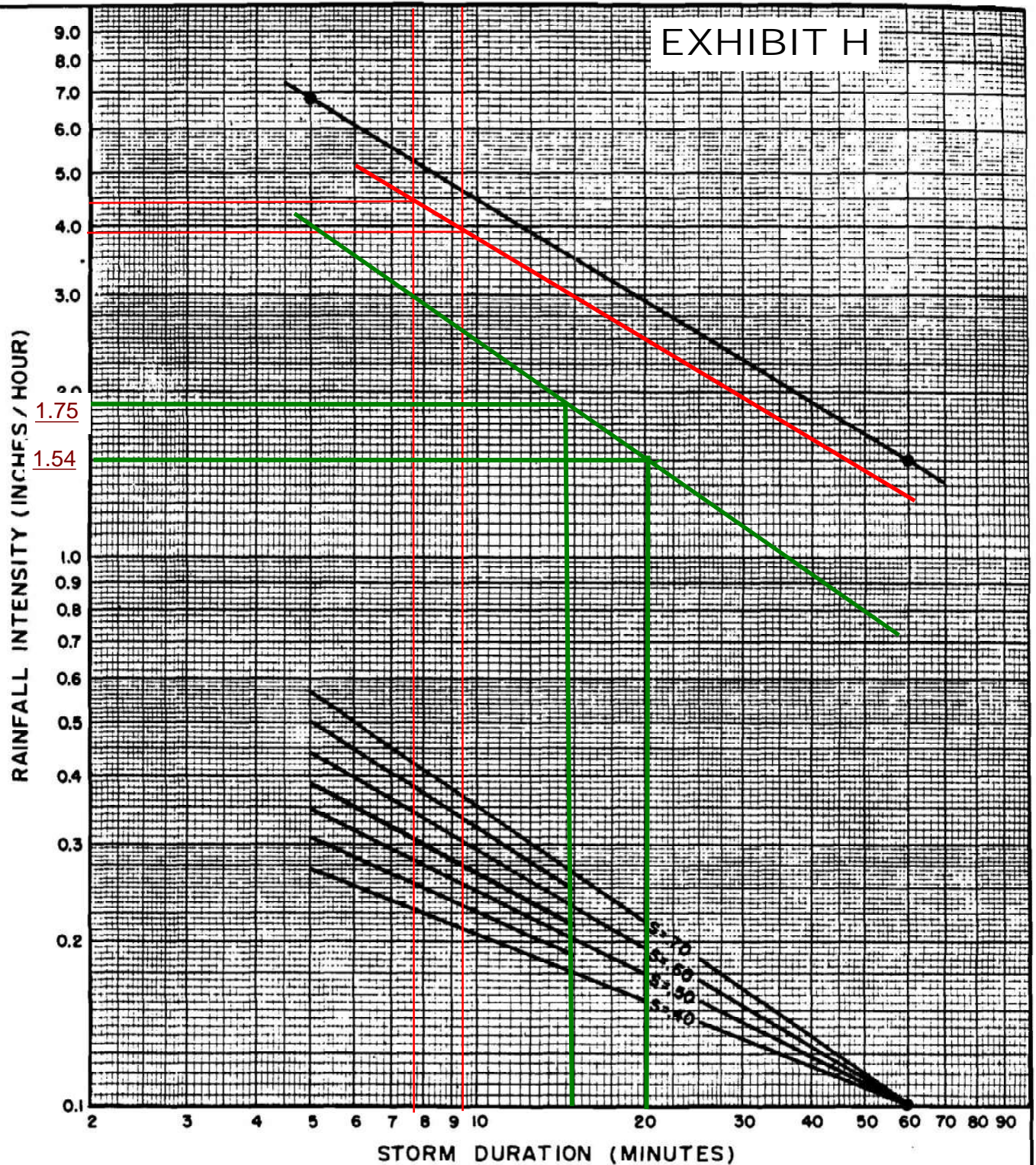
estimating peak runoff for Hydromodification performance criteria, AMC II is assumed for all portions of the area under the MS4 Permit.



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

INFILTRATION RATE FOR
PERVIOUS AREAS VERSUS
SCS CURVE NUMBERS

EXHIBIT H



DESIGN STORM FREQUENCY = 10 YEARS
 ONE HOUR POINT RAINFALL = 0.718 INCHES
 LOG-LOG SLOPE = 0.70
 PROJECT LOCATION = EXAMPLE PROBLEM

SAN BERNARDINO COUNTY
 HYDROLOGY MANUAL

INTENSITY - DURATION
 CURVES
 CALCULATION SHEET

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) $p = w \times v$
A	Suitability Assessment	Soil assessment methods	0.25	2	.5
		Predominant soil texture	0.25	1	.25
		Site soil variability	0.25	1	.25
		Depth to groundwater / impervious layer	0.25	1	.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			
B	Design	Tributary area size	0.25	3	.75
		Level of pretreatment/ expected sediment loads	0.25	3	.25
		Redundancy	0.25	3	.25
		Compaction during construction	0.25	2	.5
		Design Safety Factor, $S_B = \Sigma p$			
Combined Safety Factor, $S_{TOT} = S_A \times S_B$				3.44	
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)				8.3 IN/HR	
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} \times K_M$				2.41 IN/HR	
Supporting Data					
Briefly describe infiltration test and provide reference to test forms:					

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

BMP OPERATION & MAINTENANCE LOG

Today's Date: _____

**Name of Person Performing Activity
(Printed):** _____

Signature: _____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed
SD-10 (Site Design & Landscape Planning)	
SD-12 (Efficient Irrigation)	
SD-13 (Storm Drain Signage)	
SD-32 (Trash Storage Areas)	
SD-34 (Outdoor Material Storage Areas)	
TC-11 (Infiltration Basin) Including pretreatment infiltration filter	

Note: annual cost to maintain the post construction BMPs shall be determined by the owner.

IT'S A STORMWATER POLLUTION REVOLUTION!

Keeping construction sites and the Mojave River Watershed clean!

Stormwater runoff from construction sites are major contributors to toxins entering the Mojave River - harming our natural wildlife and eventually making its way back to our faucets, hoses, drinking water and other waterways in the High Desert.

We need your help! Follow these simple steps when doing small or large-scale construction to prevent stormwater pollution and protect our community from toxins:

- Identify path for stormwater discharge
- Secure storm drain inlets with sandbags
- Protect slopes and channels
- Store materials off the ground on wooden pallets
- Never sweep or wash anything into a storm drain

Installing Storm Drain Inlet Protection 101

Prevent sediment from entering a storm drain by following the simple installation and maintenance steps outlined below. Use silt fence, rock-filled bags, or block and gravel.

Installation:

Install protection prior to starting activity; Protect all inlets that may receive discharge; Design protection to handle maximum volume of water expected.

Maintenance:

Inspect frequently; Remove trapped sediment; Replace or repair protection as needed; Sweep streets, sidewalks and other paved areas regularly.

To report illegal dumping or for more information on stormwater pollution prevention call **1 (800) 78 CRIME** or visit our website at www.mojaveriver.org, Facebook at [MojaveWatershed](https://www.facebook.com/MojaveWatershed), Twitter [@MojaveRiver](https://twitter.com/MojaveRiver), or Pinterest at [Mojave Watershed](https://www.pinterest.com/MojaveWatershed).



Disposal Centers

Apple Valley
13450 Nomwaket Road

Hesperia Fire Station
17443 Lemon Street

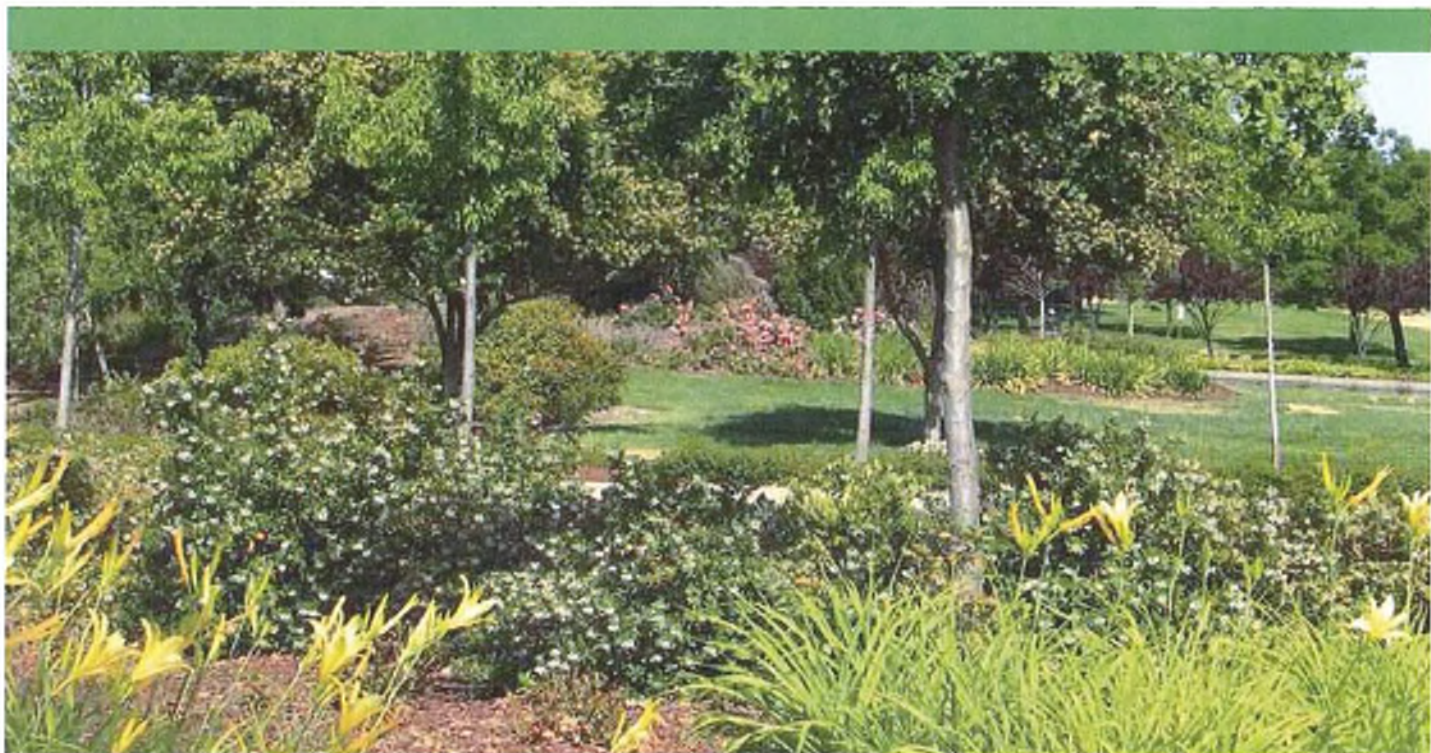
Victorville Fire Department
East of Desert Knoll Drive
on Loves Lane

Barstow Corporation Yard
900 South Avenue H

San Bernardino County
2824 East W Street
San Bernardino, CA

Don't Get Turned Away!

For hours of operation, quantity limitations and other rules and regulations, call (800) 645-9228 or visit the MRWG website at www.mojaveriver.org before dropping off materials.



The Updated Model Water Efficient Landscape Ordinance

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Landscapes are essential to the quality of life in California. They provide areas for recreation, enhance the environment, clean the air and water, prevent erosion, offer fire protection and replace ecosystems lost to development.

California's economic prosperity and environmental quality are dependant on an adequate supply of water for beneficial uses. In California, about half of the urban water used is for landscape irrigation. Ensuring efficient landscapes in new developments and reducing water waste in existing landscapes are the most cost-effective ways to stretch our limited water supplies and ensure that we continue to have sufficient water for California to prosper.

The Water Conservation in Landscaping Act of 2006 (Assembly Bill 1881, Laird) requires cities, counties, and charter cities and charter counties, to adopt landscape water conservation ordinances by January 1, 2010. Pursuant to this law, the Department of Water Resources (DWR) has prepared a Model Water Efficient Landscape Ordinance (Model Ordinance) for use by local agencies. The Model Ordinance was approved by the Office of Administrative Law on September 10, 2009. The Model Ordinance became effective on September 10.

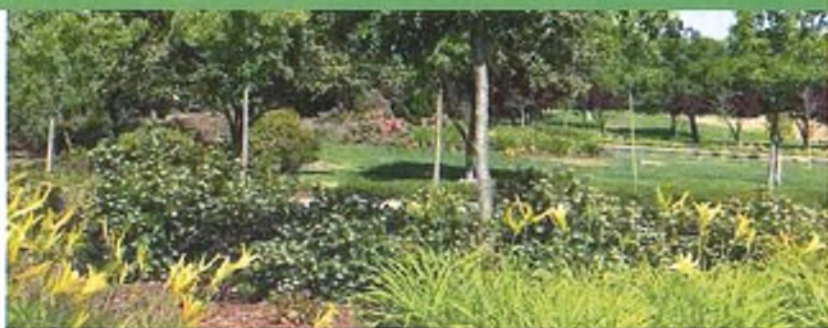
All local agencies must adopt a water efficient landscape ordinance by **January 1, 2010**. The local agencies may adopt the state Model Ordinance, or craft an ordinance to fit local conditions. In addition, several local agencies may collaborate and craft a region-wide ordinance. In any case, the adopted ordinance must be as effective as the Model Ordinance in regard to water conservation.

For more information, please visit our web site at
<http://www.water.ca.gov/wateruseefficiency/landscapeordinance/>



DWR October 2009

Important points to consider...



Water purveyors have an important role.

The enabling statute was directed to local agencies that make land use decisions and approve land development. Active participation by water purveyors can make the implementation, enforcement and follow-up actions of an ordinance more effective.

Most new and rehabilitated landscapes are subject to a water efficient landscape ordinance. Public landscapes and private development projects including developer installed single family and multi-family residential landscapes with at least 2500 sq. ft. of landscape area are subject to the Model Ordinance .

Homeowner provided landscaping at single family and multi-family homes are subject to the Model Ordinance if the landscape area is at least 5000 sq. ft

Existing landscapes are also subject to the Model Ordinance.

Water waste is common in landscapes that are poorly designed or not well maintained. Water waste (from runoff, overspray, low head drainage, leaks and excessive amounts of applied irrigation water in landscapes is prohibited by Section 2, Article X of the California Constitution.

Any landscape installed prior to January 1, 2010, that is at least one acre in size may be subject to irrigation audits, irrigation surveys or water use analysis programs for evaluating irrigation system performance and adherence to the Maximum Applied Water Allowance as defined in the 1992 Model Ordinance with an Evapotranspiration Adjustment Factor (ETAF) of 0.8. Local agencies and water purveyors (designated by the local agency) may institute these or other programs to increase efficiency in existing landscapes.

All new landscapes will be assigned a water budget.

The water budget approach is a provision in the statute that ensures a landscape is allowed sufficient water. There are two water budgets in the Model Ordinance; the Maximum Applied Water Allowance (MAWA) and the Estimated Total Water Use (ETWU).

The MAWA, is the water budget used for compliance and is an annual water allowance based on landscape area, local evapotranspiration and ETAF of 0.7. The ETWU is an annual water use estimation for design purposes and is based on the water needs of the plants actually chosen for a given landscape. The ETWU may not exceed the MAWA.

Water efficient landscapes offer multiple benefits.

Water efficient landscapes will stretch our limited water supplies. Other benefits include reduced irrigation runoff, reduced pollution of waterways, less property damage, less green waste, increased drought resistance and a smaller carbon footprint.

The Department of Water Resources will offer technical assistance.

The Department plans to offer a series of workshops, publications and other assistance for successful adoption and implementation of the Model Ordinance or local water efficient landscape ordinances. Information regarding these resources may be found on the DWR website: <http://www.water.ca.gov/wateruseefficiency/landscapeordinance/> Questions on the Model Ordinance may be sent by e-mail to DWR staff at: mweo@water.ca.gov.



R-3 AUTOMOBILE PARKING

Parked automobiles may contribute pollutants to the storm drain because poorly maintained vehicles may leak fluids containing hydrocarbons, metals, and other pollutants. In addition, heavily soiled automobiles may drop clods of dirt onto the parking surface, contributing to the sediment load when runoff is present. During rain events, or wash-down activities, the pollutants may be carried into the storm drain system. The pollution prevention activities outlined in this fact sheet are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:

Sediment	x
Nutrients	
Bacteria	
Foaming Agents	
Metals	X
Hydrocarbons	X
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Think before parking your car. Remember - The ocean starts at your front door.

Required Activities

- If required, vehicles have to be removed from the street during designated street sweeping/cleaning times.
- If the automobile is leaking, place a pan or similar collection device under the automobile, until such time as the leak may be repaired.
- Use dry cleaning methods to remove any materials deposited by vehicles (e.g. adsorbents for fluid leaks, sweeping for soil clod deposits).

Recommended Activities

- Park automobiles over permeable surfaces (e.g. gravel, or porous cement).
- Limit vehicle parking to covered areas.
- Perform routine maintenance to minimize fluid leaks, and maximize fuel efficiency.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com



R-5 DISPOSAL OF PET WASTES

Pet wastes left in the environment may introduce solids, bacteria, and nutrients to the storm drain. The type and quantity of waste will dictate the proper disposal method. Small quantities of waste are best disposed with regular trash or flushed down a toilet. Large quantities of wastes from herbivore animals may be composted for subsequent use or disposal to landfill.

Pick up after your pet! It's as easy as 1-2-3. 1) Bring a bag. 2) Clean it up. 3) Dispose of it properly (toilet or trash). The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:

Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	
Metals	
Hydrocarbons	
Hazardous Materials	
Pesticides and Herbicides	
Other	

Think before you dispose of any pet wastes. Remember - The ocean starts at your front door.

Required Activities

- All pet wastes must be picked up and properly disposed of. Pet waste should be disposed of in the regular trash, flushed down a toilet, or composted as type and quantities dictate.
- Properly dispose of unused flea control products (shampoo, sprays, or collars).
- Manure produced by livestock in uncovered areas should be removed at least daily for composting, or storage in water-tight container prior to disposal. Never hose down to stream or storm drain. Composting or storage areas should be configured and maintained so as not to allow contact with runoff. Compost may be donated to greenhouses, nurseries, and botanical parks. Topsoil companies and composting centers may also accept composted manure.
- Line waste pits or trenches with an impermeable layer, such as thick plastic sheeting.
- When possible, allow wash water to infiltrate into the ground, or collect in an area that is routed to the sanitary sewer.
- Confine livestock in fenced in areas except during exercise and grazing times. Restrict animal access to creeks and streams, preferably by fencing.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com

- Install gutters that will divert roof runoff away from livestock areas.

Recommended Activities

- In order to properly dispose of pet waste, carry bags, pooper-scooper, or equivalent to safely pick up pet wastes while walking with pets.
- Bathe pets indoors and use less toxic shampoos. When possible, have pets professionally groomed.
- Properly inoculate your pet in order to maintain their health and reduce the possibility of pathogens in pet wastes.
- Maintain healthy and vigorous pastures with at least three inches of leafy material.
- Consider indoor feeding of livestock during heavy rainfall, to minimize manure exposed to potential runoff.
- Locate barns, corrals, and other high use areas on portions of property that either drain away from or are located distant from nearby creeks or storm drains.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com



R-7 HOUSEHOLD HAZARDOUS WASTE

Household hazardous wastes (HHW) are defined as waste materials which are typically found in homes or similar sources, which exhibit characteristics such as: corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by EPA.

List of most common HHW products:

Drain openers
Oven cleaners
Wood and metal cleaners and polishes
Automotive oil and fuel additives
Grease and rust solvents
Carburetor and fuel injection cleaners
Starter fluids
Batteries
Paint Thinners
Paint strippers and removers
Adhesives
Herbicides
Pesticides
Fungicides/wood preservatives

Many types of waste can be recycled, however options for each waste type are limited. Recycling is always preferable to disposal of unwanted materials. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should be disposed of at a properly permitted landfill.

Think before disposing of any household hazardous waste. Remember - The ocean starts at your front door.

The activities outlined in this fact sheet target the following pollutants:

Sediment	
Nutrients	
Bacteria	
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x



Required Activities

- Dispose of HHW at a local collection facility. Call (714) 834-6752 for the household hazardous waste center closest to your area.
- Household hazardous materials must be stored indoors or under cover, and in closed and labeled containers.
- If safe, contain, clean up, and properly dispose all household hazardous waste spills. If an unsafe condition exists, call 911 to activate the proper response team.

Recommended Activities

- Use non-hazardous or less-hazardous products.
- Participate in HHW reuse and recycling. Call (714) 834-6752 for the participating household hazardous waste centers.

The California Integrated Waste Management Board has a Recycling Hotline (800) 553-2962, that provides information and recycling locations for used oil.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com



R-8 WATER CONSERVATION

Excessive irrigation and/or the overuse of water is often the most significant factor in transporting pollutants to the storm drain system. Pollutants from a wide variety of sources including automobile repair and maintenance, automobile washing, automobile parking, home and garden care activities and pet care may dissolve in the water and be transported to the storm drain. In addition, particles and materials coated with fertilizers and pesticides may be suspended in the flow and be transported to the storm drain.

Hosing off outside areas to wash them down not only consumes large quantities of water, but also transports any pollutants, sediments, and waste to the storm drain system. The pollution prevention activities outlined in this fact sheet are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:

Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

Think before using water. Remember - The ocean starts at your front door.

Required Activities

- Irrigation systems must be properly adjusted to reflect seasonal water needs.
- Do not hose off outside surfaces to clean, sweep with a broom instead.

Recommended Activities

- Fix any leaking faucets and eliminate unnecessary water sources.
- Use xeriscaping and drought tolerant landscaping to reduce the watering needs.
- Do not over water lawns or gardens. Over watering wastes water and promotes diseases.
- Use a bucket to re-soak sponges/rags while washing automobiles and other items outdoors. Use hose only for rinsing.
- Wash automobiles at a commercial car wash employing water recycling.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com



FP-2

LANDSCAPE MAINTENANCE

The model procedures described below focus on minimizing the discharge of pesticides and fertilizers, landscape waste, trash, debris, and other pollutants to the storm drain system and receiving waters. Landscape maintenance practices may involve one or more of the following activities:

- 1. Mowing, Trimming/Weeding, and Planting**
- 2. Irrigation**
- 3. Fertilizer and Pesticide Management**
- 4. Managing Landscape Waste**
- 5. Erosion Control**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for landscape maintenance include:

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools. Refer to Appendix D, Fertilizer and Pesticide Management Guidance for further details.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) will preserve the landscapes water efficiency.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Mowing, Trimming/Weeding, and Planting

Mowing, Trimming/Weeding

- ✓ Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.

- ✓ When conducting mechanical or manual weed control, avoid loosening the soil, which could erode into streams or storm drains.
- ✓ Use coarse textured mulches or geotextiles to suppress weed growth and reduce the use of herbicides.
- ✓ Do not blow or rake leaves, etc. into the street or place yard waste in gutters or on dirt shoulders. Sweep up any leaves, litter or residue in gutters or on street.
- ✓ Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this procedure sheet).
- ✓ Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- ✓ Where feasible, retain and/or plant selected native vegetation whose features are determined to be beneficial. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting ornamental vegetation.
- ✓ When planting or replanting consider using low water use groundcovers.

OPTIONAL:

- Careful soil mixing and layering techniques using a topsoil mix or composted organic material can be used as an effective measure to reduce herbicide use and watering.

2. Irrigation

- ✓ Utilize water delivery rates that do not exceed the infiltration rate of the soil.
- ✓ Use timers appropriately or a drip system to prevent runoff and then only irrigate as much as is needed.
- ✓ Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- ✓ Where practical, use automatic timers to minimize runoff.
- ✓ Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- ✓ If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).
- ✓ If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

3. Fertilizer and Pesticide Management

Usage

- ✓ Utilize a comprehensive management system that incorporates integrated pest management techniques.
- ✓ Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- ✓ Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution.
- ✓ Pesticide application must be under the supervision of a California qualified pesticide applicator.
- ✓ When applicable use the least toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible.
- ✓ Do not mix or prepare pesticides or fertilizers for application near storm drains.
- ✓ Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- ✓ Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- ✓ Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- ✓ Periodically test soils for determining proper fertilizer use.
- ✓ Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- ✓ Inspect pesticide/fertilizer equipment and transportation vehicles daily.
- ✓ Refer to Appendix D for further guidance on Fertilizer and Pesticide management

OPTIONAL:

- Work fertilizers into the soil rather than dumping or broadcasting them onto the surface.
- Use beneficial insects where possible to control pests (green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders prey on detrimental pest species).
- Use slow release fertilizers whenever possible to minimize leaching.

Scheduling

- ✓ Do not use pesticides if rain is expected within 24 hours.
- ✓ Apply pesticides only when wind speeds are low (less than 5 mph).

Disposal

- ✓ Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- ✓ Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- ✓ Dispose of empty pesticide containers according to the instructions on the container label.

4. Managing Landscape Waste

Also see Waste Handling and Disposal procedure sheet

- ✓ Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- ✓ Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- ✓ Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.
- ✓ Inspection of drainage facilities should be conducted to detect illegal dumping of clippings/cuttings in or near these facilities. Materials found should be picked up and properly disposed of.
- ✓ Landscape wastes in and around storm drain inlets should be avoided by either using bagging equipment or by manually picking up the material.

5. Erosion Control

Also see Waste Handling and Disposal procedure sheet

- ✓ Maintain vegetative cover on medians and embankments to prevent soil erosion. Apply mulch or leave clippings to serve as additional cover for soil stabilization and to reduce the velocity of storm water runoff.
- ✓ Minimize the use of disking as a means of vegetation management because the practice may result in erodable barren soil.
- ✓ Confine excavated materials to pervious surfaces away from storm drain inlets, sidewalks, pavement, and ditches. Material must be covered if rain is expected.

LIMITATIONS:

Alternative pest/weed controls may not be available, suitable, or effective in every case.



FP-6

WATER AND SEWER UTILITY OPERATION AND MAINTENANCE

Although the operation and maintenance of public utilities are not considered themselves a chronic source of stormwater pollution, some activities and accidents can result in the discharge of pollutants that can pose a threat to both human health and the quality of receiving waters if they enter the storm drain system. Activities associated with the operation and maintenance of water and sewer utilities to prevent and handle such incidents include the following:

- 1. Water Line Maintenance**
- 2. Sanitary Sewer Maintenance**
- 3. Spill/Leak/Overflow Control, Response, and Containment**

Cities that do not provide maintenance of water and sewer utilities should coordinate with the contracting agency responsible for these activities and ensure that these model procedures are followed.

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for water and sewer utility operation and maintenance include:

- Inspect potential non-storm water discharge flow paths and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:**1. Water Line Maintenance**

Procedures can be employed to reduce pollutants from discharges associated with water utility operation and maintenance activities. Planned discharges may include fire hydrant testing, flushing water supply mains after new construction, flushing lines due to complaints of taste and odor, dewatering mains for maintenance work. Unplanned discharges from treated, recycled water, raw water, and groundwater systems operation and maintenance activities can occur from water main breaks, sheared fire hydrants, equipment malfunction, and operator error.

Planned Discharges

✓ For planned discharges use one of the following options:

- Reuse water for dust suppression, irrigation, or construction compaction
- Discharge to the sanitary sewer system with approval
- Discharge to the storm drain system or to a creek using applicable pollution control measures listed below (this option is ONLY applicable to uncontaminated pumped ground water, water line flushing, fire hydrant testing and flushing, discharges from potable water sources other than water main breaks) and may require a permit from the Regional Water Quality Control Board.

✓ If water is discharged to a storm drain inlet (catch basin), control measures must be put in place to control potential pollutants (i.e. sediment, chlorine, etc.). Examples of some storm drain inlet protection options include:

- Silt fence – appropriate where the inlet drains a relatively flat area.
- Gravel and wire mesh sediment filter – Appropriate where concentrated flows are expected.
- Wooden weir and fabric – use at curb inlets where a compact installation is desired.

✓ Prior to discharge, inspect discharge flow path and clean/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).

✓ Select appropriate pollution control measure(s) considering the receiving system (i.e. curb inlet, drop inlet, culvert, creek, etc.) and ensure that the control device(s) fit properly.

- ✓ General design considerations for inlet protection devices include the following:
 - The device should be constructed such that cleaning and disposal of trapped sediment is made easy, while minimizing interference with discharge activities.
 - Devices should be constructed so that any standing water resulting from the discharge will not cause excessive inconvenience or flooding/damage to adjacent land or structures.
- ✓ The effectiveness of control devices must be monitored during the discharge period and any necessary repairs or modifications made as needed.

OPTIONAL:

- Sediment removal may be enhanced by placing filter fabric, gravel bags, etc. at storm drain inlets.

Unplanned Discharges

- ✓ Stop the discharge as quickly as possible by turning off water source.
- ✓ Inspect flow path of the discharged water:
 - Control erosion along the flow path.
 - Identify areas that may produce significant sediment or gullies, use sandbags to redirect the flow.
 - Identify erodible areas which may need to be repaired or protected during subsequent repairs or corrective actions
- ✓ If repairs or corrective action will cause additional discharges of water, select the appropriate procedures for erosion control, chlorine residual, turbidity, and chemical additives. Prevent potential pollutants from entering the flow path and ensure that no additional discharged water enters storm drain inlets.

2. Sanitary Sewer Maintenance

Applicable to municipalities who own and operated a sewage collection system. Facilities that are covered under this program include sanitary sewer pipes and pump stations owned and operated by the Permittee. The owner of the sanitary sewer facilities is the entity responsible for carrying out this prevention and response program.

Sewer System Cleaning

- ✓ Sewer lines should be cleaned on a regular basis to remove grease, grit, and other debris that may lead to sewer backups.
- ✓ Establish routine maintenance program. Cleaning should be conducted at an established minimum frequency and more frequently for problem areas such as restaurants that are identified
- ✓ Cleaning activities may require removal of tree roots and other identified obstructions.

Preventative and Corrective Maintenance

- ✓ During routine maintenance and inspection note the condition of sanitary sewer structures and identify areas that need repair or maintenance. Items to note may include the following:
 - cracked/deteriorating pipes
 - leaking joints/seals at manhole
 - frequent line plugs
 - line generally flows at or near capacity
 - suspected infiltration or exfiltration
- ✓ Document suggestions and requests for repair and report the information to the appropriate manager or supervisor.
- ✓ Prioritize repairs based on the nature and severity of the problem. Immediate clearing of blockage or repair is required where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, sewer line blockages). These repairs may be temporary until scheduled or capital improvements can be completed.
- ✓ Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure.

3. Spill/Leak/Overflow Control, Response, and Containment

Control

Also see Drainage System procedures sheet

- ✓ Refer to countywide *Illicit Discharge Detection and Elimination Program*. Components of this program include:
 - Investigation/inspection and follow-up
 - Elimination of illicit discharges and connections
 - Enforcement of ordinances
 - Respond to sewage spills

- Facilitate public reporting of illicit discharges and connections. A citizen's hotline for reporting observed overflow conditions should be established to supplement the field screening efforts being conducted by the Principal Permittee.

Response and Containment

- ✓ Establish lead department/agency responsible for spill response and containment. Provide coordination within departments.
- ✓ When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system to the maximum extent practicable by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.).
- ✓ If a spill reaches the storm drain notify County of Orange Health Care Agency through Control One at (714) 628-7208.
- ✓ Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.
- ✓ Record required information at the spill site.
- ✓ Perform field tests as necessary to determine the source of the spill.
- ✓ Develop additional notification procedures regarding spill reporting as needed.

LIMITATIONS:

Private property access rights needed to perform testing along storm drain right-of-ways. Requirements of municipal ordinance authority for suspected source verification testing necessary for guaranteed rights of entry.

REFERENCES:

California Storm Water Best Management Practice Handbooks. Municipal Best Management Practice Handbook. Prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line:
http://ladpw.org/wmd/npdes/public_TC.cfm

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. Water Utility Pollution Prevention Plan.

Site Design & Landscape Planning SD-10



Design Objectives

- ✓ Maximize Infiltration
- ✓ Provide Retention
- ✓ Slow Runoff
- ✓ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.



SD-10 Site Design & Landscape Planning

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

Site Design & Landscape Planning SD-10

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

SD-10 Site Design & Landscape Planning

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



Design Objectives

- ✓ Maximize Infiltration
- ✓ Provide Retention
- ✓ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.



- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
 - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
 - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
 - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
 - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ✓ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING –



DRAINS TO OCEAN” and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of “redevelopment”, then the requirements stated under “designing new installations” above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner’s association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.
- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ✓ Contain Pollutants
- Collect and Convey



- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Additional Information***Maintenance Considerations***

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ✓ Contain Pollutant
- Collect and Convey

Description

Proper design of outdoor storage areas for materials reduces opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the stormwater conveyance system. Materials may be in the form of raw products, by-products, finished products, and waste products. The type of pollutants associated with the materials will vary depending on the type of commercial or industrial activity.

Approach

Outdoor storage areas require a drainage approach different from the typical infiltration/detention strategy. In outdoor storage areas, infiltration is discouraged. Containment is encouraged. Preventative measures include enclosures, secondary containment structures and impervious surfaces.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Some materials are more of a concern than others. Toxic and hazardous materials must be prevented from coming in contact with stormwater. Non-toxic or non-hazardous materials do not have to be prevented from stormwater contact. However, these materials may have toxic effects on receiving waters if allowed to be discharged with stormwater in significant quantities. Accumulated material on an impervious surface could result in significant impact on the rivers or streams that receive the runoff.

Material may be stored in a variety of ways, including bulk piles, containers, shelving, stacking, and tanks. Stormwater contamination may be prevented by eliminating the possibility of stormwater contact with the material storage areas either through diversion, cover, or capture of the stormwater. Control measures may also include minimizing the storage area. Design requirements



SD-34 Outdoor Material Storage Areas

requirements for material storage areas are governed by Building and Fire Codes, and by current City or County ordinances and zoning requirements. Control measures are site specific, and must meet local agency requirements.

Designing New Installations

Where proposed project plans include outdoor areas for storage of materials that may contribute pollutants to the stormwater conveyance system, the following structural or treatment BMPS should be considered:

- Materials with the potential to contaminate stormwater should be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the stormwater conveyance system, or (2) protected by secondary containment structures such as berms, dikes, or curbs.
- The storage area should be paved and sufficiently impervious to contain leaks and spills.
- The storage area should slope towards a dead-end sump to contain spills and direct runoff from downspouts/roofs should be directed away from storage areas.
- The storage area should have a roof or awning that extends beyond the storage area to minimize collection of stormwater within the secondary containment area. A manufactured storage shed may be used for small containers.

Note that the location(s) of installations of where these preventative measures will be employed must be included on the map or plans identifying BMPs.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permits.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

BG-40 Landscape Maintenance



Photo Credit: Geoff Brosseau

Description

This category includes businesses that provide landscaping and landscape maintenance/gardening services.

Pollutant Sources

The following are sources of pollutants:

- Selecting plants or landscape design,
- Installing new landscaping,
- Maintaining landscapes,
- Using pesticides and fertilizers, and
- Using gas-powered equipment.

Pollutants can include:

- Nutrients (fertilizers, yard wastes),
- Pesticides,
- Heavy metals (copper, lead, and zinc),
- Hydrocarbons (fuels, oils and grease), and
- Sediments.

Approach

Minimize the potential for stormwater pollution and the need for resources/controls (water, pesticides, fertilizers) by creating and maintaining landscapes in a way that is compatible with the local soils, climate, and amount of rain and sun. Make stormwater pollution prevention BMPs a part of standard operating procedures and the employee training program.



BG-40 Landscape Maintenance

Provide employee education materials in the first language of employees, as necessary.

Source Control BMPs

The best management practices are listed by activity or area.

Landscape Design	<ul style="list-style-type: none"><input type="checkbox"/> Specify native, low maintenance, and insectary (attract beneficial insects) plants and landscape designs.<input type="checkbox"/> Design zoned, water-efficient irrigation systems using technologies such drip irrigation, soaker hoses, or microspray systems. Landscape design should be consistent with the local Water Efficient Landscape Ordinance. See the following website for a list of local ordinances: ftp://ftp.water.ca.gov/Model-Water-Efficient-Landscape-Ordinance/Local-Ordinances/<input type="checkbox"/> Do not landscape riparian areas, except to remove non-native plants and replace them with native riparian landscaping.<input type="checkbox"/> Replant with native species where possible when landscaping or building an ornamental pond. Do not assume something is native because you have seen it in your area. Contact the local nursery for information or visit the California Exotic Pest Plant Council website (www.caleppc.org).
Landscape Installation	<ul style="list-style-type: none"><input type="checkbox"/> Protect stockpiles and landscaping materials from wind and rain by storing them under tarps or secured plastic sheeting.<input type="checkbox"/> Schedule grading and excavation projects during dry weather.<input type="checkbox"/> Divert runoff from exposed soils or lower its velocity by leveling and terracing.<input type="checkbox"/> Use temporary check dams or ditches to divert runoff away from storm drains.<input type="checkbox"/> Protect storm drains with sandbags or other sediment controls.<input type="checkbox"/> Revegetation is an excellent form of erosion control for any site. Keep soils covered with vegetation or temporary cover material (mulch) to control erosion.<input type="checkbox"/> Check plant roots before buying a plant. Do not buy plants with roots are that kinked or circling around the container. Do not buy plants with soft, rotten, or deformed root crowns.<input type="checkbox"/> Do not pile soil around the plant any higher than the root crown.
Landscape Maintenance	<p>Yard Waste</p> <ul style="list-style-type: none"><input type="checkbox"/> Allow leaf drop to become part of the mulch layer in tree, shrub, and groundcover areas.<input type="checkbox"/> Keep lawn mower blades sharp, and grasscycle.

BG-40 Landscape Maintenance

	<ul style="list-style-type: none">□ Grasscycle – leave grass clippings on the lawn when mowing. Once cut, grass clippings first dehydrate, and then decompose, quickly disappearing from view. Proper mowing is required for successful grasscycling. Cut grass when the surface is dry, and keep mower blades sharp. Follow the "1/3 Rule": mow the lawn often enough so that no more than 1/3 of the length of the grass blade is cut in any one mowing. Frequent mowing will produce short clippings that will not cover up the grass surface. The lawn may have to be cut every seven days when the lawn is growing fast but only every 7 to 14 days when the lawn is growing slowly.□ Do not leave clippings on pavement or sidewalks where they can wash off into the street, gutter, or storm drain.□ Collect lawn and garden clippings, pruning waste, and tree trimmings. Chip if necessary, and compost or take to the local municipal yard waste recycling/composting facility.□ In communities with curbside pick-up of yard waste, place clippings and pruning waste at the curb in approved bags or containers. No curbside pickup of yard waste is available for commercial properties.□ Do not blow or rake leaves or other yard waste into the street, or place yard waste in gutters or on dirt shoulders, unless it is being piled up for recycling (allowed by some municipalities). After pick-up, sweep up any leaves, litter, or residue in gutters or on street. <p>Fertilizing and Pruning</p> <ul style="list-style-type: none">□ Perform soil analysis seasonally to determine actual fertilization need and application rates.□ Fertilize garden areas with a mulch of leaves, bark, or composted manure and/or garden waste.□ Apply chemical fertilizer only as needed, when plants can best use it, and when the potential for it being carried away by runoff is low. Make sure the fertilizer spreader is calibrated.□ Prune plants sparingly, if at all. A healthy plant – one that is native to the area and growing under the right conditions – should not need pruning, except when it is not in the right location (where safety or liability is a concern). <p>Watering</p> <ul style="list-style-type: none">□ Use soil probes to determine soil moisture depth, overall moisture levels, and the need to adjust irrigation schedules.□ Check sprinklers regularly. Adjust as needed to minimize or eliminate overspray onto impervious surfaces. Replace broken sprinklers or lines.
--	---

BG-40 Landscape Maintenance

	<p>Pest and Weed Control</p> <ul style="list-style-type: none">□ Obtain appropriate licenses for pest control and pesticides. Contact the Department of Pesticide Regulation for more information.□ Become trained in and offer customers less-toxic pest control or Integrated Pest Management (IPM).□ The label on a pesticide container is a legal document. Use a pesticide only as instructed on the label.□ Store pesticides, fertilizers, and other chemicals indoors or in a shed or storage cabinet.□ Use pesticides sparingly, according to instructions on the label. Rinse empty containers, and use rinsewater as product.□ Dispose of rinsed, empty containers in the trash. Dispose of unused pesticides as hazardous waste.□ To control weeds, use drip irrigation and mulch. Hand-pull weeds including roots or cut down to ground. Repeat cutting before they flower, grow new leaves, or go to seed. Use herbicides containing pelargonic acid or herbicidal soap as a last resort. <p>Handling Gasoline</p> <ul style="list-style-type: none">□ Use only containers approved by a nationally recognized testing lab, such as Underwriters Laboratories (UL). Keep the container tightly sealed. Containers should be fitted with a spout to allow pouring without spilling and to minimize the generation of vapors.□ Fill cautiously. Always use a funnel and/or spout to prevent spilling or splashing when fueling power mowers, blowers, and all other gas-powered equipment.□ Avoid spilling gasoline on the ground, especially near wells. If a spill occurs use kitty litter, saw dust, or an absorbent towel to soak up the spill, then dispose of it properly.□ Store carefully. Gasoline moves quickly through soil and into groundwater, therefore, store and use gasoline and fuel equipment as far away from your drinking water well as possible. Be certain to keep a closed cap on the gasoline container. Store at ground level, not on a shelf to minimize the danger of falling and spilling.□ Do not dispose of gasoline down the drain, into surface water, onto the ground, or in the trash. Contact the local municipality for directions on proper disposal of excess or old gasoline. Transport old gas in an approved gasoline container. <p>Working Near Waterbodies</p> <ul style="list-style-type: none">□ Do not dump lawn clippings, other yard waste, or soil along creek banks or in creeks.
--	---

BG-40 Landscape Maintenance

	<ul style="list-style-type: none">□ Do not store stockpiles of materials (soil, mulch) along creek banks. These piles can erode over time into a creek.□ Do not spray pesticides or fertilizers by creeks.□ Do not over water near streams. The excess water may carry pesticides, fertilizers, sediments, and anything else in its path directly into the creek.
--	---

Treatment Control BMPs

Not applicable.

More Information

Bay Area Stormwater Management Agencies Association, 1999. Start at the Source – Design Guidance Manual for Stormwater Quality Protection. Available on-line at: <http://www.scvurppp-w2k.com/pdfs/0910/StartAtTheSource.pdf>.

Bay Area Stormwater Management Agencies Association, Undated. *Landscape designs for Stormwater Management - Stormwater Control for Small Projects*. Available at: http://www.acterra.org/programs/stewardship/doc/landscape_dispersion.pdf.

Bay Area Water Pollution Prevention Agencies, 2001. Less-Toxic Pest Management- Problem Pesticides. Available on-line at: <http://www.sccgov.org/sites/iwm/hhw/Documents/505018Problem%20Pesticides.pdf>.

California Invasive Plant Council, Undated Website. *Prevention BMPs for Land Managers*. Available on-line at: <http://www.cal-ipc.org/ip/prevention/landmanagers.php>.

California Department of Resources Recycling and Recovery (CalRecycle), 1999. *Grasscycle! Make the Most of Your Lawn. Make the Most of Your Time*. Available on-line at: <http://www.calrecycle.ca.gov/publications/Documents/Organics/44399011.pdf>.

California Department of Resources Recycling and Recovery (CalRecycle). *Capitol Park Training Manual Description and Guidelines for Horticultural Practices*. Available on-line at: <http://www.calrecycle.ca.gov/organics/landscaping/Demos/Manual.pdf>.

Southern Sonoma County Resource Conservation District, Undated pamphlet. *A Guide for Rural Landowners and Residents of Petaluma and Sonoma Creek Watersheds*. Available on-line at: [http://www.conservation.ca.gov/dlrp/watershedportal/Documents/SSCRCD%20Creek%20Care%20Guide%20\(southern%20sonoma%20rcd\).pdf](http://www.conservation.ca.gov/dlrp/watershedportal/Documents/SSCRCD%20Creek%20Care%20Guide%20(southern%20sonoma%20rcd).pdf).

USEPA, Office of Water National Pollution Discharge Elimination System, Undated website. *Stormwater Menu of BMPs Municipal Landscaping*. Available on-line at: <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=1>.

References

Bay Area Stormwater Management Agencies Association, 1999. Start at the Source – Design Guidance Manual for Stormwater Quality Protection. Available on-line at: <http://www.scvurppp-w2k.com/pdfs/0910/StartAtTheSource.pdf>.

BG-40 Landscape Maintenance

Bay Area Stormwater Management Agencies Association, Undated. *Landscape designs for Stormwater Management - Stormwater Control for Small Projects*. Available at: http://www.acterra.org/programs/stewardship/doc/landscape_dispersion.pdf.

City of San Diego, 2012. *Storm Water Standards*. Available on-line at: <http://www.sandiego.gov/development-services/news/pdf/stormwatermanual.pdf>.

City of San Francisco, 2009. *San Francisco Stormwater Design Guidelines*. Available on-line at: <http://www.sfwater.org/modules/showdocument.aspx?documentid=2779>.

County of Los Angeles Department of Public Works, 2009. *Stormwater Best Management Practice Design and Maintenance Manual For Publicly Maintained Storm Drain Systems*. Available on-line at: <http://dpw.lacounty.gov/ldd/publications/Stormwater%20BMP%20Design%20and%20Maintenance%20Manual.pdf>.

BG-30 Food Service Facilities



Photo Credit: Geoff Brosseau

Description

This category includes:

- Restaurants
- Food truck commissaries
- Institutional cafeterias
- Grocery stores, bakeries, and delicatessens
- Any facility requiring a Health Department permit for food preparation

Pollutant Sources

The following are sources of pollutants:

- Cleaning of equipment
- Grease handling and disposal
- Spills
- Surface cleaning
- Cooling and refrigeration equipment maintenance
- Landscaping and grounds maintenance
- Dumpster and loading dock area
- Parking lots
- Illicit connections to storm drain system

Pollutants can include:

- Organic materials (food wastes)



BG-30 Food Service Facilities

- Oil and grease
- Toxic chemicals in cleaning products, disinfectants, and pesticides

Approach

Minimize exposure of rain and runoff to outdoor cleaning and storage areas by using cover and containment. In and around these areas, use good housekeeping to minimize the generation of pollutants. Make stormwater pollution prevention BMPs a part of standard operating procedures and the employee training program. Provide employee education materials in the first language of employees.

Source Control BMPs

The best management practices are listed by activity or area in the following table.

Dumpster and Loading Dock Areas	<ul style="list-style-type: none">□ Store and transfer all solid and liquid wastes, such as tallow, in watertight covered containers.□ Keep litter from accumulating around loading docks by providing trash receptacles and encouraging employees to use them.□ Bag and seal food waste before putting it in the dumpster. Do not place uncontained liquids, or leaking containers or garbage bags into a dumpster.□ Keep dumpster lids closed to keep out rainwater and to prevent trash from spilling out.□ If the dumpster regularly overflows, get a bigger one or arrange for more frequent collection. If the dumpster is shared with other tenants, speak with the property/lease manager about scheduling more frequent trash pickups or a larger dumpster.□ Don't hose out dumpsters. Apply absorbent over any fluids spilled in dumpster. Absorbent will usually be knocked out when the dumpster is emptied.□ Have the dumpster leasing company repair or replace leaky dumpsters and compactors, and have them clean out dirty dumpsters.□ Install a spill cleanup kit near the dumpster and loading dock areas.□ Post employee reminder signs such as "Keep lid closed" near tallow bins and dumpsters.□ Consider enclosing the dumpster in a roofed and bermed area to prevent exposure to rainwater, and draining the area to the sanitary sewer. Contact the local wastewater treatment plant or the county environmental health department for guidance.□ Keep dumpsters or the dumpster enclosure locked to prevent illegal dumping.□ For more information on cleaning dumpster areas see the Mobile Cleaning - Food Service Business-related business guide sheet in this series.
--	--

BG-30 Food Service Facilities

Equipment and Outdoor Cleaning	<ul style="list-style-type: none"> ❑ Make sure all discharges from cooling equipment go to the sanitary sewer and not the street, gutter, or storm drain. ❑ Clean floor mats, filters, and garbage cans in a mop sink, floor drain, or proper outside area connected to the sanitary sewer with an oil and water separator. Don't wash them in a parking lot, alley, sidewalk, or street. ❑ Consider installing anti-slip floors when you remodel. ❑ Consider cleaning filters in the dishwasher. Contact the local wastewater treatment plant or the county environmental health department for guidance. ❑ Pour wash water into a janitorial or mop sink. Don't pour it out onto a parking lot, alley, sidewalk, or street. ❑ For outdoor cleaning, have employees or contractors follow the instructions in the following business guide sheet in this series: <ul style="list-style-type: none"> ✓ Mobile Cleaning - Food Service Business-related ✓ Mobile Cleaning – Surface cleaning ❑ For more information in general on cleaning floor mats, equipment, exhaust filters, and outdoor surfaces see the Mobile Cleaning - Food Service Business-related business guide sheet in this series.
Spill Cleanup	<ul style="list-style-type: none"> ❑ Prepare a spill cleanup plan that includes: <ul style="list-style-type: none"> ✓ Procedures for different types of spills ✓ Schedule for initial and annual training of employees ✓ Cleanup kits in well-marked, accessible areas ✓ Designation of key employee who monitors cleanup ✓ Posting the plan in the work area ❑ If a spill occurs, immediately stop the spill at its source. ❑ Keep the spill from entering the street, gutter, or storm drain. ❑ Use dry methods for spill cleanup (sweeping, cat litter, etc.). Don't hose down spills. ❑ If wet cleaning (including high-temperature or high pressure washing) is required, dry clean first and then mop (or if it is absolutely necessary, wash) and collect the water. Dispose of water in sink or other indoor drain, not in the street, gutter, or storm drain. ❑ If a final rinse is necessary for health reasons, collect the rinsewater and dispose it to the sink or indoor floor drain. If outdoors, block the storm drain before applying water. Mop up or wet-vacuum water, and dispose it to a sink or indoor drain. ❑ Do not use bleach or disinfectants if there is a possibility that rinsewater could flow to a street, gutter, or storm drain.

BG-30 Food Service Facilities

	<ul style="list-style-type: none"> □ For more information on cleaning outdoor surfaces see the Mobile Cleaning - Surface Cleaning business guide sheet in this series.
Recycling and Disposal	<ul style="list-style-type: none"> □ Separate wastes. Keep your recyclable wastes in separate containers according to the type of material. They are easier to recycle if separated. □ Recycle the following materials: <ul style="list-style-type: none"> ✓ Food waste (non-greasy, non-animal food waste can be composted). Donate leftover, edible food whenever possible to local food banks. ✓ Paper and cardboard ✓ Container glass, aluminum, and tin ✓ Pallets and drums □ Dispose of toxic waste properly. Toxic waste includes used cleaners, and rags (soaked with solvents, floor cleaners, and detergents).
Grease Handling and Disposal	<ul style="list-style-type: none"> □ Never pour oil, grease, or large quantities of oily liquids such as sauces or salad dressings or waste grease down a sink, floor drain, storm drain, or into a dumpster. □ Install screens and solid traps in sink and floor drains to catch larger solids. Clean these screens and traps frequently. □ Don't try to "dissolve" grease by adding hot water or emulsifying chemicals – it will only move the grease further down the building's sewer line and make it harder to remove later. □ Recycle grease and oil. Don't pour it into sinks, floor drains, or onto a parking lot or street. Look in the phone book for "Renderers" or call the local recycling or household hazardous waste information line. □ Use tallow bins or sealed containers with tamper-proof lids. Keep the exterior of the container clean. Check for leaks. Ask the recycler for a leak-free tallow bin and replace any leaky grease containers. If grease is stored outside, keep it under a roof, if possible. □ Do not contaminate the recyclable oils and grease in the tallow bin with the waste grease from the grease trap or grease interceptor. □ Inspect and clean all waste grease removal devices (grease trap or grease interceptor) often enough to keep them functioning properly and efficiently. □ For disposal of waste grease from the grease trap or grease interceptor, see "Grease Traps" or "Septic Tanks" in the phone book.

BG-30 Food Service Facilities

Land-scaping and Grounds Maintenance	<ul style="list-style-type: none"> <input type="checkbox"/> Never dispose of leftover pesticides in the gutter, street, or storm drain. Leftover pesticides must be either used up or disposed of as hazardous waste. <input type="checkbox"/> Do not blow or rake leaves, grass, or garden clippings into the street, gutter, or storm drain. <input type="checkbox"/> If pesticides are used, do not over apply or apply when rain is forecast. <input type="checkbox"/> Do not use copper-based algaecides in pools or fountains. Control algae with chlorine or other alternatives to copper-based products.
Pest Control	<p>Food Sources</p> <ul style="list-style-type: none"> <input type="checkbox"/> Keep the kitchen free of food scraps. <input type="checkbox"/> Take out garbage each night in a closed container. <input type="checkbox"/> Refrigerate all food or store in pest-proof containers each night. <input type="checkbox"/> Keep ventilation system working properly to keep greasy residue off walls. <p>Appliances</p> <ul style="list-style-type: none"> <input type="checkbox"/> Keep dishwasher area clean. Check the trap nightly. <input type="checkbox"/> Where possible, elevate appliances at least 6 inches off the floor. <input type="checkbox"/> Clean under appliances nightly. <input type="checkbox"/> Steam clean or wash appliances weekly. <input type="checkbox"/> Remember to clean under the counter, under the sink, and the refrigerator vent. <p>Drains and Trash Cans</p> <ul style="list-style-type: none"> <input type="checkbox"/> Steam clean or scrub floor drains with a brush to help eliminate fruit flies. <input type="checkbox"/> Keep dumpster area clean – inside and out. <input type="checkbox"/> Wash garbage cans regularly. <p>Supplies and Entry Points</p> <ul style="list-style-type: none"> <input type="checkbox"/> Check for pests before bringing supplies in to the kitchen. Roaches like corrugated boxes. <input type="checkbox"/> Don't store boxes in the kitchen – take boxes away or store in a refrigerated area. <input type="checkbox"/> Seal any gaps below doors. <p>Reduce Habitat</p> <ul style="list-style-type: none"> <input type="checkbox"/> Inspect the entire establishment – inside and out. <input type="checkbox"/> Suggest physical modifications that may help to eliminate pest behavior.

BG-30 Food Service Facilities

	<ul style="list-style-type: none"> ❑ Suggest changes in food storage or cleanup practices to eliminate food sources for pests. ❑ Place boric acid powder in wall voids. ❑ Seal cracks and crevices. <p>Monitor for Pests</p> <ul style="list-style-type: none"> ❑ Use sticky traps to monitor how well the pest control program is working. Pests caught in the traps warn of a possible problem. ❑ When hiring a pest control service, look for a company that provides Integrated Pest Management (IPM) services. <p>Use Baits First</p> <ul style="list-style-type: none"> ❑ Use baits for controlling pests. Remove bait when pests are gone, or else the bait may attract more pests. ❑ Use chemicals only as a last resort. If absolutely necessary, choose less-toxic chemicals, and ask the pest service to provide label information. ❑ Apply pesticides only if necessary, not on a regular schedule. Follow label directions. Do not apply pesticides around floor drains, sinks, or food. <p>Purchasing</p> <ul style="list-style-type: none"> ❑ Use non-disposable products. Serve food on ceramic dishware rather than paper, plastic or Styrofoam, and use cloth napkins rather than paper ones. If you must use disposable products, use paper instead of Styrofoam. ❑ Buy the least toxic products available: <ul style="list-style-type: none"> ✓ Look for “non-toxic,” “non-petroleum based,” “free of ammonia, phosphates, dye, or perfume,” or “readily biodegradable” on the label. Don’t assume biodegradable products are safe. Biodegradable means the product will eventually break down, but it may harm the environment in the meantime. ✓ Avoid chlorinated compounds, petroleum distillates, phenols, formaldehyde, and caustic or acidic products. ✓ Use water-based products. ✓ Look for and purchase “recycled” and “recyclable” containers. By doing so, you help ensure a use for the recyclable materials that people collect and recycle.
Education and Training	<ul style="list-style-type: none"> ❑ Employees can help prevent pollution when urban runoff training is included in employee orientations and reviews. ❑ Train all employees upon hiring and annually thereafter. ❑ Use a training log to document employee training.

BG-30 Food Service Facilities

	<ul style="list-style-type: none">❑ Post information about or labels for BMPs where employees and customers can see them.❑ Remember the facility is liable for the behavior of contractors. Be sure all contractors hired to clean inside or outside are aware of and implement these BMPs.❑ Explain BMPs to other food businesses through your business associations or chambers of commerce.
--	--

Treatment Control BMPs

If treatment controls are installed at the facility, see Section 4 of this Handbook for information on inspecting and maintaining the BMPs.

For information on designing treatment controls, see Section 5 of the Development and Redevelopment Handbook.

References

Bay Area Pollution Prevention Group, 2010. *Gravity Grease Interceptor (GGI) Fact Sheet*. Available on-line at <http://bacwa.org/Portals/0/GGI%20Fact%20Sheet-Final.pdf>

Bay Area Pollution Prevention Group, 2010. *Hydromechanical Grease Interceptor (HGI) Fact Sheet*. Available on-line at <http://bacwa.org/Portals/0/HGI%20Fact%20Sheet%20-%20Final.pdf>

Bay Area Pollution Prevention Group, 2010. *Grease Removal Device (GRD) Fact Sheet*. Available on-line at: <http://bacwa.org/Portals/0/GRD%20Fact%20Sheet%20-%20Final.pdf>

Bay Area Pollution Prevention Group, 2007. *Avoid Fines and Health Risks from Grease Overflows*. Available on-line at: <http://bacwa.org/Portals/0/Committees/BAPPG/Archive/bappgfs.pdf>

City of Pleasanton. *BMPs for Restaurants*. Available on-line at: <http://www.cityofpleasantonca.gov/pdf/bmprest.pdf>

Contra Costa County Public Works Department. Municipal Stormwater NPDES Compliance. *Food Service Facilities*. Available on-line at: <http://www.co.contra-costa.ca.us/DocumentCenter/View/6979>

Food and Beverage Association of San Diego. *What's Cookin', Eating and Drinking Establishments Stormwater Best Management Practices*. Available on-line at: http://www.sdcounty.ca.gov/dpw/watersheds/watershedpdf/whats_cookin05-03.pdf

Orange County Public Works, OC Watersheds. Industrial/Commercial Business Activities Best Management Practices. Available on-line at: <http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities>

Sacramento Stormwater Management Program. *Waste Disposal Guidelines for Food-Handling Facilities*. Available on-line at: <http://www.sacstormwater.org/StormwaterDocuments/StormwaterBrochures/WasteDisposalforFoodHandlingFacilities.pdf>

San Mateo Countywide Stormwater Pollution Prevention Program. *Stormwater Best Management Practices for Restaurants and Food Facilities*. Training Presentation. Available on-line at: www.calfog.org/docs/SanMateoBMP071405.ppt.

BG-30 Food Service Facilities

Santa Cruz County Department of Public Works, Environmental Compliance Unit. Best Environmental Management Practices. *Restaurant Wastewater*. Available on-line at: <http://www.dpw.co.santa-cruz.ca.us/Pretreatment/BMPs%20Restaurants.pdf>

Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene “bag” is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

California Experience

The number of installations is unknown but likely exceeds a thousand. Some users have reported that these systems require considerable maintenance to prevent plugging and bypass.

Advantages

- Does not require additional space as inserts as the drain inlets are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults. Usually not suitable for large areas or areas with trash or leaves than can plug the insert.

Design and Sizing Guidelines

Refer to manufacturer’s guidelines. Drain inserts come in many configurations but can be placed into three general groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene “bag” is placed in the wire mesh box. The bag takes the form of the box. Most box products are

Design Considerations

- Use with other BMPs
- Fit and Seal Capacity within Inlet

Targeted Constituents

- ✓ Sediment
- ✓ Nutrients
- ✓ Trash
- ✓ Metals
- ✓ Bacteria
- ✓ Oil and Grease
- ✓ Organics

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.



one box; that is, the setting area and filtration through media occurs in the same box. One manufacturer has a double-box. Stormwater enters the first box where setting occurs. The stormwater flows into the second box where the filter media is located. Some products consist of one or more trays or mesh grates. The trays can hold different types of media. Filtration media vary with the manufacturer: types include polypropylene, porous polymer, treated cellulose, and activated carbon.

Construction/Inspection Considerations

Be certain that installation is done in a manner that makes certain that the stormwater enters the unit and does not leak around the perimeter. Leakage between the frame of the insert and the frame of the drain inlet can easily occur with vertical (drop) inlets.

Performance

Few products have performance data collected under field conditions.

Siting Criteria

It is recommended that inserts be used only for retrofit situations or as pretreatment where other treatment BMPs presented in this section area used.

Additional Design Guidelines

Follow guidelines provided by individual manufacturers.

Maintenance

Likely require frequent maintenance, on the order of several times per year.

Cost

- The initial cost of individual inserts ranges from less than \$100 to about \$2,000. The cost of using multiple units in curb inlet drains varies with the size of the inlet.
- The low cost of inserts may tend to favor the use of these systems over other, more effective treatment BMPs. However, the low cost of each unit may be offset by the number of units that are required, more frequent maintenance, and the shorter structural life (and therefore replacement).

References and Sources of Additional Information

Hrachovec, R., and G. Minton, 2001, Field testing of a sock-type catch basin insert, Planet CPR, Seattle, Washington

Interagency Catch Basin Insert Committee, Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Developed Sites, 1995

Larry Walker Associates, June 1998, NDMP Inlet/In-Line Control Measure Study Report

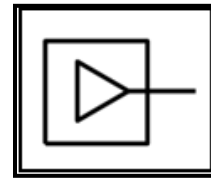
Manufacturers literature

Santa Monica (City), Santa Monica Bay Municipal Stormwater/Urban Runoff Project - Evaluation of Potential Catch basin Retrofits, Woodward Clyde, September 24, 1998

Woodward Clyde, June 11, 1996, Parking Lot Monitoring Report, Santa Clara Valley Nonpoint Source Pollution Control Program.

Outlet Protection/Velocity Dissipation Devices

SS-10



Standard Symbol

BMP Objectives	
Soil Stabilization	<input checked="" type="checkbox"/>
Sediment Control	<input checked="" type="checkbox"/>
Tracking Control	<input type="checkbox"/>
Wind Erosion Control	<input type="checkbox"/>
Non-Stormwater Management	<input type="checkbox"/>
Materials and Waste Management	<input type="checkbox"/>

Definition and Purpose

These devices are placed at pipe outlets to prevent scour and reduce the velocity and/or energy of stormwater flows.

Appropriate Applications

These devices may be used at the following locations:

- Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels.
- Outlets located at the bottom of mild to steep slopes.
- Discharge outlets that carry continuous flows of water.
- Outlets subject to short, intense flows of water, such as flash floods.
- Points where lined conveyances discharge to unlined conveyances.

Limitations

Loose rock may have stones washed away during high flows.

Grouted rock slope protection may break up in areas of freeze and thaw.

If there is not adequate drainage, and water builds up behind grouted rock slope protection, it may cause the grouted rock slope protection to break up due to the resulting hydrostatic pressure.

Outlet protection may negatively impact the channel habitat.



Outlet Protection/Velocity Dissipation Devices

SS-10

Standards and Specifications

There are many types of energy dissipaters; a flared end section and rock slope protection is shown in the figure on the previous page. Please note that this is only one example and the RE may approve other types of devices proposed by the contractor.

Flared end sections must comply with Standard Specification 70-5.02.

Rock slope protection must comply with Standard Specification Section 72.

Install rock slope protection, grouted rock slope protection, or concrete apron at selected outlet. Rock slope protection aprons are best suited for temporary use during construction.

Carefully place rock slope protection to avoid damaging the filter fabric.

For proper operation of apron:

- Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, consider placing it in upper section of apron.
- If size of apron rock slope protection is large, consider protecting underlying filter fabric with a gravel blanket.

Outlets on slopes steeper than 10% should have additional protection.

Maintenance and Inspection

At a minimum, perform inspections weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

Minimize areas of standing water by removing sediment blockages and filling scour depressions. If persistent, it might be necessary to have licensed professional re-evaluate size and type of device implemented.

Inspect apron for displacement of the rock slope protection and/or damage to the underlying fabric. Repair fabric and replace rock slope protection that has washed away.

Inspect for scour beneath the rock slope protection and around the outlet. Repair damage to slopes or underlying filter fabric immediately.

Temporary devices should be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of construction.



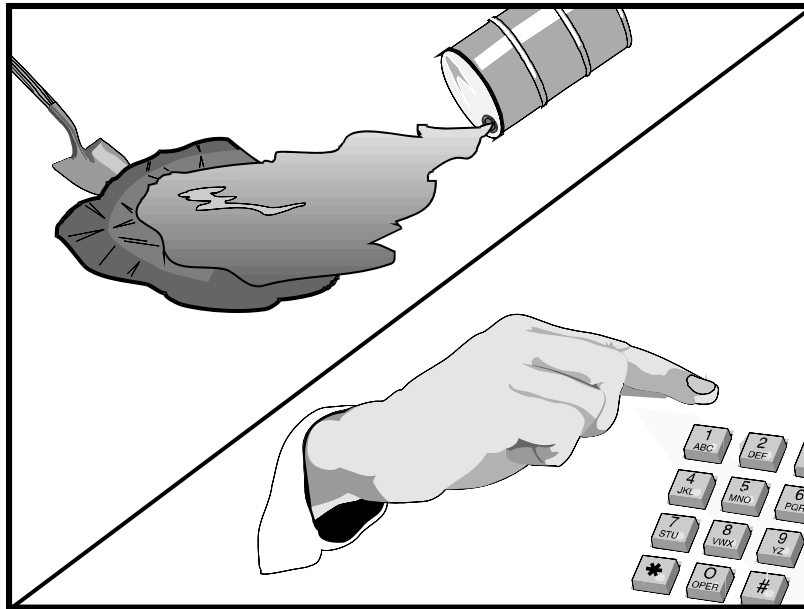
Outlet Protection/Velocity Dissipation Devices

SS-10

SWPPP or WPCP

Outlet Protection/Velocity Dissipation Devices must be discussed in Section 500.3.2 of SWPPP or Section 30.2 of the WPCP.





Description and Purpose

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

Potential Alternatives

None



- Fuels
- Lubricants
- Other petroleum distillates

Limitations

- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

Implementation

The following steps will help reduce the stormwater impacts of leaks and spills:

Education

- Be aware that different materials pollute in different amounts. Make sure that each employee knows what a “significant spill” is for each material they use, and what is the appropriate response for “significant” and “insignificant” spills.
- Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.
- Have contractor’s superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runoff during rainfall to the extent that it doesn’t compromise clean up activities.
- Do not bury or wash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:
 - Contain the spread of the spill.
 - Recover spilled materials.
 - Clean the contaminated area and properly dispose of contaminated materials.

Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runoff of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runoff of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or water can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

California Experience

Infiltration basins have a long history of use in California, especially in the Central Valley. Basins located in Fresno were among those initially evaluated in the National Urban Runoff Program and were found to be effective at reducing the volume of runoff, while posing little long-term threat to groundwater quality (EPA, 1983; Schroeder, 1995). Proper siting of these devices is crucial as underscored by the experience of Caltrans in siting two basins in Southern California. The basin with marginal separation from groundwater and soil permeability failed immediately and could never be rehabilitated.

Advantages

- Provides 100% reduction in the load discharged to surface waters.
- The principal benefit of infiltration basins is the approximation of pre-development hydrology during which a

Design Considerations

- Soil for Infiltration
- Slope
- Aesthetics

Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	■
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■

Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



significant portion of the average annual rainfall runoff is infiltrated and evaporated rather than flushed directly to creeks.

- If the water quality volume is adequately sized, infiltration basins can be useful for providing control of channel forming (erosion) and high frequency (generally less than the 2-year) flood events.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Infiltration basins require a minimum soil infiltration rate of 0.5 inches/hour, not appropriate at sites with Hydrologic Soil Types C and D.
- If infiltration rates exceed 2.4 inches/hour, then the runoff should be fully treated prior to infiltration to protect groundwater quality.
- Not suitable on fill sites or steep slopes.
- Risk of groundwater contamination in very coarse soils.
- Upstream drainage area must be completely stabilized before construction.
- Difficult to restore functioning of infiltration basins once clogged.

Design and Sizing Guidelines

- Water quality volume determined by local requirements or sized so that 85% of the annual runoff volume is captured.
- Basin sized so that the entire water quality volume is infiltrated within 48 hours.
- Vegetation establishment on the basin floor may help reduce the clogging rate.

Construction/Inspection Considerations

- Before construction begins, stabilize the entire area draining to the facility. If impossible, place a diversion berm around the perimeter of the infiltration site to prevent sediment entrance during construction or remove the top 2 inches of soil after the site is stabilized. Stabilize the entire contributing drainage area, including the side slopes, before allowing any runoff to enter once construction is complete.
- Place excavated material such that it can not be washed back into the basin if a storm occurs during construction of the facility.
- Build the basin without driving heavy equipment over the infiltration surface. Any equipment driven on the surface should have extra-wide ("low pressure") tires. Prior to any construction, rope off the infiltration area to stop entrance by unwanted equipment.
- After final grading, till the infiltration surface deeply.
- Use appropriate erosion control seed mix for the specific project and location.

Performance

As water migrates through porous soil and rock, pollutant attenuation mechanisms include precipitation, sorption, physical filtration, and bacterial degradation. If functioning properly, this approach is presumed to have high removal efficiencies for particulate pollutants and moderate removal of soluble pollutants. Actual pollutant removal in the subsurface would be expected to vary depending upon site-specific soil types. This technology eliminates discharge to surface waters except for the very largest storms; consequently, complete removal of all stormwater constituents can be assumed.

There remain some concerns about the potential for groundwater contamination despite the findings of the NURP and Nightingale (1975; 1987a,b,c; 1989). For instance, a report by Pitt et al. (1994) highlighted the potential for groundwater contamination from intentional and unintentional stormwater infiltration. That report recommends that infiltration facilities not be sited in areas where high concentrations are present or where there is a potential for spills of toxic material. Conversely, Schroeder (1995) reported that there was no evidence of groundwater impacts from an infiltration basin serving a large industrial catchment in Fresno, CA.

Siting Criteria

The key element in siting infiltration basins is identifying sites with appropriate soil and hydrogeologic properties, which is critical for long term performance. In one study conducted in Prince George's County, Maryland (Galli, 1992), all of the infiltration basins investigated clogged within 2 years. It is believed that these failures were for the most part due to allowing infiltration at sites with rates of less than 0.5 in/hr, basing siting on soil type rather than field infiltration tests, and poor construction practices that resulted in soil compaction of the basin invert.

A study of 23 infiltration basins in the Pacific Northwest showed better long-term performance in an area with highly permeable soils (Hilding, 1996). In this study, few of the infiltration basins had failed after 10 years. Consequently, the following guidelines for identifying appropriate soil and subsurface conditions should be rigorously adhered to.

- Determine soil type (consider RCS soil type 'A, B or C' only) from mapping and consult USDA soil survey tables to review other parameters such as the amount of silt and clay, presence of a restrictive layer or seasonal high water table, and estimated permeability. The soil should not have more than 30% clay or more than 40% of clay and silt combined. Eliminate sites that are clearly unsuitable for infiltration.
- Groundwater separation should be at least 3 m from the basin invert to the measured ground water elevation. There is concern at the state and regional levels of the impact on groundwater quality from infiltrated runoff, especially when the separation between groundwater and the surface is small.
- Location away from buildings, slopes and highway pavement (greater than 6 m) and wells and bridge structures (greater than 30 m). Sites constructed of fill, having a base flow or with a slope greater than 15% should not be considered.
- Ensure that adequate head is available to operate flow splitter structures (to allow the basin to be offline) without ponding in the splitter structure or creating backwater upstream of the splitter.

- Base flow should not be present in the tributary watershed.

Secondary Screening Based on Site Geotechnical Investigation

- At least three in-hole conductivity tests shall be performed using USBR 7300-89 or Bouwer-Rice procedures (the latter if groundwater is encountered within the boring), two tests at different locations within the proposed basin and the third down gradient by no more than approximately 10 m. The tests shall measure permeability in the side slopes and the bed within a depth of 3 m of the invert.
- The minimum acceptable hydraulic conductivity as measured in any of the three required test holes is 13 mm/hr. If any test hole shows less than the minimum value, the site should be disqualified from further consideration.
- Exclude from consideration sites constructed in fill or partially in fill unless no silts or clays are present in the soil boring. Fill tends to be compacted, with clays in a dispersed rather than flocculated state, greatly reducing permeability.
- The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move in the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Additional Design Guidelines

- (1) Basin Sizing - The required water quality volume is determined by local regulations or sufficient to capture 85% of the annual runoff.
- (2) Provide pretreatment if sediment loading is a maintenance concern for the basin.
- (3) Include energy dissipation in the inlet design for the basins. Avoid designs that include a permanent pool to reduce opportunity for standing water and associated vector problems.
- (4) Basin invert area should be determined by the equation:

$$A = \frac{WQV}{kt}$$

where A = Basin invert area (m²)

WQV = water quality volume (m³)

k = 0.5 times the lowest field-measured hydraulic conductivity (m/hr)

t = drawdown time (48 hr)

- (5) The use of vertical piping, either for distribution or infiltration enhancement shall not be allowed to avoid device classification as a Class V injection well per 40 CFR146.5(e)(4).

Maintenance

Regular maintenance is critical to the successful operation of infiltration basins. Recommended operation and maintenance guidelines include:

- Inspections and maintenance to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.
- Observe drain time for the design storm after completion or modification of the facility to confirm that the desired drain time has been obtained.
- Schedule semiannual inspections for beginning and end of the wet season to identify potential problems such as erosion of the basin side slopes and invert, standing water, trash and debris, and sediment accumulation.
- Remove accumulated trash and debris in the basin at the start and end of the wet season.
- Inspect for standing water at the end of the wet season.
- Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.
- Remove accumulated sediment and regrade when the accumulated sediment volume exceeds 10% of the basin.
- If erosion is occurring within the basin, revegetate immediately and stabilize with an erosion control mulch or mat until vegetation cover is established.
- To avoid reversing soil development, scarification or other disturbance should only be performed when there are actual signs of clogging, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a very light tractor.

Cost

Infiltration basins are relatively cost-effective practices because little infrastructure is needed when constructing them. One study estimated the total construction cost at about \$2 per ft (adjusted for inflation) of storage for a 0.25-acre basin (SWRPC, 1991). As with other BMPs, these published cost estimates may deviate greatly from what might be incurred at a specific site. For instance, Caltrans spent about \$18/ft³ for the two infiltration basins constructed in southern California, each of which had a water quality volume of about 0.34 ac.-ft. Much of the higher cost can be attributed to changes in the storm drain system necessary to route the runoff to the basin locations.

Infiltration basins typically consume about 2 to 3% of the site draining to them, which is relatively small. Additional space may be required for buffer, landscaping, access road, and fencing. Maintenance costs are estimated at 5 to 10% of construction costs.

One cost concern associated with infiltration practices is the maintenance burden and longevity. If improperly maintained, infiltration basins have a high failure rate. Thus, it may be necessary to replace the basin with a different technology after a relatively short period of time.

References and Sources of Additional Information

- Caltrans, 2002, BMP Retrofit Pilot Program Proposed Final Report, Rpt. CTSW-RT-01-050, California Dept. of Transportation, Sacramento, CA.
- Galli, J. 1992. *Analysis of Urban BMP Performance and Longevity in Prince George's County, Maryland*. Metropolitan Washington Council of Governments, Washington, DC.
- Hilding, K. 1996. Longevity of infiltration basins assessed in Puget Sound. *Watershed Protection Techniques* 1(3):124-125.
- Maryland Department of the Environment (MDE). 2000. *Maryland Stormwater Design Manual*. <http://www.mde.state.md.us/environment/wma/stormwatermanual>. Accessed May 22, 2002.
- Metzger, M. E., D. F. Messer, C. L. Beitia, C. M. Myers, and V. L. Kramer. 2002. The Dark Side Of Stormwater Runoff Management: Disease Vectors Associated With Structural BMPs. *Stormwater* 3(2): 24-39.
- Nightingale, H.I., 1975, "Lead, Zinc, and Copper in Soils of Urban Storm-Runoff Retention Basins," *American Water Works Assoc. Journal*. Vol. 67, p. 443-446.
- Nightingale, H.I., 1987a, "Water Quality beneath Urban Runoff Water Management Basins," *Water Resources Bulletin*, Vol. 23, p. 197-205.
- Nightingale, H.I., 1987b, "Accumulation of As, Ni, Cu, and Pb in Retention and Recharge Basin Soils from Urban Runoff," *Water Resources Bulletin*, Vol. 23, p. 663-672.
- Nightingale, H.I., 1987c, "Organic Pollutants in Soils of Retention/Recharge Basins Receiving Urban Runoff Water," *Soil Science* Vol. 148, pp. 39-45.
- Nightingale, H.I., Harrison, D., and Salo, J.E., 1985, "An Evaluation Technique for Groundwater Quality Beneath Urban Runoff Retention and Percolation Basins," *Ground Water Monitoring Review*, Vol. 5, No. 1, pp. 43-50.
- Oberts, G. 1994. Performance of Stormwater Ponds and Wetlands in Winter. *Watershed Protection Techniques* 1(2): 64-68.
- Pitt, R., et al. 1994, *Potential Groundwater Contamination from Intentional and Nonintentional Stormwater Infiltration*, EPA/600/R-94/051, Risk Reduction Engineering Laboratory, U.S. EPA, Cincinnati, OH.
- Schueler, T. 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs*. Metropolitan Washington Council of Governments, Washington, DC.
- Schroeder, R.A., 1995, *Potential For Chemical Transport Beneath a Storm-Runoff Recharge (Retention) Basin for an Industrial Catchment in Fresno, CA*, USGS Water-Resource Investigations Report 93-4140.

Southeastern Wisconsin Regional Planning Commission (SWRPC). 1991. ***Costs of Urban Nonpoint Source Water Pollution Control Measures***. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI.

U.S. EPA, 1983, ***Results of the Nationwide Urban Runoff Program: Volume 1 – Final Report***, WH-554, Water Planning Division, Washington, DC.

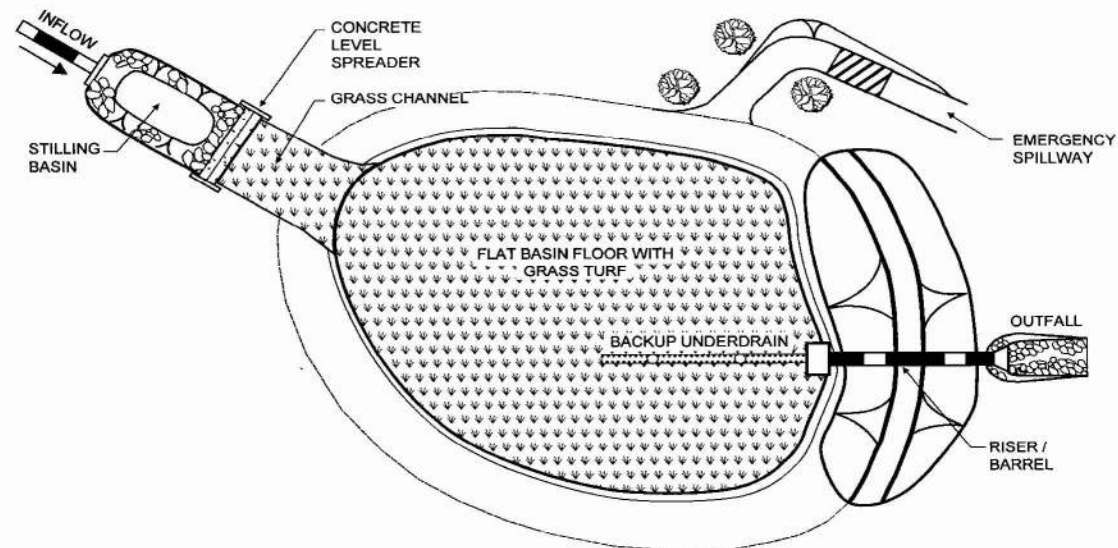
Watershed Management Institute (WMI). 1997. ***Operation, Maintenance, and Management of Stormwater Management Systems***. Prepared for U.S. Environmental Protection Agency Office of Water, Washington, DC.

Information Resources

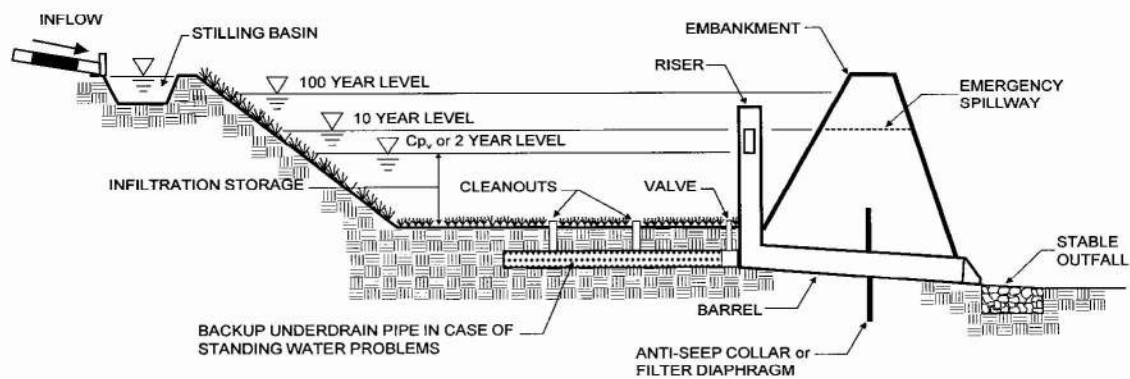
Center for Watershed Protection (CWP). 1997. ***Stormwater BMP Design Supplement for Cold Climates***. Prepared for U.S. Environmental Protection Agency Office of Wetlands, Oceans and Watersheds. Washington, DC.

Ferguson, B.K., 1994. ***Stormwater Infiltration***. CRC Press, Ann Arbor, MI.

USEPA. 1993. ***Guidance to Specify Management Measures for Sources of Nonpoint Pollution in Coastal Waters***. EPA-840-B-92-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.



PLAN VIEW



PROFILE



Design Considerations

- Tributary Area
- Area Required
- Slope
- Water Availability

Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems.

California Experience

Caltrans constructed and monitored six vegetated swales in southern California. These swales were generally effective in reducing the volume and mass of pollutants in runoff. Even in the areas where the annual rainfall was only about 10 inches/yr, the vegetation did not require additional irrigation. One factor that strongly affected performance was the presence of large numbers of gophers at most of the sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- If properly designed, vegetated, and operated, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant collateral water quality benefits.

Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	▲
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	●
<input checked="" type="checkbox"/>	Metals	▲
<input checked="" type="checkbox"/>	Bacteria	●
<input checked="" type="checkbox"/>	Oil and Grease	▲
<input checked="" type="checkbox"/>	Organics	▲

Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



- Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible.

Limitations

- Can be difficult to avoid channelization.
- May not be appropriate for industrial sites or locations where spills may occur
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.
- Swales are more susceptible to failure if not properly maintained than other treatment BMPs.

Design and Sizing Guidelines

- Flow rate based design determined by local requirements or sized so that 85% of the annual runoff volume is discharged at less than the design rainfall intensity.
- Swale should be designed so that the water level does not exceed 2/3rds the height of the grass or 4 inches, whichever is less, at the design treatment rate.
- Longitudinal slopes should not exceed 2.5%
- Trapezoidal channels are normally recommended but other configurations, such as parabolic, can also provide substantial water quality improvement and may be easier to mow than designs with sharp breaks in slope.
- Swales constructed in cut are preferred, or in fill areas that are far enough from an adjacent slope to minimize the potential for gopher damage. Do not use side slopes constructed of fill, which are prone to structural damage by gophers and other burrowing animals.
- A diverse selection of low growing, plants that thrive under the specific site, climatic, and watering conditions should be specified. Vegetation whose growing season corresponds to the wet season are preferred. Drought tolerant vegetation should be considered especially for swales that are not part of a regularly irrigated landscaped area.
- The width of the swale should be determined using Manning's Equation using a value of 0.25 for Manning's n.

Construction/Inspection Considerations

- Include directions in the specifications for use of appropriate fertilizer and soil amendments based on soil properties determined through testing and compared to the needs of the vegetation requirements.
- Install swales at the time of the year when there is a reasonable chance of successful establishment without irrigation; however, it is recognized that rainfall in a given year may not be sufficient and temporary irrigation may be used.
- If sod tiles must be used, they should be placed so that there are no gaps between the tiles; stagger the ends of the tiles to prevent the formation of channels along the swale or strip.
- Use a roller on the sod to ensure that no air pockets form between the sod and the soil.
- Where seeds are used, erosion controls will be necessary to protect seeds for at least 75 days after the first rainfall of the season.

Performance

The literature suggests that vegetated swales represent a practical and potentially effective technique for controlling urban runoff quality. While limited quantitative performance data exists for vegetated swales, it is known that check dams, slight slopes, permeable soils, dense grass cover, increased contact time, and small storm events all contribute to successful pollutant removal by the swale system. Factors decreasing the effectiveness of swales include compacted soils, short runoff contact time, large storm events, frozen ground, short grass heights, steep slopes, and high runoff velocities and discharge rates.

Conventional vegetated swale designs have achieved mixed results in removing particulate pollutants. A study performed by the Nationwide Urban Runoff Program (NURP) monitored three grass swales in the Washington, D.C., area and found no significant improvement in urban runoff quality for the pollutants analyzed. However, the weak performance of these swales was attributed to the high flow velocities in the swales, soil compaction, steep slopes, and short grass height.

Another project in Durham, NC, monitored the performance of a carefully designed artificial swale that received runoff from a commercial parking lot. The project tracked 11 storms and concluded that particulate concentrations of heavy metals (Cu, Pb, Zn, and Cd) were reduced by approximately 50 percent. However, the swale proved largely ineffective for removing soluble nutrients.

The effectiveness of vegetated swales can be enhanced by adding check dams at approximately 17 meter (50 foot) increments along their length (See Figure 1). These dams maximize the retention time within the swale, decrease flow velocities, and promote particulate settling. Finally, the incorporation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.

Only 9 studies have been conducted on all grassed channels designed for water quality (Table 1). The data suggest relatively high removal rates for some pollutants, but negative removals for some bacteria, and fair performance for phosphorus.

Table 1 Grassed swale pollutant removal efficiency data							
Removal Efficiencies (% Removal)							
Study	TSS	TP	TN	NO ₃	Metals	Bacteria	Type
Caltrans 2002	77	8	67	66	83-90	-33	dry swales
Goldberg 1993	67.8	4.5	-	31.4	42-62	-100	grassed channel
Seattle Metro and Washington Department of Ecology 1992	60	45	-	-25	2-16	-25	grassed channel
Seattle Metro and Washington Department of Ecology, 1992	83	29	-	-25	46-73	-25	grassed channel
Wang et al., 1981	80	-	-	-	70-80	-	dry swale
Dorman et al., 1989	98	18	-	45	37-81	-	dry swale
Harper, 1988	87	83	84	80	88-90	-	dry swale
Kercher et al., 1983	99	99	99	99	99	-	dry swale
Harper, 1988.	81	17	40	52	37-69	-	wet swale
Koon, 1995	67	39	-	9	-35 to 6	-	wet swale

While it is difficult to distinguish between different designs based on the small amount of available data, grassed channels generally have poorer removal rates than wet and dry swales, although some swales appear to export soluble phosphorus (Harper, 1988; Koon, 1995). It is not clear why swales export bacteria. One explanation is that bacteria thrive in the warm swale soils.

Siting Criteria

The suitability of a swale at a site will depend on land use, size of the area serviced, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the swale system (Schueler et al., 1992). In general, swales can be used to serve areas of less than 10 acres, with slopes no greater than 5 %. Use of natural topographic lows is encouraged and natural drainage courses should be regarded as significant local resources to be kept in use (Young et al., 1996).

Selection Criteria (NCTCOG, 1993)

- Comparable performance to wet basins
- Limited to treating a few acres
- Availability of water during dry periods to maintain vegetation
- Sufficient available land area

Research in the Austin area indicates that vegetated controls are effective at removing pollutants even when dormant. Therefore, irrigation is not required to maintain growth during dry periods, but may be necessary only to prevent the vegetation from dying.

The topography of the site should permit the design of a channel with appropriate slope and cross-sectional area. Site topography may also dictate a need for additional structural controls. Recommendations for longitudinal slopes range between 2 and 6 percent. Flatter slopes can be used, if sufficient to provide adequate conveyance. Steep slopes increase flow velocity, decrease detention time, and may require energy dissipating and grade check. Steep slopes also can be managed using a series of check dams to terrace the swale and reduce the slope to within acceptable limits. The use of check dams with swales also promotes infiltration.

Additional Design Guidelines

Most of the design guidelines adopted for swale design specify a minimum hydraulic residence time of 9 minutes. This criterion is based on the results of a single study conducted in Seattle, Washington (Seattle Metro and Washington Department of Ecology, 1992), and is not well supported. Analysis of the data collected in that study indicates that pollutant removal at a residence time of 5 minutes was not significantly different, although there is more variability in that data. Therefore, additional research in the design criteria for swales is needed. Substantial pollutant removal has also been observed for vegetated controls designed solely for conveyance (Barrett et al, 1998); consequently, some flexibility in the design is warranted.

Many design guidelines recommend that grass be frequently mowed to maintain dense coverage near the ground surface. Recent research (Colwell et al., 2000) has shown mowing frequency or grass height has little or no effect on pollutant removal.

Summary of Design Recommendations

- 1) The swale should have a length that provides a minimum hydraulic residence time of at least 10 minutes. The maximum bottom width should not exceed 10 feet unless a dividing berm is provided. The depth of flow should not exceed 2/3rds the height of the grass at the peak of the water quality design storm intensity. The channel slope should not exceed 2.5%.
- 2) A design grass height of 6 inches is recommended.
- 3) Regardless of the recommended detention time, the swale should be not less than 100 feet in length.
- 4) The width of the swale should be determined using Manning's Equation, at the peak of the design storm, using a Manning's n of 0.25.
- 5) The swale can be sized as both a treatment facility for the design storm and as a conveyance system to pass the peak hydraulic flows of the 100-year storm if it is located "on-line." The side slopes should be no steeper than 3:1 (H:V).
- 6) Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible. If flow is to be introduced through curb cuts, place pavement slightly above the elevation of the vegetated areas. Curb cuts should be at least 12 inches wide to prevent clogging.
- 7) Swales must be vegetated in order to provide adequate treatment of runoff. It is important to maximize water contact with vegetation and the soil surface. For general purposes, select fine, close-growing, water-resistant grasses. If possible, divert runoff (other than necessary irrigation) during the period of vegetation

establishment. Where runoff diversion is not possible, cover graded and seeded areas with suitable erosion control materials.

Maintenance

The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely. The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover.

Maintenance activities should include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Cuttings should be removed from the channel and disposed in a local composting facility. Accumulated sediment should also be removed manually to avoid concentrated flows in the swale. The application of fertilizers and pesticides should be minimal.

Another aspect of a good maintenance plan is repairing damaged areas within a channel. For example, if the channel develops ruts or holes, it should be repaired utilizing a suitable soil that is properly tamped and seeded. The grass cover should be thick; if it is not, reseed as necessary. Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Residuals (e.g., silt, grass cuttings) must be disposed in accordance with local or State requirements. Maintenance of grassed swales mostly involves maintenance of the grass or wetland plant cover. Typical maintenance activities are summarized below:

- Inspect swales at least twice annually for erosion, damage to vegetation, and sediment and debris accumulation preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the swale is ready for winter. However, additional inspection after periods of heavy runoff is desirable. The swale should be checked for debris and litter, and areas of sediment accumulation.
- Grass height and mowing frequency may not have a large impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.
- Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.
- Sediment accumulating near culverts and in channels should be removed when it builds up to 75 mm (3 in.) at any spot, or covers vegetation.
- Regularly inspect swales for pools of standing water. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g. debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained.

Cost

Construction Cost

Little data is available to estimate the difference in cost between various swale designs. One study (SWRPC, 1991) estimated the construction cost of grassed channels at approximately \$0.25 per ft². This price does not include design costs or contingencies. Brown and Schueler (1997) estimate these costs at approximately 32 percent of construction costs for most stormwater management practices. For swales, however, these costs would probably be significantly higher since the construction costs are so low compared with other practices. A more realistic estimate would be a total cost of approximately \$0.50 per ft², which compares favorably with other stormwater management practices.

Table 2 Swale Cost Estimate (SEWRPC, 1991)

Component	Unit	Extent	Unit Cost			Total Cost		
			Low	Moderate	High	Low	Moderate	High
Mobilization / Demobilization-Light	Swale	1	\$107	\$274	\$441	\$107	\$274	\$441
Site Preparation								
Clearing ^b	Acres	0.5	\$2,200	\$3,800	\$5,400	\$1,100	\$1,900	\$2,700
Grubbing ^c	Acres	0.25	\$3,800	\$5,200	\$6,600	\$950	\$1,300	\$1,650
General Excavation ^d	Yd ³	372	\$2,10	\$3,70	\$5,30	\$781	\$1,376	\$1,972
Level and Till ^e	Yd ²	1,210	\$0.20	\$0.35	\$0.50	\$242	\$424	\$605
Sites Development								
Salvaged Topsoil	Yd ²	1,210	\$0.40	\$1.00	\$1.60	\$484	\$1,210	\$1,936
Seed, and Mulch ^f ..	Yd ²	1,210	\$1.20	\$2.40	\$3.60	\$1,452	\$2,904	\$4,356
Sod ^g								
Subtotal	--	--	--	--	--	\$5,116	\$9,388	\$13,660
Contingencies	Swale	1	25%	25%	25%	\$1,279	\$2,347	\$3,415
Total	--	--	--	--	--	\$6,395	\$11,735	\$17,075

Source: (SEWRPC, 1991)

Note: Mobilization/demobilization refers to the organization and planning involved in establishing a vegetative swale.

^a Swale has a bottom width of 1.0 foot, a top width of 10 feet with 1:3 side slopes, and a 1,000-foot length.^b Area cleared = (top width + 10 feet) x swale length.^c Area grubbed = (top width x swale length).^d Volume excavated = (0.67 x top width x swale depth) x swale length (parabolic cross-section).^e Area tilled = (top width + $\frac{8(\text{swale depth}^2)}{3(\text{top width})}$) x swale length (parabolic cross-section).^f Area seeded = area cleared x 0.5.^g Area sodded = area cleared x 0.5.

Table 3 Estimated Maintenance Costs (SEWRPC, 1991)

Component	Unit Cost	Swale Size (Depth and Top Width)		Comment
		1.5 Foot Depth, One-Foot Bottom Width, 10-Foot Top Width	3-Foot Depth, 3-Foot Bottom Width, 21-Foot Top Width	
Lawn Mowing	\$0.85 / 1,000 ft ² / mowing	\$0.14 / linear foot	\$0.21 / linear foot	Lawn maintenance area = (top width + 10 feet) x length. Mow eight times per year
General Lawn Care	\$9.00 / 1,000 ft ² / year	\$0.18 / linear foot	\$0.28 / linear foot	Lawn maintenance area = (top width + 10 feet) x length
Swale Debris and Litter Removal	\$0.10 / linear foot / year	\$0.10 / linear foot	\$0.10 / linear foot	—
Grass Reseeding with Mulch and Fertilizer	\$0.30 / yd ²	\$0.01 / linear foot	\$0.01 / linear foot	Area revegetated equals 1% of lawn maintenance area per year
Program Administration and Swale Inspection	\$0.15 / linear foot / year, plus \$25 / inspection	\$0.15 / linear foot	\$0.15 / linear foot	Inspect four times per year
Total	--	\$0.58 / linear foot	\$0.75 / linear foot	--

Maintenance Cost

Caltrans (2002) estimated the expected annual maintenance cost for a swale with a tributary area of approximately 2 ha at approximately \$2,700. Since almost all maintenance consists of mowing, the cost is fundamentally a function of the mowing frequency. Unit costs developed by SEWRPC are shown in Table 3. In many cases vegetated channels would be used to convey runoff and would require periodic mowing as well, so there may be little additional cost for the water quality component. Since essentially all the activities are related to vegetation management, no special training is required for maintenance personnel.

References and Sources of Additional Information

Barrett, Michael E., Walsh, Patrick M., Malina, Joseph F., Jr., Charbeneau, Randall J, 1998, "Performance of vegetative controls for treating highway runoff," *ASCE Journal of Environmental Engineering*, Vol. 124, No. 11, pp. 1121-1128.

Brown, W., and T. Schueler. 1997. *The Economics of Stormwater BMPs in the Mid-Atlantic Region*. Prepared for the Chesapeake Research Consortium, Edgewater, MD, by the Center for Watershed Protection, Ellicott City, MD.

Center for Watershed Protection (CWP). 1996. *Design of Stormwater Filtering Systems*. Prepared for the Chesapeake Research Consortium, Solomons, MD, and USEPA Region V, Chicago, IL, by the Center for Watershed Protection, Ellicott City, MD.

Colwell, Shanti R., Horner, Richard R., and Booth, Derek B., 2000. *Characterization of Performance Predictors and Evaluation of Mowing Practices in Biofiltration Swales*. Report to King County Land And Water Resources Division and others by Center for Urban Water Resources Management, Department of Civil and Environmental Engineering, University of Washington, Seattle, WA

Dorman, M.E., J. Hartigan, R.F. Steg, and T. Quasebarth. 1989. *Retention, Detention and Overland Flow for Pollutant Removal From Highway Stormwater Runoff. Vol. 1*. FHWA/RD 89/202. Federal Highway Administration, Washington, DC.

Goldberg. 1993. *Dayton Avenue Swale Biofiltration Study*. Seattle Engineering Department, Seattle, WA.

Harper, H. 1988. *Effects of Stormwater Management Systems on Groundwater Quality*. Prepared for Florida Department of Environmental Regulation, Tallahassee, FL, by Environmental Research and Design, Inc., Orlando, FL.

Kercher, W.C., J.C. Landon, and R. Massarelli. 1983. Grassy swales prove cost-effective for water pollution control. *Public Works*, 16: 53–55.

Koon, J. 1995. *Evaluation of Water Quality Ponds and Swales in the Issaquah/East Lake Sammamish Basins*. King County Surface Water Management, Seattle, WA, and Washington Department of Ecology, Olympia, WA.

Metzger, M. E., D. F. Messer, C. L. Beitia, C. M. Myers, and V. L. Kramer. 2002. The Dark Side Of Stormwater Runoff Management: Disease Vectors Associated With Structural BMPs. *Stormwater* 3(2): 24-39.

Oakland, P.H. 1983. An evaluation of stormwater pollutant removal

through grassed swale treatment. In *Proceedings of the International Symposium of Urban Hydrology, Hydraulics and Sediment Control*, Lexington, KY. pp. 173–182.

Occoquan Watershed Monitoring Laboratory. 1983. Final Report: *Metropolitan Washington Urban Runoff Project*. Prepared for the Metropolitan Washington Council of Governments, Washington, DC, by the Occoquan Watershed Monitoring Laboratory, Manassas, VA.

Pitt, R., and J. McLean. 1986. *Toronto Area Watershed Management Strategy Study: Humber River Pilot Watershed Project*. Ontario Ministry of Environment, Toronto, ON.

Schueler, T. 1997. Comparative Pollutant Removal Capability of Urban BMPs: A reanalysis. *Watershed Protection Techniques* 2(2):379–383.

Seattle Metro and Washington Department of Ecology. 1992. *Biofiltration Swale Performance: Recommendations and Design Considerations*. Publication No. 657. Water Pollution Control Department, Seattle, WA.

Southeastern Wisconsin Regional Planning Commission (SWRPC). 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*. Technical report no. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI.

U.S. EPA, 1999, Stormwater Fact Sheet: Vegetated Swales, Report # 832-F-99-006 <http://www.epa.gov/owm/mtb/vegswale.pdf>, Office of Water, Washington DC.

Wang, T., D. Spyridakis, B. Mar, and R. Horner. 1981. *Transport, Deposition and Control of Heavy Metals in Highway Runoff*. FHWA-WA-RD-39-10. University of Washington, Department of Civil Engineering, Seattle, WA.

Washington State Department of Transportation, 1995, *Highway Runoff Manual*, Washington State Department of Transportation, Olympia, Washington.

Welborn, C., and J. Veenhuis. 1987. *Effects of Runoff Controls on the Quantity and Quality of Urban Runoff in Two Locations in Austin, TX*. USGS Water Resources Investigations Report No. 87-4004. U.S. Geological Survey, Reston, VA.

Yousef, Y., M. Wanielista, H. Harper, D. Pearce, and R. Tolbert. 1985. *Best Management Practices: Removal of Highway Contaminants By Roadside Swales*. University of Central Florida and Florida Department of Transportation, Orlando, FL.

Yu, S., S. Barnes, and V. Gerde. 1993. *Testing of Best Management Practices for Controlling Highway Runoff*. FHWA/VA-93-R16. Virginia Transportation Research Council, Charlottesville, VA.

Information Resources

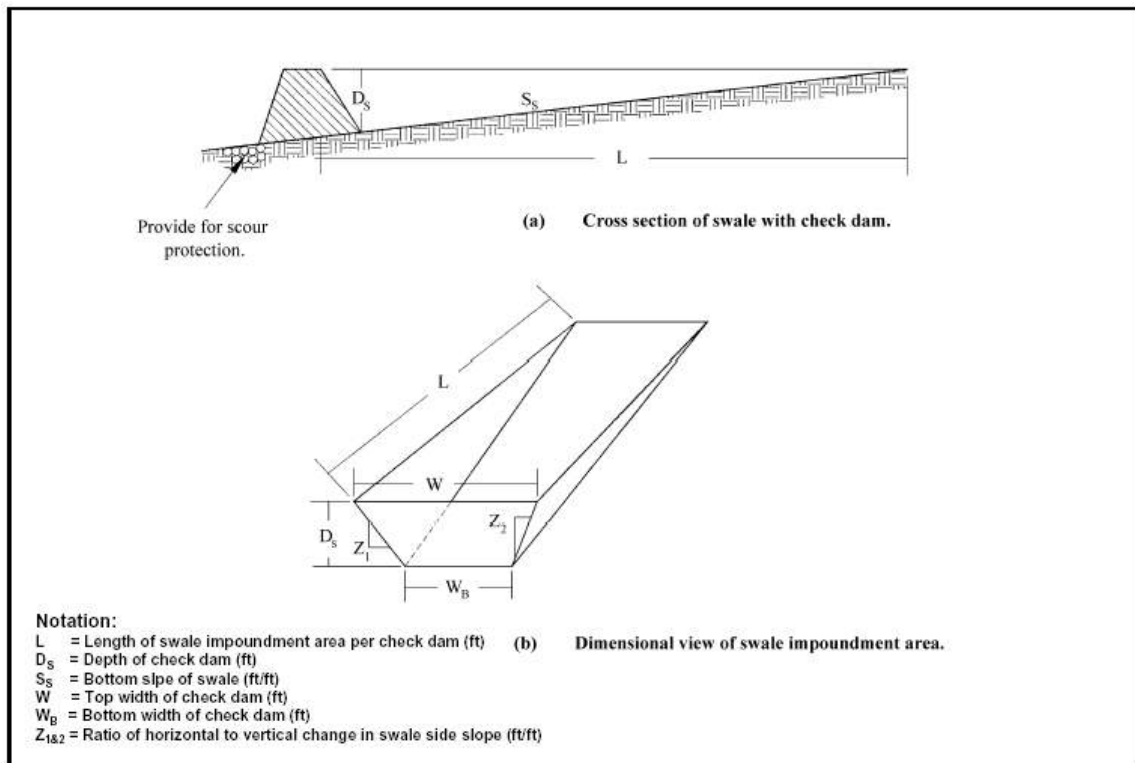
Maryland Department of the Environment (MDE). 2000. *Maryland Stormwater Design Manual*. www.mde.state.md.us/environment/wma/stormwatermanual. Accessed May 22, 2001.

Reeves, E. 1994. Performance and Condition of Biofilters in the Pacific Northwest. *Watershed Protection Techniques* 1(3):117–119.

Seattle Metro and Washington Department of Ecology. 1992. *Biofiltration Swale Performance. Recommendations and Design Considerations*. Publication No. 657. Seattle Metro and Washington Department of Ecology, Olympia, WA.

USEPA 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. EPA-840-B-92-002. U.S. Environmental Protection Agency, Office of Water. Washington, DC.

Watershed Management Institute (WMI). 1997. *Operation, Maintenance, and Management of Stormwater Management Systems*. Prepared for U.S. Environmental Protection Agency, Office of Water. Washington, DC, by the Watershed Management Institute, Ingleside, MD.





FloGard® +PLUS Catch Basin Insert Filter

FloGard®+PLUS Catch Basin Insert Filter

GENERAL FILTER CONFIGURATION

FloGard®+PLUS catch basin insert filter shall provide solids filtration through a filter screen or filter liner, and hydrocarbon capture shall be effected using a non-leaching absorbent material contained in a pouch or similar removable restraint. Hydrocarbon absorbent shall not be placed at an exposed location at the entry to the filter that would allow blinding by debris and sediment without provision for self-cleaning in operation.

Filter shall conform to the dimensions of the inlet in which it is applied, allow removal and replacement of all internal components, and allow complete inspection and cleaning in the field.

FLOW CAPACITY

Filter shall provide two internal high-flow bypass locations that in total exceed the inlet peak flow capacity. Filter shall provide filtered flow capacity in excess of the required "first flush" treatment flow. Unit shall not impede flow into or through the catch basin when properly sized and installed.

MATERIALS

Filter support frame shall be constructed of type 304 stainless steel. Filter screen, when used in place of filter liner, shall be type 304 or 316 stainless steel, with an apparent opening size of not less than 4 U.S. mesh. Filter liner, when used in place of filter screen, shall be woven polypropylene geotextile fabric liner with an apparent opening size (AOS) of not less than 40 U.S. mesh as determined by ASTM D 4751. Filter liner shall include a support basket of polypropylene geogrid with stainless steel cable reinforcement.

Filter frame shall be rated at a minimum 25-year service life. All other materials, with the exception of the hydrocarbon absorbent, shall have a rated service life in excess of 2 years.

FEATURES

- Easy to install, inspect and maintain
- Can be retrofitted to existing drain catch basins – or used in new projects
- Economical and efficient
- Catches pollutants where they are easiest to catch (at the inlet)
- No standing water – minimizes vector, bacteria and odor problems
- Can be incorporated as part of a "Treatment Train"

BENEFITS

- Lower installation, inspection and maintenance costs
- Versatile installation applications
- Higher return on investment
- Allows for installation on small and confined sites
- Minimizes vector, bacteria and odor problems
- Allows user to target specific pollutants

FloGard®+PLUS TEST RESULTS SUMMARY

Testing Agency	% TSS Removal	% Oil and Grease Removal	% PAH Removal
UCLA	80	70 to 80	
U of Auckland Tonking & Taylor Ltd. (for city of Auckland)	78 to 95		
U of Hawaii (for city of Honolulu)	80		20 to 40

Innovative stormwater management products

FloGard® +PLUS Catch Basin Insert Filter



INSTALLATION AND MAINTENANCE

Filter shall be installed and maintained in accordance with manufacturer's general instructions and recommendations.

PERFORMANCE

Filter shall provide 80% removal of total suspended solids (TSS) from treated flow with a particle size distribution consistent with typical urban street deposited sediments. Filter shall capture at least 70% of oil and grease and 40% of total phosphorus (TP) associated with organic debris from treated flow. Unit shall provide for isolation of trapped pollutants, including debris, sediments, and floatable trash and hydrocarbons, from bypass flow such that re-suspension and loss of pollutants is minimized during peak flow events.

FloGard®+PLUS COMPETITIVE FEATURE COMPARISON

Evaluation of FloGard+PLUS Units

(Based on flow-comparable units) (Scale 1-10, 10 being best)

	FloGard+PLUS	Other Insert Filter Types**
Flow Rate	10	7
Removal Efficiency*	80%	45%
Capacity – Sludge and Oil	7	7
Service Life	10	3
Installation – Ease of Handling / Installation	8	6
Ease of Inspections & Maintenance	7	7
Value	10	2

*approximate, based on field sediment removal testing in urban street application **average

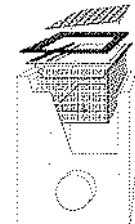
Long-Term Cost Comparison

(Scale 1-10, 10 being lowest cost, higher number being best)

	FloGard+PLUS	Other Insert Filter Types
Unit cost — initial (\$/cfs treated)	10	4
Installation cost (\$/cfs treated)	10	7
Adsorbent replacement (annual avg \$/cfs treated)	10	2
Unit materials replacement (annual avg \$/cfs treated)	10	10
Maintenance cost (annual avg \$/cfs treated)	10	7
Total first yr (\$/cfs treated)	10	5
Total Annual Avg (\$/cfs treated, avg over 20 yrs)*	10	5

*assumes 3% annual inflation

FloGard+PLUS
Combination Inlet



FloGard+PLUS
Flat Grate



FloGard+PLUS
Round Gated Inlet



Captured debris from
FloGard+PLUS,
Dana Point, CA

KriStar Enterprises, Inc.
360 Sutton Place
Santa Rosa, CA 95407

PH: 800-579-8819
FAX: 707-524-8186
www.kristar.com

© 2004-2009 KriStar Enterprises, Inc.
FGP-T 05.19.09.1M

FloGard® is a registered trademark of
KriStar Enterprises, Inc.



Proposed Civic Center (Phase 1)
9535 Sheep Creek Road
Phelan, CA 92329
APN 3066-261-10, 3066-261-18 & 3066-251-14

Results of Two Infiltration Tests for a Proposed Infiltration Basin

For: Phelan Pinon Hills Community Services District
Prepared By: Merrell Johnson Geotechnical



April 19, 2023

George Cardenas

PPHCSD Engineering Manager

4176 Warbler Road

P.O. Box 294049

Phelan, CA 92329

**Subject: Proposed Infiltration Basin | Proposed Civic Center (Phase 1) | 9535 Sheep Creek Road, Phelan, CA | APN 3066-261-10, 3066-261-08, & 3066-251-14
M.J.G. Project No. 3103.007.500**

Mr. Cardenas:

On April 17 and 18, 2023, Merrell Johnson Geotechnical's (MJG's) personnel performed two infiltration tests at the subject site. The infiltration rate of the soil was measured using the double-ring infiltrometer method, ASTM D3385-09.

The subject site's proposed development will include the construction of a Civic Center, future gymnasium, and associated site improvements. In conjunction with the new development, an infiltration basin will be constructed at the northeast corner of the neighboring future park site that bounds the east side of Civic Center site. The infiltration test was performed by MJG to provide the infiltration rate data needed to design the proposed infiltration basin. The infiltration test was performed within the limits of the proposed infiltration basin. The approximate locations of the project site, proposed development, infiltration basin, and infiltration test locations are shown on the attached Site Vicinity Map, Overall Site Plan, and Infiltration Basin Grading Plan (Sheet G-6), included with this report as Enclosures 1, 2, and 3 respectively. Enclosure 4 presents a photo of the infiltration test location.

SOIL CONDITIONS

The soil conditions encountered at the two infiltration test locations consisted of loose to medium dense silty sand with gravel (SM). The soil conditions are summarized in the following table.

Pit No.	Depth (inches)	Soil Description	Lab Test
P-1	0-7'	Brown silty sand with gravel (SM), loose to medium dense, dry	Sieve Analysis 5'-7'
P-2	0-7'	Brown silty sand with gravel (SM), loose to medium dense, dry	--

A bulk sample of the silty sand was obtained from P-1 between the depths of 5 to 7 feet. The sample was delivered to our laboratory for sieve analysis. The result of the sieve analysis is included with this report as Enclosure 5.

GROUNDWATER

A review of the California Department of Water Resources website indicates only three wells within a five-mile radius of the site. Two of the wells are listed as dry. The nearest water well that includes historic water depth data is located just south of Phelan Road, west of Coughlin Road about 4.7 miles northeast of the site. At this location the historic high groundwater level was recorded in 1917 at a depth of 869.5 feet below the ground surface. <http://wdl.water.ca.gov/waterdatalibrary/>

Based on our research of existing water well data in the vicinity of the project and our own exploratory borings drilled previously for the proposed 14-acre park site development, the depth to the historic high groundwater level is at least 100 feet below the project site's existing ground surface.

INFILTRATION TESTS

Two test pits were excavated to a depth of approximately 7 feet below the existing ground surface within the limits of the proposed infiltration basin shown on the Infiltration Basin Grading Plan, Enclosure 3. The bottoms of the two 7-feet-deep test pits correspond to the planned infiltration basin bottom elevation of 4114. The soils exposed at the two test pit locations consisted of loose to medium dense silty sand with gravel (SM).

To prepare for the infiltration tests, MJC's personnel drove a 12-inch diameter by 20-inch-high inner-ring and 24-inch diameter by 20-inch-high outer-ring (annular space) into the ground 3 inches (7.6 cm) and 5 inches (12.7 cm), respectively. Both rings were carefully filled, using rubber splash guards, to a depth of 4 inches (10.16 cm) with tap water. Mariotte Tubes were used to maintain constant water levels of 4 inches (10.16 cm) and measure the flow readings during the testing. The volume of water used at intervals of 15 minutes was recorded for about five hours. Due to the relatively rapid infiltration rates measured, test intervals longer than 15 minutes were not possible using Mariotte Tubes. The volume measurements were converted into incremental infiltration rates. The infiltration test results indicated the silty sand with gravel (SM) soils encountered at the 4114 elevation in the two test pits exhibited the infiltration rates tabulated below. The infiltration test data is included with this report as Enclosure 4.

Test No.	Location	Infiltration Rate Inner Ring	Infiltration Rate Outer Ring
P-1	Proposed Infiltration Basin	8.4 in/hr. 21.3 cm/hr.	8.8 in/hr. 22.4cm/hr.
P-2	Proposed Infiltration Basin	8.3 in/hr. 21.1 cm/hr.	8.6 in/hr. 21.9 cm/hr.

The water pH was measured at 8.0; the ground temperature at a depth of 7 feet was 60 degrees F; the ambient air and testing water temperatures varied from 49 to 60 and 55 to 56 degrees F, respectively.

We appreciate this opportunity to be of service. Should you have any questions, please contact our office.

Sincerely,

Merrell Johnson Geotechnical


Brad Merrell, P.E.

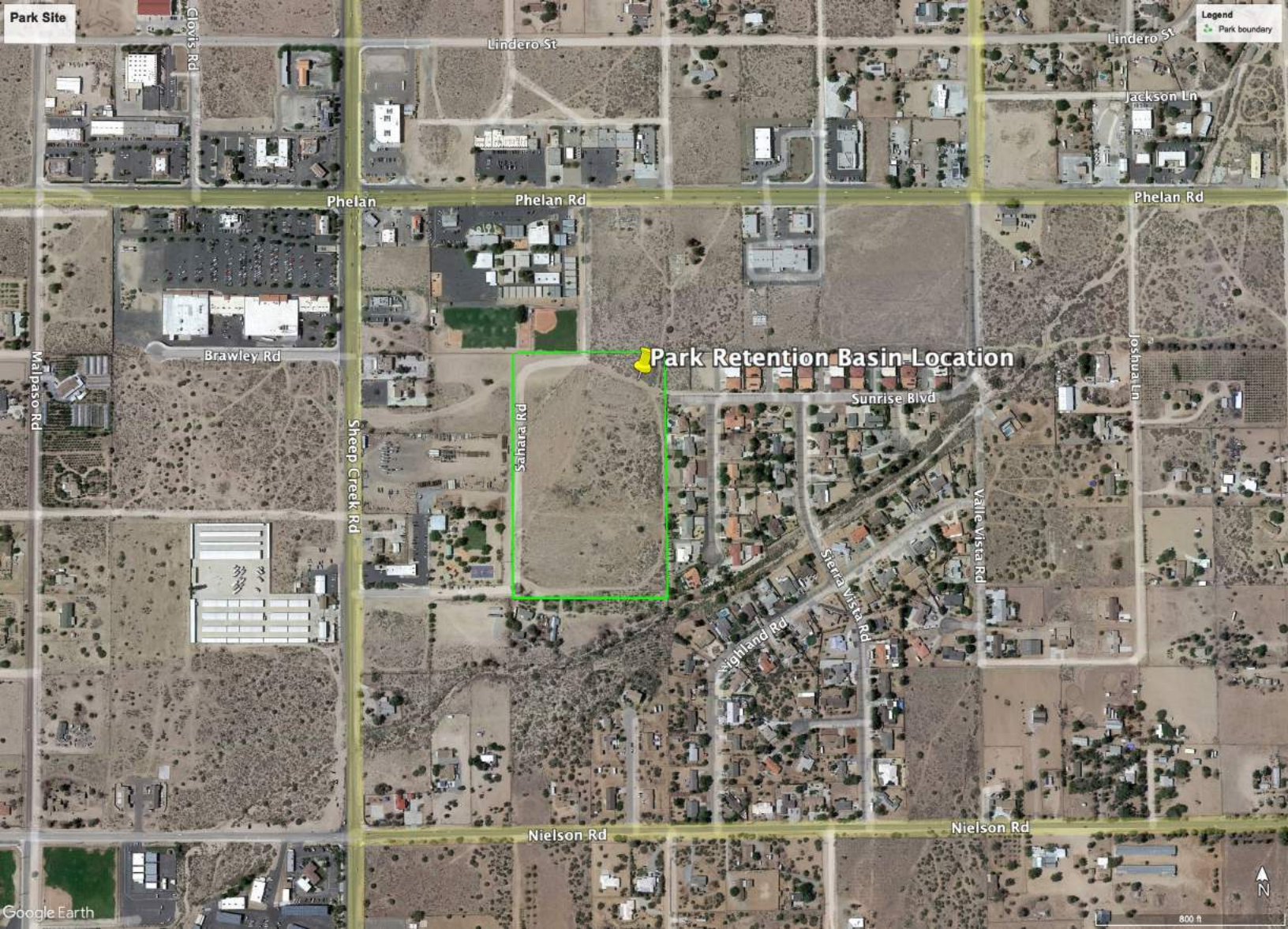
President R.C.E. 49423



Enclosures: (1) Site Vicinity Map
(2) Overall Site Plan
(3) Infiltration Basin Grading Plan
(3) Photograph of Infiltration Test
(4) Infiltration Test Data
(5) Sieve Analysis Test Data

References:

- A. Overall Site Plan (Page A-0.1), Steeno Design Studio, Inc., Job No. COM20-L01/01, May 2022.
- B. Grading Plan (Sheet G-6), TRLS Engineering, Inc., Drawn Date 02/28/2023.



Park Site

Legend
Park boundary

Lindero St

Lindero St

Jackson Ln

Phelan

Phelan Rd

Phelan Rd

Brawley Rd

Malpaso Rd

Sheep Creek Rd

Sahara Rd

Park Retention Basin Location

Sunrise Blvd

Joshua Ln

Valle Vista Rd

Sierra Vista Rd

Highland Rd

Nielson Rd

Nielson Rd

Google Earth

800 ft
N



Project Identification:

Test Location:

Liquid Used:

Tested by:

Depth to water table:

pH:

Liquid Level maintained using:

Penetration of rings—Inner:

Outer:

Date:

Constants	Area (cm)	Depth of Liquid (cm)	Liquid No.	Containers Vol/ Δh (cm ² /cm)
Inner Ring				
Annular Space				

Trial No.		Time (hr:min)	Elapsed Time: Δ /total min	Flow Readings				Liquid Temp (°C)	Incremental Infiltration Rate		Ground Temperature = 14°C at depth of 30 cm
				Inner Reading		Annular Space			Inner (cm/h)	Annular (cm/h)	
				Reading (cm)	Flow (cm ³)	Reading (cm)	Flow (cm ³)				Remarks: Weather Conditions, etc.
1	S										
	E										
2	S										
	E										
3	S										
	E										
4	S										
	E										
5	S										
	E										
6	S										
	E										
7	S										
	E										
8	S										
	E										
9	S										
	E										
10	S										
	E										

Project Identification:

Test Location:

Liquid Used:

Tested by:

Depth to water table:

pH:

Liquid Level maintained using:

Penetration of rings—Inner:

Outer:

Date:

Constants	Area (cm)	Depth of Liquid (cm)	Liquid No.	Containers Vol/ Δh (cm ² /cm)
Inner Ring				
Annular Space				

Trial No.		Time (hr:min)	Elapsed Time: Δ/total min	Flow Readings				Liquid Temp (°C)	Incremental Infiltration Rate		Ground Temperature = 14°C at depth of 30 cm
				Inner Reading		Annular Space			Inner (cm/h)	Annular (cm/h)	Remarks: Weather Conditions, etc.
				Reading (cm)	Flow (cm ³)	Reading (cm)	Flow (cm ³)				
1	S										
	E										
2	S										
	E										
3	S										
	E										
4	S										
	E										
5	S										
	E										
6	S										
	E										
7	S										
	E										
8	S										
	E										
9	S										
	E										
10	S										
	E										

Particle-Size Analysis of Soil

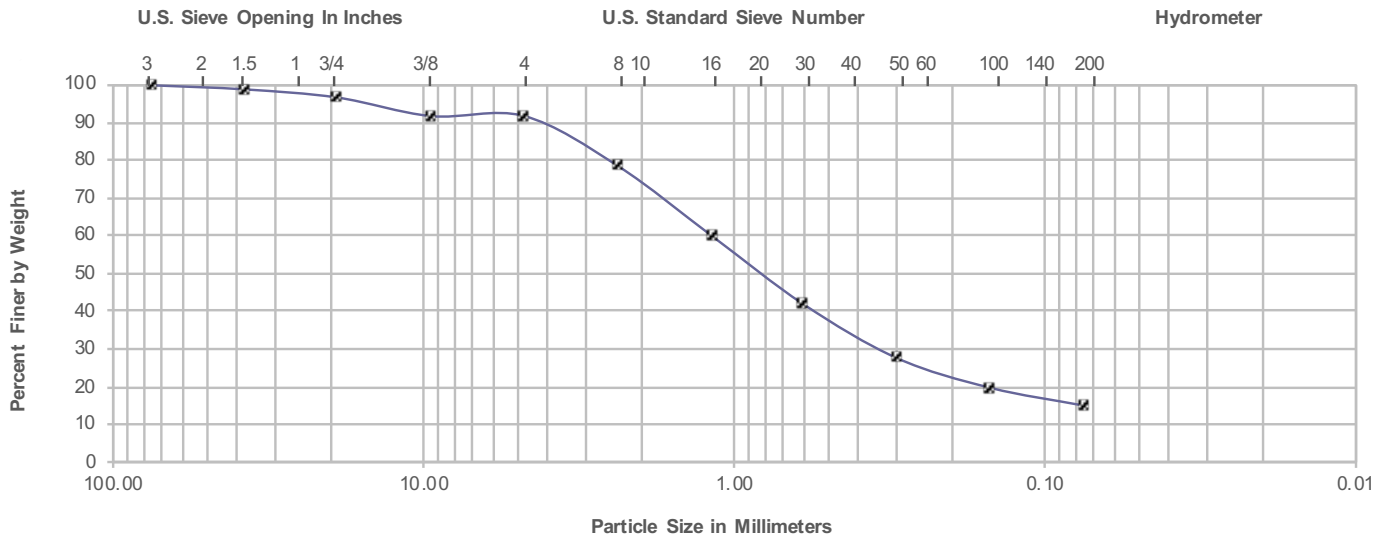
D422, D1140, D2487

Report Date: 04/19/23
 Sheet: 1 of 1
 Appendix:
 Permit No:
 Client Project No:
 Other:
 DSA File No:
 DSA Application No:
 DSA LEA No:

Project Number: 3103.007.500
 Project Title: Civic Center (Phase 1)
 Project Location: 9535 Sheep Creek Road, Phelan
 Client: Phelan Pinon Hills Community Services District

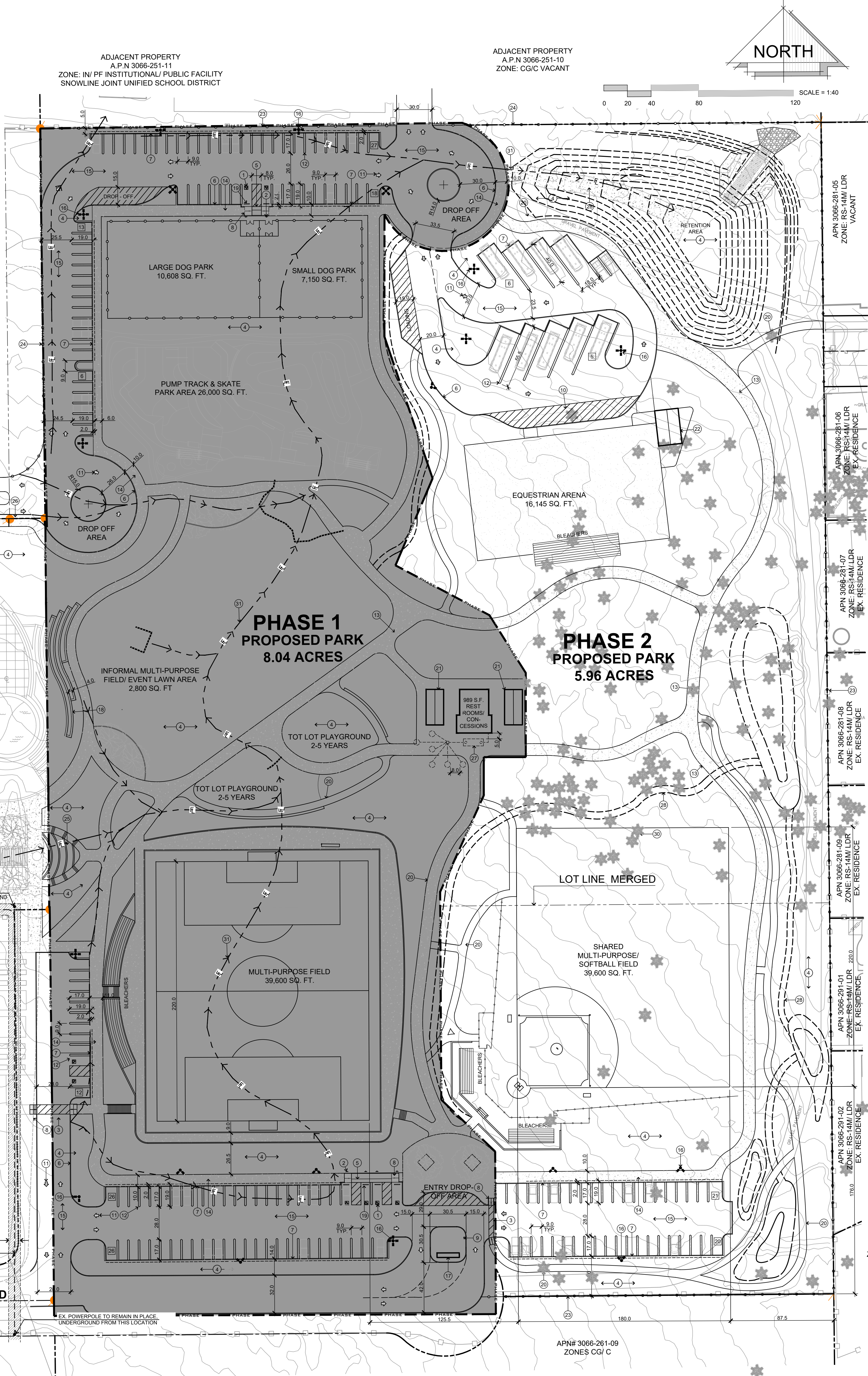
Sample ID: CDL23041901 Gravel (%): 8.2% Sand (%): 76.9% Fines (%): 15.0%

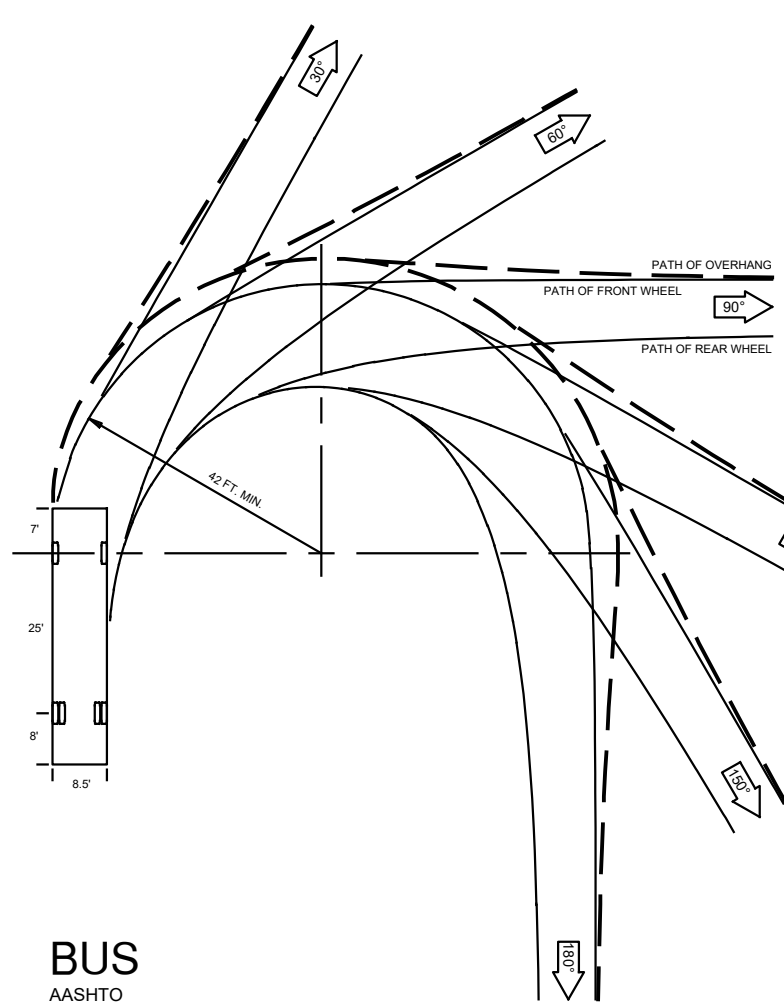
Classification, ASTM D2487: (SM) Silty sand
 Sample Origin: P-1 at 5' to 7'
 Laboratory Remarks:



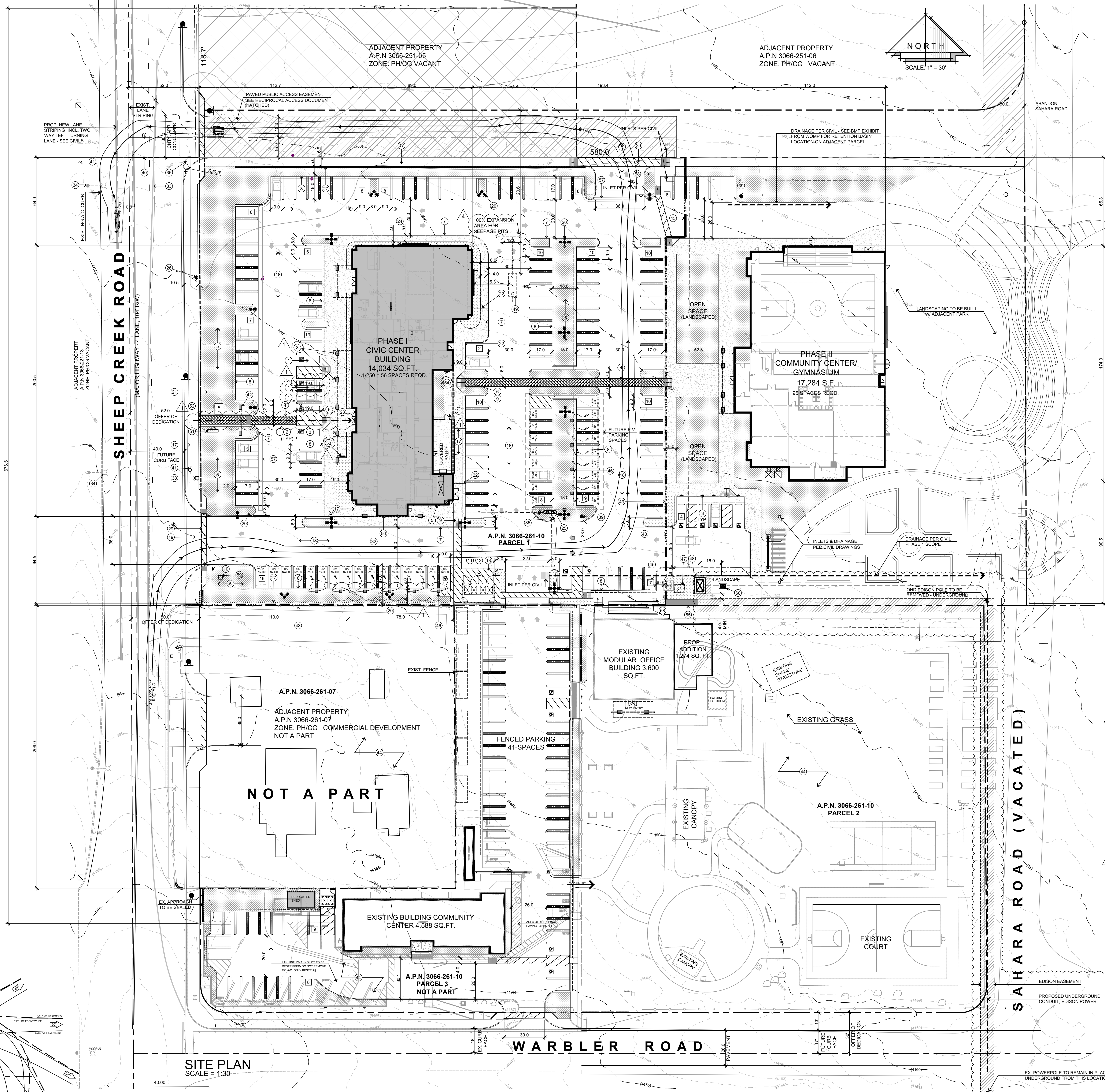
KEYED NOTES		PROJECT DATA	
#	DESCRIPTION	SYMBOL	②
1	VAN ACCESSIBLE PARKING SPACE W/ ACCESSIBILITY STALL EMBLEM PAINTED AS SHOWN		
2	DISABLED ACCESSIBLE PARKING ONLY SIGN		
3	48" WIDE ACCESSIBILITY ACCESS W/ BLUE STRIPES		
4	LANDSCAPED AREA		
5	TRUNCATED DOMES 36" DEEP X WIDTH OF RAMP OR LANDING		
6	6" WIDE CONCRETE CURB		
7	6" WIDE CONCRETE CURB W/ 2" PARKING NOSE OVER		
8	ACCESSIBLE RAMP NOT TO EXCEED 8% SL IN DIRECTION OF RUN & 2% MAX CROSS SL		
9	WARNING SIGNAGE REGARDING UNAUTHORIZED USE OF DISABLED PARKING SPACES		
10	STRIPED LOADING ZONE		
11	TRAFFIC FLOW DIRECTIONAL ARROWS PAINTED ON PAVING AS SHOWN ON PLAN		
12	DOUBLE STRIPED PAINTED PARKING STALL STRIPE		
13	4" NOMINAL THICK CONCRETE WALKWAY W/ 5% MAX. SLOPE & 2% CROSS SLOPE		
14	PROPOSED CONC. SIDEWALK		
15	PROPOSED CONCRETE OR A.C. PAVING PER GEO-TECH REPORT		
16	20" HIGH SITE LIGHT STANDARD		
17	PROPOSED MONUMENT SIGN 4' HIGH & 36SQ. FT., MAX UNDER SEPARATE PERMIT		
18	TERRACE SEATING W/ RETAINING WALL, HEIGHT VARIES. SEE GRADING PLANS		
19	CONC. WHEEL STOP AT A.D.A. PARKING SPACE		
20	6 FT. WIDE BIKE TRAILS		
21	SHADE COVER STRUCTURE W/ PICNIC TABLES		
22	SHADE SHED/STAYING AREA		
23	EXISTING FENCE TO REMAIN		
24	PROPOSED 5' HIGH CHAINLINK FENCE		
25	OVERLOOK AREA AND GARDENS		
26	LINE OF PROJECT PHASING		
27	PROPOSED 3,600 GALLON SEPTIC TANK W/ DISTRIBUTION BOX & (3) 5'-0" DIAMETER, 23" DEEP SEEPAGE PITS PLUS 100% EXPANSION AREA PER PERCOLATION REPORT		
28	CONCRETE GUTTER OR SWALE, SEE GRADING PLAN		
29	DECORATIVE CANOPY		
30	JOSHUA TREES, UNDER INCIDENTAL TAKE PERMIT REVIEW W/ CDFW, FILED 10/20/22		
31	DIRECTION OF PROPOSED DRAINAGE - SEE CIVIL PLANS		

PROJECT DATA			
ZONE:		PARKING INFORMATION:	
PER ZONING MAP:		REQUIRED PARKING STALLS:	
PROPOSED CHANGE: CR - RURAL COMMERCIAL		PHASE 1:	
PER GENERAL/ POLICY PLAN:		MULTI-PURPOSE FIELD - 39,600 SQ. FT.	
OVERLAYS:		705 SQ. FT. OF SEATING AREA @ 1/25 SQ. FT.	
FLOOD PLAIN 1 (FP1) / FIRE SAFETY 2 (FS2)		= 28 SPACES	
OCCUPANCY:		RESTROOM BUILDING - 1,760 SQ. FT.	
(A-5) ASSEMBLY & (S) STORAGE		= 38 SPACES	
CONSTRUCTION TYPE:		DOG PARKS - 1.4 MAX ALLOWED PARK ATTENDANCE (152 MAX ALLOWED THIS PARK)	
1-STORY		PHASE 2:	
FIRE SPRINKLERS:		MULTI-PURPOSE SOFTBALL FIELD - 39,600 SQ. FT.	
YES		412 SQ. FT. OF SEATING AREA @ 1/25 SQ. FT.	
A.P.N.		= 17 SPACES	
3066-251-18		FUTURE PUMP TRACK & SKATE PARK - 1.4 MAX ALLOWED PARK ATTENDANCE (128 MAX ALLOWED AT THIS PARK)	
LEGAL DESCRIPTION:		EQUESTRIAN ARENA - 16,145 SQ. FT.	
PARCEL NO. 3 OF PARCEL MAP NO. 4063, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 40, PAGE 89 OF PARCEL MAPS IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY, TOGETHER WITH THE SOUTHEAST 1/4 OF THE NORTHWEST 1/4 OF THE NORTHWEST 1/4 OF SECTION 24, TOWNSHIP 4 NORTH, RANGE 7 WEST, SAN BERNARDINO BASE AND MERIDIAN IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.		= 28 SPACES	
ZONING SETBACKS:		TOTAL REQUIRED PARKING STALLS (9x19') = 143 SPACES	
F.E.M.A. FLOOD ZONE		PROPOSED PARKING STALLS @ MIN. 9'x19' = 163 SPACES	
SITE ADDRESS:		HORSE TRAILER/ RV PARKING 18'x40' = 9 SPACES	
NW CNR. OF SAHARA RD. AND WARBLER RD.		PROPOSED "ACCESSIBLE" PARKING STALL @ 9'x19' W/ 8' UNLOADING ZONE = 8 SPACES	
PHELAN, CA 92329		TOTAL PROVIDED PARKING STALLS = 180 SPACES	
APPLICANT/OWNER:		PHASE 1 & II PROVIDED PARKING SPACES (14 ACRES DEVELOPMENT, THIS PROJECT) = 180 SPACES	
PHELAN PINON HILLS C.S.D.		TOTAL PARKING SPACES (INCLUDING CIVIC CENTER DEVELOPMENT - PLANNING RECORD #PRAA-2021-00040) = 345 SPACES	
P.O. BOX 20404		E.V. CHARGING STATIONS REQUIREMENTS - 6% OF TOTAL SPACES OVER 201 SPACES PER TABLE 5.106.5.3.3 = 20	
4176 WARBLER RD.		REQUIRED E.V. PARKING SPACES PROVIDED 9'x19' E.V. PARKING SPACES (101 STATIONS, EACH SERVING (2) PARKING SPACES (ALL AT CIVIC CENTER DEVELOPMENT RECORD #PRAA-2021-00040)) = 20 SPACES	
PHELAN, CA 92329-0409		PHASE 1 & II PROVIDED PARKING SPACES (14 ACRES DEVELOPMENT, THIS PROJECT) = 180 SPACES	
PH 760-868-1212 FAX: 760-868-2323		TOTAL PARKING SPACES (INCLUDING CIVIC CENTER DEVELOPMENT - PLANNING RECORD #PRAA-2021-00040) = 345 SPACES	
PH 760-244-5001 FAX: 760-244-1948		E.V. CHARGING STATIONS REQUIREMENTS - 6% OF TOTAL SPACES OVER 201 SPACES PER TABLE 5.106.5.3.3 = 20	
SITE INFORMATION:		REQUIRED E.V. PARKING SPACES PROVIDED 9'x19' E.V. PARKING SPACES (101 STATIONS, EACH SERVING (2) PARKING SPACES (ALL AT CIVIC CENTER DEVELOPMENT RECORD #PRAA-2021-00040)) = 20 SPACES	
A.P.N. 3066-251-18		GROSS AREA (14.58 AC.) = 635,105 SQ. FT.	
PROPOSED:		PROPOSED:	
AREA		SQ. FT.	
DOG PARKS		= 17,758 SQ. FT.	
SKATE PARK AREA		= 32,310 SQ. FT.	
RESTROOMS		= 1,760 SQ. FT.	
EQUESTRIAN ARENA		= 16,145 SQ. FT.	
MULTI-PURPOSE FIELD		= 39,600 SQ. FT.	
MULTI-PURPOSE SOFTBALL FIELD		= 39,600 SQ. FT.	
LANDSCAPED AREA (INCLUDES MULTI-PURPOSE FIELD EVENT LAWN AREA)		= 272,718 SQ. FT.	
PROP. PAVING & CONC. (TOTAL)		= 182,078 SQ. FT.	
RETENTION AREA		= 29,875 SQ. FT.	





BUS
AASHTO



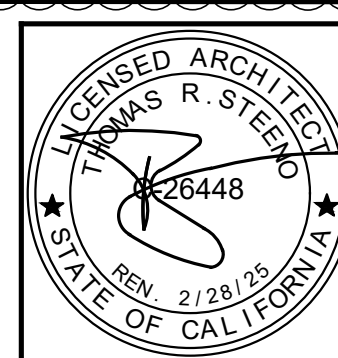
SITE PLAN
SCALE = 1:30

NOTE:
1. 5.106.5.2.1 PARKING STALL MARKING.
PAINT IN THE PAINT USED FOR STALL STRIPING, THE FOLLOWING CHARACTERS SUCH THAT THE LOWER
EDGE OF THE LAST WORD ALIGNS WITH THE END OF THE STALL STRIPING AND IS VISIBLE BENEATH A PARKED
VEHICLE: CLEAN AIR
VEHICLE
2. AN ACCESSIBLE ROUTE SHALL NOT TRAVEL BEHIND PARKING OTHER THAN HIS/ HER OWN.

STEENOD
DESIGN STUDIO INC.
ARCHITECTURE • DESIGN • PLANNING
11774 HESPERIA ROAD, SUITE B • HESPERIA, CA 92345
PHONE (760) 244-5001 • FAX (760) 244-1948
www.steenodesign.com

DATE FINISHED
MAY 2022
REVISIONS
REV. CODE 02/14/22
BLDG. CODE 02/14/22
BLDG. CODE 08/08/22
ELECTRICAL 09/30/22
MECHANICAL 10/27/22
ADDENDUM TO
STRUCTURAL 01/24/2023

THESE PLANS SHALL COMPLY WITH THE 2018 CALIFORNIA BUILDING CODE AND ALL OTHER APPLICABLE CODES AND ORDINANCES, INCLUDING THE 2018 CALIFORNIA ENERGY STANDARDS.
THESE DOCUMENTS AND THE DESIGN AND PLANS ARE THE SOLE PROPERTY OF STEENOD DESIGN STUDIO INC. ANY USE, IN WHOLE OR IN PART, FOR WHICH THEY WERE NOT PROVIDED SHALL BE UNLAWFUL.



PROJECT: CIVIC CENTER BUILDING
PHELAN PIÑON HILLS C.S.D.
SITE ADDRESS:
A.P.N. 3066-261-10
9535 SHEEP CREEK ROAD,
PHELAN, CA 92339
CONTACT:
DCN BARTZ

JOB NO.
COM20-01/01
SHEET NAME:
SITE PLAN
PAGE
A-0

PROJECT DATA

ZONE:	PER COUNTY MAP F100A (PH/CG) GENERAL COMMERCIAL	REQUIRED PARKING STALLS:
OVERLAYS:	FLOOD PLAIN 1 (FP1) / FIRE SAFETY 2 (FS2)	PHASE 1: ADMIN BLDG @ 1/250 GROSS FLR. AREA 14,034 SQ. FT. / 250 = 56 SPACES
OCCUPANCY:	(A) ASSEMBLY & (S) STORAGE (B) BUSINESS	PHASE 2: MULTI-PURPOSE BUILDING 17,284 SQ. FT. 708 SQ. FT. OF SEATING @ 1/250 SQ. FT. = 29 SPACES
CONSTRUCTION TYPE:	II-B	REMAINING BUILDING AREA = 1/250 16,578 SQ. FT. / 250 = 66 SPACES
STORIES:	1-STORY	TOTAL REQUIRED PARKING STALLS (9'x19') = 151 SPACES
FIRE SPRINKLERS:	YES	PROPOSED PARKING STALLS @ MIN. 9'x19' = 155 SPACES INCLUDES EV REQUIRED PARKING STALLS @ 9'x19' = 16 SPACES
A.P.N.	3066-261-10	PROPOSED "ACCESSIBLE" PARKING STALL @ 9'x19' W/ 8' UNLOADING ZONE = 11 SPACES
PTN. N.W. 1/4, SEC. 24 T.4N., R.7W.	UNKNOWN	TOTAL PROVIDED PARKING STALLS = 165 SPACES
SITE ADDRESS:	UNKNOWN	ALLOCATED SPACES FOR EXISTING ADMIN BLDG. = 7 SPACES
ZONING SETBACKS:	F.E.M.A. FLOOD ZONE	SURPLUS OF STALLS = 15 SPACES
APPLICANT/OWNER:	PHELAN PIÑON HILLS C.S.D. PO BOX 294049 PH: 760-868-1212 FAX: 760-868-2323	FUTURE EVSE PARKING STALLS = 20 SPACES
ARCHITECT/REPRESENTATIVE:	STEENOD DESIGN STUDIO, INC. ARCHITECT: TOM STEENOD 11774 HESPERIA ROAD, SUITE B-1 PH: 760-244-5001 FAX: 760-244-1948	SITE ENGINEERING - PHASE 1
PARCEL 1:	GROSS AREA (4.65 AC.) = 202,925 SQ. FT. 100%	IMPERVIOUS SURFACE = 99,543 SQ. FT.
PROPOSED:	PROP. BUILDING AREA = 31,318 SQ. FT. 15.4%	NON-IMPERVIOUS SURFACE = 19,002 SQ. FT.
PROP. LANDSCAPED AREA	= 35,654 SQ. FT. 17.6%	DEVELOPED AREA = 118,543 SQ. FT.
PROP. PAVING & CONC. (TOTAL)	= 136,092 SQ. FT. 67%	GRADING LIMITS = 515,432 SQ. FT.
PROP. LANDSCAPING WITH-IN RW	= 811 SQ. FT. NAP	

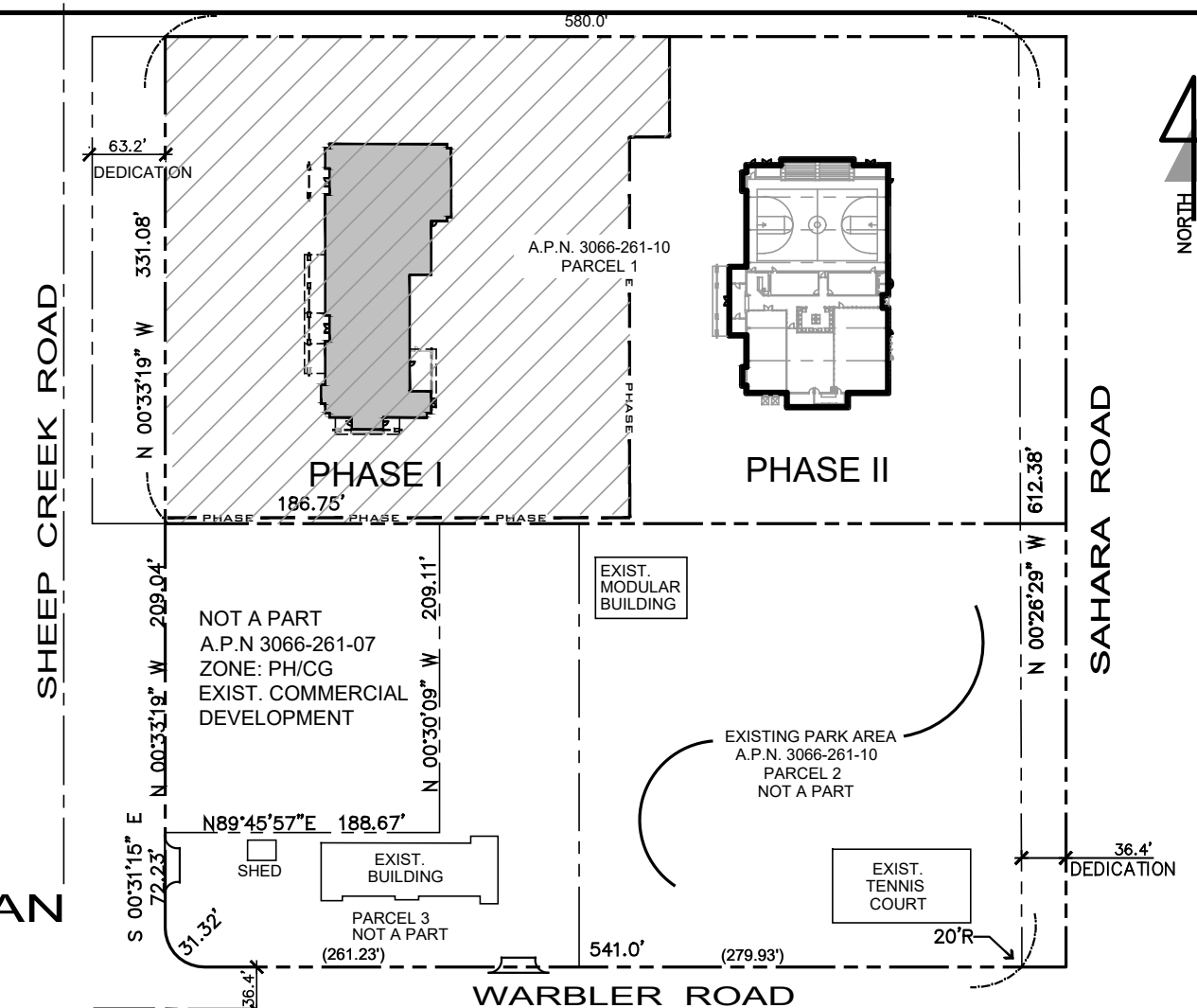
KEYED NOTES

- 1 VAN ACCESSIBLE PARKING SPACE, SEE DETAIL 4A ON SHEET AC-1
- 2 ACCESSIBILITY STALL EMBLEM PAINTED AS SHOWN
- 3 DISABLED ACCESSIBLE PARKING ONLY SIGN, SEE DETAIL 13 ON SHEET AC-1
- 4 72" WIDE ADA PATH OF TRAVEL W/ DECORATIVE PAVERS
- 5 LANDSCAPED AREA - TO INCLUDE "HILLSIDE LANDSCAPING" AT PROJECT PERIMETER - SEE WOMP BMP EXHIBIT
- 6 TRUNCATED DOMES 36" DEEP X WIDTH OF RAMP OR LANDING
- 7 6" WIDE CONCRETE CURB.
- 8 6" WIDE CONCRETE CURB. W/ 2' PARKING NOSE OVER
- 9 ACCESSIBLE RAMP NOT TO EXCEED 8% SLOPE IN DIRECTION OF RUN AND 2% MAX CROSS SLOPE
- 10 WARNING SIGNAGE REGARDING UNAUTHORIZED USE OF DISABLED PARKING SPACES
- 11 DBL. SYD. BIN TRASH ENCLOSURE PER COUNTY STANDARDS (6' HIGH)
- 12 REINFORCED CONCRETE PAD W/ 2% MAXIMUM SLOPE AWAY FROM T/E
- 13 STRIPPED LOADING ZONE
- 14 TRAFFIC FLOW DIRECTIONAL ARROWS PAINTED ON PAVING AS SHOWN ON PLAN
- 15 DOUBLE STRIPPED PAINTED PARKING STALL STRIPE
- 16 BUILDING COLUMNS AND OVERHANG
- 17 PROPOSED CONC. SIDEWALK PER COUNTY STANDARD 100 TYPE C
- 18 PROPOSED CONCRETE OR A.C. PAVING PER GEO-TECH REPORT
- 19 PROPOSED CONC. DRIVEWAY APPROACH PER COUNTY STANDARD 129-B AND LOCATED PER SAN BERNARDINO COUNTY STANDARD 130
- 20 20' HIGH SITE LIGHT STANDARD
- 21 PROPOSED MONUMENT SIGN 4' HIGH & 36SQ. FT., MAX UNDER SEPARATE PERMIT
- 22 ROOF DRAIN PIPES UNDER SIDEWALK
- 23 S.B.C.F.D. KNOX BOX
- 24 PROPOSED GAS METER
- 25 PROPOSED DOUBLE DETECTOR CHECK VALVE ASSEMBLY
- 26 RELOCATED EX. FIRE HYDRANT
- 27 PROPOSED MASONRY BLOCK WALL MAX. 6' HI. SEE GRADING PLAN FOR HEIGHTS. UNDER SEPARATE PERMIT
- 28 6" DIA. CONC. FILLED STEEL BOLLARDS
- 29 ACCESSIBILITY EASEMENT ACROSS DRIVE APPROACH @ HATCHED AREA
- 30 DASHED LINE OF EASEMENT / B.S.L.
- 31 5' HIGH WROUGHT IRON FENCE W/ GATE W/ PANIC HARDWARE
- 32 PROVIDE (16) DESIGNATED PARKING STALL FOR FUEL EFFICIENT VEHICLES WITH THE WORDS "CLEAN AIR VEHICLE" PAINTED IN THE SAME STALL STRIPING PAINT & SUCH THAT THE LAST WORD ALIGNS WITH THE END OF THE STALL STRIPING AND IS VISIBLE BENEATH A PARKED VEHICLE. GREEN CODE 5.106.5.2
- 33 EXISTING EDGE OF PAVEMENT
- 34 EX. STREET LIGHT TO REMAIN
- 35 PROPOSED F.D.C. & P.I.V. FOR FIRE SPRINKLERS
- 36 EX. FIRE HYDRANT TO BE RELOCATED
- 37 FLOW LINE, SEE GRADING PLANS
- 38 EX. WATER METER
- 39 PROPOSED FIRE HYDRANT
- 40 LINE OF EXISTING PROPERTY LINE TO BE DEDICATED
- 41 EX. FIRE HYDRANT TO REMAIN
- 42 PROJECT ENTRY PORTAL, SEE SHEET A-1.1
- 43 LINE OF PROJECT PHASING
- 44 EXISTING DEVELOPMENT
- 45 7 PARKING SPACES RESERVED FOR EXISTING OFFICE
- 46 PROVIDE 10 - 40 AMP. DUAL EVSE CHARGING PEDESTAL FOR (20) OVERALL EV PARKING STALL. GREEN CODE 5.106.5.3.3
- 47 EXISTING ELECTRICAL TRANSFORMER TO BE REMOVED, SEE ELECTRICAL SHEETS
- 48 PROP. 10" x 12" ELECTRIC TRANSFORMER PAD W/ 5'x8'-5" x 5' TRANSFORMER
- 49 TRAFFIC RATED 3,600 GAL. SEPTIC TANK W/ (2) 28" DEEP 5' DIAMETER SEEPAGE PITS, WITH DISTRIBUTION BOX AND 100% EXPANSION AREA PER EHS APPROVED PERC REPORT. THE DEPTH OF THE SEEPAGE PIT SHALL BE MEASURED BELOW THE SEWER PIPING INLET. ALL COMPONENTS TO BE DESIGNED FOR VEHICULAR TRAFFIC FOR STANDARD H-20 WHEEL LOADING
- 50 REPLACE EXISTING 800 AMP SERVICE W/ NEW 4000 AMP SERVICE
- 51 PROPOSED INTERNALLY LIT MONUMENT SIGN - UNDER DEFERRED SUBMITTAL
- 52 50" TAPERED FLAG POLE ON 6'-0" X 8'-0" CONCRETE PAD
- 53 SHORT-TERM BICYCLE PARKING - PROVIDE PERMANENTLY ANCHORED BICYCLE RACKS WITHIN 200 FT. OF THE VISITORS' ENTRANCE, READILY VISIBLE TO PASSERS BY, FOR 5% OF NEW VISITOR MOTORIZED VEHICLE PARKING SPACES BEING ADDED, WITH A MIN. OF (1) TWO-BIKE CAPACITY RACK.
- 54 LONG-TERM BICYCLE PARKING - PROVIDE SECURE BICYCLE PARKING FOR 5% OF MOTORIZED VEHICLE PARKING CAPACITY W/ A MIN. OF (1) SPACE. ACCEPTABLE PARKING FACILITIES SHALL BE CONVENIENT FROM THE STREET.
- 55 PROP. 4000 AMP ELECTRIC SERVICE
- 56 LINE OF BUILDING - TO HOUSE OPERATIONS & MAINTENANCE FOR (PER THE WOMP BMP EXHIBIT); LANDSCAPE INSPECTION, SPILL KIT INSPECTION, & EFFICIENT IRRIGATION
- 57 GUTTER - SEE CIVILS
- 58 STORM DRAIN SIGNAGE PER WOMP BMP EXHIBIT
- 59 WATER METER - 1 1/2" FOR IRRIGATION
- 60 4" X 6" PAD W/ 2'-6" X 4" BOX BY EDISON



Septic System Only

PHASE PLAN



PLANTING SUCH-AS LIST



PARKING LOT TREES (24" BOX)
MAGNOLIA GRANDIFLORA 'SAMUEL SOMMER' / SAMUEL SOMMER SOUTHERN MAGNOLIA
PARKINSONIA ACULEATA / MEXICAN PALO VERDE
QUERCUS ILEX / HOLLY OAK



SHADE/SPECIMEN TREES (48" BOX)
FRAXINUS VELUTINA GLABRA 'MODESTO' / MODESTO ASH
PARKINSONIA ACULEATA / MEXICAN PALO VERDE
PINUS MONOPHYLLA / PIÑON PINE
PROSOPIS GLANDULOSA TORREYANA / HONEY MESQUITE
QUERCUS SPP. / OAK TREES
ZELKOVA SERRATA / JAPANESE ZELKOVA



LARGE ACCENT TREE (36" BOX)
CHILOPSIS LINEARIS / DESERT WILLOW
MAGNOLIA GRANDIFLORA 'SAMUEL SOMMER' / SAMUEL SOMMER SOUTHERN MAGNOLIA
PRUNUS ILICIFOLIA / HOLLYLEAF CHERRY



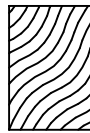
SMALL ACCENT TREE (24" BOX)
ERIOBOTRYA DEFLEXA / BRONZE LOQUAT
LAGERSTROEMIA INDICA X FAURIEI 'TUSCARORA' / TUSCARORA CRAPE MYRTLE



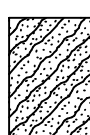
VERTICAL EVERGREEN TREES (24" BOX)
CEDRUS DEODARA / DEODORA CEDAR
PINUS ELDERICA / AFGHAN PINE
PINUS MONOPHYLLA / PIÑON PINE



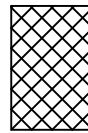
EXISTING JOSHUA TREE
*JOSHUA TREES ARE TO BE PRESERVED AND/OR TRANSPLANTED TO THE EXTENT POSSIBLE



ACCENT SHRUBS (50% 1 GAL, 50% 5 GAL)
AGAVE HAVARDIANA / HAVARD'S CENTURY PLANT
CAESALPINIA GILLESII / BIRD OF PARADISE SHRUB
DASYLIRION WHEELERI / GREY DESERT SPOON
DODONAEA VISCOSA / PURPLE LEAFED HOPBUSH
DUDLEYA PULVERULENTA / CHALK DUDLEYA
ENCELIA CALIFORNICA / CALIFORNIA ENCELIA
EUONYMUS FORTUNEI 'EMERALD GAIETY' / BURNING BUSH
HESPERALOE PARVIFLORA / RED YUCCA
HETEROMELES ARBUTIFOLIA / TOYON
LANTANA MONTEVIDENSIS / PURPLE TRAILING LANTANA
LEONITIS LEONURUS / LION'S TAIL
MIMULUS AURANTIACUS / MONKEYFLOWER
MUHLENBERGIA CAPILLARIS / PINK MUHLY GRASS
ROMNEYA COULTERI / MATILJA POPPY
SALVIA LEUCANTHA / MEXICAN BUSH SAGE



SMALL/MEDIUM SHRUBS (50% 1 GAL, 50% 5 GAL)
AGAVE HAVARDIANA / HAVARD'S CENTURY PLANT
AGAVE PARRYI / PARRY'S AGAVE
ARTEMISIA TRIDENTATA / BIG SAGEBRUSH
BACCHARIS PILULARIS 'TWIN PEAKS' / TWIN PEAKS COYOTE BRUSH
DASYLIRION WHEELERI / GREY DESERT SPOON
ENCELIA CALIFORNICA / CALIFORNIA ENCELIA
ERICAMERIA LINEARIFOLIA / TURPENTINE BUSH
ERIODICTYON TRICHOCALYX / HAIRY YERBA SANTA
HESPERALOE PARVIFLORA / RED YUCCA
LANTANA MONTEVIDENSIS / PURPLE TRAILING LANTANA
LUPINUS EXCUBITUS / GRAPE SODA LUPINE
MUHLENBERGIA CAPILLARIS / PINK MUHLY GRASS
OPUNTIA BASILARIS BRACHYCLADA / BEAVERTAIL PRICKLY PEAR
ROSMARINUS OFFICINALIS 'HUNTINGTON CARPET' / HUNTINGTON CARPET ROSEMARY
SALIX LASIOLEPIS / ARROYO WILLOW
SALVIA DORRII / DESERT SAGE
SALVIA LEUCANTHA / MEXICAN BUSH SAGE
YUCCA WHIPPLEI / CHAPARRAL YUCCA



NATIVE PLANTING (50% 1 GAL, 50% 5 GAL)
ARTEMISIA TRIDENTATA / BIG SAGEBRUSH
CEANOETHUS GREGGII / DESERT CEANOETHUS
ERIOGONUM WRIGHTII / WRIGHT'S BUCKWHEAT
FEROCACTUS CYLINDRACEUS / COMPASS BARREL CACTUS
FOUQUIERIA SPLENDENS / OCOTILLO
LARREA TRIDENTATA / CREOSOTE BUSH
OPUNTIA ACANTHOCARPA / BUCKHORN CHOLLA
YUCCA SCHIDIGERA / MOHAVE YUCCA



BIORETENTION BASINS (100% 1 GAL)
BOULETELOUA GRACILIS / BLUE GRAMA GRASS
JUNCUS MEXICANUS / MEXICAN RUSH
MUHLENBERGIA RIGENS / DEER GRASS
NASSELLA TENUISSIMA / MEXICAN FEATHER GRASS



TURF
TIFGREEN' BERMUDA HYBRID SOD

SHEEP CREEK ROAD

ADMINISTRATION BUILDING

EXISTING COMMUNITY BUILDING

WARBLER ROAD

RECREATION BUILDING

FORMAL GARDEN AREA

EXISTING PARK

COMMUNITY GARDEN

TENNIS COURT

COMMUNITY PLAZA

LIMIT OF WORK

LIMIT OF WORK

ELEMENTARY SCHOOL

14 ACRE PARK SITE LIMIT OF WORK

SCALE = 1" = 40'

NORTH

PARKING LOT WITH PV PANELS

DOG PARK

SKATE PARK AND PUMP TRACK AREA

EQUESTRIAN PARKING

EQUESTRIAN ARENA

MULTI-PURPOSE TURF AREA

PLAYGROUND AREA

RESTROOM / CONCESSION BUILDING & PICNIC AREAS

SOCCER FIELD

BALL & MULTI-USE FIELD

PARKING LOT WITH PV PANELS

PARKING LOT WITH PV PANELS

LIMIT OF WORK

LIMIT OF WORK

RESIDENTIAL

SHEEP CREEK ROAD/ WARBLER ROAD
APN: 3066-261-10 & 3066-251-18

	GRADING LIMITS (G-0 SHEET)		WATER METER
	PARENTHESES INDICATE 'EXISTING'		REDUCER
	INDICATES EXISTING GROUND ELEVATIONS		END CAP
	INDICATES PROPOSED GROUND ELEVATIONS		JOSHUA TREE
	EDGE OF EXISTING PAVEMENT		TREE
	PROPOSED ASPHALT		PINE TREE
	PAVERS		SHRUB
	NEW CONCRETE		CACTUS
	DIRT TRAVELED WAY		PEDESTAL
	CURB AND GUTTER		STREET LIGHT
	PROPOSED SLOPE		STREET SIGN
	CENTERLINE		TRAFFIC LOOP
	PROPERTY LINE		TRAFFIC SIGNAL BOX
	FLOWLINE		MAILBOX
	RIGHT-OF-WAY		BENCHMARK
	CHAIN-LINK FENCE		SURVEY MONUMENT
	WOOD POST FENCE		SEWER MANHOLE
	EXISTING BLOCK WALL		TELEPHONE MANHOLE
	POWER POLE		EXISTING SEWER LINE
	GUY WIRE		EXISTING WATER LINE
	FIRE HYDRANT		PROPOSED STORM DRAIN
	VALVE		EXISTING GAS LINE
	BLOW-OFF		EXISTING TELEPHONE LINE
	AIR RELEASE VALVE		EXISTING FIBER OPTIC LINE
	LIGHT STANDARD		EXISTING ELECTRICAL LINE
	PROPOSED BLOCK WALL		EXISTING CABLE TV LINE
			EXISTING STORM DRAIN
			EXISTING SLOPE

ACP	ASBESTOS CEMENT	GL	GRADING LIMIT
BC	BEGINNING OF CURVE	HP	HIGH POINT
BCR	BEGIN CURB RETURN	HORIZ.	HORIZONTAL
BVC	BEGIN VERTICAL CURVE	INV.	INVERT ELEVATION
BV	BUTTERFLY VALVE	L.F.	LINEAR FEET
CML	CEMENT MORTAR LINED	MH	MANHOLE
CML&C	CEMENT MORTAR LINED AND COATED	MR	MECHANICALLY RESTRAINED
C & G	CURB AND GUTTER	MJ	MECHANICAL JOINT
CL	CENTERLINE	OHPL	OVERHEAD POWERLINE
CIPP	CAST IN-PLACE PIPE	PP	POWER POLE
DIP	DUCTILE IRON PIPE	PRV	PRESSURE REDUCING VALVE
EC	END OF CURVE	PVC	POLYVINYL CHLORIDE PIPE
ECR	END CURB RETURN	PROP.	PROPOSED
EVC	END VERTICAL CURVE	PL	PROPERTY LINE
(E)	EXISTING	PUE	PUBLIC UTILITY EASEMENT
FL	FLOWLINE	PVI	POINT OF VERTICAL INTERSECTION
FS	FINISH SURFACE	RAD	RADIAL
FG	FINISH GRADE	RCP	REINFORCED CONCRETE PIPE
TC	TOP OF CURB	R/W	RIGHT OF WAY
TF	TOP OF FOOTING	S.L.	SEWER LATERAL
TW	TOP OF WALL	SD	STORM DRAIN
TG	TOP OF GRATE	STA.	STATION
FF	FINISH FLOOR	VERT.	VERTICAL
FLG'D	FLANGED	WS	WATER SERVICE
GV	GATE VALVE	Ø	DIAMETER
GB	GRADE BREAK	TMH	TELEPHONE MANHOLE

LEGAL DESCRIPTION:
PARCEL NO. 3 OF PARCEL MAP NO. 4063, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 40, PAGE 80 OF PARCEL MAPS IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY, TOGETHER WITH THE SOUTHEAST 1/4 OF THE NORTHWEST 1/4 OF THE NORTHWEST 1/4 OF SECTION 24, TOWNSHIP 4 NORTH, RANGE 7 WEST, SAN BERNARDINO BASE AND MERIDIAN IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

- S 1/2, SW 1/4, NW 1/4, NW 1/4, SEC 24, T4N, R7W
PORTION OF APN: 3066-261-10

ALR ENGINEERING HAS PREPARED A GEOTECHNICAL REPORT
AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONDUCT
ALL GRADING IN ACCORDANCE TO THIS REPORT DATED
OCTOBER 30, 2013, REVISED APRIL 25, 2022.

ALR ENGINEERING AND TESTING HAS CONDUCTED A GEOTECHNICAL INVESTIGATION AND PREPARED A REPORT DATED OCTOBER 30, 2013, REVISED APRIL 25, 2022, FOR PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT ON APN: 3066-261-10. ALL GRADING REQUIREMENTS ARE INCORPORATED IN THESE PLANS.

STEPHEN M. LONGORIA, PE 74782

I HEREBY DECLARE THAT I AM THE ENGINEER OF THE WORK FOR THIS PROJECT, THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THE DESIGN OF THE PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE AND THAT THE DESIGN IS CONSISTENT WITH CURRENT STANDARDS.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS AND SPECIFICATIONS BY THE COUNTY OF SAN BERNARDINO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK, OF MY RESPONSIBILITIES FOR THE PROJECT DESIGN.

TRLS ENGINEERING , INC.
10770 I AVE. STE. 108
HESPERIA, CA. 92345

JERRY L. MILES R.C.E. 42593
EXP: 3/31/24

05/09/2023
DATE

PLANS PREPARED BY:

10770 LA VENTURE SUITE 109

Hesperia, CA 92345
Phone: (760) 948-4900

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:			ASST. DIRECTOR OF PUBLIC WORKS
LAND DEVELOPMENT ENGINEER		DATE	DIRECTOR OF PUBLIC WORKS
			DATE

• GRAD-2021-00235	• SIP-2021-00031
• PRAA-2021-00040	• NEWNR-2021-00230
• DRNSTY-2021-00054	• WQMP-2021-00153

DRAWN BY: TRLS: DATE: 05/09/2023	PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT CIVIC CENTER DEVELOPMENT PHASE 1 9535 SHEEPCREEK RD. PHELAN, CA. 92329 (APN: 3066-261-10 & 3066-251-18)	SCALE:
		AS SHOWN
DESIGNED BY: TER DATE: -		SHEET
		1 OF 25

TITLE/ INDEX SHEET

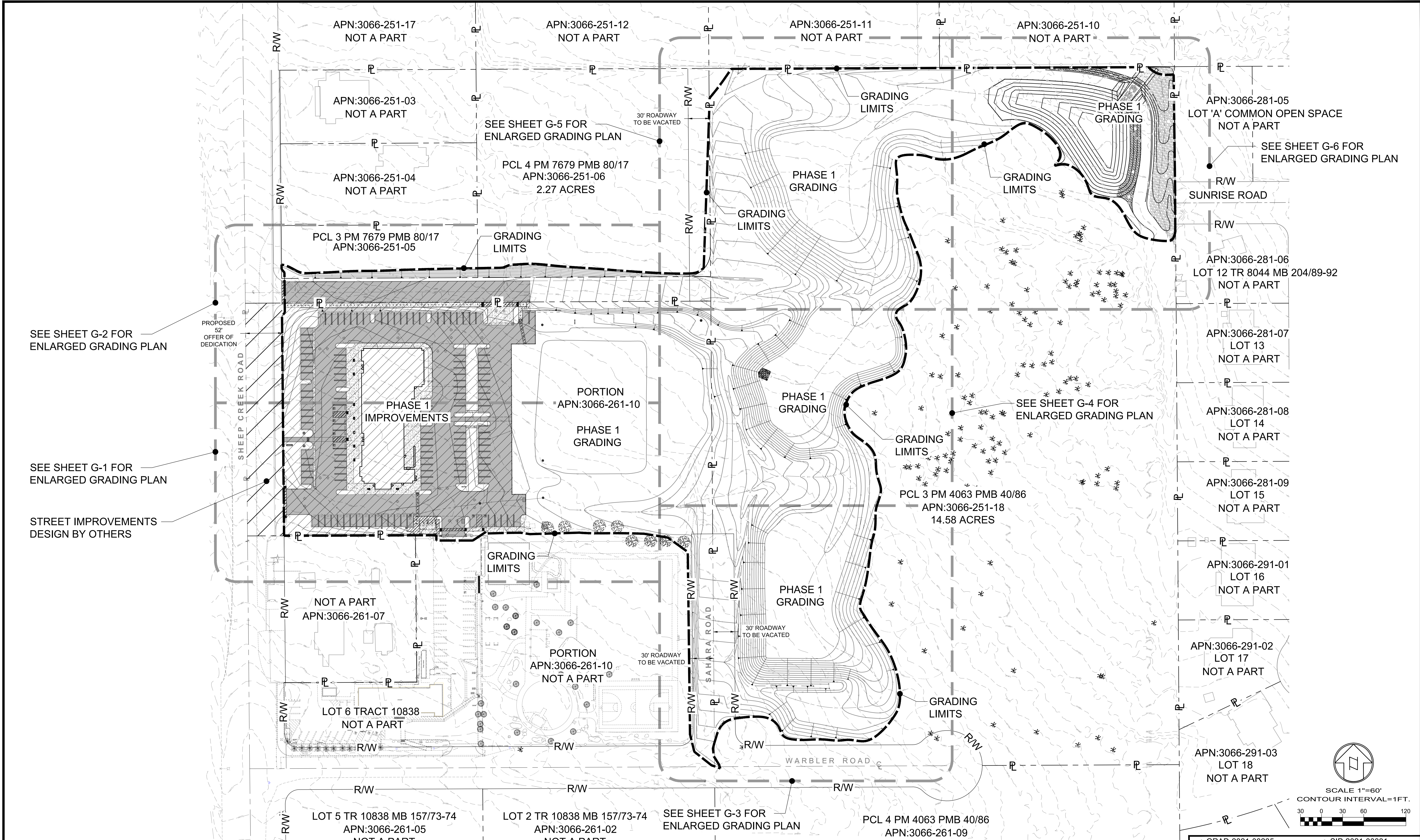
SCALE:

SHEET

1 OF 25

SHEET

T-1



DIGALERT
CALL BEFORE YOU DIG
1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

BENCHMARK:
U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE, 6.3 FT NORTH OF A SECTION MARKER PIPE, 0.6 FT EAST OF A WITNESS POST, ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND. ELEV= 3616.50

NO.	REVISION	DATE	BY

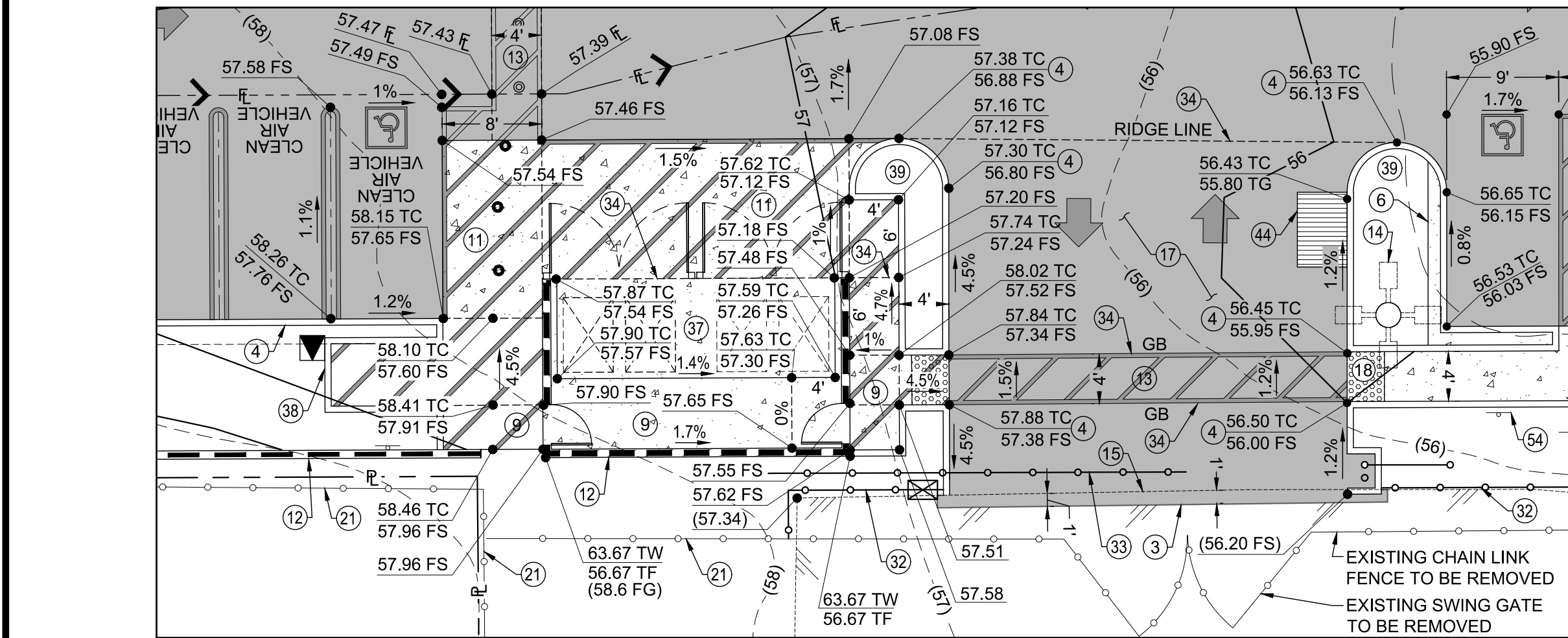
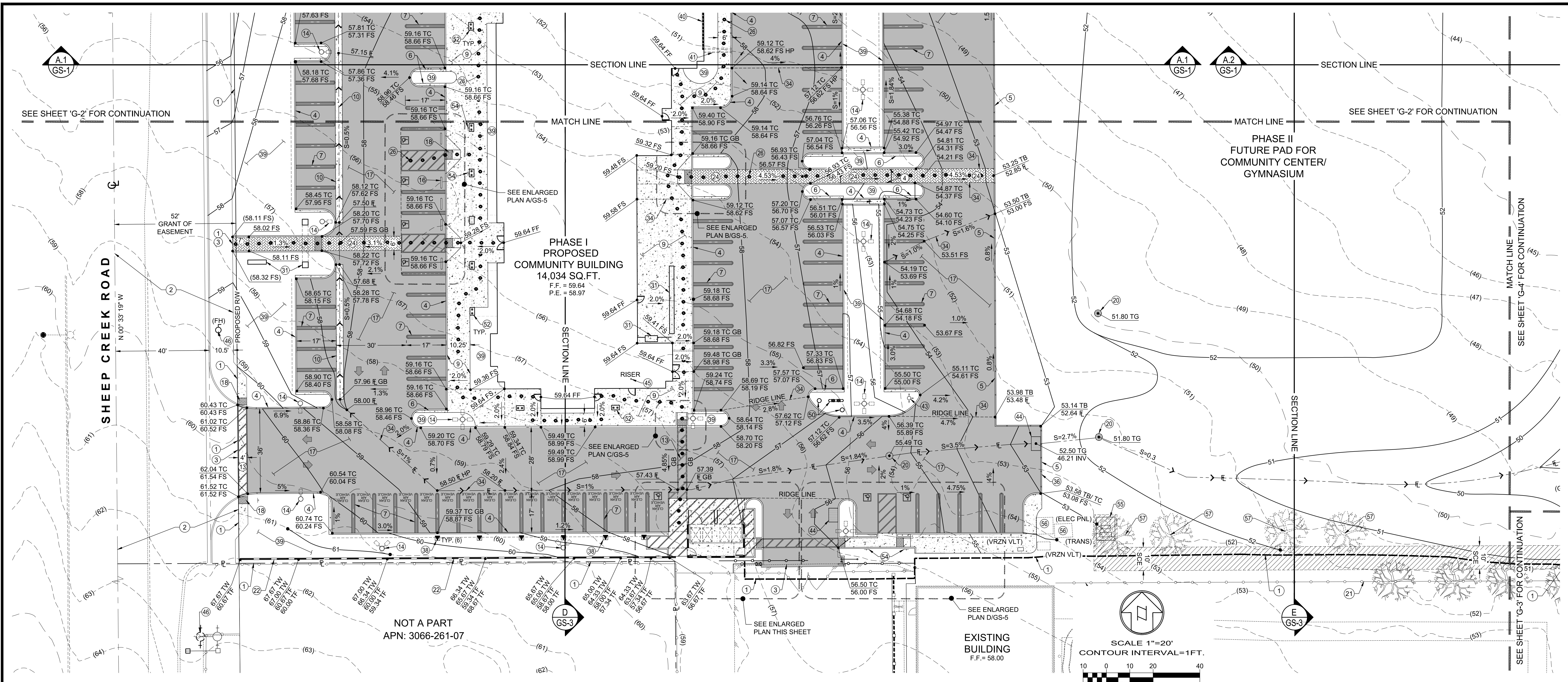
Jerry L. Miles
No. C 42593
Civil
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA
JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:
TRLS ENGINEERING Inc.
10770 1 AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900

**COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS**

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:		ASST. DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER		DIRECTOR OF PUBLIC WORKS	
DATE	DATE	DATE	DATE

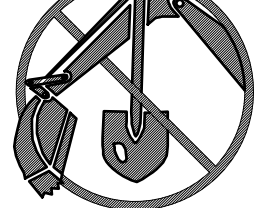
• GRAD-2021-00235 • PRAA-2021-00040 • DRNSTY-2021-00054	• SIP-2021-00031 • NEWNR-2021-00230 • WQMP-2021-00153
DRAWN BY: TRLS DATE: 05/09/2023	DISTRICT: PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT CIVIC CENTER DEVELOPMENT PHASE 1 9535 SHEEPCREEK RD. PHELAN, CA. 92329 (APN: 3066-261-10 & 3066-251-18)
DESIGNED BY: TER DATE:	APPROVED BY: DATE:
GRADING KEY PLAN	
SCALE: AS SHOWN	SHEET 2 OF 25 SHEET G-0



CONSTRUCTION NOTES

- 1 PHASE 1 GRADING LIMITS.
- 2 STREET IMPROVEMENTS BY OTHERS. STREET IMPROVEMENTS PLANS UNDER SEPARATE PERMIT. SIP-2021-00031.
- 3 MATCH EXISTING.
- 4 CONSTRUCT A1-6 HIGH CONCRETE CURB PER SPPWC STD. 120-2.
- 5 CONSTRUCT D1-6 6" HIGH ASPHALT BERM TO LIMITS SHOWN PER SPPWC STD. 120-2.
- 6 CONSTRUCT 12" WIDE CONCRETE WALK AT BACK OF CURB PER DETAIL "A" SHOWN ON SHEET G-3.
- 7 INSTALL PAINT STRIPING AND SYMBOLS PER ARCHITECTURAL PLAN.
- 8 CONSTRUCT 4" THICK CONCRETE SIDEWALK TO LIMITS SHOWN. CROSS SLOPE TO BE 2.0% MAX.
- 9 CONSTRUCT 3" WIDE CONCRETE V-GUTTER PER SBCO STD. 125
- 10 CONSTRUCT 6" THICK CONCRETE PAVEMENT TO LIMITS SHOWN
- 11 CONSTRUCT 8" BLOCK RETAINING WALL TO LIMITS SHOWN.
- 12 INSTALL 4" WIDE ADA PATH OF TRAVEL WITH STRIPING TO LIMITS SHOWN (CROSS SLOPE MAX = 1.75%)
- 13 INSTALL PARKING AREA LIGHT STANDARD PER ARCHITECTURAL PLAN.
- 14 SAWCUT LINE.
- 15 INSTALL 4" LONG CONCRETE WHEEL STOP. REFER TO ARCHITECTURAL PLAN.
- 16 INSTALL 4" AC PAVEMENT OVER 5" CLASS II BASE TO LIMITS SHOWN.
- 17 INSTALL TRUNCATED DOME PER ARCHITECTURAL PLAN.
- 18 INSTALL 5' DIA. CONCRETE MANHOLE WITH 36" TRAFFIC RATED GRATE WITH FLOGARD 36" INSERT FILTER OR APPROVED EQUAL. (REFER TO UTILITY PLAN).
- 19 PROTECT EXISTING FENCE IN PLACE.
- 20 CONSTRUCT 6' HIGH BLOCK WALL TO LIMITS SHOWN. UNDER SEPARATE PERMIT.
- 21 CONSTRUCT 6' WIDE ADA PATH OF TRAVEL. DECORATIVE PAVERS PER ARCHITECTURAL PLAN.
- 22 REFER TO ARCHITECTURAL PLAN - TYPICAL.
- 23 INSTALL 6" HIGH CHAINLINK FENCE TO LIMITS SHOWN.
- 24 INSTALL 38" WIDE ELECTRICAL POWERED ROLLING GATE (REFER TO ARCHITECTURAL PLAN).
- 25 GRADE BREAK LINE.
- 26 INSTALL 5 LINEAR FEET OF STORM DRAIN PIPE WITH END CAP.
- 27 EDGE OF PROPOSED PAVEMENT.
- 28 CONSTRUCT TRASH ENCLOSURE PER ARCHITECTURAL PLANS. CONTRACTOR TO PAINT TRASH ENCLOSURE A COMBINATION OF TWO PAINT COLORS TO BE DETERMINED BY DISTRICT STAFF. PAINT IS TO BE SHERWIN WILLIAMS EMERALD EXTERIOR ACRYLIC LATEX OR APPROVED EQUAL.
- 29 INSTALL EV CHARGING STATION PEDESTAL. REFER TO ARCHITECTURAL PLAN.
- 30 PLANTER AREA. REFER TO ARCHITECTURAL PLANS FOR LANDSCAPE INFO.
- 31 EXTENDED FOOTING. REFER TO ARCHITECTURAL FOUNDATION PLAN FOR DETAIL.
- 32 UNDER SIDEWALK DRAIN.
- 33 RELOCATED FIRE HYDRANT. REFER TO UTILITY PLAN.
- 34 INSTALL DROP INLET. REFER TO UTILITY PLAN.
- 35 FIRE LINE CONNECTION. REFER TO UTILITY PLAN.
- 36 EXISTING FIR HYDRANT TO BE RELOCATED BY OTHERS.
- 37 ARCHITECTURAL COLUMN. SEE ARCHITECTURAL PLAN.
- 38 INSTALL ADA PARKING SIGN PER ARCHITECTURAL PLAN.
- 39 PROPOSED ELECTRICAL TRANSFORMER. SEE UTILITY PLAN.
- 40 TO BE REMOVED.
- 41 TREES TO BE REMOVED. TYPICAL OF (4).

DIGALERT



CALL BEFORE YOU DIG

1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

SCALE= 1"= 10'

NO.	REVISION	DATE	BY



JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:

TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900



COUNTY OF SAN BERNARDINO DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:	ASST. DIRECTOR OF PUBLIC WORKS	DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER	DATE	DATE	DATE

• GRAD-2021-00235
• PRAA-2021-00040
• DRNSTY-2021-00054

• SIP-2021-00031
• NEWNR-2021-00230
• WQMP-2021-00153

DRAWN BY:
TERLS
DATE:
05/09/2023
DESIGNED BY:
TER
DATE:
APPROVED BY:
DATE:

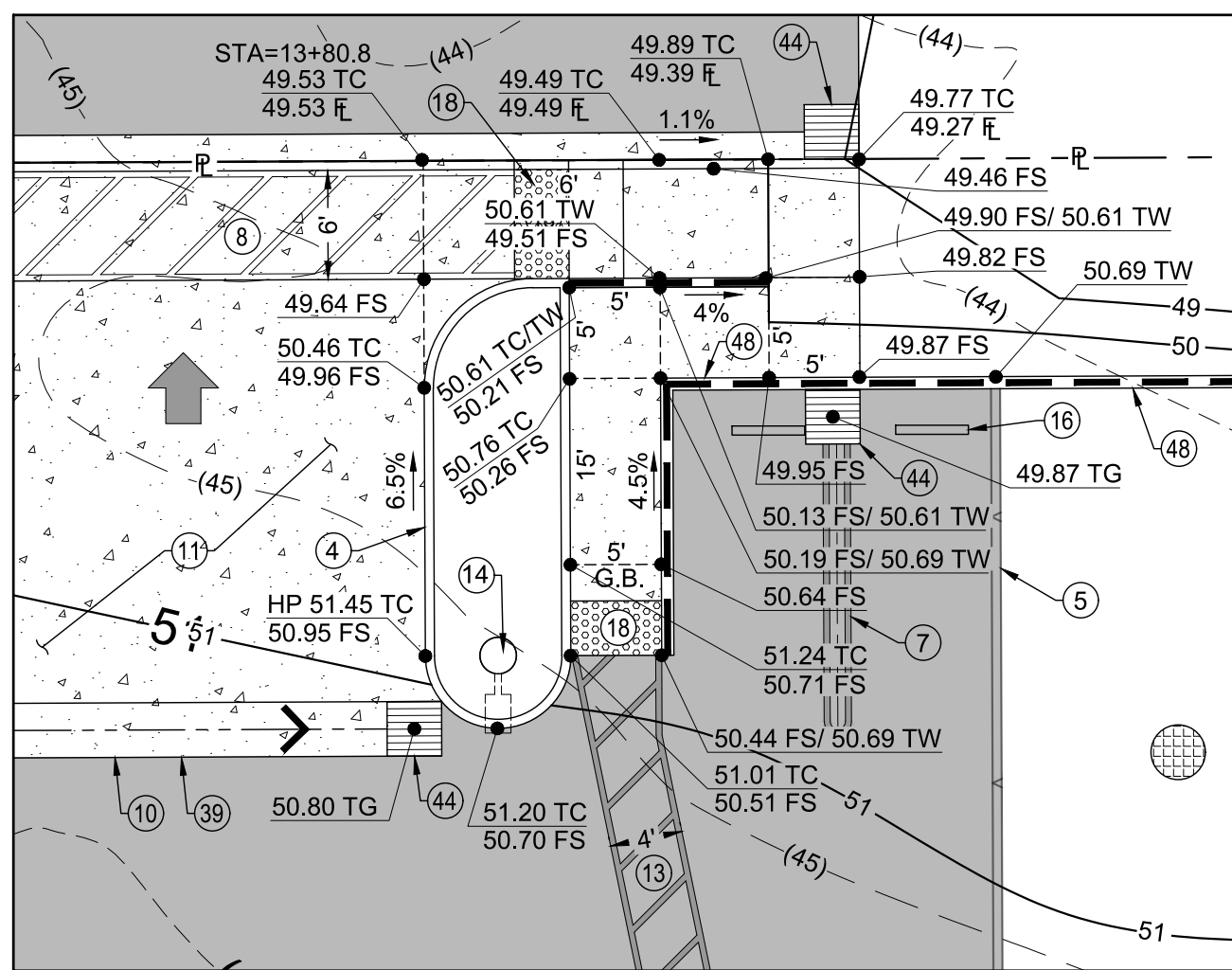
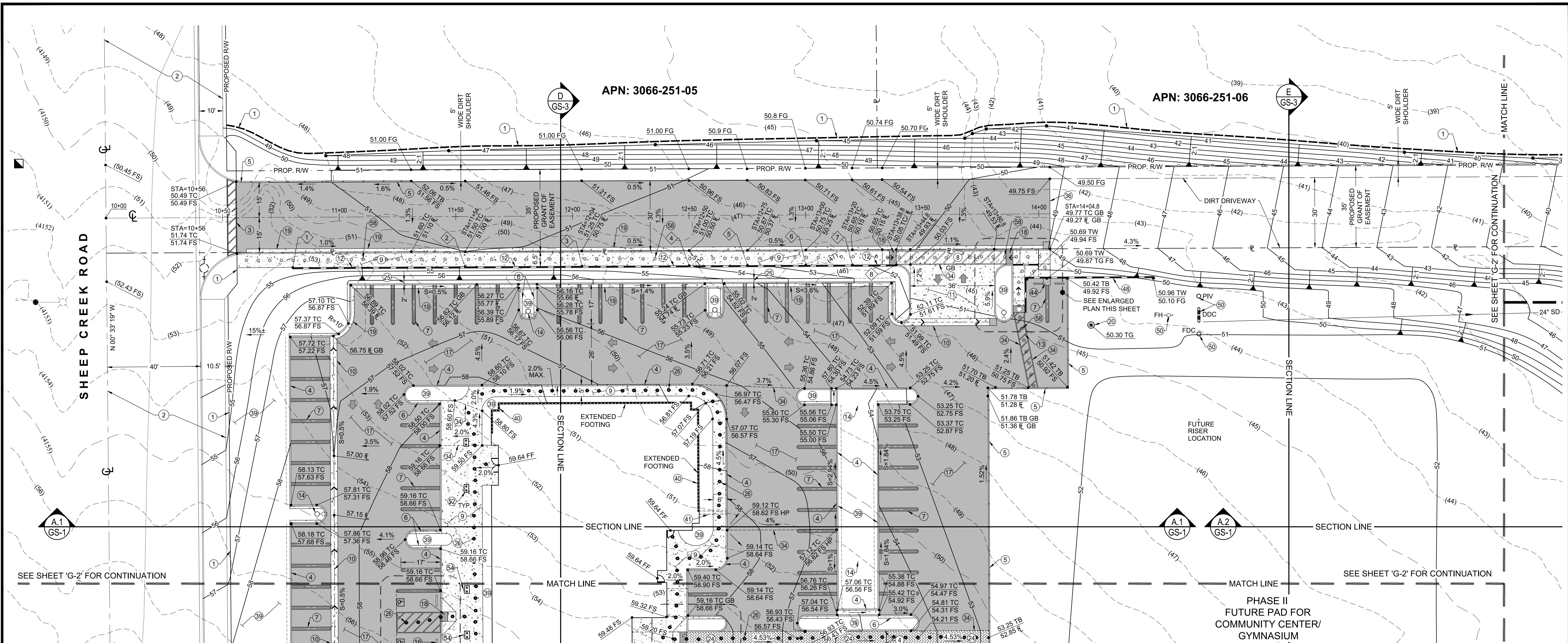
PHELAN PINON HILLS
COMMUNITY SERVICES DISTRICT
CIVIC CENTER DEVELOPMENT
PHASE 1
9535 SHEEPCREEK RD. PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)

GRADING PLAN

SCALE:
AS SHOWN

SHEET
3 OF 25

SHEET
G-1



ENLARGED PLAN

SCALE= 1"= 10'

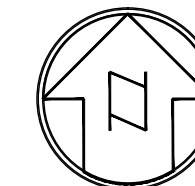
RETAINING WALL LEGEND

TW= TOP OF WALL
TF= TOP OF FOOTING

CALLOUT	ELEVATION	STATION
1	55.36 TW 51.74 TF	STA=10+80
2	55.36 TW 50.67 TF	STA=11+54
3	55.36 TW 50.67 TF	STA=12+04
4	55.36 TW 54.67 TW 50.00 TF	STA=12+50
5	54.67 TW 54.00 TW 50.00 TF	STA=12+75
6	54.00 TW 53.33 TW 50.00 TF	STA=13+00
7	53.33 TW 52.60 TW 49.33 TF	STA=13+20
8	52.67 TW 49.33 TF	STA=13+88.8

CONSTRUCTION NOTES

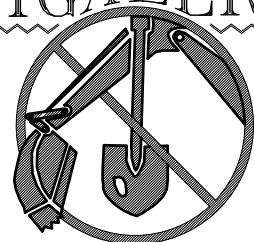
- 1 PHASE 1 GRADING LIMITS.
- 2 STREET IMPROVEMENTS BY OTHERS. STREET IMPROVEMENTS PLANS UNDER SEPARATE PERMIT. SIP-2021-00031.
- 3 MATCH EXISTING.
- 4 CONSTRUCT A1-6 HIGH CONCRETE CURB PER SPPWC STD. 120-2.
- 5 CONSTRUCT D1-6 6" HIGH ASPHALT BERM TO LIMITS SHOWN PER SPPWC STD. 120-2.
- 6 CONSTRUCT 12" WIDE CONCRETE WALK AT BACK OF CURB PER DETAIL "A" SHOWN ON SHEET G-3.
- 7 INSTALL PAINT STRIPING AND SYMBOLS PER ARCHITECTURAL PLAN.
- 8 INSTALL 6" WIDE ADA PATH OF TRAVEL STRIPING.
- 9 CONSTRUCT 4" THICK CONCRETE SIDEWALK TO LIMITS SHOWN. CROSS SLOPE TO BE 2.0% MAX.
- 10 CONSTRUCT 3" WIDE CONCRETE V-GUTTER PER SBCO STD. 125
- 11 CONSTRUCT 6" THICK CONCRETE PAVEMENT TO LIMITS SHOWN
- 12 CONSTRUCT 8" BLOCK RETAINING WALL TO LIMITS SHOWN.
- 13 INSTALL 4" WIDE ADA PATH OF TRAVEL WITH STRIPING TO LIMITS SHOWN (CROSS SLOPE MAX = 1.75%)
- 14 INSTALL PARKING AREA LIGHT STANDARD PER ARCHITECTURAL PLAN.
- 16 INSTALL 4' LONG CONCRETE WHEEL STOP. REFER TO ARCHITECTURAL PLAN.
- 17 INSTALL 4" AC PAVEMENT OVER 5" CLASS II BASE TO LIMITS SHOWN.
- 18 INSTALL TRUNCATED DOME PER ARCHITECTURAL PLAN.
- 19 CONSTRUCT 6" CURB & GUTTER PER SBCO STD. 116 TO LIMITS SHOWN.
- 20 INSTALL 5" DIA. CONCRETE MANHOLE WITH 36" TRAFFIC RATED GRATE WITH FLOGARD 36" INSERT FILTER OR APPROVED EQUAL. (REFER TO UTILITY PLAN).
- 24 CONSTRUCT 6' WIDE ADA PATH OF TRAVEL. DECORATIVE PAVERS PER ARCHITECTURAL PLAN.
- 25 CONTRACTOR TO MAINTAIN TOP OR TOE OF SLOPE A MINIMUM OF 2-FEET FROM BACK OF CURB.
- 26 ADA PATH OF TRAVEL SHOWN THUSLY.
- 34 GRADE BREAK LINE.
- 36 EDGE OF PROPOSED PAVEMENT.
- 39 PLANTER AREA. REFER TO ARCHITECTURAL PLANS FOR LANDSCAPE INFO.
- 40 EXTENDED FOOTING. REFER TO ARCHITECTURAL FOUNDATION PLAN FOR DETAIL.
- 41 UNDER SIDEWALK DRAIN.
- 44 INSTALL DROP INLET. REFER TO UTILITY PLAN.
- 48 CONSTRUCT 0.5' HIGH TO 2.0' HIGH 6" THICK BLOCK WALL TO LIMITS SHOWN.
- 50 REFER TO UTILITY PLAN.
- 52 ARCHITECTURAL COLUMN. SEE ARCHITECTURAL PLAN.
- 53 CONSTRUCT VARIABLE HEIGHT 0" TO 6" CURB TO LIMITS SHOWN.
- 54 INSTALL ADA PARKING SIGN PER ARCHITECTURAL PLAN.
- 58 FUTURE PATH OF TRAVEL.



SCALE 1"=20'
CONTOUR INTERVAL=1FT.



DIGALERT



CALL BEFORE YOU DIG

1-800-422-4133

UNDERGROUND SERVICE ALERT

Call at least 2 working days prior to excavating

BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

NO.	REVISION	DATE	BY

JERRY L. MILES
R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:

TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108

Hesperia, CA 92345

Phone: (760) 948-4900



COUNTY OF SAN BERNARDINO DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:	ASST. DIRECTOR OF PUBLIC WORKS	DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER	DATE	DATE	DATE

• GRAD-2021-00235
• PRAA-2021-00040
• DRNSTY-2021-00054

• SIP-2021-00031
• NEWNR-2021-00230
• WQMP-2021-00153

PHELAN PINON HILLS
COMMUNITY SERVICES DISTRICT
CIVIC CENTER DEVELOPMENT
PHASE 1

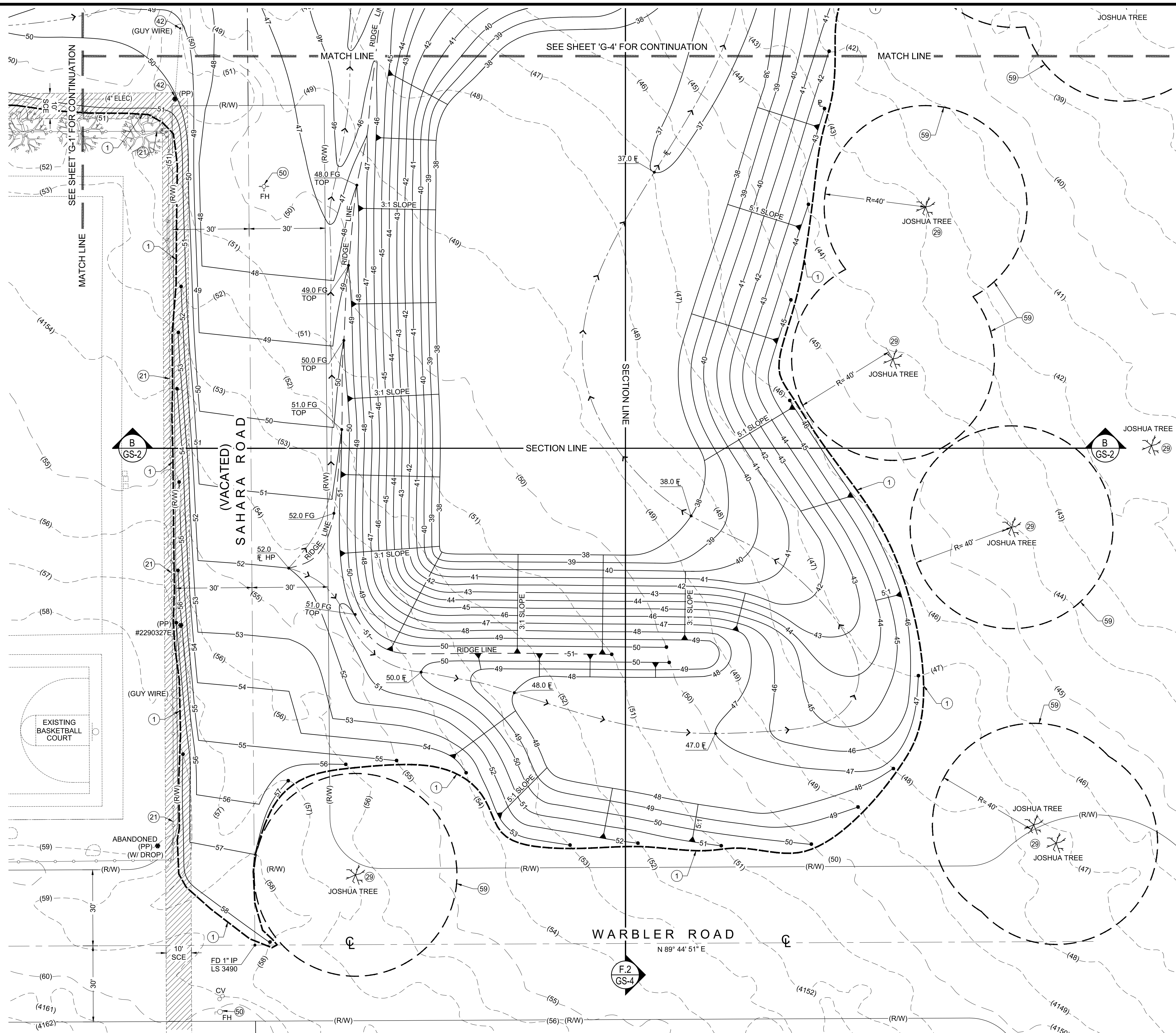
9535 SHEEPCREEK RD. PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)

GRADING PLAN

SCALE:
AS SHOWN

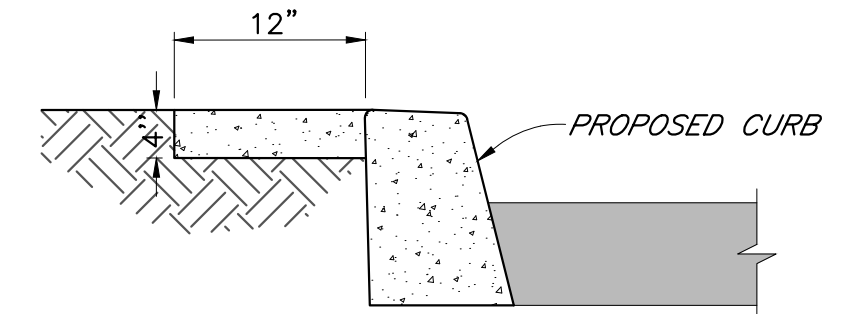
SHEET
4 OF 25

SHEET
G-2



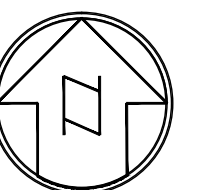
CONSTRUCTION NOTES

- ① PHASE 1 GRADING LIMITS.
- ②① PROTECT EXISTING FENCE IN PLACE.
- ②⑨ PROTECT EXISTING JOSHUA TREES IN PLACE.
- ④② PROTECT IN PLACE.
- ⑤① REFER TO UTILITY PLAN.
- ⑤⑨ CONTRACTOR MUST MAINTAIN A 40 FOOT UNDISTURBED PERIMETER AROUND ALL JOSHUA TREES

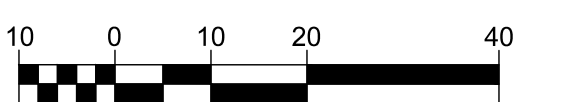


DETAIL "A" - WALK @ BACK OF CURB

NOT TO SCALE



SCALE 1"=20'
CONTOUR INTERVAL=1FT.



- | | |
|---------------------|--------------------|
| • GRAD-2021-00235 | • SIP-2021-00031 |
| • PRAA-2021-00040 | • NEWNR-2021-00230 |
| • DRNSTY-2021-00054 | • WQMP-2021-00153 |

DRAWN BY: TERLS DATE: 05/09/2023	PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT CIVIC CENTER DEVELOPMENT PHASE 1 9535 SHEEPCREEK RD, PHELAN, CA. 92329 (APN: 3066-261-10 & 3066-251-18)	SCALE: AS SHOWN
DESIGNED BY: TER DATE:		SHEET 5 OF 25
APPROVED BY: DATE:		SHEET G-3

DIGALERT

CALL BEFORE YOU DIG
1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

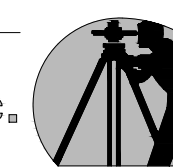
BENCHMARK:
U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD, FROM THE INTERSECTION OF PHELAN RD, 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD, 34 FT EAST OF THE CENTER LINE OF JOHNSON RD, 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD, 6.6 FT WEST OF A FENCE, 6.3 FT NORTH OF A SECTION MARKER PIPE, 0.6 FT EAST OF A WITNESS POST, ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

NO.	REVISION	DATE	BY

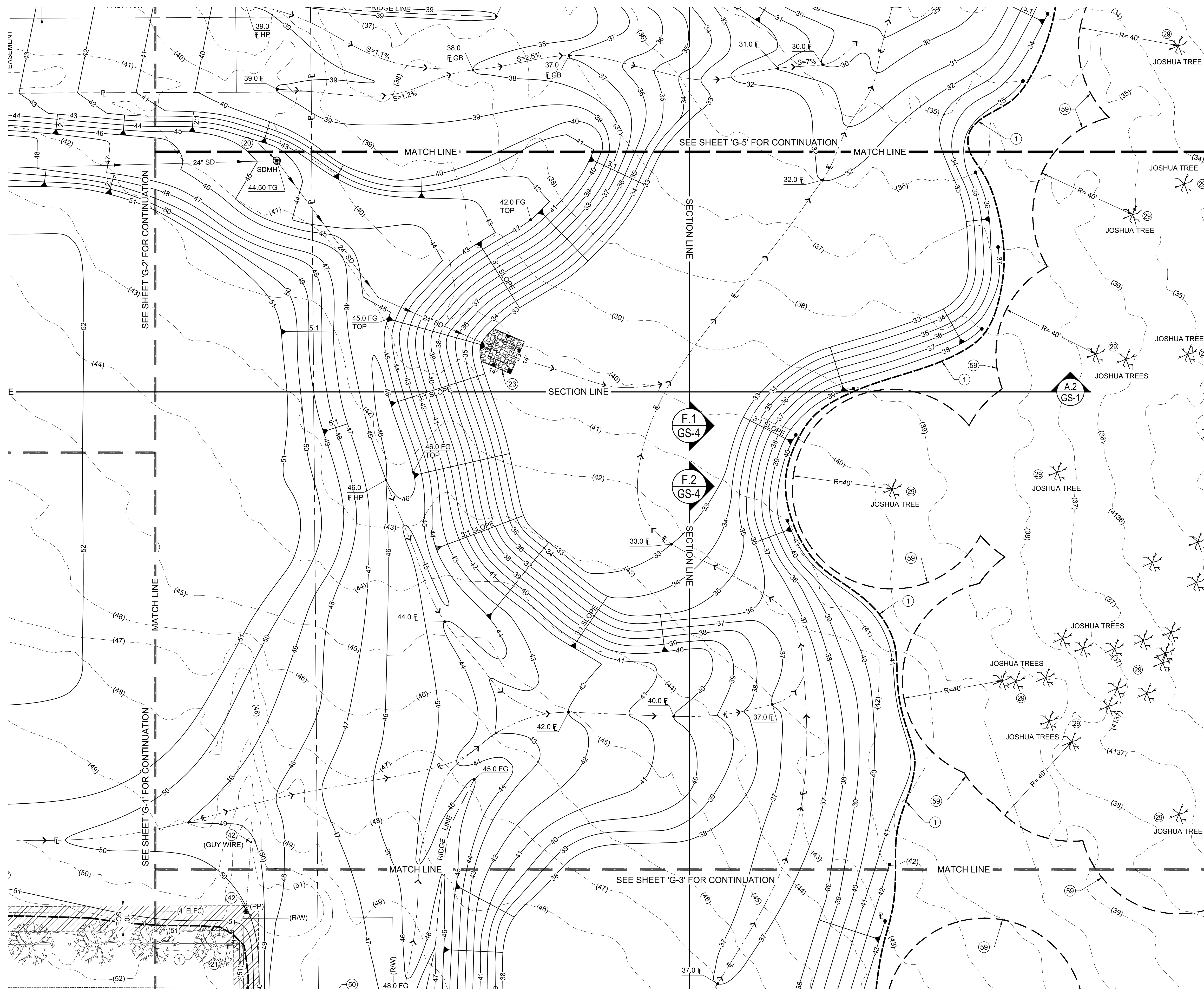


JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:
TRLs ENGINEERING Inc.
10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900

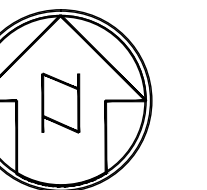


COUNTY OF SAN BERNARDINO DEPARTMENT OF PUBLIC WORKS			
DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:		ASST. DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER		DIRECTOR OF PUBLIC WORKS	
DATE	DATE	DATE	DATE

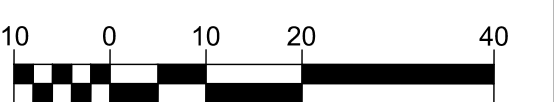


CONSTRUCTION NOTES

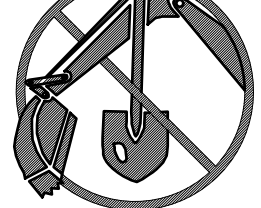
- 1 PHASE 1 GRADING LIMITS.
- 20 INSTALL 5' DIA. CONCRETE MANHOLE WITH 36" TRAFFIC RATED GRATE WITH FLOGARD 36" INSERT FILTER OR APPROVED EQUAL. (REFER TO UTILITY PLAN).
- 21 PROTECT EXISTING FENCE IN PLACE.
- 23 INSTALL 4" RIP RAP ROCK TO A DEPTH OF 18" TO LIMITS SHOWN.
- 29 PROTECT EXISTING JOSHUA TREES IN PLACE.
- 42 PROTECT IN PLACE.
- 59 CONTRACTOR MUST MAINTAIN A 40 FOOT UNDISTURBED PERIMETER AROUND ALL JOSHUA TREES



SCALE 1"=20'
CONTOUR INTERVAL=1FT.



DIGALERT



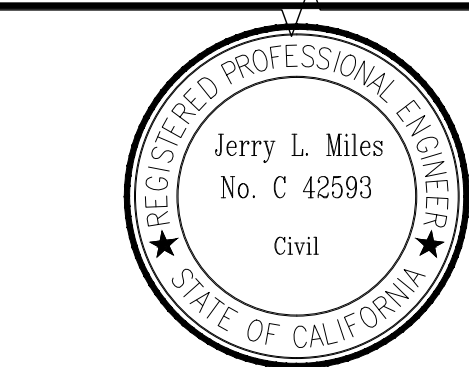
CALL
BEFORE
YOU DIG

1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF PHELAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

NO.	REVISION	DATE	BY

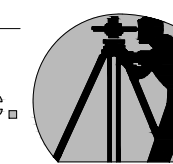


JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:

TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900



COUNTY OF SAN BERNARDINO DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:	ASST. DIRECTOR OF PUBLIC WORKS	DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER	DATE	DATE	DATE

- GRAD-2021-00235
- PRAA-2021-00040
- DRNSTY-2021-00054

- SIP-2021-00031
- NEWNR-2021-00230
- WQMP-2021-00153

DRAWN BY:
TERLS
DATE:
05/09/2023
DESIGNED BY:
TER
DATE:
APPROVED BY:
DATE:

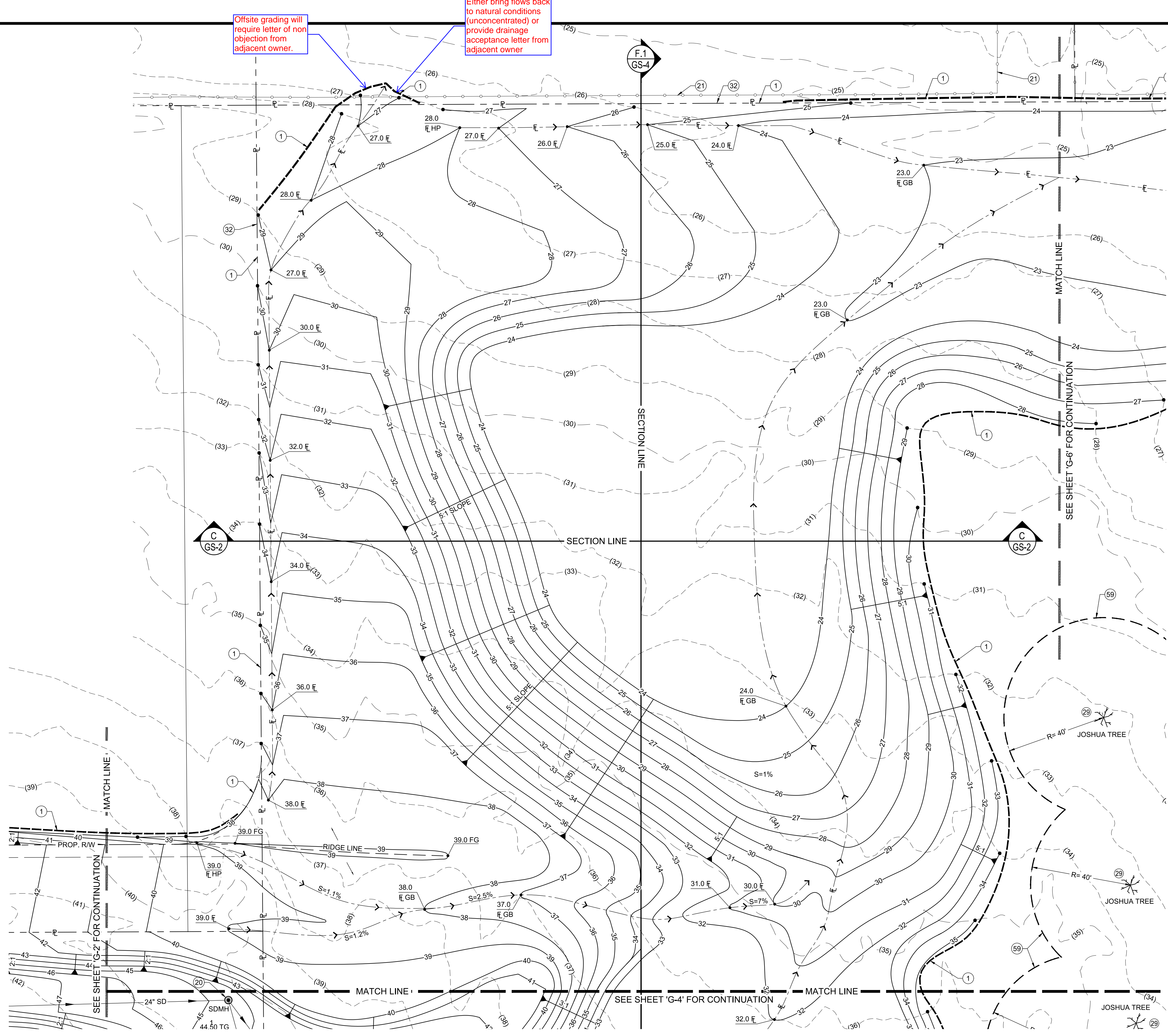
PHELAN PINON HILLS
COMMUNITY SERVICES DISTRICT
CIVIC CENTER DEVELOPMENT
PHASE 1
9535 SHEEPCREEK RD. PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)

GRADING PLAN

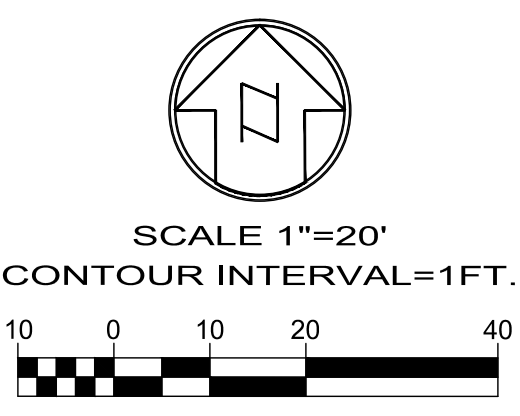
SCALE:
AS SHOWN

SHEET
6 OF 25

SHEET
G-4



- CONSTRUCTION NOTES**
- 1 PHASE 1 GRADING LIMITS.
 - 20 INSTALL 5' DIA. CONCRETE MANHOLE WITH 36" TRAFFIC RATED GRATE WITH FLOGARD 36" INSERT FILTER OR APPROVED EQUAL. (REFER TO UTILITY PLAN).
 - 21 PROTECT EXISTING FENCE IN PLACE.
 - 29 PROTECT EXISTING JOSHUA TREES IN PLACE.
 - 32 INSTALL 6' HIGH CHAINLINK FENCE TO LIMITS SHOWN.
 - 59 CONTRACTOR MUST MAINTAIN A 40 FOOT UNDISTURBED PERIMETER AROUND ALL JOSHUA TREES



DIGALERT
CALL BEFORE YOU DIG
1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

BENCHMARK:
U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

NO.	REVISION	DATE	BY

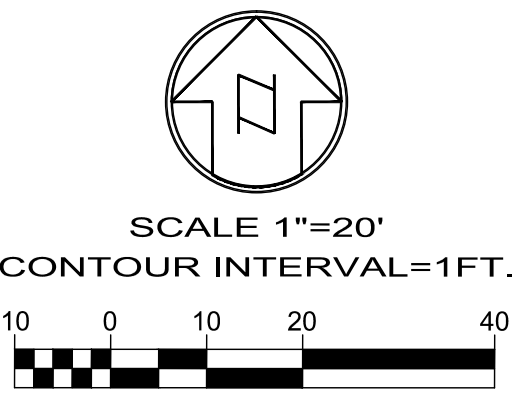
Jerry L. Miles
No. C 42593
Civil
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA
JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:
TRLS ENGINEERING Inc.
10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900


**COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS**

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:		ASST. DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER		DIRECTOR OF PUBLIC WORKS	
DATE		DATE	

DRAWN BY: TRLS DATE: 05/09/2023	PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT CIVIC CENTER DEVELOPMENT PHASE 1 9535 SHEEPCREEK RD. PHELAN, CA. 92329 (APN: 3066-261-10 & 3066-251-18)	SCALE: AS SHOWN
DESIGNED BY: TER DATE:	GRADING PLAN	SHEET 7 OF 25
APPROVED BY: DATE:		SHEET G-5

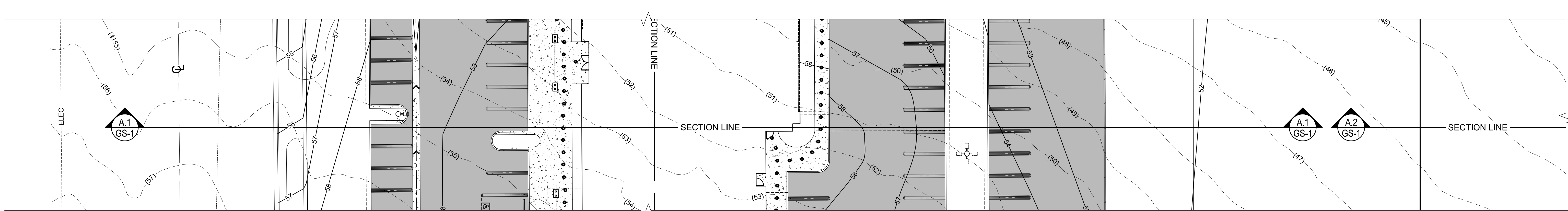
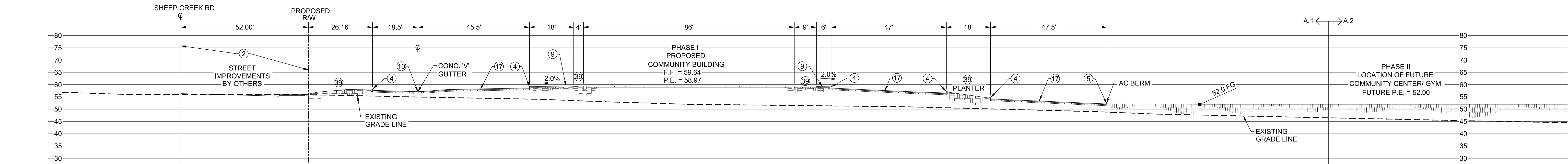


BENCHMARK:
U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD, FROM THE INTERSECTION OF PHELAN RD, 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD, 34 FT EAST OF THE CENTER LINE OF JOHNSON RD, 32.5 FT NORTH OF THE CENTER LINE OF JOHNSON RD, 6.6 FT WEST OF A FENCE, 6.3 FT NORTH OF A SECTION MARKER PIPE, 0.6 FT EAST OF A WITNESS POST, ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV = 3616.50



JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

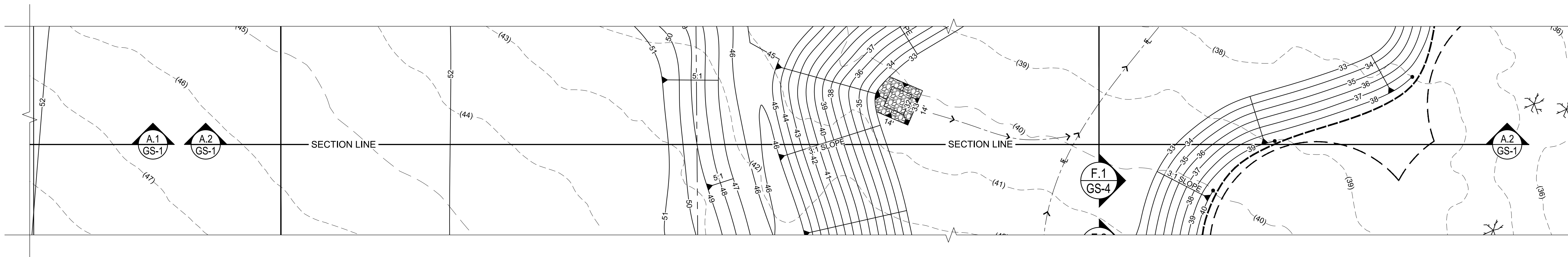
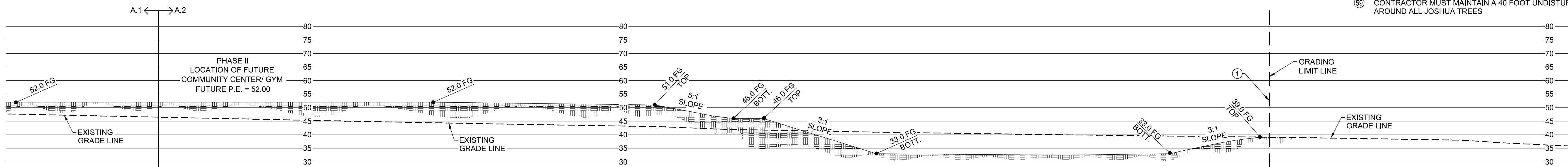
<ul style="list-style-type: none"> ● GRAD-2021-00235 ● PRAA-2021-00040 ● DRNSTY-2021-00054 	<ul style="list-style-type: none"> ● SIP-2021-00031 ● NEWNR-2021-00230 ● WQMP-2021-00153 	
DRAWN BY: TRLS DATE: 05/09/2023	PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT CIVIC CENTER DEVELOPMENT PHASE 1 9535 SHEEPCREEK RD. PHELAN, CA. 92329 (APN: 3066-261-10 & 3066-251-18)	SCALE: AS SHOWN
DESIGNED BY: TER DATE: -		SHEET 9 OF 2
APPROVED BY: DATE:	HORIZONTAL CONTROL PLAN	SHEET HC-1



SECTION 'A.1'

CONSTRUCTION NOTES

- 1 PHASE 1 GRADING LIMITS.
- 2 STREET IMPROVEMENTS BY OTHERS. STREET IMPROVEMENTS PLANS UNDER SEPARATE PERMIT. SIP-2021-00031.
- 4 CONSTRUCT A1-6 HIGH CONCRETE CURB PER SPPWC STD. 120-2.
- 5 CONSTRUCT D1-6 6" HIGH ASPHALT BERM TO LIMITS SHOWN PER SPPWC STD. 120-2.
- 9 CONSTRUCT 4" THICK CONCRETE SIDEWALK TO LIMITS SHOWN. CROSS SLOPE TO BE 2.0% MAX.
- 10 CONSTRUCT 3" WIDE CONCRETE V-GUTTER PER SBDO STD. 125.
- 17 INSTALL 4" AC PAVEMENT OVER 5" CLASS II BASE TO LIMITS SHOWN.
- 39 PLANTER AREA. REFER TO ARCHITECTURAL PLANS FOR LANDSCAPE INFO.
- 59 CONTRACTOR MUST MAINTAIN A 40 FOOT UNDISTURBED PERIMETER AROUND ALL JOSHUA TREES



SECTION 'A.2'



BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

NO.	REVISION	DATE	BY



JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:
TRLS ENGINEERING Inc.
10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900

COUNTY OF SAN BERNARDINO DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:	ASST. DIRECTOR OF PUBLIC WORKS	DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER	DATE	DATE	DATE

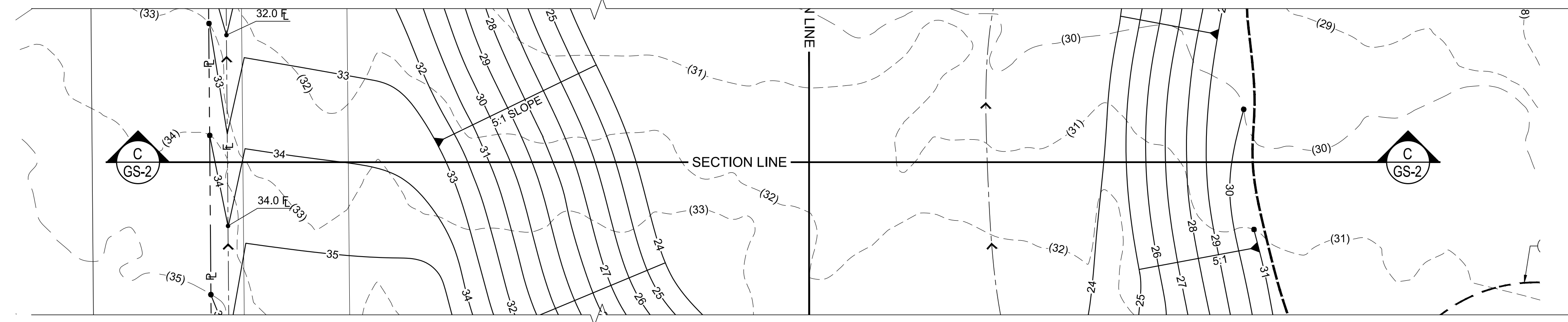
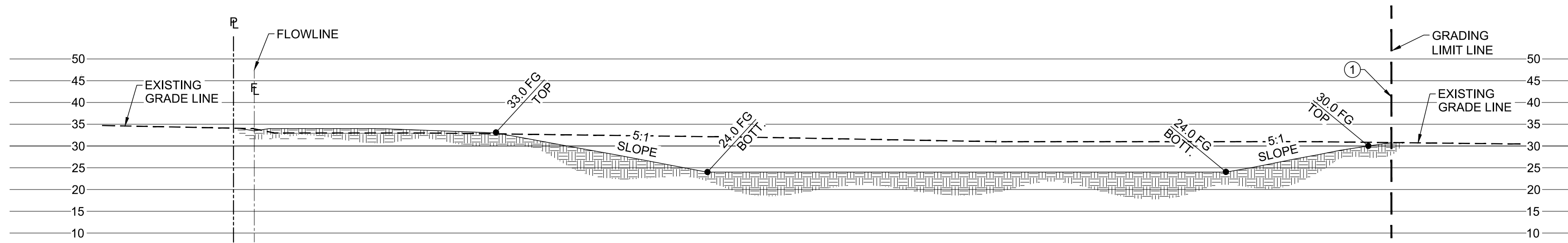
- GRAD-2021-00235
- PRAA-2021-00040
- DRNSTY-2021-00054
- SIP-2021-00031
- NEWNR-2021-00230
- WQMP-2021-00153

DRAWN BY:
TERLS
DATE:
05/09/2023
DESIGNED BY:
TER
DATE:
APPROVED BY:
DATE:

PHELAN PINON HILLS
COMMUNITY SERVICES DISTRICT
CIVIC CENTER DEVELOPMENT
PHASE 1
9535 SHEEPCREEK RD. PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)

SECTIONS

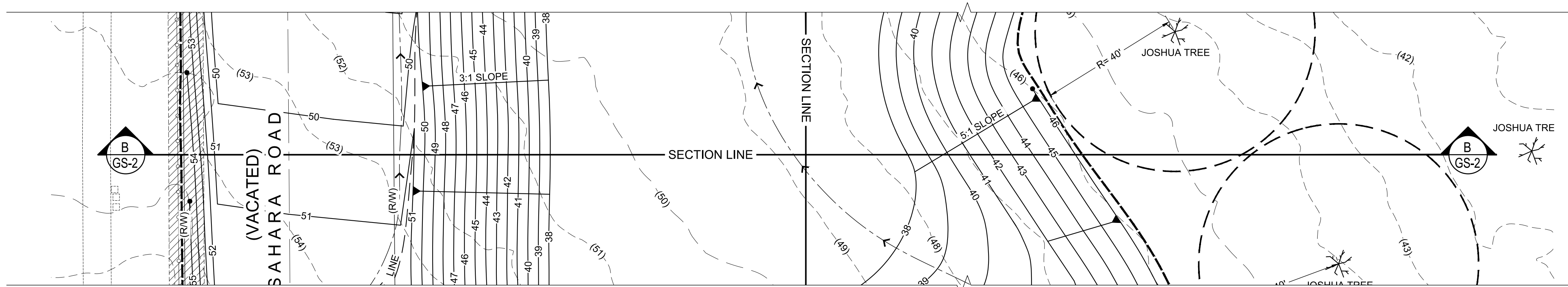
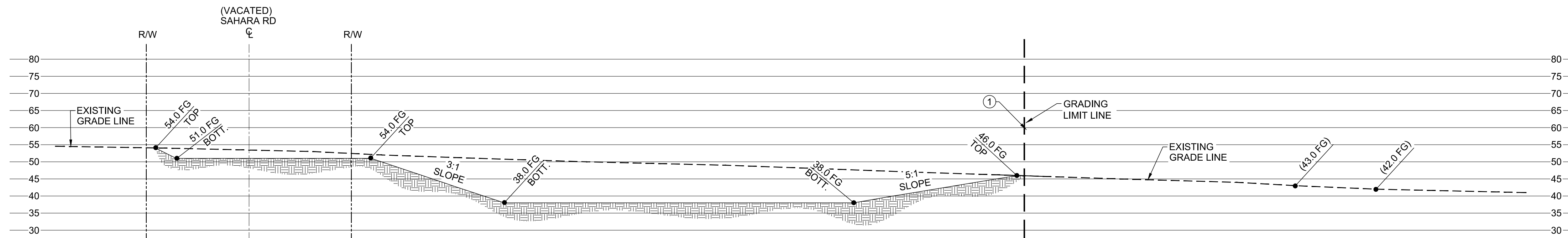
SCALE:
AS SHOWN
SHEET
10 OF 25
SHEET
GS-1



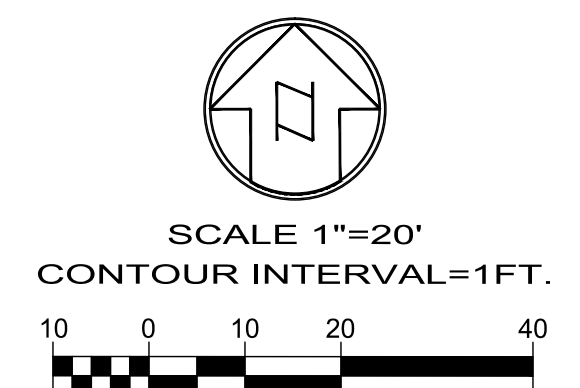
SECTION 'C'

CONSTRUCTION NOTES

- ① PHASE 1 GRADING LIMITS.



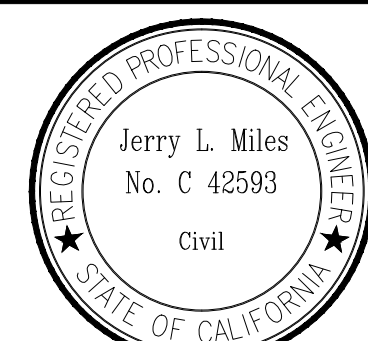
SECTION 'B'



BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND. ELEV= 3616.50

NO.	REVISION	DATE	BY

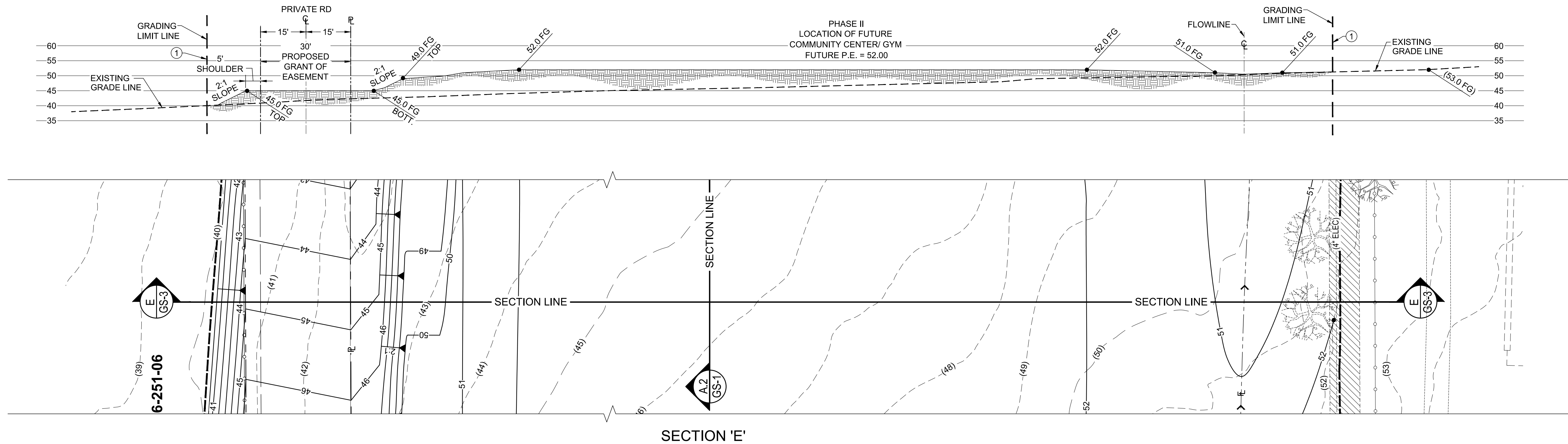


JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:
TRLS ENGINEERING Inc.
10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900

COUNTY OF SAN BERNARDINO DEPARTMENT OF PUBLIC WORKS			
DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:	ASST. DIRECTOR OF PUBLIC WORKS		
LAND DEVELOPMENT ENGINEER	DATE	DIRECTOR OF PUBLIC WORKS	DATE

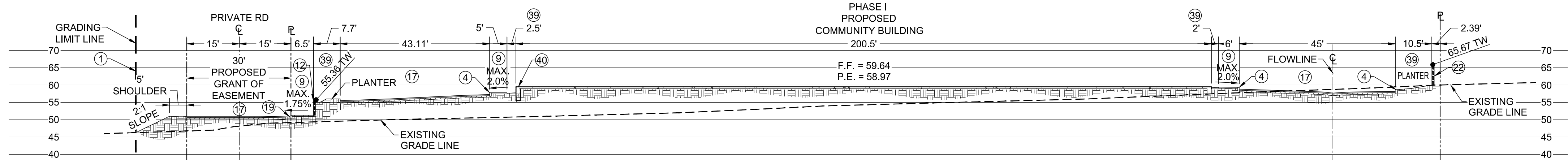
• GRAD-2021-00235 • PRAA-2021-00040 • DRNSTY-2021-00054	• SIP-2021-00031 • NEWNR-2021-00230 • WQMP-2021-00153
DRAWN BY: TERLS DATE: 05/09/2023	PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT CIVIC CENTER DEVELOPMENT PHASE 1 9535 SHEEPCREEK RD. PHELAN, CA. 92329 (APN: 3066-261-10 & 3066-251-18)
DESIGNED BY: TER DATE:	SCALE: AS SHOWN SHEET 11 OF 25
APPROVED BY: DATE:	SECTIONS GS-2



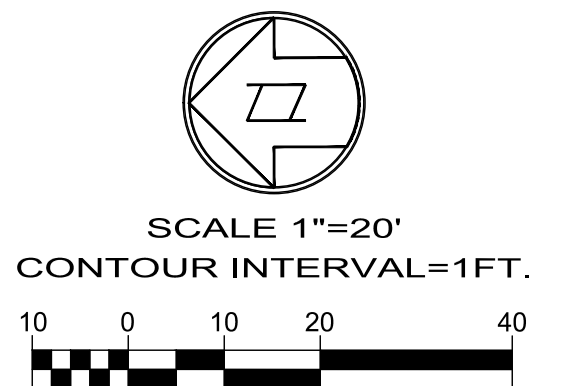
SECTION 'E'

CONSTRUCTION NOTES

- ① PHASE 1 GRADING LIMITS.
- ④ CONSTRUCT A1-6 HIGH CONCRETE CURB PER SPPWC STD. 120-2.
- ⑨ CONSTRUCT 4" THICK CONCRETE SIDEWALK TO LIMITS SHOWN. CROSS SLOPE TO BE 2.0% MAX.
- ⑫ CONSTRUCT 8" BLOCK RETAINING WALL TO LIMITS SHOWN.
- ⑰ INSTALL 4" AC PAVEMENT OVER 5" CLASS II BASE TO LIMITS SHOWN.
- ⑲ CONSTRUCT 6" CURB & GUTTER PER SBCO STD. 116 TO LIMITS SHOWN.
- ⑳ CONSTRUCT 6' HIGH BLOCK WALL TO LIMITS SHOWN. UNDER SEPARATE PERMIT.
- ㉑ PLANTER AREA. REFER TO ARCHITECTURAL PLANS FOR LANDSCAPE INFO.
- ㉒ EXTENDED FOOTING. REFER TO ARCHITECTURAL FOUNDATION PLAN FOR DETAIL.



SECTION 'D'



BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

NO.	REVISION	DATE	BY



JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:

TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900



COUNTY OF SAN BERNARDINO DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:	ASST. DIRECTOR OF PUBLIC WORKS	DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER	DATE	DATE	DATE

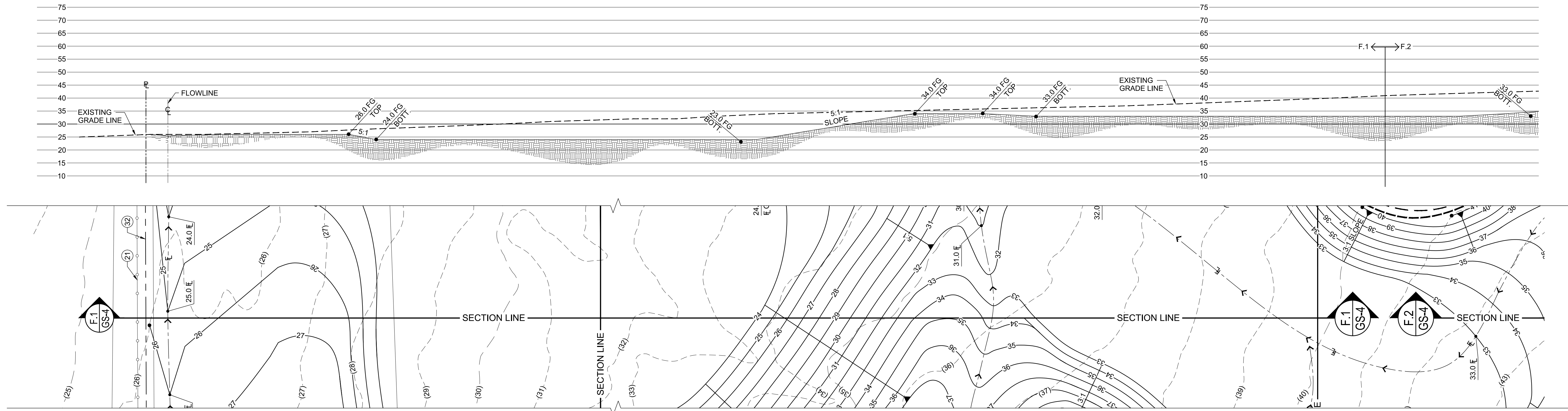
- GRAD-2021-00235
- PRAA-2021-00040
- DRNSTY-2021-00054
- SIP-2021-00031
- NEWNR-2021-00230
- WQMP-2021-00153

DRAWN BY: TER	DATE: 05/09/2023
DESIGNED BY: TER	DATE:
APPROVED BY:	DATE:

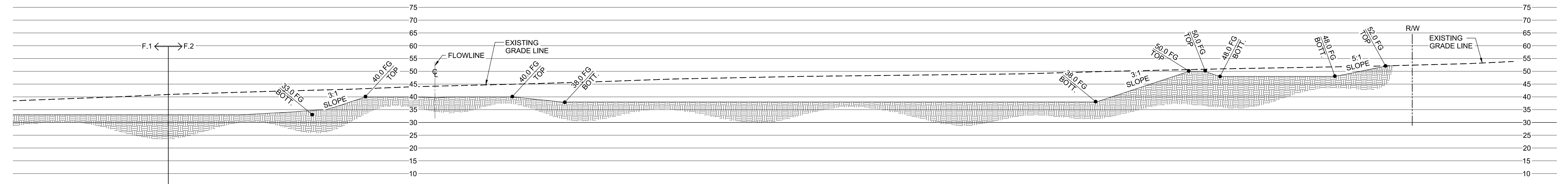
PHELAN PINON HILLS
COMMUNITY SERVICES DISTRICT
CIVIC CENTER DEVELOPMENT
PHASE 1
9535 SHEEPCREEK RD, PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)

SECTIONS

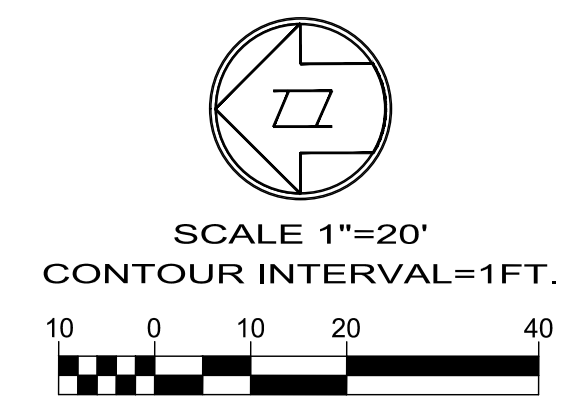
SCALE: AS SHOWN
SHEET 12 OF 25
SHEET GS-3



SECTION 'F.1'



SECTION 'F.2'



DIGALERT
CALL BEFORE YOU DIG
1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

BENCHMARK:
U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE, 6.3 FT NORTH OF A SECTION MARKER PIPE, 0.6 FT EAST OF A WITNESS POST, ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

NO.	REVISION	DATE	BY

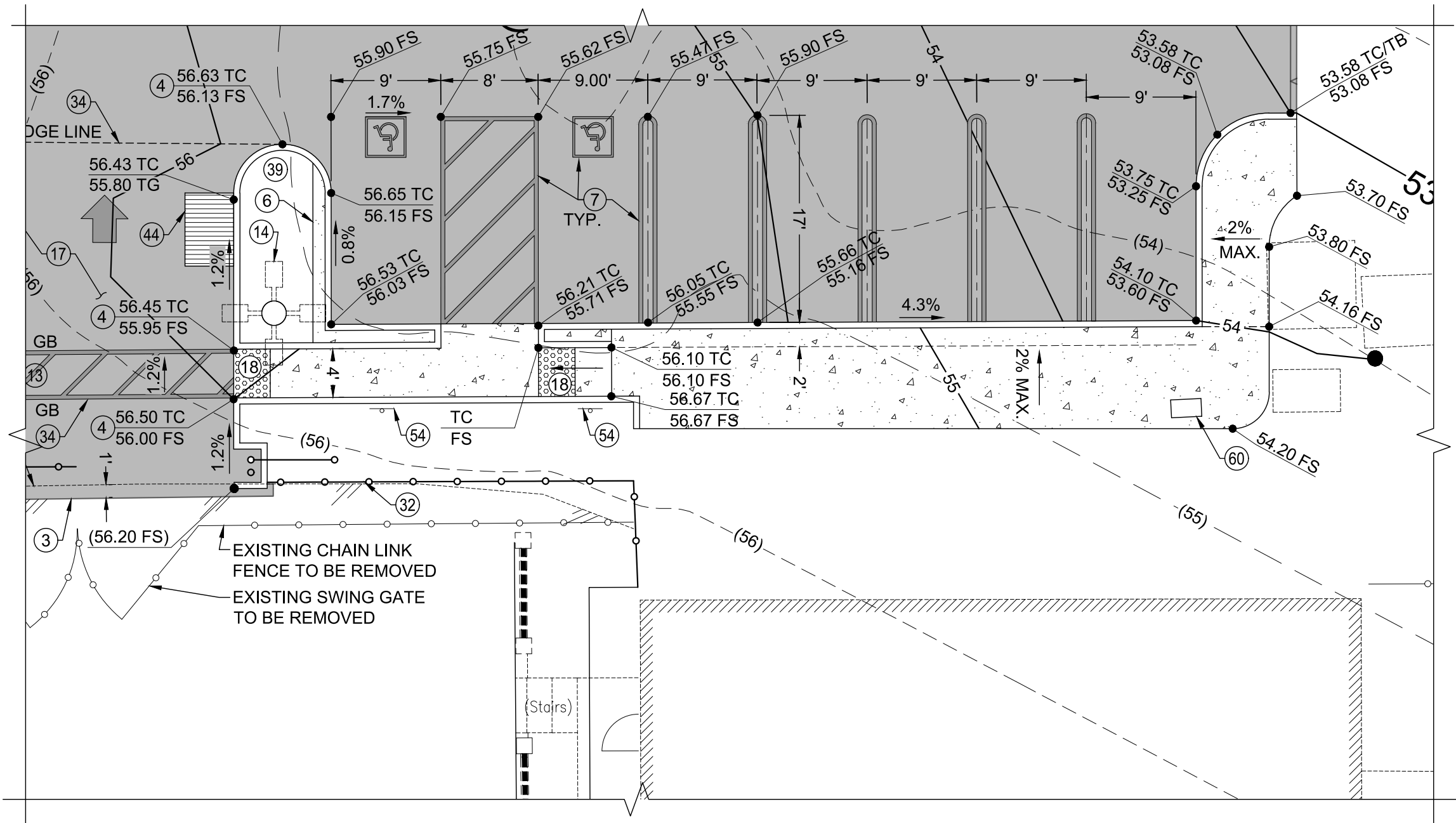
Jerry L. Miles
No. C 42593
Civil
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA
JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:
TRLS ENGINEERING Inc.
10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900

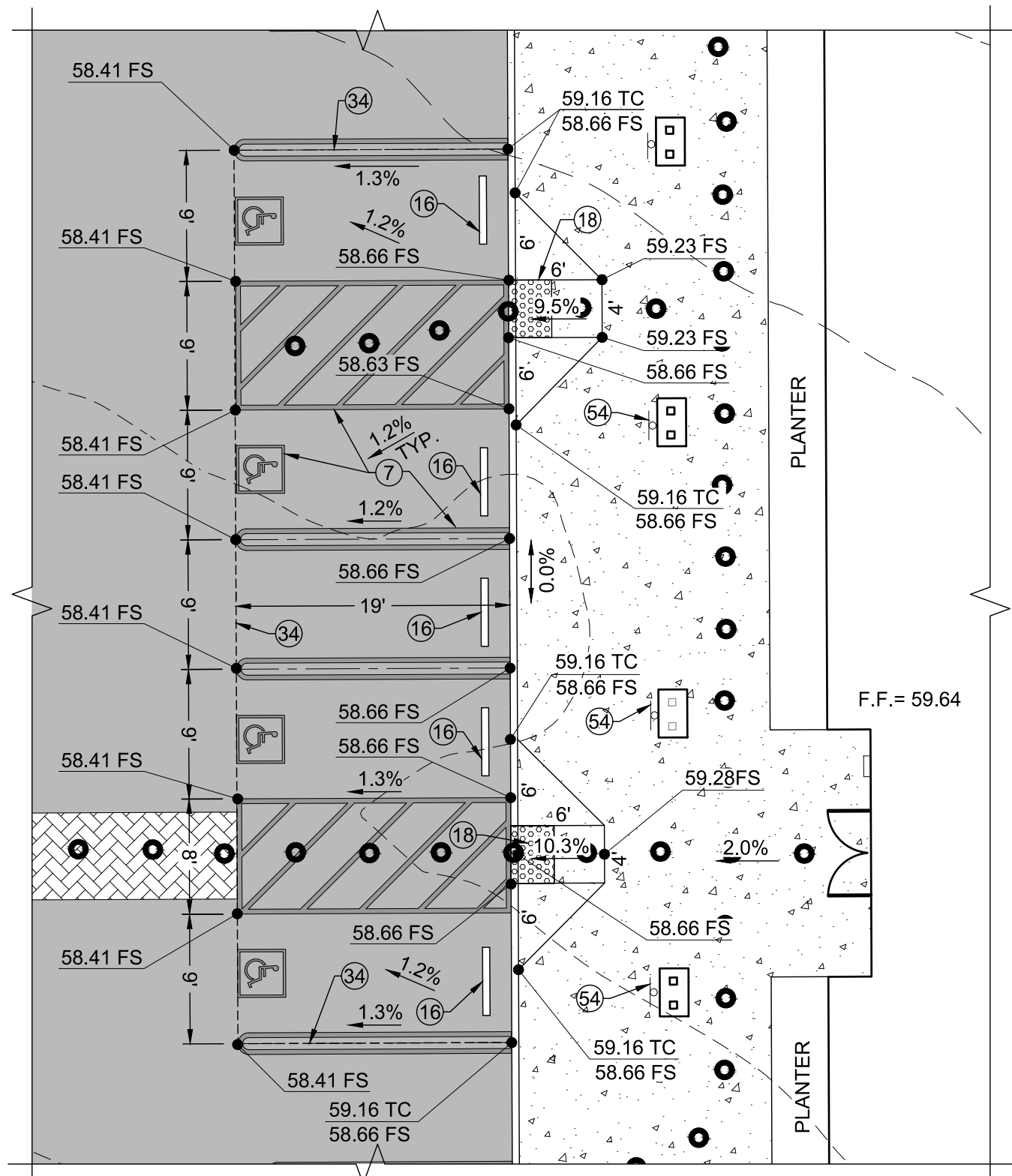
COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:		ASST. DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER		DIRECTOR OF PUBLIC WORKS	
DATE	DATE	DATE	DATE

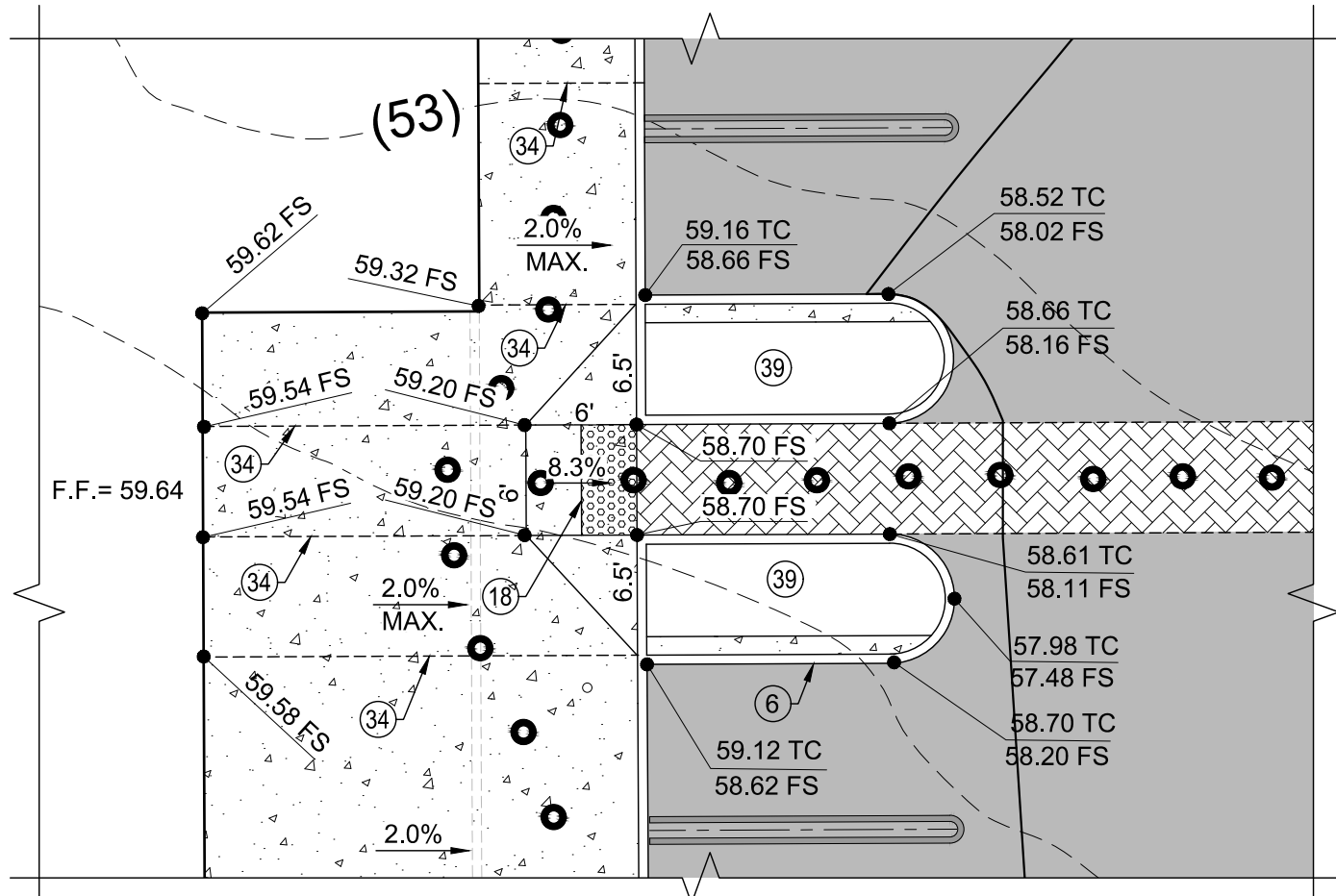
• GRAD-2021-00235 • PRAA-2021-00040 • DRNSTY-2021-00054	• SIP-2021-00031 • NEWNR-2021-00230 • WQMP-2021-00153		
DRAWN BY: TRLS DATE: 05/09/2023		PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT CIVIC CENTER DEVELOPMENT PHASE 1 9535 SHEEPCREEK RD. PHELAN, CA. 92329 (APN: 3066-261-10 & 3066-251-18)	SCALE: AS SHOWN
DESIGNED BY: TER DATE:			SHEET 13 OF 25
APPROVED BY: DATE:			SHEET GS-4



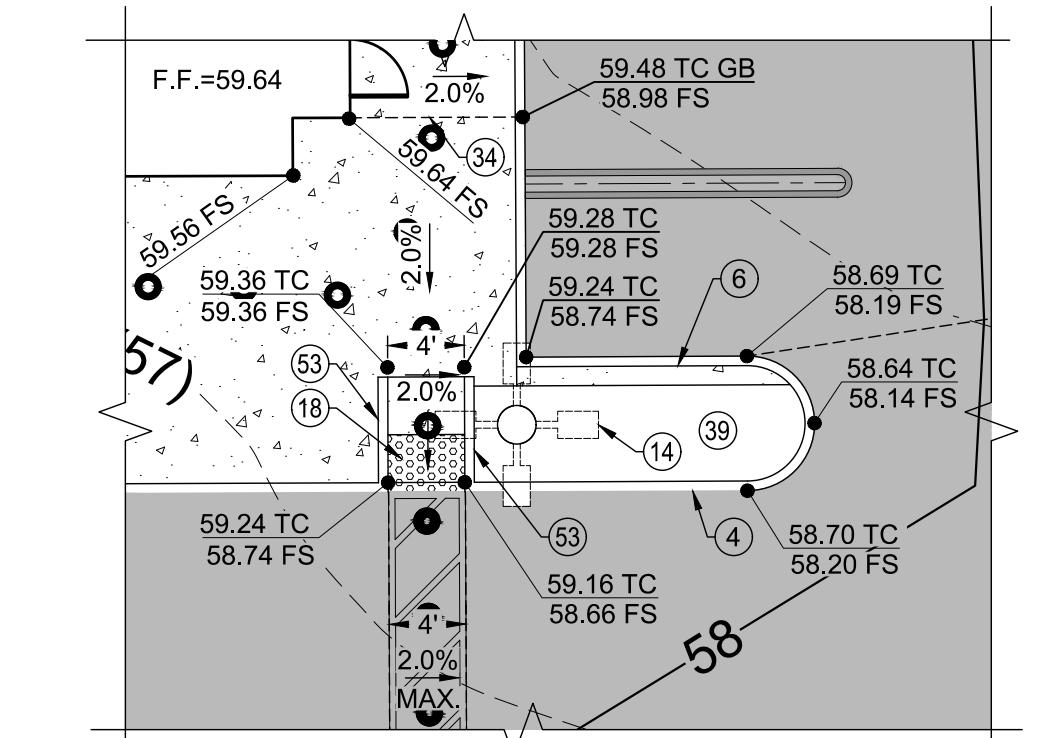
ENLARGED PLAN 'D'
SCALE: 1"=10'



ENLARGED PLAN 'A'
SCALE: 1"=10'



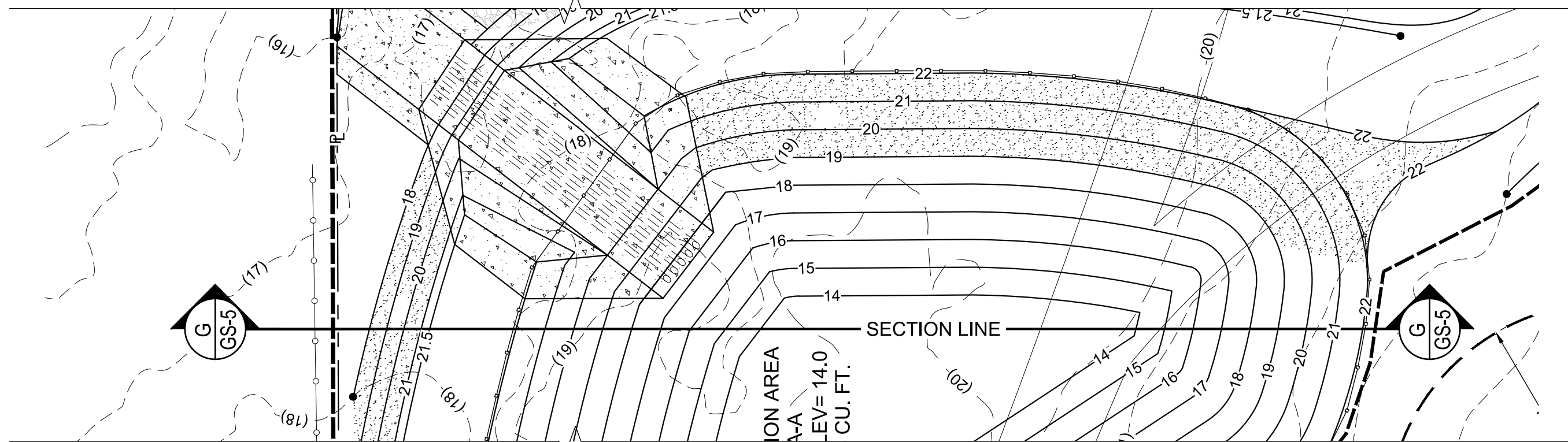
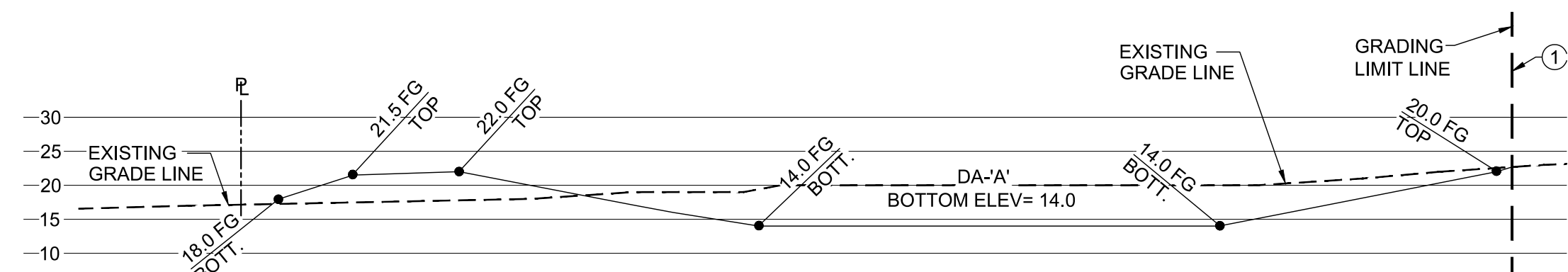
ENLARGED PLAN 'B'
SCALE: 1"=10'



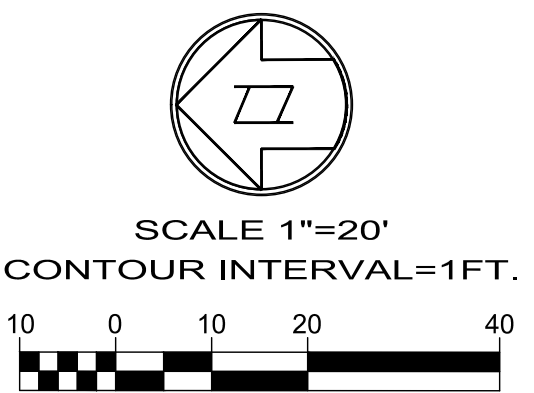
ENLARGED PLAN 'C'
SCALE: 1"=10'

CONSTRUCTION NOTES

- PHASE 1 GRADING LIMITS.
- CONSTRUCT A1-6 HIGH CONCRETE CURB PER SPPWC STD. 120-2.
- CONSTRUCT 12" WIDE CONCRETE WALK AT BACK OF CURB PER DETAIL "A" SHOWN ON SHEET G-3.
- INSTALL PAINT STRIPING AND SYMBOLS PER ARCHITECTURAL PLAN.
- INSTALL PARKING AREA LIGHT STANDARD PER ARCHITECTURAL PLAN.
- INSTALL 4' LONG CONCRETE WHEEL STOP. REFER TO ARCHITECTURAL PLAN.
- INSTALL TRUNCATED DOME PER ARCHITECTURAL PLAN.
- ADA PATH OF TRAVEL SHOWN THUSLY.
- INSTALL 6' HIGH CHAINLINK FENCE TO LIMITS SHOWN.
- GRADE BREAK LINE.
- PLANTER AREA. REFER TO ARCHITECTURAL PLANS FOR LANDSCAPE INFO.
- INSTALL ADA PARKING SIGN PER ARCHITECTURAL PLAN.
- NEW CONCRETE BOX.



SECTION 'G'



1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

NO.	REVISION	DATE	BY

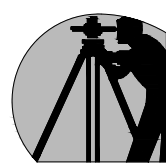


JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:

TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900



COUNTY OF SAN BERNARDINO DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:	ASST. DIRECTOR OF PUBLIC WORKS	DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER	DATE	DATE	DATE

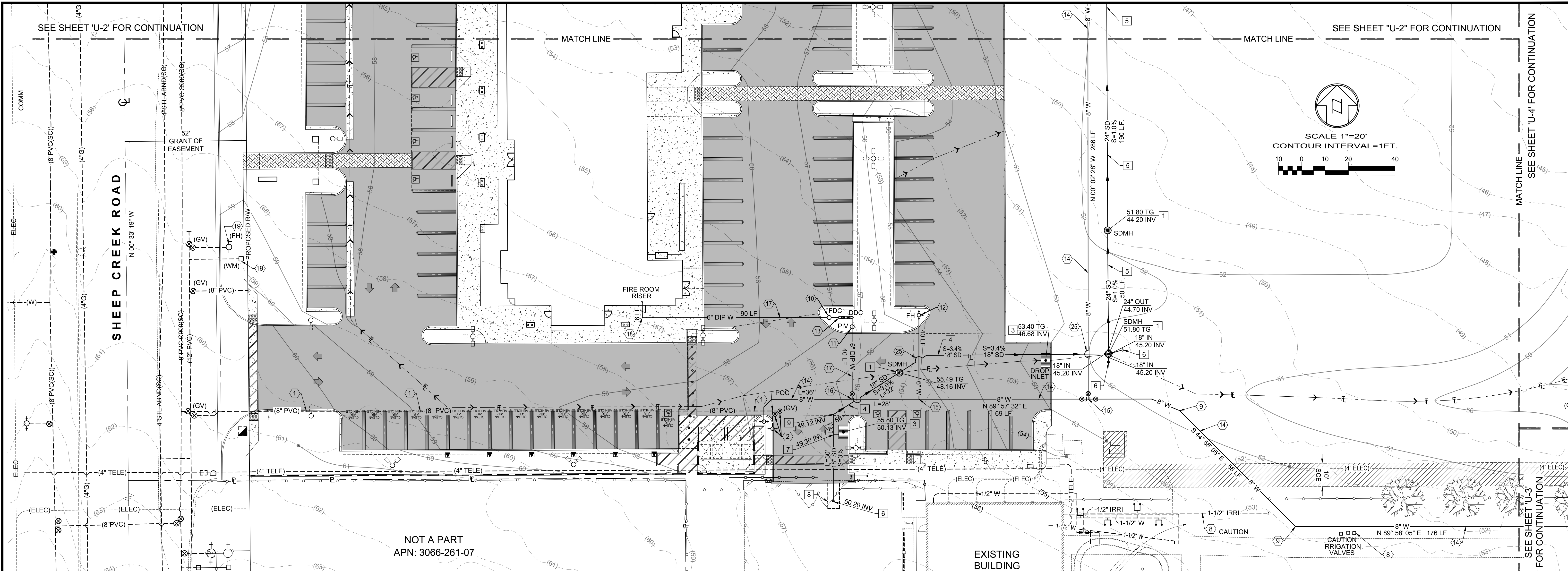
- GRAD-2021-00235
- PRAA-2021-00040
- DRNSTY-2021-00054

- SIP-2021-00031
- NEWNR-2021-00230
- WQMP-2021-00153

DRAWN BY:
TER
DATE:
05/09/2023

PHELAN PINON HILLS
COMMUNITY SERVICES DISTRICT
CIVIC CENTER DEVELOPMENT
PHASE 1
9535 SHEEPCREEK RD. PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)
ENLARGED GRADING PLANS/
SECTIONS

SCALE:
AS SHOWN
SHEET
14 OF 25
SHEET
GS-5



PPHCSD GENERAL NOTES:

- ALL WORK SHALL BE DONE IN ACCORDANCE WITH THESE PLANS AND TO THE LATEST PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT (PPHCSD OR DISTRICT) STANDARDS AND TECHNICAL SPECIFICATIONS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN A CURRENT AND APPROVED SET OF DISTRICT'S TECHNICAL SPECIFICATIONS ON THE JOB SITE AT ALL TIMES. STANDARD SPECIFICATIONS CAN BE OBTAINED ONLINE AT WWW.PPHCSD.ORG.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAKING ARRANGEMENTS FOR CONSTRUCTION INSPECTION AT LEAST 48 HOURS PRIOR TO BEGINNING OF WORK.
- IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO FAMILIARIZE HIMSELF WITH THE JOB SITE AND THE LOCATION OF ALL UNDERGROUND FACILITIES SHOWN OR NOT SHOWN ON THESE PLANS AND TO COMPARE ACTUAL CONDITIONS WITH THE DRAWINGS TO ASCERTAIN THE CONDITIONS UNDER WHICH THE WORK IS TO BE PERFORMED. THE CONTRACTOR SHALL REPORT ALL DISCREPANCIES TO THE ENGINEER PRIOR TO COMMENCEMENT OF THE WORK. COMMENCEMENT OF THE WORK SHALL CONSTITUTE FULL ACCEPTANCE OF THE EXISTING SITE CONDITIONS, AND THE CONTRACTOR WILL BE UNILATERALLY RESPONSIBLE FOR ANY DAMAGE DONE TO EXISTING UTILITIES OR OTHER STRUCTURES THAT ARE SHOWN OR NOT SHOWN ON THESE PLANS.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY, AND ALL DAMAGES TO PIPE INCURRED DURING BACK FILLING AND COMPACTION OPERATIONS.
- THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS.
- THRUST BLOCKS SHALL BE INSTALLED PER PPHCSD STANDARD DRAWING NO. W-7.
- PRIOR TO CONSTRUCTION THE CONTRACTOR SHALL CONTACT ALL UTILITY AGENCIES TO DETERMINE THE EXACT LOCATION OF ALL UTILITIES WHETHER SHOWN, OR NOT SHOWN. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROTECT ALL EXISTING FACILITIES FROM DAMAGE DURING CONSTRUCTION.
- CALL UNDERGROUND SERVICE ALERT TWO WORKING DAYS PRIOR ANY TRENCHING ETC., AT 811 OR WWW.CONTACT811.ORG. THE FOLLOWING AGENCIES SHALL BE CONTACTED PRIOR TO ANY CONSTRUCTION OR EXCAVATION BEGINS:

PHELAN PINON HILLS CSD
FRONTIER COMMUNICATIONS
SO CAL GAS COMPANY
SOUTHERN CALIFORNIA EDISON CO.
RACE COMMUNICATIONS
SPECTRUM (CHARTER)
STATE OF CA DEPT. WATER RESOURCES
LA DEPT. WATER AND POWER
COUNTY OF SAN BERNARDINO
CALTRANS DISTRICT
DIG ALERT

760-868-1212
661-948-4803
800-427-2200
909-684-8123
977-722-3833
NO DIRECT NUMBER-CALL 811
661-944-8574 / 8563
213-367-0583
909-387-8130
909-888-7153
811 OR WWW.CONTACT811.ORG

- WATER PIPELINE SHALL BE PVC C900, CLASS 200 AND INSTALLED WITH LOCATION TAPE 18" BELOW FINISHED GRADE AND 14 GA. INSULATED WIRE TAPED TO PIPE AND BROUGHT TO SURFACE AT VALVE BOX AND HYDRANTS. ALL SPLICES TO BE MADE WITH 3M CONNECTORS.
- ALL NEW FIRE HYDRANTS INSTALLED ARE TO BE COVERED AT TIME OF INSTALLATION, UNTIL THE WATER LINE IS ACTIVE.
- ANY RELOCATION OF EXISTING TYPE "A" (TWO 2-1/2" OUTLETS) AND/OR 4-1/2" BARREL SIZE HYDRANTS MUST BE REPLACED 12. TYPE "B" (TWO 2-1/2", ONE 4" OUTLETS) 5-1/4" HYDRANT.
- ANY HYDRANTS TO BE RELOCATED REQUIRE A NEW CONNECTION FROM HYDRANT VALVE AT THE WATER MAIN TO RELOCATED HYDRANT PER PPHCSD STANDARD DRAWING NO. W-3. EXISTING AC HYDRANT LATERAL SHALL BE REMOVED AND PROPERLY DISPOSED OF BY THE CONTRACTOR.
- ALL FIRE HYDRANTS REMOVED SHALL BE SALVAGED AND RETURNED TO THE DISTRICT'S YARD AT 12336 OASIS ROAD, PINON HILLS.
- THE CONTRACTOR SHALL COORDINATE ALL TIE-INS OF NEW WATER MAINS WITH WATER OPERATIONS MANAGER 760-868-1212, EXT. 314, TO KEEP INTERRUPTIONS TO A MINIMUM. NO INTERRUPTIONS TO EXISTING SERVICES SHALL BE MADE UNLESS THE DISTRICT GRANTS PRIOR APPROVAL.
- THE CONTRACTOR SHALL INSURE THAT UTILITY EASEMENTS, IF REQUIRED, HAVE BEEN RECORDED PRIOR TO START OF WORK.
- WATER MAIN SHALL HAVE A MINIMUM OF 48" OF COVER FROM TOP OF PIPE TO FINISH GRADE. TRANSMISSION PIPELINE SHALL HAVE A MINIMUM OF 60" COVER FROM TOP OF PIPE TO FINISH GRADE.
- ALL STATIONING IS BASED ON THE CENTERLINE OF THE STREET, UNLESS OTHERWISE NOTED.
- ALL SERVICE CHANGES TO BE THE RESPONSIBILITY OF THE CONTRACTOR. EXISTING SERVICE LINES TO BE REMOVED AT THE TIME OF NEW CONNECTION FROM METER TO MAIN.
- HYDRO TEST AT 200 PSI MINIMUM FOR A (2) HOUR DURATION AT THE LOWEST POINT IN THE NEW WATER LINE. SCHEDULE WITH DISTRICT 48-HOURS PRIOR TO TESTING.
- SERVICE LINES ARE TO BE INSTALLED PER STANDARD DRAWING NO.'S W-2A, W-2B, W-2C, AND W-2D.
- WATER METERS TO BE RELOCATED REQUIRE NEW SERVICE LINE FROM CORPORATION STOP TO RELOCATED WATER METER. NO COUPLINGS ARE ALLOWED. REFER TO PPHCSD STANDARD DRAWING NO.'S W-2A, W-2B, W-2C, AND W-2D.
- ALL VALVES INSTALLED BY THE CONTRACTOR SHALL BE ACCESSIBLE FOR OPERATION WITH COMPLETE VALVE CAN ASSEMBLY TO GRADE DIRECTLY FOLLOWING CONNECTION TO EXISTING WATER SYSTEM. SEE STANDARD DRAWING NO.'S W-5 AND W-6.
- THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY FIELD CHANGES MADE WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE UNDERSIGNED ENGINEER AND PHELAN PINON HILLS CSD.
- THE CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUALLY AND NOT BE LIMITED TO NORMAL WORKING HOURS; AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE DISTRICT AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE DISTRICT OR THE ENGINEER.
- ALL EXCAVATIONS SHALL BE BACKFILLED AT THE END OF EACH WORKING DAY AND ROADS OPEN TO VEHICULAR

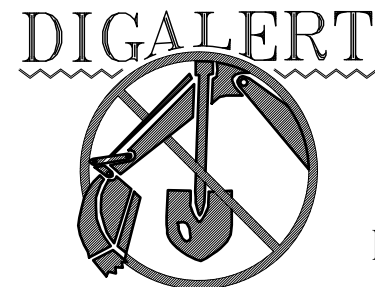
- TRAFFIC UNLESS OTHERWISE APPROVED BY PHELAN PINON HILLS CSD.
- THE CONTRACTOR SHALL OBTAIN AN EXCAVATION PERMIT OR "LETTER OF NON-OBJECTION" FROM THE COUNTY OF TRANSPORTATION DEPARTMENT, PERMIT SECTION, PRIOR TO ANY GRADING OR PIPELINE EXCAVATION WITHIN COUNTY RIGHT-OF-WAY.
- ALL PIPE DISTANCE SHOWN ARE HORIZONTAL.
- ALL WORK SHALL BE CONSTRUCTED IN ACCORDANCE TO THE VERTICAL AND HORIZONTAL MEASUREMENTS OF THESE PLANS AND EXISTING DESIGN STANDARDS. ADEQUATE STAKES SHALL BE SET UNDER THE DIRECTION OF A LICENSED SURVEYOR / ENGINEER FOR THE CONTRACTOR. ALL CONSTRUCTION SURVEYING SHALL BE PERFORMED IN ACCORDANCE WITH THE SURVEYING PROCEDURE OF THE SURVEYOR/ENGINEER OF RECORD. IF THIRD PARTY SUBCONTRACTORS PERFORM THE CONSTRUCTION LAYOUT AND SURVEYING FOR THIS PROJECT WITHOUT THE COORDINATION OF THE SURVEYOR / ENGINEER OF RECORD, THEY SHALL HAVE ASSUMED THE POSITION OF SURVEYOR / ENGINEER OF RECORD. THE FINAL CHECK OF THIS DESIGN IS TO BE THE CONSTRUCTION STAKING AS THE DESIGN MEETS THE EXISTING CONTROL AND ELEVATIONS. ALL EXISTING STREET CROSS SECTIONS SHALL BE VERIFIED FOR MINIMUM CROSS FALL AT TIME OF STAKING. ANY DISCREPANCIES TO THE STANDARD DESIGN CRITERIA SHALL BE BROUGHT TO THE ATTENTION OF THE SURVEYOR / ENGINEER OF RECORD PRIOR TO PROCEEDING WITH CONSTRUCTION. IF CONSTRUCTION CONTINUES WITHOUT VERIFICATION THE CONTRACTOR ASSUMES RESPONSIBILITY OF THE CORRECTNESS OF THE INTENDED DESIGN.
- THE CONTRACTOR IS RESPONSIBLE FOR PROTECTING ALL SURVEY MONUMENTS. ANY SURVEY MONUMENTS DISTURBED DURING THE COURSE OF CONSTRUCTION SHALL BE REPLACED BY A LICENSED SURVEYOR AND AT THE CONTRACTOR'S EXPENSE.
- THE METHOD AND LOCATION OF CONNECTION TO THE PUBLIC WATER SUPPLY AND REQUIREMENTS FOR BACKFLOW PROTECTION SHALL BE PROVIDED IN ACCORDANCE WITH DISTRICT REQUIREMENTS.
- ALL TRAFFIC CONTROL SHALL BE PER M.U.T.C.D. "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES".
- THE CONTRACTOR SHALL COORDINATE WITH OTHER UTILITIES, TRADES, AND ARCHITECTURAL PLANS TO AVOID CONFLICTS AND VERIFY BUILDING TIE-IN LOCATION.
- THE ENGINEER OF RECORD SIGNING THESE PLANS IS RESPONSIBLE FOR THE ACCURACY AND ACCEPTABILITY OF THE WORK. THE ENGINEER OF RECORD IS REQUIRED TO STAMP AND SIGN THE "DECLARATION OF ENGINEER OF RECORD" HEREON.
- THE CONTRACTOR IS NOTIFIED THAT NATIVE SOIL WITHIN THE TRENCHING AND BORING AREA MAY CONTAIN SIGNIFICANT AMOUNT OF ROCK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL, BREAKING, AND DISPOSAL OF ANY ROCKS ENCOUNTERED THAT INTERFERE WITH THE PROPOSED WORK.
- TRENCH COMPACTION TESTING TO BE PER SECTION 1.11.08 OF THE TECHNICAL SPECIFICATIONS. ALL RELATED COSTS ARE THE RESPONSIBILITY OF THE PROJECT OWNER.

UTILITY NOTES- STORM DRAIN

- INSTALL 5' DIA CONCRETE MANHOLE WITH 36" TRAFFIC RATED GRATE WITH FLOGARD 36" INSERT FILTER OR APPROVED EQUAL. SEE SHEET UD-1.
- INSTALL OLDCASTLE MODEL 660 INLET 3'-6" X 5' X 6" WITH FLOGARD INSERT FILTER MODEL FF-24DGO OR APPROVED EQUAL. SEE SHEET UD-2.
- INSTALL ADS 18" N-12 ST IB PIPE PER ASTM F2648 TO THE LIMITS SHOWN.
- BEGIN OF 18" STORM DRAIN. INSTALL 18" END CAP.
- INSTALL 18" TEE.
- SAWCUT 5' WIDE X 12' LONG TRENCH TO DEPTHS SHOWN THEN REPLACE ASPHALT OF 4" AC OVER 5" AG.
- INSTALL 45° BEND.

UTILITY NOTES- WATER

- EXISTING 8" WATER MAIN TO BE PROTECTED IN PLACE.
- EXISTING FIRE HYDRANT TO BE REMOVED AND RELOCATED INTO THE ADJACENT PLANTER. REFER TO PPHCSD STD W-3 ON SHEET UD-2. EXISTING TEE AND VALVES TO BE REMOVED AND REVISED. EXISTING END CAP AND THRUST BLOCK TO BE REMOVED.
- INSTALL 6" PVC C900 CLASS 200 WATER PIPELINE TO LIMITS SHOWN.
- CONTRACTOR TO POTHOLE EXISTING IRRIGATION LINES PRIOR TO CONSTRUCTION.
- INSTALL 45° BEND.
- INSTALL SINGLE FIRE DEPARTMENT CONNECTION (FDC) PER SAN BERNARDINO COUNTY FIRE DEPARTMENT STD. F-4 SHEET U-2.
- INSTALL POST INDICATOR VALVE PER SBDO FIRE DEPT. F-4 SHEET U-2.
- INSTALL FIRE HYDRANT PER PPHCSD STDS. W-3
- INSTALL 6" FIRE SERVICE REDUCED PRESSURE DETECTOR ASSEMBLY PER PPHCSD STD. W-15.
- INSTALL 8" PVC C900, CLASS 200 WATER PIPELINE PER PPHCSD STDS. WITH RESTRAINED JOINTS AND FITTINGS.
- INSTALL 8" TEE WITH 3- VALVES PER PPHCSD STDS.
- INSTALL 8" X 8" X 6" TEE WITH VALVE ON NORTH OUTLET PER PPHCSD STDS.
- INSTALL 6" DIA. C151/A21.51 PRESSURE CLASS 200 WATER PIPELINE WITH RESTRAINED JOINTS PER PPHCSD STDS. TO LIMITS SHOWN.
- INSTALL 90° FLANGED X MJ BEND.
- FIRE HYDRANT AND WATER METER TO BE RELOCATED PER STREET IMPROVEMENT PLANS BY OTHERS.
- PROPOSED UTILITY CROSSING. (WATER MAIN TO MAINTAIN A CLEARANCE OF 12" MIN. ABOVE STORM DRAIN).



1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE, 6.3 FT NORTH OF A SECTION MARKER PIPE, 0.6 FT EAST OF A WITNESS POST, ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

NO.	REVISION	DATE	BY



JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:

TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900



COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:		ASST. DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER		DIRECTOR OF PUBLIC WORKS	
DATE	DATE	DATE	DATE

- GRAD-2021-00235
- PRAA-2021-00040
- DRNSTY-2021-00054

- SIP-2021-00031
- NEWNR-2021-00230
- WQMP-2021-00153

DRAWN BY:
TRLS
DATE:
05/09/2023

PHELAN PINON HILLS
COMMUNITY SERVICES DISTRICT
CIVIC CENTER DEVELOPMENT
PHASE 1
9535 SHEEPCREEK RD. PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)

APPROVED BY:
DATE:

UTILITY PLAN

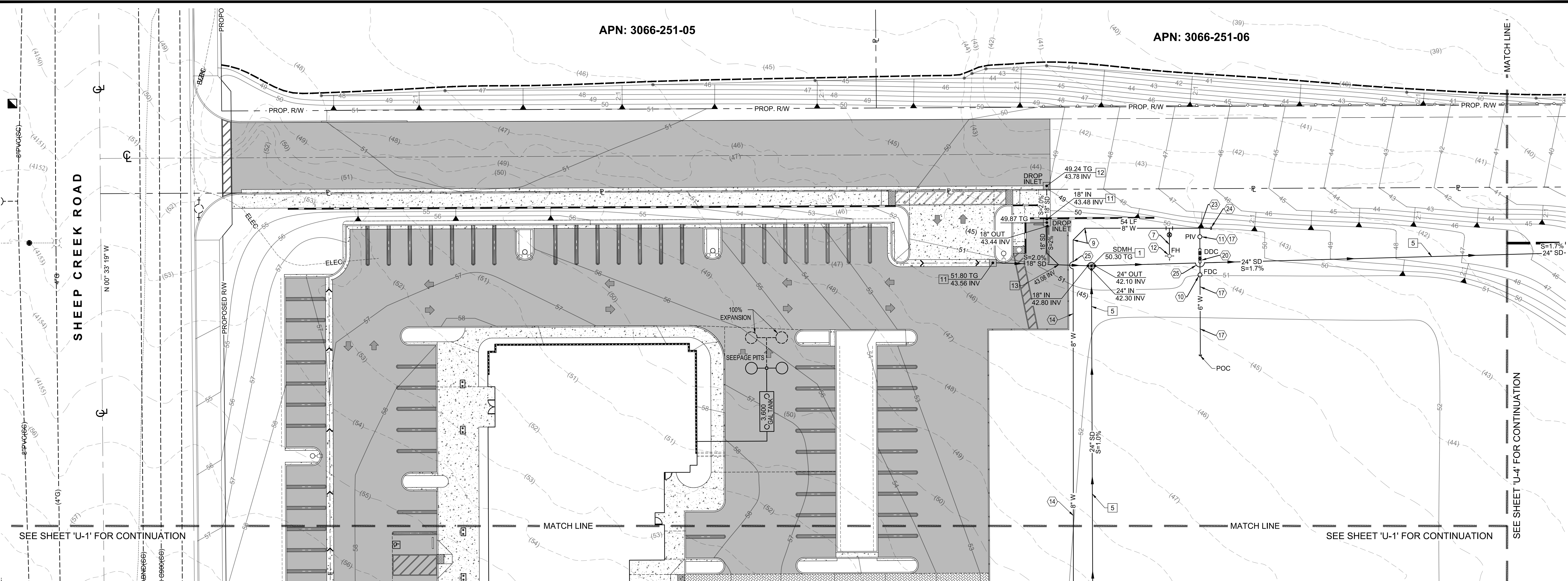
SCALE:
AS SHOWN

SHEET
15 OF 25

SHEET
U-1

APN: 3066-251-05

APN: 3066-251-06



SAN BERNARDINO COUNTY FIRE DEPARTMENT
COMMUNITY SAFETY DIVISION

620 South 'E' Street
San Bernardino, CA 92415-0179
(909) 386-8400

FIRE PREVENTION STANDARD

POST INDICATOR VALVES AND FIRE DEPARTMENT CONNECTIONS

Standard Number
F-4
Revision Date:
3-22-16



SAN BERNARDINO COUNTY FIRE DEPARTMENT
COMMUNITY SAFETY DIVISION

620 South 'E' Street
San Bernardino, CA 92415-0179
(909) 386-8400

FIRE PREVENTION STANDARD

POST INDICATOR VALVES AND FIRE DEPARTMENT CONNECTIONS

Standard Number
F-4
Revision Date:
3-22-16

EXISTING SYSTEMS

- When additions or upgrades are made to existing buildings with automatic sprinkler systems, the PIVs and FDCs shall conform to this standard when required by the fire code official.
- Existing breakaway caps on Fire Department Connections shall be replaced with threaded plugs and chains when deemed necessary by the fire code official.
- Existing Fire Department Connections that are vandalized or removed shall comply with this standard when replaced.

DIAGRAM F-4.1: PIV AND FDC PROTECTION

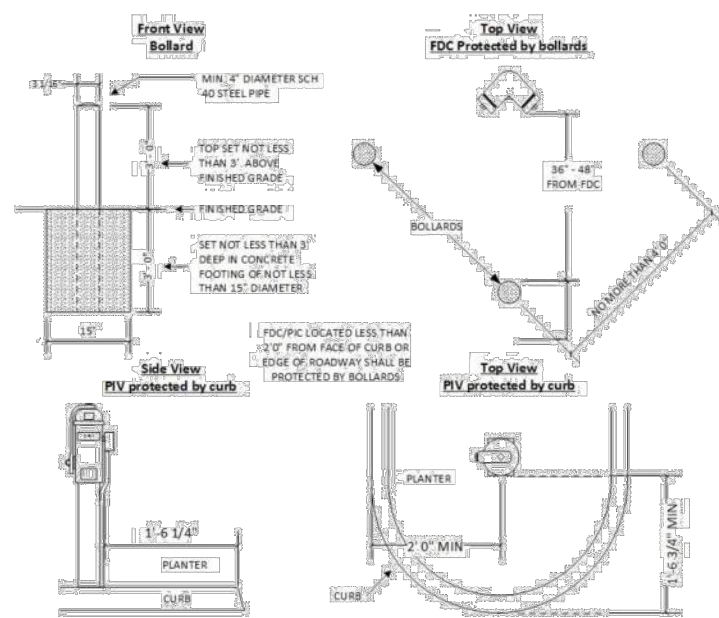
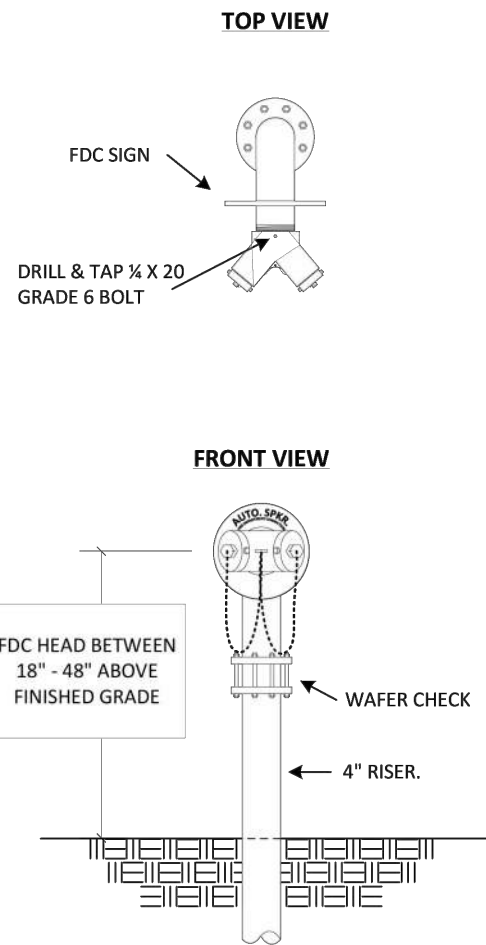


DIAGRAM F-4.2: SINGLE 4\"/>

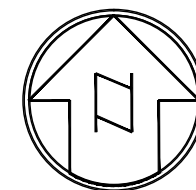


UTILITY NOTES- STORM DRAIN

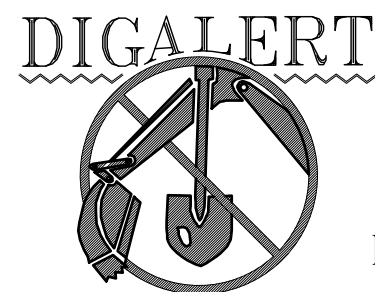
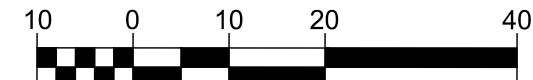
- INSTALL 5' DIA CONCRETE MANHOLE WITH 36\"/>
- INSTALL 24\"/>
- INSTALL OLDCASTLE 2'-3\"/>
- INSTALL 2' X 3' CATCH BASIN BASES AND RISER PER OLDCASTLE UT-OGD WITH FLOGARD DEBRIS BASKET AND FILTER OR APPROVED EQUAL. SEE SHEET UD-1.
- INSTALL 18\"/>

UTILITY NOTES- WATER

- INSTALL 6\"/>
- INSTALL 45\"/>
- INSTALL SINGLE FIRE DEPARTMENT CONNECTION (FDC) PER SAN BERNARDINO COUNTY FIRE DEPARTMENT STD. F-4 SHEET U-2.
- INSTALL POST INDICATOR VALVE PER SBCO FIRE DEPT. F-4 SHEET U-2.
- INSTALL FIRE HYDRANT PER PPHCSD STDS. W-3
- INSTALL 8\"/>
- INSTALL 6\"/>
- INSTALL BLOWOFF FIRE HYDRANT PER PPHCSD STD. W-4.
- POINT OF CONNECTION. REMOVE EXISTING END CAP AND THRUST BLOCK AND CONNECT TO EXISTING 8\"/>
- INSTALL 8\"/>
- INSTALL 8\"/>
- PROPOSED UTILITY CROSSING. (WATER MAIN TO MAINTAIN A CLEARANCE OF 12\"/>



SCALE 1\"/>



CALL
BEFORE
YOU DIG

1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

BENCHMARK:

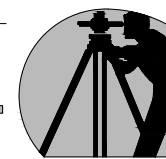
U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50



PLANS PREPARED BY:

TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900



**COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS**

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:	ASST. DIRECTOR OF PUBLIC WORKS	DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER	DATE	DATE	DATE

- GRAD-2021-00235
- PRAA-2021-00040
- DRNSTY-2021-00054

- SIP-2021-00031
- NEWNR-2021-00230
- WQMP-2021-00153

DRAWN BY:
TRLS
DATE:
05/09/2023
DESIGNED BY:
TER
DATE:
APPROVED BY:
DATE:

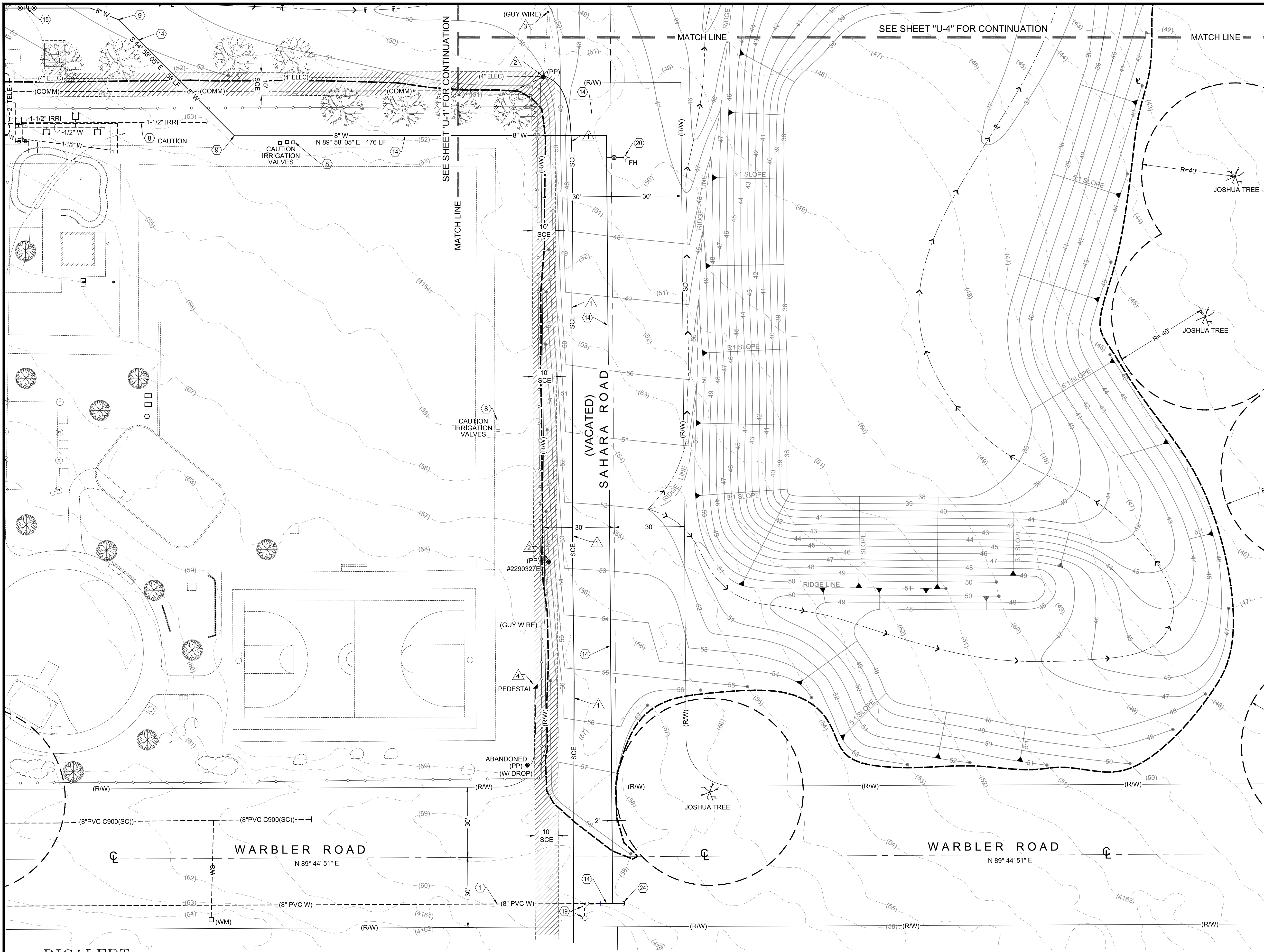
PHELAN PINON HILLS
COMMUNITY SERVICES DISTRICT
CIVIC CENTER DEVELOPMENT
PHASE 1
9535 SHEEPCREEK RD. PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)

UTILITY PLAN

SCALE:
AS SHOWN

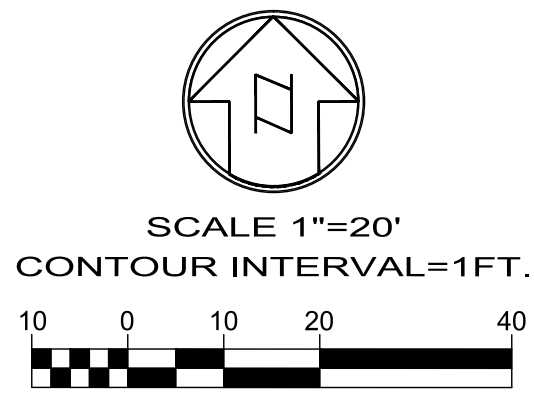
SHEET
16 OF 25

SHEET
U-2



- UTILITY NOTES- WATER**
- 1 EXISTING 8" WATER MAIN TO BE PROTECTED IN PLACE.
 - 8 CONTRACTOR TO POTHOLE EXISTING IRRIGATION LINES PRIOR TO CONSTRUCTION.
 - 9 INSTALL 45° BEND.
 - 14 INSTALL 8" PVC C900, CLASS 200 WATER PIPELINE PER PPHCSD STDs. WITH RESTRAINED JOINTS AND FITTINGS.
 - 15 INSTALL 8" TEE WITH 3- VALVES PER PPHCSD STDs.
 - 19 FIRE HYDRANT AND WATER METER TO BE RELOCATED PER STREET IMPROVEMENT PLANS BY OTHERS.
 - 20 INSTALL BLOWOFF FIRE HYDRANT PER PPHCSD STD. W-4.
 - 24 INSTALL 8" VALVE WITH 5 LF OF 8" WATER LINE WITH END CAP. END OF WATER PIPELINE CONSTRUCTION PHASE 1.

- UTILITY NOTES- ELECTRICAL**
- 1 PROPOSED UNDERGROUND SCE BY OTHERS.
 - 2 EXISTING POWER POLE TO BE REMOVED BY OTHERS.
 - 3 EXISTING GUY WIRE ANCHOR TO BE REMOVED BY OTHERS.
 - 4 EXISTING PEDESTAL TO BE REMOVED BY OTHERS.



DIGALERT
CALL BEFORE YOU DIG
1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

BENCHMARK:
U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

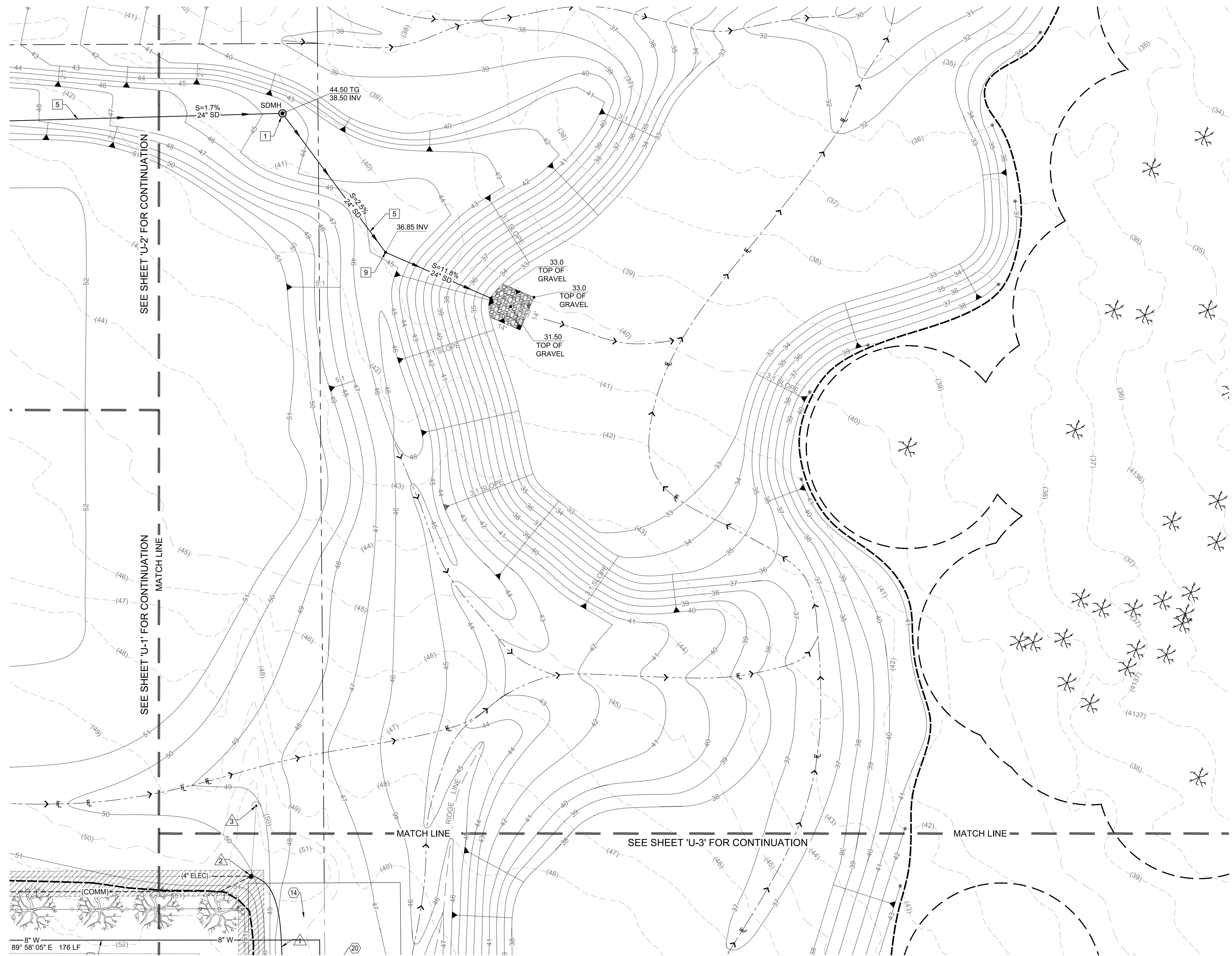
NO.	REVISION	DATE	BY

Jerry L. Miles
No. C 42593
Civil
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA
JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:
TRLS ENGINEERING Inc.
10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900

COUNTY OF SAN BERNARDINO DEPARTMENT OF PUBLIC WORKS			
DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:	ASST. DIRECTOR OF PUBLIC WORKS		
LAND DEVELOPMENT ENGINEER	DATE	DIRECTOR OF PUBLIC WORKS	DATE

• GRAD-2021-00235 • PRAA-2021-00040 • DRNSTY-2021-00054	• SIP-2021-00031 • NEWNR-2021-00230 • WQMP-2021-00153
DRAWN BY: TERLS DATE: 05/09/2023	
DESIGNED BY: TER DATE:	
APPROVED BY: DATE:	
PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT CIVIC CENTER DEVELOPMENT PHASE 1 9535 SHEEPCREEK RD. PHELAN, CA. 92329 (APN: 3066-261-10 & 3066-251-18)	
SCALE: AS SHOWN	
SHEET 17 OF 25	
SHEET U-3	



UTILITY NOTES- WATER

14 INSTALL 8" PVC C900, CLASS 200 WATER PIPELINE PER PPHCSD STDS. WITH RESTRAINED JOINTS AND FITTINGS.

UTILITY NOTES- STORM DRAIN

1 INSTALL 5' DIA CONCRETE MANHOLE WITH 36" TRAFFIC RATED GRATE WITH FLOGARD 36" INSERT FILTER OR APPROVED EQUAL. SEE SHEET UD-1.

5 INSTALL 24" ADS N-12 ST 1B PIPE PER ASTM F2648 TO THE LIMITS SHOWN.

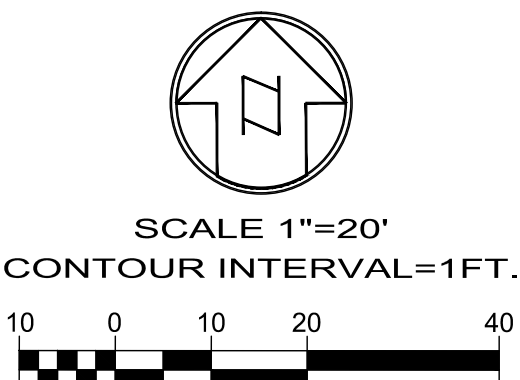
9 INSTALL 45° BEND.

UTILITY NOTES- ELECTRICAL

3 PROPOSED UNDERGROUND SCE BY OTHERS.

2 EXISTING POWER POLE TO BE REMOVED BY OTHERS.

3 EXISTING GUY WIRE ANCHOR TO BE REMOVED BY OTHERS.



DIGALERT

CALL BEFORE YOU DIG

1-800-422-4133

UNDERGROUND SERVICE ALERT

Call at least 2 working days prior to excavating

BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND. ELEV= 3616.50

NO.	REVISION	DATE	BY

Jerry L. Miles
No. C 42593
Civil
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:

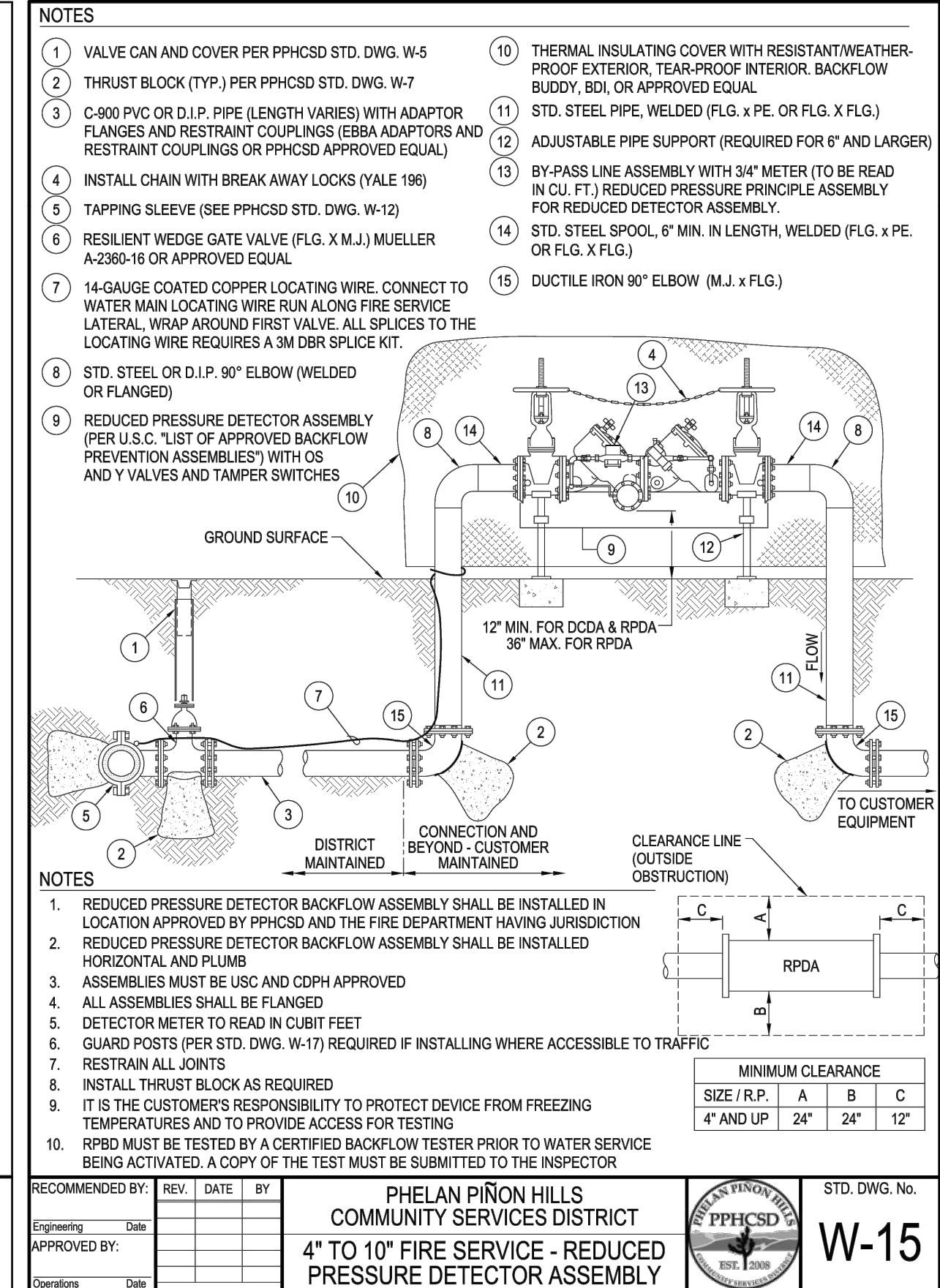
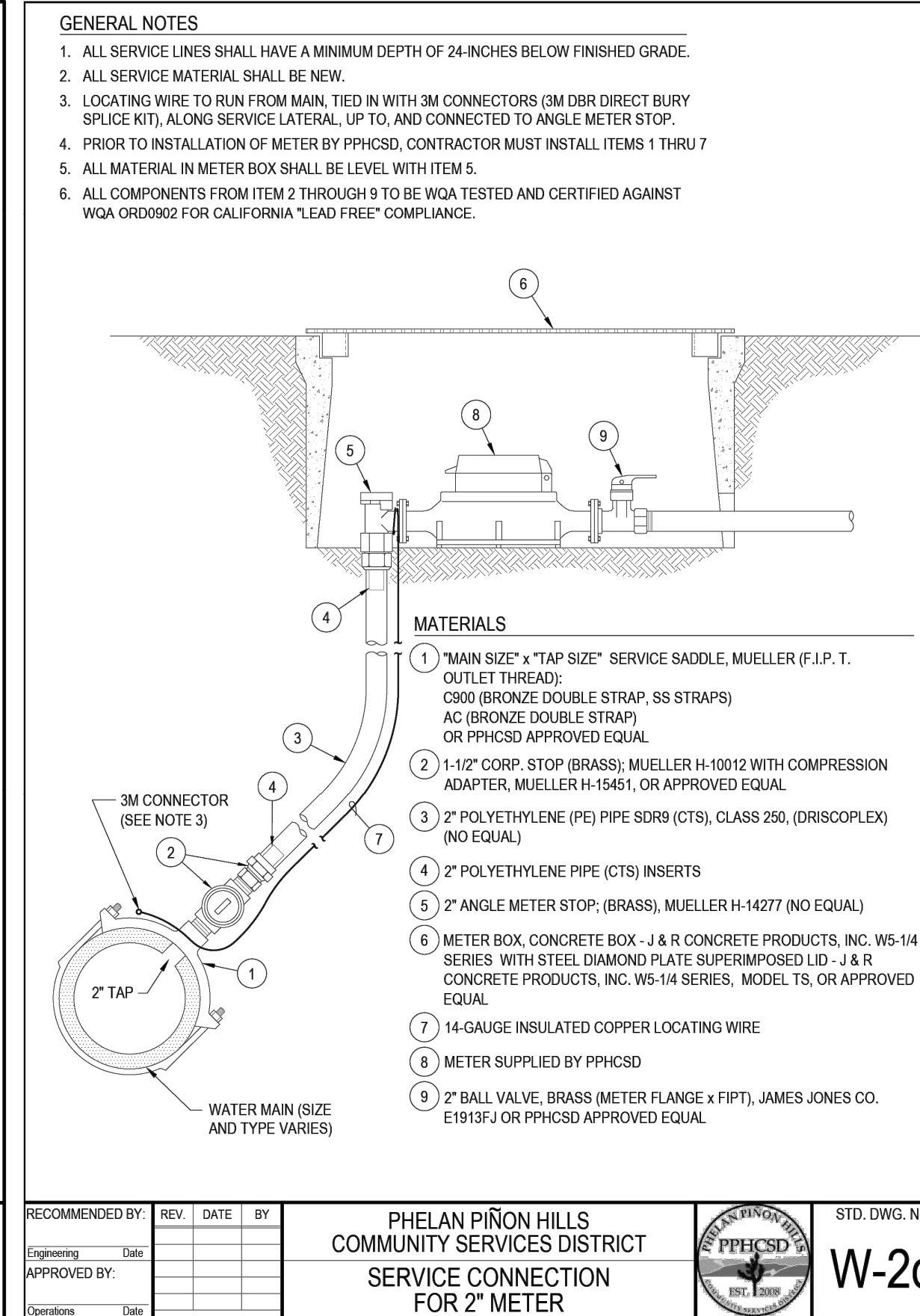
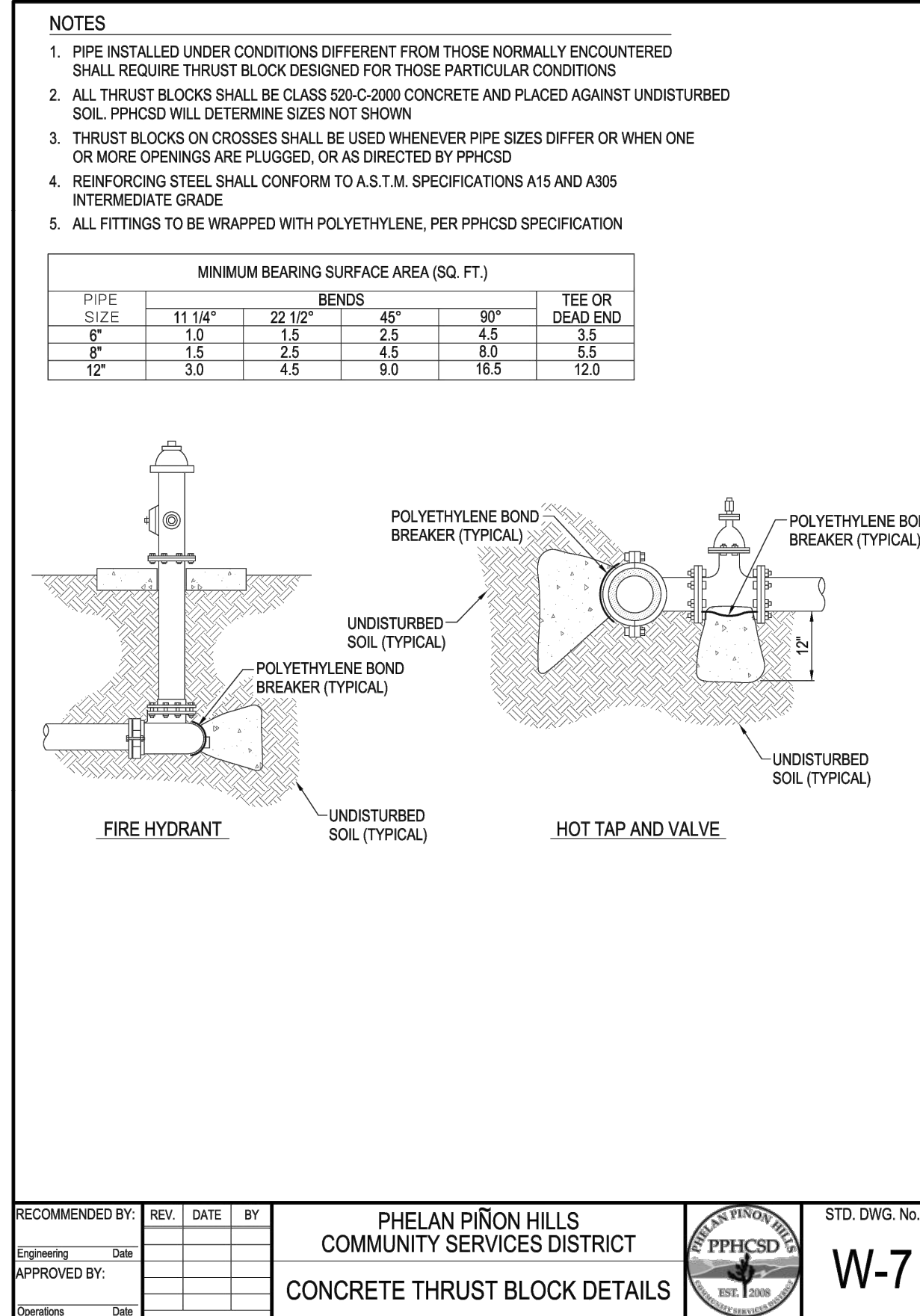
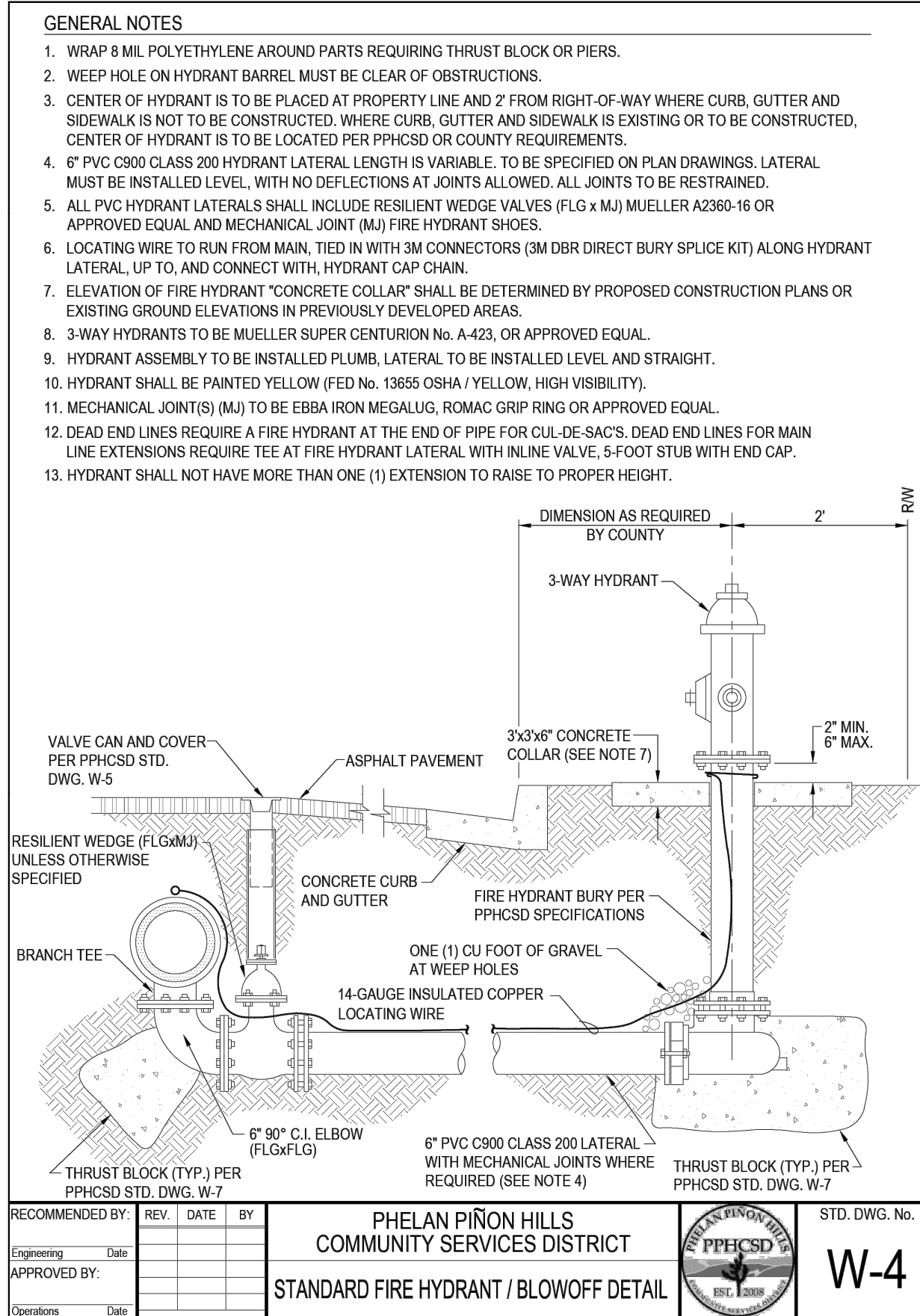
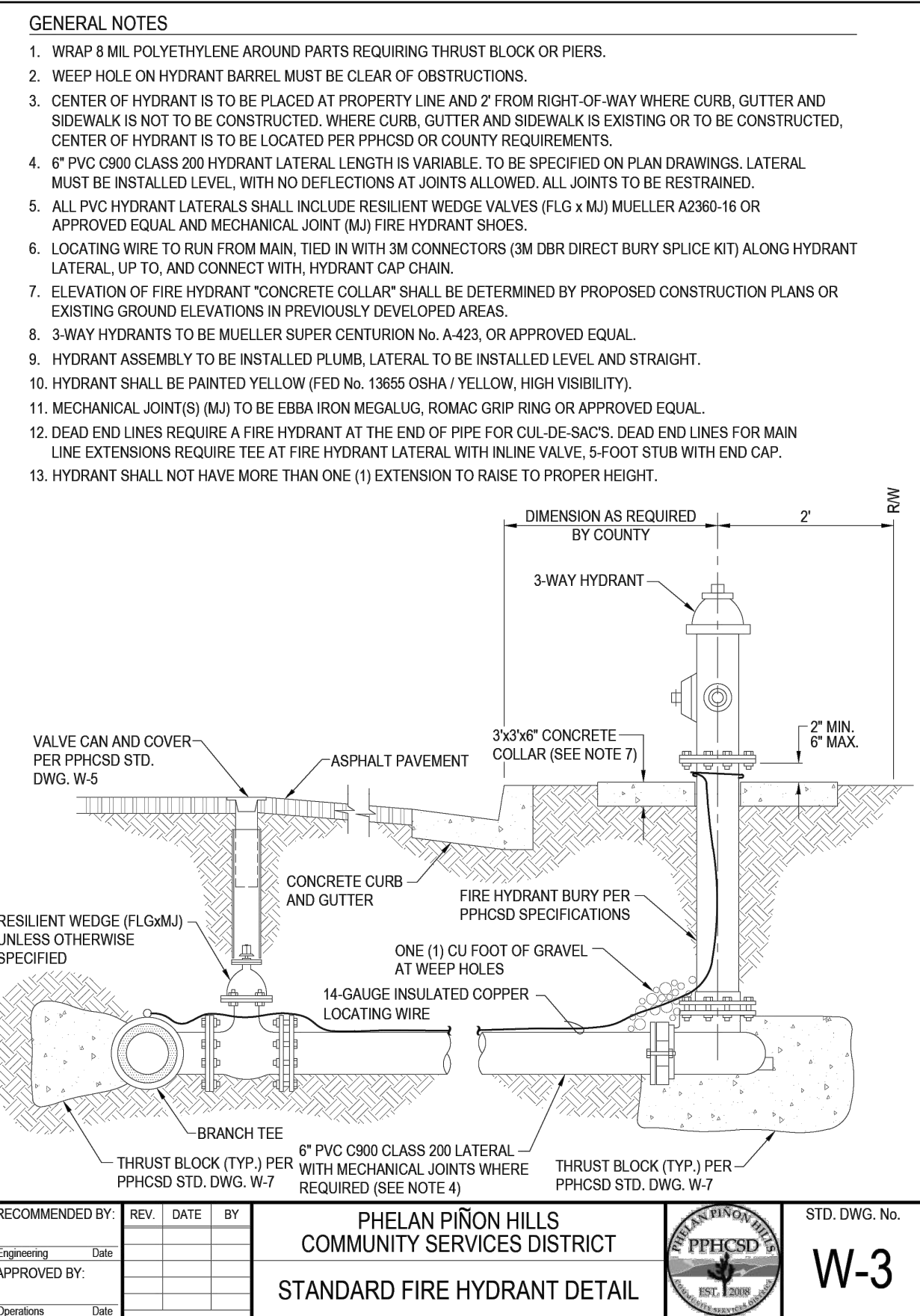
TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900

**COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS**

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:		ASST. DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER		DIRECTOR OF PUBLIC WORKS	
DATE	DATE	DATE	DATE

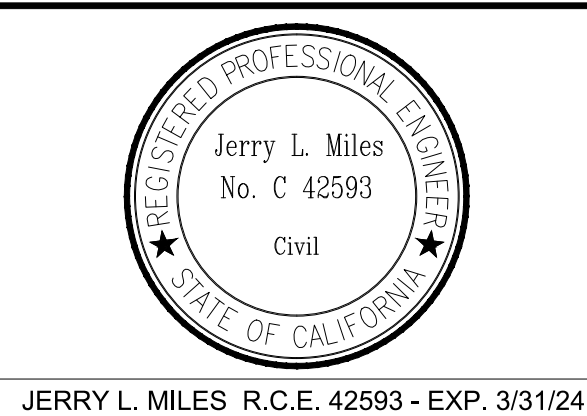
DRAWN BY: TERLS DATE: 05/09/2023	PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT CIVIC CENTER DEVELOPMENT PHASE 1 9535 SHEEPCREEK RD. PHELAN, CA. 92329 (APN: 3066-261-10 & 3066-251-18)	SCALE: AS SHOWN
DESIGNED BY: TER DATE:	UTILITY PLAN	SHEET 18 OF 25
APPROVED BY: DATE:		SHEET U-4



BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE, 6.3 FT NORTH OF A SECTION MARKER PIPE, 0.6 FT EAST OF A WITNESS POST, ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND. ELEV= 3616.50

NO.	REVISION	DATE	BY



PLANS PREPARED BY:

TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900

COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:		ASST. DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER		DIRECTOR OF PUBLIC WORKS	
DATE	DATE	DATE	DATE

• GRAD-2021-00235 • PRAA-2021-00040 • DRNSTY-2021-00054	• SIP-2021-00031 • NEWNR-2021-00230 • WQMP-2021-00153
---	---

DRAWN BY: TRLS
DATE: 05/09/2023

DESIGNED BY: TER
DATE:

APPROVED BY: DATE:

PHELAN PIÑON HILLS
COMMUNITY SERVICES DISTRICT
CIVIC CENTER DEVELOPMENT
PHASE 1
9535 SHEEPCREEK RD. PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)

UTILITY DETAILS

SCALE: AS SHOWN

SHEET 20 OF 25

SHEET UD-2

EROSION CONTROL CONSTRUCTION NOTES

- (A) INSTALL FIBER ROLLS PER CASQA DETAIL SE-5, DRAWING E2.
- (B) CONSTRUCT STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA DETAIL TC-1, DRAWING E-2.
- (C) CONSTRUCT CONCRETE WASHOUT PER CASQA DETAIL WM-8, DRAWING E-2.
- (D) INSTALL SILT FENCE PER CASQA DETAIL SE-1, DRAWING E-2.
- (E) INSTALL SANDBAG BARRIER PER CASQA DETAIL SE-8, DRAWING E-2.
- (F) CONTRACTOR TO PROVIDE DUST CONTROL ON A DAILY BASIS BY WATERING.
- (G) PROVIDE STREET SWEEPING PER CASQA DETAIL SE-7 DRAWING E-5.
- (H) CONTRACTOR TO INSTALL BONDED FIBER MATRIX TO ALL UNDEVELOPED AREAS UPON COMPLETION OF GRADING PER SECTION 21-2.02J OF THE 2022 CALTRANS STANDARD SPECIFICATIONS- SEE THIS SHEET.

CALTRANS STANDARD SPECIFICATION

21-2.02J Bonded Fiber Matrix

Bonded fiber matrix must be a hydraulically-applied material composed of fiber and tackifier and may also include seed and fertilizer as shown.

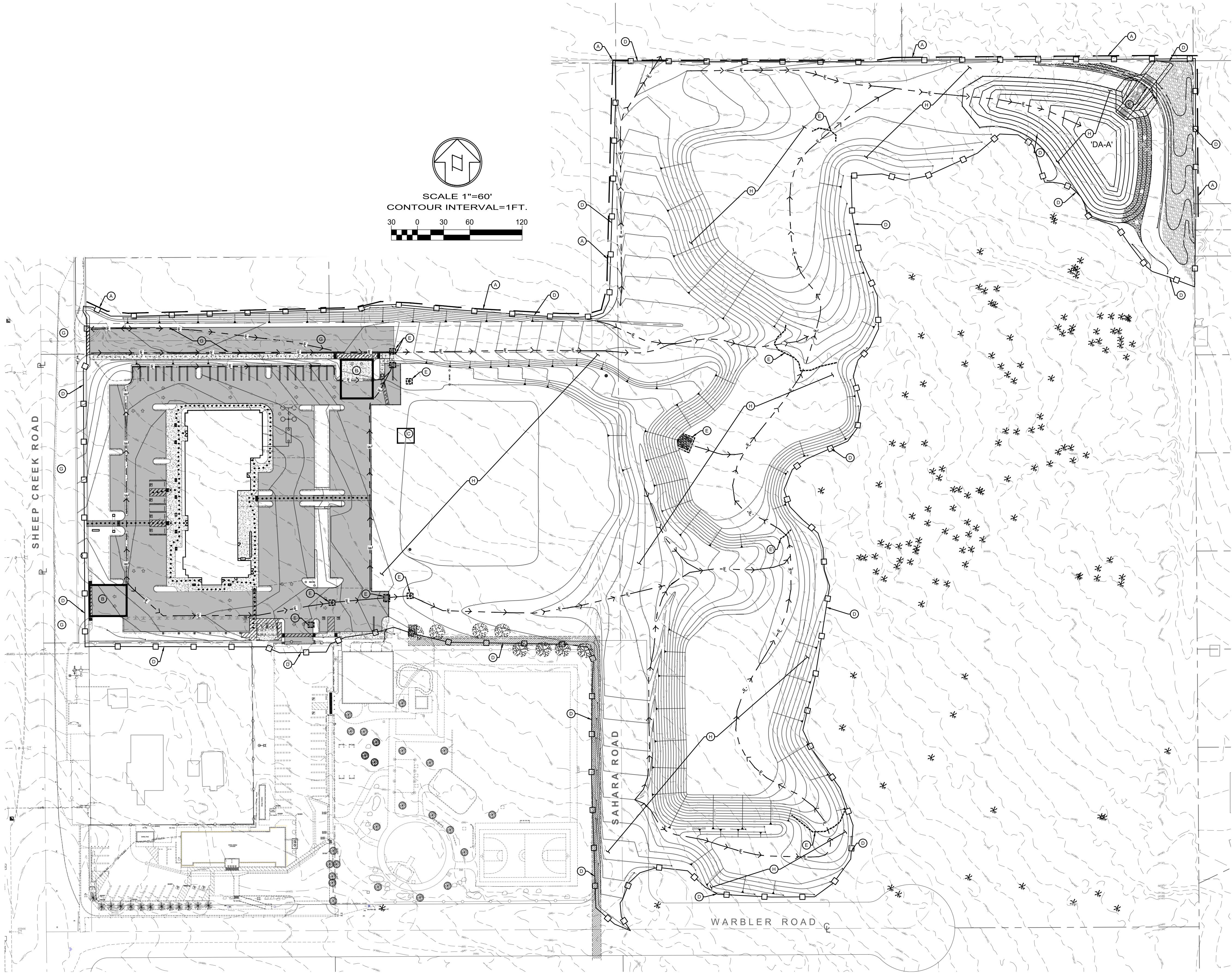
Fiber for bonded fiber matrix must be 100 percent wood fiber and comply with the specifications for fiber under section 21-2.02D, except that at least 50 percent is retained when passed through a no. 25 sieve.

Tackifier for bonded fiber matrix must:

- Be bonded to the fiber or prepackaged with the fiber by the manufacturer
- Contain a minimum of 10 percent of the combined weight of the dry fiber, activating agents, and additives
- Be an organic, high viscosity colloidal polysaccharide with activating agents or a blended hydrocolloid-based binder

COUNTY OF SAN BERNARDINO
- EROSION CONTROL NOTES

- IN CASE OF EMERGENCY, CALL PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT AT (760) 868-1212.
- POLLUTION AND EROSION PREVENTION MEASURES, ALSO KNOWN AS BEST MANAGEMENT PRACTICES (BMP'S), MUST BE INSTALLED PRIOR TO GRADING. THESE MEASURES, INCLUDING THE PREVENTION OF SEDIMENTATION OR FLOOD DAMAGE, TO OFFSITE PROPERTY SHALL BE ADEQUATE WHETHER OR NOT AN EROSION CONTROL PERMIT IS REQUIRED.
- ERODED SEDIMENTS AND OTHER POLLUTANTS MUST BE RETAINED ONSITE AND MAY NOT BE TRANSPORTED FROM THE SITE VIA SHEET FLOW, SWALES, AREA DRAINS, NATURAL DRAINAGE COURSES, OR WIND.
- EROSION CONTROL DEVICES SHALL BE FUNCTIONING AT ALL TIMES. IN CASE OF FAILURE, RAPID CONSTRUCTION OF EMERGENCY DEVICES SHALL BE IMPLEMENTED.
- STOCKPILES OF EARTH AND OTHER CONSTRUCTION-RELATED MATERIALS MUST BE PROTECTED FROM BEING TRANSPORTED FROM THE SITE BY THE FORCES OF WIND OR WATER.
- FUELS, OILS, SOLVENTS, AND OTHER TOXIC MATERIALS MUST BE STORED IN ACCORDANCE WITH THEIR LISTING AND ARE NOT TO CONTAMINATE THE SOILS AND SURFACE WATERS. ALL APPROVED STORAGE CONTAINERS ARE TO BE PROTECTED FROM THE WEATHER. SPILLS MUST BE CLEANED UP IMMEDIATELY AND DISPOSED OF IN A PROPER MANNER. SPILLS MAY NOT BE WASHED INTO THE DRAINAGE SYSTEM.
- EXCESS OR WASTE CONCRETE MUST BE CONTAINED ONSITE. PROVISIONS SHALL BE MADE TO RETAIN CONCRETE WASTES ONSITE UNTIL THEY CAN BE DISPOSED OF AS SOLID WASTE.
- DEVELOPERS/ CONTRACTORS ARE RESPONSIBLE TO ENSURE ALL EROSION CONTROL DEVICES AND BMP'S ARE INSTALLED AND FUNCTIONING PROPERLY PER PLAN. PROPER PRECAUTION SHALL BE CONSIDERED WHEN 50% OR GREATER PROBABILITY OF PREDICTED PRECIPITATION, AND AFTER ACTUAL PRECIPITATION. A CONSTRUCTION SITE INSPECTION CHECKLIST AND INSPECTION LOG SHALL BE MAINTAINED AT THE PROJECT SITE AT ALL TIMES AND AVAILABLE FOR REVIEW BY THE BUILDING OFFICIAL.
- TRASH AND CONSTRUCTION-RELATED SOLID WASTES MUST BE DEPOSITED INTO A COVERED RECEPTACLE TO PREVENT CONTAMINATION OF RAINWATER AND DISPERSAL BY WIND.
- SEDIMENTS AND OTHER MATERIALS MAY NOT BE TRACKED FROM THE SITE BY VEHICLE TRAFFIC. THE CONSTRUCTION ENTRANCE ROADWAYS MUST BE STABILIZED SO AS TO INHIBIT SEDIMENTS FROM BEING DEPOSITED INTO THE PUBLIC WAY. ACCIDENTAL DEPOSITIONS MUST BE SWEEPED UP IMMEDIATELY AND MAY NOT BE WASHED DOWN BY RAIN OR OTHER MEANS.
- ANY SLOPES WITH DISTURBED SOILS OR DENUDED OF VEGETATION MUST BE STABILIZED SO AS TO INHIBIT EROSION BY WIND AND WATER.
- ALL SILT AND DEBRIS SHALL BE REMOVED FROM ALL DEVICES WITHIN 24 HOURS AFTER EACH RAINSTORM AND BE DISPOSED OF PROPERLY.
- ALL STORM WATER CAPTURE DEVICES SHALL BE PROTECTED AT ALL TIMES.



DIGALERT

CALL BEFORE YOU DIG

1-800-422-4133

UNDERGROUND SERVICE ALERT

Call at least 2 working days prior to excavating

BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.

ELEV= 3616.50

NO.	REVISION	DATE	BY

Jerry L. Miles
No. C 42593
Civil

JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:

TRLS ENGINEERING Inc.

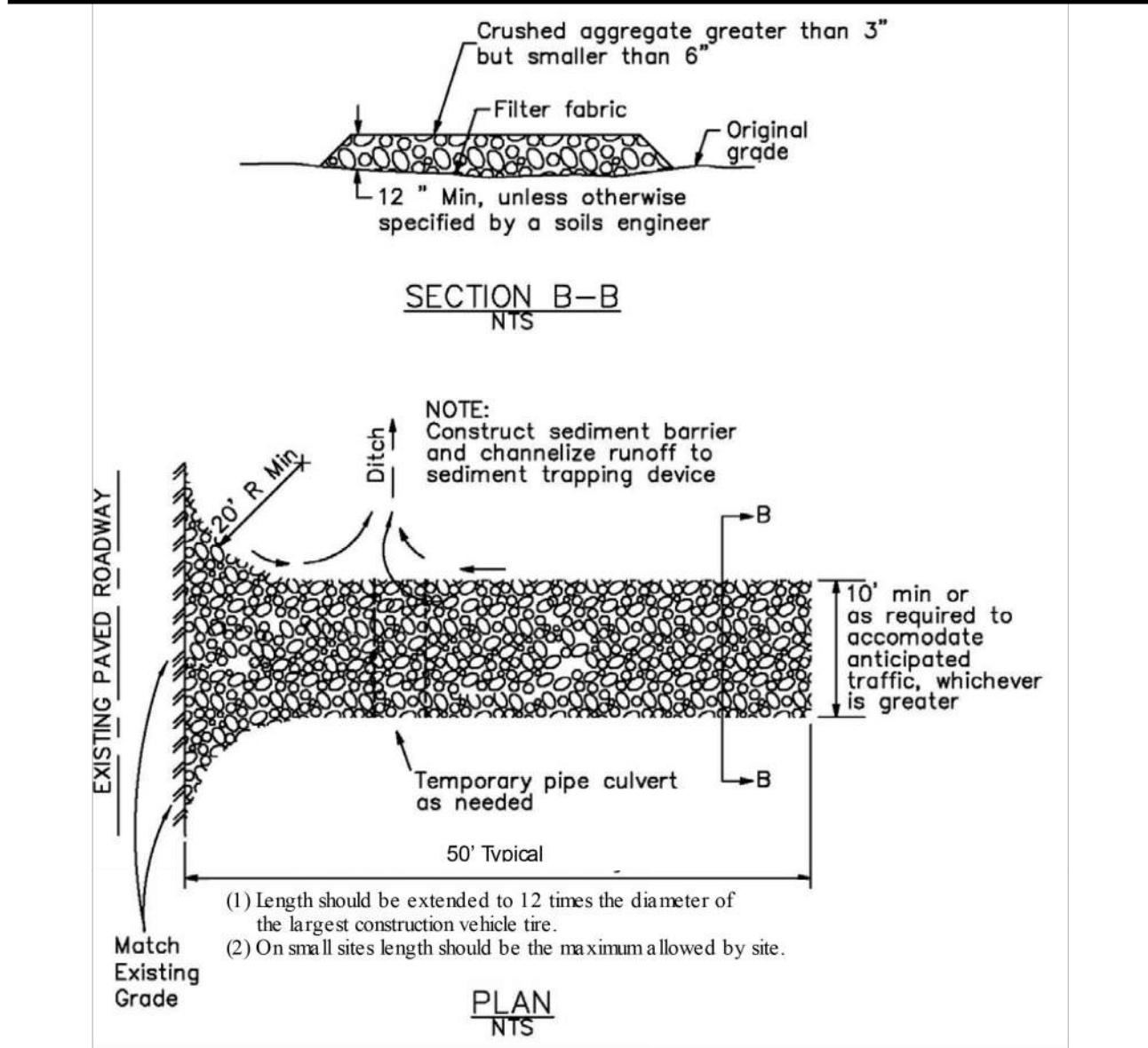
10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900

COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:		ASST. DIRECTOR OF PUBLIC WORKS	
LAND DEVELOPMENT ENGINEER		DIRECTOR OF PUBLIC WORKS	
DATE	DATE	DATE	DATE

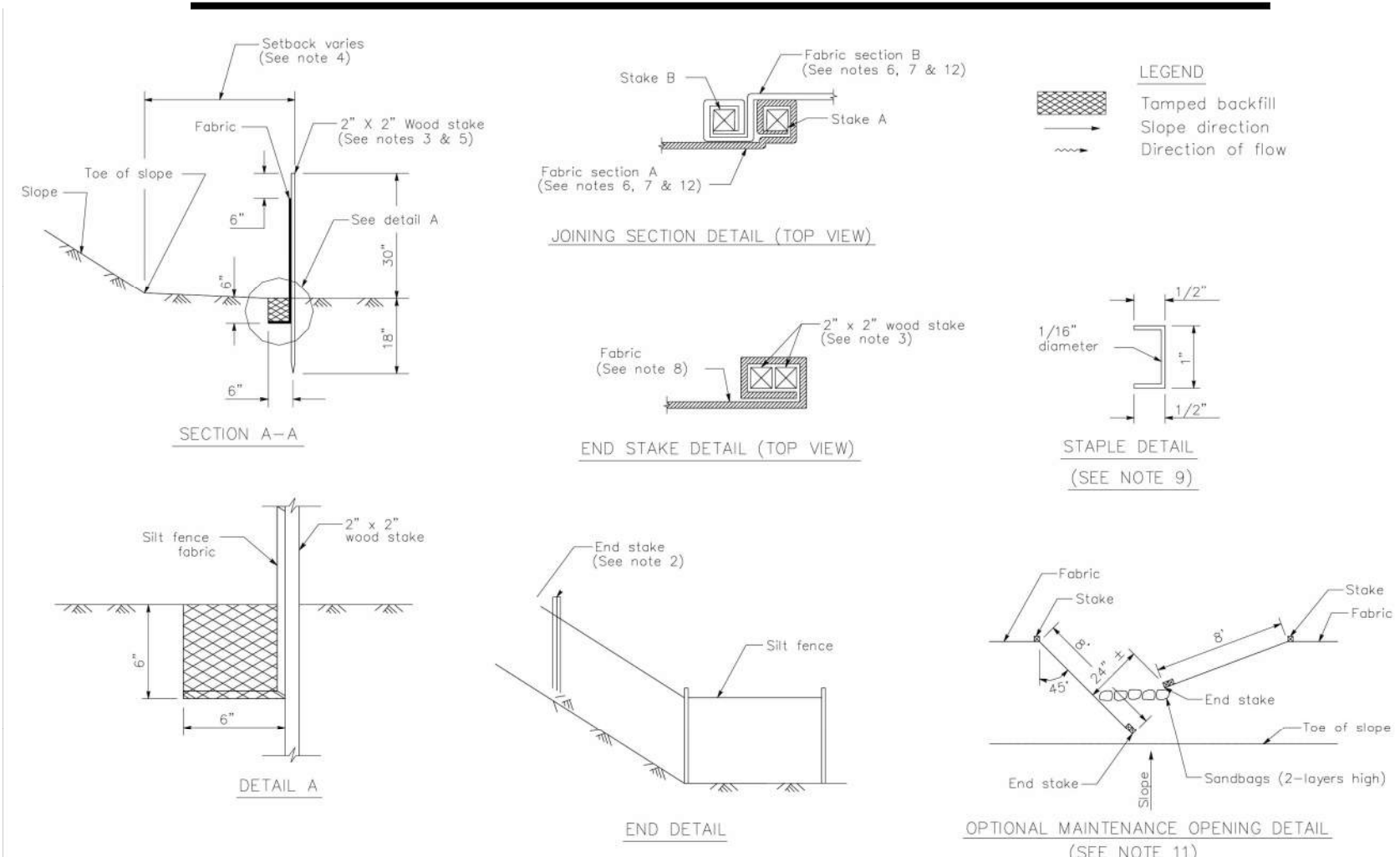
• GRAD-2021-00235 • PRAA-2021-00040 • DRNSTY-2021-00054	• SIP-2021-00031 • NEWNR-2021-00230 • WQMP-2021-00153
DRAWN BY: TRLS DATE: 05/09/2023	PHELAN PINON HILLS COMMUNITY SERVICES DISTRICT CIVIC CENTER DEVELOPMENT PHASE 1 9535 SHEEPCREEK RD. PHELAN, CA. 92329 (APN: 3066-261-10 & 3066-251-18)
DESIGNED BY: TER DATE:	SCALE: AS SHOWN
APPROVED BY: DATE:	SHEET 21 OF 25
EROSION CONTROL PLAN	
E-1	

Stabilized Construction Entrance/Exit TC-1



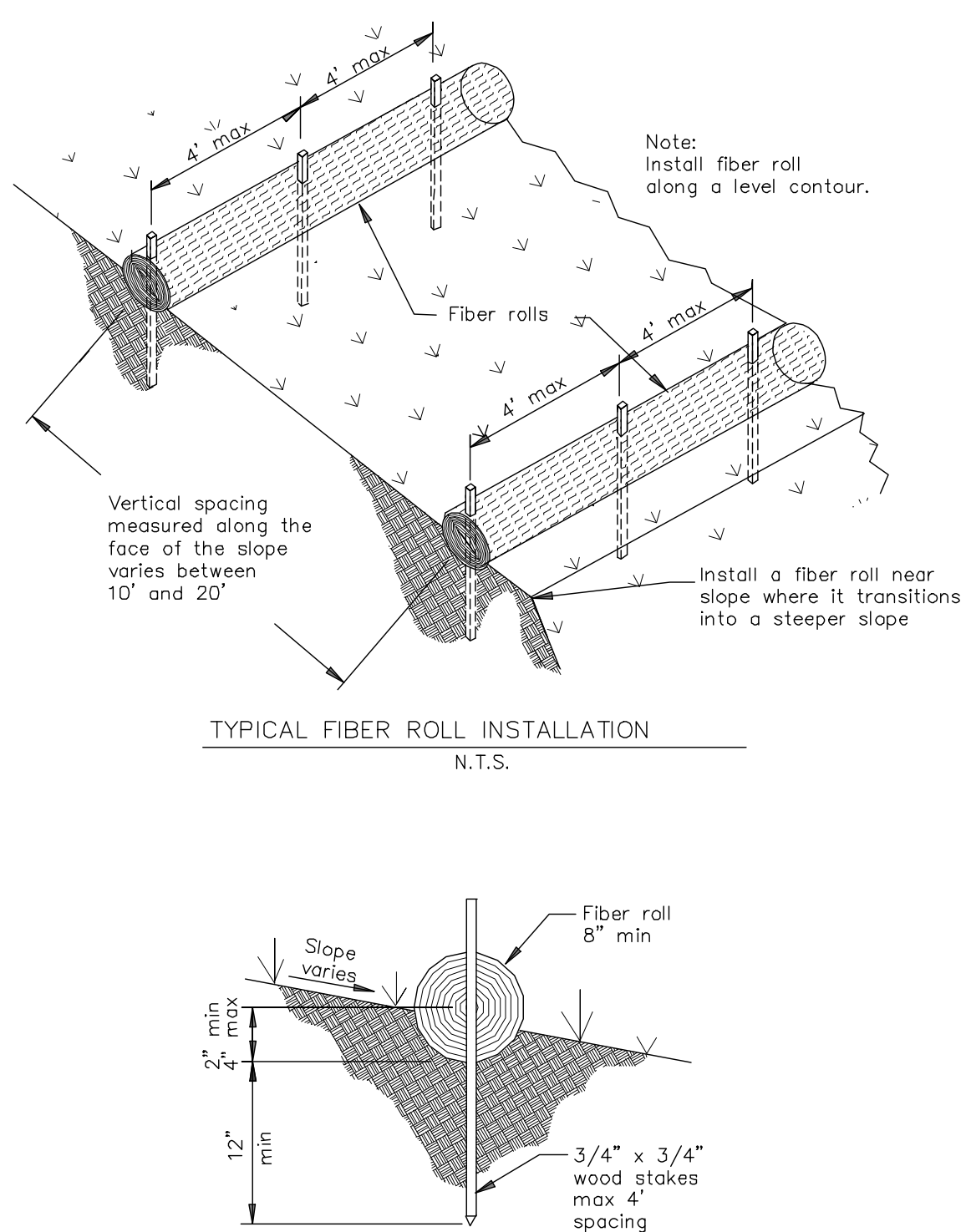
July 2012 California Stormwater BMP Handbook Construction www.casqa.org 5 of 6

Silt Fence



July 2012 California Stormwater BMP Handbook Portal Construction www.casqa.org 8 of 9

Fiber Rolls

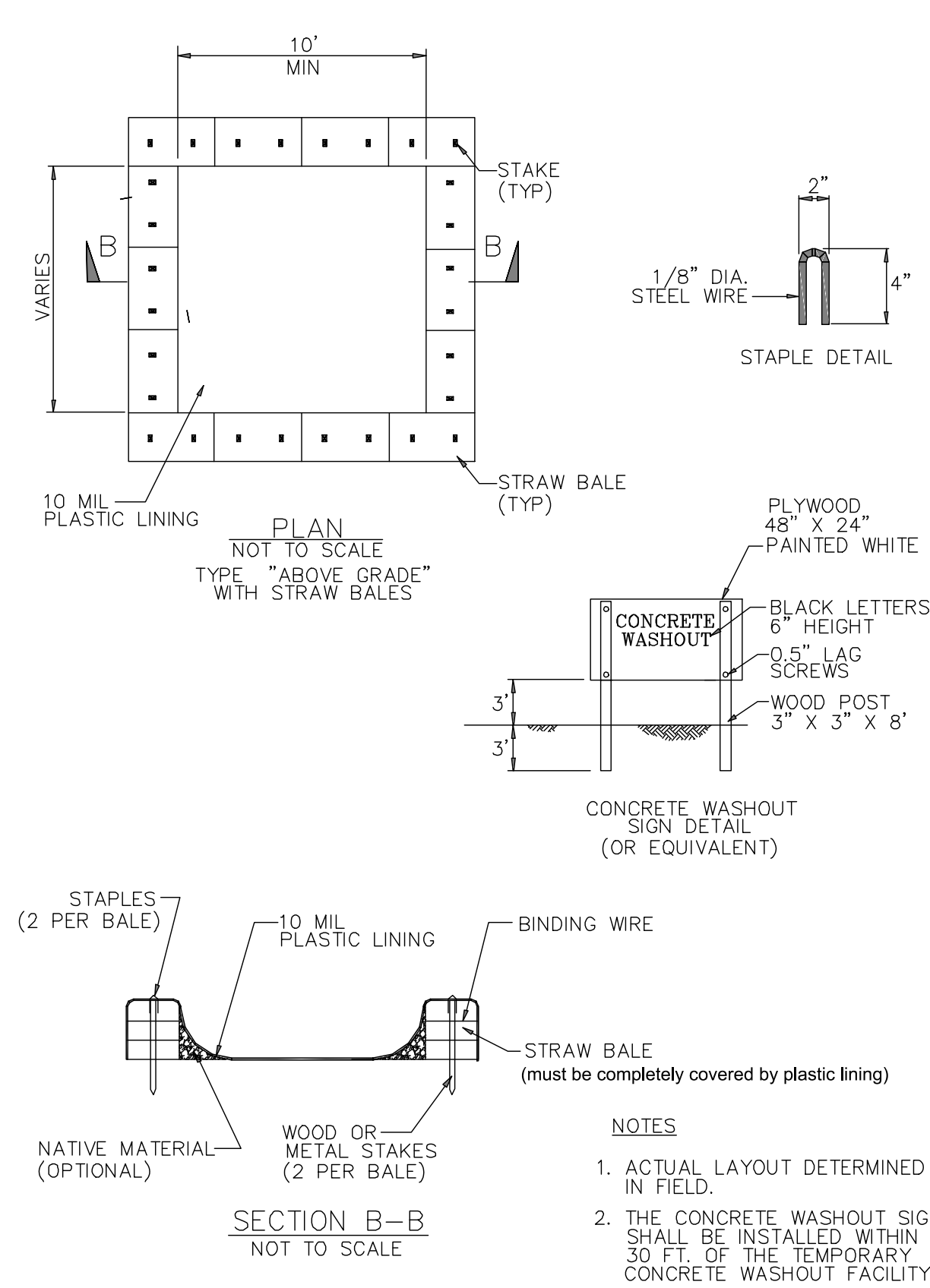


NOTES:
If more than one fiber roll is placed in a row, the rolls must be overlapped, not abutted.
Turn the ends of the fiber roll up-slope to prevent runoff from going around the roll.

July 2012 California Stormwater BMP Handbook Portal Construction www.casqa.org 5 of 5

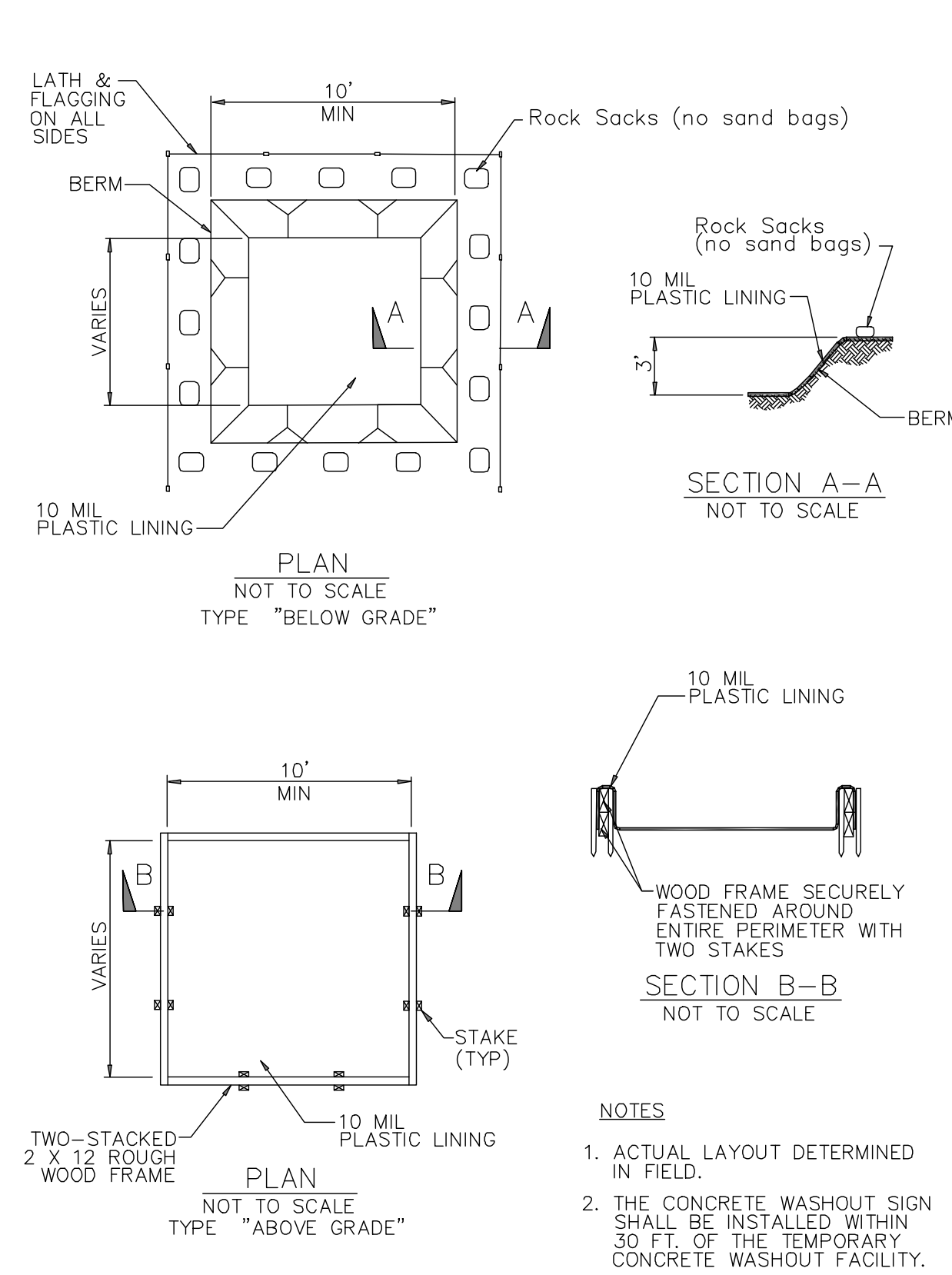
SE-5

Concrete Waste Management WM-8



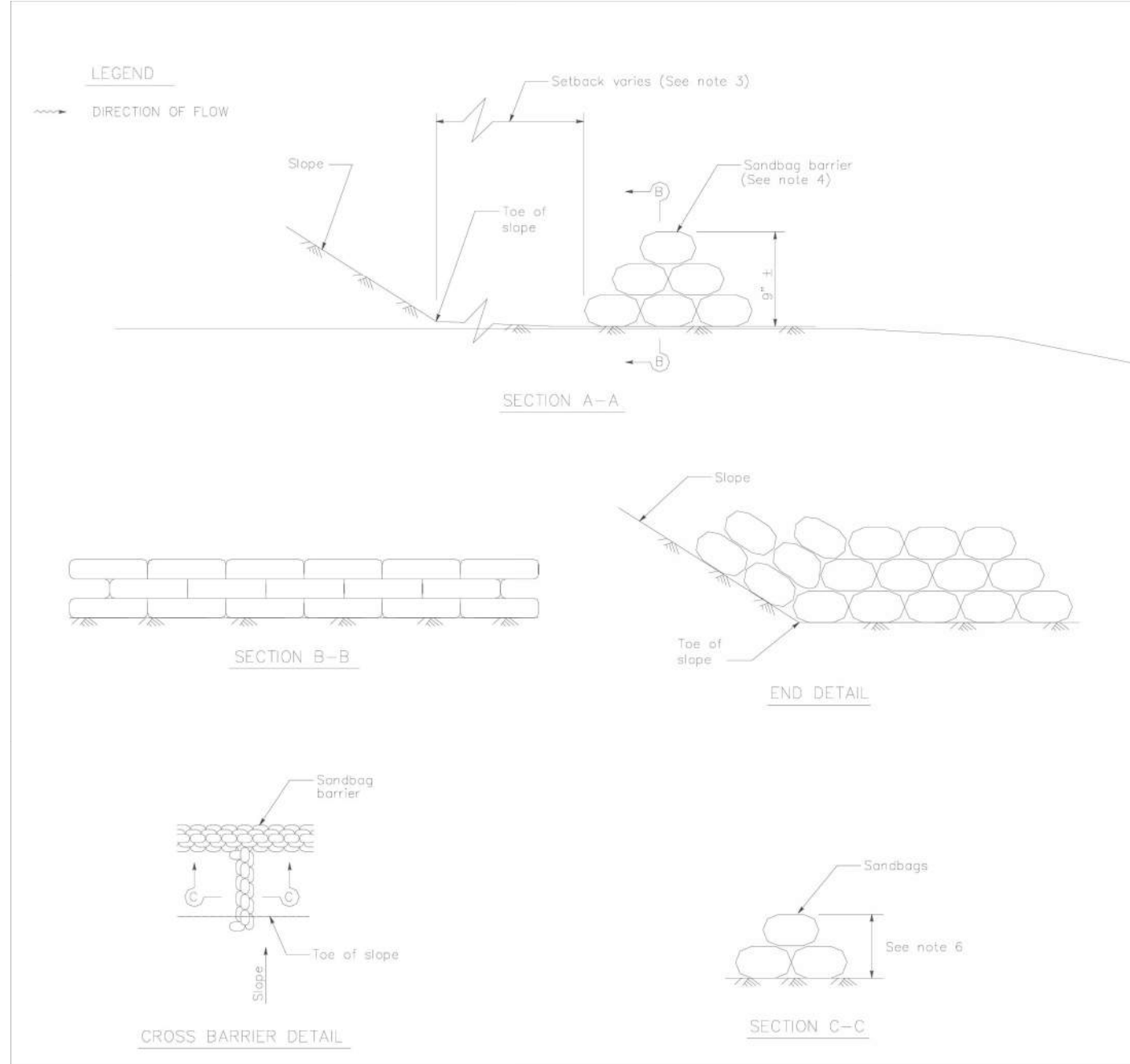
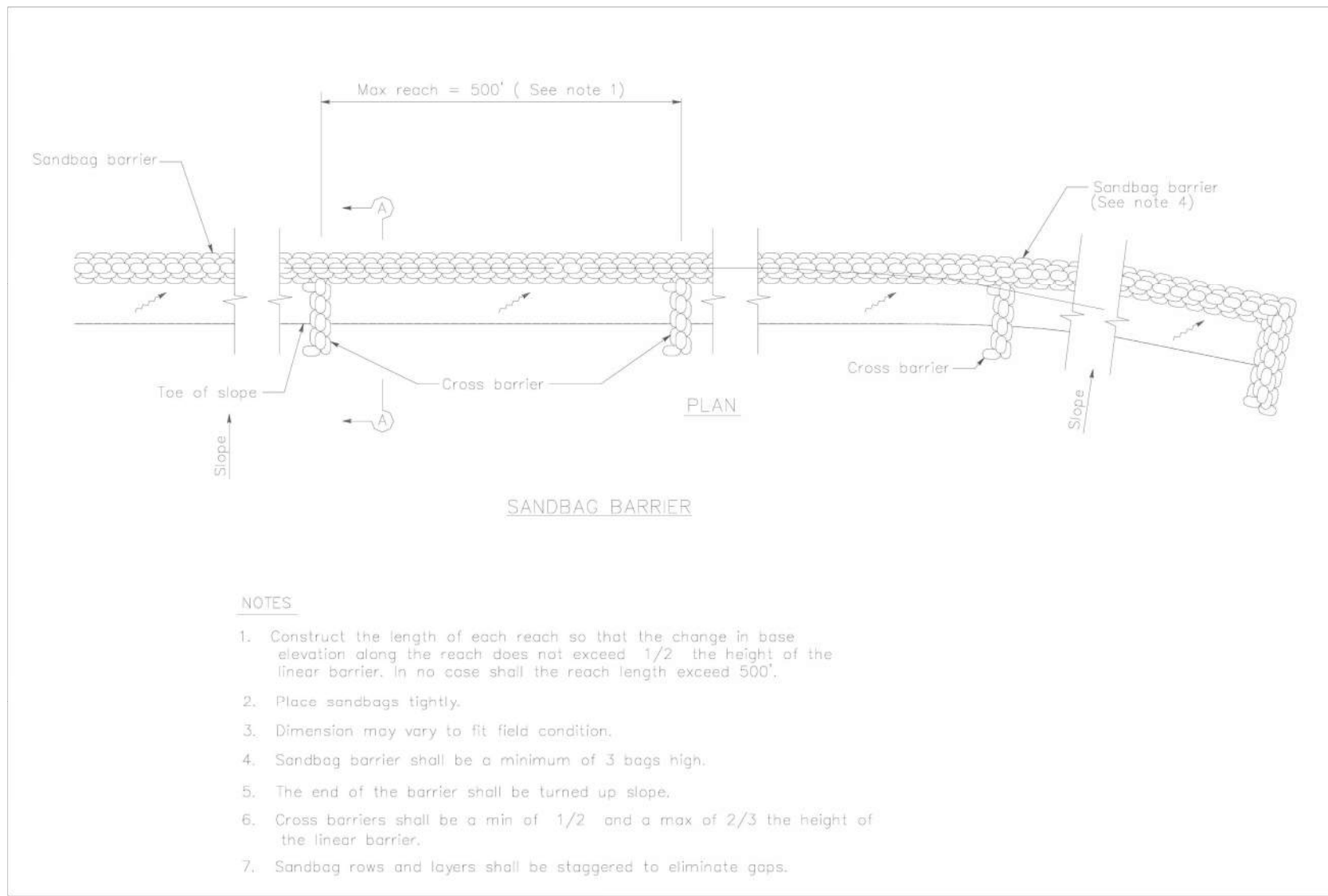
July 2012 California Stormwater BMP Handbook Construction www.casqa.org 7 of 7

Concrete Waste Management WM-8

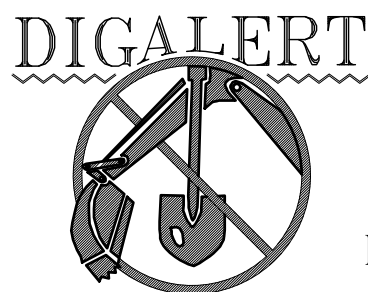


July 2012 California Stormwater BMP Handbook Construction www.casqa.org 6 of 7

Sandbag Barrier



SE-8



CALL BEFORE YOU DIG

1-800-422-4133
UNDERGROUND SERVICE ALERT
Call at least 2 working days prior to excavating

BENCHMARK:

U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD. FROM THE INTERSECTION OF PHELAN RD. 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD. 34 FT EAST OF THE CENTER LINE OF JOHNSON RD. 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD. 6.6 FT WEST OF A FENCE. 6.3 FT NORTH OF A SECTION MARKER PIPE. 0.6 FT EAST OF A WITNESS POST. ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

NO.	REVISION	DATE	BY

Jerry L. Miles
No. C 42593
Civil
JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

PLANS PREPARED BY:

TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900



COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:	DATE	DATE	DATE
LAND DEVELOPMENT ENGINEER	DATE	DIRECTOR OF PUBLIC WORKS	DATE

ASST. DIRECTOR OF PUBLIC WORKS
DIRECTOR OF PUBLIC WORKS

• GRAD-2021-00235
• PRAA-2021-00040
• DRNSTY-2021-00054

• SIP-2021-00031
• NEWNR-2021-00230
• WQMP-2021-00153

DRAWN BY:
TER
DATE:
05/09/2023
APPROVED BY:
DATE:

PHELAN PINON HILLS
COMMUNITY SERVICES DISTRICT
CIVIC CENTER DEVELOPMENT
PHASE 1
9535 SHEEPCREEK RD. PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)

SCALE:
AS SHOWN
SHEET
22 OF 25
SHEET
E-2

- ☒ Maximize Infiltration
- ☒ Provide Retention
- ☒ Slow Runoff
- ☒ Minimize Impervious Land Coverage
- ☐ Prohibit Dumping of Improper Materials
- ☐ Contain Pollutants
- ☐ Collect and Convey

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.



January 2003 California Stormwater BMP Handbook 1 of 4

2 of 4 California Stormwater BMP Handbook January 2003
New Development and Redevelopment
www.cabmphandbooks.com

January 2003 California Stormwater BMP Handbook New Development and Redevelopment 3 of 4
www.cabmphandbooks.com

4 of 4 California Stormwater BMP Handbook January 2003
New Development and Redevelopment
www.cabmphandbooks.com

January 2003 California Stormwater BMP Handbook New Development and Redevelopment 1 of 2
www.cabmphandbooks.com



- ☐ Maximize Infiltration
- ☐ Provide Retention
- ☐ Slow Runoff
- ☐ Minimize Impervious Land Coverage
- ☒ Prohibit Dumping of Improper Materials
- ☐ Contain Pollutants
- ☐ Collect and Convey

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING”



January 2003 California Stormwater BMP Handbook 1 of 2
New Development and Redevelopment
www.cabmphandbooks.com

2 of 2 California Stormwater BMP Handbook January 2003
 New Development and Redevelopment
www.cabmphandbooks.com

- ☒ Maximize Infiltration
- ☒ Provide Retention
- ☒ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures,
July 2002.

2 of 2 California Stormwater BMP Handbook January 2018
New Development and Redevelopment
www.cabmphandbooks.com

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures,
July 2002.

2 of 2 California Stormwater BMP Handbook January 2003
New Development and Redevelopment
www.cabmphandbooks.com



U.S.G.S. BENCHMARK H 35, LOCATED 3.0 MI NORTH ALONG JOHNSON RD, FROM THE INTERSECTION OF PHELAN RD, 49 FT NORTHEAST OF THE CENTER OF THE INTERSECTION OF DUNCAN RD, 34 FT EAST OF THE CENTER LINE OF JOHNSON RD, 32.5 FT NORTH OF THE CENTER LINE DUNCAN RD, 6.6 FT WEST OF A FENCE, 6.3 FT NORTH OF A SECTION MARKER PIPE, 0.6 FT EAST OF A WITNESS POST, ABOUT 1 FT HIGHER THAN THE ROAD AND SET IN THE TOP OF A CONCRETE POST PROJECTING 0.4 FT ABOVE THE GROUND.
ELEV= 3616.50

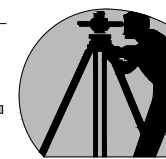
NO.	REVISION	DATE	BY



JERRY L. MILES R.C.E. 42593 - EXP. 3/31/24

TRLS ENGINEERING Inc.

10770 I AVENUE, SUITE 108
Hesperia, CA 92345
Phone: (760) 948-4900



COUNTY OF SAN BERNARDINO
DEPARTMENT OF PUBLIC WORKS

DESIGNED BY: TER	DRAWN BY: TER	CHECKED BY:	APPROVED BY:
RECOMMENDED/APPROVED BY:			ASST. DIRECTOR OF PUBLIC WORKS
LAND DEVELOPMENT ENGINEER		DATE	DIRECTOR OF PUBLIC WORKS
			DATE

9535 SHEEPCREEK RD. PHELAN, CA. 92329
(APN: 3066-261-10 & 3066-251-18)

EROSION CONTROL DETAILS

SCALE:
AS SHOWN

SHEET
23 OF 25

SHEET
E-3

PLANTING SUCH-AS LIST

- 

PARKING LOT TREES (24" BOX)
MAGNOLIA GRANDIFLORA 'SAMUEL SOMMER' / SAMUEL SOMMER SOUTHERN MAGNOLIA
PARKINSONIA ACULEATA / MEXICAN PALO VERDE
QUERCUS ILEX / HOLLY OAK
- 

SHADE/SPECIMEN TREES (48" BOX)
FRAXINUS VELUTINA GLABRA 'MODESTO' / MODESTO ASH
PARKINSONIA ACULEATA / MEXICAN PALO VERDE
PINUS MONOPHYLLA / PIÑON PINE
PROSOPIS GLANDULOSA TORREYANA / HONEY MESQUITE
QUERCUS SPP. / OAK TREES
ZELKOVA SERRATA / JAPANESE ZELKOVA
- 

LARGE ACCENT TREE (36" BOX)
CHILOPSIS LINEARIS / DESERT WILLOW
MAGNOLIA GRANDIFLORA 'SAMUEL SOMMER' / SAMUEL SOMMER SOUTHERN MAGNOLIA
PRUNUS ILICIFOLIA / HOLLYLEAF CHERRY
- 

SMALL ACCENT TREE (24" BOX)
ERIOBOTRYA DEFLEXA / BRONZE LOQUAT
LAGERSTROEMIA INDICA X FAURIEI 'TUSCARORA' / TUSCARORA CRAPE MYRTLE
- 

VERTICAL EVERGREEN TREES (24" BOX)
CEDRUS DEODARA / DEODORA CEDAR
PINUS ELDERICA / AFGHAN PINE
PINUS MONOPHYLLA / PIÑON PINE
- 

EXISTING JOSHUA TREE
*JOSHUA TREES ARE TO BE PRESERVED AND/OR TRANSPLANTED TO THE EXTENT POSSIBLE
- 

ACCENT SHRUBS (50% 1 GAL, 50% 5 GAL)
AGAVE HAVARDIANA / HAVARD'S CENTURY PLANT
CAESALPINIA GILLESII / BIRD OF PARADISE SHRUB
DASYLIIRON WHEELERI / GREY DESERT SPOON
DODONAEA VISCOSA / PURPLE LEAFED HOPBUSH
DUDLEYA PULVERULENTA / CHALK DUDLEYA
ENCELIA CALIFORNICA / CALIFORNIA ENCELIA
EUONYMUS FORTUNEI 'EMERALD GAUITY' / BURNING BUSH
HESPERALOE PARVIFLORA / RED YUCCA
HETEROMELES ARBUTIFOLIA / TOYON
LANTANA MONTEVIDENSIS / PURPLE TRAILING LANTANA
LEONITIS LEONURUS / LION'S TAIL
MIMULUS AURANTIACUS / MONKEYFLOWER
MUHLENBERGIA CAPILLARIS / PINK MUHLY GRASS
ROMNEYA COULTERI / MATILJA POPPY
SALVIA LEUCANTHA / MEXICAN BUSH SAGE
- 

SMALL/MEDIUM SHRUBS (50% 1 GAL, 50% 5 GAL)
AGAVE HAVARDIANA / HAVARD'S CENTURY PLANT
AGAVE PARRYI / PARRY'S AGAVE
ARTEMISIA TRIDENTATA / BIG SAGEBRUSH
BACCHARIS PILULARIS 'TWIN PEAKS' / TWIN PEAKS COYOTE BRUSH
DASYLIIRON WHEELERI / GREY DESERT SPOON
ENCELIA CALIFORNICA / CALIFORNIA ENCELIA
ERICAMERIA LINEARIFOLIA / TURPENTINE BUSH
ERIODICTYON TRICHOCALYX / HAIRY YERBA SANTA
HESPERALOE PARVIFLORA / RED YUCCA
LANTANA MONTEVIDENSIS / PURPLE TRAILING LANTANA
LUPINUS EXCUBITUS / GRAPE SODA LUPINE
MUHLENBERGIA CAPILLARIS / PINK MUHLY GRASS
OPUNTIA BASILARIS BRACHYCLADA / BEAVERTAIL PRICKLY PEAR
ROSMARINUS OFFICINALIS 'HUNTINGTON CARPET' / HUNTINGTON CARPET ROSEMARY
SALIX LASIOLEPIS / ARROYO WILLOW
SALVIA DORRII / DESERT SAGE
SALVIA LEUCANTHA / MEXICAN BUSH SAGE
YUCCA WHIPPLEI / CHAPARRAL YUCCA
- 

NATIVE PLANTING (50% 1 GAL, 50% 5 GAL)
ARTEMISIA TRIDENTATA / BIG SAGEBRUSH
CEANOTHUS GREGGII / DESERT CEANOTHUS
ERIOGONUM WRIGHTII / WRIGHT'S BUCKWHEAT
FEROCACTUS CYLINDRACEUS / COMPASS BARREL CACTUS
FOUQUIERIA SPLENDENS / OCOTILLO
LARREA TRIDENTATA / CREOSOTE BUSH
OPUNTIA ACANTHOCARPA / BUCKHORN CHOLLA
YUCCA SCHIDIGERA / MOHAVE YUCCA
- 

BIORETENTION BASINS (100% 1 GAL)
BOUTELOUA GRACILIS / BLUE GRAMA GRASS
JUNCUS MEXICANUS / MEXICAN RUSH
MUHLENBERGIA RIGENS / DEER GRASS
NASSELLA TENUISSIMA / MEXICAN FEATHER GRASS
- 

TURF
TIFGREEN' BERMUDA HYBRID SOD

LIMIT OF WORK

LIMIT OF WORK

LIMIT OF WORK

RESIDENTIAL

SCALE = 1" = 40'

NORTH

14 ACRE PARK SITE LIMIT OF WORK

PARKING LOT WITH PV PANELS

DOG PARK

EQUESTRIAN PARKING

SKATE PARK AND PUMP TRACK AREA

EQUESTRIAN ARENA

MULTI-PURPOSE TURF AREA

PLAYGROUND AREA

RESTROOM / CONCESSION BUILDING & PICNIC AREAS

FORMAL GARDEN AREA

COMMUNITY GARDEN

TENNIS COURT

SOCCER FIELD

BALL & MULTI-USE FIELD

PARKING LOT WITH PV PANELS

PARKING LOT WITH PV PANELS

WARBLER ROAD

LIMIT OF WORK

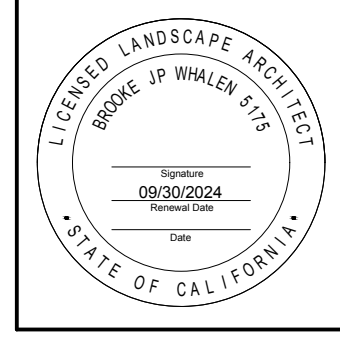
STEENOR
ARCHITECTURE + DESIGN
ARCHITECTURE + DESIGN
11774 HESPERIA ROAD, SUITE 100 • HESPERIA, CA 92346
PHONE (760) 244-0001 • FAX (760) 244-1948
WWW.STEENORDESIGN.COM

ktua
3916 Normal Street
San Diego, CA 92103
619.294.4877 | www.ktua.com

DATE FINISHED
MAY 2023

REVISIONS

THESE DOCUMENTS AND THE DESIGN AND IDEAS INCORPORATED HEREIN, AS AN INSTRUMENT OF A PROFESSIONAL SERVICE, ARE THE SOLE PROPERTY OF STEENOR DESIGN STUDIO INC. ANY USE, IN WHOLE OR IN PART, FOR WHICH THEY WERE NOT PROVIDED SHALL BE UNLAWFUL.



PROJECT: PARKS & RECREATION
PHELAN / PINION HILLS C.S.D.
SITE ADDRESS: A.P.N. 3066-281-141 / 3066-281-08 & 10
SHEEP CREEK ROAD
PHELAN, CA 92259
CONTACT: DON BARTZ

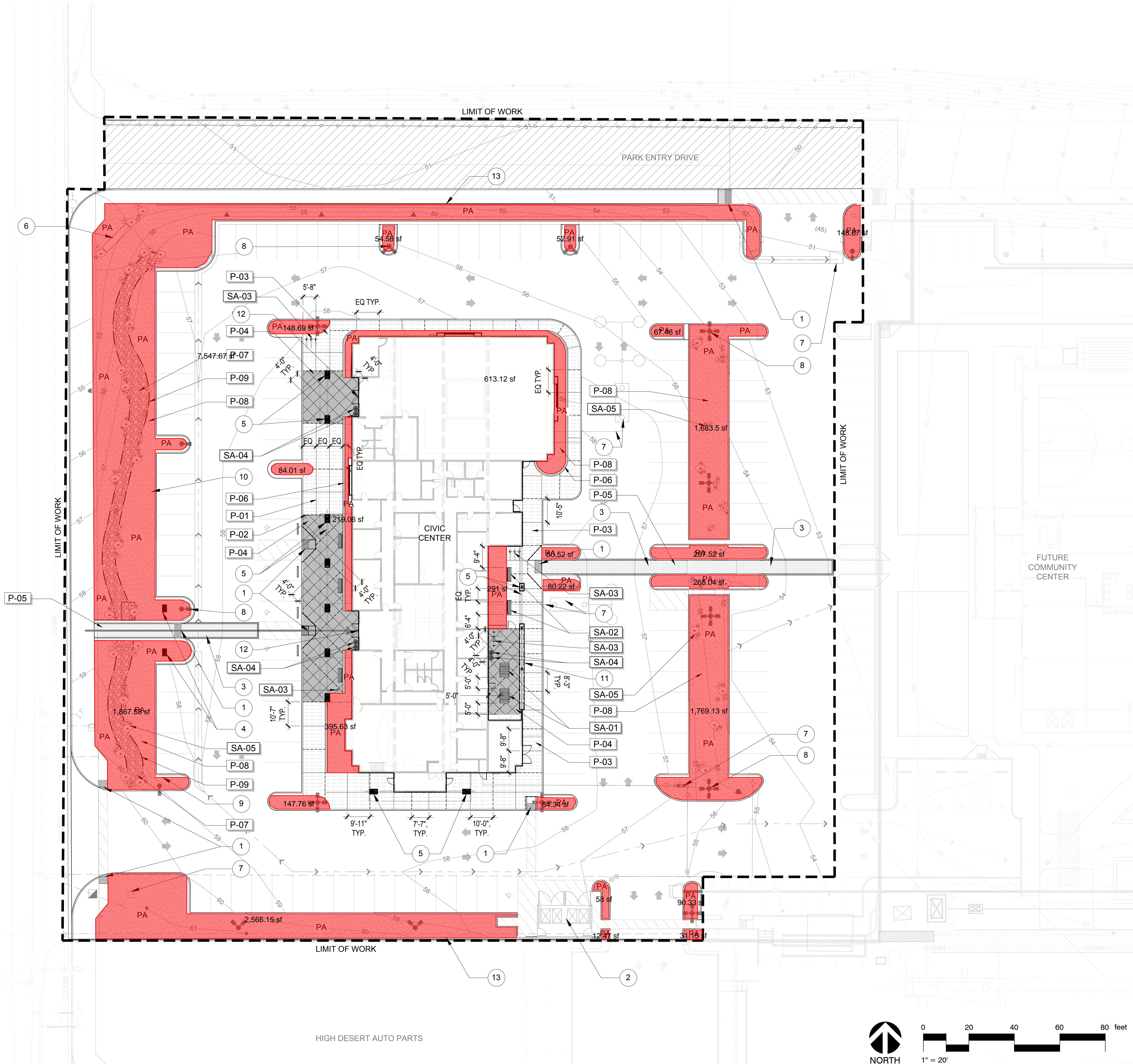
JOB NO.
2020-023.6

SHEET NAME:
LANDSCAPE PLANTING
CONCEPT PLAN - CUP

PAGE
LP-01

SHEET NOTES

1. REFER TO SHEET LC-02 FOR LANDSCAPE CONSTRUCTION NOTES.
2. REFER TO SHEET LC-03 FOR FULL LANDSCAPE CONSTRUCTION LEGEND.
3. REFER TO SHEETS LC-03 - LC-05 FOR LANDSCAPE CONSTRUCTION DETAILS.
4. AREAS LABELED "PA" ARE UNPAVED PLANTER AREAS.
5. ALL SHEET CALLOUTS ARE USED TO POINT OUT THE SYMBOL BEING USED FOR EACH SITE ELEMENT ON THE SHEET. THESE CALLOUTS ARE TYPICAL AND EACH SITE ELEMENT IS ONLY INDICATED VIA CALLOUT IN ONE LOCATION ON EACH SHEET. CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION OF ALL OF THE SITE ELEMENTS SHOWN ON PLANS NOT JUST THOSE WITH A CALLOUT (REFER TO SYMBOLS INDICATED IN LEGEND).





SHEET NOTES	
1.	REFER TO SHEET LP-02 FOR PLANTING NOTES.
2.	REFER TO SHEET LP-03 FOR FULL PLANTING LEGEND.
3.	REFER TO SHEET LP-04 FOR PLANTING DETAILS.

KTU+A PLANNING AND
LANDSCAPE ARCHITECTURE
3916 NORMAL STREET
SAN DIEGO, CA 92103
TEL 619.294.4477

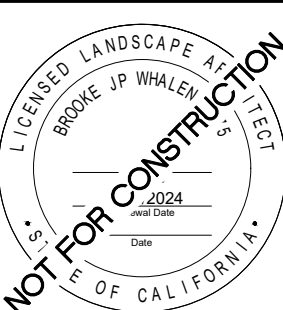


DATE FINISH _____

REVISION

THESE PLANS SHALL COMPLY WITH THE 2019 CALIFORNIA BUILDING CODE WHICH ADOPTS THE 2019 CMC, 2019 CPC, 2019 PEC, 2019 CGC, 2019 CRC AND THE 2019 ENGY STANDARD

THESE DOCUMENTS AND THE DESIGN AND IDEAS INCORPORATED HEREIN, AS AN INSTRUMENT OF A PROFESSIONAL SERVICE, ARE THE SOLE PROPERTY OF STEENO DESIGN STUDIO INC. ANY REUSE, REPRODUCTION, OR USE, IN WHOLE OR IN PART, FOR WHICH THEY WERE NOT PROVIDED SHALL BE UNLAWFUL.



PROJECT: PHELAN CIVIC CENTER PARK

JOB NO.

SHEET NAM

PLANTING PLAN

PAGE

LP-01

