APPENDIX 1

STORM WATER POLLUTION PREVENTION PLAN MANUAL

Storm Water Pollution Prevention Plan

For:
Petaluma Community Sports Field Baseball Diamond
2430 E Washington St
Petaluma, California 94954
APN: 136-070-031

Grading Permit No: TBD
Building Permit No: TBD

Discharger: GSM Landscape Architects
c/o Bart Ito
Authorized Representative
1700 Soscol Ave, Suite 23
Napa, California 95492
(707) 255-4630

Contractor: TBD
Address
Address
(###) ###-####
Contact

Qualified SWPPP Practitioner (QSP)
TBD
Company
Address
Address
(###) ###-####

Qualified SWPPP Developer (QSD)
Rick Carlile
BKF Engineers
200 Fourth Street, Suite 300
Santa Rosa, California 95401
(707) 583-8533

SWPPP Preparation Date:
March 28, 2020
BKF # 20169131-10

Estimated Project Dates:
Start of Construction: August 15, 2021
Completion of Construction: October 1, 2022
WDID No.: TBD

DRAFT

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SWPPP Certification Statement by Qualified SWPPP Developer (QSD)

Project Name: ***Petaluma Community Sports Field Baseball Diamond, APN: 136-070-031***

Town Permits: ***Grading Permit No: TBD***
Building Permit No: TBD

BKF Project Number: ***20169131-10***

"This document and all attachments were prepared under my direction or supervision as a Qualified SWPPP Developer. To the best of my knowledge and belief, the information submitted is true, accurate, and complete."

QSD's Signature	Date of SWPPP Preparation
Rick Carlile, Professional Engineer	(707) 583-8533
QSD's name and title	Telephone Number
00933	
QSD's Qualifying Professional Registration	

SWPPP Certification Statement by Discharger

Discharger (Owner or Legally Responsible Person - LRP) Certification of the Storm Water Pollution Prevention Plan

Project Name: ***Petaluma Community Sports Field Baseball Diamond,***
APN: 136-070-031

Town Permits: ***Grading Permit No: TBD***
Building Permit No: TBD

BKF Project Number: ***20169131-10***

"I certify under penalty of law that this document and all attachments were prepared by a Qualified SWPPP Developer, (QSD), under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

____
Discharger (LRP)'s Signature

____
Date

__TBD, Position__
Discharger's name and title

___(707) 303-1004___
Telephone Number

Section 1 SWPPP Requirements

1.1 Introduction

This SWPPP has been prepared to comply with the California's General Permit for *Storm Water Discharges Associated with Construction and Land Disturbance Activities* (General Permit) - State Water Resources Control Board (SWRCB) Order No. 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ, under NPDES No. CAS000002.

The Contractor shall designate a Qualified SWPPP Practitioner (QSP) to implement the provisions of the SWPPP and the Construction Site Monitoring Program (CSMP), and shall comply with the narrative effluent standards listed below:

- Storm water discharges and authorized non-storm water discharges regulated by this General Permit shall not contain a hazardous substance equal to or in excess of reportable quantities established in 40 C.F.R. §§ 117.3 and 302.4, unless a separate NPDES Permit has been issued to regulate those discharges.
- Dischargers shall minimize or prevent pollutants in storm water discharges and authorized non-storm water discharges through the use of controls, structures, and management practices that achieve BAT (Best *"economically"* Available Technology) for toxic and non-conventional pollutants and BCT (Best Conventional *"pollution control"* Technology) for conventional pollutants.

The Contractor shall notify the Owner if the QSP is no longer associated with the work. The Owner shall be notified within 24 hours and a qualified replacement named within 72 hours. The replacement QSP shall meet the Permit certification requirements.

The QSP shall have the training described in Section 5 of this SWPPP and shall be listed on the SMARTS system prior to the start of construction. The Legally Responsible Person (LRP) shall ensure that SWPPPs for all traditional project sites are developed and amended or revised by a Qualified SWPPP Developer (QSD).

This SWPPP has been designed to address the following objectives:

1. All pollutants and their sources, including sources of sediment associated with construction, construction site erosion and all other activities associated with construction activity are controlled.
2. Where not otherwise required to be under a Regional Water Quality Control Board (RWQCB) permit, all non-stormwater discharges are identified and either eliminated, controlled, or treated.
3. Site BMPs are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity to the Best Available Technology/Best Control Technology (BAT/BCT) standard.
4. Calculations and design details as well as BMP controls for site run-on are complete and correct.
5. Stabilization BMPs installed to reduce or eliminate pollutants after construction are completed.
6. Identify post-construction BMPs, which are those measures to be installed during construction that are intended to reduce or eliminate pollutants after construction is completed. See Section 3.4 for post-construction BMPs.

7. Identify and provide methods to implement BMP inspection, visual monitoring, and Construction Site Monitoring Program (CSMP) requirements to comply with the General Permit.

1.2 Permit Registration Documents

The LRP must electronically file Permit Registration Documents (PRDs) prior to the commencement of construction activity. PRDs are to be submitted to the Storm Water Multiple Application and Report Tracking System (SMARTS). Failure to obtain coverage under this General Permit for storm water discharges to waters of the United States is a violation of the Clean Water Act and the California Water Code.

	Name of PRD	**Date of Preparation**	**Date of Online Submittal**
☒	Notice of Intent (NOI)	TBD	TBD
☒	Risk Assessment	3/30/2020	TBD
☒	Site Map	3/30/2020	TBD
☒	SWPPP	3/30/2020	TBD
☒	Annual Fee	--	TBD
☒	Signed Certification Statement	TBD	TBD

1.3 SWPPP Availability and Implementation

The QSP is responsible for making available the original SWPPP at the construction site during working hours while construction is occurring. The SWPPP shall be made available upon request by a State or Municipal inspector. When the original SWPPP is retained by a crewmember in a construction vehicle, and is not currently at the construction site, current copies of the BMPs and map/drawing shall be left with the field crew, and the original SWPPP shall be made available via a request by radio/telephone.

This SWPPP shall be implemented concurrently with construction site move in and remain in effect until a Notice of Termination for the site is approved by the Regional Water Quality Control Board.

1.4 SWPPP Amendments

All amendments proposed or implemented to the SWPPP shall be approved and signed by the QSD. Amendments are to be dated, included in the SWPPP in Appendix C, and logged in Appendix C.

1.5 Retention of Records

The QSP is required to maintain a paper or electronic copy of all required records throughout construction, and provide copies of these reports to the LRP when requested during the job and at the end of the job. The LRP shall retain a copy of all required records for three years from the date generated or the date submitted to the State Water Board or Regional Water Boards, whichever is the latter. A copy of these records must be available at the construction site and within Appendix O of this SWPPP until construction is complete. The LRP shall furnish the RWQCB, SWRCB, or US

Environmental Protection Agency (EPA) any requested information to determine compliance with this General Permit within a reasonable time.

1.6 Required Non-Compliance Reporting

The QSP is required to properly document reportable discharges or other violations of the General Permit. ***Please see Section 2.3 for potential impacts to SWPPP requirements.*** As discussed in the CSMP in Appendix S, the QSP shall submit all sampling reports and all field or laboratory analytical data electronically using the SMARTS system, as part of the Annual Report, including but not limited to the following:

- Any discharge violations or to comply with RWQCB enforcement actions.
- Discharges which contain a hazardous substance in excess of reportable quantities established in 40 CFR §§ 117.3 and 302.4, unless a separate NPDES Permit has been issued to regulate those discharges.

Documentation of all reportable exceedances shall be included in this SWPPP under Appendix D**.**

1.7 Annual Report

The QSP is responsible for preparing and electronically submitting an Annual Report no later than September 1st of each year. Reporting requirements are identified in Section XVI of the General Permit and include (but are not limited to) providing a summary of:

1) Corrective actions and compliance activities, including those not implemented;
2) Violations of the General Permit;
3) Date, time, place, and name(s) of the inspector(s) for all sampling, inspections, and field measurement activities;
4) Visual observation and sample collection exception records; and
5) Training documentation of all personnel responsible for General Permit compliance activities.

The LRP is responsible for certifying the Annual Report via SMARTS, and is required to retain paper copies of all submitted documents for a period of 3 years after the Notice of Termination is accepted.

1.8 Changes to Permit Coverage

The Construction General Permit allows a permittee to reduce or increase the total acreage covered under the General Permit when a portion of the project is complete and/or conditions for termination of coverage have been met; when ownership of a portion of the project is sold to a different entity; or when new acreage is added to the project. To change the acreage covered, the permittee must electronically file modifications to PRDs (revised NOI, site map, SWPPP revisions as appropriate, and certification that new landowners have been notified of applicable requirements to obtain permit coverage, including name, address, phone number, and e-mail address of new landowners) in accordance with requirements of the General Permit within 30 days of a reduction or increase in total disturbed area.

Include any updates to PRDs submitted via SMARTS in Appendix E. Document any related SWPPP revisions/amendments in Appendix C.

1.9 Construction Site Monitoring Program

The QSP is to implement the Construction Site Monitoring Program (CSMP) in accordance with the requirements found in Appendix A. The CSMP is included in this SWPPP in Appendix S.

1.10 Notice of Termination

To terminate coverage under the General Permit, a Notice of Termination (NOT) must be submitted electronically via SMARTS. A "final site map" and photos are required to be submitted with the NOT. Filing a NOT certifies that all General Permit requirements have been met. The NOT is submitted when the construction project is complete, and within 90 days of meeting all General Permit requirements for termination and final stabilization including:

- The site will not pose any additional sediment discharge risk than it did prior to construction activity.
- All construction related equipment, materials and any temporary BMPs no longer needed are removed from the site.
- Post-construction storm water management measures are installed, and a long-term maintenance plan that is designed for a minimum of five years has been developed.

The NOT must demonstrate through photos that the project meets all of the requirements of Section II.D.1 of the General Permit by the 70% final cover method (no computational proof required).

1.11 Contractor Activities Location Map

Locations of storage areas for waste, vehicles, service, loading/unloading of materials, access (entrance/exits) points to construction site, fueling, and water storage, water transfer for dust control and compaction practices shall be shown on this map and updated regularly by the QSP. All updates of the Contractor Activities Location Map shall be included in Appendix T.

1.12 Other Plans/Permits

The following list indicates other local, state, and federal permits that are known to be associated with this project, as well as other pertinent reports and investigations. Information regarding these permits, approvals, reports or investigations may be obtained through the owner of the project and may be included in Appendix J ~ Agency Approvals and Miscellaneous Documents.

- "Geotechnical Investigation East Washington Park – Petaluma, Ca" prepared for Winzler & Kelly Consulting Engineers by Miller Pacific Engineering Group, dated September 30, 2008.*
- "Geotechnical Design Recommendations – East Washington Park – Phase 2" Prepared by Miller Pacific Engineering Group, Dated October 25, 2017.
- "Geotechnical Design Recommendations – East Washington Park – Phase 2" Prepared by Miller Pacific Engineering Group, Dated January 10, 2020.*

* It is recommended that the SWPPP and Storm Water Mitigation Plan be kept together at the site office.

Section 2 Project Information

2.1 Project and Site Description

The Petaluma Community Sports Field Baseball Diamond project is the second phase of the East Washington Park project. This portion of the project involves the development of a new baseball field, additional parking, walkways, and a concessions/restroom building. The site is located along the northeast edge of Petaluma immediately northeast Rooster Run Golf Course and southeast East Washington St. The entire property including all phases of development is approximately 24.87 acres. Phase 1 included the development of three soccer fields and accompanying concrete walkways near the south end of the property and an access drive path which connected from East Washington St to a turnaround at the south end. This included parking stalls along the southern half of the drive path and a large retention basin at the south corner of the property.

The development of Phase 2 includes development of the middle portion of the property and a widening of the existing access roadway to include parking stalls and sidewalks similar to the improvements of phase 1. The phase 2 improvements limits of construction include approximately 6.37 acres of the property.

Initial construction activities will include:

- Demolition of Existing Pavement and Planter Areas
- Rough Grading
- Subgrade Construction for New Driveways

To reduce pollutant run-off, construction practices may include, but are not held or limited to:

- Soil Stabilization Practices
- Practices to Reduce Tracking Sediment Onto Public and Private Roads
- Practices to Minimize Wind Erosion
- Practices to Minimize Contact with Storm Water
- Pre-Construction Control Practices

Site improvements will include:

- Fine Grading
- Construction of the Public City Street
- Construction of Finished Driveways, Sidewalks, Single Family Homes
- Paving and Construction of Hardscape Improvements and Associated Underground Utilities
- Landscaping

As described in detail in the Geotechnical Investigation prepared by Miller Pacific Engineering Group, the site is generally high placidity, silty clay (Adobe Clay) to depths of 3.0 to 9.0-feet below the ground surface, underlain by stiff, low to medium placidity silty and sandy clay. The water table was not encountered in any of the site borings. No faults run across the project site.

The rainy season in this area is October 15th through April 15th.

Site elevations range from approximately 108' at the northwest corner near the road entrance draining southeast to an elevation of approximately 95' at the corner of discharging into the wetlands area. Existing overland release paths across the site run to an established drainage channel. The proposed drainage system will be redirected to bioretention basins and discharge to the same wetlands areas. The proposed storm drain system is described in detail in the Stormwater Management Plan prepared by BKF Engineers.

2.2 Site Data / Storm Water Run-On from Off-Site Areas

Site Data

See Improvement Drawings.

2.3 Findings of the Construction Site Sediment and Receiving Water Risk Determination

The risk level for this project is 2. Receiving Water Risk Determination calculation sheet is included in the SWPPP as a part of Appendix B.

As described above in Section 1.6 "Required Non-Compliance Reporting", the QSP is required to properly document reportable discharges or other violations of the General Permit. Exceedances and violations may result in the project being subject to the more stringent monitoring and reporting requirements applicable to a Risk Level 3 project. This would require a major amendment to the project SWPPP, including an expanded CSMP.

2.4 Construction Schedule

Listed below are the four identified phases of construction and their proposed start dates:

August 1, 2020 to November 1, 2020	Grading and Land Development
November 1, 2020 to February 1, 2021	Subgrade stabilization and Street Expansion
February 1, 2020 to October 1, 2021	Field and Facilities Installation

This schedule is subject to change depending on permitting processes, phasing, and conditions encountered during construction and weather conditions. The QSP is required to keep an updated and detailed schedule in Appendix F.

2.5 Potential Construction Site Pollutant Sources

The following is a list of example construction materials and activities that have the potential to contribute pollutants, other than sediment, to storm water run-off:

- Vehicle fluids, including oil, grease, petroleum, and coolants
- Asphaltic emulsions associated with asphalt concrete paving operations
- Cement materials associated with Portland cement concrete (PCC) paving operations, drainage structures, median barriers, and bridge construction
- Base and subbase material
- Joint and curing compounds
- Concrete curing compounds
- Paints
- Solvents, thinners, and acids
- Sandblasting materials
- Mortar mix
- Raw landscaping materials and wastes (topsoil, plant materials, herbicides, fertilizers, mulch, pesticides)
- BMP materials (sandbags, liquid copolymer)
- Treated lumber (materials and waste)
- PCC rubble
- Masonry block rubble
- General litter

Construction activities that have the potential to contribute sediment to storm water discharges include:

- Clear and grub operations
- Grading operations
- Soil import and export operations
- Utility excavation operations
- Sandblasting operations
- Landscaping operations
- Painting

The QSP is required to maintain an ongoing and active list of potential pollutant sources, construction activities, and identify areas of the site where additional BMPs are necessary to reduce or prevent pollutants in discharges. This “SWPPP Construction Site Pollutant Checklist” must be consistent with the Material Safety Data Sheets (MSDS) for the project. It is recommended that the SWPPP and MSDS be kept together at the site office, together with the Stormwater Management Plan.

A template for the SWPPP Construction Site Pollutant Checklist is provided in Appendix G. In completing the list, the QSP, contractor, and subcontractors shall address at a minimum:

1) The quantity, physical characteristics (e.g., liquid, powder, solid), and locations of each potential pollutant source handled, produced, stored, recycled, or disposed of at the site.
2) The degree to which pollutants associated with those materials may be exposed to and mobilized by contact with storm water.
3) In describing method of control and protection, Contractor shall consider the direct and indirect pathways that pollutants may be exposed to storm water or authorized non-storm water discharges. This shall include an assessment of past spills or leaks, non-storm water discharges, and discharges from adjoining areas.

The QSD is not aware of any pre-existing contamination that has been observed on the site. If contamination is noted during construction, work shall be halted in the vicinity of the contamination. Owner is responsible for retaining a qualified individual to prepare a site risk management plan.

2.6 Identification of Non-Storm Water Discharges

Non-storm water discharges include a wide variety of sources, including improper dumping, spills, or leakage from storage tanks or transfer areas. Non-storm water discharges may contribute significant pollutant loads to receiving waters. Measures to control spills, leakage, and dumping, and to prevent illicit connections during construction, must be addressed through structural as well as non-structural BMPs.

The QSD is required to identify all potential non-storm water discharges within the project. All project activities shall be examined to determine what discharges will be generated or may be required in order to complete each activity, including mobile-type operations.

Examples of common construction activities that may result in non-storm water discharges on a project:

- Vehicle and equipment cleaning, fueling and maintenance
- Saw-cutting
- Boring
- AC and PCC grinding
- AC and PCC recycling
- Concrete mixing
- Crushing
- Blasting
- Painting
- Hydro-demolition
- Mortar mixing
- Air-blown mortar, etc.

Section 3 Best Management Practices

3.1 BMP Implementation

The Contractor is required to install BMPs as shown on the Erosion Control Plans included in Appendix R and implement/install the BMPs listed in this section of the SWPPP. The Contractor shall modify the Erosion Control Plan to reflect the phase of construction and the weather conditions. The Contractor shall install BMPs before the site is disturbed (e.g., to provide protection during grading operations or to reduce or minimize pollution from historic areas of contamination during construction). The erosion control plan shall be implemented year round.

A BMP Consideration Checklist has been provided in the body of this report, and the BMPs that are recommended for this project are included in the following sections. BMPs will be installed in a sequence to follow the progress of the grading and construction. As each area of the site is disturbed, BMPs will be installed to conform to the specific site requirements. In general, the project will have limited areas exposed at any time. Where practical, grading will occur during dry periods. Plantings shall be installed with sufficient time before rainfall begins to stabilize the soil. If this is not practical, physical means such as erosion blankets shall be used or sediment trapping devices shall be installed.

3.2 Erosion and Sediment Control

Identified in this section is a system of erosion and sediment control BMPs that have been found to be effective. As a result, there is a reduction of sediment related pollutants in storm water discharges and authorized non-storm water discharges from construction activity to the BAT/BCT standard. This General Permit additionally requires that SWPPPs be designed to address post-construction BMPs installed to reduce pollutants after construction.

3.2.1 Erosion Control

Erosion control is any source control practice that protects the soil surface and prevents soil particles from being detached by rainfall, flowing water, or wind. Erosion control consists of using project scheduling and planning to reduce soil or vegetation disturbance (particularly during the rainy season), preventing or reducing erosion potential by diverting or controlling drainage, as well as preparing and stabilizing disturbed soil areas. It should be noted that several additional BMPs, such as Check Dams (SE-4) and Fiber Rolls (SE-5) can be used for erosion control, by reducing slope length or steepness, as well as for sediment control (i.e., perimeter control or retention of sediment).

All inactive soil disturbed areas on the project site, and most active areas prior to the onset of rain, must be protected from erosion. Soil disturbed areas may include relatively flat areas as well as slopes. Typically, steep slopes and large exposed areas require the most robust erosion controls. Flatter slopes and smaller areas still require protection, but less costly materials may be appropriate for these areas, allowing savings to be directed to the more robust BMPs for steep slopes and large exposed areas. To be effective, erosion control BMPs for slopes at disturbed areas must be protected from concentrated flows.

Some erosion control BMPs can be used effectively to temporarily prevent erosion by concentrated flows. These BMPs, used alone or in combination, prevent erosion by intercepting, diverting, conveying, and discharging concentrated flows in a manner that prevents soil detachment and transport. Temporary concentrated flow conveyance controls, such as Earth Dikes and Drainage Swales (EC-9), Velocity

Dissipation Devices (EC-10) and Slope Drains (EC-11) may be required to direct run-on around or through the project in a non-erodible fashion.

The Contractor will implement the following practices for effective erosion control during construction:

- Provide effective soil cover for inactive areas and all finished slopes, open space, utility backfill, and completed lots. Inactive areas of construction are areas of construction activity that have been disturbed and are not scheduled to be re-disturbed for at least 14 days.
- Limit the use of plastic materials when more sustainable, environmentally friendly alternatives exist. Where plastic materials are deemed necessary, the discharger shall consider the use of plastic materials resistant to solar degradation.
- Implement/install the erosion control BMPs listed below.

Erosion Control BMPs

The California Stormwater BMP Handbook - Construction contains fact sheets for erosion control BMPs applicable to a wide range of project types and potential construction activities. The table below indicates the erosion control BMPs that are required, because they are certain to be needed, and those that should be implemented as needed. Erosion Control BMPs serving similar purposes shall be implemented/installed in the combination deemed most suitable for the site conditions by the QSP.

BMP#	BMP Name	Grading and Land Development	Streets and Utilities	Vertical Construction	Final Landscaping and Site Stabilization	Implement as Needed
EC-1	Scheduling	X	X	X	X	
EC-2	Preservation of Existing Vegetation					X
EC-3	Hydraulic Mulch [1]					X
EC-4	Hydroseeding [1]					X
EC-5	Soil Binders [1]					X
EC-6	Straw Mulch [1]					X
EC-7	Geotextiles & Mats [1]					X
EC-8	Wood Mulching					X
EC-9	Earth Dikes and Drainage Swales					X
EC-10	Velocity Dissipation Devices					X
EC-11	Slope Drains					X
EC-12	Streambank Stabilization					X

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EC-13	Reserved[2]					
EC-14	Compost Blankets [2]					X
EC-15	Soil Preparation / Roughening [2]					X
EC-16	Non-Vegetative Stabilization [2]					X
1) BMP fact sheet updated in 2009 2) New BMP fact sheet added in 2009		3) Temporary stabilization (must use at least one of these)				

Appendix H includes copies of the fact sheets of all the BMPs selected for this project.

3.2.2 Sediment Control

Sediment control is any practice that traps soil particles after they have been detached and moved by rain, flowing water, or wind. Sediment control measures are usually passive systems that rely on filtering or settling the particles out of the water or wind that is transporting them.

Sediment control BMPs include those practices that intercept and slow or detain the flow of storm water to allow sediment to settle and be trapped. Sediment control practices can consist of installing linear sediment barriers (such as silt fences, gravel bag berms, or fiber rolls); and constructing check dams, a sediment trap or sediment basin to retain sediment on site. Linear sediment barriers are typically placed below the toe of exposed and erodible slopes, down-slope of exposed soil areas, around soil stockpiles, and at other appropriate locations along the site perimeter. Some BMPs are dual-purpose, such as Fiber Rolls and Check Dams. By reducing effective slope length or steepness, these BMPs reduce erosion as well as promote sedimentation.

Sediment control BMPs are most effective when used in conjunction with erosion control BMPs. The combination of erosion control and sediment control is the most effective means to prevent sediment from leaving the project site and potentially entering storm drains or receiving waters. This General Permit requires that sediment controls be established and maintained at all sites, and requires the combined use with erosion controls to protect disturbed areas at most sites.

The QSP shall assure that the following practices for effective sediment control are implemented during construction:

- Effective perimeter controls are established and maintained to sufficiently control sediment discharges from the site.
- Streets are cleaned as needed to prevent unauthorized non-storm water discharges from reaching surface water or Municipal Separate Storm Sewer Systems (MS4 drainage systems).
- All run-on, all run-off within the site and all run-off that discharges off the site are effectively managed. Run-on from off-site shall be directed away from all disturbed areas or shall collectively be in compliance with the effluent limitations in this General Permit.
- Erodible landscape material is not applied at least 2 days prior to forecast rain or during rain events.
- Erodible landscape materials are stacked on pallets and covered when they are not being used or applied.
- Erodible landscape material is applied at quantities and application rates according to manufacture recommendations or based on written specifications by knowledgeable and experienced field personnel.
- Sediment control BMPs listed in the following section are implemented and installed.

Sediment Control BMPs

The California Stormwater BMP Handbook - Construction contains fact sheets for sediment control BMPs applicable to a wide range of project types and potential construction activities. The table below indicates the sediment control BMPs that are required, because they are certain to be needed, and those that should be implemented as needed. Sediment Control BMPs serving similar purposes shall be implemented/installed in the combination deemed most suitable for the site conditions by the QSP.

BMP#	**BMP Name**	**Grading and Land Development**	**Streets and Utilities**	**Vertical Construction**	**Final Landscaping and Site Stabilization**	**Implement as Needed**
SE-1	Silt Fence [1]					X
SE-2	Sediment Basin[1]					X
SE-3	Sediment Trap					X
SE-4	Check Dam [1]					X
SE-5	Fiber Rolls [1]	X	X	X	X	
SE-6	Gravel Bag Berm [1]					X
SE-7	Street Sweeping and Vacuuming	X	X	X	X	
SE-8	Sandbag Barrier[1]					X
SE-9	Straw Bale Barrier					X
SE-10	Storm Drain Inlet Protection [1]	X	X	X	X	
SE-12	Temporary Silt Dike [2]					x
SE-13	Compost Socks and Berms [2]					X
SE-14	Biofilter Bags [2]					X
1) BMP fact sheet updated in 2009 2) New BMP fact sheet added in 2009		3) Linear sediment barriers (must use at least one of these)				

Appendix H includes copies of the fact sheets of all the BMPs selected for this project.

3.2.3 Tracking Control

Tracking control consists of preventing or reducing the tracking of sediment off-site by vehicles leaving the construction area. Street Sweeping and Vacuuming (SE-7) is also a tracking control practice. All sites must have a stabilized construction entrance and implement controls to prevent off-site tracking of sediment or other loose construction-related materials. These controls should be inspected daily.

Attention to control of tracking sediment off site is essential, as dirty streets and roads near a construction site create a nuisance to the public and can generate complaints to elected officials and regulators. These complaints often result in immediate inspections and regulatory actions.

The Contractor will implement the following practices for effective sediment tracking control during construction:

- Stabilize all construction entrances and exits to prevent the off-site tracking of loose construction/landscape materials.
- Implement/install the tracking control BMPs listed below.

Tracking Control BMPs

The California Stormwater BMP Handbook - Construction contains fact sheets for tracking control BMPs. The table below indicates the tracking control BMPs that are required, because they are certain to be needed, and those that should be implemented as needed.

BMP#	BMP Name	Grading and Land Development	Streets and Utilities	Vertical Construction	Final Landscaping and Site Stabilization	Implement as Needed
TC-1	Stabilized Construction Entrance/Exit	X	X	X	X	
TC-2	Stabilized Construction Roadway	X	X	X	X	
TC-3	Entrance/Outlet Tire Wash	X	X	X	X	

Appendix H includes copies of the fact sheets of all the BMPs selected for this project.

3.2.4 Wind Erosion Control

Wind erosion control consists of applying water or other dust palliatives to prevent or minimize dust nuisance.

Other BMPs that control wind erosion are EC-1 through EC-8, and EC-14 through EC-16. Be advised that some of the dust palliatives/chemical dust suppression agents may have potential water quality impacts

The Contractor will implement the following practices for effective wind erosion control during construction:

- Good housekeeping to prevent wind erosion of materials on site.
- Implement/install the wind erosion control BMP listed below.

Wind Erosion Control BMP

The California Stormwater BMP Handbook - Construction contains a fact sheet for wind erosion control BMPs. As indicated in the table below, the wind erosion control BMPs are required.

BMP#	BMP Name	Grading and Land Development	Streets and Utilities	Vertical Construction	Final Landscaping and Site Stabilization	Implement as Needed
WE-1	Wind Erosion Control [1]	X	X	X	X	
1) BMP fact sheet updated in 2009						

Appendix H includes copies of the fact sheets of all the BMPs selected for this project.

3.3 Non-Storm Water and Materials Management

3.3.1 Non-Storm Water Management

The discharge of materials other than storm water and authorized non-storm water discharges is prohibited by NPDES regulations as well as other local codes and ordinances. It is recognized that certain authorized non-storm water discharges may be necessary for the completion of construction projects. Non-storm water management BMPs are source control BMPs that prevent pollution by limiting or reducing potential pollutants at their source or eliminating off-site discharge. These practices involve day-to-day operations of the construction site and are usually under the control of the contractor. These BMPs are also referred to as “good housekeeping practices”, which involve keeping a clean, orderly construction site. This project will incorporate “good housekeeping practices”.

The Contractor will implement the following practices for effective non-storm water management source control during construction:

- All stockpiled materials that are not actively being used shall be covered and surrounded by a berm at all times during the project. Stockpiled materials include soil, spoils, aggregate, fly-ash, stucco, hydrated lime, etc.
- All chemicals shall be sheltered and stored in watertight containers (with appropriate secondary containment to prevent any spillage or leakage) or in a storage shed (completely enclosed).
- Construction materials not designated for outdoor use shall be stored in a manner that minimizes exposure to rain.
- Contractor shall implement BMPs to prevent the off-site tracking of loose construction/landscape materials.
- Contractor shall clean streets in such a manner as to prevent unauthorized non-storm water discharges from reaching surface water or MS4 drainage systems.
- Prevent oil, grease, or fuel to leak in to the ground, storm drains or surface waters.
- Place all equipment or vehicles which are to be fueled, maintained and stored in a designated area fitted with appropriate BMPs.

- Clean leaks immediately and disposing of leaked materials properly.
- Wash vehicles in such a manner as to prevent non-storm water discharges to surface waters or MS4 drainage systems.
- Implement/install the non-storm water management source control BMPs listed below.

Non-Storm Water Management BMPs

The California Stormwater BMP Handbook - Construction contains fact sheets for non-storm water management source control BMPs applicable to a wide range of project types and potential construction activities. The table below indicates the non-storm water management source control BMPs that are required, because they are certain to be needed, and those that should be implemented as needed.

BMP#	BMP Name	Grading and Land Development	Streets and Utilities	Vertical Construction	Final Landscaping and Site Stabilization	Implement as Needed
NS-1	Water Conservation Practices	X	X	X	X	
NS-2	Dewatering Operations [1]					X
NS-3	Paving and Grinding Operations [1]		X	X		X
NS-4	Temporary Stream Crossing					X
NS-5	Clear Water Diversion					X
NS-6	Illicit Connection/ Discharge					X
NS-7	Potable Water/Irrigation					X
NS-8	Vehicle and Equipment Cleaning	X	X	X	X	
NS-9	Vehicle and Equipment Fueling	X	X	X	X	
NS-10	Vehicle and Equipment Maintenance	X	X	X	X	

NS-12	Concrete Curing [1]		x	x	x	
NS-13	Concrete Finishing [1]		X	X	X	
NS-15	Demolition Adjacent to Water					X
NS-16	Temporary Batch Plants [1]					X
1) BMP fact sheet updated in 2009						

Appendix H includes copies of the fact sheets of all the BMPs selected for this project.

3.3.2 Waste Management & Materials Pollution Control

Waste management and materials pollution control BMPs, like non-storm water management BMPs, are source control BMPs that prevent pollution by limiting or reducing potential pollutants at their source before they come in contact with storm water. These BMPs also involve day-to-day operations of the construction site which are under the control of the contractor, and are additional “good housekeeping practices” which involve keeping a clean, orderly construction site.

The Contractor will implement the following practices for effective waste management and materials pollution control during construction:

- Not dispose of rinse/wash waters to ground.
- Not allow sanitation facilities to leak. (Regular maintenance and inspection shall occur to assure that facilities do not leak.)
- Cover waste disposal containers at the end of each day and during rain events.
- Not allow discharge from waste containers.
- Protect stockpiled waste materials from wind and rain at all times (except during active use).
- Review the Spill Prevention and Control BMP WM-4. Contractor shall update the spill response procedure as necessary to be current with site conditions. Contractor shall have the necessary materials on site (spill response kit) and in a designated location for use. Spills and leaks shall be cleaned up immediately and disposed of properly. Appropriate spill response personnel shall be assigned and trained.
- Make concrete (and other) washouts water tight or arrange to have contractor/vendor to perform off-site. Contractor shall ensure the containment of concrete washout areas and other washout areas that may contain additional pollutants so there is no discharge into the underlying soil and onto the surrounding areas. Washouts shall be sized appropriately by the QSP.
- Cover stockpiled materials such as mulch and top soils when they are not actively being used.
- Shelter fertilizer containers and other landscape materials when they are not actively being used.
- Implement/install the non-storm water management source control BMPs listed below.

Waste Management & Materials Pollution Control BMPs

The California Stormwater BMP Handbook - Construction contains fact sheets for waste management & materials pollution control BMPs applicable to a wide range of project types and potential construction activities. The table below indicates the waste management & materials pollution control BMPs that are required, because they are certain to be needed, and those that should be implemented as needed.

BMP#	BMP Name	Grading and Land Development	Streets and Utilities	Vertical Construction	Final Landscaping and Site Stabilization	Implement as Needed
WM-1	Material Delivery and Storage [1]	X	X	X	X	
WM-2	Material Use [1]	X	X	X	X	
WM-3	Stockpile Management [1]	X	X	X	X	
WM-4	Spill Prevention and Control	X	X	X	X	
WM-5	Solid Waste Management	X	X	X	X	

WM-6	Hazardous Waste Management	X	X	X	X	
WM-7	Contaminated Soil Management	X	X	X	X	
WM-8	Concrete Waste Management [1]	X	X	X	X	
WM-9	Sanitary/ Septic Waste Management [1]	X	X	X	X	
WM-10	Liquid Waste Management [1]	X	X	X	X	
1) BMP fact sheet updated in 2009						

Appendix H includes copies of the fact sheets of all the BMPs selected for this project.

3.4 Post-Construction Storm Water Management Measures

The post-construction storm water management measures are described in detail in the report, “Storm Water Control Plan for Petaluma Community Sports Fields Baseball Diamond” prepared for The City Of Petaluma by BKF Engineers, dated January 15, 2020. It is recommended that the SWPPP and Storm Water Mitigation Plan be kept together at the site office.

Section 4 Rain Event Action Plan

A Rain Event Action Plan (REAP) is a document designed to protect all exposed portions of the construction site within 48 hours prior to any likely precipitation event. REAPs are also designed to ensure that the discharger has adequate materials, staff, and time to implement erosion and sediment control measures that are intended to reduce the amount of sediment and other pollutants that could be generated during the rain event. REAPs are prepared by the QSP based on the predicted rain event and construction phase, which include:

- Grading and Land Development;
- Streets and Utilities;
- Vertical Construction; and
- Final Landscaping and Site Stabilization.

REAPs are required for all Risk Level 2 and Risk Level 3 dischargers for each construction phase. An example of a REAP template is provided in Appendix P of the SWPPP. Completed REAPs must be maintained on site. It is recommended that they be maintained with the SWPPP or in an accompanying binder/folder that is referenced in the SWPPP.

The QSP must develop the REAP 48-hours in advance of any precipitation event forecast to have a 50% or greater chance of producing precipitation in the project area. The Discharger shall obtain likely precipitation forecast information from the National Weather Service Forecast Office - http://www.srh.noaa.gov/forecast. The REAP must be on site and be implemented 24 hours in advance of any predicted precipitation event.

At a minimum the REAP must include the following site and phase-specific information:

- Site Address;
- Calculated Risk Level (2 or 3);
- Site Stormwater Manager information including the name, company, and 24-hour emergency telephone number;
- Erosion and Sediment Control Provider information including the name, company, and 24-hour emergency telephone number;
- Stormwater Sampling Agent information including the name, company, and 24-hour emergency telephone number;
- Activities associated with each construction phase;
- Trades active on the construction site during each construction phase;
- Trade contractor information; and
- Suggested actions for each project phase.

Section 5 BMP Inspection, Maintenance, and Repair

5.1 Construction Site Monitoring Program

Contractor shall ensure that all inspection, maintenance repair and sampling activities at the project location are performed or supervised by a Qualified SWPPP Practitioner (QSP) representing the discharger. The QSP shall complete inspections of all BMPs as required to ensure proper functioning of the BMPs at all times during construction. The QSP may delegate any or all of these activities to an employee trained to do the task(s) appropriately, but shall ensure adequate deployment. The QSP is to implement the Construction Site Monitoring Program (CSMP) in accordance with the requirements found in Appendix A. The CSMP is included in this SWPPP in Appendix S, and shall incorporate a description of the BMP inspection locations, inspection procedures, and inspection follow-up and tracking procedures, including BMP maintenance and repair, sampling and analysis (if needed), SWPPP amendments (if needed).

Contractor shall purchase a turbidity meter and a pH meter. The QSP shall be trained in the use of both meters.

Section 6 Training

The Contractor shall designate a Qualified SWPPP Practitioner (QSP). The QSP must receive training and possess one of the certifications and or registrations specified in Table 9 of the 2009 Construction General Permit by the 2011 deadline established by the SWRCB.

The QSP is required to document all training activities (formal and informal), and retain a record of training activities in SWPPP Appendix K. Training documentation must also be submitted in the Annual Report.

The Contractor's Qualified SWPPP Practitioner is TBD

Other Contractor personnel attending tailgate training will document attendance using the form in Attachment I. Informal training will include tailgate site briefings to be conducted bi-weekly, and will address the following topics:

- Erosion Control BMPs
- Sediment Control BMPs
- Non-Storm Water BMPs
- Waste Management and Materials Pollution Control BMPs
- Emergency Procedures specific to the construction site storm water management

This SWPPP was prepared by BKF Engineers, under the direction of Rick Carlile, a registered Professional Engineer in the State of California and a Qualified SWPPP Developer. Jason Kirchmann has over 5 years of experience in the preparation of SWPPPs, and has the following previous experience:

- Has prepared over 15 project-specific SWPPPs

Section 7 Responsible Parties and Operators

7.1 Responsible Parties

A list of authorized representatives, along with project site personnel who are responsible for SWPPP activities, including the QSD and QSP, has been provided in Appendix L. This list includes the names of the individuals granted authority to sign permit-related documents.

7.2 Contractor List

The QSP is required to notify all contractors and subcontractors of the requirement for storm water management measures during the project. A list of contractors and subcontractors shall be maintained by the QSP and included in Appendix M. If subcontractors change during the project, the list will be updated accordingly. A sample “Subcontractor Notification Letter” and log is included in Appendix M.

List of Appendices

APPENDIX A

CONSTRUCTION GENERAL PERMIT

(Sections Applicable to Risk Level 2 Projects)

(Not Included in Version of SWPPP Posted on SMARTS.)

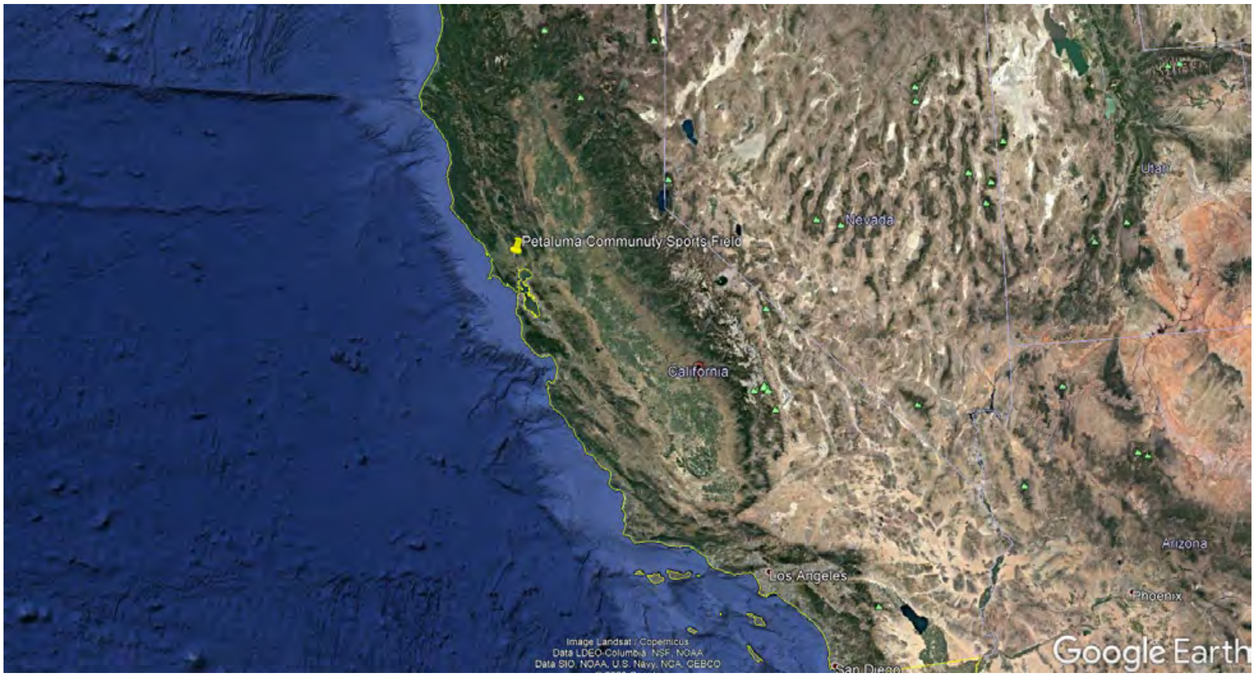
APPENDIX B

SUBMITTED PERMIT REGISTRATION DOCUMENTS

The following documents are to be filed electronically via the SMARTS system and included in this appendix per Attachment B, Section J of the General Permit. Paper copies of duplicate documents are not included in Appendix B.

1. Notice of Intent (NOI).
2. Site Map – See site map legend for specific documents to be included.
3. SWPPP – SWPPP consists of this entire document.
4. Risk Assessment – Documentation of risk assessment calculations.
5. Post Construction Water Balance Calculator – NOT APPLICABLE TO THIS LOCATION.
6. ATS Design Document and Certification – NOT APPLICABLE TO THIS PROJECT.

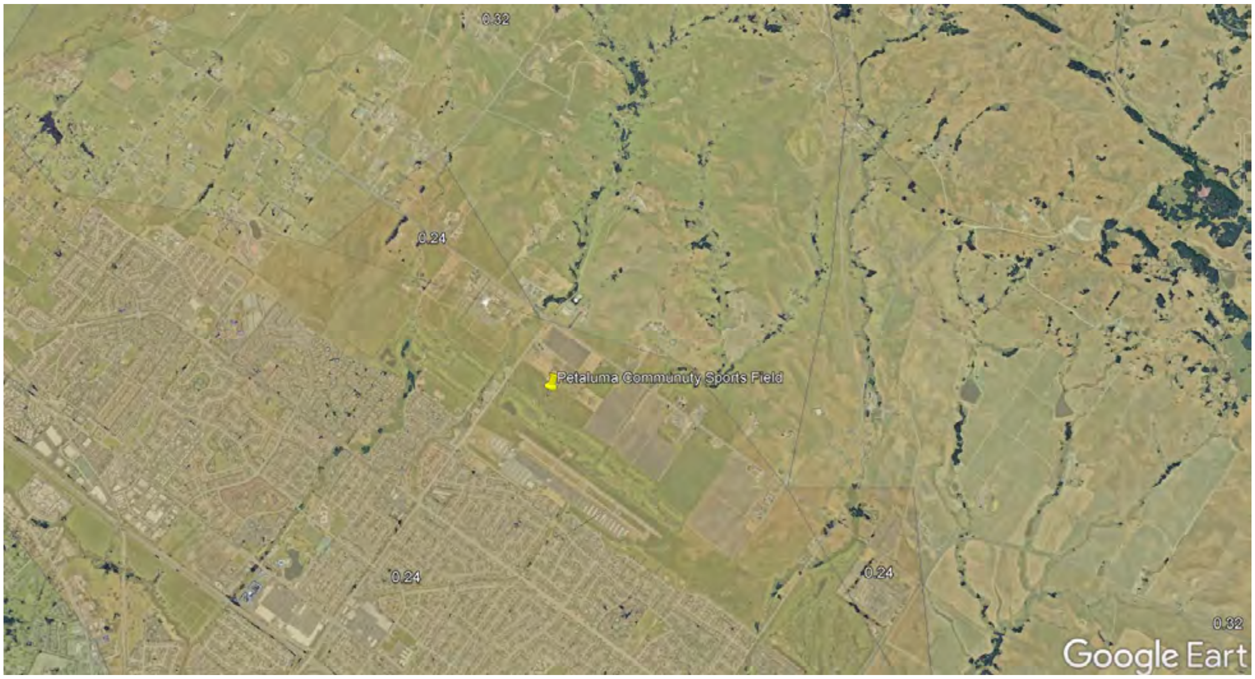
STATE LOCATION MAP



LOCAL VICINITY MAP

LS FACTOR MAP

K FACTOR


0.32
0.24
Petaluma Communuty Sports Field
0.24
0.24
0.32
Google Eart

RECEIVING WATER RISK

	A	B	C
1	**Sediment Risk Factor Worksheet**		**Entry**
2	**A) R Factor**		
3	Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site.		
4	http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm		
5	**R Factor Value**		74.53
6	**B) K Factor (weighted average, by area, for all site soils)**		
7	The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted.		
8	Site-specific K factor guidance		
9	**K Factor Value**		0.24
10	**C) LS Factor (weighted average, by area, for all slopes)**		
11	The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.		
12	LS Table		
13	**LS Factor Value**		0.44
14			
15	**Watershed Erosion Estimate (=RxKxLS) in tons/acre**	7.870368	
16	**Site Sediment Risk Factor**	**Low**	
17	Low Sediment Risk: < 15 tons/acre		
18	Medium Sediment Risk: >=15 and <75 tons/acre		
19	High Sediment Risk: >= 75 tons/acre		
20			

Receiving Water (RW) Risk Factor Worksheet	**Entry**	**Score**
A. Watershed Characteristics	**yes/no**	
A.1. Does the disturbed area discharge (either directly or indirectly) to a **303(d)-listed waterbody impaired by sediment** (For help with impaired waterbodies please visit the link below) or has a **USEPA approved TMDL implementation plan for sediment**?: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml **OR** A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? (For help please review the appropriate Regional Board Basin Plan) http://www.waterboards.ca.gov/waterboards_map.shtml	**Yes**	**High**
Region 1 Basin Plan Region 2 Basin Plan Region 3 Basin Plan Region 4 Basin Plan Region 5 Basin Plan Region 6 Basin Plan Region 7 Basin Plan Region 8 Basin Plan Region 9 Basin Plan		

Combined Risk Level Matrix

<table>
<tr><td></td><td></td><td colspan="3">Sediment Risk</td></tr>
<tr><td></td><td></td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td>Receiving Water Risk</td><td>Low</td><td>Level 1</td><td colspan="2">Level 2</td></tr>
<tr><td></td><td>High</td><td colspan="2">Level 2</td><td>Level 3</td></tr>
</table>

Project Sediment Risk:	**Low**
Project RW Risk:	**High**
Project Combined Risk:	**Level 2**

DRAFT

CONTACT US

SHARE

National Pollutant Discharge Elimination System (NPDES)

Rainfall Erosivity Factor Calculator for Small Construction Sites

EPA's stormwater regulations allow NPDES permitting authorities to waive NPDES permitting requirements for stormwater discharges from small construction sites if:

- the construction site disturbs less than five acres, and
- the rainfall erosivity factor ("R" in the revised universal soil loss equation, or RUSLE) value is less than five during the period of construction activity.

If your small construction project is located in an area where EPA is the permitting authority and your R factor is less than five, you qualify for a low erosivity waiver (LEW) from NPDES stormwater permitting. If your small construction project does not qualify for a waiver, then NPDES stormwater permit coverage is required. Follow the steps below to calculate your R-Factor.

LEW certifications are submitted through the NPDES eReporting Tool or "CGP-NeT". Several states that are authorized to implement the NPDES permitting program also accept LEWs. Check with your state NPDES permitting authority for more information.

- Submit your LEW through EPA's eReporting Tool
- List of states, Indian country, and territories where EPA is the permitting authority
- Construction Rainfall Erosivity Waiver Fact Sheet
- Appendix C of the 2017 CGP – Small Construction Waivers and Instructions

The R-factor calculation can also be integrated directly into custom applications using the R-Factor web service.

For questions or comments, email EPA's CGP staff at cgp@epa.gov.

● Select the estimated start and end dates of construction by clicking the boxes and using the dropdown calendar.

The period of construction activity begins at initial earth disturbance and ends with final stabilization.

Start Date: 08/01/2020 **End Date:** 10/01/2021

● Locate your small construction project using the search box below or by clicking on the map.

Location: -122.60788948204734 , 38.26310180765562 **Search**

● Click the "Calculate R Factor" button below to calculate an R Factor for your small construction project.

Calculate R Factor

Facility Information

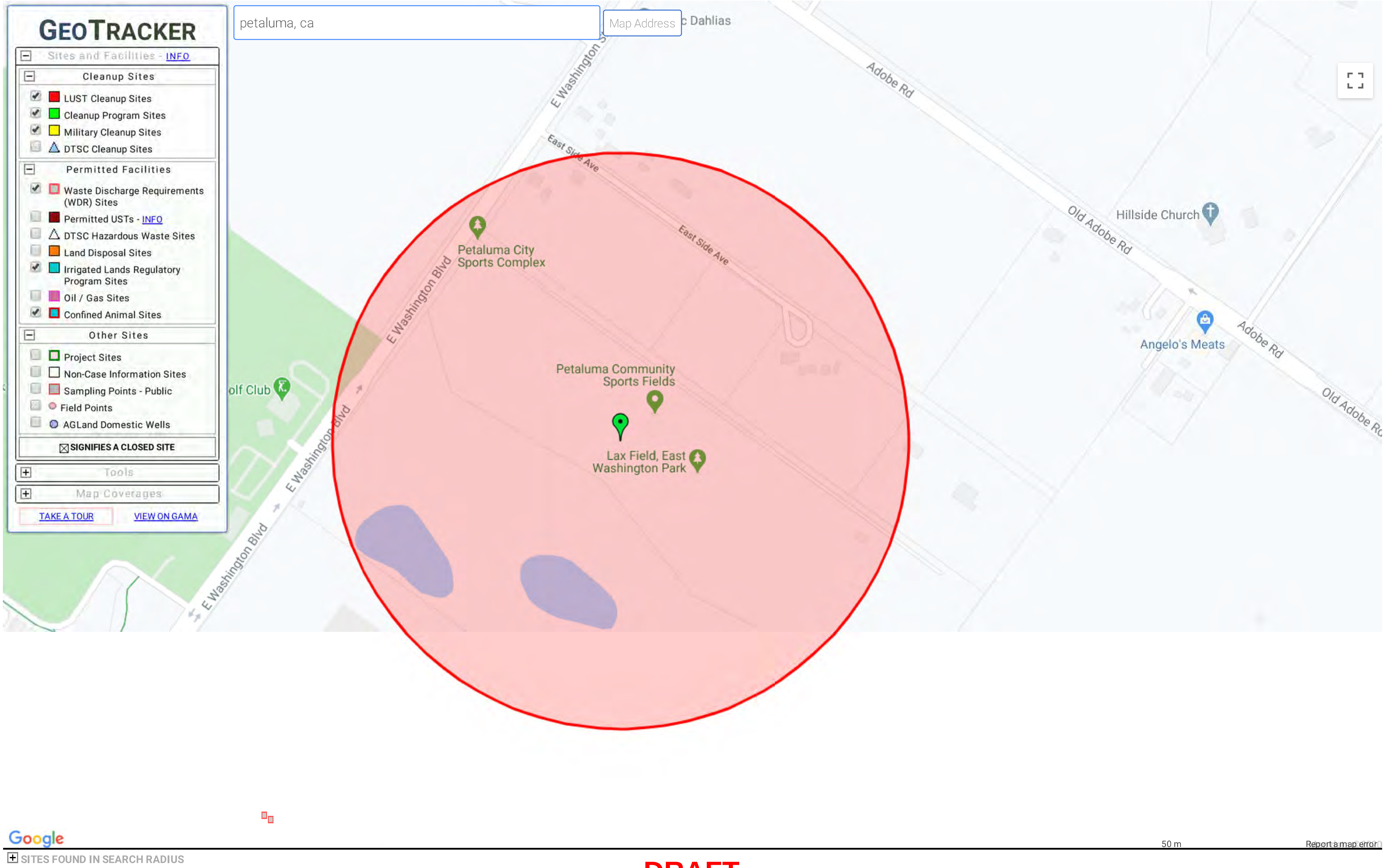
Start Date: 08/01/2020	**Latitude:** 38.2631
End Date: 10/01/2021	**Longitude:** -122.6079

Calculation Results

Rainfall erosivity factor (R Factor) = **74.53**

A rainfall erosivity factor of 5.0 or greater has been calculated for your site's period of construction.

You do NOT qualify for a waiver from NPDES permitting requirements and must seek Construction General Permit (CGP) coverage. If you are located in an area where EPA is the permitting authority, you must submit a Notice of Intent (NOI) through the NPDES eReporting Tool (NeT).Otherwise, you must seek coverage under your state's CGP.



GEOTRACKER

⊟ Sites and Facilities - INFO

⊟ Cleanup Sites

- ☑ 🟥 LUST Cleanup Sites
- ☑ 🟩 Cleanup Program Sites
- ☑ 🟨 Military Cleanup Sites
- ☐ △ DTSC Cleanup Sites

⊟ Permitted Facilities

- ☑ 🟥 Waste Discharge Requirements (WDR) Sites
- ☐ 🟥 Permitted USTs - INFO
- ☐ △ DTSC Hazardous Waste Sites
- ☐ 🟧 Land Disposal Sites
- ☑ 🟦 Irrigated Lands Regulatory Program Sites
- ☐ 🟪 Oil / Gas Sites
- ☑ 🟥 Confined Animal Sites

⊟ Other Sites

- ☐ 🟩 Project Sites
- ☐ ☐ Non-Case Information Sites
- ☐ 🟥 Sampling Points - Public
- ☐ ○ Field Points
- ☐ ● AGLand Domestic Wells

☒ SIGNIFIES A CLOSED SITE

⊞ Tools

⊞ Map Coverages

TAKE A TOUR   VIEW ON GAMA

petaluma, ca

⊞ SITES FOUND IN SEARCH RADIUS

DRAFT

Site Maps

For:
Petaluma Community Sports Field Baseball Diamond
2430 E Washington St
Petaluma, California 94954
APN: 136-070-031

WDID No.:___________

The following list of referenced plans incorporate the information listed under Attachment B, Section J.2 of the General Permit.

a. Vicinity Map – See vicinity map.
b. Site Layout – See Improvement Drawings.
c. Site Boundaries - See Improvement Drawings.
d. Drainage Areas – See Stormwater Control Plan.
e. Discharge locations – Site Improvement Drawings.
f. Sampling locations – See SWPPP Drawings.
g. Disturbed areas – Entire site is disturbed.
h. Active Disturbed Areas – Entire site is disturbed.
i. Runoff BMP Locations – See Improvement Drawings and Storm Water Control Plan.
j. Erosion Control BMPs – See Improvement Drawings.
k. Sediment Control BMPs – See Improvement Drawings.
l. ATS Location – N/A
m. Sensitive habitats – N/A. Watercourses – N/A
n. Post-Construction BMPs – See Improvement Drawings and Storm Water Control Plan.
o. Construction Activities Locations – TBD. This will be shown/updated on contractor markup of Appendix T. See SWPPP Drawings for preliminary plan.

Note that Items b - e & i - k & m - o are included in a separate SMARTS upload, but are not included in the hard copy of the SWPPP. Refer to the referenced sheets for this information.

GENERAL NOTES

1. ALL MATERIALS, WORKMANSHIP AND CONSTRUCTION SHALL FULLY CONFORM WITH THE SPECIFICATIONS, STANDARDS AND ORDINANCES OF THE CITY OF PETALUMA.

2. ALL CITY OF PETALUMA STANDARD DETAIL PLANS AND DETAIL SPECIFICATIONS AS AMENDED ARE PART OF THESES PLANS. VARIANCES FROM STANDARD DETAILS OR THESE PLANS REQUIRE THE PRIOR WRITTEN APPROVAL OF THE CITY ENGINEER.

3. THE CITY ENGINEER SHALL HAVE 48-HOUR NOTICE FOR INSPECTION.

4. THE CONTRACTOR SHALL COMPLY FULLY WITH THE REQUIREMENTS OF ASSEMBLY BILL (2040) DAVIS, ASBESTOS.

5. BLASTING (IF REQUIRED) REQUIRES A PERMIT FROM THE CITY FIRE DEPARTMENT.

6. A DEMOLITION PERMIT IS REQUIRED FOR THE REMOVAL OF EXISTING STRUCTURES NOT DESIGNATED TO BE REMOVED.

7. HOURS OF CONSTRUCTION SHALL BE LIMITED TO THE HOURS BETWEEN 7:00 AM AND 7:00 PM, MONDAY THROUGH FRIDAY, EXCEPT THAT INDOOR WORK MAY BE CONDUCTED ON SATURDAYS PROVIDED NOISE LEVELS GENERATED ARE ACCEPTABLE TO NEARBY RESIDENTS. NO CONSTRUCTION WORK SHALL BE PERMITTED ON CITY RECOGNIZED HOLIDAYS, AND SUNDAYS.

8. IF CONCENTRATION OF HISTORIC OR PREHISTORIC MATERIALS ARE ENCOUNTERED DURING GRADING OR OTHER GROUND-DISTURBING ACTIVITIES, WORK IN THE IMMEDIATE AREA OF THE FINDS SHALL BE HALTED AND THE CITY STAFF NOTIFIED. A QUALIFIED HISTORIC ARCHAEOLOGIST SHALL THEN BE CONSULTED FOR FURTHER EVALUATION OF THE SITUATION, AND ANY SUBSEQUENT RECOMMENDATIONS IMPLEMENTED.

9. NO COMBUSTIBLE CONSTRUCTION IS PERMITTED ABOVE THE FOUNDATION UNLESS AN ALL WEATHER HARD SURFACE ROAD IS PROVIDED TO WITHIN ONE HUNDRED-FIFTY FEET OF THE FARTHEST POINT OF THE BUILDING OR STRUCTURE.

10. THE CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, THE CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR ON-SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS.

11. THE CONTRACTOR AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE WILLFUL MISCONDUCT OR SOLE NEGLIGENCE OF THE DESIGN PROFESSIONAL OR OWNER.

12. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE LOCATION OF ALL EXISTING UTILITIES WITH APPROPRIATE AGENCIES.

13. THE CONTRACTOR SHALL EXPOSE ALL EXISTING UTILITIES INCLUDING SEWERS AND STORM DRAINS PRIOR TO ANY TRENCHING TO ALLOW THE ENGINEER TO VERIFY THE GRADE AND ALIGNMENT OF THE UTILITIES, AND TO VERIFY DESIGN ASSUMPTIONS AND EXACT FIELD LOCATION. EXISTING UTILITIES MAY REQUIRE RELOCATION AND/OR PROPOSED IMPROVEMENT MAY REQUIRE GRADE OR ALIGNMENT REVISION DUE TO FIELD CONDITIONS. THE CONTRACTOR IS CAUTIONED NOT TO ORDER PRECAST ITEMS OR INSTALL ANY IMPROVEMENTS UNTIL ALL CONFLICTS ARE RESOLVED. ALL IMPROVEMENTS INSTALLED OR ORDERED PRIOR TO CONFLICT RESOLUTION SHALL BE DONE SOLELY AT THE CONTRACTOR'S RISK AND AT NO EXPENSE TO THE OWNER.

14. THE CONTRACTOR SHALL CALL “UNDERGROUND SERVICE ALERT” AT (800) 642-2444 AT LEAST ONE WEEK PRIOR TO START OF CONSTRUCTION FOR LOCATING UNDERGROUND UTILITIES.

15. ANY DAMAGE TO EXISTING FACILITIES DURING CONSTRUCTION WILL BE REPAIRED IMMEDIATELY BY THE CONTRACTOR, AT HIS COST, TO THE SAME CONDITION OR BETTER AND AT THE DIRECTION OF THE APPROPRIATE AGENCY.

16. THE LOCATIONS OF UNDERGROUND OBSTRUCTIONS SHOWN ON THE PLANS ARE APPROXIMATE ONLY AND SHOULD NOT BE TAKEN AS FINAL OR ALL INCLUSIVE. THE CONTRACTOR IS CAUTIONED THAT THE PLANS MAY NOT INCLUDE ALL EXISTING UTILITIES AND THAT THE OWNER, ENGINEER AND CITY OF PETALUMA ASSUMES NO RESPONSIBILITY FOR OBSTRUCTIONS WHICH MAY BE ENCOUNTERED.

17. UNAUTHORIZED CHANGES & USES: THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

18. ALL CITY PUBLIC UTILITIES PROPOSED IN UNIMPROVED EASEMENTS SHALL HAVE A MAINTENANCE ACCESS ROAD BUILT THEREON IN ACCORDANCE WITH CITY STANDARDS.

19. EXCAVATIONS OVER FIVE FEET DEEP REQUIRE AN EXCAVATION PERMIT FROM THE STATE DEPARTMENT OF INDUSTRIAL SAFETY.

20. MANHOLE FRAMES AND COVERS SHALL BE BROUGHT TO FINISH GRADE AFTER PAVING.

21. THE CONCRETE CONTRACTOR SHALL STAMP THE LETTER “S” ON THE FACE OF CURB DIRECTLY ABOVE THE SEWER LATERAL, “W” ON THE FACE OF CURB DIRECTLY ABOVE THE WATER SERVICES, AND “B” ON THE FACE OF CURB ABOVE A BLOWOFF OR AIR RELIEF VALVE. LETTERS SHALL BE NEAT, CLEAR AND 4-INCHES HIGH.

UNLESS OTHERWISE NOTED ON THESE PLANS, PIPE MATERIALS SHALL BE THE FOLLOWING:

SANITARY SEWER - FORCE MAIN: DR-11
STORM DRAIN - HDPE ADS N-12
WATER MAINS - PVC C900 CL150
WATER LATERALS - PER CITY DETAILS
WATER HYDRANT RUNS - PER CITY SPECIFICATIONS

22. ALL WATER MAINS, WATER SERVICES AND SEWER LATERALS REQUIRING RELOCATION SHALL BE ACCURATELY LOCATED BY THE CONTRACTOR AND SHOWN UPON THE CONSTRUCTION PLANS. ONE SET OF “DRAWINGS OF RECORD” PLANS SO MARKED AND CERTIFIED AS TO ACCURACY AND COMPLETENESS BY THE CONTRACTOR SHALL BE RETURNED TO THE CITY ENGINEER BY THE CONTRACTOR.

23. ALL SEWER PIPE LENGTHS SHOWN ARE MEASURED HORIZONTALLY TO CENTER OF MANHOLES AND CLEANOUTS.

24. SEWER LATERALS SHALL HAVE 4.5 FEET OF COVER (FROM T.C. AT CURB LINE) AND NOT LESS THAN 1/4-INCH FALL PER FOOT. SEWER LATERALS SHALL BE PLACED UNDER THE UNDERGROUND JOINT TRENCH UTILITIES AND KEPT CLEAR OF DRIVEWAYS.

25. THE NEW WATER LINES SHALL NOT BE PHYSICALLY CONNECTED TO THE CITY WATER SYSTEM UNTIL TESTED, CHLORINATED, AND APPROVED. WATER MAINS SHALL BE INSTALLED WITH A MINIMUM COVER OF 3.5 FEET FROM FINISHED GRADE.

26. FIVE HOURS MAXIMUM SHUTDOWN TIME OF EXISTING MAINS WHILE MAKING CONNECTIONS; 24-HOUR NOTICE OF SHUTDOWN TO BE GIVEN BY SUBDIVIDER TO ALL WATER CUSTOMERS. EXISTING VALVES TO BE OPERATED BY CITY WATER DIVISION PERSONNEL ONLY.

27. ALL HOT TAPS TO EXISTING CITY MAINS LARGER THAN 2” SHALL BE DONE BY CITY WATER DEPARTMENT PERSONNEL UNLESS OTHERWISE DETERMINED BY THE WATER DEPARTMENT SUPERINTENDENT.

28. WHEREVER POSSIBLE, GATE VALVES SHOULD BE LOCATED ON THE PROJECTION OF CURB LINES.

29. WATER SERVICES SHALL BE PLACED OVER THE TOP OF THE UNDERGROUND JOINT TRENCH UTILITIES. WATER SERVICES SHALL NOT BE INSTALLED WITHIN CURB CUTS FOR DRIVEWAYS.

30. ALL FIRE HYDRANTS FOR THE PROJECT MUST BE TESTED, FLUSHED, AND IN SERVICE PRIOR TO THE COMMENCEMENT OF COMBUSTIBLE CONSTRUCTION ON THE SITE.

31. PROVIDE FIRE HYDRANT MARKERS AT EACH HYDRANT LOCATION AS SHOWN ON CITY STANDARD DET. 857.02.

32. ALL DRAINAGE FACILITIES SHALL BE INSTALLED IN ACCORDANCE WITH THE “SONOMA COUNTY WATER AGENCY FLOOD CONTROL DESIGN STANDARDS” AND THE CITY OF PETALUMA “STORM DRAIN DETAIL SPECIFICATION NO. 31”.

33. ALL STORM DRAINPIPE LENGTHS SHOWN ARE MEASURED HORIZONTALLY EXCLUDING ALL STRUCTURES AND END SECTIONS.

34. ALL SIDE OPENINGS OF STORM DRAIN INLETS SHALL BE IN THE DIRECTION OF UPSTREAM FLOW.

35. THE CONTRACTOR SHALL HIRE AN INDEPENDENT TELEVISION INSPECTION SERVICE TO PERFORM A CLOSED-CIRCUIT TELEVISION INSPECTION OF ALL NEWLY CONSTRUCTED STORM DRAINS. RECORDS SHALL BE SUBMITTED TO CITY OF PETALUMA PUBLIC WORKS DEPARTMENT.

36. WHERE THE NEW AC PAVEMENT OF THIS IMPROVEMENT JOINS EXISTING STREETS, IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CONSTRUCT PAVEMENT CONFORMS AS REQUIRED BY THE PLANS.

37. THE SURFACE COURSE OF ASPHALT CONCRETE SHALL CONSIST OF 1/2-INCH MAXIMUM MEDIUM GRADED AGGREGATE.

38. AGGREGATE BASE MATERIALS SHALL BE PLACED IN ACCORDANCE WITH SECTION 26-1.04 OF THE STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA, LATEST EDITION.

39. GRADE BREAKS ON CURBS AND SIDEWALKS TO BE ROUNDED OFF IN FORMS AND FINISHED SURFACING.

40. INSTALL SIGNING AND STRIPING TO CONFORM WITH THE CURRENT EDITION OF THE CALTRANS TRAFFIC MANUAL. (SIGNING AND STRIPING DIAGRAMS - SEE SHEET NO. C7.1 OF THESE IMPROVEMENT PLANS.)

41. ROUTES OF INGRESS TO AND EGRESS FROM PROJECT SITE FOR ALL HEAVY CONSTRUCTION VEHICLES SHALL BE VIA EAST WASHINGTON STREET.

42. GRADING SHALL BE DONE IN CONFORMANCE WITH THE GEOTECHNICAL DESIGN RECOMMENDATIONS DATED JANUARY 10, 2020 PREPARED BY MILLER PACIFIC ENGINEERING GROUP, SHALL CONFORM WITH CHAPTER 18 AND APPENDIX J, OF THE UNIFORM BUILDING CODE, 1988 EDITION, AND SHALL BE PERFORMED UNDER THE OBSERVATION OF A SOILS ENGINEER.

43. THE CONTRACTOR SHALL PROVIDE RECORD DRAWINGS BY THE CONTRACTOR FOR ANY SUBDRAINS REQUIRED BY THE PROJECT SOILS ENGINEER DURING CONSTRUCTION.

44. MILLER PACIFIC ENGINEERING GROUP IS THE GEOTECHNICAL ENGINEER TO BE CONTACTED FOR SOIL RELATED CONSTRUCTION. PROVIDE A MINIMUM OF 48 HOURS NOTICE FOR INITIAL SITE VISIT AND 24 HOURS NOTICE FOR SUBSEQUENT INSPECTION NOTIFICATIONS.

45. ALL OFF-SITE DRAINAGE IMPROVEMENTS SHALL BE COMPLETED PRIOR TO OCTOBER 15. THE CONTRACTOR SHALL COMPLY WITH ALL PROVISIONS OF FISH AND WILDLIFE PERMITS, IF ANY, OBTAINED FOR THIS PROJECT.

46. THE CONTRACTOR SHALL SUBMIT A GRADING SCHEDULE FOR REVIEW BY THE BUILDING DEPARTMENT PRIOR TO ISSUANCE OF THE GRADING PERMIT TO ASSURE COMPLETION OF THIS PROJECT PRIOR TO WINTER RAINS OR PROVIDE MEASURES FOR WINTERIZING INCOMPLETE WORK.

47. ALL EARTH CUT OR TRENCHING SPOIL EXCESS MATERIAL SHALL BE COMPLETELY REMOVED TO AN OFF-SITE LOCATION APPROVED BY THE CITY BUILDING DEPARTMENT. TEMPORARY STOCKPILES ARE NOT PERMITTED ADJACENT TO THE EXISTING HOMES OR WITHIN THE DRIP LINES OF TREES TO BE SAVED. TEMPORARY STOCKPILES SHALL NOT OBSTRUCT EXISTING DRAINAGE FLOWS.

48. THE CONTRACTOR SHALL PROVIDE FOR EROSION AND SEDIMENT TRANSPORT CONTROL, DUST, NOISE CONTROL AS REQUIRED BY GOVERNING AGENCIES.

49. ALL GRADED AREA SHALL BE HYDRO-SEEDED PRIOR TO WINTER RAINS.

MAPPING NOTES

PRESERVE AND PERPETUATE EXISTING SURVEY MONUMENTATION WHICH WILL BE DISTURBED OR REMOVED TO FACILITATE THE PROPOSED IMPROVEMENTS. IF WORK WILL BE CONDUCTED IN AN AREA WHICH RESULTS IN THE DISTURBANCE OF MONUMENTATION, RETAIN THE SERVICES OF A LICENSED LAND SURVEYOR TO LOCATE SAID MONUMENTATION PRIOR TO DISTURBANCE. ADDITIONALLY, RETAIN THE SERVICES OF A LICENSED LAND SURVEYOR TO RE-ESTABLISH MONUMENTATION WHICH HAS BEEN DISTURBED AS A RESULT OF PROJECT CONSTRUCTION AND TO FILE THE APPROPRIATE DOCUMENTATION, PURSUANT TO BUSINESS AND PROFESSIONS CODE SECTION 8771, WITH THE SONOMA COUNTY RECORDER ONCE CONSTRUCTION IS COMPLETE.

TOPOGRAPHIC INFORMATION SHOWN HEREON WAS MAPPED BY WILLIS LAND SURVEYING AND SUPPLEMENTED BY BKF ENGINEERS.

TREE TRUNK DIAMETERS ARE APPROXIMATE AND WERE MEASURED AT CHEST HEIGHT (48”±). CONSULT A CERTIFIED TREE ARBORIST WHEN IT IS NECESSARY TO ACCURATELY DETERMINE PERTINENT TREE INFORMATION.

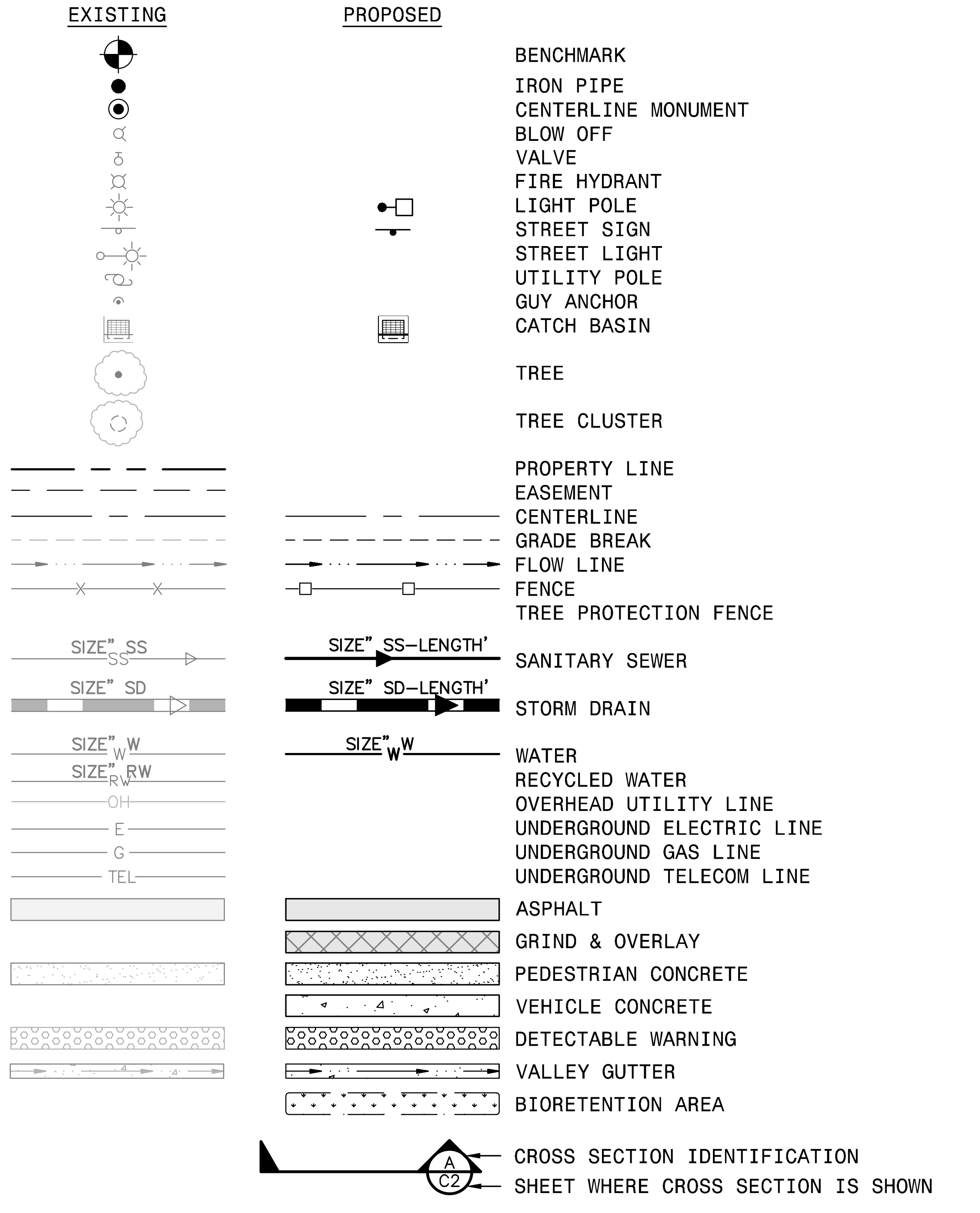
BOUNDARY INFORMATION SHOWN HEREON IS NOT A BOUNDARY SURVEY. THE LINE WORK SHOWN WAS COMPILED FROM RECORD INFORMATION ONLY AND AS SUCH IT SHOULD NOT BE REPRESENTED OR CONSTRUED AS ACTUAL ENTITLEMENT.

BENCHMARK: THE VERTICAL DATUM FOR THIS PROJECT IS BASED UPON THE LOCAL CITY BENCHMARK - MONUMENT DISC IN MONUMENT WELL AT THE INTERSECTION OF E WASHINGTON AND REDWOOD CIRCLE.
ELEVATION OF SAID BENCHMARK IS ASSUMED 76.27 FEET NGVD 29.

BASIS OF BEARINGS: BASIS OF BEARING IS N35°19'52"E BETWEEN FOUND CITY STREET MONUMENTS ALONG E WASHINGTON STREET AT REDWOOD CIRCLE AND PARKLAND WAY AS SHOWN ON THAT CERTAIN RECORD OF SURVEY FILED IN BOOK 377 AT PAGE 21, OFFICIAL RECORDS OF SONOMA COUNTY.

BKF
ENGINEERS / SURVEYORS / PLANNERS
200 4TH ST, STE. 300 SANTA ROSA, CA 95401
(707) 583-8500 FAX: (707) 583-8539

SYMBOLS & LEGEND



APPROXIMATE SITE EARTHWORK VOLUME TABLE		
CUT (CY)	FILL (CY)	NET (CY)*
9,000	6,500	2,500 CUT

ABBREVIATIONS

±	MORE OR LESS	FT	FOOT	SF	SQUARE FEET
AB	AGGREGATE BASE	GB	GRADE BREAK	SG	SUBGRADE
AC	ASPHALT CONCRETE	GI	GRATE INLET	SO	SIDE OPENING
APN	ASSESSOR'S PARCEL NUMBER	INV	BOTTOM INSIDE OF PIPE	SS	SANITARY SEWER
BO	BLOWOFF	L	LENGTH	SSCO	SANITARY SEWER CLEAN OUT
BW	BOTTOM OF WALL	LT	LEFT	SSMH	SANITARY SEWER MANHOLE
CB	CATCH BASIN	LP	LIGHT POLE	STA	STATION
CL	CENTERLINE	MAX	MAXIMUM	STD	STANDARD
CL2	CLASS II	MH	MANHOLE	TB	TOP OF BOX
CO	CLEAN OUT	MIN	MINIMUM	TC	TOP OF CURB
CONC	CONCRETE	NO	NUMBER	TF	TRANSFORMER
DI	DROP INLET	NTS	NOT TO SCALE	TFC	TOP OF FLUSH CURB
DW	DRIVEWAY	PCC	PORTLAND CEMENT CONCRETE	TG	TOP OF GRATE
E	ELECTRIC	PL	PROPERTY LINE	TW	TOP OF WALL
EG	EXISTING GROUND	PUE	PUBLIC UTILITY EASEMENT	TYP	TYPICAL
ELEV	ELEVATION	R	RADIUS	UB	UTILITY BOX
EP	EDGE OF PAVEMENT	RT	RIGHT	UP	UTILITY POLE
ER	EDGE OF ROAD	RTWL	RETAINING WALL	VC	VERTICAL CURVE
ESMT	EASEMENT	R/W	RIGHT OF WAY	VLT	VAULT
EX	EXISTING	S=	SLOPE	W	WATER
FF	FINISHED FLOOR	SD	STORM DRAIN	WL	WHITE LINE
FG	FINISHED GRADE	SDCO	STORM DRAIN CLEANOUT	WM	WATER METER
FL	SURFACE FLOWLINE	SDMH	STORM DRAIN MANHOLE	WS	WATER SERVICE

LICENSED PROFESSIONAL ENGINEER
RICHARD E. CARLILE
No. 57885
CIVIL
STATE OF CALIFORNIA
4-8-2021

DES: RFC
DRWN: RFC
CHKD: RFC

GSM landscape architects, inc.
landscape architecture
site planning
1700 Soscol Ave., Suite 23
Napa, CA 94559
(707) 255-4630
www.gsmlainc.com

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PUBLIC WORKS & UTILITIES
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PH. 707-778-4546 FAX. 707-778-4508

PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND
GENERAL NOTES, LEGEND, & ABBREVIATIONS
2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 4/12/21
FILE NO: 16913I_SITE
JOB NO: 1628
SHEET NO:
C0.1
OF 59

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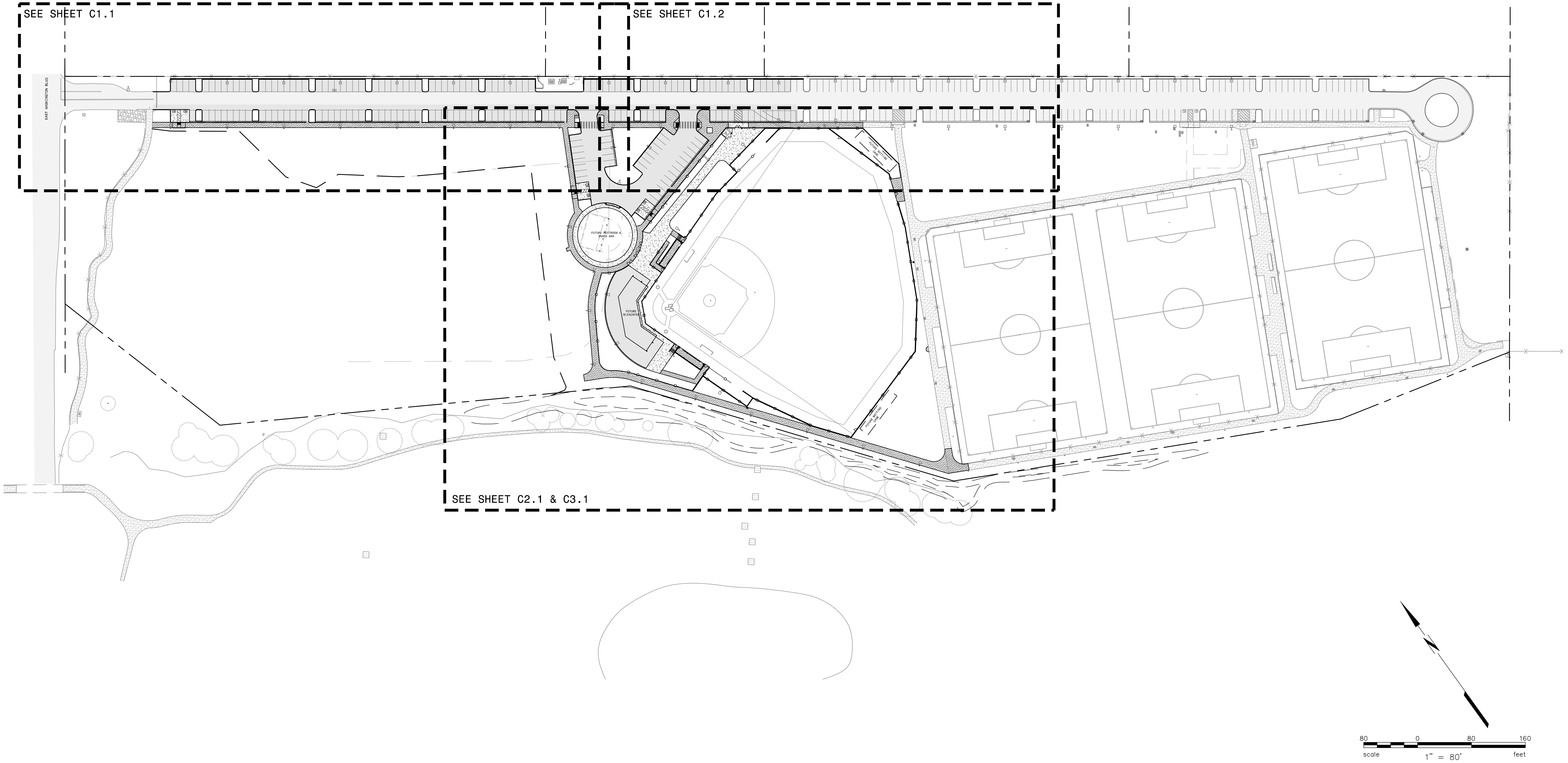

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PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND
SITE DEVELOPMENT MAP
2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 4/12/21
FILE NO: 169131_SITE
JOB NO: 1628
SHEET NO:
C0.2
OF 59

No. 57885
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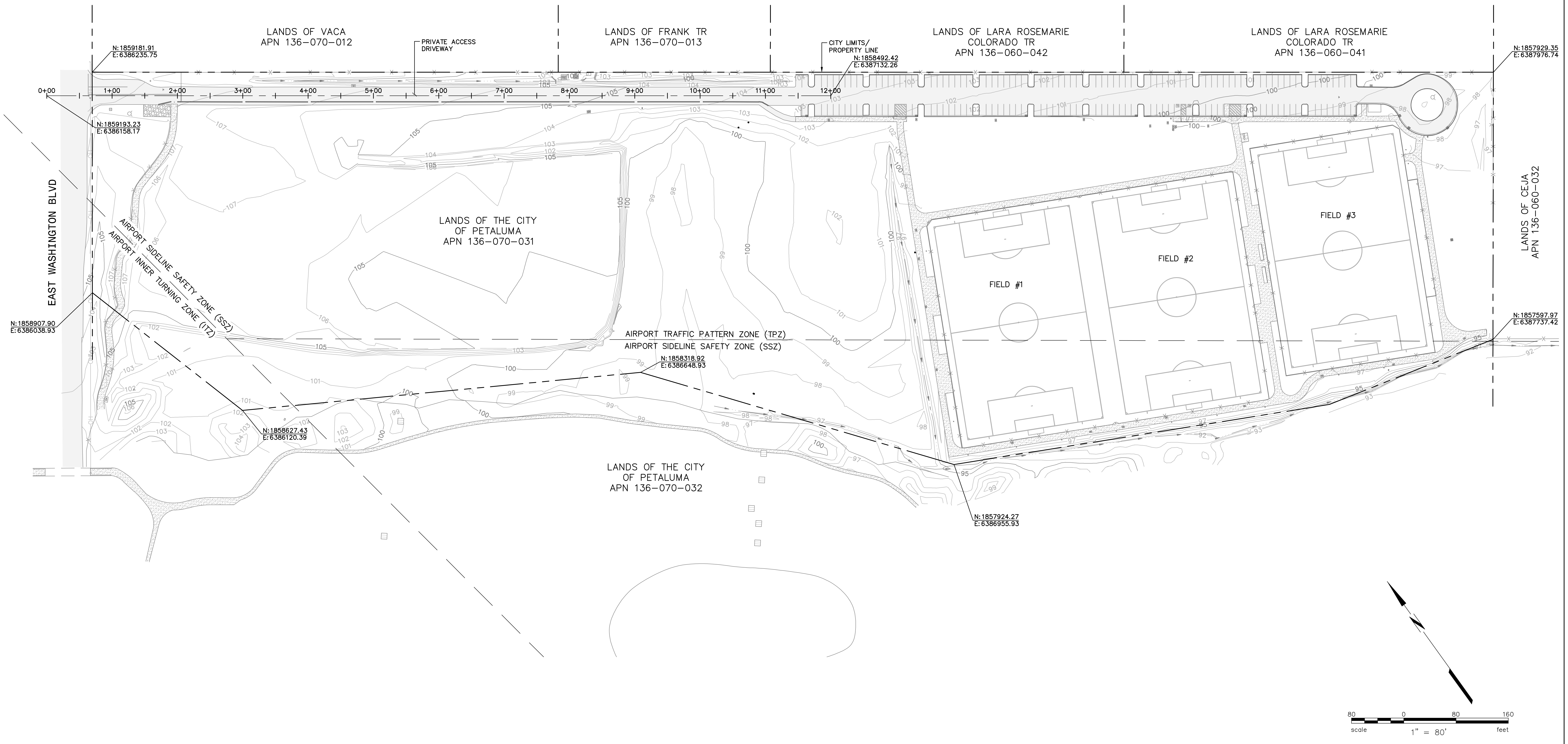

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PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND
EXISTING CONDITION MAP
2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 4/12/21
FILE NO: 16913I_SITE
JOB NO: 1628
SHEET NO:
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OF 59

RICHARD E. CARLILE
No. 57885
CIVIL
4-8-2021

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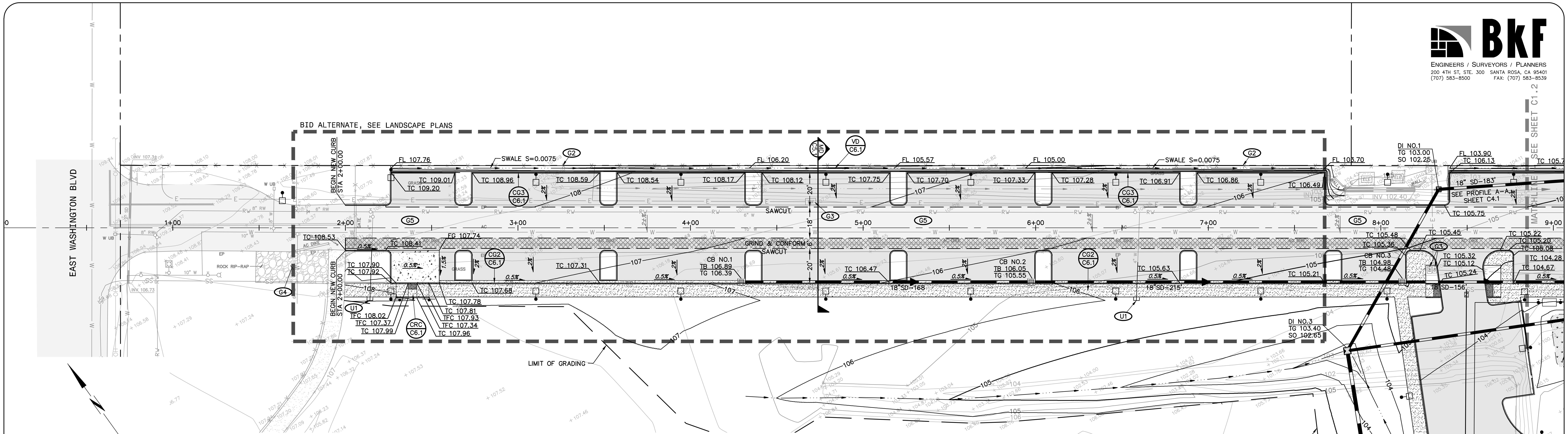
(707) 583-8500 FAX: (707) 583-8539



UTILITY KEYNOTES

CONTRACTOR TO VERIFY EXISTING UTILITY DEPTH PRIOR TO ANY SITE GRADING. CONTRACTOR SHALL CONTACT PROJECT ENGINEER IMMEDIATELY IN EVENT THAT THERE IS A CONFLICT WITH THE PROPOSED UTILITY OR STRUCTURAL SECTION.

(U1) EXTEND EXISTING WATER SERVICE LINE AND CAP 2-FEET BEHIND PROPOSED SIDEWALK.

GRADING AND STREET KEYNOTES

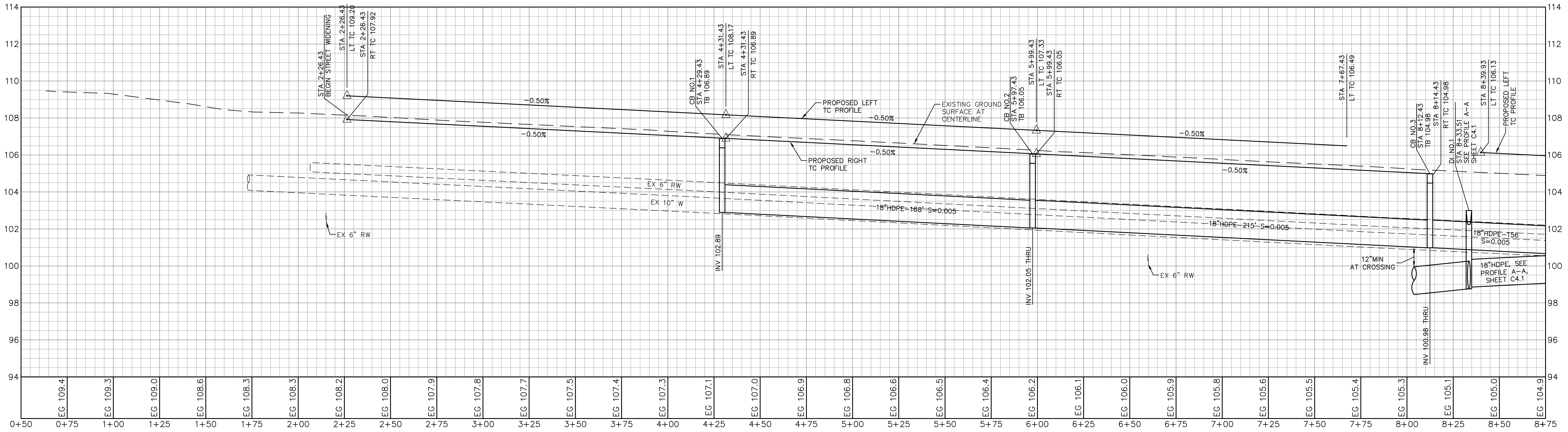
(G1) CONFORM TO EXISTING SIDEWALK IN A MANNER WHICH CREATES A UNIFORM TRANSITION AND DOES NOT IMPEDE DRAINAGE.

(G2) CONFORM TO PROPOSED CONCRETE SWALE AT 3:1 SLOPE MAX IN A MANNER WHICH DOES NOT IMPEDE DRAINAGE.

(G3) ADJUST EXISTING UTILITY BOX TO FINISHED GRADE. REPLACE BOX WITH TRAFFIC RATED STRUCTURE WHERE PULL BOX IS WITHIN DRIVEN PATH.

(G4) REMOVE EXISTING GRAVEL AREA AND REPLACE WITH NATIVE BACKFILL.

(G5) CONTRACTOR SHALL REMOVE AND REPLACE ALL FAILED SECTIONS OF ASPHALT ALONG EXISTING ROADWAY AT DIRECTION OF OWNER.



MAIN DRIVE AISLE CENTERLINE PROFILE

STA 0+50.00 TO STA 8+75.00
SCALE
HORIZONTAL: 1"=30'
VERTICAL: 1"=3'

No. 57885
4-8-2021

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PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND
ENTRY ROAD UTILTIY
PLAN AND PROFILE
2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 4/12/21
FILE NO: 169131_SITE
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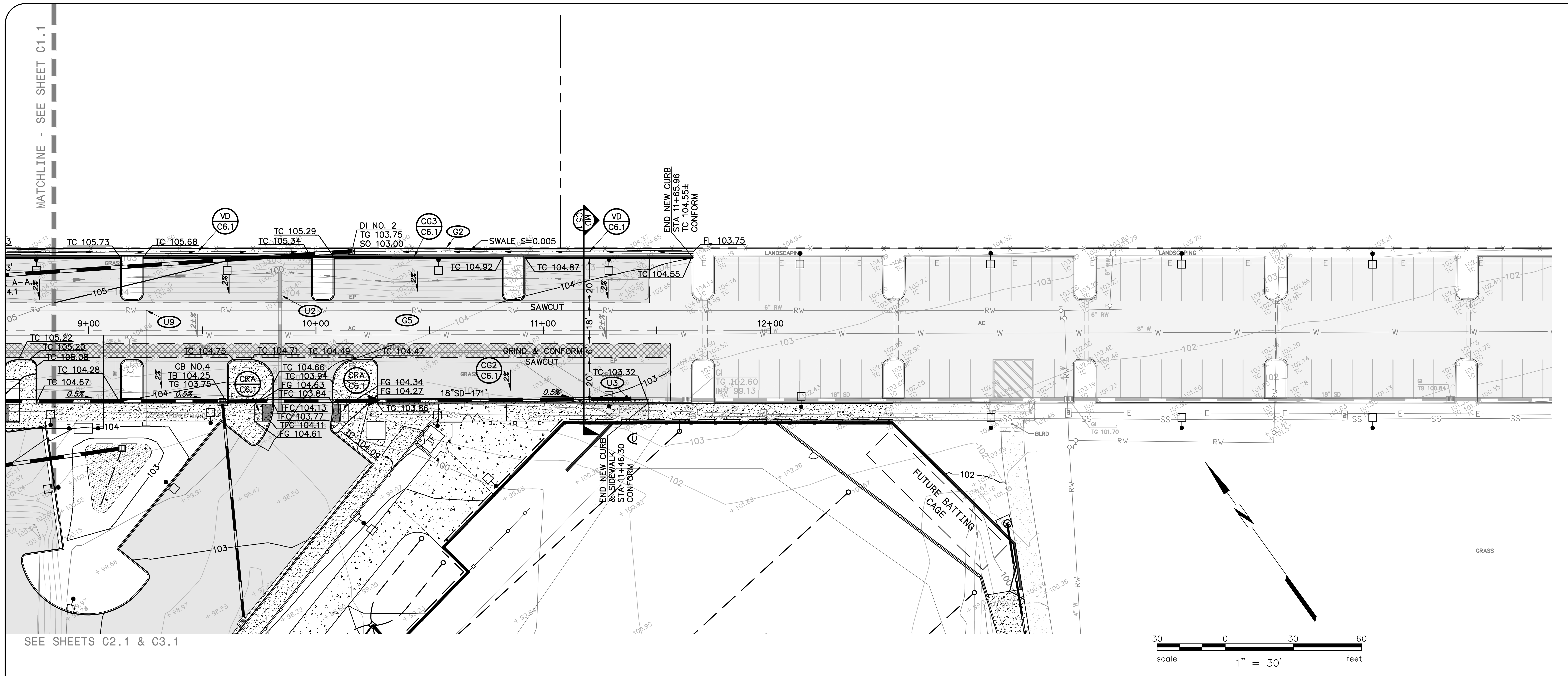
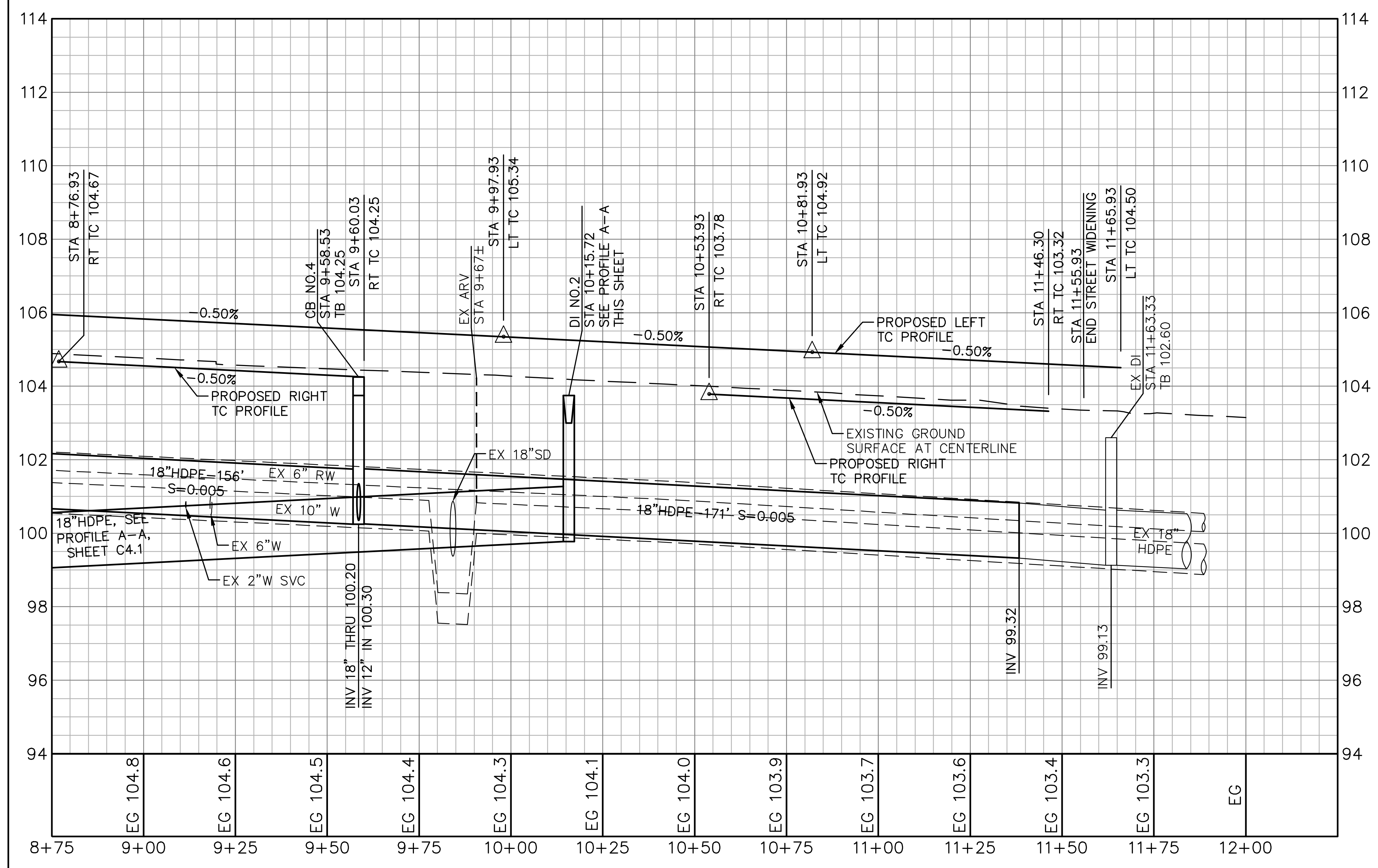
OF 59





MAIN DRIVE AISLE CENTERLINE PROFILE

STA 8+75.00 TO STA 12+00.00

SCALE
HORIZONTAL: 1"=30'
VERTICAL: 1"=3'

UTILITY KEYNOTES

CONTRACTOR TO VERIFY EXISTING UTILITY DEPTH PRIOR TO ANY SITE GRADING. CONTRACTOR SHALL CONTACT PROJECT ENGINEER IMMEDIATELY IN EVENT THAT THERE IS A CONFLICT WITH THE PROPOSED UTILITY OR STRUCTURAL SECTION.

(U2) REMOVE EXISTING STORM DRAIN CULVERT TO LIMITS OF ROADWAY IMPROVEMENTS. ABANDON REMAINING IN ACCORDANCE WITH CITY OF PETALUMA STANDARD DETAIL 507.

(U3) CONTRACTOR TO VERIFY INVERT OF EXITING STORM DRAIN LINE PRIOR TO ANY SITE GRADING. CONNECT PROPOSED STORM DRAIN TO EXISTING WITH CONCRETE COLLAR AS NECESSARY IN ACCORDANCE WITH SONOMA COUNTY STANDARD DETAIL 410.

(U9) INSTALL 6"x6"x4" CUT-IN TEE TO EXISTING RECYCLED WATER LINE AND CAP AT BACK OF SIDEWALK UNDER AUTHORIZED CITY INSPECTION.

GRADING AND STREET KEYNOTES

(G1) CONFORM TO EXISTING SIDEWALK IN A MANNER WHICH CREATES A UNIFORM TRANSITION AND DOES NOT IMPEDE DRAINAGE.

(G2) CONFORM TO PROPOSED CONCRETE SWALE AT 3:1 SLOPE MAX IN A MANNER WHICH DOES NOT IMPEDE DRAINAGE.

(G3) ADJUST EXISTING UTILITY BOX TO FINISHED GRADE. REPLACE BOX WITH TRAFFIC RATED STRUCTURE WHERE PULL BOX IS WITHIN DRIVEN PATH.

(G5) CONTRACTOR SHALL REMOVE AND REPLACE ALL FAILED SECTIONS OF ASPHALT ALONG EXISTING ROADWAY AT DIRECTION OF OWNER.

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ENGINEERS / SURVEYORS / PLANNERS
200 4TH ST, STE. 300 SANTA ROSA, CA 95401
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PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND
ENTRY ROAD UTILITY
PLAN AND PROFILE
2430 E WASHINGTON ST PETALUMA, CA 94954

No. 57885
CIVIL
4-8-2021

DATE: 4/12/21
FILE NO: 169131_SITE
JOB NO: 1628
SHEET NO:
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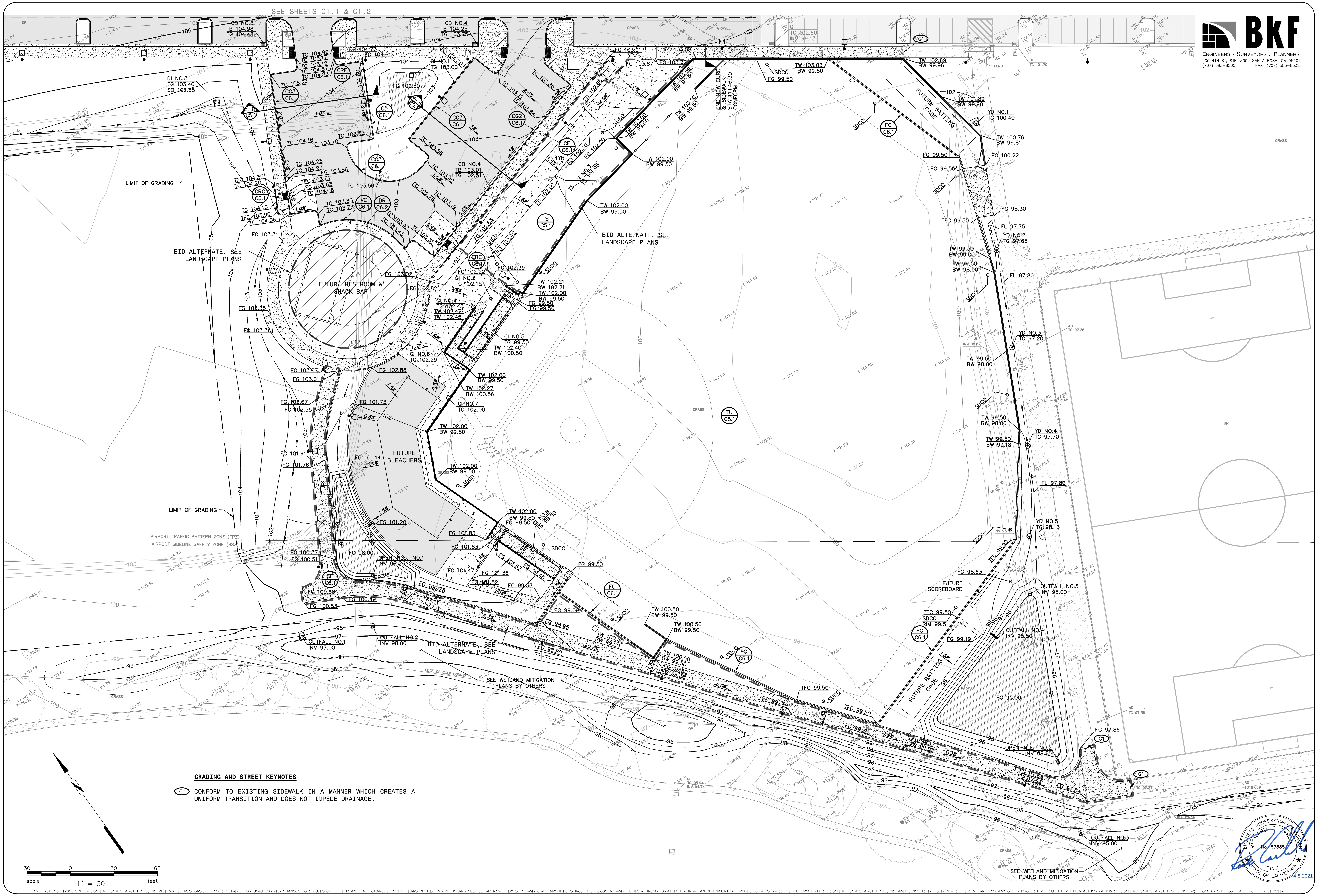

GRADING AND STREET KEYNOTES

G1 CONFORM TO EXISTING SIDEWALK IN A MANNER WHICH CREATES A UNIFORM TRANSITION AND DOES NOT IMPEDE DRAINAGE.

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PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND

SITE GRADING PLAN

2430 E WASHINGTON ST PETALUMA, CA 94954

No. 57885
4-8-2021

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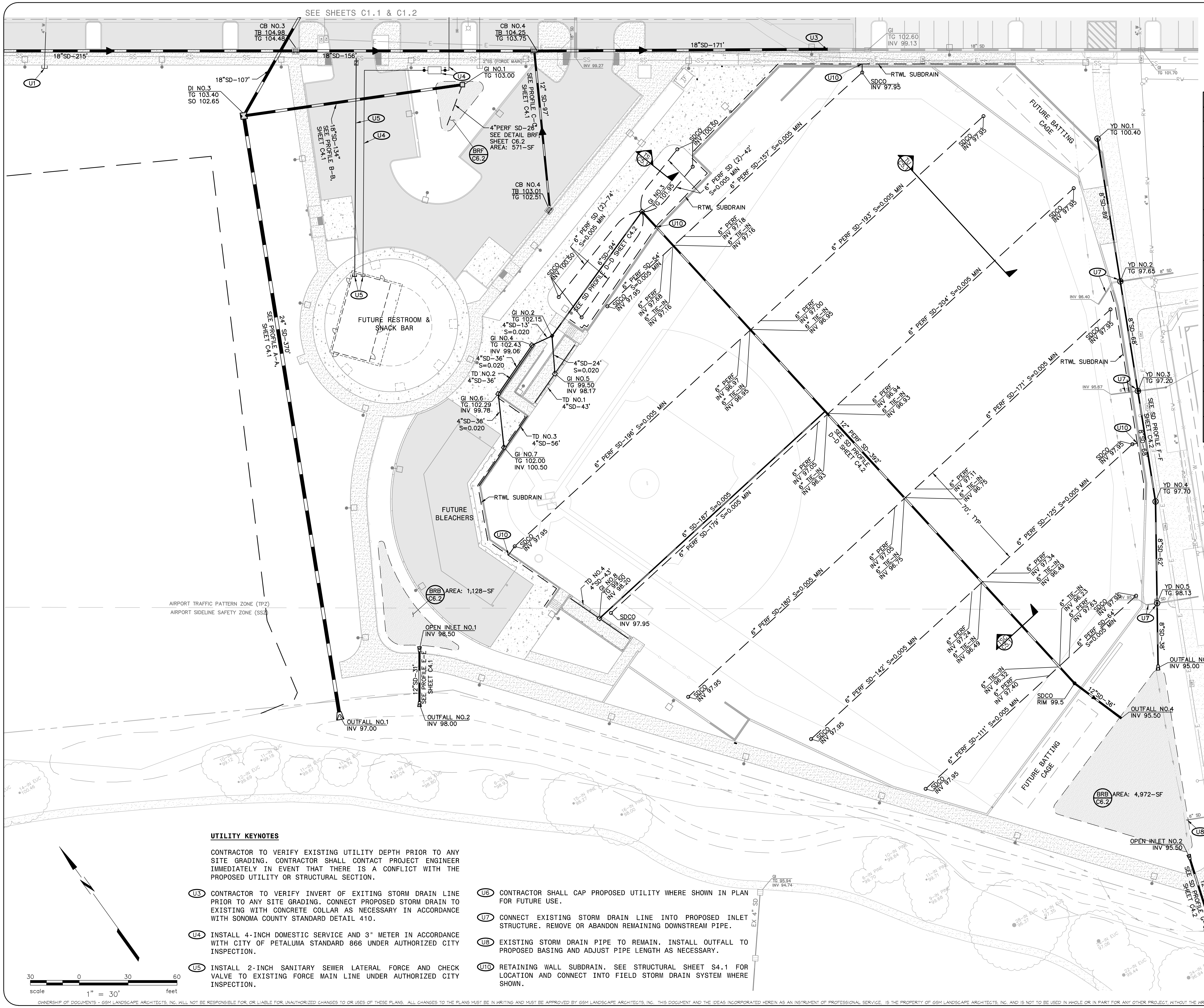

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DRAINAGE STRUCTURE TABLE				
STRUCTURE	NO.	MODEL	SIZE	DETAIL
CATCH BASIN	1–5	PER CITY OF PETALUMA STANDARD 401–B, SEE SHEET C6.2	24"x36"	
DROP INLET	1–2	OLDCASTLE PRECAST MODEL 2K W/ BD2424PF GRATE AND SO AS SHOWN IN PLAN AND EQUIVALENT	24"x24"	DI C6.2
DROP INLET	3	OLDCASTLE PRECAST MODEL 1M W/ REDWOOD COVER AND SO AS SHOWN IN PLAN AND EQUIVALENT	36"x36"	DI C6.2
GRATE INLET	1	OLDCASTLE PRECAST MODEL 2K W/ BD2424PF GRATE OR EQUIVALENT	24"x24"	DI C6.2
GRATE INLET	2	OLDCASTLE PRECAST MODEL EK W/ CB1212PF GRATE OR EQUIVALENT	12"x12"	DI C6.2
GRATE INLET	3	OLDCASTLE PRECAST MODEL CK W/ CB1818PF GRATE OR EQUIVALENT	18"x18"	DI C6.2
GRATE INLET	4–7	PER TRENCH DRAIN MANUFACTURER'S RECOMMENDATIONS AND WITH TRASH CAPTURE INSERT	12"x12"	
TRENCH DRAIN	1–4	ACO K100 WITH 478Q IRON LOCKING GRATE OR EQUIVALENT	4", LENGTH PER PLAN	
YARD DRAIN	1–5	NDS 900GRKIT CATCH BASIN KIT WITH ATRIUM GRATE OR APPROVED EQUAL	9"x9"	
OPEN INLET	1–2	OLDCASTLE ROUND FLARED END SECTION	12"	
OUTFALL	1–3,5	SEE DETAIL	12" & 24"	OF C6.2
OUTFALL	4	SEE DETAIL	12"	OF3 C6.2

UTILITY KEYNOTES

CONTRACTOR TO VERIFY EXISTING UTILITY DEPTH PRIOR TO ANY SITE GRADING. CONTRACTOR SHALL CONTACT PROJECT ENGINEER IMMEDIATELY IN EVENT THAT THERE IS A CONFLICT WITH THE PROPOSED UTILITY OR STRUCTURAL SECTION.

- U3 CONTRACTOR TO VERIFY INVERT OF EXITING STORM DRAIN LINE PRIOR TO ANY SITE GRADING. CONNECT PROPOSED STORM DRAIN TO EXISTING WITH CONCRETE COLLAR AS NECESSARY IN ACCORDANCE WITH SONOMA COUNTY STANDARD DETAIL 410.
- U4 INSTALL 4-INCH DOMESTIC SERVICE AND 3" METER IN ACCORDANCE WITH CITY OF PETALUMA STANDARD 866 UNDER AUTHORIZED CITY INSPECTION.
- U5 INSTALL 2-INCH SANITARY SEWER LATERAL FORCE AND CHECK VALVE TO EXISTING FORCE MAIN LINE UNDER AUTHORIZED CITY INSPECTION.
- U6 CONTRACTOR SHALL CAP PROPOSED UTILITY WHERE SHOWN IN PLAN FOR FUTURE USE.
- U7 CONNECT EXISTING STORM DRAIN LINE INTO PROPOSED INLET STRUCTURE. REMOVE OR ABANDON REMAINING DOWNSTREAM PIPE.
- U8 EXISTING STORM DRAIN PIPE TO REMAIN. INSTALL OUTFALL TO PROPOSED BASING AND ADJUST PIPE LENGTH AS NECESSARY.
- U10 RETAINING WALL SUBDRAIN. SEE STRUCTURAL SHEET S4.1 FOR LOCATION AND CONNECT INTO FIELD STORM DRAIN SYSTEM WHERE SHOWN.

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PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND
SITE UTILITY PLAN
2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 4/12/21
FILE NO: 169131_SITE
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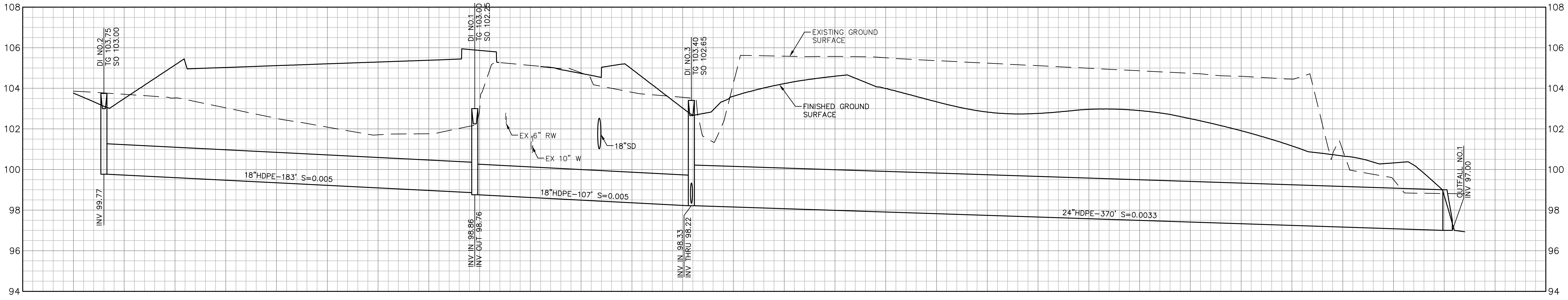
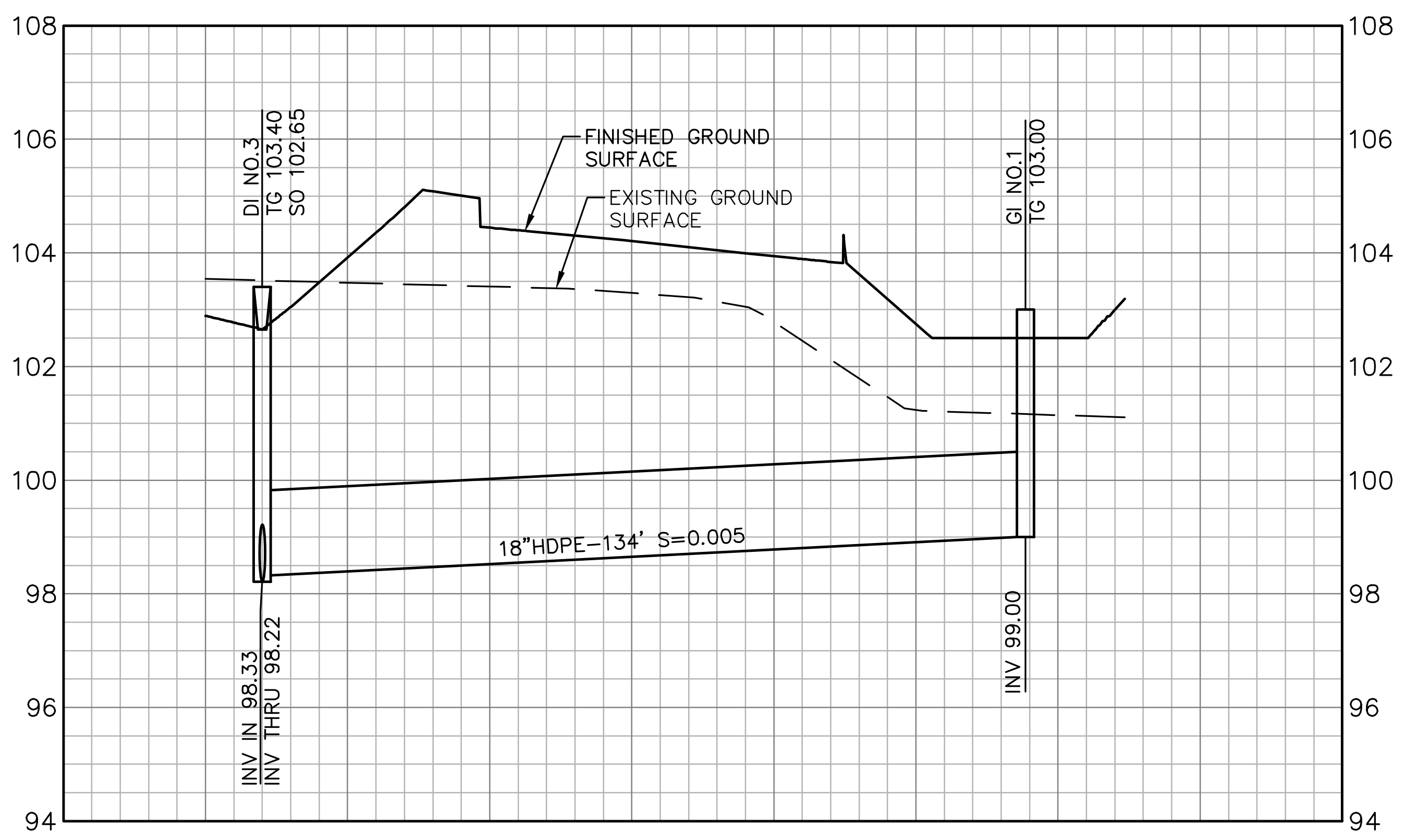


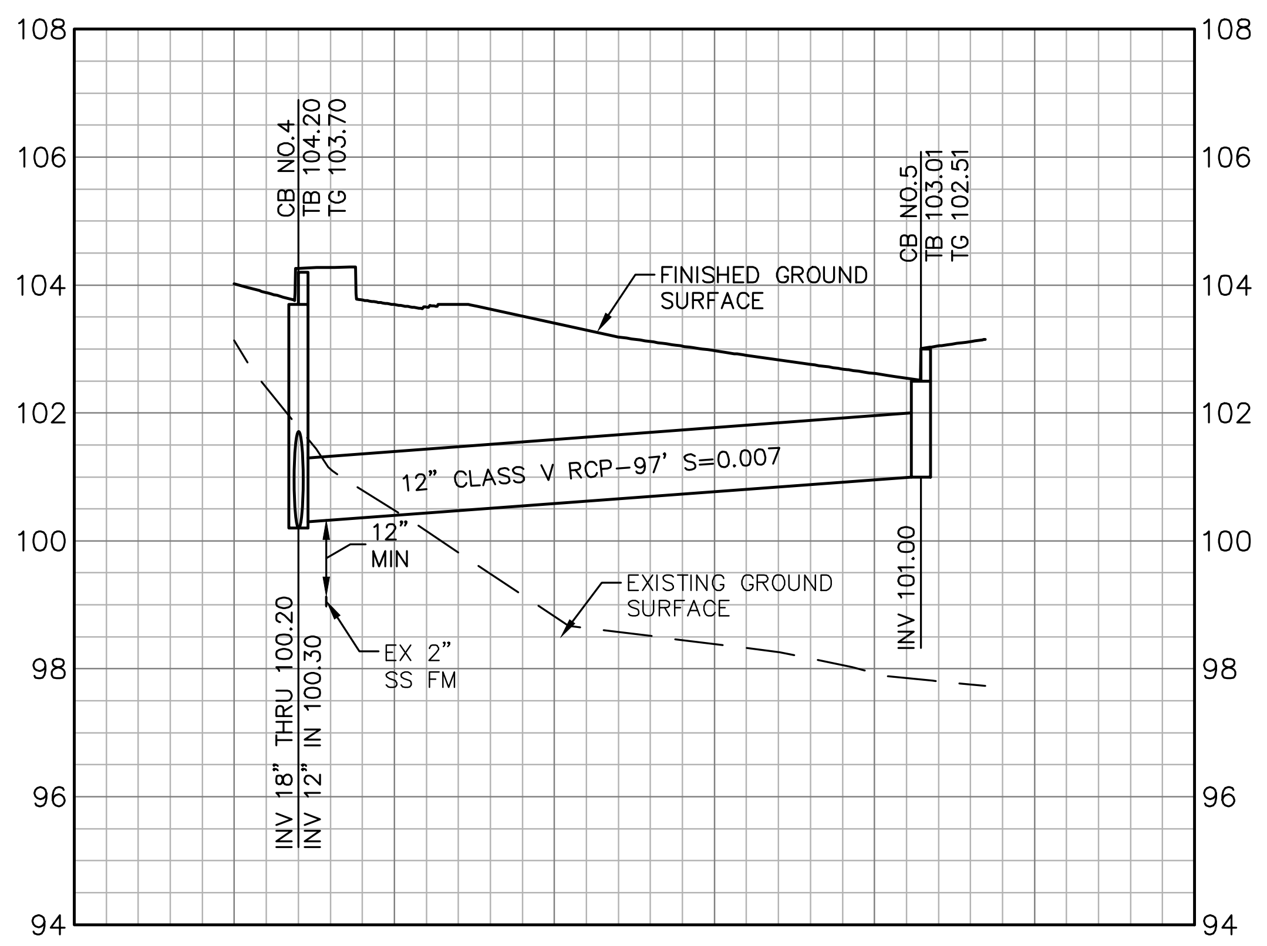
STORM DRAIN PROFILE A–A

SCALE
HORIZONTAL: 1"=30'
VERTICAL: 1"=3'



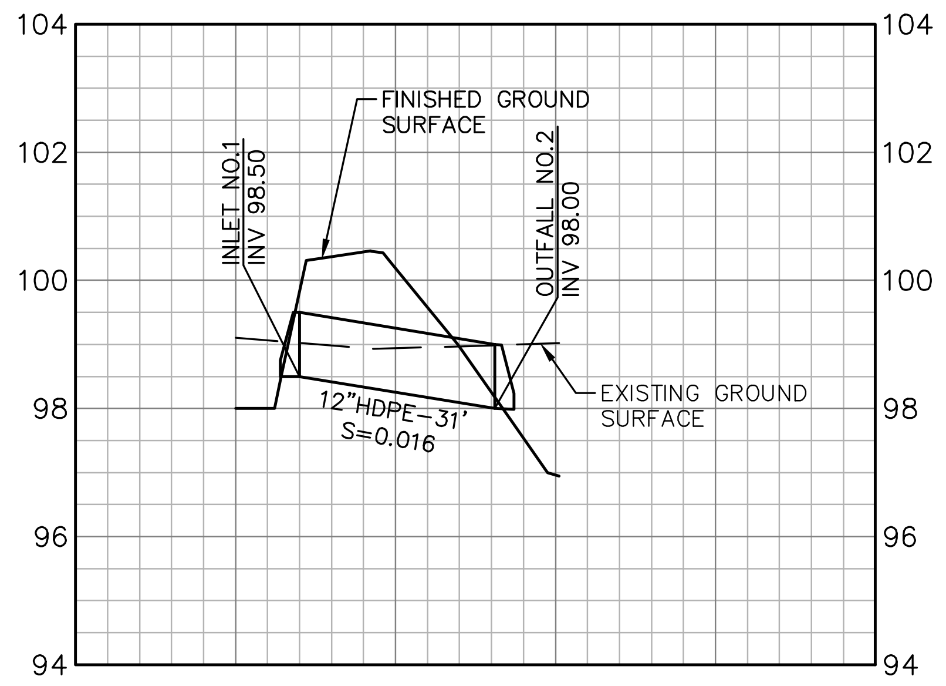
STORM DRAIN PROFILE B–B

SCALE
HORIZONTAL: 1"=30'
VERTICAL: 1"=3'



STORM DRAIN PROFILE C–C

SCALE
HORIZONTAL: 1"=30'
VERTICAL: 1"=3'



STORM DRAIN PROFILE E–E

SCALE
HORIZONTAL: 1"=30'
VERTICAL: 1"=3'

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PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND

STORM DRAIN PROFILES

2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 4/12/21
FILE NO: 169131_SITE
JOB NO: 1628
SHEET NO:
C4.1
OF 59

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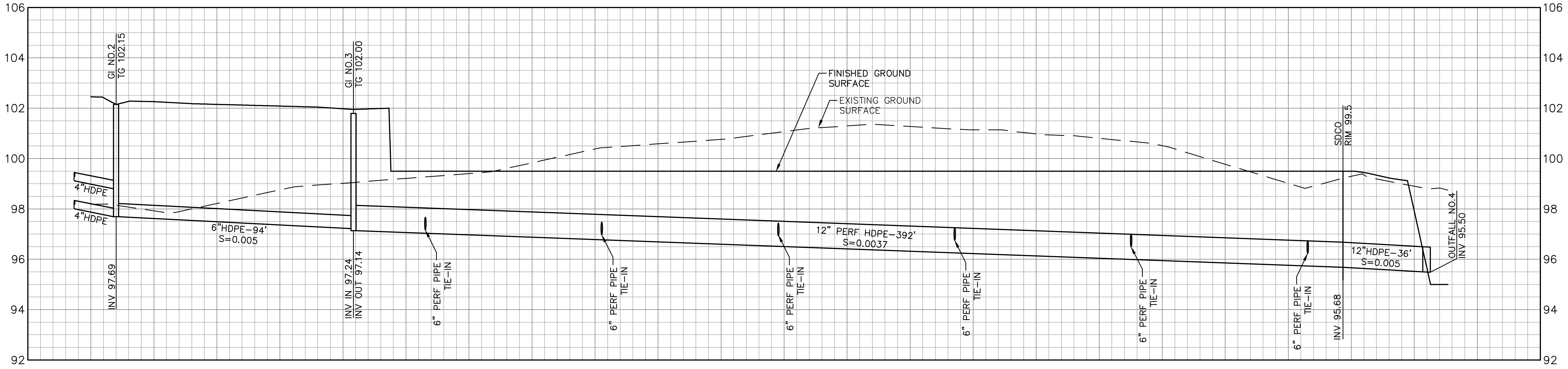
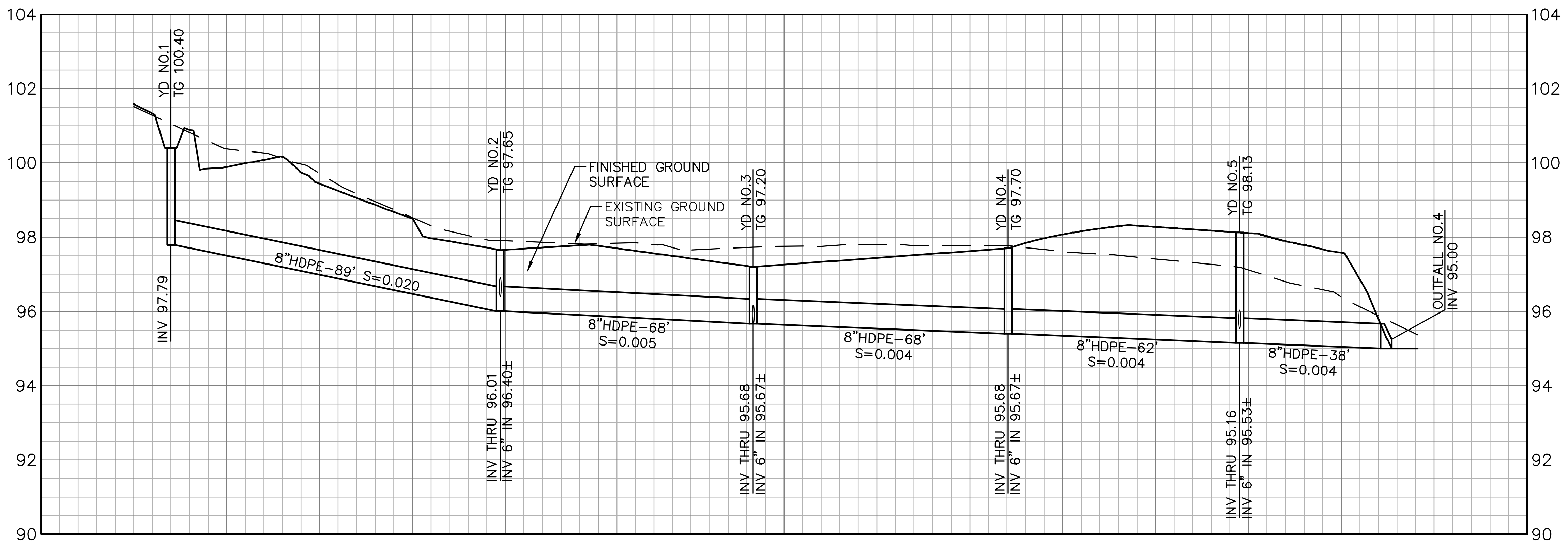


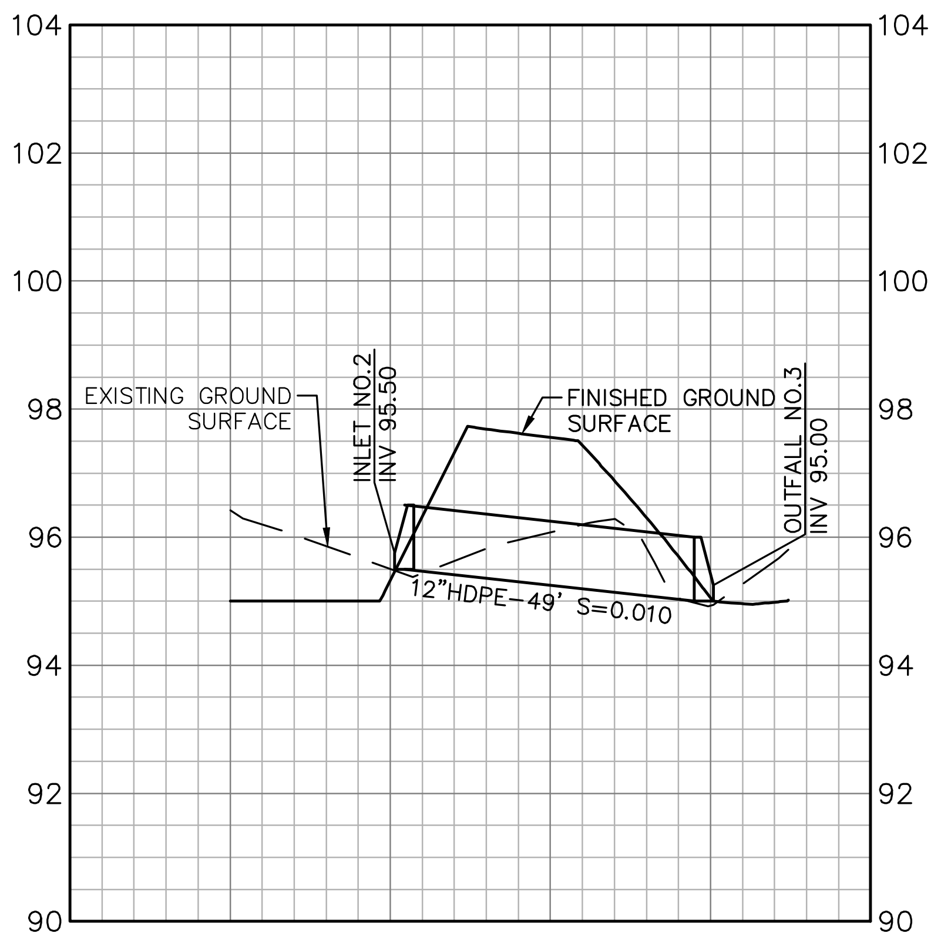
STORM DRAIN PROFILE D–D

SCALE
HORIZONTAL: 1"=30'
VERTICAL: 1"=3'



STORM DRAIN PROFILE F–F

SCALE
HORIZONTAL: 1"=30'
VERTICAL: 1"=3'



STORM DRAIN PROFILE G–G

SCALE
HORIZONTAL: 1"=30'
VERTICAL: 1"=3'

DES: RFC
DRWN: RFC
CHKD: RFC

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BASEBALL DIAMOND
STORM DRAIN PROFILES
2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 4/12/21
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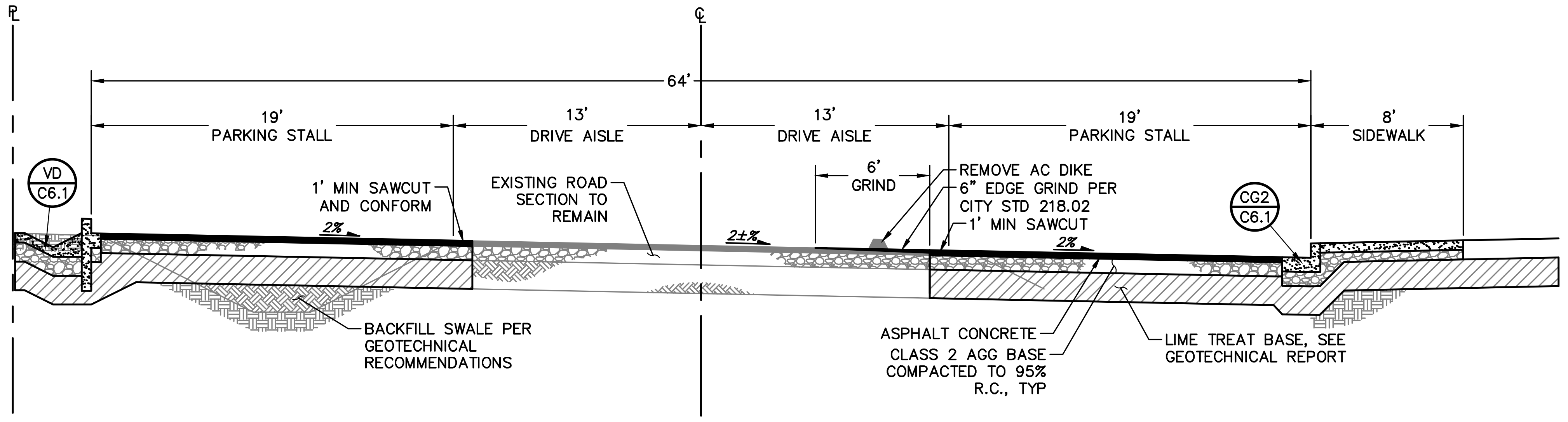
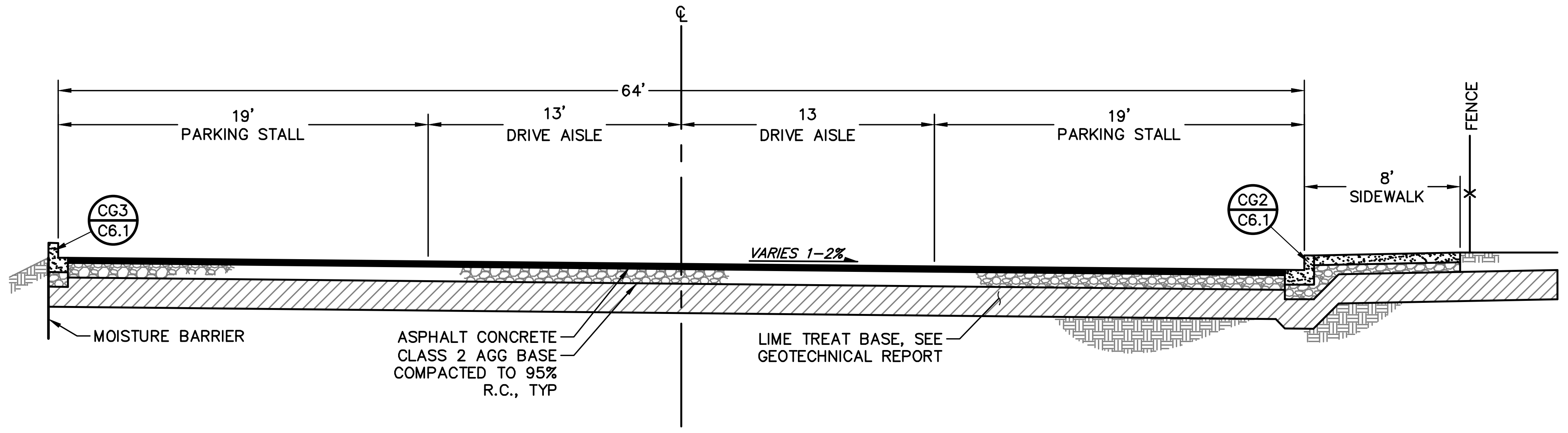
SHEET NO:
C4.2
OF 59

No. 57885
CIVIL
4-8-2021



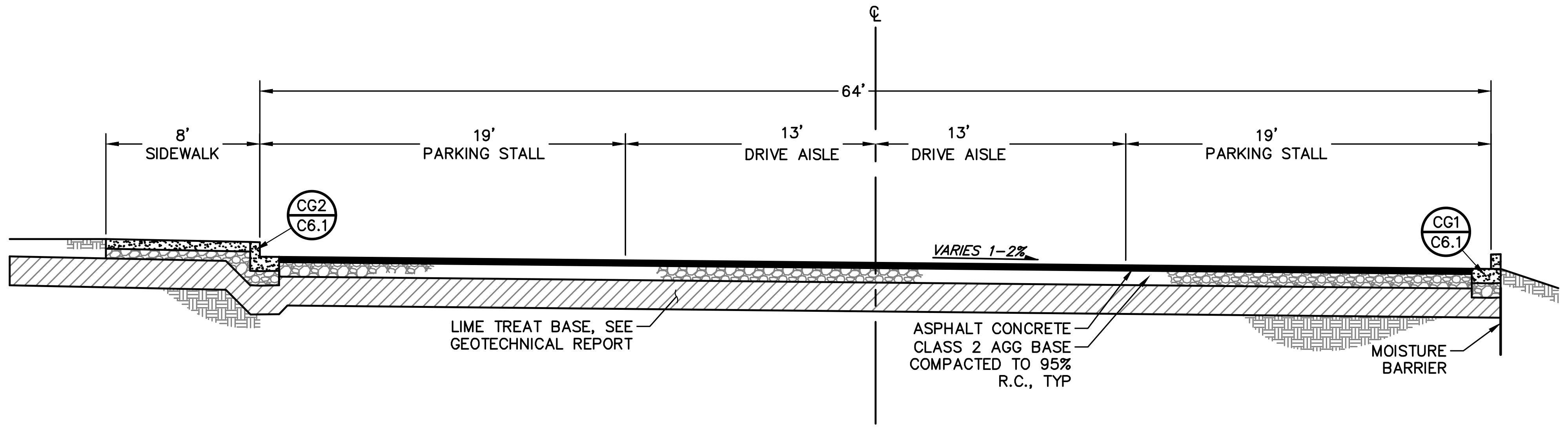
MD – MAIN DRIVE AISLE

NO SCALE



SECTION A–A

SEE SHEET C2.1
NO SCALE



SECTION B–B

SEE SHEET C2.1
NO SCALE

STRUCTURAL SECTION TABLE					
AC AREA	T.I.	R–VALUE	A.C.(IN)	CLASS 2 AB (IN)	LIME TREAT/SELECT FILL* (FT)
PARKING LOT AC	6	40	3.5"	6"	18"
BLEACHER AREA AC	6	40	3.5"	6"	18"
BID ALTERNATE CONCESSION AREA AC	6	40	3.5"	6"	18"

CONTRACTOR SHALL REVIEW THE GEOTECHNICAL REPORT PREPARED FOR THIS PROJECT TO CONFIRM THESE CONDITIONS AND TO REVIEW SAID REPORT FOR SITE PREPARATION AND GRADING RECOMMENDATIONS.

*LIME TREATMENT/SELECT FILL SHALL BE IN ACCORDANCE WITH GEOTECHNICAL REPORT.

MATERIALS TABLE				
SURFACE TYPE	LOCTION	CONCRETE SECTION (IN)	CLASS 2 AB (IN)	NOTE
REINFORCED CONCRETE	VEHICULAR AREAS	7	6	1
REINFORCED CONCRETE	SIDEWALKS ADJACENT TO DRIVE AREAS	SEE DETAIL CG2, SHEET C6.1		
REINFORCED CONCRETE	WALKWAYS, NON–VEHICULAR CONCRETE FLATWORK AREAS	4	4	2

NOTES:
1. PROVIDE #3 BARS AT 18–INCH ON CENTER AND EXPANSION JOINTS IN ACCORDANCE WITH THE CALTRANS STANDARD SPECIFICATIONS. CONCRETE TO HAVE BROOMED FINISH.
2. PROVIDE POLYPROPYLENE FIBER REINFORCEMENT: 3.0 LBS/CY (0.02 BY VOLUME), 1½" MINIMUM LENGTH.

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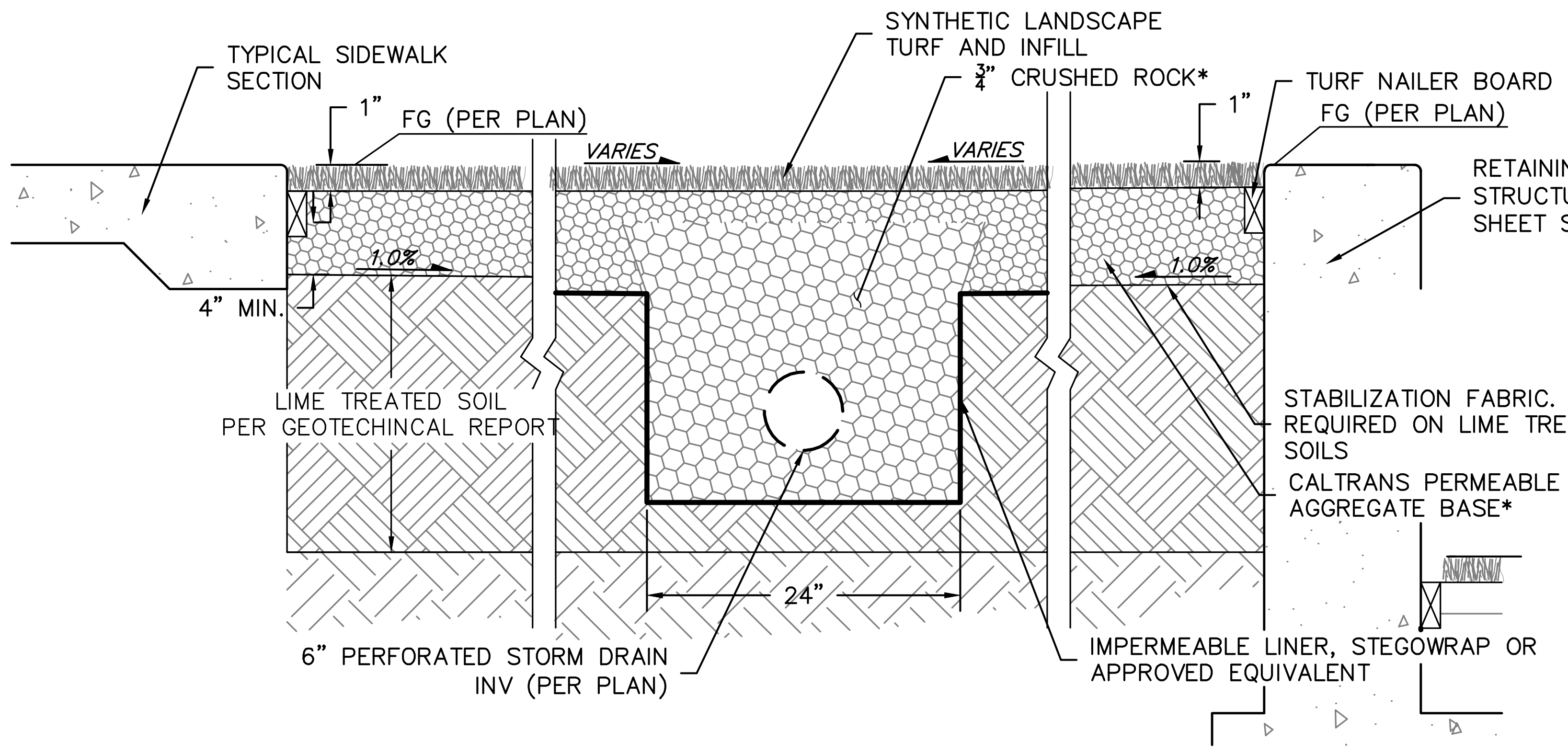
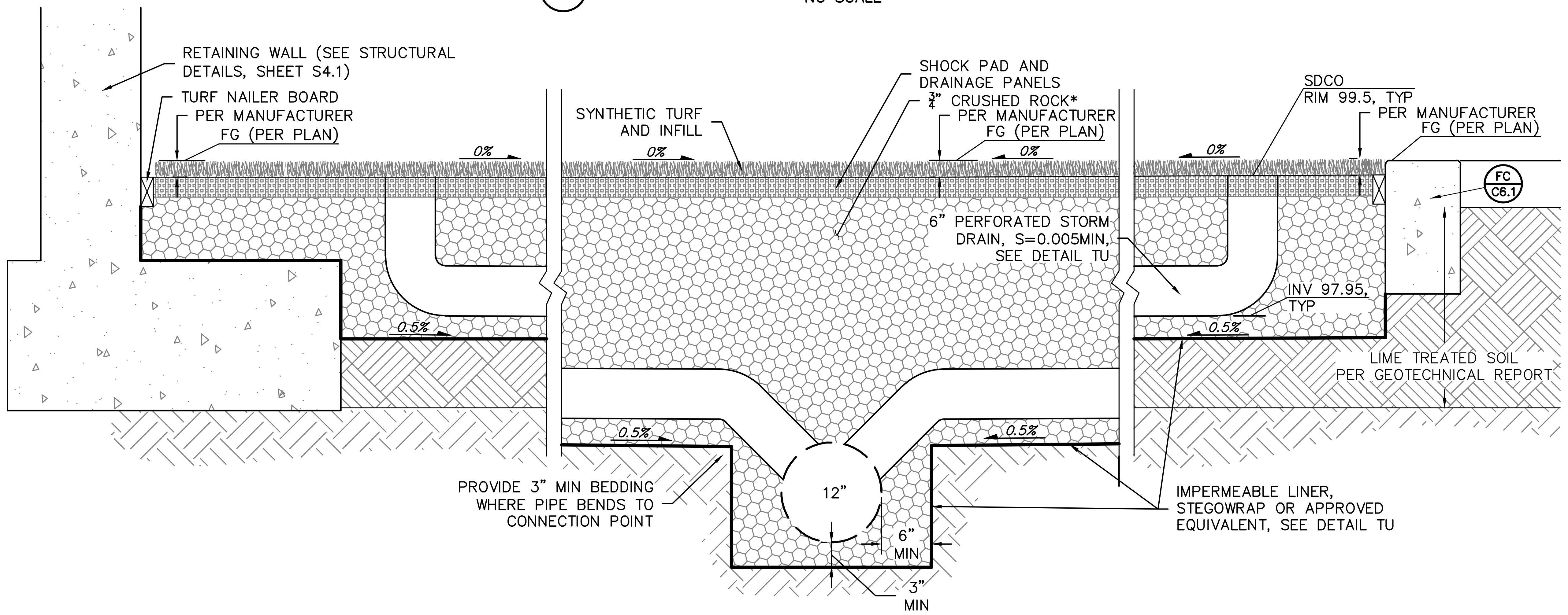


* ALL ROCK LAYERS SHALL BE PLACED IN 8" MAX LOOSE LIFTS AND COMPACTED PRIOR TO ADDITIONAL FILL

TS – TYPICAL TURF SEATING SECTION

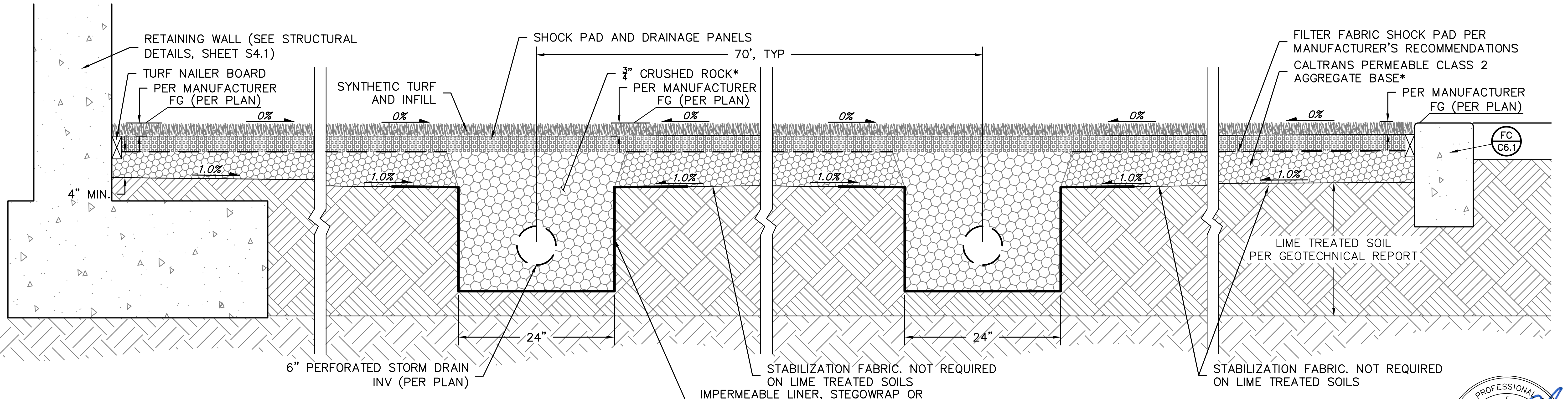
NO SCALE



* ALL ROCK LAYERS SHALL BE PLACED IN 8" MAX LOOSE LIFTS AND COMPACTED PRIOR TO ADDITIONAL FILL

TSC – TYPICAL SUBDRAIN COLLECTION SECTION

NO SCALE



* ALL ROCK LAYERS SHALL BE PLACED IN 8" MAX LOOSE LIFTS AND COMPACTED PRIOR TO ADDITIONAL FILL

TU – TYPICAL TURF FIELD SECTION

NO SCALE

RICHARD E. CARLILE
No. 57885
CIVIL
4-8-2021

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PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND

TYPICAL SECTIONS

2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 4/12/21
FILE NO: 169131_SITE
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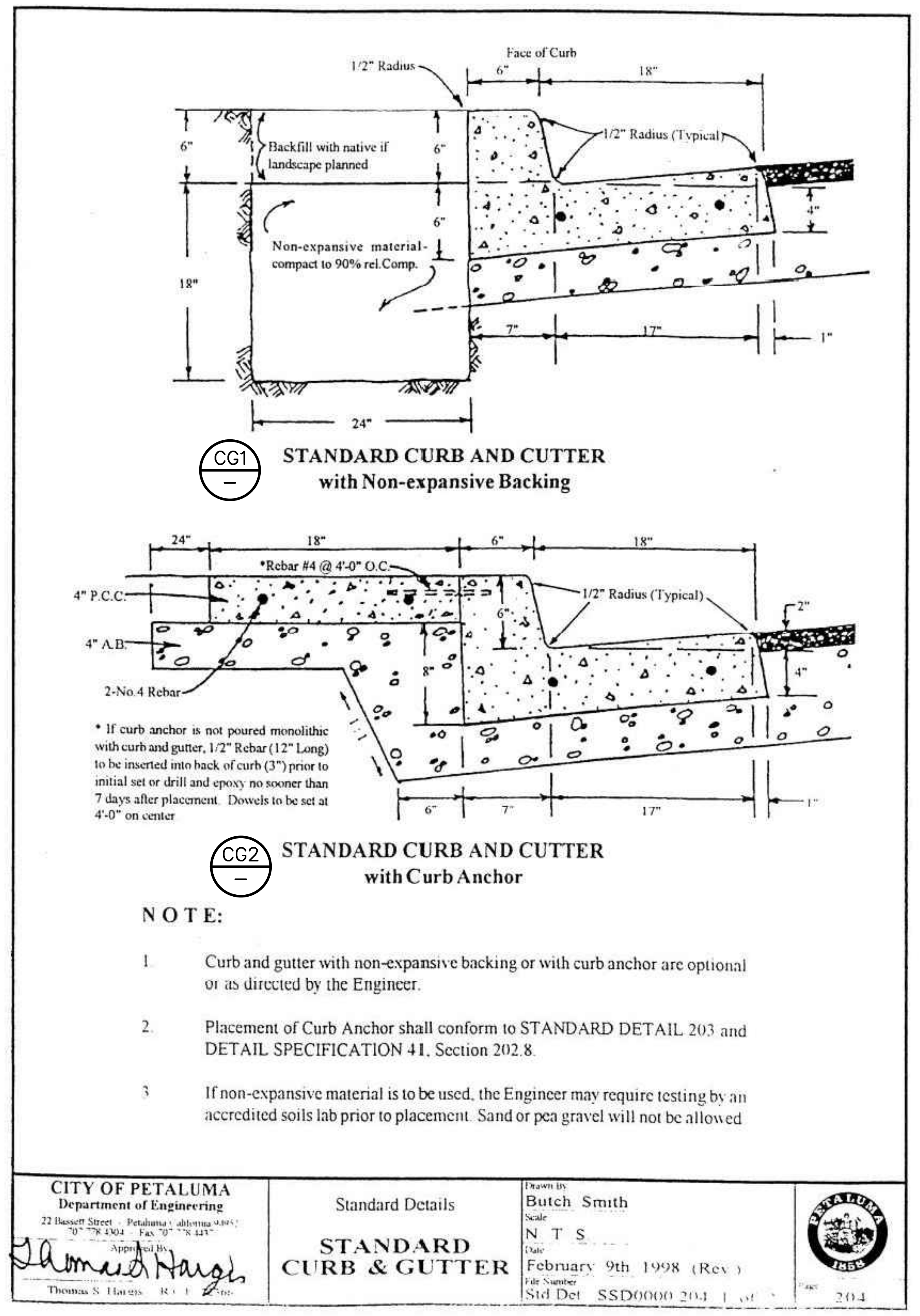


CG1 STANDARD CURB AND CUTTER with Non-expansive Backing

* If curb anchor is not poured monolithic with curb and gutter, 1/2" Rebar (12" Long) to be inserted into back of curb (3") prior to initial set or drill and epoxy no sooner than 7 days after placement. Dowels to be set at 4'-0" on center

CG2 STANDARD CURB AND CUTTER with Curb Anchor

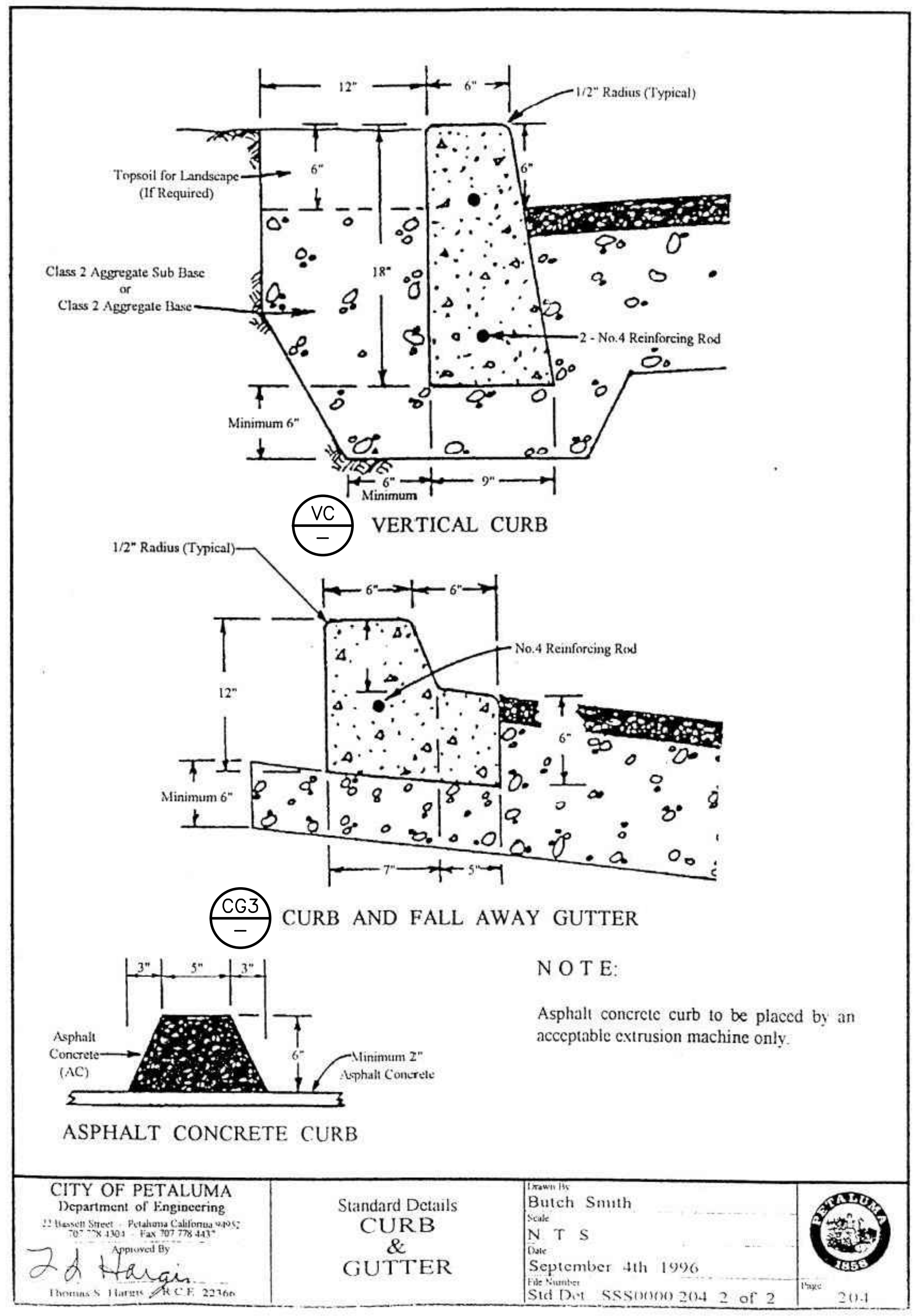
NOTE:

1. Curb and gutter with non-expansive backing or with curb anchor are optional or as directed by the Engineer.
2. Placement of Curb Anchor shall conform to STANDARD DETAIL 203 and DETAIL SPECIFICATION 41, Section 202.8.
3. If non-expansive material is to be used, the Engineer may require testing by an accredited soils lab prior to placement. Sand or pea gravel will not be allowed

CITY OF PETALUMA
Department of Engineering
22 Bassett Street · Petaluma California 94952
707 778 4304 · Fax 707 778 4437
Approved By
Thomas S. Hargis R.C.E. 22366

Standard Details
STANDARD CURB & GUTTER

Drawn By: Butch Smith
Scale: N T S
Date: February 9th 1998 (Rev.)
File Number: Std Det SSD0000 204 1 of 2
Page: 204



VC VERTICAL CURB

CG3 CURB AND FALL AWAY GUTTER

ASPHALT CONCRETE CURB

NOTE:

Asphalt concrete curb to be placed by an acceptable extrusion machine only.

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Department of Engineering
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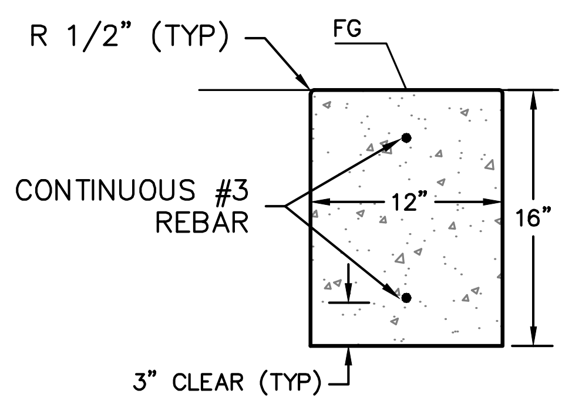
707 778 4304 · Fax 707 778 4437
Approved By
T. S. Hargis
Thomas S. Hargis R.C.E. 22366

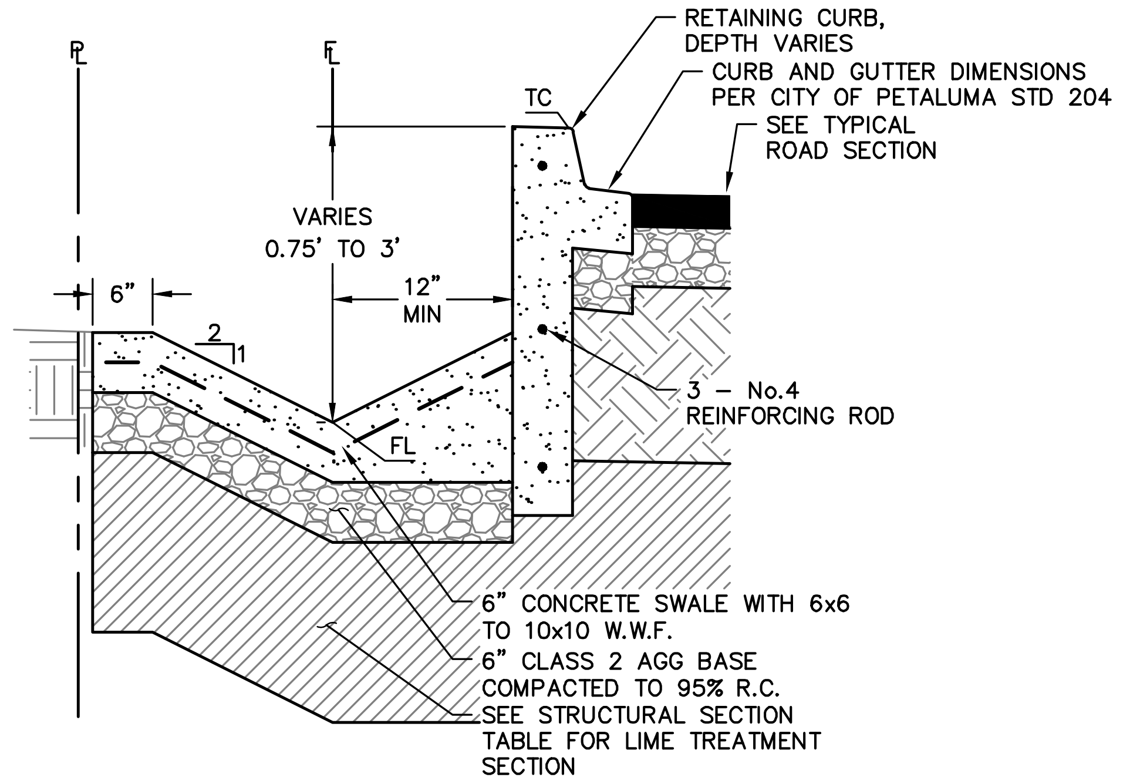
Standard Details
CURB & GUTTER

Drawn By: Butch Smith
Scale: N T S
Date: September 4th 1996
File Number: Std Det SSS0000 204 2 of 2
Page: 204



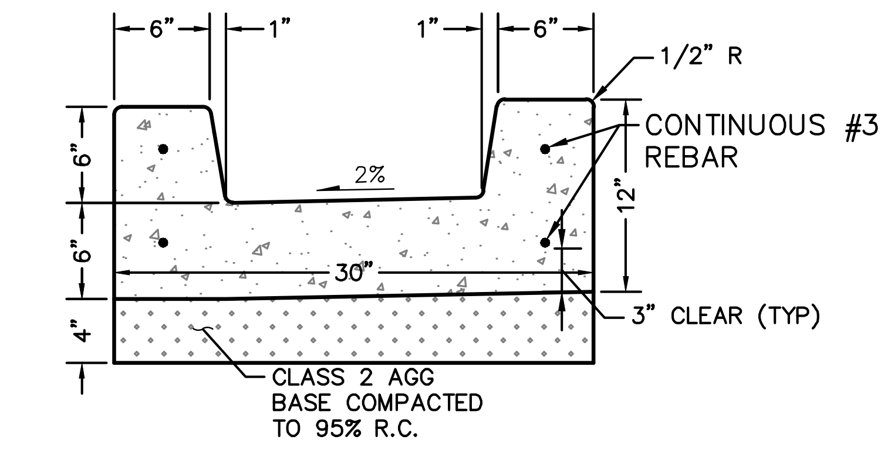
FC FLUSH CURB

NO SCALE



VD CONCRETE "V" DITCH

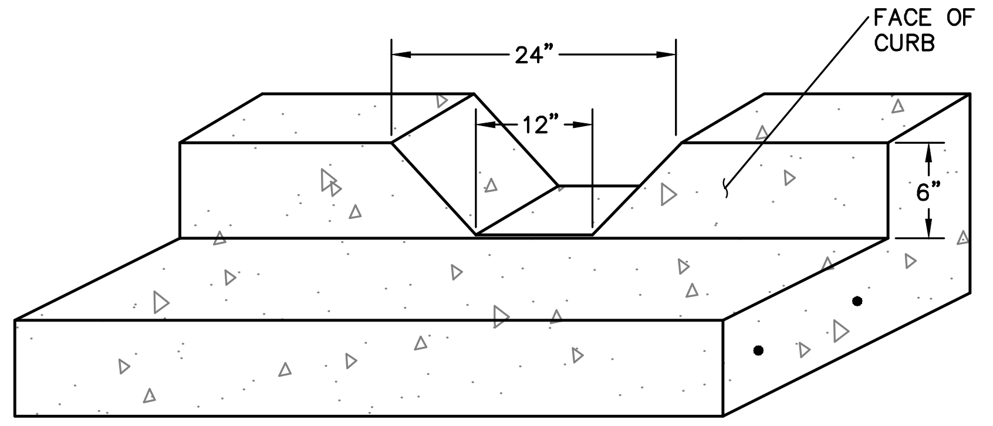
NO SCALE



1. DESIGN SHALL CONFORM TO THESE REQUIREMENTS EXCEPT AS OTHERWISE APPROVED BY THE CITY ENGINEER.
2. ALL CONCRETE SHALL BE CLASS "A" P.C.C..

CTD CURB TRENCH DRAIN DETAIL

NO SCALE

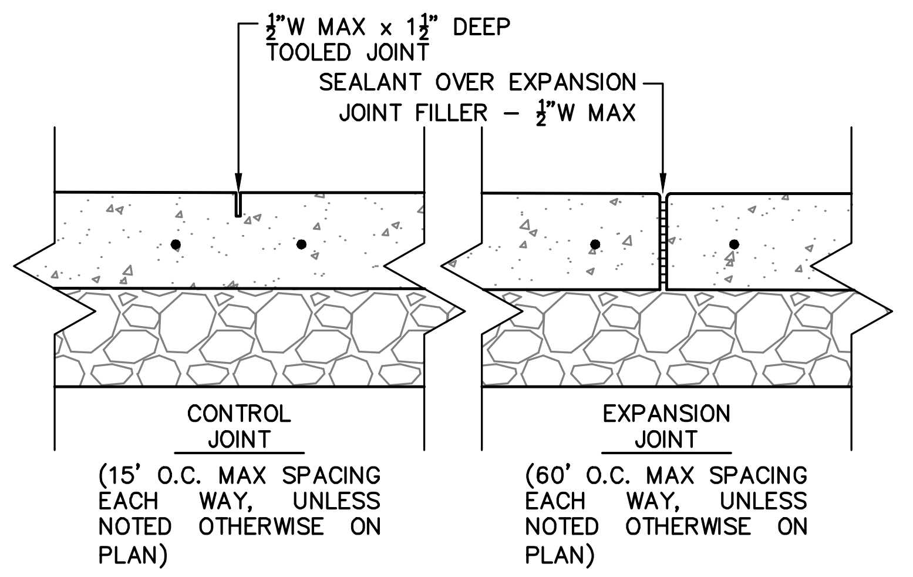


NOTE
PROVIDE WEAKENED PLANE JOINTS 1/8-INCH WIDE AND 1.5-INCH DEEP EVERY 15-FEET. PROVIDE EXPANSION JOINTS EVERY 60-FEET AND AT CHANGES IN DIRECTION. USE 1/4-INCH THICK PREMOLDED JOINT FILLER FULL THICKNESS OF CONCRETE.

LOCATE CURB DEPRESSIONS WHERE SHOWN ON THESE DRAWINGS AT INTERVALS NOT EXCEEDING 15-FEET ON CENTER.

CD CURB DEPRESSION DETAIL

NO SCALE



NOTES

CONCRETE WALKWAY TO BE INSTALLED IN ACCORDANCE WITH GEOTECHNICAL REPORT RECOMMENDATIONS.

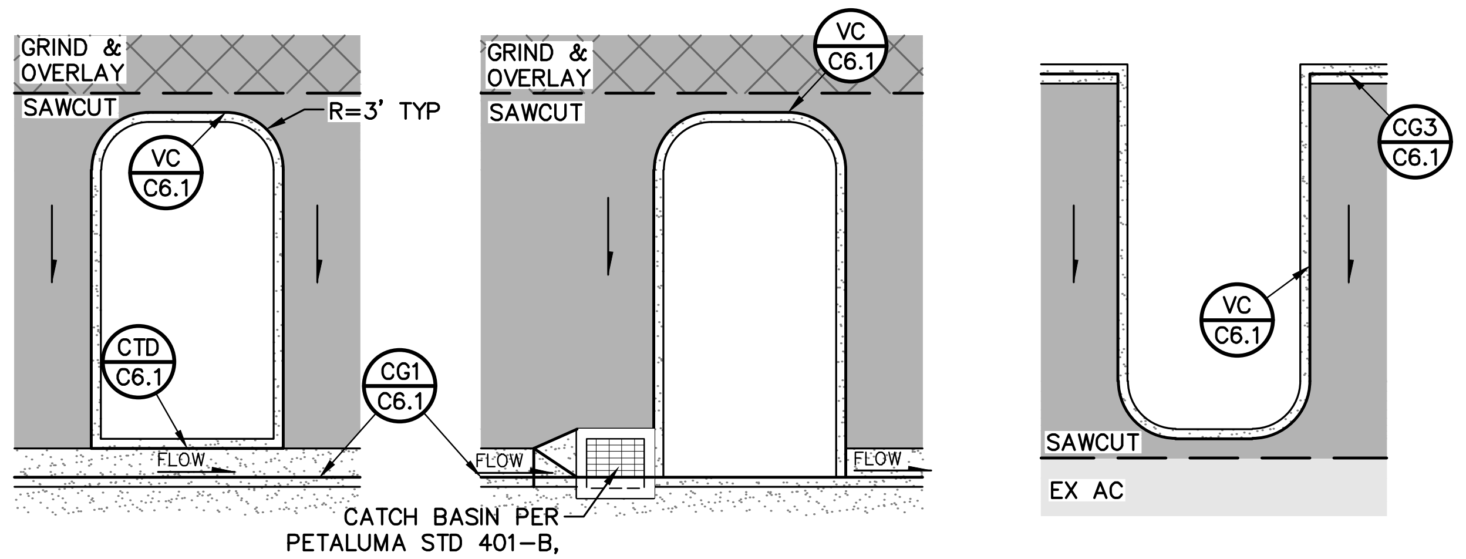
SCARIFY EXISTING SUBGRADE A MINIMUM OF 8" IN DEPTH PER GEOTECHNICAL RECOMMENDATIONS.

SEE LANDSCAPE ARCHITECTURAL DRAWINGS FOR ALL OTHER INFORMATION INCLUDING SCORING, FINISH COLOR, CONTROL JOINT LOCATION, EXPANSION JOINT LOCATION, STAIRS AND HANDRAILS.

WALKWAY SHALL HAVE A CROSS SLOPE NO GREATER THAN 2% IN ACCORDANCE WITH SECTION 11B405.3 OF THE CBC AND WHICH DOES NOT IMPEDE DRAINAGE.

CF TYPICAL CONCRETE FLATWORK SECTION

NO SCALE



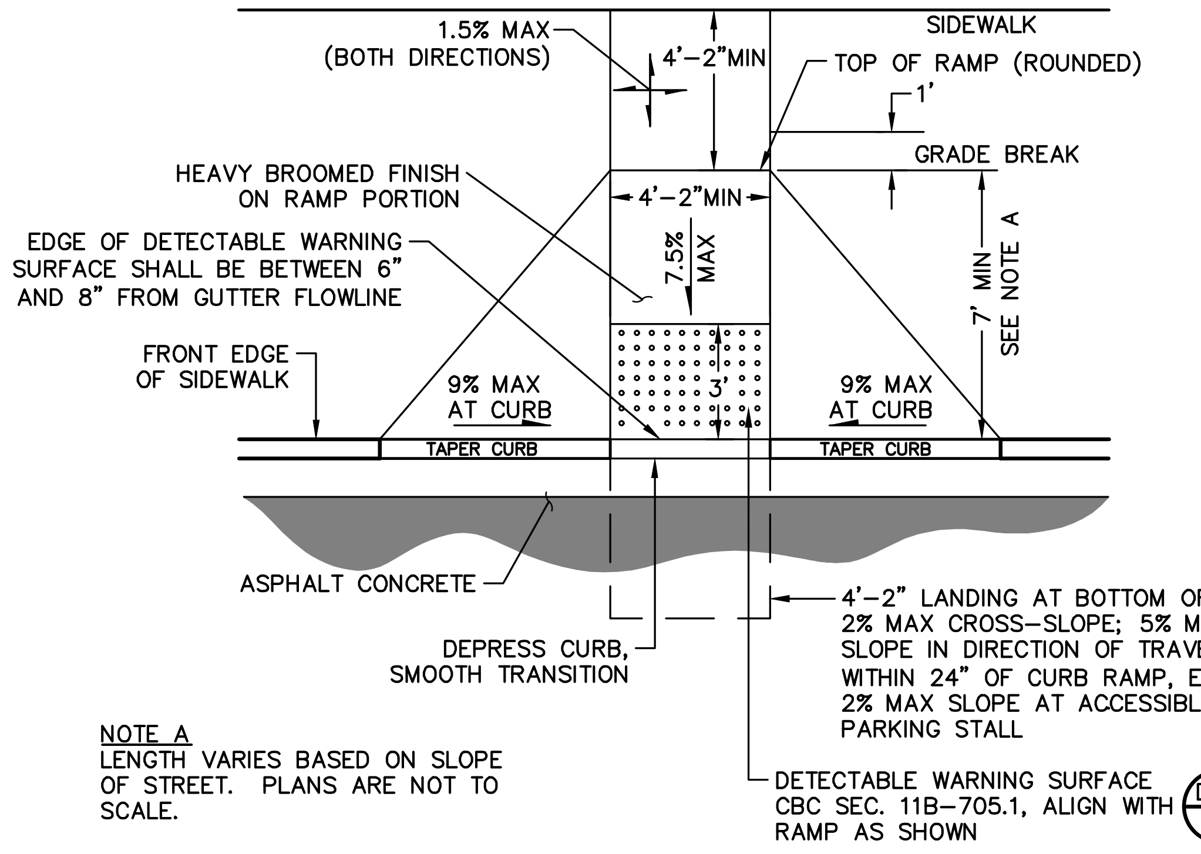
FLOW THROUGH CURB

CATCH BASIN CURB

FALL AWAY CURB

TYPICAL CURB DETAIL

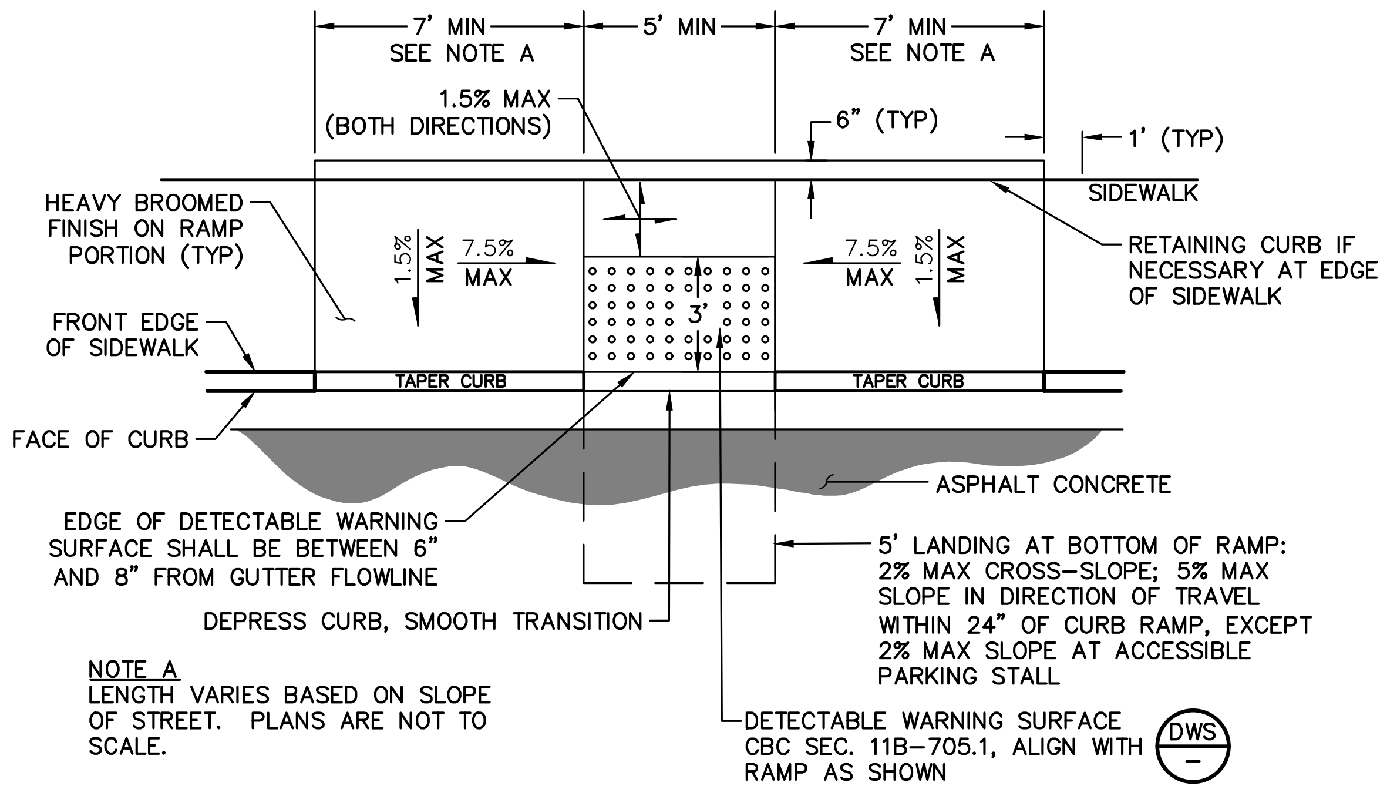
NO SCALE



NOTE A
LENGTH VARIES BASED ON SLOPE OF STREET. PLANS ARE NOT TO SCALE.

CRA CASE "A" CURB RAMP

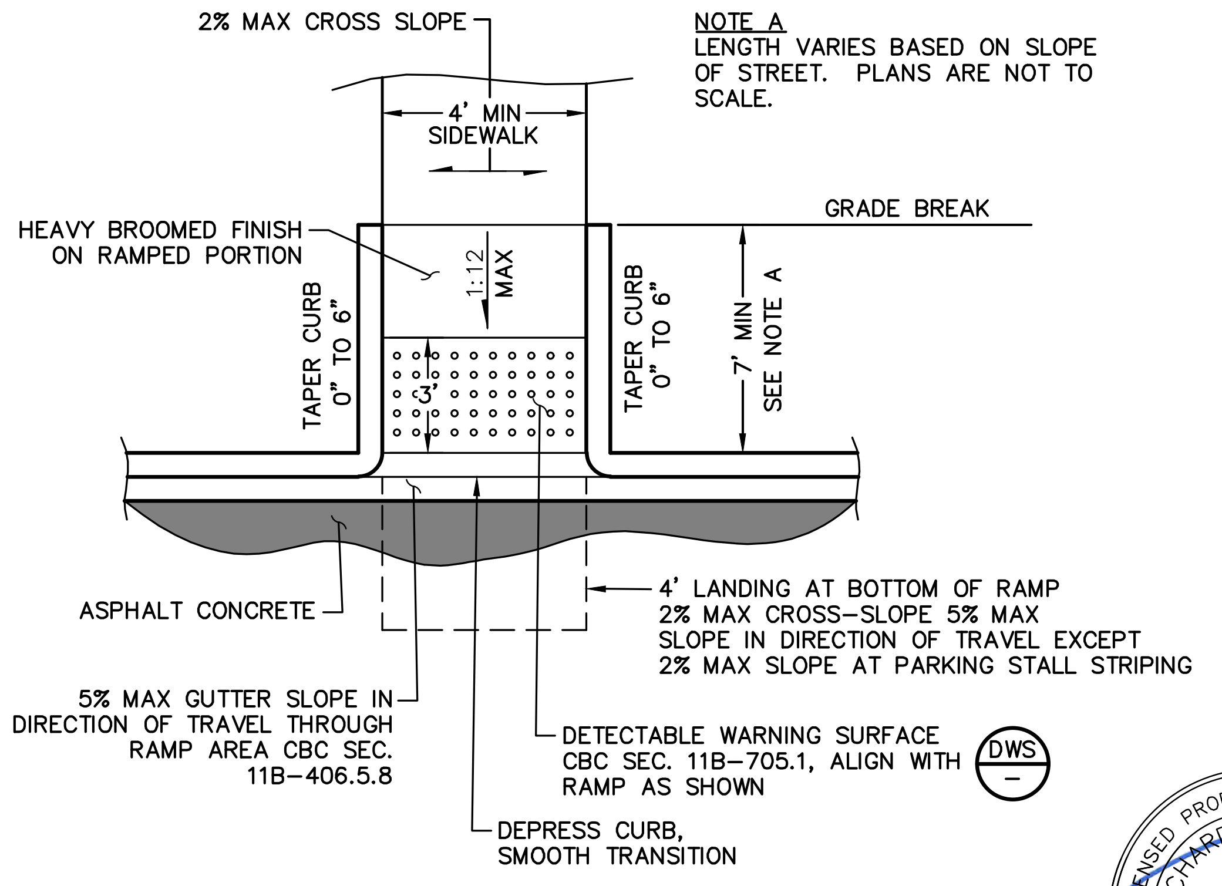
NO SCALE



NOTE A
LENGTH VARIES BASED ON SLOPE OF STREET. PLANS ARE NOT TO SCALE.

CRC CASE "C" CURB RAMP

NO SCALE



NOTE A
LENGTH VARIES BASED ON SLOPE OF STREET. PLANS ARE NOT TO SCALE.

CRF CASE "F" CURB RAMP

NO SCALE

RICHARD F. CARLILE No. 57885 CIVIL
4-8-2021

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PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND
CONSTRUCTION DETAILS
2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 4/12/21
FILE NO: 169131_SITE
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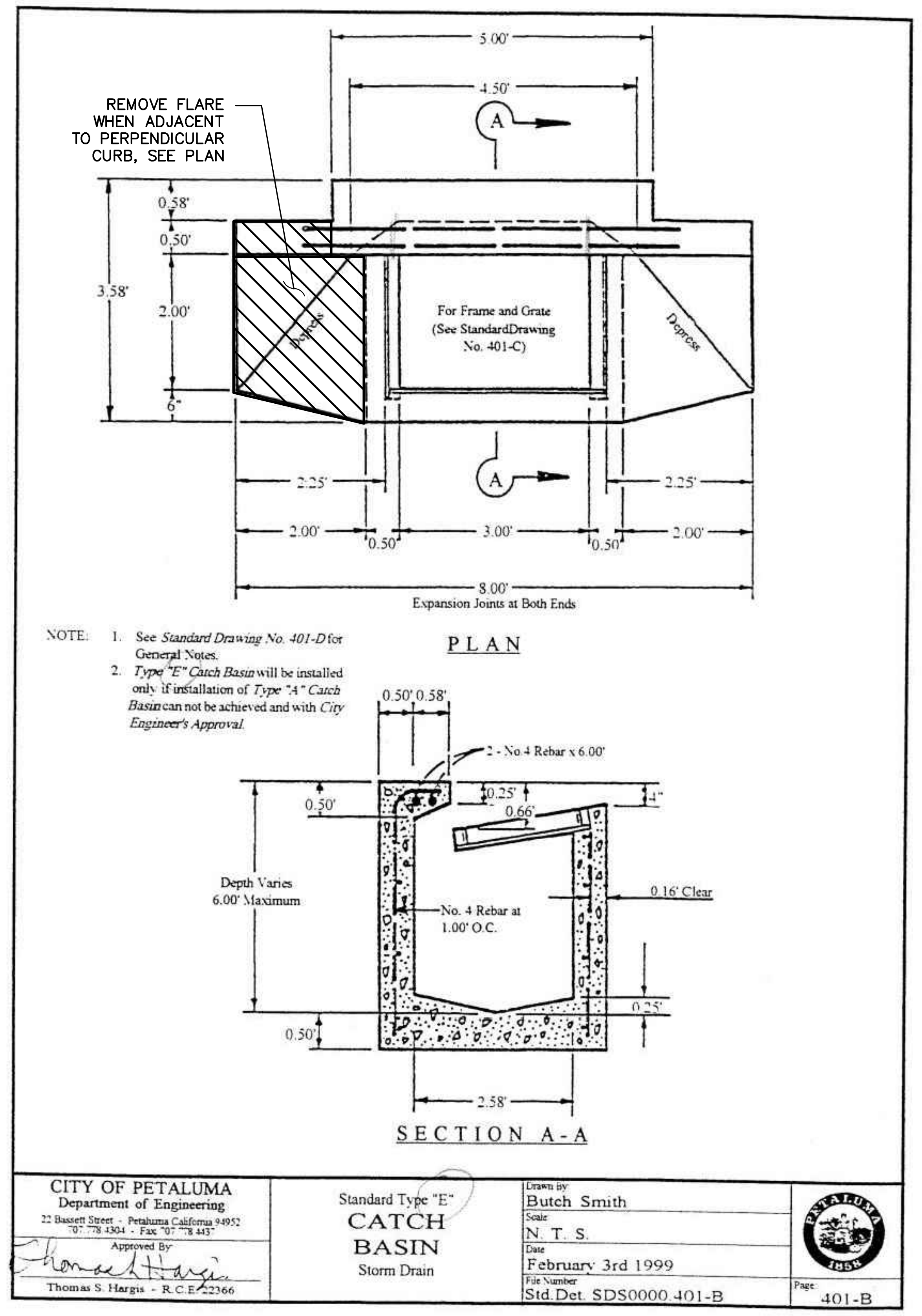
OF 59



NOTE:
1. See *Standard Drawing No. 401-D* for General Notes.
2. *Type "E" Catch Basin* will be installed only if installation of *Type "A" Catch Basin* can not be achieved and with *City Engineer's Approval.*

CITY OF PETALUMA
Department of Engineering
22 Bassett Street - Petaluma California 94952
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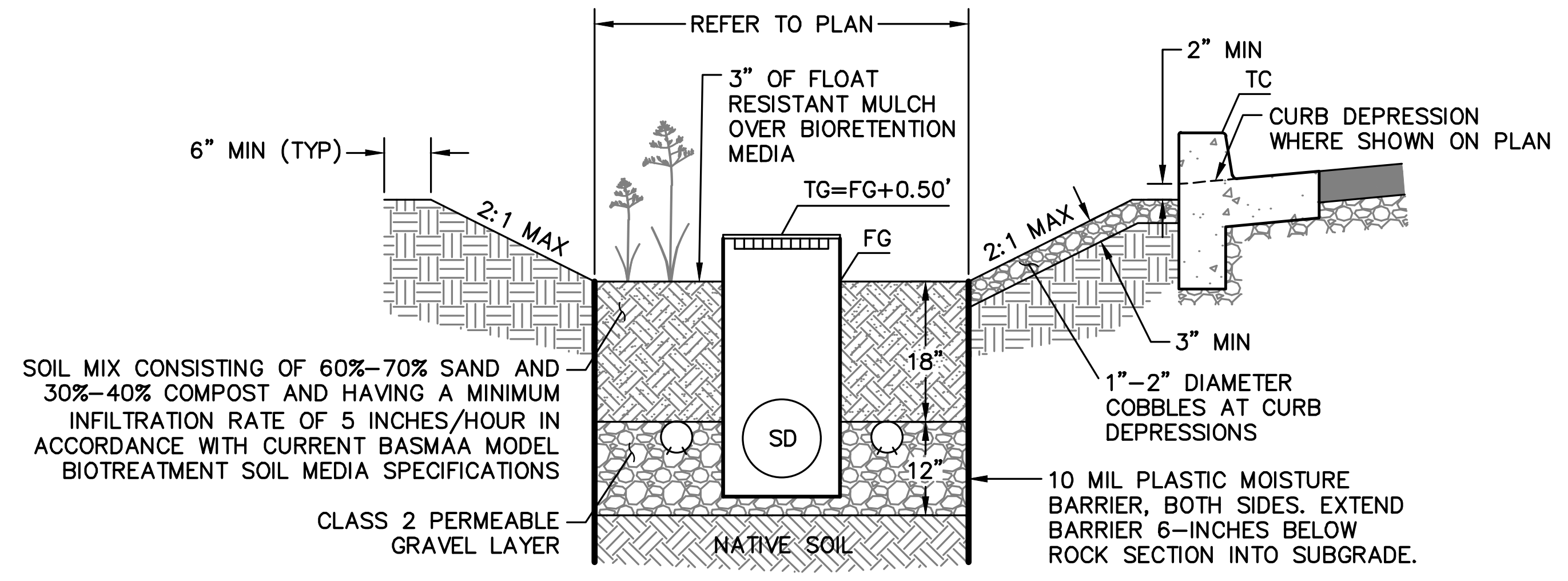
Approved By:
Thomas S. Hargis
Thomas S. Hargis - R.C.E. 22366

Standard Type "E"
CATCH
BASIN
Storm Drain

Drawn By: Butch Smith
Scale: N. T. S.
Date: February 3rd 1999
File Number: Std.Det. SDS0000.401-B
Page: 401-B

REFER TO THE LANDSCAPE ARCHITECT'S DRAWINGS FOR PLANTING.

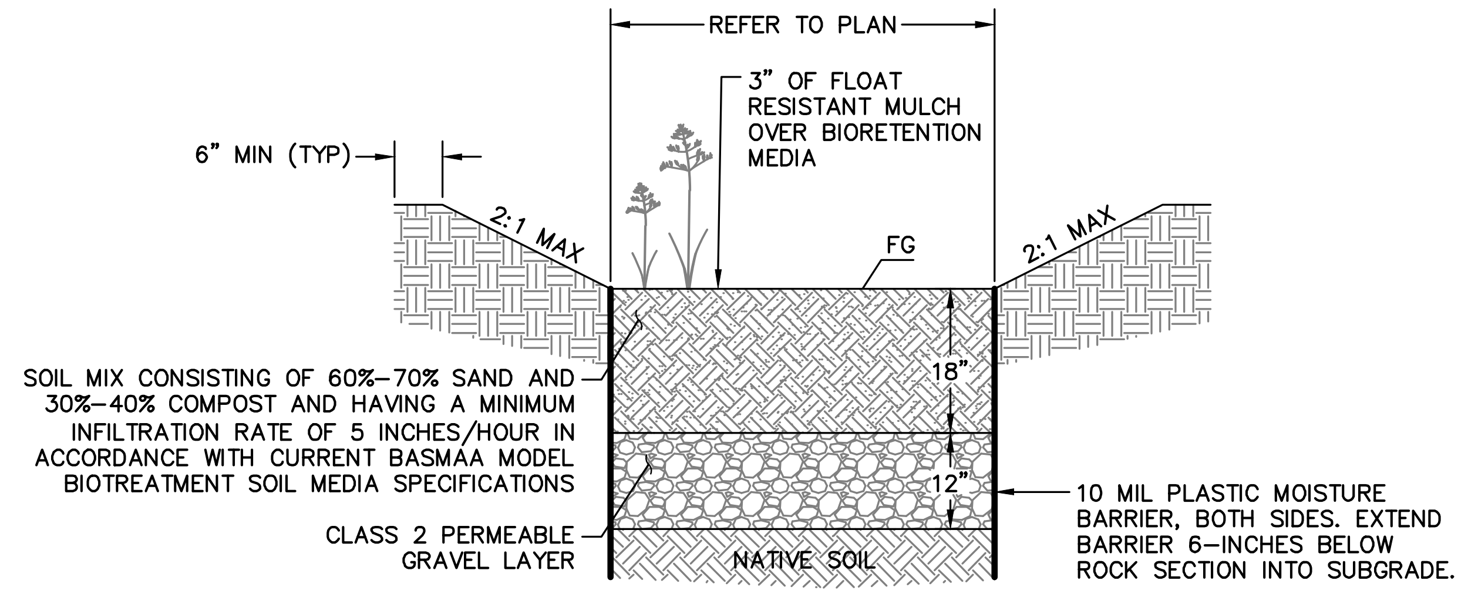


NOTE:
BIORETENTION FACILITIES SHALL INCLUDE PERFORATED SUBDRAINS WHERE SHOWN ON PLAN. THE TOP OF SUBDRAINS SHALL MATCH THE TOP OF THE CLASS 2 PERMEABLE GRAVEL LAYER.

BRF BIORETENTION FACILITY

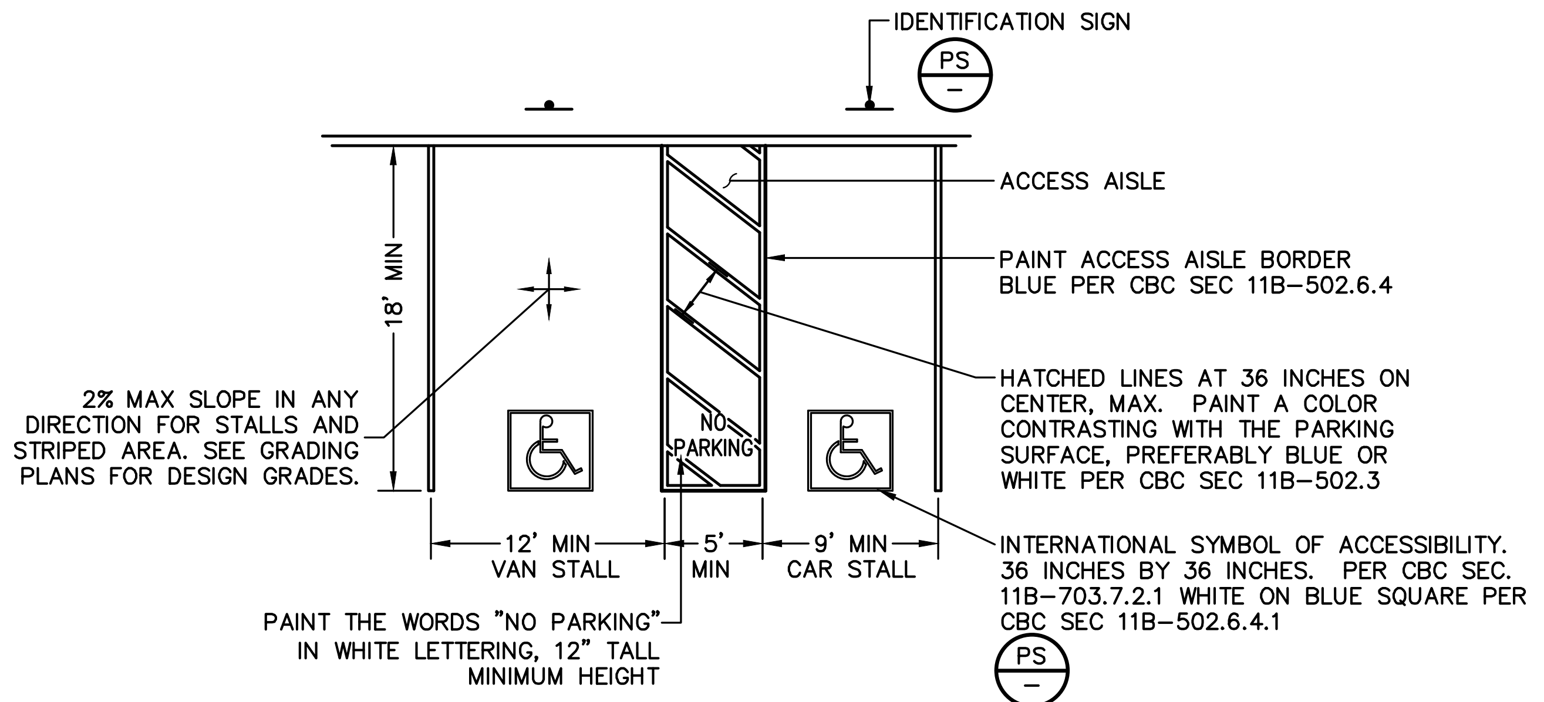
NO SCALE

REFER TO THE LANDSCAPE ARCHITECT'S DRAWINGS FOR PLANTING.



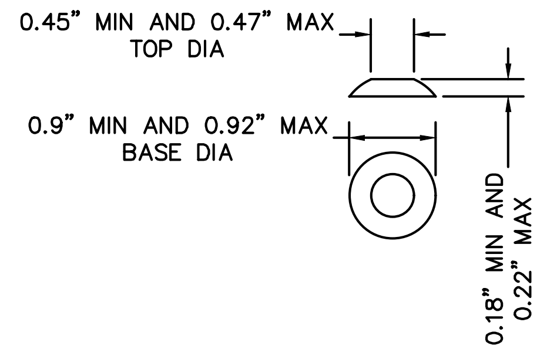
BRB BIORETENTION BASIN

NO SCALE

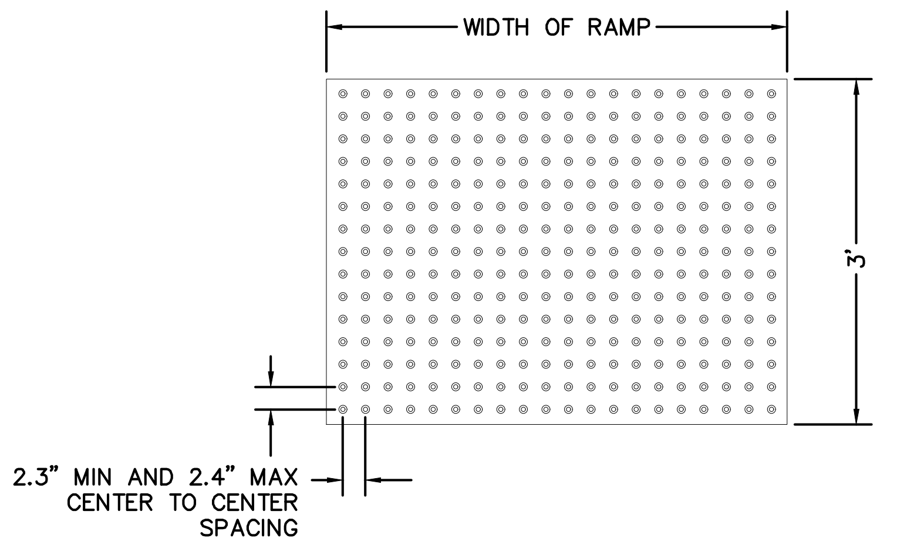


AP ACCESSIBLE PARKING IDENTIFICATION

NO SCALE



RAISED TRUNCATED DOME

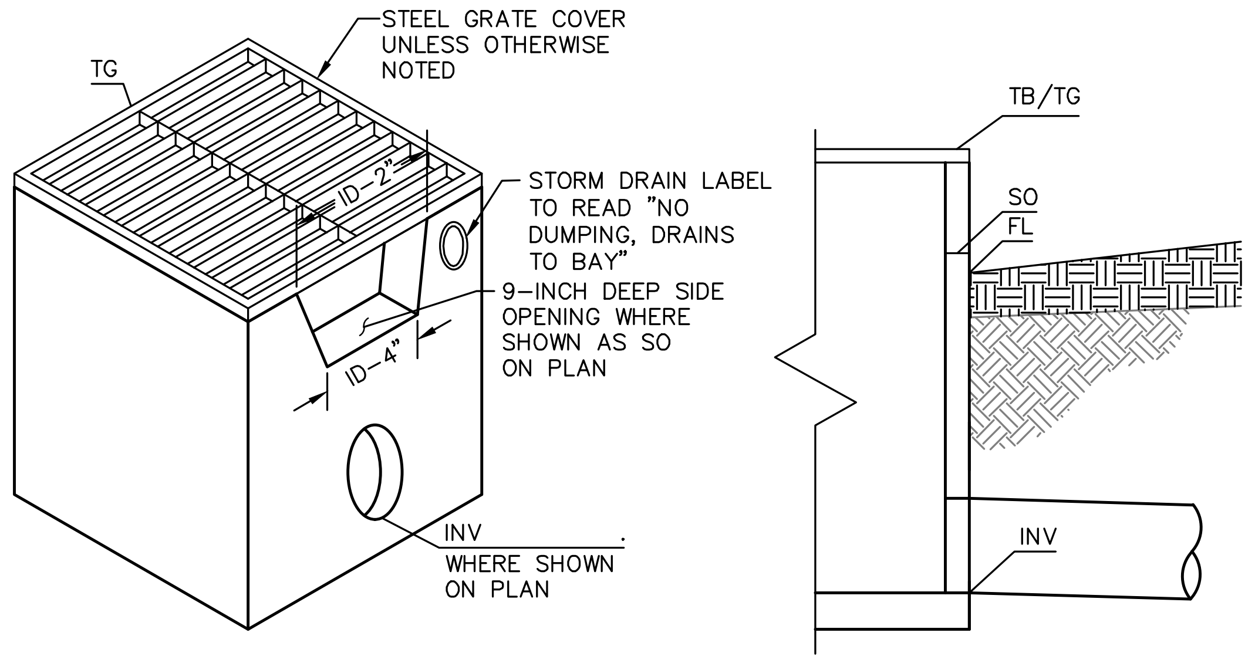


RAISED TRUNCATED DOME PATTERN

NOTES:
1. DETECTABLE WARNING SURFACE SHALL MEET SPECIFICATIONS PER CBC 11B-705.1
2. TRUNCATED DOMES SHALL ALIGN WITH THE RAMP IN THE DIRECTION OF TRAVEL.
3. AT CURB RAMPS, FRONT EDGE OF DETECTABLE WARNING SURFACE SHALL BE BETWEEN 6 AND 8 INCHES OF FACE OF CURB.
4. DETECTABLE WARNING SURFACE SHALL BE YELLOW CONFORMING TO FS 33538 OF FEDERAL STANDARD 595C.

DWS DETECTABLE WARNING SURFACE

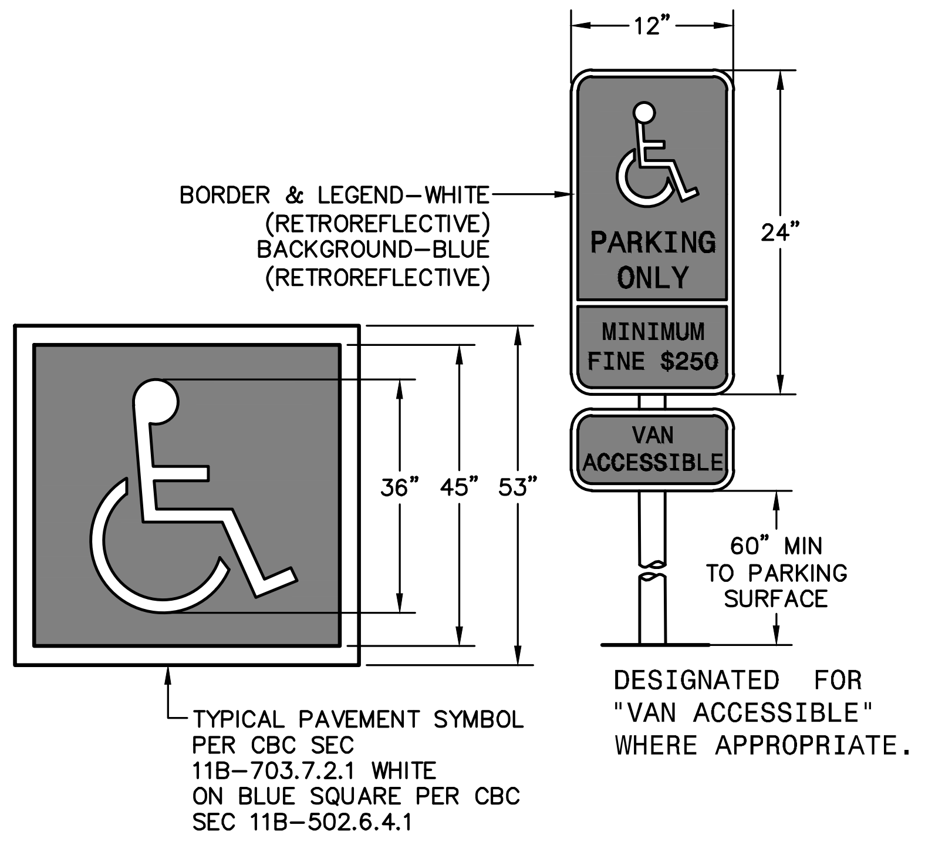
NO SCALE



*PRECAST MODEL SHALL BE OLDCASTLE CB1212, CB1818, OR CB2424 FOR 12"DI, 18"DI, AND 24" DI RESPECTIVELY UNLESS OTHERWISE APPROVED EQUAL

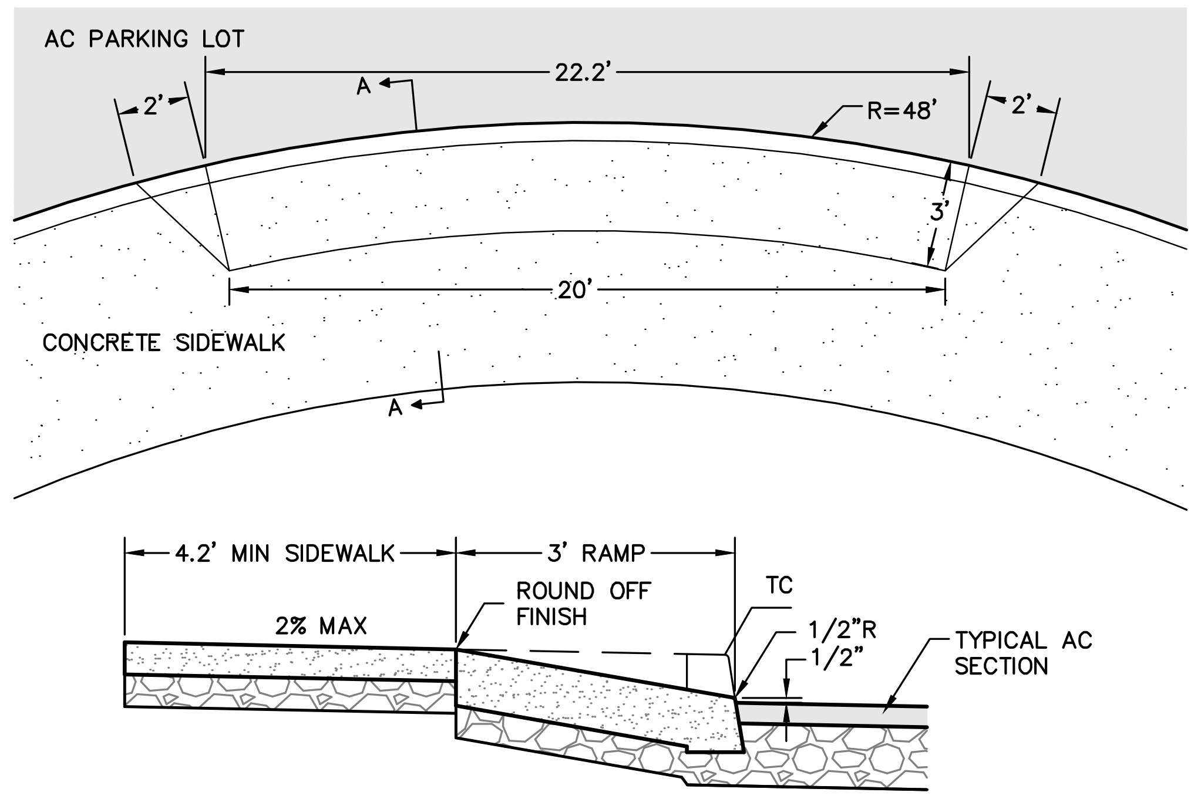
DI DROP INLET DETAIL

NO SCALE



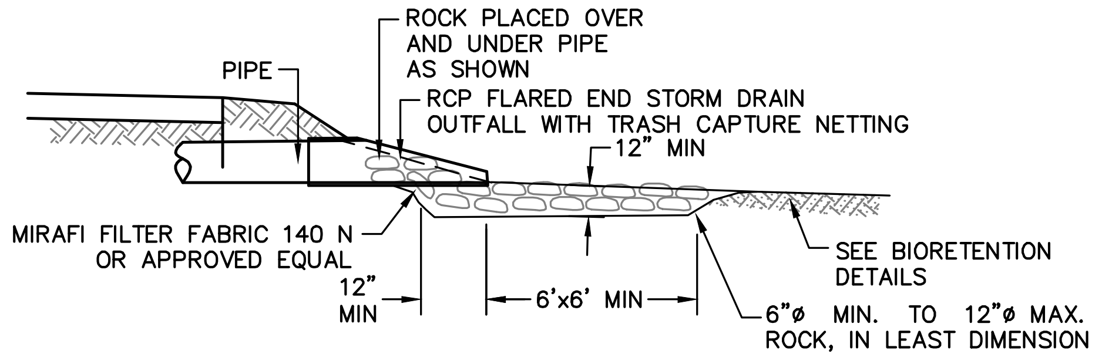
PS PARKING SPACE SIGNAGE

NO SCALE



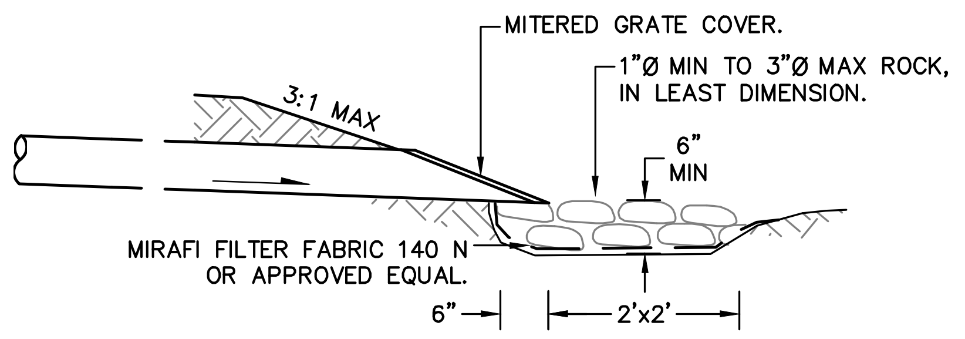
DR DRIVE RAMP DETAIL

NO SCALE



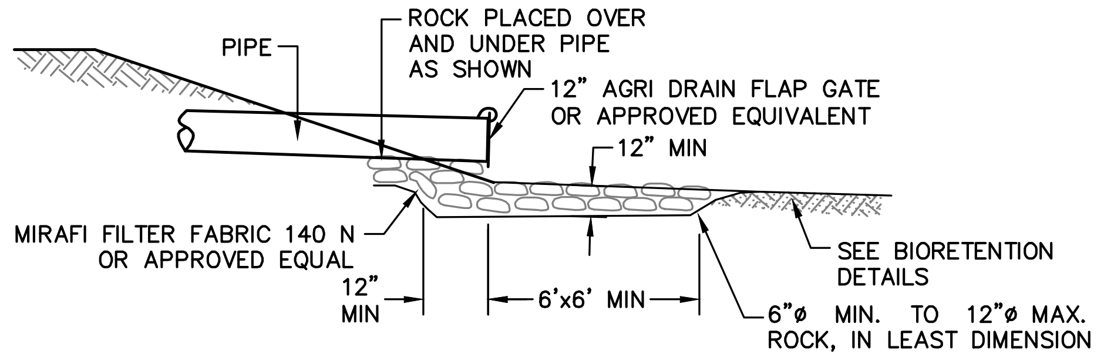
OF OUTFALL DETAIL

NO SCALE



OF2 OUTFALL DETAIL

NO SCALE



OF3 OUTFALL DETAIL

NO SCALE

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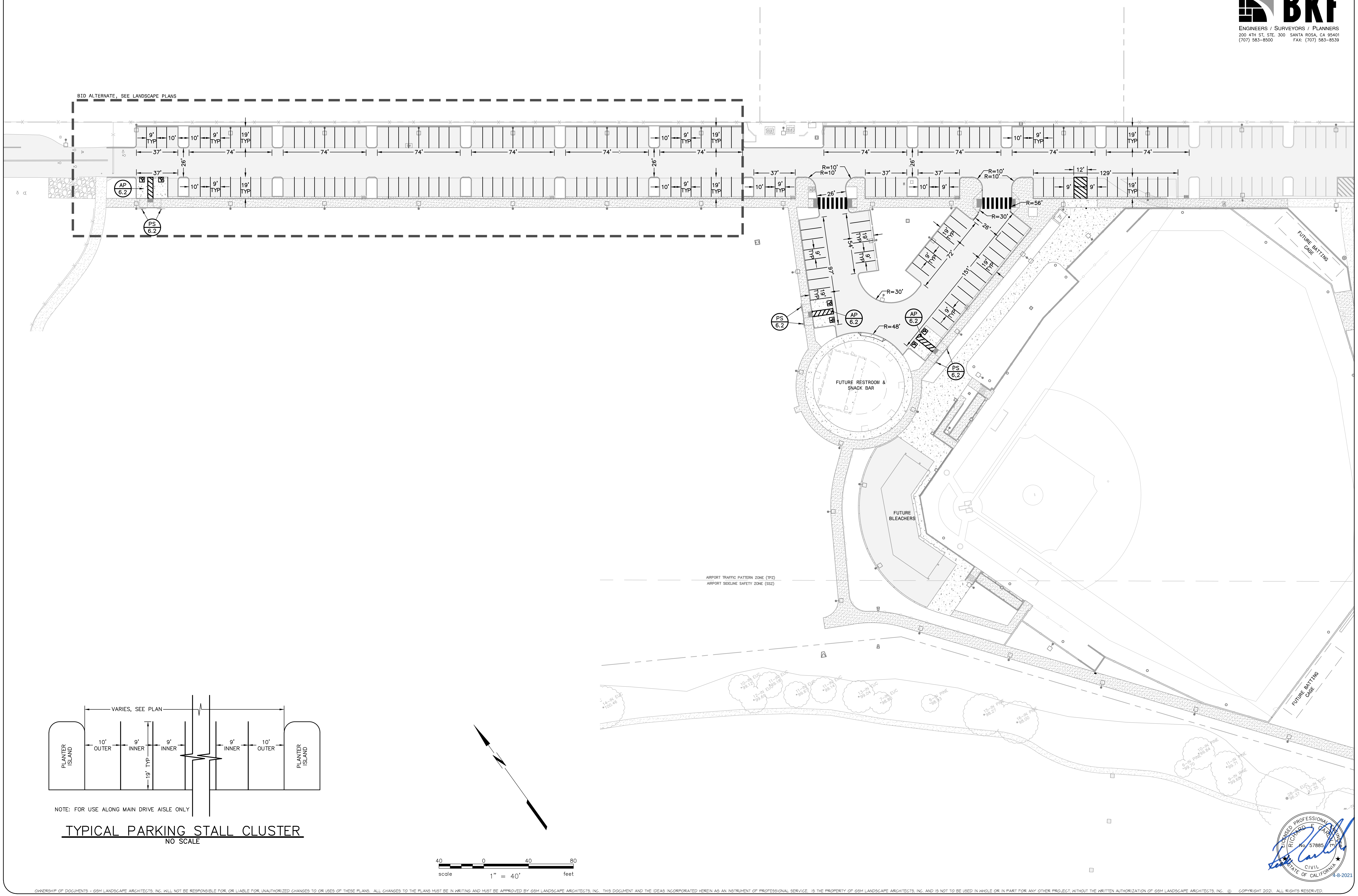

NOTE: FOR USE ALONG MAIN DRIVE AISLE ONLY

TYPICAL PARKING STALL CLUSTER
NO SCALE

40 0 40 80
scale 1" = 40' feet

No. 57885
CIVIL
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PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND
STRIPING PLAN
2430 E WASHINGTON ST PETALUMA, CA 94954

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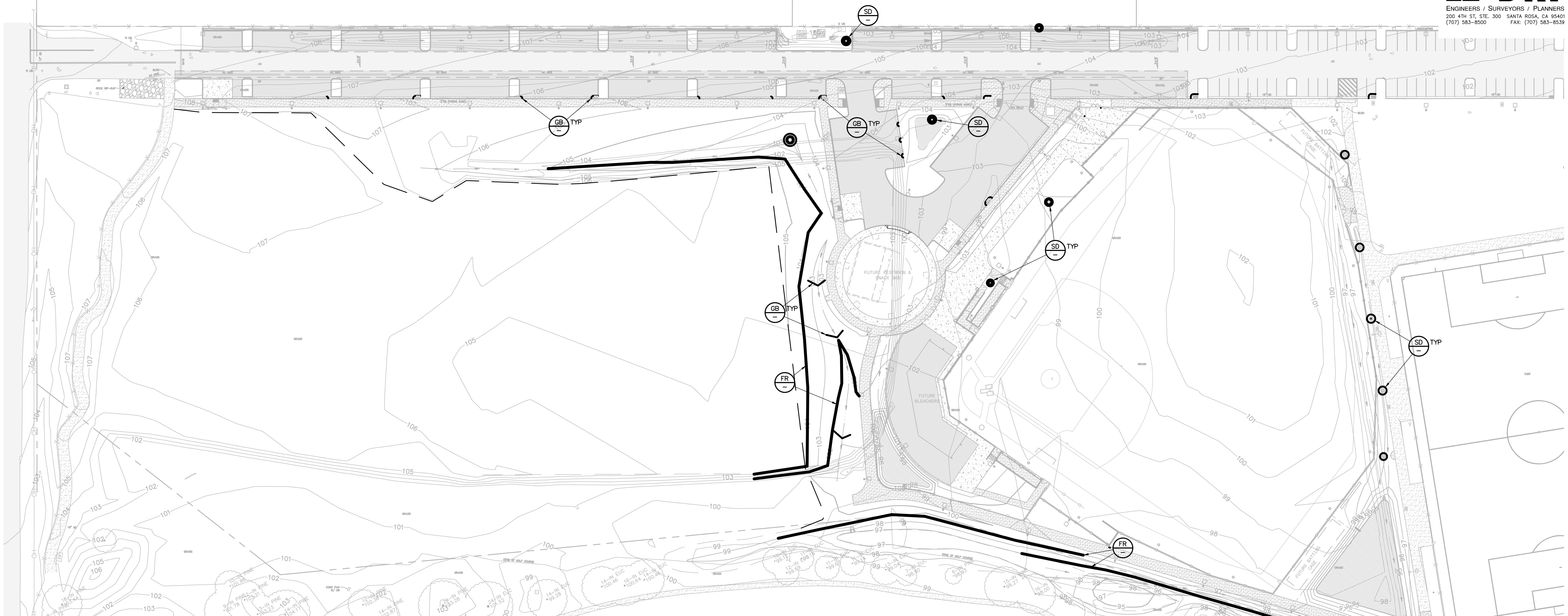
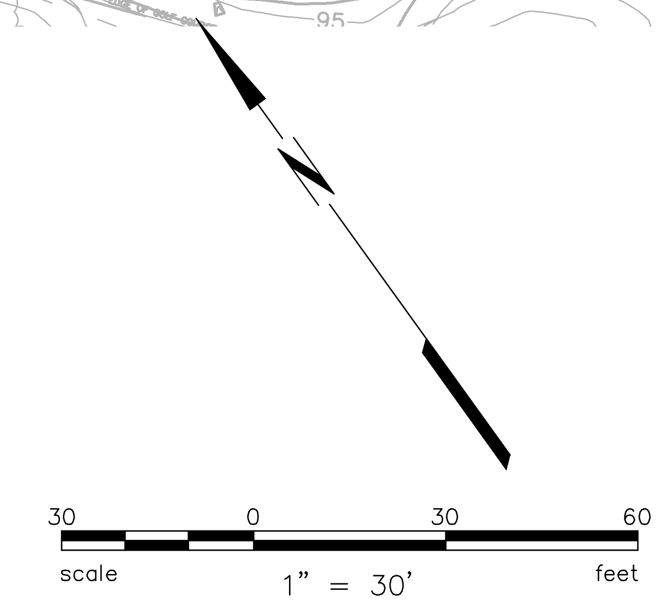
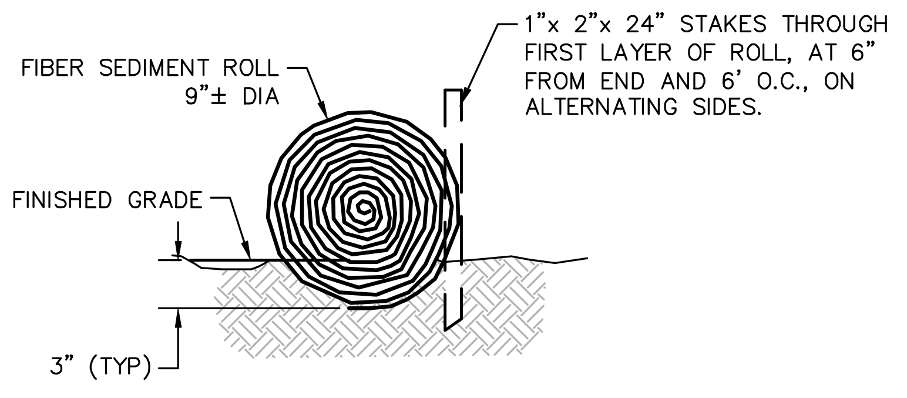
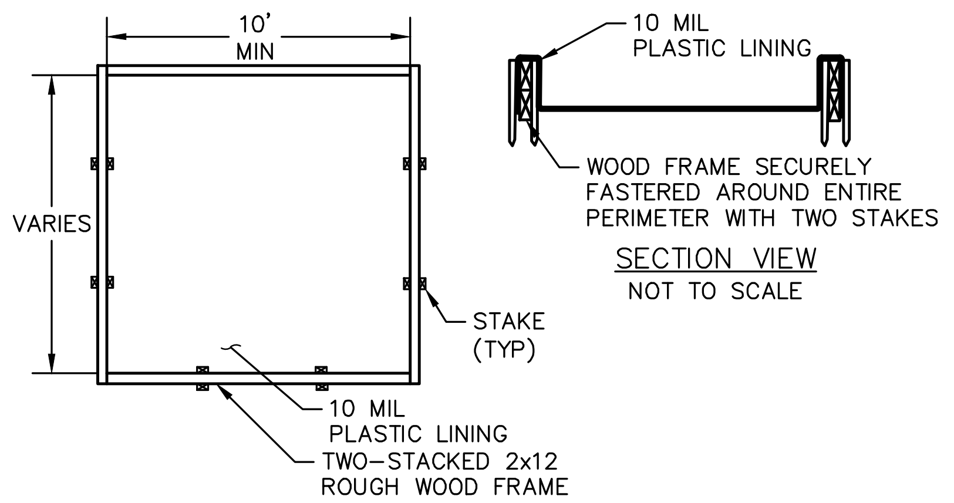






FR — FIBER ROLL DETAIL
NO SCALE



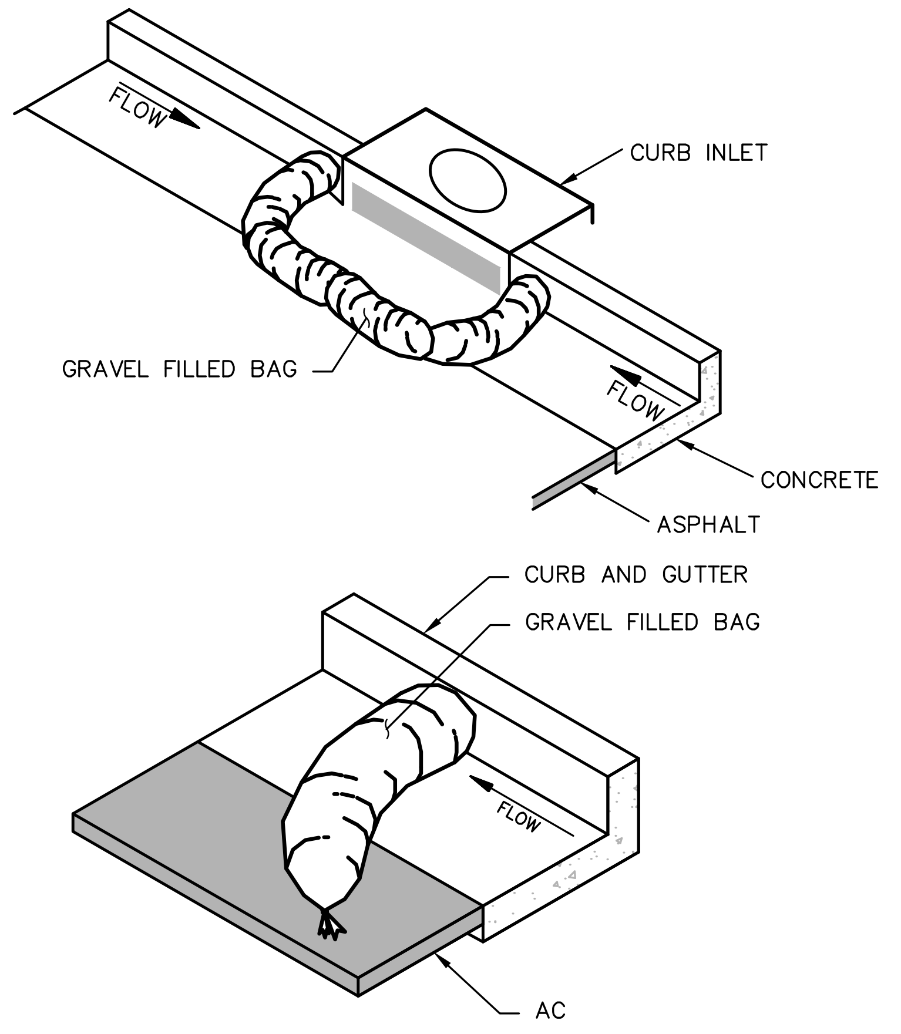
SECTION VIEW
NOT TO SCALE

PLAN VIEW
NOT TO SCALE

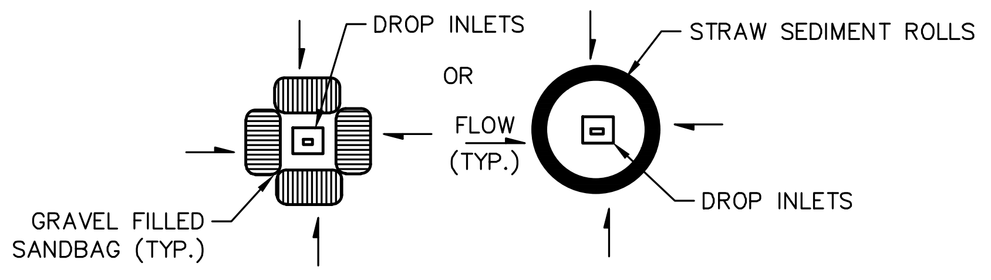
NOTES:

1. LOCATION IN PLAN SHOWN FOR GRAPHIC PURPOSE ONLY. LOCATION TO BE APPROVED BY INSPECTOR.
2. CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.
3. CONSTRUCT A BERMED AREA LARGE ENOUGH FOR LIQUID AND WASTE CONCRETE MATERIALS GENERATED DURING WASHOUT PROCEDURES. WASHOUT WASTES INTO THE TEMPORARY WASHOUT WHERE THE CONCRETE CAN SET, BE BROKEN UP, AND THEN DISPOSED PROPERLY. WASHOUT SHOULD BE LINED WITH A 10 MIL PLASTIC SO THERE IS NO DISCHARGE INTO THE UNDERLYING SOIL. REFER TO PROJECT SWPPP FOR BMP INSPECTION AND MAINTENANCE.

CW — CONCRETE WASHOUT DETAIL
NO SCALE



GB — GRAVEL BAG DETAILS
NO SCALE



SD — TYPICAL SEDIMENT DEVICES
NO SCALE

No. 57885
CIVIL
4-8-2021

DES: RFC
DRWN: RFC
CHKD: RFC

GSM landscape architects, inc.
landscape architecture
site planning
1700 Soscol Ave., Suite 23
Napa, CA 94559
(707) 255-4630
www.gsmlainc.com

CITY OF PETALUMA
PUBLIC WORKS & UTILITIES
202 N. McDowell Blvd., PETALUMA, CALIFORNIA, 94954
PH. 707-778-4546 FAX. 707-778-4508

PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND
SEDIMENT CONTROL PLAN
2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 4/12/21
FILE NO: 16913I_SITE
JOB NO: 1628
SHEET NO:
C8.1
OF 59

APPENDIX C
SWPPP AMENDMENTS AND AMENDMENT LOG

SWPPP Amendment No.

Project Name: ***Petaluma Community Sports Field Baseball Diamond, APN: 136-070-031***

Town Permits: ***Grading Permit No: TBD***
Building Permit No: TBD

BKF Project Number: ***20169131-10***

Qualified SWPPP Developer (QSD) Certification of the Storm Water Pollution Prevention Plan Amendment

"I certify under a penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

______________________	______________________
QSD's Signature	Date
Rick Carlile, Project Engineer	(707) 583-8533
QSD's name and title	Telephone Number

Discharger (Owner or Legally Responsible Person - LRP) Approval of the Storm Water Pollution Prevention Plan Amendment

"I certify under a penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

______________________	______________________
Discharger (or LRP)'s Signature	Date
______________________	______________________
Discharger's name and title	Telephone Number

Amendment Log

Project Name: ***Petaluma Community Sports Field Baseball Diamond,***
APN: 136-070-031

Town Permits: ***Grading Permit No: TBD***
Building Permit No: TBD

BKF Project Number: ***20169131-10***

Amendment No.	Date	Brief Description of Amendment	Prepared By

APPENDIX D

NAL/NEL EXCEEDANCE SITE EVALUATIONS

There are no NELs for this project.

Numeric Action Levels (NALs)

pH outside the range of 6.5 to 8.5 requires an NAL report.
Turbidity greater than 250 NTU requires an NAL report.

APPENDIX E

SUBMITTED CHANGES TO PRDS
(DUE TO CHANGE IN OWNERSHIP OR ACREAGE)

APPENDIX F

CONSTRUCTION SCHEDULE

APPENDIX G

CONSTRUCTION ACTIVITIES, MATERIALS USED AND ASSOCIATED POLLUTANTS

SWPPP Construction Site Pollutant Checklist

CATEGORY - ADHESIVES **Page of .**

Examples:	Adhesives, glues, Resins and epoxy synthetics, Caulks, sealers, putty, sealing agents, Coal tars (naphtha, pitch)	**Pollutants:**	Phenolics, formaldehydes Phenolics, formaldehydes Asbestos, phenolics, formaldehydes Benzene, phenols, naphthalene

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – “L” = Liquid, “P” = Powder, “S” = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY - CLEANERS			**Page of .**
Examples:	Polishes, (metal, ceramic, tile) Etching agents, Cleaners, ammonia, lye, caustic sodas Bleaching agents Chromate salts	**Pollutants:**	Metals Metals Acidity/alkalinity Acidity/alkalinity Chromium

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – "L" = Liquid, "P" = Powder, "S" = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY - PLUMBING **Page of .**

Examples:	Solder (lead, tin), flux (zinc chloride) Pipe fitting (cut shavings) Galvanized metals (nails, fences) Electrical wiring	**Pollutants:**	Lead, copper, zinc, tin Copper Zinc Copper, lead

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – “L” = Liquid, “P” = Powder, “S” = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY - PAINTING **Page of .**

Examples:	Paint thinner, acetone, MEK, stripper Paints, lacquers, varnish, enamels Turpentine, gum spirit, solvents Sanding Paints	**Pollutants:**	VOCs Metals, Phenolics, mineral spirits VOCs Metals Metals

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – “L” = Liquid, “P” = Powder, “S” = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY – WOODS **Page of .**

Examples:	Sawdust Particle board dusts Treated woods	**Pollutants:**	BOD Formaldehyde Copper, creosote

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – "L" = Liquid, "P" = Powder, "S" = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY – MASONRY AND CONCRETE **Page of .**

Examples:	Dusts (brick, cement) Colored chalks (pigments) Concrete curing compounds Glazing compounds Cleaning surfaces	**Pollutants:**	Acidity, sediments Metals See MSDS Asbestos Acidity

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – “L” = Liquid, “P” = Powder, “S” = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY – FLOORS AND WALLS	**Page of .**

Examples:	Flashing Drywall Tile cutting (ceramic dusts) Adhesives (see Adhesives category)	**Pollutants:**	Copper, aluminum Dusts Minerals

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – "L" = Liquid, "P" = Powder, "S" = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY – REMODELING AND DEMOLITION	**Page of .**

Examples:	Insulation Coolant reservoirs Adhesives (See Adhesives category)	**Pollutants:**	Asbestos Freon

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – “L” = Liquid, “P” = Powder, “S” = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY – AIR CONDITIONING AND HEATING **Page of .**

Examples:	Insulating Coolant reservoirs Adhesives (See Adhesives category)	**Pollutants:**	Asbestos Freon

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – "L" = Liquid, "P" = Powder, "S" = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY – YARD OPERATION AND MAINTENANCE			Page of .
Examples:	Vehicle and machinery maintenance Gasoline, oils, additives Marking paints (sprays) Grading, earth moving Portable toilets Fire hazard control (herbicides) Health and Safety Wash waters (herbicides, concrete, oils and greases)	**Pollutants:**	Oils and grease, coolants Benzene & derivatives, oils, grease Vinyl chloride, metals Erosion (sediments) BOD, disinfectants (spills) Sodium arsenite, dinitro compounds Rodenticides, insecticides (see above categories)

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – "L" = Liquid, "P" = Powder, "S" = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY – LANDSCAPING AND EARTHMOVING			Page of .
Examples:	Planting, plant maintenance Excavation, tilling Masonry and concrete Solid wastes (trees, shrubs) Exposing natural lime /mineral deposits Soil additives Revegetation of graded areas	**Pollutants:**	Pesticides, herbicides, nutrients Erosion (sediments) (see above categories) BOD Acidity/alkalinity, metals Aluminum sulfate, sulfur Fertilizers

Product Name, Physical Form (L, P or S)*	Storage Location	Method of Control and Protection	Quantity

*Physical Form – "L" = Liquid, "P" = Powder, "S" = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

SWPPP Construction Site Pollutant Checklist

CATEGORY - MATERIALS STORAGE **Page of .**

Examples:	Waste storage (used oils, solvents,etc) Hazardous waste containment Raw material piles	**Pollutants:**	Spills, leaks Spills, leaks Dusts, sediments

Product Name, Physical Form (L, P or S)*	**Storage Location**	**Method of Control and Protection**	**Quantity**

*Physical Form – "L" = Liquid, "P" = Powder, "S" = Solid

Note: VOC = Volatile organic compounds, BOD = Biological oxygen demand due to the use of oxygen by decomposing materials.

References: USEPA. 1973. Processes, Procedures, and Methods to Control Pollution Resulting From Construction Activity. Office of Air and Water Programs, EPA 430/9-73-007. October, 1973. Meech, Mark L. and Margaret Lattin Bazany. 1991. Construction Creates Own Set of Hazardous Wastes, Hazmat World August, 1991. Gosselin, R.E. Ph.D, R.P. Smith Ph.D., and H.C. Hodge Ph.D. 1984. Clinical Toxicology of Commercial Products, Fifth Ed. Williams and Wilkins, Baltimore/London.

APPENDIX H

CASQA BMP HANDBOOK FACT SHEETS

(Not Included in Version of SWPPP Posted on SMARTS.)

APPENDIX I

VISUAL INSPECTION FIELD LOG SHEET - RISK LEVEL 2

EFFLUENT SAMPLING FIELD LOG SHEETS - RISK LEVEL 2

Risk Level 2
Visual Inspection Field Log Sheet

Date and Time of Inspection:	Report Date:

Inspection Type:

☐Weekly BMP Inspections	☐Before Predicted Rain	☐During Rain Event	☐After Qualifying Rain Event	☐Contained Stormwater Release	☐Quarterly Non-Stormwater

Site Information

Construction Site Name:

Construction Stage:	Completed Activities:	Approximate Area of Exposed Site:

Weather Information

Precipitation: ☐ Yes ☐ No

Date Rain Predicted to Occur:	Predicted % Chance of Rain:

Estimated Storm Start:	Estimated Storm Duration:	Estimate Time Since Last Storm:	Rain Gauge Reading:
(date and time)	(hours)	(days or hours)	(inches)

Deficiencies Identified (see BMP Inspection & Discharge Inspection Checklists Attached)

BMP w/ Deficiency	Corrective Action Required	SWPPP Revision (Yes/No)	Date to be Completed

Inspector Information

Inspector Name:	Inspector Title:
Signature:	Date:

Provide photos to document conditions as necessary

BMP Inspection Checklist (On-Site if safely accessible)				
BMP	V1 (V/D)	V2 (V/D)	V3 (V/D)	Corrective Action Required
SWPPP				
Are all BMPs shown on the site maps installed in the proper location(s) and according to the details in the SWPPP?				
Preservation of Existing Vegetation				
Is temporary fencing provided to preserve vegetation in areas where no construction activity is planned?				
Erosion Control				
Are there any non-vegetated areas that may require temporary erosion control?				
Is the area where erosion controls are used free from visible erosion?				
Temporary Linear Sediment Barriers (Silt Fence, Fiber Rolls, Sanbags, etc)				
Are linear barriers installed where necessary and properly spaced?				
Are linear barriers free of accumulated litter?				
Is the built up sediment less than 1/3 the height of the barrier?				
Storm Drain Inlet Protection				
Are storm drain inlet protection devices in working order and being properly maintained?				
Stockpiles				
Are stockpiles located at least 15 m from concentrated flows, downstream drainage courses and storm drain inlets?				
Are required covers and/or perimeter controls in place?				
Sediment Basins				
Are basin controls (inlets, outlets, diversions, weirs, spillways, and racks) in working order?				
Tracking Control				
Is the entrance stabilized to prevent tracking?				
Is the stabilized entrance inspected daily to ensure that it is working properly?				
Are all paved areas free of visible sediment tracking or other particulate matter?				
Wind Erosion Control				
Is dust control implemented (via water trucks or other means)?				

V1 = Visual Inspection Location 1
V = Viewed
D = Deficiency noted

BMP	V1 (V/D)	V2 (V/D)	V3 (V/D)	Corrective Action Required
Materials Pollution Control				
Are material storage areas and washout areas protected from run-on and run-off, and located at least 15 m from concentrated flows and downstream drainage facilities?				
Are all material handling and storage areas clean, organized, free of spills, leaks, or any other deleterious material; and stocked with appropriate clean-up supplies?				
Are liquid materials, hazardous materials, and hazardous wastes stored in temporary containment facilities?				
Are bagged & boxed materials stored on pallets?				
Are hazardous materials and wastes stored in appropriate, labeled containers?				
Are proper storage, clean-up, and spill-reporting procedures for hazardous materials and wastes posted in open, conspicuous and accessible locations adjacent to storage areas?				
Are temporary containment facilities free of spills and rainwater?				
Are temporary containment facilities and bagged/boxed materials covered?				
Are temporary concrete washout facilities designated and being used?				
Are temporary concrete washout facilities functional for receiving and containing concrete waste and are concrete residues prevented from entering the drainage system?				
Do temporary concrete washout facilities provide sufficient volume and freeboard for planned concrete operations?				
Waste Management				
Are concrete wastes, including residues from cutting and grinding, contained and disposed of off-site or in concrete washout facilities?				
Is the site free of litter?				
Are trash receptacles provided in the yard, trailer areas, and at locations where workers congregate for lunch and break periods?				
Is litter from work areas collected and placed in watertight dumpsters?				
Are waste management receptacles free of leaks?				
Are the contents of waste management receptacles properly protected from contact with storm water or from being dislodged by winds?				

V1 = Visual Inspection Location 1
V = Viewed
D = Deficiency noted

BMP	V1 (V/D)	V2 (V/D)	V3 (V/D)	Corrective Action Required
Are waste management receptacles filled at or beyond capacity?				
Vehicle & Equipment Fueling, Cleaning, and Maintenance				
Are vehicle and equipment fueling, cleaning and maintenance areas reasonably clean and free of spills, leaks, or any other deleterious material?				
Are vehicle and equipment fueling, cleaning and maintenance activities performed on an impermeable surface in dedicated areas?				
If no, are drip pans used?				
Are dedicated fueling, cleaning, and maintenance areas located at least 15 m away from downstream drainage facilities and watercourses and protected from run-on and run-off?				
Is wash water contained for infiltration/ evaporation and disposed of appropriately?				
Is on-site cleaning limited to washing with water (no soap, soaps substitutes, solvents, or steam)?				
On each day of use, are vehicles and equipment inspected for leaks and if necessary, repaired?				
Dewatering Operations				
Are all one-time dewatering operations covered by the General Permit inspected before and as they occur and BMPs implemented as necessary during discharge?				
Is ground water dewatering handled in conformance with the dewatering permit issued by the RWQCB?				
Is required treatment provided for dewatering effluent?				
Temporary Water Body Crossing or Encroachment				
Are temporary water body crossings and encroachments constructed appropriately?				
Does the project conform to the requirements of the 404 permit and/or 1601 agreement?				
Illicit Connection/ Discharge				
Is there any evidence of illicit discharges or illegal dumping on the project site?				
If yes, has the Owner/Operator been notified?				
Discharge Points				
Are discharge points and discharge flows free from visible pollutants and significant sediment transport?				
General				
Are there any other potential concerns at the site?				

V1 = Visual Inspection Location 1
V = Viewed
D = Deficiency noted

Discharge or other Stormwater Inspection (if applicable)				
Observation	V1 (Yes/No)	V2 (Yes/No)	V3 (Yes/No)	Corrective Action Required
Odors				
Floating Material				
Suspended Material				
Sheen				
Discolorations				
Turbidity				

V1 = Visual Inspection Location 1
V = Viewed
D = Deficiency noted

Risk Level 2
Effluent Sampling Field Log Sheet

Construction Site Name:	Date and Time of Inspection:
Sampling Event Type:	
☐ Stormwater	☐ Non-stormwater

Field Meter Type and Calibration

pH Meter ID No./Desc: Calibration Date/Time:	Turbidity Meter ID No./Desc: Calibration Date/Time:

Field pH and Turbidity Measurements

Measurement		S1	S2	S3	Sampler
Time	1st				
	2nd				
	3rd				
pH	1st				
	2nd				
	3rd				
Turbidity	1st				
	2nd				
	3rd				
Rain Gauge Reading	1st				
	2nd				
	3rd				
Weather Observations	1st				
	2nd				
	3rd				
Site Observations	1st				
	2nd				
	3rd				
Noted Deficiencies	1st				
	2nd				
	3rd				

S1 = Sample Location 1

Risk Level 2 Non-Visible Pollutant Field Log Sheet	
Construction Site Name:	Date and Time of Inspection:

Grab Samples Collected		
Discharge Location Description	Sample Type	Time

Sampler Information	
Sampler Name:	Sampler Title:
Signature:	Date:

APPENDIX J

AGENCY APPROVALS AND MISCELLANEOUS DOCUMENTS

APPENDIX K

TRAINING REPORTING FORM

Trained Contractor Personnel Log

Storm Water Management Training Log

Project Name: Petaluma Community Sports Field Baseball Diamond

Project Number/Location: ____________________

Storm Water Management Topic: (check as appropriate)

- ☐ SWPPP Implementation
- ☐ BMP Inspection and Maintenance
- ☐ Record Keeping
- ☐ Erosion Control
- ☐ Wind Erosion Control
- ☐ Non-storm water management
- ☐ Storm Water Sampling
- ☐ Sediment Control
- ☐ Tracking Control
- ☐ Waste Management and Materials Pollution Control

Specific Training Objective: ____________________

Location: ____________________ Date: ____________________

Instructor: ____________________ Telephone: ____________________

Course Length (hours): ____________________

Attendee Roster (attach additional forms if necessary)

Name	Company	Phone

Name	Company	Phone

COMMENTS:

APPENDIX L

RESPONSIBLE PARTIES

Property Owners / Dischargers:
GSM Landscape Architects
c/o Bart Ito
1700 Soscol Ave, Suite 23
Napa, California 95492

Legally Responsible Person:
TBD
Position
1700 Soscol Ave, Suite 23
Napa, California 95492

Qualified SWPPP Practitioner
TBD,
Company
Address
Address

Qualified SWPPP Developer
Rick Carlile, Project Engineer
BKF Engineers
200 4th Street, Suite 300
Santa Rosa, Ca 95401

APPENDIX M

CONTRACTORS AND SUBCONTRACTORS

CONTRACTOR/SUBCONTRACTOR LIST

(All contractors, subcontractors, and individuals who will be directed by the QSP.)

Project Name: Petaluma Community Sports Field Baseball Diamond

Project Number/Location: ____________________

COMPANY NAME	CONTACT NAME	ADDRESS	PHONE NUMBER	EMERGENCY CONTACT #	SPECIFIC AREAS OF RESPONSIBILITY

USE ADDITIONAL PAGES AS NECESSARY

“Subcontractor Notification Letter”

SWPPP Notification

Company:
Address:
City, State, ZIP:

Dear Sir/Madam,

Please be advised that the California State Water Resources Control Board has adopted the General Permit (General Permit) for Storm Water Discharges Associated with Construction Activity (CAS000002). The goal of these permits is prevent the discharge of pollutants associated with construction activity from entering the storm drain system, ground and surface waters.

The Owner has developed a Storm Water Pollution Prevention Plan (SWPPP) in order to implement the requirements of the Permits.

As a subcontractor, you are required to comply with the SWPPP and the Permits for any work that you perform on site. Any person or group who violates any condition of the Permits may be subject to substantial penalties in accordance with state and federal law. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP and the Permits. A copy of the Permits and the SWPPP are available for your review at the construction office. Please contact me if you have further questions.

Sincerely,

Name:
Title:

APPENDIX N

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APPENDIX O

CONSTRUCTION RECORDS

APPENDIX P

RAIN EVENT ACTION PLAN FORM

Rain Event Action Plan (REAP)

Date:		**WDID Number:**	
Date Rain Predicted to Occur:		**Predicted % chance of rain:**	

Site Information:

Site Name, City and Zip Code

Project Risk Level: ☐ Risk Level 2 ☐ Risk Level 3

Site Stormwater Manager Information:

Name, Company, Emergency Phone Number (24/7)

Erosion and Sediment Control Contractor – Labor Force contracted for the site:

Name, Company, Emergency Phone Number (24/7)

Stormwater Sampling Agent:

Name, Company, Emergency Phone Number (24/7)

Current Phase of Construction

Check ALL the boxes below that apply to your site.

- ☐ Grading and Land Development
- ☐ Streets and Utilities
- ☐ Vertical Construction
- ☐ Final Landscaping and Site Stabilization
- ☐ Inactive Site
- ☐ Other:

Activities Associated with Current Phase(s)

Check ALL the boxes below that apply to your site (some apply to all Phases).

Grading and Land Development:

- ☐ Demolition
- ☐ Rough Grade
- ☐ Soil Amendment(s):
- ☐ Rock Crushing
- ☐ Equip. Maintenance/Fueling
- ☐ Vegetation Removal
- ☐ Finish Grade
- ☐ Excavation (______ ft)
- ☐ Erosion and Sediment Control
- ☐ Material Delivery and Storage
- ☐ Vegetation Salvage-Harvest
- ☐ Blasting
- ☐ Soils Testing
- ☐ Surveying
- ☐ Other:

Streets and Utilities:

- ☐ Finish Grade
- ☐ Equip. Maintenance/Fueling
- ☐ Curb and Gutter/Concrete Pour
- ☐ Utility Install: water-sewer-gas
- ☐ Storm Drain Installation
- ☐ Masonry
- ☐ Paving Operations
- ☐ Material Delivery & Storage
- ☐ Other:

Vertical Construction:

- ☐ Framing
- ☐ Masonry
- ☐ Drywall/Interior Walls
- ☐ Equip. Maintenance/Fueling
- ☐ Exterior Siding
- ☐ Flooring
- ☐ Carpentry
- ☐ Electrical
- ☐ Plumbing
- ☐ HVAC
- ☐ Insulation
- ☐ Roofing
- ☐ Concrete/Forms/Foundation
- ☐ Painting
- ☐ Stucco
- ☐ Tile
- ☐ Landscaping & Irrigation
- ☐ Other:

Final Landscaping & Site Stabilization:

- ☐ Stabilization
- ☐ Finish Grade
- ☐ Painting and Touch-Up
- ☐ Drainage Inlet Stencils
- ☐ Other:
- ☐ Vegetation Establishment
- ☐ Storage Yard/ Material Removal
- ☐ Irrigation System Testing
- ☐ Inlet Filtration
- ☐ Other:
- ☐ E&S Control BMP Removal
- ☐ Landscape Installation
- ☐ Other:
- ☐ Perm. Water Quality Ponds
- ☐ Other:

Inactive Construction Site:

- ☐ E & S Control Device Installation
- ☐ E & S Control Device Maintenance
- ☐ Routine Site Inspection
- ☐ Street Sweeping
- ☐ Trash Removal
- ☐ Other:

Rain Event Action Plan (REAP)

Date:

WDID Number:

Trades Active on Site during Current Phase(s)

Check ALL the boxes below that apply to your site

- ☐ Storm Drain Improvement
- ☐ Street Improvements
- ☐ Material Delivery
- ☐ Trenching
- ☐ Concrete Pouring
- ☐ Foundation
- ☐ Demolition
- ☐ Material Delivery
- ☐ Tile Work- Flooring
- ☐ Drywall
- ☐ HVAC installers
- ☐ Exterior Siding
- ☐ Insulation
- ☐ Fireproofing
- ☐ Steel Systems
- ☐ Grading Contractor
- ☐ Water Pipe Installation
- ☐ Sewer Pipe Installation
- ☐ Gas Pipe Installation
- ☐ Electrical Installation
- ☐ Communication Installation
- ☐ Erosion and Sediment Control
- ☐ Equipment Fueling/Maintenance
- ☐ Utilities, e.g., Sewer, Electric
- ☐ Roofers
- ☐ Stucco
- ☐ Masons
- ☐ Landscapers
- ☐ Riggers
- ☐ Utility Line Testers
- ☐ Surveyor- Soil Technician
- ☐ Sanitary Station Provider
- ☐ Electrical
- ☐ Carpentry
- ☐ Plumbing
- ☐ Masonry
- ☐ Water, Sewer, Electric Utilities
- ☐ Rock Products
- ☐ Painters
- ☐ Carpenters
- ☐ Pest Control: e.g., termite prevention
- ☐ Water Feature Installation
- ☐ Utility Line Testers
- ☐ Irrigation System Installation
- ☐ Other:

Trade Contractor Information Provided

Check ALL the boxes below that apply to your site.

- ☐ Educational Material Handout
- ☐ Contractual Language
- ☐ Other:
- ☐ Tailgate Meetings
- ☐ Fines and Penalties
- ☐ Other:
- ☐ Training Workshop
- ☐ Signage
- ☐ Other:

Continued on next page.

Rain Event Action Plan (REAP)

Date of REAP		**WDID Number:**	
Date Rain Predicted to Occur:		**Predicted % chance of rain:**	

Predicted Rain Event Triggered Actions

Below is a list of suggested actions and items to review for this project. Each active Trade should check all material storage areas, stockpiles, waste management areas, vehicle and equipment storage and maintenance, areas of active soil disturbance, and areas of active work to ensure the proper implementation of BMPs. Project-wide BMPs should be checked and cross-referenced to the BMP progress map.

Trade or Activity	**Suggested action(s) to perform / item(s) to review prior to rain event**
☐ Information & Scheduling	☐ Inform trade supervisors of predicted rain ☐ Check scheduled activities and reschedule as needed ☐ Alert erosion/sediment control provider ☐ Alert sample collection contractor (if applicable) ☐ Schedule staff for extended rain inspections (including weekends & holidays) ☐ Check Erosion and Sediment Control (ESC) material stock ☐ Review BMP progress map ☐ Other:____________________________________ ☐ ______________________________________ ☐ ______________________________________
☐ Material storage areas	☐ Material under cover or in sheds (ex: treated woods and metals) ☐ Perimeter control around stockpiles ☐ Other:____________________________________ ☐ ______________________________________ ☐ __________________________________
☐ Waste management areas	☐ Dumpsters closed ☐ Drain holes plugged ☐ Recycling bins covered ☐ Sanitary stations bermed and protected from tipping ☐ Other:____________________________________ ☐ ______________________________________ ☐ ______________________________________
☐ Trade operations	☐ Exterior operations shut down for event (e.g., no concrete pours or paving) ☐ Soil treatments (e.g.,: fertilizer) ceased within 24 hours of event ☐ Materials and equipment (ex: tools) properly stored and covered ☐ Waste and debris disposed in covered dumpsters or removed from site ☐ Trenches and excavations protected ☐ Perimeter controls around disturbed areas ☐ Fueling and repair areas covered and bermed ☐ Other:____________________________________ ☐ ______________________________________ ☐ __________________________________
☐ Site ESC BMPs	☐ Adequate capacity in sediment basins and traps ☐ Site perimeter controls in place ☐ Catch basin and drop inlet protection in place and cleaned ☐ Temporary erosion controls deployed ☐ Temporary perimeter controls deployed around disturbed areas and stockpiles ☐ Roads swept; site ingress and egress points stabilized ☐ Other:____________________________________ ☐ ______________________________________ ☐ __________________________________
☐ Concrete rinse out area	☐ Adequate capacity for rain ☐ Wash-out bins covered ☐ Other:____________________________________ ☐ ______________________________________ ☐ __________________________________
☐ Spill and drips	☐ All incident spills and drips, including paint, stucco, fuel, and oil cleaned ☐ Drip pans emptied ☐ Other:____________________________________ ☐ ______________________________________ ☐ __________________________________

Continued on next page.

☐ Other / Discussion / Diagrams	☐ __________ ☐ __________ ☐ __________ ☐ __________ ☐ __________ ☐ __________ ☐ __________ ☐ __________ ☐ __________ ☐ __________ ☐ __________ ☐ __________ ☐ __________

Attach a printout of the weather forecast from the NOAA website to the REAP.

I certify under penalty of law that this Rain Event Action Plan (REAP) will be performed in accordance with the General Permit by me or under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

____Date: ____________________

Qualified SWPPP Practitioner (Use ink please)

APPENDIX Q

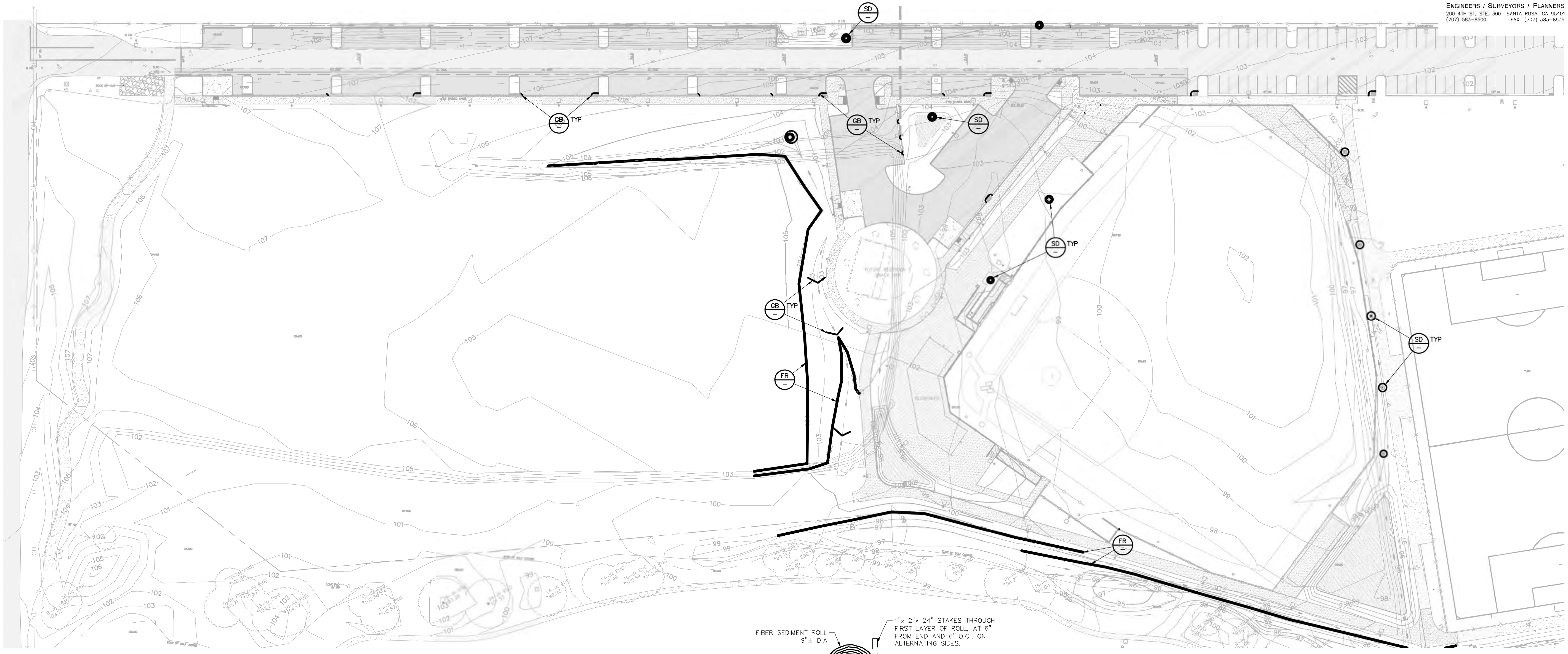
TEST METHODS, DETECTION LIMITS, REPORTING UNITS, APPLICABLE NALS AND NELS

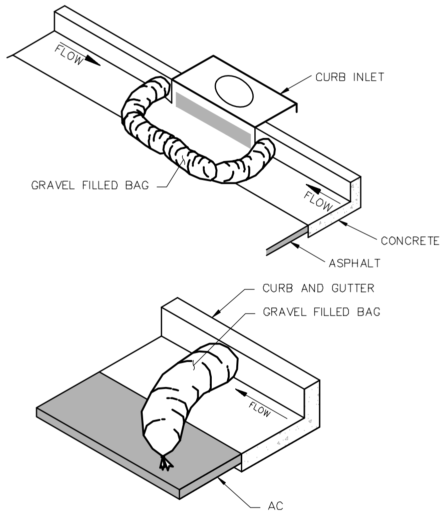
TURBIDITY – NUMERIC ACTION LEVEL – GREATER THAN 250 NTU

pH – NUMERIC ACTION LEVEL – OUTSIDE RANGE OF 6.5 TO 8.5

APPENDIX R
EROSION CONTROL PLAN

BKF
ENGINEERS / SURVEYORS / PLANNERS
200 4TH ST, STE. 300 SANTA ROSA, CA 95401
(707) 583-8500 FAX: (707) 583-8539

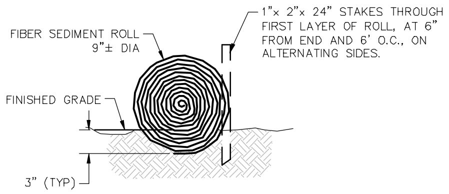




GRAVEL BAG DETAILS

GB
—

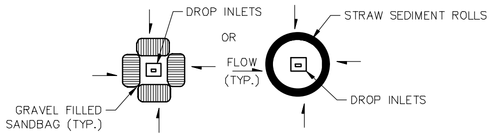
NO SCALE



FIBER ROLL DETAIL

FR
—

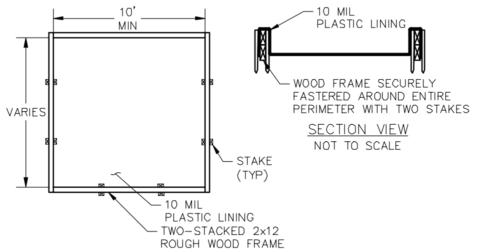
NO SCALE



TYPICAL SEDIMENT DEVICES

SD
—

NO SCALE



PLAN VIEW
NOT TO SCALE

SECTION VIEW
NOT TO SCALE

NOTES:

1. LOCATION IN PLAN SHOWN FOR GRAPHIC PURPOSE ONLY. LOCATION TO BE APPROVED BY INSPECTOR.
2. CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.
3. CONSTRUCT A BERMED AREA LARGE ENOUGH FOR LIQUID AND WASTE CONCRETE MATERIALS GENERATED DURING WASHOUT PROCEDURES. WASHOUT WASTES INTO THE TEMPORARY WASHOUT WHERE THE CONCRETE CAN SET, BE BROKEN UP, AND THEN DISPOSED PROPERLY. WASHOUT SHOULD BE LINED WITH A 10 MIL PLASTIC SO THERE IS NO DISCHARGE INTO THE UNDERLYING SOIL. REFER TO PROJECT SWPPP FOR BMP INSPECTION AND MAINTENANCE.

CONCRETE WASHOUT DETAIL

CW
—

NO SCALE

30 0 30 60
scale 1" = 30' feet

DES: RFC
DRWN: RFC
CHKD: RFC

GSM landscape architects, inc.
landscape architecture
site planning
1700 Soscol Ave., Suite 23
Napa, CA 94559
(707) 255-4630
www.gsmlainc.com

CITY OF PETALUMA
PUBLIC WORKS & UTILITIES
202 N. McDowell Blvd., PETALUMA, CALIFORNIA, 94954
PH. 707-778-4546 FAX. 707-778-4508

PETALUMA COMMUNITY SPORTS FIELDS
BASEBALL DIAMOND
SEDIMENT CONTROL PLAN
2430 E WASHINGTON ST PETALUMA, CA 94954

DATE: 2/20/2020
FILE NO: XXXX.DWG
JOB NO: 1628
SHEET NO:
C8.1
OF

APPENDIX S

CONSTRUCTION SITE MONITORING PROGRAM

APPENDIX S

Construction Site Monitoring Program

Section 1 Construction Site Monitoring Program

1.1 Construction Site Monitoring Program

The following Construction Site Monitoring Program (CSMP), its methodology, strategy, monitoring and sampling procedures, are only intended to be a guide to assist the QSP and LRP who are subject to the Construction Activity and the Storm Water Discharge Permit, 2009-0009-DWQ (General Permit), as amended by 2010-0014-DWQ and 2012-0006-DWQ. The intent is to comply with Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ. LRP or QSP who have questions about specific requirements of the General Permit or this guidance document are advised to consult with the appropriate RWQCB.

Section 2 Construction Site Monitoring Requirements

2.1 Construction Site Monitoring Requirements

The General Permit (Attachments C, D, E; Section I.1.a) requires that a written site specific Construction Site Monitoring Program (CSMP) be developed by each discharger prior to the commencement of construction activities, and be revised as necessary to reflect project revisions and that the CSMP be included with the SWPPP. The CSMP should be developed to meet the specific requirements and objectives identified in the General Permit for each risk level. The CSMP shall be amended as necessary by the QSP.

2.2 Types of Monitoring Required by the General Permit

The specific monitoring required for each construction site depends upon the project risk level, project size, BMPs implemented and effluent quality. The General Permit may require the following types of monitoring:

- Visual inspections of Best Management Practices (BMPs);
- Visual monitoring of the site related to qualifying storm events;
- Visual monitoring of the site for non-stormwater discharges;
- Sampling and analysis of construction site runoff;
- Sampling and analysis of receiving waters;
- Sampling and analysis of non-stormwater discharges;
- Bio-assessment monitoring of receiving waters;
- Sampling and analysis of ATS operations; and

- Soil particle size analysis.

Tables S-1 -- Summary of Risk Level 2 Monitoring

Sampling & Analysis	Type of Monitoring	When
	Effluent sampling: Turbidity	Collect a minimum of three samples per day of discharge. Collect runoff samples representative of site discharges.
	Effluent sampling: pH	During construction phases with high risk of high pH discharge. Collect a minimum of three samples per day of discharge. Collect runoff samples representative of site discharges.
	Non-visible pollutants: spill/BMP failure based on pollutant source assessment	Within first two hours of discharge from site. Collect samples of runoff affected by the spilled or released material(s) and runoff unaffected by the spilled or released material(s).
	Contained rain water	At time of discharge.
	Non-stormwater	At locations where discharged off the site.
	Particle size	When sediment basins are used. If needed to justify site specific sediment risk using RUSLE.
	Other	RWQCB or TMDLs may require other monitoring.
Visual Inspections	Non-stormwater inspection	Quarterly for each drainage area.
	Qualifying rain event: Pre-rain inspection	All drainage areas, BMPs, and stormwater containments within two business days of each qualifying rain event.
	Qualifying rain event: Post-rain inspection	All discharge locations within two business days after each qualifying rain event. Visually observe discharge of contained stormwater when discharged.
	During rain inspection	See BMP inspection below.
	BMP	Weekly and every 24 hours during extended storm events.

2.3 Purpose of the Construction Site Monitoring Program

The purpose of the CSMP is to address the following objectives:

- To demonstrate that the site is in compliance with the applicable discharge prohibitions, Numeric Action Levels (NALs);
- To determine whether non-visible pollutants are present at the construction site and are causing or contributing to any exceedance of water quality objectives;
- To determine whether immediate corrective actions, additional BMP implementation, or SWPPP revisions are necessary to reduce pollutants in stormwater discharges and authorized non-stormwater discharges; and
- To determine whether BMPs included in the SWPPP and/or Rain Event Action Plan (REAP) are effective in preventing or reducing pollutants in stormwater discharges and authorized non-stormwater discharges.

Section 3 Visual Monitoring (Inspection)

Risk Level 2 sites are required to conduct visual monitoring (inspections). Visual monitoring includes:

- Inspections of BMPs;
- Inspections before and after qualifying rain events; and
- Inspection for non-stormwater discharges.

Visual inspections are required for the duration of the project with the goal of confirming that appropriately selected BMPs have been implemented, are being maintained, and are effective in preventing potential pollutants from coming into contact with stormwater. An inspection checklist has been included under Appendix I.

3.1 BMP Inspection

The General Permit requires that BMPs be inspected weekly and once each 24-hour period during extended storm events. The QSP shall make the inspection on a day where there is measurable rainfall. If there is a 48-hour dry period prior to the total multi-day accumulation of 0.5 inches of rain, the inspection checklist does not need to be kept. Otherwise, an inspection checklist is required and must be maintained in the SWPPP binder for all days with measurable rainfall. The purpose of these inspections is to identify BMPs that:

- Need maintenance to operate effectively;
- Failed; or
- Could fail to operate as intended.

If deficiencies are identified during BMP inspections, repairs or design changes to BMPs must be initiated within 72 hours of identification and need to be completed as soon as possible.

All BMP inspections must be documented on an inspection checklist. Included in Appendix I is a BMP inspection check list. The checklist should be made site specific based on the BMPs and outfalls for each construction project, but at minimum the form should include:

- Inspection date, and date the inspection report was written;
- Weather information, including presence or absence of precipitation, estimate of the beginning of qualifying storm event, duration of event, time elapsed since last storm, and approximate amount of rainfall in inches;
- Site information, including stage of construction, activities completed, and approximate area of the site exposed;
- A description of the BMPs evaluated and any deficiencies noted;
- If the construction site is safely accessible during inclement weather, list the observations of all BMPs: erosion controls, sediment controls, chemical and waste controls, and non-stormwater controls. Otherwise, list the results of visual inspections at all relevant outfalls, discharge points, downstream locations, and identify any projected maintenance activities;
- Report the presence of noticeable odors or any visible sheen on the surface of any dischargers;
- Any corrective actions required, including any necessary changes to the SWPPP and the associated implementation dates;
- Photographs taken during the inspection, if any; and
- Inspector’s name, title, and signature.

An example Visual Inspection Field Log Sheet is included in Appendix I.

3.2 Qualifying Rain Event Inspections

The General Permit requires that the construction site be inspected within two days prior to a predicted qualifying rain event and within two days after a qualifying rain event. These inspections are only required during normal business hours of the construction site.

The General Permit defines a qualifying rain event as one that produces ½-inch or more of precipitation with a 48 hour or greater period between rain events.

The General Permit requires that dischargers only use weather forecasts from the National Oceanographic and Atmospheric Administration (NOAA). Pre-project inspections should be initiated after consulting NOAA for a qualifying rain event with 50% or greater probability of precipitation (PoP). These forecasts can be obtained at: **http://www.srh.noaa.gov/forecast**.

Records must be kept of all qualifying rain event inspections. Records need to be maintained on site and document the following:

- Personnel performing the observations;
- Observation date and time;
- Weather conditions (including the rain gauge reading for the qualifying rain event);
- Locations observed; and
- Corrective actions taken in response to observations.

A Visual Inspection Field Log Sheet is included in Appendix I.

3.2.1 Pre-Rain Event Inspection

The purpose of the pre-rain event inspection is to make sure the site and the BMPs are ready for the predicted rain. The pre-rain event inspection needs to cover:

- All stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources;
- All BMPs to identify whether they have been properly implemented per the SWPPP and/or REAP;
- Stormwater storage and containment areas to detect leaks and ensure maintenance of adequate freeboard; and
- The presence or absence of floating and suspended materials, a sheen on the surface, discolorations, turbidity, odors, and source(s) of any observed pollutants within stored stormwater.

3.2.2 Post-Rain Event Inspection

The purpose of the post-rain event inspection is to observe the discharge locations and the discharge of any stored or contained rainwater; determine if BMPs functioned as designed; and identify if any additional BMPs are required. The post-rain event inspection needs to cover:

- All stormwater discharge locations;
- The discharge of stored or contained stormwater that is derived from and discharged subsequent to a qualifying rain event; and All BMPs to determine if they were adequately designed, implemented, and effective.

After assessing BMPs it should be noted on the inspection form whether the BMPs need maintenance.

3.3 Non-Stormwater Discharges Inspections

The General Permit requires that construction sites, regardless of risk level, be inspected quarterly for the presence of non-stormwater discharges. Records must be kept of all inspections and must be maintained on site.

Non-stormwater discharge inspections are only required during normal business hours of the construction site. The purpose of these inspections is to detect unauthorized non-stormwater discharges and observe authorized non-stormwater discharges. Quarterly inspections need to include each drainage area of the project and document the following:

- Presence or indications of unauthorized and authorized non-stormwater discharges and their sources;
- Pollutant characteristics of the non-stormwater discharge (floating and suspended material, sheen, discoloration, turbidity, odor, etc);
- Personnel performing the observations;
- Dates and approximate time each drainage area and non-stormwater discharge was observed; and
- Response taken to observations.

For Risk Level 2 sites, non-stormwater discharges shall be collected and analyzed for pH and turbidity. If there is a potential for non-visible pollutants, a sample shall be collected and sent to a certified lab for testing for the potential pollutant.

An Effluent Sampling Field Log Sheets has been included in Appendix I. A Visual Inspection Field Log Sheet is included in Appendix I.

Section 4 Water Quality Sampling and Analysis Procedures

The purpose of sampling is to determine whether BMPs implemented on a construction site are effective in controlling potential construction site pollutants, which come in contact with stormwater or non-stormwater, and to demonstrate compliance with the applicable NALs or NELs.

This section discusses the procedures and the information that need to be included in the CSMP for water quality sampling and analysis. This section is divided into the following:

- Potential pollutant sources;
- Monitoring constituents by risk level;
- Sampling locations;
- Sample collection and handling; and
- Analytical methods, laboratories, and field meters.

Water quality sampling and analysis of pH and turbidity is required for Risk Level 2 projects. Risk Level 2 projects are also required to conduct water quality sampling and analysis when there is a risk of non-visible pollutant discharge. If a source for potential non-visible pollutants is identified, a sample shall be collected down-gradient from the discharge location(s) where the visual observations were made triggering the monitoring and which can be safely accessed.

4.1 Potential Pollutant Sources

4.1.1 Sediment and Turbidity

Conditions or areas at a construction site that may cause sediment, silt, and/or turbidity in site runoff include:

- Exposed soil areas with inadequate erosion control measures;
- Areas of active grading;
- Poorly stabilized slopes;
- Lack of perimeter sediment controls;
- Areas of concentrated flow on unprotected soils;
- Poorly maintained erosion and sediment control measures;
- Tracking sediment onto roads and paved surfaces;
- Unprotected soil stockpiles; and
- Failure of an erosion or sediment control measure.

4.1.2 High pH

Conditions or areas at a construction site that may cause high pH in site discharges include:

- Concrete pours and curing;
- Concrete waste management areas;
- Soil amendments (e.g. fly ash and lime); and
- Mortar and stucco mixing, application, and waste management areas.

4.1.3 Non-Visible Pollutants

Monitoring for pollutants not visually detectable is only required if those pollutants are determined to be potentially present in stormwater leaving the construction site; and is typically the result of a BMP failure or spill on the construction site. This determination is documented in the pollutant source assessment in the SWPPP.

Projects should attempt to eliminate the exposure of construction materials to prevent stormwater pollution and limit sampling and analysis requirements. It is important to note that covered construction materials or those that are in their final constructed form, do not need to be monitored. Materials that are stored exposed to precipitation and may generate runoff need to be considered for non-visible pollutant monitoring.

Non-visible pollutants may also exist on the project site as a result of the land use prior to the start of the construction activity. To determine the potential of pollutants to exist on the construction site as a result of past land use activities, dischargers should review existing environmental and real estate documentation. Good sources of information on previously existing contamination and past land uses include, but are not limited to, the following:

- Initial Studies or Environmental Impact Reports (EIRs) prepared under the requirements of the California Environmental Quality Act (CEQA);
- Environmental Assessments or Environmental Impact Statements (EIS) prepared under the requirements of the National Environmental Policy Act (NEPA); and
- Phase I Assessments prepared for property transfers.

Non-visible pollutants in site discharges may result from materials that:

- Are being used in construction activities;
- Are stored on the construction site;
- Were spilt during construction operations and not cleaned up;
- Were stored (or used) in a manner that presented the potential for a release of the material during past land use activities;
- Were spilt during previous land use activities and not cleaned up; or
- Were applied to soil as part of past land use activities.

4.2 Monitoring Constituents

Risk Level 2

- At a minimum, Risk Level 2 projects are required to collect water quality samples for pH (during construction phases with a high risk of high pH discharge) and turbidity (all phases). Additional monitoring may be required by the RWQCB.
- Risk Level 2 projects are required to collect water quality samples if there is a BMP breach, malfunction, leakage, or spill. Water quality samples should be taken for non-visible pollutants that may have been discharged from the site as identified in the site pollutant source assessment (see Section 3.2.1 of this guidance document).
- Particle size analysis may be needed if a Risk Level 2 project is using a sediment basin or if needed to justify a site specific risk level calculation using RUSLE. The particle size analysis provides the information needed to determine the K-factor.

4.3 Sampling Locations

4.3.1 Stormwater Runoff

Risk Level 2 projects are required to collect water quality samples of runoff that is discharged off-site. Samples must be representative of the runoff associated with construction activity from the entire project disturbed area. Samples locations representative of runoff in each drainage area should be considered to ensure adequate representation of the flow and characteristics of the site's discharges.

4.3.2 Non-Stormwater Runoff

Risk Level 2 projects are also required to collect water quality samples to characterize authorized and unauthorized non-stormwater discharged from the site.

4.3.3 Receiving Water

Not Required.

4.3.4 Non-Visible Pollutant Monitoring

In situations where a breach, malfunction, leakage, or spill has occurred, dischargers must collect a sample of runoff that has come into contact with the materials and must also collect a runoff sample that has not come into contact with the materials (uncontaminated sample) for comparison. The QSP shall consult with the QSD and a certified lab to determine proper test procedures for determining whether there are pollutants in the runoff.

4.4 Sample Collection and Handling

It is important to use the correct methods to collect and handle samples to ensure the samples are valid. While the handling requirements apply primarily to grab samples collected for laboratory analysis, field measurements can be affected by sample collection procedures.

SSC samples should be taken as a normal grab sample, where the bottle is submerged facing upstream and filled. SSC samples need to be collected in a separate bottle because the analysis requires the entire volume of the bottle. Many grab samples can be partitioned out of a larger container used to collect the samples for various analyses but that is not the case for SSC.
All samples must be maintained between 0-6 degrees Celsius during delivery to the laboratory. Samples must be kept on ice, or refrigerated, from sample collection through delivery to the laboratory. Shipped samples should be placed inside coolers with ice. Make sure the sample bottles are well packaged to prevent breakage and secure cooler lids with packaging tape.

Ship samples that will be laboratory analyzed to the analytical laboratory right away. Many analytical methods have short hold-times before which the analysis must be started. Hold times are measured from the time the sample is collected to the time the sample is analyzed. The General Permit requires that samples be received by the analytical laboratory within 48 hours of the physical sampling (unless otherwise required by the analytical laboratory).

Most sites will require the use of some sort of field meter to measure turbidity and pH. Some field meters can be placed directly in the flow of water and gather instantaneous data. Meters with probes that can be directly placed into the flow are ideal, however low flow conditions may not allow for this type of measurement. In this case, grab samples can be collected and placed within the field meter's recording container.

All monitoring instruments and equipment (including a discharger's own field instruments for measuring pH and turbidity) should be calibrated and maintained in accordance with manufacturers' specifications to ensure accurate measurements. Many manufacturers provide step-by-step instructions for the use and calibration of their meters and these instructions should be followed.

If using field meters, pH and turbidity measurements should be conducted immediately (i.e. samples should not be stored for later measurement).

Collect proper information regarding time and sampling conditions, appropriately label the bottles, and fill out the required chain of custody forms and field logs.

4.5 Analytical Methods, Laboratories, and Field Meters

All laboratory analyses must be conducted according to analytical procedures specified in 40 Code of Federal Regulations (CFR) Part 136, unless other analytical procedures have been specified in the General Permit or by the RWQCB. With the exception of field analyses conducted by the discharger for turbidity and pH, all analyses must be sent to and conducted by a state-certified analytical laboratory. Currently, the SSC method is not state certified and a limited number of laboratories have the capability of doing this analysis.

Analytical laboratories should be contacted and a contract should be worked out before the wet season to minimize potential disruptions during the critical sampling period. A laboratory should be chosen foremost by their accreditation, ability to perform the required samples in the desired turn-around-time, and then by their proximity for ease of sample delivery. Although with overnight mail delivery, proximity is less important, it may still be an important factor to avoid bottle breakage during shipment.

State-certified analytical laboratories can be found by using the Environmental Laboratory Accreditation Program's (ELAP) website at: http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx.

The analytical method/protocol, minimum detection limits, and reporting units for the water quality constituents specifically identified in the General Permit are presented in Table S-2.

Table S-2

Parameter	Test Method/Protocol	Minimum Detection Limit	Minimum Sample Volume	Container Type
pH	Field meter or pH test kit	0.2 pH Units	NA	Plastic
Turbidity	Field meter or EPA 180.1	1 NTU	500 mL	Plastic
SSC	ASTM Method D 3977-97	5 mg/L	200 mL	Contact Lab

Non-visible pollutants may include a wide range of analytical methods. A list of potential non-visible pollutants based on common construction activities is shown in Table S-3. This list is not meant to be inclusive but to provide general guidance for projects. Consult with the analytical laboratory or 40 CFR Part 136 to identify specific analytical methods, sample volume, and containers needed for the expected non-visible pollutants.

Dischargers can perform pH analysis on site with a calibrated pH meter, or pH test kit. Dischargers can perform turbidity analysis using a calibrated turbidity meter (turbidimeter), either on site or at an accredited analytical laboratory.

Many manufacturers offer single parameter meters or multiple parameter meters with various optional probes. Dischargers will need to determine the best type of meter for their individual situation. Any meter selected for field monitoring should have the ability to be calibrated, be accompanied by detailed operation instructions, and should be ruggedly designed for field use and long term storage (you are unlikely to need it during the dry season).

Table S-3 -- Potential Non-Visible Pollutants based on Common Construction Activities

Activity	Potential Pollutant Source	Laboratory Analysis
Water line flushing	Chlorinated water	Residual chlorine
Portable toilets	Bacteria, disinfectants	Total/fecal coliform
Concrete & Masonry	Acid wash Curing compounds Concrete rinse water	pH pH, alkalinity, Volatile organic compounds (VOCs) pH
Painting	Resins Thinners Paint Strippers Solvents Adhesives Sealants	Semi-volatile organic compounds (SVOCs) Phenols, VOCs VOCs Phenols VOCs Phenols, SVOCs SVOCs
Cleaning	Detergents Bleaches Solvents	Methylene Blue Activated Substances (MBAS),phosphates Residual chlorine VOCs
Landscaping	Pesticides/Herbicides Fertilizers Lime and gypsum Aluminum sulfate, sulfur	Check with analytical laboratory $NO_3/NH_3/P$ Acidity/alkalinity Total dissolved solids (TDS), alkalinity
Treated wood	Copper, arsenic, selenium	Metals
Soil amendments & dust control	Lime, gypsum Plant gums Magnesium chloride Calcium chloride Natural brines Lignosulfonates	pH Biochemical oxygen demand (BOD) Alkalinity, TDS Alkalinity, TDS Alkalinity, TDS Alkalinity, TDS

Hand held single parameters are usually the least costly and are designed with a user friendly interface. Multi-parameter meters are more costly, but provide increased versatility, have user friendly interfaces, and can provide instantaneous readings of multiple parameters. Probes for the multi-parameter meters can be attached to cables of varying lengths that make it possible to sample at a greater distance from the runoff flow.

Hach, Hydrolab, Global Water, Fisher Scientific, and LaMott are some known manufacturers and/or vendors of turbidity and pH meters. Whichever turbidity meter is selected, it is important to use the same meter; different meters may have different results even if properly calibrated. If you need to use several turbidity meters, then assign each meter to a specific location.

Dischargers utilizing a sediment basin are required to conduct a soil particle analysis. Dischargers may also want to conduct this analysis to establish site-specific particle size information, which can be used to justify the project risk level using RUSLE. (The particle size analysis provides the K factor.) The soil particle analysis is conducted using the American Society for Testing and Materials (ASTM) test method ASTM D-422 (Standard Test Method for Particle-Size Analysis of Soils), as revised, to determine the percentages of sand, very fine sand, silt, and clay on the site. The percentages of particles less than 0.02 mm in diameter must also be determined. This analysis is conducted before construction starts and is reported with the Permit Registration Documents (PRDs).

3.3 Watershed Monitoring Option

Not Applicable.

3.4 Monitoring Exemptions

Dischargers are not required to physically collect samples or conduct visual observations during dangerous weather conditions (flooding, electrical storms, etc.) or outside of scheduled construction site business hours. An explanation must be provided in the Annual Report if a project was unable to collect required samples or visual observations because of dangerous weather conditions.

Section 5 Quality Assurance and Quality Control

An effective QA/QC plan will be implemented as part of the CSMP to ensure that analytical data can be used with confidence. QA/QC procedures to be initiated include the following:

- Field logs;
- Clean sampling techniques;
- Sample Chains of Custody (COCs); and
- Data verification.

Each of these procedures is discussed in more detail in the following sections.

5.1 Field Logs

The purpose of field logs is to record sampling information and field observations during monitoring that may explain any uncharacteristic analytical results. At a minimum, sampling information to be included in the field log includes:

- The date and time of water quality sample collection;

- Sampling personnel;
- Sample container identification numbers;
- And types of samples that were collected;
- Field observations for any abnormalities at the sampling location (color, odor, BMPs, etc.); and
- Field measurements for pH and turbidity.

Examples of field logs to record visual inspections and sample collection and field measurements are provided in Appendix I.

5.2 Clean Sampling Techniques

Clean sampling techniques involve the use of certified clean containers for sample collection and clean powder-free nitrile gloves during sample collection and handling. As discussed previously, adoption of a clean sampling approach will minimize the chance of field contamination and questionable data results.

5.3 Sample Chain-of-Custody

The sample COC is an important documentation step that tracks samples from collection through analysis to ensure the validity of the sample. Sample COC procedures include the following:

- Proper labeling of samples;
- Use of COC forms for all samples; and
- Prompt sample delivery to the analytical laboratory.

Analytical laboratories usually provide COC forms to be filled out for sample containers.

5.4 Data Verification

After analytical results are received from the analytical laboratory, the data should be verified to ensure that it is complete, accurate, and the appropriate QA/QC requirements were met. Data should be verified as soon as the data reports are received.

The COC and laboratory reports need to be checked to make sure all requested analyses were performed and all samples are accounted for in the reports.

Check laboratory reports to make sure hold times were met and that the reporting levels meet or are lower than the reporting levels agreed to in the contract.

Check data for outlier values and follow up with the laboratory. Occasionally typographical errors, unit reporting errors, or incomplete results are reported and should be easily detected. These errors need to be identified, clarified, and corrected quickly by the laboratory. Attention should be paid to data that is an order of magnitude or more different than similar locations, or is inconsistent with previous data from the same location.

For laboratory analyses, EPA establishes QA/QC checks and acceptable criteria. This data is typically reported along with the sample results. Data reviewers should evaluate the reported QA/QC data to check for contamination (look at method, field, and equipment blanks), precision (laboratory matrix spike duplicates), and accuracy (matrix spikes and laboratory control samples). When QA/QC checks are outside acceptable ranges, the laboratory must flag the data, and usually provides an explanation of the potential impact to the sample results.

Check the data set for outlier values and, accordingly, confirm results and re-analyze samples where appropriate. Sample re-analysis should only be undertaken when it appears that some part of the QA/QC resulted in a value out of the expected range. Initial data, even if outside the expected range may not be discounted unless the analytical laboratory identifies the required QA/QC criteria were not met. If this occurs, the project should obtain a written statement from the analytical laboratory regarding the validity of the sample result.

Similarly, field data needs to be checked as soon as possible to identify potential errors. Reported data and observations should be verified to ensure that it is complete and accurate as soon as the field logs are received.

Field logs should be checked to make sure all required measurements were completed and appropriately documented. Crews may occasionally miss-record a value. Reported values that appear out of the typical range or inconsistent, should be followed up on immediately to identify potential reporting or equipment problems.

Equipment calibration notations should be verified for outlier data, and if appropriate, equipment calibrations should be checked after sampling. Observations noted on the field logs can also help to identify potential interferences. Notations should be made of any errors and actions taken to correct the equipment or recording errors.

Section 6 Reporting and Records Retention

6.1 Reporting and Records Retention

The General Permit identifies several areas of non-compliance reporting. It is the responsibility of the permittee to properly document reportable discharges or other violations of the General Permit. Exceedances and violations should be reporting using the SMARTS system and include the following:

- Numeric Action Level (NAL) exceedances (NAL Exceedance Report upon request of the RWQCB);
- Self-reporting of any other discharge violations or to comply with RWQCB enforcement actions; and
- Discharges which contain a hazardous substance in excess of reportable quantities established in 40 CFR §§ 117.3 and 302.4, unless a separate NPDES Permit has been issued to regulate those discharges.

In the event of the exceedance of a NAL, document the subsequent site evaluation in the SWPPP Appendix D. All reportable exceedances shall be included in the SWPPP. Include the results of an NAL exceedance site evaluation along with other non-compliance events in SWPPP Appendix D. A copy of all Reports and Records shall be provided to the LRP.

6.2 Numeric Action Level Exceedance Report

In the event that the storm event average of the samples exceeds an applicable NAL, Risk Level 2 dischargers must electronically submit all storm event sampling results to the SWRCB's SMARTS no later than 10 days after the conclusion of the storm event. In addition, the RWQCBs may request the submittal of an NAL Exceedance Report. The discharger must certify each NAL Exceedance Report in accordance with the General Permit's Special Provisions for Construction Activity.

An NAL Exceedance Report must contain the following information:

- Analytical method(s), method reporting unit(s), and MDL(s) of each analytical parameter;
- Date, place, time of sampling, visual observation (inspections), and/or measurements, including precipitation; and
- Description of the current BMPs associated with the sample that exceeded the NAL and the proposed corrective actions taken.

6.3 Numeric Effluent Limitation Violation Report

Not applicable to Risk Level 2 sites.

6.4 Non-Compliance reporting

The QSP is required to properly document reportable discharges or other violations of the General Permit. See Section 2.3 for potential impacts to SWPPP requirements. As discussed in the CSMP in Appendix S, the QSP shall submit all sampling reports and all field or laboratory analytical data electronically using the SMARTS system, as part of the Annual Report, including but not limited to the following:

- Any discharge violations or to comply with RWQCB enforcement actions; and
- Discharges which contain a hazardous substance in excess of reportable quantities established in 40 CFR §§ 117.3 and 302.4, unless a separate NPDES Permit has been issued to regulate those discharges.

Documentation of all reportable exceedances shall be included in this SWPPP under Appendix D.

6.5 Annual Report

All dischargers are required to prepare and electronically submit an Annual Report no later than September 1 each year. The Annual Reports must be certified in accordance with the Special Provisions in the General Permit. The Annual Report must include the following stormwater monitoring information:

- A summary and evaluation of all sampling and analysis results, including original laboratory reports;

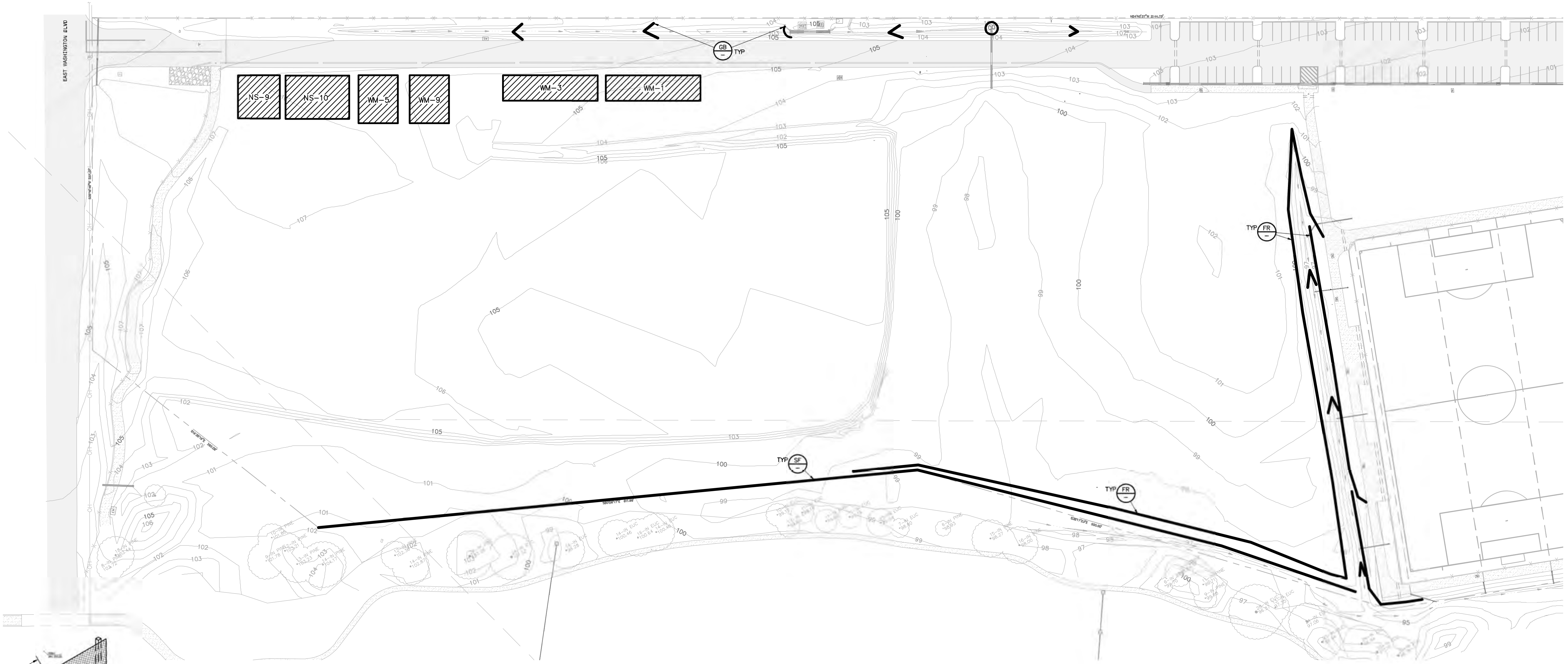
- The analytical method(s), method reporting unit(s), and MDL(s) of each analytical parameter (analytical results that are less than the MDL must be reported as “less than the MDL” or “<MDL”);
- A summary of all corrective actions taken during the compliance year;
- Identification of any compliance activities or corrective actions that were not implemented;
- A summary of all violations of the General Permit;
- The individual(s) who performed facility inspections, sampling, visual observation (inspections), and/or measurements;
- The date, place, time of facility inspections, sampling, visual observation (inspections), and/or measurements, including precipitation (rain gauge); and
- The visual observations and sample collection exception records and reports.

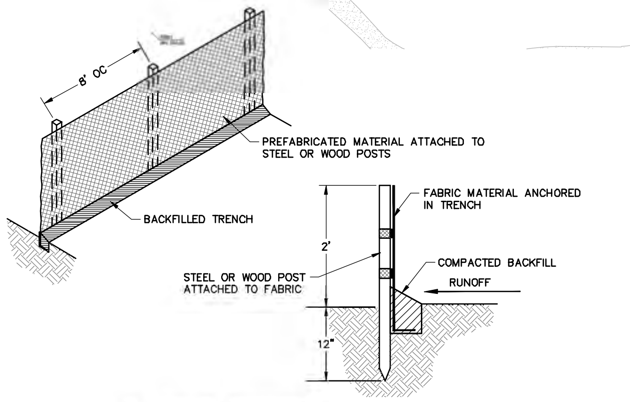
6.6 Records Retention

Dischargers must retain records of all stormwater monitoring information and copies of all reports (including Annual Reports) for a period of at least three years from date of submittal or longer if required by the RWQCB. These records include:

- The date, place, and time of facility inspections, sampling, visual observations (inspections), and/or measurements, including precipitation;
- The individual(s) who performed the facility inspections, sampling, visual observation (inspections), and/or measurements;
- The date and approximate time of analyses;
- The individual(s) who performed the analyses;
- A summary of all analytical results from the last three years, the method detection limits and reporting limits, and the analytical techniques or methods used;
- Rain gauge readings from site inspections;
- QA/QC records and results;
- Non-stormwater discharge inspections and visual observations (inspections) and stormwater discharge visual observation records;
- Visual observation and sample collection exemption records;
- NAL Exceedance Reports; and
- The records of any corrective actions and follow-up activities that resulted from analytical results, visual observations (inspections), or inspections.

Results of field measurements and laboratory analyses must be kept in the SWPPP. It is also recommended that training logs, COCs, and other documentation related to sampling and analysis be kept with the project’s SWPPP.





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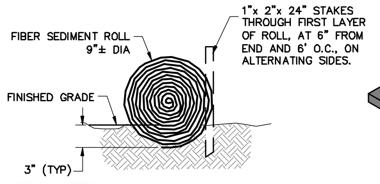

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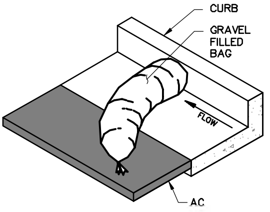

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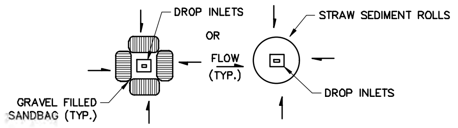

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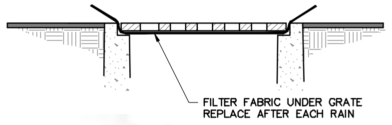

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NOTE

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WM-9	SANITARY/SEPTIC WASTE MANAGEMENT.
NS-9	VEHICLE AND EQUIPMENT REFUELING.
NS-10	VEHICLE AND EQUIPMENT MAINTENANCE.

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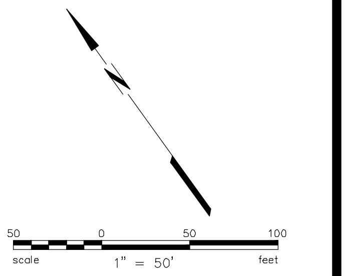
SEE IMPROVEMENT DRAWINGS FOR EROSION AND SEDIMENT CONTROL.



SWPPP EXHIBIT
PRE-CONSTRUCTION

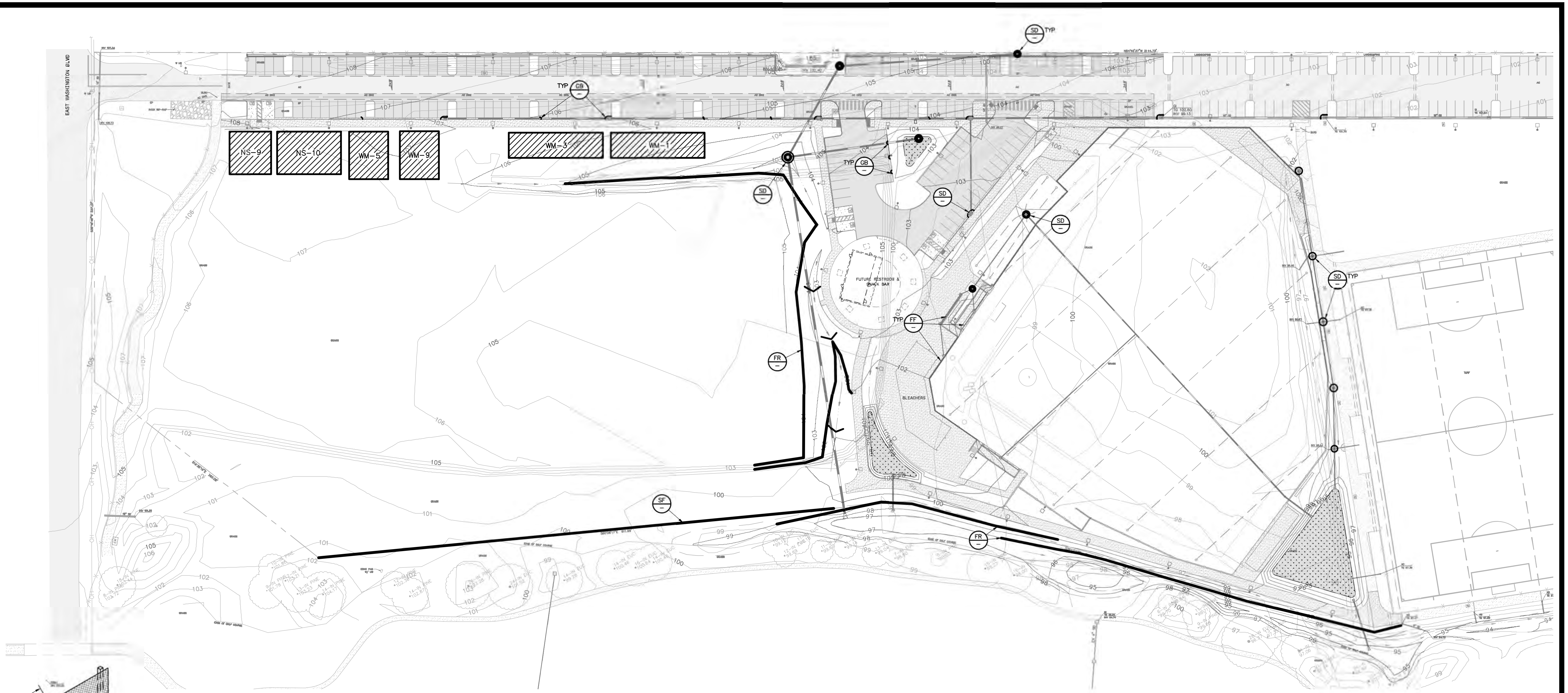
PETALUMA COMMUNITY SPORTS
FIELDS BASEBALL DIAMOND
CITY OF PETALUMA, CALIFORNIA
MARCH 2020

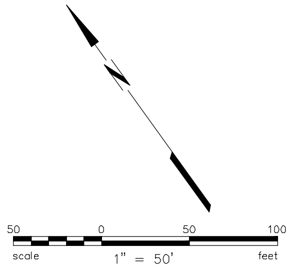
PREPARED BY

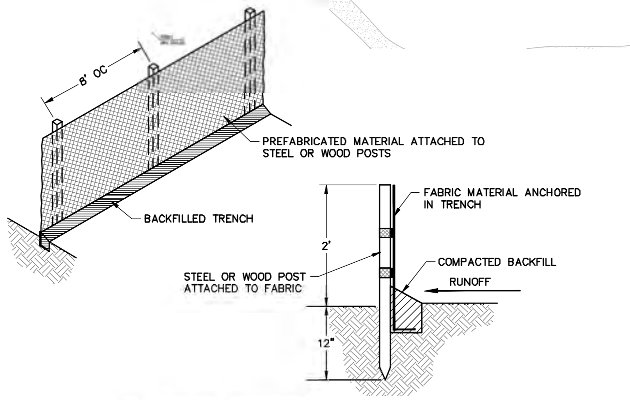
BKF
ENGINEERS / SURVEYORS / PLANNERS
200 4TH ST, STE. 300 SANTA ROSA, CA 95401
(707) 583-8500 FAX: (707) 583-8539

JOB NO. 20169092

SHEET 1 OF 5 SHEETS







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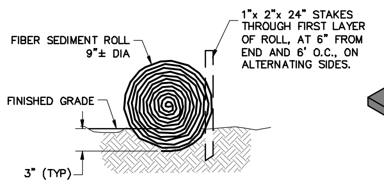

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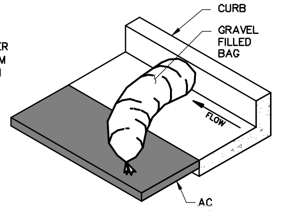

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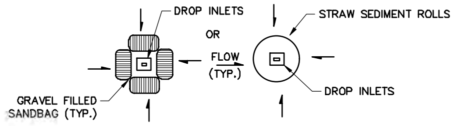

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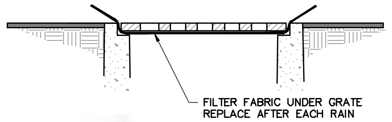

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FIELDS BASEBALL DIAMOND
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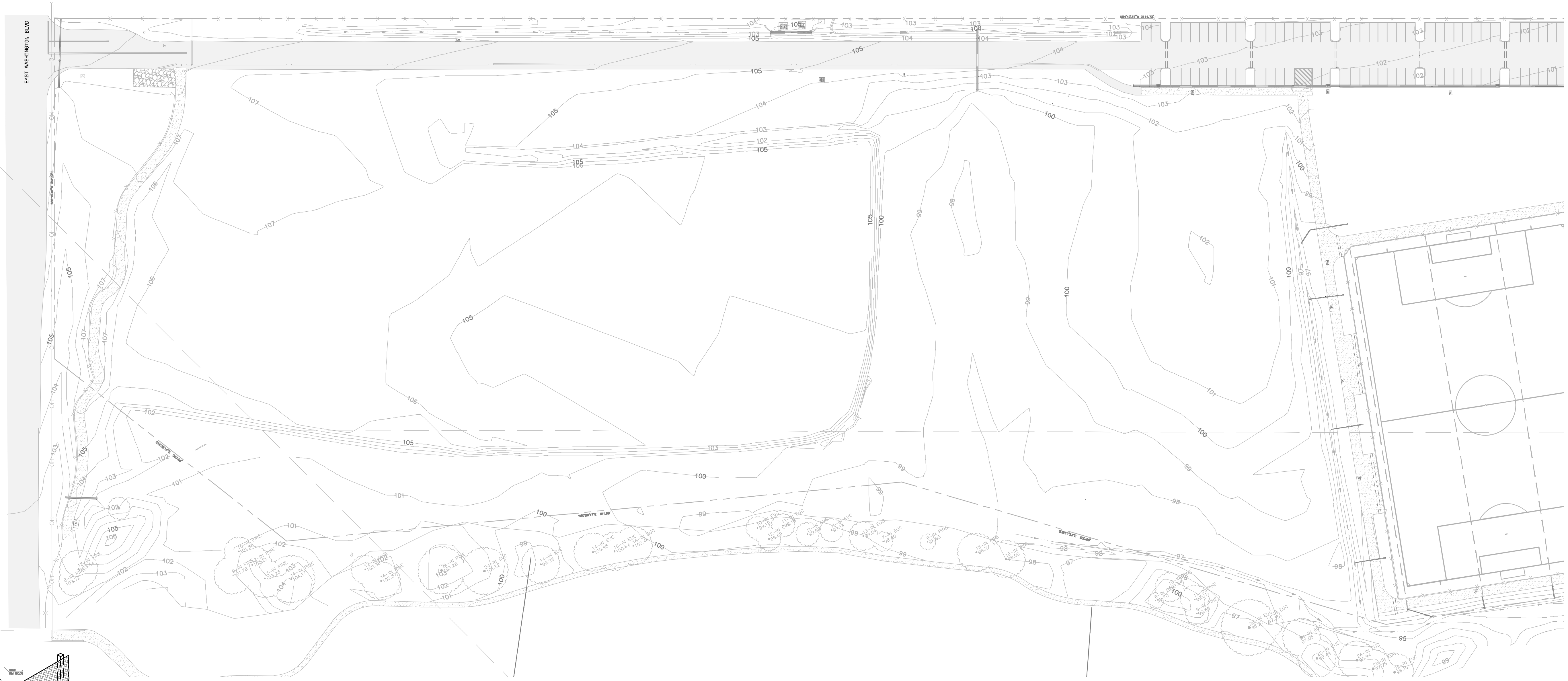

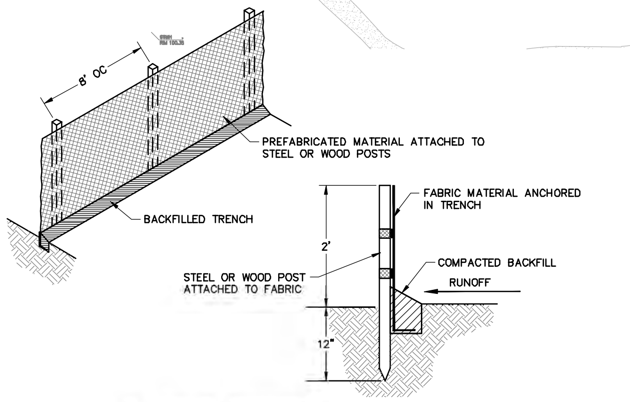

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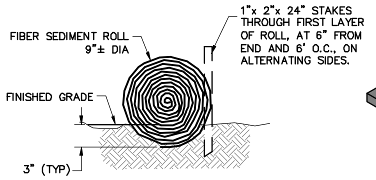

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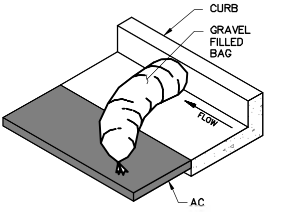

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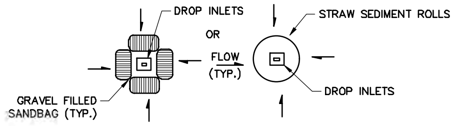

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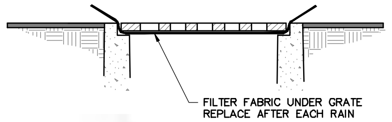

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scale 1" = 50' feet

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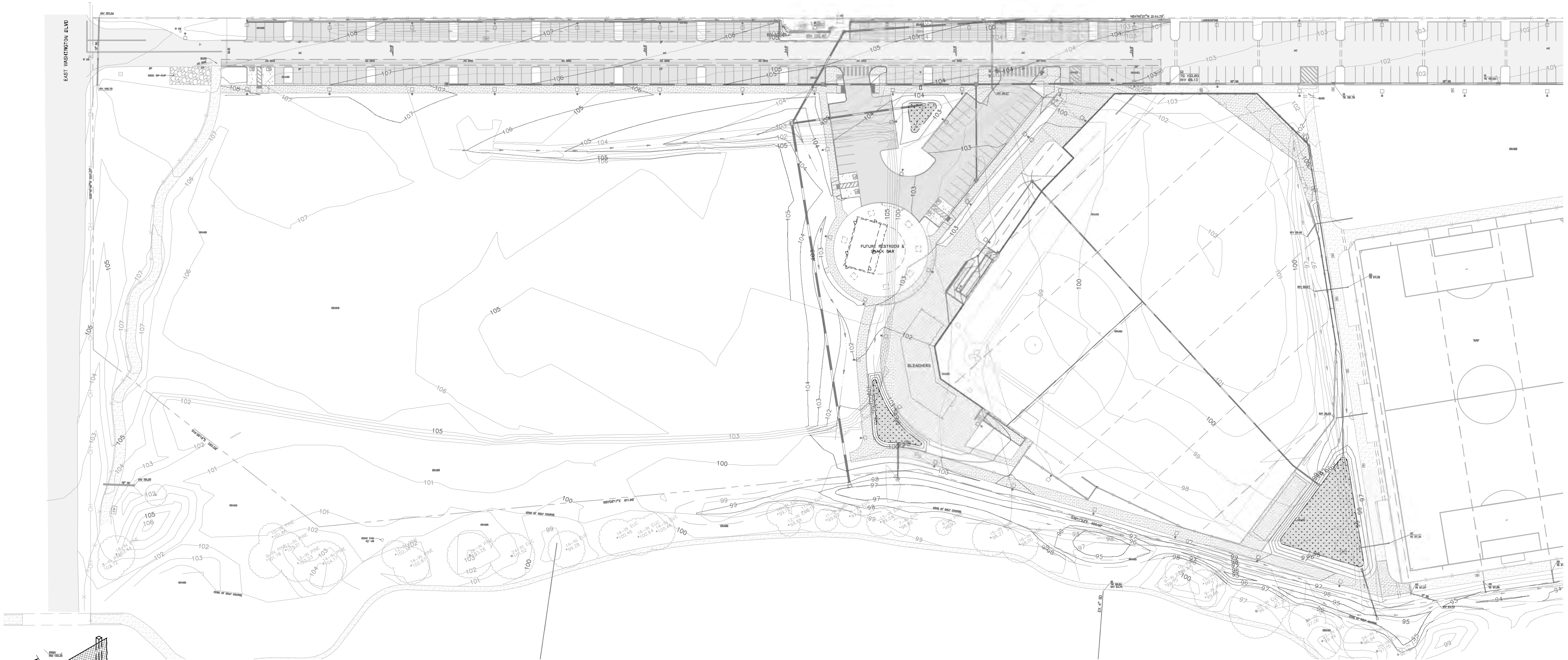
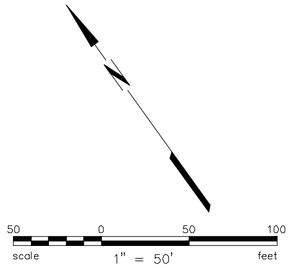
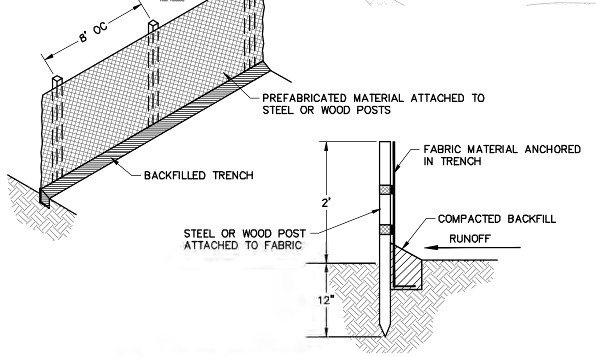
SHEET 3 OF 5 SHEETS

Plot Mar 31, 2020 at 1:00pm







SF
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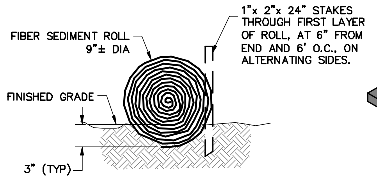
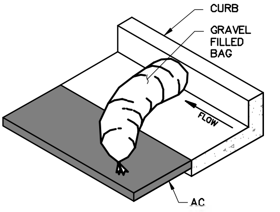
SILT FENCE DETAIL

NO SCALE



FR
–
FIBER ROLL

NO SCALE



GB
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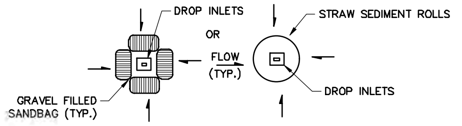
GRAVEL BAGS

NO SCALE



SD
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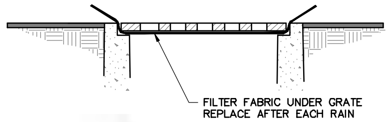
TYPICAL SEDIMENT DEVICES

NO SCALE



FF
–
FILTER FABRIC

NO SCALE

NOTE

CONTRACTOR SHALL IMPLEMENT LINEAR SEDIMENT CONTROL PER TABLE SHOWN BELOW AND THE CONSTRUCTION GENERAL PERMIT.

CRITICAL SLOPE/SHEET FLOW LENGTH COMBINATIONS	
SLOPE PERCENTAGE	SHEET FLOW LENGTH NOT TO EXCEED
0–25%	20–FEET
25–50%	15–FEET
OVER 50%	10–FEET

BMP NO.	BMP
WM-1	MATERIAL DELIVERY AND STORAGE.
WM-3	STOCKPILE MANAGEMENT.
WM-5	SOLID WASTE MANAGEMENT.
WM-9	SANITARY/SEPTIC WASTE MANAGEMENT.
NS-9	VEHICLE AND EQUIPMENT REFUELING.
NS-10	VEHICLE AND EQUIPMENT MAINTENANCE.

GENERAL NOTES

BMPS SHOWN AND LISTED ON THIS DRAWING DO NOT REFLECT ALL BMPS REQUIRED OR RECOMMENDED FOR IMPLEMENTATION FOR THIS PROJECT. A MORE EXHAUSTIVE LIST OF BMPS REQUIRED AND RECOMMENDED FOR THIS PROJECT CAN BE FOUND IN THE BODY OF THE SWPPP AND IS SUBJECT TO CHANGE.

QSP SHALL AMEND THESE DRAWINGS THOUGHOUT CONSTUCTION TO ENSURE COMPLIANCE WITH THE STATE WATER RESOURCES CONTROL BOARD (SWRCB) ORDER NO. 2009-0009-DWQ, AS AMENDED BY 2010-0014-DWQ AND 2012-0006-DWQ AND REFLECT CONSTRUCTION ACTIVITIES.

SAMPLING LOCATIONS ARE APPROXIMATE AND COULD CHANGE DURING CONSTRUCTION. QSP SHALL AMEND SAMPLING LOCATIONS DURING CONSTRUCTION AND SITE STABILIZATIONS.

SEE IMPROVEMENT DRAWINGS FOR EROSION AND SEDIMENT CONTROL.

SWPPP EXHIBIT
POST-CONSTRUCTION

PETALUMA COMMUNITY SPORTS
FIELDS BASEBALL DIAMOND
CITY OF PETALUMA, CALIFORNIA
MARCH 2020

PREPARED BY

BKF
ENGINEERS / SURVEYORS / PLANNERS
200 4TH ST, STE. 300 SANTA ROSA, CA 95401
(707) 583-8500 FAX: (707) 583-8539

JOB NO. 20169092

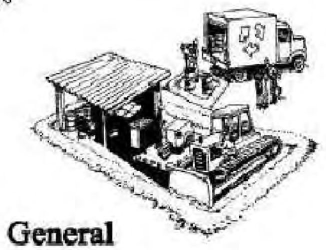
SHEET 4 OF 5 SHEETS

Plot Mar 31, 2020 at 1:08pm

DRAFT

Stormwater Pollution Prevention Program

Stormwater
Pollution Prevention Program



Pollution Prevention – It's Part of the Plan

It is your responsibility to do the job right!

Runoff from streets and other paved areas is a major source of pollution in local creeks, San Francisco Bay and the Pacific Ocean. Construction activities can directly affect the health of our waters unless contractors and crews plan ahead to keep dirt, debris, and other construction waste away from storm drains and creeks. Following these guidelines will ensure your compliance with local stormwater ordinance requirements. Remember, ongoing monitoring and maintenance of installed controls is crucial to proper implementation.

General Construction & Site Supervision

Advance planning prevents pollution

✓**Schedule excavation and grading activities for dry weather periods.** To reduce soil erosion, plant temporary vegetation or place other erosion controls before rain begins.

✓**Locate and protect storm drains** in the vicinity of the site with berms or filters during wet weather periods.

✓**Control the amount of runoff crossing your site** (especially during excavation) by using berms or temporary or permanent drainage ditches to divert water flow around the site. Reduce stormwater runoff velocities by constructing temporary check dams or berms where appropriate.

✓**Train your employees and subcontractors.** Make these brochures available to everyone who works on the construction site. Inform subcontractors about the new stormwater requirements and their responsibilities.

Good housekeeping practices

✓**Designate one completely contained area for auto parking, vehicle refueling, and routine equipment maintenance.** The designated area should be well away from streams or storm drain inlets, and bermed if necessary. Make major repairs off site.

✓**Keep materials out of the rain – prevent runoff contamination at the source.** Cover exposed piles of soil or construction materials with plastic sheeting or temporary roofs.

✓**Keep pollutants off exposed surfaces.** Place trash cans and recycling receptacles around the site to minimize litter.

✓**Dry sweep paved surfaces** that drain to storm drains, creeks, or channels. If pavement flushing is necessary, use silt ponds or other techniques to trap sediment and other pollutants.

✓**Clean up leaks, drips and other spills immediately** so they do not contaminate soil or groundwater or leave residue on paved surfaces. **Use dry cleanup methods** whenever possible. If you must use water, use just enough to keep the dust down.

✓**Cover and maintain dumpsters.** Check frequently for leaks. Place dumpsters under roofs or cover with tarps or plastic sheeting secured around the outside of the dumpster. A plastic liner is recommended to prevent leakage of liquids. **Never clean out a dumpster by hosing it down on the construction site.**

✓**Make sure portable toilets are maintained in good working order** by the leasing company and that wastes are disposed of properly. Check toilets frequently for leaks.

Materials/waste handling

✓**Practice source reduction – minimize waste when you order materials.** Order only the amount you need to finish the job.

✓**Use recyclable materials** whenever possible. Arrange for pick-up of recyclable materials such as concrete, asphalt, scrap metal, solvents, degreasers, cleared vegetation, paper, rock, and vehicle maintenance materials such as used oil, antifreeze, batteries, and tires.

✓**Dispose of all wastes and demolition debris properly.** Many construction materials and wastes can be recycled, including solvents, water-based paints, vehicle fluids, broken asphalt and concrete, wood, and cleared vegetation. Materials and debris that cannot be recycled must be taken to an appropriate landfill or disposed of as hazardous waste. **Never bury waste materials or leave them in the street or near a creek or stream bed.**

Heavy Equipment Operation

Site planning and preventive vehicle maintenance

✓ Designate a completely contained area of the construction site, well away from streams or storm drain inlets, for auto and equipment parking, refueling, and routine vehicle and equipment maintenance.

✓ Maintain all vehicles and heavy equipment. Inspect frequently for and repair leaks.

✓ Perform major maintenance, repair jobs, and vehicle and equipment washing off site.

✓ If you must drain and replace motor oil, radiator coolant, or other fluids on site, use drip pans or drop cloths to catch drips and spills. Collect all spent fluids, store in separate containers, and recycle whenever possible, or dispose of fluids as hazardous waste.

✓ Do not use diesel oil to lubricate or clean equipment or parts.

✓ Recycle used vehicle batteries.

Clean up spills immediately when they happen

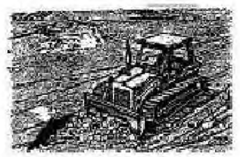
✓ Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry cleanup methods (absorbent materials, cat litter, and/or rags) whenever possible. If you must use water, use just enough to keep the dust down.

✓ Sweep up spilled dry materials immediately. Never attempt to "wash them away" with water, or bury them. Use as little water as possible for dust control.

✓ Clean up spills on dirt areas by digging up and properly disposing of contaminated soil.

✓ Report significant spills to the appropriate spill response agencies immediately. You are required by law to report all significant releases of hazardous materials, including oil. To report a spill, call the following agencies: 1) Dial 911 or your local emergency response number, 2) Call the Governor's Office of Emergency Services Warning Center, (800) 852-7550 (24 hours).

Earth-Moving Activities



During Construction

✓Remove existing vegetation only when absolutely necessary.

✓Seed or plant temporary vegetation for erosion control on slopes or where construction is not immediately planned.

✓Protect downslope drainage courses, streams, and storm drains with hay bales, temporary drainage swales, silt fences, berms or storm drain inlet filters.

✓Use check dams or ditches to divert runoff around excavations and graded areas.

✓ Cover stockpiles and excavated soil with secured tarps or plastic sheeting.

✓ Properly monitor and maintain all erosion and sediment controls.

✓ Properly report failures of erosion and sediment controls to the local stormwater authority.

General Business Practices

✓Schedule excavation and grading work for dry weather.

✓Perform major equipment repairs away from the job site.

✓When refueling or when vehicle/equipment maintenance must be done on site, work within a completely bermed area away from storm drains.

✓Do not use diesel oil to lubricate or clean equipment or parts.

Watch for soil and ponded groundwater that may be contaminated.

If any of these conditions are observed, test for contamination and contact the Regional Water Quality Control Board.

- Unusual soil conditions, discoloration, or odor
- Abandoned underground tanks
- Abandoned wells
- Buried barrels, debris, or trash.

Roadwork & Paving

✓ Develop and implement erosion/sediment control plans for roadway embankments.

✓ Schedule excavation and grading work for dry weather.

✓ Check all equipment for leaks and repair leaking equipment promptly.

✓ Perform major maintenance, repairs, and washing of equipment away from the construction site.

✓ When refueling or vehicle/equipment maintenance must be done on site, designate a completely contained area away from storm drains and creeks.

✓ Do not use diesel oil to lubricate or clean equipment or parts.

✓ Recycle used oil, batteries, concrete, broken asphalt, etc. whenever possible.

✓ Train employees in using these best management practices.

During Construction

✓ Avoid paving and seal coating in wet weather, or when rain is forecast before fresh pavement will have time to cure.

✓ Cover and seal catch basins and manholes when applying seal coat, slurry seal, fog seal, etc.

✓ Use check dams, ditches, or berms to divert runoff around excavations.

✓ Never wash excess material from exposed- aggregate concrete or similar treatments into a street or storm drain. Collect and recycle, or dispose to dirt area.

✓ Cover stockpiles and other construction materials with plastic tarps. Protect from rainfall and prevent runoff with temporary roofs or plastic sheets and berms.

✓ Catch drips from paver with drip pans or absorbent material (cloth, rags, etc.) placed under machine when not in use.

✓ Clean up all spills and leaks using "dry" methods (with absorbent materials/rags), or dig up and remove contaminated soil.

✓ Collect and recycle or appropriately dispose of excess abrasive gravel or sand.

✓ Avoid over-application by water trucks for dust control.

Asphalt/Concrete Removal

✓ Avoid creating excess dust when breaking asphalt or concrete.

✓ After breaking up old pavement, be sure to remove all chunks and pieces from the site.

✓ Make sure broken pavement does not come in contact with rainfall or runoff.

✓ Protect nearby storm drain inlets during saw-cutting. Shovel or vacuum saw-cut slurry deposits and remove from the site.

✓ Never hose down streets to clean up tracked dirt. Use dry sweep methods.

Fresh Concrete & Mortar Application

General Business Practices

✓ Both at your yard and the construction site, always store both dry and wet materials under cover, protected from rainfall and runoff. Protect dry materials from wind.

✓ Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from gutters, storm drains, rainfall, and runoff.

✓ Wash out concrete mixers only in designated wash-out areas in your yard, where the water will flow into containment ponds or onto dirt. Let concrete harden and dispose of as garbage. Whenever possible, recycle washout by pumping back into mixers for reuse. **Never dispose of washout into the street, storm drains, drainage ditches, or streams.**

During Construction

✓ Don't mix up more fresh concrete or cement than you will use in a day.

✓ Set up and operate small mixers on tarps or heavy plastic drop cloths.

✓ When cleaning up after driveway or sidewalk construction, wash fines onto dirt areas, not down the driveway or into the street or storm drain.

✓ Prevent aggregate wash from driveway/patio construction from entering storm drains. Hose aggregate wash onto dirt areas and spade into dirt.

✓ Place hay bales or other erosion controls downslope to capture runoff carrying mortar or cement before it reaches the storm drain.

✓ When breaking up paving, be sure to pick up all the pieces and dispose properly.

✓ Recycle large chunks of broken concrete at a landfill.

✓ Dispose of small amounts of excess dry concrete, grout, and mortar in the trash.

✓ Never bury solid or hazardous waste material.

Painting & Application of Solvents & Adhesives

Handling Paint Products

✓ **Keep all liquid paint products and wastes away from the gutter, street, and storm drains.** Liquid residues from paints, thinners, solvents, glues, and cleaning fluids are hazardous wastes and must be disposed of at a hazardous waste collection facility (contact your local stormwater program).

Painting cleanup

✓ **Never clean brushes or rinse paint containers into a street, gutter, storm drain, or stream.**

✓ **For water-based paints,** paint out brushes to the extent possible. Rinse to the sanitary sewer once you have gained permission from the local wastewater treatment authority. Never pour paint down a drain.

✓ **For oil-based paints,** paint out brushes to the extent possible and clean with thinner or solvent in a proper container. Filter and reuse thinners and solvents. Dispose of excess liquids and residue as hazardous waste.

Paint removal

✓ **Paint chips and dust from non-hazardous dry stripping and sand blasting** may be swept up or collected in plastic drop cloths and disposed of as trash.

✓ **Chemical paint stripping residue and chips and dust from marine paints or paints containing lead or tributyl tin** must be disposed of as hazardous wastes.

✓ When stripping or cleaning **building exteriors** with high-pressure water, block storm drains. Wash water onto a dirt area and spade into soil. Or, check with the local wastewater treatment authority to find out if you can collect (mop or vacuum) building cleaning water and dispose to the sanitary sewer. Sampling of the water may be required to assist the wastewater treatment authority in making its decision.

Recycle/reuse leftover paints whenever possible.

✓ Recycle or dispose of excess **water-based** paint at a household hazardous waste collection facility, or use up. When they are thoroughly dry, empty paint cans, used brushes, rags, and drop cloths may be disposed of as garbage in a sanitary landfill.

✓ Reuse leftover **oil-based paint.** Dispose of excess liquid, including sludges, as hazardous waste.

✓ Small quantity generators should check with the San Mateo County Environmental Health Division regarding recycling or hazardous waste disposal.

✓ Unopened cans of paint may be able to be returned to the paint vendor. Check with the vendor regarding its "buy-back" policy.

Landscaping, Gardening, and Pool Maintenance

✓ Protect stockpiles and landscaping materials from wind and rain by storing them under tarps or secured plastic sheeting.

✓ Store pesticides, fertilizers, and other chemicals indoors or in a shed or storage cabinet.

✓ Schedule grading and excavation projects for dry weather.

✓ Use temporary check dams or ditches to divert runoff away from storm drains.

✓ Protect storm drain inlets with hay bales, berms, filter mats or other inlet protection measures.

✓ **Revegetation is an excellent form of erosion control for any site.**

Landscaping/Garden Maintenance

✓ Use up pesticides and follow label directions. Rinse containers, and use rinsewater as product. Dispose of rinsed containers in the trash.

✓ Dispose of unused pesticides as hazardous waste.

✓ Collect lawn and garden clippings, pruning waste, and tree trimmings. Chip if necessary, and compost.

✓ Do not place yard waste in gutters. In communities with curbside yard waste recycling, leave clippings and pruning waste for pickup in approved bags or containers. Or, take to a landfill that composts yard waste.

✓ **Do not blow or rake leaves, etc. into the street.**

Pool/Fountain/Spa Maintenance

✓ Never discharge chlorinated pool or spa water to a street or storm drain.

✓ When emptying a pool or spa, let chlorine dissipate for 5 to 7 days. Then recycle water by draining it gradually onto a landscaped area, or drain the dechlorinated water to a storm drain.

✓ Chlorinated water may be to discharged to the sanitary sewer (if allowed by the local sewage treatment authority) by running a hose to a utility sink or sewer pipe cleanout junction.

✓ **Do not use copper-based algaecides.** Control algae with chlorine or other alternatives to copper-based pool chemicals. **Copper is harmful to aquatic life and cannot be completely removed by the sewage treatment plant.**

Storm drain polluters may be liable for fines of up to $25,000 per day!

SWPPP EXHIBIT
POLLUTION PREVENTION
PETALUMA COMMUNITY SPORTS
FIELDS BASEBALL DIAMOND
CITY OF PETALUMA, CALIFORNIA
MARCH 2020

PREPARED BY

BKF
ENGINEERS / SURVEYORS / PLANNERS
200 4TH ST, STE. 300 SANTA ROSA, CA 95401
(707) 583-8500 FAX: (707) 583-8539

JOB NO. 20169092

SHEET 5 OF 5 SHEETS

Plot Mar 31, 2020 at 1:03pm

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DRAFT

APPENDIX T

CONTRACTOR ACTIVITIES LOCATION MAP

APPENDIX U

BIOASSESSMENT SUMMARY AND RESOURCES

Bioassessment Summary and Resources

Not required for Risk Level 2 sites.

APPENDIX 2

GEOTECHNICAL INVESTIGATION REPORT

Miller Pacific
ENGINEERING GROUP

504 Redwood Blvd.
Suite 220
Novato, California 94947
T 415 / 382-3444
F 415 / 382-3450

GEOTECHNICAL INVESTIGATION
EAST WASHINGTON PARK
PETALUMA, CALIFORNIA

September 30, 2008

Project No. 1206.04

Prepared For:
Winzler & Kelly Consulting Engineers
495 Tesconi Circle
Santa Rosa, CA 95401-4619

CERTIFICATION

This document is an instrument of service, prepared by or under the direction of the undersigned professionals, in accordance with the current ordinary standard of care. The service specifically excludes the investigation of radon, asbestos, toxic mold and other biological pollutants, and other hazardous materials. The document is for the sole use of the client and consultants on this project. Use by third parties or others is expressly prohibited without written permission. If the project changes, or more than two years have passed since issuance of this report, the findings and recommendations must be reviewed by the undersigned.

MILLER PACIFIC ENGINEERING GROUP
(a California corporation)

REVIEWED BY

TIMOTHY J. REYNOLDS
No. 2686
Exp. 12/31/08
GEOTECHNICAL

Nathaniel R. Swanson
Staff Geologist

Timothy J. Reynolds
Geotechnical Engineer No. 2686
(Expires 12/31/08)

GEOTECHNICAL INVESTIGATION
EAST WASHINGTON PARK
PETALUMA, CALIFORNIA

TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION
EAST WASHINGTON PARK
PETALUMA, CALIFORNIA

I. INTRODUCTION

This report summarizes Miller Pacific Engineering Group's (MPEG) geotechnical investigation for the planned East Washington Park Sports Complex development in Petaluma, California. As shown on the Site Location Map, Figure 1, the project site is located about 0.5 miles southwest of the intersection of Adobe Road and East Washington Street in eastern Petaluma. The project will include new baseball diamonds and soccer fields, several ancillary structures, field lights, paved roads, flatwork, paths and landscaping on an approximately 23 acre, undeveloped parcel. The development area will occupy the entire extent of the parcel, as shown on Figure 2.

The purpose of our geotechnical investigation is to explore subsurface conditions and develop geotechnical criteria for design of the new sports fields, ancillary structures and other site improvements. The scope of our geotechnical investigation included review of readily-available geotechnical and geologic data, subsurface exploration with 11 exploratory borings, laboratory testing, engineering evaluation, and development of recommendations appropriate for the project and site. In accordance with our proposal letter dated June 12, 2008, MPEG is providing the following services:

1. Subsurface exploration within the project site with eleven borings;
2. Laboratory testing of select samples to determine the engineering properties of the soils; and,
3. A geotechnical report that contains;
    - Review of available geologic and geotechnical reference data,
    - Results of subsurface exploration and laboratory testing,
    - Evaluation of the pertinent geologic hazards and geotechnical conditions,
    - Design-level recommendations for;
        i. General site grading and subgrade preparation,
        ii. Synthetic turf field subgrade preparation and design parameters for the permeable rock drainage system underlying the turf material (Appendix B),
        iii. Vehicular, pedestrian and track pavement sections,
        iv. Exterior and interior concrete slabs, and
        v. Foundations for small buildings, dugouts, bleachers, backstops, foul poles, and lighting.

Appendix B of this report includes specifications and recommended details for subdrainage of synthetic turf fields.

We will remain available for consultation with the Design Team throughout the design process. Our services during bidding and construction will be provided under a separate agreement.

II. PROJECT DESCRIPTION

The planned East Washington Park project will include three natural-turf baseball diamonds, three synthetic-turf soccer fields, a BMX bicycle area, approximately 2,300 linear feet of paved roadway with three roundabouts, widening of East Washington Street, a restroom/concession/storage structure (1,000 sq. ft.), a restroom/concession structure (840 sq. ft.), a restroom (123 sq. ft.), a maintenance building (860 sq. ft), a trash enclosure (340 sq. ft.), a gazebo, six dugouts, shade structures, foul poles, field lights, approximately 3,500 linear feet of asphalt-concrete (AC) paved pathways, exterior concrete flatwork for terraces and sidewalks, and landscaping. The locations of these various improvements are shown on Figure 2.

III. SITE CONDITIONS

A. Regional Geology

The site is located within the Coast Range Geomorphic Province of California. The regional bedrock geology consists of complexly folded, faulted, sheared, and altered sedimentary, igneous, and metamorphic rock of the Jurassic-Cretaceous age (65-190 million years ago) Franciscan Complex.

The regional topography is characterized by northwest-southeast trending mountain ridges and intervening valleys that reflect the geologic structure of the same orientation. Extensive faulting, folding and erosion/deposition continuing through late Tertiary formed the valley area surrounding the project site, and the Sonoma Mountains to the east. Fault activity is presently concentrated along the San Andreas Fault zone, a complex group of generally parallel, northwesterly trending faults. This zone includes the active Rodgers Creek Fault that traverses through the Sonoma Mountains.

Geologic mapping of the area by the California Division of Mines and Geology (CDMG, 1980) indicates that the project site is underlain by late Holocene outer-edge alluvial fan deposits consisting mainly of fine sand, silt, and silty clay. Near surface soil in this area is known locally as “Adobe” which is clayey and is commonly highly expansive in nature.

B. Surface Conditions

The project site is located approximately one half-mile southwest of the intersection of Adobe Road and East Washington Street in Petaluma on the southeast side of East Washington Street. The existing site consists of three low alluvial tongues, each approximately 10 feet tall and gently sloping to the southwest. The three tongues are separated by two narrow, natural swales that also slope to the southwest. The central swale within the site is delineated as a wetland. The site is blanketed by dark brown, high plasticity clay that, at the time of our exploration (July 2008), had undergone extensive desiccation shrinkage. Surface cracks up to six inches wide and three feet deep were observed.

C. Field Exploration and Laboratory Testing

We explored subsurface conditions in the planned improvement area with 11 auger borings to depths between 4.5 to 15.0 feet on July 30, 2008. The boring locations are shown on Figure 2. The soils encountered in our borings were logged and samples were obtained for laboratory testing. The subsurface exploration program is discussed in more detail in Appendix A. A Soil Classification Chart is shown on Figure A-1. The boring logs are presented on Figures A-2 through A-12 of Appendix A.

Laboratory testing of samples from the exploratory borings included moisture content, dry density, unconfined compression, and plasticity. The results of the moisture content, dry density, and unconfined compression tests are presented on the boring logs. The plasticity test results are presented on Figure A-13. The laboratory testing program also is discussed in more detail in Appendix A.

D. Subsurface Conditions

Our subsurface exploration generally confirms the mapped local geologic conditions. The soils within the project site generally consist of high plasticity silty clay (Adobe) from depths of 1.5 to 9 feet below the ground surface, underlain by stiff, low to medium plasticity sandy clay. Lenses of silty and clayey sand were encountered in Boring 3. Our past experience, as well as current site observation and laboratory testing, indicate that the Adobe clay is moderately to highly expansive (will undergo large volume changes with seasonal changes in moisture content).

Groundwater was not observed in any of the borings we excavated. However, groundwater levels can fluctuate seasonally and we performed drilling during the summer season when groundwater levels are generally very low. We anticipate that surface water infiltration can become temporarily perched on top of relatively low permeability clayey soil layers following extended rains.

E. Seismicity and Other Hazards

The site is located within a seismically active area and will therefore experience the effects of future earthquakes. Earthquakes are the product of the build-up and sudden release of strain along a “fault” or zone of weakness in the earth's crust. Stored energy may be released as soon as it is generated or it may be accumulated and stored for long periods of time. Individual releases may be so small that they are detected only by sensitive instruments, or they may be violent enough to cause destruction over vast areas.

Faults are seldom single breaks in the earth's crust but typically are braids of breaks that comprise shatter or shear zones which link to form networks of major and minor faults. Within the Bay Area, faults are concentrated along the San Andreas Fault zone. The movement between rock formations along either side of a fault may be horizontal, vertical, or a combination and is radiated outward in the form of energy waves. The amplitude and frequency of earthquake ground motions partially depends on the material through which it is moving. The earthquake force is transmitted through hard rock in short, rapid vibrations, while this energy movement becomes a long, high-amplitude motion when moving through soft ground materials, such as bay mud.

An “active” fault is one that shows displacement within the last 11,000 years and, therefore, is considered more likely to generate a future earthquake than a fault that shows no sign of recent rupture. The locations of the currently known active faults relative to the project site are shown on Figure 3. The closest active fault that could produce significant seismic shaking is the Rodgers Creek fault located approximately 3 miles northeast of the site.

Probability of Future Earthquakes: To evaluate earthquake probability in this region, the USGS has assembled a group of researchers into the "Working Group on California Earthquake Probabilities" to estimate the probabilities of earthquakes on active faults. Potential sources were analyzed considering fault geometry, geologic slip rates, geodetic strain rates, historic activity, and micro-seismicity, to arrive at estimates of probabilities of earthquakes with a Moment Magnitude greater than 6.7 by 2032.

The probability studies focus on seven "fault systems" within the Bay Area. Fault systems are composed of different, interacting fault segments capable of producing earthquakes within the individual segment or in combination with other segments of the same fault system. The probabilities for the individual fault segments in the San Francisco Bay Area are presented on Figure 3.

In addition to the seven fault systems, the studies included probabilities of "background earthquakes." These earthquakes are not associated with the identified fault systems and may occur on lesser faults (i.e., West Napa) or previously unknown faults (i.e., the 1989 Loma Prieta and 2000 Napa/Mt. Veeder Earthquake). When the probabilities on all seven fault systems and the background earthquakes are combined mathematically, there is a 62 percent chance for a magnitude 6.7 or larger earthquake to occur in the Bay Area by the year 2032. Smaller earthquakes (between magnitudes 6.0 and 6.7), capable of considerable damage depending on proximity to urban areas, have about an 80 percent chance of occurring in the Bay Area by 2032 (USGS, 2002).

Additional studies by the USGS regarding the probability of large earthquakes in the Bay Area are on going. These current evaluations include data from additional active faults and updated geological data.

Fault Surface Rupture: Under the Alquist-Priolo Special Studies Zone Act[1], the California Division of Mines and Geology (CDMG) produced 1:24,000 scale maps showing all known active faults and defining zones within which special fault studies are required. Based on currently available published geologic information, the project site is not located within an

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[1] The Alquist Priolo Earthquake Fault Zoning Act prohibits placing most structures for human occupancy across traces of active faults. These fault zones are shown on maps issued by the Department of Conservation's Division of Mines and Geology.

Alquist-Priolo Special Studies Zone. The potential for fault surface rupture is therefore considered to be low.

Seismic Shaking: The site will likely experience seismic ground shaking similar to other areas in the seismically active San Francisco Bay Area. Earthquakes along several active faults in the region, as shown on Figure 3, could cause moderate to strong ground shaking at the site. The intensity of earthquake ground motions will depend on the characteristics of the generating fault, distance to the fault and rupture zone, earthquake magnitude, earthquake duration, and site-specific geologic conditions. Medium stiff to stiff soils underlie the site to the depths explored. Empirical attenuation equations developed for stiff soil sites provide approximate estimates of median peak site accelerations. A summary of the principal active faults affecting the site, their closest distance, moment magnitude of characteristic earthquake and probable peak ground accelerations which an earthquake on the fault could generate at the site, are shown in Table A.

TABLE A
ESTIMATED PEAK GROUND ACCELERATION
FOR PRINCIPAL ACTIVE FAULTS
EAST WASHINGTON PARK
PETALUMA, CALIFORNIA

Fault	Moment Magnitude for Characteristic Earthquake	Closest Estimated Distance	Median Peak Ground Acceleration
Rodgers Creek	7.0	3 km	0.48g
San Andreas	7.8	27 km	0.19g
Hayward North	6.4	25 km	0.13g
West Napa	6.5	25 km	0.13g
Maacama South	6.9	35 km	0.11g

References: Sources: USGS (2008), Abrahamson and Silva (1997)

The potential for strong seismic shaking at the project site is high. Due to its close proximity, the Rodgers Creek Fault (approximately 4 kilometers to the northeast) presents the highest potential for severe ground shaking. The most significant adverse impact associated with strong seismic shaking is potential damage to structures and improvements.

Minimum mitigation measures should include designing the structures and foundations in accordance with the most recent (2007) California Building Code. Recommended seismic coefficients are provided in Section IV-C of this report.

Liquefaction Potential and Related Impacts: Liquefaction refers to the sudden, temporary loss of soil shear strength during strong ground shaking. Liquefaction-related phenomena can include ground settlement, flow failure, and lateral spreading. These phenomena can occur where there are saturated, loose, granular deposits. Based on our subsurface exploration and laboratory testing, the alluvial soils at the site contain relatively high percentages of fine-grained material (silts and clays) and/or are relatively stiff/dense. Therefore, liquefaction potential at the site is considered to be low.

Expansive Soil: Clays and silts of moderate to high plasticity, when located near the ground surface, can exhibit expansive characteristics (shrinking and swelling with seasonal drying and wetting cycles) that can be detrimental to lightly-loaded structures and flatwork. Our exploration encountered up to 9 feet of plastic, potentially expansive soils near the ground surface. Based on our exploration, laboratory testing, and experience in the area, we judge that the near-surface soils at the site pose a significant hazard to site development due to expansive soil shrink/swell.

Mitigation options for expansive soils can include proper site preparation (through moisture conditioning), lime treatment, or the use of select fill to minimize potential damage from expansive soils. Geotechnical recommendations for site preparation and foundation design are provided in Sections IV-D and IV-E, respectively.

Flooding: The development area is not within a FEMA 100-year flood zone. The project Civil Engineer is responsible for site drainage and should evaluate flooding potential and provide appropriate mitigation.

Other Commonly Considered Hazards: Because the site is relatively flat and is not located at the base of a slope where an offsite landslide event would impact the project area, landsliding/slope stability, lurching, and ground cracking are not considered a significant risk. The site is not located in close proximity to any large bodies of water. Therefore seiche and tsunamis do not pose a significant risk.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

Based on our current investigation and previous experience with similar sites and projects, we conclude that the site is suitable for the planned improvements. New structures can be safely supported on conventional spread footings provided that the pads are properly prepared to mitigate the expansive soil conditions as discussed below. New “pole” or sign structures and field lights can be safely supported on drilled piers. The primary geotechnical concerns relative to site development are near-surface expansive soil and appropriate foundation design to resist strong seismic ground shaking. The potential for strong seismic ground shaking at the site was discussed in an earlier section. Site expansive soil conditions are discussed in more detail below. Design recommendations for these and other geotechnical issues are provided in the sections that follow.

B. Expansive Soil

Expansive soils tend to swell (heave) and shrink when they are alternately wetted and dried, respectively. This shrink/swell cycle can be very damaging to structures founded in expansive clay soil. As encountered in our borings, near surface soils of high plasticity clay with a potential for expansion blanket the entire project site from 1.5 to 9 feet deep.

On synthetic turf athletic fields, the potential impact of near surface expansive subgrade soils is the development of visible undulations of the synthetic turf surface over time. This condition does not make the field unplayable or affect its ability to drain and support the weight of athletic activities. The primary issues raised by this condition are aesthetics and long-term conformance to specified finished grade tolerances. For natural turf fields, we judge that near surface expansive subgrade soils can be sufficiently mitigated by consistent irrigation of the natural turf, which should minimize the negative aesthetic effects of undulating surfaces.

For new structures, pavements, flatwork, and synthetic fields, two basic options are commonly employed to mitigate expansive near-surface soil:

1) Improvement of the near-surface expansive soils by either addition of lime or cement (Treatment), or replacement with non-expansive import fill (Select Fill); or,

2) Use of drilled pier and grade beam foundation systems to gain foundation support for new structures below the unstable near-surface expansive soils. This option would not mitigate the hazard to flatwork or pavement

Based on our understanding of site conditions and planned development, we judge that improving the near-surface expansive soil by means of Lime Treatment will provide more value to the project than using drilled pier foundations or select fill for the following reasons:

- Improved near-surface soil (either Select Fill or Treated on-site clays) will allow for the use of more conventional, and less costly, shallow spread footings instead of drilled piers;

- Improving the near surface expansive soil will provide a much improved pavement subgrade condition (higher R-value) which will allow a reduced pavement section. Depending in the total area of pavement for driveways and parking areas, this could result in significant cost savings to the project.

- Improved near-surface soil will provide a more planar surface over the life of the synthetic turf field by reducing differential shrink/swell of subgrade soils.

- If construction is performed from late fall to mid spring, wet soil conditions from seasonal rains are likely. Wet soil conditions can make site preparation and grading difficult or impossible. Treatment with lime not only mitigates expansive potential of near-surface soils, but also can mitigate wet soil conditions and allow construction to proceed through the wet season, providing added flexibility to the construction schedule.

C. Seismic Design

The site will experience strong ground shaking similar to other areas of the seismically active San Francisco Bay Region. Mitigation of ground shaking includes seismic design of the structure in conformance with the provisions of the most recent version of the California Building Code (2007). Based on the interpreted subsurface conditions, we recommend the CBC coefficients and site values shown in Table B below for use in equations 30A-4 through 30A-8 to calculate the design base shear of the new construction.

TABLE B
2007 CBC FACTORS
EAST WASHINGTON PARK
PETALUMA, CALIFORNIA

Factor Name	Coefficient	CBC Table	Site Specific Value
Site Class[1]	$S_{A,B,C,D,E,\text{ or }F}$	1613.5.2	S_D
Site Coefficient	F_a	1613.5.3 (1)	1.0
Site Coefficient	F_v	1613.5.3 (2)	1.5
Spectral Acc. (short)	S_s	1613.5.1	1.7 g
Spectral Acc. (1-sec)	S_1	1613.5.1	0.7 g

(1) Site Class C Description: Stiff soil profile with shear wave velocities between 600 and 1,200 fps, Standard Penetration Test N values between 15 and 50, and undrained shear strength between 1,000 and 2,000 psf.

Probabilistic Seismic Hazard Analysis – Probabilistic Seismic Hazard Analysis (PSHA) analyzes all possible earthquake scenarios while incorporating the probability of each individual event to occur. The probability is determined in the form of the recurrence interval, which is the average rate at which an earthquake of some size will be exceeded. Therefore, the design earthquake is not solely dependent on the fault with the closest distance to the site and/or the largest magnitude, but rather the probability of given seismic events of occurring.

Utilizing USGS data we calculated the PGA_{DBE} listed below in Table C. The ground motion given by the USGS Earthquake Seismic Hazards program is for rock and alluvial sites.

TABLE C
PROBABILISTIC SEISMIC HAZARD ANALYSIS
EAST WASHINGTON PARK
PETALUMA, CALIFORNIA

	Percent Chance of Exceedance	Statistical Return Period	Peak Ground Acceleration, Rock	Peak Ground Acceleration, Alluvium
PGA_{DBE}	10% in 50 years	475 years	0.578g	0.578g

Site Coordinates (Lat., Long.): N38.264, W122.610
Reference: USGS (2002)

D. Site Grading

1. General – Depending on time of construction, wet subgrade soils may be encountered. In warm weather, soils in these areas can typically be over-excavated, spread out and air-dried to a suitable moisture content before replacing and re-compacting. During the rainy season, however, this is usually not feasible due to cool and wet weather conditions. Therefore, the owner should anticipate some remediation of soft and saturated soils will be required if grading occurs during the months of October to May. These remediation measures typically consist of replacement with a suitable fill material or in-place treatment using soil additives such as lime or cement.

If near-surface soils are dry and desiccated, subgrade should be moisture conditioned for a minimum of two weeks prior to grading to swell the surface clay soils. This initial moisture conditioning should sufficiently moisten the clay soils to depths at which seasonal moisture fluctuations do not commonly occur, at approximately three feet below the surface. We should be on-site to observe as many as 10 shallow test pit excavations up to four feet deep in order to verify that native soils have been moisture conditioned to above optimum moisture content[2].

2. Limits of Soil Improvements - Recommendations for improving near surface soils are intended for structural areas and not areas of landscaping or natural turf fields. The limits of improvement should be as follows:

a. Five feet beyond the edge of new building foundations and to a minimum depth of 18 inches below bottom of footing or 30 inches below finished subgrade.
b. Three feet beyond the edge of synthetic turf fields, and pavement or flatwork, and to a depth of 18 inches below finished subgrade.

3. Surface Preparation - Clear all structures, concrete slabs, asphalt pavement, over-size debris, and organic matter from areas where improvements are planned. Existing concrete foundations, slabs or asphalt pavements should be removed where they conflict with new grades and foundations because “hard points” and reflection cracking are expected if new structures are located over old improvements.

Any construction debris or abandoned utilities encountered during site grading should be removed from the site. Excavations to remove oversized materials or old improvements should be

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[2] Optimum moisture content refers to the water content at which the soil can be compacted to the maximum dry density, as determined by laboratory test procedure (ASTM 1557).

backfilled with compacted fill in accordance with subsequent sections of this report. Utilities may be abandoned in place in many cases provided low-strength cement grout completely fills any void in the utility and they are of a sufficient depth below new improvements.

Excavate loose or saturated soils to expose firm, suitably moist, natural soils. Following clearing, stripping and required excavations, the exposed soils within the building areas (extending to 5 feet beyond perimeter footings and 3 feet beyond exterior slabs or pavements) should be scarified to a depth of 8-inches, moisture conditioned to 2 to 3 percent above optimum moisture content, and compacted to at least 90 percent relative compaction. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density, as determined by laboratory test procedure (ASTM 1557-92). Optimum moisture is the water content, by percent of dry soil weight that corresponds to maximum dry density.

4. <u>Fill Materials</u> - The on-site near surface materials will not be suitable for use as Select Fill in structural areas unless treated in the manner described below. Imported fill may also be considered if it meets the criteria below.

5. <u>Soil Treatment</u> - Where soil treatment is planned to mitigate expansive soil conditions the soil treatment shall: (1) be composed of high calcium or dolomitic quicklime in conformance to the most recent Caltrans Standard Specification; (2) placed at a treatment rate of 5 percent by dry unit weight of existing soil (assume 110 pcf); and (3) placed in a manner conforming to the most recent Caltrans Standard Specification. Section 24: Lime Stabilization, from the 2006 CalTrans Standards Specifications manual is included in Appendix C for reference.

6. <u>Imported Select Fill</u> - If imported fill is used to raise building site grades, it shall be free of organic matter, have a Liquid Limit of less than 40, a Plasticity Index of less than 20, have a minimum R-value of 40, and conform to the gradation limits in Table D.

TABLE D
IMPORTED FILL GRADATION LIMITS
EAST WASHINGTON PARK
PETALUMA, CALIFORNIA

Particle Size	Percent Finer by Dry Weight
4 inch	100
No. 4 sieve	20 - 100
No. 200 sieve	0 - 50

7. Compaction - Treated on-site soils and imported Select Fill used as fill and backfill should be conditioned to near the optimum moisture content. Properly moisture conditioned and cured materials should subsequently be placed in loose horizontal lifts, typically 8 inches thick or less, and uniformly compacted to a minimum of 90 percent relative compaction to produce a firm non-yielding surface. With appropriate equipment, Treated on-site soils can be compacted in lifts as thick as 18-inches. Regular wetting of subgrade surfaces shall be performed to maintain this moisture condition until pavements, flatwork, or other final improvements have been installed. Subgrades consisting of onsite clayey soils shall not be permitted to dry beyond the range specified above prior to placing of pavements and concrete slabs on grade.

8. Cut and Fill Slope Construction - If minor cut or fill slopes are planned to level the building area, the slopes should be limited to 2:1 (horizontal:vertical).

E. Foundation Design

Provided site preparation and grading are preformed in accordance with the recommendations above, new building loads should be supported on shallow spread footings bearing on at least 18 inches of non-expansive site soils, import Select Fill or lime treated on-site clay soil. Footings should be designed with the values in Table E. New pole or sign structures can be supported on drilled pier foundations designed in accordance with the criteria presented in Table E, below.

TABLE E
FOUNDATION DESIGN CRITERIA
EAST WASHINGTON PARK
PETALUMA, CALIFORNIA

Shallow Footings

Minimum Width[1]:	12 inches
Minimum Embedment[2]:	12 inches
Allowable bearing pressure[3]:	
Dead plus live loads:	3,000 psf
Total design loads:	3,500 psf
Base friction coefficient:	0.35
Lateral Passive Resistance[4]:	350 pcf
Modulus of Subgrade Reaction, $k_{s:}$	250 pci

Drilled Piers for Pole Structures Only

Minimum Pier Diameter:	12 inches
Minimum Embedment[5]:	5 feet
Skin Friction, f_s:	700 psf
Uplift capacity:	0.8 x Skin Friction
Lateral Passive Resistance[6,7]:	350 pcf

(1) Size foundations to maintain uniform bearing pressures.
(2) Footing depths will be verified during construction.
(3) Uniform rectangular pressure distribution.
(4) Equivalent fluid pressure. Neglect upper 6-inches unless foundations are confined by concrete slabs or asphalt pavements.
(5) Depths will need to be verified in the field and may require deepening upon inspection.
(6) Apply values over an effective width of 2-pier diameters
(7) Equivalent fluid pressure. Neglect where horizontal distance to slope face is less than 3-pier diameters from edge of pier.

F. Concrete Slabs-on-Grade

For interior concrete floor slabs, we recommend they be at least 5 inches thick and that they be reinforced with steel reinforcing bars (not wire mesh). We also recommend crack control joints in both directions and that the reinforcing bars extend through the control joints. The Structural Engineer should design the concrete slab floors.

Interior concrete slabs should also be underlain by at least 4 inches of clean, open-graded (¾-inch) aggregate to act as a capillary moisture break. Where moisture vapor would be detrimental to the interior floor covering, a vapor barrier consisting of a minimum 10-mil plastic sheeting shall cover the base rock. The vapor barrier should meet the requirements of ASTM

E-1745. To aid concrete curing and protect the vapor barrier from puncture, cover the membrane with about 2 inches of sand.

Exterior concrete slabs should be at least 4 inches thick and reinforced as described above for interior slabs. Exterior concrete slabs may be placed directly on compacted Select Fill or Treated on-site clay soil. For improved performance, a 4-inch section of Class II AB compacted to a minimum of 92% relative compaction can be placed beneath exterior concrete slabs.

G. Underground Utilities

Trench excavations having a depth of 5 feet or more must be excavated and shored in accordance with OSHA regulations. Pursuant to OSHA classifications, near-surface alluvial clay soil are Type B, granular alluvial soil below the near-surface clay are Type C. Bedding materials for utility pipes should be well graded sand with 90 to 100 percent of particles passing the No. 4 sieve and no more than 5 percent finer than the No. 200 sieve. Provide the minimum bedding beneath the pipe in accordance with the manufacturer’s recommendation, typically 3 to 6 inches.

Import Select Fill or Treated on-site soil may be used as compacted trench backfill above the pipe and bedding material. The backfill materials should be placed in uniform lifts (four to eight inches depending upon the size of compaction equipment), moisture conditioned to near optimum moisture content and compacted to a minimum of 90 percent relative compaction. The upper six inches within pavement areas should be additionally compacted to at least 95 percent relative compaction during subgrade preparation. Outside of pavement and building areas, the compaction can be reduced to 85 percent. Jetting for compaction of trench backfill is not permitted.

H. Surface Drainage

Careful consideration should be given to design of finished grades at the site. We recommend that the building areas be raised slightly and that the adjoining landscaped areas be sloped downward at least 0.25 feet for 5 feet (5 percent) from the perimeter of building foundations. Where hard surfaces, such as concrete or asphalt adjoin foundations, slope these surfaces at least 0.10 feet in the first 5 feet (2 percent). Site drainage improvements should be connected into the existing City storm drainage system if possible.

I. Subsurface Drainage

As described in Section III-B, Surface Conditions, two southwest-sloping natural drainage swales exist on the site; one is delineated as a wetland. If fill is to be placed within these swales, sub-drains should be installed to carry water that seasonally occupies these drainage swales to an appropriate storm drain, preventing natural water flow from destabilizing fill that may placed within these swales during grading. We recommend that perforated pipes be installed along the alignment of drainage swales or at the heads of drainage swales per Figure 4 to transport water to the storm drain system.

J. Pavement Design

For preliminary planning, flexible asphalt pavements supported on un-treated clay soil or lime treated clay soil/Select Fill subgrade should be designed for Traffic Indices (TI) of 4.0, 5.0, or 6.0 as shown in Table F. These values are based on an assumed R-value of 50 for the Treated clay soil or Select Fill, and an R-value of 5 for the untreated clay soil. The upper six inches of pavement subgrade should be compacted to a minimum of 95 percent relative compaction. During construction, we must test the subgrade soil to verify the R-value condition.

TABLE F
ASPHALT PAVEMENT THICKNESS
EAST WASHINGTON PARK
PETALUMA, CALIFORNIA

	Untreated Soil		Treated Soil or Select Fill		
Traffic Index	Asphalt Concrete(1) (inches)	Aggregate Base(2) (inches)	Asphalt Concrete(1) (inches)	Aggregate Base(2) (inches)	Treatment Depth(3) (inches)
4.0	2.5	8.0	2.5	6.0	18.0
5.0	2.75	10.5	2.75	6.0	18.0
6.0	3.25	13.0	3.25	6.0	18.0

(1) Asphalt concrete shall conform to asphalt concrete criteria presented in the Caltrans Standard Specifications (2006). Asphalt concrete shall be placed in layers not exceeding 2.5 inches in thickness and compacted to a minimum of 95% relative compaction
(2) Aggregate Base shall conform to Class 2 Aggregate Base criteria in the CalTrans Standard Specifications (2006).
(3) Lime-treated subgrade materials shall have a minimum R-value of 50.

Following installation and backfill compaction for underground utilities, the pavement subgrade should be further compacted by rolling to provide a firm unyielding surface compacted to at least 95 percent relative compaction at near-optimum moisture content. The subgrade soils should be maintained moist until completion of the entire pavement surface. The aggregate material should be placed in uniform lifts not exceeding six inches in thickness, and in a manner to prevent segregation. The aggregate should similarly be moisture conditioned to near-optimum moisture content, and rolled to provide a smooth unyielding surface compacted to at least 95 percent relative compaction.

V. SUPPLEMENTAL GEOTECHNICAL SERVICES

We must review the plans and specifications for the project when they are nearing completion to confirm that the intent of our geotechnical recommendations has been incorporated and provide supplemental recommendations, if needed.

During construction, we must observe and test site grading (in particular lime treatment of expansive soils or import, and compaction of select fill) and surface drainage. We also need to observe foundation excavations for the structures and associated improvements to confirm that the soils encountered during construction are consistent with the design criteria. These construction services will be provided under a separate agreement.

VI. LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering practices in the San Francisco Bay Area at the time the report was prepared. This report has been prepared for the exclusive use of Winzler & Kelly Consulting Engineers and/or its assignees specifically for this project. No other warranty, expressed or implied, is made. Our evaluations and recommendations are based on the data obtained during our subsurface exploration program and our experience with soils in this geographic area.

Our approved scope of work did not include an environmental assessment of the site. Consequently, this report does not contain information regarding the presence or absence of toxic or hazardous wastes.

The evaluations and recommendations do not reflect variations in subsurface conditions that may exist between boring locations or in unexplored portions of the site. Should such variations become apparent during construction, the general recommendations contained within this report will not be considered valid unless MPEG is given the opportunity to review such variations and revise or modify our recommendations accordingly. No changes may be made to the general recommendations contained herein without the written consent of MPEG.

We recommend that this report, in its entirety, be made available to project team members, contractors, and subcontractors for informational purposes and discussion. We intend that the information presented within this report be interpreted only within the context of the report as a whole. No portion of this report should be separated from the rest of the information presented herein. No single portion of this report shall be considered valid unless it is presented with and as an integral part of the entire report.

LIST OF REFERENCES

Abrahamson, N. and Silva, W., "Empirical Response Spectral Attenuation Relations for Shallow Crustal Earthquakes," Seismological Research Letters, Vol. 68, No. 1, Jan/Feb 1996, pp. 94-127.

Abrahamson, N. and Silva, W., "Arias Duration of Horizontal Strong Shaking Attenuation Relation, 1996.

American Society for Testing and Materials, "2004 Annual book of ASTM Standards, Section 4, Construction, Volume 4.08, Soil and Rock; Dimension Stone; Geosynthetics," ASTM, Philadelphia, 1997.

Boore, Joyner, and Fumal, "Ground Motion Estimates for Strike- and Reverse-Slip Faults (1994)," Lecture Notes from CE 275, Fall Semester 1997, University of California at Berkeley.

California Building Code, 2007 Edition, California Building Standards Commission/International Conference of Building Officials, Whittier, California.

California Department of Conservation, Division of Mines and Geology, Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada to be Used with the 1997 Uniform Building Code, International Conference of Building Officials, Whittier, California, February 1998.

California Division of Mines and Geology, Special Publication 42, "Alquist-Priolo Special Studies Zone Act," 1972 (Revised 1988).

California Division of Mines and Geology, Special Report 120, "Geology for Planning in Sonoma County," 1980.

Caltrans Standard Specifications, State of California Department of Transportation, Section 24 (Lime Stabilization), 2006

Idriss, I.M. "An Overview of Earthquake Ground Motions Pertinent to Seismic Zonation." Fifth International Conference on Seismic Zonation, Nice French Riviera. 1995.

Southern California Earthquake Center, "Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction Hazards in California," University of Southern California, March 1999.

U.S. Geological Survey, "Database of Potential Sources for Earthquakes Larger than Magnitude 6 in Northern California," The Working Group on Northern California Earthquake Potential, Open File Report 96-705, 1996.

U.S. Geological Survey, "Interpolated Probabilistic Ground Motion for the Conterminous 48 States by Latitude Longitude, 2002 Data," Retrieved August 14, 2008, from http://eqint.cr.usgs.gov/eq-men/html/lookup-2002-interp-06.html.

U.S. Geological Survey, “Summary of Earthquake Probabilities in the San Francisco Bay Region, 2003 to 2032,” The Working Group on California Earthquake Probabilities, 2002.

Wesnousky, Steven G., "Earthquakes, Quaternary Faults, and Seismic Hazard in California," Journal of Geophysical Research, Vol. 91, No. B12, pp. 12587-12631, 1986.

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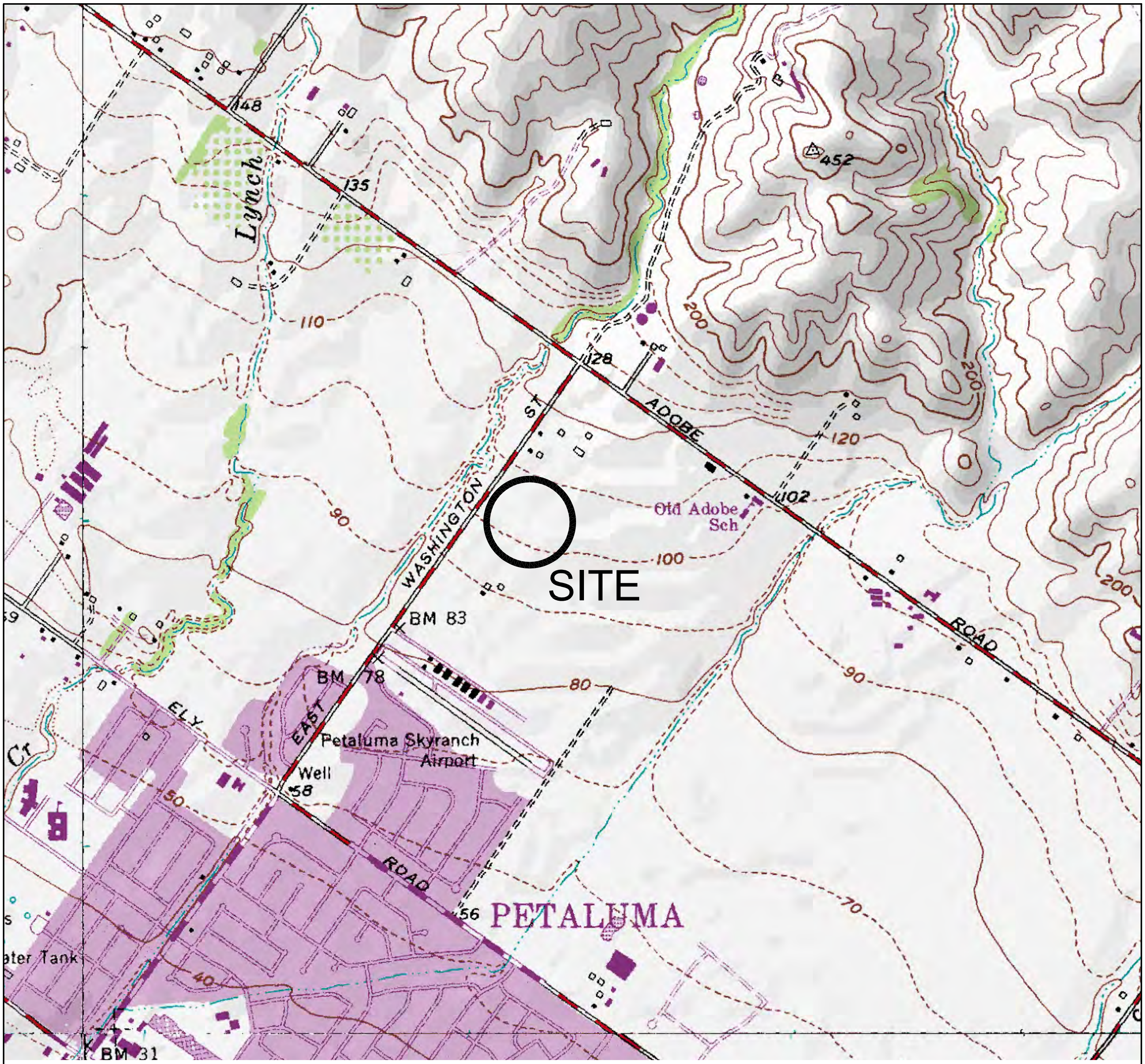
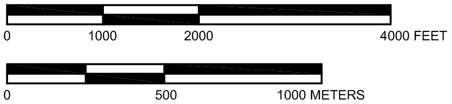
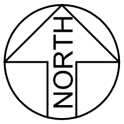


SITE LOCATION

SCALE





REFERENCE: DeLorme 3D TopoQuads, 2002

Miller Pacific

ENGINEERING GROUP

1333 N. McDowell Blvd.
Suite C
Petaluma, CA 94947
T 707 / 765-6140
F 707 / 765-6222
www.millerpac.com

FILE: 1206.04 SM.dwg

SITE LOCATION MAP

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed N/A
Drawn NRS
Checked

1
FIGURE

Approximate Location of Boring by MPEG, July 30, 2008

NORTH

SCALE

0 75 150 300 FEET

REFERENCE: Winzler & Kelly Consulting Engineers, 2008

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1333 N. McDowell Blvd.
Suite C
Petaluma, CA 94947
T 707 / 765-6140
F 707 / 765-6222
www.millerpac.com

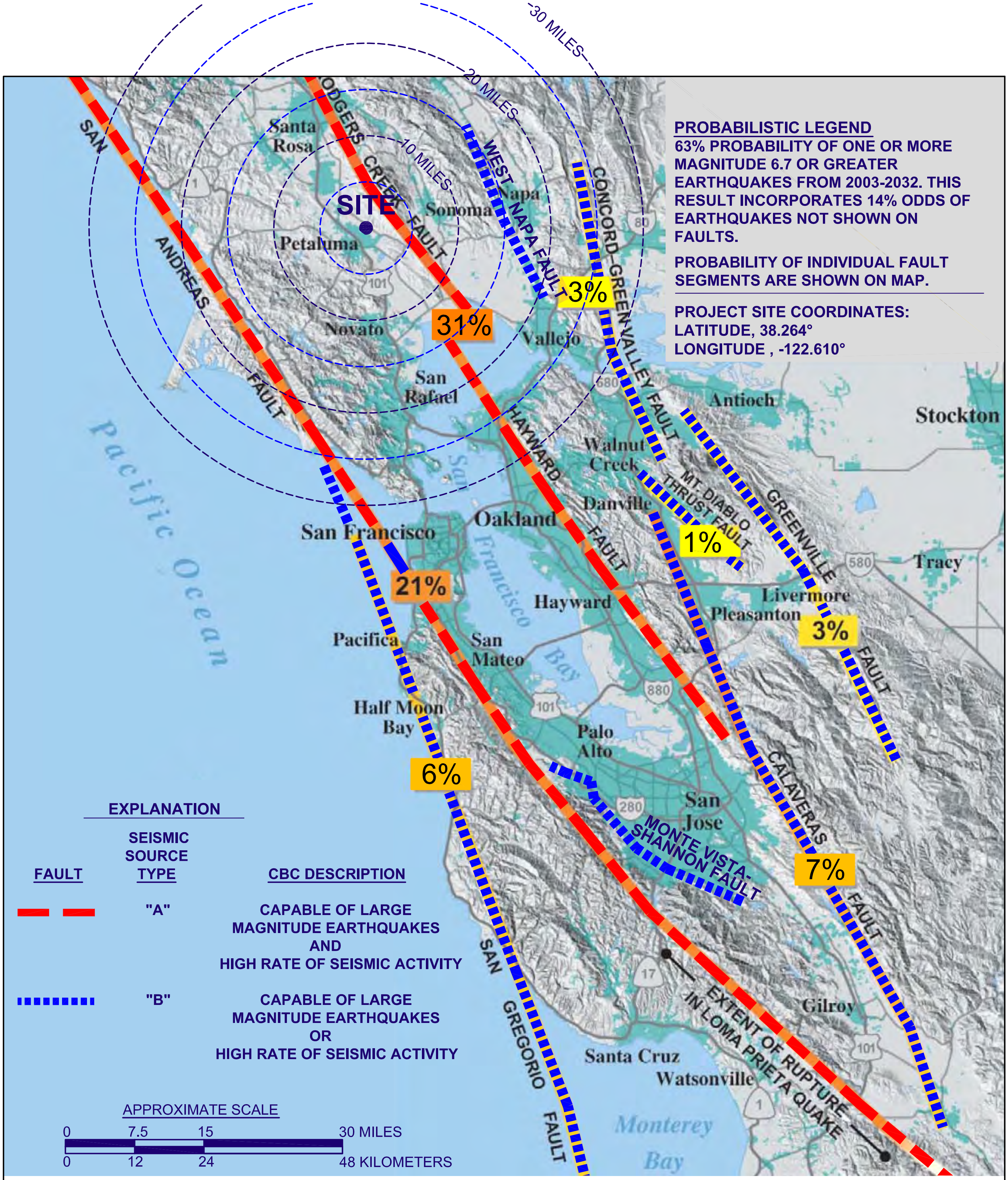
SITE PLAN

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed N/A
Drawn NRS
Checked

2
FIGURE



REFERENCES:

1) REVISED 2002 CALIFORNIA PROBABILISTIC SEISMIC HAZARD MAPS, CGS, 2003.

2) ACTIVE FAULT MAP MODIFIED FROM SUMMARY OF EARTHQUAKE PROBABILITIES IN THE S.F. BAY REGION, 2002 - 2031, THE WORKING GROUP ON CALIFORNIA EARTHQUAKE PROBABILITIES, 2003.

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1333 N. McDowell Blvd.
Suite C
Petaluma, CA 94947
T 707 / 765-6140
F 707 / 765-6222
www.millerpac.com

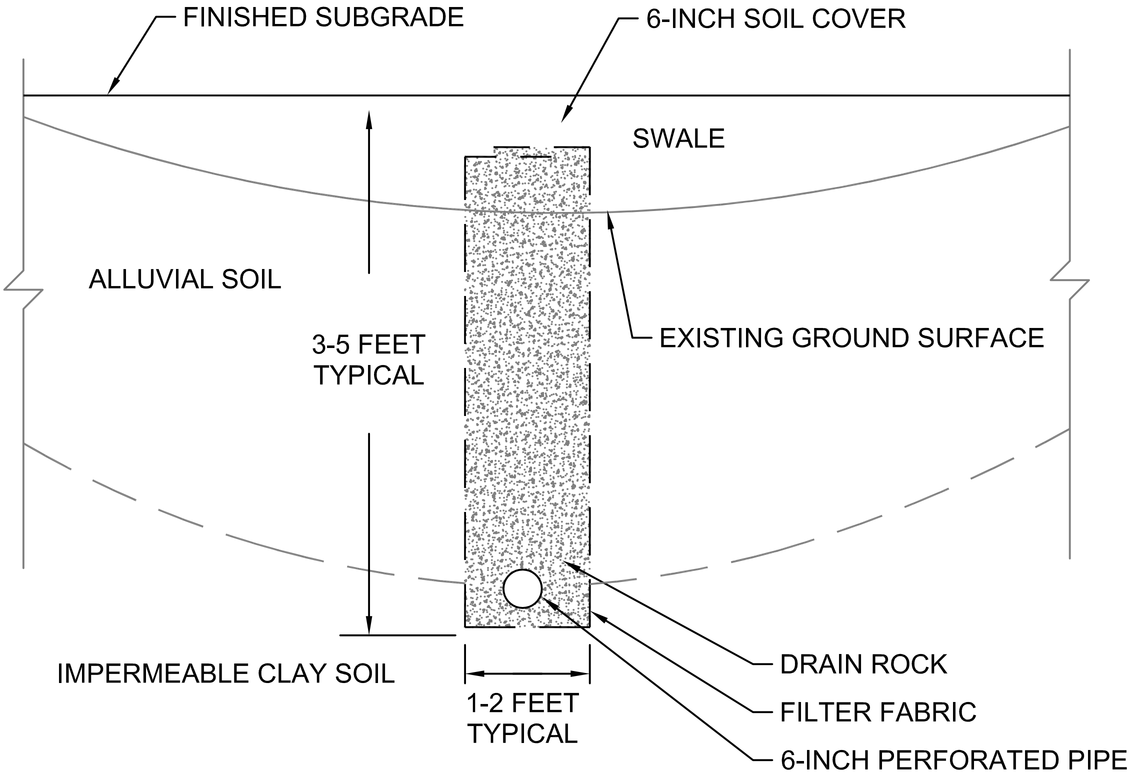
ACTIVE FAULT MAP

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

3
FIGURE



NOTES:

(1) PIPE TO BE 4-INCH DIAMETER, PERFORATIONS DOWN, S=0.02 MIN., WITH TIGHT PIPE TO GRAVITY DISCHARGE

(2) FILTER FABRIC TO BE MIRAFI 140N

(3) PERMEABLE MATERIAL TO BE CALTRANS CLASS 1A OR 1B

(4) USE SWEEPS FOR ALL SUBDRAIN BENDS/ELBOWS

TYPICAL DETAIL TRENCH SUBDRAIN

(NO SCALE)

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FILE: 1206.04 Subdrain.dwg

1333 N. McDowell Blvd.
Suite C
Petaluma, CA 94947
T 707 / 765-6140
F 707 / 765-6222
www.millerpac.com

TYPICAL DETAIL TRENCH SUBDRAIN

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed NRS
Drawn NRS
Checked

4
FIGURE

APPENDIX A
SUBSURFACE EXPLORATION AND LABORATORY TESTING

1.0 Subsurface Exploration

We explored subsurface conditions at the site by drilling eleven test borings on July 30, 2008 at the locations shown on Figure 2. Test borings were drilled to maximum depths of 4.5 to 15 feet using 6-inch diameter continuous flight solid augers mounted on an all-terrain drill rig.

The soils encountered were logged and identified by our field geologist in general accordance with ASTM Standard D 2487, "Field Identification and Description of Soils (Visual-Manual Procedure)." This standard is briefly explained on Figure A-1, Soil Classification Chart and Key to Log Symbols. The boring logs are presented on Figures A-2 through A-12.

We obtained “undisturbed” samples from our borings using a 3-inch diameter, split-barrel modified California sampler with 2.5 by 6-inch brass tube liners, and disturbed samples using a 2-inch diameter Standard Penetration Test sampler and no liners. The sampler was driven with a 140-pound hammer falling 30 inches. The number of blows required to drive the samplers 18 inches was recorded and is reported on the boring logs as blows per foot for the last 12 inches of driving. The samples obtained were examined in the field, sealed to prevent moisture loss, and transported to our laboratory.

2.0 Laboratory Testing

We conducted laboratory tests on selected intact samples to verify field identifications and to evaluate engineering properties. The following laboratory tests were conducted in accordance with the ASTM standard test method cited:

- Laboratory Determination of Water (Moisture Content) of Soil, Rock, and Soil-Aggregate Mixtures, ASTM D 2216;
- Density of Soil in Place by the Drive-Cylinder Method, ASTM D 2937;
- Atterberg Limits (Plasticity), ASTM D 4318; and,
- Unconfined Compressive Strength of Cohesive Soil, ASTM D 2166.

The moisture content, dry density, unconfined compression, and Atterberg Limits test results are shown on the exploratory Boring Logs. The Atterberg Limits tests are summarized on Figure A-13.

The exploratory boring logs, description of soils encountered and the laboratory test data reflect conditions only at the location of the boring at the time they were excavated or retrieved. Conditions may differ at other locations and may change with the passage of time due to a variety of causes including natural weathering, climate and changes in surface and subsurface drainage.

MAJOR DIVISIONS		SYMBOL		DESCRIPTION
COARSE GRAINED SOILS over 50% sand and gravel	CLEAN GRAVEL	GW	▨	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	▨	Poorly-graded gravels or gravel-sand mixtures, little or no fines
	GRAVEL with fines	GM	▨	Silty gravels, gravel-sand-silt mixtures
		GC	▨	Clayey gravels, gravel-sand-clay mixtures
	CLEAN SAND	SW	▨	Well-graded sands or gravelly sands, little or no fines
		SP	▨	Poorly-graded sands or gravelly sands, little or no fines
	SAND with fines	SM	▨	Silty sands, sand-silt mixtures
		SC	▨	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS over 50% silt and clay	SILT AND CLAY liquid limit <50%	ML	▥	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	▨	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays
		OL	▥	Organic silts and organic silt-clays of low plasticity
	SILT AND CLAY liquid limit >50%	MH	▥	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
		CH	▨	Inorganic clays of high plasticity, fat clays
		OH	▨	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS		PT	▤	Peat, muck, and other highly organic soils
ROCK			▩	Undifferentiated as to type or composition

KEY TO BORING AND TEST PIT SYMBOLS

CLASSIFICATION TESTS

AL	ATTERBERG LIMITS TEST
SA	SIEVE ANALYSIS
HYD	HYDROMETER ANALYSIS
P200	PERCENT PASSING NO. 200 SIEVE
P4	PERCENT PASSING NO. 4 SIEVE

STRENGTH TESTS

TV	FIELD TORVANE (UNDRAINED SHEAR)
UC	LABORATORY UNCONFINED COMPRESSION
TXCU	CONSOLIDATED UNDRAINED TRIAXIAL
TXUU	UNCONSOLIDATED UNDRAINED TRIAXIAL
	UC, CU, UU = 1/2 Deviator Stress

SAMPLER TYPE

▮	MODIFIED CALIFORNIA	⊠	HAND SAMPLER
▯	STANDARD PENETRATION TEST	⊠	ROCK CORE
▨	THIN-WALLED / FIXED PISTON	X	DISTURBED OR BULK SAMPLE

SAMPLER DRIVING RESISTANCE

Modified California and Standard Penetration Test samplers are driven 18 inches with a 140-pound hammer falling 30 inches per blow. Blows for the initial 6-inch drive seat the sampler. Blows for the final 12-inch drive are recorded onto the logs. Sampler refusal is defined as 50 blows during a 6-inch drive. Examples of blow records are as follows:

25	sampler driven 12 inches with 25 blows after initial 6-inch drive
85/7"	sampler driven 7 inches with 85 blows after initial 6-inch drive
50/3"	sampler driven 3 inches with 50 blows during initial 6-inch drive or beginning of final 12-inch drive

NOTE: Test boring and test pit logs are an interpretation of conditions encountered at the excavation location during the time of exploration. Subsurface rock, soil or water conditions may vary in different locations within the project site and with the passage of time. Boundaries between differing soil or rock descriptions are approximate and may indicate a gradual transition.

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SOIL CLASSIFICATION CHART

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Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

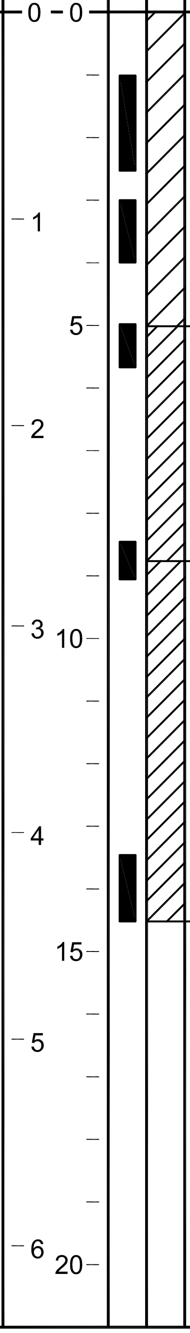
A-1
FIGURE

BORING 1

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 108-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)
				14.0	
			50		
			62	23.6	100
		6300 UC	67/9"	24.1	100
			58/7"	17.5	110
			64	27.8	93



SILTY CLAY (CH)
dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches

SILTY CLAY (CL)
medium brown, moist, very stiff, medium to high plasticity

SANDY CLAY (CL)
tan-brown, slightly moist, very stiff, low to medium plasticity, trace fine grained gravel

Bottom of boring at 14.5 feet
No groundwater encountered

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-2
FIGURE

BORING 2

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 105-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0			SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches
			30	16.5						
			38	21.8						grades to moist
						1				
			36	22.3						
							5			Bottom of boring at 5.0 feet No groundwater encountered
						2				
						3	10			
						4				
							15			
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

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Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-3
FIGURE

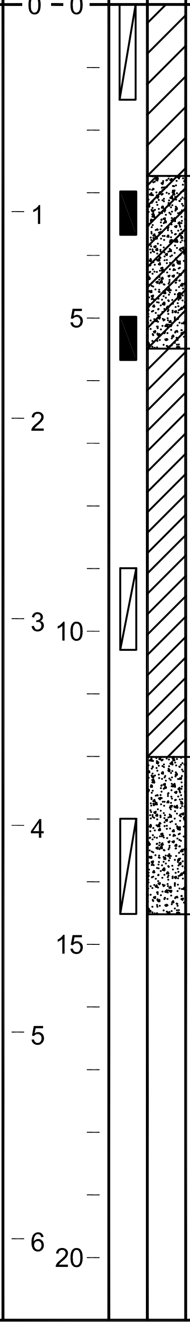
BORING 3

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 101-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	
			25	12.5		**SILTY CLAY (CH)** dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches
			56/9"	16.2	107	**CLAYEY SAND (SC)** light brown, moist, dense, fine to medium-grained sand
			62/9"	23.4	95	
			37/9"	26.7		**SANDY CLAY (CL)** light to medium brown, moist, very stiff, low to medium plasticity
			41	13.1		**SAND w/ GRAVEL (SM)** tan, slightly moist, dense, fine to coarse grained

Bottom of boring at 14.5 feet
No groundwater encountered



NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-4
FIGURE

BORING 4

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 102-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0		▨	SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity, trace sand
									▨	grades to slightly moist
			40	17.5				▭	▨	
						1			▨	
			65	15.6				▭	▨	
							5			Bottom of boring at 4.5 feet No groundwater encountered
						2				
						3	10			
						4				
							15			
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

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Petaluma, California

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Designed
Drawn NRS
Checked

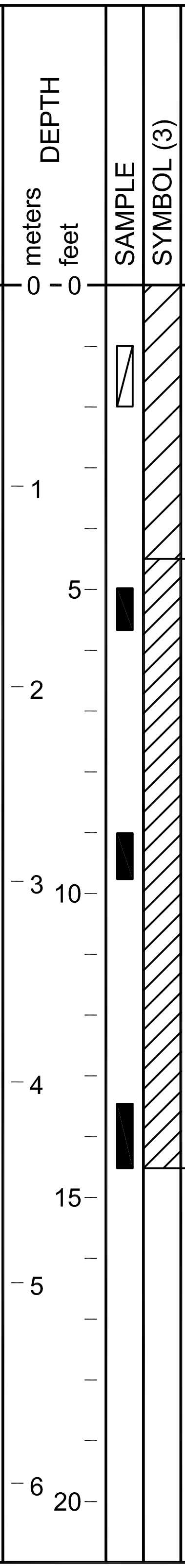
A-5
FIGURE

BORING 5

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 100-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)
			53	13.7	
			53/7"	17.0	93
			61/9"	20.2	99
			58	21.3	104



SILTY CLAY (CH)
dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches

SANDY CLAY (CL)
medium brown, slightly moist, very stiff, medium plasticity

Bottom of boring at 14.5 feet
No groundwater encountered

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

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Designed
Drawn NRS
Checked

A-6
FIGURE

BORING 6

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 98-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0		▨	SILTY CLAY (CH) dark brown, moist, very stiff, high plasticity
			25	12.7				▯	▨	
						1			▨	
		6300 UC	55/9"	20.2	106		5	■	▨	SANDY CLAY (CL) medium brown, moist, very stiff, medium plasticity
						2			▨	
			63/9"	19.0	108			■	▨	
						3	10		▨	
						4			▨	
			50/10"	21.8	102			■	▨	
							15			Bottom of boring at 14.5 feet No groundwater encountered
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

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Designed
Drawn NRS
Checked

A-7
FIGURE

BORING 7

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 95-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0			SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity
										grades to moist
			18	26.9						
						1				
			58	25.4						
							5			Bottom of boring at 4.5 feet No groundwater encountered
						2				
						3	10			
						4				
							15			
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

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Designed
Drawn NRS
Checked

A-8
FIGURE

BORING 8

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 99.5-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters feet	SAMPLE	SYMBOL (3)	
			18	18.4			▯	▨	**SILTY CLAY (CH)** dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches
			36	28.1	90		■	▨	
								▨	**SILTY CLAY (CL)** medium brown, moist, very stiff, medium to high plasticity
			52/6"	15.5	113		■	▨	**SANDY CLAY (CL)** tan-brown, slightly moist, very stiff, low to medium plasticity, trace fine grained gravel
			49	21.7			▯	▨	
									Bottom of boring at 14.5 feet No groundwater encountered

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-9
FIGURE

BORING 9

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 100-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0		▨	SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity
									▨	SANDY CLAY (CL) medium brown, slightly moist to moist, very stiff, low to medium plasticity
			30	15.9				☐	▨	
						1			▨	
			32/9"	19.0				☐	▨	
							5			Bottom of boring at 4.5 feet No groundwater encountered
						2				
						3	10			
						4				
							15			
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

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Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-10
FIGURE

BORING 10

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 101-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters / feet	SAMPLE	SYMBOL (3)	
			45	13.3		0 – 0	■	▨	SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches
		8500 UC	57	19.0	103	1	■	▨	
						5 2		▨	SILTY CLAY (CL) medium brown, moist, very stiff, medium to high plasticity
			60/9"	16.7	96	3 10	■	▨	SANDY CLAY (CL) tan-brown, slightly moist, very stiff, low to medium plasticity, trace fine grained gravel
			67	25.4	103	4	■	▨	
						15 5 6 20			Bottom of boring at 14.5 feet No groundwater encountered

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-11
FIGURE

BORING 11

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 103.5-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0			SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity
			30	16.4						grades to moist
						1				
			53/9"	19.8						
							5			Bottom of boring at 4.8 feet No groundwater encountered
						2				
						3	10			
						4				
							15			
						5				
						6	20			

NOTES:
(1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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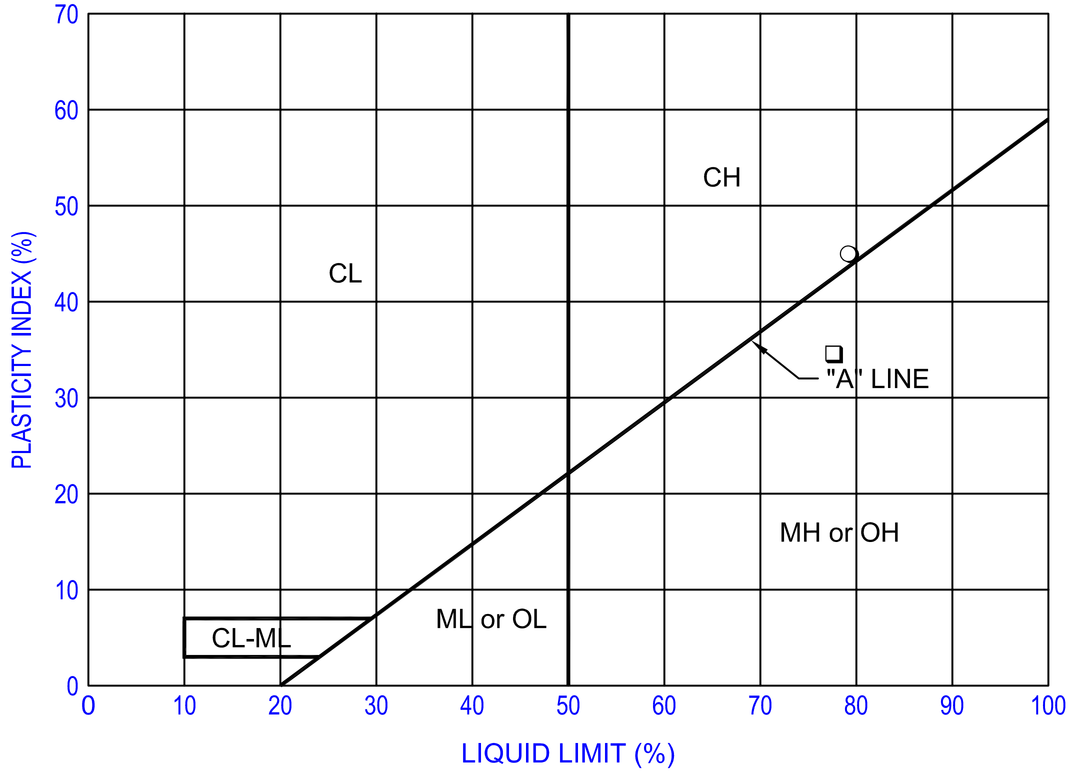
BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-12
FIGURE



SYMBOL	SAMPLE SOURCE	CLASSIFICATION	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)
❑	BORING 6 1 to 2.5 Feet	CLAYEY SILT (MH) dark brown	77	43	34
❍	BORING 11 2 to 2.5 Feet	SILTY CLAY (CH) dark brown	79	34	45

REFERENCE: Liquid Limit, Plastic Limit, and Plasticity Index of Soils, ASTM D 4318

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PLASTICITY CHART

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Designed
Drawn NRS
Checked

A-13
FIGURE

APPENDIX B

SPECIFICATIONS AND DETAILS FOR SUBDRAINAGE OF SYNTHETIC TURF FIELDS

SECTION 02790
PERMEABLE BASE FOR SYNTHETIC TURF SYSTEM

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Contractor's scope of work includes site preparation, excavation, disposal of excess or unsuitable material, subgrade grading, installation of subsurface drain pipe and perimeter header, and the selection, purchase, grading and compaction of top and bottom rock in accordance with the lines, grades, and cross-sections shown on the drawings.

1.02 QUALITY ASSURANCE

A. Reference Standards - ASTM: American Society for Testing and Materials.

B. Contractor's Materials Testing Agency Qualifications: An independent testing agency qualified to conduct soil materials and rock-definition testing that complies with ASTM E329 or D3740 and has personnel with at least 5 years of experience performing the following ASTM standard test methods and practices;

1. D75: Standard Practice of Sampling Aggregates.
2. C125: Standard Terminology Relating to Concrete and Concrete Aggregates
3. C131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
4. C136: Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
5. C702: Standard Practice for Reducing Samples of Aggregate to Testing Size.
6. D1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
7. D2434: Standard Test Method for Permeability of Granular Soils (Constant Head).
8. D4253: Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
9. D5821: Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate

C. Owner's Testing Agency shall review Contractor's submittals under this specification and recommend action as defined under Section 01300 - Submittals.

D. The Owner shall reject material delivered to the site not meeting specifications. All material rejected by the Owner shall be removed from the site and replaced with suitable material at the Contractor's expense.

1.03 SUBMITTALS

A. Submittals prior to installation:

1. Submit five (5) copies of product data on pipe, pipe accessories, filter fabric and separation fabric.

2. Submit five (5) copies of certification signed by Contractor's Materials Testing Agency stating they meet the qualifications presented in Article 1.2.B - Quality Assurance.

3. CalTrans Class 1B permeable material: submit five (5) copies of certification signed by Contractor’s Rock Manufacturer stating material supplied to the project meets the requirements as specified in the Standard Specifications.

4. Bottom and Top Rock: The following items shall be submitted as a complete package. Failure to submit all items listed below will result in the submittal being returned to the Contractor as incomplete.

   a. Submit one (1) sample each, sealed five-gallon container of bottom and top rock materials.

   b. Submit five (5) copies of certification signed by Contractor's Rock Manufacturer stating that the submittal samples where prepared and tested within the last 60 days by the rock manufacturer and meet the gradation requirements specified in Paragraph 2.06.B.1 or 2.06.C.1. Certification shall list specified gradation requirements and show results of gradation test conducted in accordance with ASTM C136.

   c. Submit five (5) copies of report signed by Contractor's Materials Testing Agency certifying that submittal samples meet all specified requirements as listed in Paragraph 2.06, CRUSHED STONE. The report must present test results performed in accordance with the following ASTM standard test methods and practices:

      i. C131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

      ii. C136: Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

      iii. D2434: Standard Test Method for Permeability of Granular Soils (Constant Head).

      iv. D4253: Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

   d. Additional reporting requirements for this submittal:

      i. Description of ASTM D2434 testing apparatus and procedure used to prepare samples for testing.

B. Submittals during construction:

1. For every 700 tons of bottom rock material produced, submit five (5) copies of certificate of compliance signed by Contractor stating that a quality control sample was

collected, prepared, and tested by the Contractor's Rock Manufacturer and/or Contractor's Materials Testing Agency and meets the specified gradation requirements. Certification shall report specified gradation requirements and results of gradation test conducted in accordance with ASTM C136. This submittal shall be received and approved by the Owner prior to delivery of the material to the site.

2. For every 400 tons of top rock material produced, submit five (5) copies of certificate of compliance signed by Contractor stating that a quality control sample was collected, prepared, and tested by the Contractor's Rock Manufacturer and/or Contractor's Materials Testing Agency and meets the specified gradation requirements. Certification shall report specified gradation requirements and results of gradation test conducted in accordance with ASTM C136. This submittal shall be received and approved by the Owner prior to delivery of the material to the site.

3. Submit certification signed by the Contractor's Synthetic Turf Installer stating that they have visited the site and observed the initial placement and compaction of top rock and find the surface suitable to install the synthetic turf. This submittal shall be received and approved by the Owner prior to acceptance of the work.

1.04 MATERIAL TESTING AND INSPECTION DURING CONSTRUCTION

A. The Owner’s Testing Agent will be present intermittently to observe the Contractor's operation, to perform tests and measurements. Such observations, tests, measurements shall not alter the requirements of the drawing or specifications nor imply any superintendence or control of the Contractor’s operation, nor warranty the Contractor’s work.

B. Submittal samples shall be held by Owner’s Testing Agent for possible testing until completion of construction.

C. During construction, the Contractor shall perform his own inspection of and testing by Contractor's Materials Testing Agency or Rock Manufacturer on rock materials to the degree he deems necessary for him to assure compliance of the rock materials with the specifications. This inspection and testing shall be in addition to that which is specifically required by this specification.

D. Contractor's Materials Testing Agency shall be required to conduct the following tests during construction:

1. If ASTM C136 test results conducted by the Contractor's Rock Manufacturer on a quality control sample as defined in Article 1.03 - B indicates a difference of 10% or greater passing the no. 4 sieve size from the test results of the approved bottom rock submittal sample, ASTM D2434 testing shall be conducted on the material to confirm that the material meets the minimum permeability requirement.

2. If ASTM C136 test results conducted by the Contractor's Rock Manufacturer on a quality control sample as defined in Article 1.03 - B indicates a difference of 10% or greater passing the no. 8 sieve size from the test results of the approved top rock

submittal sample, ASTM D2434 testing shall be conducted on the material to confirm that the material meets the minimum permeability requirement.

E. The Owner's Testing Agent shall periodically inspect and/or obtain samples of rock materials at the source and/or as they are delivered to the site. Any rock material that does not conform to the approved submittal samples will be rejected immediately or tested by the Owner's Testing Agent to verify compliance with the specifications. Such tests shall imply no warranty of the Contractor's work or compliance with the specifications.

1. Costs for initial rock material testing by the Owner's Testing Agent are the responsibility of the Owner. Costs for any rock material testing by the Owner's Testing Agent on rock materials that are a replacement for rock materials that were rejected by the Owner's Testing Agent due to nonconformance with the specifications, Contractor's submittals or quality control test results, will be borne by the Contractor and may be invoiced to the Contractor by the Owner or deducted from the next Progress Payment.

F. The Owner's Testing Agent shall conduct the following tests during construction:

1. Laboratory and field testing (ASTM D4253 and D2167, D2922, or D3017) to determine density of compacted rock materials.
2. Field percolation testing at four to six locations on the completed top rock surface to confirm a minimum percolation rate of 40 in/hr.

1.05 SITE CONDITIONS

A. The Contractor shall satisfy himself as to the nature and quantity of materials to be moved and other work to be performed, and shall notify the Owner of any differences between site conditions shown on the drawings and actual conditions prior to commencement of work.

PART 2 - PRODUCTS

2.01 HEADER (LEDGER, NAILER)

A. The header will be used by the turf system installer as a means of attaching the turf carpet along the edges of the turf system at the locations shown on the drawings.

B. The header shall be 2”x 4” TREX brand wood-polymer lumber, or approved equal.

C. The header shall be attached to concrete curbing using ½” x 6” SS expansion bolt spaced according to the drawings.

2.02 DRAINAGE PIPE

A. Corrugated High Density Polyethylene (CHDPE) may be substituted for Polyvinyl Chloride (PVC) Pipe where PVC pipe is noted on the drawings.

B. Polyvinyl Chloride (PVC) Pipe: PVC pipe and fittings shall meet the extra strength minimum of SDR-35 of the requirements of ASTM Specification D3034. Joints shall be rubber ring for Storm Drainage Pipe. Manufactured by J-M Manufacturing, Stockton, CA, (1-800-621-4404), or accepted equal.

1. PVC Smooth Wall Perforated Drain Pipe: Size as noted on the drawings, and manufactured to meet CALTRANS Standard Specification Section 68 and AASHTO M278, or accepted equal. Color, White.

2. Storm Drain Pipe: SDR-35. Size as noted on the drawings and manufactured to meet Caltrans standard specifications. Color, White.

C. Corrugated High Density Polyethylene (CHDPE) Storm Drain Pipe: CHDPE solid wall pipe and fittings shall be N-12 drainage pipe with P4-12 1B WT pipe joint assembly as manufactured by Advanced Drainage Systems, 800-821-6710. Inc., or accepted equal. Local sales representative: Jim Winslow, 510-913-2211.

D. Corrugated High Density Polyethylene (CHDPE) Perforated Drain Pipe: Perforated CHDPE pipe and fittings shall be N-I 2 Series 65 WT Corrugated HDPE Pipe and fittings as manufactured by Advanced Drainage Systems, 800-821-6710. Inc., or accepted equal. Local sales representative: Jim Winslow, 510-913-2211.

E. Flat Panel Drainage Composite (FPDC) Perforated HDPE flat panel pipe and fittings shall be AdvanEdge Series 12-inch HDPE Flat Panel Pipe and fittings as manufactured by Advanced Drainage Systems, 800-821-6710. Inc., or accepted equal. Local sales representative: Jim Winslow, 510-913-2211.

2.03 DRAIN INLETS & BURIED JUNCTION BOXES

A. By Christy, Model No. as shown on the drawings. Christy, 800-486-7070; Hanson Concrete Products, Pleasanton, CA, 925-426-4933 or accepted equal.

2.04 NONWOVEN GEOTEXTILE

A. Nonwoven geotextile (Filter Fabric) placed in the subsurface drainage trenches shall conform to the following specifications.

Mechanical Properties	Test Method	Unit	Minimum Ave. Roll Value
Grab tensile strength	ASTM D4632	lbs	120(MD), 120(CD)
Grab tensile elongation	ASTM D4632	%	50(MD), 50(CD)
Trapezoid tear strength	ASTM D4533	lbs	45(MD), 45(CD)
Mullen burst strength	ASTM D3786	psi	225
Puncture strength	ASTM D4833	lbs	65
Apparent opening size	ASTM D4751	mm	0.20
Permittivity	ASTM D4491	sec^{-1}	1.5
Flow rate	ASTM D4491	$gal/min/ft^2$	130

2.05 WOVEN GEOTEXTILE

A. Woven geotextile (Separation Fabric) placed on the subgrade shall conform to the following specifications.

Mechanical Properties	Test Method	Unit	Minimum Ave. Roll Value
Tensile Strength (ultimate)	ASTM D4595	lbs/in	2000(MD), 1500(CD)
Grab tensile strength	ASTM D4632	lbs	250(MD), 250(CD)
Grab tensile elongation	ASTM D4632	%	20(MD), 20(CD)
Trapezoid tear strength	ASTM D4533	lbs	100(MD), 50(CD)
Mullen burst strength	ASTM D3786	psi	450
Puncture strength	ASTM D4833	lbs	120
Apparent opening size	ASTM D4751	mm	0.30
Permittivity	ASTM D4491	sec^{-1}	0.40
Flow rate	ASTM D4491	$gal/min/ft^2$	30

2.06 CRUSHED STONE

A. Drainage Trench Rock shall be crushed stone conforming to the requirements for Bottom Rock in Section 2.05.B. or CalTrans Class 1B permeable material.

B. Bottom Rock shall be crushed angular stone conforming to the following requirements:

1. Gradation Requirements (ASTM C136):
   a. Maximum particle size: 1-1/2"
   b. Maximum percent passing #200 sieve: 3%
   c. Gradation Criteria:

$$D_{60}/D_{10} > 2.5 \; ; \; 0.6 < \frac{D^2_{30}}{D_{10}\, D_{60}} < 3 \; ; \; \frac{D_{15} \text{ of bottom rock}}{D_{85} \text{ of top rock}} \leq 5 \; ; \; S(x) - S(½\, x) < 60\%$$

["D_{60}" is the particle size diameter of which 60 percent of the test sample's particle diameters are smaller. This and other specified diameters shall be interpolation from a semi-log plot of the gradation test results.]

["S(x) - S(½ x)" is the difference in percent passing between any sieve and the sieve representing half of its nominal opening size. The difference between these percentages shall not exceed 60 percent.]

2. Drainage Requirements (ASTM D2434):
   a. Permeability > 750 in/hr (5.3 X 10^{-1} cm/sec) [Test with rock saturated and compacted between 92% and 100% of maximum per ASTM D4253]

3. Durability Requirements (ASTM C131):
   a. LA Abrasion (500 revs) < 40

C. Top Rock shall be crushed angular stone conforming to the following requirements:

1. Gradation Requirements (ASTM C136):
    - a. Maximum particle size: 3/8"
    - b. Maximum percent passing #200 sieve: 3%
    - c. Gradation Criteria:

$$D_{60}/D_{10} > 5 \; ; \; 0.8 < \frac{D^2_{30}}{D_{10}\,D_{60}} < 3 \; ; \; \frac{D_{85} \text{ of top rock}}{D_{15} \text{ of bottom rock}} \geq 0.2 \; ; \; S(x) - S(\tfrac{1}{2}x) < 40\%$$

2. Drainage Requirements:
    - a. Laboratory Permeability > 75 in/hr (5.3 X 10^{-2} cm/sec) (ASTM D2434) [Test with rock saturated and compacted to between 92% and 95% of maximum per ASTM D4253]
    - b. Field percolation rate of at least 30 in/hr.

3. Durability Requirements (ASTM C131):
    - a. LA Abrasion (500 revs) < 40

D. Gradation Ranges: Bottom and top rock within the following ranges will generally meet the requirements listed above. This information is not a warranty, it is only intended to help guide the Contractor's Rock Manufacturer in the production of the materials.

Gradation Sieve Size	Bottom Rock Percent Passing	Top Rock Percent Passing
2”	100	-
1-1/2”	90 – 100	-
1”	75 – 100	-
3/4”	65 – 95	-
1/2”	55 – 85	100
3/8”	40 – 75	85 – 100
No. 4	20 – 55	60 – 85
No. 8	10 – 30	35 – 65
No. 16	5 – 20	10 – 45
No. 30	0 – 7	0 – 30
No. 50/60	0 – 5	0 – 15
No. 100	0 – 3	0 – 8
No. 200	0 – 2	0 – 3

PART 3 – EXECUTION

3.01 GENERAL

A. Excavating and grading shall be performed in conformance with the alignment, grade and cross-sections indicated on the drawings.

3.02 SPILLAGE, DUST AND EROSION CONTROL

A. The Contractor shall prevent spillage when hauling on or adjacent to any public street or highway. In the event that spillage occurs, the Contractor shall remove all spillage and sweep, wash or otherwise clean such streets in accordance with City, County and/or State requirements.

B. The Contractor shall take all precautions needed to prevent a dust nuisance to adjacent public and private properties and to prevent erosion and transportation of soil to downstream properties due to work under this contract. Any damage so caused by the Contractor's work shall be corrected or repaired by the Contractor.

3.03 SUBGRADE GRADING

A. The subgrade beneath the permeable base shall be prepared in accordance with the geotechnical report(s) and Earthwork specifications.

3.04 COMPACTED FILL

A. Any fill material placed to create the planned subgrade shall be placed in accordance with the geotechnical report(s) and Earthwork specifications.

3.05 SUBGRADE SLOPES AND GRADE TOLERANCES

A. Final subgrade grades shall conform to the lines and grades shown on the drawings.

B. The subgrade shall be excavated to create a positive slope towards the subsurface drain pipes. Unless otherwise specified on the drawings, the minimum slope of the subgrade shall be 1.0%.

C. The final subgrade grade shall be rolled with a smooth drum roller to remove all localized depressions deeper than ½ inch caused by construction and compaction equipment tires or rollers.

D. The measured grades shall not deviate more than 0.08 feet from the planned grades and not vary more than 0.04 feet in 10 feet in any direction. Laser grading is recommended.

E. All subgrade grades shown on the drawings shall be completed by the Contractor and inspected by the Owner and Engineer prior to commencing with the subsequent work items.

F. A conformance survey, performed by a licensed surveyor, is recommended.

3.06 SUBSURFACE DRAINAGE SYSTEM

A. A system of shallow trenches shall be excavated to the lines, grades and dimensions shown on the drawings.

B. The excavated trenches shall be free of loose soil and debris.

C. A layer of filter fabric shall be placed in the shallow trench and backfilled with at least 2 inches of bottom rock or CalTrans Class 1B permeable material. A perforated drain pipe shall then be placed in the trench in accordance with the drawings. The pipe shall be laid with the perforations down and at a minimum slope of 0.5% unless otherwise specified on the drawings. Lengths of pipe shall be joined by fittings fabricated by the pipe manufacturer. The perforated drain pipe shall be covered with at least 2 inches of bottom rock or CalTrans Class 1B permeable material.

D. All trench rock backfill shall be placed in layers eight inches or less in loose thickness and densified to achieve at least 92% of the maximum density (ASTM D4253).

E. Solid pipe clean out risers with end caps shall be installed at locations designated on the drawings. The maximum allowable bend angle for the subdrain clean out is 45 degrees.

F. The perforated sub-drain pipes shall connect to a non-perforated discharge pipe. The discharge pipe shall connect into the storm water drainage system as shown on the drawings.

G. The flat panel drains shall be connected to the perforated sub-drain pipe using connections and fittings by the pipe manufacturer.

H. Flat panels shall be secured to the ground surface to prevent displacement during rock placement operations. Secure using 60d nail with 1-3/4 inch o.d. steel washer at 2 feet on center.

3.07 PERIMETER HEADER

D. The Contractor shall provide and install the header in accordance with the layout and details shown on the drawings. The header will be used by the turf system installer as a means of attaching the turf carpet along the edge of the playfield.

3.08 GEOTEXTILE

A. Geotextile shall not be installed until a perimeter header has been installed.

B. Geotextile shall not be installed until subdrainage trenches have been excavated.

C. Geotextile rolls shall be handled in such a way that they are not damaged.

D. Geotextile shall be placed on exposed subgrade surfaces in accordance with the drawings. The geotextile shall be rolled out parallel to the long direction of the playfield.

E. Geotextile shall be securely anchored and then rolled in such a manner as to continually keep the geotextile sheet in tension.

F. Geotextile seams shall be anchored using 60d nails through 1-1/2” round washers placed at 36 to 48 inches on center during placement. Additional anchoring shall be installed as required to prevent bunching of the geotextile.

G. Adjacent widths of geotextile shall be “shingled” and have a 6-inch overlap at all edges.

H. Holes or tears in the geotextile shall be repaired with a fabric patch spot-seamed with a minimum 24 inch overlap in all directions.

3.09 BOTTOM ROCK

A. The specified bottom rock shall be carefully placed and compacted over the subgrade to the grades and elevations shown on the drawings. If the thickness of the planned bottom rock exceeds 6 inches, the rock shall be placed in horizontal layers not exceeding 8 inches and each layer compacted to 92% of the maximum density with a vibratory smooth drum roller.

B. Should any segregation of the material occur, during any stage of the stockpiling, spreading or grading, the Contractor shall immediately remove and dispose of segregated material and correct or change handling procedures to prevent any further separation.

C. Finished surface shall be proof rolled to 92% of the maximum density with a vibratory smooth drum roller to provide a non-yielding, smooth, flat surface.

D. Final bottom rock grades shall conform to the lines and grades shown on the drawings. The measured grades shall not deviate more than 0.08 feet from the planned grades and not vary more than 0.04 feet in 10 feet in any direction. Laser grading is recommended.

E. The surface of the bottom rock shall be sloped as shown on the drawings.

F. Bottom rock grades shall be completed by the Contractor and inspected by the Owner and Engineer prior to commencing with the subsequent work items.

G. A conformance survey, performed by a licensed surveyor, is recommended.

3.10 TOP ROCK

A. The specified top rock shall be carefully placed using a self-propelled paving machine in order to minimize segregation. Alternative placement methods may be proposed by the Contractor. The Owner may approve these methods provided the Contractor can, to the satisfaction of the Owner, present a history of successful use on past projects and by constructing a representative test area using these methods that shows these methods do not result in significant segregation.

B. A small trial area (15 feet square, minimum) of top rock shall be installed prior to installing the completed surface. The Contractor's Synthetic Turf Installer shall observe the placement and compaction of top rock in the trial area and determine whether the surface is suitable to install the synthetic turf. The Contractor shall modify installation procedures and/or material used until the Contractor's Synthetic Turf Installer is satisfied.

C. Should any segregation of the material occur, during any stage of the work, the Contractor shall immediately remove and dispose of segregated material and correct or change handling procedures to prevent any further segregation.

D. The finished surface shall be compacted to 92% of the maximum density with a vibratory smooth drum roller to provide a non-yielding, smooth, flat surface.

E. Final top rock grades shall conform to the lines and grades shown on the drawings. The measured grades shall not deviate more than 0.04 feet from the planned grades and not vary more than 0.02 feet in 10 feet in any direction. Laser grading is recommended.

F. The surface of the top rock shall be sloped as shown on the drawings.

G. All top rock grades shown on the drawings shall be completed by the Contractor and inspected by the Owner and Engineer prior to commencing with the subsequent work items.

H. A conformance survey, performed by a licensed surveyor, is recommended.

I. Field percolation testing shall be conducted by the Owner's Testing Agent in accordance with Section 1.04.F.2. The Contractor shall correct the top rock layer, at no cost to the Owner, if the minimum percolation requirement is not achieved.

3.11 FINISHING OF SURFACE PLANARITY

A. Finish surface planarity shall be adjusted by the Contractor using the string line method. A mason’s line held taught between two workman separated by a distance of approximately 40 feet, shall be placed directly on the finished rock surface, parallel to the long axis of the field. A third workman shall check for separations between the mason’s line and the finished surface that are equal to or greater than the tolerances specified in 3.10-E. The entire finished surface shall be checked with the mason’s line in increments no greater than 3 linear feet. Areas of separation shall be identified with marking paint and the depth of separation indicated.

B. Areas identified with marking paint shall be filled with top rock to the depth indicated and raked by hand. Filled areas shall be compacted to 92% of the maximum density to provide a non-yielding, smooth, flat surface.

C. The entire finished surface shall be rechecked using the method described in 3.11-A and 3.11-B along the short axis of the field.

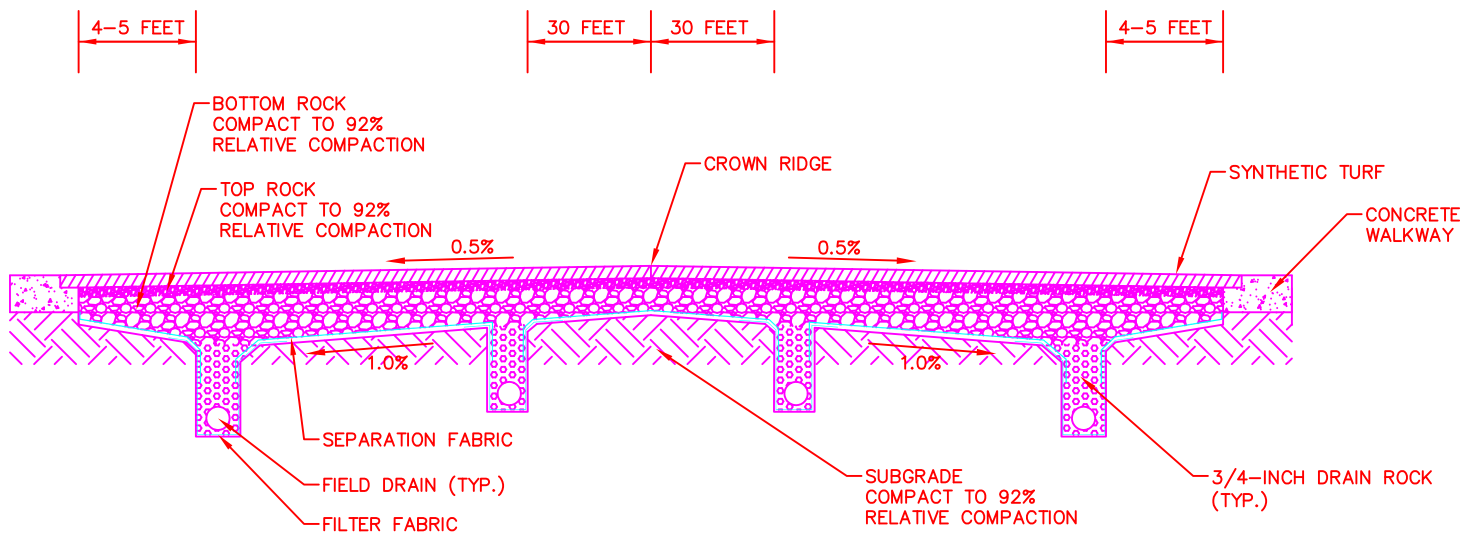
D. Roller marks, tire tracks, footprints or other impressions on the finished surface shall be raked out where they are equal to or greater than the tolerances specified in 3.10-E.

E. Following long and short axis checking and corrections, the Contractor shall notify the Owner that the finished surface is ready for inspection.

F. The Contractor shall perform a final string line check along the long axis of the field in the presence of the Owner and Contractor’s Synthetic Turf Installer. Finished surface planarity shall be approved by the Owner prior to installation of synthetic turf system.

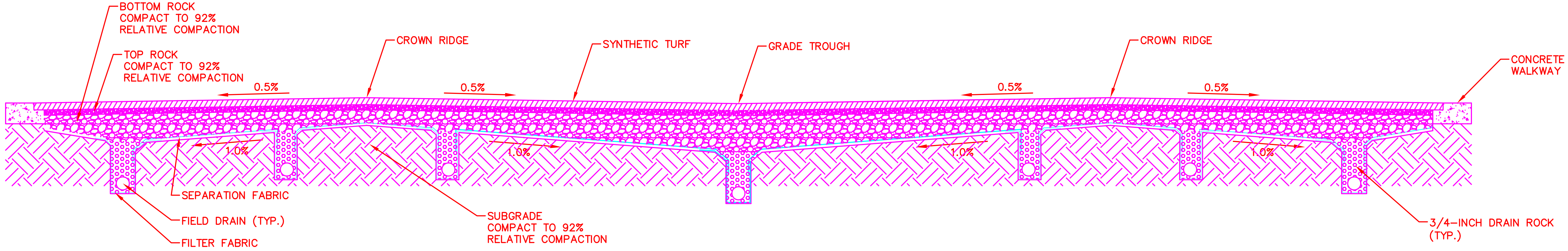
G. Damage to the finished surface planarity occurring after approval shall be corrected by the Contractor using the method described in 3.11-A through F.

END OF SECTION



X TYPICAL CROSS–SECTION: SINGLE SOCCER FIELD

NOT TO SCALE



X TYPICAL CROSS–SECTION: DOUBLE SOCCER FIELD

NOT TO SCALE

Miller Pacific
ENGINEERING GROUP

FILE: 1206.04 TurfSections.dwg

1333 N. McDowell Blvd.
Suite C
Petaluma, CA 94947
T 707 / 765-6140
F 707 / 765-6222
www.millerpac.com

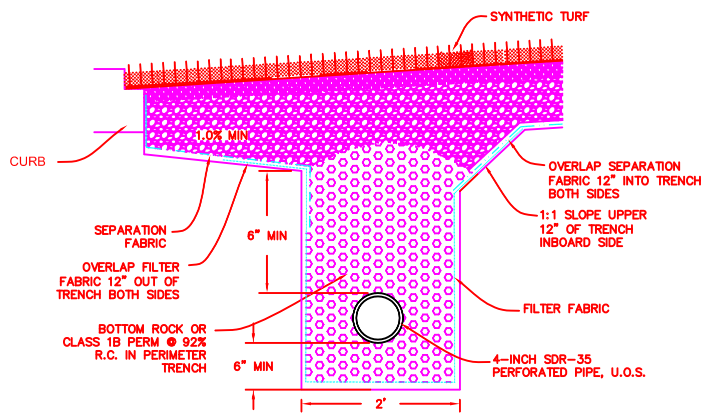
TYPICAL SYNTHETIC TURF SOCCER FIELD SECTIONS

East Washington Park
Petaluma, California

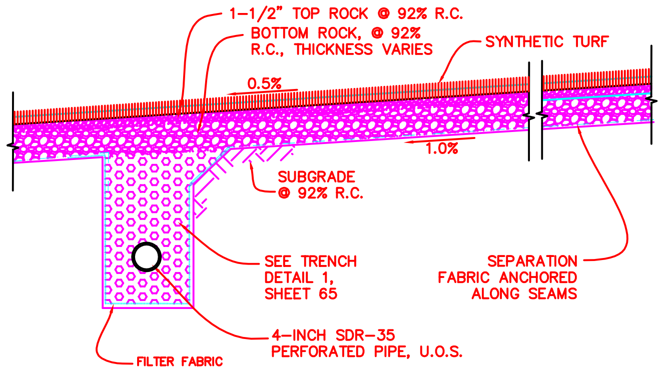
Project No. 1206.04 Date: 9/22/08

Designed NRS
Drawn NRS
Checked

B-1
FIGURE



PERIMETER TRENCH DETAIL
NOT TO SCALE



TYPICAL FIELD SECTION
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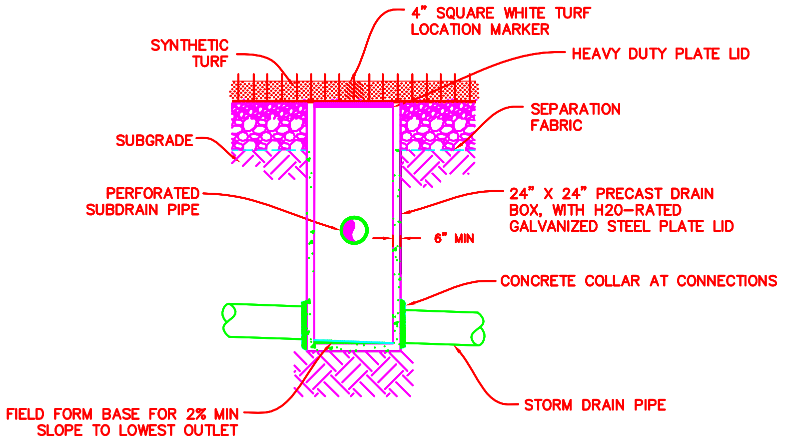

BURIED JUNCTION BOX DETAIL
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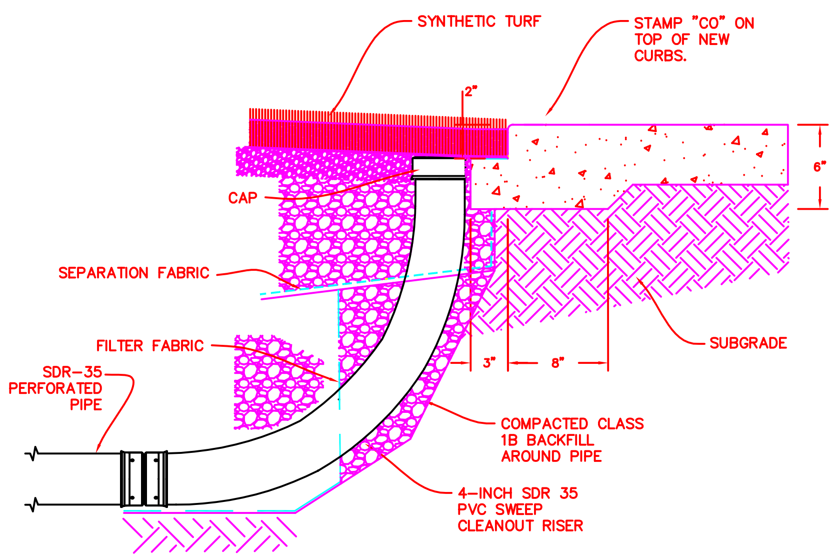

FIELD DRAIN CLEANOUT DETAIL
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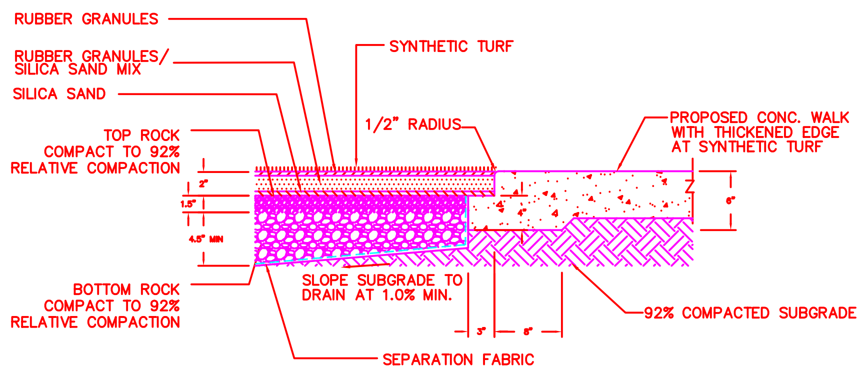

SYNTHETIC TURF TO WALKWAY DETAIL
NOT TO SCALE

Miller Pacific
ENGINEERING GROUP

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1333 N. McDowell Blvd.
Suite C
Petaluma, CA 94947
T 707 / 765-6140
F 707 / 765-6222
www.millerpac.com

TYPICAL SYNTHETIC TURF DETAILS

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed NRS
Drawn NRS
Checked

B-2
FIGURE

APPENDIX C
CALTRANS STANDARD SPECIFICATIONS SECTION 24: LIME STABILIZATION

SUBBASES AND BASES

SECTION 24: LIME STABILIZATION

24-1.01 DESCRIPTION

- This work shall consist of mixing lime and water with soil and compacting the mixture to the lines, grades and dimensions shown on the plans and as specified in these specifications and the special provisions.

24-1.02 MATERIALS

- Material to be stabilized shall be the native soil or embankment, containing no rocks or solids, other than soil clods, larger than 2$^1/_2$ inches in any dimension. Removing and disposing of rocks and solids larger than 2$^1/_2$ inches, from native soil or embankment other than imported borrow, will be paid for as extra work as provided in Section 4-1.03D. Removing and disposing of rocks and solids larger than 2$^1/_2$ inches from imported borrow shall be at the expense of the Contractor.
- Lime shall conform to the requirements in ASTM Designation: C 977 with the exception that when a 250-gram test sample of quicklime is dry sieved in a mechanical sieve shaker for 10 minutes ±30 seconds it shall conform to the following grading requirements:

Sieve Sizes	Percentage Passing
$^3/_8$"	98-100
No. 100	0-25
No. 200	0-15

- A Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished with each delivery of lime and shall be submitted to the Engineer with a certified copy of the weight of each delivery.
- Water for mixing with soil and lime shall be free from oil and shall contain not more than 650 parts per million of chlorides as Cl, nor more than 1,300 parts per million of sulfates as SO_4. The water shall not contain an amount of impurities that will cause a reduction in the strength of the stabilized material.

24-1.03 GENERAL

- The amount of lime to be added to the material to be stabilized shall be as specified in the special provisions.
- Handling, spreading and mixing operations shall be conducted in such a manner that a hazard is not presented to construction personnel or the public. Lime shall be prevented from blowing by suitable means selected by the Contractor.
- If lime of more than one type or from more than one source are used on the project, separate application rates will be determined for lime of each source or type. Lime from more than one source or of more than one type shall not be mixed.
- The lime shall be protected from exposure to moisture until used and shall be sufficiently dry to flow freely when handled.

- Lime shall not be spread while the ambient temperature is below 35° F, nor when the ambient temperature is expected to drop below 35° F before mixing and compacting are to be completed.
- The in-place moisture of the material to be stabilized shall be maintained above the optimum moisture, as determined by California Test 373, during the mixing operation. During compaction, finish rolling and grading, sufficient water shall be added to the surface of the material to prevent the surface from drying until curing seal is applied.
- No traffic other than the equipment performing the work will be allowed to pass over the spread lime, the mixed material or the compacted surface of the lime stabilized material. After application of the curing seal, no traffic will be permitted on the lime stabilized material for a period of 3 days. Damage to curing seal or lime stabilized material shall be repaired promptly by the Contractor at the Contractor's expense, as directed by the Engineer.

24-1.04 PREPARING MATERIAL

- Unless otherwise ordered or approved by the Engineer, the material to be stabilized shall be placed to the lines, grades and dimensions shown on the plans and compacted to a relative compaction of not less than 90 percent, before lime is added. The surface of the material to be stabilized shall not vary more than 0.08-foot above or below the grade established by the Engineer, before lime is added.

24-1.05 SPREADING

- Lime shall be spread using equipment which will uniformly distribute the lime over the area to be stabilized.
- Tailgate spreading of lime will not be permitted.
- Lime shall be spread uniformly on the roadbed, and the rate of spread per square foot shall not vary by more than 10 percent of the rate designated by the Engineer.
- Lime may be spread on the prepared material in either a slurry or dry form at the option of the Contractor. Hydrated lime shall not be spread in dry form. Either hydrated lime or quicklime may be used to prepare the slurry.
- The distance which lime may be spread ahead of the mixing operation will be determined by the Engineer. In no case shall spread lime be allowed to remain exposed at the end of the work day.
- Lime applied in slurry form shall be prepared and distributed using equipment and procedures capable of keeping the slurried lime in suspension and spreading the slurry uniformly over the area to be stabilized. The lime content of the slurry shall be as approved by the Engineer.

24-1.06 MIXING

- Mixing lime and the material to be stabilized shall be conducted using equipment capable of mixing the materials uniformly to the depth specified.
- Lime and the material to be stabilized may be mixed off site.
- Mixing or remixing operations, regardless of the equipment used, shall continue until the material is uniformly mixed and free of streaks or pockets of lime. Prior to compaction, all mixed material other than rock or aggregate

previously treated with asphalt, lime or cement shall comply with the following grading requirements:

Sieve Sizes	Percentage Passing
1"	98 min.
No. 4	60 min.

- When granular lime in dry form is used, the material shall be mixed at least twice. The first and final mixings shall not be performed on the same day.
- When the stabilized material, exclusive of one-inch or larger clods, is sprayed with a phenolphthalein alcohol indicator solution, areas showing no color reaction will be considered evidence of inadequate mixing.
- The depth of mixing of the lime stabilized material shall not vary more than 0.1-foot from the planned depth at any point. Mixing to a depth that exceeds the planned depth by 10 percent or more shall be considered evidence of an inadequate amount of lime and additional lime shall be added at the Contractor's expense.
- The entire mixing operation shall be completed within 7 days of the initial spreading of lime, unless otherwise permitted by the Engineer.

24-1.07 COMPACTION

- Compaction shall begin as soon as possible, but not more than 24 hours after final mixing.
- Prior to initial compaction, maximum density will be determined on a composite of material from 5 random locations within the test area by California Test 216. The composite sample will be obtained after all mixing has been completed. The moisture content of the composite sample will be determined by California Test 226.
- Initial compaction shall be by means of sheepsfoot or segmented wheel rollers and shall be immediately followed with final compaction by rolling with steel drum or pneumatic-tired rollers. Vibratory rollers will not be allowed.
- Where the required thickness is 0.50-foot or less, the mixture shall be compacted in one layer. Where the required thickness is more than 0.50-foot, the mixture shall be compacted in 2 or more layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed 0.50-foot, except that the maximum compacted thickness of a single layer may be increased provided the Contractor can demonstrate to the Engineer that the equipment and method of operation will provide uniform distribution of the lime and the required compacted density throughout the layer.
- Areas inaccessible to rollers shall be compacted to the required relative compaction by other means satisfactory to the Engineer.
- The lime stabilized soil shall be compacted to a relative compaction of not less than 95 percent, except that the minimum relative compaction may be reduced to 92 percent provided the Contractor increases the lime content 0.5-percent at the Contractor's expense.
- The relative compaction will be calculated on the dry weight basis.
- In-place density of the compacted lime stabilized material will be determined by California Test 231. A composite of material from a minimum of 5 random

selected sites, taken at the time in-place density is determined, will be used to determine the in-place moisture content, by California Test 226.

24-1.08 FINISH ROLLING AND GRADING

- The finished surface of the lime stabilized material shall be the grading plane and at any point shall not vary more than 0.08-foot above or below the grade established by the Engineer, except that when the lime stabilized material is to be covered by material which is paid for by the cubic yard, the surface of the finished lime stabilized material shall not extend above the grade established by the Engineer.
- If the compacted material is above the grade tolerances specified in this section, the excess material shall be trimmed, removed, and disposed of. No loose material shall be left on the finished plane. Trimming of excess material shall not be conducted unless finish rolling can be completed within 2 hours after trimming.
- Trimmed surfaces shall receive finish rolling consisting of at least one complete coverage with steel drum or pneumatic-tired rollers. Vibratory rollers will not be allowed. Minor indentations may remain in the surface of the finished material after final trimming and rolling. Under no circumstances will it be permissible to add new or trimmed lime stabilized material to fill low areas or to raise the grade of compacted lime stabilized material.

24-1.09 CURING

- A curing seal, consisting of SS or CSS grade asphaltic emulsion, shall be furnished and applied to the surface of the top layer of lime stabilized material in conformance with the provisions in Section 94, "Asphaltic Emulsions."
- Curing seal shall be applied at a rate of between 0.10-gallon and 0.20-gallon per square yard of surface. The exact rate will be determined by the Engineer.
- Curing seal shall be applied within 48 hours of completion of initial compaction and on the same day as trimming and finish rolling are completed. The curing seal shall be applied as soon after finish rolling as is practicable. The lime stabilized material shall be at optimum moisture when the curing seal is applied.
- Curing seal shall not be placed when the atmospheric temperature is below 40° F.
- Curing by water will not be allowed, unless authorized by the Engineer.
- Damage to the curing seal shall be promptly repaired by the Contractor at the Contractor's expense, as directed by the Engineer.

24-1.10 MEASUREMENT

- Lime stabilization will be measured by the square yard, determined from horizontal measurements of the planned surface of the lime stabilized material.
- Lime will be measured by the ton in conformance with the provisions in Section 9-1.01, "Measurement of Quantities," except that if the minimum relative compaction is reduced to 92 percent, the quantity of lime to be paid for will be the weight of lime multiplied by the factor X / (X+0.5) where X equals the percent of lime ordered by the Engineer.
- Bituminous curing seal will be measured in conformance with the provisions in Section 94, "Asphaltic Emulsions."

24-1.11 PAYMENT

- Items of work, measured as provided in Section 24-1.10, "Measurement," will be paid for at the contract prices per square yard for lime stabilization, per ton for lime, and per ton for asphaltic emulsion (curing seal).
- The above contract prices and payments shall include full compensation for furnishing all labor, materials, tool, equipment, and incidentals, and for doing all the work involved in constructing the lime stabilization complete in place, as shown on the plans, and as specified in the specifications and the special provisions, and as directed by the Engineer.
- Full compensation for preparing material, spreading lime and mixing and compacting the lime stabilized material shall be considered as included in the contract price paid per square yard for lime stabilization and no additional compensation will be allowed therefor.
- No adjustment of compensation will be made for any increase or decrease in the quantity of lime required, regardless of the reason for such increase or decrease. The provisions in Section 4-1.03B, "Increased or Decreased Quantities," shall not apply to the item of lime.

APPENDIX D
IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Important Information About Your
Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

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

Read the Full Report

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

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

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

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

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

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

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

Subsurface Conditions Can Change

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

Most Geotechnical Findings Are Professional Opinions

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

A Report's Recommendations Are *Not* Final

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

A Geotechnical Engineering Report Is Subject to Misinterpretation

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

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

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

Read Responsibility Provisions Closely

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

Geoenvironmental Concerns Are Not Covered

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

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

MPEG MILLER PACIFIC ENGINEERING GROUP

January 24, 2022
File: 1477.072altr(REVb).doc

GSM Landscape Architects Inc.
1700 Soscol Ave., Suite 23
Napa, California 94559
Attn: Mr. Bart Ito

Re: Geotechnical Design Recommendations
East Washington Park – Phase 2
Petaluma, California

Introduction & Project Description

We are pleased to present our geotechnical recommendations for the planned synthetic turf play field as part of the East Washington Park – Phase 2 project located in Petaluma, California. The project location is shown on Site Map, Figure 1. We understand the improvements include constructing a new synthetic turf baseball field on currently undeveloped land adjacent to a recently completed synthetic turf soccer field. Additionally, the project includes constructing a new restroom/concession structure, paved pedestrian paths, asphalt parking areas, landscaped areas, and site utilities.

Our work was performed in accordance with our Agreement dated July 1, 2016. We previously performed a Geotechnical Investigation for the entirety of the park project dated September 30, 2008. The scope and purpose of our services includes updating our recommendations in this letter report to aid in the design and construction of the project.

Existing Conditions

The proposed project site is undeveloped and covered in low grasses. As shown on Figure 2, the completed Phase 1 portion of the project, consisting of three synthetic turf soccer fields, is located to the immediate east. Additional undeveloped land to the west will be developed in the future as part of Phase 3 of the East Washington Park project.

Field Exploration and Laboratory Testing

As previously discussed, we provided a Geotechnical Investigation Report, dated September 30, 2008, that included a subsurface exploration in the general vicinity of the proposed improvements. Our previous exploration included 11-borings drilled with track mounted equipment to depths between 4.5 to 15.0-feet on July 30, 2008. The boring locations are shown on Figure 2. The soils encountered in our borings were logged and samples were obtained for laboratory testing. The subsurface exploration program is discussed in more detail in Appendix A along with a Soil Classification Chart on Figure A-1. The boring logs are presented on Figures A-2 through A-12 of Appendix A.

Laboratory testing of samples from the exploratory borings included moisture content, dry density, unconfined compression, and plasticity index testing. The results of the moisture content, dry density, and unconfined compression tests are presented on the boring logs and the plasticity index test results are presented on Figure A-13. The laboratory testing program also is discussed in more detail in Appendix A.

Subsurface Conditions

The soils within the project site generally consist of high plasticity, silty clay (Adobe Clay) to depths of 3.0- to 9.0-feet below the ground surface, underlain by stiff, low to medium plasticity silty and sandy clay. Lenses of silty and clayey sand were encountered in Boring 3. Our past experience, as well as current site observation and laboratory testing, indicate that the Adobe clay is moderately to highly expansive (will undergo large volume changes with seasonal changes in moisture content).

Groundwater was not observed in any of the borings we excavated. However, our borings were not left open for an extended period of time to allow groundwater levels to equalize. Therefore, the groundwater elevations observed may not reflect actual levels. Typically, groundwater levels fluctuate seasonally with higher levels anticipated during the winter/rainy season.

Discussion and Recommendations

Based on our experience with similar projects, it is our opinion that construction of a new synthetic turf playfield is feasible from a geotechnical engineering standpoint. The primary geotechnical issues at the project site are site grading, expansive soils, providing a firm and uniform subgrade for the proposed field, and design of an adequate drainage system under the field.

Site Grading

We anticipate moderate site grading will be required for the proposed improvements. Site preparation and grading should conform to the following recommendations and criteria:

1. Surface Preparation – Clear all vegetation and over-sized debris from areas that will be within the new project work area. Excavate loose soil to expose firm natural soils. Any landscaping vegetation within the field areas should be scraped from the surface, stockpiled for reuse in landscaping, or removed from the site. Any construction debris or abandoned utilities encountered during site grading should be removed from the site. Utilities could also be abandoned in place, in many cases, provided cement grout completely fills any void in the utility. Rocks or concrete pieces larger than 6 inches encountered during subgrade preparation or site grading should be removed from the site.

2. Materials – In structural areas (i.e., pavement areas, structures, etc.) the underlying expansive soils and rock mixtures generated from on-site excavations are not suitable for use as fill, unless lime treated. If imported fill is required, the material shall consist of soil and rock mixtures that: (1) are free of organic material, (2) have a Liquid Limit less than 40 and a Plasticity Index of less than 20, and (3) have a maximum particle size of 4 inches. Any imported fill material shall be tested to determine its suitability for use as fill material.

3. Compacted Fill –Subgrade surface should be scarified to a depth of 8 inches, moisture conditioned to near optimum moisture content and compacted to a minimum of 90% relative

compaction. In landscape areas, the relative compaction may be reduced to 85%. The maximum laboratory dry density and optimum moisture content of fill materials should be determined in accordance with ASTM Test Method D-1557, "Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using a 10-lb. Rammer and 18-in. Drop."

New fill or backfill should be conditioned to a moisture content within 3% of the optimum moisture content. Properly moisture conditioned and cured on-site materials should be placed in loose horizontal lifts of 8 inches thick or less, and uniformly compacted to at least 90% relative compaction. In areas of new asphalt pavement, the upper 8-inches should be further compacted to 95% relative compaction to provide a firm and unyielding surface under heavy construction equipment.

4. Soil Treatment – As previously discussed, the site is blanketed with high plasticity, highly expansive, clayey soils. These soils will change in volume with fluctuations in moisture content; expanding/swelling when wet and shrinking when dry. Expansive soils are capable of exerting significant expansion pressures on building foundations, interior floor slabs and exterior flatwork. Distress from expansive soil movement can include cracking of brittle wall coverings (stucco, plaster, drywall, etc.), racked door and/or window frames, and uneven floors and cracked slabs. Flatwork, pavements, and concrete slabs-on-grade are particularly vulnerable to distress due to their low bearing pressures. Additionally, expansive soils will result in an uneven playing surface on the synthetic turf fields.

Based on our experience with similar projects, to mitigate the expansive potential of the surficial highly expansive clay these soils should be treated with high calcium lime. The high calcium lime chemically reacts with the highly expansive clay effectively removing its expansive potential and significantly lowering its plasticity. Based on the plasticity index of the surficial clay we recommend introducing at least 6% high calcium lime by soil weight (110 pcf) in the upper 18-inches of soil underlying, and 5-feet beyond, the synthetic turf and flatwork. The treatment depth should be increased to 36-inhces in areas where structures will be placed (i.e. restroom/concession building). The lime treatment shall be placed in a manner conforming to the most recent Caltrans Standard Specification. The percentage of lime added should be verified prior to construction via laboratory optimum lime percentage testing.

Synthetic Turf G-Max

The hardness of a field is measured by its G-Max value. This value is a measure of the g-forces (g) absorbed in a 20-pound object falling 24-inches onto a playing surface. A G-Max value of 200 g is considered the maximum safety threshold for a playing surface. An industry standard G-Max range for a safe playing surface is between 120 to 180 g. The g-max value is influenced by the infill type and the drainage layer.

Synthetic Turf Infill

Synthetic turf has been historically been infilled with crumb rubber or a combination of sand and crumb rubber. Recently, the infill trend is shifting from crumb rubber and moving to cork and/or coconut fiber. Crumb rubber infill tends to produce fields that have G-Max values within the safety guidelines, between 120 and 180. However, cork and/or coconut fiber infilled fields tend to produce higher G-Max values and usually require a shock pad underlying the turf to produce acceptable G-Max values. As with all synthetic turf playing surfaces, G-Max values tend to increase with age and routine maintenance and testing is recommended to prolong the design life within the safety standards.

Synthetic Turf Drainage

For preliminary design, we recommend that the surface of the field be designed with a 0.5% to 1.0% slope. A permeable layer (drainrock, drainage panels, etc.) underlie the synthetic turf to carry water laterally to collector drains, typically located at the field perimeters. If a permeable stone system, as described below, is utilized the subgrade should be graded to a minimum slope of 1.0%.

Permeable Base Options – There are three drainage options for the synthetic turf permeable base. The first option is a single stone permeable system with drainage panels, the second is a two stone (bottom and top rock) permeable system, and the third is a Brock (or similar) shock/drainage pad system. Each option is discussed in more detail below:

Single Stone Permeable Base – The single stone permeable section consists of placing a layer of permeable well graded rock on the subgrade over flat drainage panels configured in a "herringbone" pattern. A stabilization fabric (such as Mirafi FW500) should be placed over the subgrade prior to the placement of the rock. The permeable rock will transmit collected rain water to the flat panel drains. The flat panel drains will then transmit the water to a perimeter collector drain that connects to the City Storm Water system. The advantage of this system is fewer materials are used in the permeable base requiring less grading time. However, the single stone permeable system has less water storage capacity and slower drainage than the two-stone system. Depending on the finished grades, excavation may be required to achieve the planned subgrade.

Two-Stone Permeable Base – The two-stone permeable rock system is constructed similar to the one-rock system. The difference is the section consists of a layer of larger, highly permeable "Bottom Rock" and a thin finer graded "Top Rock" to facilitate a smooth finished surface for the placement of the synthetic turf. The bottom rock provides more pore space for water to quickly transfer water to the storm drain collection system. "Top Rock", is placed on the bottom rock to act as a leveling coarse and reduces the potential of larger gravels "poking" into the synthetic turf causing bumps in the surface. The two-stone system can be designed using either flat panel drains or conventional trench type drains. The advantage of the two-rock system is that the rock section has a higher storage and flow rate capacity compared to the other options. However, the two rock system may cost more in time (grading two layers) and materials than the one rock system. Depending on the finished grades, excavation may be required to achieve the planned subgrade.

Shock/Drainage Pads – Shock/drainage pads such as Brock Powerbase YSR, ThermaGreen SportLite with drainage channels, ProPlay Sport 20D or approved equivalent, may be utilized in lieu of a permeable rock system. Shock/drainage pads are perforated to allow vertical drainage. The bottom of the pads contain grooves that allow water to be transmitted laterally to the storm drain system. Due to the inherent high permeability of the pads, the subgrade slope may be reduced to 0.5%. To reduce erosion of the subgrade, a layer of Caltrans Class 2 Aggregate

Baserock or other approved granular fill soil should be placed on the subgrade prior to placing the pads. Some shock/drainage pad manufactures, such as Brock, recommend placing a nonwoven filter fabric (i.e. Mirafi 140N) over the granular layer to protect the product for future recycling. The advantage of the shock/drainage pad system is a reduced section thickness (i.e. less excavation) and a softer field with a lower G-Max value. However, this system is usually more costly and is expected to have a shorter design life (20-years).

Seismic Design

The project site is located in a seismically active area. Therefore, structures should be designed in conformance to the seismic provisions of the California Building Code (CBC). However, since the goal of the building code is protection of life safety, some structural damage may still occur during strong ground shaking.

Based on the results of our subsurface exploration and laboratory testing we judge the site should be classified as “Site Class D” per ASCE 7-16. The ASCE 7-16 mapped spectral acceleration parameters at a period of 0.2-second, S_S, and 1.0-second, S_1, at the project site are 1.86 g and 0.71 g, respectively. Per ASCE 7-16 Table 11.4-1 a Site-Specific Ground Motion shall be developed per ASCE 7-16 Section 11.4.8 for S_S values greater than 1.0 g for Site Class E sites and all cases for Site Class F sites. Additionally, a Site-Specific Ground Motion Hazard Analysis shall be performed per ASCE 7-16 Section 11.4.8 if the S_1 value is greater than 0.2 g for Site Class D, greater than 1.0 g for Site Class E, and all cases for Site Class F. Therefore, per ASCE 7-16 Section 11.4.8, we performed a Site-Specific Ground Motion Hazard Analysis per ASCE 7-16 Section 21.2, as described in the sections below.

Probabilistic (MCE) Ground Motions: Method 1 – A probabilistic acceleration response spectrum, corresponding to a 2% chance of exceedance in 50-years (2,475 return period) was generated utilizing the United States Geologic Survey (USGS) online Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/, accessed 2019) for a Site Class D soil profile (V_{S30} = 270 m/s) and the Dynamic: Conterminous U.S. 2014 (v4.2.1) model. The accelerations given were modified by the risk coefficients C_{RS} and C_{R1}, 0.90 and 0.89, respectively. The accelerations were further converted to the probabilistic spectral response acceleration in the maximum horizontal response utilizing the procedures outlined by ASCE 7-16 Section 21.2. These modifications to the probabilistic spectra correspond to a response with a risk targeted level of 1% probability of collapse within a 50-year period. The resulting probabilistic MCE values and spectra are presented on Figures 3 and 4, respectively.

Deterministic (MCE_R) Ground Motions – A deterministic acceleration response spectrum was generated utilizing the NGA attenuation models outlined by Abrahamson, Silva & Kamai (2014); Boore, Stewart, Seyhan & Atkinson (2014); Campbell & Borzognia (2014); and Chiou & Youngs (2014) NGA2 West models for a Site Class D (V_{S30} = 270 m/s). The geometric average of the 84th percentile spectral accelerations from the aforementioned attenuation relationships were modified for the maximum horizontal direction, utilizing the procedures outlined by ASCE 7-16 Section 21.2. The resulting deterministic MCE values and spectra are shown on Figures 3 and 4, respectively. The maximum value of the Deterministic MCE shall not be less than the scaled deterministic spectra with a maximum value of 1.5 x Fa = 1.5 g, as described in ASCE 7-16 Section 21.2.

Site Specific MCE_R – The site specific MCE_R spectral response acceleration at any period shall be taken as the lesser of the response accelerations from the probabilistic ground motions and the deterministic ground motions and is presented on Figure 4. Additionally, per ASCE 7-16 Section 21.3, the design spectral response acceleration at any period is equal to $2/3^{rds}$ the MCE_R Response Spectrum, but not less than 80% of the modified General Response Spectrum, as shown on Figure 5.

Per ASCE 7-16 Section 21.4, the MCE_R spectral response acceleration parameters shall be taken from the Site-Specific Spectrum defined as follows and are presented on Figure 5 and summarized on Table A:

- S_{DS} – The S_{DS} parameter shall be taken as 90% of the maximum spectral acceleration, S_a, obtained from the site-specific spectrum, at any period between 0.2 and 5.0-seconds. However, the values obtained shall not be less than 80% of the values determined in accordance with ASCE 7-16 Section 11.4.5.
- S_{D1} – The S_{D1} parameter shall be taken as the maximum value of the product, TS_a, for periods between 1.0 and 2.0-seconds for Site Class C and B sites; and periods between 1.0 and 5.0-seconds for Site Class D, E & F sites. However, the values obtained shall not be less than 80% of the values determined in accordance with ASCE 7-16 Section 11.4.5.
- S_{MS} – The S_{MS} parameter is equal to 1.5 times the S_{DS} value, but not less than 80% of the values determined in accordance with ASCE 7-16 Section 11.4.4.
- S_{M1} – The S_{M1} parameter is equal to 1.5 times the S_{D1} value, but not less than 80% of the values determined in accordance with ASCE 7-16 Section 11.4.4.

TABLE A
ASCE 7-16 SEISMIC PARAMETERS
East Washington Park – Phase 2
Petaluma, California

Factor Name	Coefficient	ASCE 7-16 Site Specific Value
Site Class[1]	$S_{A,B,C,D,E,\text{ or }F}$	S_D
Spectral Acc. (short)	S_S	1.86 g
Spectral Acc. (1-sec)	S_1	0.71 g
Spectral Response (short)	SM_S	1.70 g
Spectral Response (1-sec)	SM_1	1.55 g
Design Spectral Response (short)	SD_S	1.13 g
Design Spectral Response (1-sec)	SD_1	1.03 g
$MCE_G{}^2$ PGA adjusted for Site Class	PGA_M	0.86 g

Notes:

1. Site Class D Description: Stiff soil profile with shear wave velocities between 600 and

1,200 ft/sec, standard blow counts between 15 and 50 blows per foot, and undrained shear strength between 1,000 and 2,000 psf.

2. Maximum Considered Earthquake Geometric Mean.

Foundation Design

We understand the proposed restroom/concession structure will consist of relatively heavy concrete masonry unit (CMU) construction with concrete slab on grade floors. Provided the soils are lime treated, the restroom/concession structure may be supported on a shallow foundation system. Localized deepening of foundation excavations or over-excavation and re-compaction may be required if looser materials are encountered in the foundation excavations. Additionally, ancillary improvements (i.e. fencing, light posts etc.) will be supported on a drilled pier foundation system. Shallow and deep foundation design criteria are presented in Table B below.

TABLE B
FOUNDATION DESIGN CRITERIA
East Washington Park – Phase 2
Petaluma, California

Shallow Foundations

Minimum footing width[1]:	12 inches
Minimum footing embedment depth (below lowest adjacent grade):	18 inches
Allowable soil bearing pressure (lime treated):	
Dead plus live loads:	2,500 psf
Total design loads (includes wind or seismic):	3,300 psf
Base friction coefficient:	0.30
Lateral passive resistance[2, 3, 4]:	300 pcf

Drilled Piers

Minimum diameter:	18 inches
Minimum Depth:	5 feet
Skin Friction (dead plus live loads)[4,5,6]:	500 psf
Lateral passive resistance[2,7,8]:	300 pcf

Notes:

1.) Size footing widths to avoid significantly different foundation pressures.
2.) Equivalent Fluid Pressure, not to exceed 3,000 psf.
3.) Ignore uppermost 6-inches unless concrete or asphalt surfacing exists adjacent to foundation.
4.) May increase design values by 1/3 for total design loads including seismic.
5.) Uplift resistance is equal to 80% the vertical resistance.
6.) Neglect the upper 3-feet for natural soil and 1-foot for lime treated soils, unless concrete or asphalt surfacing exists adjacent to foundation.
7.) Apply values over effective width of two pier diameters.
8.) Equivalent fluid pressure.

Retaining Wall Design

We understand retaining walls up to 4-feet in height will be constructed. These walls may be supported on shallow foundations as described above. Walls free to rotate at the top, (i.e. "unrestrained") and walls structurally connected at the top (i.e. "restrained"), should be designed using the design criteria shown in Table C below.

TABLE C
RETAINING WALL DESIGN CRITERIA
East Washington Park – Phase 2
Petaluma, California

Foundations See Table E	
Unrestrained Earth Pressure[1]	40 pcf
Restrained Earth Pressure[1]	60 pcf
Surcharge Loading[2,3]	100 psf
Seismic Surcharge[4,5]	10 x H psf

Notes:
1) Equivalent fluid pressure.
2) Apply to the upper 3-feet. Rectangular distribution.
3) Surcharge loading not required if retaining walls are backfilled with lime treated or other non-expansive soils.
4) Rectangular distribution. The factor of safety for short-term seismic conditions can be reduced to 1.0 or greater.
5) Seismic surcharge loading is not required for retaining walls less than 6-feet in height.

Drainage shall be provided for all retaining walls taller than two feet. Either Caltrans Class 1B permeable material within filter fabric or Caltrans Class 2 permeable material can be used. The seepage should be collected in a 4-inch perforated PVC drain line at the base of the wall. The permeable material shall extend at least 12 inches from the back of the wall and be continuous from the bottom of the wall to within 12 inches of the ground surface. Alternatively, drainage panels, such as Mirifi 100N, may be utilized. Additionally, waterproofing should be constructed behind retaining walls that abut interior space. The Project Architect and/or waterproofing expert should design the waterproofing system.

Seepage collected in the drain line should be conveyed off-site by gravity in closed pipe to the storm drainage system. The pipe shall have a minimum slope of one percent to drain. To maintain the wall drainage system, clean outs shall be installed at the upstream end and at all major changes in direction. Water proofing of any below grade residential walls should be designed by the Architect to prevent moisture infiltration through the wall into living spaces.

Concrete Slab-on-Grade

If interior concrete slabs are planned, we recommend they be at least 5-inches thick and reinforced with steel bars (not wire mesh). Contraction joints should be incorporated in the concrete slab in both directions, no greater than 10-feet on center. Additionally, the reinforcing bars shall extend through the control joints. For improved performance, concrete slabs-on-grade may be increased to 6-inches thick. The project Structural Engineer should design the concrete slab floors.

To improve interior moisture conditions, a minimum 5-inch layer of clean, free draining, 3/4-inch angular gravel or crushed base rock should be placed beneath the interior concrete slabs to form a capillary moisture break. The base rock must be placed on a properly moisture conditioned and compacted subgrade that has been approved by the Geotechnical Engineer. A plastic membrane vapor barrier, 15-mil or thicker, should be placed over the drain rock. The vapor barrier shall meet the Class A requirements outlined in ASTM E 1745 and be installed per ASTM 1643. Eliminating the capillary moisture break and/or plastic vapor barrier may result in excess moisture intrusion through the floor slabs resulting in poor performance of floor coverings, mold growth or other adverse conditions.

Exterior concrete slabs should be at least 4-inches thick and reinforced as described above for interior slabs. For improved performance, exterior concrete slabs shall be underlain with at least 4-inches or more of Caltrans Class 2 Aggregate Base compacted to at least 92 percent relative compaction. Some movement should be expected for exterior concrete slabs as the underlying soils react to seasonal moisture changes and downslope soil creep.

Site Utilities

Excavations for utilities will encounter hard packed lime treated soil and stiff clayey soil. Trench excavations having a depth of five feet or more and will be entered by workers must be sloped, braced, or shored in accordance with current Cal/OSHA regulations. On-site soils appear to be Type B. All excavations where collapse of excavation sidewall, slope or bottom could result in injury or death of workers should be evaluated by the contractor’s safety officer and designated competent person prior to entering in accordance with current Cal/OSHA regulations.

Bedding materials for utility pipes should be well graded sand with 90 to 100 percent of particles passing the No. 4 sieve and no more than 5 percent finer than the No. 200 sieve. Provide the minimum bedding beneath the pipe in accordance with the manufacturer’s recommendation, typically 3 to 6 inches. Trench backfill may consist of on-site soils moisture conditioned to at least 2 percent over the optimum moisture content, placed in thin lifts and compacted to at least 90 percent R.C. Backfill for trenches within pavement areas should consist of non-expansive granular fill. Use equipment and methods that are suitable for work in confined areas without damaging utility conduits. Where utility lines cross under or through perimeter footings, they should be sealed to reduce moisture intrusion into the areas under the slabs and/or footings.

Pavement Structural Sections

Typically, asphalt pavement sections are designed utilizing two variables, the R-Value (a measure of the subgrade resistance) and the Traffic Index (TI – a measure of the amount of daily traffic). Based on our experience with similar projects, lime treatment will significantly increase the R-Value of a soil. Therefore, for design purposes we utilized an R-Value of 40, for lime treated subgrade, to calculate asphalt pavement sections. We have calculated various pavement sections for the project site and anticipated soil conditions in accordance with Caltrans procedures for flexible pavement design utilizing multiple TI values as shown in Table D.

TABLE D
ASPHALT PAVEMENT SECTIONS
East Washington Park
Petaluma, California

T.I.	Asphalt Concrete	Aggregate Baserock
4.0	2.5-inches	6.0-inches
5.0	3.0-inches	6.0-inches
6.0	3.5-inches	6.0-inches

Note:

1.) Assumes subgrade has been lime treated.
2.) To reduce the overall section thickness the “2 to 1” rule of thumb may be applied, where 2-inches of AB is equivalent to 1-inch of AC. For example a section consisting of 4.0-inches of AC overlying 15.5-inches of AB (19.5-inches total) may be reduced to 6.0-inches of AC overlying 11.5-inches of AB (17.5-inches total).

Prior to construction of the new pavement section, the existing subgrade should be scarified to a minimum depth of 8-inches, moisture-conditioned to near-optimum moisture content. The subgrade should then be compacted to a minimum of 95 percent relative compaction per ASTM D-1557 and to produce a firm and unyielding surface when proof rolled with heavy construction equipment.

The aggregate baserock should conform to requirements for Caltrans Class 2 Aggregate Base as presented in Section 26 of the latest edition of the Caltrans Standard Specifications (2015). The baserock should be placed in 6-inch maximum lifts on a properly prepared, firm and unyielding subgrade and compacted to at least 95 percent relative compaction. Additionally, the compacted aggregate baserock section should be firm and unyielding under heavy construction equipment.

Asphalt concrete should conform to Caltrans ¾-inch maximum, medium Type A specifications, should contain no less than 4.5 percent asphalt, and should be placed in accordance with the procedures outlines in Section 39 of the latest edition (2015) of the Caltrans Standard Specifications. Additionally, the top lift of asphalt should consist of ½-inch maximum aggregate. Asphalt concrete should be compacted in lifts not exceeding 2-inches in thickness to a minimum of 92 percent of the theoretical maximum density.

Additional Services

We are prepared to begin design of the synthetic turf field once the field drainage system and the existing or proposed storm drainage system are known. During construction, we should be present to observe foundation excavations and confirm that the subsurface conditions, materials, and work are as expected and are consistent with our recommendations.

We hope this provides you with the information you require at this time. Please do not hesitate to call with any questions or if we can be of further assistance.

Sincerely,
MILLER PACIFIC ENGINEERING GROUP

BENJAMIN S. PAPPAS
GE 2786
EXP. 09/30/22

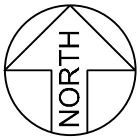
Benjamin S. Pappas
Geotechnical Engineer No. 2786
(Expires 9/30/22)

Attachments: Figures 1 through 5
Appendix A

Latitude: 38.2642
Longitude: -122.6079

SITE LOCATION MAP

(Not to Scale)



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Novato, CA 94947
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F 415 / 382-3450
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SITE LOCATION MAP

GSM - East Washington Park
Phase 2 Improvements
Petaluma, California

Project No. 1477.072 Date: 10/26/17

Drawn BSP
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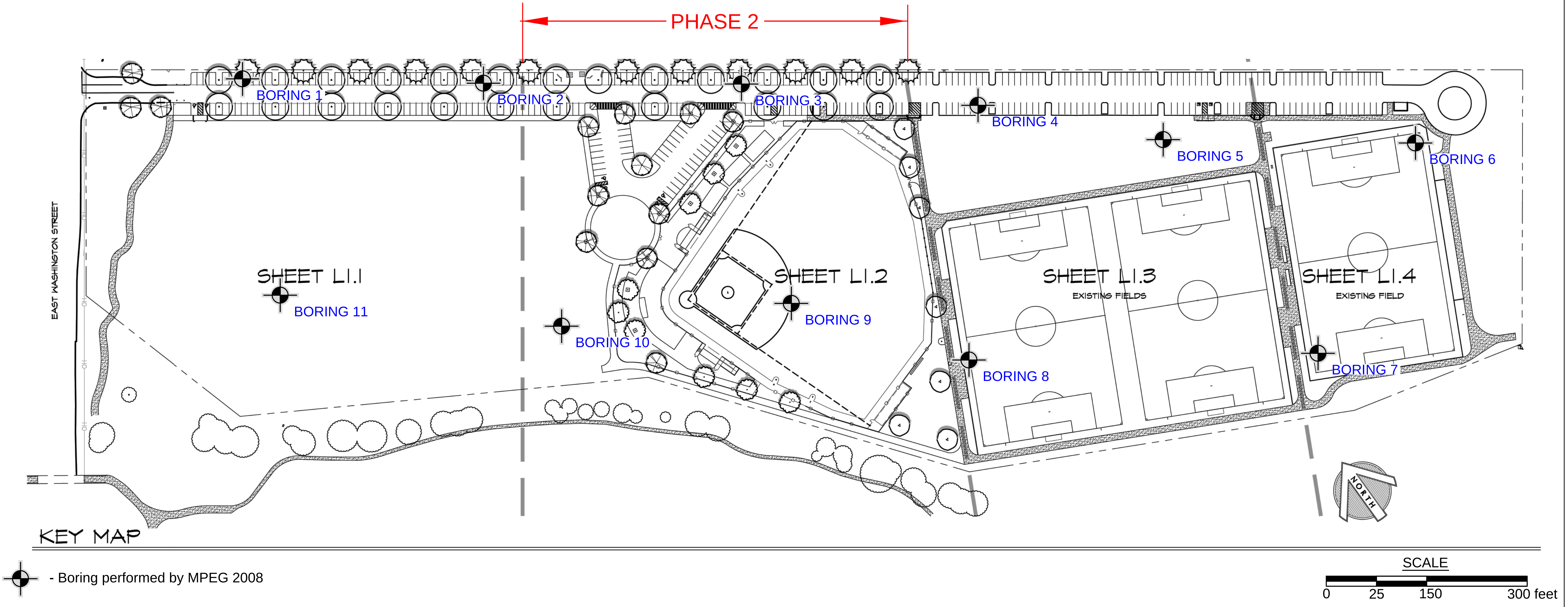
1
FIGURE



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SITE PLAN

GSM - East Washington Park
Phase 2 Improvements
Petaluma, California

Project No. 1477.072 Date: 10/26/17

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2
FIGURE

APPENDIX A
SUBSURFACE EXPLORATION AND LABORATORY TESTING

1.0 Subsurface Exploration

We explored subsurface conditions at the site by drilling eleven test borings on July 30, 2008 at the locations shown on Figure 2. Test borings were drilled to maximum depths of 4.5 to 15 feet using 6-inch diameter continuous flight solid augers mounted on an all-terrain drill rig.

The soils encountered were logged and identified by our field geologist in general accordance with ASTM Standard D 2487, "Field Identification and Description of Soils (Visual-Manual Procedure)." This standard is briefly explained on Figure A-1, Soil Classification Chart and Key to Log Symbols. The boring logs are presented on Figures A-2 through A-12.

We obtained “undisturbed” samples from our borings using a 3-inch diameter, split-barrel modified California sampler with 2.5 by 6-inch brass tube liners, and disturbed samples using a 2-inch diameter Standard Penetration Test sampler and no liners. The sampler was driven with a 140-pound hammer falling 30 inches. The number of blows required to drive the samplers 18 inches was recorded and is reported on the boring logs as blows per foot for the last 12 inches of driving. The samples obtained were examined in the field, sealed to prevent moisture loss, and transported to our laboratory.

2.0 Laboratory Testing

We conducted laboratory tests on selected intact samples to verify field identifications and to evaluate engineering properties. The following laboratory tests were conducted in accordance with the ASTM standard test method cited:

- Laboratory Determination of Water (Moisture Content) of Soil, Rock, and Soil-Aggregate Mixtures, ASTM D 2216;
- Density of Soil in Place by the Drive-Cylinder Method, ASTM D 2937;
- Atterberg Limits (Plasticity), ASTM D 4318; and,
- Unconfined Compressive Strength of Cohesive Soil, ASTM D 2166.

The moisture content, dry density, unconfined compression, and Atterberg Limits test results are shown on the exploratory Boring Logs. The Atterberg Limits tests are summarized on Figure A-13.

The exploratory boring logs, description of soils encountered and the laboratory test data reflect conditions only at the location of the boring at the time they were excavated or retrieved. Conditions may differ at other locations and may change with the passage of time due to a variety of causes including natural weathering, climate and changes in surface and subsurface drainage.

MAJOR DIVISIONS		SYMBOL	DESCRIPTION
COARSE GRAINED SOILS over 50% sand and gravel	CLEAN GRAVEL	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
	GRAVEL with fines	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	CLEAN SAND	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
	SAND with fines	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS over 50% silt and clay	SILT AND CLAY liquid limit <50%	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	SILT AND CLAY liquid limit >50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS		PT	Peat, muck, and other highly organic soils
ROCK			Undifferentiated as to type or composition

KEY TO BORING AND TEST PIT SYMBOLS

CLASSIFICATION TESTS

AL	ATTERBERG LIMITS TEST
SA	SIEVE ANALYSIS
HYD	HYDROMETER ANALYSIS
P200	PERCENT PASSING NO. 200 SIEVE
P4	PERCENT PASSING NO. 4 SIEVE

STRENGTH TESTS

TV	FIELD TORVANE (UNDRAINED SHEAR)
UC	LABORATORY UNCONFINED COMPRESSION
TXCU	CONSOLIDATED UNDRAINED TRIAXIAL
TXUU	UNCONSOLIDATED UNDRAINED TRIAXIAL
	UC, CU, UU = 1/2 Deviator Stress

SAMPLER TYPE

■	MODIFIED CALIFORNIA	⊠	HAND SAMPLER
▯	STANDARD PENETRATION TEST	⊠	ROCK CORE
▨	THIN-WALLED / FIXED PISTON	X	DISTURBED OR BULK SAMPLE

SAMPLER DRIVING RESISTANCE

Modified California and Standard Penetration Test samplers are driven 18 inches with a 140-pound hammer falling 30 inches per blow. Blows for the initial 6-inch drive seat the sampler. Blows for the final 12-inch drive are recorded onto the logs. Sampler refusal is defined as 50 blows during a 6-inch drive. Examples of blow records are as follows:

25	sampler driven 12 inches with 25 blows after initial 6-inch drive
85/7"	sampler driven 7 inches with 85 blows after initial 6-inch drive
50/3"	sampler driven 3 inches with 50 blows during initial 6-inch drive or beginning of final 12-inch drive

NOTE: Test boring and test pit logs are an interpretation of conditions encountered at the excavation location during the time of exploration. Subsurface rock, soil or water conditions may vary in different locations within the project site and with the passage of time. Boundaries between differing soil or rock descriptions are approximate and may indicate a gradual transition.

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Suite C
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SOIL CLASSIFICATION CHART

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
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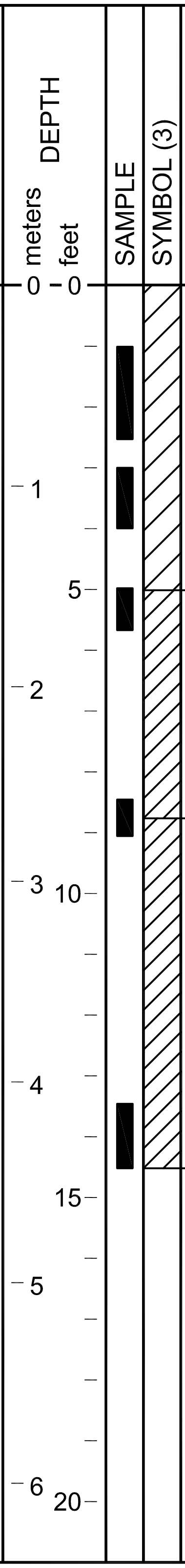
A-1
FIGURE

BORING 1

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 108-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)
				14.0	
			50		
			62	23.6	100
		6300 UC	67/9"	24.1	100
			58/7"	17.5	110
			64	27.8	93



SILTY CLAY (CH)
dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches

SILTY CLAY (CL)
medium brown, moist, very stiff, medium to high plasticity

SANDY CLAY (CL)
tan-brown, slightly moist, very stiff, low to medium plasticity, trace fine grained gravel

Bottom of boring at 14.5 feet
No groundwater encountered

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-2
FIGURE

BORING 2

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 105-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0			SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches
			30	16.5						
			38	21.8		1				grades to moist
			36	22.3						
							5			Bottom of boring at 5.0 feet No groundwater encountered
						2				
						3	10			
						4				
							15			
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-3
FIGURE

BORING 3

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 101-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
			25	12.5		0	0	▯	▨	**SILTY CLAY (CH)** dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches
			56/9"	16.2	107	1		▮	▩	**CLAYEY SAND (SC)** light brown, moist, dense, fine to medium-grained sand
			62/9"	23.4	95		5	▮	▩	
						2			▨	**SANDY CLAY (CL)** light to medium brown, moist, very stiff, low to medium plasticity
			37/9"	26.7		3	10	▯	▨	
			41	13.1		4		▯	▦	**SAND w/ GRAVEL (SM)** tan, slightly moist, dense, fine to coarse grained
						5	15			Bottom of boring at 14.5 feet No groundwater encountered
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-4
FIGURE

BORING 4

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 102-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0		▨	SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity, trace sand
									▨	grades to slightly moist
			40	17.5				▭	▨	
						1			▨	
			65	15.6				▭	▨	
							5			Bottom of boring at 4.5 feet No groundwater encountered
						2				
						3	10			
						4				
							15			
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-5
FIGURE

BORING 5

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 100-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0		▨	SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches
			53	13.7				▨	▨	
						1			▨	
			53/7"	17.0	93		5	■	▨	SANDY CLAY (CL) medium brown, slightly moist, very stiff, medium plasticity
						2			▨	
			61/9"	20.2	99	3	10	■	▨	
						4			▨	
			58	21.3	104			■	▨	
							15			Bottom of boring at 14.5 feet No groundwater encountered
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
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A-6
FIGURE

BORING 6

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 98-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0		▨	SILTY CLAY (CH) dark brown, moist, very stiff, high plasticity
			25	12.7				▯	▨	
						1			▨	
		6300 UC	55/9"	20.2	106		5	■	▨	SANDY CLAY (CL) medium brown, moist, very stiff, medium plasticity
						2			▨	
			63/9"	19.0	108			■	▨	
						3	10		▨	
						4			▨	
			50/10"	21.8	102			■	▨	
							15			Bottom of boring at 14.5 feet No groundwater encountered
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

Miller Pacific
ENGINEERING GROUP

FILE: 1206.04BL.dwg

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-7
FIGURE

BORING 7

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 95-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0		▨	SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity
									▨	grades to moist
			18	26.9				▯	▨	
						1			▨	
			58	25.4				▯	▨	
							5			Bottom of boring at 4.5 feet No groundwater encountered
						2				
						3	10			
						4				
							15			
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

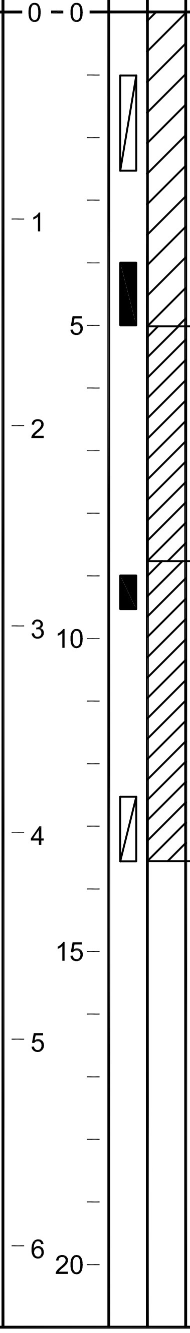
A-8
FIGURE

BORING 8

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 99.5-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters feet	SAMPLE	SYMBOL (3)	
			18	18.4					SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches
			36	28.1	90				
									SILTY CLAY (CL) medium brown, moist, very stiff, medium to high plasticity
			52/6"	15.5	113				SANDY CLAY (CL) tan-brown, slightly moist, very stiff, low to medium plasticity, trace fine grained gravel
			49	21.7					
									Bottom of boring at 14.5 feet No groundwater encountered



NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-9
FIGURE

BORING 9

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 100-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0		▨	SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity
									▨	SANDY CLAY (CL) medium brown, slightly moist to moist, very stiff, low to medium plasticity
			30	15.9				☐	▨	
						1			▨	
			32/9"	19.0				☐	▨	
							5			Bottom of boring at 4.5 feet No groundwater encountered
						2				
						3	10			
						4				
							15			
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-10
FIGURE

BORING 10

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 101-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0		▨	SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity, rootlets present in upper 6 inches
			45	13.3				■	▨	
						1			▨	
		8500 UC	57	19.0	103			■	▨	
							5		▨	SILTY CLAY (CL) medium brown, moist, very stiff, medium to high plasticity
						2			▨	
									▨	SANDY CLAY (CL) tan-brown, slightly moist, very stiff, low to medium plasticity, trace fine grained gravel
			60/9"	16.7	96			■	▨	
						3	10		▨	
						4			▨	
			67	25.4	103			■	▨	
										Bottom of boring at 14.5 feet No groundwater encountered
							15			
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-11
FIGURE

BORING 11

EQUIPMENT: Track-mounted AT-300
6" solid flight augers

DATE: 7/30/08
ELEVATION: 103.5-Feet*
*REFERENCE: Site Plan, Winzler & Kelly, 2008

OTHER TEST DATA	OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters	DEPTH feet	SAMPLE	SYMBOL (3)	
						0	0		▨	SILTY CLAY (CH) dark brown, dry to slightly moist, very stiff, high plasticity grades to moist
			30	16.4				☐	▨	
						1			▨	
			53/9"	19.8				☐	▨	
							5			Bottom of boring at 4.8 feet No groundwater encountered
						2				
						3	10			
						4				
							15			
						5				
						6	20			

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m^3 = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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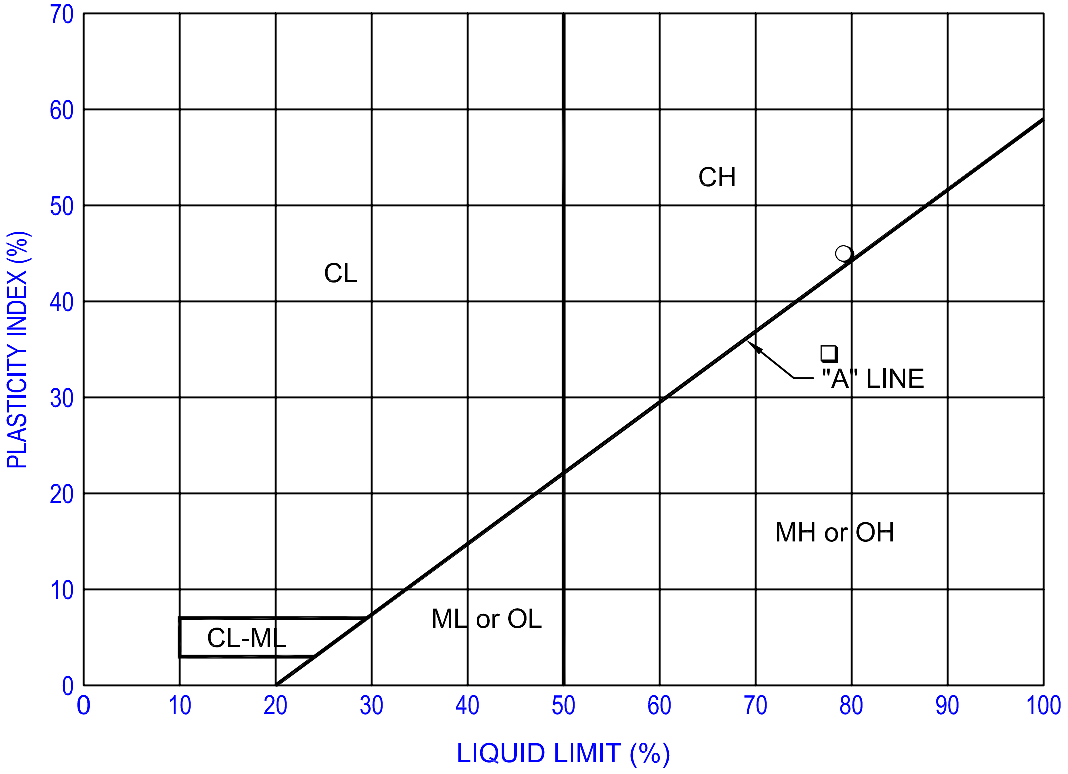
BORING LOG

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-12
FIGURE



SYMBOL	SAMPLE SOURCE	CLASSIFICATION	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)
❑	BORING 6 1 to 2.5 Feet	CLAYEY SILT (MH) dark brown	77	43	34
❍	BORING 11 2 to 2.5 Feet	SILTY CLAY (CH) dark brown	79	34	45

REFERENCE: Liquid Limit, Plastic Limit, and Plasticity Index of Soils, ASTM D 4318

Miller Pacific
ENGINEERING GROUP

FILE: 1206.04 PI.dwg

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PLASTICITY CHART

East Washington Park
Petaluma, California

Project No. 1206.04 Date: 9/22/08

Designed
Drawn NRS
Checked

A-13
FIGURE

APPENDIX 3

MUSCO LIGHTING
DRAWINGS, CALCULATIONS, AND
SPECIFICATIONS

MUSCO LIGHTING, INC.
Light Structure Pole and Foundation Standard

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ITEM : **Structural Calculations**
Pole Foundation Standard

PROJECT : **Petaluma Community Sports Field**
Baseball Diamond
Petaluma, CA

PROJECT NO : **188270**
363.787

DATE : **1/10/2022**

REGISTERED PROFESSIONAL ENGINEER
JOSH RANDALL
No. 4506
Exp. 6-30-23
STRUCTURAL
STATE OF CALIFORNIA

ENGINEER : KNA STRUCTURAL ENGINEERS
JOSH RANDALL, SE No. 4506
9931 Muirlands Blvd
Irvine, Ca 92618

MUSCO LIGHTING, INC.
Light Structure Pole and Foundation Standard

Calculation Index

CONTENTS:

CODE REFERENCE:

2019 CBC

ACI 318-14
Building Code Requirements for Structural Concrete

AISC 360-16
Specifications for Structural Steel Buildings

KNA STRUCTURAL ENGINEERS

POLE DESIGNATION: LS70-A W/ 3 FIXTURES
MANUFACTURER: MUSCO
PROJECT NO: 188270

JOB NO: 363.787
PROJECT: Petaluma Community Sports Field
LOCATION: Petaluma, CA

ASCE 7-16
WIND CRITERIA 92 MPH,EXP C
LOAD COMB 1.2 DEAD + 1.0 WIND

POLE ID: C1, C2
(A1, D1, D2 Sim.)

LED **1500**
EPA/FIXTURE*, Af = 3.1 ft2
D.L./FIXTURE** = 91.0 lbs
D.L. ECE/FIXTURE*** = 20.0 lbs

** EPA = EFFECTIVE PROJECTED AREA OF LIGHT FIXTURE INCLUDING CROSSARM, PER MUSCO*
*** D.L.= DEAD LOAD OF FIXTURE, & CROSSARM, PER MUSCO*
****D.L.= DEAD LOAD OF ECE, PER MUSCO*

```
  | P = SUPERIMPOSED WT + POLE WT
    v
^ |||a     <--
| |v|      <--
| |||      <--    <---
| |v|      <--
| |||      <--
| |v|      <--
  |||      <--
l |v|      <--
  |||      <--
| |||      <--
| |||      <--
| |v|      <--
| |||      <--
| |v|      <--
| |||      <--
| |v|      <--
v | |b     <--
```

<--FIXTURES, F/Af= qz*Gf*Cf = 32.33 PSF MAX ***(29.4-1)***

<--where $qz=.00256*Kz*Kzt*Kd*Ke(V)^2$ 25.56 PSF MAX ***(26.10-1)***

ATTACHMENT TYPE	NUMBER	DIST. FROM TOP POLE,FT	PA SQ FT	Cf	EPA SQ FT	Kz	qz PSF	WIND,F LBS	WEIGHT,P LBS
LED1500	3.0	0.5		1.0	3.11	1.178	25.52	301	273
	0.0	3.0		1.3	3.11	1.169	25.33	0	0
	0.0	5.5		1.3	3.11	1.160	25.13	0	0
	0.0	8.0		1.3	3.11	1.150	24.93	0	0
	0.0	10.5		1.3	3.11	1.141	24.72	0	0
	0.0	13.0		1.3	3.11	1.131	24.50	0	0
	0.0	15.5		1.3	3.11	1.120	24.28	0	0
	0.0	18.0		1.3	3.11	1.110	24.04	0	0
LED1200	2.0	11.6	2.51	1.3	3.27	1.137	24.63	203	131
LED575	2.0	56.6	1.82	1.3	2.37	0.849	18.39	110	109
ECE	7.0	59.9	9.00	1.3	11.70	0.849	18.39	272	140
							TOTALS =	887	653

POLE, F/Af= qz*Gf*Cf = 38.80 PSF MAX ***(29.4-1)***

where $qz=.00256*Kz*Kzt*Kd*Ke(V)^2$ = 25.56 PSF MAX ***(26.10-1)***

LOADING DIAGRAM

INPUT

-> l = 71.55 ft. (ht. from adj. grade)
-> l = 71.55 ft. (ht. from grade)
->tA = 0.12 in. (pole thk. @ top)
->dA = 4.75 in. (pole diam. @ top)
->dB = 13.4 in. (pole diam. @ btm)
->tB = 0.179 in. (pole thk. @ btm)
->Fy = 38.0 ksi (fixt mount sect. = 5.25 ft)
->Fy = 55.0 ksi (other pole sect.)
-> E = 29,000 ksi
->Kzt= 1 ***(Figure 26.8-1)***
->Kd = 1 ***(Table 26.6-1)***
-> Kz = 1.179 MAX-EXP C @ 71.6 FT. ***(Table 26.10-1)***
->Ke = 1.00 ***(Table 26.9-1)***
-> Cf = 1.00 LIGHT FIXTURE (INCLUDED IN EPA)
-> Cf = 1.200 MAX (VARIES 0.5-1.2 FOR RND POLE) ***(Figure 29.5-1)***
POLE DAMPING, beta= 0.025 ***Per Musco test***

OUTPUT

-> POLE NATURAL FREQUENCY = 0.403 Hz ***1/(2PI*(DELTA/386)^0.5) where DELTA is due to self weight***
-> Gf= 1.27 ***(Section 26.11.5)*** ***(Reference Vibration Problems in Engineering by Timoshenko, 4th ED. pg.34)***

Pole Properties:

Ia =	4.68	in4	taper =	0.140	in/ft
Ib =	162	in4	db/da =	2.821	
ra =	1.638	in	rb =	4.675	in.
Aa =	1.745	in2	Ab =	7.43	in2
Sa =	1.97	in3	Sb =	24.25	in3

From Critical Buckling Loads of Tapered Columns, ASCE 2/62:

n = Log (Ib/(Ia)/Log (dB/dA) = 3.42
P* = (Ib/Ia)/(Ib/Ia)^.333 = 10.6
kl/req* (1/(P*)^.5)[kl/ra] = 338 (where k= 2.1)

AISC 360-16 Specification Table B4.1, Case 15

for Fy =	55.0	KSI	38	KSI
D/t < .45E/Fy =	237		343	(MAX)
D/t < .31E/Fy =	163		237	Noncompact
D/t < .07E/Fy =	37		53	Compact
D/t < .11E/Fy =	58		84	Slender element Section for Uniform Comp

Section 26.11.5 Gust-Effect Factor

constant epsilon,e =		0.2	Lz	=	527.0
constant l	=	500	N1	=	2.326
Vz	=	91.33	Rn	=	0.082
4.6n1h/Vz	=	1.452			
4.6n1B/Vz	=	0.015	R	=	1.215
15.4n1L/Vz	=	0.051	g_R	=	3.967
			c	=	0.200
Rh	=	0.464	Iz	=	0.191
RB	=	0.990	Q	=	0.920
RL	=	0.967	G	=	0.886
		Gf = 1.265			

SHEAR,F=	**1.184** ***KIPS***	**MOMENT, M =**	**48.57**	***K-FT***	**e= M/F**	**=**	**41.02** ***FT***	**AXIAL,P =**	**1.736**	***KIPS***	**ASD Forces at groundline (for foundation design)**
SHEAR,F=	**1.973** ***KIPS***	**MOMENT, M =**	**80.94**	***K-FT***	**e= M/F**	**=**	**41.02** ***FT***	**AXIAL,P =**	**2.083**	***KIPS***	**Nominal Forces at groundline**

M < ΦMn = 115 K-FT Precast Base O.K.
Pole Stress Check = 0.876 Max. < 1 Pole O.K.
Max. Deflection = 83.339 Inch <0.10H= 86 Inch AASHTO 10.4.2

Distance from top of Pole FT	Outside Diameter of Pole,D IN	Pole thick,t IN	D/t	Kz	qz PSF	Cf Pole	kl/r eqiv.	E3-4 Fe	E3-2 or E3-3 Design comp strength, Pr KIPS	Acting unfactored, Pr KIPS	F8.1-F8.4 Design fle trength, M K-FT	eq'd flex. trength, M K-FT	Pr/Pc	H1-1b for Pr/Pc <0.2	H1-1a for Pr/Pc ≥ 0.2	2nd Order /1st Order Moment FT-K	CSR O.K.	Req'd shea trength,, KIPS	1st Order Delta IN	C2.2a P-Delta Moment FT-K	Total 2nd Order Moment FT-K	E7-19 Q	ACTING MOM DUE TO DL	M/I	DEFL DUE TO DL IN
0	4.75	0.12	39.6	1.179	25.56	1.2	338	2.51	3.46	0.000	7.89	0.0	0.000	0.000	N.A.	1.000	Y	0.000	83.3	0.0	0.0	1.40	0.00	0.000	60.2
1	4.75	0.12	39.6	1.176	25.48	1.2	338	2.51	3.46	0.279	7.89	0.2	0.097	0.077	N.A.	1.413	Y	0.316	81.0	0.1	0.2	1.40	0.00	0.031	58.5
2	4.75	0.12	39.6	1.172	25.40	1.2	338	2.51	3.46	0.285	7.89	0.5	0.099	0.127	N.A.	1.273	Y	0.332	78.7	0.1	0.6	1.40	0.28	0.092	56.8
3	4.75	0.12	39.6	1.169	25.33	1.2	338	2.51	3.46	0.291	7.89	0.8	0.101	0.180	N.A.	1.243	Y	0.347	76.3	0.2	1.0	1.40	0.57	0.154	55.2
4	4.75	0.12	39.6	1.165	25.25	1.2	338	2.51	3.46	0.297	7.89	1.2	0.103	0.234	N.A.	1.228	Y	0.362	74.0	0.3	1.4	1.40	0.87	0.217	53.5
5	4.75	0.12	39.6	1.162	25.17	1.2	338	2.51	3.46	0.303	7.89	1.5	0.105	0.291	N.A.	1.219	Y	0.377	71.7	0.3	1.9	1.40	1.17	0.268	51.8
6	4.90	0.12	40.8	1.158	25.09	1.2	338	2.51	3.57	0.309	11.02	1.9	0.104	0.264	N.A.	1.212	Y	0.392	69.4	0.4	2.3	1.16	1.47	0.302	50.2
7	5.04	0.12	42.0	1.154	25.01	1.2	338	2.51	3.68	0.316	11.62	2.3	0.103	0.293	N.A.	1.206	Y	0.408	67.2	0.5	2.8	1.14	1.78	0.331	48.6
8	5.18	0.12	43.2	1.150	24.93	1.2	338	2.51	3.78	0.322	12.22	2.7	0.102	0.321	N.A.	1.201	Y	0.424	64.9	0.6	3.3	1.13	2.10	0.355	47.0
9	5.32	0.12	44.3	1.147	24.84	1.2	338	2.51	3.89	0.329	12.85	3.2	0.102	0.347	N.A.	1.197	Y	0.441	62.7	0.6	3.8	1.12	2.43	0.376	45.4
10	5.46	0.12	45.5	1.143	24.76	1.2	338	2.51	3.99	0.336	13.49	3.6	0.101	0.371	N.A.	1.193	Y	0.458	60.5	0.7	4.3	1.11	2.76	0.392	43.8
11	5.60	0.12	46.7	1.139	24.67	1.2	338	2.51	4.10	0.343	14.14	4.1	0.101	0.394	N.A.	1.189	Y	0.475	58.4	0.8	4.9	1.10	3.10	0.406	42.3
12	5.74	0.12	47.8	1.135	24.59	1.2	338	2.51	4.20	0.482	14.81	4.7	0.138	0.444	N.A.	1.187	Y	0.696	56.3	0.9	5.6	1.09	3.45	0.424	40.7
13	5.88	0.12	49.0	1.131	24.50	1.2	338	2.51	4.31	0.489	15.50	5.4	0.136	0.479	N.A.	1.181	Y	0.714	54.2	1.0	6.4	1.08	3.93	0.447	39.3
14	6.02	0.12	50.2	1.127	24.41	1.2	338	2.51	4.41	0.497	16.20	6.1	0.135	0.511	N.A.	1.177	Y	0.732	52.1	1.1	7.2	1.07	4.43	0.466	37.8
15	6.16	0.12	51.3	1.122	24.32	0.7	338	2.51	4.52	0.505	16.91	6.8	0.134	0.542	N.A.	1.173	Y	0.743	50.1	1.2	8.0	1.06	4.93	0.482	36.3
16	6.30	0.12	52.5	1.118	24.23	0.7	338	2.51	4.62	0.513	17.64	7.6	0.133	0.570	N.A.	1.169	Y	0.754	48.1	1.3	8.9	1.05	5.44	0.495	34.9
17	6.44	0.12	53.7	1.114	24.14	0.7	338	2.51	4.72	0.521	18.39	8.4	0.132	0.596	N.A.	1.166	Y	0.766	46.2	1.4	9.7	1.04	5.95	0.505	33.5
18	6.58	0.12	54.8	1.110	24.04	0.7	338	2.51	4.83	0.530	19.15	9.1	0.132	0.620	N.A.	1.163	Y	0.777	44.3	1.5	10.6	1.03	6.48	0.514	32.2
19	6.72	0.12	56.0	1.105	23.95	0.7	338	2.51	4.93	0.539	19.93	9.9	0.131	0.642	N.A.	1.160	Y	0.789	42.4	1.6	11.5	1.02	7.01	0.521	30.9
20	6.86	0.12	57.2	1.101	23.85	0.7	338	2.51	5.04	0.547	20.72	10.7	0.130	0.663	N.A.	1.157	Y	0.801	40.6	1.7	12.4	1.02	7.56	0.526	29.6
21	7.00	0.12	58.3	1.096	23.75	0.7	338	2.51	5.14	0.556	21.53	11.5	0.130	0.682	N.A.	1.155	Y	0.813	38.9	1.8	13.3	1.01	8.11	0.530	28.3
22	7.14	0.12	59.5	1.092	23.65	0.7	338	2.51	5.25	0.566	22.35	12.3	0.129	0.700	N.A.	1.152	Y	0.825	37.1	1.9	14.2	1.00	8.67	0.533	27.1
23	7.28	0.12	60.7	1.087	23.55	0.7	338	2.51	5.35	0.575	23.19	13.2	0.129	0.717	N.A.	1.150	Y	0.838	35.5	2.0	15.1	1.00	9.24	0.535	25.9
24	7.42	0.12	61.8	1.082	23.45	0.7	338	2.51	5.46	0.585	24.04	14.0	0.129	0.733	N.A.	1.148	Y	0.851	33.8	2.1	16.1	0.99	9.82	0.536	24.7
25	7.56	0.12	63.0	1.077	23.35	0.7	338	2.51	5.56	0.594	24.91	14.9	0.128	0.748	N.A.	1.146	Y	0.864	32.3	2.2	17.0	0.98	10.41	0.536	23.6
26	7.70	0.12	64.2	1.073	23.24	0.7	338	2.51	5.67	0.604	25.79	15.7	0.128	0.761	N.A.	1.143	Y	0.877	30.7	2.3	18.0	0.98	11.01	0.536	22.5
27	7.84	0.12	65.3	1.068	23.13	0.7	338	2.51	5.77	0.614	26.69	16.6	0.128	0.774	N.A.	1.141	Y	0.890	29.2	2.3	19.0	0.97	11.62	0.535	21.4
28	7.98	0.12	66.5	1.062	23.02	0.7	338	2.51	5.88	0.624	27.60	17.5	0.128	0.787	N.A.	1.139	Y	0.903	27.8	2.4	20.0	0.97	12.24	0.534	20.4
29	8.12	0.12	67.7	1.057	22.91	0.7	338	2.51	5.98	0.635	28.53	18.4	0.127	0.798	N.A.	1.137	Y	0.917	26.4	2.5	21.0	0.96	12.87	0.532	19.4
30	8.26	0.12	68.8	1.052	22.79	0.7	338	2.51	6.09	0.646	29.48	19.3	0.127	0.809	N.A.	1.135	Y	0.931	25.0	2.6	22.0	0.96	13.51	0.530	18.4
31	8.40	0.12	70.0	1.047	22.68	0.7	338	2.51	6.19	0.656	30.43	20.3	0.127	0.819	N.A.	1.133	Y	0.945	23.7	2.7	23.0	0.95	14.16	0.528	17.5
32	8.54	0.12	71.2	1.041	22.56	0.7	338	2.51	6.29	0.667	31.41	21.2	0.127	0.828	N.A.	1.131	Y	0.959	22.5	2.8	24.0	0.95	14.82	0.525	16.5
33	8.68	0.12	72.3	1.036	22.44	0.7	338	2.51	6.40	0.678	32.40	22.2	0.127	0.837	N.A.	1.129	Y	0.973	21.2	2.9	25.1	0.94	15.49	0.523	15.7
34	8.82	0.12	73.5	1.030	22.31	0.7	338	2.51	6.50	0.690	33.40	23.2	0.127	0.846	N.A.	1.127	Y	0.988	20.1	2.9	26.1	0.94	16.18	0.520	14.8
35	8.96	0.12	74.7	1.024	22.19	0.7	338	2.51	6.61	0.701	34.43	24.2	0.127	0.854	N.A.	1.125	Y	1.002	18.9	3.0	27.2	0.94	16.87	0.517	14.0
36	9.10	0.12	75.8	1.018	22.06	0.7	338	2.51	6.71	0.713	35.46	25.2	0.127	0.862	N.A.	1.123	Y	1.017	17.8	3.1	28.3	0.93	17.58	0.513	13.2
37	9.24	0.12	77.0	1.012	21.93	0.7	338	2.51	6.82	0.725	36.51	26.2	0.128	0.869	N.A.	1.121	Y	1.032	16.8	3.2	29.4	0.93	18.30	0.510	12.4
38	9.38	0.12	78.2	1.006	21.79	0.7	338	2.51	6.92	0.742	37.58	27.3	0.129	0.876	N.A.	1.119	Y	1.047	15.8	3.3	30.5	0.92	19.03	0.446	11.7
39	9.20	0.179	51.4	0.999	21.65	0.7	338	2.51	10.06	0.760	56.29	28.3	0.091	0.607	N.A.	1.118	Y	1.061	14.8	3.3	31.6	1.06	19.78	0.381	11.0
40	9.34	0.179	52.2	0.993	21.51	0.7	338	2.51	10.22	0.778	57.91	29.4	0.091	0.612	N.A.	1.116	Y	1.076	13.9	3.4	32.8	1.05	20.55	0.378	10.4
41	9.48	0.179	53.0	0.986	21.36	0.7	338	2.51	10.37	0.796	59.56	30.5	0.092	0.616	N.A.	1.114	Y	1.091	13.0	3.5	33.9	1.04	21.33	0.375	9.7
42	9.62	0.179	53.8	0.979	21.22	0.7	338	2.51	10.53	0.814	61.22	31.6	0.093	0.620	N.A.	1.112	Y	1.106	12.2	3.5	35.1	1.04	22.14	0.372	9.1
43	9.76	0.179	54.5	0.972	21.06	0.7	338	2.51	10.69	0.833	62.92	32.7	0.093	0.623	N.A.	1.110	Y	1.121	11.4	3.6	36.3	1.03	22.96	0.370	8.5
44	9.90	0.179	55.3	0.965	20.90	0.7	338	2.51	10.84	0.851	64.63	33.8	0.094	0.627	N.A.	1.109	Y	1.136	10.6	3.7	37.5	1.03	23.80	0.367	7.9
45	10.04	0.179	56.1	0.957	20.74	0.7	338	2.51	11.00	0.871	66.37	34.9	0.095	0.630	N.A.	1.107	Y	1.151	9.8	3.7	38.7	1.02	24.66	0.364	7.3
46	10.18	0.179	56.9	0.950	20.58	0.7	338	2.51	11.16	0.890	68.12	36.1	0.096	0.634	N.A.	1.105	Y	1.167	9.1	3.8	39.9	1.02	25.54	0.362	6.8
47	10.32	0.179	57.7	0.942	20.40	0.7	338	2.51	11.31	0.910	69.91	37.3	0.097	0.637	N.A.	1.104	Y	1.182	8.4	3.9	41.1	1.01	26.44	0.359	6.3
48	10.46	0.179	58.4	0.933	20.23	0.7	338	2.51	11.47	0.930	71.71	38.5	0.097	0.640	N.A.	1.102	Y	1.198	7.7	3.9	42.4	1.01	27.36	0.357	5.8
49	10.60	0.179	59.2	0.925	20.04	0.7	338	2.51	11.62	0.950	73.54	39.7	0.098	0.643	N.A.	1.101	Y	1.213	7.0	4.0	43.7	1.00	28.30	0.354	5.3
50	10.74	0.179	60.0	0.916	19.85	0.7	338	2.51	11.78	0.970	75.39	40.9	0.099	0.646	N.A.	1.099	Y	1.229	6.4	4.1	44.9	1.00	29.26	0.352	4.8

51	10.88	0.179	60.8	0.907	19.65	0.7	338	2.51	11.94	0.991	77.26	42.1	0.100	0.648	N.A.	1.098	Y	1.245	5.9	4.1	46.2	1.00	30.24	0.350	4.4
52	11.02	0.179	61.6	0.898	19.45	0.7	338	2.51	12.09	1.012	79.16	43.4	0.100	0.651	N.A.	1.096	Y	1.260	5.3	4.2	47.5	0.99	31.25	0.347	4.0
53	11.16	0.179	62.4	0.888	19.23	0.7	338	2.51	12.25	1.033	81.07	44.6	0.101	0.653	N.A.	1.095	Y	1.276	4.8	4.2	48.9	0.99	32.27	0.345	3.6
54	11.30	0.179	63.1	0.877	19.01	0.7	338	2.51	12.40	1.055	83.02	45.9	0.102	0.656	N.A.	1.093	Y	1.292	4.3	4.3	50.2	0.98	33.31	0.343	3.2
55	11.44	0.179	63.9	0.867	18.78	0.7	338	2.51	12.56	1.077	84.98	47.2	0.103	0.658	N.A.	1.092	Y	1.308	3.8	4.3	51.6	0.98	34.38	0.341	2.9
56	11.58	0.179	64.7	0.855	18.53	0.7	338	2.51	12.72	1.099	86.97	48.5	0.104	0.660	N.A.	1.090	Y	1.323	3.4	4.4	52.9	0.98	35.47	0.339	2.6
57	11.72	0.179	65.5	0.849	18.39	0.7	338	2.51	12.87	1.230	88.98	49.9	0.115	0.668	N.A.	1.089	Y	1.449	3.0	4.4	54.4	0.97	36.58	0.338	2.2
58	11.86	0.179	66.3	0.849	18.39	0.7	338	2.51	13.03	1.253	91.01	51.4	0.115	0.672	N.A.	1.087	Y	1.465	2.6	4.5	55.9	0.97	37.82	0.337	2.0
59	12.00	0.179	67.1	0.849	18.39	0.7	338	2.51	13.18	1.276	93.06	52.9	0.116	0.675	N.A.	1.085	Y	1.481	2.2	4.5	57.4	0.97	39.08	0.336	1.7
60	12.14	0.179	67.8	0.849	18.39	0.7	338	2.51	13.34	1.439	95.14	54.5	0.129	0.685	N.A.	1.084	Y	1.770	1.9	4.6	59.1	0.96	40.37	0.335	1.4
61	12.28	0.179	68.6	0.849	18.39	0.7	338	2.51	13.50	1.462	97.24	56.3	0.130	0.691	N.A.	1.082	Y	1.787	1.6	4.6	60.9	0.96	41.82	0.336	1.2
62	12.42	0.179	69.4	0.849	18.39	0.7	338	2.51	13.65	1.486	99.36	58.1	0.131	0.696	N.A.	1.080	Y	1.803	1.3	4.7	62.7	0.96	43.29	0.336	1.0
63	12.56	0.179	70.2	0.849	18.39	0.7	338	2.51	13.81	1.510	101.51	59.9	0.131	0.702	N.A.	1.078	Y	1.820	1.1	4.7	64.6	0.95	44.79	0.335	0.8
64	12.70	0.179	71.0	0.849	18.39	0.7	338	2.51	13.97	1.534	103.68	61.7	0.132	0.707	N.A.	1.077	Y	1.838	0.8	4.7	66.4	0.95	46.31	0.335	0.6
65	12.84	0.179	71.7	0.849	18.39	0.7	338	2.51	14.12	1.559	105.87	63.6	0.132	0.711	N.A.	1.075	Y	1.855	0.6	4.8	68.3	0.95	47.86	0.335	0.5
66	12.98	0.179	72.5	0.849	18.39	0.7	338	2.51	14.28	1.583	108.08	65.4	0.133	0.716	N.A.	1.073	Y	1.872	0.5	4.8	70.2	0.94	49.43	0.335	0.4
67	13.12	0.179	73.3	0.849	18.39	0.7	338	2.51	14.43	1.608	110.32	67.3	0.134	0.720	N.A.	1.071	Y	1.890	0.3	4.8	72.1	0.94	51.02	0.335	0.2
68	13.26	0.179	74.1	0.849	18.39	0.7	338	2.51	14.59	1.634	112.58	69.2	0.134	0.725	N.A.	1.070	Y	1.908	0.2	4.8	74.0	0.94	52.65	0.334	0.2
69	13.40	0.179	74.9	0.849	18.39	0.7	338	2.51	14.75	1.659	114.86	71.1	0.135	0.729	N.A.	1.068	Y	1.926	0.1	4.8	76.0	0.93	54.29	0.334	0.1
70	13.54	0.179	75.7	0.849	18.39	0.7	338	2.51	14.90	1.685	117.16	73.0	0.136	0.733	N.A.	1.066	NA	1.944	0.1	4.8	77.9	0.93	55.96	0.333	0.0
71	13.68	0.179	76.4	0.849	18.39	0.7	338	2.51	15.06	1.711	119.49	75.0	0.136	0.736	N.A.	1.065	NA	1.963	0.0	4.9	79.9	0.93	57.66	0.333	0.0
72	13.82	0.179	77.2	0.849	18.39	0.7	338	2.51	15.21	1.756	121.84	77.0	0.138	0.741	N.A.	1.063	NA	1.982	0.0	4.9	81.8	0.93	59.39	0.000	0.0

Reference: 2019 CBC, ASCE 7-16

INPUT:

Job Location:	Petaluma, CA		
Site Class	D		Per Soil Report
0.2 Sec MCE, Ss	1.860	g	Per Soil Report
1.0 Sec MCE, S_1	0.710	g	Per Soil Report
$S_{MS} = F_a S_S$	1.700	g	Per Soil Report
$S_{M1} = Fv S_1$	1.550	g	Per Soil Report
$S_{DS} = 2/3 S_{MS}$	1.133	g	Per Soil Report
$S_{D1} = 2/3 S_{M1}$	1.033	g	Per Soil Report
$Ts = S_{D1}/S_{DS}$	0.912	sec	
Long Period transition period, T_L	8.0	sec	ASCE 7-16 -Figure 22-12
Risk Category	II		Table 1604.5
Seismic Design Category	D		2019 CBC Section 1613.3.5

OUTPUT:

Light Pole Class	LS70A		
Fundamental Period, T	2.48	sec	See structural calculations, pg 1
Seismic coeff., R	1.5		ASCE 7-16 Table 15.4-2
Overstrength Factor, Ω	1.5		ASCE 7-16 Table 15.4-2
Importance Factor, I	1.00		ASCE 7-16 Section 15.4.1.1 & Table 1.5-2
Redundancy factor, ρ	1.0		ASCE 7-16 Section 15.6
DESIGN SEISMIC FORCE			
$V = C_S W$			ASCE 7-16 Eqn. 12.8-1
$C_S = S_{DS}/(R/I)$ for $T \le T_S$	0.756	g	ASCE 7-16 Eqn. 12.8-2
C_S max. for $T \le T_L$, $C_S = S_{D1}/T(R/I)$	0.278	g	ASCE 7-16 Eqn. 12.8-3
C_S min = $0.044 S_{DS} I \ge 0.03$	0.050	g	ASCE 7-16 Eqn. 15.4-1
if $S_1 \ge 0.6g$, C_S min = $0.8 S_1/(R/I)$	0.379	g	ASCE 7-16 Eqn. 15.4-2
Load Combination, 1.2D+ 1.0E			ASCE 7-16 Section 2.3.2 Load Comb 5
where E = Eh + Ev			ASCE 7-16 Eqn. 12.4-1
and Eh = pQ_E	0.379	W	ASCE 7-16 Eqn. 12.4-3
and Ev = $0.2 S_{DS} D$	0.227	D	ASCE 7-16 Eqn. 12.4-4
Load Combination, 1.2D + (pQe + $0.2 S_{DS} D$)			

Load Combination, 1.2D + (pQe + $0.2 S_{DS} D$) 1.427 D + 0.379 W

Total Seismic Weight, W = 2.262 kips See following page

SEISMIC SHEAR, V = 1.059 kips < 1.973 kips WIND SHEAR WIND CONTROLS

Vertical Distribution of Seismic Force, $F_{x} = C_{vx}V$ ASCE7-16 Eqn. 12.8-11 & Section 12.8.5

k= 1.991

Item	w	h_x	$w_x h_x^k$	$w_x h_x^k/\sum w_x h_x^k$	Cvx*V	OTM
fixtures	0.273	71	1322	0.430	0.368	26.12
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
Top Pole Section	0.034	68.9	155	0.050	0.043	2.97
2nd Pole Section	0.343	49.8	820	0.266	0.228	11.36
1st Pole Section	0.698	18.76	239	0.078	0.066	1.25
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
LED1200	0.131	60.00	454	0.147	0.126	7.58
LED575	0.109	15.00	24	0.008	0.007	0.10
ECE	0.140	15.00	31	0.010	0.009	0.13
1/2 Precast base above grade	0.534	8.00	34	0.011	0.009	0.07
Sum	2.262		3079	1.000	0.857	49.59
Total Dead Load at grade	2.796					

SEISMIC OTM = 49.59 kip-ft < 80.94 kip-ft Wind OTM WIND CONTROLS

KNA STRUCTURAL ENGINEERS

POLE DESIGNATION: LS70-B W/ 5 FIXTURES
MANUFACTURER: MUSCO
PROJECT NO: 188270

JOB NO: 363.787
PROJECT: Petaluma Community Sports Field
LOCATION: Petaluma, CA

ASCE 7-16
WIND CRITERIA 92 MPH,EXP C
LOAD COMB 1.2 DEAD + 1.0 WIND

POLE ID: A2

LED	**1500**		
EPA/FIXTURE*, Af	=	3.0	ft2
D.L./FIXTURE**	=	92.8	lbs
D.L. ECE/FIXTURE***	=	20.0	lbs

** EPA = EFFECTIVE PROJECTED AREA OF LIGHT FIXTURE INCLUDING CROSSARM, PER MUSCO*
*** D.L.= DEAD LOAD OF FIXTURE, & CROSSARM, PER MUSCO*
****D.L.= DEAD LOAD OF ECE, PER MUSCO*

```
      | P = SUPERIMPOSED WT + POLE WT
        v
^  |||a       <--   <--FIXTURES, F/Af= qz*Gf*Cf   =      33.33  PSF MAX  (29.4-1)
|  |v|        <--   <--where qz=.00256*Kz*Kzt*Kd*Ke(V)^2  25.62  PSF MAX  (26.10-1)
|  |||        <--   <---
|  |v|        <--
|  |||        <--
|  |v|        <--
   |||        <--
l  |v|        <--
   |||        <--
|  |v|        <--
|  |||        <--
|  |v|        <--
|  |||        <--
|  |v|        <--
|  |||        <--
|  |v|        <--
v  | |b       <--
```

ATTACHMENT TYPE	NUMBER	DIST. FROM TOP POLE,FT	PA SQ FT	Cf	EPA SQ FT	Kz	qz PSF	WIND,F LBS	WEIGHT,P LBS
LED1500	5.0	0.5		1.0	2.99	1.181	25.58	497	464
	0.0	3.0		1.3	2.99	1.172	25.39	0	0
	0.0	5.5		1.3	2.99	1.163	25.20	0	0
	0.0	8.0		1.3	2.99	1.154	25.00	0	0
	0.0	10.5		1.3	2.99	1.144	24.79	0	0
	0.0	13.0		1.3	2.99	1.134	24.57	0	0
	0.0	15.5		1.3	2.99	1.124	24.35	0	0
	0.0	18.0		1.3	2.99	1.113	24.12	0	0
LED400	1.0	22.4	1.59	1.3	2.07	1.094	23.70	64	71
LED575	1.0	57.4	1.98	1.3	2.57	0.849	18.39	62	65
ECE	7.0	60.7	9.00	1.3	11.70	0.849	18.39	280	140
							TOTALS =	902	740

POLE, F/Af= qz*Gf*Cf = 39.99 PSF MAX ***(29.4-1)***
where $qz=.00256*Kz*Kzt*Kd*Ke(V)^2$ = 25.62 PSF MAX ***(26.10-1)***

LOADING DIAGRAM

INPUT

-> l = 72.39 ft. (ht. from adj. grade)
-> l = 72.39 ft. (ht. from grade)
->tA = 0.12 in. (pole thk. @ top)
->dA = 4.75 in. (pole diam. @ top)
->dB = 13.40 in. (pole diam. @ btm)
->tB = 0.179 in. (pole thk. @ btm)
->Fy = 38.0 ksi (fixt mount sect. = 5.25 ft)
->Fy = 55.0 ksi (other pole sect.)
-> E = 29,000 ksi
->Kzt= 1 ***(Figure 26.8-1)***
->Kd = 1 ***(Table 26.6-1)***
-> Kz = 1.182 MAX-EXP C @ 72.4 FT. ***(Table 26.10-1)***
->Ke = 1.00 ***(Table 26.9-1)***
-> Cf = 1.00 LIGHT FIXTURE (INCLUDED IN EPA)
-> Cf = 1.200 MAX (VARIES 0.5-1.2 FOR RND POLE) ***(Figure 29.5-1)***
POLE DAMPING, beta= 0.025 ***Per Musco test***

OUTPUT

-> POLE NATURAL FREQUENCY = 0.358 Hz ***1/(2PI*(DELTA/386)^0.5) where DELTA is due to self weight***
-> Gf= 1.30 ***(Section 26.11.5)*** ***(Reference Vibration Problems in Engineering by Timoshenko, 4th ED. pg.34)***

Pole Properties:

Ia = 4.68	in4	taper =	0.140	in/ft	
Ib = 162	in4	db/da =	2.821		
ra = 1.638	in	rb =	4.675	in.	
Aa = 1.745	in2	Ab =	7.43	in2	
Sa = 1.97	in3	Sb =	24.25	in3	

From Critical Buckling Loads of Tapered Columns, ASCE 2/62:
n = Log (Ib/(Ia)/Log (dB/dA) = 3.42
P* = (Ib/Ia)/(Ib/Ia)^.333 = 10.6
kl/req* (1/(P*)^.5)[kl/ra] = 341 (where k= 2.1)

AISC 360-16 Specification Table B4.1, Case 15

for Fy =	55.0	KSI	38	KSI
D/t < .45E/Fy =	237		343	(MAX)
D/t < .31E/Fy =	163		237	Noncompact
D/t < .07E/Fy =	37		53	Compact
D/t < .11E/Fy =	58		84	Slender element Section for Uniform Comp

Section 26.11.5 Gust-Effect Factor

constant epsilon,e	=	0.2	Lz	=	528.2
constant l	=	500	N1	=	2.069
Vz	=	91.49	Rn	=	0.087
4.6n1h/Vz	=	1.304			
4.6n1B/Vz	=	0.014	R	=	1.300
15.4n1L/Vz	=	0.046	g_R	=	3.937
			c	=	0.200
Rh	=	0.494	Iz	=	0.191
RB	=	0.991	Q	=	0.920
RL	=	0.970	G	=	0.886
		Gf = 1.301			

SHEAR,F=	**1.217**	***KIPS***	**MOMENT, M =**	**53.71**	***K-FT***	**e= M/F =**	**44.13**	***FT***	**AXIAL,P =**	**1.964**	***KIPS***	**ASD Forces at groundline (for foundation design)**
SHEAR,F=	**2.029**	***KIPS***	**MOMENT, M =**	**89.52**	***K-FT***	**e= M/F =**	**44.13**	***FT***	**AXIAL,P =**	**2.356**	***KIPS***	**Nominal Forces at groundline**

M < ΦMn = 115 K-FT Precast Base O.K.

Pole Stress Check = 0.814 Max. < 1 Pole O.K.

Distance from top of Pole FT	Outside Diameter of Pole,D IN	Pole thick,t IN	D/t	Kz	qz PSF	Cf Pole	kl/r eqiv.	E3-4 Fe	E3-2 or E3-3 Design comp strength, Pr KIPS	Acting unfactored, Pr KIPS	F8.1-F8.4 Design fle trength, M K-FT	eq'd flex. trength, M K-FT	Pr/Pc	H1-1b for Pr/Pc <0.2	H1-1a for Pr/Pc ≥ 0.2	2nd Order /1st Order Moment FT-K	CSR O.K.	Req'd shea trength,, KIPS	1st Order Delta IN	C2.2a P-Delta Moment FT-K	Total 2nd Order Moment FT-K	E7-19 Q	ACTING MOM DUE TO DL	M/I	DEFL DUE TO DL IN
0	4.75	0.120	39.6	1.182	25.62	1.2	341	2.45	3.38	0.000	7.89	0.0	0.000	0.000	N.A.	1.000	Y	0.000	87.5	0.0	0.0	1.40	0.00	- 0.000	76.12
1	4.75	0.120	39.6	1.179	25.54	1.2	341	2.45	3.38	0.470	7.89	0.3	0.167	0.130	N.A.	1.432	Y	0.512	85.2	0.1	0.4	1.40	0.00	0.051	74.11
2	4.75	0.120	39.6	1.175	25.47	1.2	341	2.45	3.38	0.476	7.89	0.8	0.169	0.211	N.A.	1.287	Y	0.528	82.8	0.2	1.0	1.40	0.48	0.153	72.11
3	4.75	0.120	39.6	1.172	25.39	1.2	341	2.45	3.38	0.482	7.89	1.3	0.171	0.294	N.A.	1.256	Y	0.544	80.5	0.3	1.6	1.40	0.95	0.256	70.11
4	4.75	0.120	39.6	1.168	25.32	1.2	341	2.45	3.38	0.488	7.89	1.9	0.173	0.380	N.A.	1.241	Y	0.560	78.2	0.4	2.3	1.40	1.44	0.360	68.13
5	4.75	0.120	39.6	1.165	25.24	1.2	341	2.45	3.38	0.497	7.89	2.4	0.176	0.468	N.A.	1.232	Y	0.575	75.8	0.6	3.0	1.40	1.93	0.370	66.16
6	4.90	0.179	27.4	1.161	25.16	1.2	341	2.45	5.14	0.506	17.52	3.0	0.118	0.270	N.A.	1.225	Y	0.591	73.6	0.7	3.7	1.40	2.43	0.346	64.21
7	5.04	0.179	28.2	1.157	25.08	1.2	341	2.45	5.30	0.516	18.44	3.6	0.117	0.298	N.A.	1.220	Y	0.607	71.3	0.8	4.4	1.38	2.94	0.379	62.29
8	5.18	0.179	28.9	1.154	25.00	1.2	341	2.45	5.45	0.526	19.39	4.2	0.116	0.323	N.A.	1.216	Y	0.624	69.1	0.9	5.1	1.36	3.46	0.405	60.39
9	5.32	0.179	29.7	1.150	24.91	1.2	341	2.45	5.60	0.536	20.35	4.9	0.115	0.347	N.A.	1.212	Y	0.641	66.9	1.0	5.9	1.34	3.99	0.428	58.51
10	5.46	0.179	30.5	1.146	24.83	1.2	341	2.45	5.75	0.546	21.35	5.5	0.114	0.369	N.A.	1.208	Y	0.658	64.7	1.1	6.7	1.32	4.53	0.446	56.65
11	5.60	0.179	31.3	1.142	24.75	1.2	341	2.45	5.91	0.557	22.36	6.2	0.113	0.389	N.A.	1.205	Y	0.676	62.6	1.3	7.4	1.31	5.08	0.460	54.82
12	5.74	0.179	32.1	1.138	24.66	1.2	341	2.45	6.06	0.568	23.40	6.9	0.112	0.409	N.A.	1.202	Y	0.694	60.5	1.4	8.2	1.29	5.65	0.472	53.02
13	5.88	0.179	32.8	1.134	24.57	1.2	341	2.45	6.21	0.579	24.46	7.6	0.112	0.427	N.A.	1.199	Y	0.713	58.4	1.5	9.1	1.28	6.22	0.481	51.25
14	6.02	0.179	33.6	1.130	24.49	1.2	341	2.45	6.36	0.590	25.54	8.3	0.111	0.444	N.A.	1.196	Y	0.732	56.4	1.6	9.9	1.26	6.80	0.488	49.50
15	6.16	0.179	34.4	1.126	24.40	0.7	341	2.45	6.52	0.602	26.65	9.0	0.111	0.460	N.A.	1.193	Y	0.743	54.4	1.7	10.8	1.25	7.40	0.494	47.79
16	6.30	0.179	35.2	1.122	24.31	0.7	341	2.45	6.67	0.614	27.78	9.8	0.110	0.474	N.A.	1.191	Y	0.754	52.5	1.9	11.6	1.24	8.01	0.498	46.10
17	6.44	0.179	36.0	1.118	24.22	0.7	341	2.45	6.82	0.626	28.93	10.5	0.110	0.488	N.A.	1.188	Y	0.766	50.5	2.0	12.5	1.22	8.63	0.501	44.44
18	6.58	0.179	36.8	1.113	24.12	0.7	341	2.45	6.97	0.639	30.10	11.3	0.110	0.501	N.A.	1.186	Y	0.778	48.6	2.1	13.4	1.21	9.26	0.503	42.81
19	6.72	0.179	37.5	1.109	24.03	0.7	341	2.45	7.13	0.651	31.30	12.1	0.110	0.512	N.A.	1.184	Y	0.790	46.8	2.2	14.3	1.20	9.90	0.503	41.21
20	6.86	0.179	38.3	1.105	23.93	0.7	341	2.45	7.28	0.664	32.52	12.9	0.110	0.523	N.A.	1.182	Y	0.803	45.0	2.3	15.2	1.19	10.56	0.503	39.65
21	7.00	0.179	39.1	1.100	23.84	0.7	341	2.45	7.43	0.678	33.76	13.7	0.109	0.534	N.A.	1.180	Y	0.815	43.2	2.5	16.2	1.18	11.23	0.503	38.11
22	7.14	0.179	39.9	1.096	23.74	0.7	341	2.45	7.58	0.691	35.02	14.5	0.109	0.543	N.A.	1.178	Y	0.828	41.5	2.6	17.1	1.17	11.92	0.502	36.60
23	7.28	0.179	40.7	1.091	23.64	0.7	341	2.45	7.74	0.776	36.31	15.4	0.120	0.559	N.A.	1.177	Y	0.905	39.8	2.7	18.1	1.16	12.62	0.501	35.12
24	7.42	0.179	41.5	1.086	23.54	0.7	341	2.45	7.89	0.790	37.62	16.3	0.120	0.569	N.A.	1.175	Y	0.918	38.1	2.9	19.1	1.15	13.40	0.502	33.67
25	7.56	0.179	42.2	1.081	23.43	0.7	341	2.45	8.04	0.805	38.95	17.2	0.120	0.579	N.A.	1.173	Y	0.931	36.4	3.0	20.2	1.14	14.20	0.502	32.25
26	7.70	0.179	43.0	1.077	23.33	0.7	341	2.45	8.19	0.819	40.31	18.2	0.120	0.588	N.A.	1.172	Y	0.945	34.9	3.1	21.3	1.13	15.01	0.501	30.87
27	7.84	0.179	43.8	1.072	23.22	0.7	341	2.45	8.35	0.834	41.69	19.1	0.120	0.596	N.A.	1.170	Y	0.958	33.3	3.2	22.4	1.12	15.84	0.500	29.51
28	7.98	0.179	44.6	1.067	23.11	0.7	341	2.45	8.50	0.850	43.09	20.1	0.120	0.604	N.A.	1.168	Y	0.972	31.8	3.4	23.4	1.12	16.68	0.499	28.18
29	8.12	0.179	45.4	1.062	23.00	0.7	341	2.45	8.65	0.865	44.51	21.1	0.120	0.612	N.A.	1.166	Y	0.986	30.3	3.5	24.6	1.11	17.53	0.497	26.88
30	8.26	0.179	46.1	1.056	22.89	0.7	341	2.45	8.80	0.881	45.96	22.0	0.120	0.619	N.A.	1.165	Y	1.000	28.8	3.6	25.7	1.10	18.41	0.495	25.61
31	8.40	0.179	46.9	1.051	22.78	0.7	341	2.45	8.96	0.896	47.43	23.1	0.120	0.625	N.A.	1.163	Y	1.015	27.4	3.8	26.8	1.09	19.30	0.535	24.37
32	8.10	0.179	45.3	1.046	22.66	0.7	341	2.45	8.63	0.911	44.35	24.1	0.127	0.694	N.A.	1.161	Y	1.029	26.0	3.9	28.0	1.11	20.20	0.575	23.16
33	8.24	0.179	46.1	1.040	22.54	0.7	341	2.45	8.79	0.927	45.80	25.1	0.127	0.699	N.A.	1.160	Y	1.043	24.7	4.0	29.1	1.10	21.12	0.570	21.98
34	8.38	0.179	46.8	1.035	22.42	0.7	341	2.45	8.94	0.943	47.26	26.2	0.127	0.704	N.A.	1.158	Y	1.057	23.4	4.1	30.3	1.09	22.05	0.565	20.84
35	8.52	0.179	47.6	1.029	22.29	0.7	341	2.45	9.09	0.959	48.75	27.2	0.127	0.709	N.A.	1.156	Y	1.071	22.1	4.3	31.5	1.09	23.00	0.560	19.73
36	8.66	0.179	48.4	1.023	22.17	0.7	341	2.45	9.24	0.976	50.26	28.3	0.127	0.713	N.A.	1.154	Y	1.086	20.9	4.4	32.7	1.08	23.97	0.556	18.66
37	8.80	0.179	49.2	1.017	22.04	0.7	341	2.45	9.40	0.992	51.80	29.4	0.127	0.718	N.A.	1.153	Y	1.100	19.7	4.5	33.9	1.07	24.95	0.551	17.62
38	8.94	0.179	50.0	1.011	21.90	0.7	341	2.45	9.55	1.010	53.36	30.5	0.127	0.721	N.A.	1.151	Y	1.115	18.6	4.6	35.1	1.07	25.96	0.546	16.61
39	9.08	0.179	50.7	1.005	21.77	0.7	341	2.45	9.70	1.027	54.94	31.6	0.127	0.725	N.A.	1.149	Y	1.130	17.5	4.7	36.3	1.06	26.97	0.541	15.63
40	9.22	0.179	51.5	0.998	21.63	0.7	341	2.45	9.85	1.044	56.54	32.8	0.127	0.729	N.A.	1.147	Y	1.145	16.4	4.8	37.6	1.06	28.01	0.536	14.69
41	9.36	0.179	52.3	0.992	21.49	0.7	341	2.45	10.01	1.062	58.17	33.9	0.127	0.732	N.A.	1.146	Y	1.160	15.4	4.9	38.9	1.05	29.06	0.531	13.78
42	9.50	0.179	53.1	0.985	21.34	0.7	341	2.45	10.16	1.080	59.82	35.1	0.128	0.735	N.A.	1.144	Y	1.176	14.4	5.0	40.1	1.04	30.13	0.526	12.90
43	9.64	0.179	53.9	0.978	21.19	0.7	341	2.45	10.31	1.099	61.49	36.3	0.128	0.738	N.A.	1.142	Y	1.191	13.4	5.2	41.4	1.04	31.22	0.521	12.05
44	9.78	0.179	54.7	0.971	21.04	0.7	341	2.45	10.46	1.117	63.18	37.5	0.128	0.740	N.A.	1.140	Y	1.206	12.5	5.3	42.7	1.03	32.33	0.517	11.24
45	9.92	0.179	55.4	0.964	20.88	0.7	341	2.45	10.62	1.136	64.90	38.7	0.128	0.743	N.A.	1.138	Y	1.222	11.6	5.4	44.0	1.03	33.46	0.512	10.45
46	10.06	0.179	56.2	0.956	20.72	0.7	341	2.45	10.77	1.155	66.64	39.9	0.129	0.745	N.A.	1.137	Y	1.238	10.8	5.5	45.4	1.02	34.60	0.507	9.69
47	10.20	0.179	57.0	0.948	20.55	0.7	341	2.45	10.92	1.175	68.40	41.2	0.129	0.747	N.A.	1.135	Y	1.254	10.0	5.5	46.7	1.02	35.77	0.503	8.97
48	10.34	0.179	57.8	0.940	20.38	0.7	341	2.45	11.07	1.195	70.19	42.4	0.129	0.749	N.A.	1.133	Y	1.269	9.2	5.6	48.1	1.01	36.95	0.498	8.27
49	10.48	0.179	58.6	0.932	20.20	0.7	341	2.45	11.23	1.215	72.00	43.7	0.130	0.751	N.A.	1.131	Y	1.285	8.4	5.7	49.4	1.01	38.16	0.494	7.61
50	10.62	0.179	59.4	0.924	20.01	0.7	341	2.45	11.38	1.235	73.83	45.0	0.130	0.753	N.A.	1.129	Y	1.301	7.7	5.8	50.8	1.00	39.38	0.489	6.97

51	10.76	0.179	60.1	0.915	19.82	0.7	341	2.45	11.53	1.255	75.68	46.3	0.131	0.755	N.A.	1.127	Y	1.318	7.1	5.9	52.2	1.00	40.63	0.485	6.37
52	10.90	0.179	60.9	0.906	19.62	0.7	341	2.45	11.68	1.276	77.56	47.6	0.131	0.757	N.A.	1.126	Y	1.334	6.4	6.0	53.6	1.00	41.89	0.481	5.79
53	11.04	0.179	61.7	0.896	19.41	0.7	341	2.45	11.84	1.297	79.46	49.0	0.132	0.758	N.A.	1.124	Y	1.350	5.8	6.1	55.0	0.99	43.18	0.477	5.24
54	11.18	0.179	62.5	0.886	19.20	0.7	341	2.45	11.99	1.319	81.38	50.3	0.132	0.760	N.A.	1.122	Y	1.366	5.2	6.1	56.5	0.99	44.49	0.473	4.72
55	11.32	0.179	63.3	0.876	18.97	0.7	341	2.45	12.14	1.340	83.32	51.7	0.132	0.761	N.A.	1.120	Y	1.382	4.7	6.2	57.9	0.98	45.82	0.469	4.23
56	11.46	0.179	64.0	0.865	18.74	0.7	341	2.45	12.29	1.362	85.29	53.1	0.133	0.763	N.A.	1.118	Y	1.398	4.2	6.3	59.4	0.98	47.17	0.465	3.77
57	11.60	0.179	64.8	0.853	18.49	0.7	341	2.45	12.45	1.384	87.28	54.5	0.133	0.764	N.A.	1.117	Y	1.415	3.7	6.4	60.8	0.98	48.54	0.461	3.33
58	11.74	0.179	65.6	0.849	18.39	0.7	341	2.45	12.60	1.472	89.29	56.0	0.140	0.769	N.A.	1.115	Y	1.492	3.2	6.4	62.4	0.97	49.94	0.458	2.92
59	11.88	0.179	66.4	0.849	18.39	0.7	341	2.45	12.75	1.494	91.33	57.5	0.141	0.770	N.A.	1.113	Y	1.509	2.8	6.5	63.9	0.97	51.42	0.454	2.54
60	12.02	0.179	67.2	0.849	18.39	0.7	341	2.45	12.90	1.517	93.39	59.0	0.141	0.772	N.A.	1.111	Y	1.526	2.4	6.5	65.5	0.96	52.92	0.451	2.19
61	12.16	0.179	68.0	0.849	18.39	0.7	341	2.45	13.06	1.680	95.47	60.6	0.154	0.782	N.A.	1.109	Y	1.822	2.1	6.6	67.2	0.96	54.45	0.449	1.86
62	12.30	0.179	68.7	0.849	18.39	0.7	341	2.45	13.21	1.704	97.57	62.5	0.155	0.786	N.A.	1.107	Y	1.840	1.7	6.7	69.1	0.96	56.15	0.447	1.56
63	12.44	0.179	69.5	0.849	18.39	0.7	341	2.45	13.36	1.728	99.70	64.3	0.155	0.790	N.A.	1.104	Y	1.857	1.4	6.7	71.0	0.95	57.86	0.445	1.29
64	12.58	0.179	70.3	0.849	18.39	0.7	341	2.45	13.51	1.752	101.85	66.2	0.156	0.794	N.A.	1.102	Y	1.874	1.1	6.8	72.9	0.95	59.60	0.443	1.04
65	12.72	0.179	71.1	0.849	18.39	0.7	341	2.45	13.67	1.776	104.02	68.1	0.156	0.798	N.A.	1.100	Y	1.892	0.9	6.8	74.9	0.95	61.36	0.441	0.82
66	12.86	0.179	71.9	0.849	18.39	0.7	341	2.45	13.82	1.800	106.21	70.0	0.156	0.801	N.A.	1.098	Y	1.910	0.7	6.8	76.8	0.95	63.15	0.439	0.63
67	13.00	0.179	72.6	0.849	18.39	0.7	341	2.45	13.97	1.825	108.43	71.9	0.157	0.805	N.A.	1.096	Y	1.928	0.5	6.9	78.8	0.94	64.96	0.437	0.46
68	13.14	0.179	73.4	0.849	18.39	0.7	341	2.45	14.12	1.850	110.67	73.8	0.157	0.808	N.A.	1.093	Y	1.946	0.4	6.9	80.7	0.94	66.80	0.435	0.32
69	13.28	0.179	74.2	0.849	18.39	0.7	341	2.45	14.28	1.876	112.93	75.8	0.158	0.811	N.A.	1.091	Y	1.965	0.2	6.9	82.7	0.94	68.66	0.433	0.20
70	13.42	0.179	75.0	0.849	18.39	0.7	341	2.45	14.43	1.901	115.22	77.8	0.158	0.814	N.A.	1.089	Y	1.983	0.1	6.9	84.7	0.93	70.55	0.431	0.11
71	13.56	0.179	75.8	0.849	18.39	0.7	341	2.45	14.58	1.927	117.53	79.7	0.159	0.817	N.A.	1.087	NA	2.002	0.1	7.0	86.7	0.93	72.47	0.429	0.05
72	13.70	0.179	76.6	0.849	18.39	0.7	341	2.45	14.73	1.953	119.86	81.8	0.159	0.820	N.A.	1.085	NA	2.021	0.0	7.0	88.7	0.93	74.41	0.427	0.01
73	13.84	0.179	77.3	0.849	18.39	0.7	341	2.45	14.89	1.980	122.21	83.8	0.160	0.822	N.A.	1.083	NA	2.040	0.0	7.0	90.8	0.93	76.37	0.000	0.00

Reference: 2019 CBC, ASCE 7-16

INPUT:

Job Location:	Petaluma, CA		
Site Class	D		Per Soil Report
0.2 Sec MCE, Ss	1.860	g	Per Soil Report
1.0 Sec MCE, S_1	0.710	g	Per Soil Report
$S_{MS} = F_a S_S$	1.700	g	Per Soil Report
$S_{M1} = Fv S_1$	1.550	g	Per Soil Report
$S_{DS} = 2/3S_{MS}$	1.133	g	Per Soil Report
$S_{D1} = 2/3S_{M1}$	1.033	g	Per Soil Report
Ts =S_{D1}/S_{DS}	0.912	sec	
Long Period transition period, T_L	8.0	sec	ASCE 7-16 -Figure 22-12
Risk Category	II		Table 1604.5
Seismic Design Category	D		2019 CBC Section 1613.3.5

OUTPUT:

Light Pole Class	LS70-B		
Fundamental Period, T	2.79	sec	See structural calculations, pg 6
Seismic coeff., R	1.5		ASCE 7-16 Table 15.4-2
Overstrength Factor, Ω	1.5		ASCE 7-16 Table 15.4-2
Importance Factor, I	1.00		ASCE 7-16 Section 15.4.1.1 & Table 1.5-2
Redundancy factor, ρ	1.0		ASCE 7-16 Section 15.6
DESIGN SEISMIC FORCE			
$V = C_S W$			ASCE 7-16 Eqn. 12.8-1
$C_S = S_{DS}/(R/I)$ for $T \leq T_S$	0.756	g	ASCE 7-16 Eqn. 12.8-2
C_S max. for $T \leq T_L$, $C_S = S_{D1}/T(R/I)$	0.247	g	ASCE 7-16 Eqn. 12.8-3
C_S min = $0.044 S_{DS} I \geq 0.03$	0.050	g	ASCE 7-16 Eqn. 15.4-1
if $S_1 \geq 0.6g$, C_S min = $0.8 S_1/(R/I)$	0.379	g	ASCE 7-16 Eqn. 15.4-2
Load Combination, 1.2D+ 1.0E			ASCE 7-16 Section 2.3.2 Load Comb 5
where E = Eh + Ev			ASCE 7-16 Eqn. 12.4-1
and Eh = pQ_E	0.379	W	ASCE 7-16 Eqn. 12.4-3
and Ev = $0.2S_{DS}D$	0.227	D	ASCE 7-16 Eqn. 12.4-4
Load Combination, $1.2D + (pQe + 0.2S_{DS}D)$			

Load Combination, $1.2D + (pQe + 0.2S_{DS}D)$ 1.427 D + 0.379 W

Total Seismic Weight, W = 2.504 kips See following page

SEISMIC SHEAR, V = 1.150 kips < 2.029 kips WIND SHEAR WIND CONTROLS

Vertical Distribution of Seismic Force, $F_{x} =$ $C_{vx}V$ ASCE7-16 Eqn. 12.8-11 & Section 12.8.5

k= 2.000

Item	w	h_x	$w_xh_x^k$	$w_xh_x^k/\sum w_xh_x^k$	Cvx*V	OTM
fixtures	0.464	70.5	2306	0.557	0.528	37.22
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
Top Pole Section	0.034	68.5	160	0.039	0.037	2.50
2nd Pole Section	0.357	53.25	1012	0.244	0.232	12.34
1st Pole Section	0.839	22	406	0.098	0.093	2.05
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
LED400	0.071	50.00	178	0.043	0.041	2.03
LED575	0.065	15.00	15	0.004	0.003	0.05
ECE	0.140	15.00	32	0.008	0.007	0.11
1/2 Precast base above grade	0.534	8.00	34	0.008	0.008	0.06
Sum	2.504		4142	1.000	0.948	56.36
Total Dead Load at grade	3.038					

SEISMIC OTM = 56.36 kip-ft < 89.52 kip-ft Wind OTM WIND CONTROLS

Cretex
Concrete Products, Inc.

CRETEX CONCRETE PRODUCTS, INC.

SCOPE: Analysis of an annular prestressed concrete pole member based on compatible strain procedure per ACI-318-11 with an ultimate concrete strain of 0.003.
PROJECT: Musco Standard Pole Base
DATE: May-14-2014 9:49 AM
POLE TYPE = 3B

PROGRAM VERSION 2.3 Standard

USER DEFINED INPUTS

CROSS-SECTION OUTER DIAMTER = D_o =	**13.32**	INCHES
HOLLOW CORE INSIDE DIAMETER = D_i =	**6.125**	INCHES
TENDON CIRCLE DIAMETER = D_t =	**10.32**	INCHES
NUMBER OF TENDONS = N (56 or less and even)	**12**	
TENDON DIAMETER = d_t =	**0.5**	INCHES
NOMINAL TENDON AREA = A_{ps} =	**0.1531**	IN^2
ULTIMATE TENDON STRENGTH = f_{pu} =	**270**	KSI
TENDON YIELD STRENGTH = f_{py} =	**230**	KSI
CONCRETE COMPRESSIVE STRENGTH = F'_c =	**9500**	PSI
MODULUS OF ELASTICITY - STEEL = E_s =	**29000**	KSI
INITIAL PRESTESS FACTOR = IPF =	**0.64**	
PRESTRESS LOSS FACTOR = PLF =	**0.82**	
*PHI FACTOR USED =	**0.9**	

OUTPUT

PHI FACTOR = ϕ =	0.90		
PRESTESSING STRAIN IN TENDON = ε_{se} =	0.0049		
CONCRETE SERVICE STRESS DUE TO PRESTRESS =	2369	PSI	
CROSS SECTIONAL AREA =	110	IN^2	
GROSS MOMENT OF INERTIA =	1476	IN^4	
DISTANCE TO NEUTRAL AXIS FROM COMP. SIDE = c =	6.15	INCHES	
CONCRETE COMPRESSIVE FORCE =	274	KIPS	
AREA OF BONDED REINFORCEMENT =	1.84	IN^2	
MINIMUM BONDED REINFORCEMENT AREA =	0.22	IN^2	**SATISFIED**
REINFORCEMENT RATIO = ρ_p =	0.0207		
REINFORCEMENT INDEX = ω =	0.3756		
MAXIMUM REINFORCEMENT INDEX =	0.2340		**EXCEEDED**
STRAND DEVELOPMENT LENGTH = L_d =	64	INCHES	

RESULTS

NOMINAL MOMENT CAPACITY = M_n =	128	FT-KIPS	
DESIGN MOMENT CAPACITY = ϕM_n =	**115**	FT-KIPS	
CRACKING LOAD MOMENT =	57	FT-KIPS	**SATISFIED**

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KNA STRUCTURAL ENGINEERS

POLE DESIGNATION:	LSS70-C W/ 7 FIXTURES		JOB NO:	363.787
MANUFACTURER:	MUSCO		PROJECT:	Petaluma Community Sports Field
PROJECT NO:	188270		LOCATION:	Petaluma, CA

ASCE 7-16
WIND CRITERIA 92 MPH,EXP C
LOAD COMB 1.2 DEAD + 1.0 WIND

POLE ID: B1
(B2 Sim.)

LED	**1500**		
EPA/FIXTURE*, Af	=	3.2	ft2
D.L./FIXTURE**	=	103.0	lbs
D.L. ECE/FIXTURE***	=	20.0	lbs

** EPA = EFFECTIVE PROJECTED AREA OF LIGHT FIXTURE INCLUDING CROSSARM, PER MUSCO*
*** D.L.= DEAD LOAD OF FIXTURE, & CROSSARM, PER MUSCO*
****D.L.= DEAD LOAD OF ECE, PER MUSCO*

```
  | P = SUPERIMPOSED WT + POLE WT
  v
^ |||a    <--   <--FIXTURES, F/Af= qz*Gf*Cf    =       31.86  PSF MAX   (29.4-1)
| |v|     <--   <--where qz=.00256*Kz*Kzt*Kd*Ke(V)^2   25.57  PSF MAX   (26.10-1)
| |||     <--   <---
| |v|     <--
| |||     <--
| |v|     <--
  |||     <--
l |v|     <--
  |||     <--
| |v|     <--
| |||     <--
| |v|     <--
| |||     <--
| |v|     <--
| |||     <--
| |v|     <--
v_|_|b    <--
              POLE, F/Af= qz*Gf*Cf  =                  22.31  PSF MAX   (29.4-1)
              where qz=.00256*Kz*Kzt*Kd*Ke(V)^2 =      25.57  PSF MAX   (26.10-1)

        LOADING DIAGRAM
```

ATTACHMENT TYPE	NUMBER	DIST. FROM TOP POLE,FT	PA SQ FT	Cf	EPA SQ FT	Kz	qz PSF	WIND,F LBS	WEIGHT,P LBS
LED1500	7.0	0.5		1.0	3.21	1.178	25.53	715	721
	0.0	3.0		1.3	3.21	1.170	25.34	0	0
	0.0	5.5		1.3	3.21	1.160	25.14	0	0
	0.0	8.0		1.3	3.21	1.151	24.94	0	0
	0.0	10.5		1.3	3.21	1.141	24.73	0	0
	0.0	13.0		1.3	3.21	1.131	24.52	0	0
	0.0	15.5		1.3	3.21	1.121	24.29	0	0
	0.0	18.0		1.3	3.21	1.110	24.06	0	0
	0.0	20.5		1.3	3.21	1.099	23.82	0	0
LED575	1.0	56.7	1.98	1.3	2.57	0.849	18.39	59	65
ECE	8.0	60.0	9.00	1.3	11.70	0.849	18.39	268	160
							TOTALS =	1042	946

INPUT

-> l = 71.72 ft. (ht. from adj. grade)
-> l = 71.72 ft. (ht. from grade)
->tA = 0.125 in. (pole thk. @ top)
->dA = 7.00 in. (pole diam. @ top)
->dB = 15.75 in. (pole diam. @ btm)
->tB = 0.179 in. (pole thk. @ btm)
->Fy = 38.0 ksi (fixt mount sect. = 5.25 ft)
->Fy = 55.0 ksi (other pole sect.)
-> E = 29,000 ksi
->Kzt= 1 ***(Figure 26.8-1)***
->Kd = 1 ***(Table 26.6-1)***
-> Kz = 1.180 MAX-EXP C @ 71.7 FT. ***(Table 26.10-1)***
->Ke = 1.00 ***(Table 26.9-1)***
-> Cf = 1.00 LIGHT FIXTURE (INCLUDED IN EPA)
-> Cf = 0.700 MAX (VARIES 0.5-1.2 FOR RND POLE) ***(Figure 29.5-1)***
POLE DAMPING, beta= 0.025 ***Per Musco test***

OUTPUT

-> POLE NATURAL FREQUENCY = 0.425 Hz ***1/(2PI*(DELTA/386)^0.5) where DELTA is due to self weight***
-> Gf= 1.25 ***(Section 26.11.5)*** ***(Reference Vibration Problems in Engineering by Timoshenko, 4th ED. pg.34)***

Pole Properties:

Ia =	15.96	in4	taper =	0.140	in/ft
Ib =	265	in4	db/da =	2.250	
ra =	2.431	in	rb =	5.506	in.
Aa =	2.700	in2	Ab =	8.76	in2
Sa =	4.56	in3	Sb =	33.70	in3

From Critical Buckling Loads of Tapered Columns, ASCE 2/62:
n = Log (Ib/(Ia)/Log (dB/dA) = 3.47
P* = (Ib/Ia)/(Ib/Ia)^.333 = 6.5
kl/req* (1/(P*)^.5)[kl/ra] = 291 (where k= 2.1)

AISC 360-16 Specification Table B4.1, Case 15

for Fy = 55.0 KSI		38	KSI
D/t < .45E/Fy =	237	343	(MAX)
D/t < .31E/Fy =	163	237	Noncompact
D/t < .07E/Fy =	37	53	Compact
D/t < .11E/Fy =	58	84	Slender element Section for Uniform Compr

Section 26.11.5 Gust-Effect Factor

constant epsilon,e	=	0.2	Lz	=	527.3
constant l	=	500	N1	=	2.451
Vz	=	91.36	Rn	=	0.079
4.6n1h/Vz	=	1.533			
4.6n1B/Vz	=	0.020	R	=	1.171
15.4n1L/Vz	=	0.068	g_R	=	3.980
			c	=	0.200
Rh	=	0.449	Iz	=	0.191
RB	=	0.987	Q	=	0.920
RL	=	0.956	G	=	0.886
		Gf = 1.246			

SHEAR,F=	**1.373 *KIPS***	**MOMENT, M =**	**61.35**	***K-FT***	**e= M/F =**	**44.70 *FT***	**AXIAL,P =**	**2.483 *KIPS***	**ASD Forces at groundline (for foundation design)**
SHEAR,F=	**2.288 *KIPS***	**MOMENT, M =**	**102.26**	***K-FT***	**e= M/F =**	**44.70 *FT***	**AXIAL,P =**	**2.979 *KIPS***	**Nominal Forces at groundline**

M < ΦMn= 159 K-FT Precast Base O.K.
Pole Stress Check = 0.676 Max. < 1 Pole O.K.
Max. Deflection = 53.273 Inch <0.10H= 86 Inch AASHTO 10.4.2

Distance from top of Pole FT	Outside Diameter of Pole,D IN	Pole thick,t IN	D/t	Kz	qz PSF	Cf Pole	kl/r eqiv.	E3-4 Fe	E3-2 or E3-3 Design comp strength, Pr KIPS	Acting unfactored, Pr KIPS	F8.1-F8.4 Design fle trength, M K-FT	eq'd flex. trength, M K-FT	Pr/Pc	H1-1b for Pr/Pc <0.2	H1-1a for Pr/Pc ≥ 0.2	2nd Order /1st Order Moment FT-K	CSR O.K.	Req'd shea trength,, KIPS	1st Order Delta IN	C2.2a P-Delta Moment FT-K	Total 2nd Order Moment FT-K	E7-19 Q	ACTING MOM DUE TO DL	M/I	DEFL DUE TO DL IN
0	7.00	0.125	56.0	1.180	25.57	0.7	291	3.37	7.19	0.000	16.71	0.0	0.000	0.000	N.A.	1.000	Y	0.000	53.3	0.0	0.0	1.185	0.00	0.000	54.22
1	7.00	0.125	56.0	1.177	25.49	0.7	291	3.37	7.19	0.730	16.71	0.4	0.122	0.089	N.A.	1.269	Y	0.728	51.9	0.1	0.5	1.185	0.00	0.023	52.88
2	7.00	0.125	56.0	1.173	25.42	0.7	291	3.37	7.19	0.739	16.71	1.1	0.123	0.139	N.A.	1.179	Y	0.741	50.6	0.2	1.3	1.185	0.74	0.070	51.54
3	7.00	0.125	56.0	1.170	25.34	0.7	291	3.37	7.19	0.749	16.71	1.8	0.125	0.191	N.A.	1.161	Y	0.754	49.3	0.3	2.1	1.185	1.48	0.117	50.20
4	7.00	0.125	56.0	1.166	25.26	0.7	291	3.37	7.19	0.758	16.71	2.6	0.126	0.243	N.A.	1.153	Y	0.767	47.9	0.4	3.0	1.185	2.24	0.164	48.86
5	7.00	0.125	56.0	1.162	25.18	0.7	291	3.37	7.19	0.771	16.71	3.4	0.129	0.296	N.A.	1.148	Y	0.779	46.6	0.5	3.9	1.185	3.00	0.167	47.54
6	7.36	0.179	41.1	1.159	25.10	0.7	291	3.37	10.75	0.785	37.03	4.2	0.088	0.173	N.A.	1.145	Y	0.793	45.3	0.6	4.8	1.154	3.78	0.155	46.22
7	7.50	0.179	41.9	1.155	25.02	0.7	291	3.37	10.96	0.800	38.35	5.0	0.088	0.192	N.A.	1.142	Y	0.806	44.0	0.7	5.7	1.145	4.57	0.175	44.91
8	7.64	0.179	42.7	1.151	24.94	0.7	291	3.37	11.17	0.814	39.70	5.8	0.087	0.210	N.A.	1.140	Y	0.820	42.7	0.8	6.6	1.136	5.38	0.193	43.62
9	7.78	0.179	43.4	1.147	24.86	0.7	291	3.37	11.38	0.829	41.07	6.6	0.087	0.227	N.A.	1.139	Y	0.834	41.4	0.9	7.5	1.128	6.20	0.208	42.33
10	7.92	0.179	44.2	1.143	24.77	0.7	291	3.37	11.59	0.844	42.46	7.4	0.087	0.243	N.A.	1.138	Y	0.848	40.2	1.0	8.5	1.12	7.03	0.223	41.06
11	8.06	0.179	45.0	1.139	24.69	0.7	291	3.37	11.80	0.860	43.87	8.3	0.087	0.259	N.A.	1.136	Y	0.862	38.9	1.1	9.4	1.112	7.89	0.235	39.80
12	8.20	0.179	45.8	1.135	24.60	0.7	291	3.37	12.01	0.875	45.31	9.2	0.087	0.273	N.A.	1.135	Y	0.877	37.7	1.2	10.4	1.104	8.75	0.247	38.55
13	8.34	0.179	46.6	1.131	24.52	0.7	291	3.37	12.22	0.891	46.77	10.1	0.087	0.288	N.A.	1.134	Y	0.891	36.5	1.3	11.4	1.097	9.64	0.257	37.32
14	8.48	0.179	47.4	1.127	24.43	0.7	291	3.37	12.43	0.907	48.25	11.0	0.088	0.301	N.A.	1.133	Y	0.906	35.3	1.5	12.4	1.09	10.54	0.267	36.10
15	8.62	0.179	48.1	1.123	24.34	0.7	291	3.37	12.64	0.924	49.75	11.9	0.088	0.314	N.A.	1.132	Y	0.921	34.1	1.6	13.4	1.083	11.45	0.275	34.90
16	8.76	0.179	48.9	1.119	24.25	0.7	291	3.37	12.85	0.940	51.28	12.8	0.088	0.326	N.A.	1.131	Y	0.937	32.9	1.7	14.5	1.076	12.38	0.283	33.72
17	8.90	0.179	49.7	1.115	24.15	0.7	291	3.37	13.06	0.957	52.83	13.7	0.088	0.338	N.A.	1.130	Y	0.952	31.7	1.8	15.5	1.07	13.33	0.289	32.55
18	9.04	0.179	50.5	1.110	24.06	0.7	291	3.37	13.27	0.974	54.41	14.7	0.088	0.349	N.A.	1.129	Y	0.968	30.6	1.9	16.6	1.064	14.30	0.295	31.39
19	9.18	0.179	51.3	1.106	23.97	0.7	291	3.37	13.48	0.992	56.00	15.7	0.088	0.360	N.A.	1.128	Y	0.984	29.5	2.0	17.7	1.057	15.28	0.301	30.26
20	9.32	0.179	52.1	1.102	23.87	0.7	291	3.37	13.69	1.010	57.62	16.7	0.089	0.370	N.A.	1.127	Y	1.000	28.4	2.1	18.8	1.052	16.28	0.306	29.14
21	9.46	0.179	52.8	1.097	23.77	0.7	291	3.37	13.90	1.028	59.26	17.7	0.089	0.380	N.A.	1.126	Y	1.016	27.3	2.2	19.9	1.046	17.30	0.310	28.04
22	9.60	0.179	53.6	1.092	23.67	0.7	291	3.37	14.11	1.046	60.93	18.7	0.089	0.390	N.A.	1.125	Y	1.032	26.2	2.3	21.0	1.04	18.34	0.314	26.96
23	9.74	0.179	54.4	1.088	23.57	0.7	291	3.37	14.32	1.065	62.61	19.7	0.089	0.399	N.A.	1.124	Y	1.049	25.2	2.5	22.2	1.035	19.39	0.317	25.90
24	9.88	0.179	55.2	1.083	23.47	0.7	291	3.37	14.53	1.083	64.32	20.8	0.089	0.408	N.A.	1.123	Y	1.066	24.2	2.6	23.4	1.03	20.46	0.321	24.86
25	10.02	0.179	56.0	1.078	23.36	0.7	291	3.37	14.74	1.102	66.05	21.9	0.090	0.417	N.A.	1.122	Y	1.083	23.2	2.7	24.5	1.025	21.56	0.323	23.84
26	10.16	0.179	56.7	1.073	23.26	0.7	291	3.37	14.95	1.122	67.81	23.0	0.090	0.425	N.A.	1.121	Y	1.100	22.2	2.8	25.7	1.02	22.67	0.326	22.83
27	10.30	0.179	57.5	1.068	23.15	0.7	291	3.37	15.16	1.141	69.59	24.1	0.090	0.433	N.A.	1.120	Y	1.117	21.2	2.9	27.0	1.015	23.80	0.328	21.85
28	10.44	0.179	58.3	1.063	23.04	0.7	291	3.37	15.37	1.161	71.39	25.2	0.091	0.440	N.A.	1.119	Y	1.134	20.3	3.0	28.2	1.01	24.95	0.330	20.88
29	10.58	0.179	59.1	1.058	22.93	0.7	291	3.37	15.58	1.182	73.21	26.3	0.091	0.448	N.A.	1.118	Y	1.152	19.3	3.1	29.5	1.006	26.12	0.331	19.93
30	10.72	0.179	59.9	1.053	22.81	0.7	291	3.37	15.79	1.201	75.06	27.5	0.091	0.455	N.A.	1.117	Y	1.169	18.4	3.2	30.7	1.001	27.31	0.355	19.01
31	10.42	0.179	58.2	1.048	22.70	0.7	291	3.37	15.34	1.221	71.18	28.7	0.096	0.497	N.A.	1.116	Y	1.187	17.5	3.3	32.0	1.011	28.53	0.378	18.10
32	10.56	0.179	59.0	1.042	22.58	0.7	291	3.37	15.55	1.241	73.00	29.9	0.096	0.504	N.A.	1.115	Y	1.204	16.7	3.4	33.3	1.006	29.76	0.378	17.22
33	10.70	0.179	59.8	1.036	22.46	0.7	291	3.37	15.76	1.262	74.84	31.1	0.096	0.511	N.A.	1.114	Y	1.221	15.8	3.5	34.6	1.002	31.01	0.379	16.35
34	10.84	0.179	60.6	1.031	22.33	0.7	291	3.37	15.97	1.282	76.71	32.3	0.096	0.517	N.A.	1.113	Y	1.239	15.0	3.7	36.0	0.997	32.28	0.379	15.51
35	10.98	0.179	61.3	1.025	22.21	0.7	291	3.37	16.18	1.303	78.60	33.6	0.097	0.523	N.A.	1.112	Y	1.257	14.2	3.8	37.3	0.993	33.57	0.379	14.70
36	11.12	0.179	62.1	1.019	22.08	0.7	291	3.37	16.39	1.324	80.51	34.8	0.097	0.529	N.A.	1.111	Y	1.274	13.5	3.9	38.7	0.989	34.89	0.379	13.90
37	11.26	0.179	62.9	1.013	21.95	0.7	291	3.37	16.60	1.346	82.44	36.1	0.097	0.535	N.A.	1.110	Y	1.292	12.7	4.0	40.1	0.985	36.22	0.378	13.13
38	11.40	0.179	63.7	1.007	21.81	0.7	291	3.37	16.81	1.368	84.40	37.4	0.098	0.540	N.A.	1.109	Y	1.310	12.0	4.1	41.5	0.981	37.58	0.378	12.38
39	11.54	0.179	64.5	1.000	21.68	0.7	291	3.37	17.02	1.390	86.38	38.7	0.098	0.546	N.A.	1.107	Y	1.328	11.3	4.2	42.9	0.977	38.96	0.377	11.66
40	11.68	0.179	65.3	0.994	21.53	0.7	291	3.37	17.23	1.412	88.38	40.1	0.098	0.551	N.A.	1.106	Y	1.346	10.6	4.3	44.3	0.974	40.36	0.377	10.95
41	11.82	0.179	66.0	0.987	21.39	0.7	291	3.37	17.44	1.434	90.41	41.4	0.099	0.556	N.A.	1.105	Y	1.365	9.9	4.3	45.8	0.97	41.78	0.376	10.27
42	11.96	0.179	66.8	0.980	21.24	0.7	291	3.37	17.65	1.457	92.46	42.8	0.099	0.561	N.A.	1.104	Y	1.383	9.3	4.4	47.2	0.967	43.22	0.376	9.61
43	12.10	0.179	67.6	0.973	21.09	0.7	291	3.37	17.86	1.480	94.53	44.2	0.099	0.565	N.A.	1.103	Y	1.401	8.7	4.5	48.7	0.963	44.69	0.375	8.97
44	12.24	0.179	68.4	0.966	20.93	0.7	291	3.37	18.07	1.504	96.62	45.6	0.100	0.570	N.A.	1.101	Y	1.420	8.1	4.6	50.2	0.96	46.19	0.374	8.36
45	12.38	0.179	69.2	0.959	20.77	0.7	291	3.37	18.28	1.527	98.74	47.0	0.100	0.574	N.A.	1.100	Y	1.439	7.5	4.7	51.7	0.956	47.70	0.373	7.77
46	12.52	0.179	69.9	0.951	20.60	0.7	291	3.37	18.49	1.551	100.88	48.5	0.101	0.578	N.A.	1.099	Y	1.457	6.9	4.8	53.3	0.953	49.24	0.372	7.20
47	12.66	0.179	70.7	0.943	20.43	0.7	291	3.37	18.70	1.575	103.04	49.9	0.101	0.583	N.A.	1.098	Y	1.476	6.4	4.9	54.8	0.95	50.80	0.371	6.65
48	12.80	0.179	71.5	0.935	20.26	0.7	291	3.37	18.91	1.600	105.22	51.4	0.102	0.587	N.A.	1.096	Y	1.495	5.9	5.0	56.4	0.947	52.39	0.370	6.12
49	12.94	0.179	72.3	0.926	20.07	0.7	291	3.37	19.12	1.624	107.43	52.9	0.102	0.591	N.A.	1.095	Y	1.513	5.4	5.0	58.0	0.944	54.00	0.369	5.62
50	13.08	0.179	73.1	0.918	19.88	0.7	291	3.37	19.33	1.649	109.66	54.5	0.102	0.594	N.A.	1.094	Y	1.532	4.9	5.1	59.6	0.941	55.64	0.368	5.14

51	13.22	0.179	73.9	0.909	19.69	0.7	291	3.37	19.54	1.675	111.91	56.0	0.103	0.598	N.A.	1.093	Y	1.551	4.5	5.2	61.2	0.938	57.30	0.367	4.68
52	13.36	0.179	74.6	0.899	19.48	0.7	291	3.37	19.75	1.700	114.19	57.6	0.103	0.602	N.A.	1.091	Y	1.570	4.1	5.3	62.8	0.935	58.99	0.366	4.24
53	13.50	0.179	75.4	0.889	19.27	0.7	291	3.37	19.96	1.726	116.49	59.1	0.104	0.605	N.A.	1.090	Y	1.589	3.7	5.3	64.5	0.932	60.70	0.365	3.83
54	13.64	0.179	76.2	0.879	19.05	0.7	291	3.37	20.17	1.752	118.81	60.7	0.104	0.609	N.A.	1.089	Y	1.608	3.3	5.4	66.1	0.93	62.44	0.363	3.43
55	13.78	0.179	77.0	0.869	18.82	0.7	291	3.37	20.38	1.778	121.15	62.4	0.105	0.612	N.A.	1.088	Y	1.626	2.9	5.5	67.8	0.927	64.20	0.362	3.06
56	13.92	0.179	77.8	0.857	18.58	0.7	291	3.37	20.58	1.805	123.52	64.0	0.105	0.615	N.A.	1.086	Y	1.645	2.6	5.5	69.5	0.924	65.99	0.361	2.71
57	14.06	0.179	78.6	0.849	18.39	0.7	291	3.37	20.79	1.897	125.91	65.7	0.109	0.621	N.A.	1.085	Y	1.723	2.3	5.6	71.3	0.922	67.81	0.360	2.38
58	14.20	0.179	79.3	0.849	18.39	0.7	291	3.37	21.00	1.924	128.32	67.4	0.110	0.624	N.A.	1.084	Y	1.742	2.0	5.6	73.0	0.919	69.72	0.359	2.07
59	14.34	0.179	80.1	0.849	18.39	0.7	291	3.37	21.21	1.951	130.75	69.2	0.110	0.628	N.A.	1.082	Y	1.761	1.7	5.7	74.9	0.917	71.66	0.358	1.79
60	14.48	0.179	80.9	0.849	18.39	0.7	291	3.37	21.42	1.979	133.21	70.9	0.111	0.631	N.A.	1.081	Y	1.780	1.5	5.7	76.7	0.914	73.62	0.358	1.52
61	14.62	0.179	81.7	0.849	18.39	0.7	291	3.37	21.63	2.167	135.69	72.9	0.120	0.640	N.A.	1.080	Y	2.068	1.2	5.8	78.6	0.912	75.62	0.357	1.28
62	14.76	0.179	82.5	0.849	18.39	0.7	291	3.37	21.84	2.195	138.19	74.9	0.121	0.645	N.A.	1.078	Y	2.087	1.0	5.8	80.8	0.91	77.80	0.357	1.06
63	14.90	0.179	83.2	0.849	18.39	0.7	291	3.37	22.05	2.223	140.72	77.0	0.121	0.650	N.A.	1.076	Y	2.107	0.8	5.9	82.9	0.907	80.01	0.357	0.85
64	15.04	0.179	84.0	0.849	18.39	0.7	291	3.37	22.26	2.252	143.27	79.1	0.121	0.654	N.A.	1.075	Y	2.127	0.6	5.9	85.1	0.905	82.24	0.356	0.68
65	15.18	0.179	84.8	0.849	18.39	0.7	291	3.37	22.47	2.281	145.84	81.3	0.122	0.659	N.A.	1.073	Y	2.147	0.5	6.0	87.2	0.903	84.51	0.356	0.52
66	15.32	0.179	85.6	0.849	18.39	0.7	291	3.37	22.68	2.310	148.43	83.4	0.122	0.664	N.A.	1.072	Y	2.168	0.4	6.0	89.4	0.901	86.81	0.355	0.38
67	15.46	0.179	86.4	0.849	18.39	0.7	291	3.37	22.89	2.340	151.05	85.6	0.123	0.668	N.A.	1.070	Y	2.188	0.3	6.0	91.6	0.899	89.13	0.355	0.26
68	15.60	0.179	87.2	0.849	18.39	0.7	291	3.37	23.10	2.369	153.69	87.8	0.123	0.672	N.A.	1.069	Y	2.209	0.2	6.0	93.9	0.897	91.48	0.355	0.17
69	15.74	0.179	87.9	0.849	18.39	0.7	291	3.37	23.31	2.399	156.35	90.0	0.124	0.676	N.A.	1.067	Y	2.230	0.1	6.1	96.1	0.895	93.87	0.354	0.09
70	15.88	0.179	88.7	0.849	18.39	0.7	291	3.37	23.52	2.430	159.03	92.3	0.124	0.680	N.A.	1.066	NA	2.251	0.0	6.1	98.3	0.893	96.28	0.353	0.04
71	16.02	0.179	89.5	0.849	18.39	0.7	291	3.37	23.73	2.460	161.74	94.5	0.124	0.684	N.A.	1.064	NA	2.272	0.0	6.1	100.6	0.891	98.73	0.353	0.01
72	16.16	0.179	90.3	0.849	18.39	0.7	291	3.37	23.94	2.491	164.47	96.8	0.125	0.688	N.A.	1.063	NA	2.294	0.0	6.1	102.9	0.889	101.20	0.000	0.00

Reference: 2019 CBC, ASCE 7-16

INPUT:

Job Location:	Petaluma, CA		
Site Class	D		Per Soil Report
0.2 Sec MCE, Ss	1.860	g	Per Soil Report
1.0 Sec MCE, S_1	0.710	g	Per Soil Report
$S_{MS} = F_a S_S$	1.700	g	Per Soil Report
$S_{M1} = Fv S_1$	1.550	g	Per Soil Report
$S_{DS} = 2/3 S_{MS}$	1.133	g	Per Soil Report
$S_{D1} = 2/3 S_{M1}$	1.033	g	Per Soil Report
$Ts = S_{D1}/S_{DS}$	0.912	sec	
Long Period transition period, T_L	8.0	sec	ASCE 7-16 -Figure 22-12
Risk Category	II		Table 1604.5
Seismic Design Category	D		2019 CBC Section 1613.3.5

OUTPUT:

Light Pole Class	LS70-C		
Fundamental Period, T	2.35	sec	See structural calculations, pg 12
Seismic coeff., R	1.5		ASCE 7-16 Table 15.4-2
Overstrength Factor, Ω	1.5		ASCE 7-16 Table 15.4-2
Importance Factor, I	1.00		ASCE 7-16 Section 15.4.1.1 & Table 1.5-2
Redundancy factor, ρ	1.0		ASCE 7-16 Section 15.6
DESIGN SEISMIC FORCE			
$V = C_S W$			ASCE 7-16 Eqn. 12.8-1
$C_S = S_{DS}/(R/I)$ for $T \leq T_S$	0.756	g	ASCE 7-16 Eqn. 12.8-2
C_S max. for $T \leq T_L$, $C_S = S_{D1}/T(R/I)$	0.293	g	ASCE 7-16 Eqn. 12.8-3
C_S min = $0.044 S_{DS} I \geq 0.03$	0.050	g	ASCE 7-16 Eqn. 15.4-1
if $S_1 \geq 0.6g$, C_S min = $0.8 S_1/(R/I)$	0.379	g	ASCE 7-16 Eqn. 15.4-2
Load Combination, 1.2D+ 1.0E			ASCE 7-16 Section 2.3.2 Load Comb 5
where E = Eh + Ev			ASCE 7-16 Eqn. 12.4-1
and $Eh = pQ_E$	0.379	W	ASCE 7-16 Eqn. 12.4-3
and $Ev = 0.2 S_{DS} D$	0.227	D	ASCE 7-16 Eqn. 12.4-4
Load Combination, $1.2D + (pQe + 0.2 S_{DS} D)$			

Load Combination, $1.2D + (pQe + 0.2 S_{DS} D)$	1.427	D	+	0.379	W

Total Seismic Weight, W =	3.201	kips	See following page

SEISMIC SHEAR, V =	1.467	kips	<	2.288	kips WIND SHEAR	WIND CONTROLS

Vertical Distribution of Seismic Force, $F_{x} =$ $C_{vx}V$ ASCE7-16 Eqn. 12.8-11 & Section 12.8.5

k= 1.927

Item	w	h_x	$w_x h_x^k$	$w_x h_x^k / \sum w_x h_x^k$	Cvx*V	OTM
fixtures	0.721	71.24	2685	0.598	0.724	51.61
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
Top Pole Section	0.063	69.13	221	0.049	0.060	4.13
2nd Pole Section	0.491	54.20	1080	0.240	0.291	15.79
1st Pole Section	1.026	22.85	427	0.095	0.115	2.63
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
			0	0.000	0.000	0.00
LED575	0.065	15.00	12	0.003	0.003	0.05
ECE	0.160	15.00	30	0.007	0.008	0.12
1/2 Precast base above grade	0.675	8.00	37	0.008	0.010	0.08
Sum	3.201		4492	1.000	1.212	74.41
Total Dead Load at grade	3.875					

SEISMIC OTM = 74.41 kip-ft < 102.26 kip-ft Wind OTM WIND CONTROLS

Cretex
Concrete Products, Inc.

CRETEX CONCRETE PRODUCTS, INC.

SCOPE: Analysis of an annular prestressed concrete pole member based on compatible strain procedure per ACI-318-11 with an ultimate concrete strain of 0.003.
PROJECT: Musco Standard Pole Base
DATE: May-14-2014 9:50 AM
POLE TYPE = 4B

PROGRAM VERSION 2.3 Standard

USER DEFINED INPUTS

CROSS-SECTION OUTER DIAMTER = D_o = **15.67** INCHES
HOLLOW CORE INSIDE DIAMETER = D_i = **8.375** INCHES
TENDON CIRCLE DIAMETER = D_t = **12.625** INCHES
NUMBER OF TENDONS = N (56 or less and even) **12**
TENDON DIAMETER = d_t = **0.5** INCHES
NOMINAL TENDON AREA = A_{ps} = **0.1531** IN^2
ULTIMATE TENDON STRENGTH = f_{pu} = **270** KSI
TENDON YIELD STRENGTH = f_{py} = **230** KSI
CONCRETE COMPRESSIVE STRENGTH = F'_c = **9500** PSI
MODULUS OF ELASTICITY - STEEL = E_s = **29000** KSI
INITIAL PRESTESS FACTOR = IPF = **0.64**
PRESTRESS LOSS FACTOR = PLF = **0.82**
*PHI FACTOR USED = **0.9**

OUTPUT

PHI FACTOR = ϕ = 0.90
PRESTESSING STRAIN IN TENDON = ε_{se} = 0.0049
CONCRETE SERVICE STRESS DUE TO PRESTRESS = 1890 PSI
CROSS SECTIONAL AREA = 138 IN^2
GROSS MOMENT OF INERTIA = 2718 IN^4
DISTANCE TO NEUTRAL AXIS FROM COMP. SIDE = c = 6.06 INCHES
CONCRETE COMPRESSIVE FORCE = 298 KIPS
AREA OF BONDED REINFORCEMENT = 1.84 IN^2
MINIMUM BONDED REINFORCEMENT AREA = 0.28 IN^2 **SATISFIED**
REINFORCEMENT RATIO = ρ_p = 0.0166
REINFORCEMENT INDEX = ω = 0.3345
MAXIMUM REINFORCEMENT INDEX = 0.2340 **EXCEEDED**
STRAND DEVELOPMENT LENGTH = L_d = 68 INCHES

RESULTS

NOMINAL MOMENT CAPACITY = M_n = 177 FT-KIPS
DESIGN MOMENT CAPACITY = ϕM_n = **159** FT-KIPS
CRACKING LOAD MOMENT = 76 FT-KIPS **SATISFIED**

DESIGN OF EMBEDDED POLE FOOTING-
NONCONSTRAINED
2019 CBC Section 1807.3.2.1

Mark/Type			LS70-A	LS70-B	LS70-C
Grade			A1	A2	B1
INPUT					
Shear, P	lbs	=	1,184	1,217	1,373
height of P above grade, h	ft	=	43.0	46.1	46.7
allow lateral brg pressure, s	psf/ft	=	300	300	300
max allow lateral brg pressure	psf/ft	=	3000	3000	3000
Pier Diameter, b*	ft	=	5.0	5.0	5.0
*Eff. Width of 2*pier diameter					
OUPUT					
Moment at grade, M	ft-lbs	=	50,934	56,146	64,099
acting lateral brg pressure, S_1	psf	=	667	688	720
allow lateral brg pressure, S_1	psf	=	667	688	720
$A=2.34P/(S_1 b)$		=	0.83	0.83	0.89
Min req'd embedment, d	ft	=	6.67	6.88	7.20
$=A/2\{1+(1+4.36h/A)^{1/2}\}$					
Add Depth to Ignore			2.00	2.00	2.00
Total Embed Required			8.67	8.88	9.20
USE 30 IN DIAMETER --->			12'-0		
USE 30 IN DIAMETER --->				12'-0	
USE 30 IN DIAMETER --->					14'-0

ATC Hazards by Location

APPENDIX A

Search Information

Coordinates: 38.264751888426964, -122.60824369664664

Elevation: 109 ft

Timestamp: 2021-04-29T18:51:31.856Z

Hazard Type: Wind

ASCE 7-16

MRI 10-Year	63 mph
MRI 25-Year	70 mph
MRI 50-Year	74 mph
MRI 100-Year	78 mph
Risk Category I	86 mph
Risk Category II	92 mph
Risk Category III	98 mph
Risk Category IV	102 mph

ASCE 7-10

MRI 10-Year	72 mph
MRI 25-Year	79 mph
MRI 50-Year	85 mph
MRI 100-Year	91 mph
Risk Category I	100 mph
Risk Category II	110 mph
Risk Category III-IV	115 mph

ASCE 7-05

ASCE 7-05 Wind Speed	85 mph

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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Spectrum, as shown on Figure 5.

Per ASCE 7-16 Section 21.4, the MCE_R spectral response acceleration parameters shall be taken from the Site-Specific Spectrum defined as follows and are presented on Figure 5 and summarized on Table A:

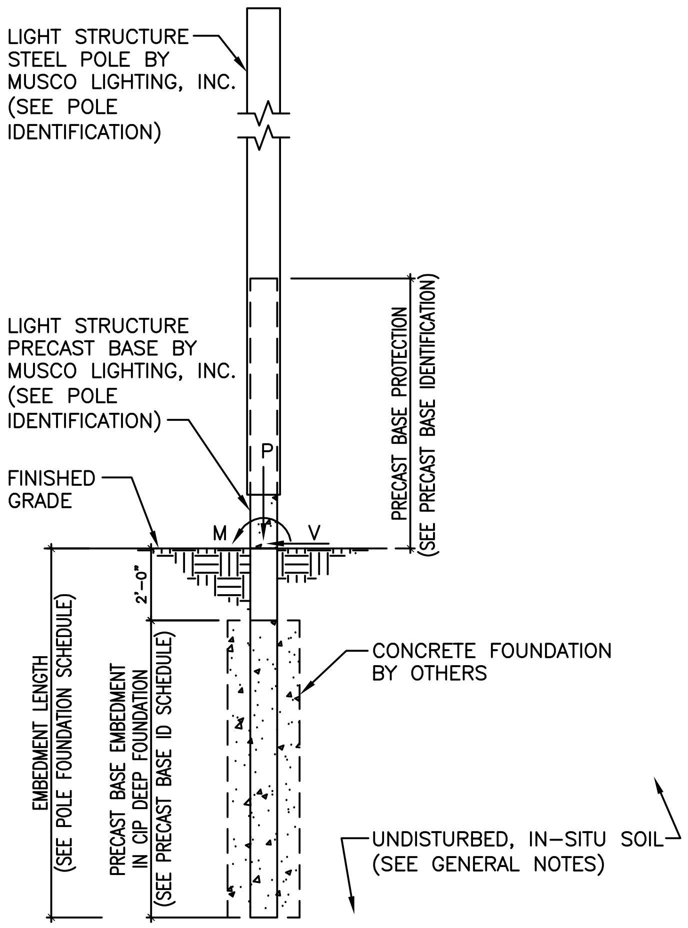
- S_{DS} – The S_{DS} parameter shall be taken as 90% of the maximum spectral acceleration, S_a, obtained from the site-specific spectrum, at any period between 0.2 and 5.0-seconds. However, the values obtained shall not be less than 80% of the values determined in accordance with ASCE 7-16 Section 11.4.5.
- S_{D1} – The S_{D1} parameter shall be taken as the maximum value of the product, TS_a, for periods between 1.0 and 2.0-seconds for Site Class C and B sites; and periods between 1.0 and 5.0-seconds for Site Class D, E & F sites. However, the values obtained shall not be less than 80% of the values determined in accordance with ASCE 7-16 Section 11.4.5.
- S_{MS} – The S_{MS} parameter is equal to 1.5 times the S_{DS} value, but not less than 80% of the values determined in accordance with ASCE 7-16 Section 11.4.4.
- S_{M1} – The S_{M1} parameter is equal to 1.5 times the S_{D1} value, but not less than 80% of the values determined in accordance with ASCE 7-16 Section 11.4.4.

TABLE A
ASCE 7-16 SEISMIC PARAMETERS
East Washington Park – Phase 2
Petaluma, California

Factor Name	Coefficient	ASCE 7-16 Site Specific Value
Site Class[1]	$S_{A,B,C,D,E,\text{ or }F}$	S_D
Spectral Acc. (short)	S_S	1.86 g
Spectral Acc. (1-sec)	S_1	0.71 g
Spectral Response (short)	SM_S	1.70 g
Spectral Response (1-sec)	SM_1	1.55 g
Design Spectral Response (short)	SD_S	1.13 g
Design Spectral Response (1-sec)	SD_1	1.03 g
MCE_G[2] PGA adjusted for Site Class	PGA_M	0.86 g

Notes:

1. Site Class D Description: Stiff soil profile with shear wave velocities between 600 and 1,200 ft/sec, standard blow counts between 15 and 50 blows per foot, and undrained shear strength between 1,000 and 2,000 psf.
2. Maximum Considered Earthquake Geometric Mean.



LIGHT POLE FOUNDATION DETAIL

SCALE: NO SCALE

POLE FOUNDATION SCHEDULE
(SEE LIGHT POLE FOUNDATION DETAIL)

TYPE	ASD GROUNDLINE FORCES (MAXIMUM)			C.I.P. DEEP FOUNDATION	
	MOMENT (M) KIP-FT	SHEAR (V) KIPS	VERTICAL (P) KIPS *	DIAMETER INCHES	EMBEDMENT FEET
LSS70-A	48.570	1.184	1.736	30"	12'-0"
LSS70-B	53.710	1.217	1.964	30"	12'-0"
LSS70-C	61.350	1.373	2.483	30"	14'-0"

* VERTICAL FORCE DOES NOT INCLUDE WEIGHT OF PRECAST BASE. VERTICAL (P) LOAD IS THE DRESSED POLE WEIGHT FOR ERECTION PURPOSES.

PRECAST BASE IDENTIFICATION

PRECAST BASE TYPE	WEIGHT LBS	OVERALL LENGTH FEET	HEIGHT ABOVE GRADE FEET	EMBEDMENT IN C.I.P. DEEP FOUNDATION FEET	OUTSIDE DIAMETER INCHES
3B	2,670	20'-0"	8'-0"	10'-0"	13.375"
4B	3,710	22'-0"	8'-0"	12'-0"	15.750"

POLE IDENTIFICATION

LOCATION MARK	POLE TYPE	PRECAST BASETYPE	FIXTURE CONFIGURATION (MAX # OF FIXTURES PER CROSSARM)	FIXTURE EPA (MAXIMUM)
A1	LSS70-A	3B	4 LED1500	7.8
C1, C2			3 (2 LED1500, 1 LED900)	
D1, D2			4 LED1500	
A2	LSS70-B	3B	5 (4 LED1500, 1 LED1200)	12.0
B1	LSS70-C	4B	7 (5 LED1500, 2 LED1200)	16.1
B2			6 (5 LED1500, 1 LED900)	

LED 900 FIXTURE: EPA = 2.6 SQ-FT MAX & WEIGHT = 40 LBS (FIXTURE ALONE), PER MUSCO LIGHTING, INC.

LED 1200 FIXTURE: EPA = 2.4 SQ-FT MAX & WEIGHT = 45 LBS (FIXTURE ALONE), PER MUSCO LIGHTING, INC.

LED 1500 FIXTURE: EPA = 2.7 SQ-FT MAX & WEIGHT = 80 LBS (FIXTURE ALONE), PER MUSCO LIGHTING, INC.

POLE AUXILIARY ATTACHMENTS

LOCATION MARK	ATTACHMENT TYPE & QUANTITY	ATTACHMENT ELEVATION A.G.L. - FT
C1, C2	(2) LED1200	60
A1, A2	(1) LED400	50
A1, A2, B1, B2, D1, D2	(1) LED575	15
C1, C2	(2) LED575	15

STATEMENT OF SPECIAL INSPECTIONS*

ITEM	CONTINUOUS/PERIODIC	SCOPE
1. PIER FOUNDATIONS	CONTINUOUS	INSPECT INSTALLATION OF DRILLED PIER FOUNDATIONS. VERIFY DIAMETER, EMBEDMENT DEPTHS AS SCHEDULED, DEPTHS OF FILL, AND BEARING STRATA
2. CONCRETE PLACEMENT	CONTINUOUS	INSPECT PLACEMENT OF CONCRETE FOR PROPER APPLICATION TECHNIQUES. VERIFY THAT CONCRETE CONVEYANCE AND DEPOSITING AVOIDS SEGREGATION OR CONTAMINATION. VERIFY THAT CONCRETE IS PROPERLY CONSOLIDATED.
3. CRETEX PRECAST/ PRESTRESSED CONCRETE BASES	(PCI CERTIFIED)	FABRICATOR EXEMPT.** REFERENCE ICC ESR-3765.
4. STRUCTURAL STEEL	(L.A. CITY APPROVED)	FABRICATOR EXEMPT.** REVIEW CERTIFIED MILL TESTS REPORTS AND IDENTIFICATION MARKINGS.

<u>* The Special Inspector shall be a qualified person who shall demonstrate competence, to the satisfaction of the Building Official, for inspection of the particular type of construction or operation requiring special inspection.</u>

<u>**Special inspections shall not be required when the work is done on the premises of a fabricator registered and approved by the City to perform such work without special inspection.</u>

No. 4506
Exp. 6-30-23

GENERAL NOTES

ALL CONSTRUCTION AND WORKMANSHIP SHALL CONFORM TO THE CALIFORNIA BUILDING CODE, 2019 EDITION.

WIND- ASCE 7-16, Vult = 92 MPH (EXPOSURE C); Vasd = 71 MPH (EXPOSURE C), RISK CATEGORY II

SEISMIC - SS=1.860; S1=0.710; SDS=1.133; SD1=1.033; RISK CATEGORY=II; I=1.0; SITE CLASS=D; R=1.5; SEISMIC DESIGN CATEGORY=D; SEISMIC-FORCE-RESISTING-SYSTEM=NON-BUILDING STRUCTURE, NOT SIMILAR TO BUILDINGS; ANALYSIS PROCEDURE=EQUIVALENT LATERAL FORCE PROCEDURE.

REFERENCE POLE LOCATION DRAWING FOR ACTUAL POLE PLACEMENT AND SITE LOCATION.

THE CONTRACTOR IS SOLELY RESPONSIBLE FOR ALL CONSTRUCTION PROCEDURES AND SAFETY CONDITIONS AT THE JOB SITE.

SOIL DESIGN PARAMETERS

REFERENCE GEOTECHNICAL ENGINEERING INVESTIGATION PREPARED BY MILLER PACIFIC ENGINEERING GROUP, DATED JANUARY 10, 2020; MILLER PACIFIC ENGINEERING GROUP PROJECT NO. 1477.072altr(REVa).

ALLOWABLE VERTICAL SOIL CAPACITY - 500 PSF (SKIN FRICTION). THE UPPER 3 FT OF NATURAL SOILS AND 1 FT OF LIME TREATED SOILS SHALL BE NEGLECTED UNLESS CONCRETE OR ASPHALT SURFACING EXISTS ADJACENT TO FOUNDATION.

ALLOWABLE LATERAL PASSIVE SOIL BEARING PRESSURE: 300 PSF/FT TO A MAXIMUM OF 3,000 PSF/FT ACTING OVER AN EFFECTIVE WIDTH OF TWO PIER DIAMETERS.

A REPRESENTATIVE OF MILLER PACIFIC ENGINEERING GROUP SHOULD BE AVAILABLE AT THE TIME OF THE FOUNDATION INSTALLATION TO VERIFY THE SOIL DESIGN PARAMETERS AND TO PROVIDE ASSISTANCE IF ANY PROBLEMS ARISE IN FOUNDATION INSTALLATION.

ENCOUNTERING SOIL FORMATIONS THAT WILL REQUIRE SPECIAL DESIGN CONSIDERATIONS OR EXCAVATION PROCEDURES MAY EXIST. POLE FOUNDATIONS MAY NEED TO BE REANALYZED ACCORDING TO THE SOIL CONDITIONS THAT EXIST.

IF ANY DISCREPANCIES OR INCONSISTENCIES ARISE, NOTIFY THE ENGINEER OF SUCH DISCREPANCIES. FOUNDATIONS WILL THEN BE REVISED ACCORDINGLY.

ALL PRECAST BASES AND CONCRETE BACKFILL MUST BEAR ON AND AGAINST FIRM, UNDISTURBED SOIL OR AS APPROVED BY A GEOTECHNICAL ENGINEER.

ALL EXCAVATIONS MUST BE FREE OF LOOSE SOIL AND DEBRIS PRIOR TO FOUNDATION INSTALLATION AND PLACEMENT OF CONCRETE BACKFILL. CASING MAY BE REQUIRED IF CAVING OCCURS. IN SUCH A CASE, APPROVAL BY A GEOTECHNICAL ENGINEER IS REQUIRED.

ALL EXCAVATIONS MUST BE FREE OF WATER OR CONCRETE SHALL BE PLACED WITH A TREMIE PIPE IN ACCORDANCE WITH ACI STANDARD 336. CONCRETE PLACED BY THE TREMIE METHOD SHALL HAVE A MINIMUM ULTIMATE STRENGTH OF 1,000 PSI GREATER THAN REQUIRED UNDER "CONCRETE BACKFILL" BELOW.

CONCRETE BACKFILL

CONCRETE BACKFILL WITHOUT STEEL REINFORCEMENT SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH AT 28 DAYS OF 4,500 PSI (2,500PSI USED FOR STRUCTURAL DESIGN). SEE STATEMENT OF SPECIAL INSPECTIONS REQUIRED.

CONCRETE BACKFILL SHALL ATTAIN A MINIMUM STRENGTH OF 2,500 PSI PRIOR TO STEEL POLE ERECTION.

USE TYPE V PORTLAND CEMENT OR AS RECOMMENDED BY THE ENGINEER.
MAX. W/C RATIO = 0.45

MIX IN CONFORMANCE WITH ASTM C-94

AGGREGATES PER ASTM C-33. (1" MAX AGG. SIZE). 3/8" MAX AGG. SIZE ACCEPTABLE WHERE PUMP MIXES ARE USED FOR UNREINFORCED CONCRETE BACKFILL.

PLACE CONCRETE IMMEDIATELY AFTER COMPLETION OF EXCAVATION AND INSPECTION BY THE GEOTECHNICAL ENGINEER. NO EXCAVATIONS SHALL BE LEFT UNPROTECTED OR OPEN OVERNIGHT.

CONCRETE SHALL BE PLACED IN ONE CONTINUOUS OPERATION (NO CONSTRUCTION JOINT) TO GRADE, WITH SPECIAL EQUIPMENT, WITH A MAXIMUM FREEFALL OF 5 FT AND TO PREVENT CONCRETE FROM STRIKING THE SIDES OF THE EXCAVATION. VIBRATE TOP 5 FT.

MISCELLANEOUS

FIXTURES MUST BE LOCATED TO MAINTAIN 10'-0" MINIMUM HORIZONTAL CLEARANCE FROM ANY OBSTRUCTION.

POLES, FIXTURES, PRECAST BASES, ELECTRICAL ITEMS, PLATFORMS, SPECIFICATIONS, AND INSTALLATION PER MUSCO LIGHTING, INC.

POLE SUPPORT FOUNDATION	MUSCO LIGHTING, INC. 2107 STEWART ROAD MUSCATINE, IOWA 52761 MUSCO No. 188270	DATE 01/10/22
PETALUMA COMMUNITY SPORTS FIELD BASEBALL DIAMOND PETALUMA, CA	KNA STRUCTURAL ENGINEERS 9931 MUIRLANDS BLVD. IRVINE CA, 92618 KNA No. 363.787	SHEET C1 OF 1

LIGHTING SPECIFICATION
PREPARED FOR

Petaluma Community Sports Field

Baseball Lighting Project
Petaluma, CA
February 3, 2022

Project # 188270

SUBMITTED BY:

Musco Sports Lighting, LLC

2107 Stewart Road
PO Box 260
Muscatine, Iowa 52761
Local Phone: 563/263-2281
Toll Free: 800/756-1205
Fax: 800/374-6402

We Make It Happen®

SECTION 26 56 00

SPORTS FIELD LIGHTING

PART I - GENERAL

1.1 Related Documents

Drawings and general provisions of the bid documents, including general and supplementary conditions apply to this section.

1.2 Description of Work

A. The Sports Lighting section includes:

1. Galvanized steel pole and luminaire mounting crossarms
2. LED Luminaire, with appropriate glare/spill light control
3. Remote driver enclosure
4. Pole Foundations
5. Control System

B. The purpose of this specification is to define the performance standards, product values and features, required manufacturer's service responsibilities, and design standards for the Petaluma Community Sports Field Baseball Diamond in Petaluma, California.

1.1.1 Submittals

A. Musco Sports Lighting LLC is the only pre-approved equipment supplier.

B. All other manufacturers must submit each item in this article according to the conditions of the contract and specification section 10 days prior to bid for consideration. Any deviations to the specification require the manufacturer to list and describe in detail such deviations. Failure to provide this information shall be grounds for immediate rejection.

C. Submittal information required:

1. Light scans as per Section 1.04 of the specification.
2. Spill scans as per Section 1.05 of the specification.
3. Detailed warranty information as per Section 3.01 of the specification.
4. Detail foundation design as described in Section 2.01
5. Provide written information for the automated control system to include monitoring. Also provide examples of system reporting and access for numbers for personal contact to operate the system.
6. A list of (10) similar project references in the State of California in the past 5 years using the proposed equipment. The list shall include contact names and phone numbers.
7. Lighting Manufacturer will supply certified photometric reports from Independent Testing Lab (ITL) or a Certified Lab along with an aiming angle summary for verification.

1.4 Sports Lighting Performance

A. Illumination Levels and Design Factors: The illumination levels specified shall be based on light levels for 25 years. Light levels shall not drop below specified targeted lighting levels during the specified warranty period. Appropriate light loss factors shall be applied and submitted for the basis of design.

Area of Lighting	Light Level	Uniformity	# of Points	Size of Area	Grid Spacing
Baseball	50 foot-candles Infield - 30 foot-candles Outfield	2:1 Infield – 2.5:1 Outfield	25 Infield – 106 Outfield	Irregular 324'/360'/330'	30' x 30'

1.5.1 Spill And Glare Analysis

C. Submitted spill/glare computer models shall depict the field test stations shall be shown at the property line with the field lights on. Bidder shall submit, as described below:

	Maximum
Property Line Maximum Vertical Footcandles	20fc
Property Line Horizontal Footcandles	15fc
Property Line Candela Per Fixture	35,000Cd

PART 2. MATERIALS

A. Pole Structural Steel

1. The pole shafts shall be high strength low alloy tapered tubular steel that is equal to current ASTM A595 standards, with galvanized coating inside and out. All connections of pole sections shall be by slip fitting the top section over the lower section by a length of at least 1.5 times the diameters.

2. Steel components of the poles shall be hot dip galvanized t current ASTM A-123. Steel portions of the pole shall be constructed such that all segments of the pole can be readily heated to like temperatures in commercially available galvanizing methods.

3. To avoid problems of galvanize adherence to differing steel alloys, all steel components used for the pole must be of the same type steel.

4. All exposed steel components of the pole shall be at least 18" above the surface of the ground to avoid exposure of the steel to the heavily moisture and oxygen laden air, both above and below the surface. There shall be a cap to cover the top of the pole so that rain will not enter the interior of the pole.

5. To avoid stress corrosion of the pole, there shall be no weld points of the steel portion of the pole within 18" of the ground. The pole shall be galvanized steel.

6. The poles for this project have been designed to withstand 95 mph winds based upon CBC-C standards. The premise of the wind speed criteria will be the 50 year mean recurrent isotach wind map. Applicable gust factors to be applied per code.

B. Foundation Design

1. The Manufacturer shall provide a stamped foundation design, prepared by a Structural Engineer, licensed in the State of California.

2. The foundation design shall be based upon recommendations contained in the Geotechnical Report furnished by the Owner. Reference Geotechnical Report from GSM Landscape Architects Inc. File: 1477.072altr (REVa), dated January 10, 2020.

3. It is the contractor's responsibility to notify the owner of soil conditions other than the design criteria. The owner shall then be responsible and absorb the additional costs associated with: Providing engineered foundation embedment design by a registered engineer in the State of California for soils other than specified soil conditions. Additional materials required to achieve alternate foundation. No direct burial steel poles allowed.

4. Lightning Protection: Manufacturer shall provide integrated lightning grounding via concrete encased electrode grounding system as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A. If grounding is not integrated into the structure, the Manufacturer shall supply grounding electrodes, copper down conductors and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be not less than 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

C. LED Sports Lighting Fixtures:

The lens is permanently sealed to keep optics away from harmful environmental elements. Fixture is vented and filtered to adapt to environmental elements. Heat sink with a unique convective air cooling design with high thermal conductivity and corrosion resistant construction. Machine mounted surface for maximum heat transfer of diode assembly and maintains low LED junction temperature during high wattage operation. Custom high power diode package with a metal core printed circuit board. The light control visors are factory aimed. Controls and directs more light onto the field which reduced glare and spill and enhances the on-field playability. Fixture is powder coated gray.

D. Remote Electrical Enclosure:

Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum enclosures. Drivers are remote for ease of installation and servicing. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure.

E. Wire Harness: Spiral wound, abrasion protection sleeve, strain relief, plug-in connections

F. Energy Consumption: The average kWh consumption for the entire facility shall not exceed 61.93.

G. Controls and Monitoring System:

1. Factory assembled lighting control cabinet (LCC) – The LCC shall be assembled and wired by a UL listed panel builder. The LCC shall contain Contactors, Monitoring and Control System and door mounted Manual off-on-auto selector switches. The LCC shall arrive at the job site ready to attach to an existing wall, switchgear, or a free standing enclosure.

a. Control Wire Terminations - The Control Wire Terminations shall include UL listed terminal blocks mounted on a DIN rail and 250 volt, 16 amp, touch safe type fuse holders.

b. The ECE shall be constructed of aluminum and shall be powder coated gray. The cabinet door shall utilize a lockable, 3 point latching assembly that provides a NEMA 4 rated seal.

c. Contactor Modules – Contactors shall be UL listed for lighting applications. They shall be rated at full capacity, be electrically held, utilize a 120 volt coil and be rated for operation in a ambient temperature range from -40 degrees C to +70 degrees C.

d. Manual off-on-auto Selector Switches – For on site manual control, three position selector switches shall be factory mounted to the ECE door. The switches shall be keyed and maintain position, with make before break contacts. The switches shall be factory wired to control terminal blocks.

e. Warranty – The LCC shall be covered under the standard warranty for the accompanying lighting equipment.

2. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The manufacturer shall notify the owner of outages within 24 hours, or the next business day. The controller shall determine switch position (manual or auto) and contactor status (open or closed). The Monitoring System shall be factory wired to control terminal blocks.
3. Remote Lighting Control System: The Lighting Control System shall allow owners and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs. The Light Control System shall be factory wired to control terminal blocks.

PART 3 EXECUTION

3.1 Warranty

A. 25-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.

B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

3.2 Field Technician

A. Manufacturer shall have available a local factory trained technician to provide project support including but not limited to: Lamp replacement, confirm luminaire, aiming points, troubleshoot, and educate customer maintenance personnel.

END OF SECTION