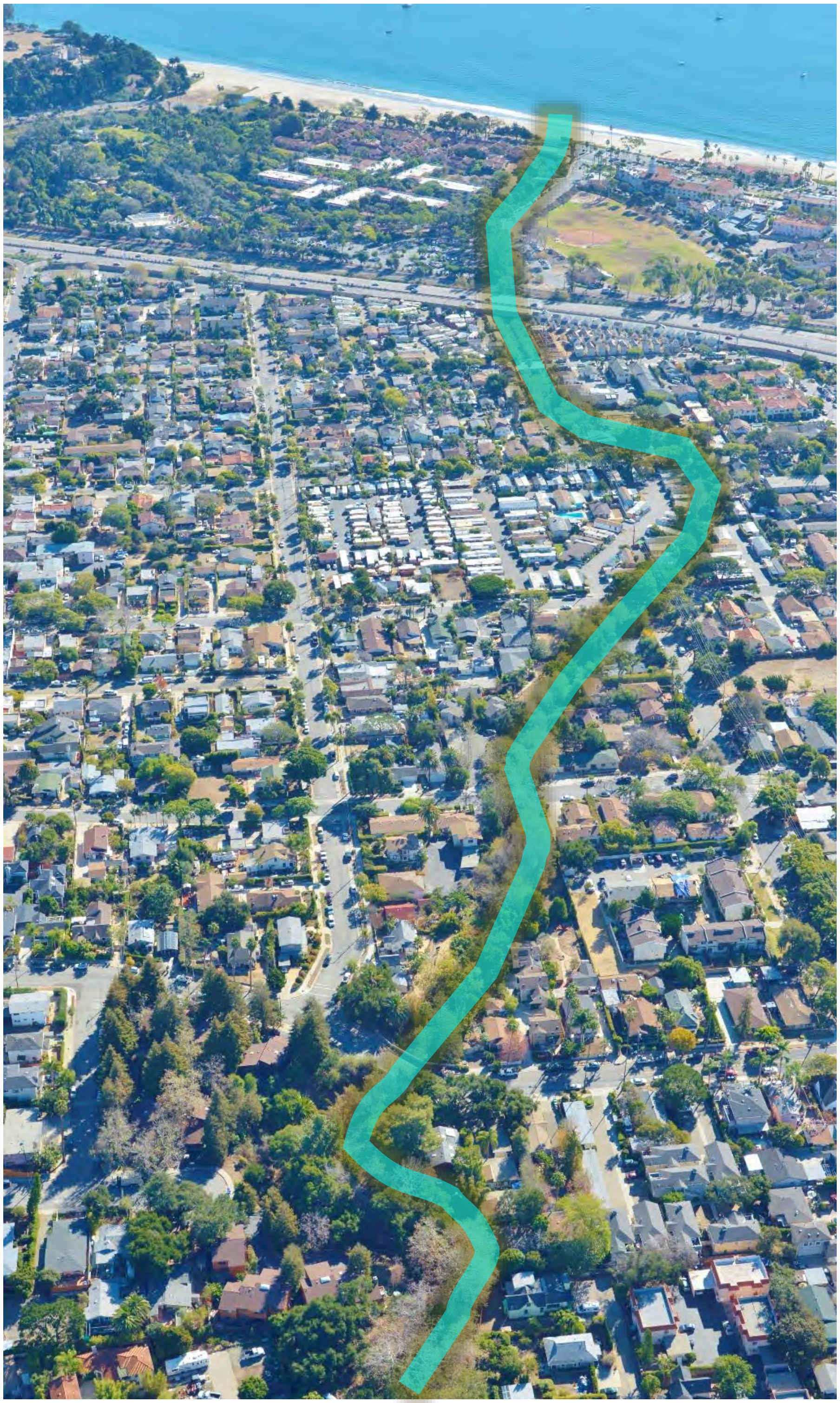
Sycamore Creek Project Study Report



Prepared for

Santa Barbara County
Flood Control and
Water Conservation
District

Prepared By:

March 7, 2018

The Sycamore Creek Project Study Report has been prepared under the direction of Mohammed Wahiduzzaman and Thomas Conti, Registered Civil Engineers. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which the recommendations, conclusions, and decisions are based.

REGISTERED PROFESSIONAL ENGINEER
Md Wahiduzzaman
No. C49838
CIVIL
STATE OF CALIFORNIA

Md. Wahiduzzaman

March 7, 2018

REGISTERED CIVIL ENGINEER Date

REGISTERED PROFESSIONAL ENGINEER
T. Conti
No. C73108
CIVIL
STATE OF CALIFORNIA

Thomas Conti

March 7, 2018

REGISTERED CIVIL ENGINEER Date

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Executive Summary

Project Sponsorship

This report documents the findings of a hydraulic study for the Lower Sycamore Creek Watershed in Santa Barbara, CA. This study was undertaken by Bengal Engineering as a cooperative venture between the City of Santa Barbara (City) and the Santa Barbara County Flood Control and Water Conservation District (District); the study area is located within the jurisdictional City Limits; but both the City and the District have the authority to construct facilities for collection, control and discharge of stormwater in the community.

Purpose

The City and Caltrans have already completed key public works projects in the lower reach of Sycamore Creek to address flooding concerns or replace elderly bridges. Additional projects are currently under design. The City is also planning future projects which steps closer to improve flood control protection to the community.

The District knows that should the hydraulic analysis for each of these projects be undertaken individually, variables in project approach, professional judgement and engineering analysis are expected, and that these variables will be difficult to reconcile in a larger study of the watershed.

To alleviate these challenges, the District contracted Bengal Engineering to perform this study.

Bengal was selected because of our expertise in regional hydraulic modeling, knowledge of the engineering of nearby bridges, understanding of agency and community expectations, and our familiarly with both District and FEMA practices.

Goals of this Study

This Project Study Report defines:

- The target stream conveyance—the appropriate design flow for both engineering and planning purposes which heretofore has not been specified through a study such as this
- The appropriate locations / types for the channel walls
- locations where vegetated stream banks may be implemented
- Locations of real property conflicts
- Project costs, including right of way acquisitions

Key Project Data: Existing Lower Sycamore Creek

Item	Data
Sycamore Creek Watershed Area	2,600 acres
100-yr peak discharge	3,306 cfs*
50-yr peak discharge	2,942 cfs*
10-yr peak discharge	1,897 cfs*
Maximum Non-Damaging Discharge (at Zoo Bridge)**	1,100 cfs
Maximum Non-Damaging Discharge (at Indio Muerto Bridge)**	1,200 cfs

* Source: FEMA Flood Insurance Study (FIS)

** Maximum discharge prior to lateral spreading (overtopping)

Key Factors

Hydrology and Hydraulics:

While stand-alone projects built in past years haven't alleviated flooding by increased overall flood capacity of Lower Sycamore Creek, these project have provided building blocks. These past projects, plus the future projects mentioned herein will help achieve global improvements; For example, the Highway 101 Bridge over Sycamore Creek, constructed in 2010 is currently partially closed, intentionally, to limit flow because the adjacent channels cannot accommodate additional discharge as they exist. However in the future, when the remaining channel improvements are built, all the spans of the Hwy 101 bridge can be opened so that the completed system can work in unison.

Existing Restrictions

Even with the Highway 101 Bridge over Sycamore Cr. completed, the same bridges identified in previous studies remain problematic because these areas constrict flow.

Replacement Bridge Locations

Location	Limitations	Capacity (cfs)	Recommendation
Por La Mar Bridge 1	Two center piers and low soffit	1,800	Replace bridge with clear span
Por La Mar Bridge 2	Two center piers and low soffit	1,500	Replace bridge with clear span
S.B. Zoo	Two center piers and low soffit	1,100	Replace bridge with clear span
U.P.R.R. Bridge	Embankments	2,400	Vertical walls
Indio Muerto Street Bridge	Narrow bridge, Two center piers and low soffit	1,200	Replace bridge with clear span
Carpinteria Street Br	Two center piers and low soffit	2,600	Replace bridge with clear span

Undersized Channel Locations

Location	Limitations	Capacity (cfs)	Recommendation
Cabrillo Blvd to US 101	Narrow channel	1,300 to 1,800	Increase channel width to varying configuration depending on ROW impacts.
Indo Muerto to Cacique St	Narrow channel	1,200	Increase channel width to 60’. Predominantly vertical wall because of ROW impacts.

Planning Participants/Objectives:

A next step in the development of this project, beyond the scope of this Project Study Report, is form and coordinate a Consensus Group comprised of Federal and State regulatory agencies such as the Environmental Protection Agency, the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Wildlife, California Coastal Commission, Regional Water Quality Control Board,and other City Departmens including Public Works, Parks including Creeks Division, and various City review and permitting bodies; community non-govermental and non-profit orginizations, and the public at-large. This is the model approach successfully used by the Lower Mission Creek Project, in not only outreach and coordination but defining the following project activities:

- Provide increased flood protection along this reach of Sycamore Creek;
- Restore the native species of native riparian community along the project reach;
- Remove and suppress invasive non-native vegetation and replace with native plants;
- Enhance the aquatic habitat by changing the streambed characteristics;
- Define the project that is self-mitigating; and
- Achieved these objectives with a positive benefit to cost ratio

Reference: Santa Barbara Streams, Lower Mission Creek Flood Control Feasibility Study, U.S. Army Corps of Engineers, September 2000

As with the Lower Mission Creek Project, a goal with the Sycamore Creek Project will be to identify a self-mitigating project.

Costs and Conclusions:
Cost data was compiled for the final report in spring of 2018. Costs of construction and real property will likely fluctuate with time. These costs derived for the project are all encompassing not speculating how funding will be obtained nor who will be fiscally responsible for implementation.

Costs:

- Our estimate shows that 2/3 of the costs for hydraulic improvements on Sycamore Creek are bridge replacement.
- See appendix E for Anticipated Project Costs

Target Conveyance:

- The construction of the Highway 101 crossing at Sycamore Creek in 2010 now sets the capacity limits for Sycamore Creek. The Bridge was constructed with three “bays”. The three bays, if unobstructed, in combination would handle 3,000 cfs.

Real Property:

- Ahead of project implementation, the County and the City should consider purchasing parcels in conflict, which encroach into the creek.
- See appendix C Right of Way Exhibits

Preferred Wall Type:

- Pile wall systems have several advantages, too many to discuss (please see channel wall type selection section).

Introduction

The City of Santa Barbara (City) has completed several public works projects within the lower reach of Sycamore Creek. Several more are under design or planned for the future. Each of these projects has been undertaken with limited time, budget and scope to accommodate the needs of the individual projects.

This study evaluates the overall performance of the completed system. To do this, the District hired Bengal Engineering to create coordinated computer model (HEC-RAS) to analyze the performance of the stream. This model is used to evaluate the improvements made so far and determine “what remains to be done” to protect the community from flood flows. The result will deliver a project, which will allow for future FEMA Flood Insurance Revision Map (FIRM) revisions reducing the amount of residences in the 100 year flood plain.

This study also sets engineering guideline for this reach.

Report Goals

This Project Study Report defines:

- The target stream conveyance—the appropriate design flow
- The appropriate locations / types for the channel walls
- locations where vegetated stream banks may be implemented
- Locations of real property conflicts
- Project costs, including right of way acquisitions

Background

In 2003, the City and the District worked together to commission a *Flood Capacity Master Plan for Sycamore Creek (called “The 2003 Plan herein”)* dated November 21, 2003 prepared by Penfield and Smith to evaluate the existing capacity of the creek system and the capacity improvement potential of the system.

The 2003 Plan has served as a guide for projects in terms of potential conveyance goals, but did not specify a detailed configuration of much of the completed project and its associated impacts.

The City and District both recognized that the effectiveness of a long-term flood control project could be jeopardized by near-term project. Further these agencies recognized that if the projects were not coordinated to evaluate hydraulic performance as part of the whole, short term design features could be detrimental to the overall objective to protect the public as a system which would be completed in parts-and-pieces as advantages budgets and circumstances presented themselves. The 2003 Plan defined the stream conveyance capacity at 3,000 cubic feet per second (cfs). With this finding, public and private projects proceeded toward this objective.

Recent Project History

As anticipated in the development of the 2003 Plan significant development projects began breaking ground in 2007. The following is the known list of projects.

Completed Projects			
Year	**Project**	**Design Intent**	**Lead Agency**
2007	Mason Street Pedestrian Bridge	Provide pedestrian route over Sycamore Creek.	City of Santa Barbara
2010	Highway 101 Improvements from Olive Mill Road to Milpas Street	Highway 101 widening from Olive Mill Road to Milpas Street. This included Highway 101 Sycamore Creek Bridge.	Caltrans
2013	Lower Sycamore Creek Channel Widening and Punta Gorda Street Bridge Replacement	Replace the Punta Gorda Bridge over Sycamore Creek and complete channel widening downstream between Punta Gorda Street and US Highway 101.	City of Santa Barbara
2015	Cacique & Soledad Street Pedestrian/Bicycle & Corridor Improvements	Replace the pedestrian crossing on Cacique Street and place a new pedestrian crossing on Soledad Street over Sycamore Creek.	City of Santa Barbara

Active Projects			
2014	Quinientos Street Bridge Replacement	Replace the Quinientos Street Bridge over Sycamore Creek.	City of Santa Barbara
2015	Montecito Street Bridge Replacement and Pedestrian Improvements	Replace the Montecito Street Bridge and complete pedestrian improvements.	City of Santa Barbara

Future Projects			
TBD	Carpinteria Street Bridge Replacement	Highway Bridge Program Funded	City of Santa Barbara

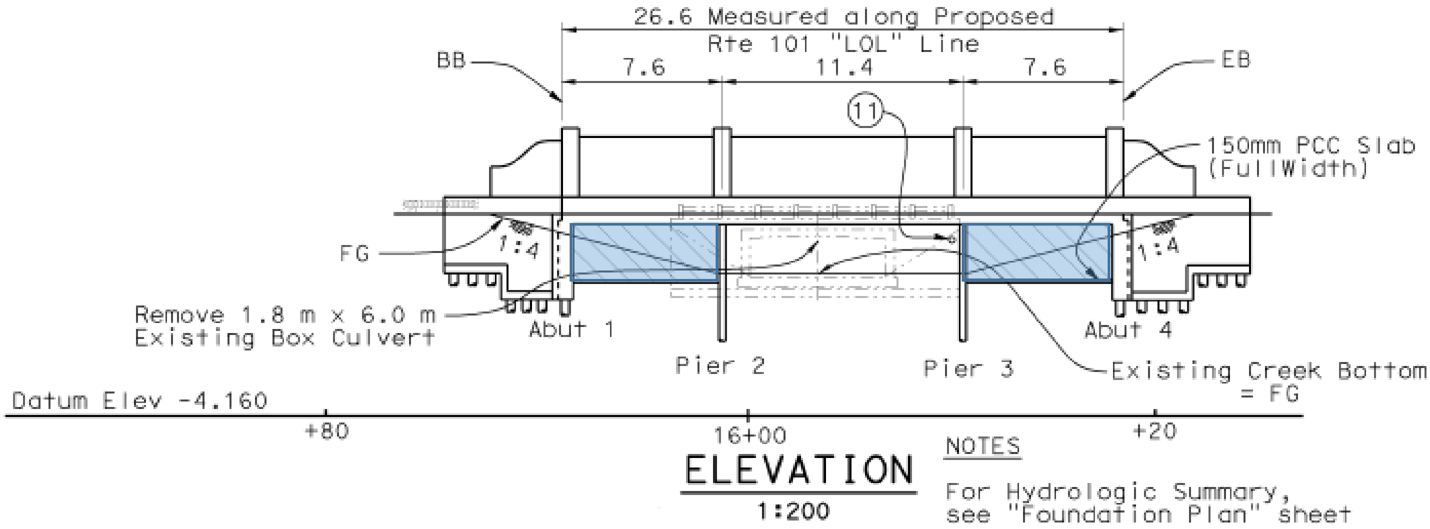
Target Conveyance

The California Department of Transportation (Caltrans) completed various improvements to Highway 101 in 2009-2010. These improvements include widening of the vehicle travel way and replacement of the bridges over the creeks, including the Hwy 101 bridge at Sycamore Creek.

While the Caltrans project had funding for the transportation improvements (highway and bridge improvements), the Highway 101 widening project did not have the budget or scope to address the flood control capacity improvements in the channels outside of the State right-of-way.

This scenario--two agencies working together—a transportation department upgrading the roadway network -- a flood control agencies upgrading the flood protection system, is familiar to agency personnel in Santa Barbara. For example, across town on the Mission Creek, the District working with USACOE improved flood conveyance by designing channel improvements while the City of Santa Barbara, working with Caltrans Local Assistance, has been replacing the bridges using FHWA Highway Bridge Program money. The combined effort improves both the transportation system and the flood control facilities, sometimes building the projects at the same time.

In the case of the Hwy 101 bridge at Sycamore Creek, Caltrans engineers coordinated with the District, planning ahead for the future flood control project which would be built outside the Caltrans right-of-way. To accomplish this, Caltrans built a bridge which they anticipated would be large enough for the increased flows resulting from the future Sycamore creek improvements. But because of the limitations in the existing channel capacity outside of the State right-of-way, Caltrans engineers blocked two of the three-spans in the new bridge, on-purpose, to restrict flows until the channel improvements can be built by the District. Someday when the channel is improved, the “plugs” under the bridge will opened, and the system will function with joint benefits, like the Mission Creek Project.



The Bridge was constructed with three “bays”. The three bays, if unobstructed, in combination would handle 3,000 cfs. Due to the existing downstream capacity deficiencies of Sycamore Creek, Caltrans has limited capacity by only opening the center bay.

Sycamore Creek Watershed

Sycamore Creek is located within an alluvial coastal basin with the ground surface sloping gently from north to south. The project jurisdictional area is in the Eastside area of the City of Santa Barbara, CA. The relatively flat topography in the area is bisected by the active Sycamore Creek channel, which generally flows to the south. Sycamore Creek is an ephemeral, or intermittent, drainage along its length.

The Sycamore Creek Watershed (see figure 1) is relatively short in length. The upper portion of Lower Sycamore Creek is less urbanized in comparison to other watersheds in the Santa Barbara area. Upper Sycamore Creek originates in the Los Padres National Forest and contains five tributaries in the foothills: the main stem, beginning near Sheffield Reservoir, the Parma Park tributaries, Coyote Creek, Westmont Creek, and Chelham Creek, a tributary east of Westmont Drive. These tributaries converge adjacent to the intersection of Sycamore Canyon Road and Stanwood Drive in Sycamore canyon.

The creek then follows a narrow canyon to Alameda Padre Serra. The slope in this middle reach becomes less-steep as the creek traverses a medium-density residential area.

Downstream the creek drains into the lower reach floodplain areas which are highly-developed. This zone includes areas of significant historic flooding during large rain events. The slope in this reach becomes flatter as the creek empties into the ocean at East Beach, where a sandbar forms a small lagoon.

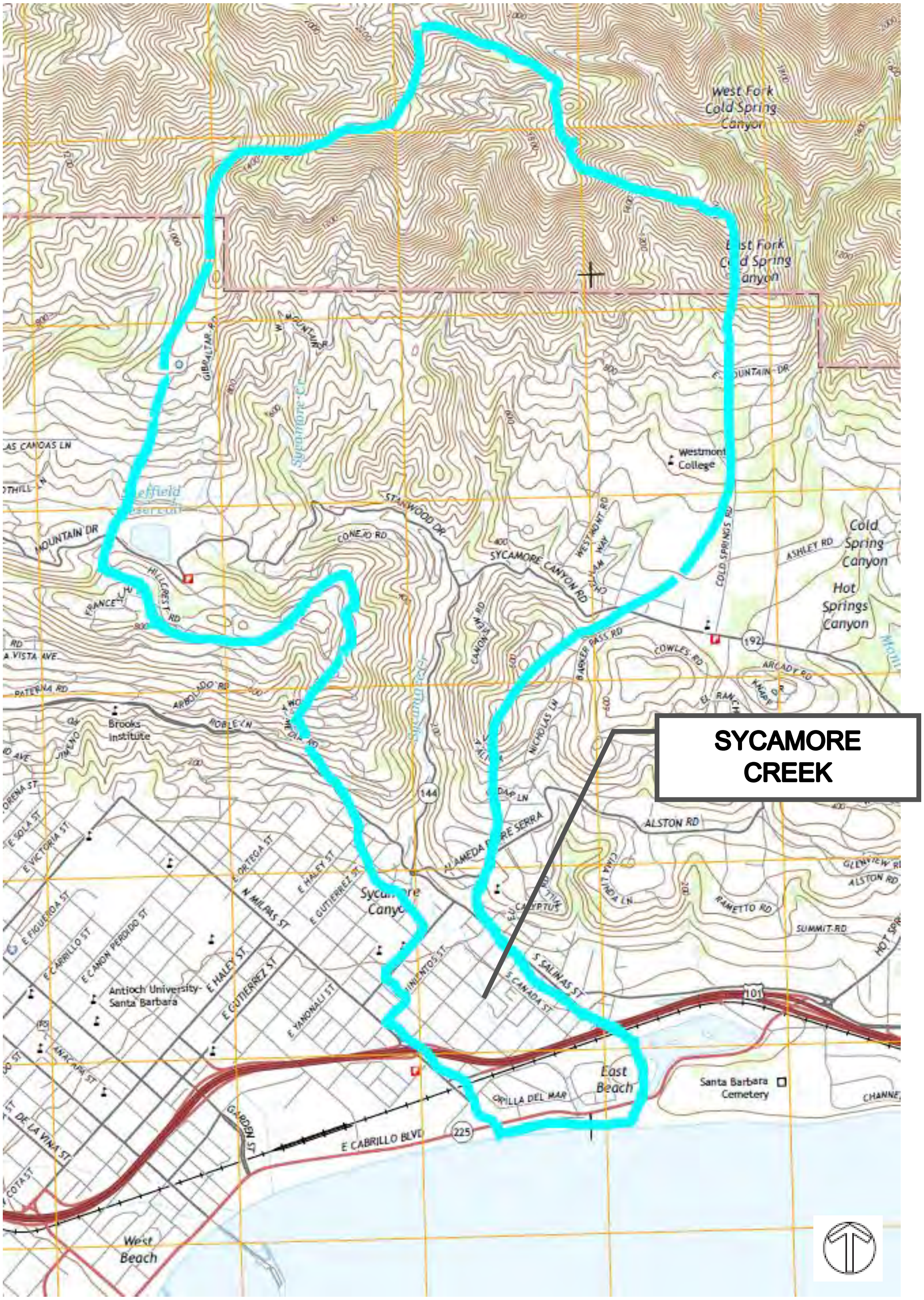
Area: Approximately 2,600 acres

- 20% under County jurisdiction
- 55% under City jurisdiction
- 25% under Los Padres National Forest Jurisdiction

Project Study Area

The Sycamore Creek area considered in this Project Study Report (see figure 2), begins at Yanonali Bridge and travels 1.1 miles to the Pacific Ocean, completely within the City of Santa Barbara jurisdiction. This area of Sycamore Creek is located in an urbanized area and retains a mostly natural streambed. Pipe and wire revetment bank protection is installed throughout much of this reach. Several bridges of various configurations also occur in this region.

The lowest portion(s) of Sycamore Creek (see figure 3), from Cabrillo Blvd. to the Pacific Ocean, is within the California Coastal Commissions (CCC) permit jurisdiction. This means projects south of Cabrillo Blvd. would be required to get a CCC permit. The section from Highway 101 to Cabrillo Blvd. is considered to be in the "appealable jurisdiction", which means a public or private entity could request to the CCC that the project should obtain a CCC permit.



Sycamore Creek Watershed

FIGURE 1

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REFERENCE:

U.S.G.S. Santa Barbara
7.5-Minute Quadrangle, 2015

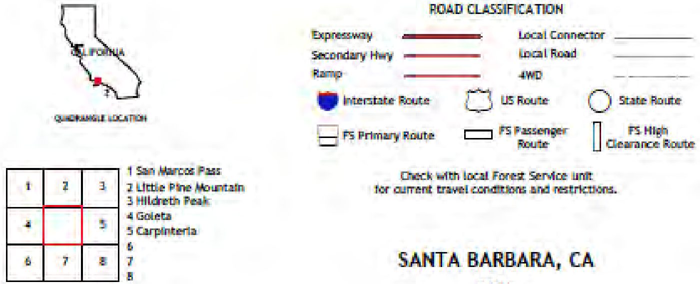


FIGURE 2

REFERENCE:

City of Santa Barbara
Local Coastal Program
Jurisdictional Boundaries as Certified by California Coastal Commission on July 21, 1991
Map prepared by City of Santa Barbara, Planning Division, AJN, TRB, 9/29/2014

FIGURE 3

Floodplain Description

Within the project limits, the Federal Emergency Management Agency (FEMA) defines floodplains for Sycamore Creek. A floodway is a portion of the base floodplain which must be kept free of encroachment. Floodways are a regulatory tool used to manage development in floodplains.

Flood History

Damaging floods in this area are reported to have occurred as early as 1862. Floods of sufficient magnitude to cause extensive damage along Lower Sycamore Creek occurred in 1862, 1909, 1914, 1927, 1938, 1962, 1966, 1967, 1969, 1971, 1995, 1998 and 2005.

The worst flooding in the area took place in 1969, 1971, 1995 and 1998. The storms in 1966 and 1969 caused considerable damage throughout the area due to flooding, erosion, and debris deposition.

During the1995 floods, residents in the neighborhood adjacent to Sycamore Creek chopped holes through the wooden Caltrans sound wall along the highway in order to facilitate the passage of flood flows. The sound wall has since been replaced and now incorporates floodgates which allow flood flows to pass unobstructed.

Hydrology

The drainage area is located in a narrow coastal zone rising steeply to the crest of the Santa Ynez Mountains in a north-south direction. The mountains rise about 3,000-3,500 feet in less than 5 miles. The crest elevations of the drainage basin starts about 3,000 feet above mean sea level. In the upper reaches the stream has fairly steep gradients. In the lower reaches, on the alluvial plain below the foothills, slopes average approximately 150 vertical feet/mile.

The mountains above Santa Barbara provide significant orographic uplift and receive much higher precipitation than the coastal plain. The mean seasonal precipitation for the drainage area is approximately 18-inches-per-year along the coast and 30-inches-per-year in the mountains.

The majority of the precipitation occurs between November and April. Flooding typically occurs between December and March. The majority of the precipitation is a result of general winter storms associated with extra-tropical cyclones of North Pacific origin. The rainfall events that cause flooding in the Santa Barbara area are intense and are typical in coastal California. These floods are of a short duration, with extreme flooding lasting a few hours or less.

Sycamore Creek is a well-established channel that runs through the City of Santa Barbra. Increasing urbanization of the watershed during the historical period has contributed to increased run-off.

A Flood Insurance Study (FIS) was issued by FEMA. The 100-year discharge cited in the FIS for Sycamore Creek at De La Guerra Street was 3,306 ft3/sec.

Sycamore Creek Flood Frequency Summary

The FEMA Flood Insurance Study Statistical Frequency Analysis of Peak Flows are summarized below:

Percent Chance Exceedance	Return Period (yrs.)	Peak Discharge (ft^3/sec)
.2	500	4,207
1	100	3,306
2	50	2,942
10	10	1,897

Hydraulic Analysis

The hydraulic analysis for the project reach was performed using the USACE HEC-River Analysis System (HEC-RAS) program, Version 5.0.0 (USACE, 2016).

The model was developed to reflect the existing conditions and all of proposed channel improvements along Sycamore Creek.

Survey and Mapping

From 2013 to 2017 various topographic surveys of the creek have been completed for projects initiated and managed by the City of Santa Barbara. Bengal Engineering obtained this available ground topography to use as a base creek topographic map or digital terrain map. This original digital terrain map was enhanced by additional field surveyed cross sections and merged with the Eastside base mapping for the City of Santa Barbara. This base mapping created the original digital model of the creek and its surrounding area.

After this base mapping was completed we have received the 2016 LIDR GIS data from the City of Santa Barbara. This new digital terrain model fits very well with our current HEC-RAS model and will be utilized for the final report comparison.

Hydraulic Model

The industry standard Hydrologic Engineering Center River Analysis System "HEC-RAS" program (version 5.0.3) was used to develop georeferenced stream station lines, cross section alignments and cross section profiles. The cross sections profiles were cut using the digital model surface.

This digital model formed the basis of the existing creek capacity to establish existing conditions. The model was collated with the recent FEMA FIRM panel 06083C1391H effective November 4, 2015 to match station for station with this FIRM map.

The proposed condition model required successive and selective runs to determine the creek improvements necessary for channel improvements that could contain the 3,000 cfs target conveyance set by the Highway 101 project.

Our analyses started at the Pacific Ocean working up the creek to target conveyance capacity through reconfiguring in the following order:

1. Structures within the local jurisdiction
2. Highway 101 (opening of the bays, one by one)
3. Evaluating and reconfiguring the channels where less-than-ideal capacity is creating overland flow

Results

The target conveyance analysis profiles, cross sections, and results are included in Appendix A.

Geotechnical

Regional Geology

The project area is located within the Western Transverse Ranges physiographic province of Southern California. This geologic province consists of a complex series of east-west trending mountain ranges and valleys. The structural orientation of this province is transverse to the general north-northwest structural trend of the other geologic provinces in California. The Western Transverse Ranges province extends from Ventura County west to Point Arguello, and is dominated by the east-west trending Santa Ynez Mountain Range. Cretaceous to Cenozoic sedimentary marine rocks and Miocene volcanic rocks dominate the Western Transverse Ranges region.

The project site is located within an elevated portion of the Santa Barbara coastal plain characterized by a gently undulating, but generally north to south sloping ground surface. It is thought the elevated nature of the plain is caused by tectonic uplift during the Quaternary age (Dibblee, 1986). The area is underlain by late Pleistocene-age older alluvium and Holocene-age alluvium over the south-dipping homoclinal structure of the Santa Ynez Mountains.

Geologic Units

The surficial geologic formations and major geologic structural features present in the general area of the project are shown on Figure 4, Local Geologic Map. The exposed formations in the immediate vicinity vary from Miocene-age to recent (i.e. Holocene) deposits. These deposits include the Monterey Formation (T_{mu}), upper and middle Pleistocene older alluvium (Q_{oa}), upper Pleistocene “intermediate” alluvial deposits (Q_{ia}), and recent alluvium (Q_a). The area is underlain by Holocene to upper Pleistocene age alluvium consisting of unconsolidated to slightly consolidated clay and, poorly to moderately sorted silt, sand and gravel deposits (Dibblee, 1986, Minor et al., 2009).

Record Soil Investigations

Bengal Engineering’s scope did not include field soil investigations or recommendations for specific soil parameters to use in design.

Since the project is still in its infancy, the District preferred to gather the available boring logs from recent projects so this information will be handy when more engineering moves forward. See Appendix B for the boring logs.

Qe	**Estuarine deposits (Holocene)**—Locally organic-rich clay, silt, and subordinate sand deposited primarily in peritidal environment in low-lying coastal areas of modern and historically active sloughs. Maximum thickness probably less than 20 m
Qac	**Alluvium and colluvium (Holocene and upper Pleistocene)**—Poorly consolidated silt, sand, and gravel deposits of modern drainages and piedmont alluvial fans and floodplains. Exposed thickness generally less than 10 m
Qia	**Intermediate alluvial deposits (upper Pleistocene)**—Weakly consolidated, stratified silt, sand, and gravel that form low, rounded, moderately dissected terraces and piedmont alluvial fans that rest at higher elevations than the modern coastal piedmont surface underlain by unit Qac. Thickness probably locally exceeds 20 m
Qoa	**Older alluvial deposits (upper and middle Pleistocene)**—Moderately consolidated, crudely stratified, poorly sorted sand and sandstone, gravel, conglomerate, and breccia, and rare interbeds of clay, silt, and mudstone comprising proximal to distal facies of alluvial fans shed from the Santa Ynez Mountains. Unit forms dissected, gently south-sloping elevated terraces, interfluvial caps, and other erosional remnants as thick as 35 m
—■——■—	**Reverse fault**—Rectangles on apparent upthrown side

REFERENCE

GEOLOGIC MAP OF THE SANTA BARBARA COASTAL PLAIN AREA, SANTA BARBARA COUNTY, CALIFORNIA

By

Scott A. Minor,[1] Karl S. Kellogg,[1] Richard G. Stanley,[2] Larry D. Gurrola,[3] Edward A. Keller,[4] and Theodore R. Brandt[1]

2009

FIGURE 4

Preliminary Right of Way Analysis

An intent of this Project Study Report is to preliminarily identify permanent property acquisitions that will be required to construct the project based on preliminary design presented herein. Final limits of acquisitions that will be subject to change and will be identified at final design. At that time, acquisitions will be defined as fee or easement. Temporary construction easements will also be identified at the time of final design.

All acquisitions will be in conformance with the law, including the State of California's Relocation Assistance and Real Property Acquisitions Guidelines found in Title 25, Division 1, Chapter 6, and Subchapter 1 of the California Code of Regulations.

See appendix C "Right of Way Exhibits" for areas of potential acquisitions. Please note the property mapping was generated from County GIS mapping. The exact areas quantified would be refined in final design when a licensed surveyor compiles survey boundary work.

Creek Configuration:

When looking at completing capacity improvements the project will ultimately be a balance between the project capacity improvement goals and restoration or enhancement of the natural creek corridor. The expectations will be high from the local environmental community to re-establish natural riparian corridors. The predominant accepted method to do establish a more natural creek corridor is to emulate a vegetated sloped creek bank. This will be difficult in Sycamore Creek because the urban encroachment.

Creek Configuration Methodology

In order to look at the proposed configuration we first had to understand the existing conditions. The first order of business was establishing the FEMA baseline from the November 4 of 2015 FIRM and correlating it with the topographic mapping. Once this was completed, we obtained the most current orthophotogrpahy available to overlay this for understanding possible conflicts.

After the mapping was established to understand any impacts, we input the HEC-RAS parameters on to the mapping to further validate possible conflicts. We then went to visit the sites of potential conflict to confirm the proximity to the proposed channel.

See appendix D "Channel Configuration Exhibits" for proposed Sycamore Creek improvements footprint.

Channel Wall Type Selection

The creek corridor is crowded by dense development. Today, single family homes, condominiums, apartment buildings, trailer parks, even the Santa Barbara Zoo are located near the top-of-bank. The creek is also crossed by City streets, the Hwy 101 or “the Crosstown Freeway” as well as the the Union Pacific Railroad.

Various utilities, both overhead and underground crisscross the project corridor.

In order to accommodate much of the existing development while increasing conveyance in certain areas by widening the creek, engineers anticipate that a mix of channel cross-section configurations will be needed. In places where there is more room available, the channel may be widen using vegetated side-slopes. In other areas, because of the close proximity of existing development, and because of the prohibitive cost to acquire right-of-way, vertical walls will likely be needed to widening the channel while also minimizing the project footprint.

At the time this report was created, the area of study had recently experienced a fair amount of redevelopment. For example, the Sycamore Creek Development on Punta Gorda Street (also known as the “Tiny Houses Project”) has replaced an old trailer park (2015). Nearby, the Puente Gordo Street Bridge has been replaced and portions of the downstream channel have been modified (2015).

Upstream at Indio Muerto Street a substantial housing complex was constructed on property previously occupied by smaller duplexes and workshops (2016).

Further upstream at Cacique Street, two larger mobile home parks have been the subject of recent discussion, even controversy, regarding future redevelopment. Projects such as these could affect the Lower Sycamore Creek Project and therefore the locations where either vertical channel walls or sloping channel banks will be located in the future.

At the time this report was prepared, engineers acknowledged development opportunities but did not study multiple scenarios for locations of vertical walls because of limited time and budget.

See the “Channel Configuration Exhibits” in this report for possible locations of the walls.

In this report, the key points for this topic include:

A) the project will likely include vertical channel walls at various locations to accommodate the limited space available at those locations.

B) Based on the existing information, Bengal provides a preliminary recommendation of the types of wall which hold promise for the project.

C) Bengal has gathered the boring logs from various projects in anticipation of additional study of this important topic. Much work remains to be done.

Estimated Wall Heights for the Project at Various Locations

Location	Roadway Elevation*	Creek flowline Elevation *	Exposed Wall Height
Punta Gorda St.Br	20+/-	9’+/-	11’+/-
N. of Indio Muerto St.	28+/-	15’+/-	13’+/-
Cacique St. Br.	29’+/-	17’+/-	12’+/-
U/S of Carpinteria St. Br.	34’+/-	20’+/-	14’+/-
Quinientos St. Br	45’+/-	30’+/-	15’+/-
Mason Str. Br.	51+/-	36’+/-	15’+/-
Yanonali St. Br	60’+/-	50’+/-	10’+/-

*North American Vertical Datum 1988 (NAVD 88)

Types of walls considered:

1. **Gravity Walls or Walls on Spread Footing Foundation**

The use of walls which are supported by larger footings, such as a Gravity wall or spread footings face challenges making them generally unsuitable for this project. These challenges include:

- High ground water/ standing water the downstream reaches complicate construction of any alternative wall type. However attempting to build larger or spread footings in saturated soils presents construction hurdles which are more-easily avoided with piles.
- Use of a spread footing system will require a larger construction footprint and therefore more right-of-way compared to walls supported by piles
- This larger foundation footprint will also require more shoring and greater earthwork compared to walls supported by piles
- Typically, in order to save cost, material which is excavated on site, is used for backfill once wall is completed. Because the project has limited room to stockpile and perhaps dewater excavated material while also providing construction access, this wall type presents more logistical challenge for material handling than pile wills.
- Requires a large volume of material (specific to Gravity Wall).
- Appropriate for low walls or lightly loaded walls (specific to Gravity Walls).
- Length of construction will likely be longer than pile walls.

2. Sheet Pile Walls

We envision that the use of sheet piling may also face challenges, which include:

- Because of the height of the walls, ground anchors (tiebacks) may be needed. These will anchors would penetrating the private property behind the wall, likely generating greater challenges to acquire right-of-way in comparison to a wall system which doesn't require tiebacks.
- The construction of sheet pile walls present aesthetic challenges which could be controversial in an urban setting. Measures used to "hide" the wall could be expensive to implement and perhaps difficult to maintain.
- Steel sheet pile and could face limited service-life due to corrosion, especially in the downstream reach near the beach. Cost and effort to replace this sheet pile sometime in future could be substantial because effort for permitting and costs-for-construction have historically increased.
- Concerns with construction-generated vibration and "drivability" for sheet pile remain key questions to be investigated should this option be further considered.

3. Wall Supported on Driven Piles

At a different location, that is one one with greater distances to safeguard the existing buildings and underground infrastructure from vibration and noise, a foundation using driven piles could be an option.

But at this location:

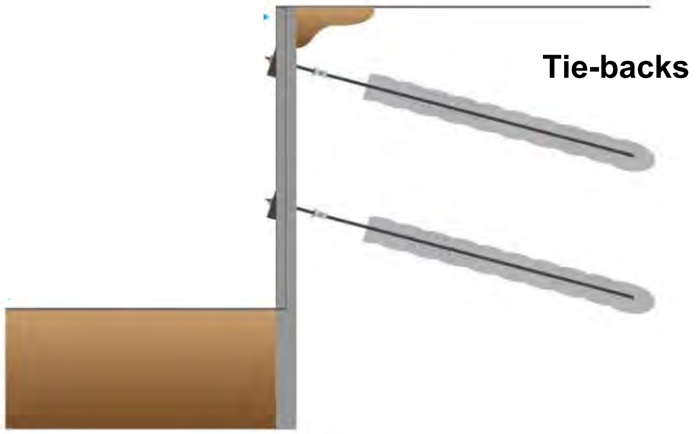
- Driven piles raise liability concerns due to construction noise and vibration
- Overhead power lines raise immediate questions in terms of practicality.
- The variable geology in the region presents uncertainty and therefore likely greater geotechnical investigation.

4. Soil-Anchored Wall

An soil-anchored wall (also called a "Tieback wall) includes a wall face supported by soil anchors penetrating the soil behind the wall .

Challenges envisioned for such a system in this project include:

- Soil-anchor walls present risk construction / performance challenges in the variable geology expected on this site. As the soil varies, so could the length and configuration of the tieback system
- The right-of-way behind the wall needed to accommodate the anchors could be difficult and expensive to obtain. Other systems do not require this space.
- Use of soil anchors in a flood wall the saturated soil which will occur during flood conditions presents an engineering challenge which may be difficult to overcome. Soil properties will change rapidly during sequential flooding / draw-down events.
- Should unforeseen geologic conditions be encountered which degrade the expected performance of the tiebacks, the project could be stalled while another solution is considered. Such a delay will be detrimental in such tight working conditions and construction periods.



Cross Section of a Tieback Wall

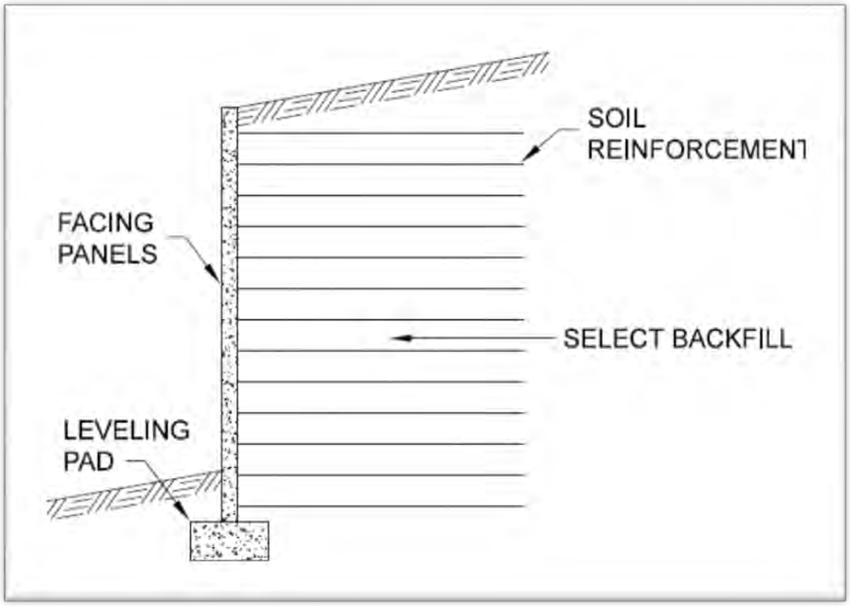
5. Mechanically Stabilized Earth Wall

Mechanically stabilized earth, also called “MSE walls”, are built by alternating vertical layers of proprietary soil reinforcement material with select backfill soil creating an engineered “layer cake” behind the wall.

The outer face of the wall is usually made from precast concrete panels which hook to the soil reinforcement in back of the wall facing via proprietary connections because many of these systems are patented.

Challenges envisioned with this system include:

- The use of MSE in a permanent flood-control project is non-standard application for this system. MSE walls are generally used in “dry” applications such as roadway embankments and site grading. This application allows the backfill “high and dry”, providing engineers more consistent soil properties for design.
- The reinforced backfill requires more right-of-way to accommodate the soil reinforcement behind the wall compared to some wall systems.
- More construction room is needed build MSE walls than some other systems.
- Accommodating surface drains / inlets from areas behind the walls could be difficult because of the reinforcing mats in the backfill and the openings in the MSE walls.
- Proprietary nature of these patented wall systems can present bidding and construction and issues in a competitive-bid project.



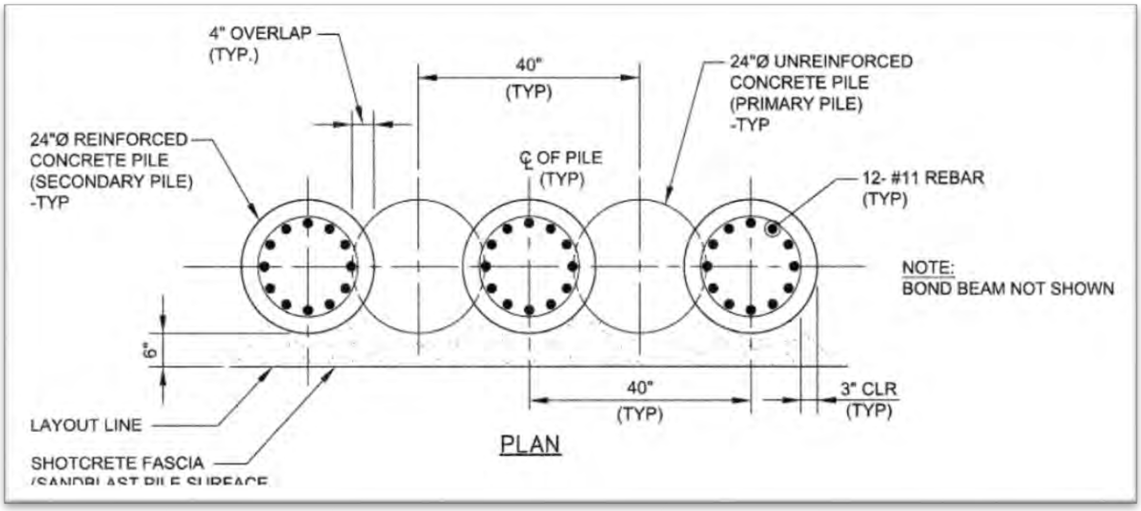
Cross Section of an MSE Wall

6. Secant Pile Walls

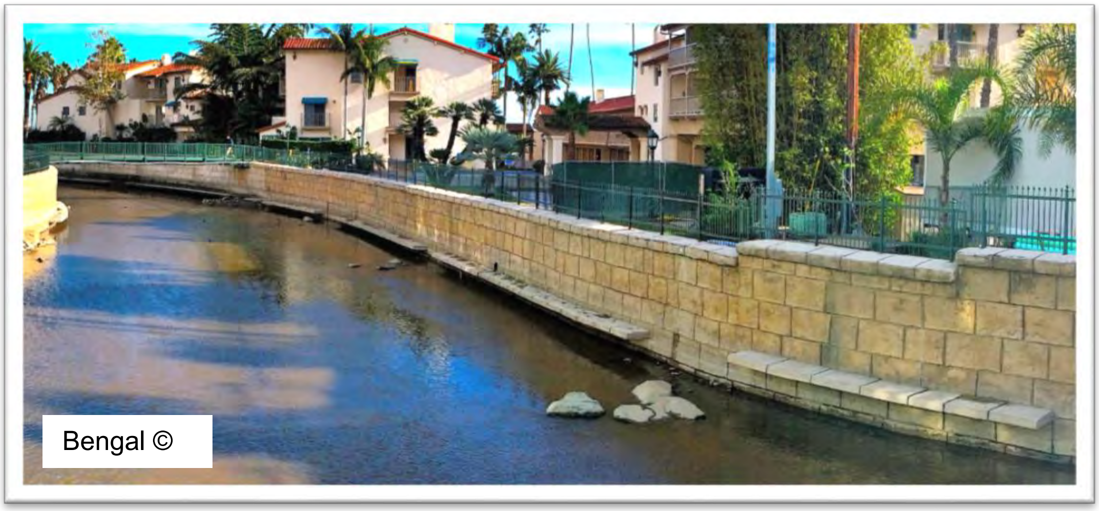
Secant pile walls constructed by series of drilling a series of overlapping holes which are filled with concrete to form a continuous wall system.

Bengal Engineering has designed these for the District on the Lower Mission Creek Project.

Advantages with this wall system will be discussed with the Soldier Pile alternative, below.



Plan-View of Bengal-Designed Secant Pile Wall: for the Mason St. Bridge



Example of Secant Pile Wall: Lower Mission Cr. at of Mason St. Bridge (Bengal Photo ©)

7. Soldier Pile Walls

Soldier pile walls are built by constructing a line of piles (like a line of “soldiers”) to support a wall which spans from pile-to-pile. The piles can be driven or cast-in-drilled-holes.

Bengal Engineering designed many such walls locally including those at Cota Street Bridge, Haley / De La Vina Street Bridge, and Cabrillo Blvd. Bridge.

Example of Soldier Pile Flood Wall: Lower Mission Cr. at Cabrillo Blvd. (Bengal Photo ©)

Advantages of Secant-Pile or Soldier Pile Wall system

We envision advantages for either system on the Sycamore Creek Project could include:

- Smaller construction footprint compared to many systems
- Less dewatering for excavation than many systems
- Less excavation / handling of excavated materials than many systems
- No need for tie backs, therefore less right-of-way acquisition cost
- Longer service life than some alternatives
- System allows decorative fascia which can vary
- Known local success
- Familiarity by District / City
- Likely lower cost

Conclusions and Recommendations

Our conclusions and recommendation are limited to the reach of Sycamore Creek from the Pacific Ocean to Alameda Padre Serra.

This limited study was completed by reviewing the available information about Sycamore Creek within the limits of the project study area.

This report provides practical considerations to these reaches of Sycamore Creek. But this report was prepared with limited time, budget and information. A project of this magnitude, spanning approximately 1.2 miles and 8 city blocks which are densely developed, will require significant environmental review and engineering analysis block-by-block.

While we stand by our conclusions and recommendations, new and additional information during detailed design may supersede some of our findings and conclusions.

Costs:

- Our estimate shows that 70 to 80% of the costs for hydraulic improvements on Sycamore Creek are bridge replacement.

Target Conveyance:

- The construction of the Highway 101 crossing at Sycamore Creek in 2010 now sets the capacity limits for Sycamore Creek. The Bridge was constructed with three “bays”. The three bays, if unobstructed, in combination would handle 3,000 cfs.

Real Property:

- Ahead of project implementation, the County should consider purchasing parcels in conflict, which encroach into the creek.
- See appendix C Right of Way Exhibits

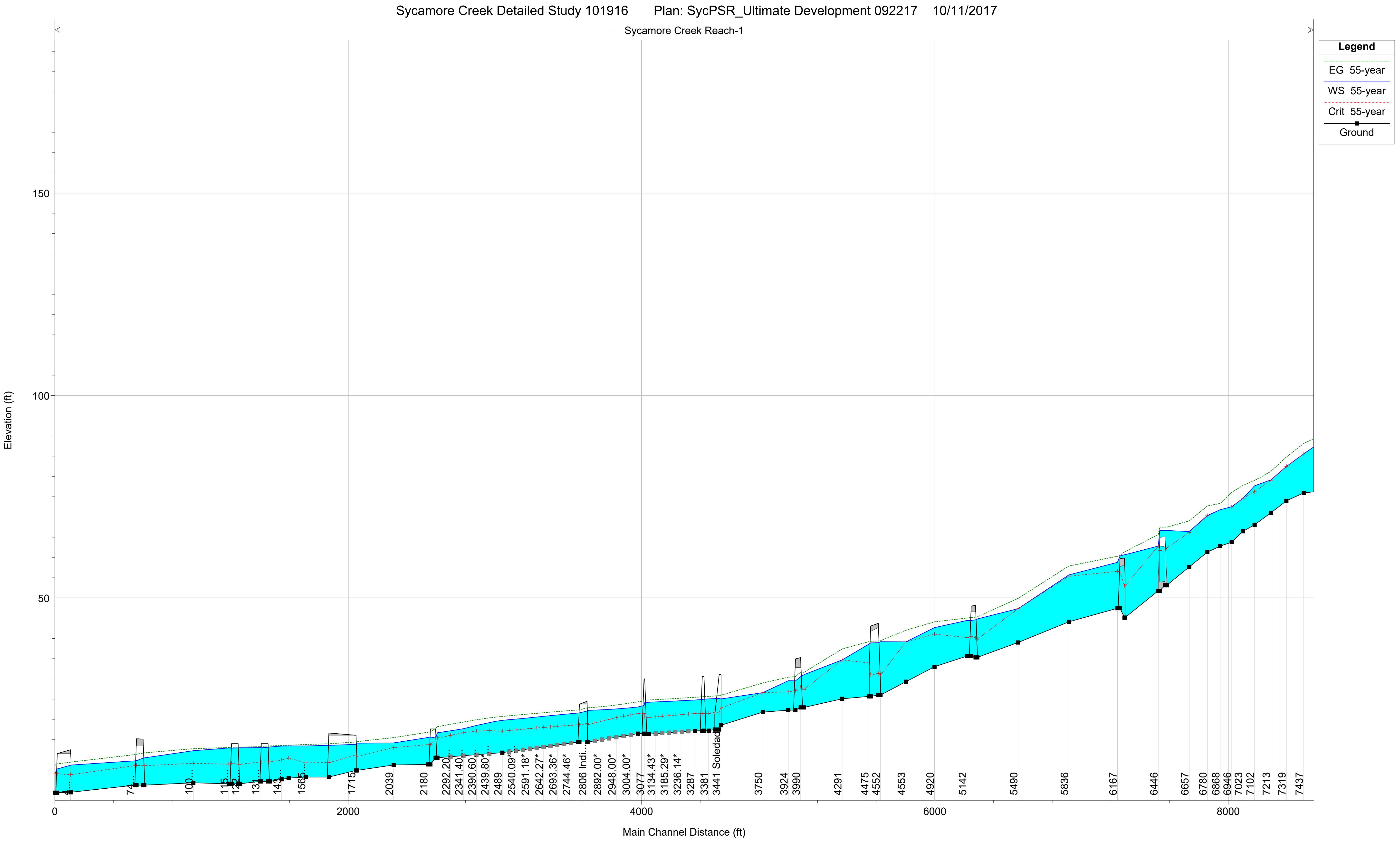
Preferred Wall Type:

- Pile wall systems have several advantages, too many to discuss (please see channel wall type selection section).

Appendix A – HEC-RAS Exhibits

HEC-RAS Plan: SycPSR_Ult Dev Locations: User Defined   Profile: 55-year

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	
Sycamore Creek	Reach-1	6503	55-year	3000.00	53.10	66.65	62.32	67.48	0.002145	8.04	729.73	0.41
Sycamore Creek	Reach-1	6473		Culvert								
Sycamore Creek	Reach-1	6446	55-year	3000.00	51.78	62.81	62.81	65.68	0.014451	13.62	237.74	0.91
Sycamore Creek	Reach-1	6219	55-year	3000.00	45.13	60.68	52.95	61.39	0.001742	6.80	479.73	0.32
Sycamore Creek	Reach-1	6200		Bridge								
Sycamore Creek	Reach-1	6167	55-year	3000.00	47.44	58.79	56.58	60.29	0.004490	10.31	388.59	0.59
Sycamore Creek	Reach-1	5836	55-year	3000.00	44.10	55.69	55.36	57.89	0.010820	11.90	252.53	0.93
Sycamore Creek	Reach-1	5490	55-year	3000.00	39.00	47.35	47.35	49.89	0.076117	12.78	234.73	1.00
Sycamore Creek	Reach-1	5212	55-year	3000.00	35.31	44.81	39.81	45.32	0.001489	5.71	525.43	0.33
Sycamore Creek	Reach-1	5185		Bridge								
Sycamore Creek	Reach-1	5142	55-year	3000.00	35.65	44.44	40.21	45.04	0.001931	6.23	481.28	0.37
Sycamore Creek	Reach-1	4920	55-year	3000.00	33.00	42.67	41.06	44.09	0.006137	9.57	313.41	0.73
Sycamore Creek	Reach-1	4553	55-year	3000.00	29.30	39.15	39.15	42.02	0.012184	13.58	220.87	1.01
Sycamore Creek	Reach-1	4552	55-year	3000.00	26.00	39.19	30.96	39.42	0.000480	3.88	772.60	0.21
Sycamore Creek	Reach-1	4518		Bridge								
Sycamore Creek	Reach-1	4475	55-year	3000.00	25.69	38.62	33.93	39.22	0.004026	6.20	483.89	0.40
Sycamore Creek	Reach-1	4291	55-year	3000.00	25.10	34.70	34.70	37.40	0.011940	13.20	227.32	1.01
Sycamore Creek	Reach-1	4031	55-year	3000.00	22.96	31.05	27.40	31.63	0.001691	6.09	492.29	0.40
Sycamore Creek	Reach-1	3990		Bridge								
Sycamore Creek	Reach-1	3924	55-year	3000.00	22.28	29.56	26.80	30.43	0.003021	7.49	400.32	0.49
Sycamore Creek	Reach-1	3750	55-year	3000.00	21.80	26.61	26.61	29.01	0.013321	12.42	241.49	1.00
Sycamore Creek	Reach-1	3465	55-year	3000.00	18.56	25.05	22.81	25.97	0.003532	7.70	389.39	0.53
Sycamore Creek	Reach-1	3441 Soledad Br		Bridge								
Sycamore Creek	Reach-1	3423	55-year	3000.00	17.50	25.12	21.77	25.79	0.002151	6.56	457.39	0.42
Sycamore Creek	Reach-1	3381	55-year	3000.00	17.22	25.06	21.49	25.69	0.001972	6.38	470.57	0.40
Sycamore Creek	Reach-1	3333 Cacique (R)		Bridge								
Sycamore Creek	Reach-1	3287	55-year	3000.00	17.18	24.79	21.45	25.46	0.002163	6.57	456.78	0.42
Sycamore Creek	Reach-1	3261.57*	55-year	3000.00	17.06	24.70	21.31	25.36	0.002132	6.49	462.21	0.42
Sycamore Creek	Reach-1	3236.14*	55-year	3000.00	16.95	24.62	21.17	25.26	0.002054	6.39	469.20	0.41
Sycamore Creek	Reach-1	3210.71*	55-year	3000.00	16.83	24.54	21.04	25.16	0.001956	6.29	476.77	0.41
Sycamore Creek	Reach-1	3185.29*	55-year	3000.00	16.71	24.46	20.90	25.06	0.001867	6.20	483.92	0.40
Sycamore Creek	Reach-1	3159.86*	55-year	3000.00	16.59	24.39	20.76	24.97	0.001797	6.12	489.97	0.39
Sycamore Creek	Reach-1	3134.43*	55-year	3000.00	16.48	24.31	20.62	24.89	0.001758	6.07	493.89	0.38
Sycamore Creek	Reach-1	3109	55-year	3000.00	16.36	24.24	20.48	24.80	0.001739	6.04	496.57	0.38
Sycamore Creek	Reach-1	3077		Bridge								
Sycamore Creek	Reach-1	3032	55-year	3000.00	16.48	23.07	21.44	24.34	0.004973	9.04	331.75	0.65
Sycamore Creek	Reach-1	3004.00*	55-year	3000.00	16.19	22.88	21.10	24.06	0.004560	8.73	343.57	0.62
Sycamore Creek	Reach-1	2976.00*	55-year	3000.00	15.89	22.71	20.77	23.80	0.004121	8.37	358.22	0.59
Sycamore Creek	Reach-1	2948.00*	55-year	3000.00	15.60	22.58	20.42	23.56	0.003617	7.94	377.85	0.56
Sycamore Creek	Reach-1	2920.00*	55-year	3000.00	15.30	22.47	20.05	23.34	0.003065	7.50	400.19	0.51
Sycamore Creek	Reach-1	2892.00*	55-year	3000.00	15.01	22.38	19.60	23.16	0.002631	7.10	422.62	0.47
Sycamore Creek	Reach-1	2864.00*	55-year	3000.00	14.71	22.30	19.14	23.00	0.002279	6.73	445.49	0.44
Sycamore Creek	Reach-1	2836	55-year	3000.00	14.42	22.22	18.69	22.86	0.002002	6.41	468.28	0.40
Sycamore Creek	Reach-1	2806 Indio Muerto		Bridge								
Sycamore Creek	Reach-1	2770	55-year	3000.00	14.40	21.58	18.67	22.33	0.002586	6.96	430.80	0.46
Sycamore Creek	Reach-1	2744.46*	55-year	3000.00	14.16	21.42	18.53	22.20	0.002648	7.10	422.80	0.47
Sycamore Creek	Reach-1	2718.91*	55-year	3000.00	13.93	21.26	18.41	22.07	0.002722	7.23	415.04	0.48
Sycamore Creek	Reach-1	2693.36*	55-year	3000.00	13.69	21.09	18.29	21.93	0.002790	7.35	408.25	0.48
Sycamore Creek	Reach-1	2667.82*	55-year	3000.00	13.45	20.92	18.14	21.79	0.002863	7.46	401.97	0.49
Sycamore Creek	Reach-1	2642.27*	55-year	3000.00	13.21	20.76	18.01	21.65	0.002942	7.57	396.09	0.50
Sycamore Creek	Reach-1	2616.73*	55-year	3000.00	12.98	20.58	17.89	21.50	0.003026	7.68	390.55	0.51
Sycamore Creek	Reach-1	2591.18*	55-year	3000.00	12.74	20.41	17.75	21.35	0.003103	7.77	386.02	0.51
Sycamore Creek	Reach-1	2565.64*	55-year	3000.00	12.50	20.24	17.59	21.20	0.003160	7.84	382.66	0.52
Sycamore Creek	Reach-1	2540.09*	55-year	3000.00	12.26	20.08	17.42	21.04	0.003202	7.89	380.22	0.52
Sycamore Creek	Reach-1	2514.55*	55-year	3000.00	12.03	19.92	17.26	20.89	0.003210	7.92	378.88	0.52
Sycamore Creek	Reach-1	2489	55-year	3000.00	11.79	19.77	17.07	20.74	0.003154	7.91	379.30	0.52
Sycamore Creek	Reach-1	2439.80*	55-year	3000.00	11.54	19.20	17.23	20.37	0.004007	8.68	345.71	0.59
Sycamore Creek	Reach-1	2390.60*	55-year	3000.00	11.29	18.51	17.08	19.91	0.005002	9.47	316.84	0.67
Sycamore Creek	Reach-1	2341.40*	55-year	3000.00	11.03	17.70	16.71	19.34	0.006140	10.27	292.33	0.76
Sycamore Creek	Reach-1	2292.20*	55-year	3000.00	10.78	17.17	16.05	18.80	0.005883	10.24	293.15	0.74
Sycamore Creek	Reach-1	2243	55-year	3000.00	10.53	16.69	15.40	18.19	0.006420	9.82	305.41	0.70
Sycamore Creek	Reach-1	2213 Puente Gorda		Bridge								
Sycamore Creek	Reach-1	2180	55-year	3000.00	8.87	15.53	13.76	16.82	0.005082	9.10	329.52	0.63
Sycamore Creek	Reach-1	2039	55-year	3000.00	8.75	14.19	13.03	15.51	0.006155	9.21	325.61	0.70
Sycamore Creek	Reach-1	1911	55-year	3000.00	7.39	14.14	10.75	14.50	0.001045	4.78	627.14	0.34
Sycamore Creek	Reach-1	1715		Bridge								
Sycamore Creek	Reach-1	1565	55-year	3000.00	5.75	13.44	9.26	13.80	0.000883	4.80	627.76	0.31
Sycamore Creek	Reach-1	1486	55-year	3000.00	5.50	13.44	10.41	13.61	0.000745	4.25	1376.55	0.27
Sycamore Creek	Reach-1	1438	55-year	3000.00	5.20	13.42	9.98	13.56	0.000589	3.81	1456.23	0.24
Sycamore Creek	Reach-1	1385	55-year	3000.00	4.67	13.19	9.49	13.44	0.000936	4.82	1101.00	0.29
Sycamore Creek	Reach-1	1350		Bridge								
Sycamore Creek	Reach-1	1318	55-year	3000.00	4.67	13.05	9.50	13.28	0.000871	4.66	1135.92	0.28
Sycamore Creek	Reach-1	1227	55-year	3000.00	4.10	12.98	8.92	13.16	0.000662	4.18	1203.84	0.25
Sycamore Creek	Reach-1	1190		Bridge								
Sycamore Creek	Reach-1	1150	55-year	3000.00	4.10	12.94	8.93	13.05	0.000439	3.40	1412.58	0.20
Sycamore Creek	Reach-1	1005	55-year	3000.00	4.33	12.27	9.16	12.76	0.001596	6.15	651.08	0.38
Sycamore Creek	Reach-1	814	55-year	3000.00	3.76	10.49	8.58	11.72	0.003995	8.92	336.26	0.61
Sycamore Creek	Reach-1	783		Bridge								
Sycamore Creek	Reach-1	749	55-year	3000.00	3.75	9.76	8.57	11.31	0.005650	9.99	300.30	0.72
Sycamore Creek	Reach-1	513	55-year	3000.00	2.00	8.73	6.34	9.45	0.002189	6.84	438.66	0.49
Sycamore Creek	Reach-1	452		Bridge								
Sycamore Creek	Reach-1	403	55-year	3000.00	1.90	6.57	6.57	8.65	0.010202	11.58	259.13	1.00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Elevation (ft)
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Main Channel Distance (ft)
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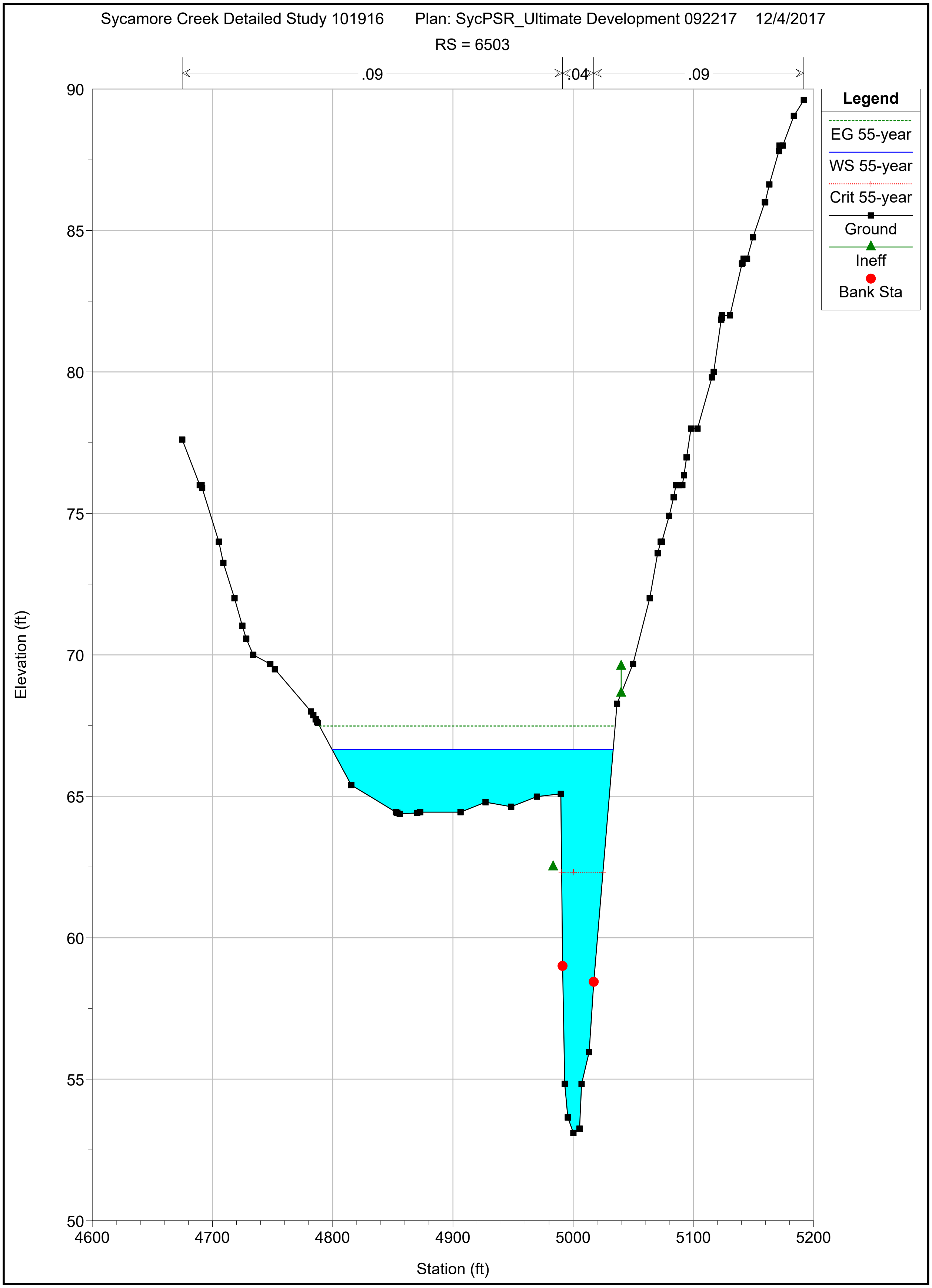Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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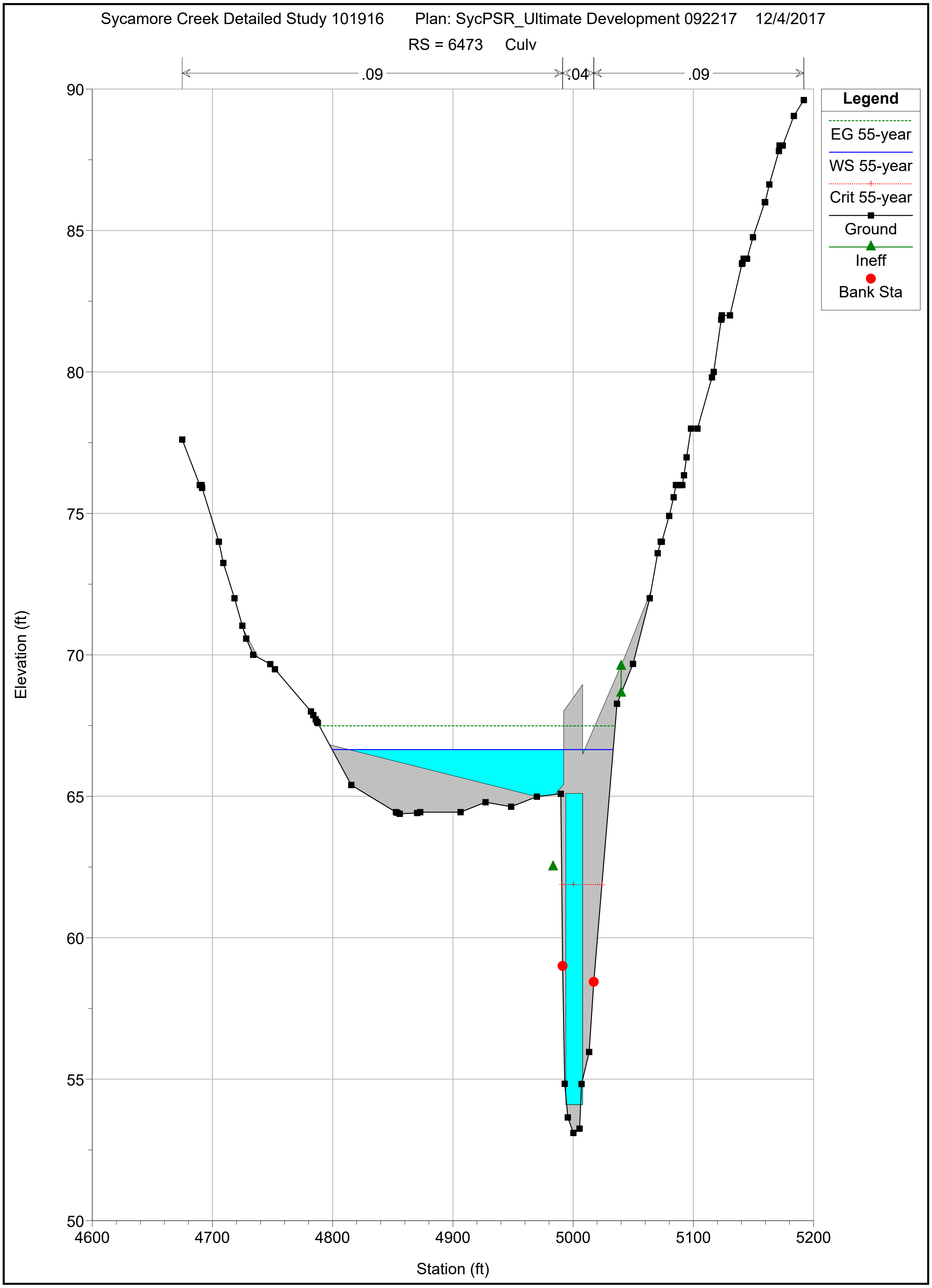
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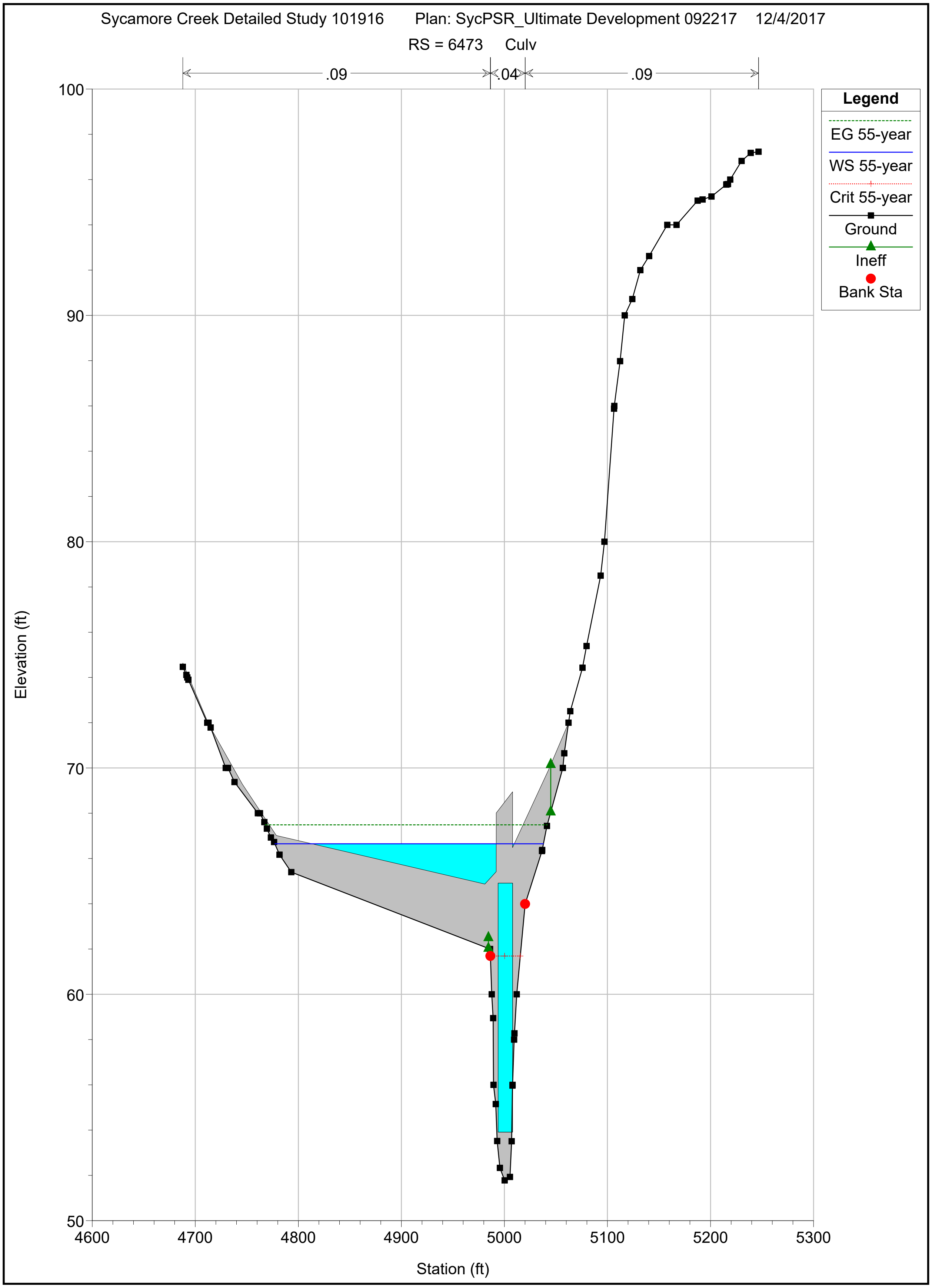Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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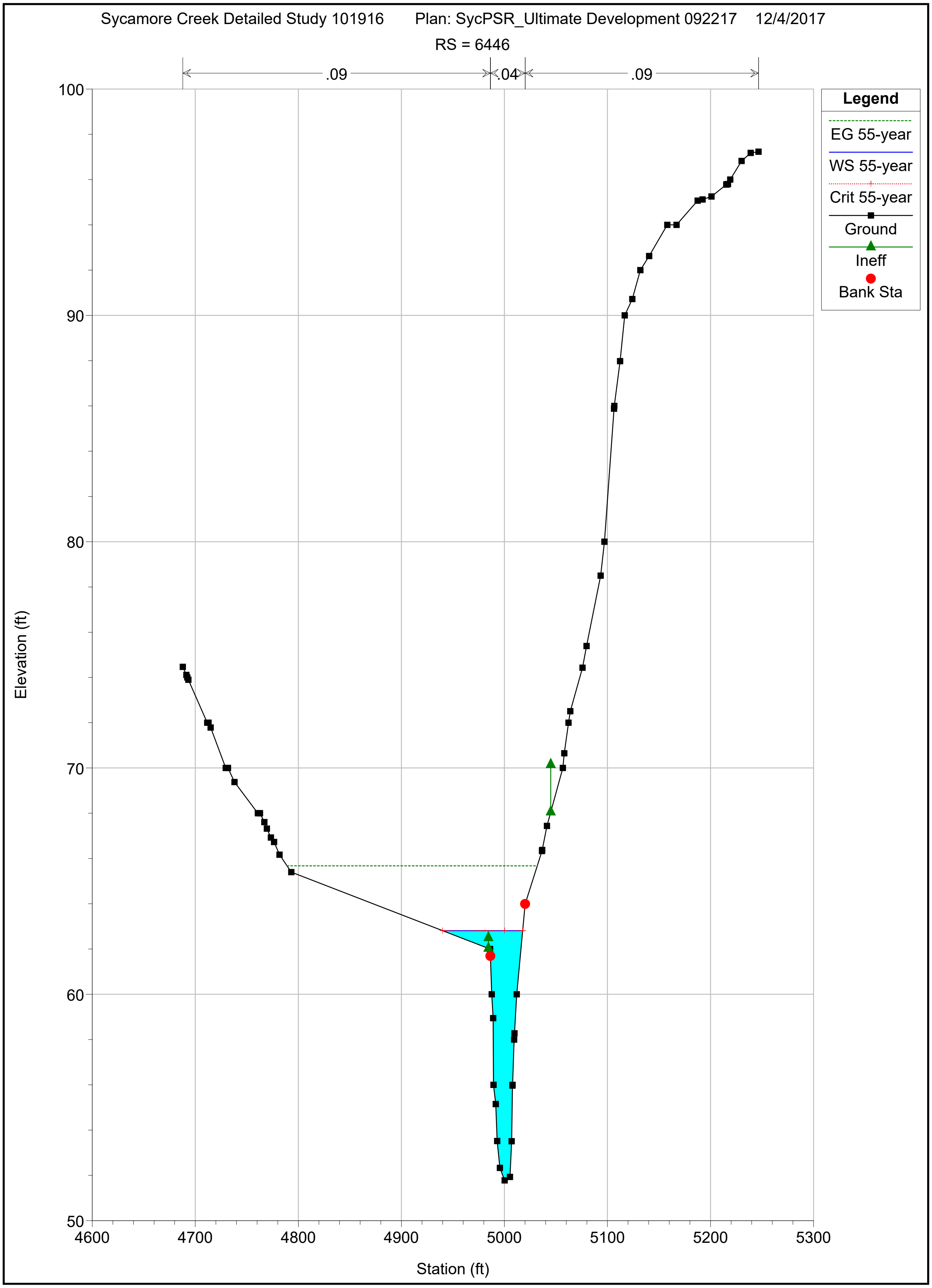
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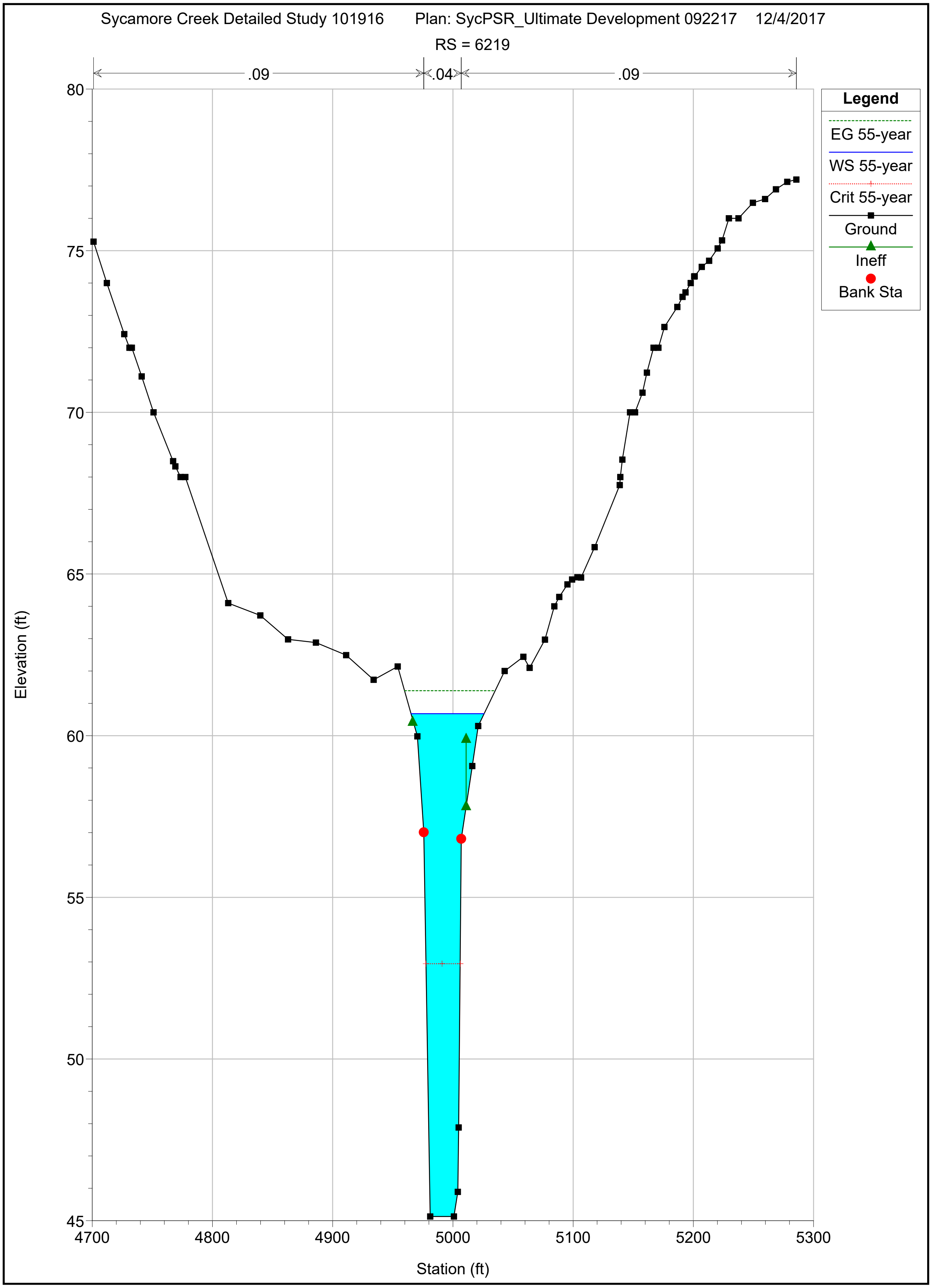
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Crit 55-year
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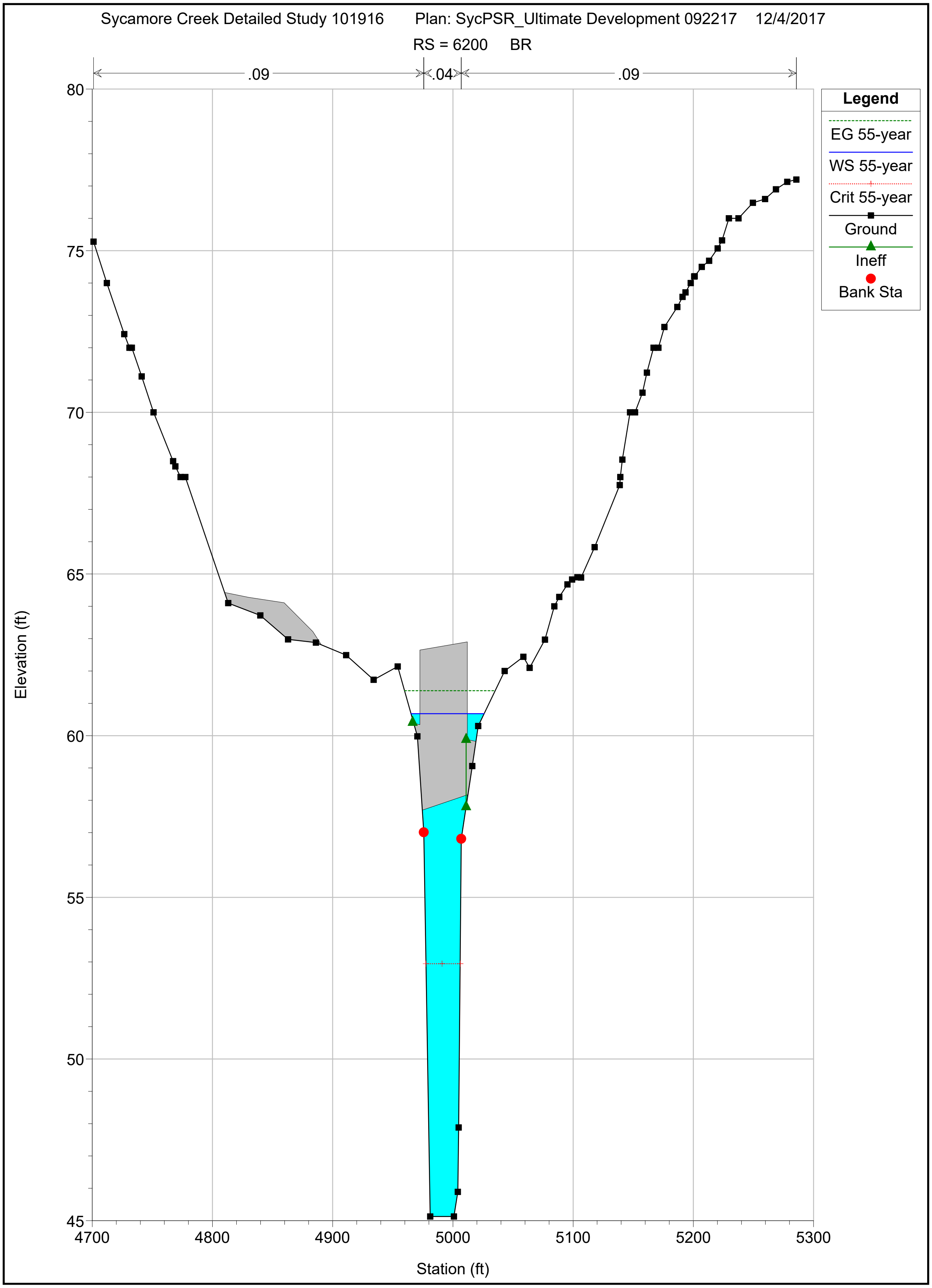Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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Crit 55-year
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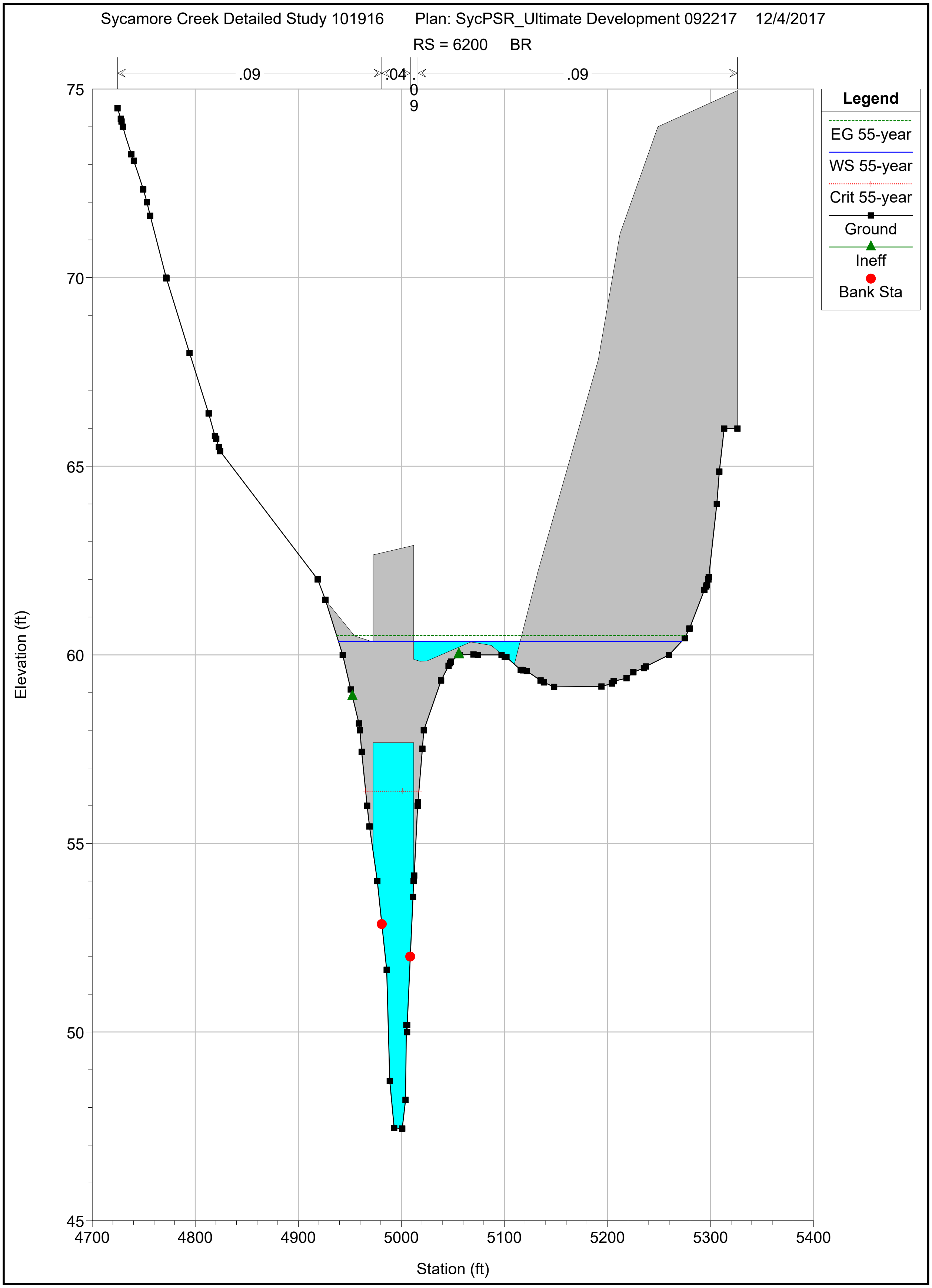
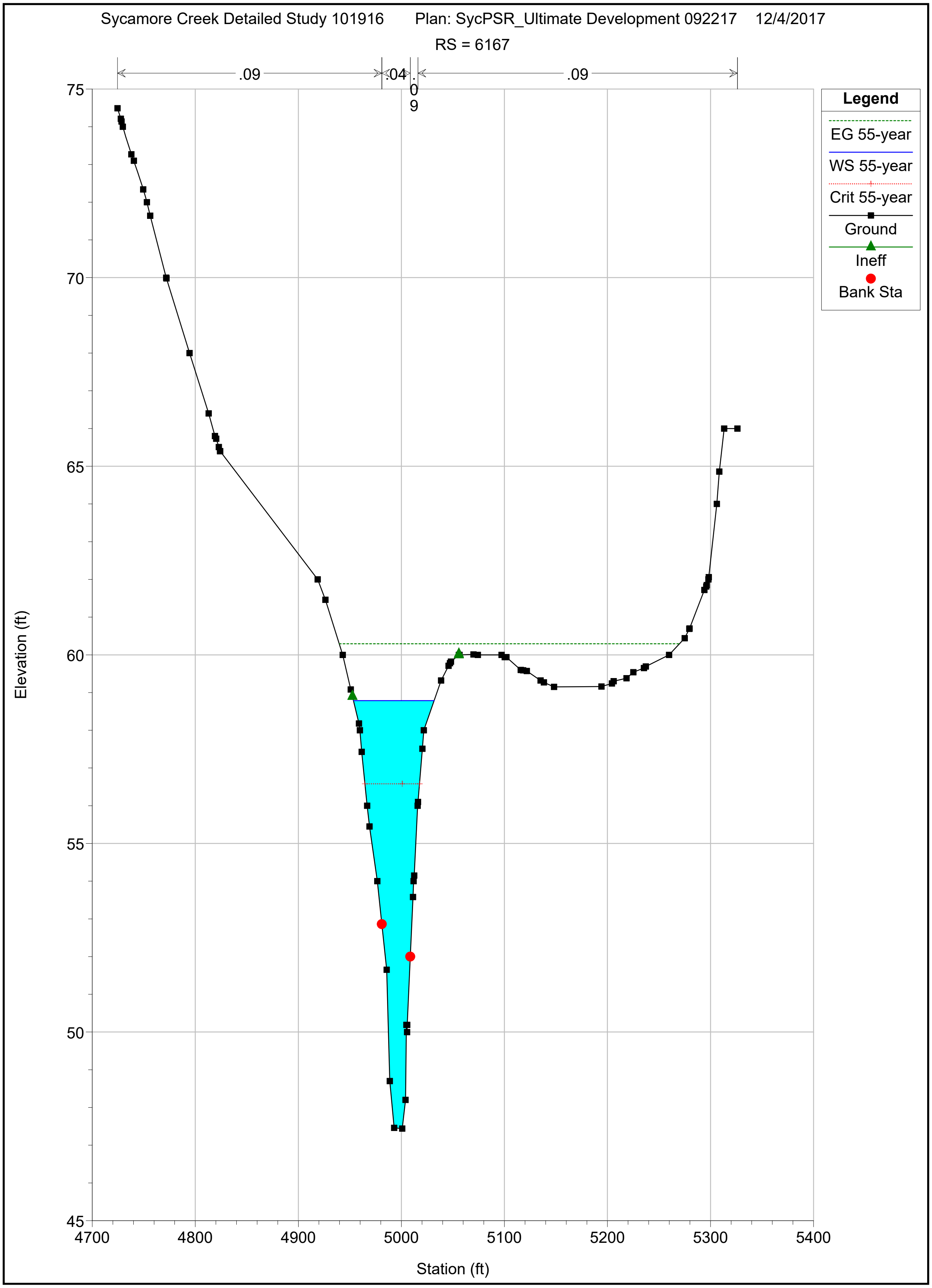
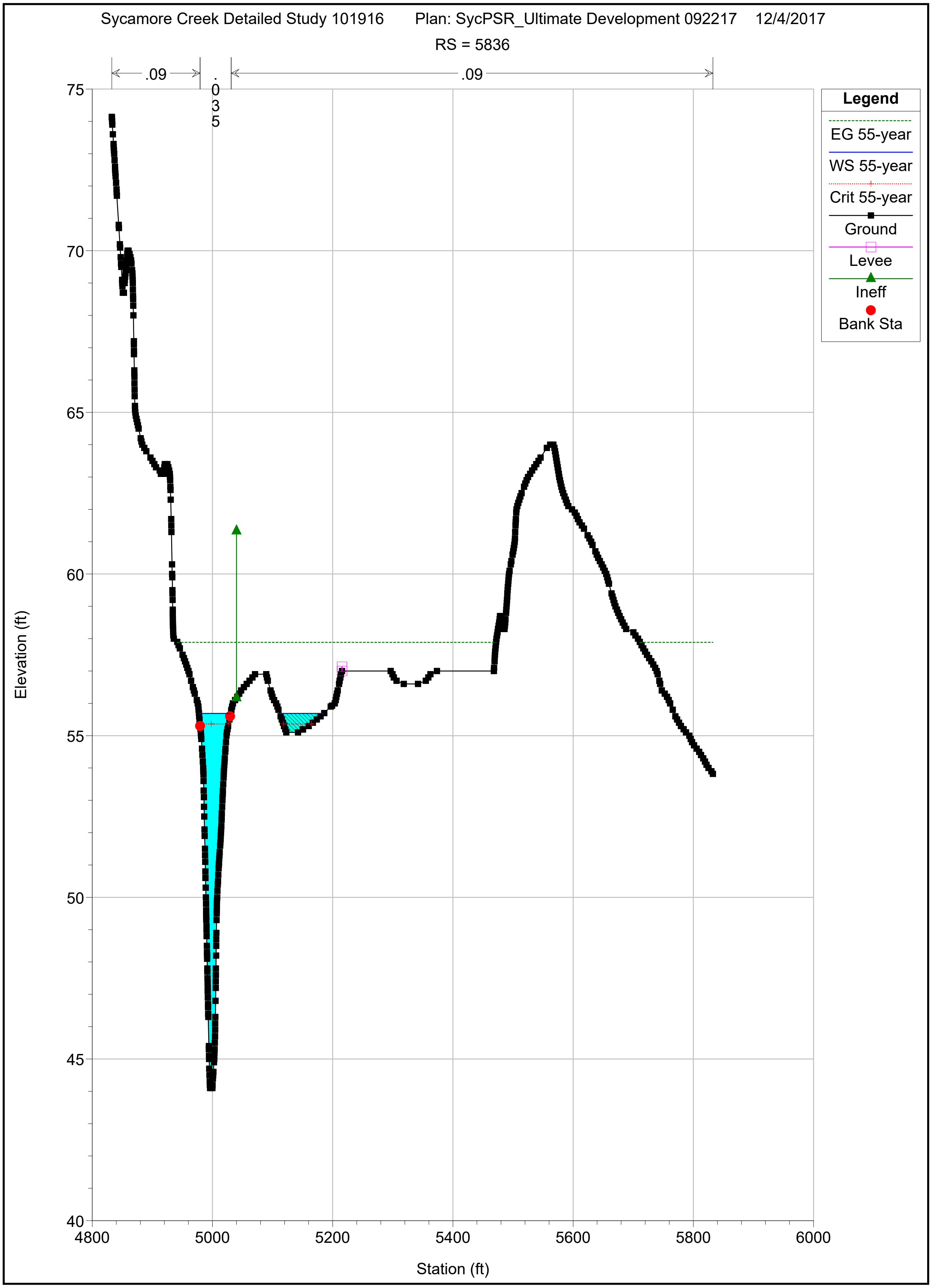
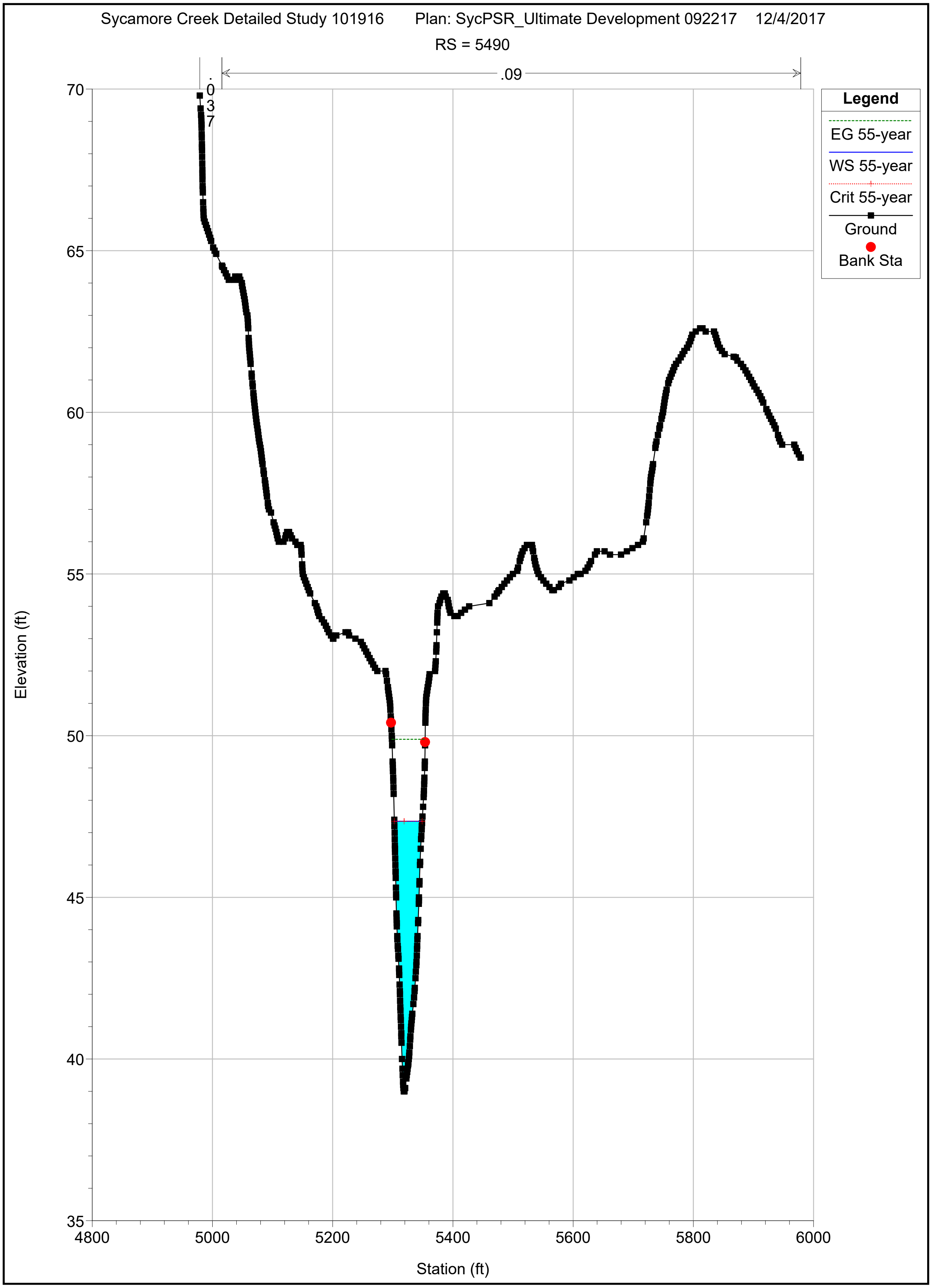
5100
5200
5300
Station (ft)


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 6200 BR
.09
.04
.
0
9
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
75
70
65
60
55
50
45
4700
4800
4900
5000
5100
5200
5300
5400
Station (ft)

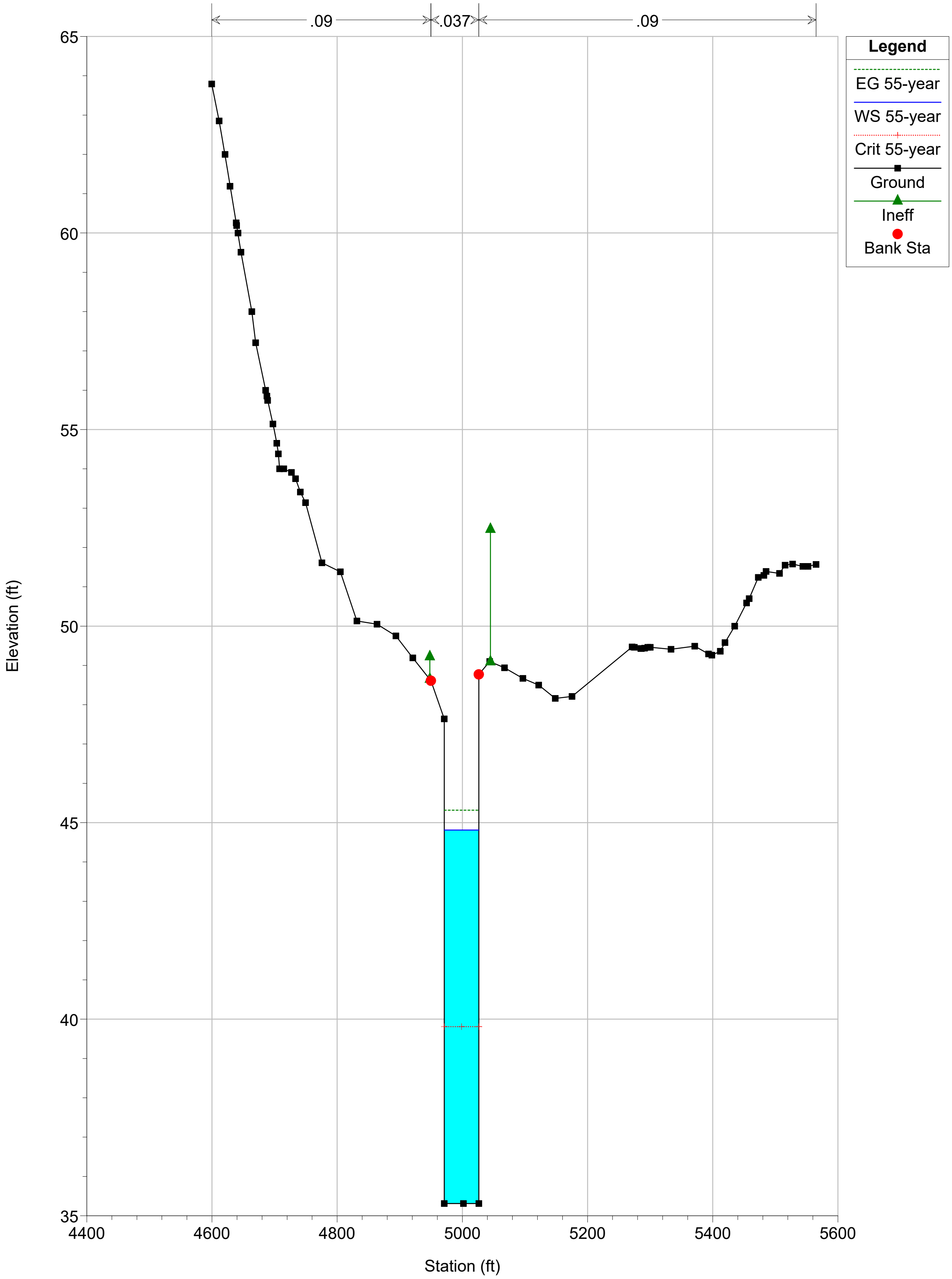

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 6167
.09
.04
.09
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
75
70
65
60
55
50
45
4700
4800
4900
5000
5100
5200
5300
5400

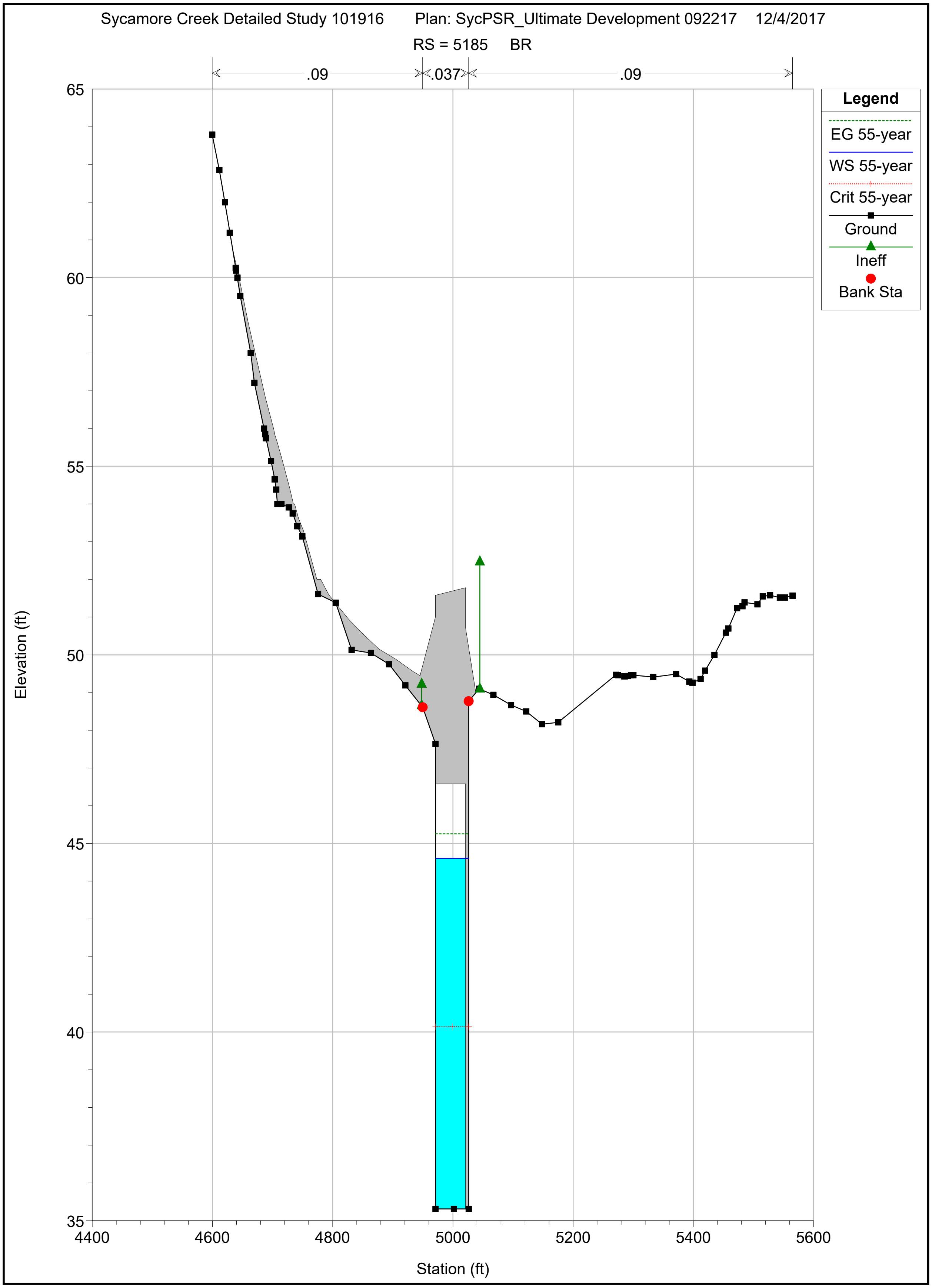
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 5836
.09
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
75
70
65
60
55
50
45
40
Station (ft)
4800
5000
5200
5400
5600
5800
6000

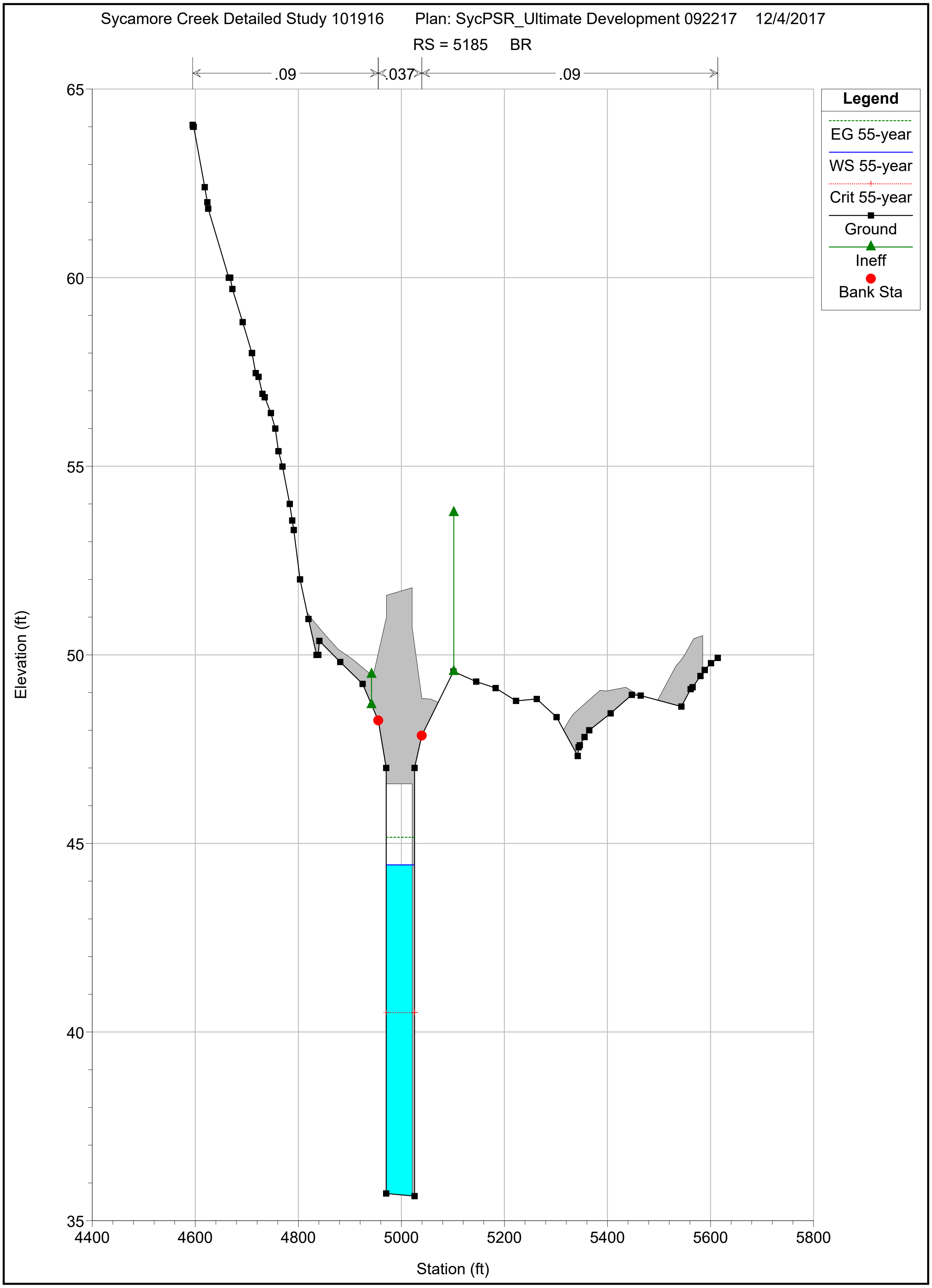

Sycamore Creek Detailed Study 101916   Plan: SycPSR_Ultimate Development 092217   12/4/2017
RS = 5490
.037
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
70
65
60
55
50
45
40
35
4800
5000
5200
5400
5600
5800
6000

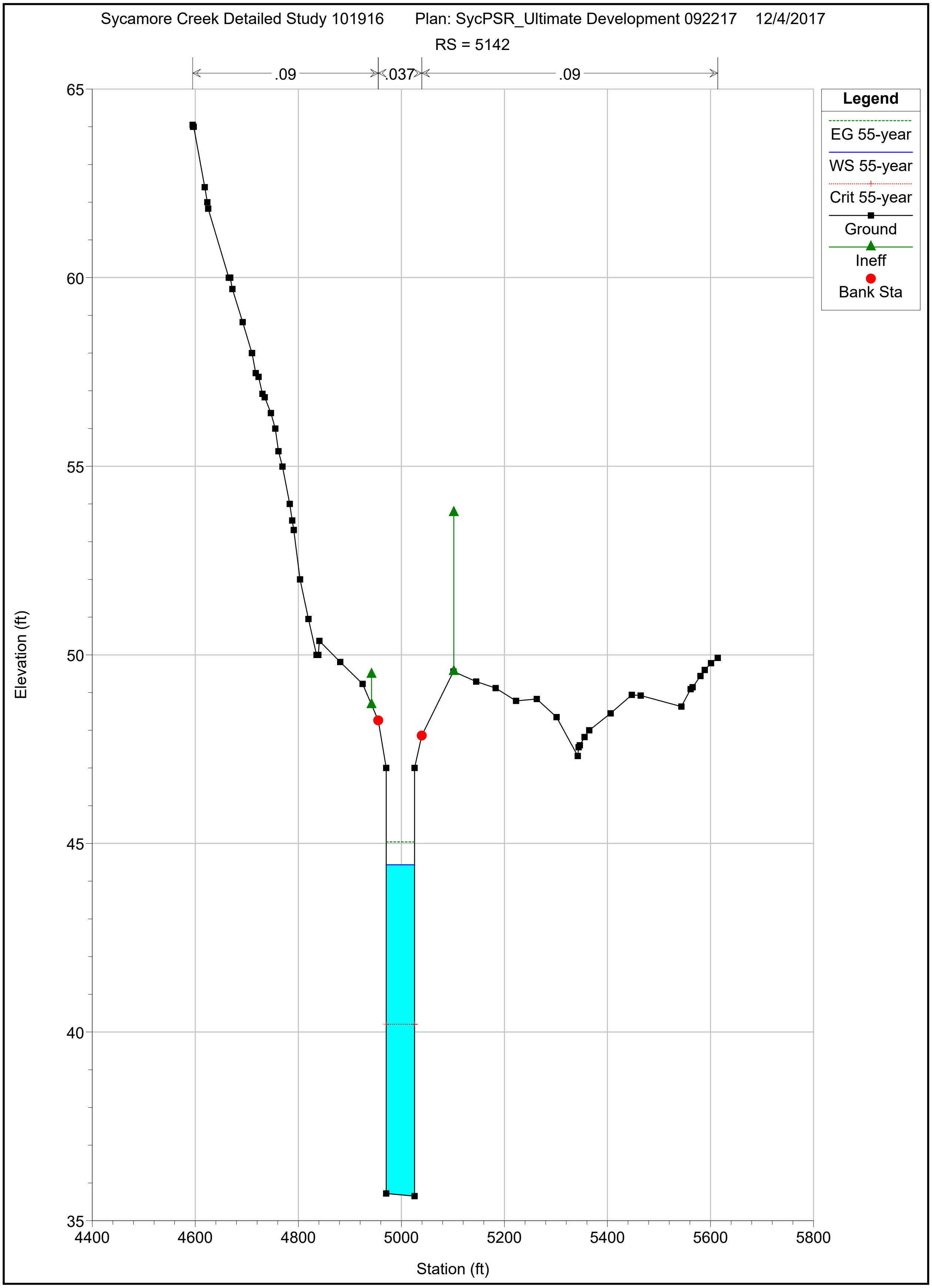
Sycamore Creek Detailed Study 101916   Plan: SycPSR_Ultimate Development 092217   12/4/2017

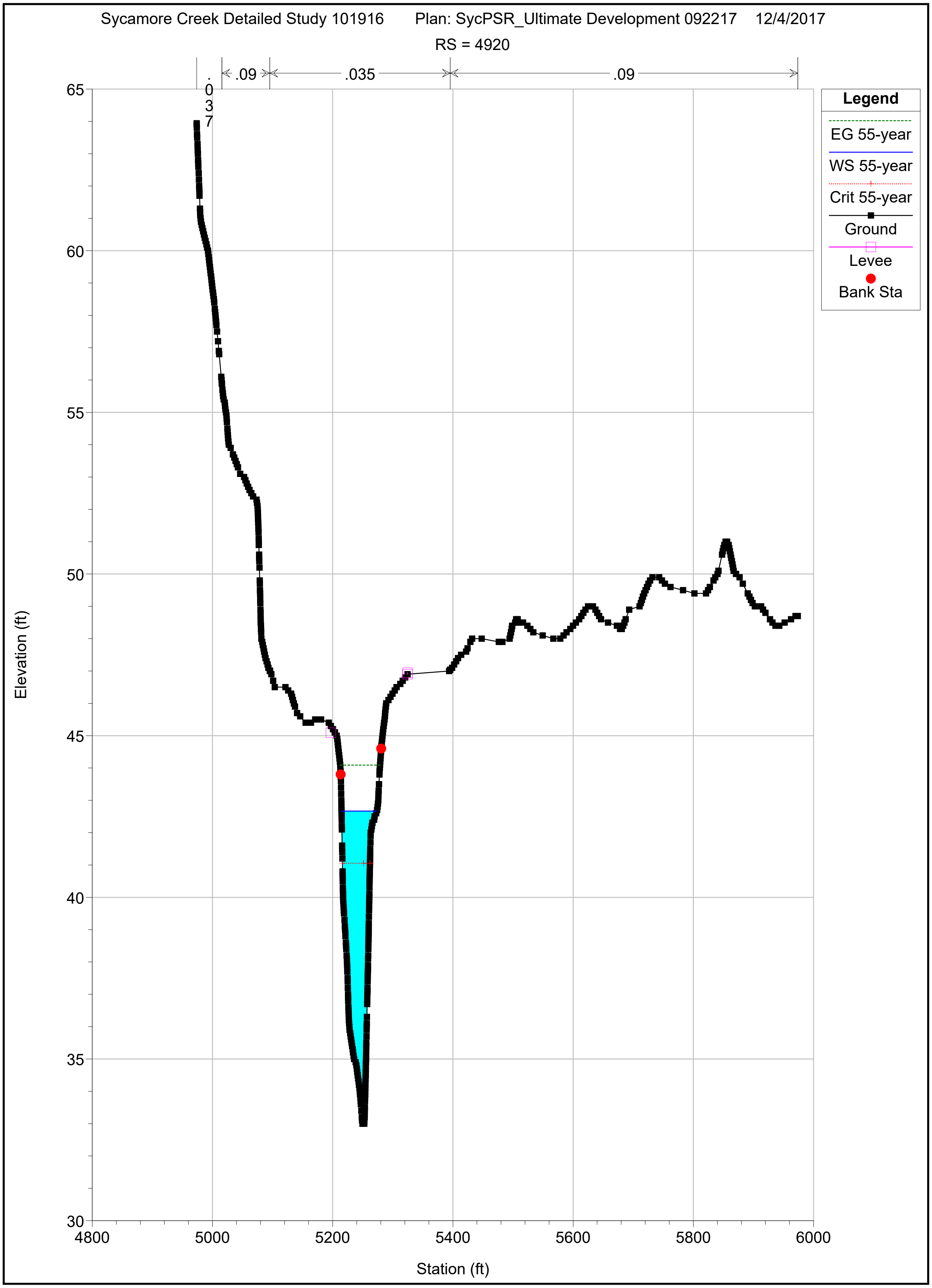
RS = 5212

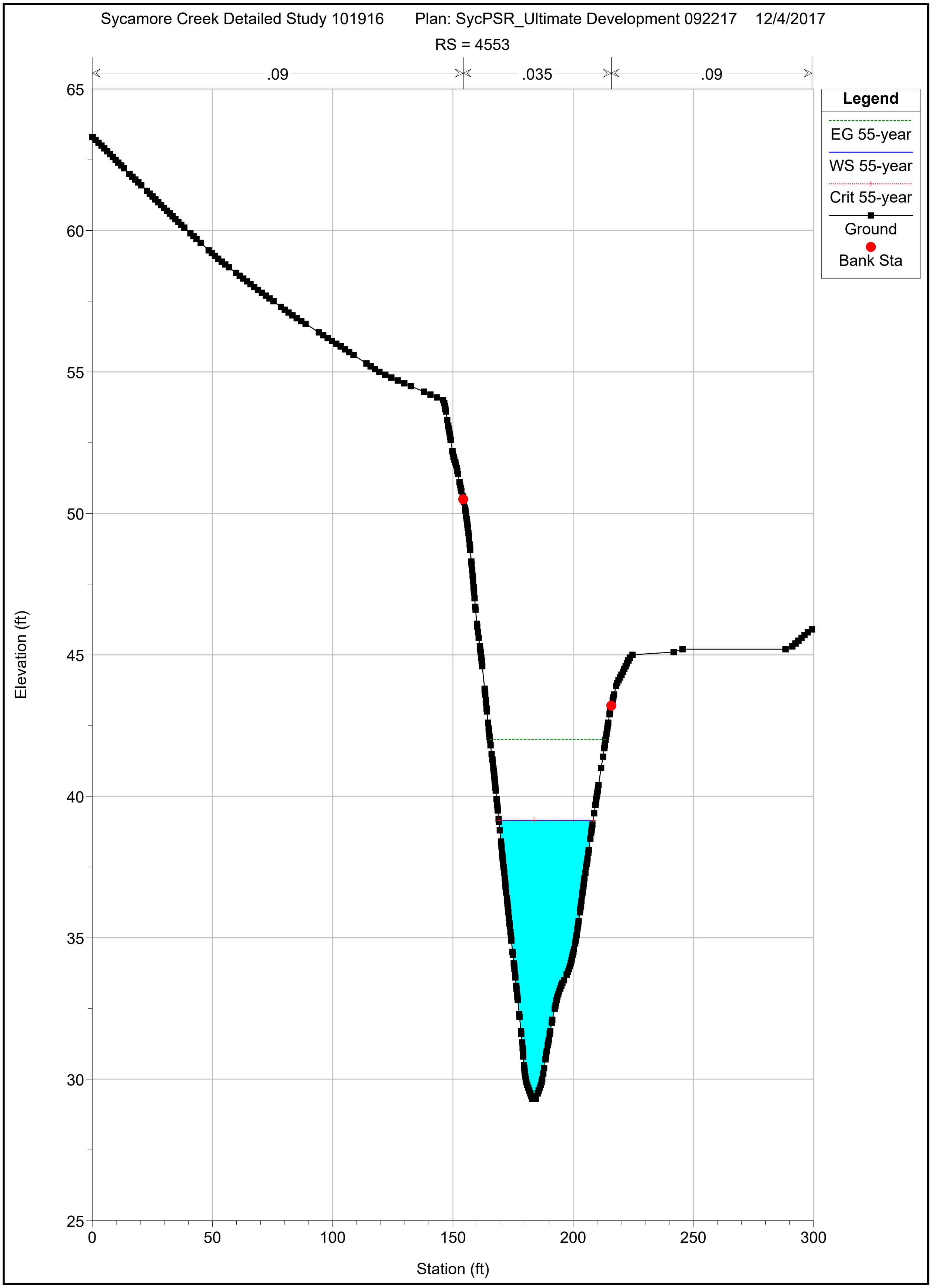


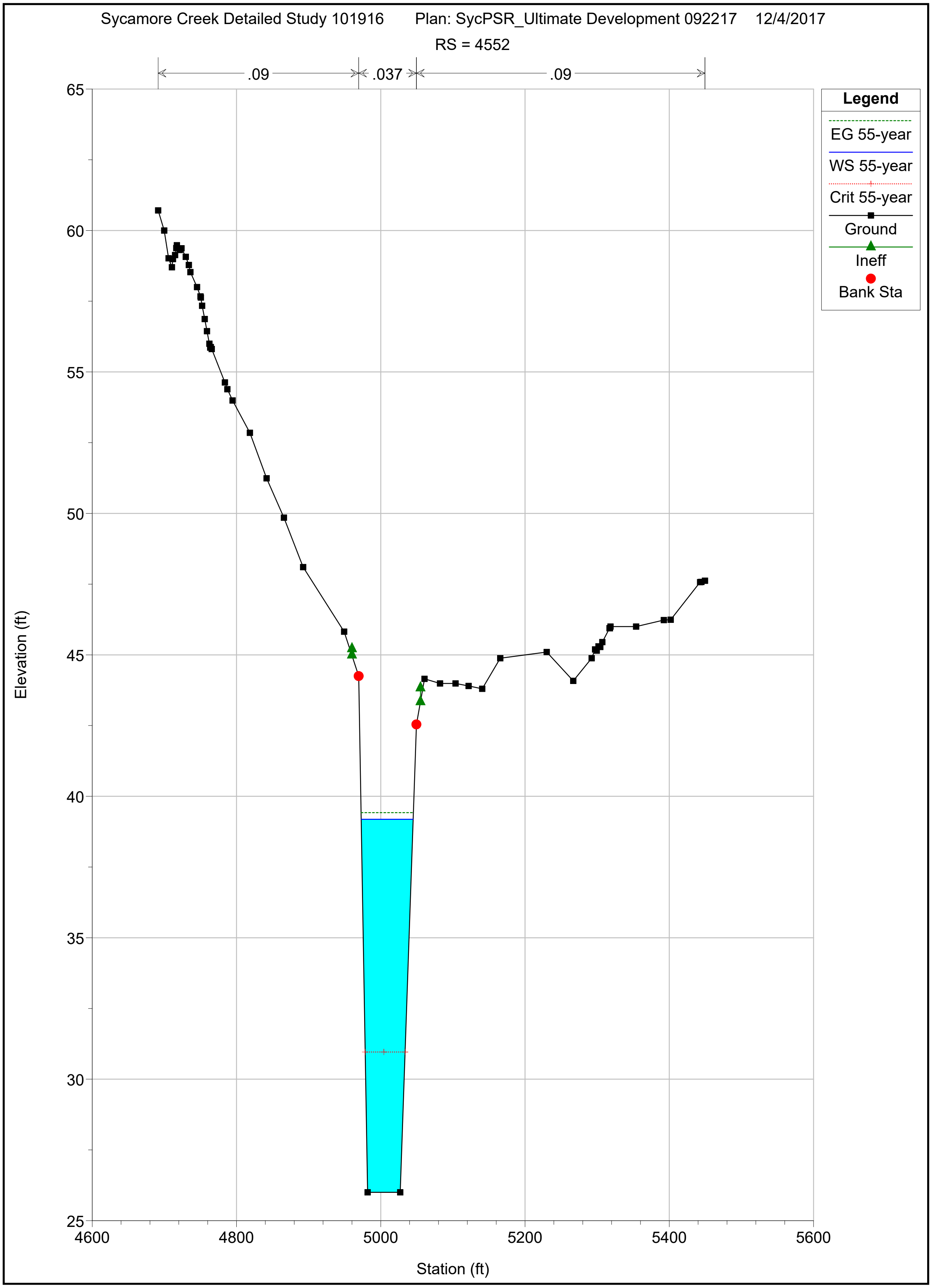
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 5185 BR
.09
.037
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
65
60
55
50
45
40
35
Elevation (ft)
4400
4600
4800
5000
5200
5400
5600
Station (ft)

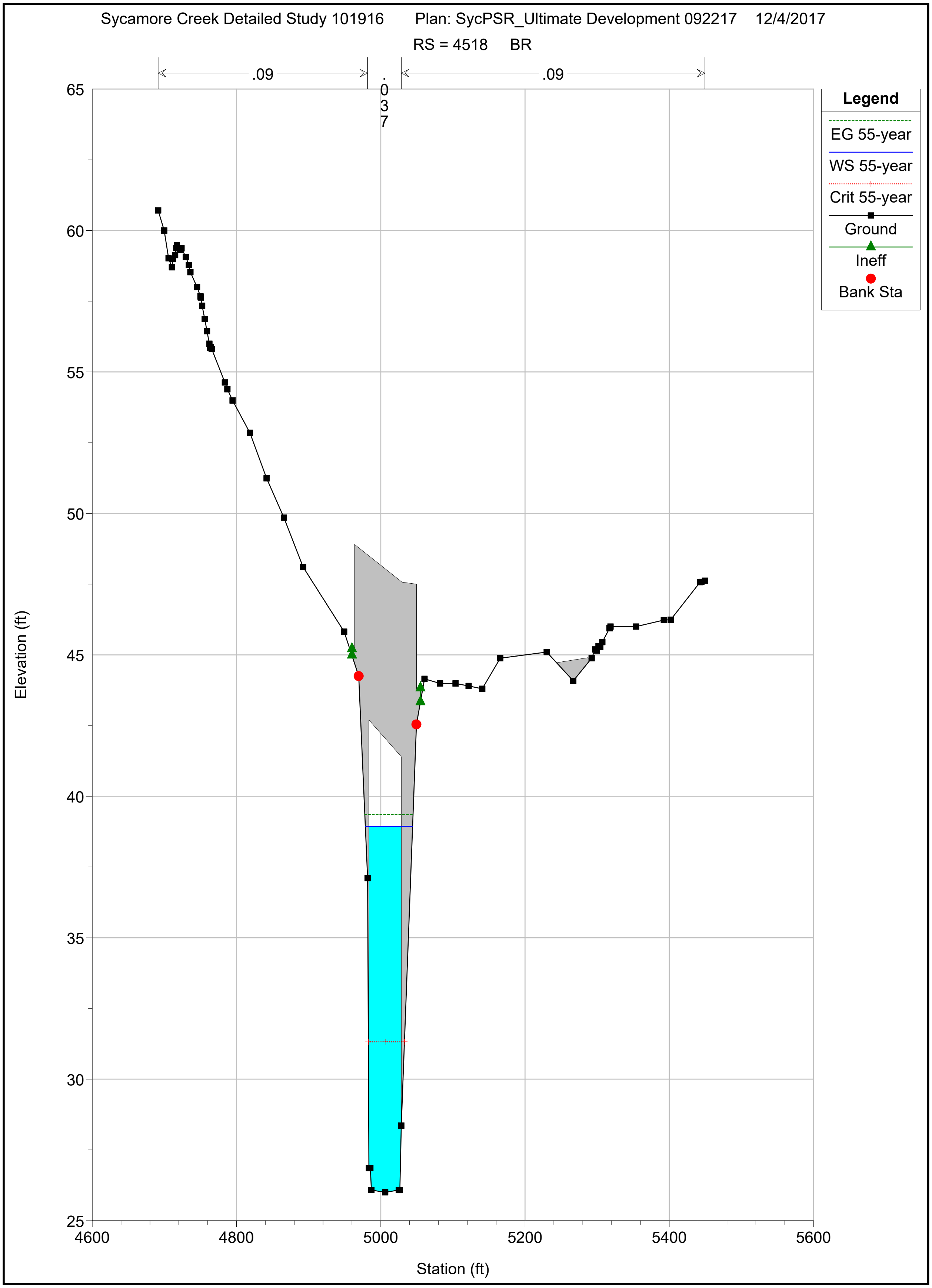

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 5185 BR
.09
.037
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
65
60
55
50
45
40
35
Station (ft)
4400
4600
4800
5000
5200
5400
5600
5800


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 5142
.09
.037
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
65
60
55
50
45
40
35
4400
4600
4800
5000
5200
5400
5600
5800
Station (ft)

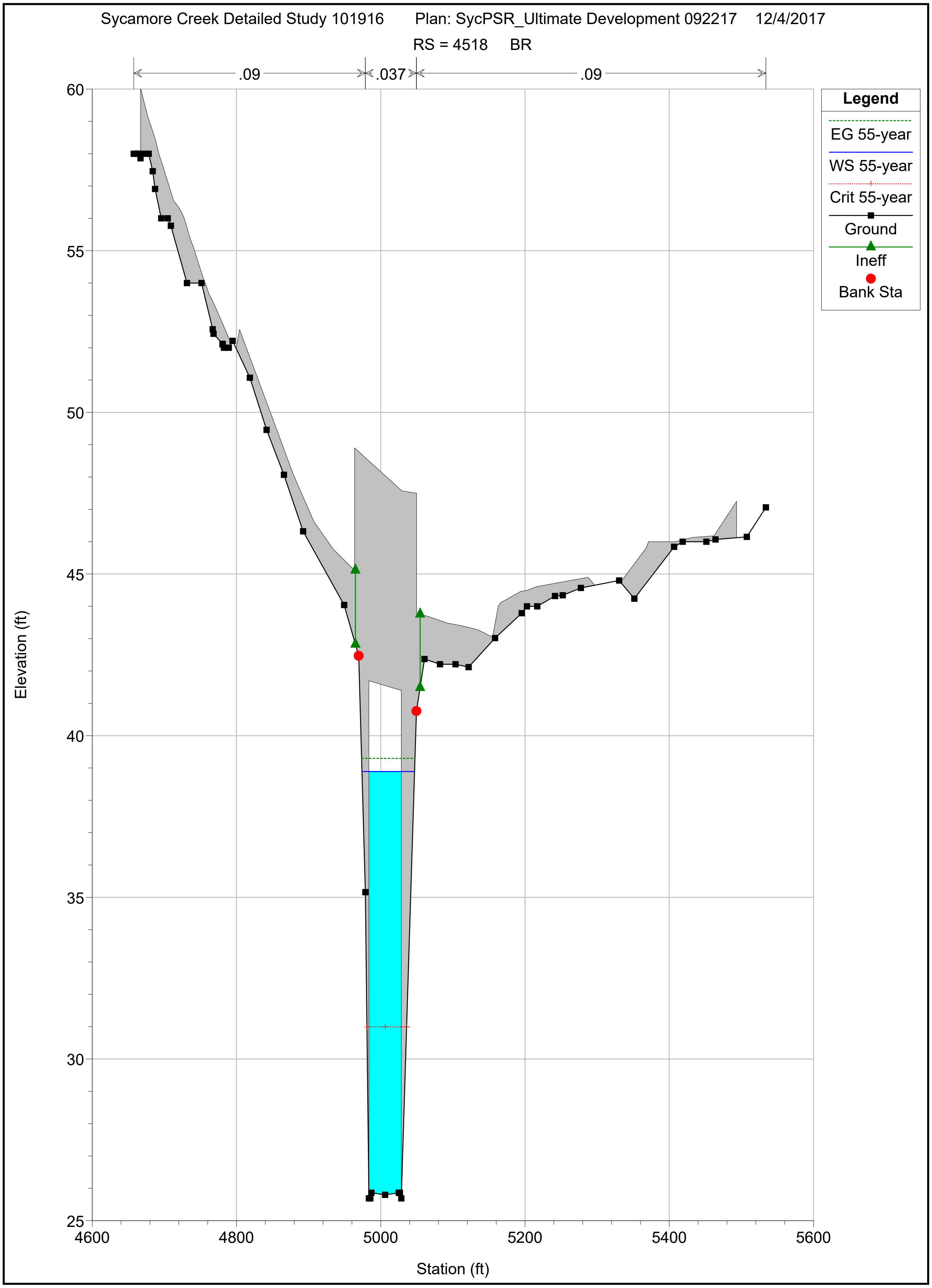
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 4920
.037
.09
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Bank Sta
Elevation (ft)
65
60
55
50
45
40
35
30
4800
5000
5200
5400
5600
5800
6000
Station (ft)

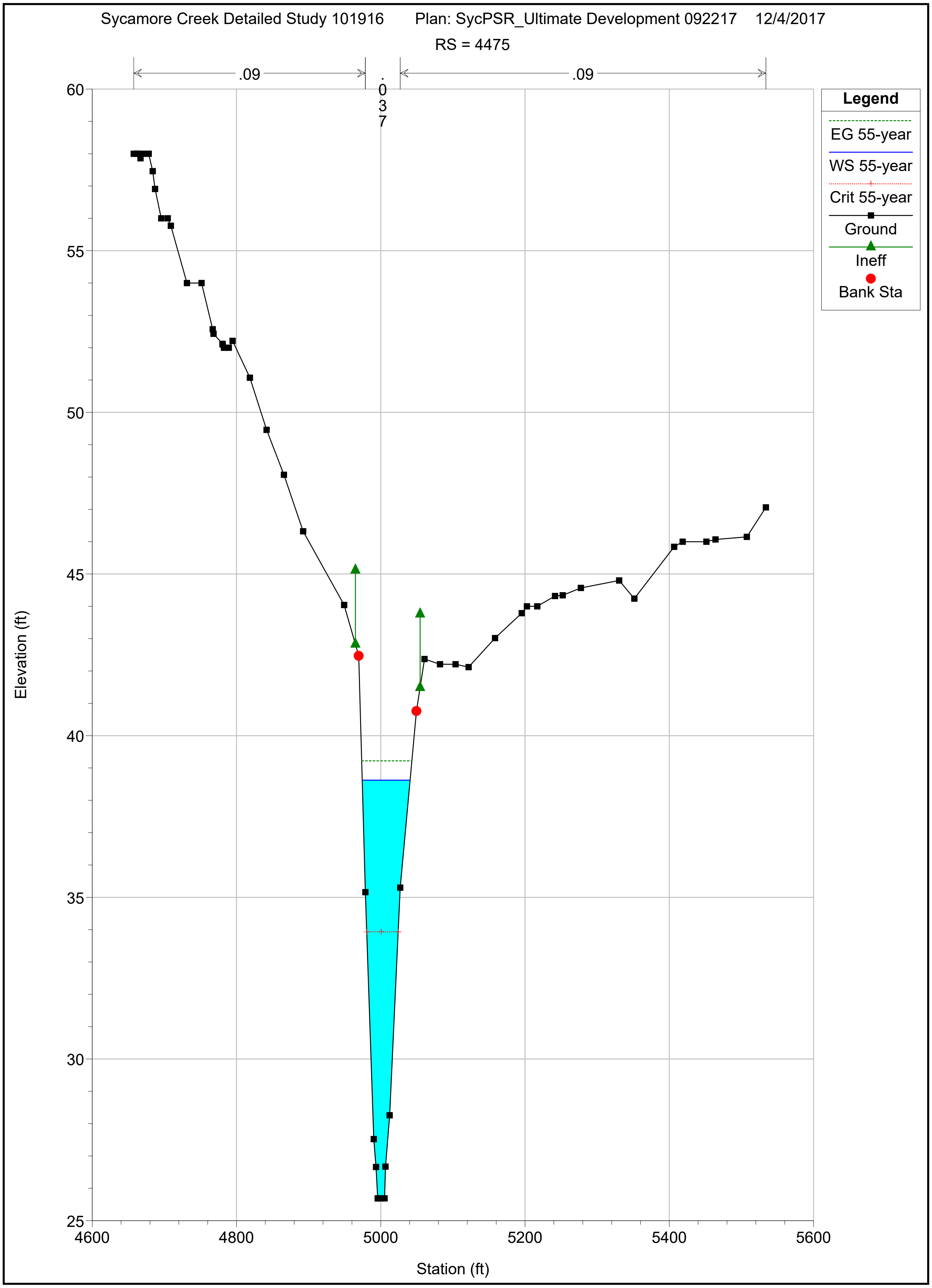

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 4553
.09
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Bank Sta
Elevation (ft)
65
60
55
50
45
40
35
30
25
0
50
100
150
200
250
300
Station (ft)

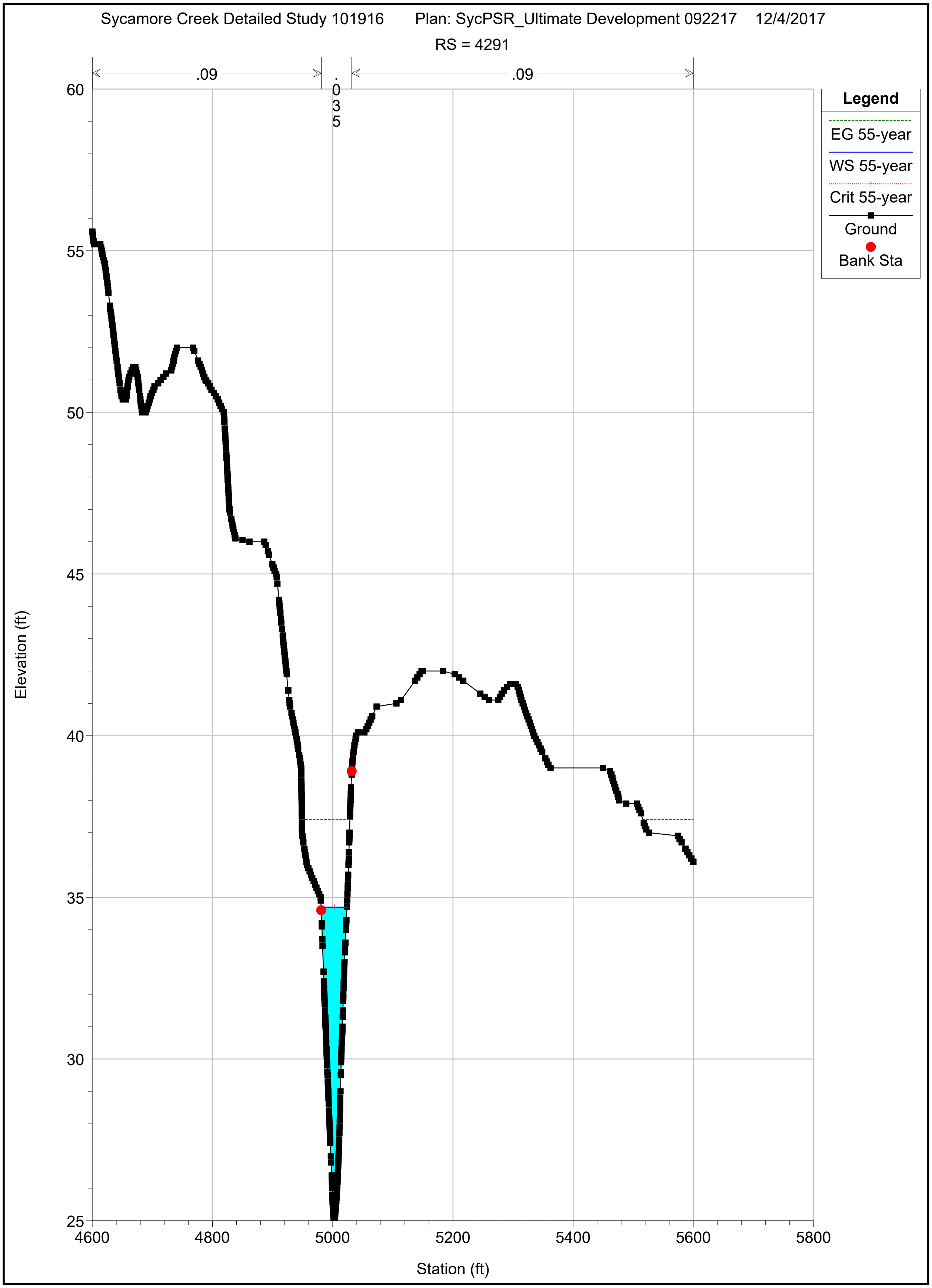

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 4552
.09
.037
.09
65
60
55
50
45
40
35
30
25
4600
4800
5000
5200
5400
5600
Elevation (ft)
Station (ft)
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta



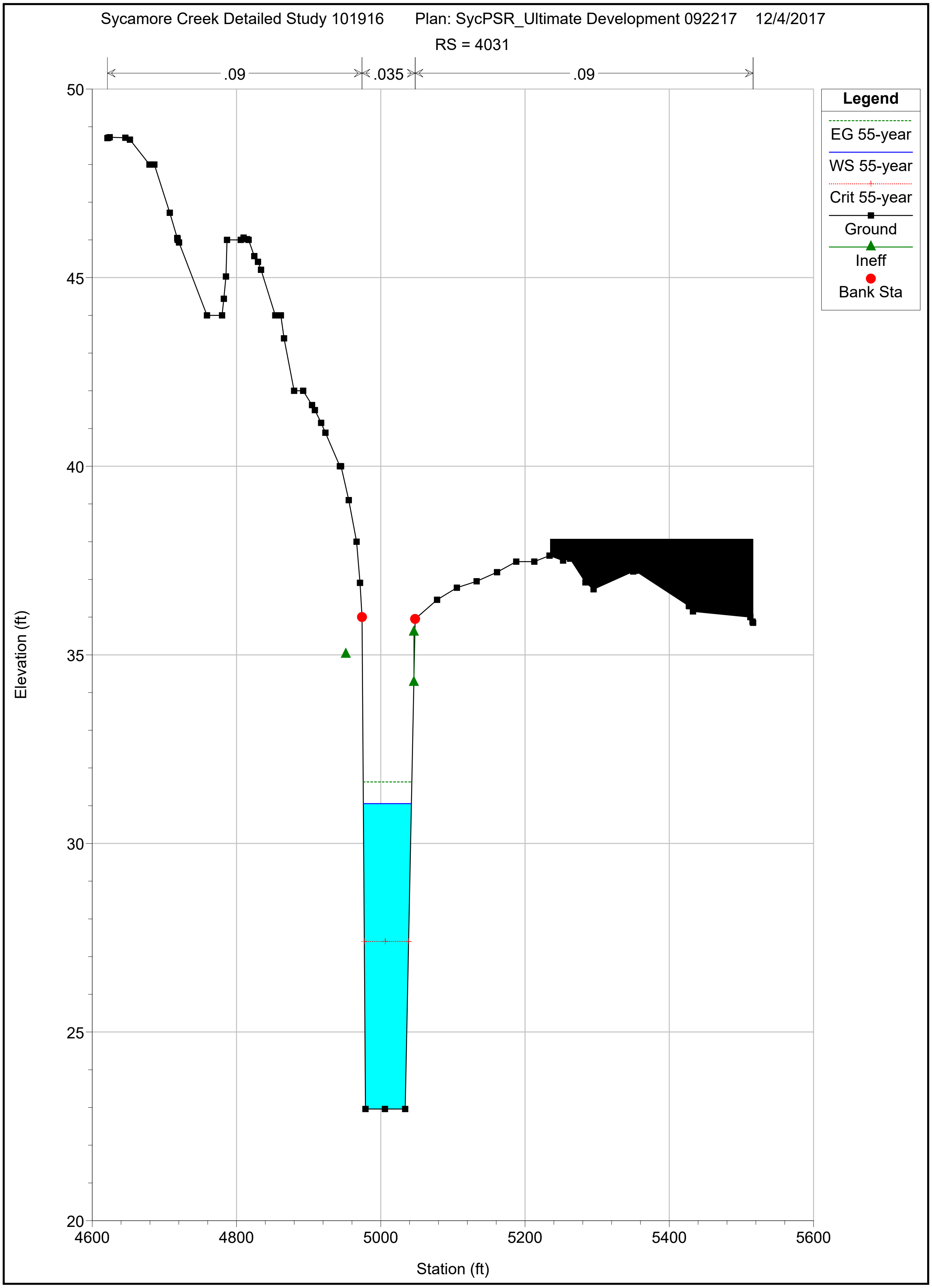
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 4518 BR
.09
.037
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
65
60
55
50
45
40
35
30
25
Elevation (ft)
4600
4800
5000
5200
5400
5600
Station (ft)

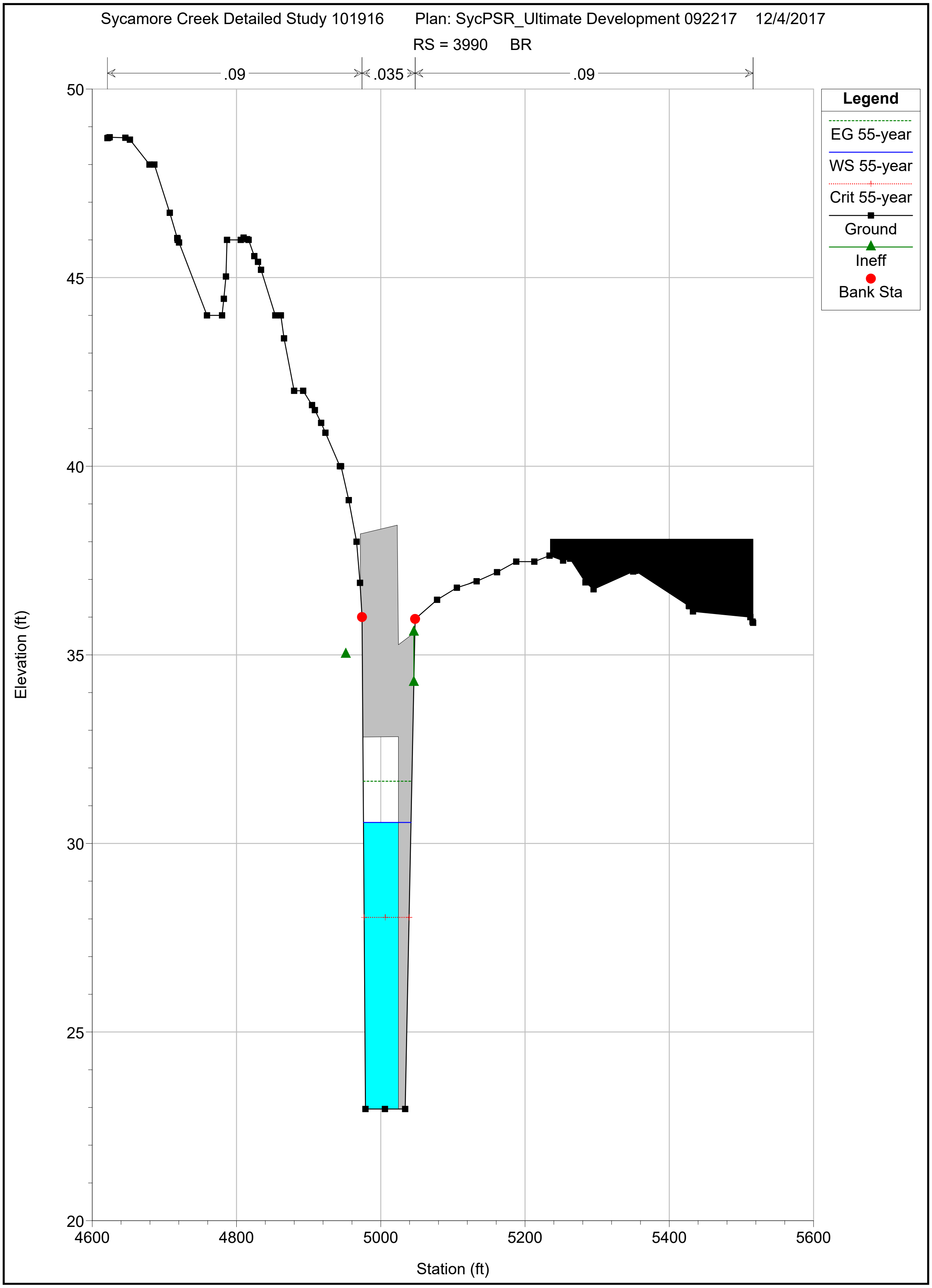

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 4518 BR
.09
.037
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
60
55
50
45
40
35
30
25
4600
4800
5000
5200
5400
5600
Station (ft)

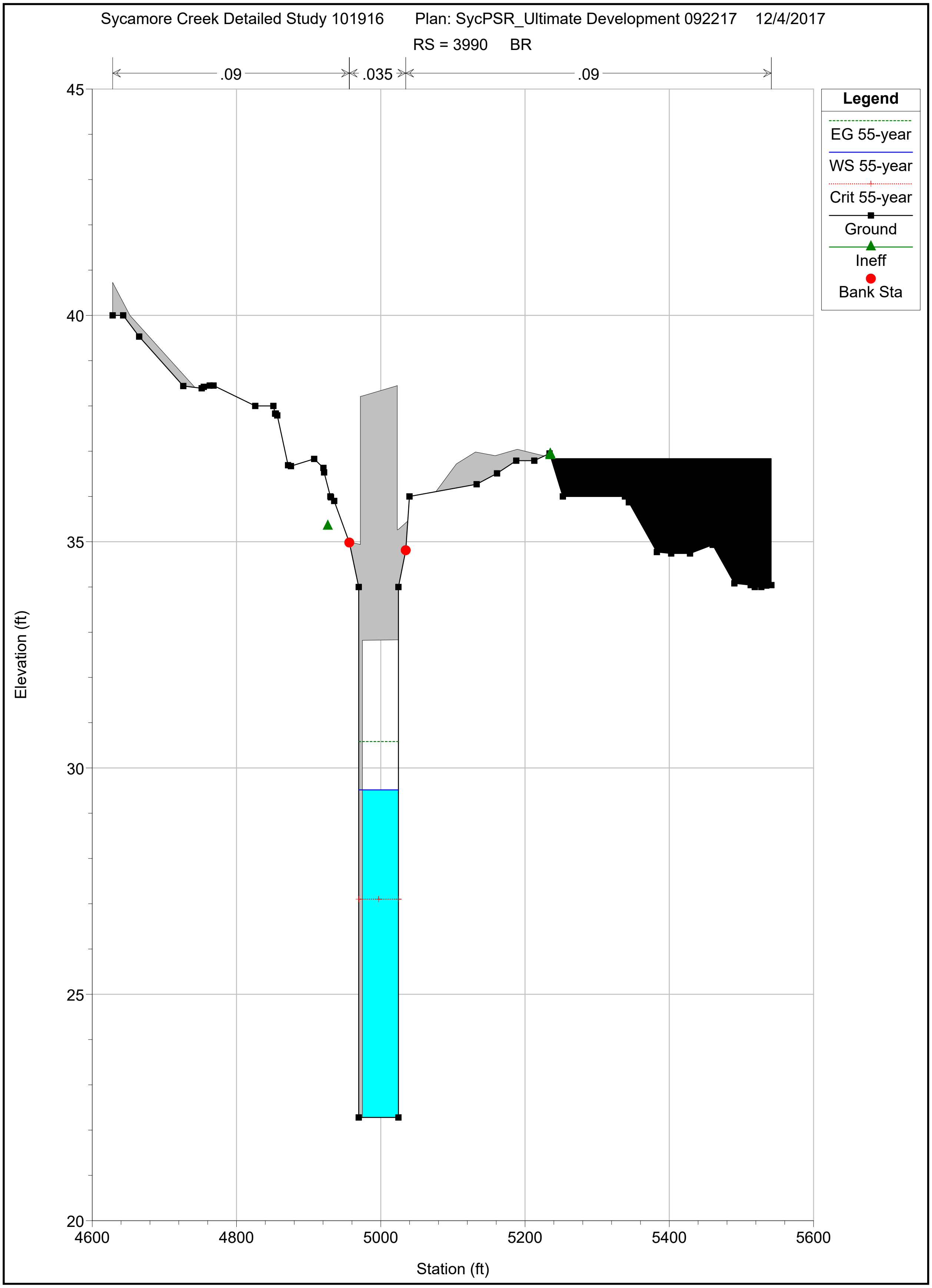

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 4475
.09
.037
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
60
55
50
45
40
35
30
25
4600
4800
5000
5200
5400
5600
Station (ft)

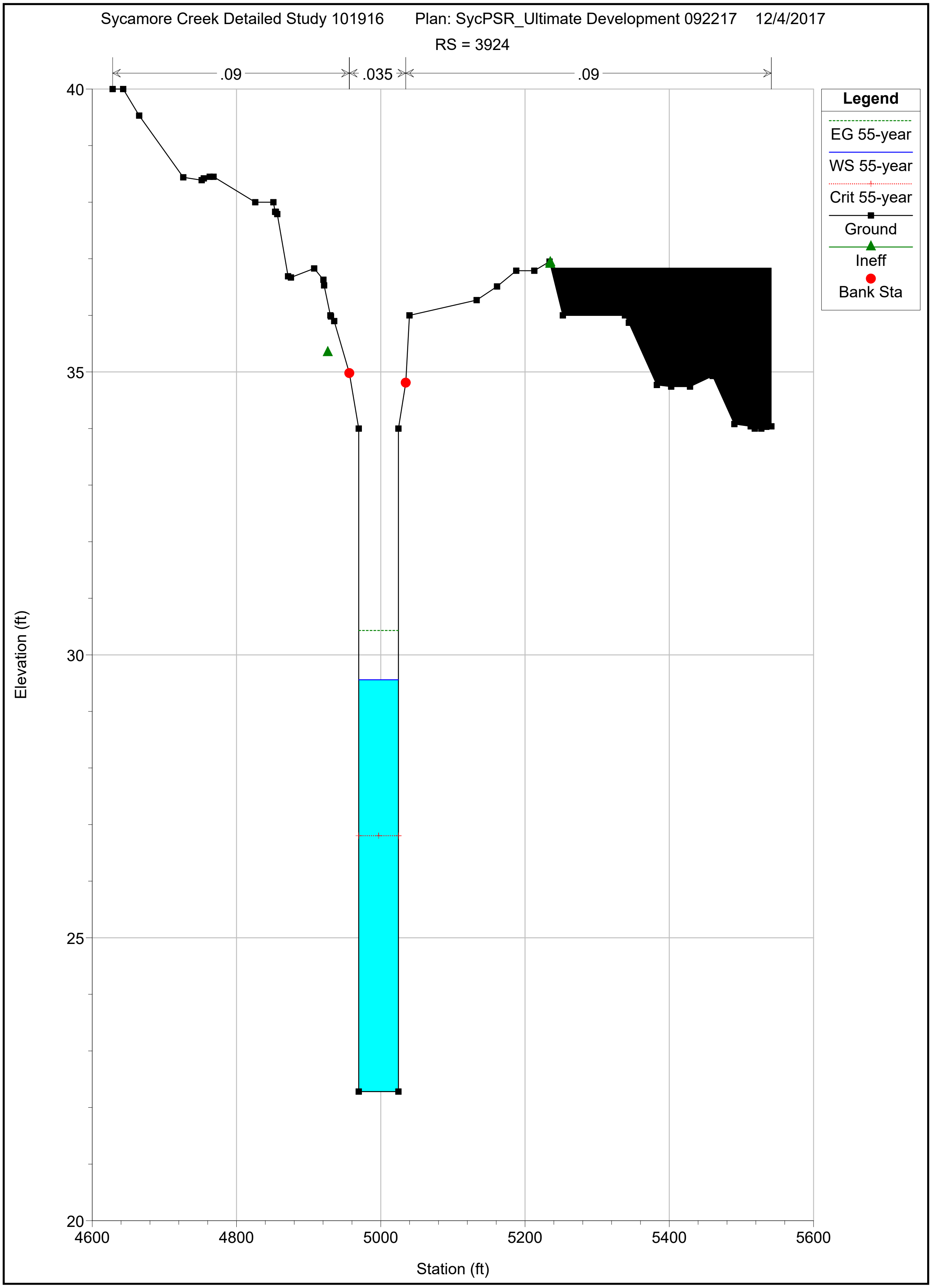


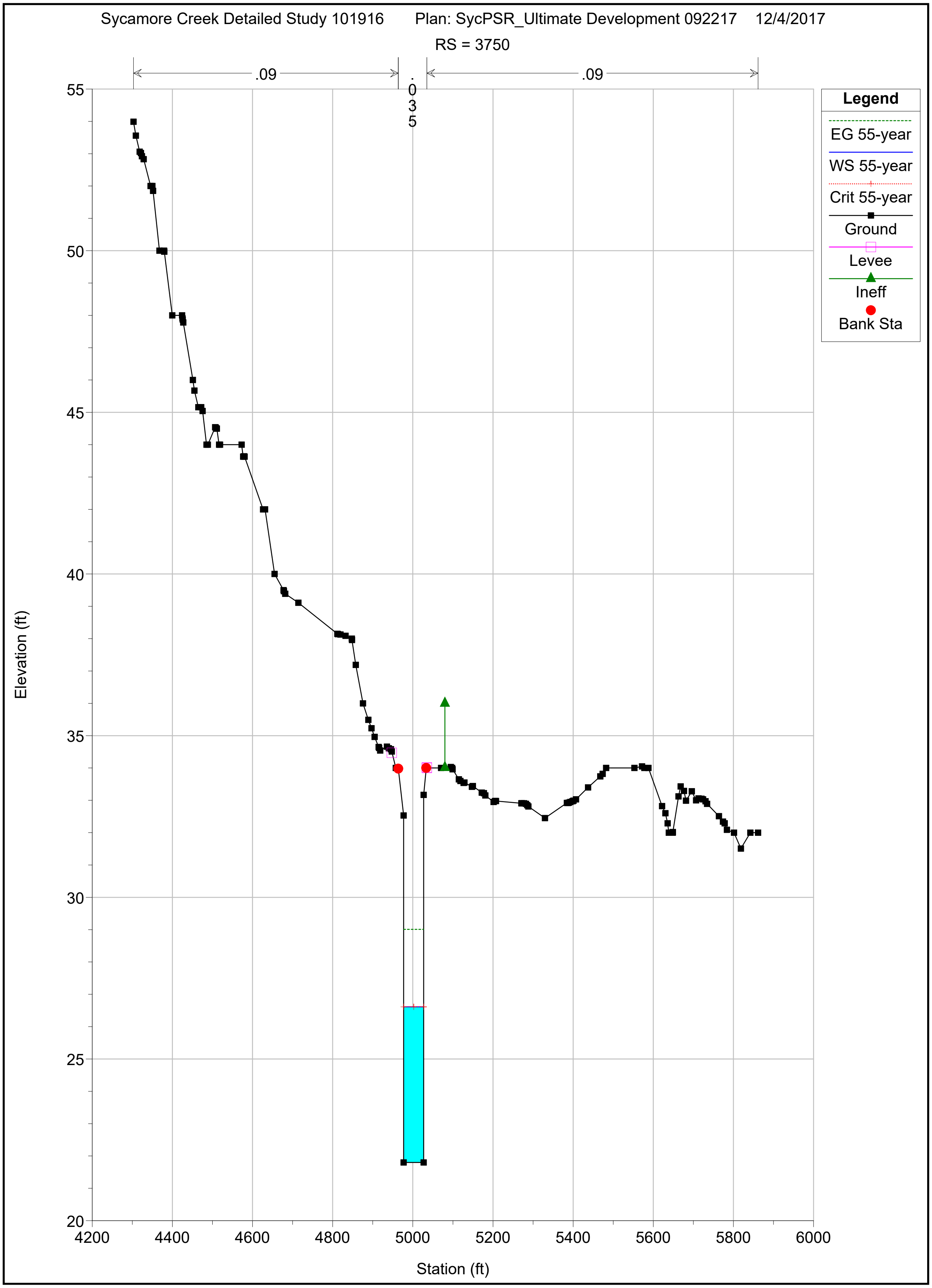
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 4291
.09
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Bank Sta
Elevation (ft)
60
55
50
45
40
35
30
25
4600
4800
5000
5200
5400
5600
5800
Station (ft)


Sycamore Creek Detailed Study 101916
Plan: SycPSR_Ultimate Development 092217
12/4/2017
RS = 4031
.09
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
50
45
40
35
30
25
20
Station (ft)
4600
4800
5000
5200
5400
5600


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3990 BR
.09
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
50
45
40
35
30
25
20
4600
4800
5000
5200
5400
5600


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3990 BR
.09
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
45
40
35
30
25
20
4600
4800
5000
5200
5400
5600


Sycamore Creek Detailed Study 101916
Plan: SycPSR_Ultimate Development 092217
12/4/2017
RS = 3924
.09
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
40
35
30
25
20
Station (ft)
4600
4800
5000
5200
5400
5600


Sycamore Creek Detailed Study 101916
Plan: SycPSR_Ultimate Development 092217
12/4/2017
RS = 3750
.09
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
55
50
45
40
35
30
25
20
Station (ft)
4200
4400
4600
4800
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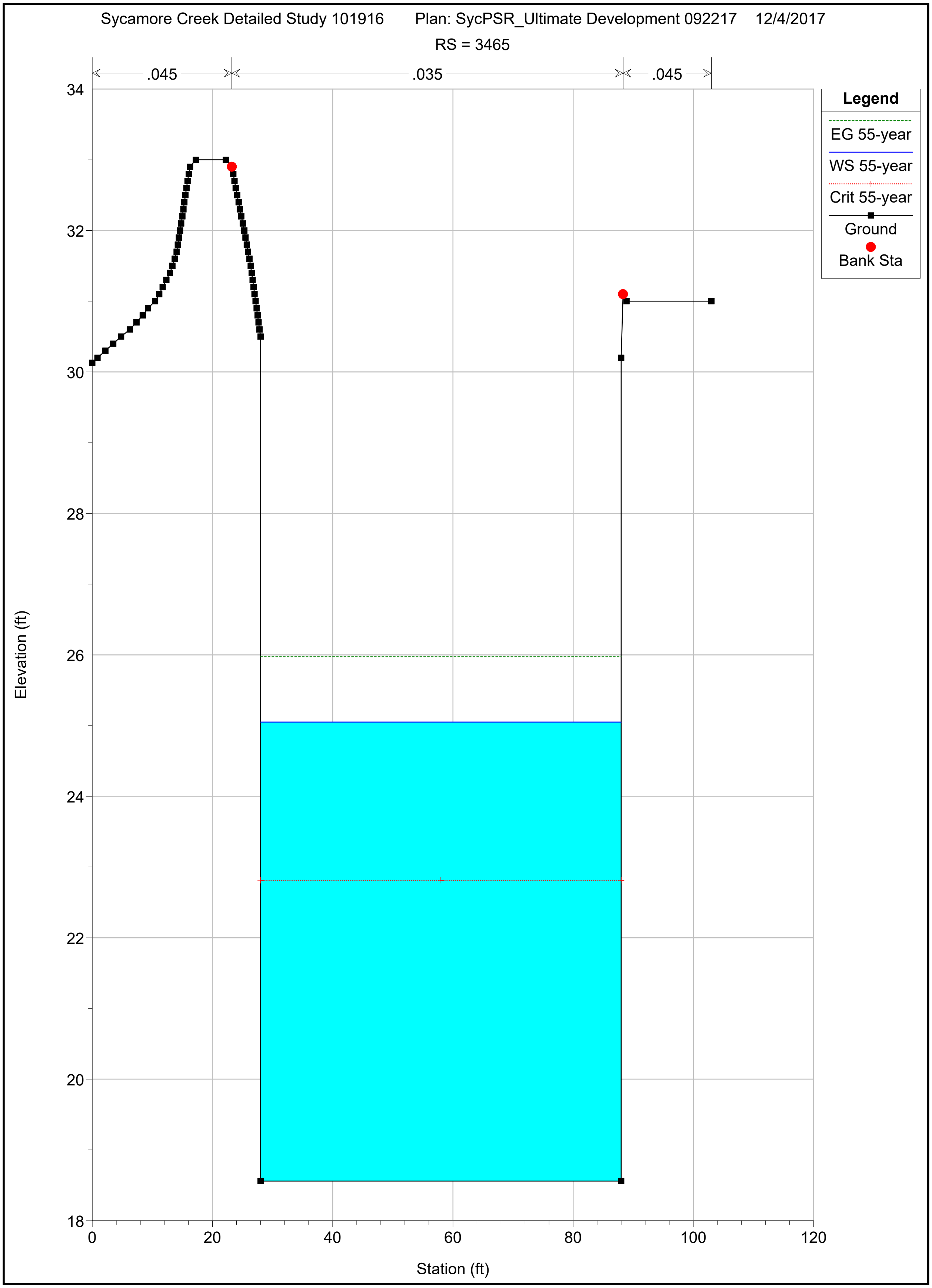
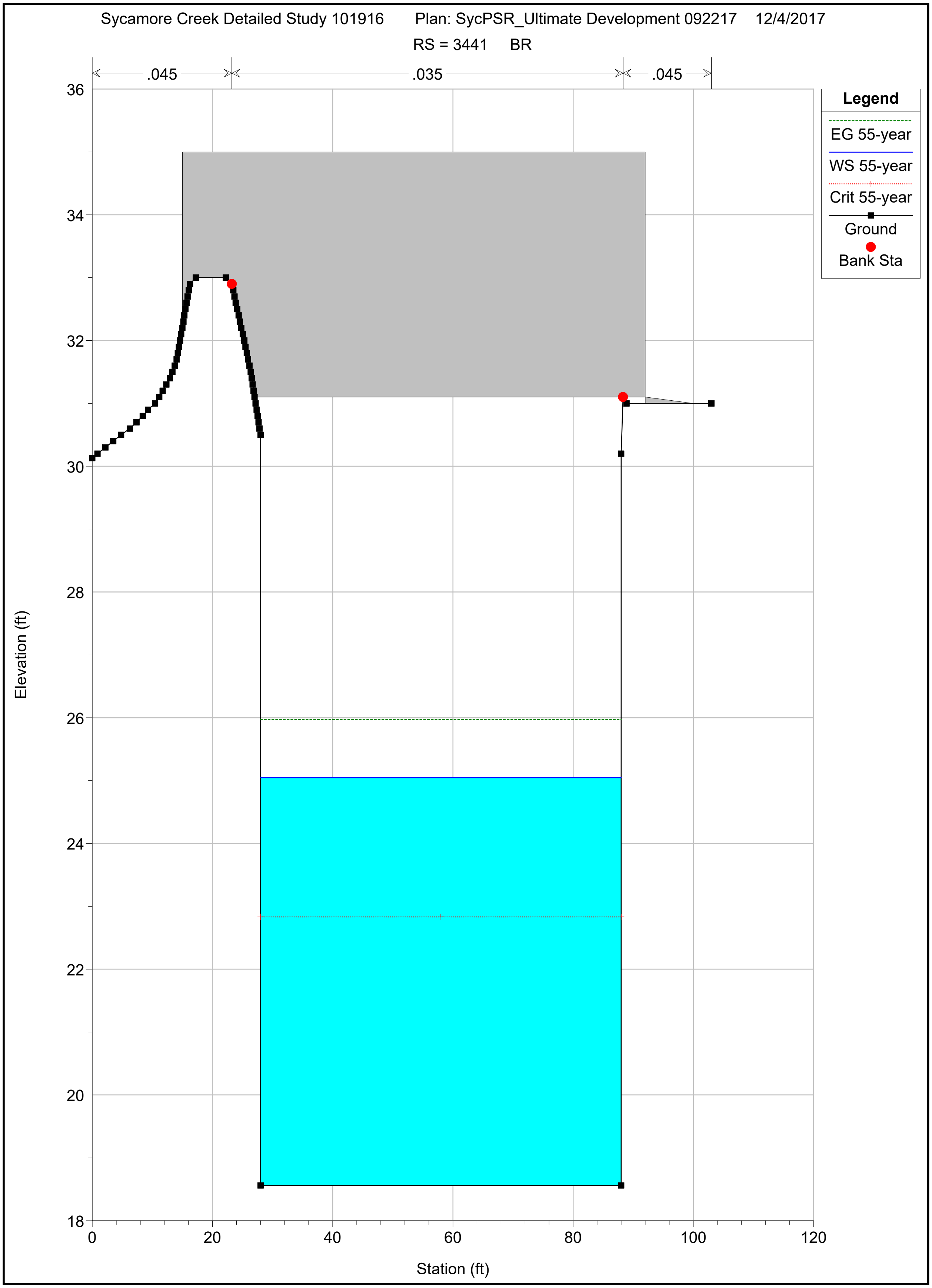
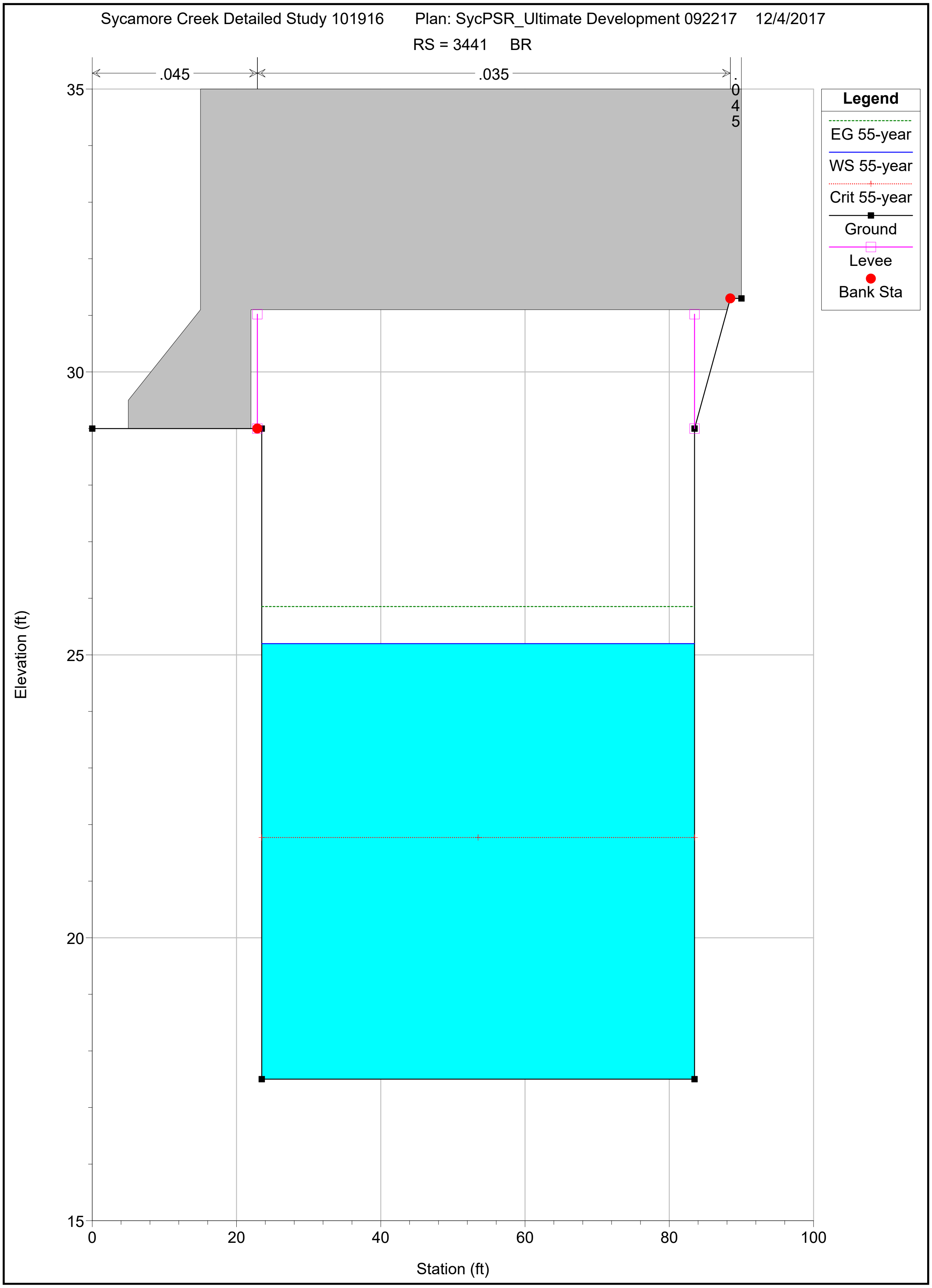
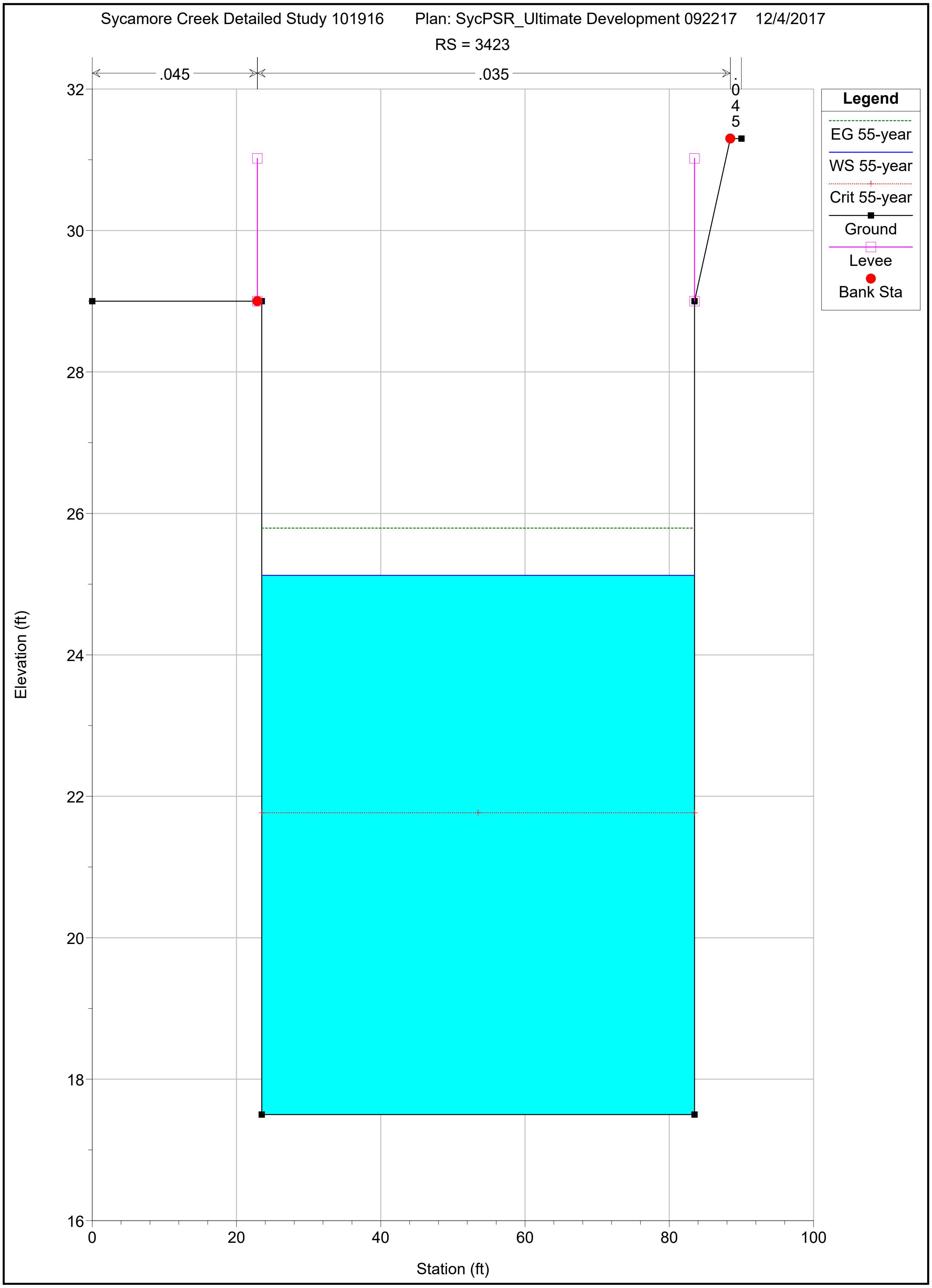
5200
5400
5600
5800
6000

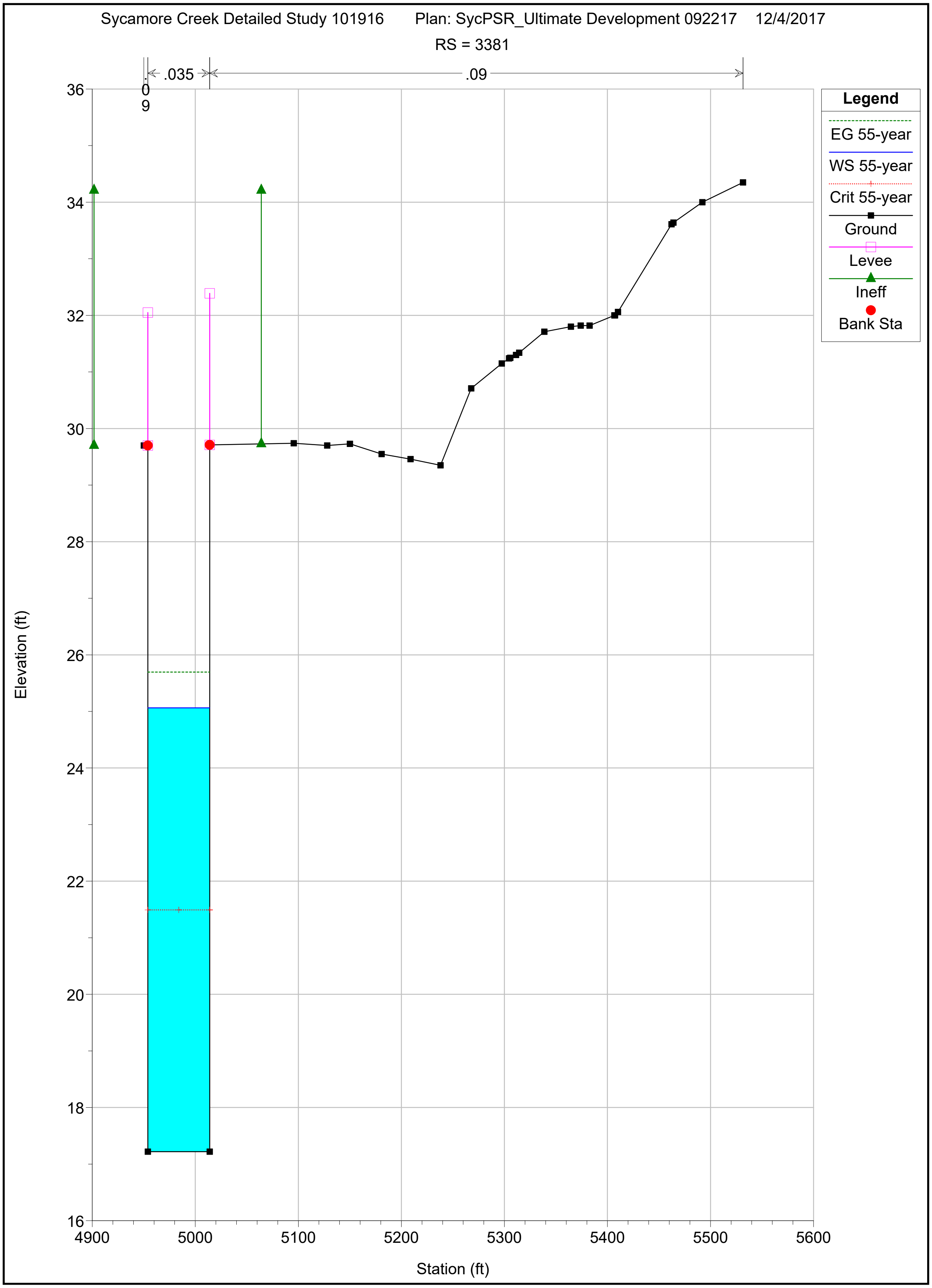

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3465
.045
.035
.045
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Bank Sta
Elevation (ft)
34
32
30
28
26
24
22
20
18
0
20
40
60
80
100
120
Station (ft)

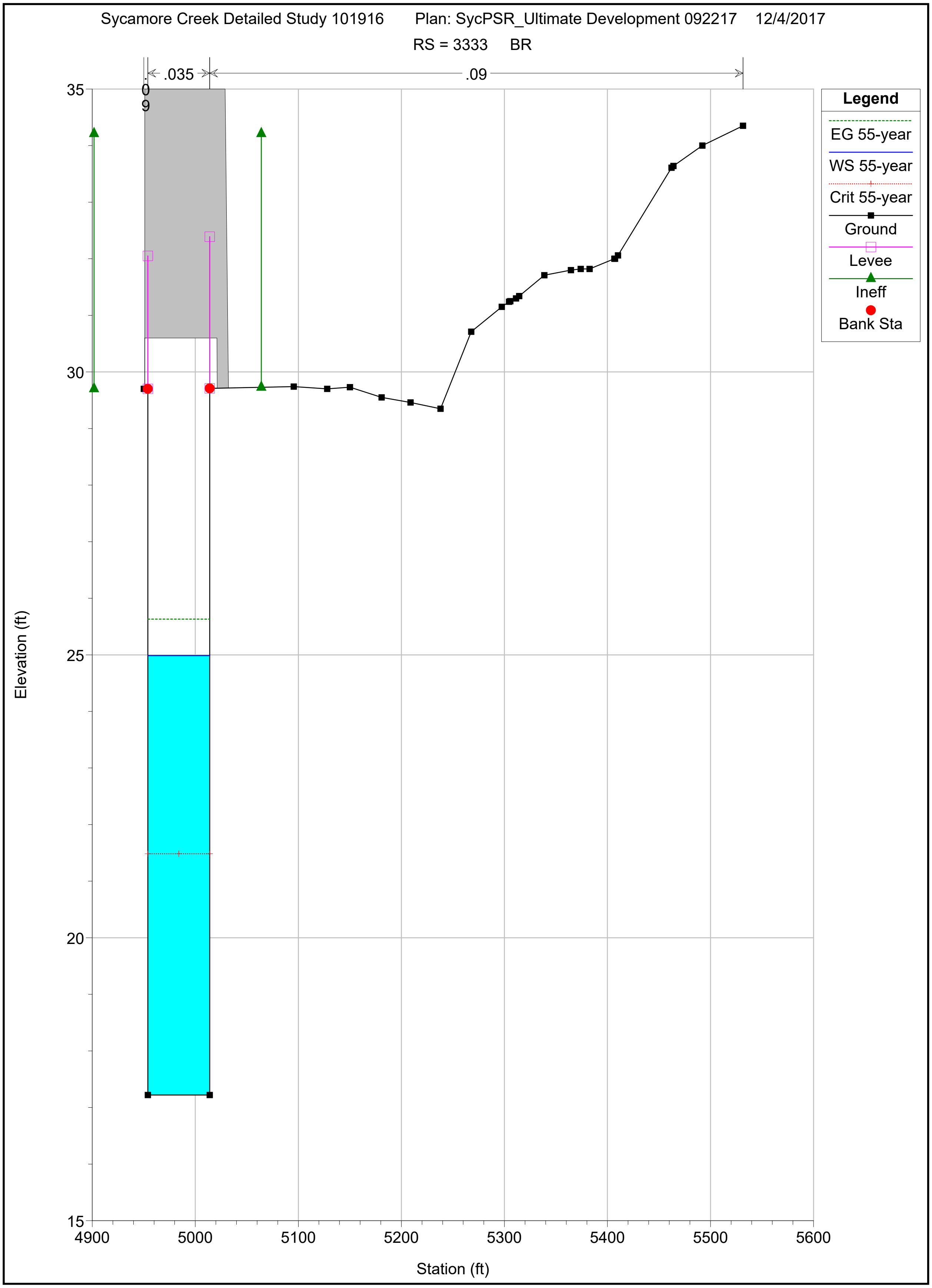
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3441 BR
.045
.035
.045
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Bank Sta
Elevation (ft)
Station (ft)
36
34
32
30
28
26
24
22
20
18
0
20
40
60
80
100
120

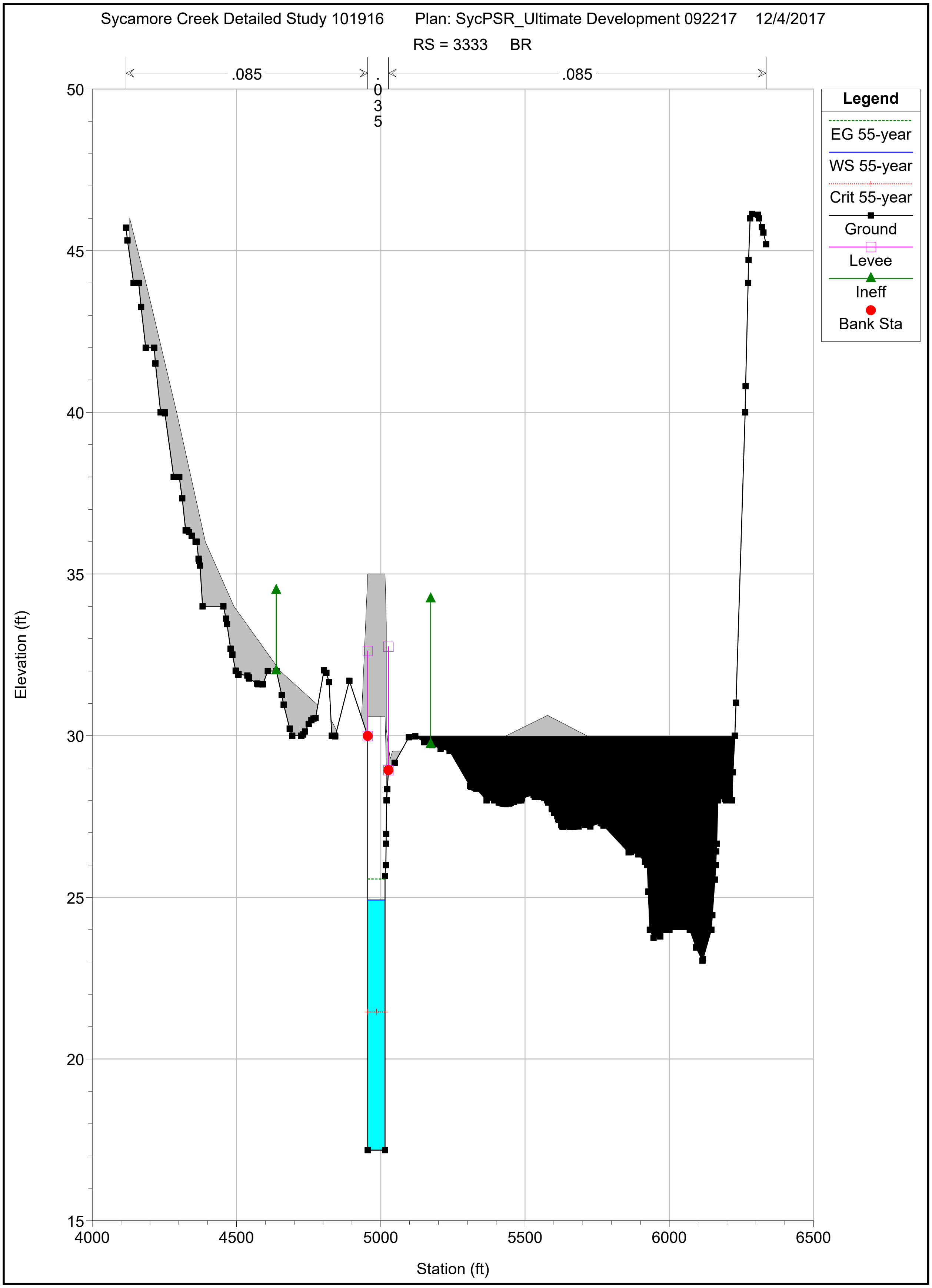

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3441 BR
.045
.035
.045
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Bank Sta
Elevation (ft)
35
30
25
20
15
Station (ft)
0
20
40
60
80
100

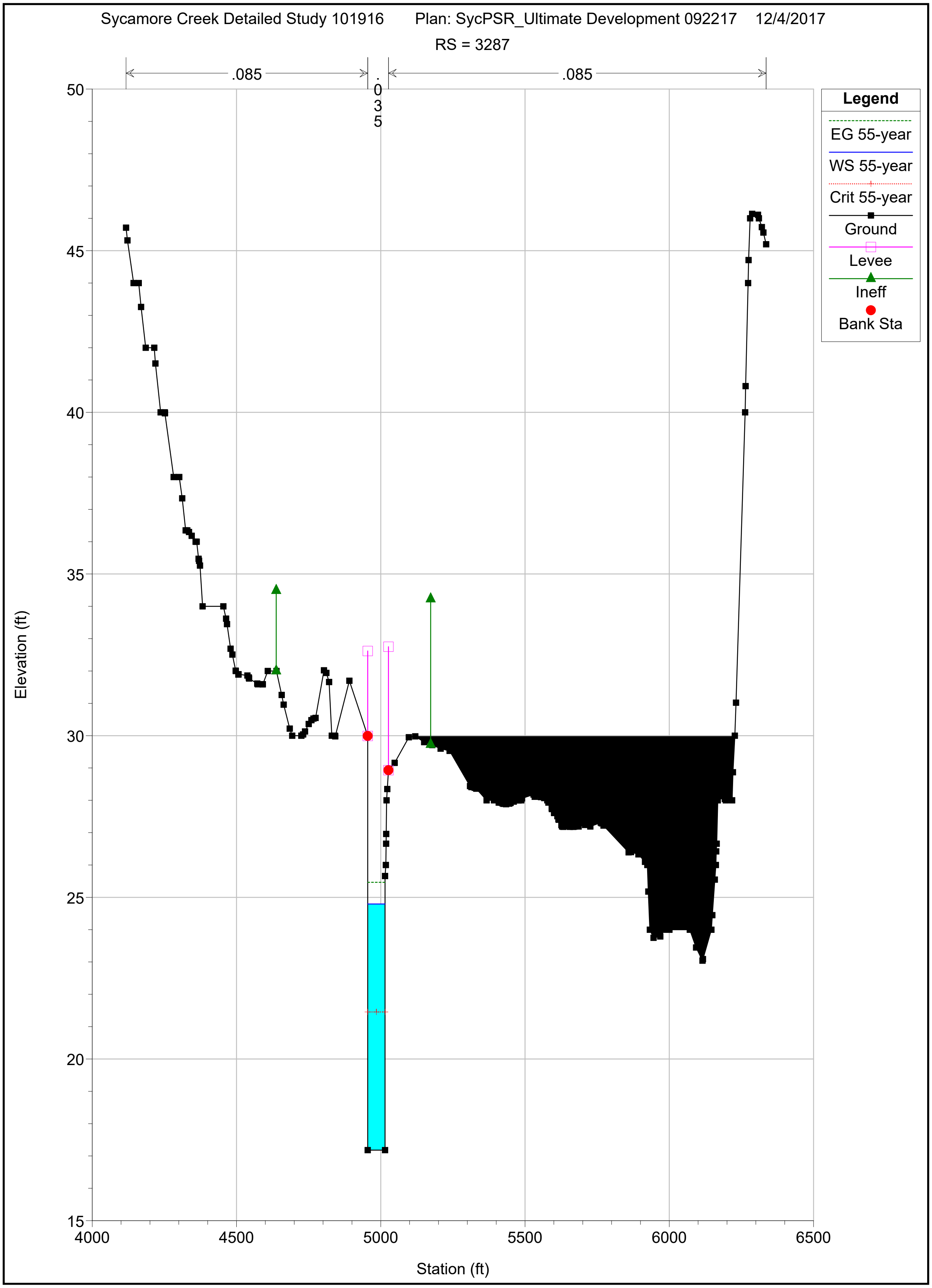


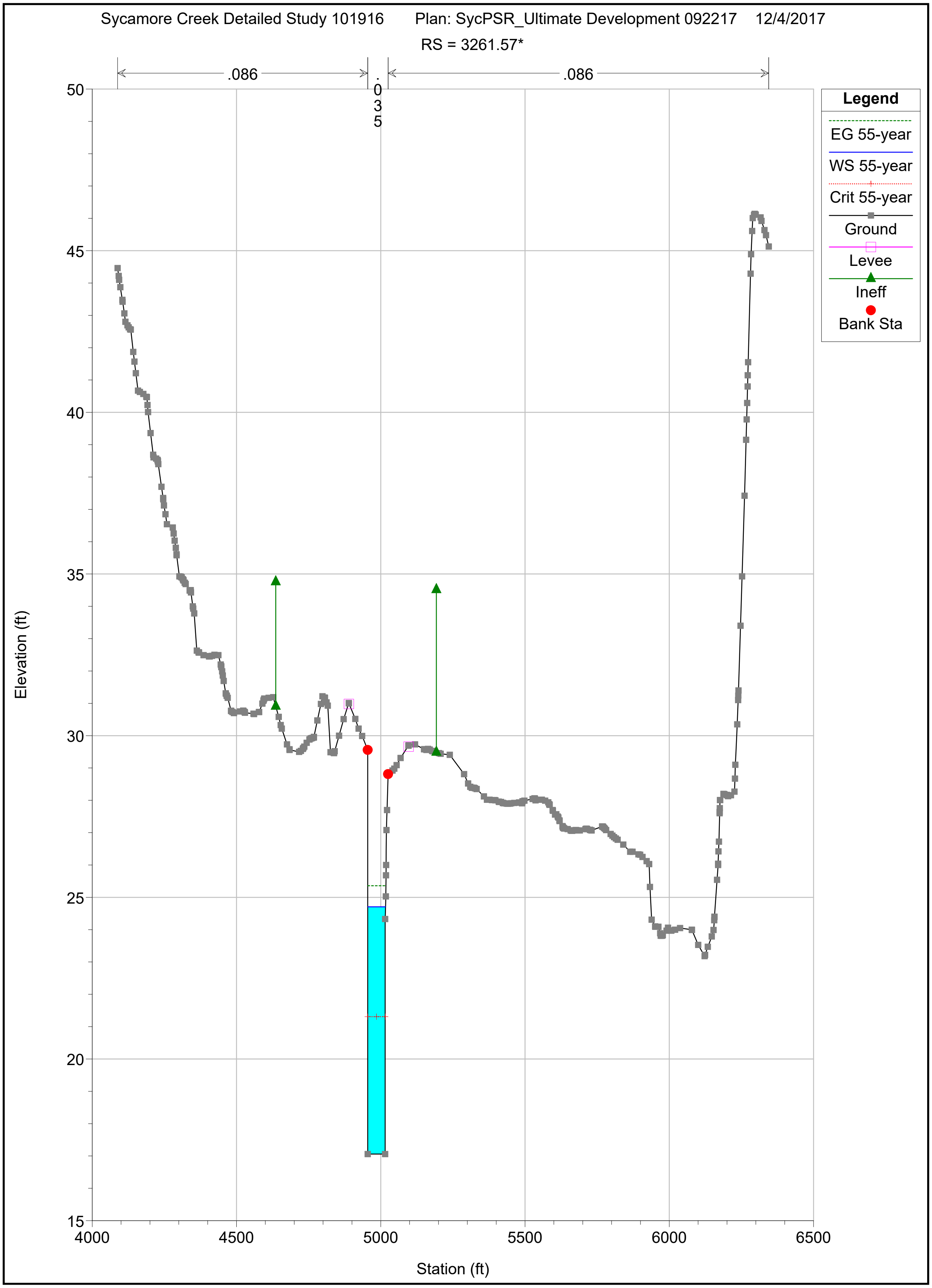
Sycamore Creek Detailed Study 101916
Plan: SycPSR_Ultimate Development 092217
12/4/2017
RS = 3423
.045
.035
.045
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Bank Sta
Elevation (ft)
32
30
28
26
24
22
20
18
16
0
20
40
60
80
100
Station (ft)

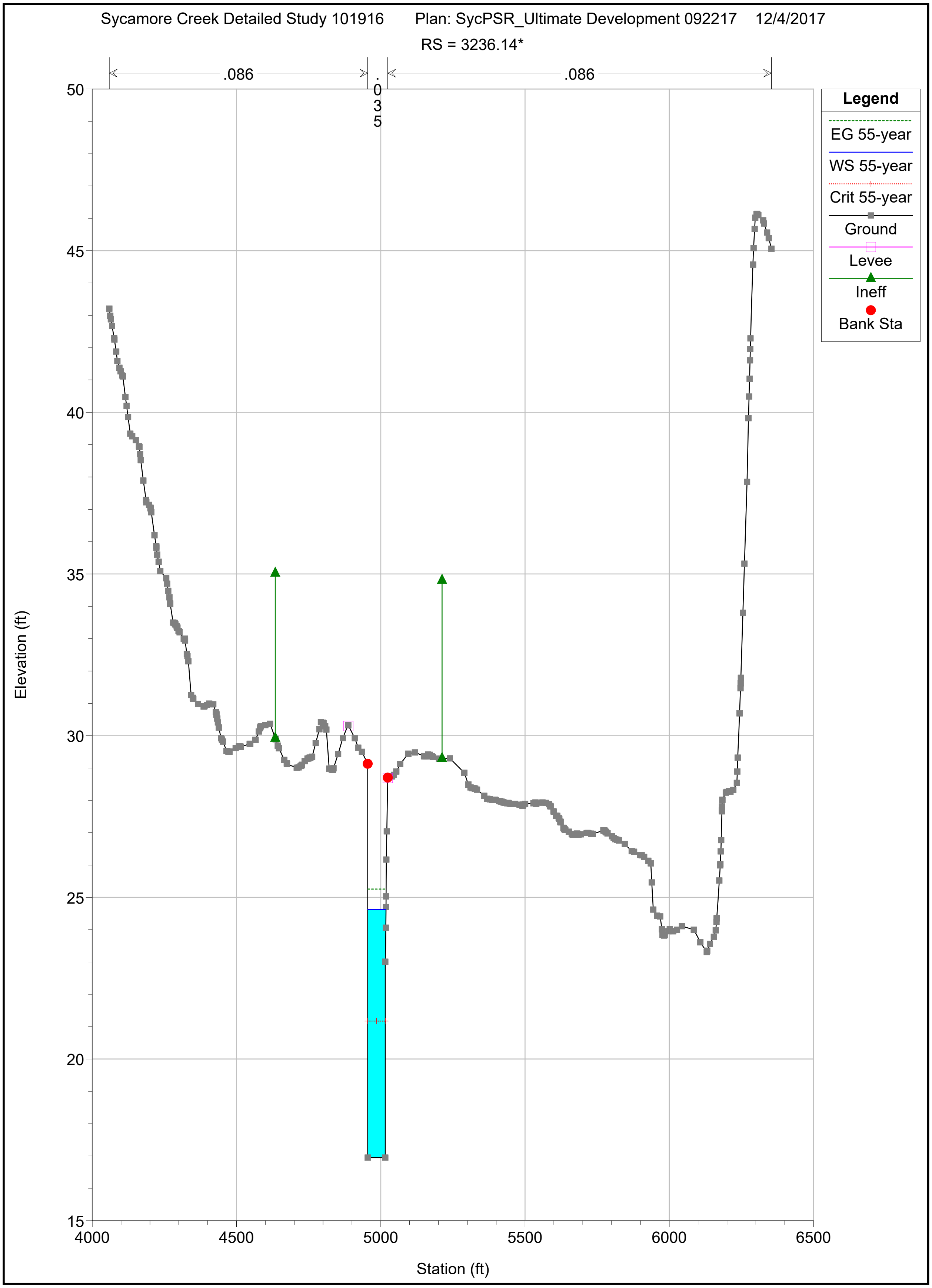

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3381
.0
9
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
36
34
32
30
28
26
24
22
20
18
16
4900
5000
5100
5200
5300
5400
5500
5600
Station (ft)

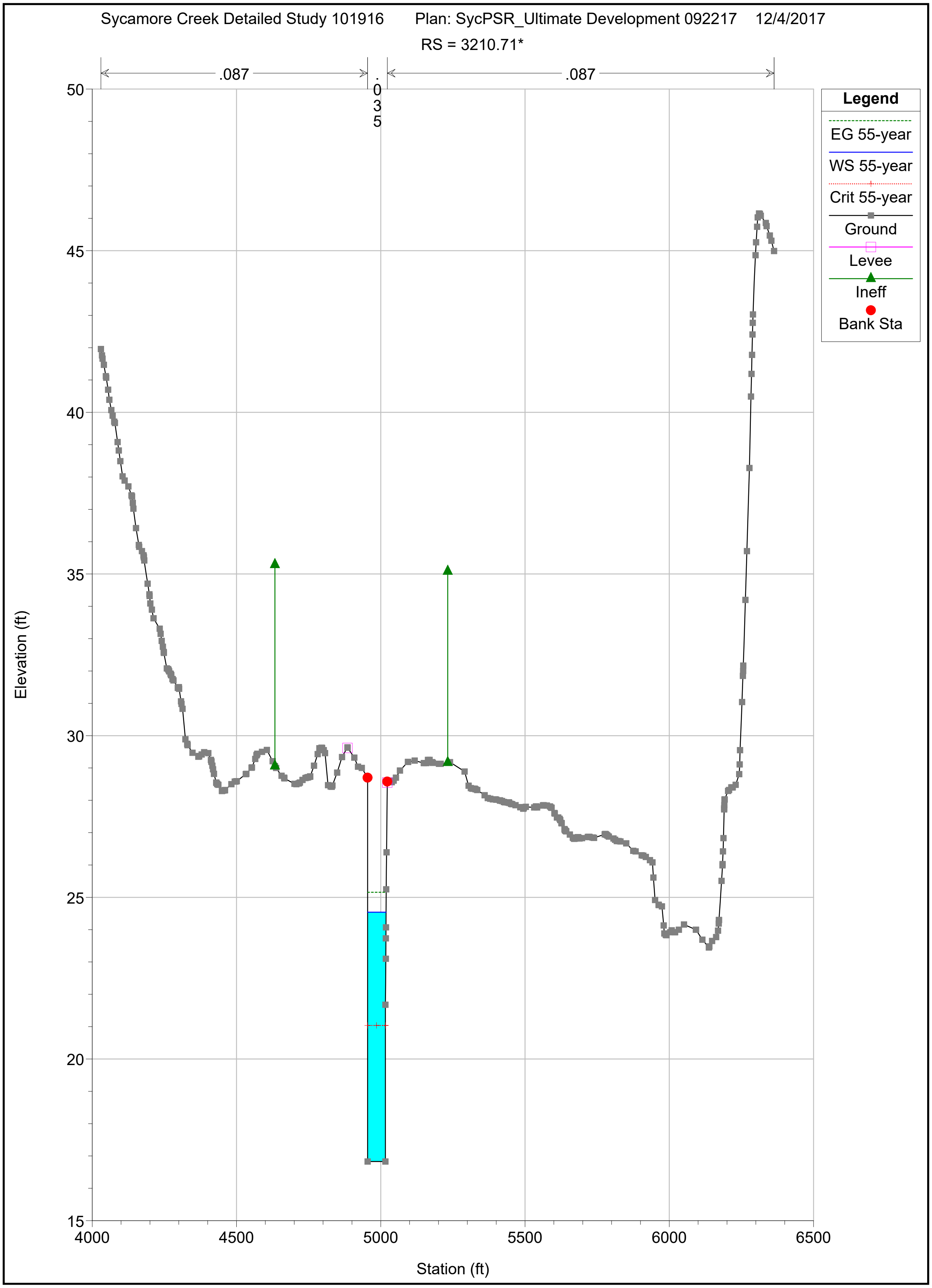

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3333 BR
.035
.09
.
0
9
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
35
30
25
20
15
Station (ft)
4900
5000
5100
5200
5300
5400
5500
5600

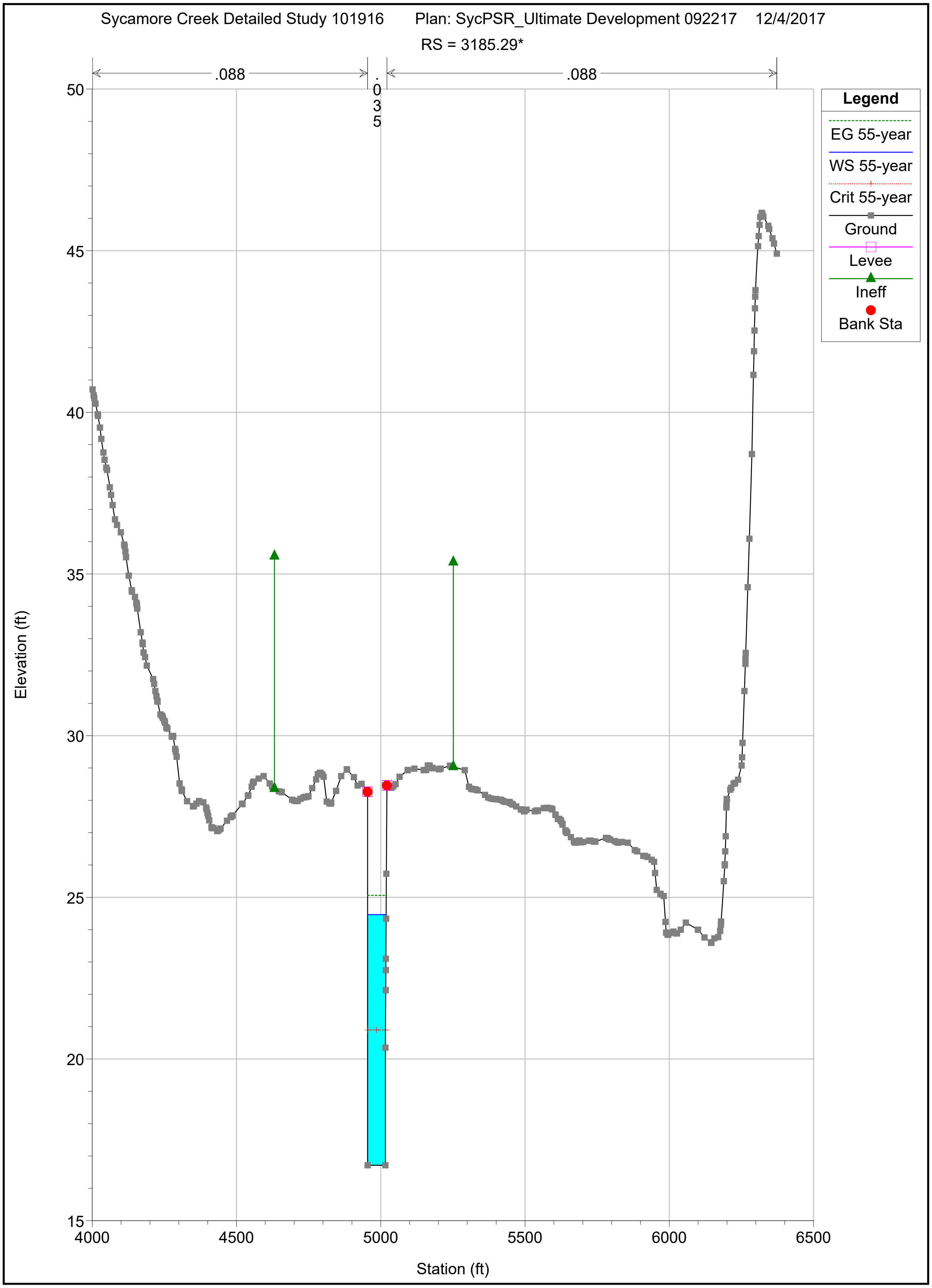

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3333 BR
.085
.035
.085
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
50
45
40
35
30
25
20
15
Station (ft)
4000
4500
5000
5500
6000
6500

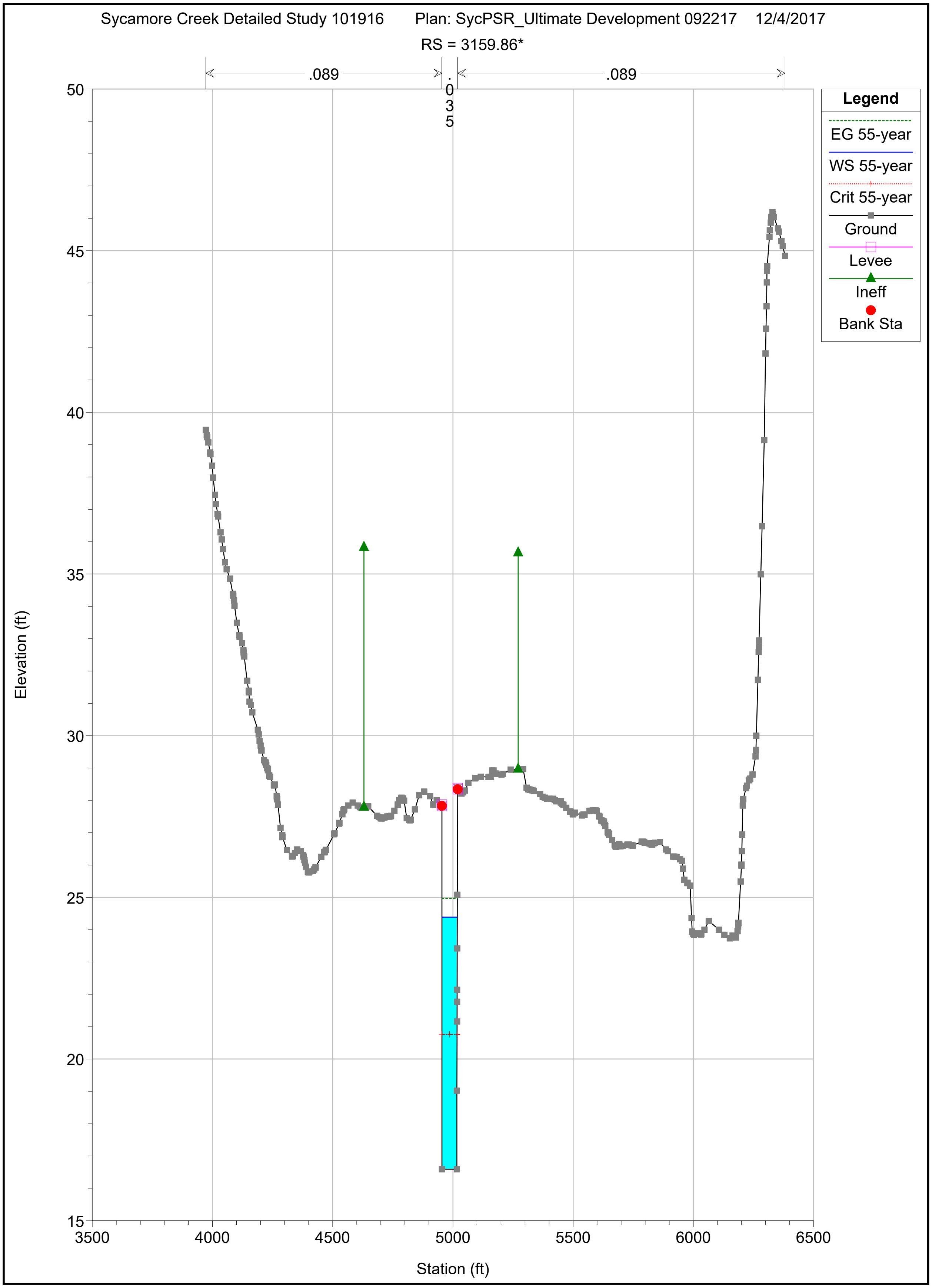

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3287
.085
.035
.085
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
50
45
40
35
30
25
20
15
4000
4500
5000
5500
6000
6500

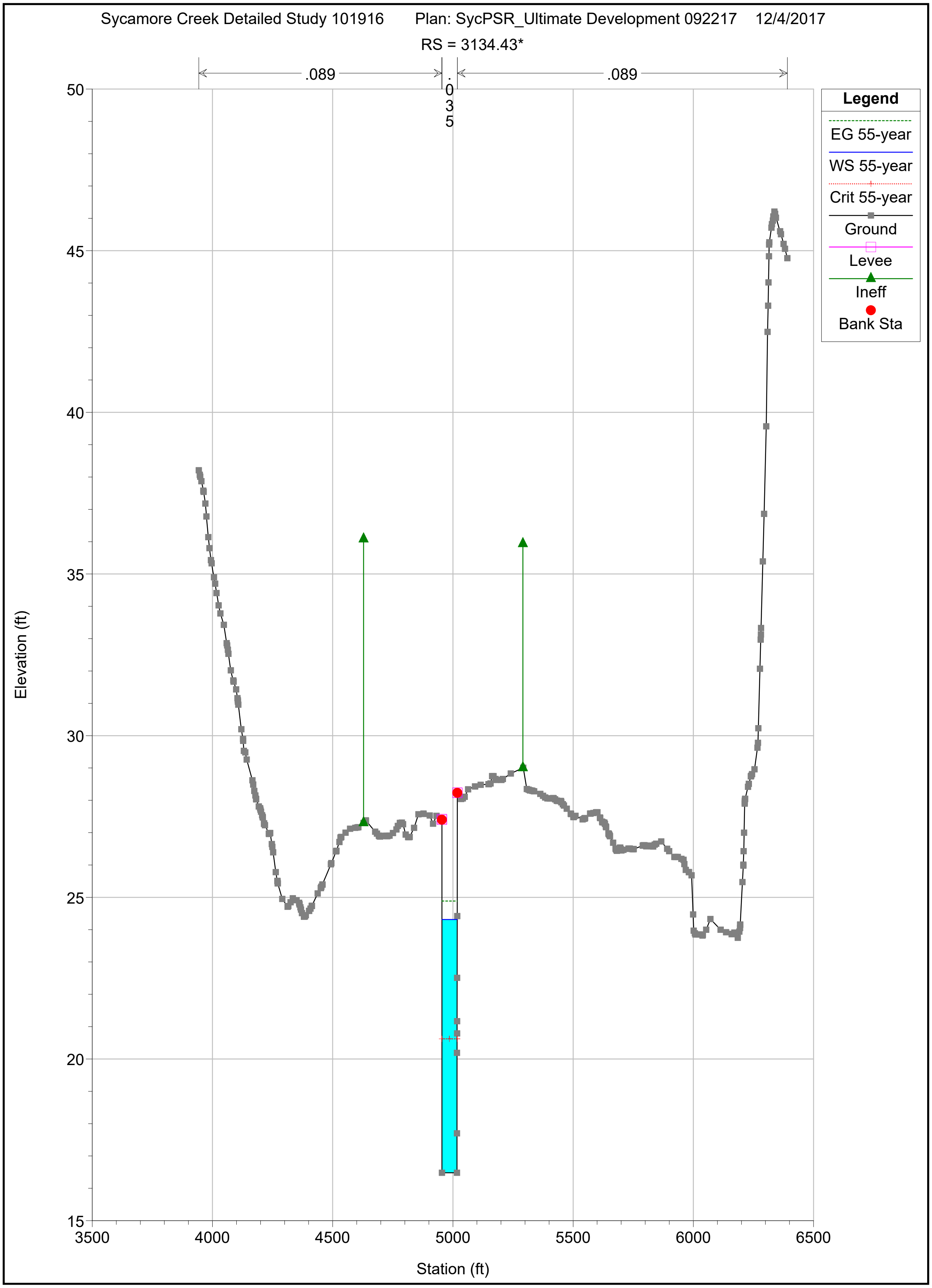

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3261.57*
.086
.
0
3
5
.086
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
50
45
40
35
30
25
20
15
4000
4500
5000
5500
6000
6500

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3236.14*
.086
.035
.086
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
50
45
40
35
30
25
20
15
4000
4500
5000
5500
6000
6500
Station (ft)


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3210.71*
.087
.035
.087
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
50
45
40
35
30
25
20
15
Station (ft)
4000
4500
5000
5500
6000
6500


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3185.29*
.088
.035
.088
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
50
45
40
35
30
25
20
15
4000
4500
5000
5500
6000
6500
Station (ft)


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3159.86*
.089
.035
.089
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
50
45
40
35
30
25
20
15
3500
4000
4500
5000
5500
6000
6500


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3134.43*
.089
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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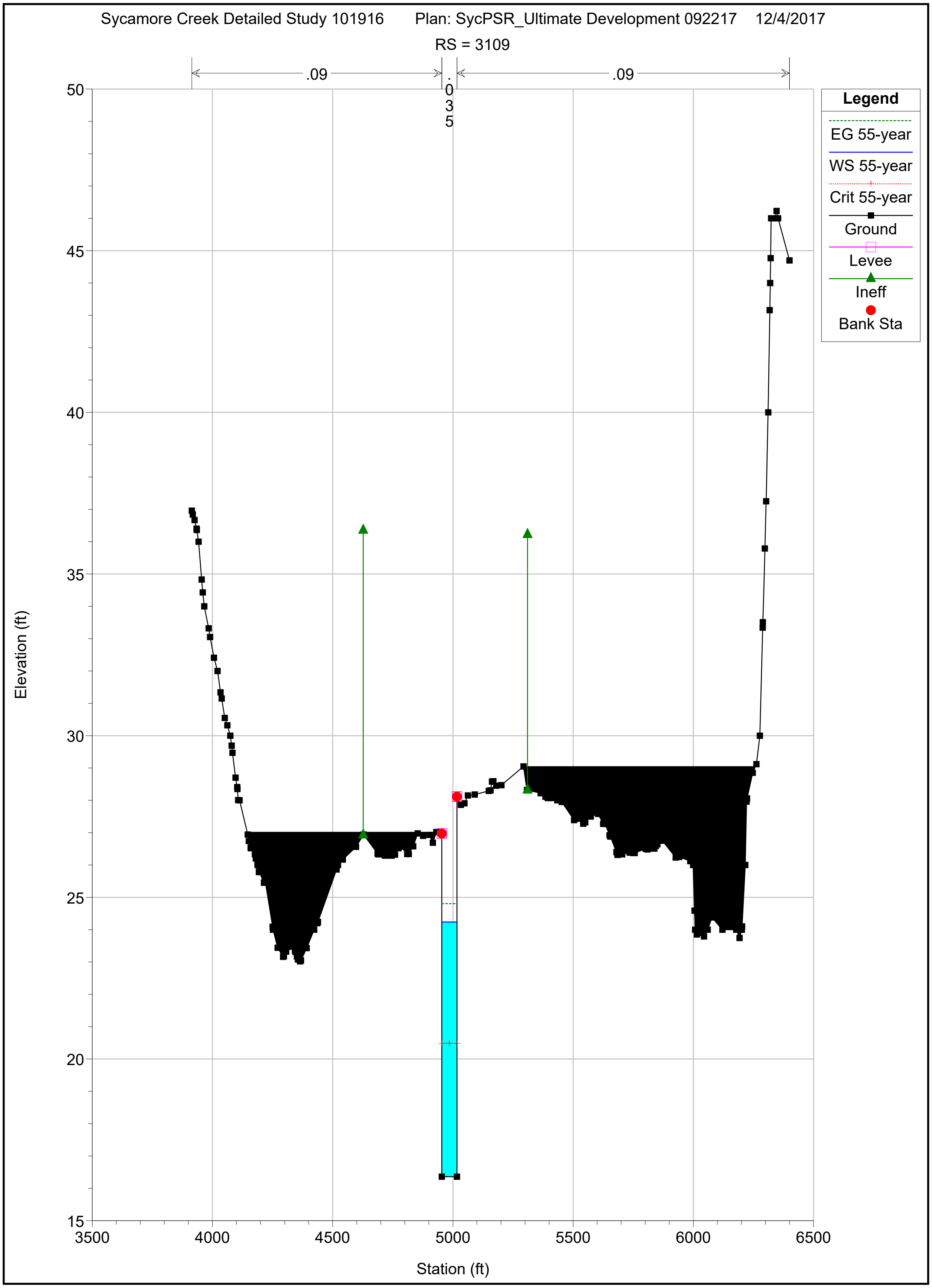
Station (ft)


Sycamore Creek Detailed Study 101916
Plan: SycPSR_Ultimate Development 092217
12/4/2017
RS = 3109
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.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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4500
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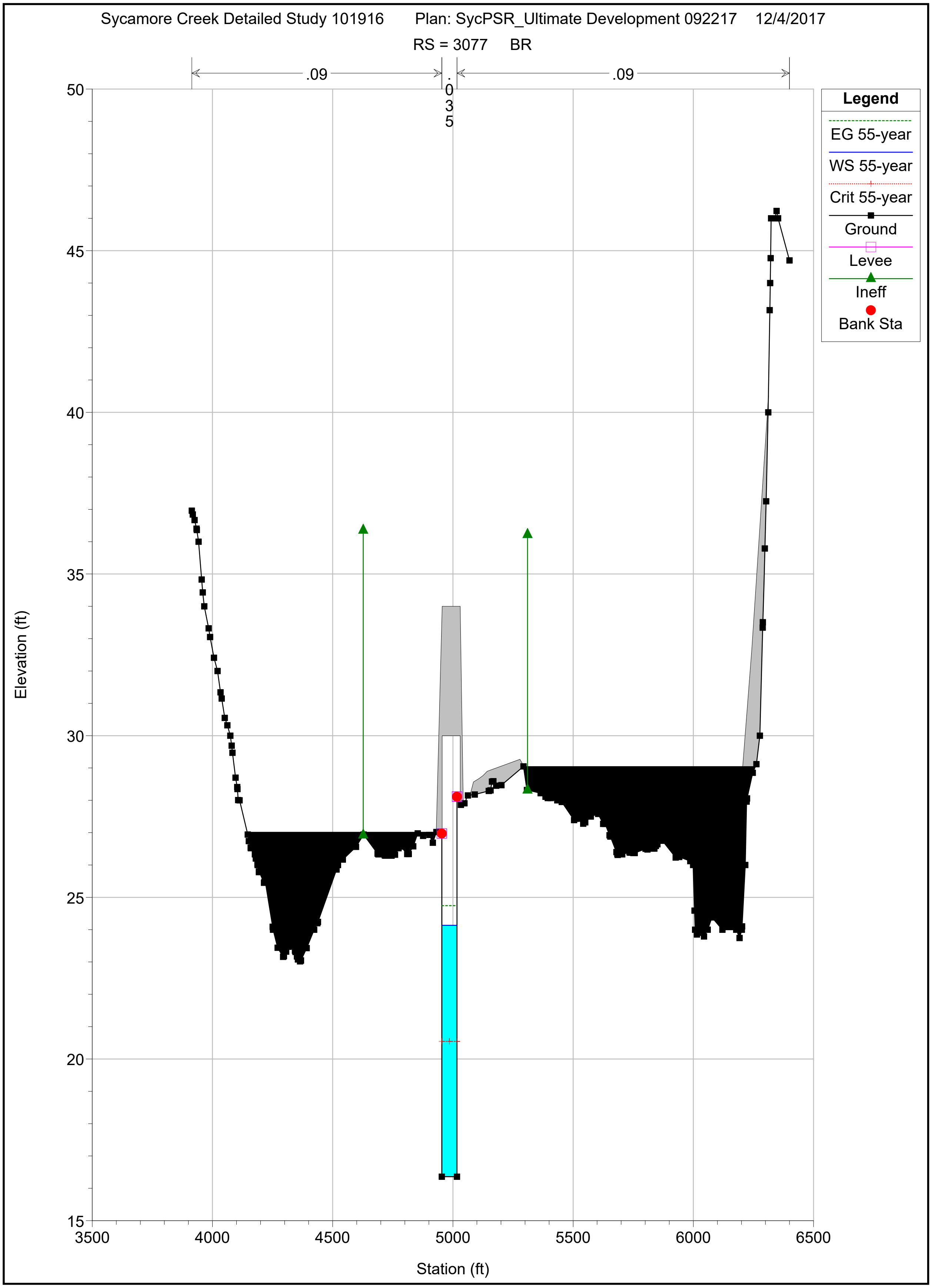
Station (ft)

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3077 BR
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.035
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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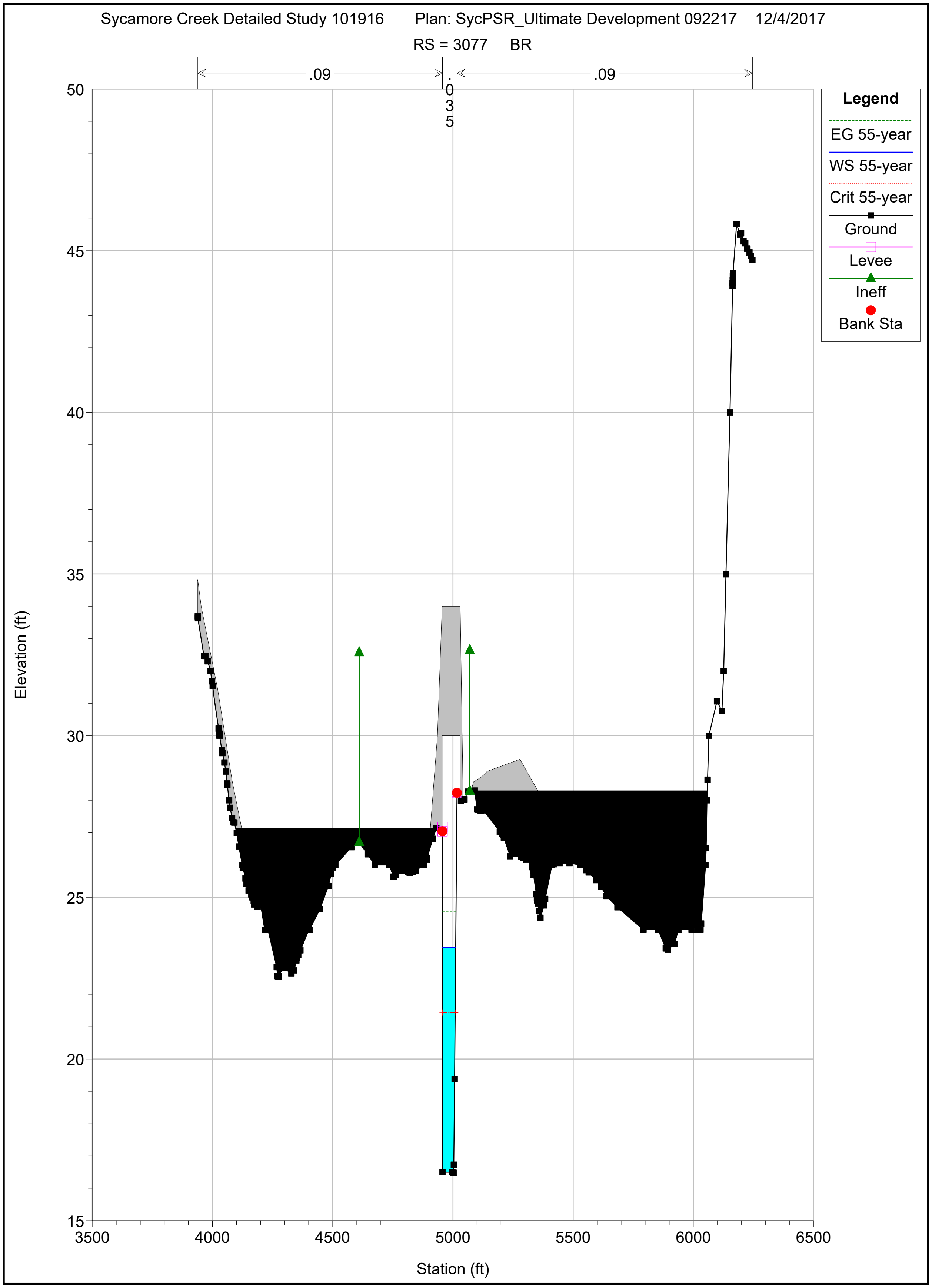
Station (ft)


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 3077 BR
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.035
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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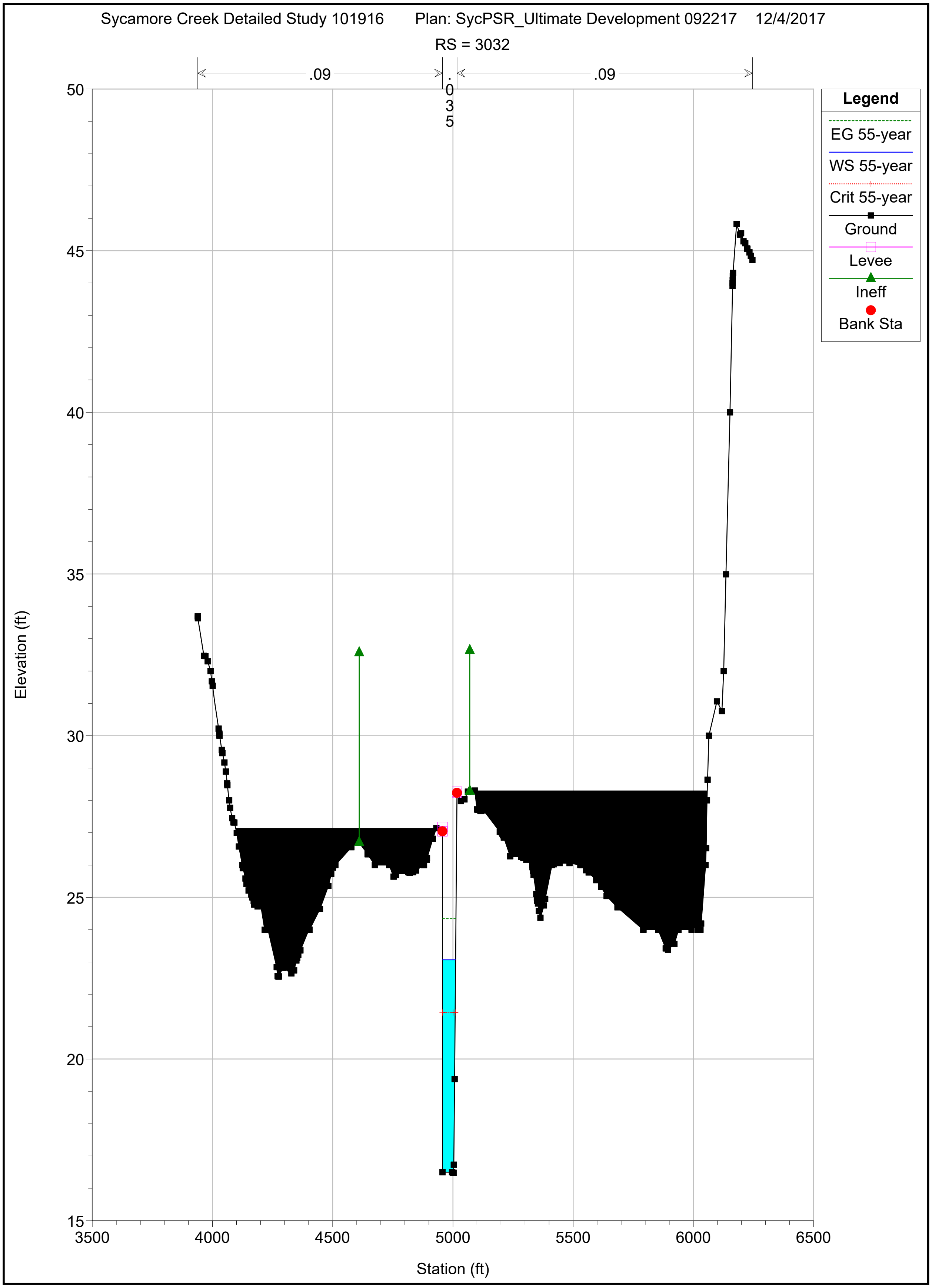
Station (ft)


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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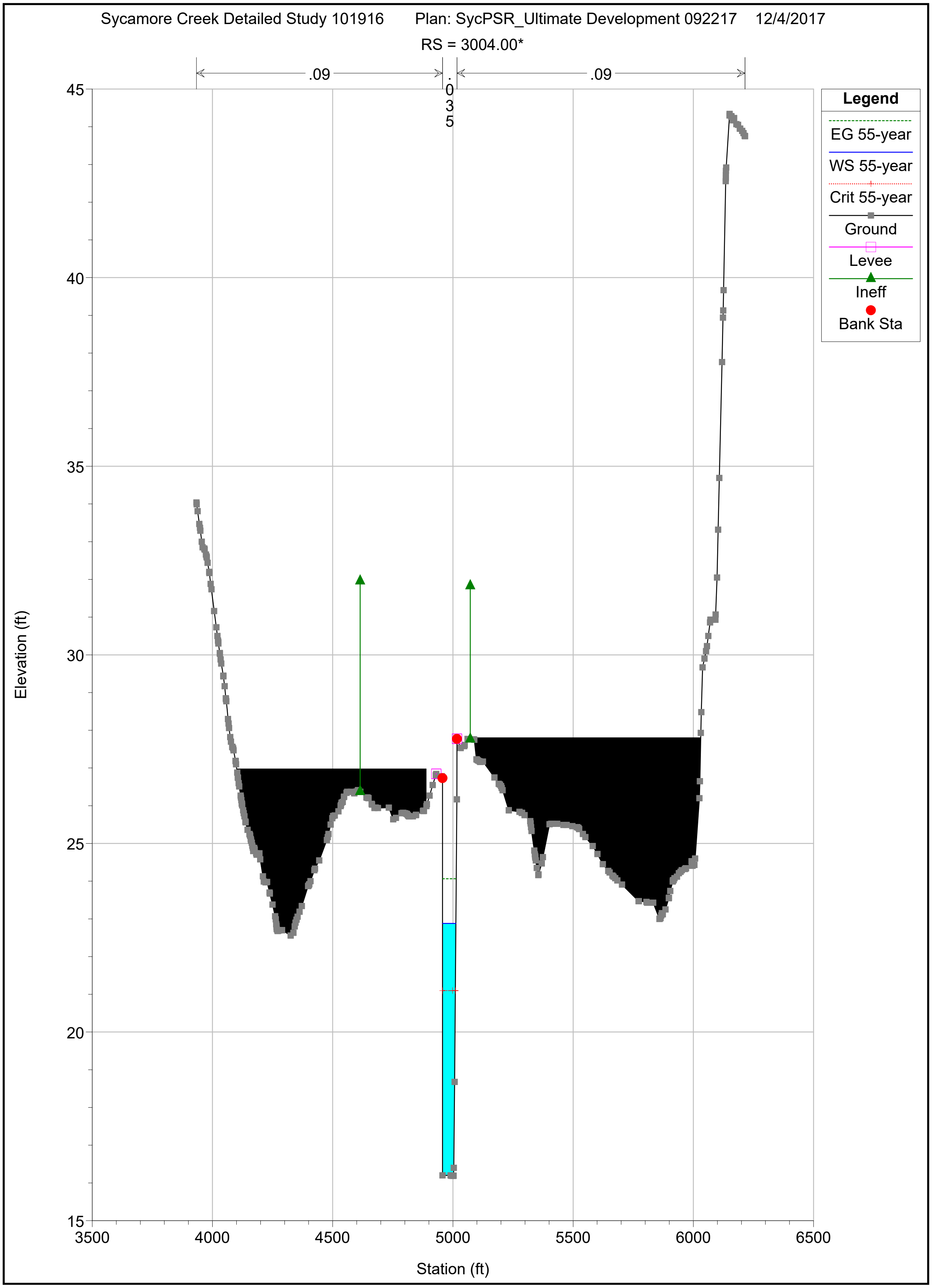
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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Legend
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WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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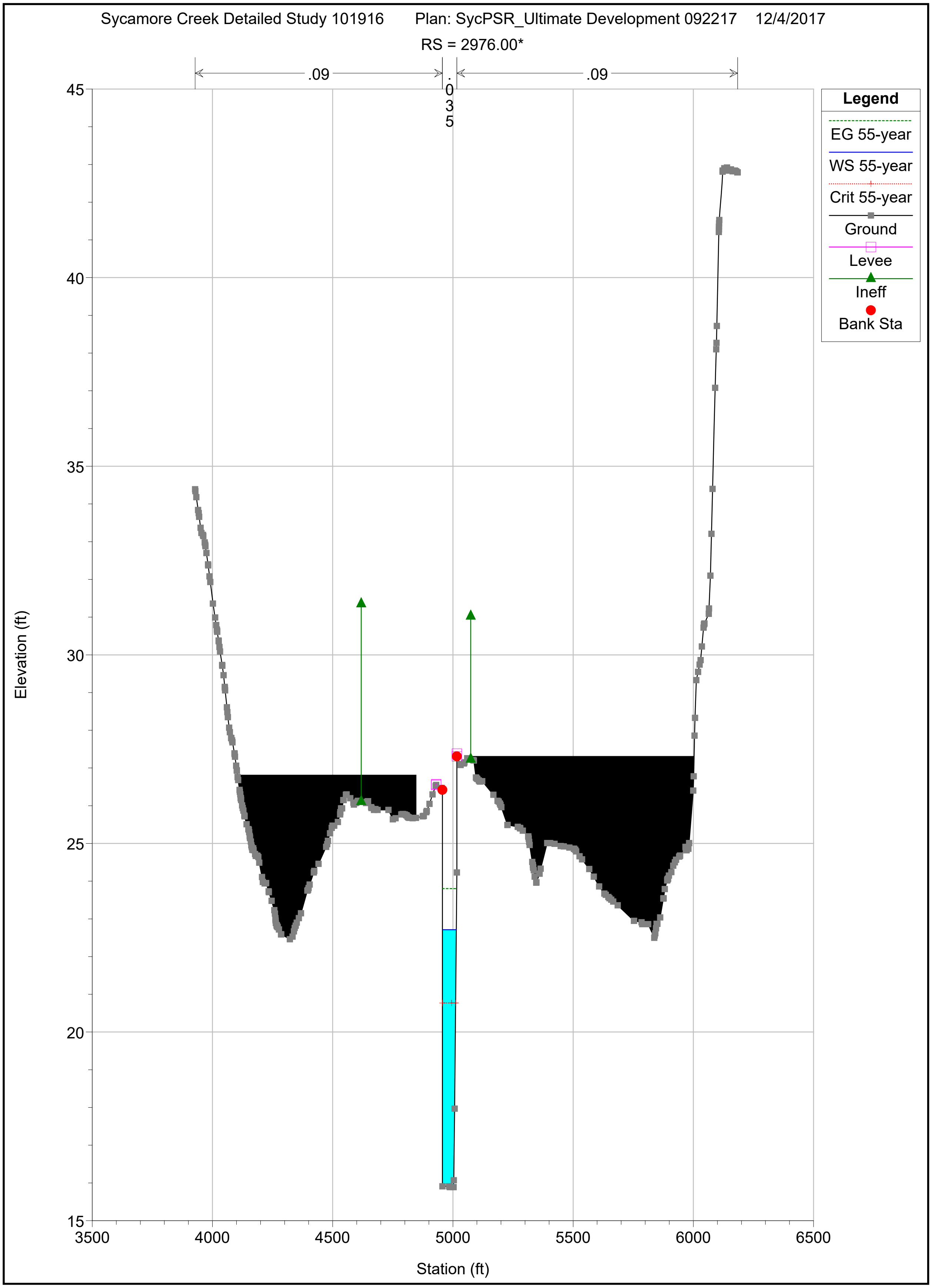
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2976.00*
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.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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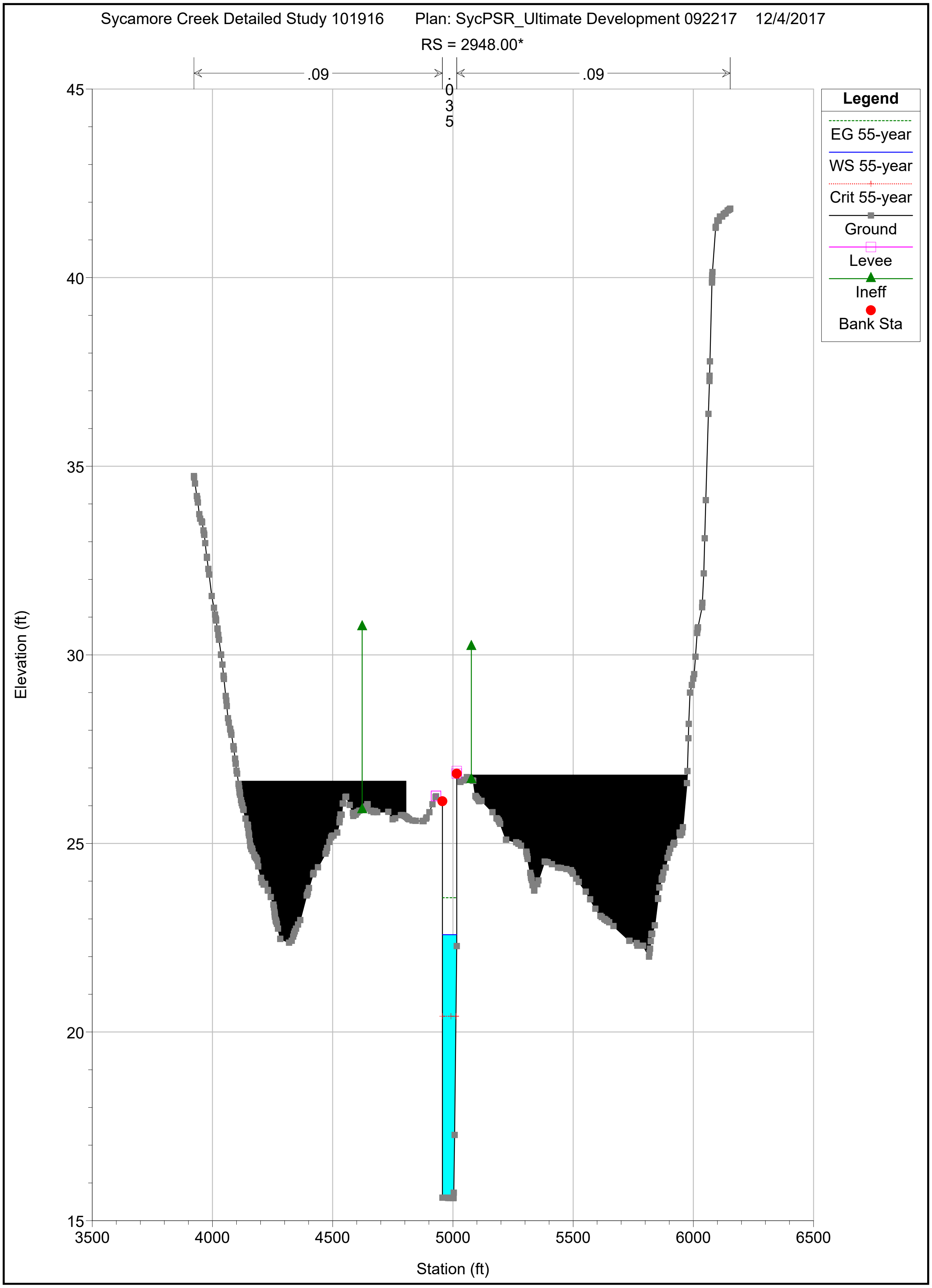
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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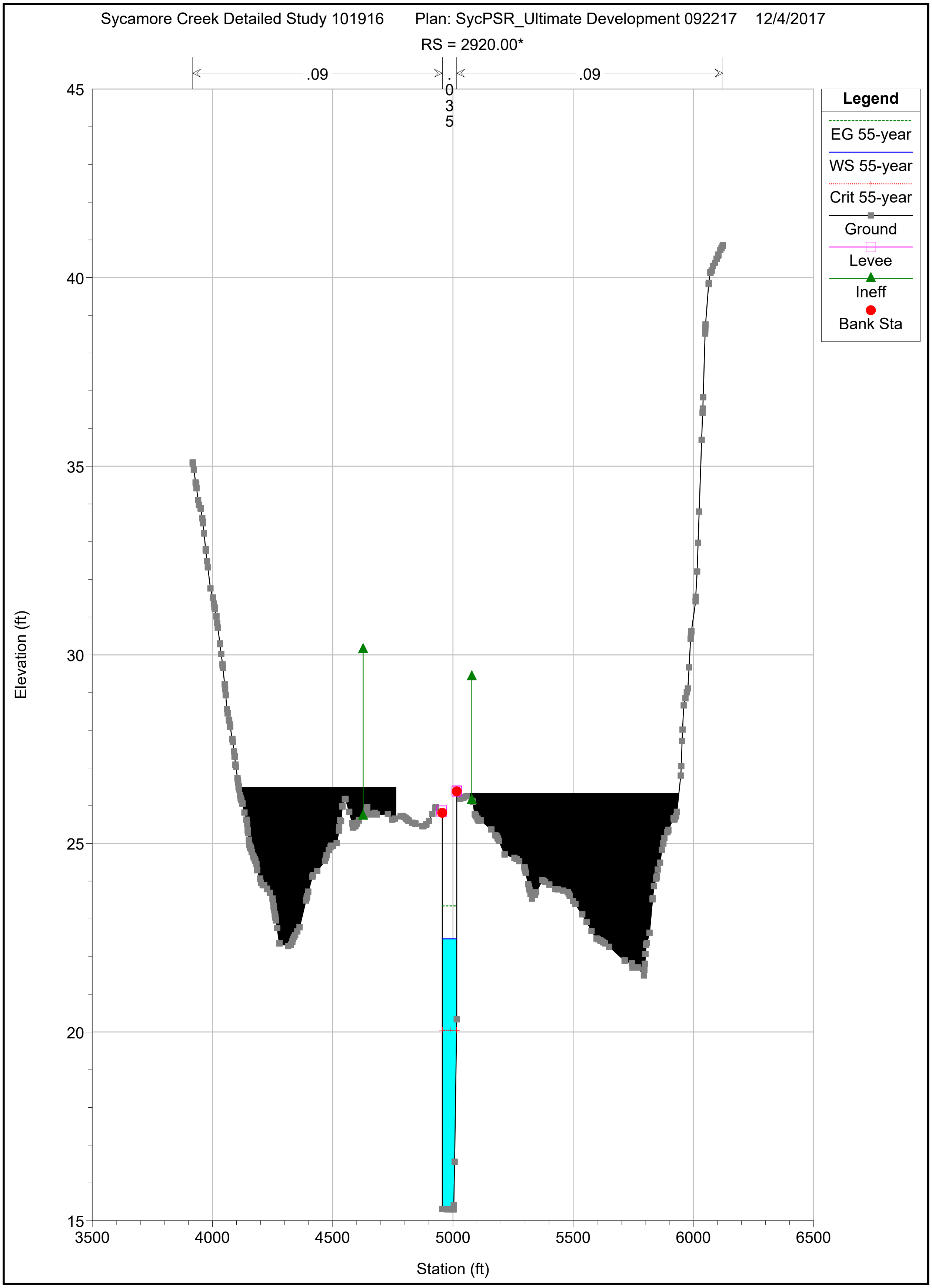
6000
6500
Station (ft)


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2920.00*
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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40
35
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25
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15
3500
4000
4500
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5500
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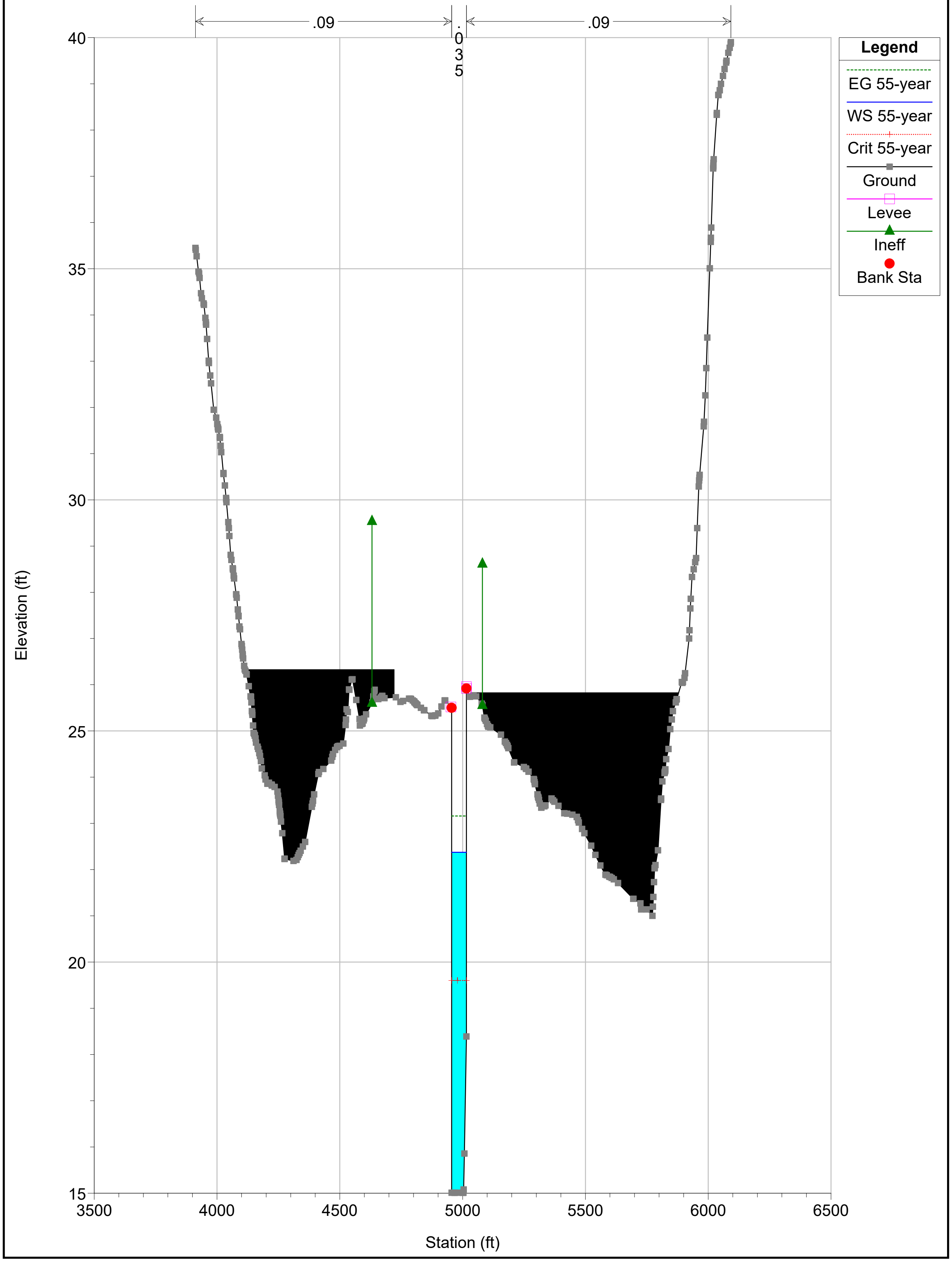
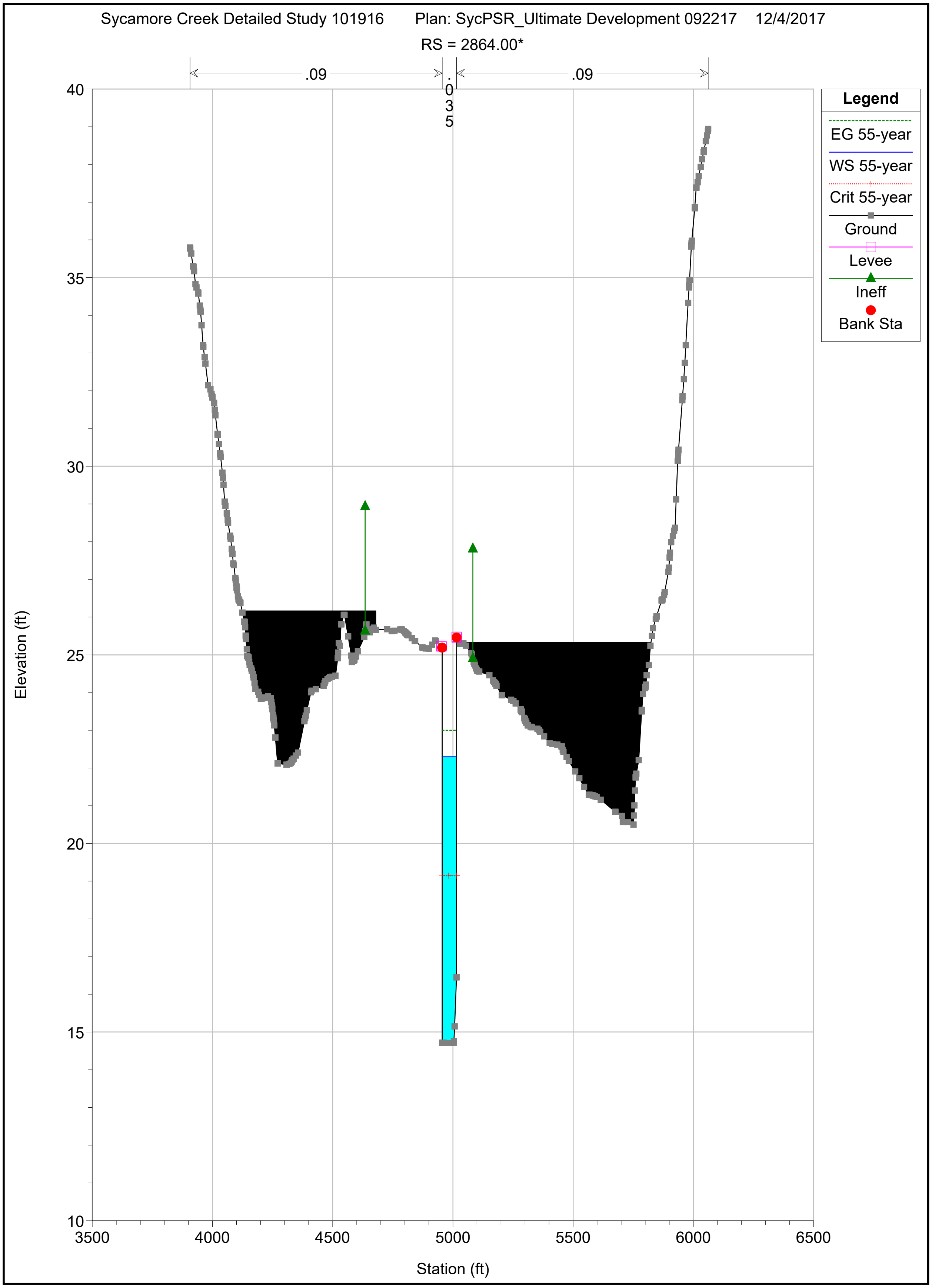
6500
Station (ft)

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017

RS = 2892.00*





Sycamore Creek Detailed Study 101916
Plan: SycPSR_Ultimate Development 092217
12/4/2017
RS = 2864.00*
.09
.035
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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3500
4000
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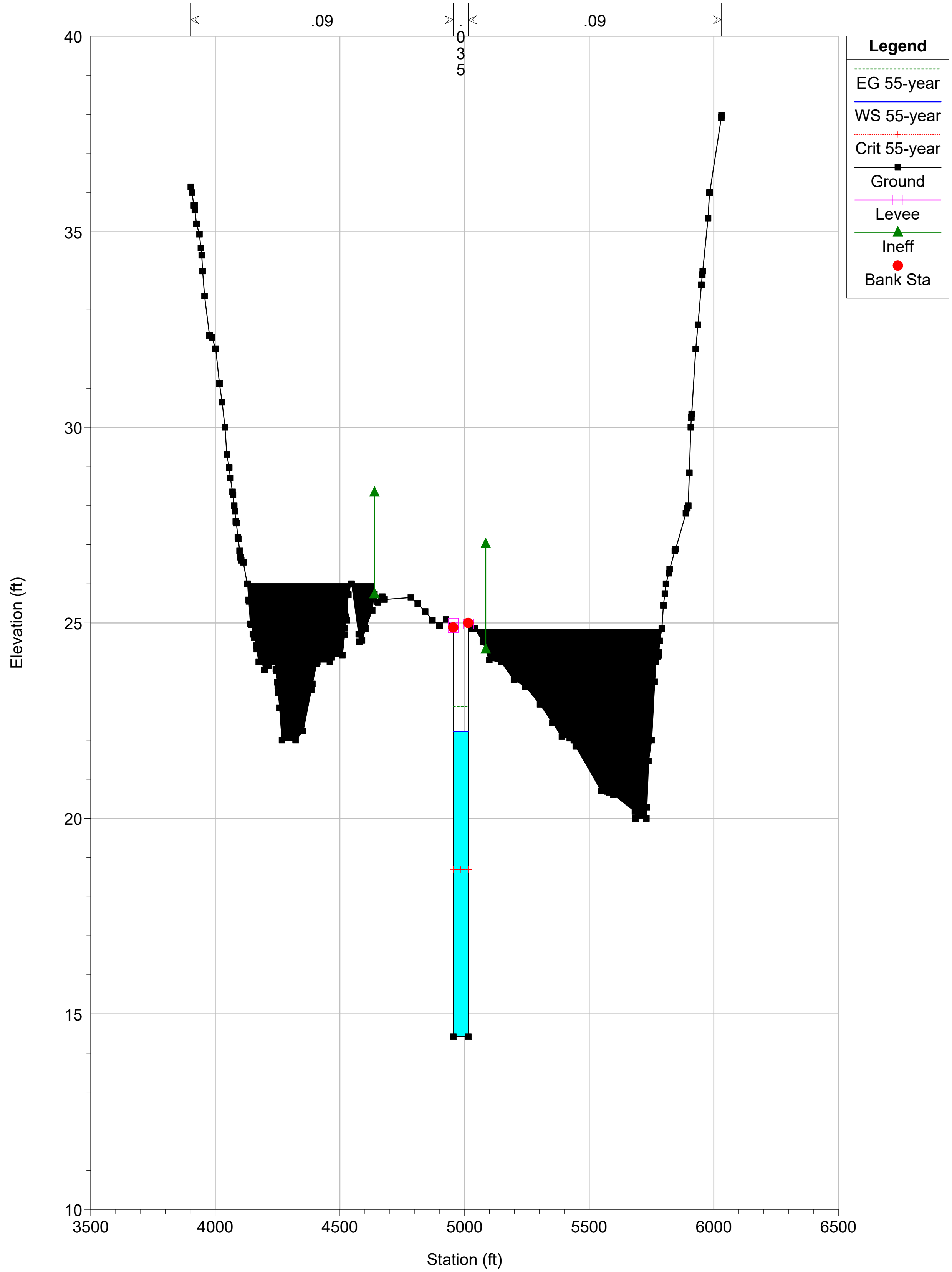
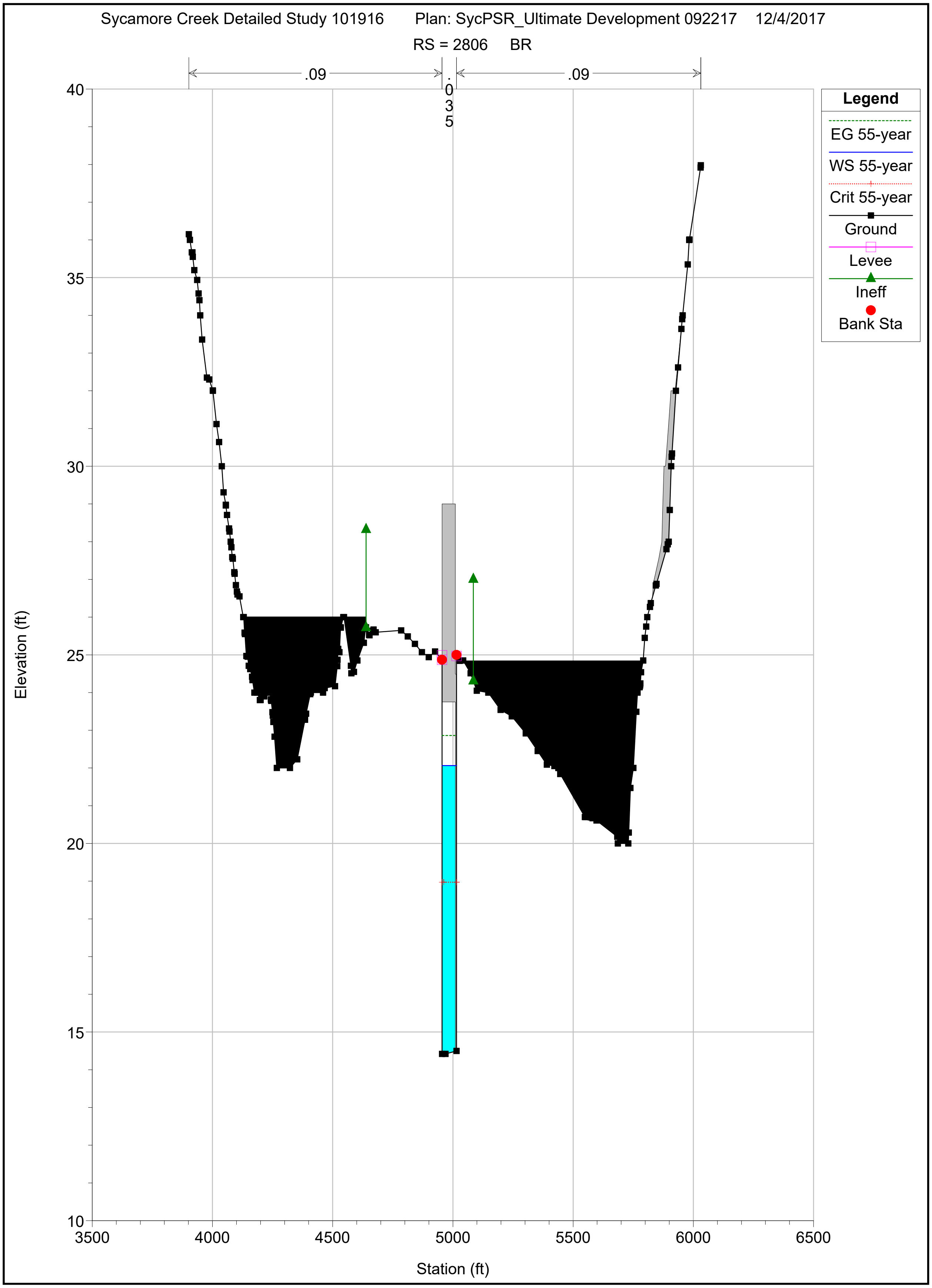
6000
6500
Station (ft)

Sycamore Creek Detailed Study 101916   Plan: SycPSR_Ultimate Development 092217   12/4/2017

RS = 2836




Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2806 BR
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.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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15
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Station (ft)
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4500
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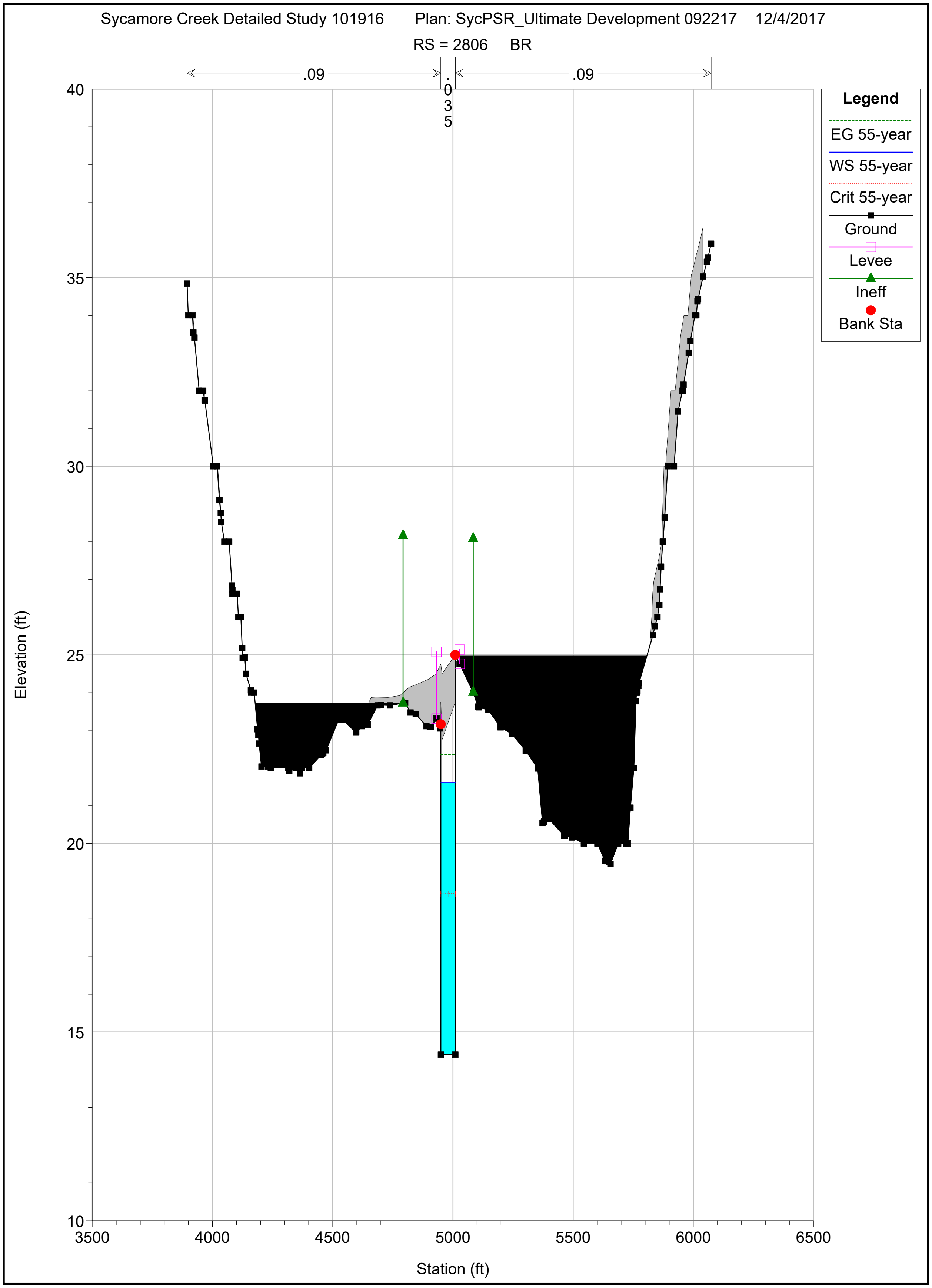
6000
6500



Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2806 BR
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.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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15
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Station (ft)
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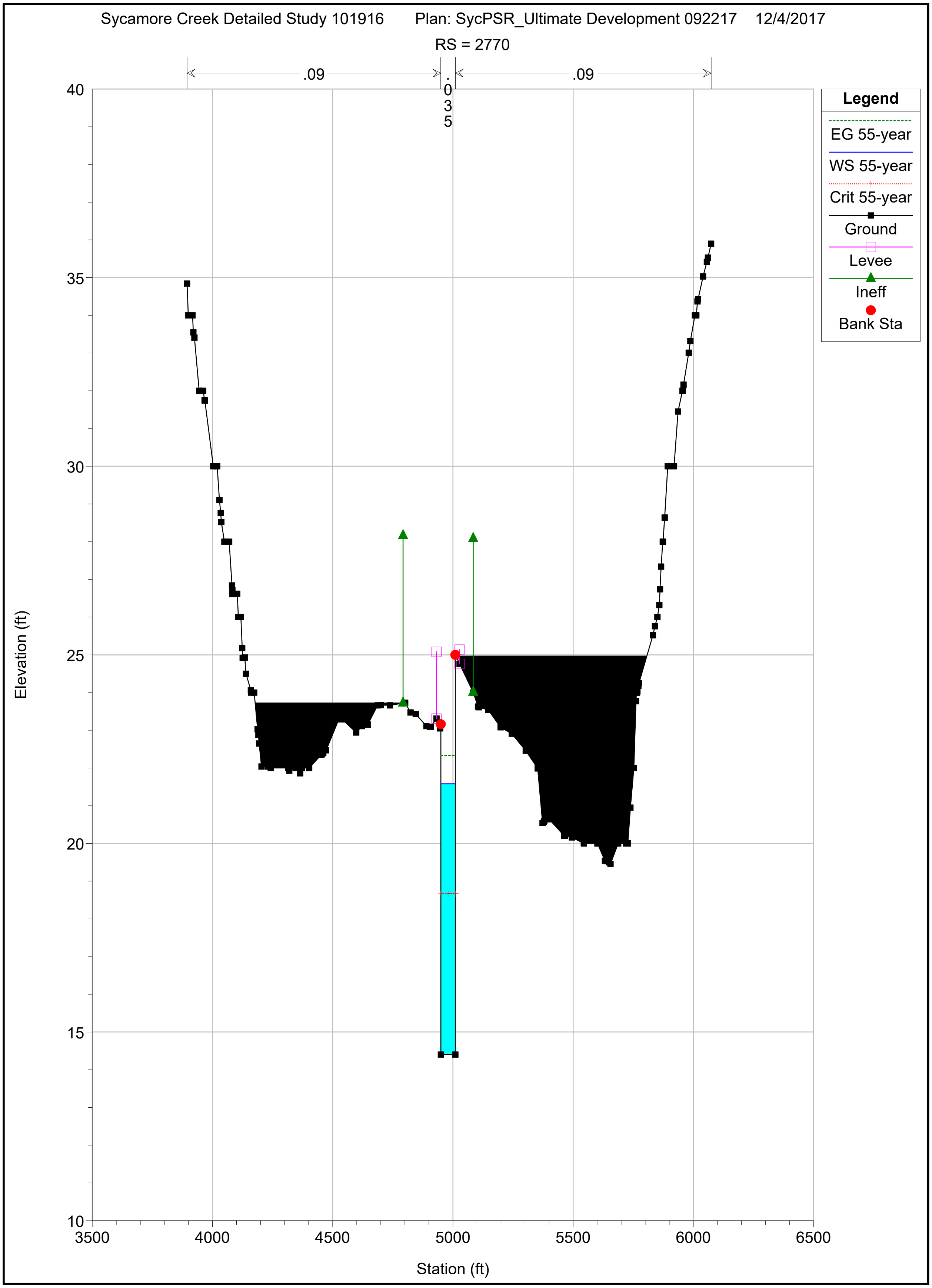
6000
6500


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2770
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.035
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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25
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15
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3500
4000
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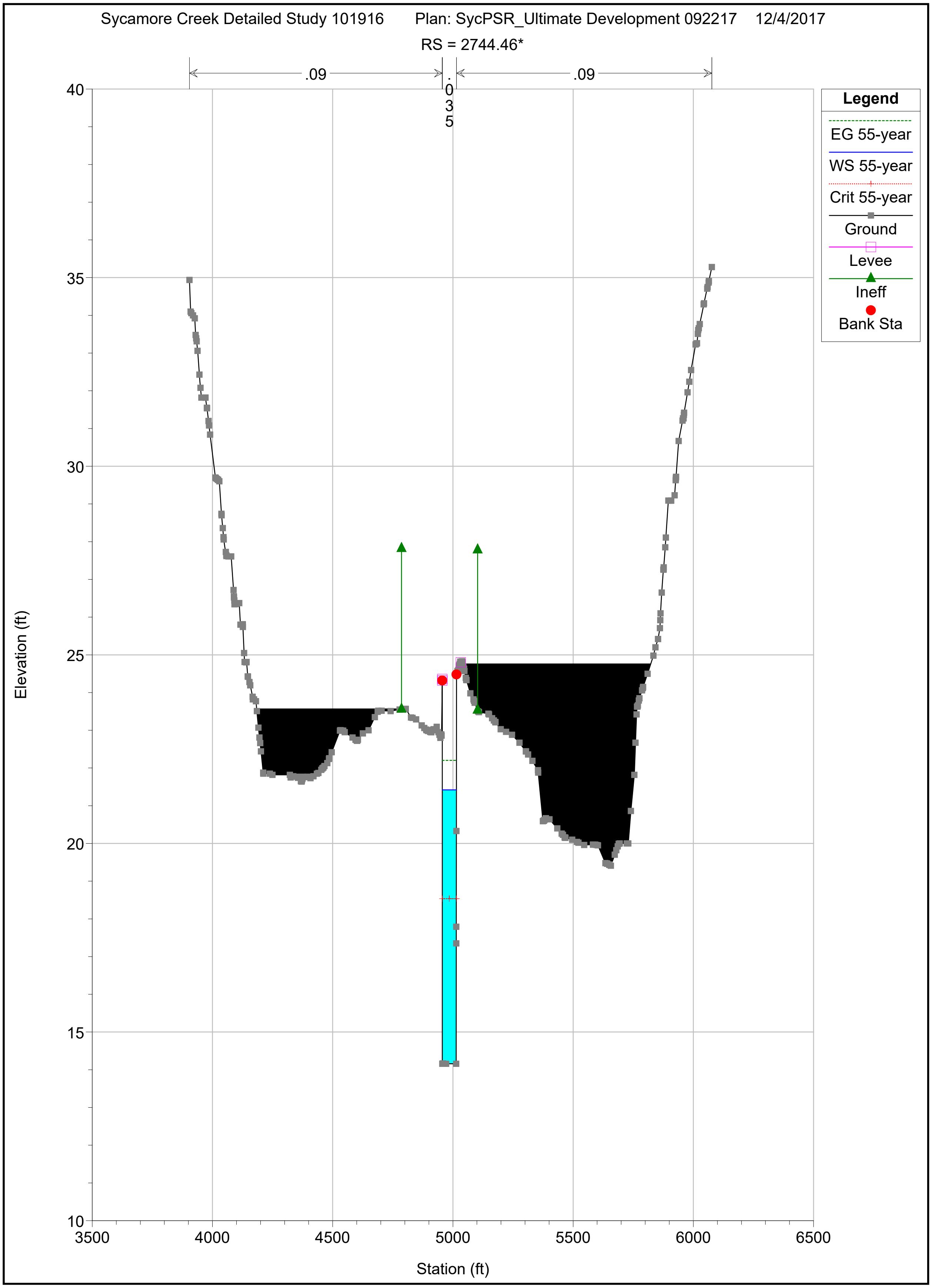
6000
6500


Sycamore Creek Detailed Study 101916
Plan: SycPSR_Ultimate Development 092217
12/4/2017
RS = 2744.46*
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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6000
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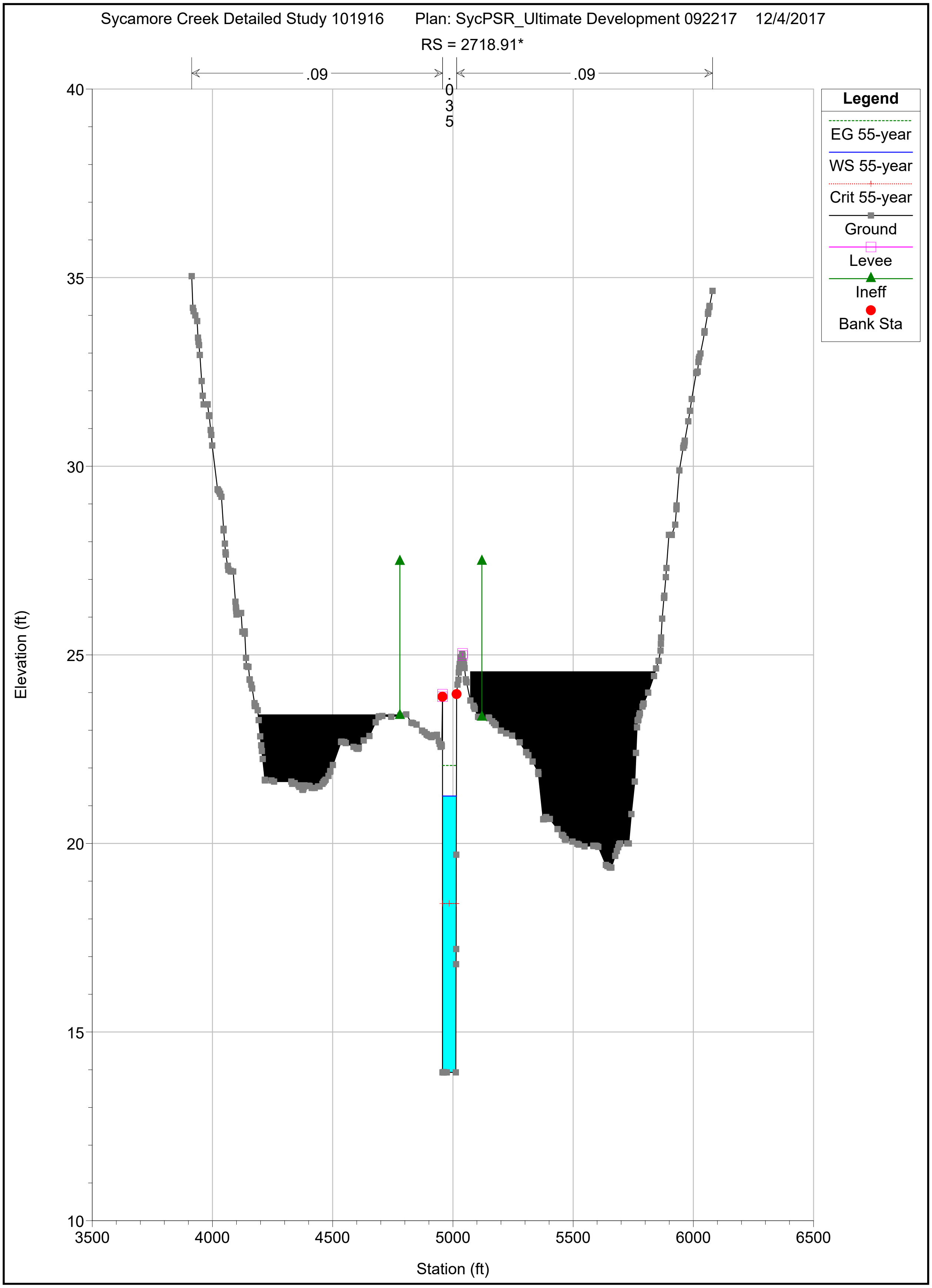
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2718.91*
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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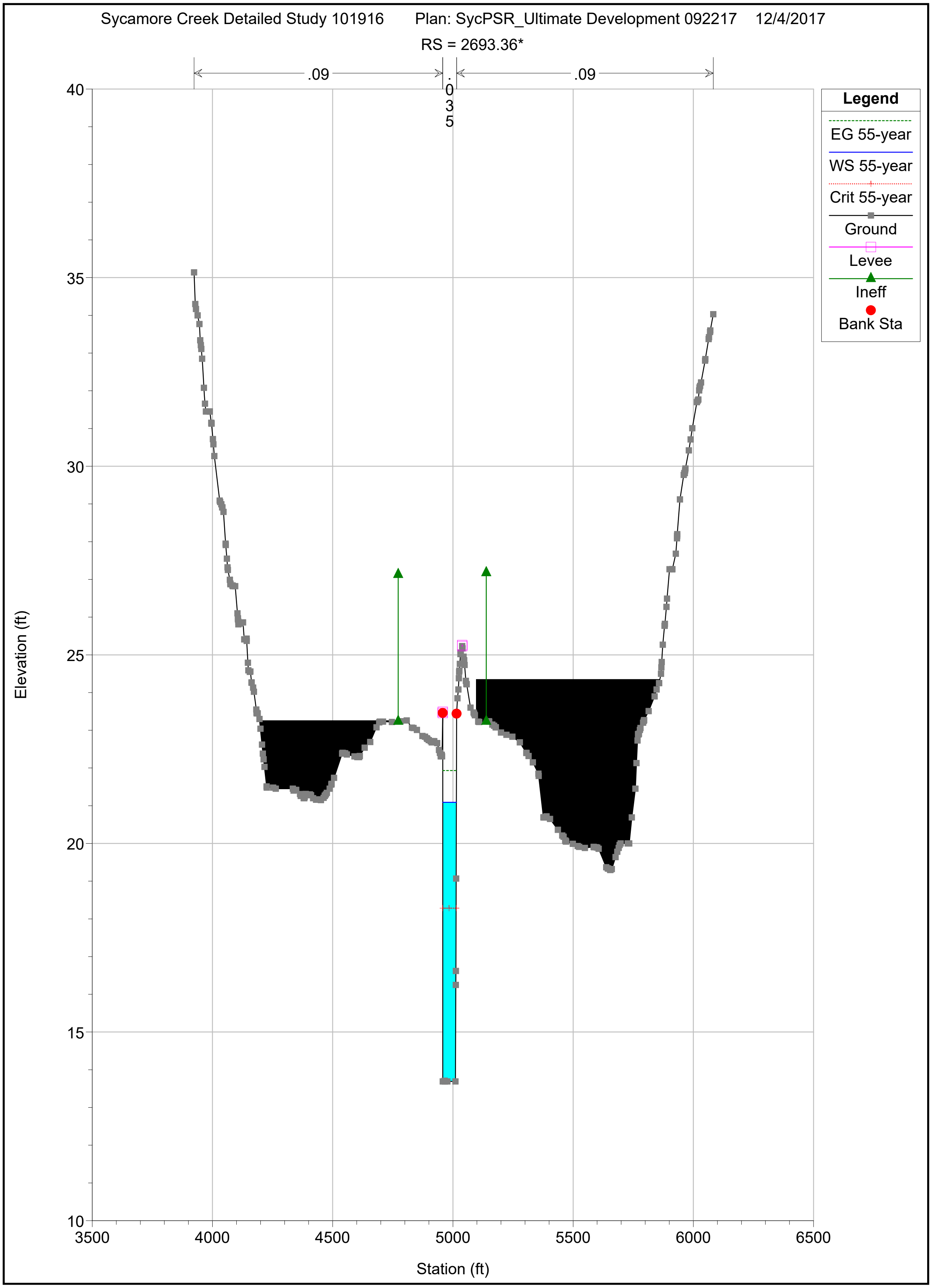
Station (ft)


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2693.36*
.09
.035
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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25
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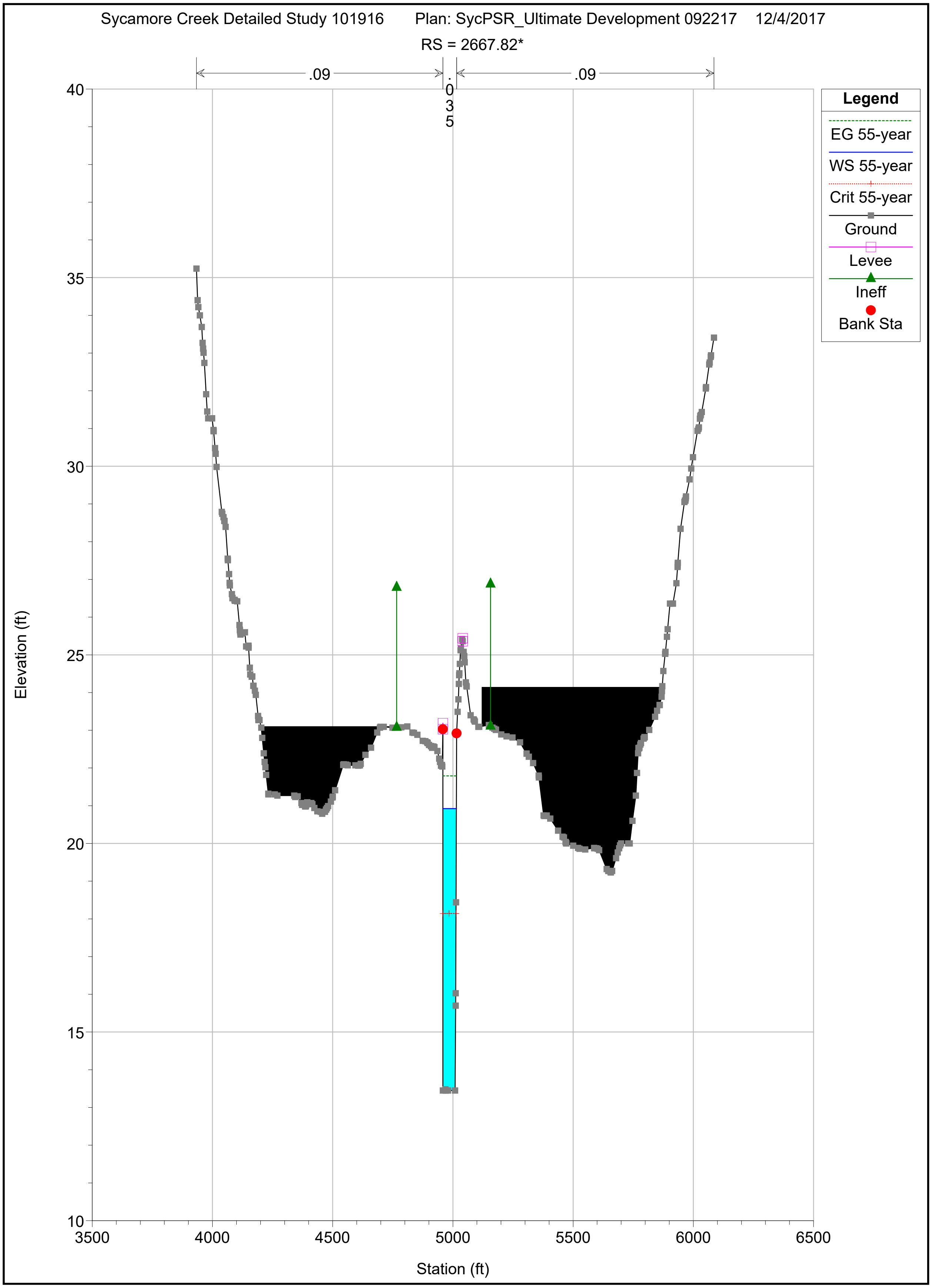
6000
6500

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2667.82*
.09
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.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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15
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Station (ft)
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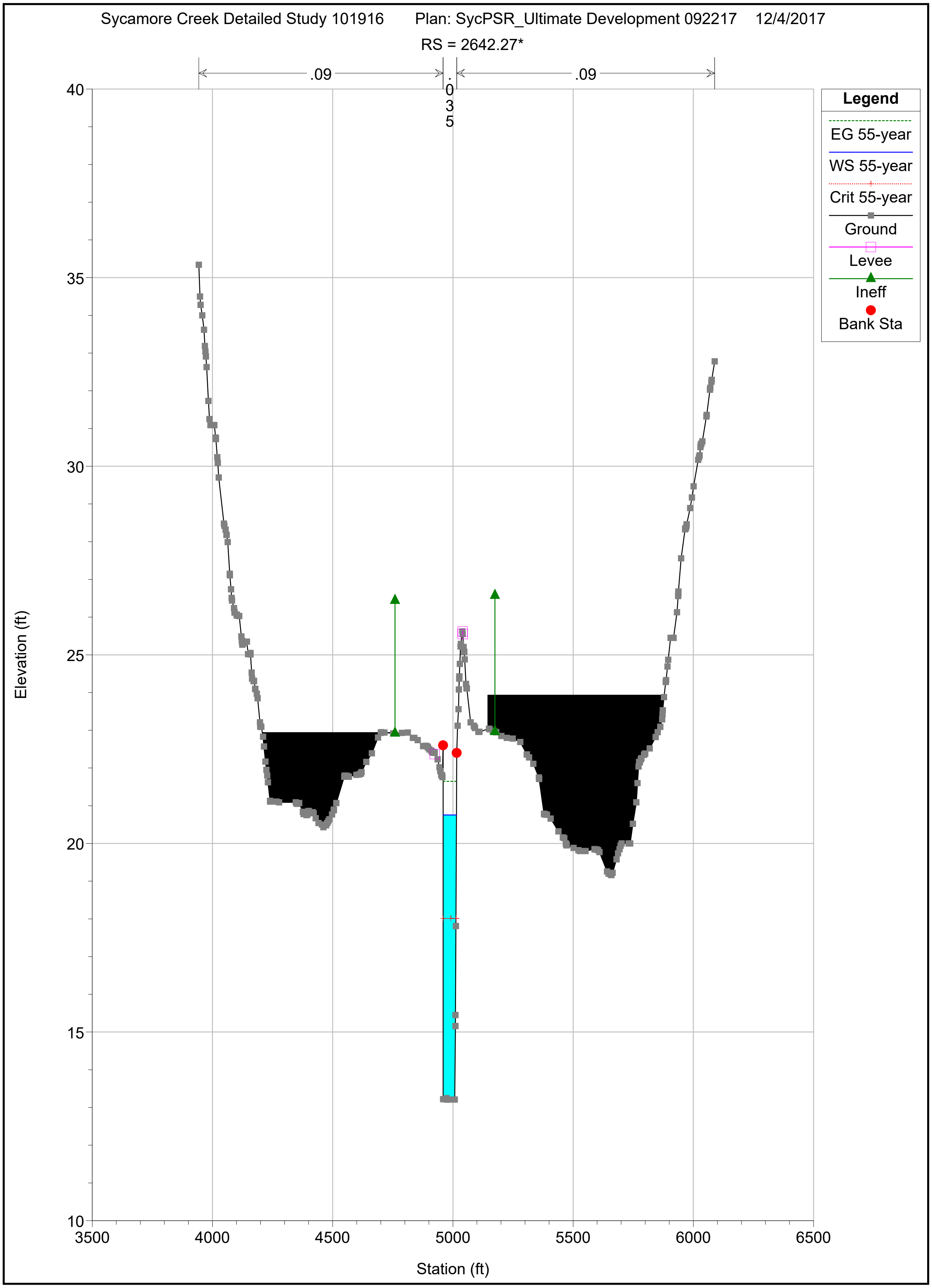
6500


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2642.27*
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.035
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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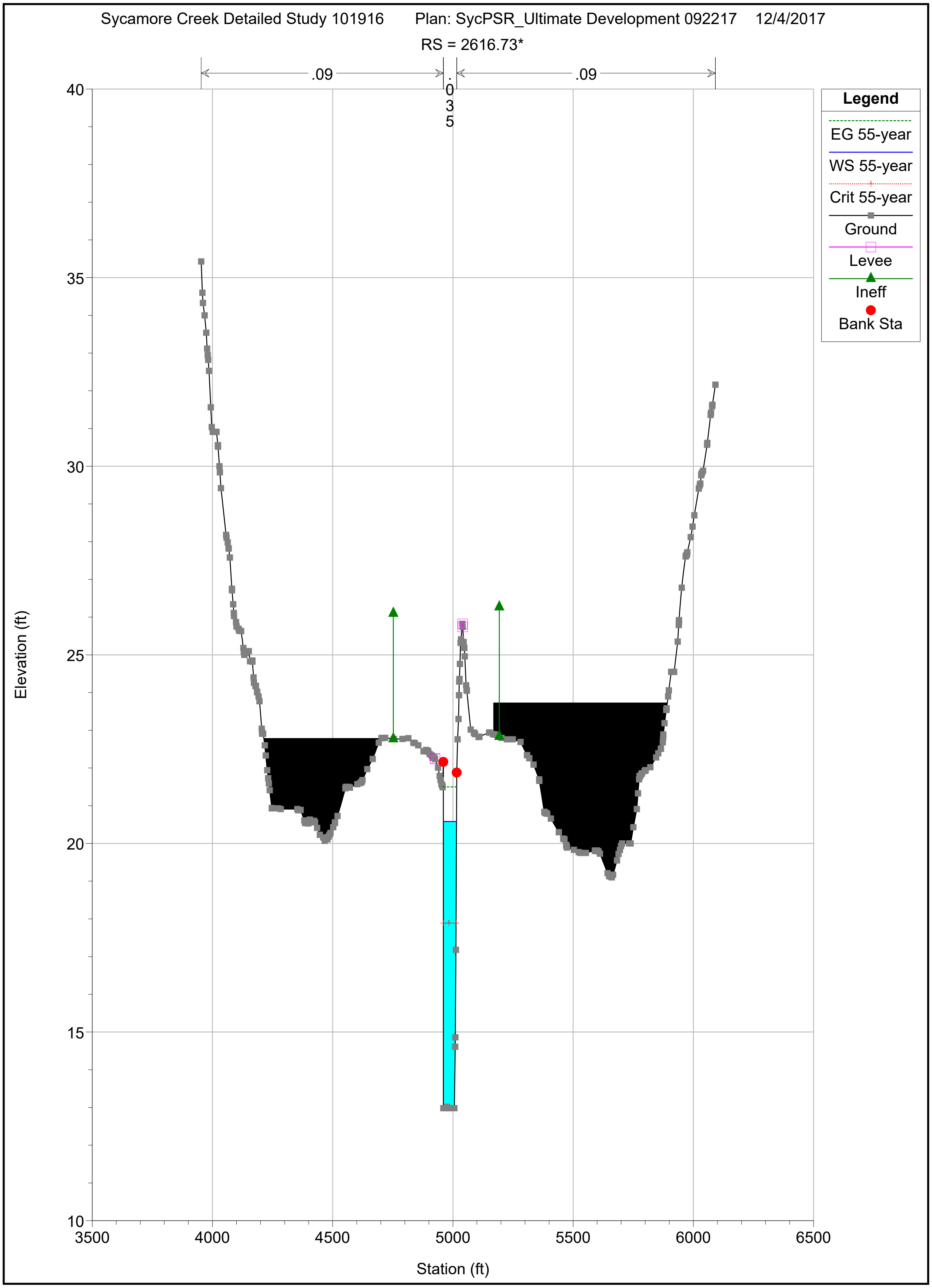Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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.035
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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35
30
25
20
15
10
Station (ft)
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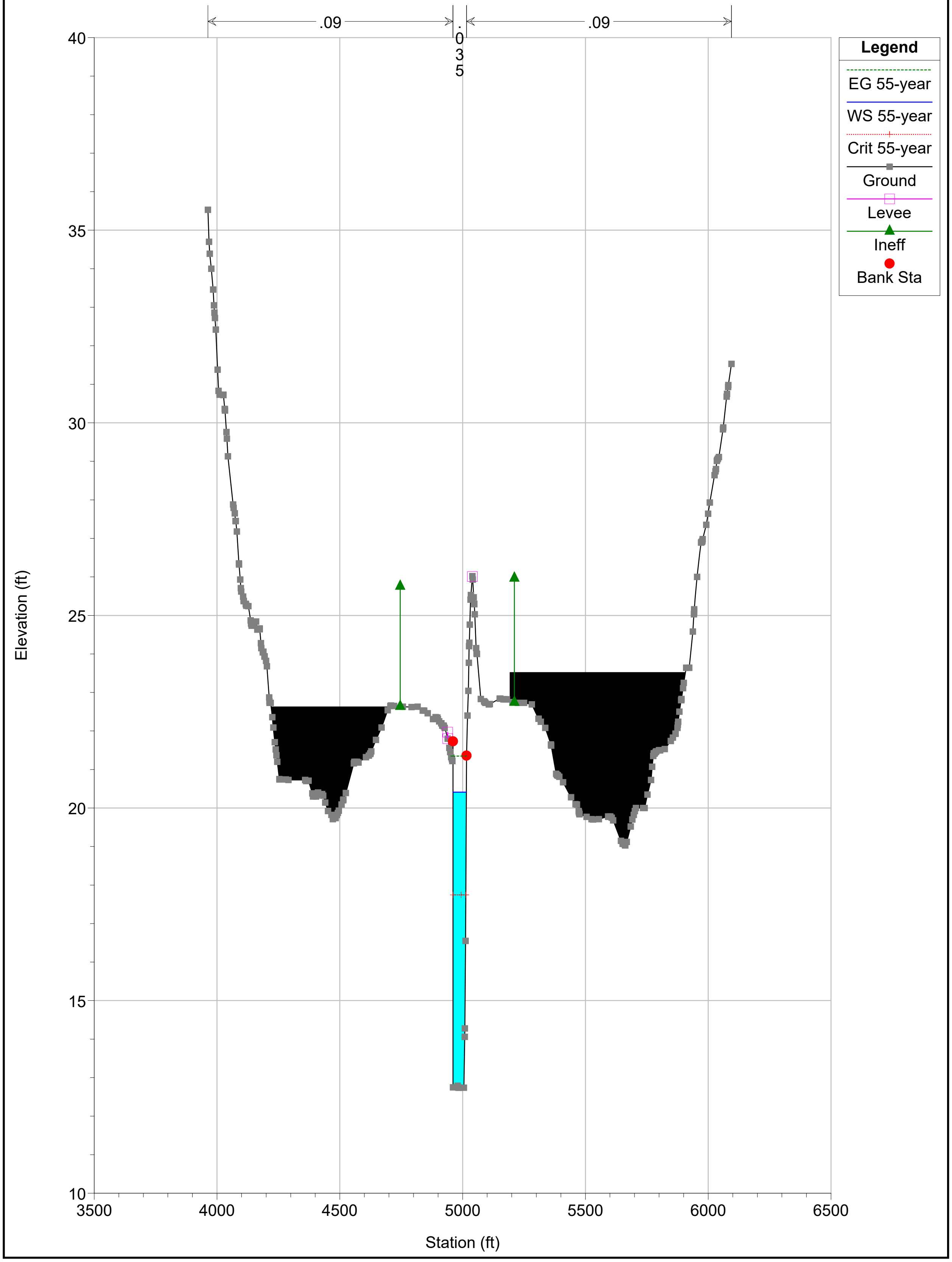
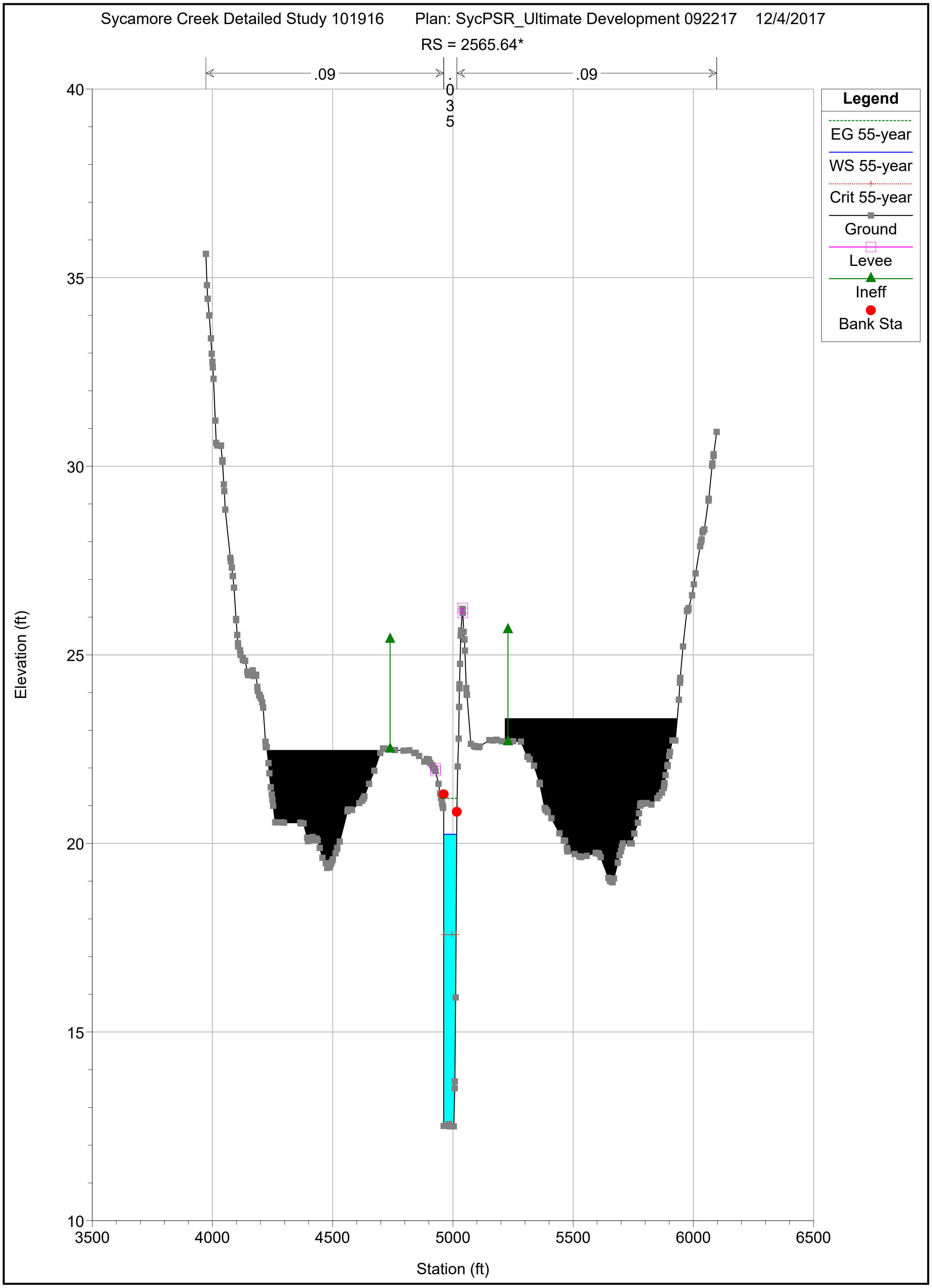
6500

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017

RS = 2591.18*



Sycamore Creek Detailed Study 101916
Plan: SycPSR_Ultimate Development 092217
12/4/2017
RS = 2565.64*
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.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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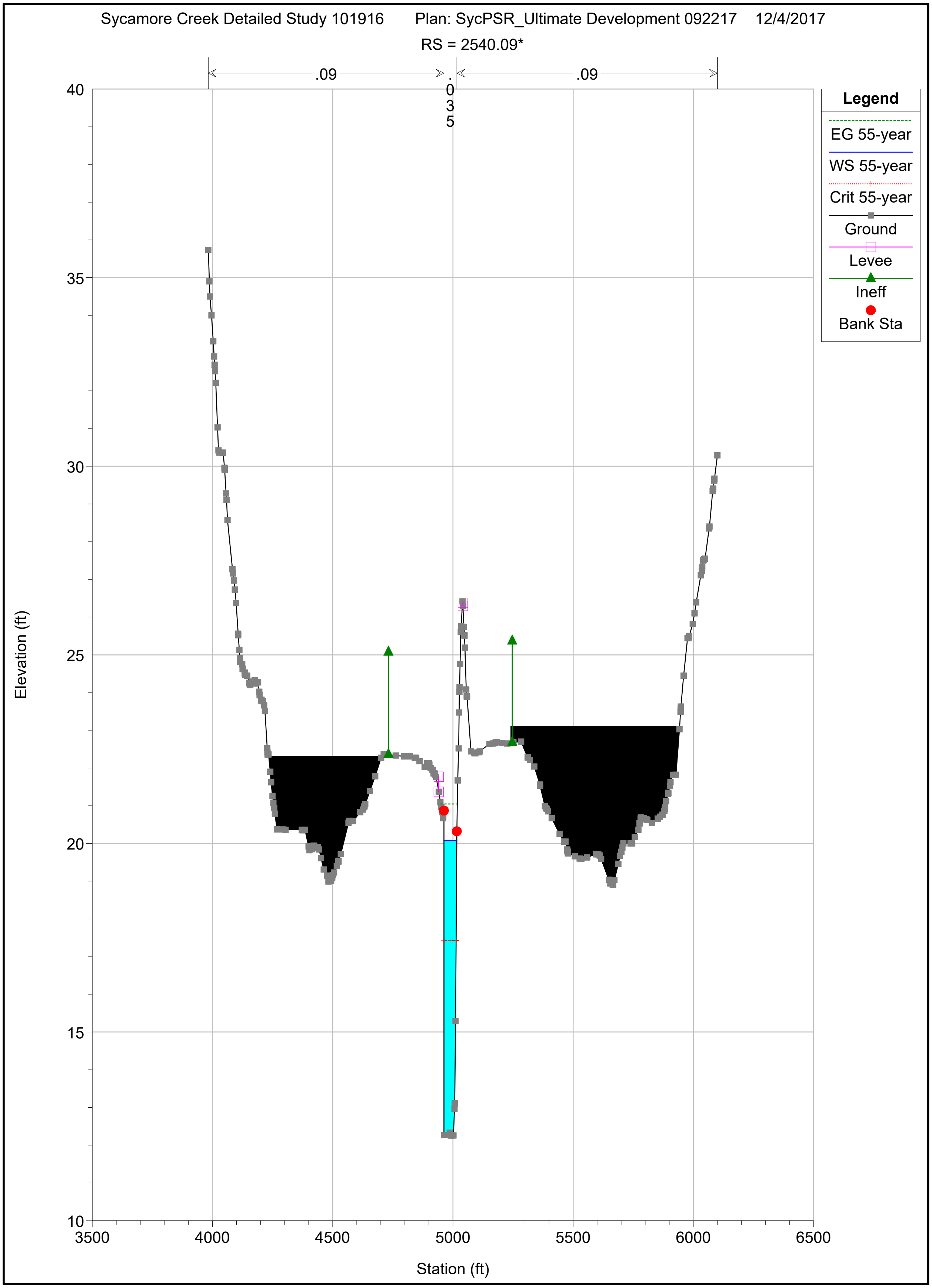
6000
6500


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2540.09*
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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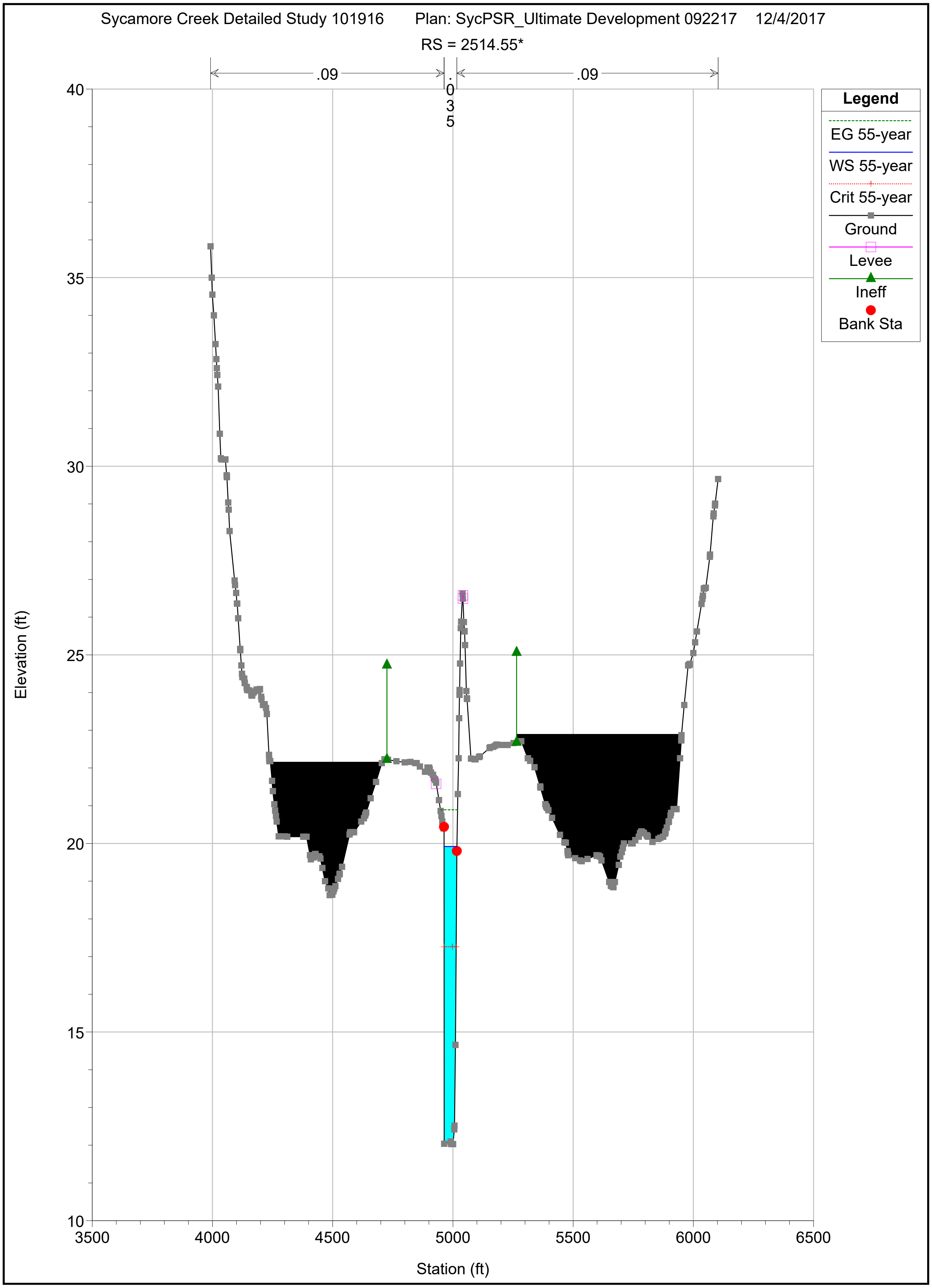
Station (ft)


Sycamore Creek Detailed Study 101916
Plan: SycPSR_Ultimate Development 092217
12/4/2017
RS = 2514.55*
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.035
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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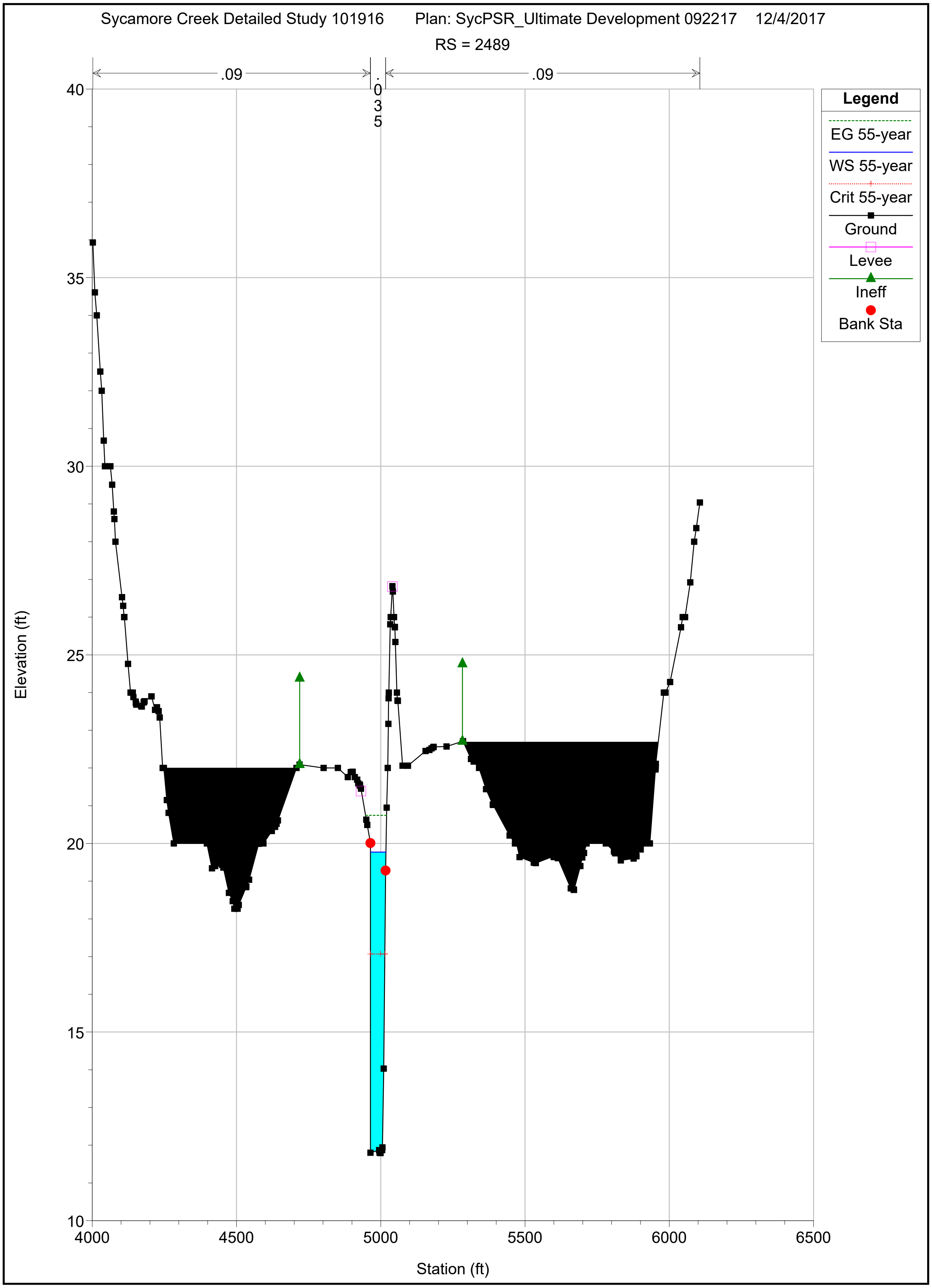
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2489
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.035
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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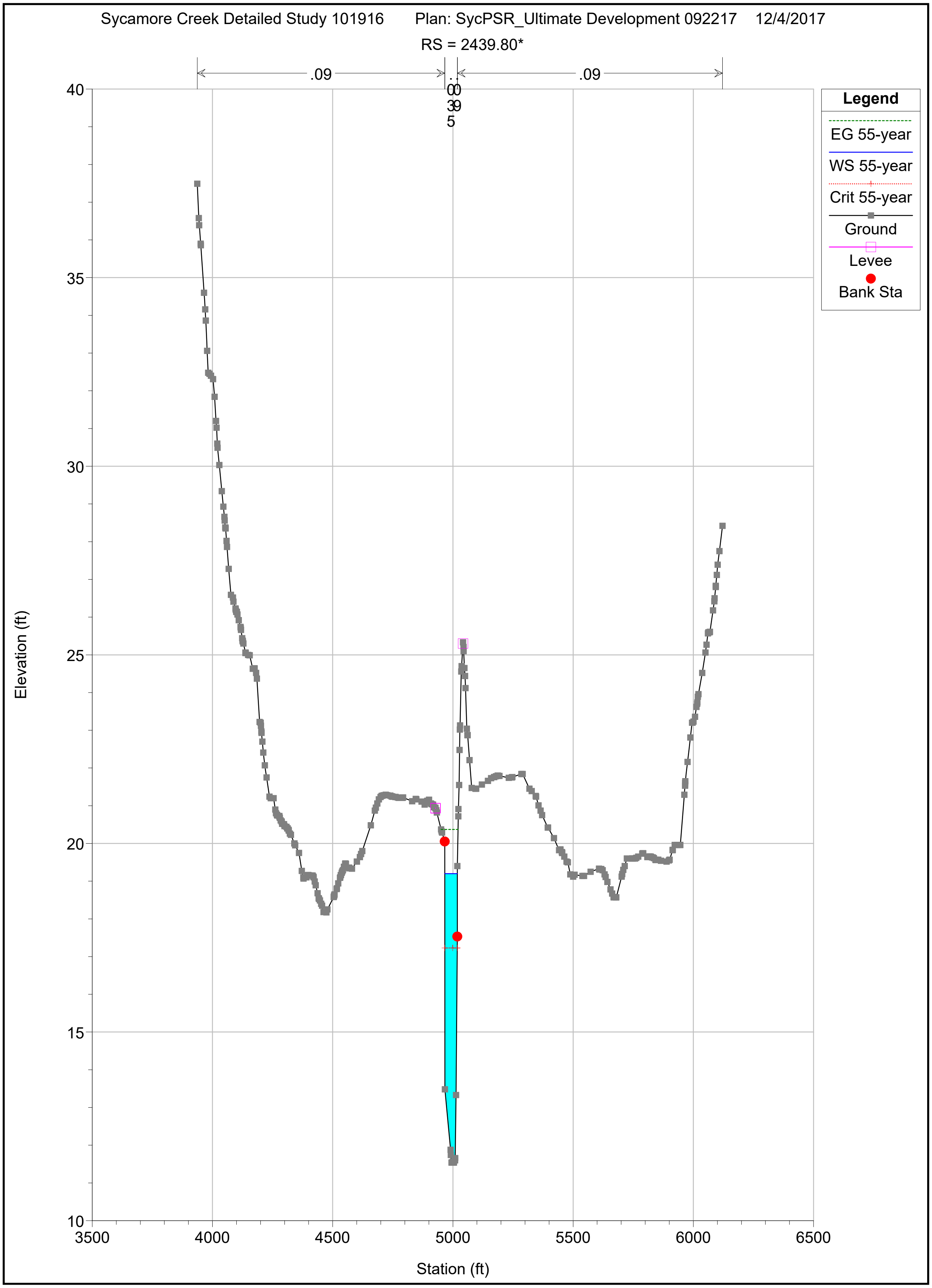
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2439.80*
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.09
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Bank Sta
Elevation (ft)
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Station (ft)
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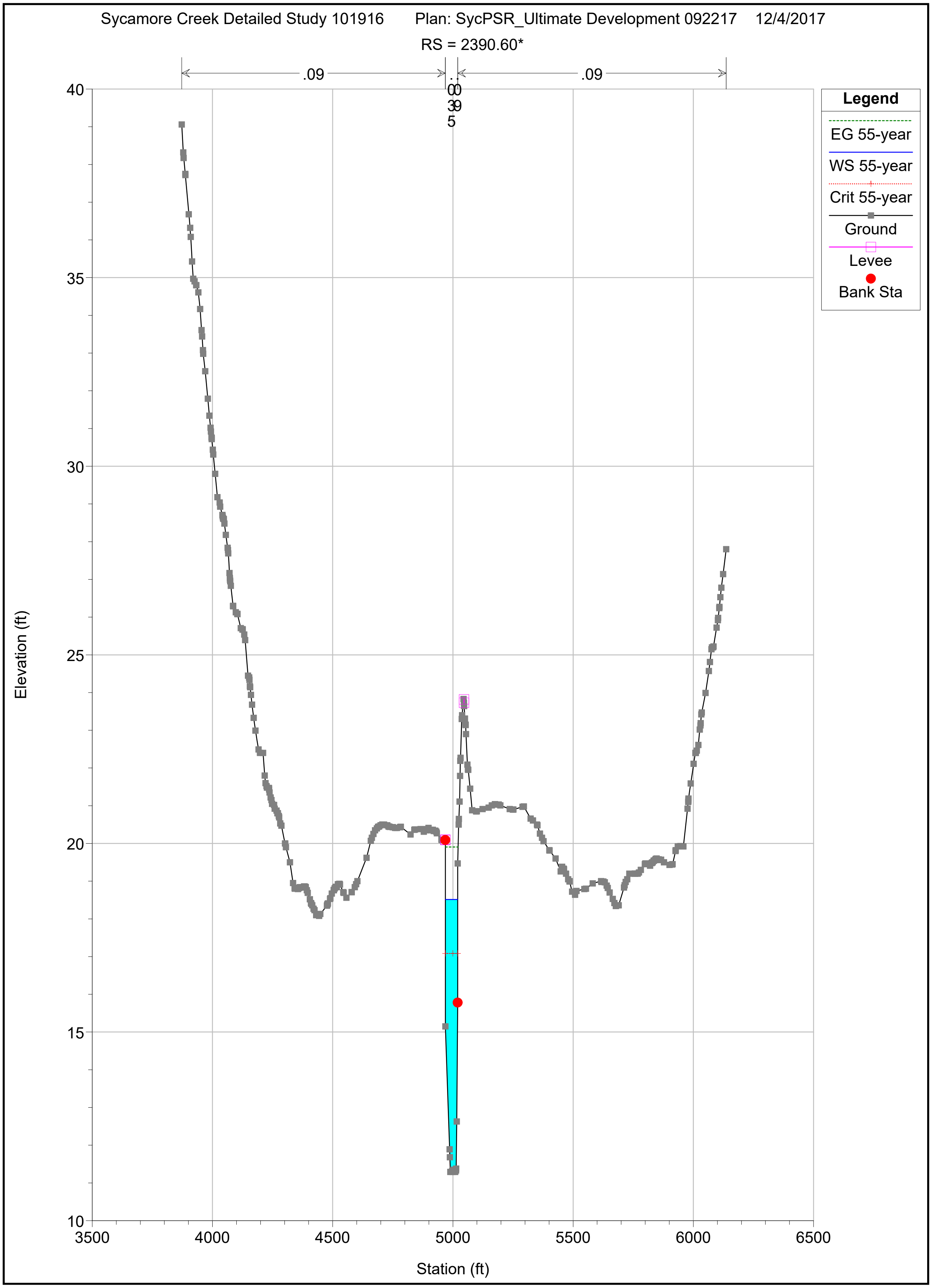
Sycamore Creek Detailed Study 101916
Plan: SycPSR_Ultimate Development 092217
12/4/2017
RS = 2390.60*
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.035
.09
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
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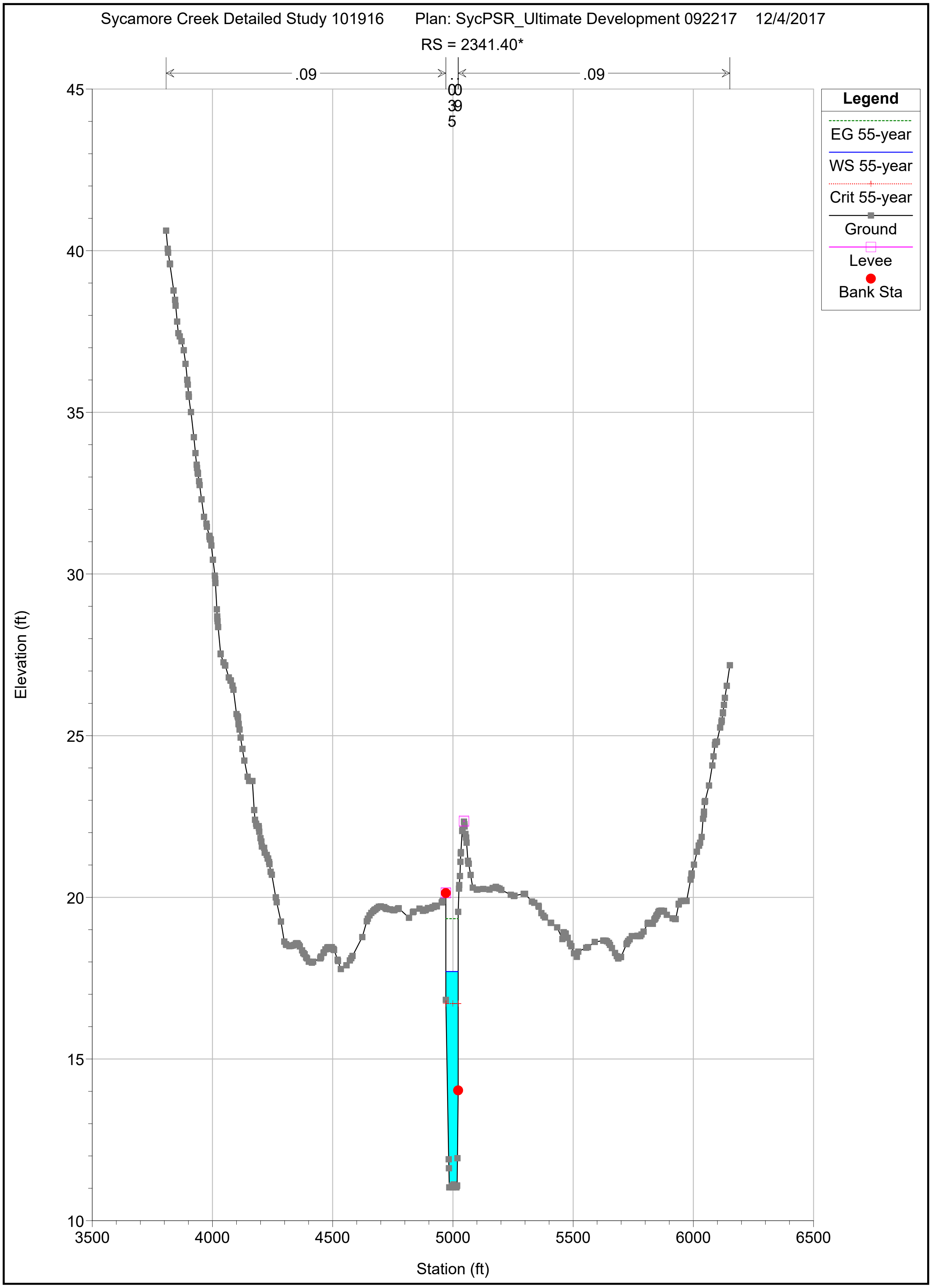
6500


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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.
0
3
5
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0
9
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Bank Sta
Elevation (ft)
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Station (ft)
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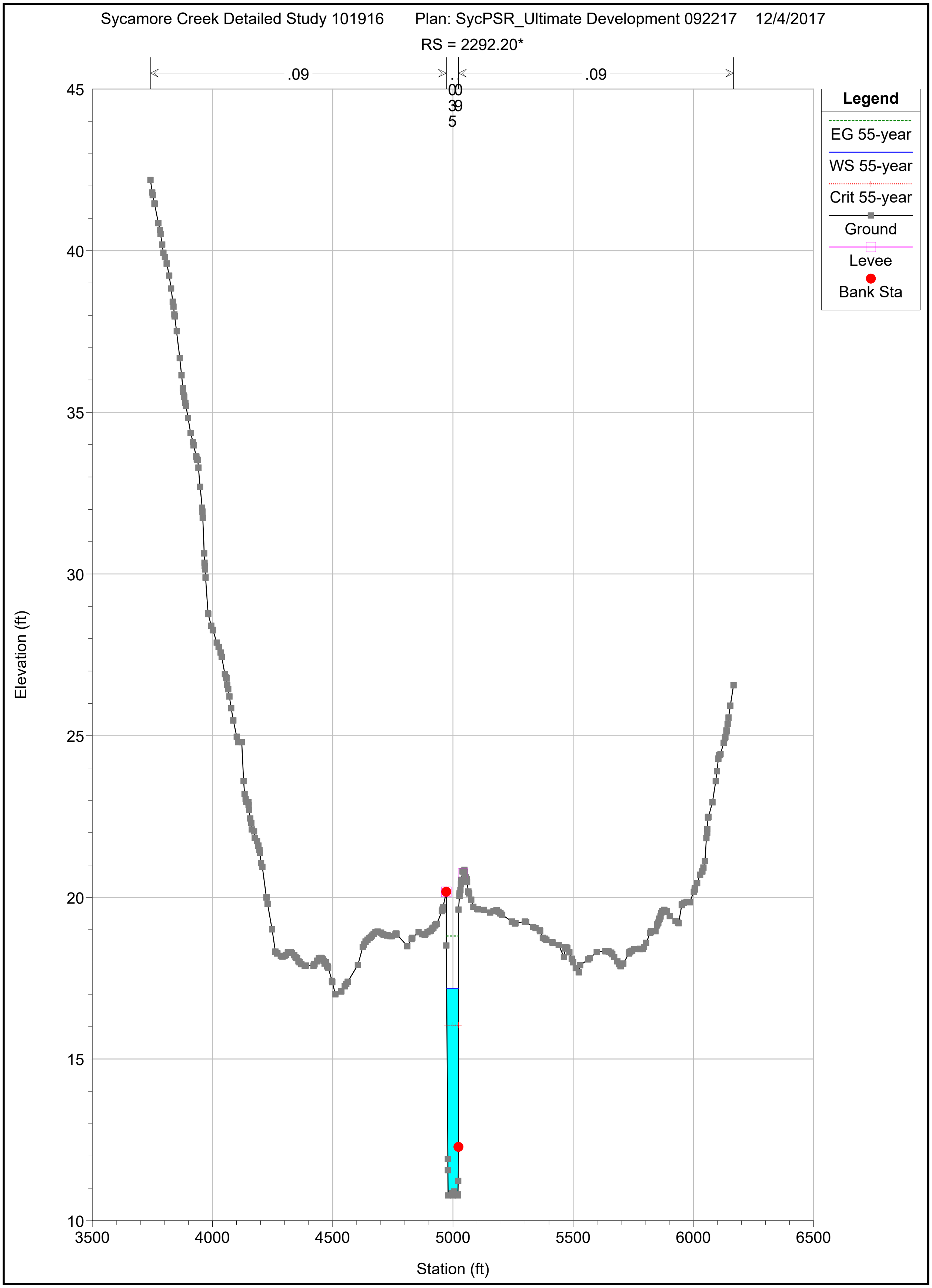
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2292.20*
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.035
.09
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
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4000
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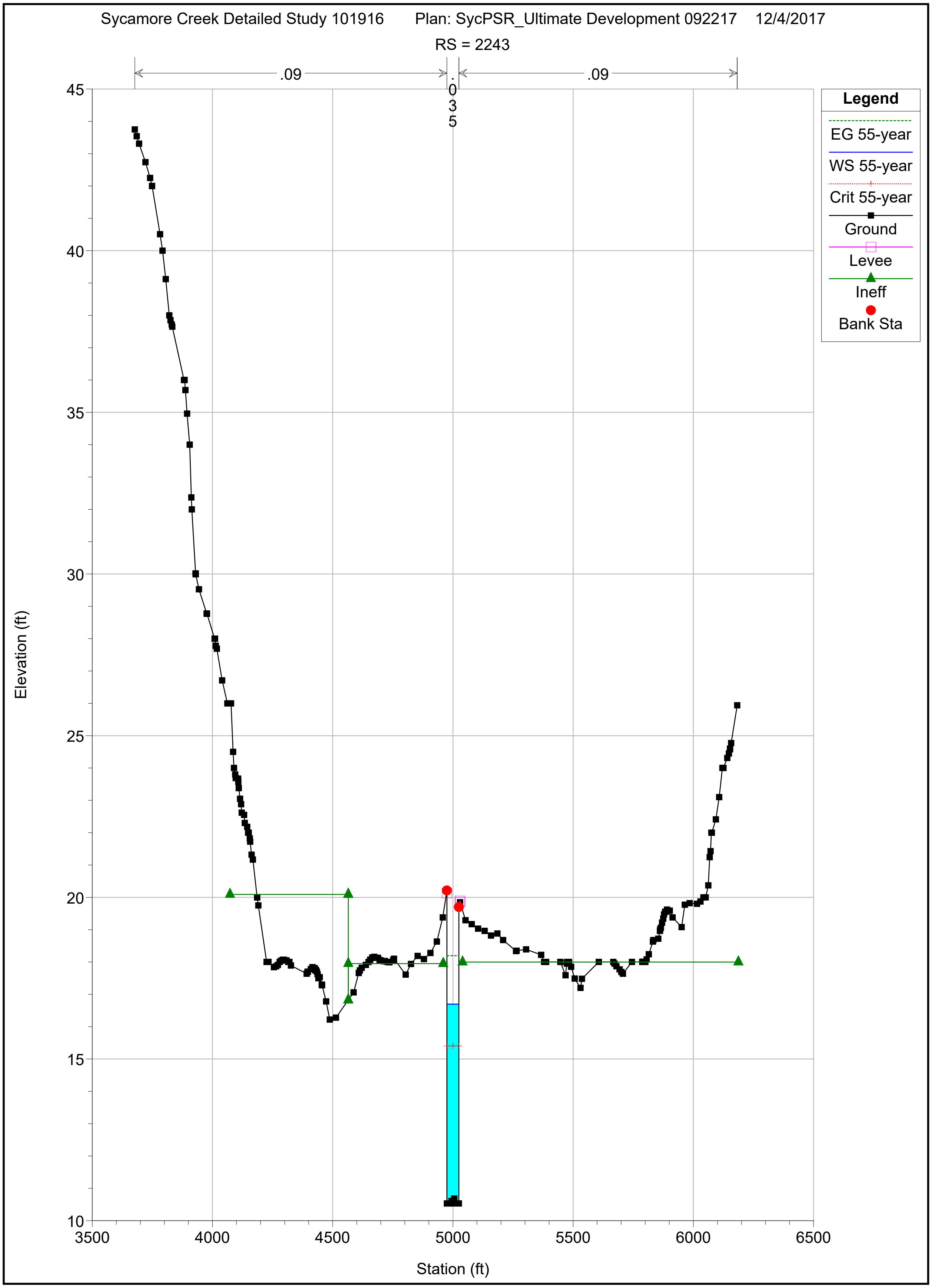
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2243
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.035
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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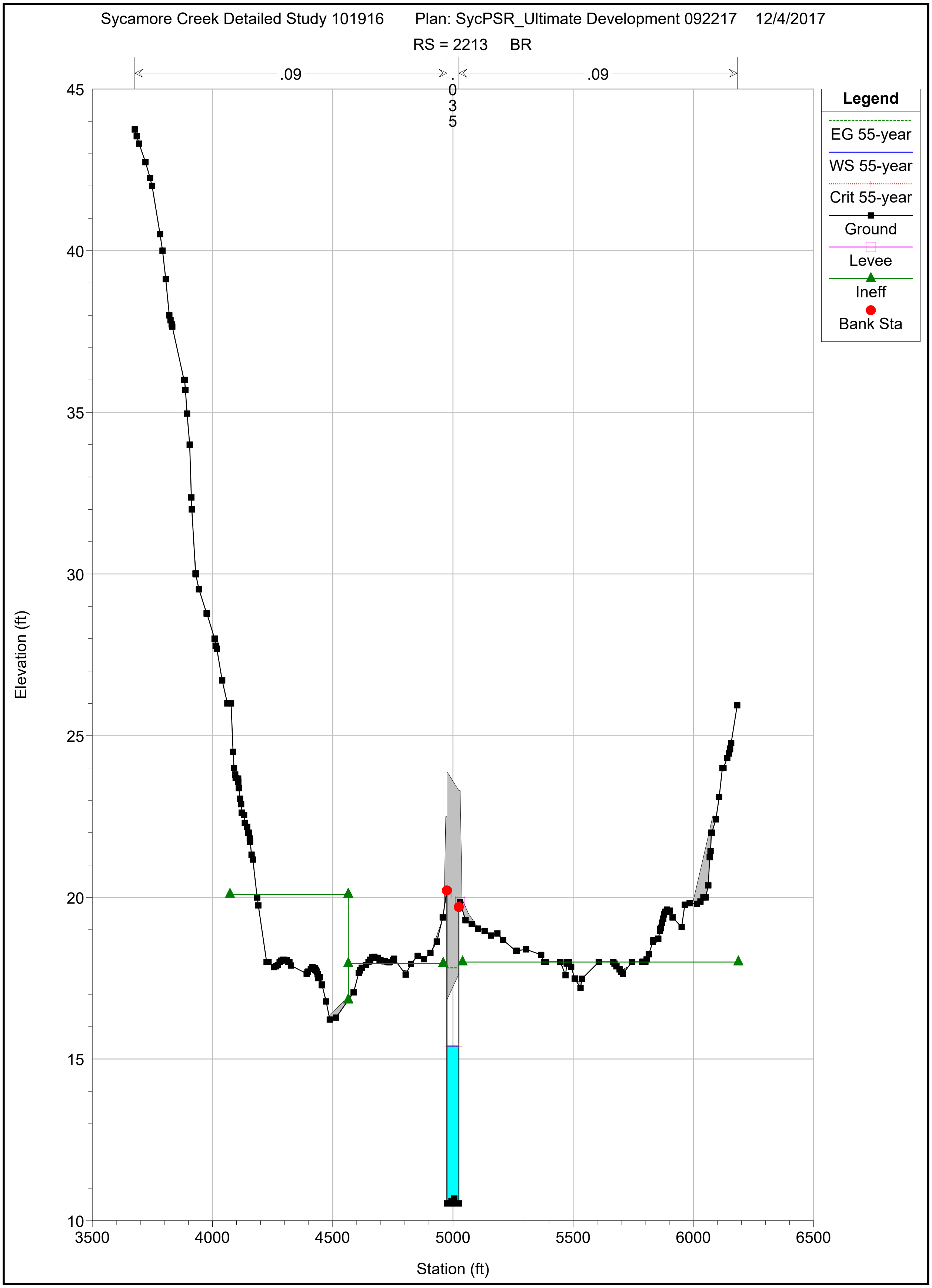
6500


Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2213 BR
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.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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4000
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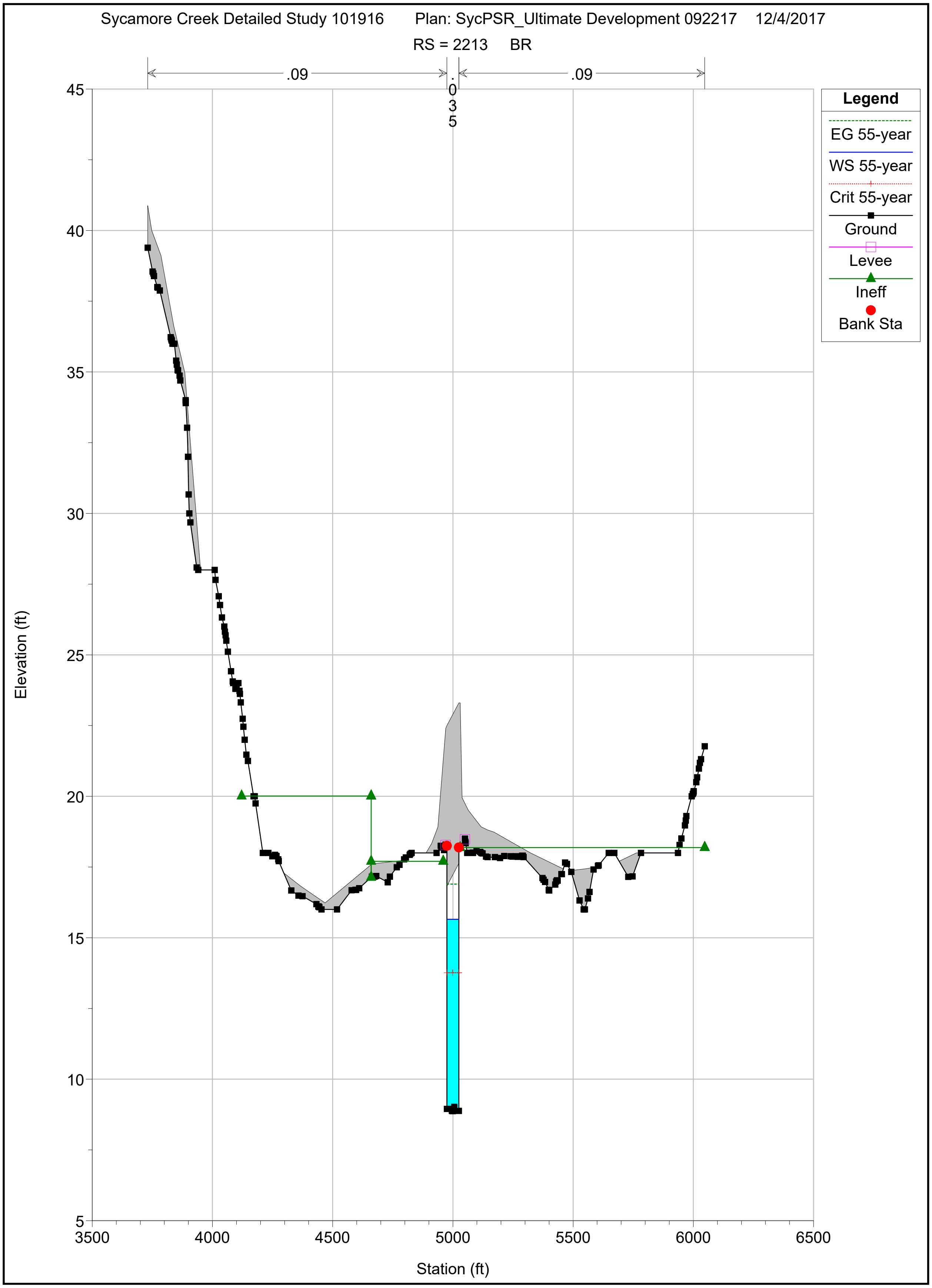
Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
RS = 2213 BR
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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4500
5000
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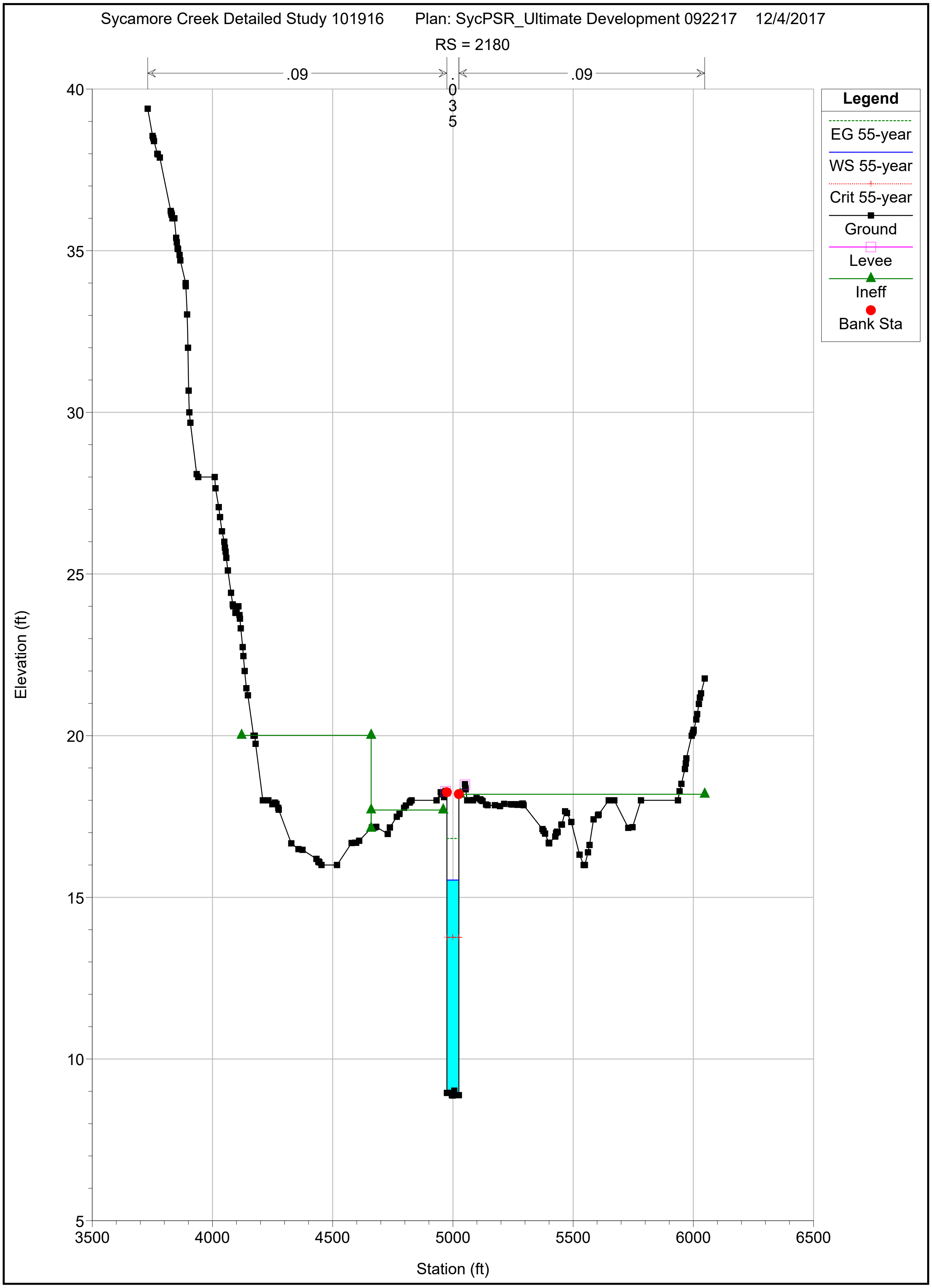
6000
6500
Station (ft)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WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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25
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10
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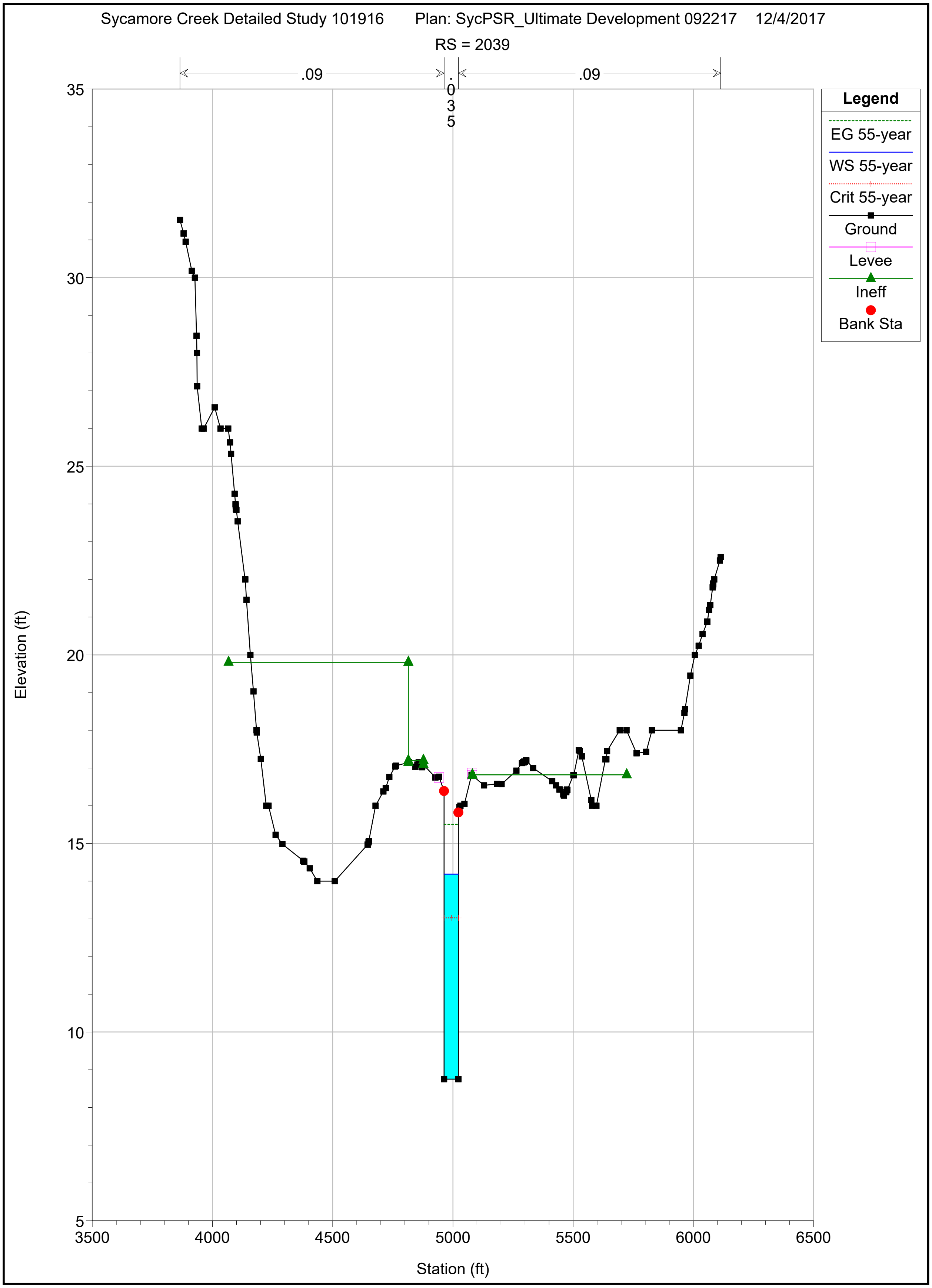
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Crit 55-year
Ground
Levee
Ineff
Bank Sta
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10
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4500
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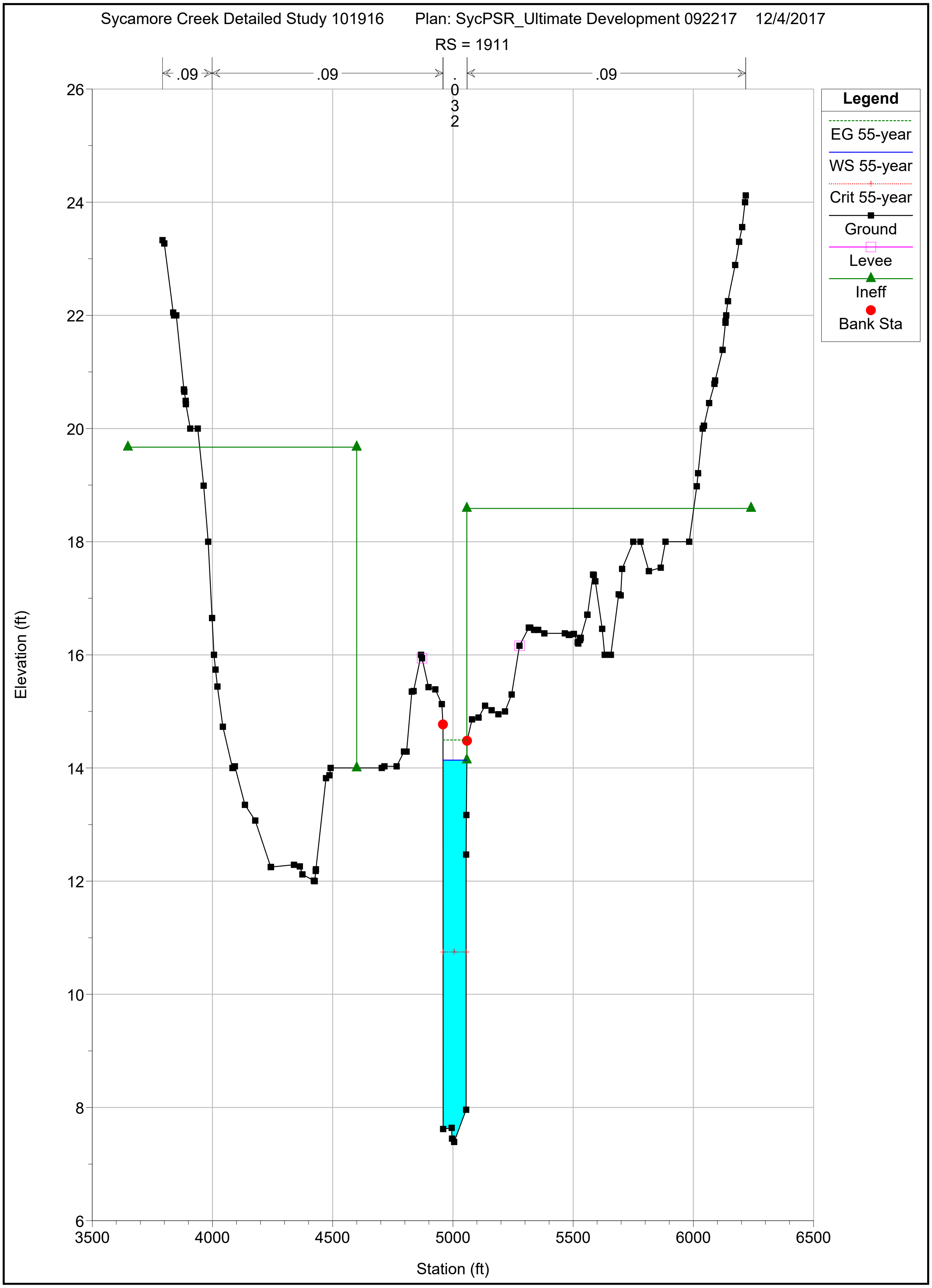
Station (ft)

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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16
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12
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8
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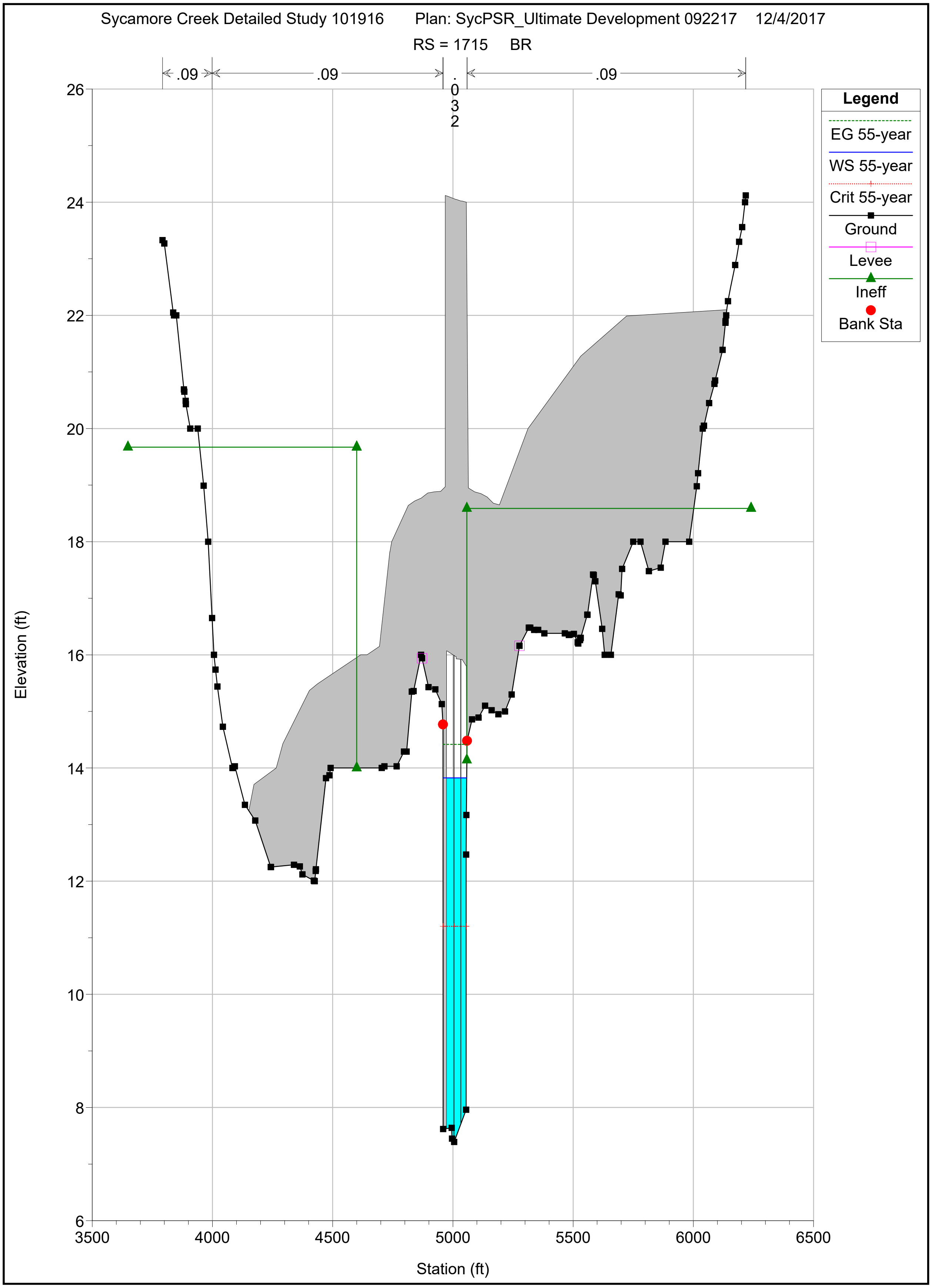
6000
6500

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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Crit 55-year
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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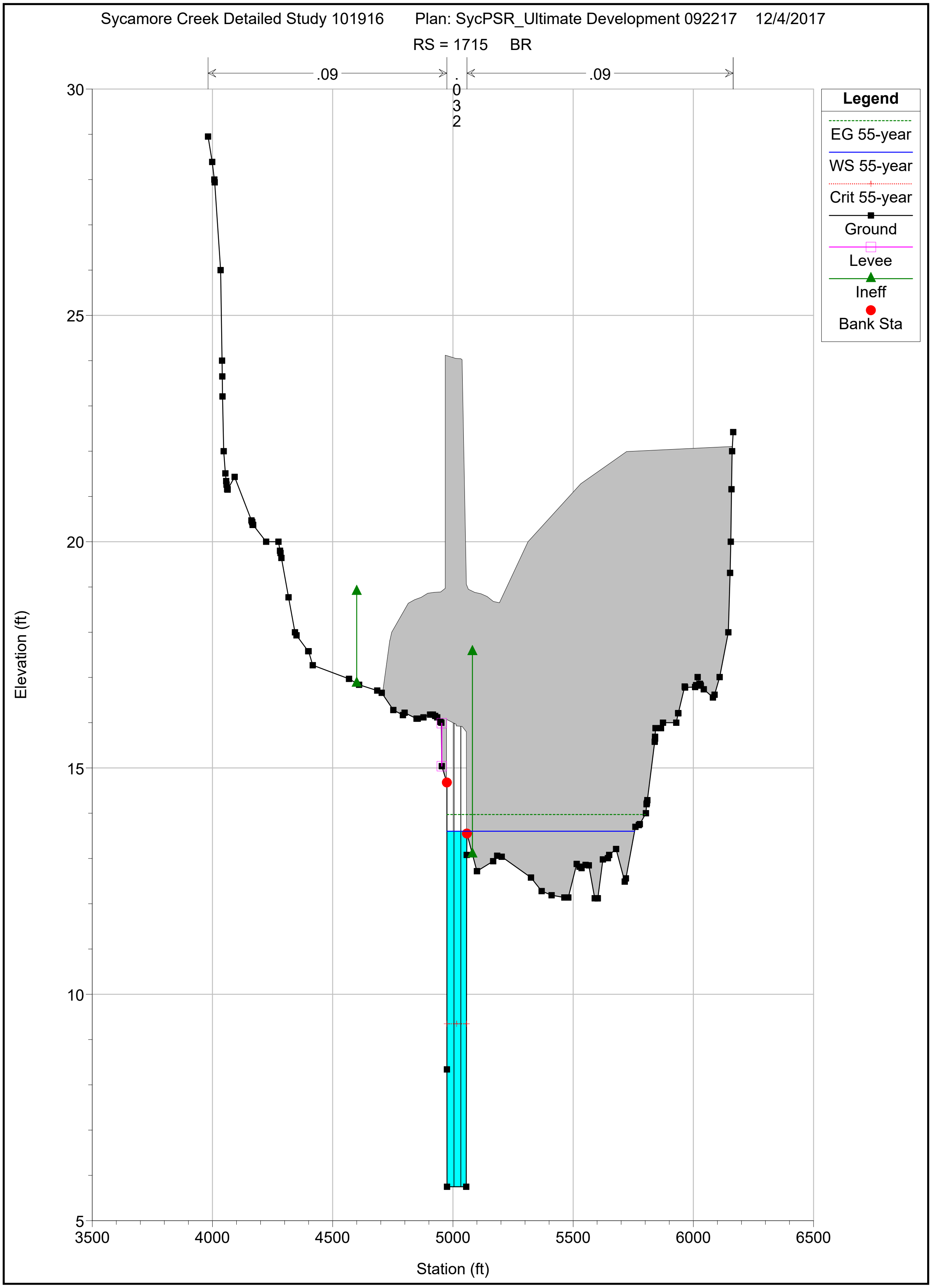
Station (ft)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Crit 55-year
Ground
Levee
Ineff
Bank Sta
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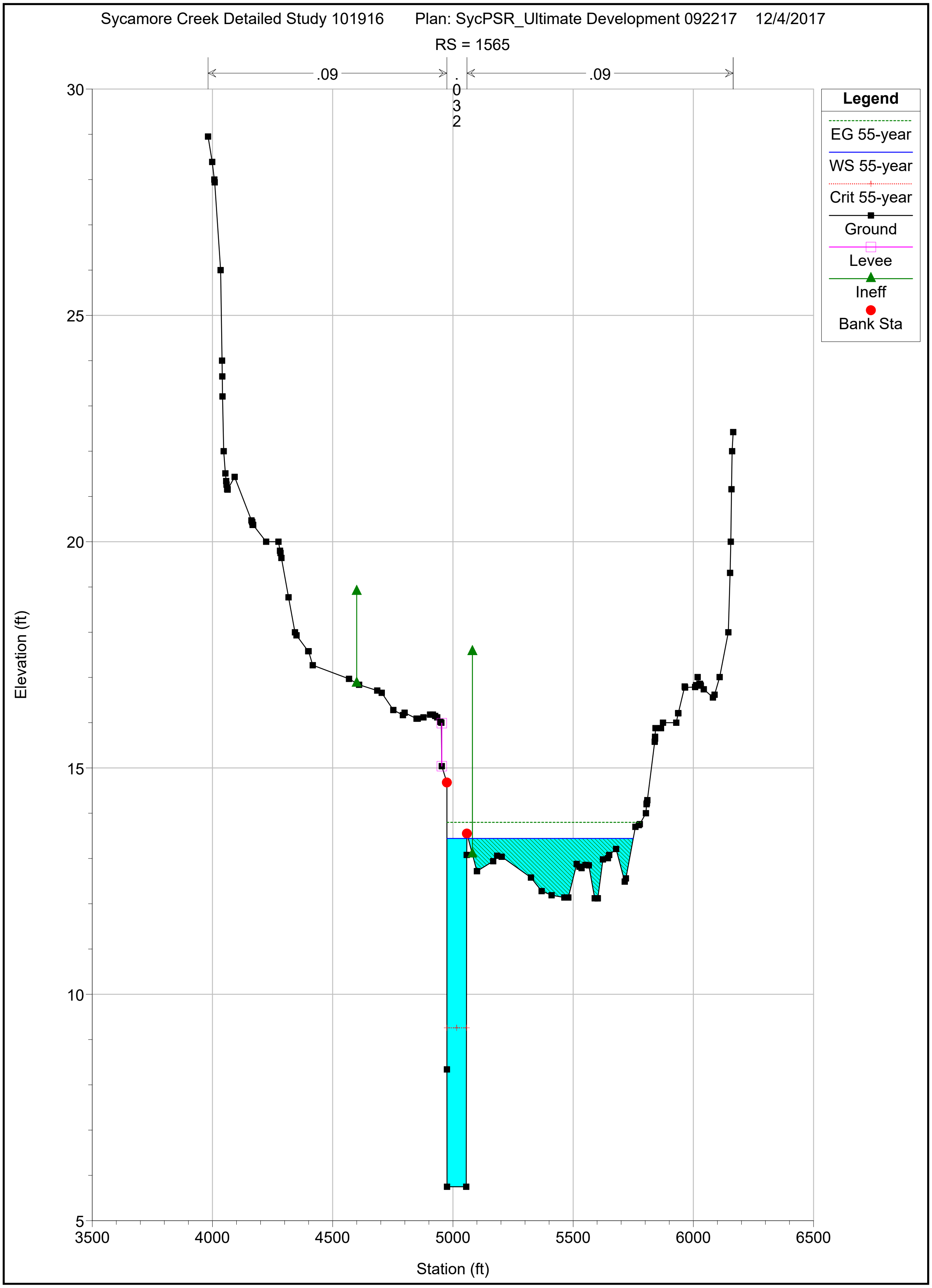
Station (ft)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Crit 55-year
Ground
Levee
Ineff
Bank Sta
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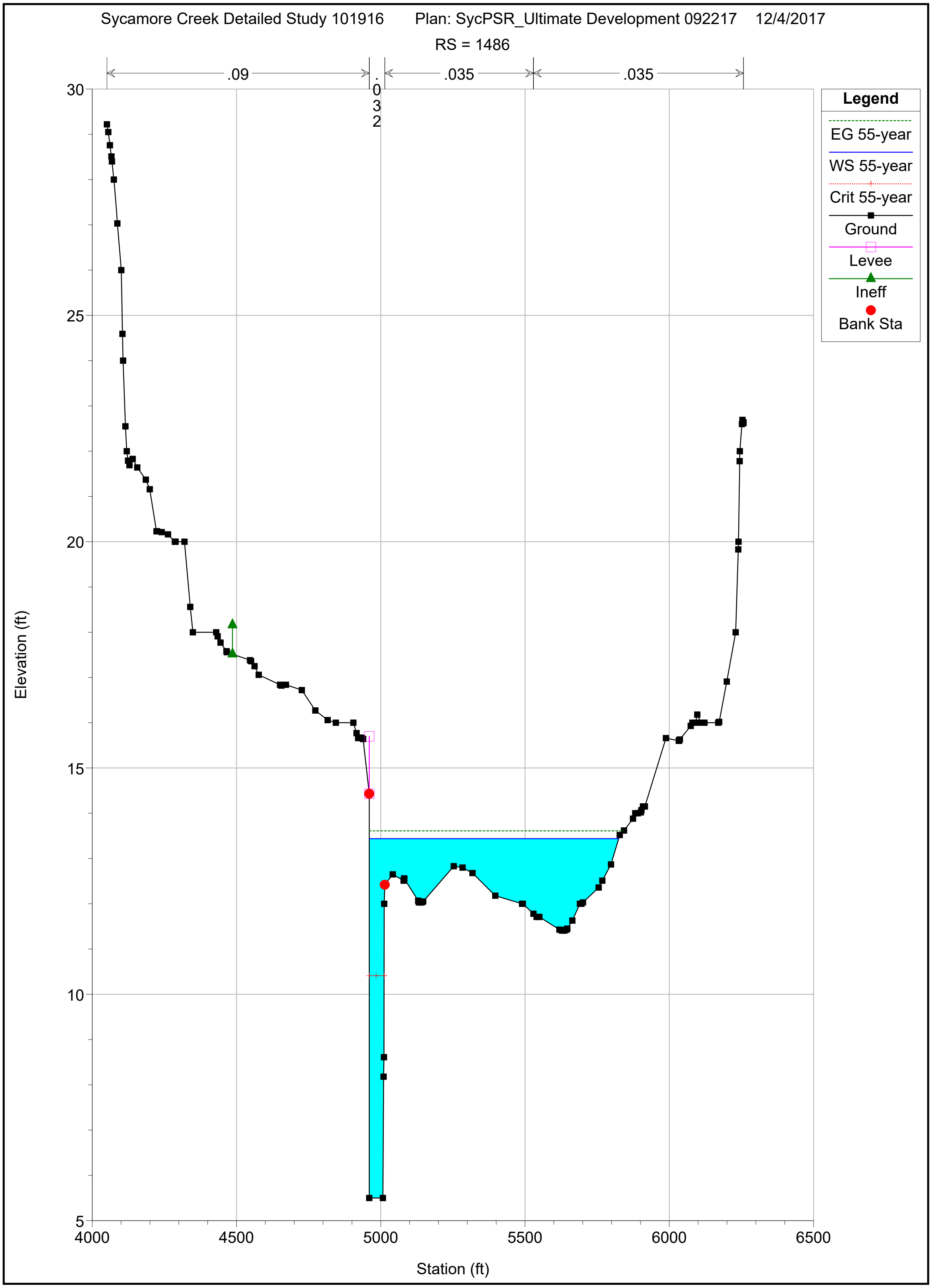
Station (ft)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Crit 55-year
Ground
Levee
Ineff
Bank Sta
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6000
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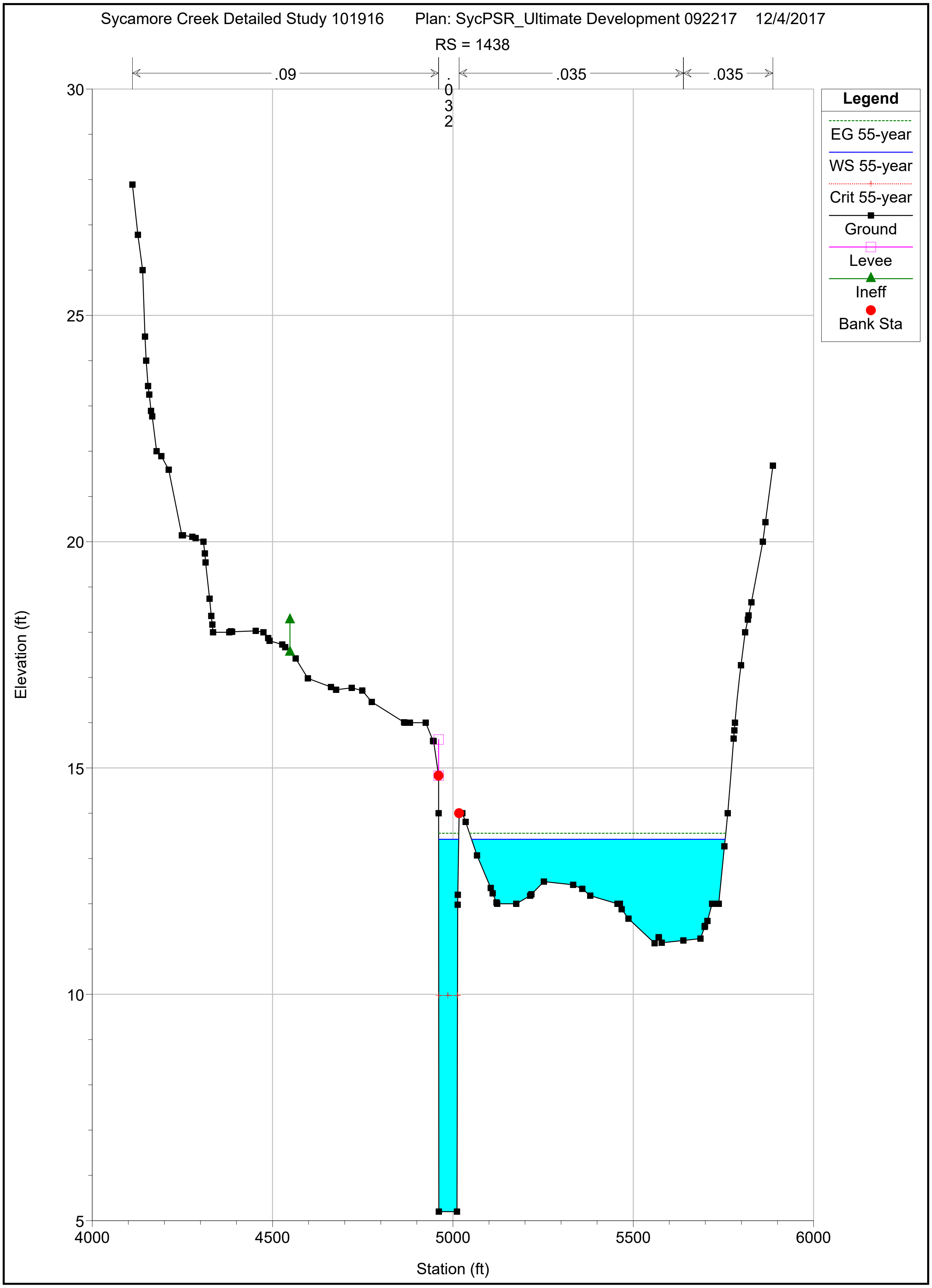
Station (ft)

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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Crit 55-year
Ground
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Station (ft)
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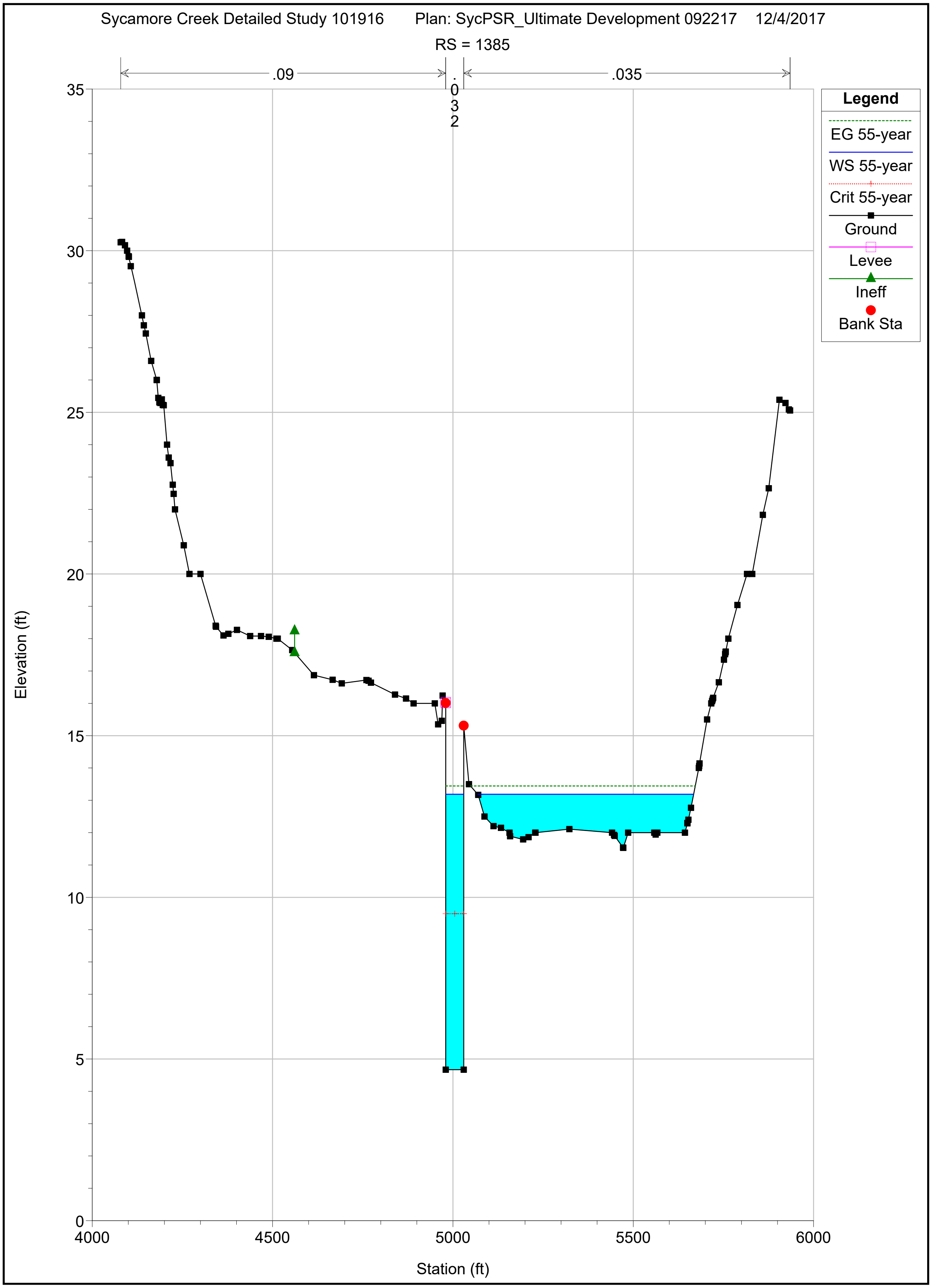
6000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12/4/2017
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WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
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Station (ft)
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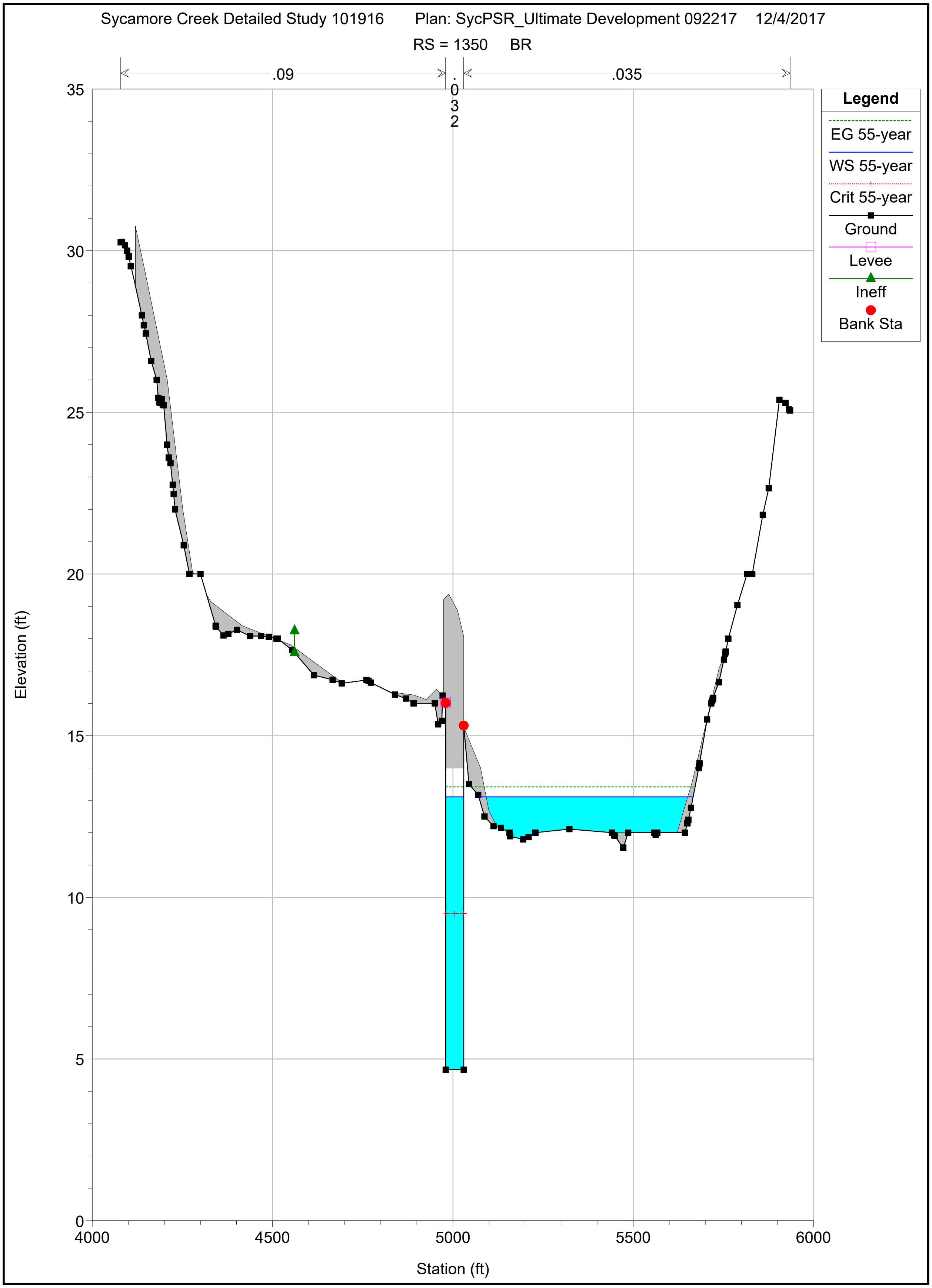Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
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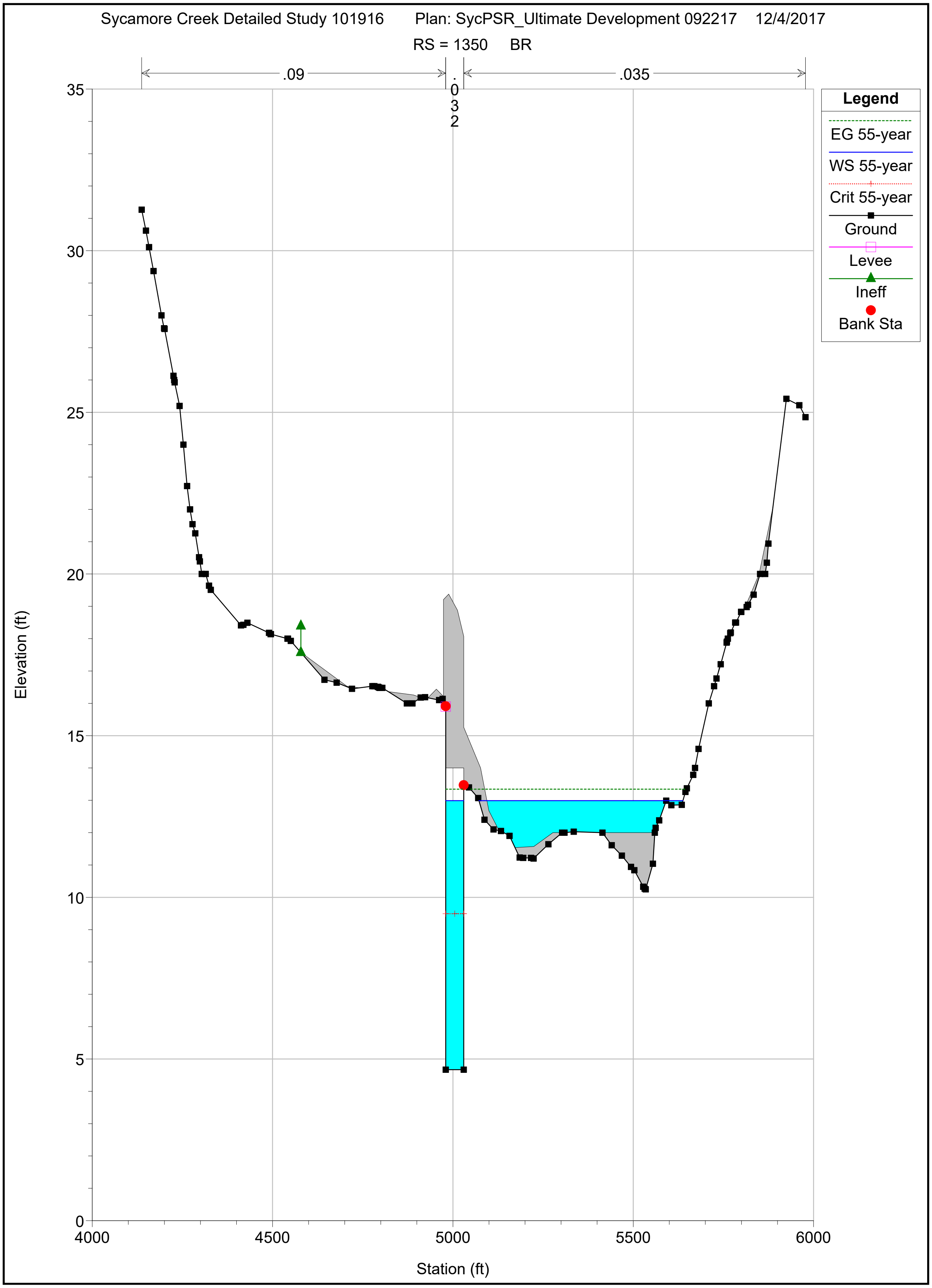
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Crit 55-year
Ground
Levee
Ineff
Bank Sta
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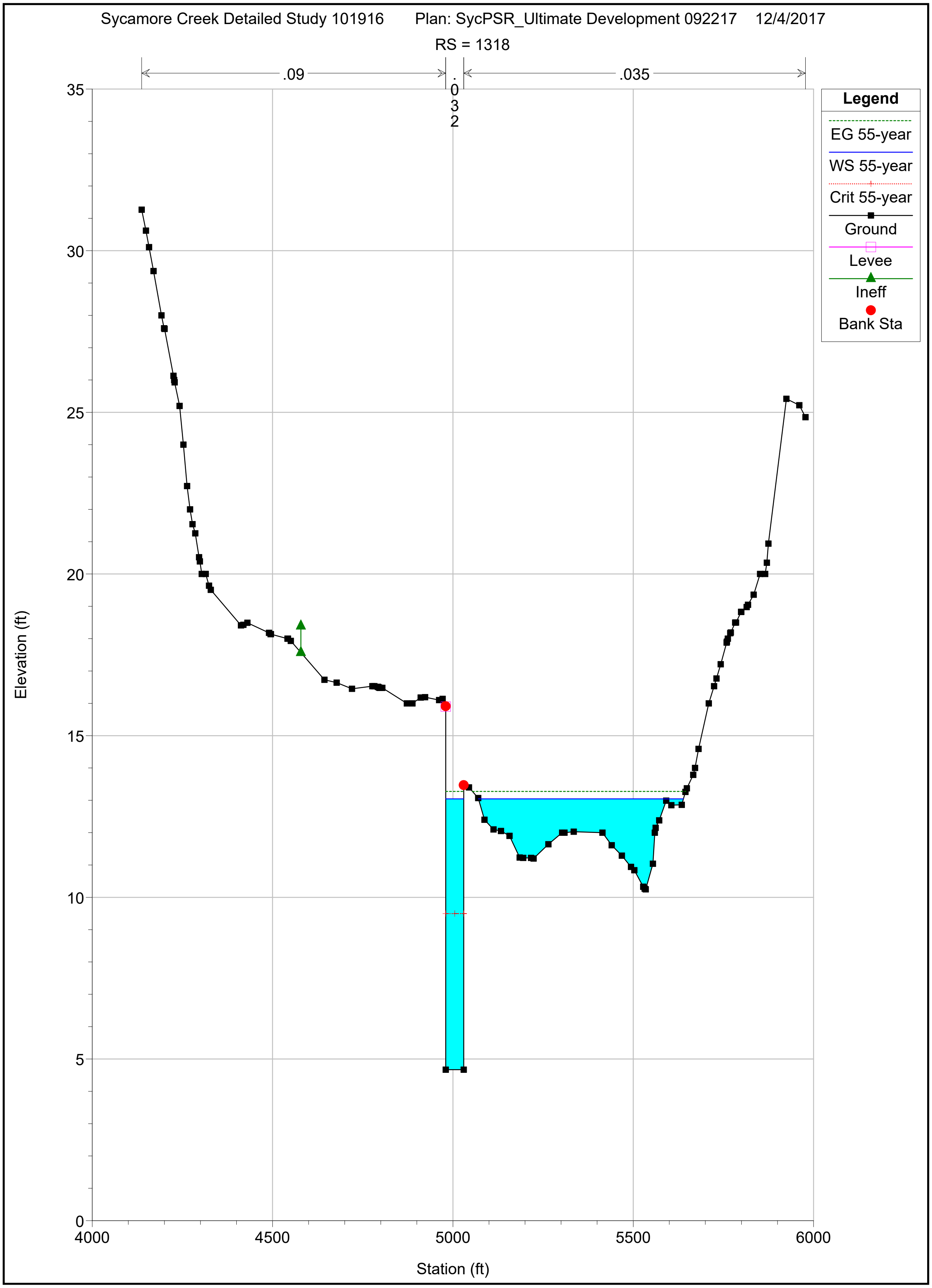
Station (ft)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Crit 55-year
Ground
Levee
Ineff
Bank Sta
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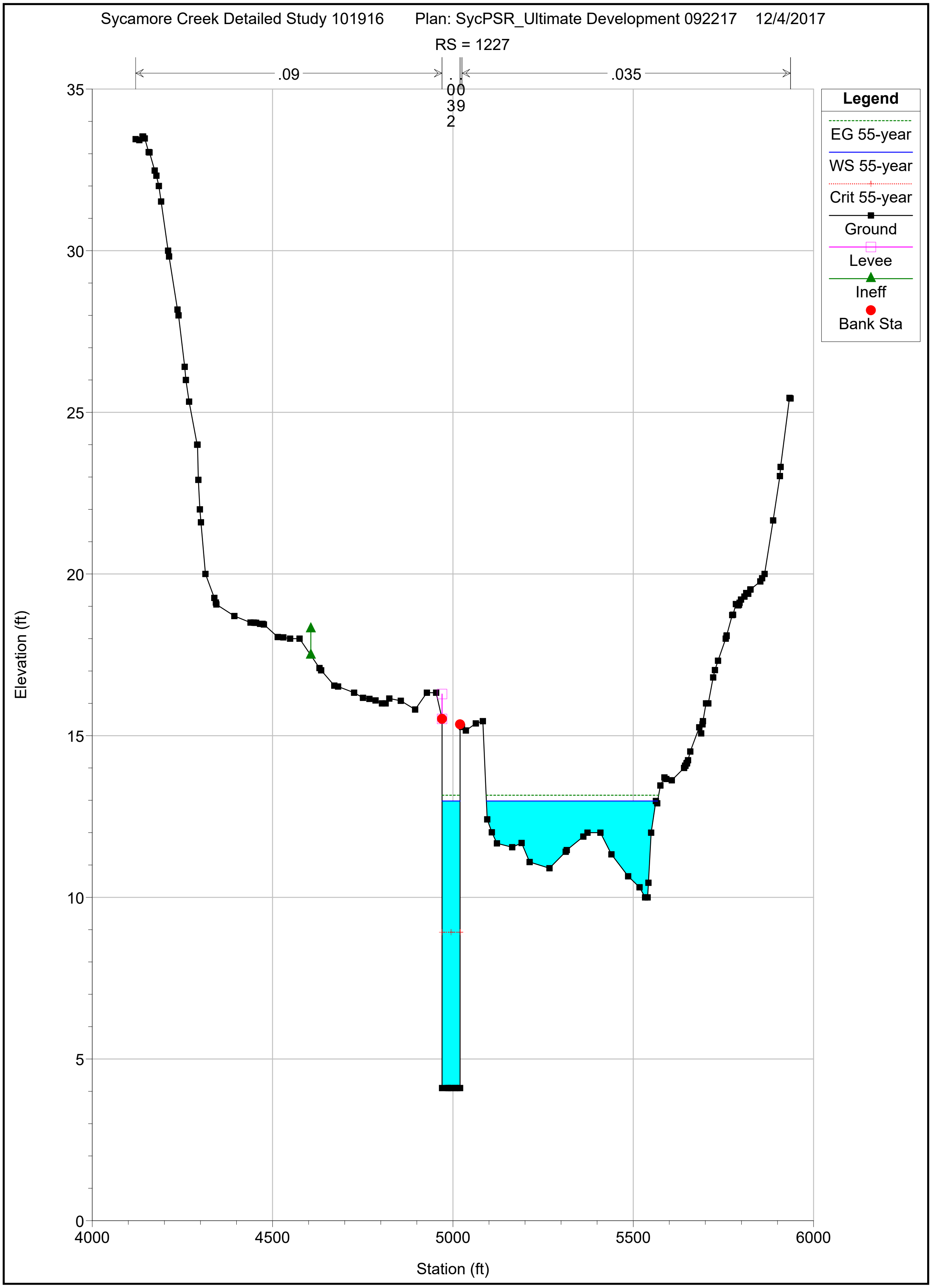
Station (ft)



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WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
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Station (ft)
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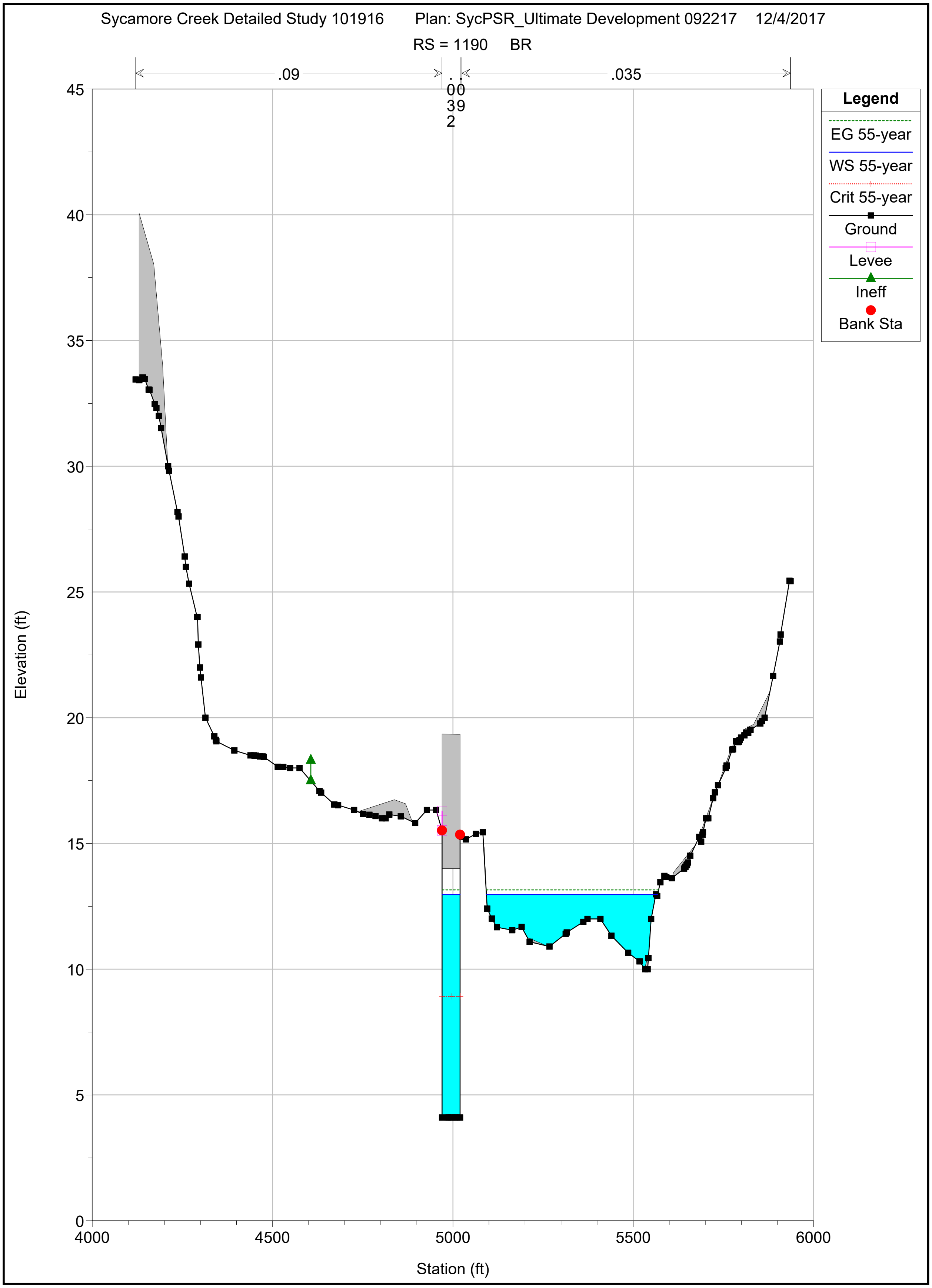
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3
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9
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
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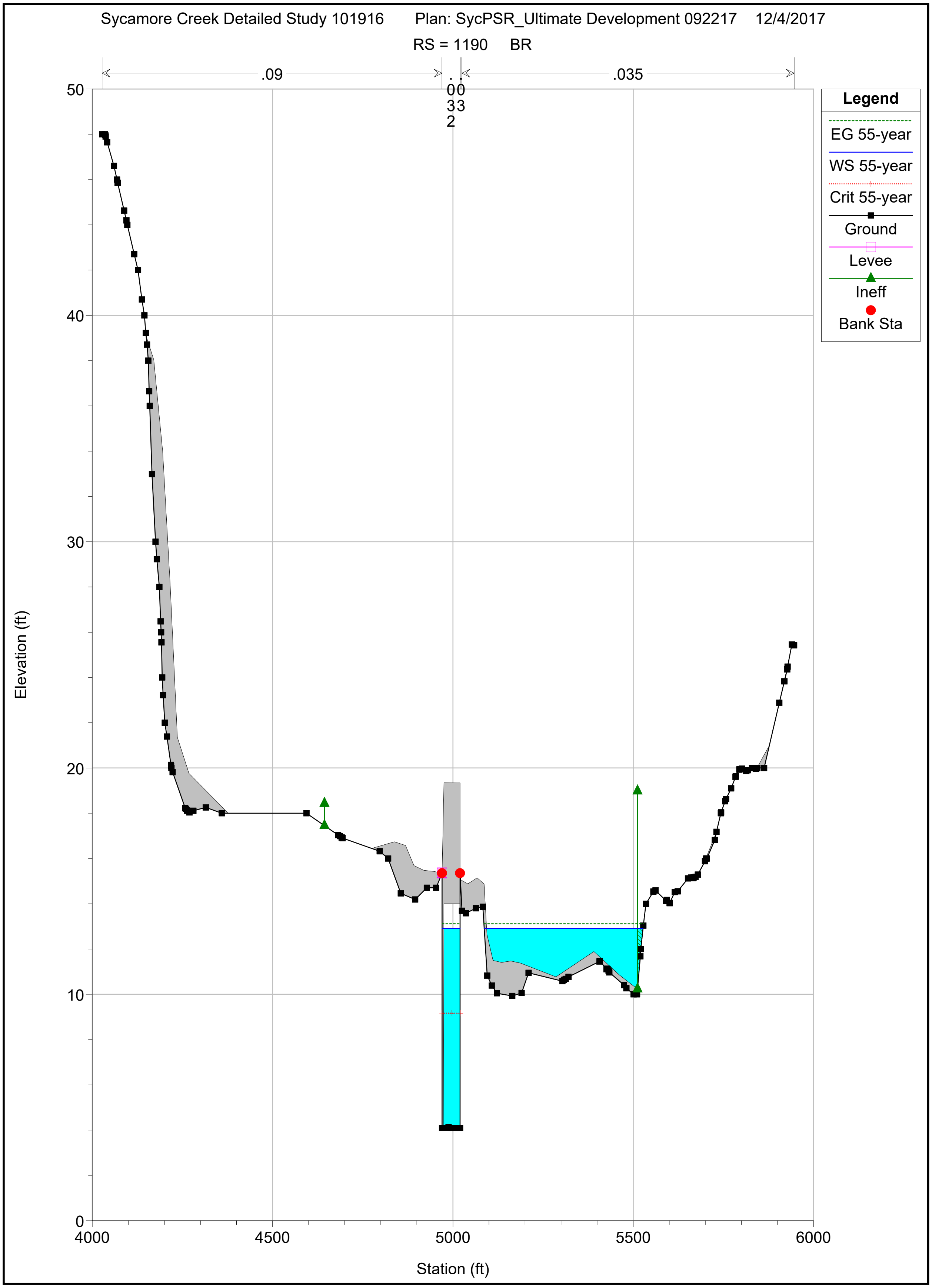
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
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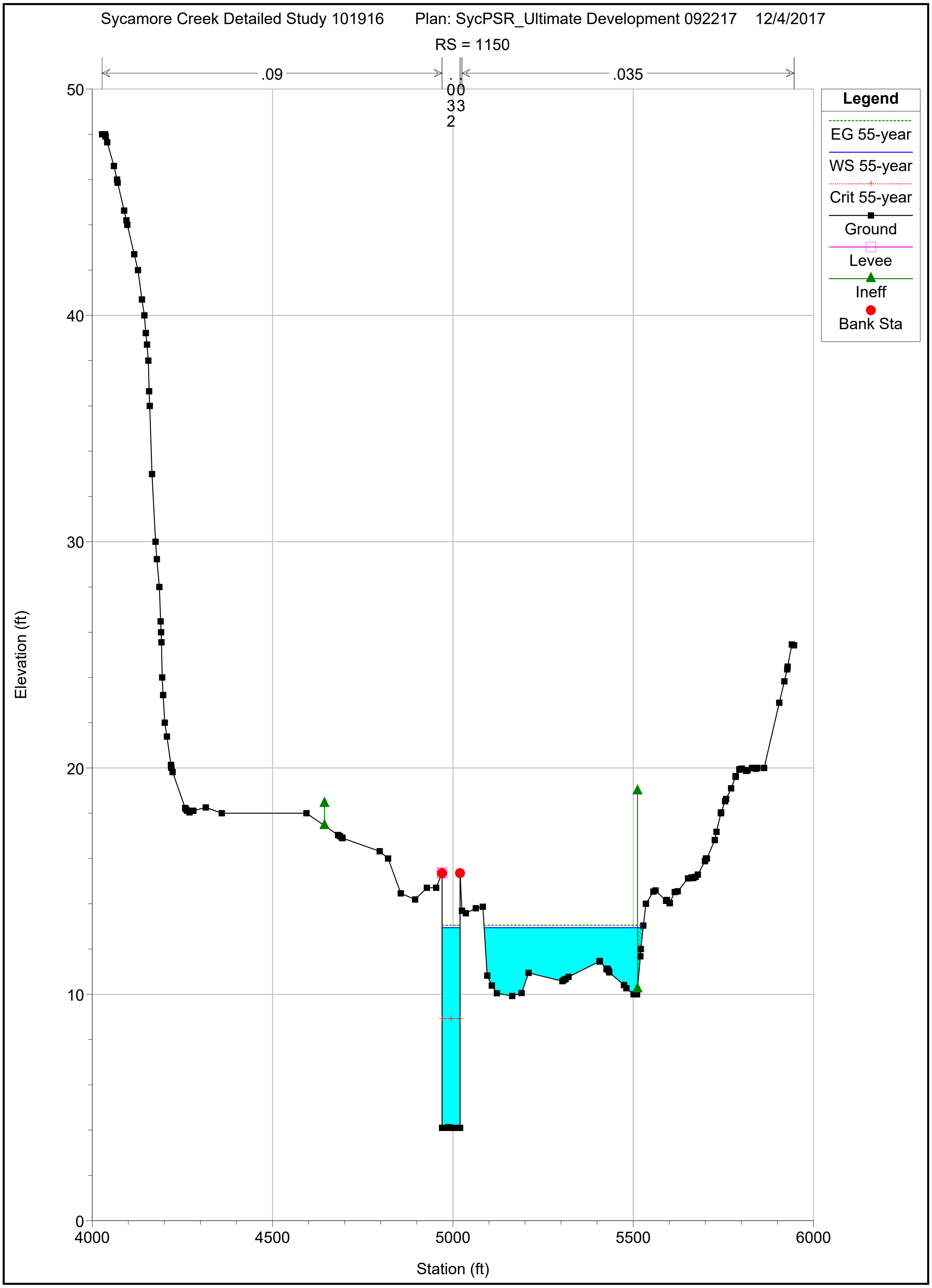
Station (ft)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2
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0
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Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
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Station (ft)
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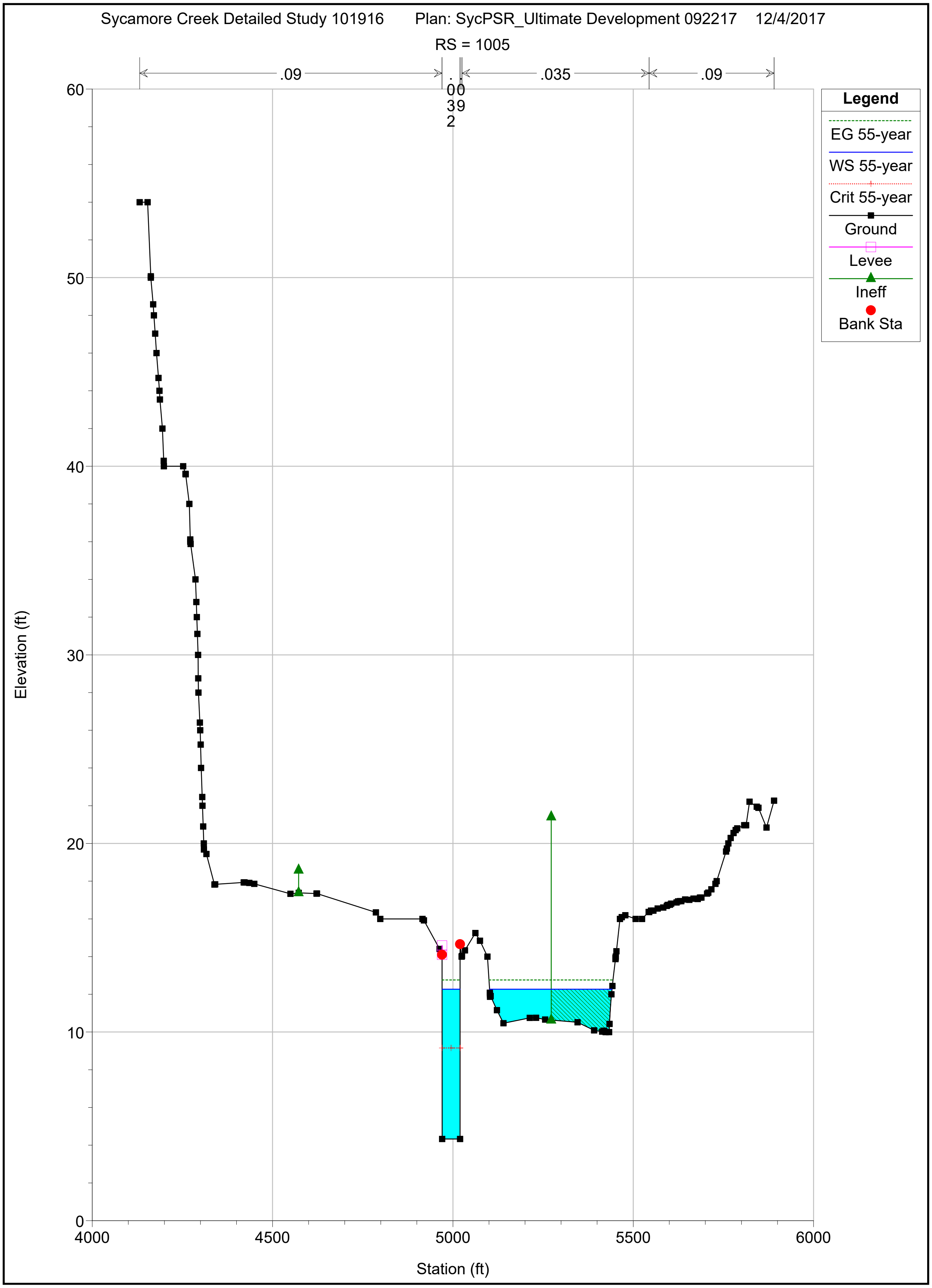
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.
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2
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
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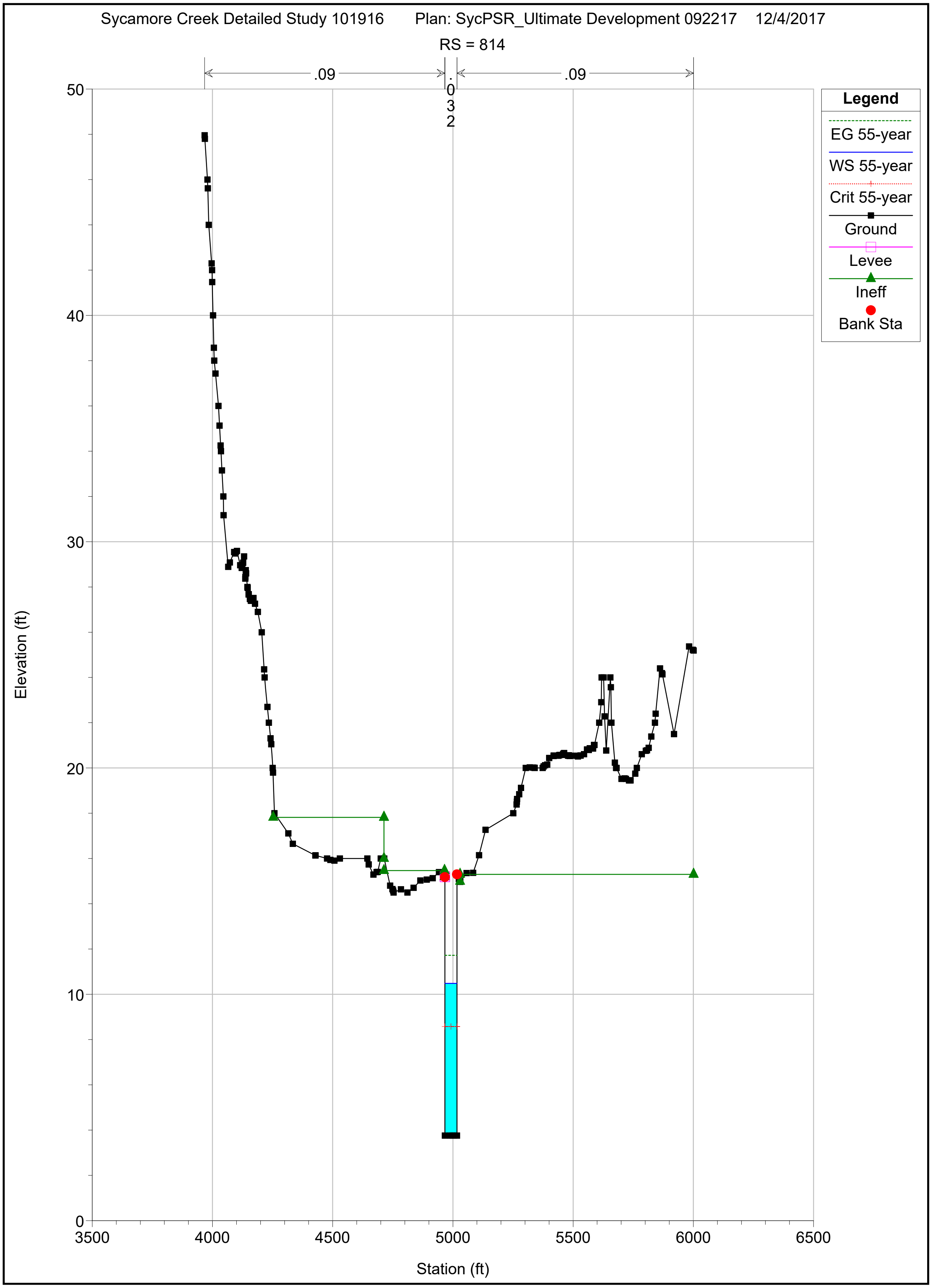
Station (ft)



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WS 55-year
Crit 55-year
Ground
Levee
Ineff
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Station (ft)
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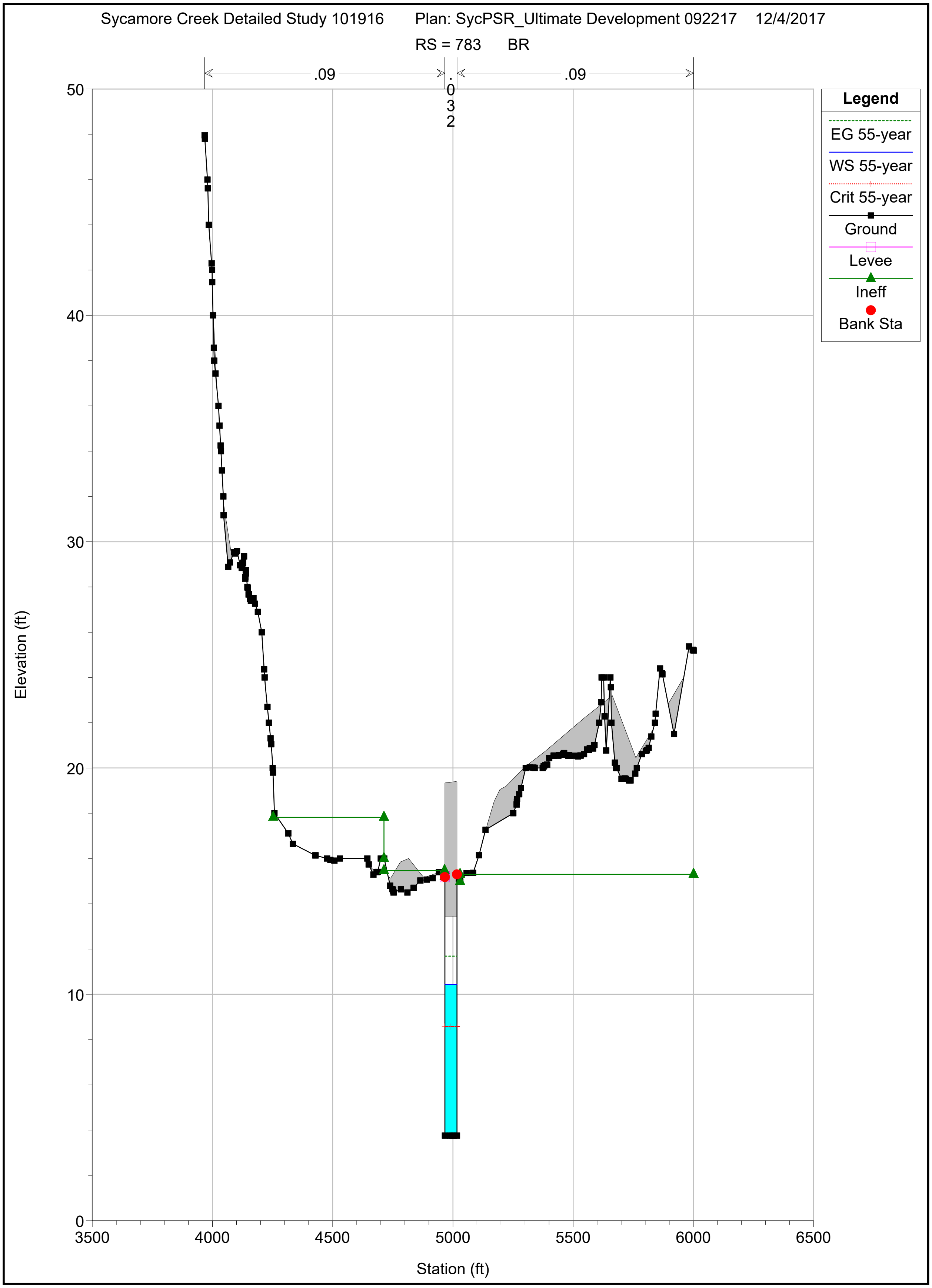
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WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
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Station (ft)
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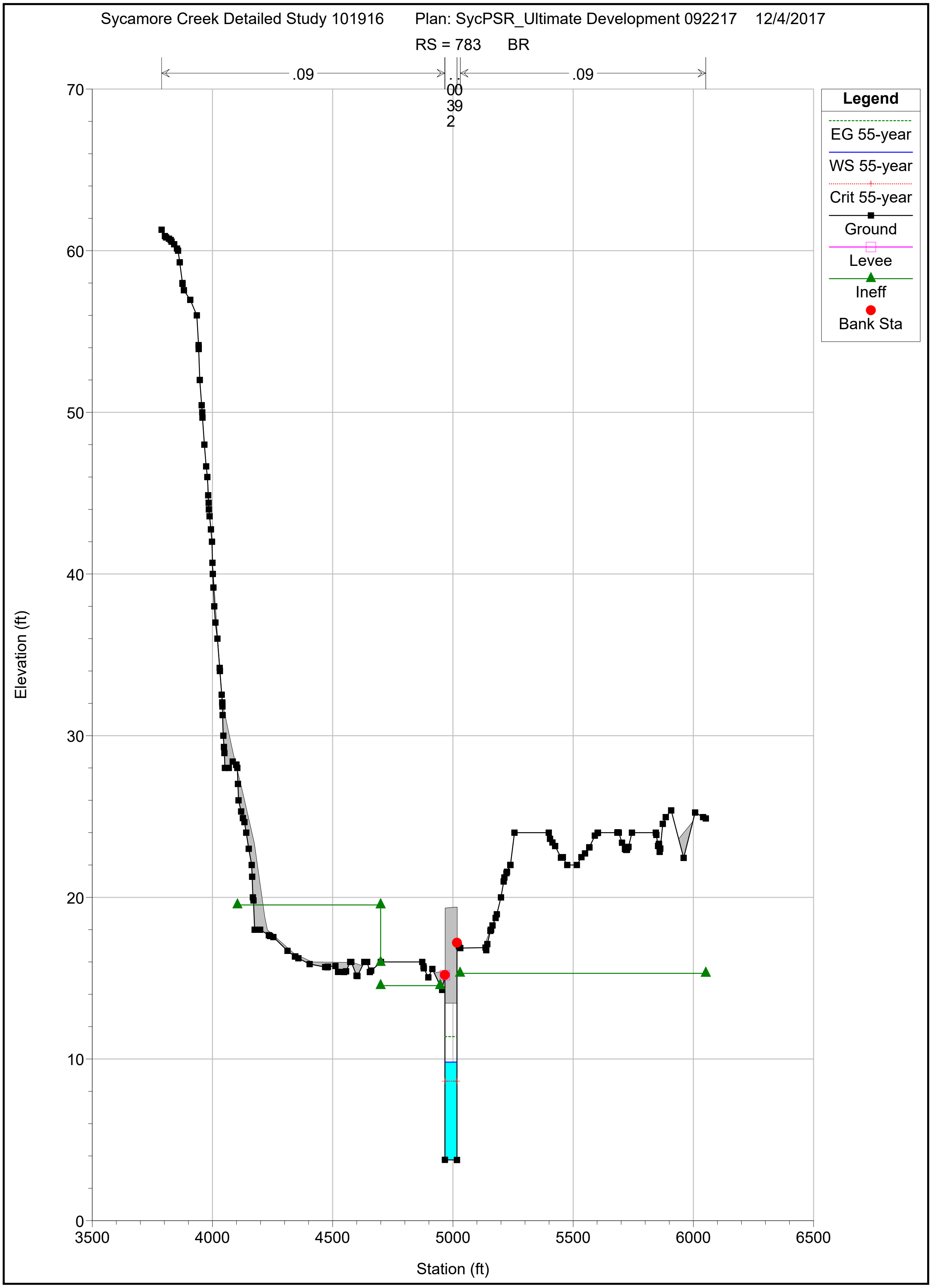
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39
2
.09
Legend
EG 55-year
WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
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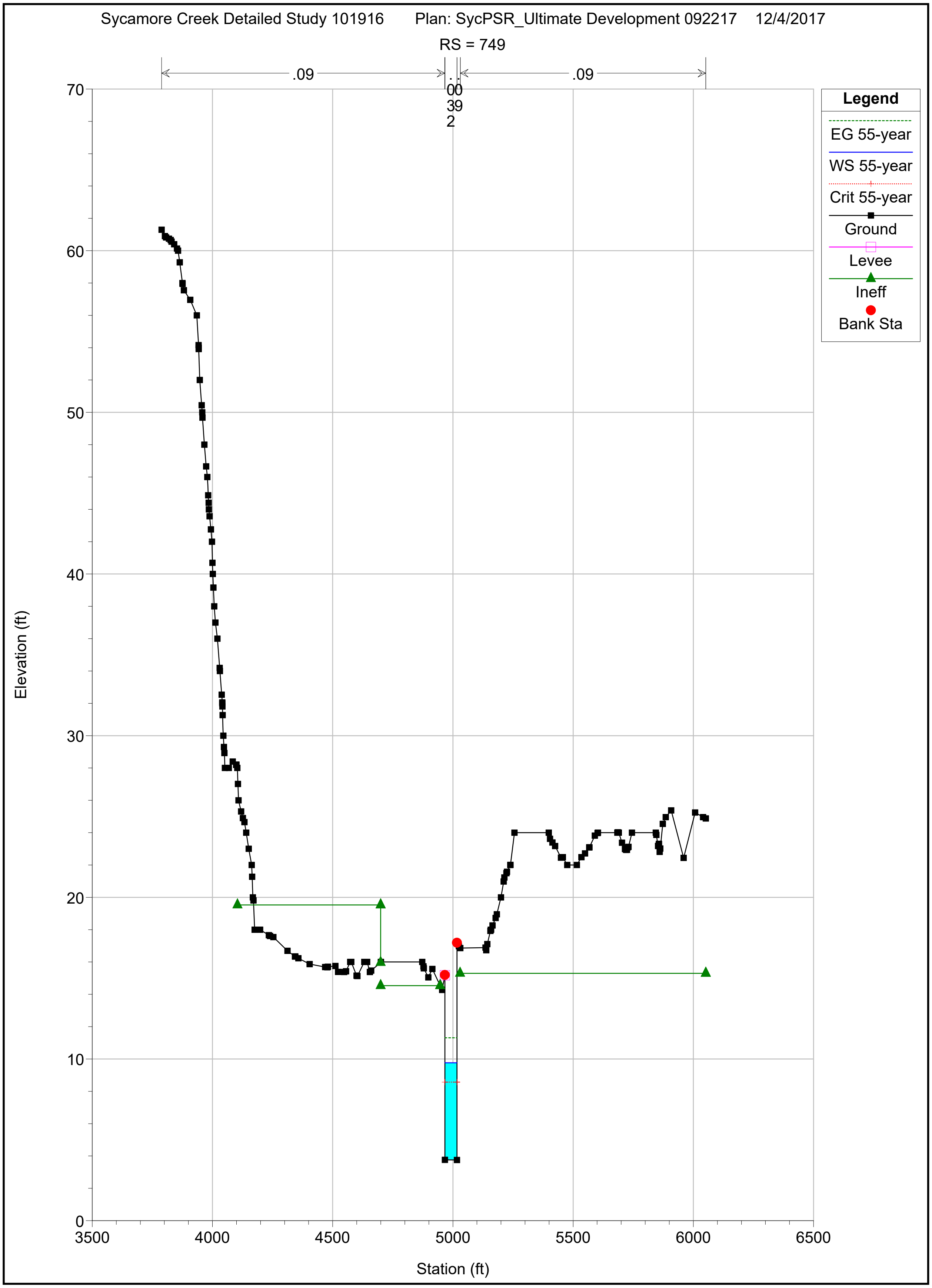
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Station (ft)
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Crit 55-year
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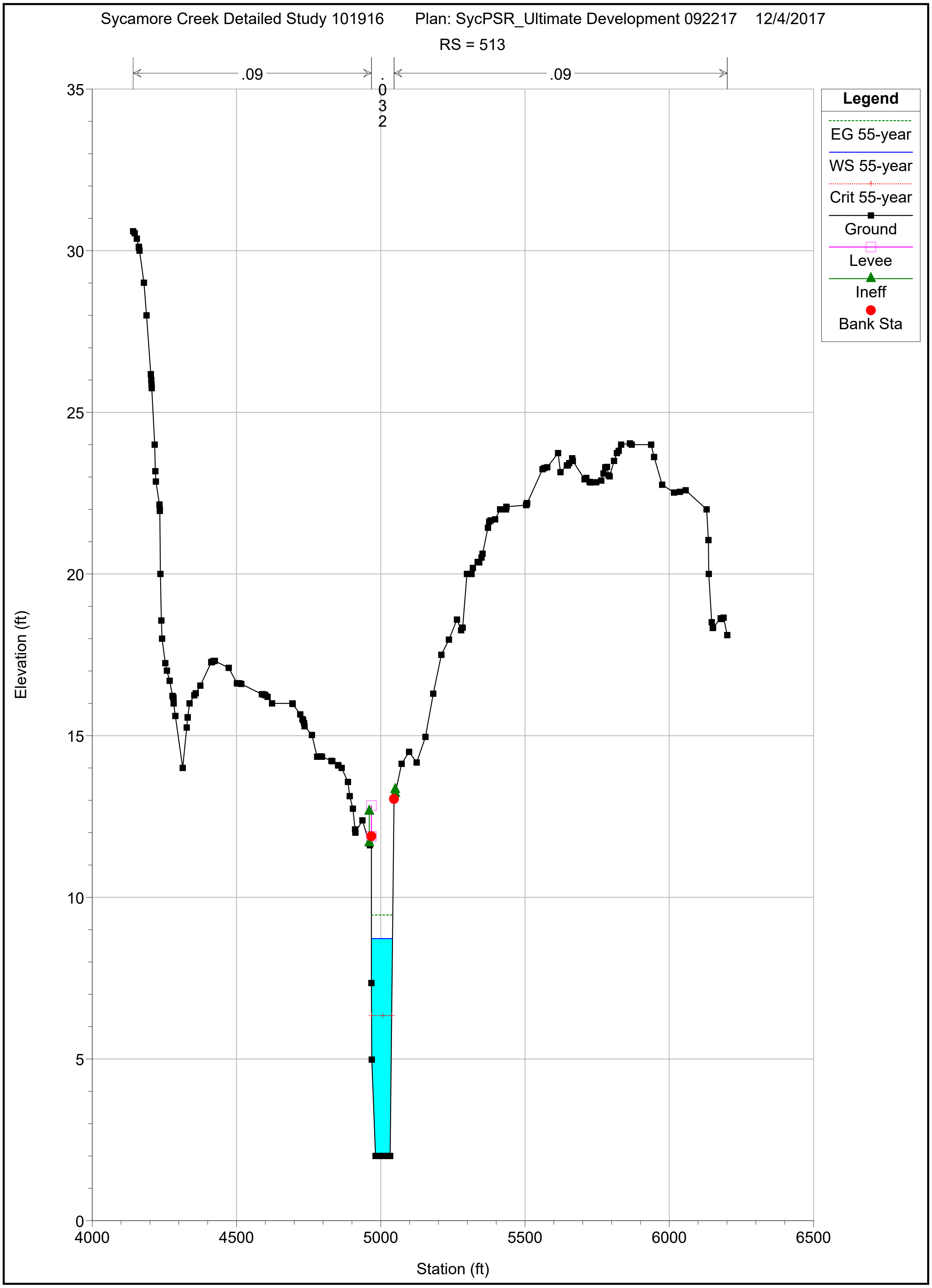
Bank Sta

Sycamore Creek Detailed Study 101916 Plan: SycPSR_Ultimate Development 092217 12/4/2017
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Crit 55-year
Ground
Levee
Ineff
Bank Sta
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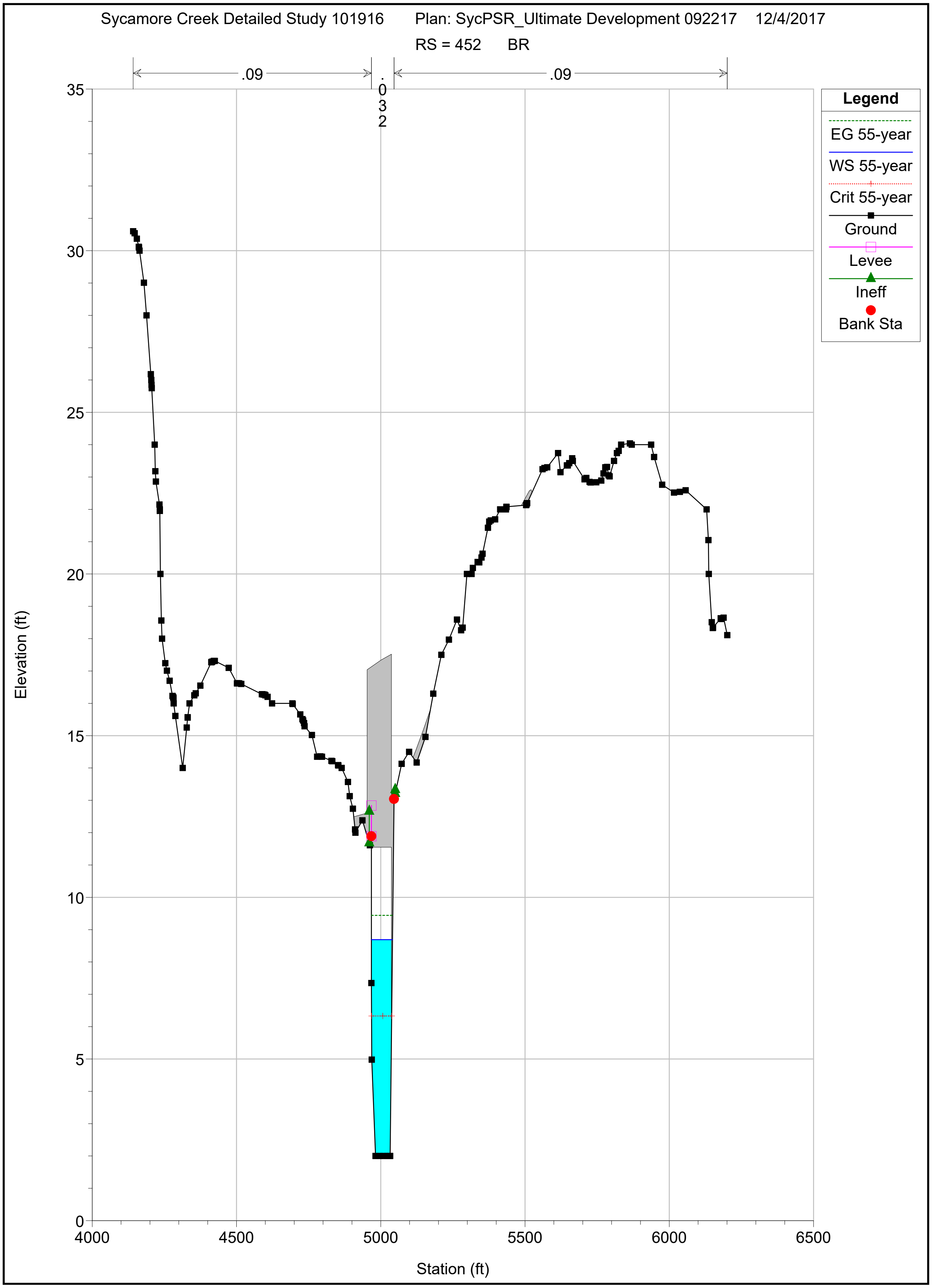
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WS 55-year
Crit 55-year
Ground
Levee
Ineff
Bank Sta
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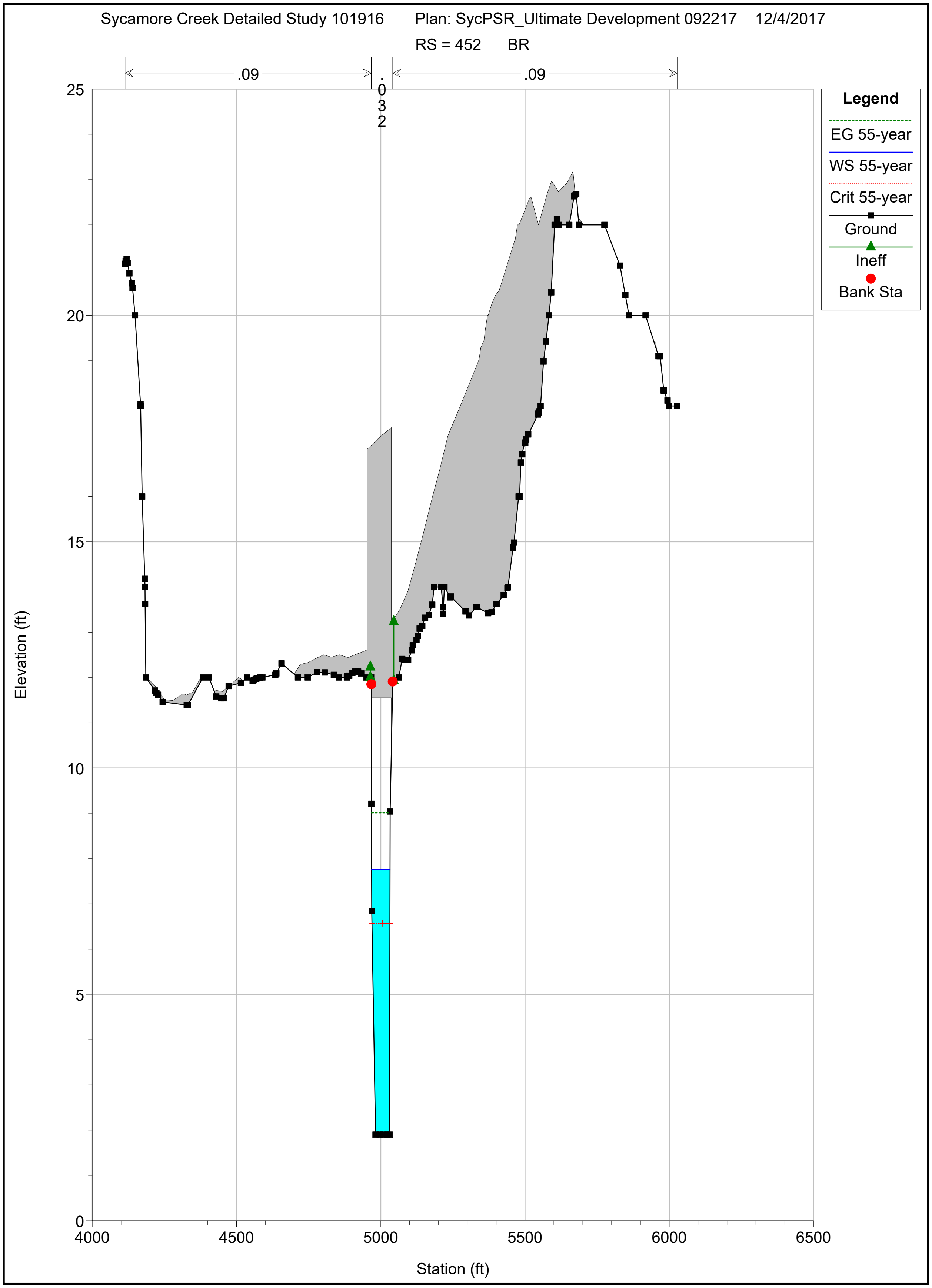

Sycamore Creek Detailed Study 101916
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12/4/2017
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.09
Legend
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WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
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Station (ft)
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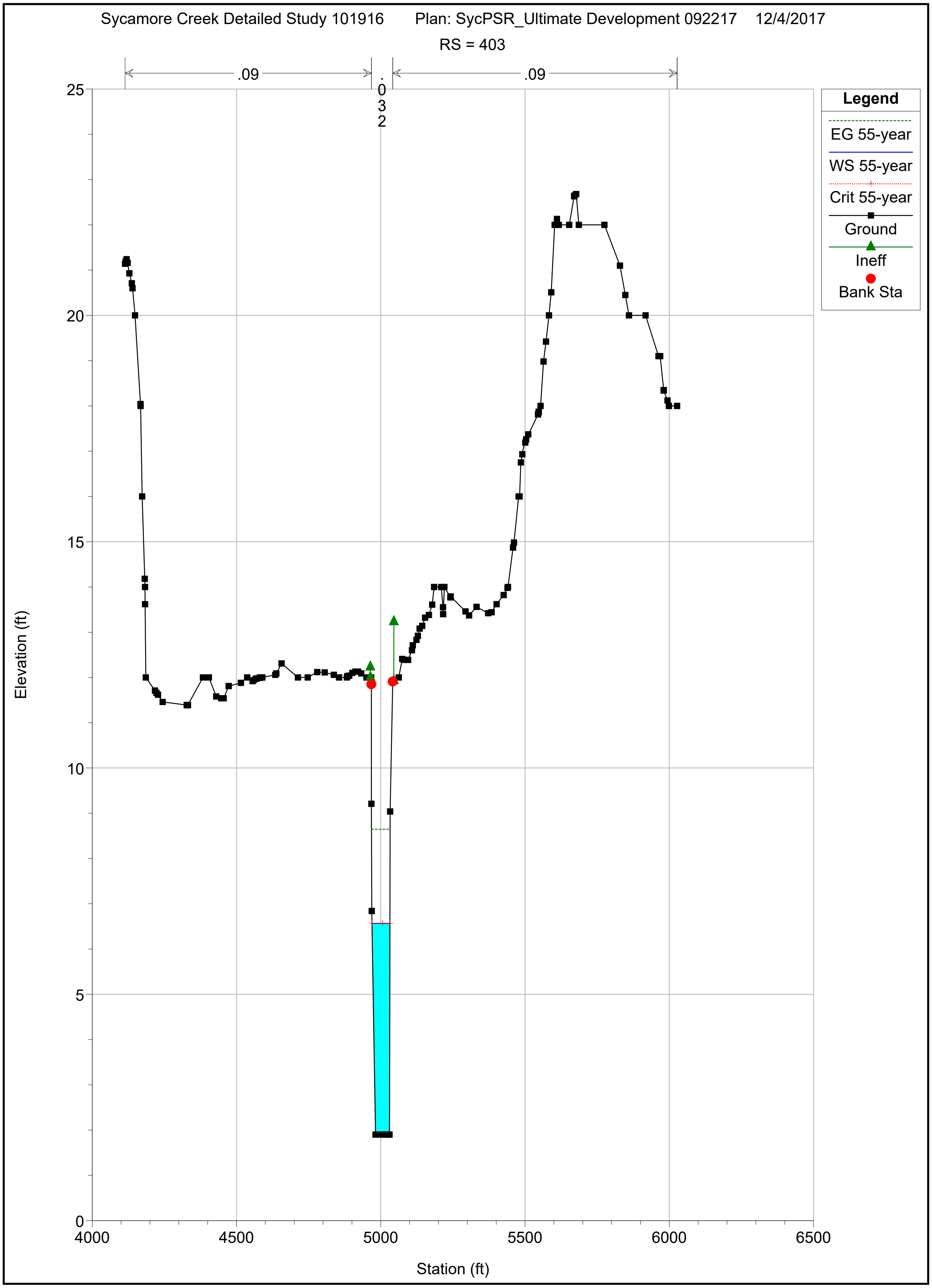
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WS 55-year
Crit 55-year
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
0
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10
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20
25
4000
4500
5000
5500
6000
6500

Appendix B – Soil Investigation Logs and Testing

The purpose of the compilation of soils data and testing is for maintaining a record for projects that occurred within close proximity to Sycamore Creek.

Cabrillo Blvd

Log of Test Boring Plan Sheet

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
05	SB	225	6.3/6.7	44	44

CERTIFIED ENGINEERING GEOLOGIST

R. W. FOX No. 78 Exp. 8-15-95 CERTIFIED ENGINEERING GEOLOGIST

11-20-95
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

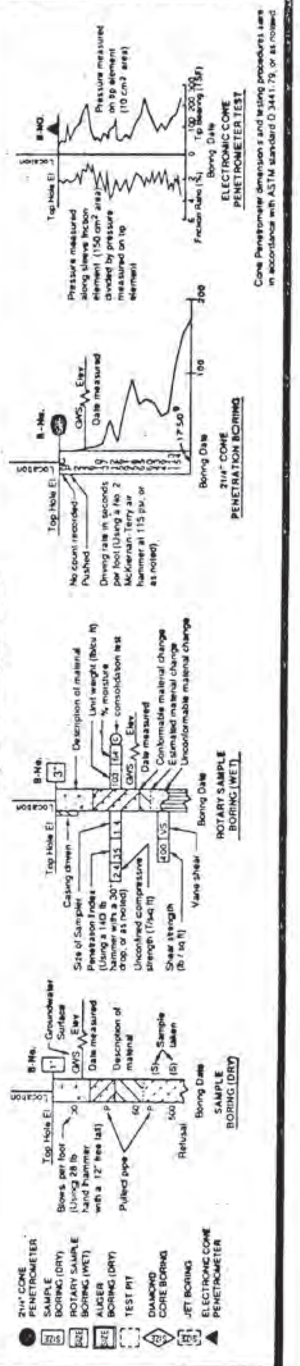
Penetration Index (Blows / Ft)	Granular	Cohesive
0-4	Very loose	Very soft
5-9	Loose	Soft
10-19	Slightly compact	Stiff
20-34	Compact	Very stiff
35-69	Dense	Hard
>70	Very dense	Very hard

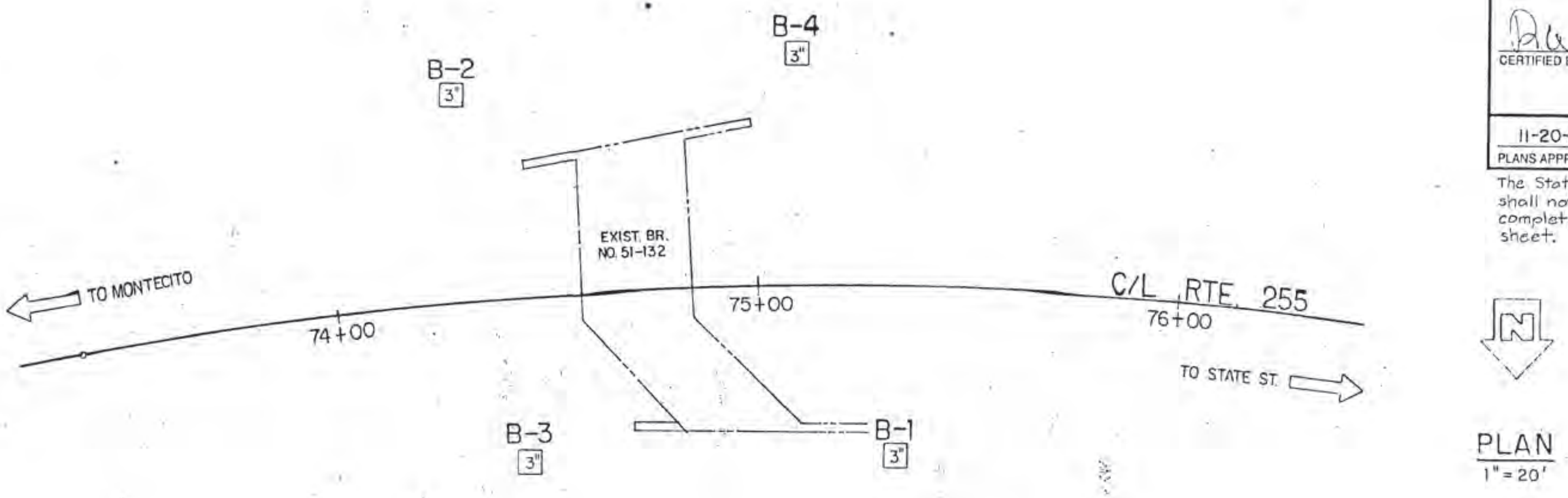
NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

LEGEND OF EARTH MATERIALS

- ▨ GRAVEL
- ▨ SAND
- ▨ SILT
- ▨ CLAY
- ▨ SANDY CLAY or CLAYEY SAND
- ▨ SANDY SILT or SILTY SAND
- ▨ SILTY CLAY
- ▨ CLAYEY SILT
- ▨ PEAT and/or ORGANIC MATTER
- ▨ FILL MATERIAL
- ▨ IGNEOUS ROCK
- ▨ SEDIMENTARY ROCK
- ▨ METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS





PLAN
1" = 20'

AS BUILT

CORRECTIONS BY GREG CHELINI

CONTRACT NO. 05-339104

DATE 11-21-97

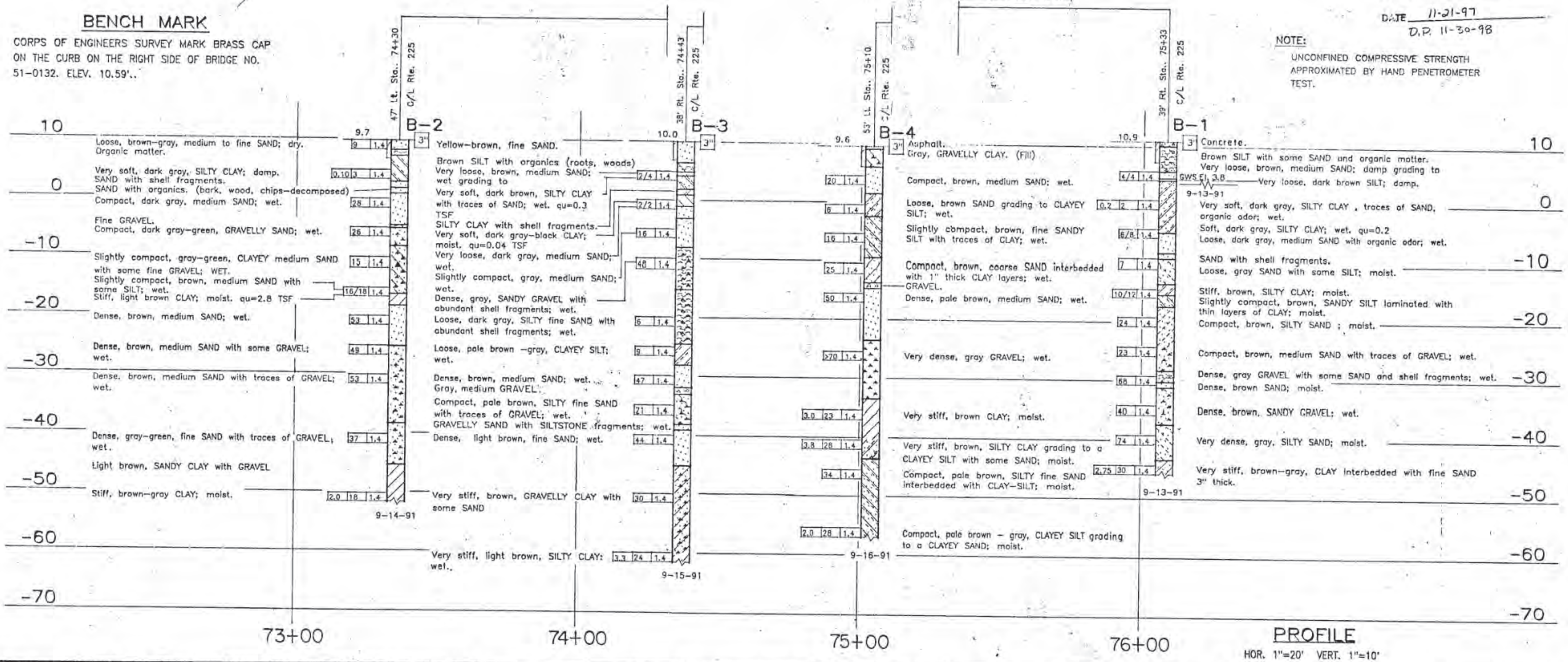
D.P. 11-30-98

BENCH MARK

CORPS OF ENGINEERS SURVEY MARK BRASS CAP ON THE CURB ON THE RIGHT SIDE OF BRIDGE NO. 51-0132. ELEV. 10.59'..

GWS EL. not shown B-2, B-3, B-4 But does exist

NOTE:
UNCONFINED COMPRESSIVE STRENGTH APPROXIMATED BY HAND PENETROMETER TEST.



B-2

Loose, brown-gray, medium to fine SAND; dry. Organic matter.
Very soft, dark gray, SILTY CLAY; damp.
SAND with shell fragments.
SAND with organics. (bark, wood, chips-decomposed)
Compact, dark gray, medium SAND; wet.
Fine GRAVEL.
Compact, dark gray-green, GRAVELLY SAND; wet.
Slightly compact, gray-green, CLAYEY medium SAND with some fine GRAVEL; WET.
Slightly compact, brown, medium SAND with some SILT; wet.
Stiff, light brown CLAY; moist. qu=2.8 TSF
Dense, brown, medium SAND; wet.
Dense, brown, medium SAND with some GRAVEL; wet.
Dense, brown, medium SAND with traces of GRAVEL; wet.
Dense, gray-green, fine SAND with traces of GRAVEL; wet.
Light brown, SANDY CLAY with GRAVEL
Stiff, brown-gray CLAY; moist.

B-3

Yellow-brown, fine SAND.
Brown SILT with organics (roots, woods)
Very loose, brown, medium SAND; wet grading to
Very soft, dark brown, SILTY CLAY with traces of SAND; wet. qu=0.3 TSF
SILTY CLAY with shell fragments.
Very soft, dark gray-black CLAY; moist. qu=0.04 TSF
Very loose, dark gray, medium SAND; wet.
Slightly compact, gray, medium SAND; wet.
Dense, gray, SANDY GRAVEL with abundant shell fragments; wet.
Loose, dark gray, SILTY fine SAND with abundant shell fragments; wet.
Loose, pale brown -gray, CLAYEY SILT; wet.
Dense, brown, medium SAND; wet.
Gray, medium GRAVEL.
Compact, pale brown, SILTY fine SAND with traces of GRAVEL; wet.
GRAVELLY SAND with SILTSTONE fragments; wet.
Dense, light brown, fine SAND; wet.
Very stiff, brown, GRAVELLY CLAY with some SAND
Very stiff, light brown, SILTY CLAY; wet.,

B-4

Asphalt.
Gray, GRAVELLY CLAY. (Fill)
Compact, brown, medium SAND; wet.
Loose, brown SAND grading to CLAYEY SILT; wet.
Slightly compact, brown, fine SANDY SILT with traces of CLAY; wet.
Compact, brown, coarse SAND interbedded with 1" thick CLAY layers; wet.
GRAVEL.
Dense, pale brown, medium SAND; wet.
Very dense, gray GRAVEL; wet.
Very stiff, brown CLAY; moist.
Very stiff, brown, SILTY CLAY grading to a CLAYEY SILT with some SAND; moist.
Compact, pale brown, SILTY fine SAND interbedded with CLAY-SILT; moist.
Compact, pale brown - gray, CLAYEY SILT grading to a CLAYEY SAND; moist.

B-1

Concrete.
Brown SILT with some SAND and organic matter.
Very loose, brown, medium SAND; damp grading to
Very loose, dark brown SILT; damp.
Very soft, dark gray, SILTY CLAY , traces of SAND, organic odor; wet.
Soft, dark gray, SILTY CLAY; wet. qu=0.2
Loose, dark gray, medium SAND with organic odor; wet.
SAND with shell fragments.
Loose, gray SAND with some SILT; moist.
Stiff, brown, SILTY CLAY; moist.
Slightly compact, brown, SANDY SILT laminated with thin layers of CLAY; moist.
Compact, brown, SILTY SAND ; moist.
Compact, brown, medium SAND with traces of GRAVEL; wet.
Dense, gray GRAVEL with some SAND and shell fragments; wet.
Dense, brown SAND; moist.
Dense, brown, SANDY GRAVEL; wet.
Very dense, gray, SILTY SAND; moist.
Very stiff, brown-gray, CLAY interbedded with fine SAND 3" thick.

PROFILE
HOR. 1"=20' VERT. 1"=10'

OFFICE OF TRANSPORTATION MATERIALS & RESEARCH	ENGINEERING GEOLOGY BRANCH	FIELD INVESTIGATION BY:
DRAWN BY LEONY L. LOPEZ	10/91	
CHECKED BY		B. KOMORNICZAK

State of
CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 6

BRIDGE NO. 51-132
POST MILE 6.51

SYCAMORE CREEK BRIDGE (REPLACE)
LOG OF TEST BORINGS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 05
EA 339101

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 3-30-93 4-27-93 11/21/97

REVISION DATES (PRELIMINARY STAGE ONLY)

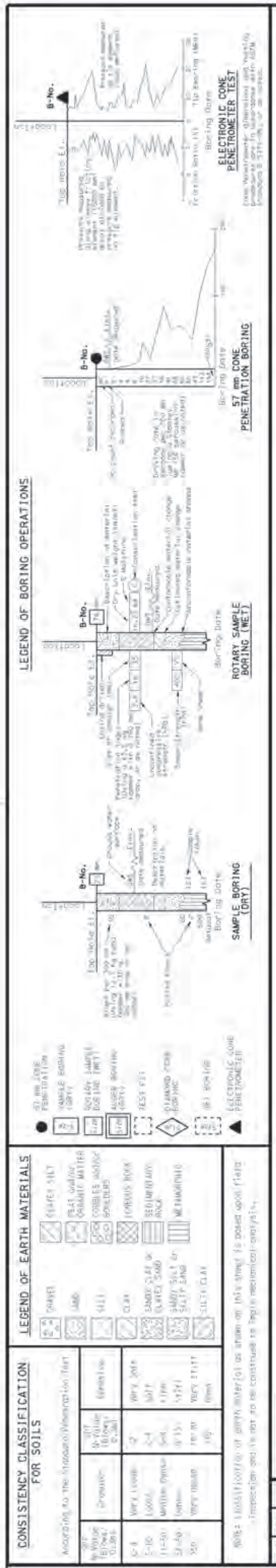
SHEET 10 OF 10

C-1-3956

TL 6051 REV 3/90

US 101

Log of Test Boring Plan Sheet



DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SB	101	17.4/20.6	510	652

REGISTERED CIVIL ENGINEER 3-17-05

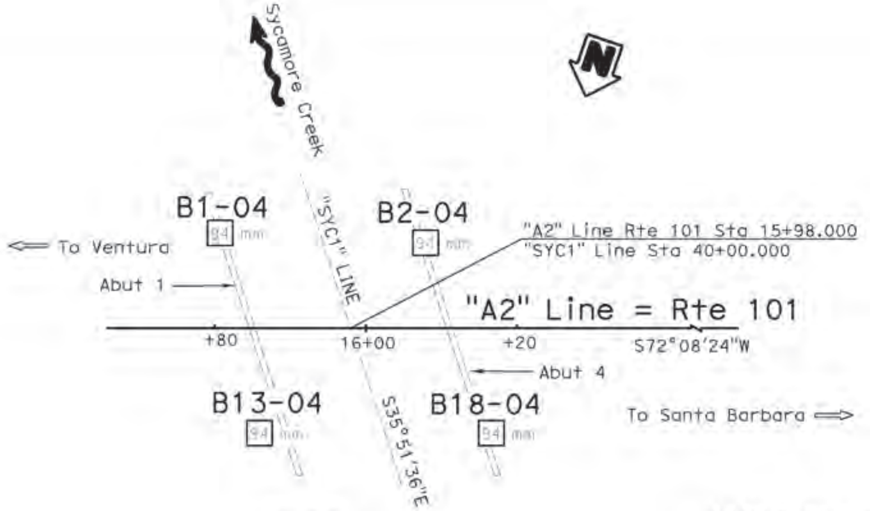
9-17-07
PLANS APPROVAL DATE

Sara von Schwind
No. C050789
Exp. 9-30-05
CIVIL

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

BENCH MARK

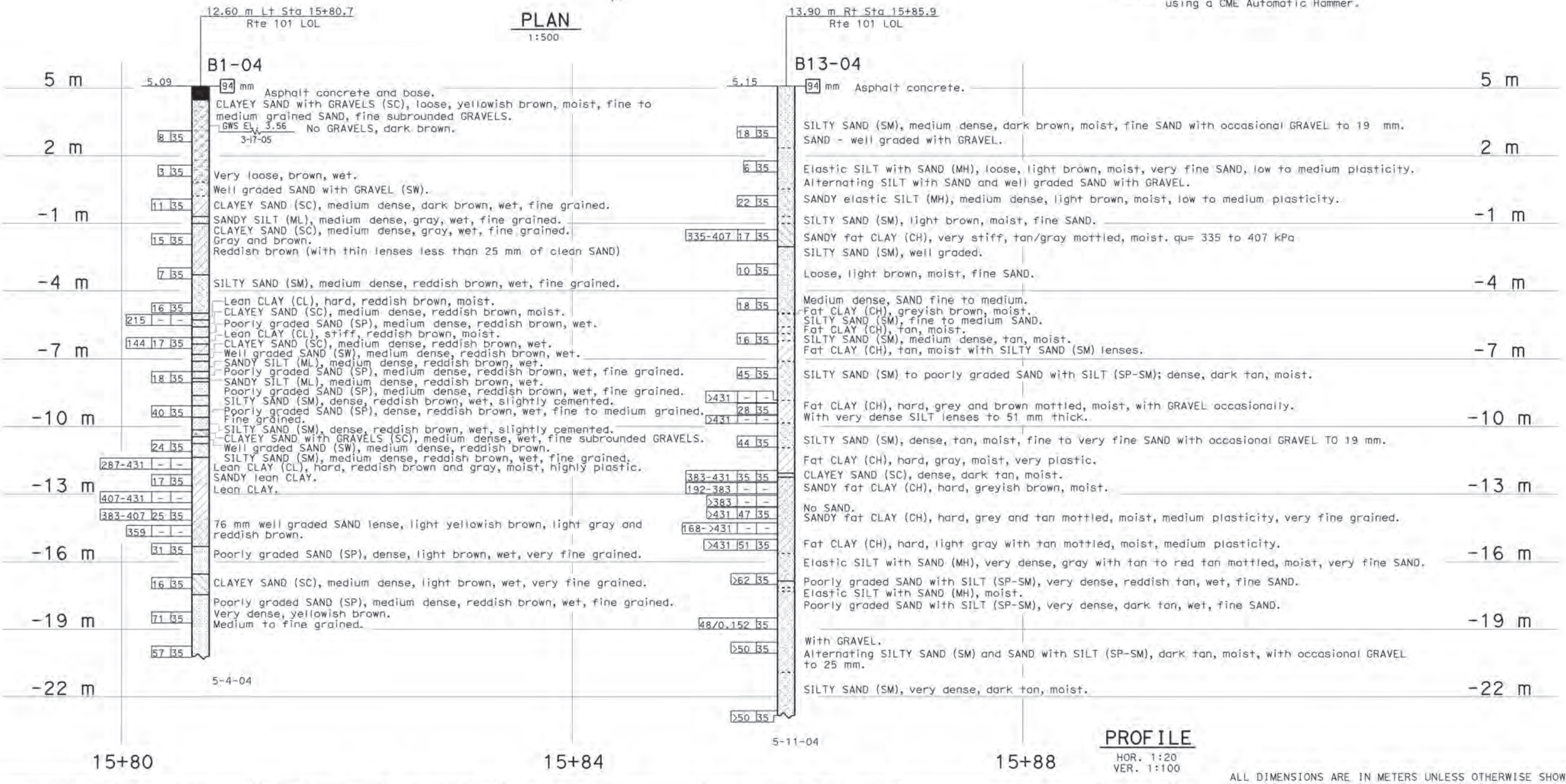
SB101 pm12.30 = NAVD88 4.962 m
SB101 pm12.19 = NAVD88 3.726 m



PLAN

1:500

Note: Boring B1-04 was conducted using a CME Automatic Hammer.



12.60 m Lt Sta 15+80.7
Rte 101 LOL

B1-04

94 mm Asphalt concrete and base.
CLAYEY SAND with GRAVELS (SC), loose, yellowish brown, moist, fine to medium grained SAND, fine subrounded GRAVELS.
GWS EL. 3.56
3-17-05
No GRAVELS, dark brown.
Very loose, brown, wet.
Well graded SAND with GRAVEL (SW).
CLAYEY SAND (SC), medium dense, dark brown, wet, fine grained.
SANDY SILT (ML), medium dense, gray, wet, fine grained.
CLAYEY SAND (SC), medium dense, gray, wet, fine grained.
Gray and brown.
Reddish brown (with thin lenses less than 25 mm of clean SAND)
SILTY SAND (SM), medium dense, reddish brown, wet, fine grained.
Lean CLAY (CL), hard, reddish brown, moist.
CLAYEY SAND (SC), medium dense, reddish brown, moist.
Poorly graded SAND (SP), medium dense, reddish brown, wet.
Lean CLAY (CL), stiff, reddish brown, moist.
CLAYEY SAND (SC), medium dense, reddish brown, wet.
Well graded SAND (SW), medium dense, reddish brown, wet.
SANDY SILT (ML), medium dense, reddish brown, wet.
Poorly graded SAND (SP), medium dense, reddish brown, wet, fine grained.
SANDY SILT (ML), medium dense, reddish brown, wet.
Poorly graded SAND (SP), medium dense, reddish brown, wet, fine grained.
SILTY SAND (SM), dense, reddish brown, wet, slightly cemented.
Poorly graded SAND (SP), dense, reddish brown, wet, fine to medium grained.
Fine grained.
SILTY SAND (SM), dense, reddish brown, wet, slightly cemented.
CLAYEY SAND with GRAVELS (SC), medium dense, wet, fine subrounded GRAVELS.
Well graded SAND (SW), medium dense, reddish brown.
SILTY SAND (SM), medium dense, reddish brown, wet, fine grained.
Lean CLAY (CL), hard, reddish brown and gray, moist, highly plastic.
SANDY lean CLAY.
Lean CLAY.
76 mm well graded SAND lense, light yellowish brown, light gray and reddish brown.
Poorly graded SAND (SP), dense, light brown, wet, very fine grained.
CLAYEY SAND (SC), medium dense, light brown, wet, very fine grained.
Poorly graded SAND (SP), medium dense, reddish brown, wet, fine grained.
Very dense, yellowish brown.
Medium to fine grained.
5-4-04

13.90 m Rt Sta 15+85.9
Rte 101 LOL

B13-04

94 mm Asphalt concrete.
SILTY SAND (SM), medium dense, dark brown, moist, fine SAND with occasional GRAVEL to 19 mm.
SAND - well graded with GRAVEL.
Elastic SILT with SAND (MH), loose, light brown, moist, very fine SAND, low to medium plasticity.
Alternating SILT with SAND and well graded SAND with GRAVEL.
SANDY elastic SILT (MH), medium dense, light brown, moist, low to medium plasticity.
SILTY SAND (SM), light brown, moist, fine SAND.
SANDY fat CLAY (CH), very stiff, tan/gray mottled, moist. qu= 335 to 407 kPa
SILTY SAND (SM), well graded.
Loose, light brown, moist, fine SAND.
Medium dense, SAND fine to medium.
Fat CLAY (CH), greyish brown, moist.
SILTY SAND (SM), fine to medium SAND.
Fat CLAY (CH), tan, moist.
SILTY SAND (SM), medium dense, tan, moist.
Fat CLAY (CH), tan, moist with SILTY SAND (SM) lenses.
SILTY SAND (SM) to poorly graded SAND with SILT (SP-SM); dense, dark tan, moist.
Fat CLAY (CH), hard, grey and brown mottled, moist, with GRAVEL occasionally.
With very dense SILT lenses to 51 mm thick.
SILTY SAND (SM), dense, tan, moist, fine to very fine SAND with occasional GRAVEL TO 19 mm.
Fat CLAY (CH), hard, gray, moist, very plastic.
CLAYEY SAND (SC), dense, dark tan, moist.
SANDY fat CLAY (CH), hard, greyish brown, moist.
No SAND.
SANDY fat CLAY (CH), hard, grey and tan mottled, moist, medium plasticity, very fine grained.
Fat CLAY (CH), hard, light gray with tan mottled, moist, medium plasticity.
Elastic SILT with SAND (MH), very dense, gray with tan to red tan mottled, moist, very fine SAND.
Poorly graded SAND with SILT (SP-SM), very dense, reddish tan, wet, fine SAND.
Elastic SILT with SAND (MH), moist.
Poorly graded SAND with SILT (SP-SM), very dense, dark tan, wet, fine SAND.
With GRAVEL.
Alternating SILTY SAND (SM) and SAND with SILT (SP-SM), dark tan, moist, with occasional GRAVEL to 25 mm.
SILTY SAND (SM), very dense, dark tan, moist.
5-11-04

PROFILE

HOR. 1:20
VER. 1:100

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	FIELD INVESTIGATION BY:	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN 6	BRIDGE NO. 51-0332	SYCAMORE CREEK BR (REPLACE)
DRAWN BY	F. Nguyen 9/04						
CHECKED BY	S. von Schwind		S. von Schwind, W. Hoon			KILOMETER POST 19.8	LOG OF TEST BORINGS 1 OF 2

DES CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 4/04)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 05
EA 447801

DISREGARD PRINTS BEARING EARLIER REVISION DATES

SHEET 18 OF 19

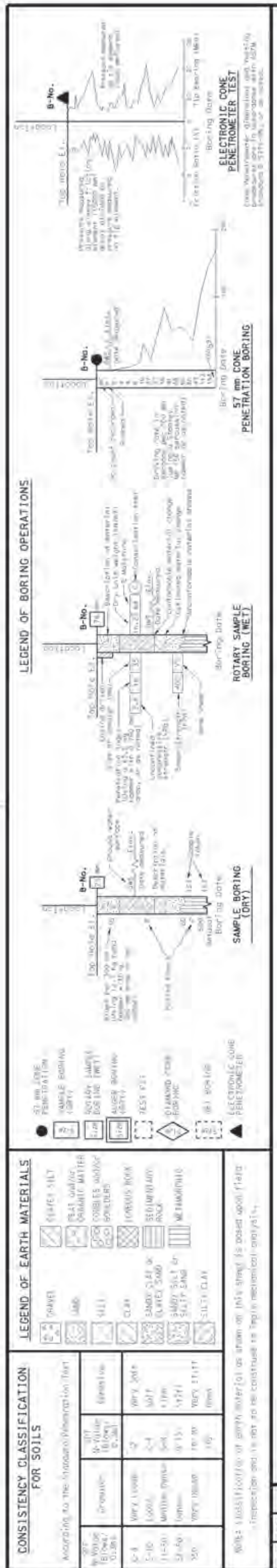
DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SB	101	17.4/20.6	511	652

3-17-05
REGISTERED CIVIL ENGINEER

Sara von Schwind
No. C050789
Exp. 9-30-05
CIVIL

9-17-07
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.



FOR PLAN VIEW, SEE "LOG OF TEST BORINGS" 1 OF 2

B2-04

Asphalt concrete.

SANDY SILT (ML), loose, brown, moist, fine SAND, non-plastic.

SANDY CLAY (CL), stiff, brown, moist, fine SAND, medium plasticity.

SILTY SAND (SM), medium dense, brown, moist, fine, uniformly graded, non-plastic.

CLAYEY SAND (SC), medium dense, brown, moist, fine SAND, low plasticity.
SILTY SAND (SM), medium dense, brown, moist, fine, trace fine GRAVEL, uniformly graded, non-plastic.

Lean CLAY (CL), stiff, brown, moist, medium plasticity.

Poorly graded SAND (SP), medium dense, brown, moist, fine to medium graded, non-plastic.
CLAYEY SAND (SC), medium dense, brown, moist, fine SAND, low plasticity.
SILT with SAND (ML), medium dense, brown, moist, fine, uniformly graded, non-plastic.

Poorly graded SAND (SP), dense, brown, moist, fine, trace of fine subrounded GRAVEL, non-plastic, lense of GRAVEL at elev -8.15 m.
Lense of lean CLAY from elev -8.70 to elev -8.76 m, stiff, brown, moist, low plasticity.

Lean CLAY (CL), hard, brown, moist, medium plasticity.

SILTY SAND (SM), medium dense to dense, brown, moist, fine SAND, non-plastic.

Hard drilling from elev -13.88 m to -14.25 m.

Lean CLAY (CL), hard, greenish gray, moist, medium plasticity.
Poorly graded SAND with GRAVEL (SP), dense, light brown, moist, fine SAND, fine rounded GRAVEL, low plasticity.
SILTY SAND (SM), very dense, tan, moist, fine SAND, non-plastic.
Poorly graded SAND (SP), very dense, light brown, moist, fine, uniformly graded, non-plastic.
CLAYEY SAND (SC), dense, light green, moist, fine, low plasticity.
Poorly graded SAND (SP), very dense, light brown, moist, fine to medium grained, non-plastic.

B18-04

Asphalt concrete.

SILT (ML), loose, brown, moist, some very fine SAND and ORGANICS throughout.

SILTY SAND (SM), medium dense, dark tan, moist, poorly graded fine SAND.
With GRAVEL, gray, GRAVEL in tip - well rounded 25 mm, slight organic odor and some small roots (black).
SANDY elastic SILT (MH).

Fat CLAY (CH), very stiff, dark tan, moist, medium plasticity.

CLAYEY SAND (SC), medium dense, dark reddish tan, moist, SAND is well graded.

SANDY SILT (MH), medium dense, dark tan, moist.

Fat CLAY (CH), dark tannish gray.
SANDY SILT (MH), medium dense, dark tan, moist
SILTY SAND (SM), medium dense, tan, moist.
SANDY elastic SILT (MH).
SILTY SAND (SM), medium dense, tan, moist, SAND is fine to medium.
SANDY elastic SILT (MH), dark reddish tan, moist, fine grained.

Poorly graded SAND (SP), dense, dark tan, moist.
SILTY SAND (SM), dense, dark tan, moist, SAND is fine to very fine grained.
With GRAVEL to 25 mm, well rounded.
Varying amount of SILT/SAND.
Lean CLAY (CL), soft, tan, moist, medium plasticity.
CLAYEY SAND (SC), medium dense, dark tan, moist, fine to medium grained.
SILTY SAND (SM), dark reddish tan, moist.
SANDY fat CLAY (CH), brown, moist.
Lean CLAY (CL), hard, brown, moist.
CLAYEY SAND (SC), medium dense, tan to gray, moist, with occasional 13 mm GRAVEL, fine grained.

SANDY lean CLAY (CL), hard, gray/tan mottled. SAND is very fine and ribboned throughout sample, medium plasticity.
SILTY SAND (SM), dark tan, moist.
Fat CLAY (CH), hard, gray, moist, high plasticity.
SANDY lean CLAY (CL), dark reddish tan with red brown mottled, moist, very fine grained.
Fat CLAY (CH), hard, gray, moist.

SILTY SAND (SM), dense, gray and tan mottled, moist, fine to very fine grained.

Very dense.

Weak cementation.
With some GRAVEL to 51 mm.

With very occasional GRAVEL to 13 mm.

PROFILE

HOR. 1:100
VER. 1:100

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

ENGINEERING SERVICES	GEOTECHNICAL SERVICES
DRAWN BY	F. Nguyen 9/04
CHECKED BY	S. von Schwind

FIELD INVESTIGATION BY:
S. von Schwind
W. Hoon, D. Appelbaum

STATE OF
CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 6

BRIDGE NO. 51-0332
KILOMETER POST 19.8

SYCAMORE CREEK BR (REPLACE)
LOG OF TEST BORINGS 2 OF 2

DOS CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 4/04)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 05
EA 447801

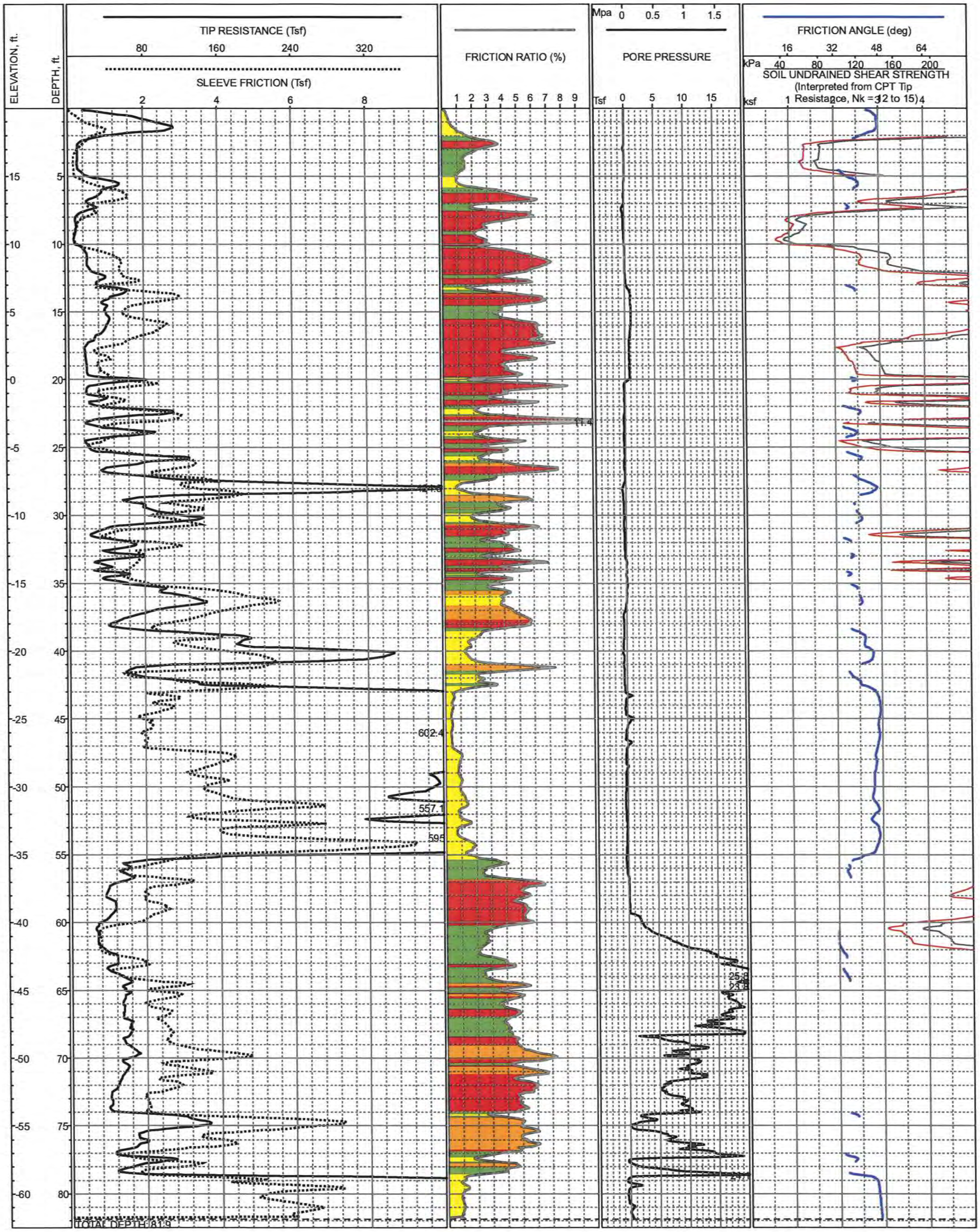
DISREGARD PRINTS BEARING EARLIER REVISION DATES

SHEET 19 OF 19

FILE => 51_0332_l4b02.dgn

Punta Gorda Bridge Project

Log of Test Boring and Cone Penetrometer Testing



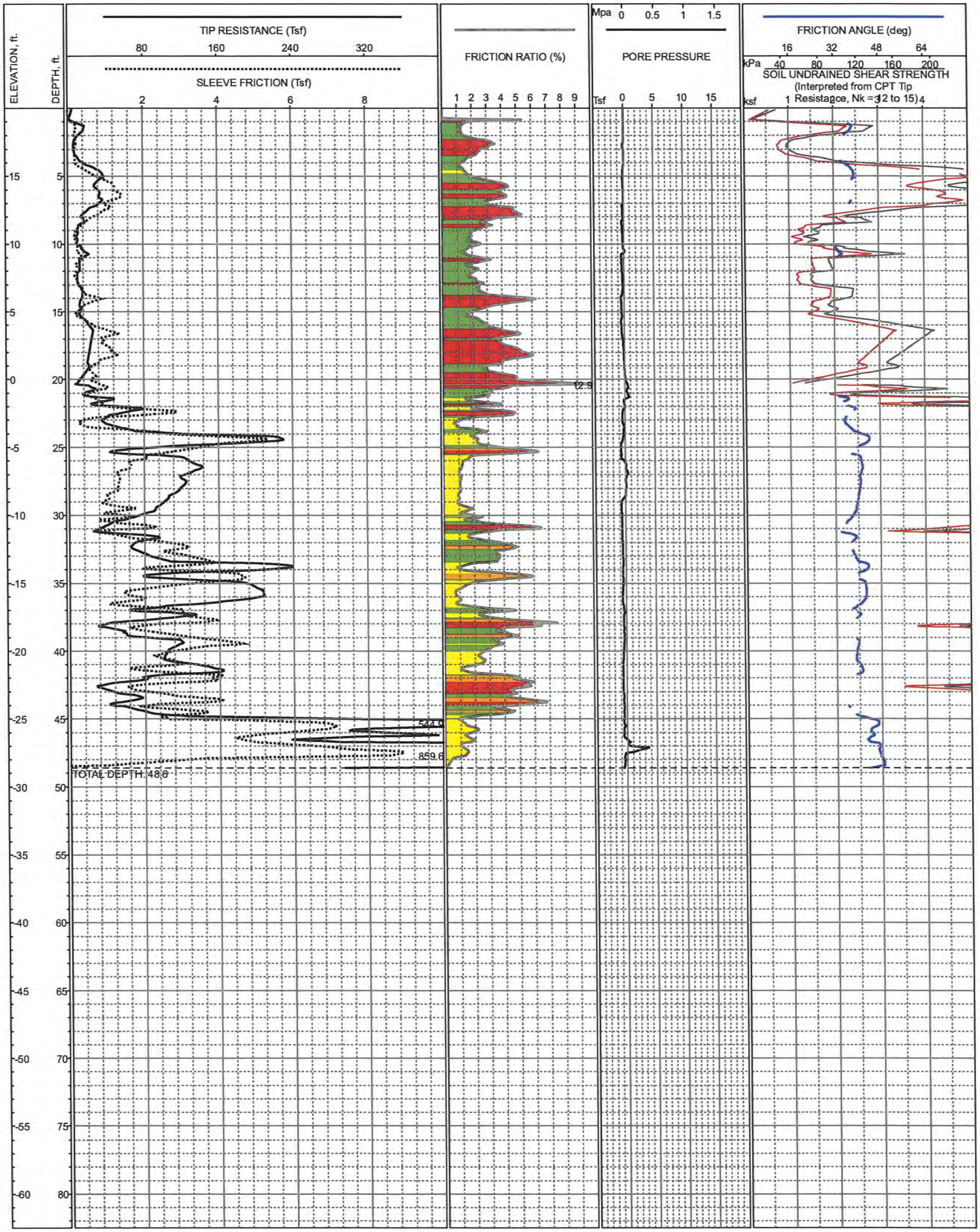
LOCATION:
SURFACE EL: 20.0ft +/- (MSL)
COMPLETION DEPTH: 81.9ft
TESTDATE: 3/31/2010

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: K Robinson

LOG OF CPT NO: CPT-1

Sycamore Creek Enhancement Project
Santa Barbara, California

N:\Projects\3037_PenfieldSmith\3037-047_SycamoreCreek\Explorations\CPT\2010\Logs\2010_04_29_Logs_Su_Fr\MXD\Logs_VK10C_Su_Fr.mxd,04/29/2010,CDean



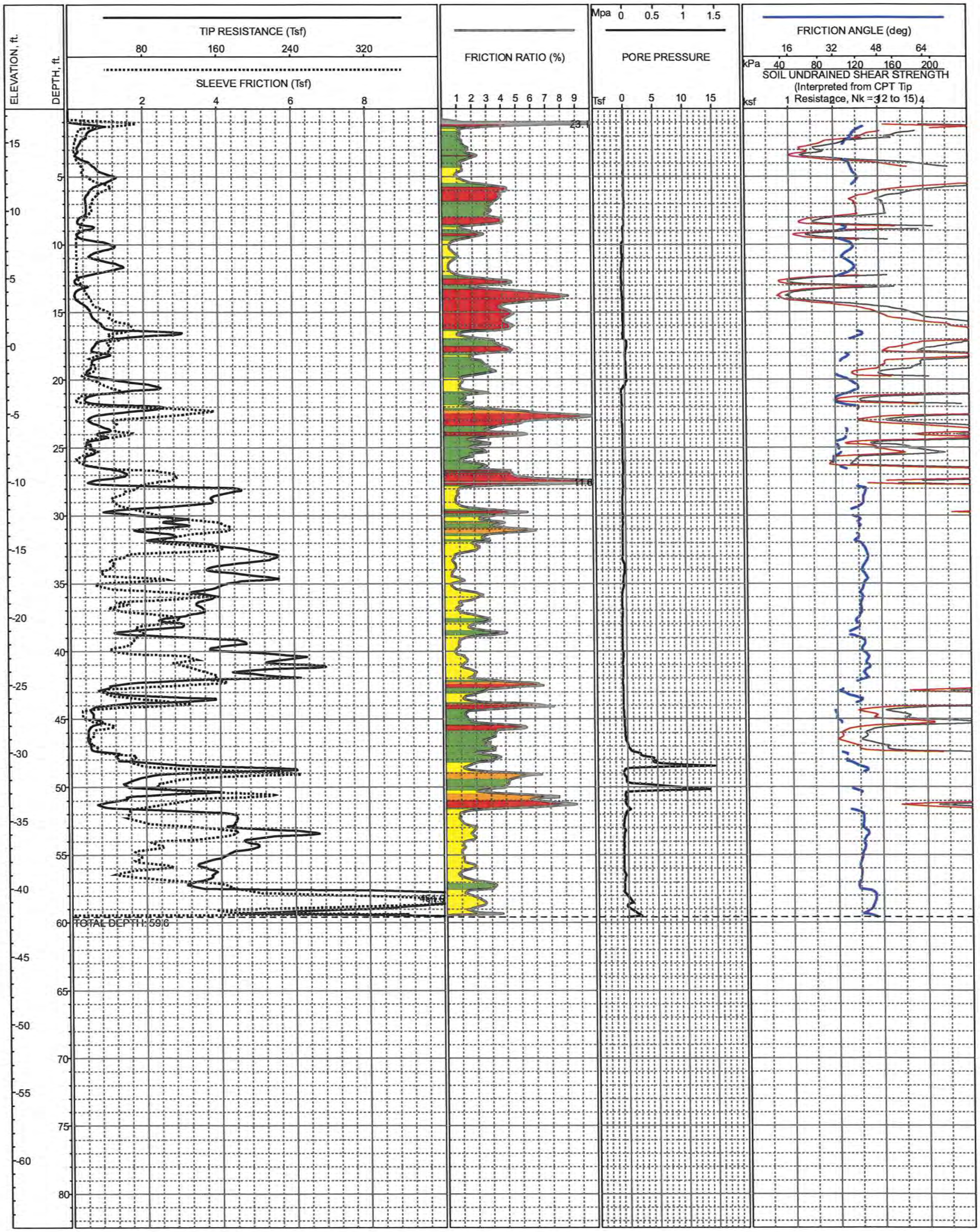
LOCATION:
SURFACE EL: 20.0ft +/- (MSL)
COMPLETION DEPTH: 48.6ft
TESTDATE: 3/31/2010

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: K Robinson

LOG OF CPT NO: CPT-2

Sycamore Creek Enhancement Project
Santa Barbara, California

N:\Projects\3037_PenfieldSmith\3037-047_SycamoreCreek\Explorations\CPT\2010\Logs\2010_04_29_Logs_Su_Fr\MXD\Logs_VK10C_Su_Fr.mxd,04/29/2010,CDean



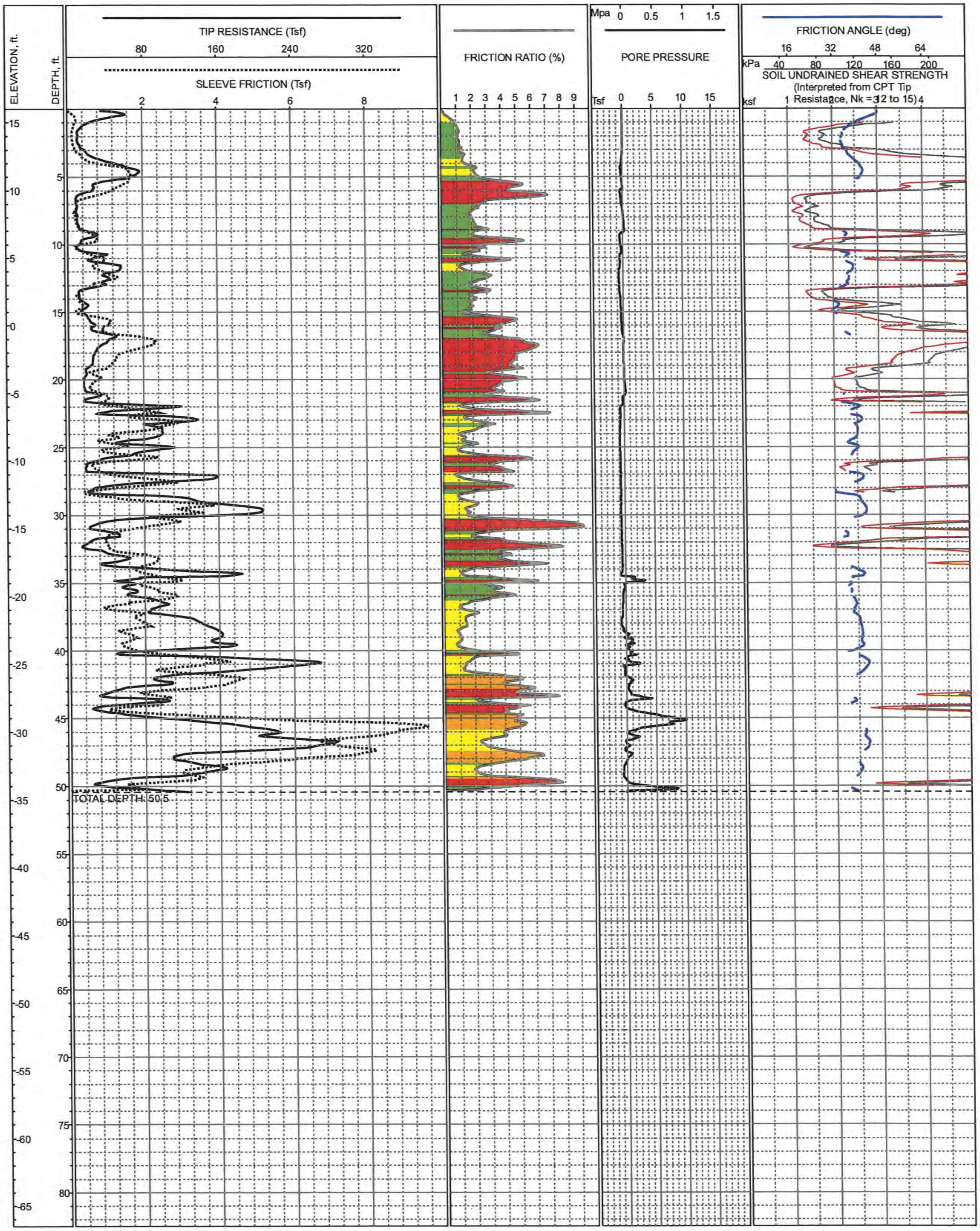
LOCATION:
SURFACE EL: 17.5ft +/- (MSL)
COMPLETION DEPTH: 59.6ft
TESTDATE: 4/1/2010

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: K Robinson

LOG OF CPT NO: CPT-3

Sycamore Creek Enhancement Project
Santa Barbara, California

N:\Projects\3037_PenfieldSmith\3037-047_SycamoreCreek\Explorations\CPT\2010\Logs\2010_04_29_Logs_Su_Fr\MXD\Logs_VK10C_Su_Fr.mxd,04/29/2010,CDean



LOCATION:
SURFACE EL: 16.0ft +/- (MSL)
COMPLETION DEPTH: 50.5ft
TESTDATE: 4/1/2010

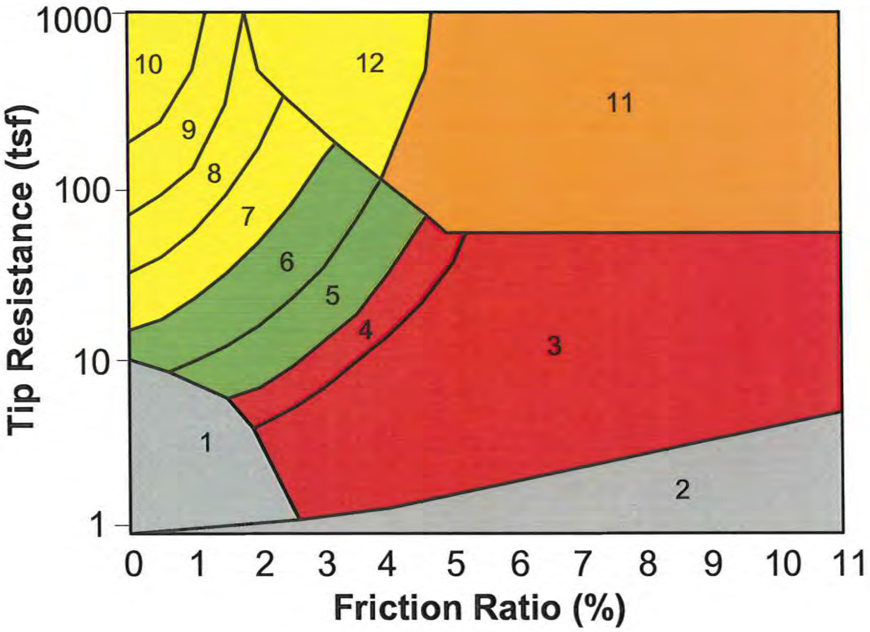
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: K Robinson

LOG OF CPT NO: CPT-4

Sycamore Creek Enhancement Project
Santa Barbara, California

N:\Projects\3037_PenfieldSmith\3037-047_SycamoreCreek\Explorations\CPT\2010\Logs\2010_04_29_Logs_Su_Fr\MXD\Logs_VK10C_Su_Fr.mxd,04/29/2010,CDean

COLOR LEGEND FOR FRICTION RATIO TRACES



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

*overconsolidated or cemented

CPT CORRELATION CHART
(Robertson and Campanella, 1988)

KEY TO CPT LOGS

Sycamore Creek Enhancement Project
Santa Barbara, California

LOCATION: See Plate 2 - Subsurface Exploration Location PlanN 1,979,586 E 6,058,062

SURFACE EL: 18 ft +/- (rel. NAVD 88 datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
		A		**ARTIFICIAL FILL (af)** Sandy Lean CLAY (CL): dark brown (7.5YR3/2), moist, fine sand, with roots and some fine gravel							
16	2										
14	4										
			(15)	- turns to brown (7.5YR4/2) with dark brown mottles, with yellow sand inclusions, piece of clay tile	129	112	15				
12	6			Silty CLAY (CL-ML) to Sandy Lean CLAY (CL) with sand and gravel lenses: stiff, brown (7.5YR4/2 to 4/3), moist, fine to medium sand							p 2.3
10	8		▽								
											t 0.6
8	10		(10)	- becomes medium stiff at ~9-1/2', dark gray (7.5YR4/1) silty clay, wet - sand lens at ~10', silty fine sand grades to well-graded sand with gravel, fine to coarse sand, fine gravel	126	101 107	25 19	61			p 2.5
6	12										
4	14										
			(17)	- clayey sand lens at ~14-1/2', medium dense, fine to coarse sand, with some fine gravel, grades to sandy clay at ~15'	133	114	17	22			
2	16										
0	18										
-2	20			- fine gravel lense at ~20', subangular gravel							
-4	22										
-6	24		(13)	- silty sand lens at ~24-1/2', loose, with charcoal inclusions and staining, fine to medium sand, grades to sandy clayey silt at ~26'	137 129	116 108	18 20	48			u 1.6
-8	26										
											t 0.7
-10	28			Silty SAND with gravel (SM) with sandy clay and sandy silt lenses: medium dense, brown (7.5YR4/4), wet, medium sand, some coarse, fine to coarse gravel ~1" diameter - sandy lean clay lens at ~29-1/2'							
-12	30		(24)		134	110	21				
-14	32										
-16	34		31				21				
-18	36										
-20	38										
			4	- more gravels in drilling at ~39'							

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 101.0 ft
DEPTH TO WATER: 8.5 ft
BACKFILLED WITH: Grout
DRILLING DATE: April 23, 2010
GW measured in hollow-stem auger beofore beginning mud rotary

DRILLING METHOD: 6-inch-dia. Mud Rotary Wash
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Co.
LOGGED BY: K Robinson
CHECKED BY: G S Denlinger

LOG OF BORING NO. DH-1

Sycamore Creek Enhancement Project
Santa Barbara, California

PLATE A-6a

LOCATION: See Plate 2 - Subsurface Exploration Location PlanN 1,979,586 E 6,058,062

SURFACE EL: 18 ft +/- (rel. NAVD 88 datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
				☒		- lens of sandy silt to silt with sand at ~40-1/2', soft - gravels encountered in drilling between ~40-44'			17				
-24	42												
-26	44					Lean CLAY (CL): stiff, brown (7.5YR4/3), wet, with fine gravel at ~44-1/2', with charcoal inclusions, becomes sandy at ~46'							
				▨	(15)								
-28	46						131 130	109 108	20 21		27	11	u 0.7 t 0.5 p 2.8
-30	48												
-32	50												
						Silty SAND (SM): medium dense, brown (7.5YR4/3), wet, medium sand, with some fine gravel and trace coarse gravel at ~56'							
-34	52												
-36	54												
				▨	(40)								
-38	56							108	18				
						- ~1-1/2' gravel layer at ~57' during drilling							
-40	58												
-42	60			▨	(44)	- grades to clayey sand (SC), gray (7.5YR5/1), with black striping ~1" thick, some iron oxide staining	128	112	15				
						Sandy Lean CLAY (CL): very stiff, dark gray to gray (7.5Y4/1 to 5/1), wet, with few fine dusky yellow gravels							p 4.5+
-44	62												
-46	64												
				▨	(43)	- turns to clayey fine sand at ~65', medium dense, yellow brown (10YR5/4) with gray and olive gray (5Y5/2) pockets and lenses, some medium sand, some fine gravel	139	121	15				u 2.9
-48	66												
-50	68												
						Fat CLAY (CH): very stiff, greenish gray (10Y6/1), wet, with abundant iron oxide inclusions and staining							
-52	70			▨	(39)		127	102	25				u 3.6 p 4.5+
-54	72												
-56	74					Clayey SAND (SC): dense, olive gray to light olive gray (5Y5/2 to 7/2), wet, with iron oxide staining and charcoal staining, very fine sand							
				▨	(61)		129 133	108 112	19 19				
-58	76												
-60	78					Poorly graded SAND with silt (SP-SM) with occasional gravel lenses: very dense, light yellow brown (10YR6/4), wet, with pockets of dark yellow brown							
				☒	79								

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 101.0 ft
DEPTH TO WATER: 8.5 ft
BACKFILLED WITH: Grout
DRILLING DATE: April 23, 2010
GW measured in hollow-stem auger beofore beginning mud rotary

DRILLING METHOD: 6-inch-dia. Mud Rotary Wash
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Co.
LOGGED BY: K Robinson
CHECKED BY: G S Denlinger

LOG OF BORING NO. DH-1

Sycamore Creek Enhancement Project
Santa Barbara, California

LOCATION: See Plate 2 - Subsurface Exploration
Location PlanN 1,979,586 E 6,058,062

SURFACE EL: 18 ft +/- (rel. NAVD 88 datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
				☒		(10YR4/6), fine to medium sand			22				
-64	82												
-66	84												
				☒	72					6			
-68	86					- gravel lens at ~86', ~3" thick, well-graded gravel with clay, yellow brown (10YR5/8), fine gravel ~1/4" diameter, some 1/2" diameter							
-70	88												
				☒	65								
-72	90					- gravel lens at ~90', ~4" thick, silty sand with fine gravel, subrounded, yellow brown (10YR5/8)							
-74	92					- ~1' gravel lens at ~92' during drilling							
-76	94												
						- with few fine gravels ~1/2" diameter at ~95'							
-78	96												
						- ~3' of gravels and cobbles at ~97' during drilling							
-80	98												
-82	100					SILT (ML): very stiff, yellow brown (10YR5/8), wet, turns to sandy silt at ~100' with silt lenses - turns to gravelly silty clay (CL-ML) at ~100-1/2', fine gravel							
-84	102												
-86	104												
-88	106												
-90	108												
-92	110												
-94	112												
-96	114												
-98	116												
-100	118												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 101.0 ft
DEPTH TO WATER: 8.5 ft
BACKFILLED WITH: Grout
DRILLING DATE: April 23, 2010
GW measured in hollow-stem auger beofore beginning mud rotary

DRILLING METHOD: 6-inch-dia. Mud Rotary Wash
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Co.
LOGGED BY: K Robinson
CHECKED BY: G S Denlinger

LOG OF BORING NO. DH-1

Sycamore Creek Enhancement Project
Santa Barbara, California

LOCATION: See Plate 2 - Subsurface Exploration Location PlanN 1,979,554 E 6,058,123

SURFACE EL: 16 ft +/- (rel. NAVD 88 datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
						Silty SAND (SM): dark brown (7.5YR3/2), moist, with gravel, grades to clayey sand/sandy lean clay at ~2', fine grained, subrounded							
14	2												
12	4					Sandy Lean CLAY (CL): soft, brown (7.5YR4/2), moist, fine sand, turns to silty clay, dark brown with charcoal inclusions near shoe, dark brown, with roots, wet							
				▨	(5)			90	28	68			t 0.5
10	6												
					▽								
8	8					Silty CLAY with sand (CL-ML): stiff, brown (7.5YR4/2), wet, fine sand							
6	10			▨	(16)		127	104	22		26	6	t 0.5
4	12												
						Sandy Fat CLAY (CH): very stiff, brown (7.5YR4/4), wet, with gray brown mottles, with some fine gravel, charcoal inclusions, fine sand							
2	14												
				▨	(25)			111	17				
0	16												p 3.0
-2	18												
-4	20			▨	(20)	Sandy Lean CLAY (CL): stiff, strong brown (7.5YR4/6), wet	99	85	17				
-6	22												
						- poorly-graded sand with clay between 20-25'							
-8	24												p 2.0
				▨	(15)	Sandy SILT (ML): stiff, strong brown (7.5YR4/6), wet, with poorly-graded sand lens at 26.25', fine sand, with charcoal staining, strong brown lean clay at 26.5'							
-10	26												
-12	28												
-14	30												
-16	32												
-18	34												
-20	36												
-22	38												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 26.5 ft
DEPTH TO WATER: 7.5 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: April 22, 2010
GW measured ~24 hours after completion of drilling

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Co.
LOGGED BY: K Robinson
CHECKED BY: G S Denlinger

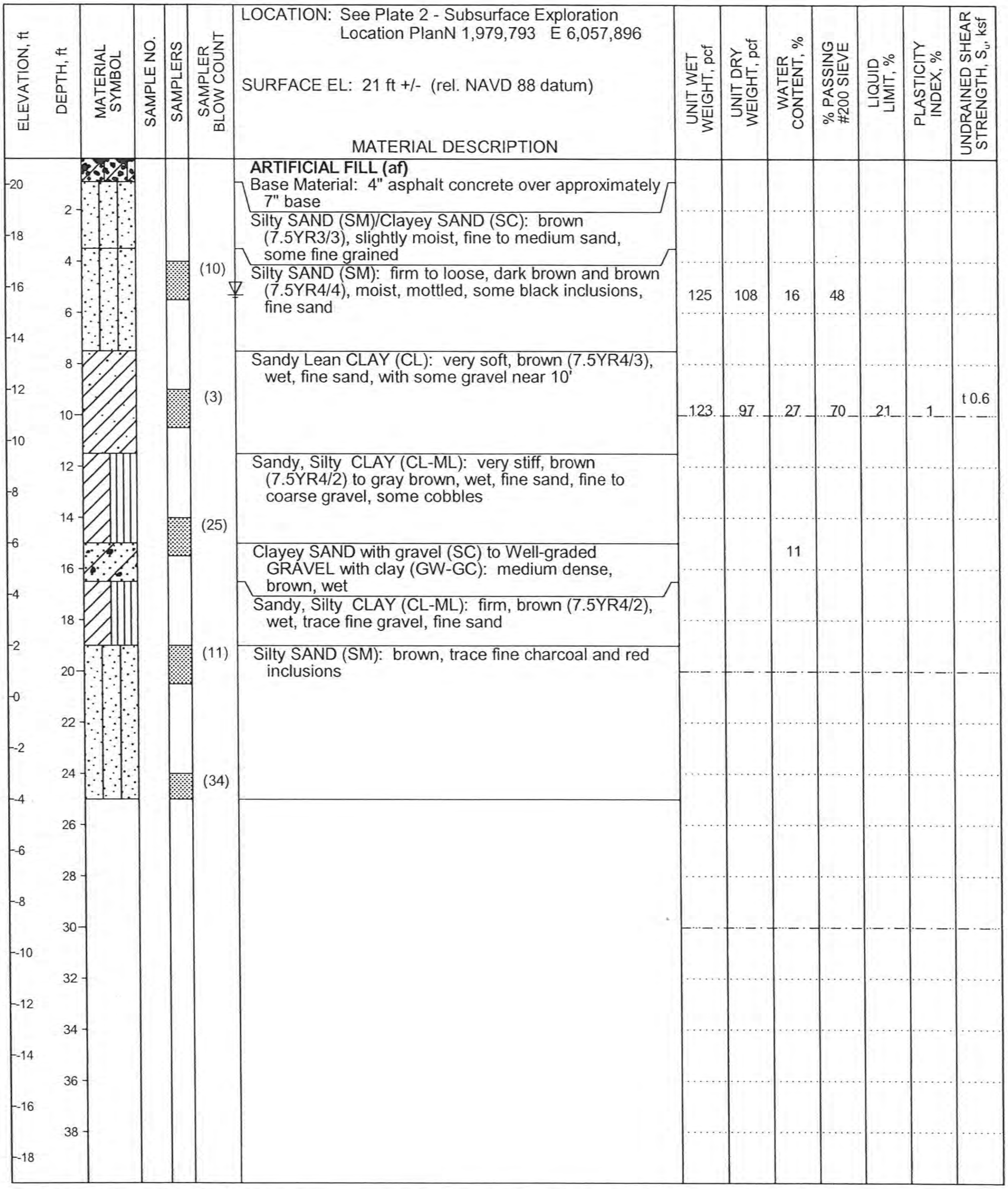
LOG OF BORING NO. DH-2

Sycamore Creek Enhancement Project
Santa Barbara, California

PLATE A-7

LOCATION: See Plate 2 - Subsurface Exploration Location PlanN 1,979,793 E 6,057,896

SURFACE EL: 21 ft +/- (rel. NAVD 88 datum)



SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
	ARTIFICIAL FILL (af) Base Material: 4" asphalt concrete over approximately 7" base							
	Silty SAND (SM)/Clayey SAND (SC): brown (7.5YR3/3), slightly moist, fine to medium sand, some fine grained							
(10)	Silty SAND (SM): firm to loose, dark brown and brown (7.5YR4/4), moist, mottled, some black inclusions, fine sand	125	108	16	48			
(3)	Sandy Lean CLAY (CL): very soft, brown (7.5YR4/3), wet, fine sand, with some gravel near 10'	123	97	27	70	21	1	t 0.6
(25)	Sandy, Silty CLAY (CL-ML): very stiff, brown (7.5YR4/2) to gray brown, wet, fine sand, fine to coarse gravel, some cobbles							
	Clayey SAND with gravel (SC) to Well-graded GRAVEL with clay (GW-GC): medium dense, brown, wet			11				
	Sandy, Silty CLAY (CL-ML): firm, brown (7.5YR4/2), wet, trace fine gravel, fine sand							
(11) (34)	Silty SAND (SM): brown, trace fine charcoal and red inclusions							

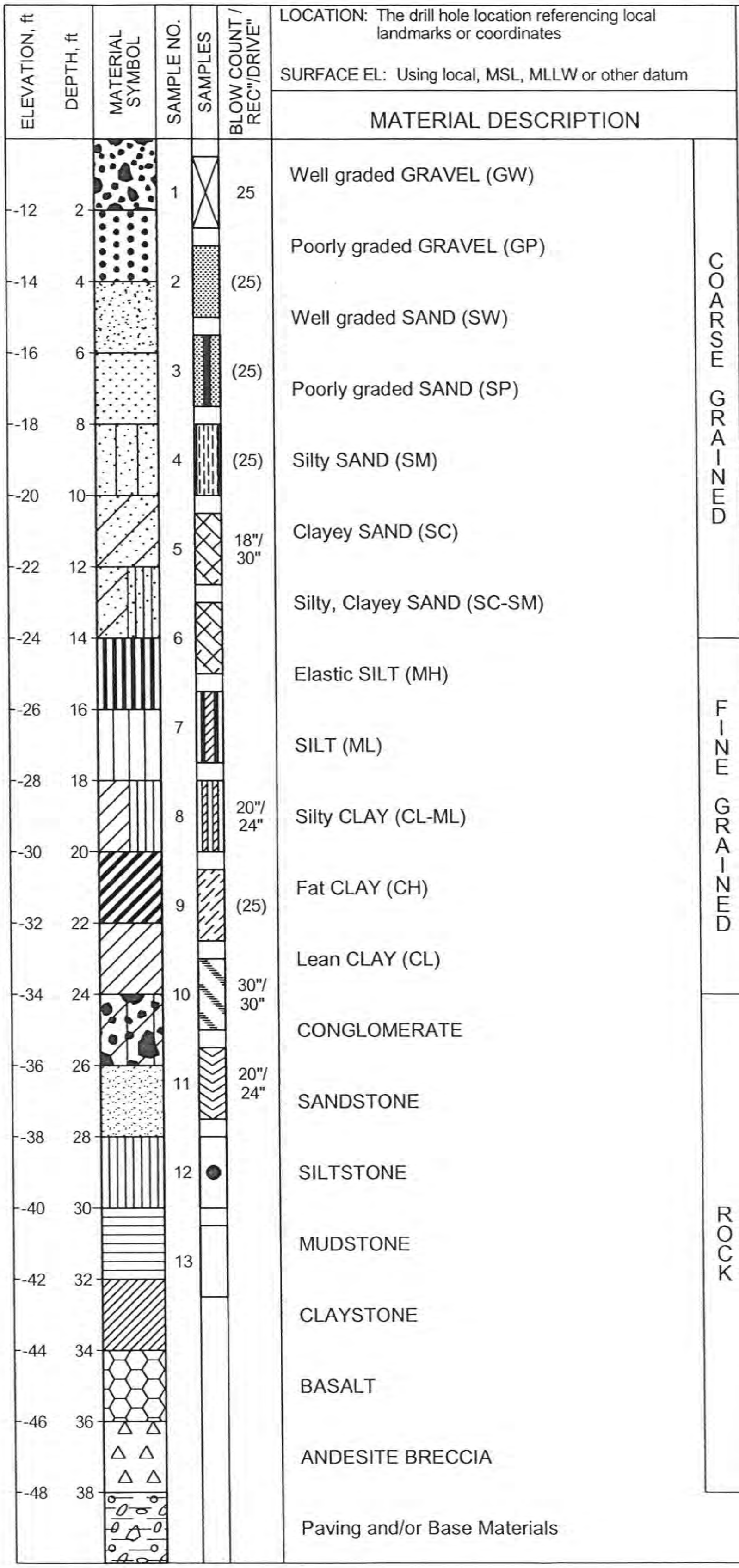
The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 25.0 ft
DEPTH TO WATER: 5.3 ft
BACKFILLED WITH: Cuttings, patched with concrete dyed black
DRILLING DATE: April 23, 2010
GW measured in adjacent CPT

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Drilling Co.
LOGGED BY: K Robinson
CHECKED BY: G S Denlinger

LOG OF BORING NO. DH-3
Sycamore Creek Enhancement Project
Santa Barbara, California

PLATE A-8



LOCATION: The drill hole location referencing local landmarks or coordinates

SURFACE EL: Using local, MSL, MLLW or other datum

MATERIAL DESCRIPTION

COARSE GRAINED
- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- Silty SAND (SM)
- Clayey SAND (SC)
- Silty, Clayey SAND (SC-SM)

FINE GRAINED
- Elastic SILT (MH)
- SILT (ML)
- Silty CLAY (CL-ML)
- Fat CLAY (CH)
- Lean CLAY (CL)

ROCK
- CONGLOMERATE
- SANDSTONE
- SILTSTONE
- MUDSTONE
- CLAYSTONE
- BASALT
- ANDESITE BRECCIA

Paving and/or Base Materials

General Notes

Soil Texture Symbol

Sloped line in symbol column indicates transitional boundary

Samplers and sampler dimensions (unless otherwise noted in report text) are as follows:

Symbol for:

1	SPT Sampler, driven 1-3/8" ID, 2" OD
2	CA Liner Sampler, driven 2-3/8" ID, 3" OD
3	CA Liner Sampler, disturbed 2-3/8" ID, 3" OD
4	Thin-walled Tube, pushed 2-7/8" ID, 3" OD
5	Bulk Bag Sample (from cuttings)
6	CA Liner Sampler, Bagged
7	Hand Auger Sample
8	CME Core Sample
9	Pitcher Sample
10	Lexan Sample
11	Vibracore Sample
12	No Sample Recovered
13	Sonic Soil Core Sample

Sampler Driving Resistance

Number of blows with 140 lb. hammer, falling 30" to drive sampler 1 ft. after seating sampler 6"; for example,

Blows/ft	Description
25	25 blows drove sampler 12" after initial 6" of seating
86/11"	After driving sampler the initial 6" of seating, 36 blows drove sampler through the second 6" interval, and 50 blows drove the sampler 5" into the third interval
50/6"	50 blows drove sampler 6" after initial 6" of seating
Ref/3"	50 blows drove sampler 3" during initial 6" seating interval

Blow counts for California Liner Sampler shown in ( )

Length of sample symbol approximates recovery length

Classification of Soils per ASTM D2487 or D2488

Geologic Formation noted in bold font at the top of interpreted interval

Strength Legend

Q = Unconfined Compression
u = Unconsolidated Undrained Triaxial
t = Torvane
p = Pocket Penetrometer
m = Miniature Vane

Water Level Symbols

▽	Initial or perched water level
▼	Final ground water level
∿	Seepages encountered

Rock Quality Designation (RQD) is the sum of recovered core pieces greater than 4 inches divided by the length of the cored interval.

KEY TO TERMS & SYMBOLS USED ON LOGS

Laboratory Testing

Penfield & Smith
Project No. 3037.047

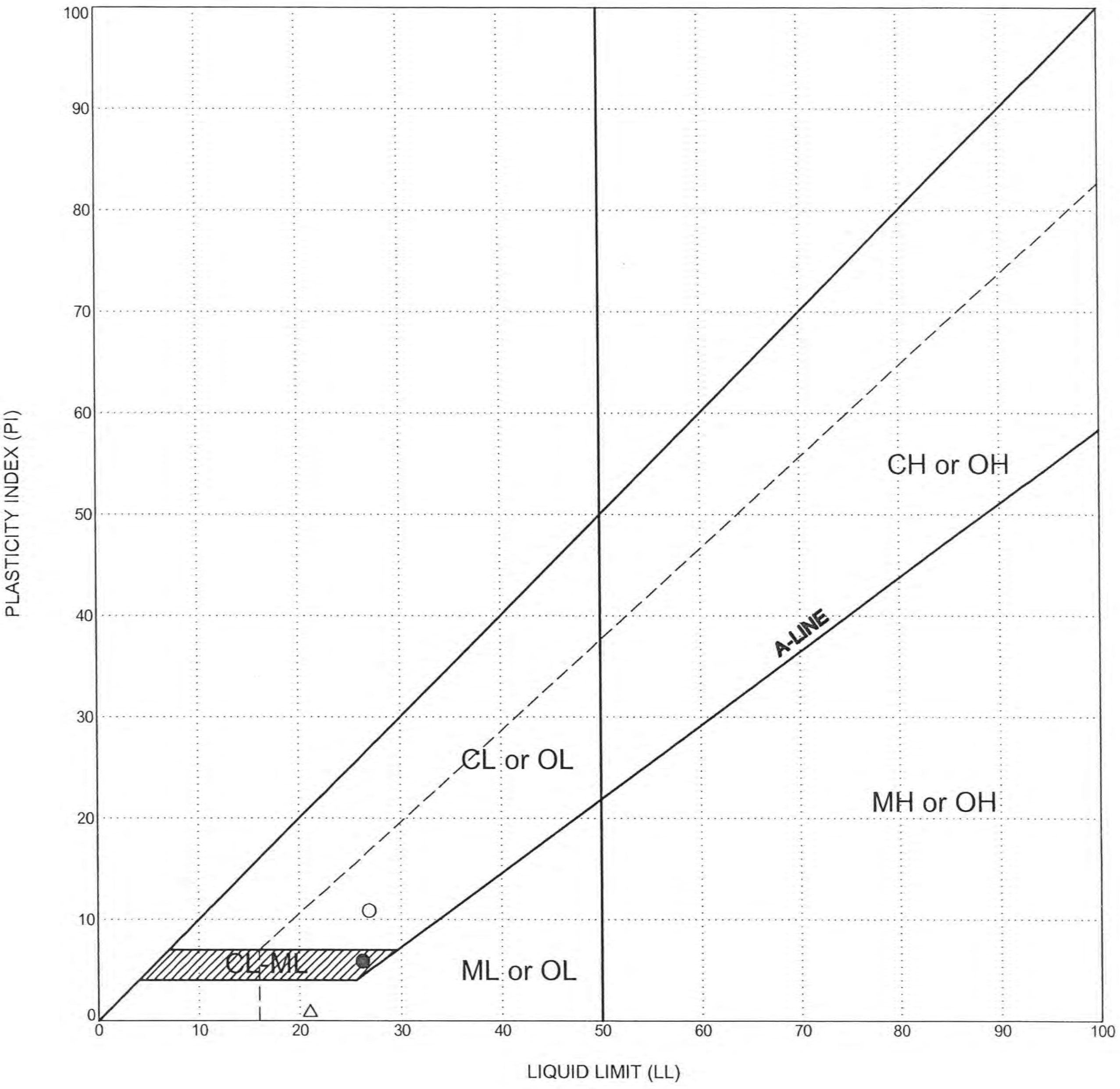
DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	SPECIFIC GRAVITY
								LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4 (%)				
DH-1	5.0	1A	Sandy Lean CLAY (CL)	129	112	15																	
DH-1	6.0	1B	Lean CLAY (CL) to Silty CLAY (CL-ML)																				
DH-1	9.0																						
DH-1	10.0		Sandy Lean CLAY (CL)	126	101	25	61																
DH-1	10.5		Silty SAND (SM)		107	19						0.5	31										
DH-1	11.0																						
DH-1	15.0	3A	Clayey SAND (SC)				22																
DH-1	15.5	3B	Clayey SAND (SC)	133	114	17																	
DH-1	25.0	4A	Silty SAND (SM)	137	116	18									1.6(3)								
DH-1	25.5	4B	Silty SAND (SM)	129	108	20																	
DH-1	26.0	4C	Silty SAND (SM)				48																
DH-1	27.0																						
DH-1	30.0	5A	Sandy Lean CLAY (CL)	134	110	21																	
DH-1	30.5	5B	Silty SAND (SM)																				
DH-1	35.0	6A	Silty SAND with gravel (SM)			21																	
DH-1	40.0	7A	Silty SAND with gravel (SM)			17																	
DH-1	45.0	8A	Lean CLAY (CL)	131	109	20									0.7(5.4)								
DH-1	45.5	8B	Lean CLAY (CL)	130	108	21		27	11														
DH-1	46.0																						
DH-1	55.5		Silty SAND (SM)		108	18						0.2	38										
DH-1	60.0	10A	Clayey SAND (SC)	128	112	15																	
DH-1	61.0																						
DH-1	65.0	11A	Sandy Lean CLAY (CL)	139	121	15									2.9(7.8)								
DH-1	70.0	12A	Fat CLAY (CH)	127	102	25									3.6(7.8)								
DH-1	71.0																						
DH-1	75.0	13A	Clayey SAND (SC)	129	108	19																	
DH-1	75.5	13B	Clayey SAND (SC)	133	112	19																	
DH-1	80.0	14	Poorly-graded SAND with silt (SP-SM)			22																	
DH-1	85.0	15A	Poorly-graded SAND with silt (SP-SM)				6																
DH-2	5.0																						

SUMMARY OF LABORATORY TEST RESULTS
Sycamore Creek Enhancement Project
Santa Barbara, California

DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	SPECIFIC GRAVITY
								LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4 (%)				
DH-2	5.5	1	Clayey SAND (SC)		90	28	68					0.1	34										
DH-2	6.0																						
DH-2	10.5	2	Silty CLAY with sand (CL-ML)	127	104	22		26	6														
DH-2	11.0																						
DH-2	15.5	3A	Sandy Fat CLAY (CH)		111	17						0.5	23										
DH-2	16.0																						
DH-2	21.0	4B	Sandy Lean CLAY (CL)	99	85	17																	
DH-2	24.0																						
DH-3	5.0	1	Silty SAND (SM)	125	108	16	48																
DH-3	9.0																						
DH-3	9.5	2A	Sandy SILT (ML)	123	97	27	70	21	1			0.0	37										
DH-3	10.0	2B	Sandy Lean CLAY (CL)									0.2	31										
DH-3	15.0	3B	Clayey SAND with gravel (SC)			11																	

SUMMARY OF LABORATORY TEST RESULTS

Sycamore Creek Enhancement Project
Santa Barbara, California

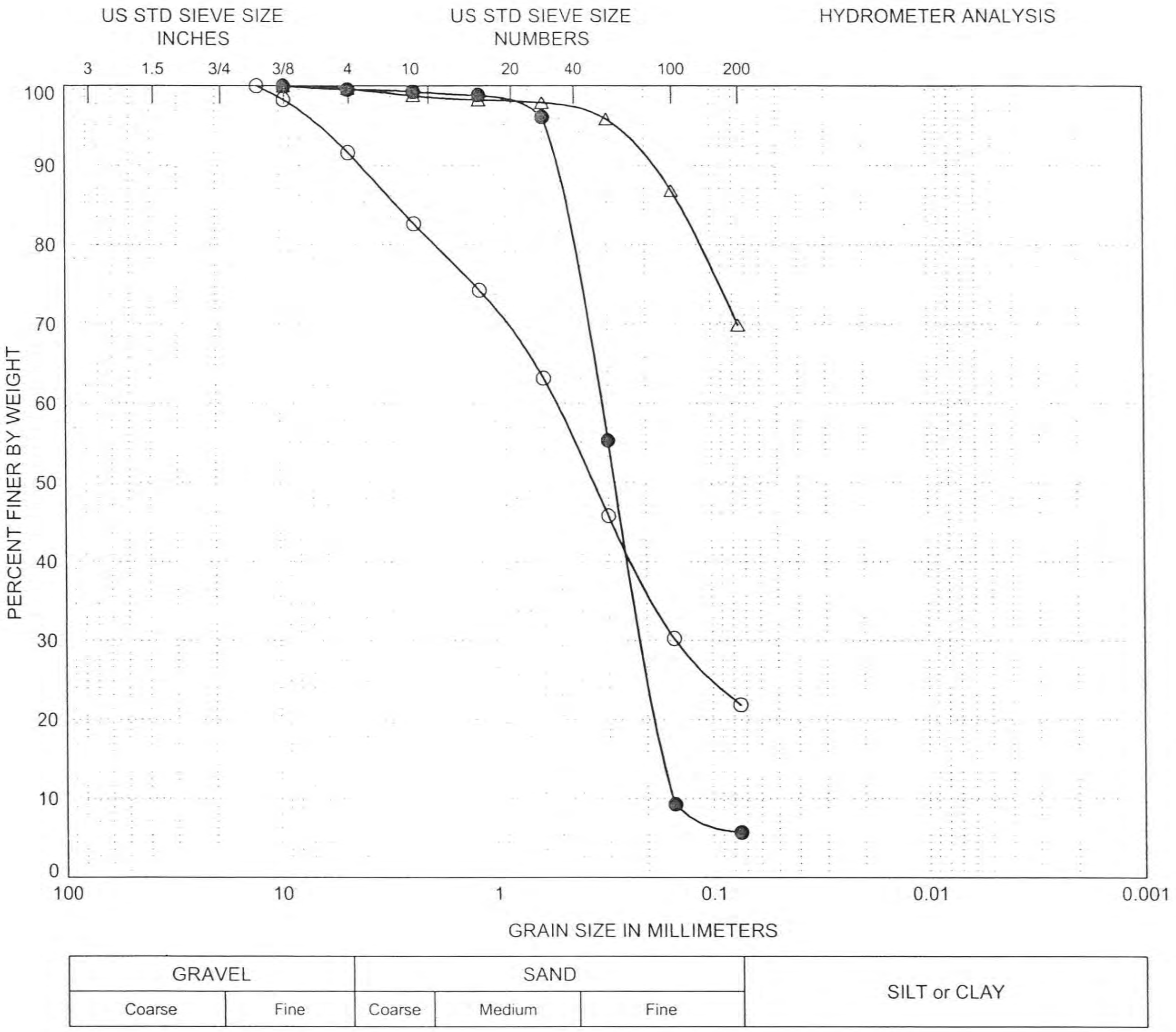


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	DH-1	45.5	Lean CLAY (CL)	27	16	11
●	DH-2	10.5	Silty CLAY with sand (CL-ML)	26	20	6
△	DH-3	9.5	Sandy SILT (ML)	21	20	1

PLASTICITY CHART

Sycamore Creek Enhancement Project
Santa Barbara, California

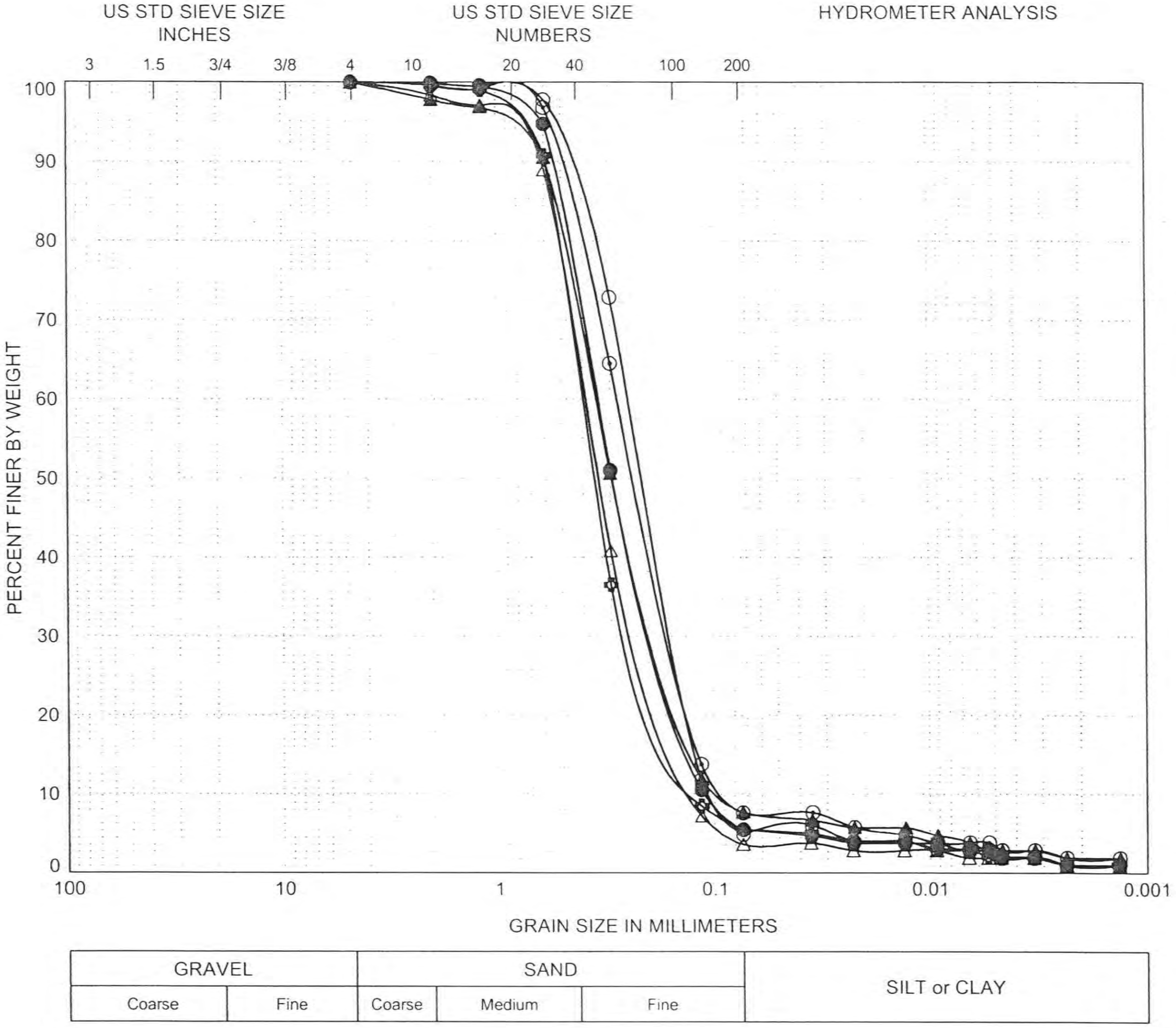
PLATE B-2



LEGEND (location)	(depth,ft)		CLASSIFICATION	Cc	Cu
○	DH-1	15.0	Clayey SAND (SC)		
●	DH-1	85.0	Poorly-graded SAND with silt (SP-SM)	0.9	2.1
△	DH-3	9.5	Sandy SILT (ML)		

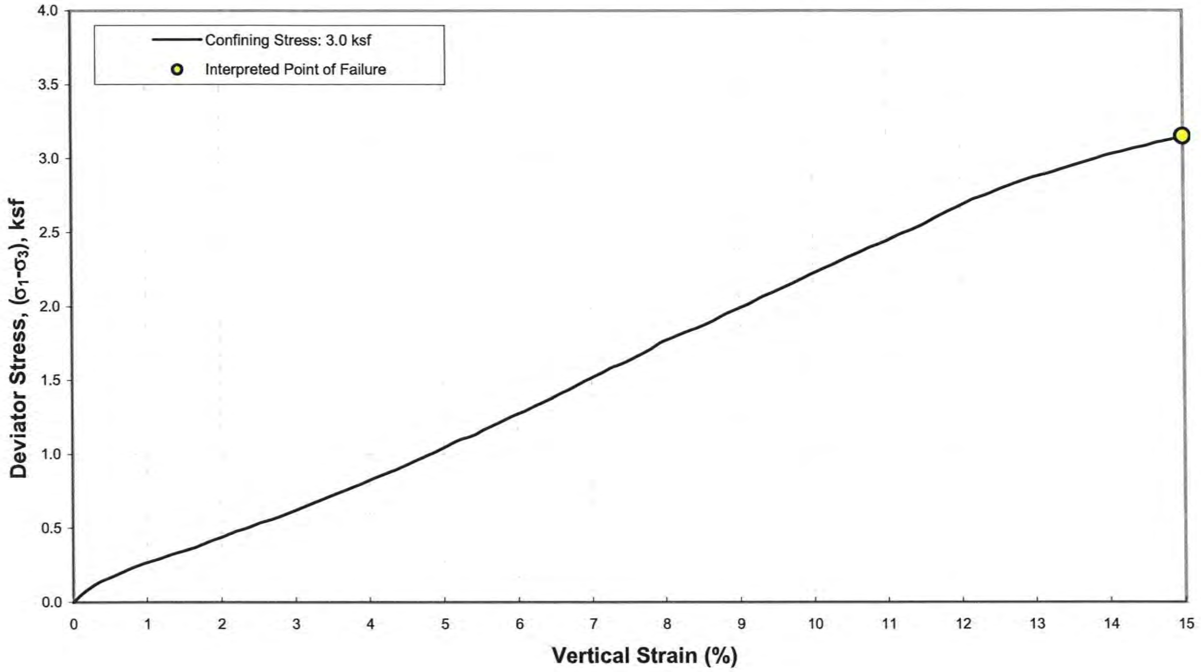
GRAIN SIZE CURVES

Sycamore Creek Enhancement Project
Santa Barbara, California



	LEGEND (location)	(depth,ft)	CLASSIFICATION	Cc	Cu
○	G-1	0.0	Poorly graded SAND (SP)	1.2	3.1
●	G-2	0.0	Poorly graded SAND with silt (SP-SM)	0.9	3.1
△	G-3	0.0	Poorly graded SAND (SP)	1.0	3.2
▲	G-4	0.0	Poorly graded SAND with silt (SP-SM)	1.0	3.7
⊙	G-5	0.0	Poorly graded SAND with silt (SP-SM)	1.6	5.0
✿	G-6	0.0	Poorly graded SAND with silt (SP-SM)	1.2	3.3

GRAIN SIZE CURVES
Sycamore Creek Enhancement Project
Santa Barbara, California



SAMPLE ID	Boring Number:	DH-01
	Sample Number:	#4A
	Sample Depth:	25.0ft
	USCS Classification:	Silty SAND (SM): brown, wet
	Sample Type:	Ring
SAMPLE PROPERTIES	Water Content, %	18.2
	Wet Density, pcf	137.1
	Dry Density, pcf	116.0
	Saturation, %	100
	Void Ratio	0.51
	Diameter, in	2.367
	Height, in	4.950
	Height/Diameter	2.1

	Sieve Size	% Passing	Other Parameters	
CLASSIFICATION	3/8-in. (9.5mm)	---	Liquid Limit	---
	No. 4 (4.75mm)	---	Plastic Limit	---
	No. 10 (2.0mm)	---	Plasticity Index	---
	No. 30 (0.6mm)	---	Estimated Gs	2.81
	No. 100 (0.150mm)	---		
	No. 200 (0.075mm)	---		

TEST SUMMARY	Strain Rate, %/min	1.01
	Cell Pressure, ksf	3.0
	Deviator Stress at Failure, ksf	3.2
	Undrained Shear Strength, ksf	1.6
	Axial Strain at Failure, %	15.0
	Tested By:	JC
	Date Tested:	05.17.10

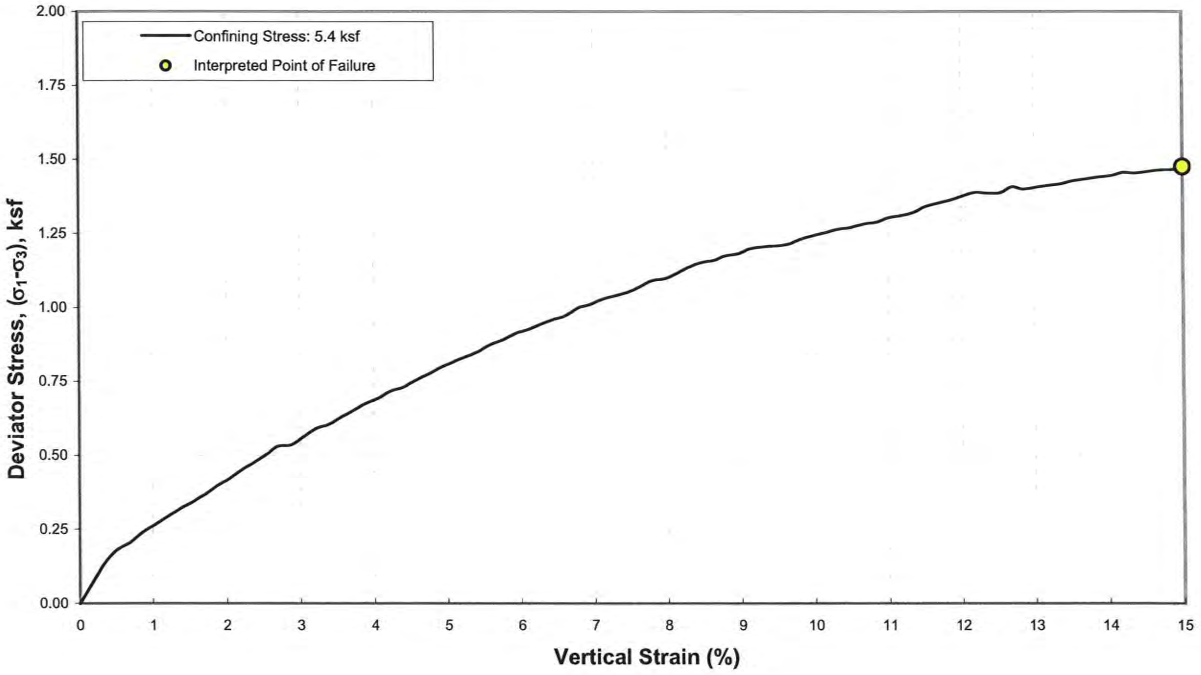
SAMPLE IMAGES

REMARKS

Test Method: ASTM 2850.

UNCONSOLIDATED, UNDRAINED TRIAXIAL TEST

Sycamore Creek Enhancement Project
Santa Barbara, California



SAMPLE ID	Boring Number:	DH-01
	Sample Number:	#8A
	Sample Depth:	45.0ft
	USCS Classification:	Lean CLAY (CL): dark brown, wet
	Sample Type:	Ring
SAMPLE PROPERTIES	Water Content, %	20.1
	Wet Density, pcf	131.4
	Dry Density, pcf	109.5
	Saturation, %	100
	Void Ratio	0.54
	Diameter, in	2.388
	Height, in	5.020
	Height/Diameter	2.1

CLASSIFICATION	Sieve Size	% Passing	Other Parameters	
	3/8-in. (9.5mm)	---	Liquid Limit	---
	No. 4 (4.75mm)	---	Plastic Limit	---
	No. 10 (2.0mm)	---	Plasticity Index	---
	No. 30 (0.6mm)	---	Estimated Gs	2.7
	No. 100 (0.150mm)	---		
	No. 200 (0.075mm)	---		

TEST SUMMARY	Strain Rate, %/min	1.00
	Cell Pressure, ksf	5.4
	Deviator Stress at Failure, ksf	1.5
	Undrained Shear Strength, ksf	0.7
	Axial Strain at Failure, %	15.0
	Tested By:	JC
	Date Tested:	05.18.10

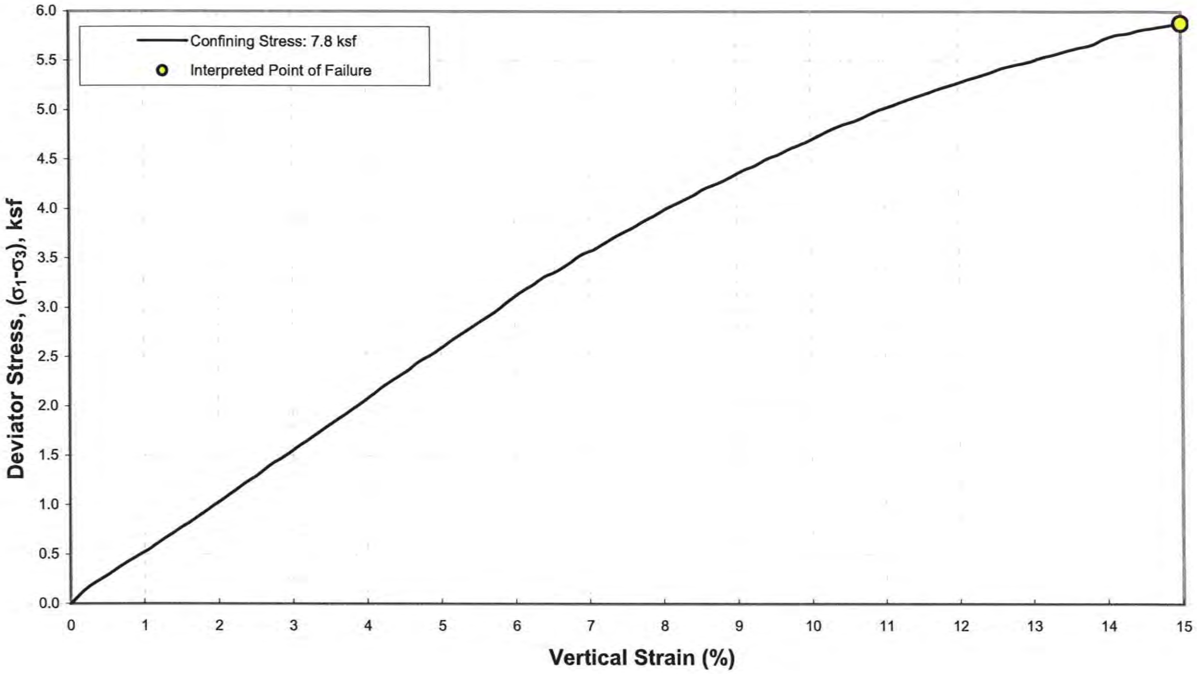
SAMPLE IMAGES

REMARKS

Test Method: ASTM 2850.

UNCONSOLIDATED, UNDRAINED TRIAXIAL TEST

Sycamore Creek Enhancement Project
Santa Barbara, California



SAMPLE ID	Boring Number:	DH-01
	Sample Number:	#11A
	Sample Depth:	65.0ft
	USCS Classification:	Sandy Lean CLAY (CL): dark yellowish brown, wet
	Sample Type:	Ring
SAMPLE PROPERTIES	Water Content, %	14.8
	Wet Density, pcf	138.5
	Dry Density, pcf	120.6
	Saturation, %	100
	Void Ratio	0.40
	Diameter, in	2.404
	Height, in	4.940
	Height/Diameter	2.1

	Sieve Size	% Passing	Other Parameters	
CLASSIFICATION	3/8-in. (9.5mm)	---	Liquid Limit	---
	No. 4 (4.75mm)	---	Plastic Limit	---
	No. 10 (2.0mm)	---	Plasticity Index	---
	No. 30 (0.6mm)	---	Estimated Gs	2.71
	No. 100 (0.150mm)	---	S_u from T_v, ksf	---
	No. 200 (0.075mm)	---	S_u from PP, ksf	2.8

TEST SUMMARY	Strain Rate, %/min	1.00
	Cell Pressure, ksf	7.8
	Deviator Stress at Failure, ksf	5.9
	Undrained Shear Strength, ksf	2.9
	Axial Strain at Failure, %	15.0
	Tested By:	JC
	Date Tested:	05.20.10

SAMPLE IMAGES

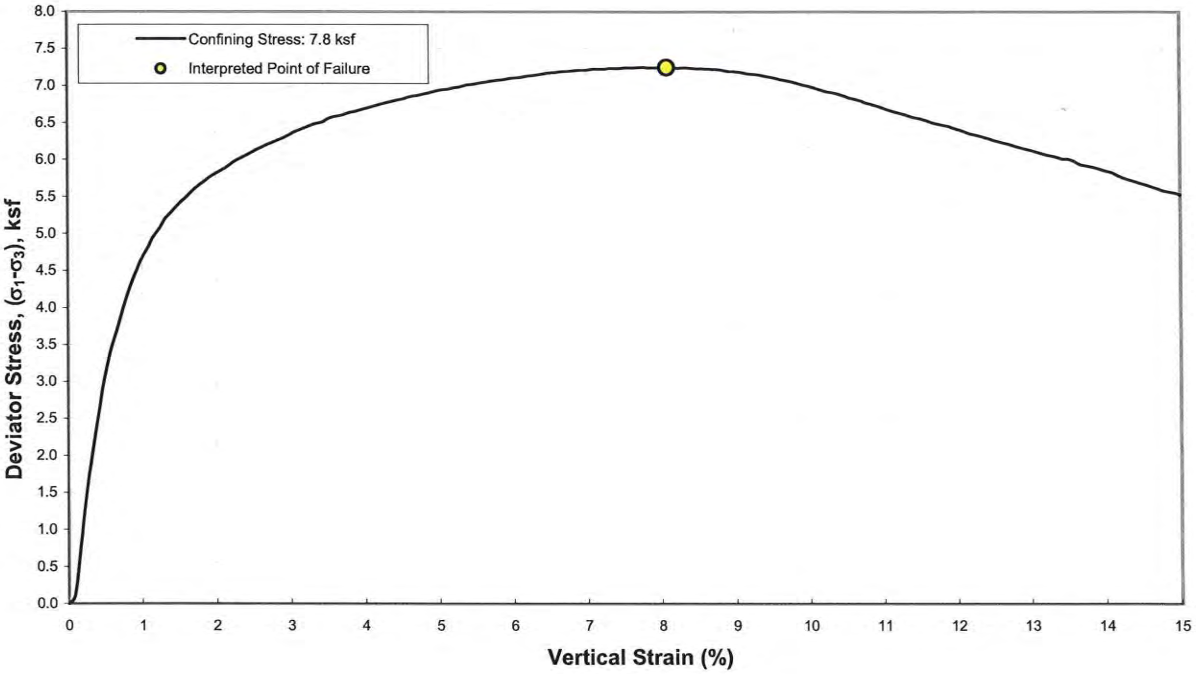
REMARKS

Test Method: ASTM 2850.

UNCONSOLIDATED, UNDRAINED TRIAXIAL TEST

Sycamore Creek Enhancement Project
Santa Barbara, California

PLATE B-4c



SAMPLE ID

Boring Number:	DH-01
Sample Number:	#12A
Sample Depth:	70.0ft
USCS Classification:	Fat CLAY (CH): olive gray with FeO2 mottling, wet
Sample Type:	Ring

SAMPLE PROPERTIES

Water Content, %	24.7
Wet Density, pcf	127.2
Dry Density, pcf	102.0
Saturation, %	100
Void Ratio	0.68
Diameter, in	2.396
Height, in	5.030
Height/Diameter	2.1

CLASSIFICATION

Sieve Size	% Passing
3/8-in. (9.5mm)	---
No. 4 (4.75mm)	---
No. 10 (2.0mm)	---
No. 30 (0.6mm)	---
No. 100 (0.150mm)	---
No. 200 (0.075mm)	---

Other Parameters	
Liquid Limit	---
Plastic Limit	---
Plasticity Index	---
Estimated Gs	2.74
S_u from T_v, ksf	---
S_u from PP, ksf	4.5+

TEST SUMMARY

Strain Rate, %/min	0.51
Cell Pressure, ksf	7.8
Deviator Stress at Failure, ksf	7.2
Undrained Shear Strength, ksf	3.6
Axial Strain at Failure, %	8.1
Tested By:	JC
Date Tested:	05.19.10

SAMPLE IMAGES

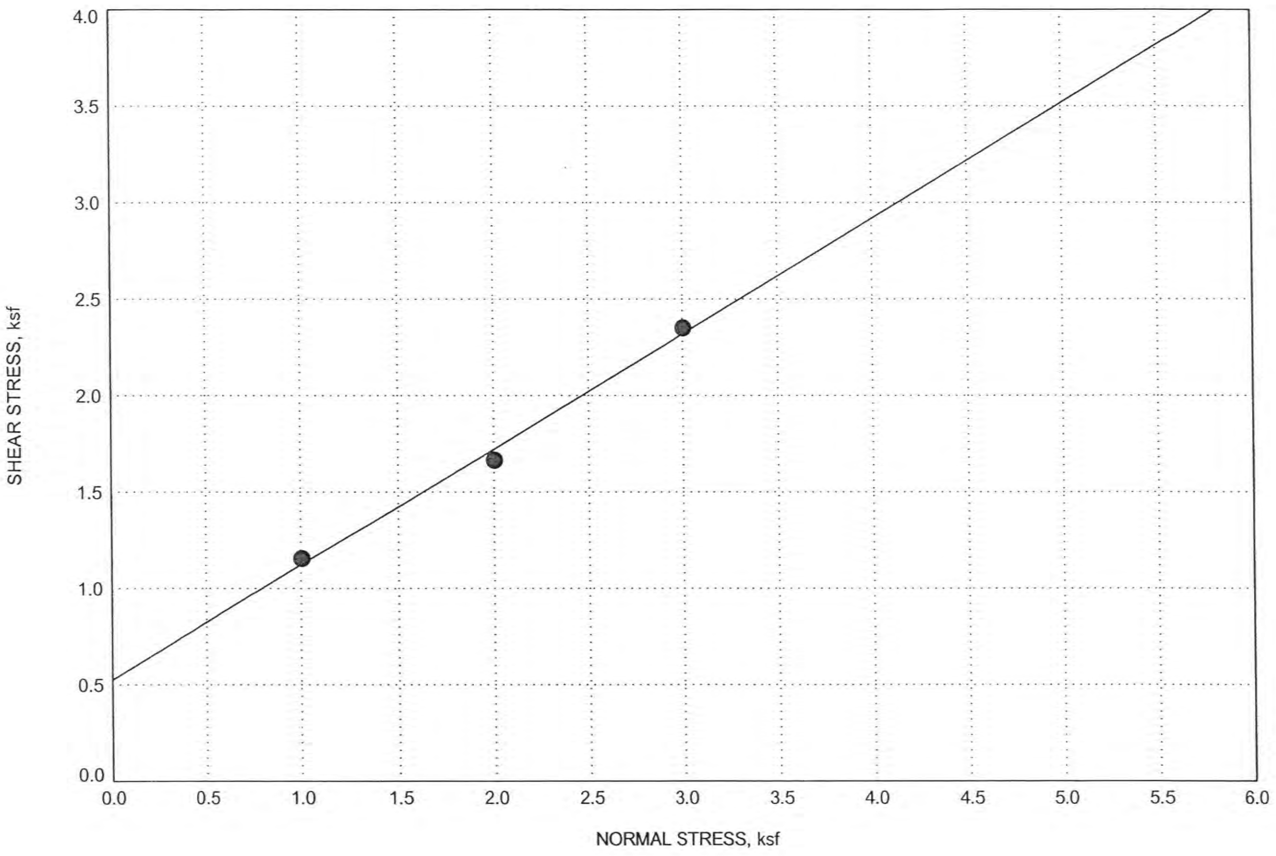
REMARKS

Test Method: ASTM 2850.
Effective stress lower than requested: test run at overburden for 65.0ft.

UNCONSOLIDATED, UNDRAINED TRIAXIAL TEST

Sycamore Creek Enhancement Project
Santa Barbara, Callifornia

PLATE B-4d

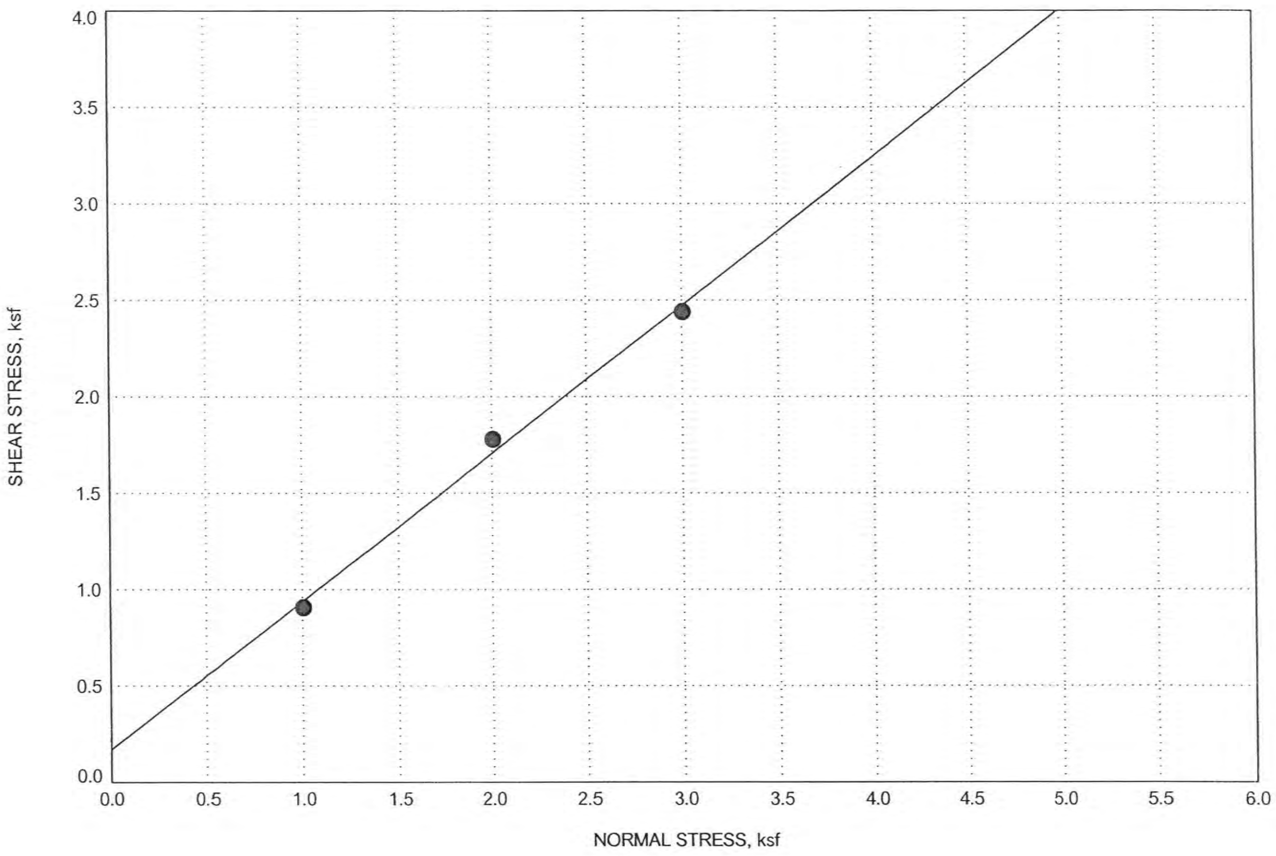


COHESION, ksf	0.5
ANGLE OF INTERNAL FRICTION, deg	31
LOCATION	DH-1
DEPTH, ft	10.5
MOISTURE CONTENT, %	19
UNIT DRY WEIGHT, pcf	107
MATERIAL DESCRIPTION	Silty SAND (SM)
SAMPLE CONDITION	Driven Ring

DIRECT SHEAR TEST RESULTS

Sycamore Creek Enhancement Project
Santa Barbara, California

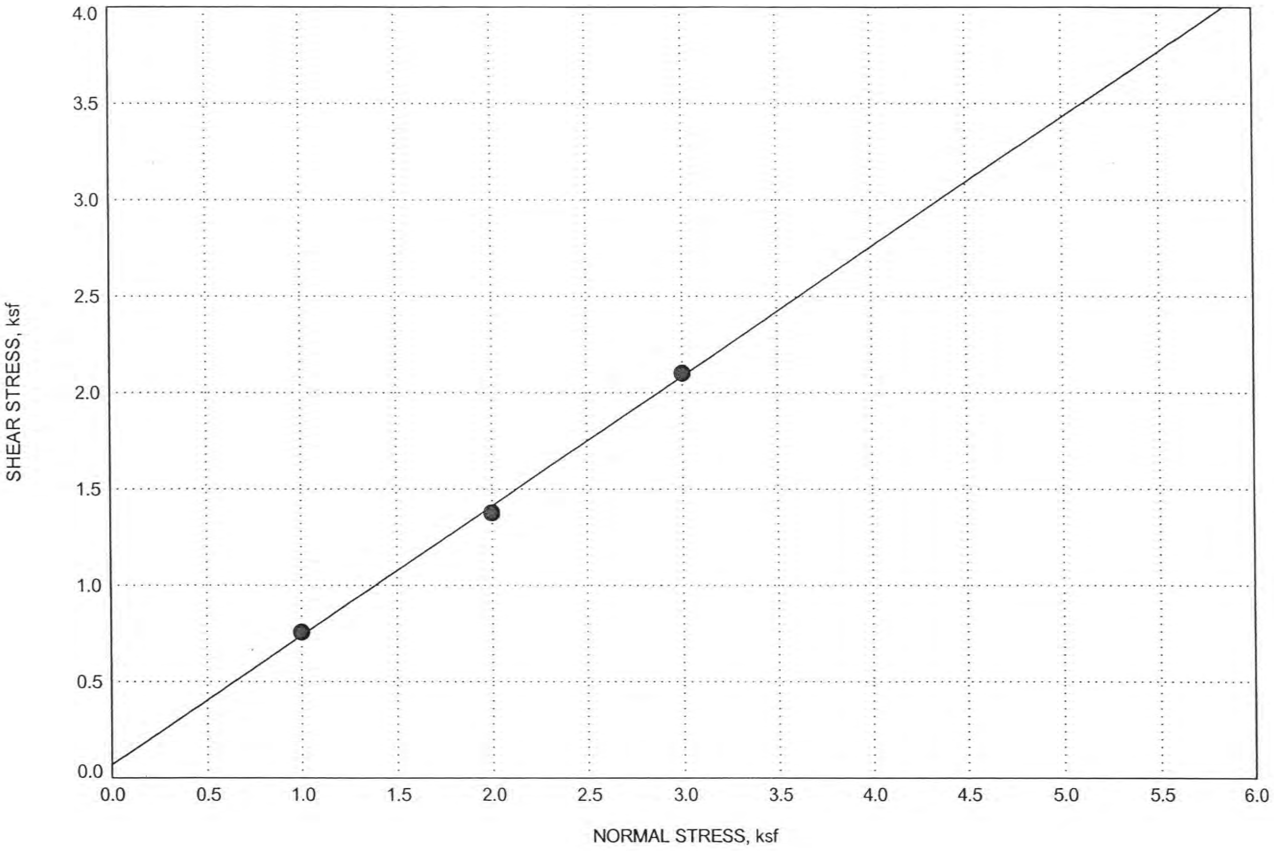
PLATE B-5a



COHESION, ksf	0.2
ANGLE OF INTERNAL FRICTION, deg	38
LOCATION	DH-1
DEPTH, ft	55.5
MOISTURE CONTENT, %	18
UNIT DRY WEIGHT, pcf	108
MATERIAL DESCRIPTION	Silty SAND (SM)
SAMPLE CONDITION	Driven Ring

DIRECT SHEAR TEST RESULTS
Sycamore Creek Enhancement Project
Santa Barbara, California

PLATE B-5b

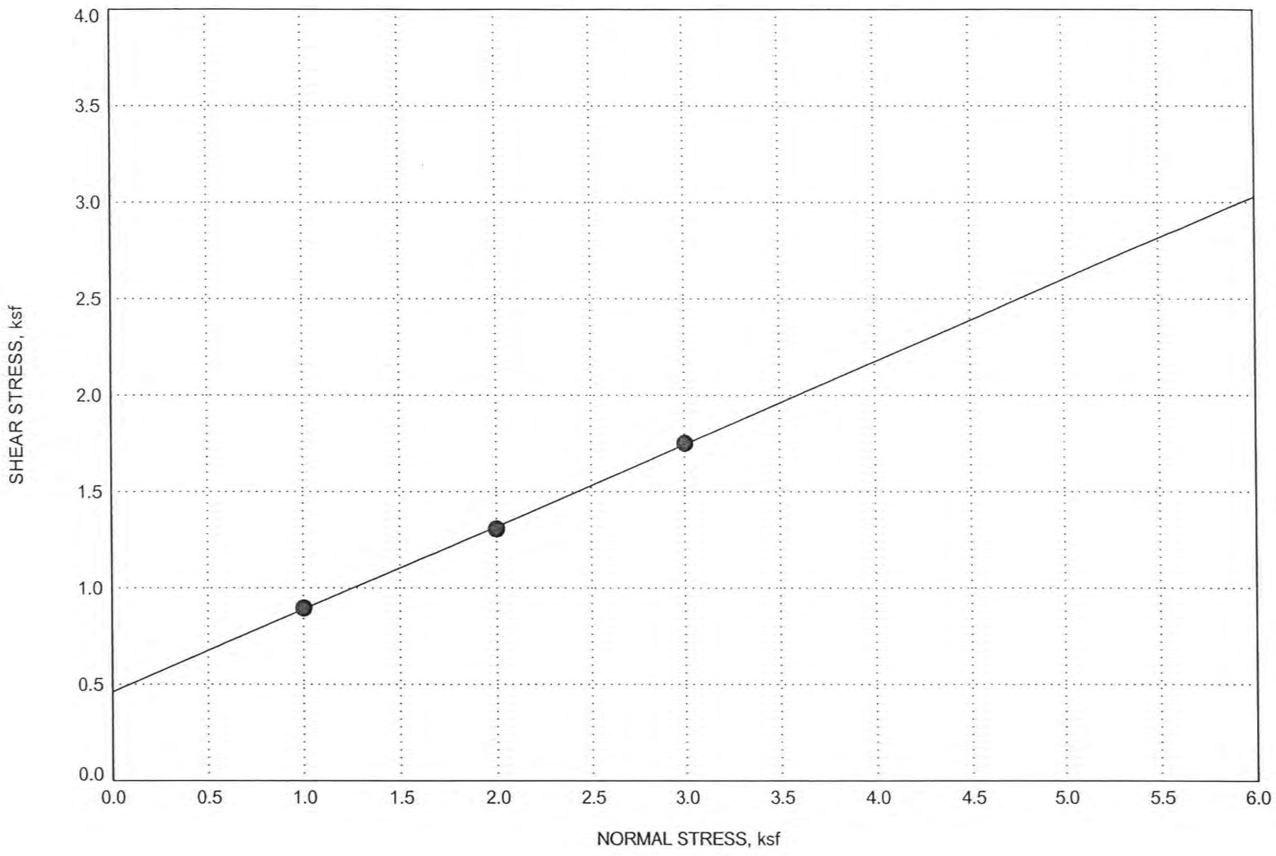


COHESION, ksf	0.1
ANGLE OF INTERNAL FRICTION, deg	34
LOCATION	DH-2
DEPTH, ft	5.5
MOISTURE CONTENT, %	28
UNIT DRY WEIGHT, pcf	90
MATERIAL DESCRIPTION	Clayey SAND (SC)
SAMPLE CONDITION	Driven Ring

DIRECT SHEAR TEST RESULTS

Sycamore Creek Enhancement Project
Santa Barbara, California

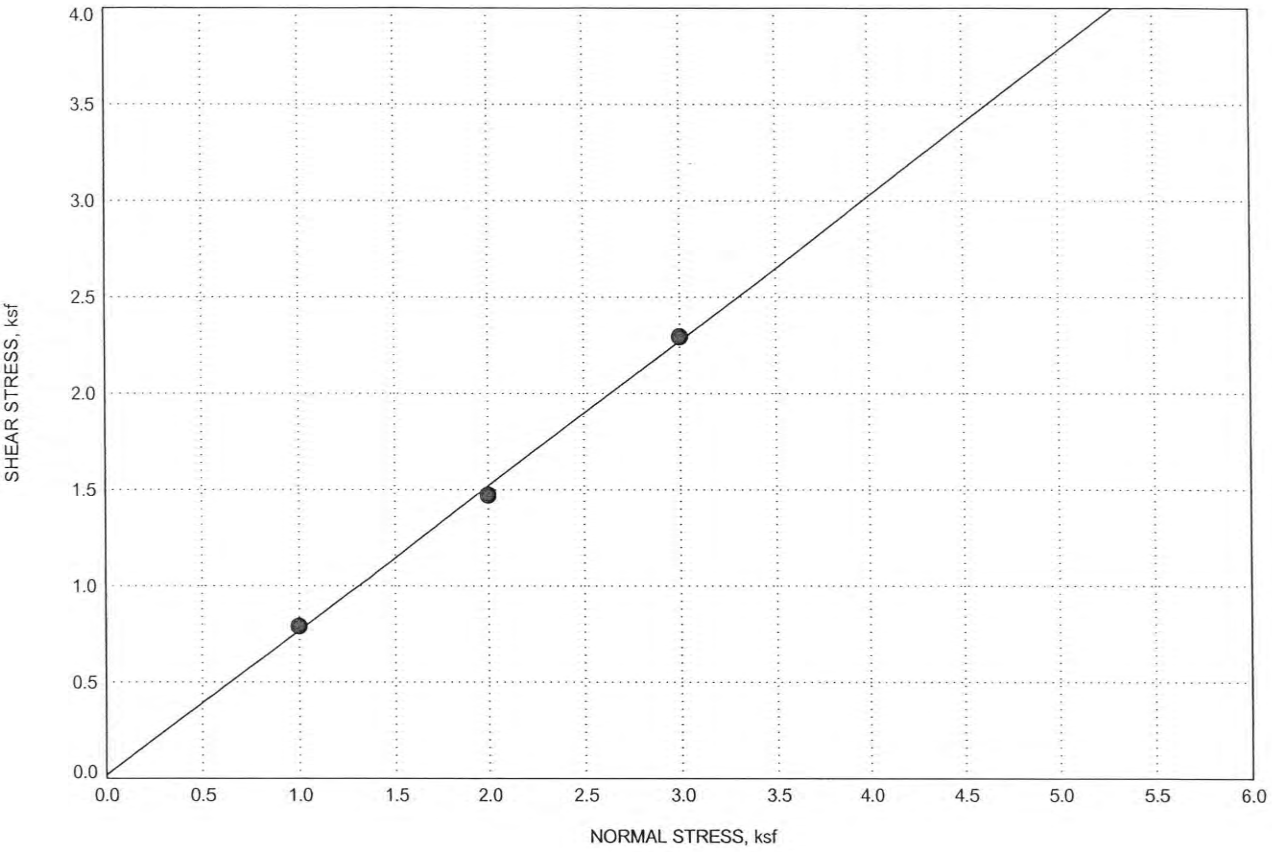
PLATE B-5c



COHESION, ksf	0.5
ANGLE OF INTERNAL FRICTION, deg	23
LOCATION	DH-2
DEPTH, ft	15.5
MOISTURE CONTENT, %	17
UNIT DRY WEIGHT, pcf	111
MATERIAL DESCRIPTION	Sandy Fat CLAY (CH)
SAMPLE CONDITION	Driven Ring

DIRECT SHEAR TEST RESULTS
Sycamore Creek Enhancement Project
Santa Barbara, California

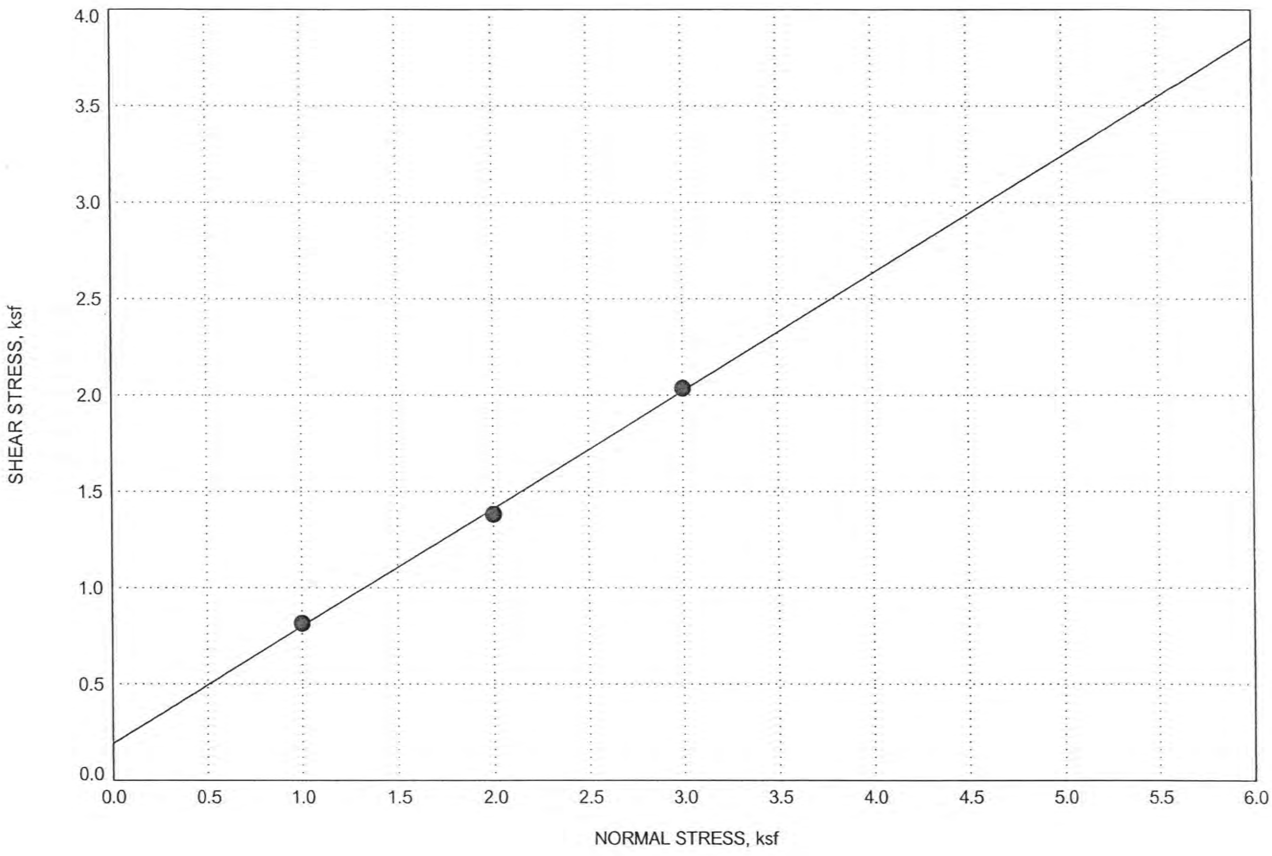
PLATE B-5d



COHESION, ksf	0.0
ANGLE OF INTERNAL FRICTION, deg	37
LOCATION	DH-3
DEPTH, ft	9.5
MOISTURE CONTENT, %	27
UNIT DRY WEIGHT, pcf	97
MATERIAL DESCRIPTION	Sandy SILT (ML)
SAMPLE CONDITION	Ring Sample

DIRECT SHEAR TEST RESULTS
Sycamore Creek Enhancement Project
Santa Barbara, California

PLATE B-5e



COHESION, ksf	0.2
ANGLE OF INTERNAL FRICTION, deg	31
LOCATION	DH-3
DEPTH, ft	10
MOISTURE CONTENT, %	
UNIT DRY WEIGHT, pcf	
MATERIAL DESCRIPTION	Sandy Lean CLAY (CL)
SAMPLE CONDITION	Driven Ring

DIRECT SHEAR TEST RESULTS
Sycamore Creek Enhancement Project
Santa Barbara, California

PLATE B-5f

COOPER

Corrosivity Test Summary

CTL # 446-084
Client: Fugro West
Remarks:

Date: 5/14/2010
Project: Sycamore Creek

Tested By: PJ

Checked: PJ
Proj. No: 3037.047

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP	Moisture	Soil Visual Description
Boring	Sample, No.	Depth, ft.	As Rec.	Minimum	Saturated	mg/kg	mg/kg	%		(Redox)	As Received	
						Dry Wt.	Dry Wt.	Dry Wt.		mv	%	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	Cal 643	SM 2580B	ASTM D2216	
DH-1	5B	30.5	-	3089	-	15	<5	<0.0005	8.3	-	15.7	Reddish Brown Silty SAND

Cacique and Soledad Bicycle and Pedestrian Bridges Project

Log of Test Boring Plan Sheet

Bengal Engineering
250 Big Sur Drive
Goleta CA 93117
Telephone: (805) 563-0788

BORING NUMBER B-1

PAGE 1 OF 2

CLIENT City of Santa Barbara
PROJECT NAME Cacique & Soledad Ped Bridges
PROJECT NUMBER
PROJECT LOCATION Cacique St @ Sycamore Creek
DATE STARTED 3/12/15 **COMPLETED** 3/12/15
GROUND ELEVATION 29.5 ft NAVD 88 **HOLE SIZE** 8" inches
DRILLING CONTRACTOR Choice Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA - CME 75
▽ **AT TIME OF DRILLING** 16.00 ft / Elev 13.50 ft
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES Drill Road and Auto Hammer Used
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0				**3" Asphalt Concrete (AC) over 11" Aggregate Base (AB)**								
					Earth Fill (ef)								
					Alluvium (Qal)								
25	5	AU 1					11						
		MC 2	5-7		Sandy Silt to Silty Sand (SM/ML) - brown to grayish brown, medium dense, slightly moist to moist, scattered charcoal fragments (alluvium)		13	101					
20	10	SPT 3	2-3-5 (8)		Silt with some Sand (ML) - light borwn, medium stiff, moist		10						
15	15				Cuttings are finer-grained with increased moisture content								
		MC 4	11-12		▽ Clayey Sand (SC) - orange to reddish brown, stiff, very moist to wet		15	117				48	SV
10	20	SPT 5	7-5-10 (15)		Beds (4"-6" thick) of mottled Silty Clay (CL) and fine-grained Clayey Sand (SC) - orange-brown, medium stiff to medium dense, very moist to wet		17						
5	25	MC 6	6-11		Silty Clay (CL) to fine-grained Sandy Clay (SC) - reddish brown, medium stiff, very moist, mottled, occasional gravel clast		18	115	29	15	14		ATT
0	30	SPT 7	1-2-2 (4)		Silty Sand (SM), Silty Clay (CL) and Clayey Sand with Gravel - light orange brown to dark brown, loose to slightly stiff, very moist to wet		24					55	SV
-5	35	MC 8	30-50/5"		Silty Clay (CL) - rust orange to brown orange, hard, slightly moist, mottled								
-10	40				*Begin to add water to augers at 40' bg.								

(Continued Next Page)

BORING NUMBER B-1

PAGE 2 OF 2

CLIENT City of Santa Barbara

PROJECT NAME Cacique & Soledad Ped Bridges

PROJECT NUMBER

PROJECT LOCATION Cacique St @ Sycamore Creek

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS			FINES CONTENT (%)	OTHER TESTS
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
	40	SPT 9	2-4-7 (11)		Beds of fine-grained Silty Sand (SM/ML), Silty Clay (CL) and Clayey Silt (ML) - light brown to light orange brown, medium stiff to medium dense, very moist to wet		14 25	122					DS
-15	45												
		MC 10	6-8		Clayey Sand (SC) and Silty Clay (CL) - light ornage brown, slightly dense to medium stiff, very moist to wet		20	110				58	SV
-20	50												
		SPT 11	10-12-17 (29)		4" to 6" thick beds of Sandy Clay (SC), Sandy Silt (ML) and Silty Clay (CL) with scattered gravel - light orange brown, stiff/dense, moist to very moist		17						
-25	55												
					*Rougher drilling to 60' bg. Probable gravels and cobbles (?)								
-30	60												
		MC 12	30-50/5"		Gravelly Clay (GC) with occasional small SS cobble - brown, very stiff, moist		13						
-35	65												
					*Driller notes continued rough drilling to ~66' bg, eases to botton of boring.								
-40	70	SPT 13	7-8-10 (18)		Silty, Sandy Clay (SC) with scattered small gravel - orange brown, stiff, moist, mottled in areas		22						

Boring backfilled with native materials, sealed with bentonite pellets and capped with cold-mix asphalt at surface.
Bottom of borehole at 70.5 feet.

Bengal Engineering
250 Big Sur Drive
Goleta CA 93117
Telephone: (805) 563-0788

BORING NUMBER B-2

PAGE 1 OF 1

CLIENT City of Santa Barbara
PROJECT NAME Cacique & Soledad Ped Bridges
PROJECT NUMBER
PROJECT LOCATION Cacique St @ Sycamore Creek
DATE STARTED 3/12/15 **COMPLETED** 3/12/15
GROUND ELEVATION 29 ft NAVD 88 **HOLE SIZE** 8" inches
DRILLING CONTRACTOR Choice Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA - CME 75
▽ **AT TIME OF DRILLING** 18.00 ft / Elev 11.00 ft
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES Drill Road and Auto Hammer Used
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
	0				**4" Asphalt Concrete (AC) over 9" Aggregate Base (AB)**								
					Earth Fill (ef)								
					Alluvium (Qal)								
25	5												
		MC 1	8-10		Sandy Silt / Silty Sand (ML/SM) with occasional rootlet and scatterred charcoal fragments - brown, medium dense, slightly moist (alluvium)		7	106					DS
20	10												
		SPT 2	3-5-6 (11)		same as above (ML/SM), medium stiff / medium dense, slightly moist to moist, occasional root		16						
15	15												
		MC 3	7-8		Clayey fine Sand to Sandy Clay (SC) - reddish brown, medium stiff, very moist to wet		17	115					DS
					▽								
10	20												
		SPT 4	3-4-5 (9)		same as above (SC), slightly to medium stiff, wet to very moist, occasionally mottled		18						CHEM
5	25												
		MC 5	9-10		Beds of Clayey Silt (ML), Silty Clay (CL), and fine-grained Sandy Clay / Clayey Sand (SC) - orange brown, medium stiff, very moist		19	115					
0	30												
		SPT 6	6-11-18 (29)		Clayey Sand (SC) grading to Silty Clay (CL) - reddish brown, medium dense to hard (clay), moist to slightly moist, mottled		19		35	17	18		ATT
-5	35												
		MC 7	8-7		Sandy, Silty Clay (CL) - orange brown, stiff, moist, varicolored and mottled		19	114					
-10	40												
		SPT 8	6-8-10 (18)		Clayey Sand to Sandy Clay (SC) with occasional gravel and Silty Clay (CL) with trace Sand - orange brown to reddish brown, stiff, moist to very moist, mottled		21						

Boring backfilled with native materials, sealed with bentonite pellets and capped with cold-mix asphalt at surface.
Bottom of borehole at 41.5 feet.

BENGAL GEOTECH BH V5 - BENGAL MOD GINT STD US LAB 2-10-10.GDT - 10/13/15 21:15 - C:\PROGRAM FILES (X86)\GINT\PROJECTS\CACIQUE-SOLEDAD.GPJ

Bengal Engineering
250 Big Sur Drive
Goleta CA 93117
Telephone: (805) 563-0788

BORING NUMBER B-3

PAGE 1 OF 2

CLIENT City of Santa Barbara

PROJECT NAME Cacique & Soledad Ped Bridges

PROJECT NUMBER

PROJECT LOCATION Cacique St @ Sycamore Creek

DATE STARTED 3/12/15 **COMPLETED** 3/12/15

GROUND ELEVATION 30 ft NAVD 88 **HOLE SIZE** 8" inches

DRILLING CONTRACTOR Choice Drilling

GROUND WATER LEVELS:

DRILLING METHOD HSA - CME 75

∇ **AT TIME OF DRILLING** 18.00 ft / Elev 12.00 ft

LOGGED BY E. Pongracz **CHECKED BY**

AT END OF DRILLING ---

NOTES Drill Road and Auto Hammer Used

AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES CONTENT (%)	OTHER TESTS
30	0				**Asphalt Concrete (AC) - 3" thick, no base below**								
					Earth Fill (ef)								
					Alluvium (Qal)								
25	5	SPT 1	3-3-4 (7)		Sandy Silt/Silty Sand (SM/ML) with widely scattered root and charcoal fragments - brown, slightly dense, slightly moist		9						
		BULK AU 2					8					44	SV
20	10	MC 3	6-9		Silty Sand to Sandy Silt (SM/ML) to Clayey Silt (ML) - light brown, medium dense / medium stiff, moist to wet		15	114					
15	15	SPT 4	5-6-10 (16)		Clayey Silt (ML) - reddish brown, stiff, moist, occasional mottles		16		28	17	11		ATT
					∇								
10	20	MC 5	6-7		Clayey Silt (ML) to Silty Clay (CL) - reddish brown, medium stiff, moist to very moist		18	113					CONS
5	25	SPT 6	4-5-6 (11)		Silty Clay (CL) to Clayey Silt (ML) - orange borwn, medium stiff to stiff, moist *Free water probably encountered for first time while drilling to 30' below grade.		21		30	19	11		ATT
0	30	MC 7	30-50/4"		Clay with Silt (CL) - brown, very stiff to hard, moist; in sharp contact with Silty Clay with Gravel (CL) - orange brown, very stiff, moist		13	125	34	20	14		CONS, ATT
-5	35	SPT 8	5-12-14 (26)		Silty Clay (CL) with scattered small gravel - light brown, very stiff, moist; in sharp contact with fine-grained Sand with Silt (SP) - brownish orange, dense, wet		22						
-10	40												

(Continued Next Page)

Bengal Engineering
250 Big Sur Drive
Goleta CA 93117
Telephone: (805) 563-0788

BORING NUMBER B-3

PAGE 2 OF 2

CLIENT City of Santa Barbara

PROJECT NAME Cacique & Soledad Ped Bridges

PROJECT NUMBER

PROJECT LOCATION Cacique St @ Sycamore Creek

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS			FINES CONTENT (%)	OTHER TESTS
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
-10	40	☒ MC 9	18-50/3"		Fine- to coarse-Sand with some silt (SW) grading to Gravelly Clay (GC) with fine sand and occasional small cobble - browinish orange, dense / stiff, moist to wet *Rougher drilling from 40' to 50' below grade.		15	122					
-15	45												
-20	50	SPT 10	12-30-32 (62)		Beds of Sand with Silt (SP), Gravelly Sand (SW), and Silty Clay with Gravel (CL/GC) - light brown, stiff / very dense, moist		14						
-25	55				*Driller notes hard drilling @ 55' below grade.								
-30	60	SPT 11	5-10-19 (29)		Bedded Silty Clay (CL), Clayey Silt with Gravel (ML) and fine-grained Sand with Silt (SP/SM) - orange brown to reddish brown, very stiff to dense, moist *Driller notes easier drilling on way to 70' bg.		20						
-35	65												
-40	70	SPT 12	18-27-34 (61)		4" to 6" thick beds of Gravelly Clay (GC), Gravelly Sand (SW) and Silty Sand (SM) with gravel - brownish orange, very dense / very stiff, moist, occasional small cobble of sandstone		14						

Boring backfilled with native materials, sealed with bentonite pellets and capped with cold-mix asphalt at surface.

Bottom of borehole at 71.5 feet.

Laboratory Testing

SubSurface Designs Inc.

12848 Foothill Boulevard • Sylmar, California 91342
(818) 898-1595 • (Fax) 898-4003

April 14, 2015

PIN# 7000X

Bengal Engineereing, Inc.
250 Big Sur Drive
Goleta, California 93117

Subject: Cacique-Soledad Pedestrian Bridges
Results of Laboratory Testing

Dear Sirs:

Pursuant to your request please find attached hereto the results of soil engineering laboratory testing on the soil samples you provided. Sampling techniques, subsurface conditions, and other factors may vary across the subject site. Therefore, the test results may or may not be representative of the overall site conditions and care should be taken accordingly in interpreting the testing data provided. Interpretation of the laboratory test results and applications of the results on the design and construction of the project are beyond the scope of our work.

Services performed by this facility were conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other warranties are either expressed or implied.

If you have any questions, please do not hesitate to contact this office.

Respectfully submitted:
SUBSURFACE DESIGNS, INC.

REGISTERED PROFESSIONAL ENGINEER
JONATHAN EDWARD MAHN
C 60293
CIVIL
STATE OF CALIFORNIA

Jon Mahn
Principal Engineer
RCE 60293

JEM/mm: 7000X

Dist: (2) Addressee
(1) File

LABORATORY TESTING RESULTS

Laboratory Testing Method

Laboratory Recapitulation - Table I-1

Chemical Test Results - Table I-2

Atterberg Limits

Sieve Analysis

Shear Strength Diagram

Consolidation Diagram

LABORATORY TESTING METHODS

Soil Classification

Soils are visually classified in accordance with the latest version of ASTM D 2488. Soils are classified in accordance with the latest version of ASTM D 2487 when testing, such as laboratory determination of particle-size characteristics, liquid limit, and plasticity index, is performed.

Moisture and Density Tests

The moisture content and in-place dry density of all undisturbed samples obtained were determined. The test results are presented in the Laboratory Recapitulation - Table I. Tests are performed in accordance with the latest version of ASTM D 2216.

Direct Shear Tests

Direct single-shear tests were performed on representative undisturbed samples to determine their strength characteristics. The desired normal load was applied to the specimen and allowed to come to equilibrium. The rate of deflection on the sample was between 0.01 and 0.005 inches per minute. All samples were saturated prior to shear testing. The results are plotted on the Shear Test Diagrams. Tests are performed in accordance with the latest version of ASTM D 3080.

Consolidation

Consolidation tests were performed on undisturbed samples to predict the soils behavior under a specific load. Loads are applied in increasing load increments and the results are recorded. The samples are usually inundated at a designated load to determine the effect of water contacting the bearing soil. The results are plotted on the "Consolidation Pressure Curve," figures. The load at which the water is added is noted on the drawing. Tests are performed in accordance with the latest version of ASTM D 2435.

Sieve Analysis

Dry Method:

A group of fourteen (14) sieves are assembled, with the sieve having the largest opening at the top, and the one having the smallest at the bottom. A solid collecting pan is placed below the bottom sieve. A 3000 gram specimen is weighed to within ±0.1g and placed in the topmost sieve. The assembly is completed by placing a solid cover over the top sieve. The sieve assembly is securely fastened into a mechanical sieve-shaking device. The group of assembled sieves is subjected to the action of the sieve shaker for a period of 300 seconds. Each sieve and the pan is weighed to within ±0.1g to determine the portion of the specimen retained. Tests are performed in accordance with the latest version of ASTM D 421.

Sieve Series	
Sieve #	Opening (mm)
3"	75.00
2"	50.00
1.5"	38.10
1"	25.40
¾"	19.00
⅜"	9.50
4	4.75
10	2.00
20	0.85
30	0.60
50	0.30
80	0.18
100	0.15
200	0.075
Pan	-

Atterberg Limits

This test covers the determination of the liquid limit, plastic limit, and the plasticity index of soils. Tests are performed in accordance with the latest version of ASTM D 4318.

LABORATORY RECAPITULATION - TABLE I-1

PIN 7000X / Cacique-Soledad Pedestrian Bridges

Location	Depth	Material Description	In Situ Dry Density (P.C.F.)	In Situ Water (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	%Passing # 200 Sieve	Max. Dry Density (pcf)	Optimum Moisture (%)	Expansion Index
B - 1	1.5	Sandy Silt / Silty Sand (SM/ML)		11.0							
B - 1	5.0	Sandy Silt / Silty Sand (SM/ML)	101.4	13.1							
B - 1	10.0	Silty Sand (ML)		9.8							
B - 1	15.0	Calyey Sand (SC)	117.3	15.1				47.7			
B - 1	20.0	Silty Clay (CL) Clayey Sand (SC)		16.6							
B - 1	25.0	Silty Clay (CL) Clayey Sand (SC)	114.9	18.3	28.9	15.4	10				
B - 1	30.0	Silty Sand (SM) Silty Clay (CL) Clayey Sand		24.4				54.9			
B - 1	35.0	Silty Clay (CL)									
B - 1	40.0	Silty Sand (SM/ML) Silty Clay (CL) Clayey Silt (ML)		24.9							
B - 1	40.1	Silty Sand (SM/ML) Silty Clay (CL) Clayey Silt (ML)	122.1	14.4							
B - 1	45.0	Clay Sand (SC) Silty Clay (CL)	110.0	20.4				58.1			
B - 1	50.0	Sandy Clay (SC) Sandy Silt (ML) Silty Clay (CL)		17.3							
B - 1	60.0	Gravelly Clay (GC)		13.1							
B - 1	69.0	Silty Sandy Clay (SC)		21.9							
B - 2	5.0	Sandy Silt / Silty Sand (ML/SM)	106.4	6.6							
B - 2	10.0	Sandy Silt / Silty Sand (ML/SM)		15.7							
B - 2	15.0	Clayey Sand / Sandy Clay (ML/SM)	114.9	17.1							
B - 2	20.0	Clayey Sand / Sandy Clay (ML/SM)		17.6							
B - 2	25.0	Clayey Silt (ML) Silty Clay (CL)	115.1	19.0							
B - 2	30.0	Clayey Sand (SC) Silty Clay (CL)		19.4	35.3	16.8	20				
B - 2	35.0	Sandy Silty Clay (CL)	113.7	19.2							
B - 2	40.0	Clayey Sand / Sandy Clay (SC)		21.4							
B - 3	5.0	Sandy Silt (SM/ML)		9.0							
B - 3	7.0	Silty Sand / Sandy Silt (SM/ML) Clayey Silt (ML)		8.0				43.7			
B - 3	10.0	Silty Sand / Sandy Silt (SM/ML) Clayey Silt (ML)	113.6	15.1							
B - 3	15.0	Clayey / Silt (ML)		16.2	28.2	17.1	10				
B - 3	20.0	Clayey / Silt (ML) Silty Clay (CL)	113.4	18.3							
B - 3	25.0	Silty Clay (CL) Clayey Silt (CL)		20.9	29.6	18.9	10				
B - 3	30.0	Clayey Silt (CL) Silty Clay With Gravels (CL)	125.3	12.9	34.0	19.6	10				
B - 3	35.0	Silty Clay (CL) Sandy Silt (SP)		21.9							
B - 3	40.0	Sand with Silt (SW) Gravelly Clay (GC)	121.9	15.3							
B - 3	50.0	Sandyu with Silt (SP) Silty Clay with Gravels (CL/GC)		14.2							
B - 3	60.0	Silty Clay (CL) Clayey Silt		19.9							

SubSurface Designs, Inc.

LABORATORY RECAPITULATION - TABLE I-1

PIN 7000X / Cacique-Soledad Pedestrian Bridges

Location	Depth	Material Description	In Situ Dry Density (P.C.F.)	In Situ Water (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	%Passing # 200 Sieve	Max. Dry Density (pcf)	Optimum Moisture (%)	Expansion Index
B - 3	70.0	with Gravels (ML) Gravelly Sand (SW) SIlty Sand (SM)		14.2							

CHEMICAL TEST RESULTS

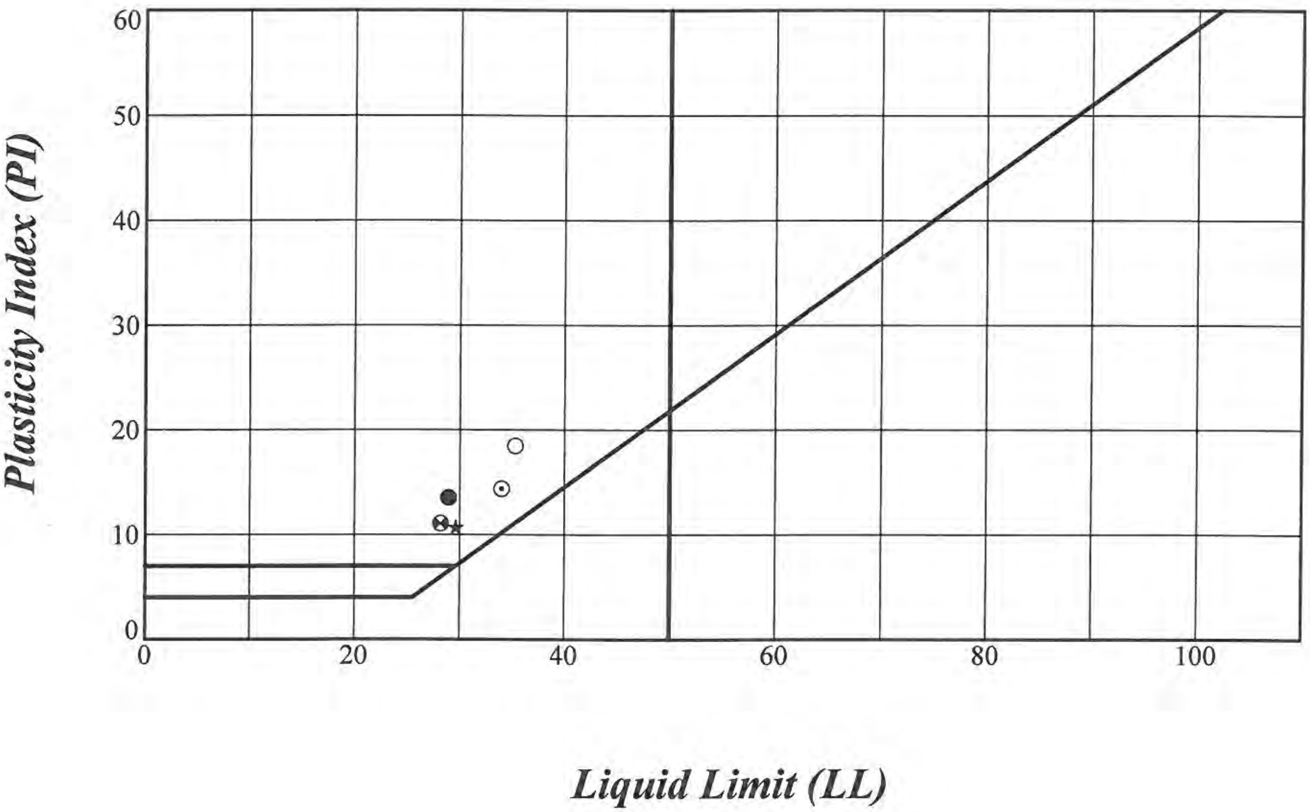
Table C-2

Location	Depth (ft)	Sulfate (ppm)	Chloride (ppm)	pH	Resistivity (Ohms-cm)
B-2	20.0	112	30	7.14	1200

ATTERBERG LIMITS

PROJECT NAME: *Cacique-Soledad Pedestrian Bridges*

PROJECT NUMBER: *PIN 7000X*



Sample Identification			Material Description	LL	PL	PI
●	B - 1	25.0'	Silty Clay (CL) Clayey Sand (SC)	29	15	14
○	B - 2	30.0'	Clayey Sand (SC) Silty Clay (CL)	35	17	18
⊗	B - 3	15.0'	Clayey Silt (ML)	28	17	11
★	B - 3	25.0'	Silty Clay (CL) Clayey Silt (CL)	30	19	11
⊙	B - 3	30.0'	Clayey Silt (CL) Silty Clay With Gravels (CL)	34	20	14

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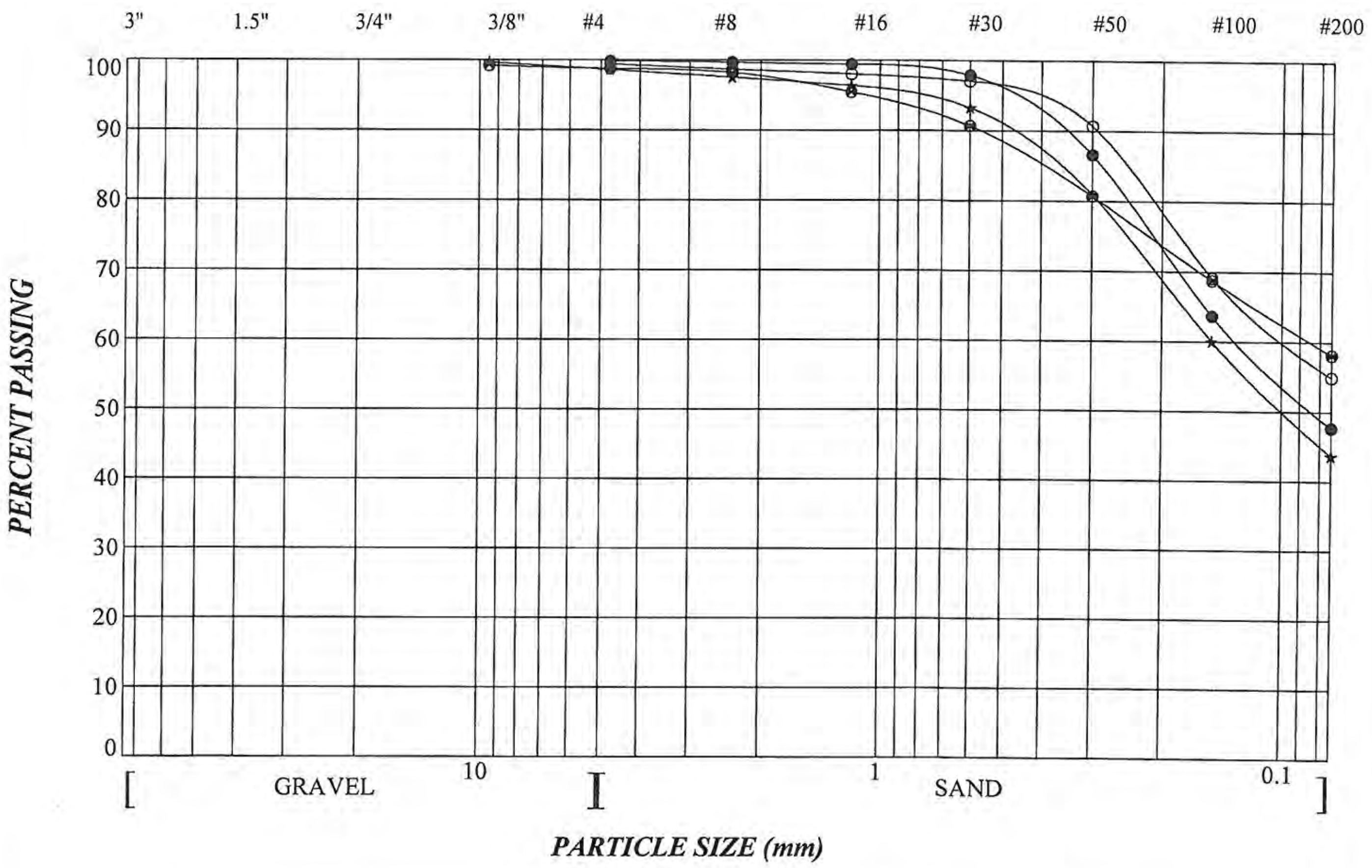
SIEVE ANALYSIS

PROJECT NAME: *Cacique-Soledad Pedestrian Bridges*

PROJECT NUMBER: *PIN 7000X*



Sample Identification			Material Description	LL	PL	PI	Cc	Cu
●	B - 1	15.0'	Calyey Sand (SC)					
○	B - 1	30.0'	Silty Sand (SM) Silty Clay (CL) Clayey Sand					
⊗	B - 1	45.0'	Clay Sand (SC) Silty Clay (CL)					
★	B - 3	7.0'	Silty Sand / Sandy Silt (SM/ML) Clayey Silt (ML)					

Sample Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B - 1	15.0'	4.75	0.128				52.1	47.7	
○	B - 1	30.0'	4.75	0.096				44.5	54.9	
⊗	B - 1	45.0'	9.5	0.085			0.4	40.6	58.1	
★	B - 3	7.0'	9.5	0.15			1.0	54.9	43.7	

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Figure SV.1

SHEAR TEST

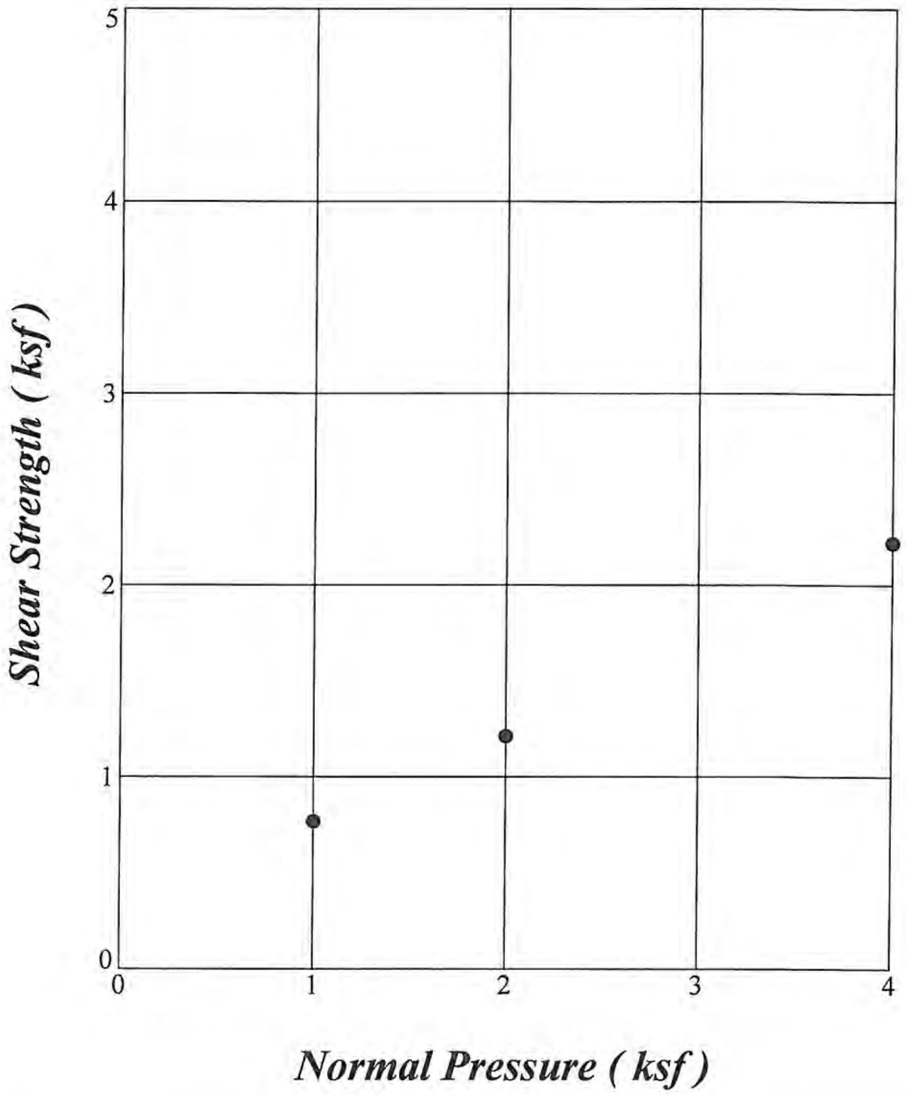
PROJECT NAME: *Cacique-Soledad Pedestrian Bridges*

SAMPLE ID: *B - 1 @ 40.00'*

PROJECT NUMBER: *PIN 7000X*

MATERIAL DESCRIPTION: *Silty Sand (SM/ML) Silty Clay (CL) Clayey Sil*

TEST METHOD: *Ultimate Saturated Shear*



MOISTURE CONTENT (%)	DENSITY (pcf)	RESULTS
In Situ: *24.9*		Phi (deg.):
Saturated: *19.7*	Dry Density:	Cohesion (ksf):

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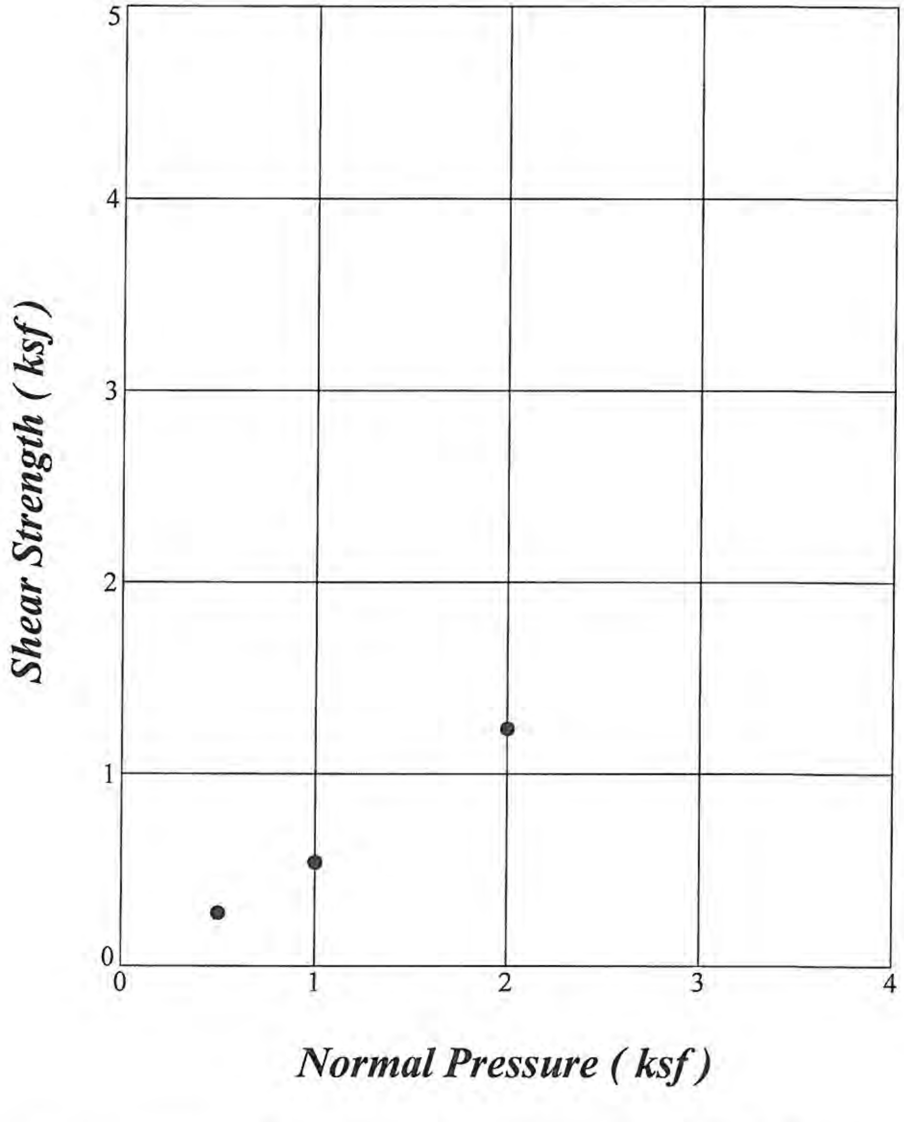
Figure S.1

SHEAR TEST

PROJECT NAME: *Cacique-Soledad Pedestrian Bridges*	SAMPLE ID: *B - 2 @ 5.00'*
PROJECT NUMBER: *PIN 7000X*	MATERIAL DESCRIPTION: *Sandy Silt / Silty Sand (ML/SM)*
TEST METHOD: *Ultimate Saturated Shear*	



MOISTURE CONTENT (%)		DENSITY (pcf)		RESULTS	
In Situ:	*6.6*			Phi (deg.):	
Saturated:	*24.7*	Dry Density:	*106.4*	Cohesion (ksf):	

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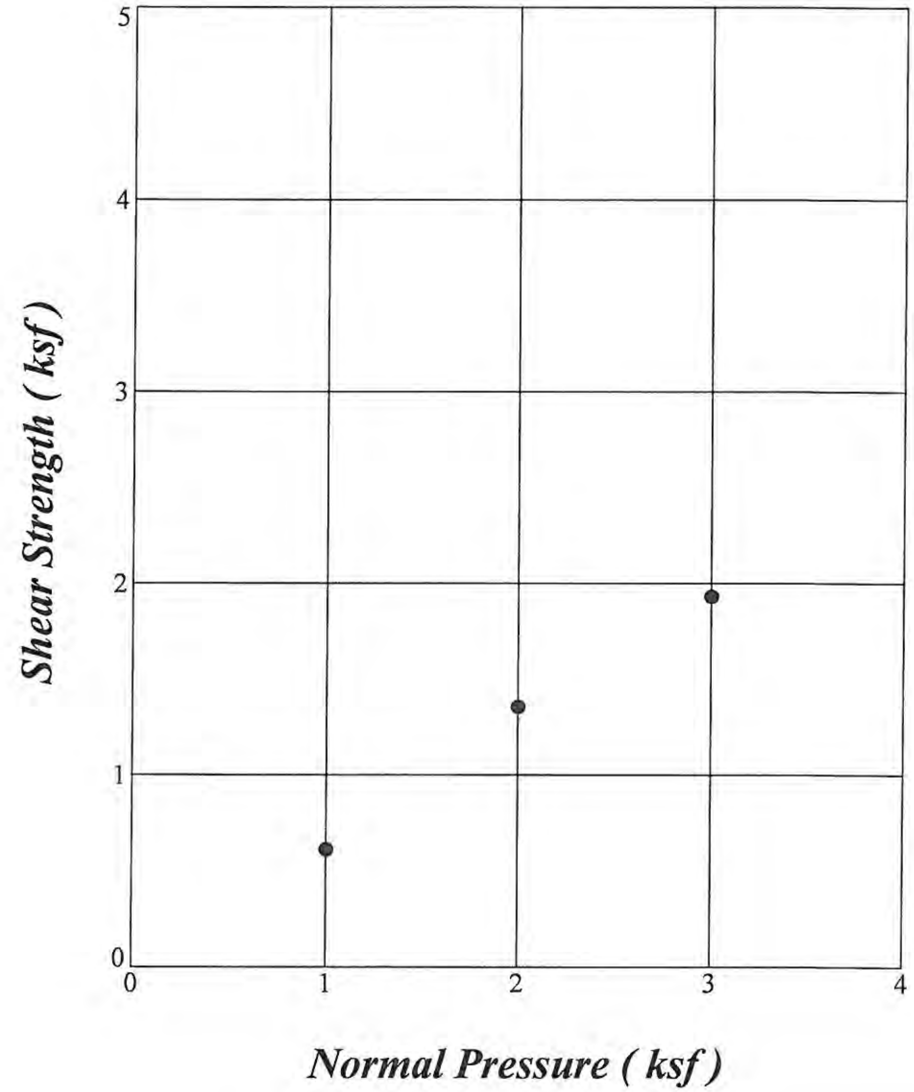
Figure S.2

SHEAR TEST

PROJECT NAME: *Cacique-Soledad Pedestrian Bridges*	SAMPLE ID: *B - 2 @ 15.00'*
PROJECT NUMBER: *PIN 7000X*	MATERIAL DESCRIPTION: *Clayey Sand / Sandy Clay (ML/SM)*

TEST METHOD: *Ultimate Saturated Shear*



MOISTURE CONTENT (%)		DENSITY (pcf)		RESULTS	
In Situ:	*17.1*			Phi (deg.):	
Saturated:	*19.4*	Dry Density:	*114.9*	Cohesion (ksf):	

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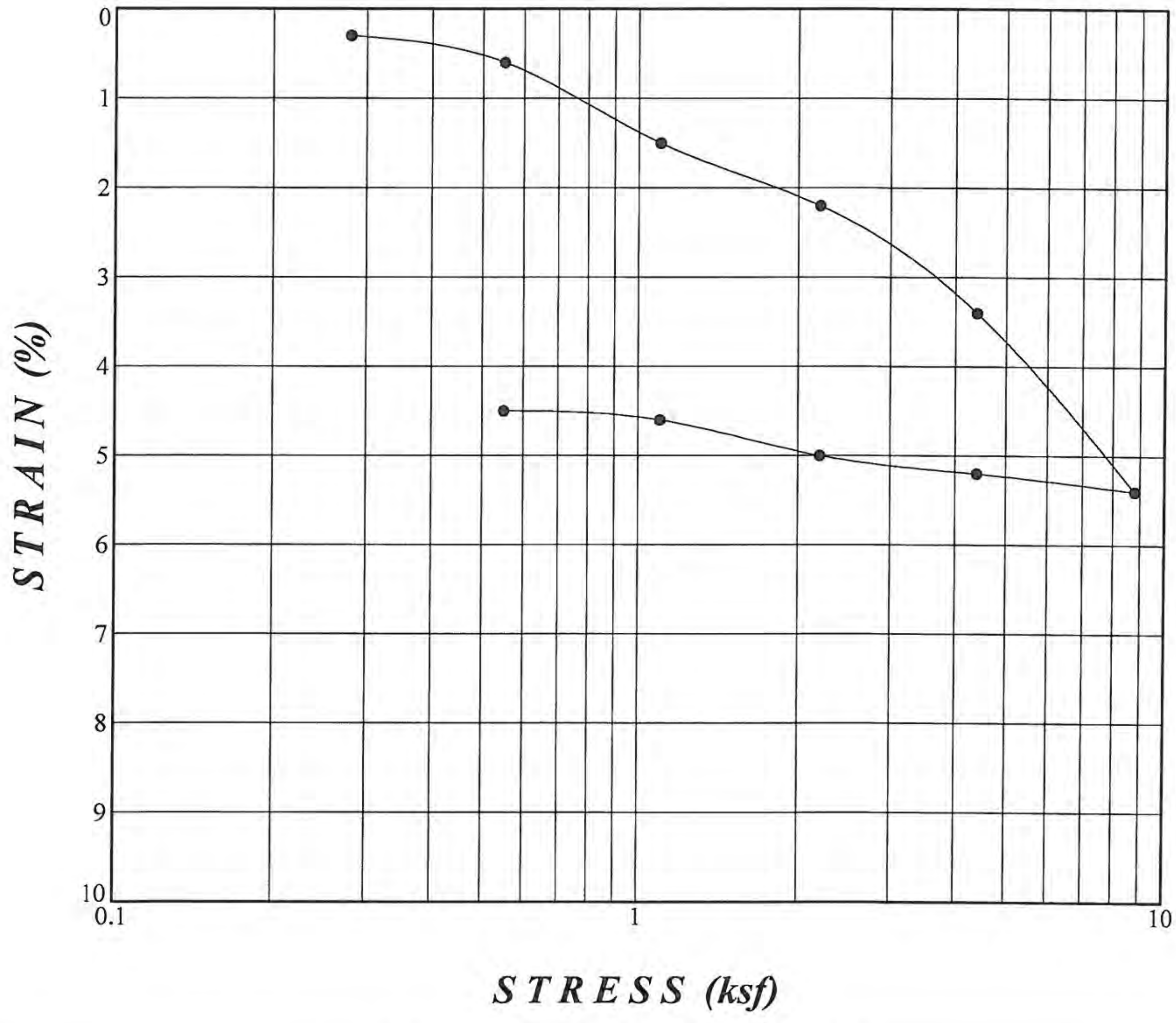
Figure S.3

CONSOLIDATION TEST

PROJECT NAME: *Cacique-Soledad Pedestrian Bridges*	SAMPLE ID: *B - 3 @ 20.00'*
PROJECT NUMBER: *PIN 7000X*	MATERIAL DESCRIPTION: *Clayey / Silt (ML) Silty Clay (CL)*

Load (psf) water added to test at: 100



MOISTURE CONTENT (%)		DRY DENSITY (pcf)		
In Situ:	*18.3*	Before Test:	*113.4*	

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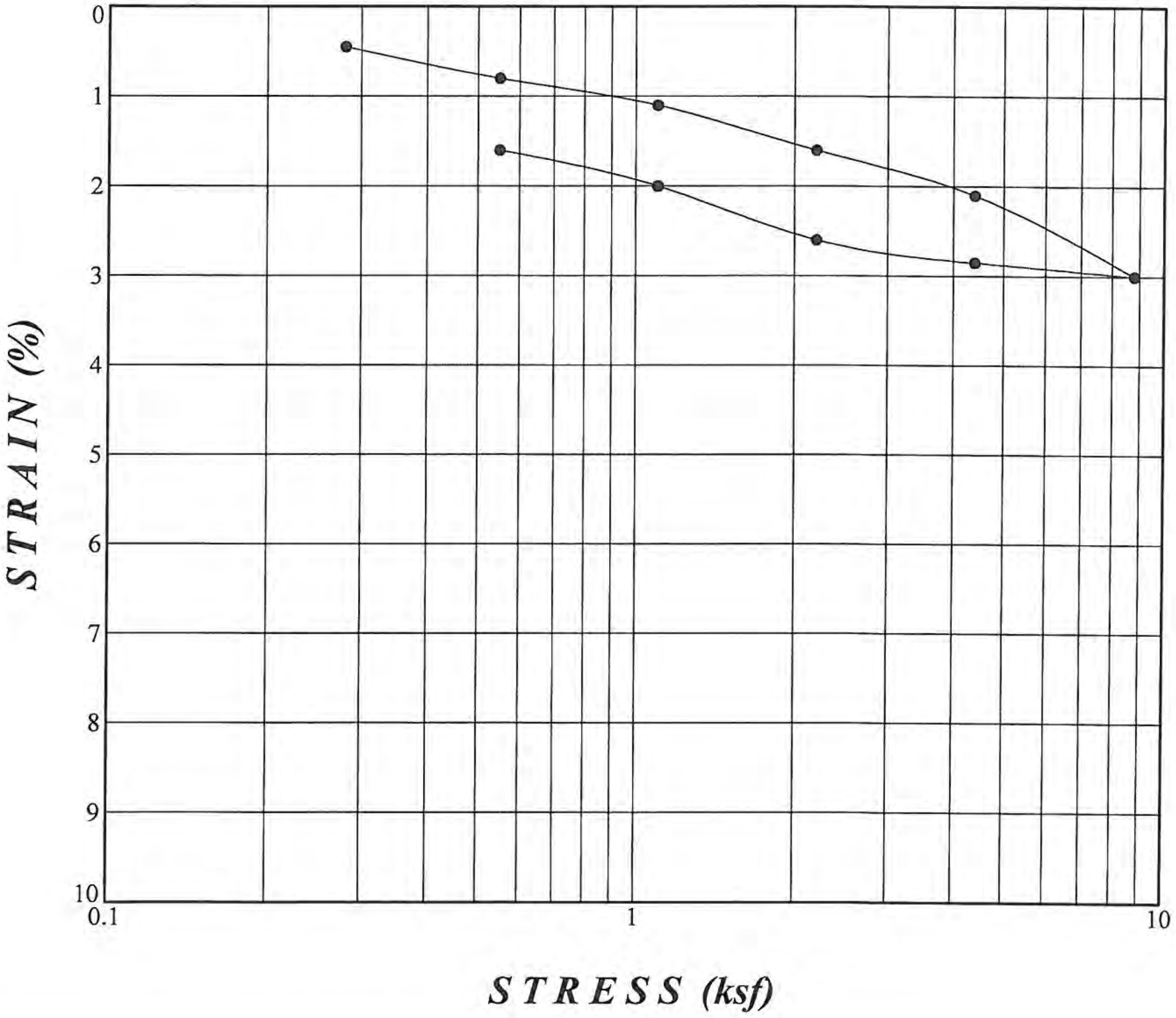
CONSOLIDATION TEST

PROJECT NAME: *Cacique-Soledad Pedestrian Bridges*	SAMPLE ID: *B - 3 @ 30.00'*
PROJECT NUMBER: *PIN 7000X*	MATERIAL DESCRIPTION: *Clayey Silt (CL) Silty Clay With Gravels (CL)*

Load (psf) water added to test at: 100



MOISTURE CONTENT (%)	DRY DENSITY (pcf)	
In Situ: *12.9*	Before Test: *125.3*	

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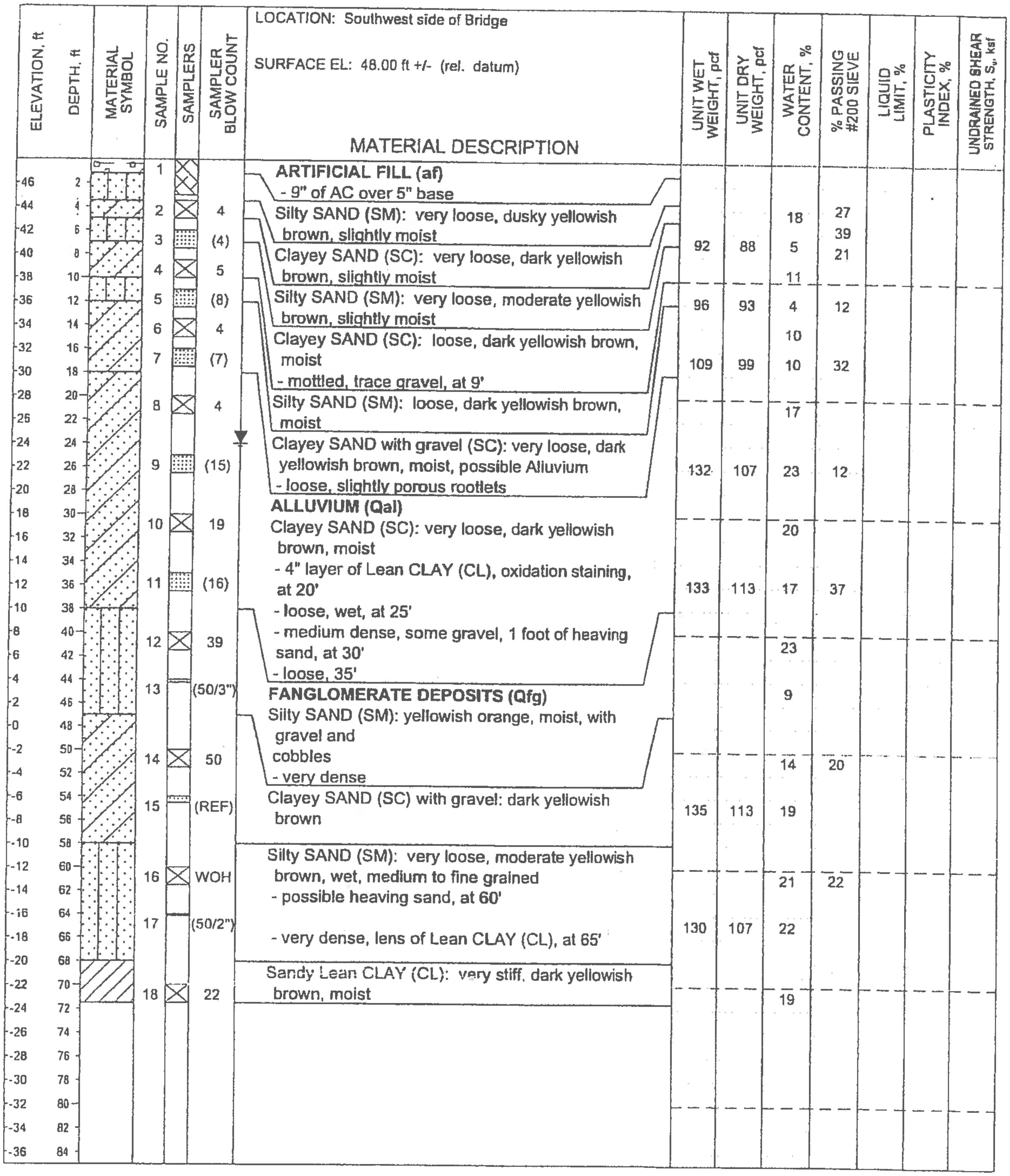
Figure C.2

Mason Street Pedestrian Bridge Project

Log of Test Boring Plan Sheet

January 2002
Project No. 01-42-0941

FUGRO



LOCATION: Southwest side of Bridge

SURFACE EL: 48.00 ft +/- (rel. datum)

SAMPLE NO.	SAMPLER BLOW COUNT	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
1								
2	4			18	27			
3	(4)	92	88	5	39 21			
4	5			11				
5	(8)	96	93	4	12			
6	4			10				
7	(7)	109	99	10	32			
8	4			17				
9	(15)	132	107	23	12			
10	19			20				
11	(16)	133	113	17	37			
12	39			23				
13	(50/3")			9				
14	50			14	20			
15	(REF)	135	113	19				
16	WOH			21	22			
17	(50/2")	130	107	22				
18	22			19				

MATERIAL DESCRIPTION

ARTIFICIAL FILL (af)
- 9" of AC over 5" base

Silty SAND (SM): very loose, dusky yellowish brown, slightly moist

Clayey SAND (SC): very loose, dark yellowish brown, slightly moist

Silty SAND (SM): very loose, moderate yellowish brown, slightly moist

Clayey SAND (SC): loose, dark yellowish brown, moist
- mottled, trace gravel, at 9'

Silty SAND (SM): loose, dark yellowish brown, moist

Clayey SAND with gravel (SC): very loose, dark yellowish brown, moist, possible Alluvium
- loose, slightly porous rootlets

ALLUVIUM (Qal)

Clayey SAND (SC): very loose, dark yellowish brown, moist
- 4" layer of Lean CLAY (CL), oxidation staining, at 20'
- loose, wet, at 25'
- medium dense, some gravel, 1 foot of heaving sand, at 30'
- loose, 35'

FANGLOMERATE DEPOSITS (Qfg)

Silty SAND (SM): yellowish orange, moist, with gravel and cobbles
- very dense

Clayey SAND (SC) with gravel: dark yellowish brown

Silty SAND (SM): very loose, moderate yellowish brown, wet, medium to fine grained
- possible heaving sand, at 60'
- very dense, lens of Lean CLAY (CL), at 65'

Sandy Lean CLAY (CL): very stiff, dark yellowish brown, moist

COMPLETION DEPTH: 71.5 ft
DEPTH TO WATER: 24.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: December 10, 2001

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

DRILLING METHOD: 8-in. dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Testing
LOGGED BY: CWelke
CHECKED BY: GSDenlinger

LOG OF DRILL HOLE NO. DH-1
Mason Street Bridge
Santa Barbara, California

PLATE A-1

LOCATION: Northeast side of Bridge

SURFACE EL: 48.00 ft +/- (rel. datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
46	2					**ARTIFICIAL FILL (af)** 8.5" AC over 5.5" base							
44	4		1	☒	(7)	Silty SAND (SM): loose, dusky yellowish brown, slightly moist	107	97	10				
42	6		2	☒	2								
40	8		3	☒		fine grained sand			6				
38	10		4	▦	(5)	- very loose	101	91	11	27			
36	12		5	☒	4	- slightly darker			12				
34	14		6	▦	(7)	- 3" lens of Lean CLAY (CL), thick Clayey SAND (SC): loose, dusky yellowish brown, moist, roots up to 1/8" in diameter, oxidation zones, possible Alluvium	105	96	10				
32	16		7	☒	4				25				
30	18												
28	20		8	▦	(67)	Sandy Lean CLAY (CL): soft, dark yellowish brown, moist, roots up to 1/8" in diameter, possible Alluvium	292	277	6				
26	22												
24	24												
22	26		9	☒	5	**ALLUVIUM (Qal)** Clayey SAND (SC) with gravel and cobbles: dense, dark yellowish brown, moist			10				
20	28												
18	30		10	☒	10	- loose, moist to wet, at 25' - moderate yellowish brown, wet, at 30'			18	15			
16	32												
14	34												
12	36		11	▦	(17)	- medium dense, at 30'	129	105	23				
10	38					**FANGLOMERATE DEPOSITS (Qfg)**							
8	40		12	▦	(50/4")	Clayey SAND with gravel (SC): very dense, dusky yellowish brown, moist, cobbles	131	106	24				
6	42												
4	44												
2	46		13	☒	26	- medium dense, at 45'			25				
0	48												
-2	50		14	▦	(41)	Sandy lean CLAY (CL) to Clayey SAND (SC): very stiff, dark yellowish orange, moist, sandy	128	106	21	35			
-4	52												
-6	54												
-8	56		15	☒	23	- lenses of Clayey SANDY (SC), fine grained sand			19	24			
-10	58												
-12	60		16	▦	(50/5")		136	116	18				
-14	62												
-16	64					- harder drilling from 62' to 63'							
-18	66		17	☒	27				18				
-20	68												
-22	70		18	▦	(52)	Sandy Lean CLAY (CL): hard, dark yellowish brown, moist, lenses of Sandy CLAY (SC)	129	103	24				
-24	72												
-26	74												
-28	76		19	☒	38	Clayey GRAVEL with sand (GC): dense, dark yellowish brown, moist subrounded							
-30	78												
-32	80		20	▦	(83)	- very dense							
-34	82												
-36	84												

COMPLETION DEPTH: 80.5 ft
DEPTH TO WATER: 25.0 ft
BACKFILLED WITH: Cuttings
DRILLING DATE: December 11, 2001

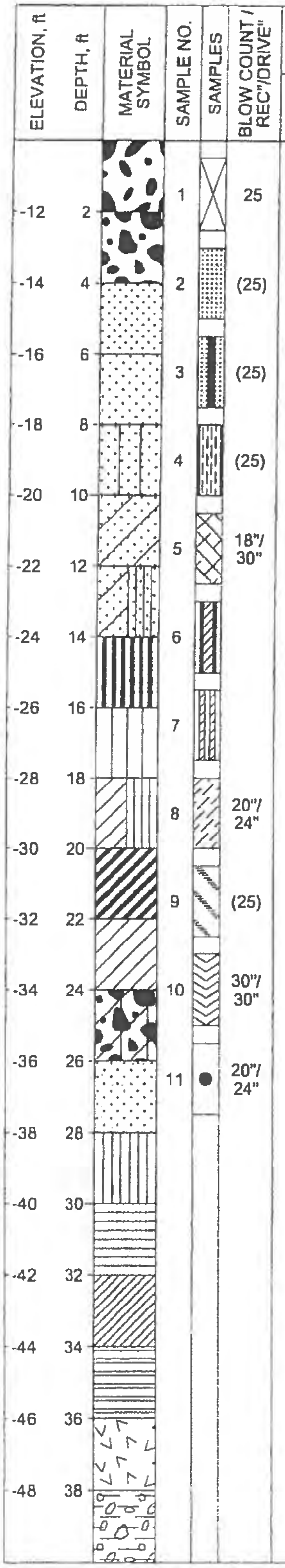
The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

DRILLING METHOD: 8-in. dia. Hollow Stem Auger
HAMMER TYPE: Automatic Trip
DRILLED BY: S/G Testing
LOGGED BY: CWelke
CHECKED BY: GSDenlinger

LOG OF DRILL HOLE NO. DH-2
Mason Street Bridge
Santa Barbara, California

PLATE A-2

LOCATION: The drill hole location referencing local landmarks or coordinates
SURFACE EL: Using local, MSL, MLLW or other datum



MATERIAL DESCRIPTION

COARSE GRAINED

Well graded GRAVEL (GW)

Poorly graded GRAVEL (GP)

Well graded SAND (SW)

Poorly graded SAND (SP)

Silty SAND (SM)

Clayey SAND (SC)

Silty, Clayey SAND (SC-SM)

FINE GRAINED

Elastic SILT (MH)

SILT (ML)

Silty CLAY (CL-ML)

Fat CLAY (CH)

Lean CLAY (CL)

ROCK

CONGLOMERATE

SANDSTONE

SILTSTONE

MUDSTONE

CLAYSTONE

SHALE

GRANITE

Paving and/or Base Materials

General Notes

Soil Texture Symbol

Sloped line in symbol column indicates transitional boundary

Samplers and sampler dimensions (unless otherwise noted in report text) are as follows:

Symbol for:	
1	SPT Sampler, driven 1 3/8" ID, 2" OD
2	CA Liner Sampler, driven 2 3/8" ID, 3" OD
3	CA Liner Sampler, disturbed 2 3/8" ID, 3" OD
4	Thin-walled Tube, pushed 2 7/8" ID, 3" OD
5	Bulk Bag Sample (from cuttings)
6	Hand Auger Sample
7	CME Core Sample
8	Lexan Sample
9	Pitcher Sample
10	Vibracore Sample
11	No Sample Recovered

Sampler Driving Resistance

Number of blows with 140 lb. hammer, falling 30-in. to drive sampler 1-ft. after seating sampler 6-in.; for example,

Blows/ft	Description
25	25 blows drove sampler 12" after initial 6" of seating
86/11"	After driving sampler the initial 6" of seating, 36 blows drove sampler through the second 6" interval, and 50 blows drove the sampler 5" into the third interval
50/6"	50 blows drove sampler 6" after initial 6" of seating
Ref/3"	50 blows drove sampler 3" during initial 6" seating interval

Blow counts for California Liner Sampler shown in ( )

Length of sample symbol approximates recovery length

Classification of Soils per ASTM D2487 or D2488

Geologic Formation noted in bold font at the top of interpreted interval

Strength Legend

Q = Unconfined Compression
u = Unconsolidated Undrained Triaxial
t = Torvane
p = Pocket Penetrometer
m = Miniature Vane

Water Level Symbols

▽	Initial or perched water level
▼	Final ground water level
∿	Seepages encountered

Rock Quality Designation (RQD) is the sum of recovered core pieces greater than 4 inches divided by the length of the cored interval.

KEY TO TERMS & SYMBOLS USED ON LOGS

Laboratory Testing

LOCATION	SAMPLE NUMBER	DEPTH, ft	SAMPLE CLASSIFICATION	UWW pcf	UDW pcf	MC %	FINES %	LL %	PI %	COMPACTION TEST MAX DD pcf	COMPACTION TEST OPT MC %	DIRECT SHEAR TEST C ksf	DIRECT SHEAR TEST PHI deg	COMPRESSIVE STRENGTH TESTS Q_u ksf	COMPRESSIVE STRENGTH TESTS S_u Cell Prs. ksf	CORROSIVITY TESTS R	CORROSIVITY TESTS pH	CORROSIVITY TESTS Cl	CORROSIVITY TESTS SO_4	R-VALUE	EXPANSION INDEX	TEST LISTING
DH-1		3.0	Silty SAND (SM)				27													33		S, R
DH-1	2	3.5	Clayey SAND (SC)			18	39															M, S, H
DH-1	3	6.0	Silty SAND (SM)	92	88	5	21					0.33	26									T, D, F
DH-1	4	8.5	Clayey SAND (SC)			11																M
DH-1	5	11.0	Silty SAND (SM)	96	93	4	12															T, F
DH-1	6	13.5	Clayey SAND (SC)			10																M
DH-1	7	16.0	Clayey SAND (SC)	109	99	10	32					0.20	33									T, D, F
DH-1	8	20.0	Clayey SAND (SC)			17										2977	7.92	124	15			M, Co
DH-1	9	25.0	Clayey SAND (SC)	132	107	23	12															T, F
DH-1	10	30.0	Clayey SAND (SC)			20																M

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Direct Shear Test
C = Assigned Cohesion, ksf
PHI = Assigned Friction Angle, degrees

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Density
S = Sieve Analysis
F = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-value
E = Expansion

SUMMARY OF LABORATORY TEST RESULTS

Mason Street Bridge, Santa Barbara, California

LOCATION	SAMPLE NUMBER	DEPTH, ft	SAMPLE CLASSIFICATION							COMPACTION TEST		DIRECT SHEAR TEST		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	TEST LISTING
				UWW pcf	UDW pcf	MC %	FINES %	LL %	PI %	MAX DD pcf	OPT MC %	C ksf	PHI deg	Q_u ksf	S_u Cell Prs. ksf	R	pH	Cl	SO_4			
DH-1	11	35.0	Clayey SAND (SC)	133	113	17	37					0.46	32									T, D, F
DH-1	12	40.0	Silty SAND (SM)			23																M
DH-1	13	44.0	Silty SAND (SM)			9																M
DH-1	14	50.0	Clayey SAND (SC)			14	20															M, F
DH-1	15	54.0	Clayey SAND (SC)	135	113	19																T
DH-1	16	60.0	Silty SAND (SM)			21	22															M, F
DH-1	17	64.0	Silty SAND (SM)	130	107	22																T
DH-1	18	70.0	Sandy Lean CLAY (CL)			19																M
DH-2	2	3.5	Silty SAND (SM)	107	97	10																T
DH-2	3	6.0	Silty SAND (SM)			6																M

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Direct Shear Test
C = Assigned Cohesion, ksf
PHI = Assigned Friction Angle, degrees

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
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t = Torvane
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Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Density
S = Sieve Analysis
F = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-value
E = Expansion

SUMMARY OF LABORATORY TEST RESULTS

Mason Street Bridge, Santa Barbara, California

LOCATION	SAMPLE NUMBER	DEPTH, ft	SAMPLE CLASSIFICATION							COMPACTION TEST		DIRECT SHEAR TEST		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	TEST LISTING
				UWW pcf	UDW pcf	MC %	FINES %	LL %	PI %	MAX DD pcf	OPT MC %	C ksf	PHI deg	Q_u ksf	S_u Cell Prs ksf	R	pH	Cl	SO_4			
DH-2	4	8.5	Silty SAND (SM)	101	91	11	27					0.26	29									T, D, F
DH-2	5	11.0	Silty SAND (SM)			12																M
DH-2	6	13.5	Clayey SAND (SC)	105	96	10																T
DH-2	7	16.0	Sandy Lean CLAY (CL)			25																M
DH-2	8	20.0	Clayey SAND (SC)	292	277	6																T
DH-2	9	25.0	Clayey SAND (SC)			10																M
DH-2	10	30.0	Clayey SAND (SC)			18	15															M, F
DH-2	11	35.0	Clayey SAND (SC)	129	105	23																T
DH-2	12	39.0	Clayey SAND with gravel (SC)	131	106	24																T
DH-2	13	45.0	Clayey SAND with gravel (SC)			25																M

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Direct Shear Test
C = Assigned Cohesion, ksf
PHI = Assigned Friction Angle, degrees

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Density
S = Sieve Analysis
F = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-value
E = Expansion

SUMMARY OF LABORATORY TEST RESULTS

Mason Street Bridge, Santa Barbara, California

LOCATION	SAMPLE NUMBER	DEPTH, ft	SAMPLE CLASSIFICATION						COMPACTION TEST		DIRECT SHEAR TEST		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	TEST LISTING
			UWW pcf	UDW pcf	MC %	FINES %	LL %	PI %	MAX DD pcf	OPT MC %	C ksf	PHI deg	Q_u ksf	S_u Cell Prs ksf	R	pH	Cl	SO_4			
DH-2			Sandy Lean CLAY (CL) to Clayey SAND (SC)																		
	14	50.0	128	106	21	35					0.42	35									T, D, F
DH-2			Sandy Lean CLAY (CL)																		
	15	55.0			19	24															M, F
DH-2			Sandy Lean CLAY (CL) to Clayey SAND (SC)																		
	16	60.0	136	116	18																T
DH-2			Sandy Lean CLAY (CL) to Clayey SAND (SC)																		
	17	65.0			18										4719	7.05	58	83			M, Co
DH-2			Sandy Lean CLAY (CL)																		
	18	70.0	129	103	24																T

Classification Tests
UWW = Unit Wet Weight
UDW = Unit Dry Weight
MC = Moisture Content
Fines = % passing #200 Sieve
LL = Liquid Limit
PI = Plasticity Index

Compaction Test
MAX DD = Maximum Dry Density
OPT MC = Optimum Moisture Content

Direct Shear Test
C = Assigned Cohesion, ksf
PHI = Assigned Friction Angle, degrees

Compressive Strength Tests
Qu = Unconfined Compression
Su = Undrained Shear Strength
u = Unconsolidated Undrained
p = Pocket Penetrometer
t = Torvane
m = Miniature Vane

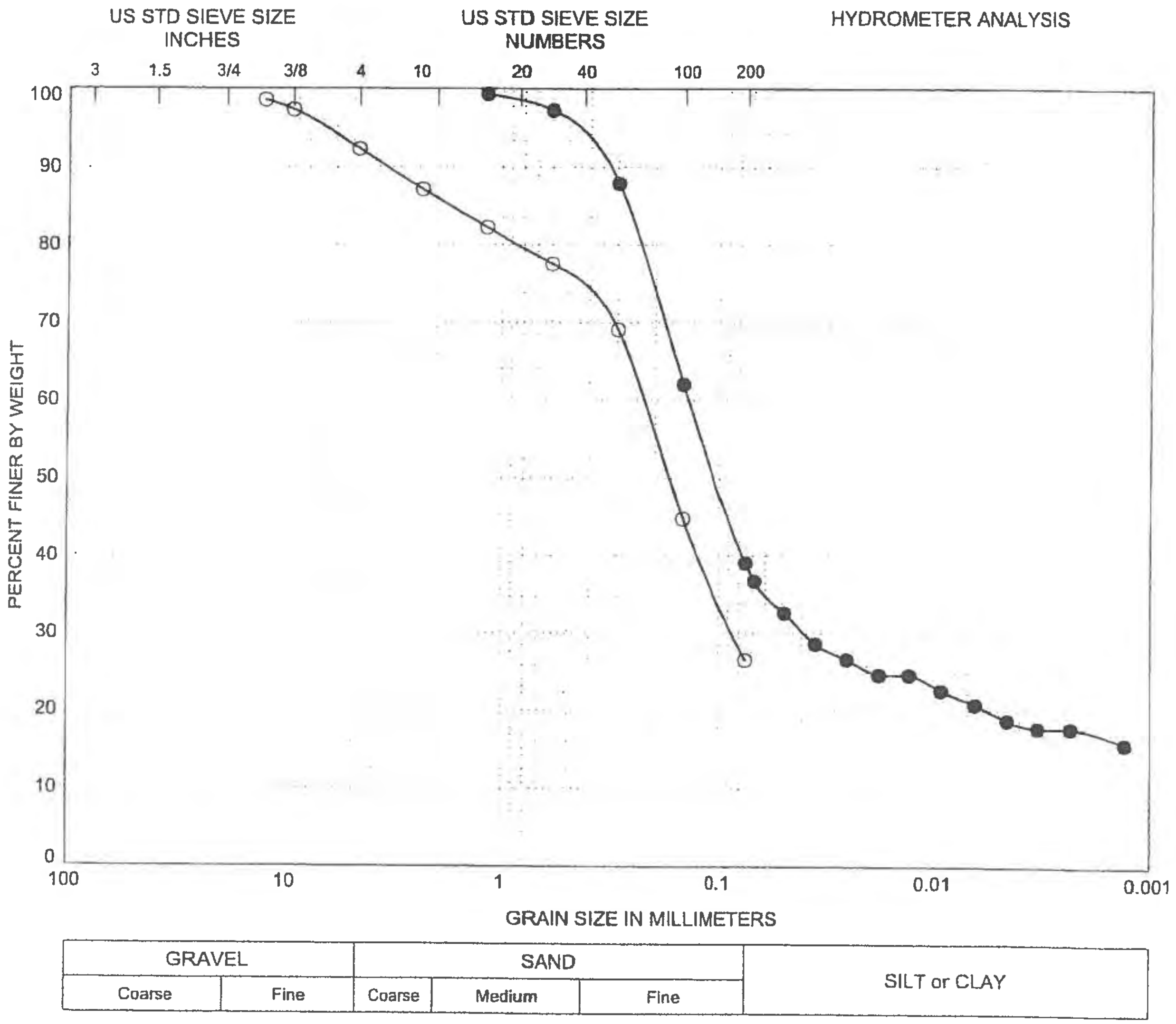
Corrosivity Tests
R = Resistivity, ohm-cm, satur.
pH = pH
Cl = Chloride, ppm
SO_4 = Sulfate, ppm

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Density
S = Sieve Analysis
F = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
P = Compaction Test
D = Direct Shear Test
C = Consolidation Test
Co = Corrosivity Tests
CU = CU Triaxial
U = UU Triaxial
R = R-value
E = Expansion

LAB SUMMARY 3(2/1/02\12:07 PM)

SUMMARY OF LABORATORY TEST RESULTS

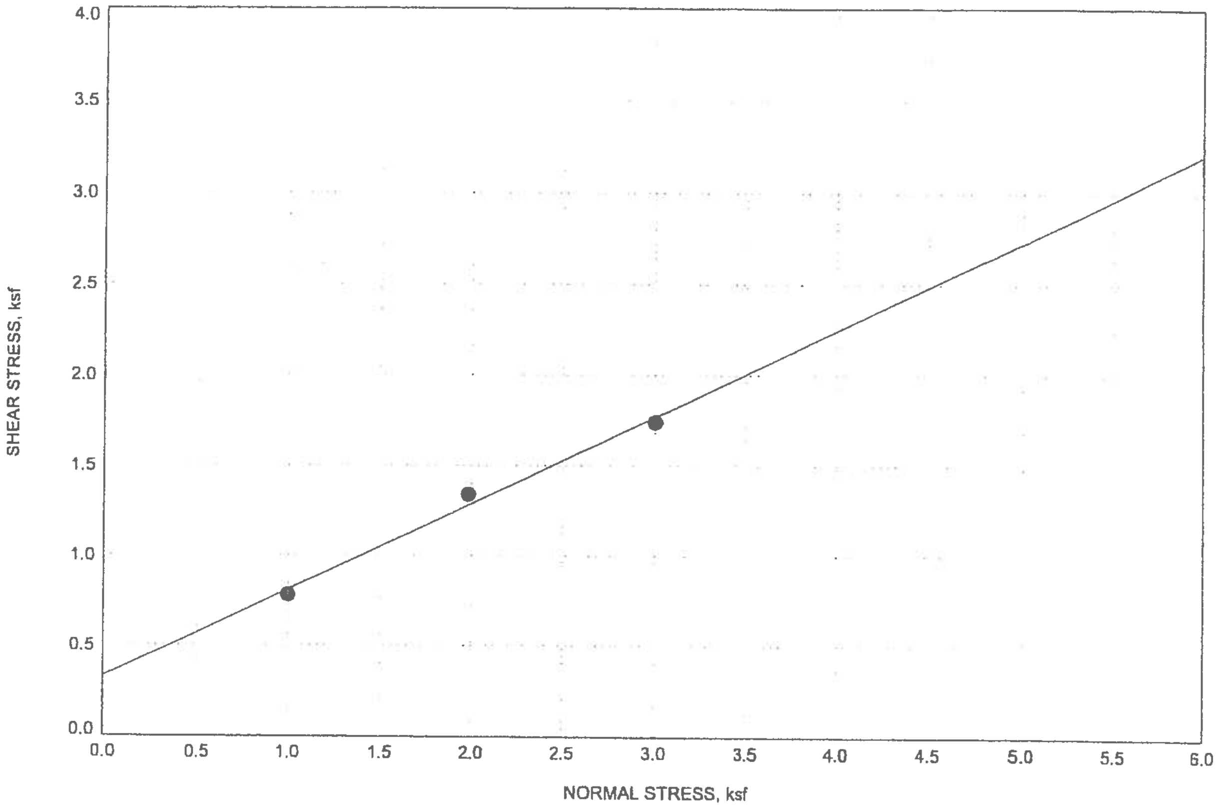
Mason Street Bridge, Santa Barbara, California



LEGEND			CLASSIFICATION	Cc	Cu
	(location)	(depth,ft)			
○	DH-1	3.0	Silty SAND (SM)		
●	DH-1	3.5	Clayey SAND (SC)		

GRAIN SIZE CURVES
Mason Street Bridge
Santa Barbara, California

PLATE B-2

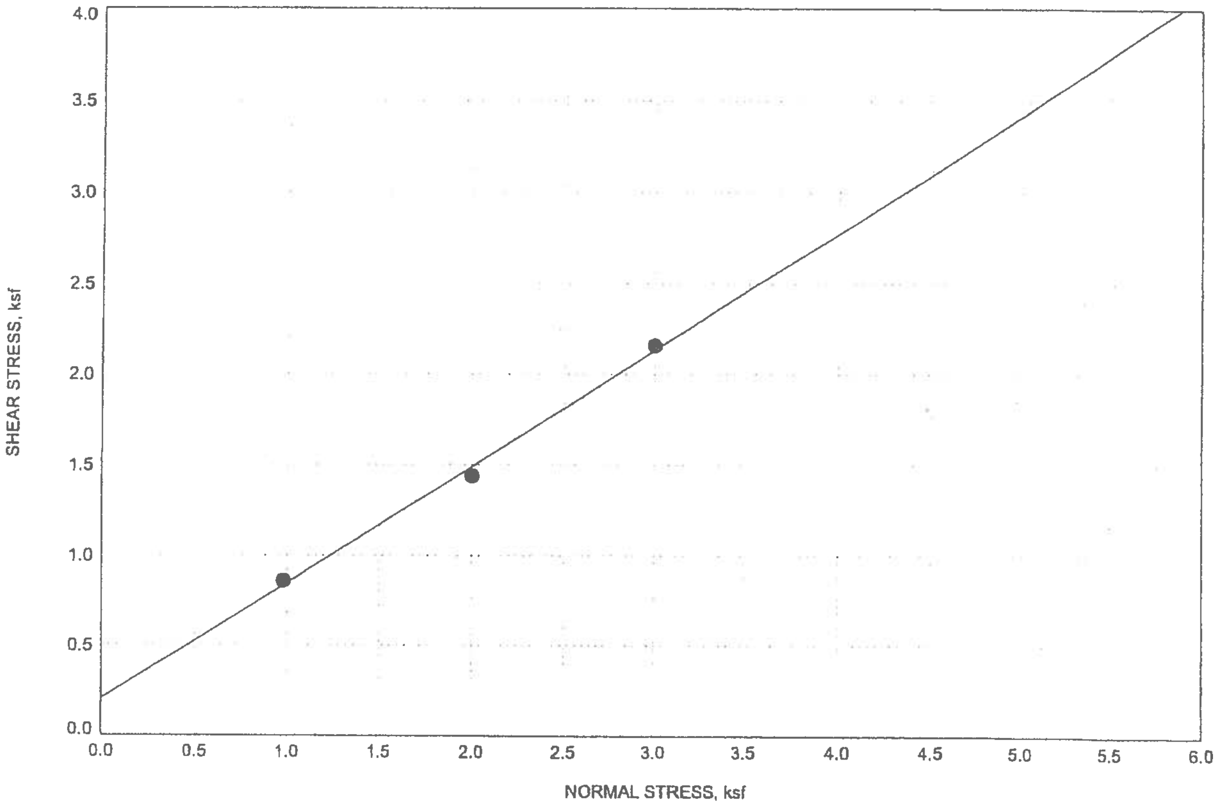


	● PEAK
COHESION, ksf	0.3
ANGLE OF INTERNAL FRICTION, deg	25.6
LOCATION	DH-1
DEPTH, ft	6
MOISTURE CONTENT, %	5
UNIT DRY WEIGHT, pcf	88
MATERIAL DESCRIPTION	Silty SAND (SM)
SAMPLE CONDITION	Ring Driven

DIRECT SHEAR TEST RESULTS

Mason Street Bridge
Santa Barbara, California

PLATE B-3a

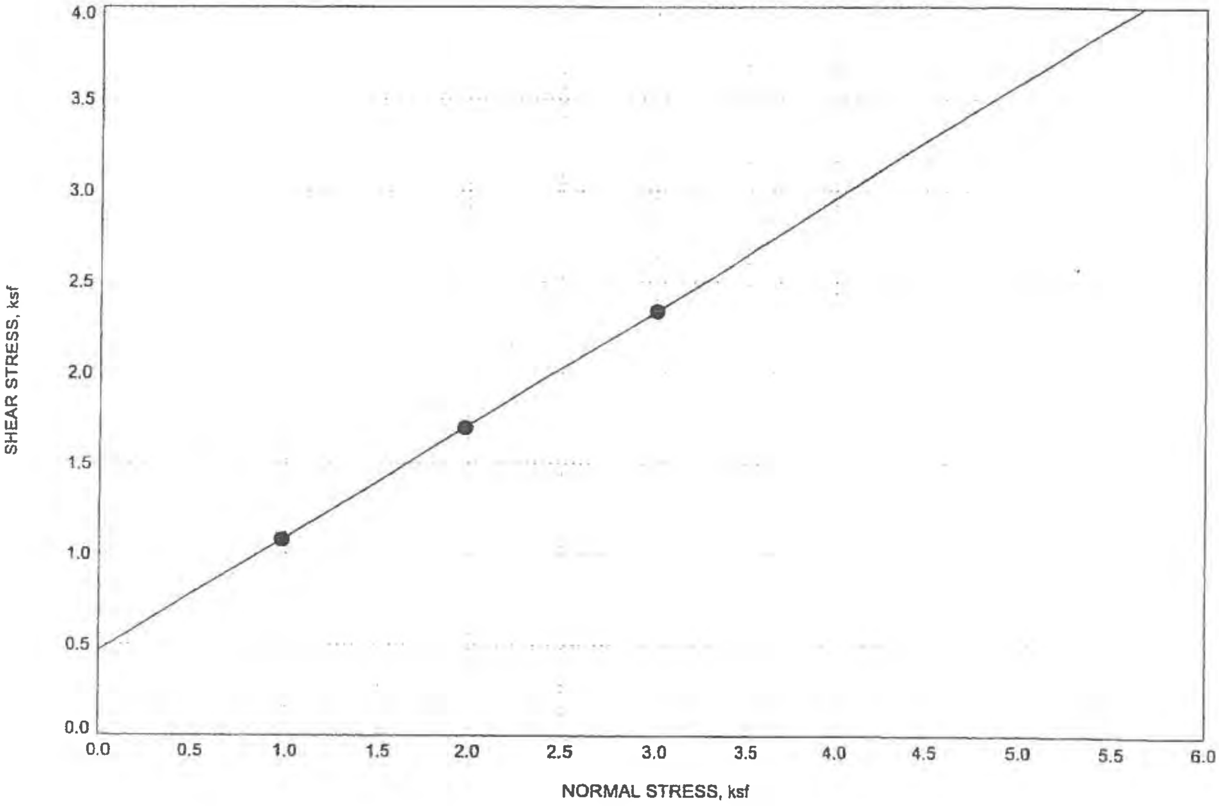


	● PEAK
COHESION, ksf	0.2
ANGLE OF INTERNAL FRICTION, deg	32.7
LOCATION	DH-1
DEPTH, ft	16
MOISTURE CONTENT, %	10
UNIT DRY WEIGHT, pcf	99
MATERIAL DESCRIPTION	Clayey SAND (SC)
SAMPLE CONDITION	Ring Driven

DIRECT SHEAR TEST RESULTS

Mason Street Bridge
Santa Barbara, California

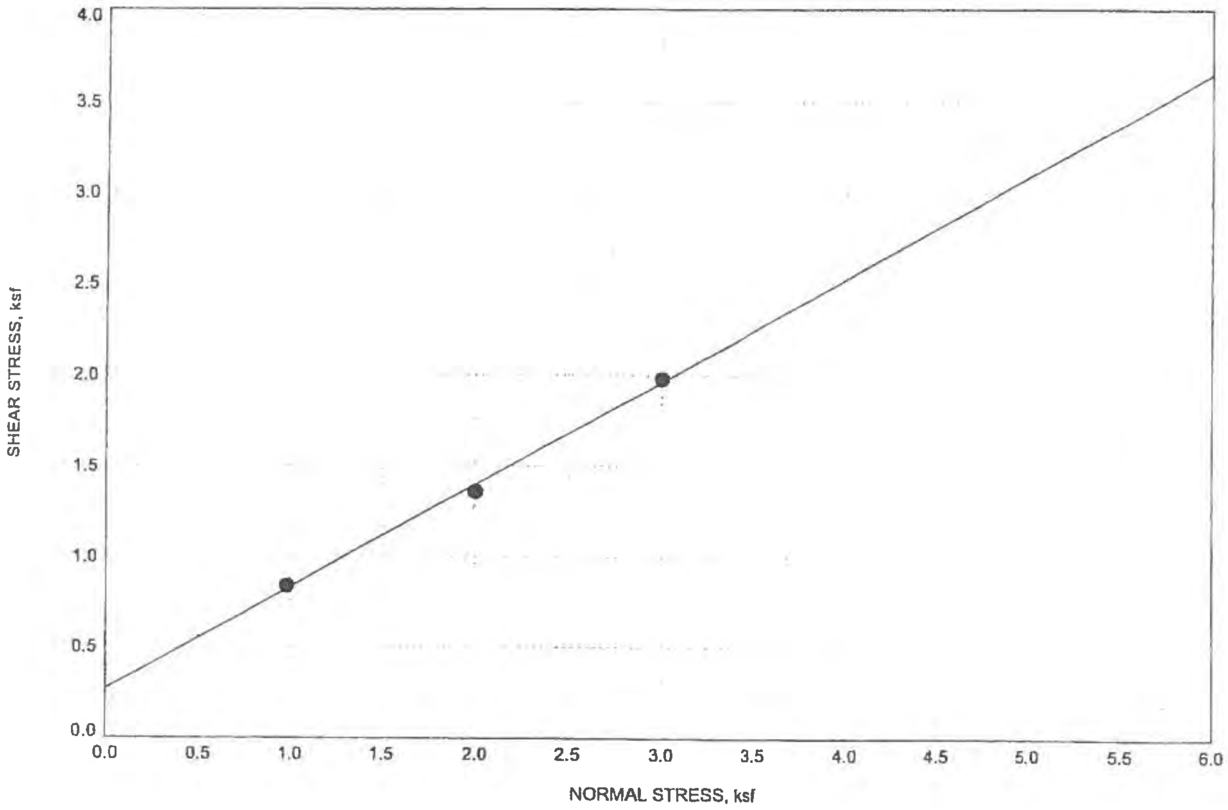
PLATE B-3b



	● PEAK
COHESION, ksf	0.5
ANGLE OF INTERNAL FRICTION, deg	31.9
LOCATION	DH-1
DEPTH, ft	35
MOISTURE CONTENT, %	17
UNIT DRY WEIGHT, pcf	113
MATERIAL DESCRIPTION	Clayey SAND (SC)
SAMPLE CONDITION	Ring Driven

DIRECT SHEAR TEST RESULTS

Mason Street Bridge
Santa Barbara, California

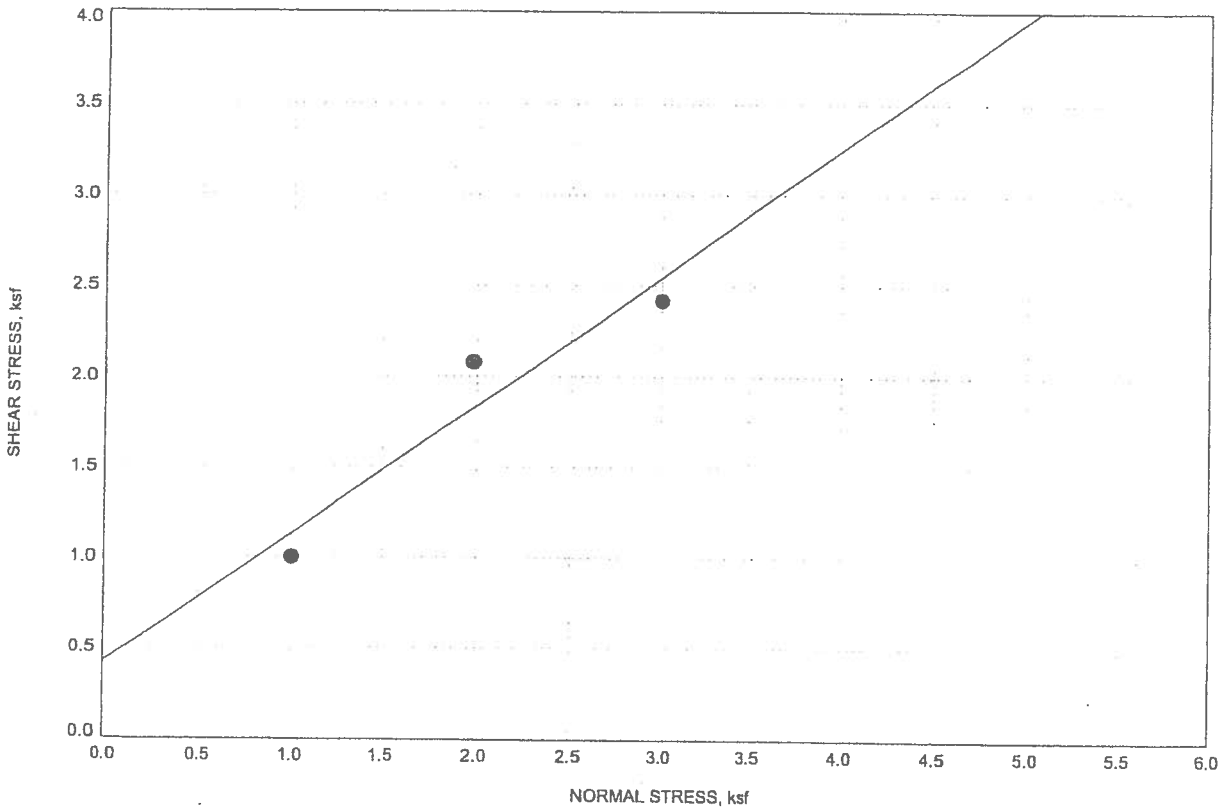


	● PEAK
COHESION, ksf	0.3
ANGLE OF INTERNAL FRICTION, deg	29.4
LOCATION	DH-2
DEPTH, ft	8.5
MOISTURE CONTENT, %	11
UNIT DRY WEIGHT, pcf	91
MATERIAL DESCRIPTION	Silty SAND (SM)
SAMPLE CONDITION	Ring Driven

DIRECT SHEAR TEST RESULTS

Mason Street Bridge
Santa Barbara, California

PLATE B-3d



	● PEAK
COHESION, ksf	0.4
ANGLE OF INTERNAL FRICTION, deg	35.2
LOCATION	DH-2
DEPTH, ft	50
MOISTURE CONTENT, %	21
UNIT DRY WEIGHT, pcf	106
MATERIAL DESCRIPTION	Sandy Lean CLAY (CL) to Clayey SAND (SC)
SAMPLE CONDITION	Ring Driven

DIRECT SHEAR TEST RESULTS

Mason Street Bridge
Santa Barbara, California

PLATE B-3e

Quinientos Street Bridge Replacement Project

Log of Test Boring and Cone Penetrometer Testing

Bengal Engineering
250 Big Sur Drive
Goleta CA 93117
Telephone: (805) 685-6511

BORING NUMBER B-1

CLIENT City of Santa Barbara
PROJECT NAME Quinientos St Bridge Replacement
PROJECT NUMBER
PROJECT LOCATION xing Sycamore Creek
DATE STARTED 7/15/14 **COMPLETED** 7/15/14
GROUND ELEVATION **HOLE SIZE** 8" inches
DRILLING CONTRACTOR Choice Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA - Track Rig CME 75
∇ **AT TIME OF DRILLING** 41.70 ft
LOGGED BY E. Pongracz **CHECKED BY**
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS			FINES CONTENT (%)	OTHER TESTS
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
	0				**Asphalt Concrete (AC)** 3" thick								
					Aggregate Base (AB) Gravelly Sand - light yellowish brown, dense								
					Earth Fill (ef)								
	5	GB 1 MC 2	7-11		Fine-grained Silty Sand/Sandy Silt (SM/ML) - brown, dense/stiff, slightly moist								
	10	SPT 3	15-19-20 (39)		**Alluvium (Qal)** Sandy Silt (ML) - light brown, very stiff, slightly moist, occ. slightly porous								
	15	MC 4	15-33		Fine-grained Silty Sand (SM) - reddish to orange-brown, dense, moist; contains lens of dark brown Silty Clay (CL) with scattered roots (alluvium)								
	20	SPT 5	15-29-40 (69)		Clayey Gravel w/ Sand to Clayey Sand w/Gravel (GC/SC) - dark brown to orange brown, stiff to very stiff, very moist; in sharp contact with Sand with Silt (SM) - tan to light yellowish brown								
	25	MC 6	12-23		Fine-grained Sandy Silt (ML) with Clay and occ. small gravel - reddish brown, stiff, moist								
					@29' - Driller notes harder drilling								
	30	SPT 7	35-39-26 (65)		Clayey, Gravelly Sand (SC) - orange brown; in sharp contact with Clayey Sand (SC) - orange brown, very stiff, moist								
	35	MC 8	8-17		Sandy Clay (SC) with widely scatt. gravel in sharp contact with mottled Silty Clay (CL) - orange brown to yellow gray, stiff, very moist, water on sampler (probable perched water)								
	40												

(Continued Next Page)

Bengal Engineering
250 Big Sur Drive
Goleta CA 93117
Telephone: (805) 685-6511

BORING NUMBER B-1

CLIENT City of Santa Barbara

PROJECT NAME Quinientos St Bridge Replacement

PROJECT NUMBER

PROJECT LOCATION xing Sycamore Creek

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS			FINES CONTENT (%)	OTHER TESTS
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
	40	SPT 9	7-11-15 (26)	▽	Bedded Sandy, Clayey Silt (ML) wit scatt. gravel in sharp contact with Gravelly Sand w/ Clay (SW) - brownish orange to orange brown, stiff/dense, very moist to wet								
	45	MC 10	34-50/3"		same as above								
	50	SPT 11	9-11-12 (23)		2"-3" thick beds of Silty Sand (SM), Sandy Silt (SM/ML), Gravelly Sand (SW) and Clayey Gravel (GC) - orange brown, stiff/dense, moist								
	55				@55'-60' - Driller notes easier drilling								
	60	SPT 12	6-6-7 (13)		Beds of Silty Sand (SM), medium-grained Sand with Silt (SW), and Clayey Silt (ML/CL) - orange brown to brown orange, very dense to very stiff, very moist								
	65												
	70	13	7-11-18 (29)		Gravelly Sand with Clay (SP/SC), Silty Sand with Gravel (SM); in sharp contact with fine-grained Sandy Silt (ML) with occ. gravel and Clayey Silt (ML) - orange brown to reddish brown, very dense to medium stiff, moist to very moist								

Boring terminated at 71.5' below grade. Boring backfilled with native materials. Asphalt cold patch applied at surface.
Bottom of borehole at 71.5 feet.

Bengal Engineering
250 Big Sur Drive
Goleta CA 93117
Telephone: (805) 685-6511

BORING NUMBER B-2

PAGE 1 OF 2

CLIENT City of Santa Barbara

PROJECT NAME Quinientos St Bridge Replacement

PROJECT NUMBER

PROJECT LOCATION xing Sycamore Creek

DATE STARTED 7/15/14 **COMPLETED** 7/15/14

GROUND ELEVATION **HOLE SIZE** 8" inches

DRILLING CONTRACTOR Choice Drilling

GROUND WATER LEVELS:

DRILLING METHOD HSA - Track Rig CME 75

∇ **AT TIME OF DRILLING** 39.60 ft

LOGGED BY E. Pongracz **CHECKED BY**

AT END OF DRILLING ---

NOTES

AFTER DRILLING ---

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS			FINES CONTENT (%)	OTHER TESTS
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
	0				**Asphalt Concrete (AC)** 3" thick								
					Aggregate Base (AB) Gravelly Sand - light yellowish brown, dense								
					Earth Fill (ef)								
	5	SPT 1	2-2-2 (4)		Fine-grained Silty Sand (SM) - light brown, slightly dense, slightly moist, scattered rootlets								
	10	MC 2	12-15		Fine-grained Silty Sand (SM) with scatt. gravel - brown, dense, slightly moist, mottled								
	15	SPT 3	2-2-3 (5)		same as above (SM)								
					Fanglomerate (Qf)								
	20	MC 4	23-25		Sandy Gravel to Gravelly Sand (GW to SW) grading to Clayey Sand (SC) - brown to reddish brown, very dense to stiff, moist, mottled (alluvium)								
	25	SPT 5	7-10-11 (21)		Sandy, Clayey Silt (ML) grading to Clayey Sand/Sandy Clay (SC) - gray to light brown to orange brown, stiff, moist to very moist, sample contained ~4" thick cobble								
					Driller notes hard drilling to 30' below grade.								
	30	MC 6	50		Sand to Silty Sand (SM) - light yellow to yellowish brown, dense, moist (probable weatherd boulder)								
					Driller notes driling continues to be hard.								
	35												

(Continued Next Page)

Bengal Engineering
250 Big Sur Drive
Goleta CA 93117
Telephone: (805) 685-6511

BORING NUMBER B-2

CLIENT City of Santa Barbara

PROJECT NAME Quinientos St Bridge Replacement

PROJECT NUMBER

PROJECT LOCATION xing Sycamore Creek

ELEV (ft)	DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	UNDRAINED SHR STRENGTH (tsf)	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	ATTERBERG LIMITS			FINES CONTENT (%)	OTHER TESTS
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
	35	SPT 7	24-28-36 (64)		**Fanglomerate (Qf)** *(continued)* Fractured Silt/Sand (ML/SP) - light brownish yellow to light yellowish brown, very dense, wet, weathered zone of brown silty clay (CL) (cobbles/boulders?) Very hard drilling from 38' to 40' below grade.								
	40	SPT 8	7-17-19 (36)		▽ Silty Sand (SM) to Clayey Sand (SC) with small gravel - orange brown, dense/stiff, very moist Driller notes continued hard drilling.								
	45	SPT 9	4-7-9 (16)		Beds of Clayey Silt (ML), Clayey Sand (SC) to Silty, Clayey Sand with scattered Gravel (SC) - orange brown, stiff to very stiff, very moist								
	50	SPT 10	6-9-13 (22)		Silty Sand (SM) to Sandy Silt (ML) - orange brown, stiff to very stiff, moist								
	55												
	60	SPT 11	9-21-29 (50)		Sand with Silt (SP) grading to Silty Sand (SM) with Clay - orange brown, very dense, moist to very moist								

Boring terminated at 61.5' below grade. Boring backfilled with native materials. Asphalt cold patch applied at surface.
Bottom of borehole at 61.5 feet.

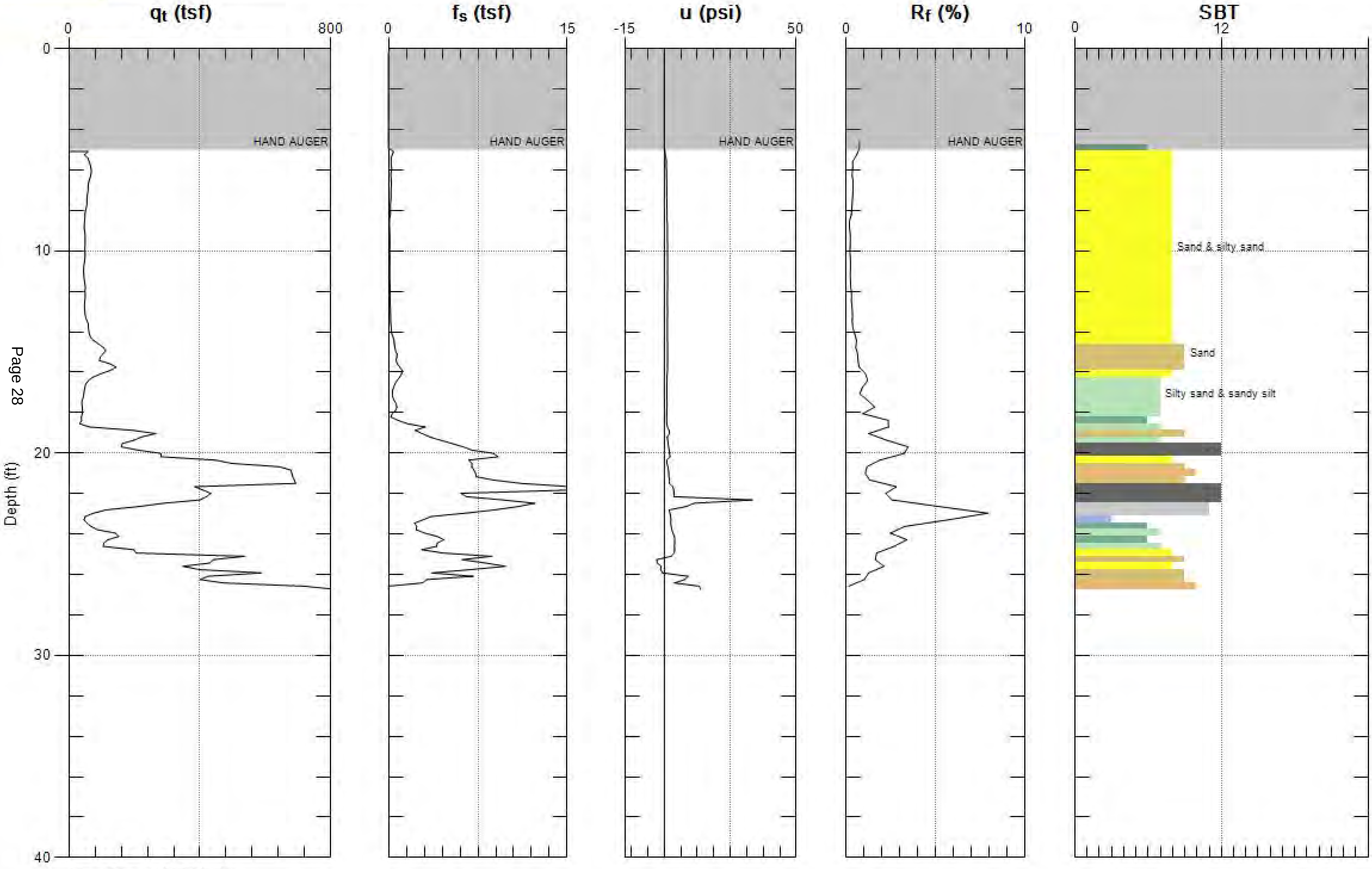
LOGS OF CPT

GREGG **BENGAL ENGINEERING**

Ground Elev: 43.5'

Site: QUINIENTOS ST. BRIDGE Engineer: E.PONGRACZ

Sounding: CPT-1 **Date: 7/15/2014 07:48**



Max. Depth: 26.739 (ft)
Avg. Interval: 0.328 (ft)

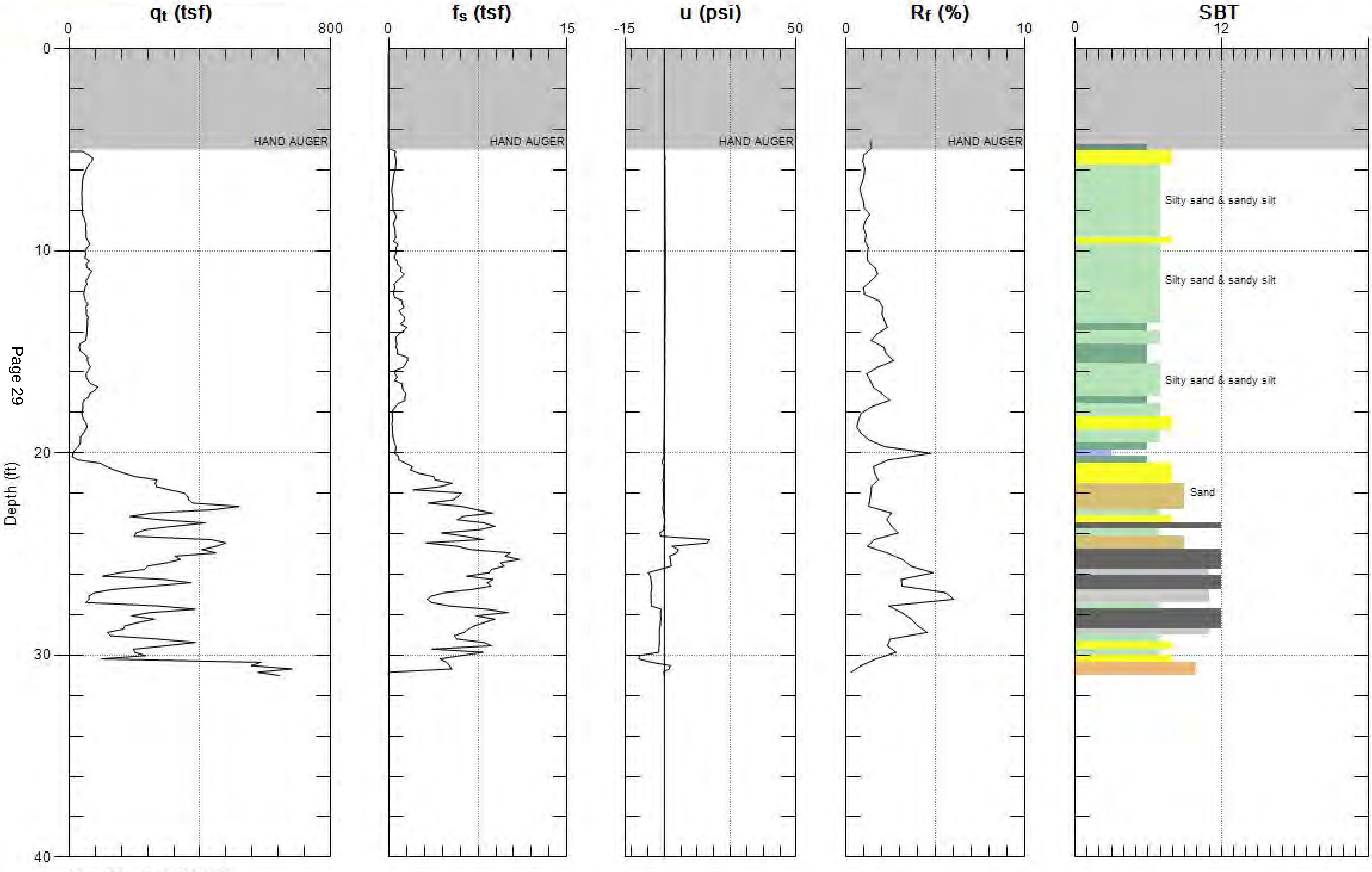
SBT: Soil Behavior Type (Robertson 1990)

GREGG **BENGAL ENGINEERING**

Ground Elev: 44.8'

Site: QUINIENTOS ST. BRIDGE Engineer: E.PONGRACZ

Sounding: CPT-2 **Date: 7/15/2014 08:37**



Max. Depth: 31.004 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Laboratory Testing

SubSurface Designs Inc.

12848 Foothill Boulevard • Sylmar, California 91342
(818) 898-1595 • (Fax) 898-4003

August 25, 2014

PIN# 7000U

Bengal Engineereing, Inc.
250 Big Sur Drive
Goleta, California 93117

Subject: Quinientos Street Bridge
Results of Laboratory Testing

Dear Sirs:

Pursuant to your request please find attached hereto the results of soil engineering laboratory testing on the soil samples you provided. Sampling techniques, subsurface conditions, and other factors may vary across the subject site. Therefore, the test results may or may not be representative of the overall site conditions and care should be taken accordingly in interpreting the testing data provided. Interpretation of the laboratory test results and applications of the results on the design and construction of the project are beyond the scope of our work.

Services performed by this facility were conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other warranties are either expressed or implied.

If you have any questions, please do not hesitate to contact this office.

Respectfully submitted:
SUBSURFACE DESIGNS, INC.

C 60293

Jon Mahn
Principal Engineer
RCE 60293

JEM/mm: 7000U.01L

Dist: (2) Addressee
(1) File

LABORATORY TESTING RESULTS

Laboratory Testing Method

Laboratory Recapitulation - Table I-1

Atterberg Limits

Sieve Analysis

Shear Strength Diagram

LABORATORY TESTING METHODS

Soil Classification

Soils are visually classified in accordance with the latest version of ASTM D 2488. Soils are classified in accordance with the latest version of ASTM D 2487 when testing, such as laboratory determination of particle-size characteristics, liquid limit, and plasticity index, is performed.

Moisture and Density Tests

The moisture content and in-place dry density of all undisturbed samples obtained were determined. The test results are presented in the Laboratory Recapitulation - Table I. Tests are performed in accordance with the latest version of ASTM D 2216.

Direct Shear Tests

Direct single-shear tests were performed on representative undisturbed samples to determine their strength characteristics. The desired normal load was applied to the specimen and allowed to come to equilibrium. The rate of deflection on the sample is approximately 0.05 inches per minute. All samples were saturated prior to shear testing. The results are plotted on the Shear Test Diagrams. Tests are performed in accordance with the latest version of ASTM D 3080.

Sieve Analysis

A group of fourteen (14) sieves are assembled, with the sieve having the largest opening at the top, and the one having the smallest at the bottom. A solid collecting pan is placed below the bottom sieve. A 3000 gram specimen is weighed to within ±0.1g and placed in the topmost sieve. The assembly is completed by placing a solid cover over the top sieve. The sieve assembly is securely fastened into a mechanical sieve-shaking device. The group of assembled sieves is subjected to the action of the sieve shaker for a period of 300 seconds. Each sieve and the pan is weighed to within ±0.1g to determine the portion of the specimen retained. Tests are performed in accordance with the latest version of ASTM D 421.

Sieve Series	
Sieve #	Opening (mm)
3"	75.00
2"	50.00
1.5"	38.10
1"	25.40

Sieve Series	
¾"	19.00
⅜"	9.50
4	4.75
10	2.00
20	0.85
30	0.60
50	0.30
80	0.18
100	0.15
200	0.075
Pan	-

Atterberg Limits

This test covers the determination of the liquid limit, plastic limit, and the plasticity index of soils. Tests are performed in accordance with the latest version of ASTM D 4318.

CHEMICAL TEST RESULTS

Table I-2

Location	Depth (ft)	Sulfate (ppm)	Chloride (ppm)	pH	Resistivity (Ohms-cm)
B-1	40.0	58	30	7.50	1400

LABORATORY RECAPITULATION - TABLE I-1

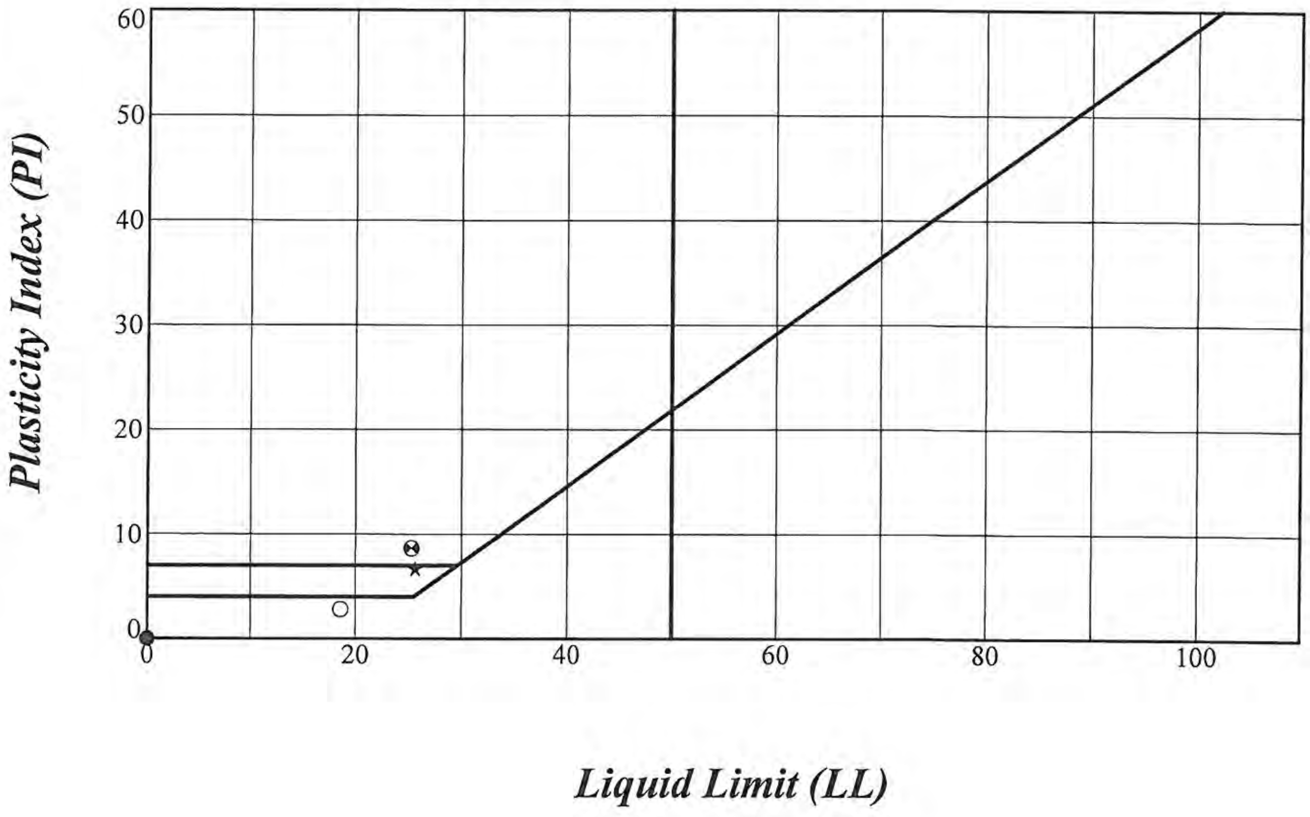
PIN 7000U / Quinientos Street Bridge Replacement

Location	Depth	Material Description	In Situ Dry Density (P.C.F.)	In Situ Water (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	%Passing # 200 Sieve	Max. Dry Density (pcf)	Optimum Moisture (%)	Expansion Index
B - 1	3.0	Silty Sand (SM)		4.4	NP	NP	NP	46.6			
B - 1	5.0	Silty Sand (SM)	103.6	6.0							
B - 1	10.0	Silty Sand (SM)		6.8	18.6	15.8	3				
B - 1	15.0	Silty Sand (SM)	123.8	11.4							
B - 1	20.0	Clayey Sand (SC)		11.4							
B - 1	25.0	Clayey Sand (SC)	120.6	14.0							
B - 1	30.0	Clayey Sand (SC)		12.5							
B - 1	35.0	Clayey Sand (SC)	126.7	8.8							
B - 1	40.0	Clayey Sand (SC)		13.5							
B - 1	45.0	Clayey Sand (SC)	119.5	13.3							
B - 1	50.0	Clayey Sand (SC)		15.1							
B - 1	60.0	Clayey Sand (SC)		16.0							
B - 1	70.0	Clayey Sand (SC)		14.6							
B - 2	5.0	Silty Sand (SM)		5.9							
B - 2	10.0	Silty Sand (SM)	120.9	7.4							
B - 2	15.0	Silty Sand (SM)		7.8							
B - 2	20.0	Poorly Graded Sand with Gravel (SP)	129.0	8.6							
B - 2	25.0	Clayey Sand (SC)		12.9	25.3	16.7	8	36.9			
B - 2	30.0	Silty Sand (SM)	909.1	9.8							
B - 2	35.0	Clayey Sand (SC)		7.2							
B - 2	40.0	Clayey Sand (SC)		15.1							
B - 2	45.0	Sandy Silty Clay (CL-ML)		18.0	25.7	19.0	7	60.3			
B - 2	50.0	Sandy Silty Clay (CL-ML)		13.7							
B - 2	60.0	Sandy Silty Clay (CL-ML)		13.5							
TP - 1	0.5	Poorly Graded Sand with Gravel (SP)		1.9				1.0			

ATTERBERG LIMITS

PROJECT NAME: *Quinientos Street Bridge Replacement*

PROJECT NUMBER: *PIN 7000U*



Sample Identification			Material Description	LL	PL	PI
●	B - 1	3.0'	Silty Sand (SM)	NP	NP	NP
○	B - 1	10.0'	Silty Sand (SM)	19	16	3
⊗	B - 2	25.0'	Clayey Sand (SC)	25	17	8
★	B - 2	45.0'	Sandy Silty Clay (CL-ML)	26	19	7

SubSurface Designs, Inc.

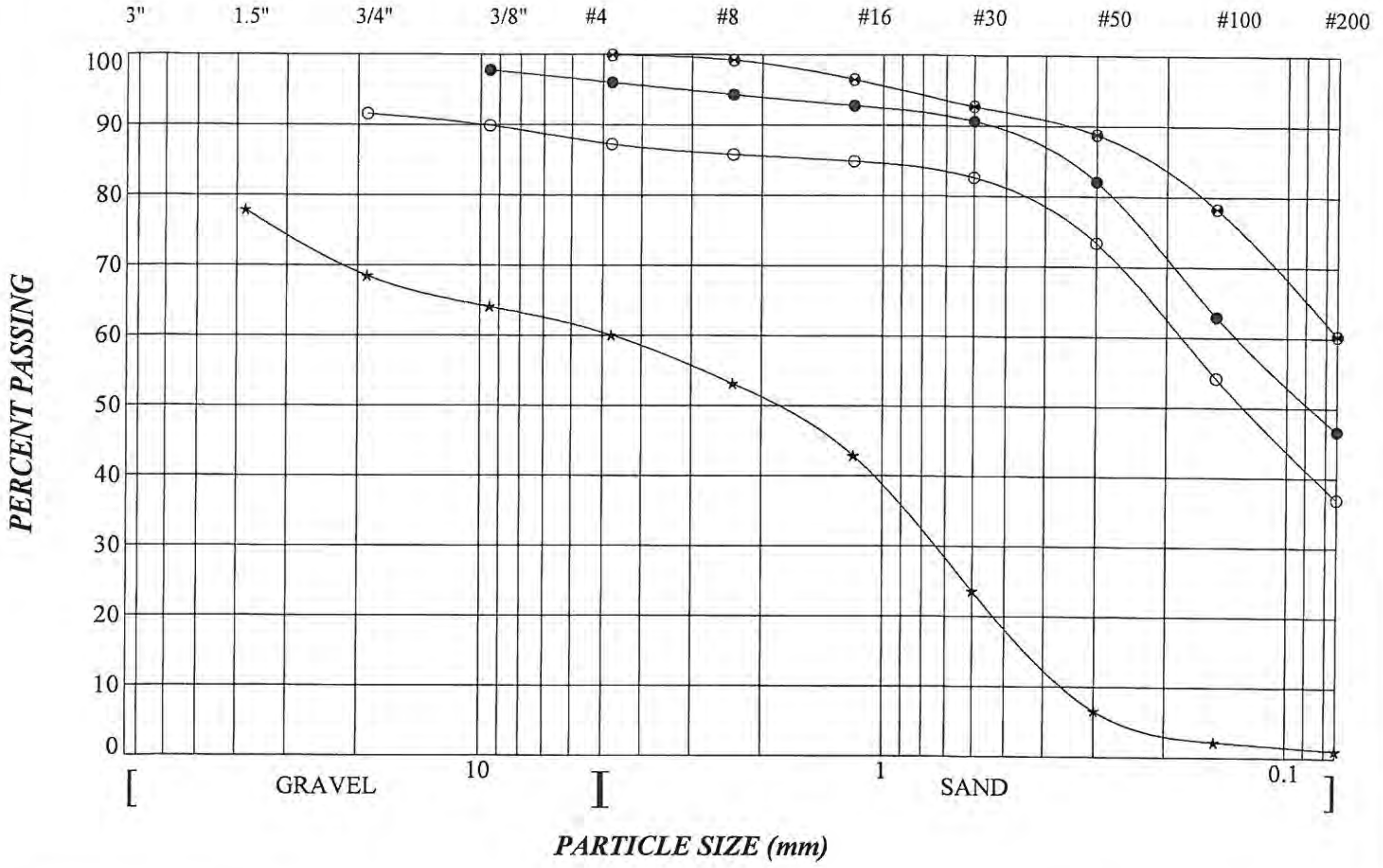
GEOTECHNICAL ENGINEERS & ENGINEERING GEOLOGISTS

Figure A.1

SIEVE ANALYSIS

PROJECT NAME: *Quinientos Street Bridge Replacement*

PROJECT NUMBER: *PIN 7000U*



Sample Identification			Material Description	LL	PL	PI	Cc	Cu
●	B - 1	3.0'	Silty Sand (SM)	NP	NP	NP		
○	B - 2	25.0'	Clayey Sand (SC)	25	17	8		
⊗	B - 2	45.0'	Sandy Silty Clay (CL-ML)	26	19	7		
★	TP - 1	0.5'	Poorly Graded Sand with Gravel (SP)				0.35	13.70

Sample Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B - 1	3.0'	9.5	0.132			1.7	49.4	46.6	
○	B - 2	25.0'	19	0.185			4.3	50.3	36.9	
⊗	B - 2	45.0'	4.75					39.6	60.3	
★	TP - 1	0.5'	38.1	4.725	0.751	0.345	17.8	59.0	1.0	

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GEOTECHNICAL ENGINEERS & ENGINEERING GEOLOGISTS

Figure SV.1

SHEAR TEST

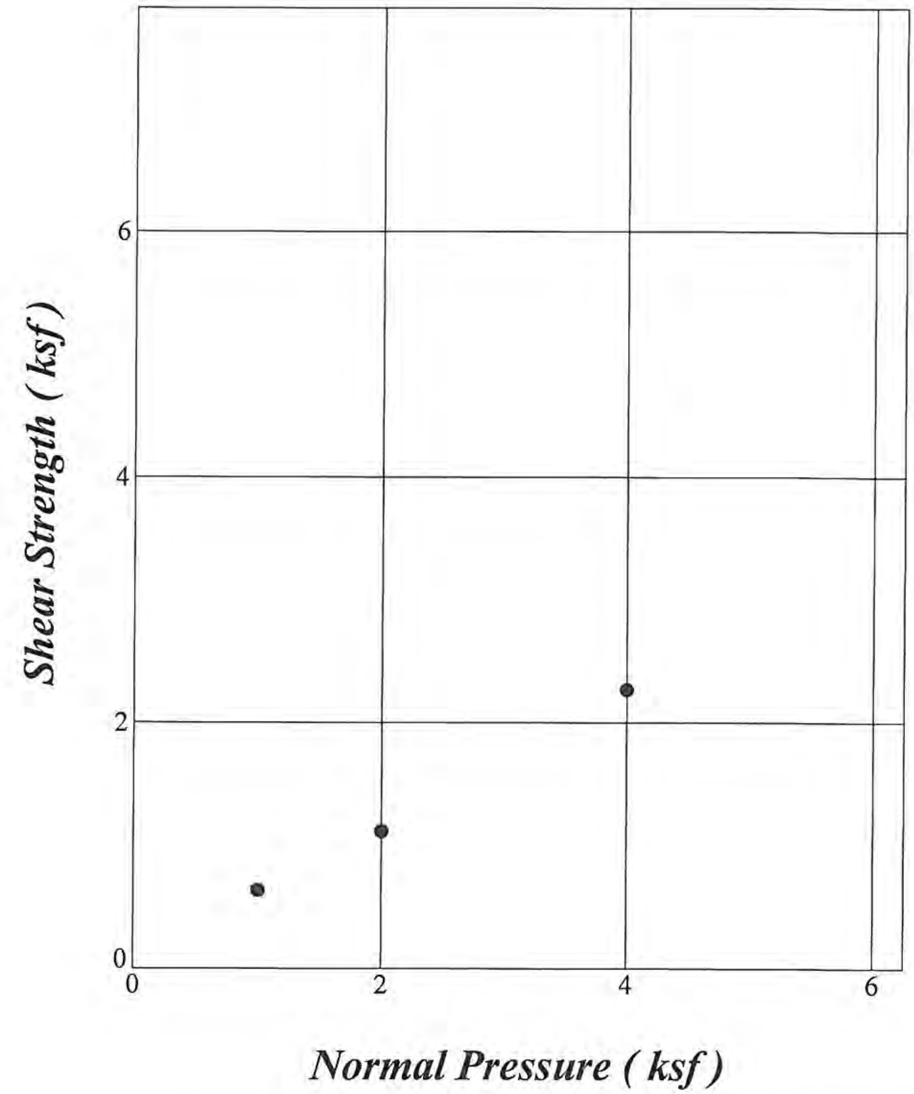
PROJECT NAME: *Quinientos Street Bridge Replacement*

SAMPLE ID: *B - 1 @ 5.00'*

PROJECT NUMBER: *PIN 7000U*

MATERIAL DESCRIPTION: *Silty Sand (SM)*

TEST METHOD: *Ultimate Saturated Shear*



MOISTURE CONTENT (%)

In Situ: *6.0*

Saturated: *23.7*

DENSITY (pcf)

Dry Density: *103.6*

RESULTS

Phi (deg.):

Cohesion (ksf):

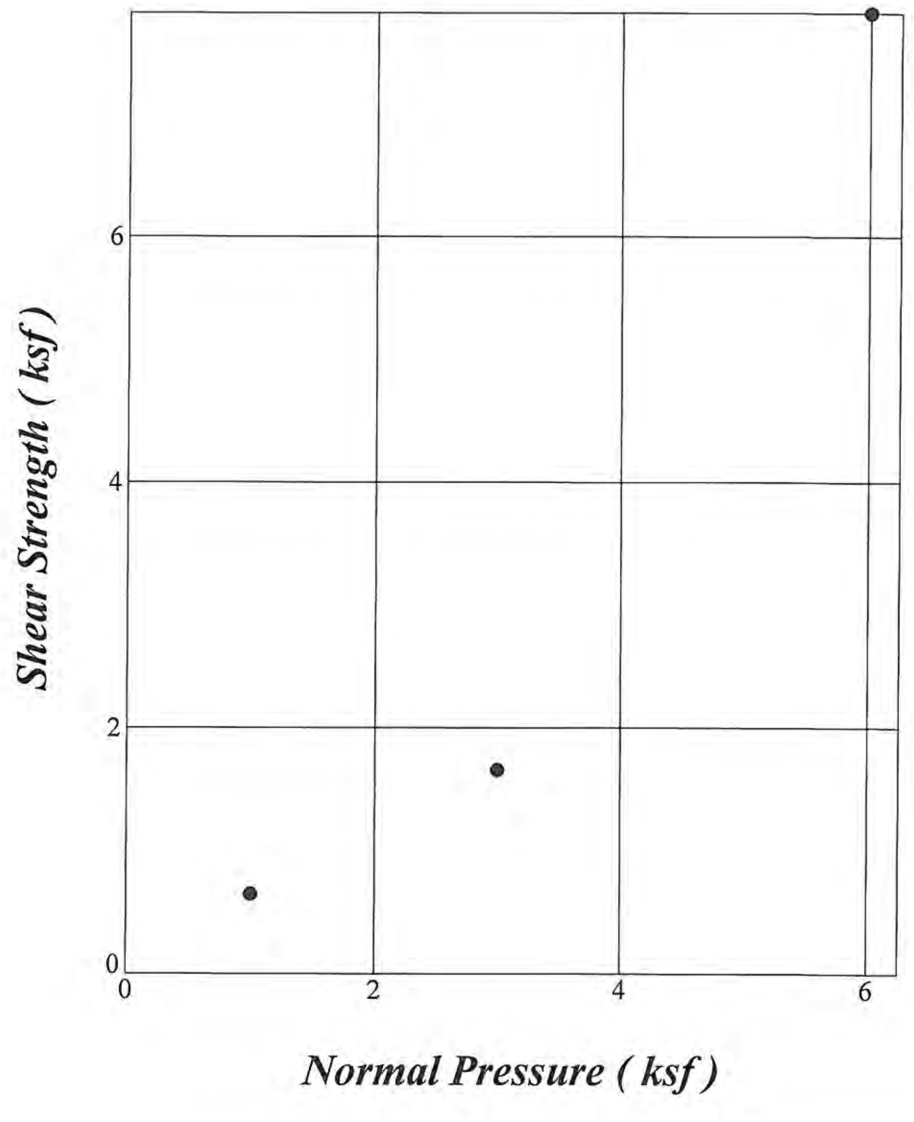
SubSurface Designs, Inc.

GEOTECHNICAL ENGINEERS & ENGINEERING GEOLOGISTS

Figure S.1

SHEAR TEST

PROJECT NAME: *Quinientos Street Bridge Replacement*	SAMPLE ID: *B - 1 @ 45.00'*
PROJECT NUMBER: *PIN 7000U*	MATERIAL DESCRIPTION: *Clayey Sand (SC)*
TEST METHOD: *Ultimate Saturated Shear*	



MOISTURE CONTENT (%)		DENSITY (pcf)		RESULTS	
In Situ:	*13.3*			Phi (deg.):	
Saturated:	*20.7*	Dry Density:	*119.5*	Cohesion (ksf):	

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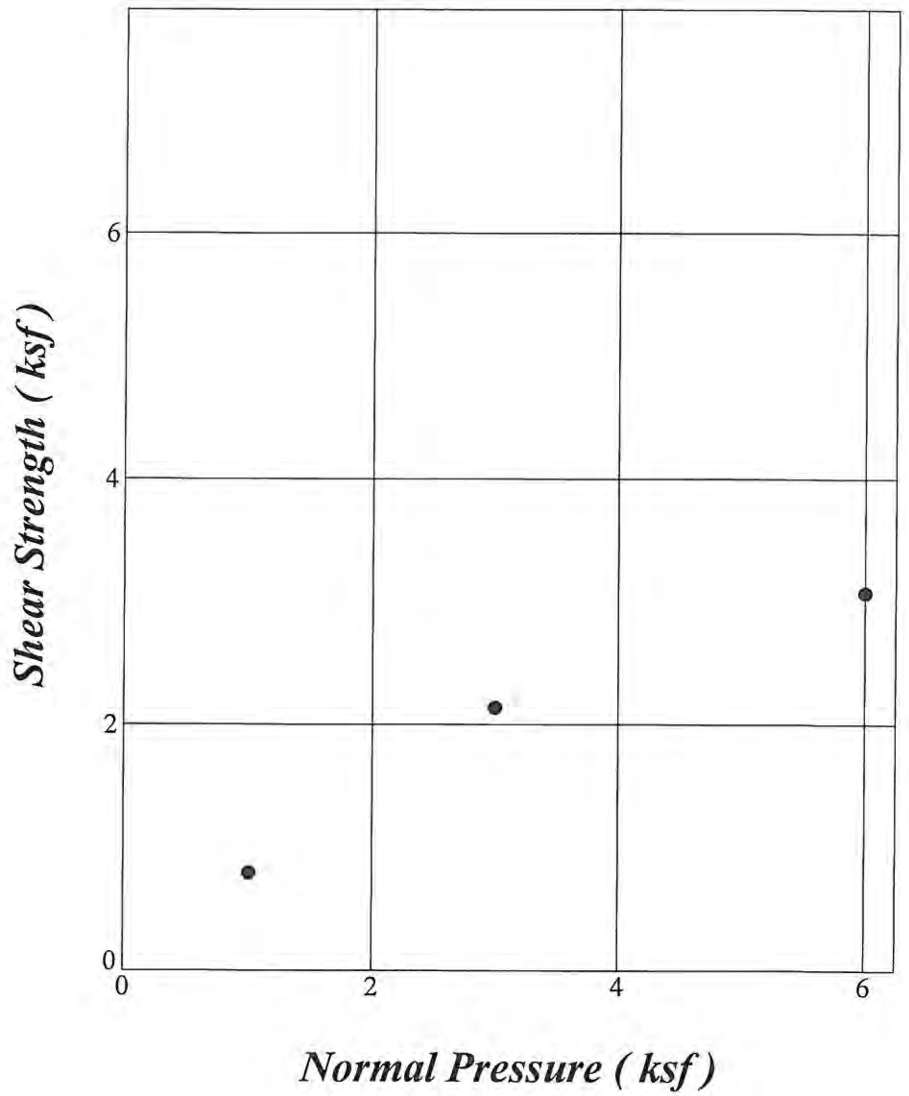
GEOTECHNICAL ENGINEERS & ENGINEERING GEOLOGISTS

Figure S.2

SHEAR TEST

PROJECT NAME:	*Quinientos Street Bridge Replacement*	SAMPLE ID:	*B - 2 @ 30.00'*
PROJECT NUMBER:	*PIN 7000U*	MATERIAL DESCRIPTION:	*Silty Sand (SM)*
TEST METHOD:	*Ultimate Saturated Shear*		



MOISTURE CONTENT (%)		**DENSITY (pcf)**		**RESULTS**	
In Situ:	*9.8*			Phi (deg.):	
Saturated:	*19.2*	Dry Density:	*909.1*	Cohesion (ksf):	

SubSurface Designs, Inc.

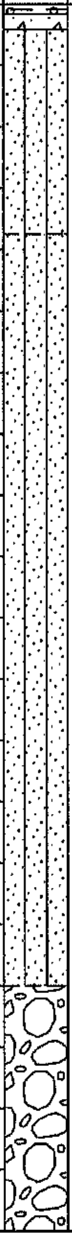
GEOTECHNICAL ENGINEERS & ENGINEERING GEOLOGISTS

Montecito Street Bridge Replacement Project

Log of Test Boring

LOCATION: See Plate 2 - Subsurface Exploration Plan
N 1,982,564 E 6,055,891.4
CA State Plane, Zone V, NAD83 ft

SURFACE EL: 60.1 ft +/- (rel. NAVD 88 datum)



ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
					ASPHALT CONCRETE (4")							
					CONCRETE (6")							
58	2				**ARTIFICIAL FILL (af)** SILTY SAND (SM); medium dense; brown; moist; mostly fine SAND; trace gravel; red and yellow speckles							
56	4											
		1	▨	(27)		131	125	5				
54	6											
52	8				**ALLUVIUM (Qal)** SILTY SAND (SM); medium dense; brown; moist; mostly fine SAND; little fines; with pale brown veins							
50	10	2	☒	14				14				
48	12											
46	14											
44	16	3a 3b	▨	(24)	- some fines; slightly clayey	113	105	8	31			
42	18											
40	20	4	☒	14	- very moist; increasing clay content			13				
38	22											
36	24											
34	26	5	▨	(29)		125	113	11	34	19	1	
32	28											
30	30	6	☒	14	- trace pulverized gravel and cobble in sampler			20				
28	32				**OLDER ALLUVIUM (Qoal)** COBBLES and BOULDERS; silty SANDSTONE; very soft; yellow; intensely weathered; in a matrix of clayey GRAVEL with SAND (GC); dense; multicolored, brown, red, yellow and gray; moist; rig chatter and loss of drilling fluid at 32'							
26	34											
		7	☒	33								
24	36											
22	38											

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 76.0 ft
DEPTH TO WATER: Not Measured
BACKFILLED WITH: Cement Grout
DRILLING DATE: May 6, 2015

DRILLING METHOD: 4.875-inch-dia. Mud Rotary Wash
HAMMER TYPE: 140-lb Automatic Trip
DRILLED BY: SoCal Drilling
LOGGED BY: J. Martos
CHECKED BY: L A Berry
RIG TYPE: Mayhew 1000

LOG OF DRILL HOLE NO. DH-01

Montecito Street Bridge Replacement
Santa Barbara, California

PLATE A-1a

LOCATION: See Plate 2 - Subsurface Exploration Plan
N 1,982,564 E 6,055,891.4
CA State Plane, Zone V, NAD83 ft

SURFACE EL: 60.1 ft +/- (rel. NAVD 88 datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
			8	▨	(90/10.5")	- very dense							
18	42												
16	44					CLAYEY SAND (SC); dense; dark yellowish brown; moist; some fines; trace GRAVEL							
			9	☒	29				17	28	24	15	
14	46												
12	48					SILTY SAND (SM); very dense; dark yellowish brown; moist; fine SAND; strong cementation; possible boulder							
10	50		10	☒	ref/5.5"								
						- rig chatter from 51' to 54'							
8	52												
6	54					CLAYEY SAND (SC); thickly bedded with interbeds of lean CLAY (CL). SAND (SC); very dense; dark yellowish brown; very moist; mostly fine SAND; some coarse SAND. CLAY (CL); very stiff; mottled dark yellowish brown and pale brown; moist							
			11a 11b	☒	40								
4	56								21				
2	58					CLAYEY SAND (SC); very dense; dark yellowish brown; very moist; mostly fine SAND; some fines; trace coarse GRAVEL							
0	60												
			12a 12b	▨	(67)		134 136	114 113	17 20	42			u 2.2
-2	62												
-4	64												
			13	☒	ref/4"	- wet; mostly fine SAND; some coarse SAND							
-6	66												
-8	68												
-10	70		14	☒	50/5.5"	- moist; mostly fine to medium SAND			14				
-12	72												
						- loss of drilling fluid from 73' to 75'							
-14	74												
			15	▨	(50/5")								
-16	76					**Boring terminated at approximately 76 feet**	131	111	18				
-18	78												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 76.0 ft
DEPTH TO WATER: Not Measured
BACKFILLED WITH: Cement Grout
DRILLING DATE: May 6, 2015

DRILLING METHOD: 4.875-inch-dia. Mud Rotary Wash
HAMMER TYPE: 140-lb Automatic Trip
DRILLED BY: SoCal Drilling
LOGGED BY: J. Martos
CHECKED BY: L A Berry
RIG TYPE: Meyhew 1000

LOG OF DRILL HOLE NO. DH-01

Montecito Street Bridge Replacement
Santa Barbara, California

LOCATION: See Plate 2 - Subsurface Exploration Plan
N 1,982,673 E 6,055,904.7
CA State Plane, Zone V, NAD83 ft

SURFACE EL: 60.8 ft +/- (rel. NAVD 88 datum)

ELEVATION, ft	DEPTH, ft	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
					ASPHALT CONCRETE (4")							
60					CONCRETE (6")							
					ARTIFICIAL FILL (af) SILTY SAND (SM); medium dense; brown; moist; mostly fine SAND; pockets of yellow and white speckles							
	2											
58												
	4											
56												
		1	▨	(23)		99	89	11				
	6											
54												
					ALLUVIUM (Qal) SILTY SAND (SM); medium dense; brown; moist; some fines							
	8											
52												
	10	2	☒	13				14	43			
50												
	12											
48												
					Poorly-graded GRAVEL with SAND (GP); medium dense; multicolored, red, grey and yellow; wet; slight rig chatter from 13' to 16'							
	14											
46		3	☒	17								
	16				SILTY SAND (SM); medium dense; brown; moist; fine SAND							
44												
	18											
42												
	20	4	☒	12				13	32	18	NP	
40												
	22											
38												
	24											
36		5	▨	(29)		120	111	9				
	26											
34												
	28											
32												
	30	6	☒	17	- yellow			13				
30												
	32				**OLDER ALLUVIUM (Qoal)** COBBLES and BOULDERS; SANDSTONE; dark yellowish brown; in a matrix of clayey SAND (SC); very dense; dark yellowish brown; very moist; mostly medium to coarse SAND; rig chatter at 32'							
28												
	34											
26												
	36											
24		7	☒	50/3"	- rig chatter and very hard drilling from 37.5' to 41'							
	38											
22												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 86.0 ft
DEPTH TO WATER: Not Measured
BACKFILLED WITH: Cement Grout
DRILLING DATE: May 7, 2015

DRILLING METHOD: 4.875-inch-dia. Mud Rotary Wash
HAMMER TYPE: 140-lb Automatic Trip
DRILLED BY: SoCal Drilling
LOGGED BY: J. Martos
CHECKED BY: L A Berry
RIG TYPE: Mayhew 1000

LOG OF DRILL HOLE NO. DH-02

Montecito Street Bridge Replacement
Santa Barbara, California

PLATE A-2a

LOCATION: See Plate 2 - Subsurface Exploration Plan
N 1,982,673 E 6,055,904.7
CA State Plane, Zone V, NAD83 ft

SURFACE EL: 60.8 ft +/- (rel. NAVD 88 datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
20													
	42		8	▨	(36)	CLAYEY SAND (SC); medium dense; strong brown; very moist; fine SAND							
18							136	114	19	49			u 1.0
	44												
16													
	46												
14													
	48												
12													
	50		9	☒	64	- very dense; moist			16				
10													
	52												
8						- rig chatter from 53' to 53.5'							
	54					SILTY SAND (SM); very dense; mottled strong brown and brown; very moist; some fines							
6			10	▨	(100)		131	108	21				
	56						135	118	15	49	21	4	
4													
	58												
2													
	60		11	☒	45	- mostly fine SAND; trace coarse SAND			15				
0													
	62												
-2													
	64												
-4			12	▨	(ref/5.5")		140	124	13				
	66												
-6													
	68												
-8													
	70		13	☒	67	- dark yellowish brown; moist; slightly clayey			17				
-10													
	72												
-12													
	74												
-14			14	☒	77				19				
	76												
-16													
	78												
-18													

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 86.0 ft
DEPTH TO WATER: Not Measured
BACKFILLED WITH: Cement Grout
DRILLING DATE: May 7, 2015

DRILLING METHOD: 4.875-inch-dia. Mud Rotary Wash
HAMMER TYPE: 140-lb Automatic Trip
DRILLED BY: SoCal Drilling
LOGGED BY: J. Martos
CHECKED BY: L A Berry
RIG TYPE: Mayhew 1000

LOG OF DRILL HOLE NO. DH-02

Montecito Street Bridge Replacement
Santa Barbara, California

PLATE A-2b

LOCATION: See Plate 2 - Subsurface Exploration Plan
N 1,982,673 E 6,055,904.7
CA State Plane, Zone V, NAD83 ft

SURFACE EL: 60.8 ft +/- (rel. NAVD 88 datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
-20													
	82					CLAYEY SAND (SC); very dense; dark yellowish brown; moist; mostly fine SAND; some coarse to medium SAND							
-22													
	84												
-24			15	▨	(50/5")								
	86					**Boring terminated at approximately 86 feet**	136	118	16				
-26													
	88												
-28													
	90												
-30													
	92												
-32													
	94												
-34													
	96												
-36													
	98												
-38													
	100												
-40													
	102												
-42													
	104												
-44													
	106												
-46													
	108												
-48													
	110												
-50													
	112												
-52													
	114												
-54													
	116												
-56													
	118												
-58													

COMPLETION DEPTH: 86.0 ft
DEPTH TO WATER: Not Measured
BACKFILLED WITH: Cement Grout
DRILLING DATE: May 7, 2015

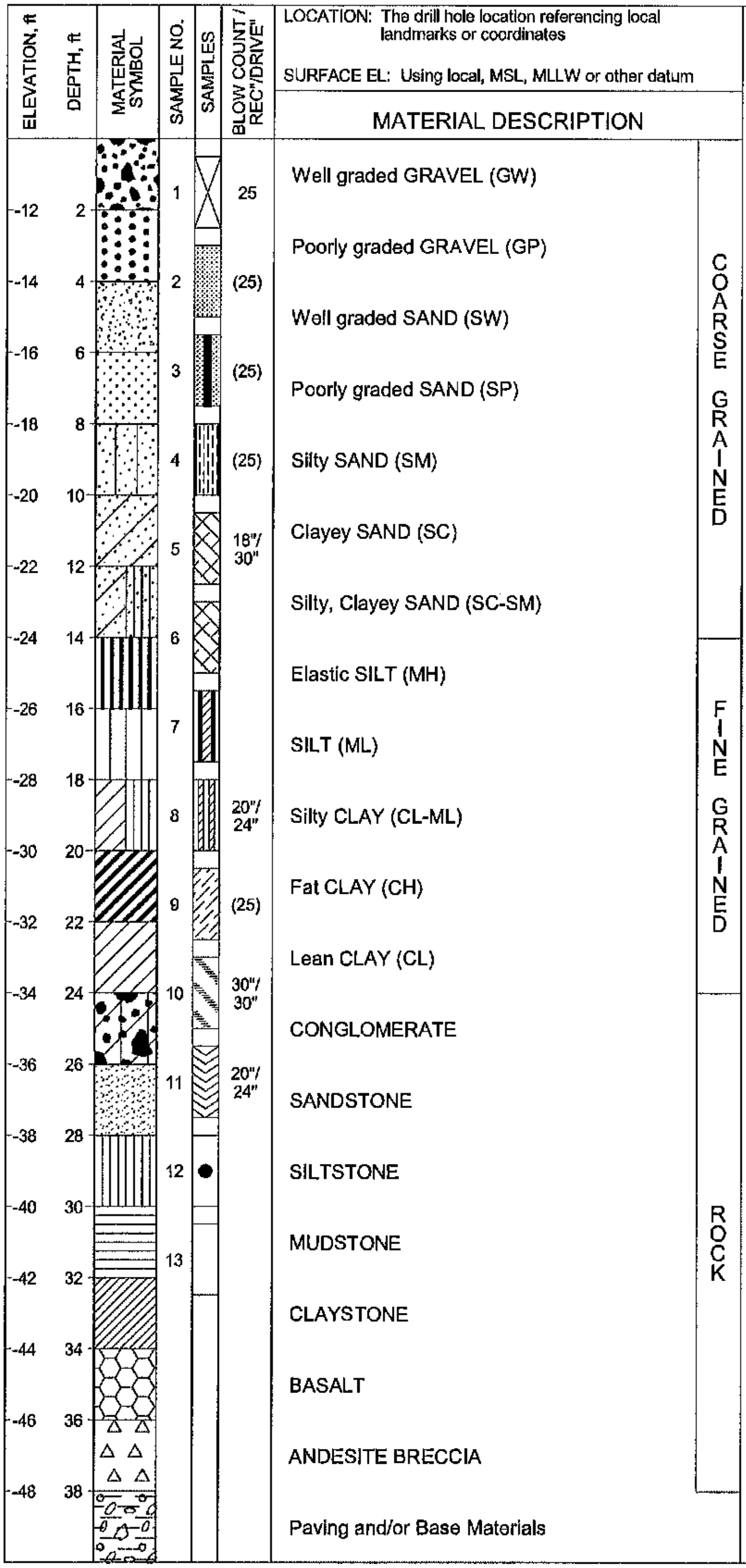
DRILLING METHOD: 4.875-inch-dia. Mud Rotary Wash
HAMMER TYPE: 140-lb Automatic Trip
DRILLED BY: SoCal Drilling
LOGGED BY: J. Martos
CHECKED BY: L A Berry
RIG TYPE: Mayhew 1000

LOG OF DRILL HOLE NO. DH-02

Montecito Street Bridge Replacement
Santa Barbara, California

LOCATION: The drill hole location referencing local landmarks or coordinates

SURFACE EL: Using local, MSL, MLLW or other datum



MATERIAL DESCRIPTION

- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- Silty SAND (SM)
- Clayey SAND (SC)
- Silty, Clayey SAND (SC-SM)
- Elastic SILT (MH)
- SILT (ML)
- Silty CLAY (CL-ML)
- Fat CLAY (CH)
- Lean CLAY (CL)
- CONGLOMERATE
- SANDSTONE
- SILTSTONE
- MUDSTONE
- CLAYSTONE
- BASALT
- ANDESITE BRECCIA
- Paving and/or Base Materials

General Notes

Soil Texture Symbol

Sloped line in symbol column indicates transitional boundary

Samplers and sampler dimensions (unless otherwise noted in report text) are as follows:

Symbol for:

1	SPT Sampler, driven 1-3/8" ID, 2" OD
2	CA Liner Sampler, driven 2-3/8" ID, 3" OD
3	CA Liner Sampler, disturbed 2-3/8" ID, 3" OD
4	Thin-walled Tube, pushed 2-7/8" ID, 3" OD
5	Bulk Bag Sample (from cuttings)
6	CA Liner Sampler, Bagged
7	Hand Auger Sample
8	CME Core Sample
9	Pitcher Sample
10	Lexan Sample
11	Vibracore Sample
12	No Sample Recovered
13	Sonic Soil Core Sample

Sampler Driving Resistance

Number of blows with 140 lb. hammer, falling 30" to drive sampler 1 ft. after seating sampler 6"; for example,

Blows/ft	Description
25	25 blows drove sampler 12" after initial 6" of seating
86/11"	After driving sampler the initial 6" of seating, 36 blows drove sampler through the second 6" interval, and 50 blows drove the sampler 5" into the third interval
50/6"	50 blows drove sampler 6" after initial 6" of seating
Ref/3"	50 blows drove sampler 3" during initial 6" seating interval

Blow counts for California Liner Sampler shown in ( )

Length of sample symbol approximates recovery length

Classification of Soils per ASTM D2487 or D2488

Geologic Formation noted in bold font at the top of interpreted interval

Strength Legend

Q = Unconfined Compression
u = Unconsolidated Undrained Triaxial
t = Torvane
p = Pocket Penetrometer
m = Miniature Vane

Water Level Symbols

- ⊻ Initial or perched water level
- ⊻ Final ground water level
- Seepages encountered

Rock Quality Designation (RQD) is the sum of recovered core pieces greater than 4 inches divided by the length of the cored interval.

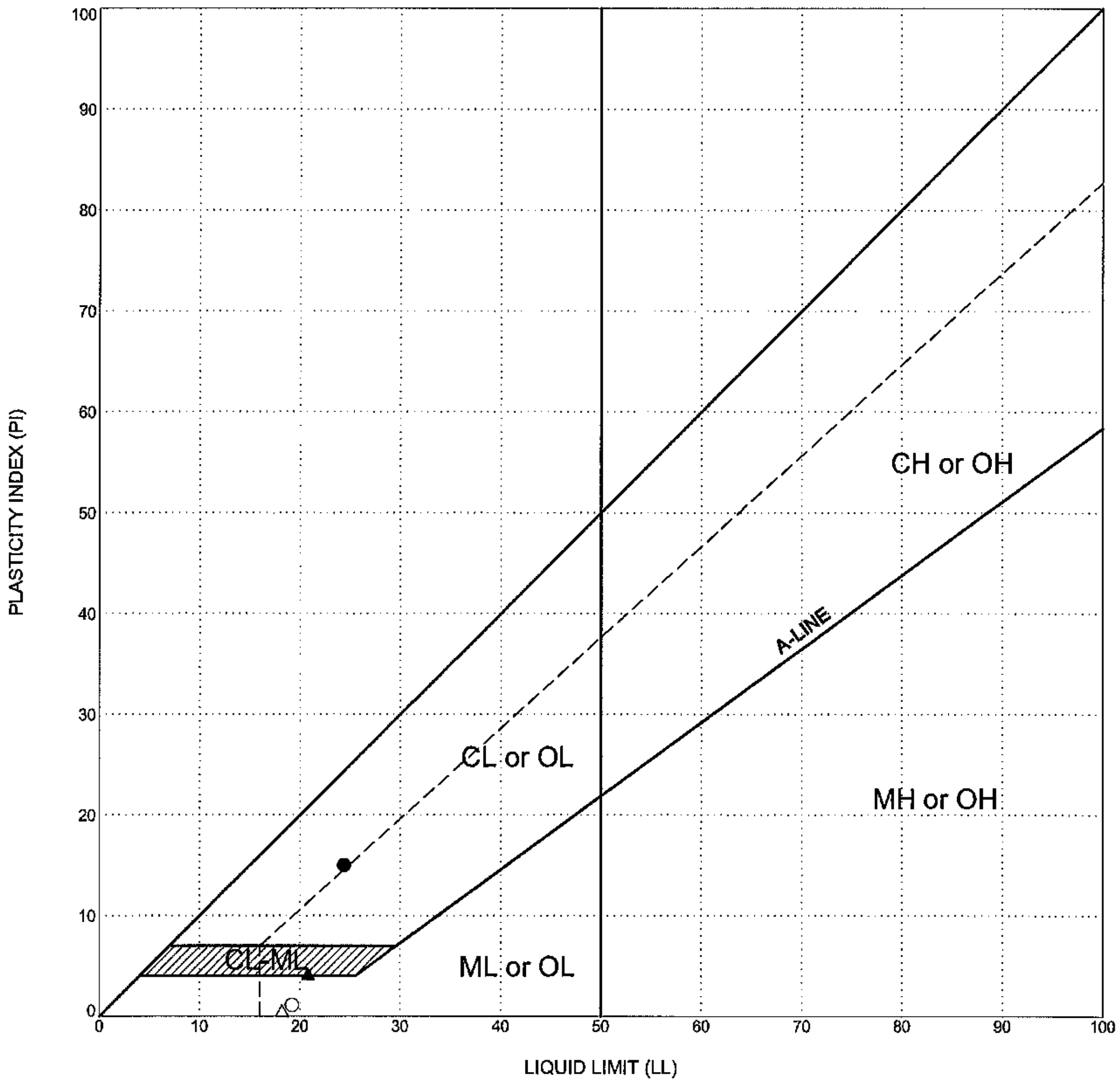
KEY TO TERMS & SYMBOLS USED ON LOGS

Laboratory Testing

DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWW pcf	UDW pcf	MC %	FINES %	ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSIVITY TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	Specific Gravity
								LL	PI	MAX DD pcf	OPT MC %	C ksf	PHI deg	Qu, ksf	S_u (Cell Prs.) ksf	R	pH	Cl	So_4 (ppm)				
DH-01	5.0	1	Silty SAND (SM)	131	125	5														53			
DH-01	10.0	2	Silty SAND (SM)			14																	
DH-01	15.5	3	Silty SAND (SM)	113	105	8	31					0.1	37										
DH-01	20.0	4	Silty SAND (SM)			13										3034	8.30	9	82.0				
DH-01	25.5	5	Silty SAND (SM)	125	113	11	34	19	1														
DH-01	30.0	6	Silty SAND (SM)			20																	
DH-01	45.0	9	Clayey SAND (SC)			17	28	24	15														
DH-01	56.0	11	Sandy CLAY (CL)			21																	
DH-01	60.5	12a	Clayey SAND (SC)	134	114	17	42																
DH-01	61.0	12b	Clayey SAND (SC)	136	113	20									2.2(4.3)								
DH-01	70.0	14	Clayey SAND (SC)			14																	
DH-01	75.5	15	Clayey SAND (SC)	131	111	18																	
DH-02	5.0	1a	Silty SAND (SM)	99	89	11																	
DH-02	5.5	1b	Silty SAND (SM)													1101	7.80	25	1065.0				
DH-02	10.0	2	Silty SAND (SM)			14	43																
DH-02	20.0	4	Silty SAND (SM)			13	32	18	NP														
DH-02	25.5	5a	Silty SAND (SM)	120	111	9						0.1	37										
DH-02	30.0	6	Silty SAND (SM)			13																	
DH-02	42.5	8a	Clayey SAND (SC)	136	114	19	49								1(3.3)								
DH-02	50.0	9	Clayey SAND (SC)			16																	
DH-02	55.0	10a	Silty SAND (SM)	131	108	21																	
DH-02	56.0	10b	Silty SAND (SM)	135	118	15	49	21	4														
DH-02	60.0	11	Silty SAND (SM)			15										1808	7.80	27	143.0				
DH-02	65.0	12	Silty SAND (SM)	140	124	13																	
DH-02	70.0	13	Silty SAND (SM)			17																	
DH-02	75.0	14	Silty SAND (SM)			19																	
DH-02	85.5	15	Clayey SAND (SC)	136	118	16																	

SUMMARY OF LABORATORY TEST RESULTS

Montecito Street Bridge Replacement
Santa Barbara, California

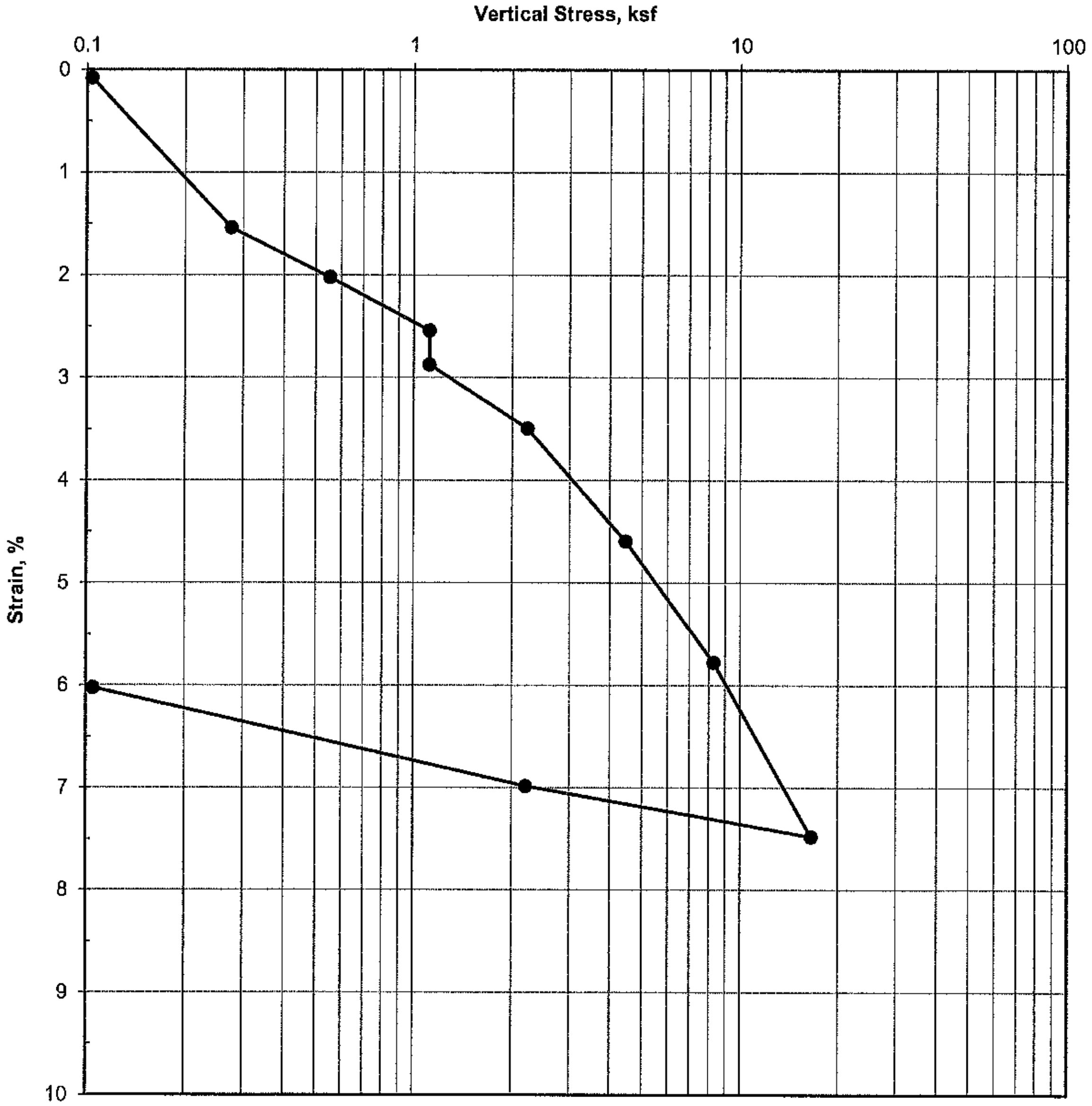


LEGEND			CLASSIFICATION	ATTERBERG LIMITS TEST RESULTS		
	location	depth, ft		LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)
○	DH-01	25.5	Silty SAND (SM)	19	18	1
●	DH-01	45.0	Clayey SAND (SC)	24	9	15
△	DH-02	20.0	Silty SAND (SM)	18	18	NP
▲	DH-02	56.0	Silty SAND (SM)	21	17	4

PLASTICITY CHART

Montecito Street Bridge Replacement
Santa Barbara, California

PLATE B-2



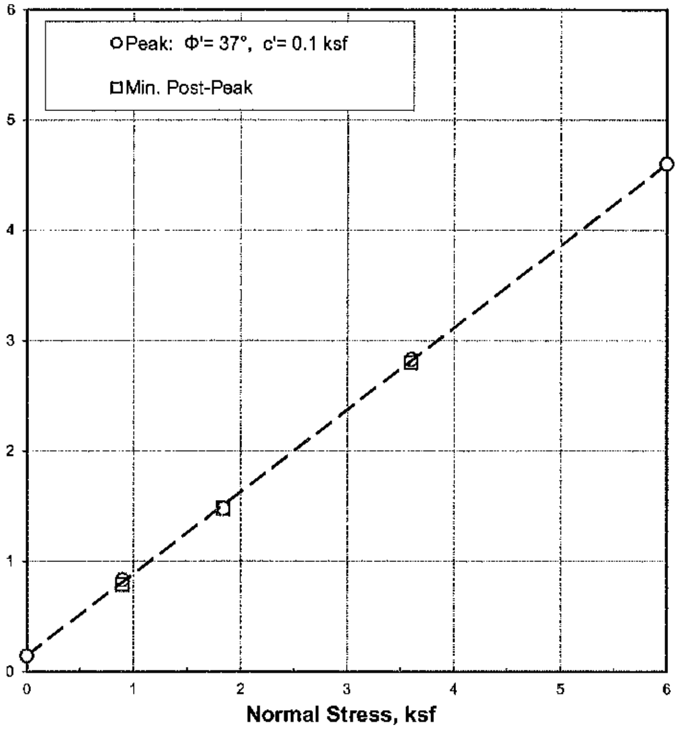
SAMPLE ID	Boring, Sample #, Depth	DH-02 , #8b , 43.0 ft
	USCS Classification:	Clayey SAND (SC): dark yellowish brown, moist

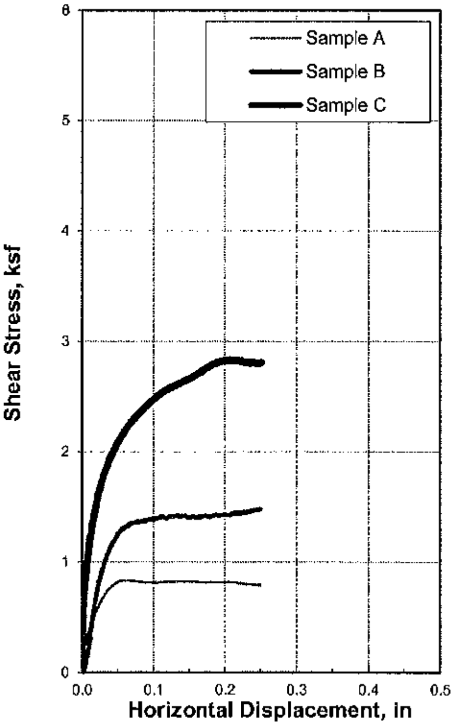
		Initial	Final
PROPERTIES	Water Content, %	18.1%	14.8%
	Dry Unit Weight, pcf	112.5	119.7
	Saturation, %	102%	103%
	Void Ratio	0.47	0.38
	Diameter, in	2.42	2.42
	Height, in	0.82	0.77

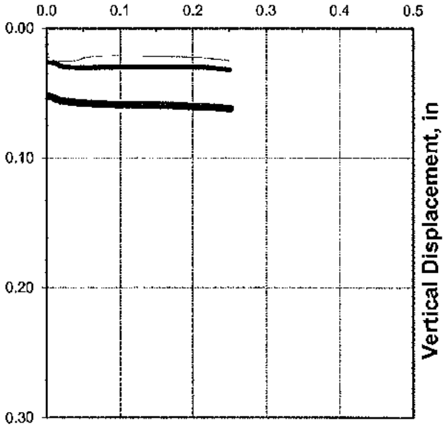
SUMMARY	Preconsolidation Pressure, ksf	---
	Inundation Increment, ksf	1.11
	Liquid Limit	---
	Plastic Limit	---
	Plasticity Index	---
	Passing #200	---
	Estimated Gs	2.65
REMARKS	Test Method: D2435	

CONSOLIDATION
Montecito Street Bridge Replacement
Santa Barbara, California

PLATE B-5c





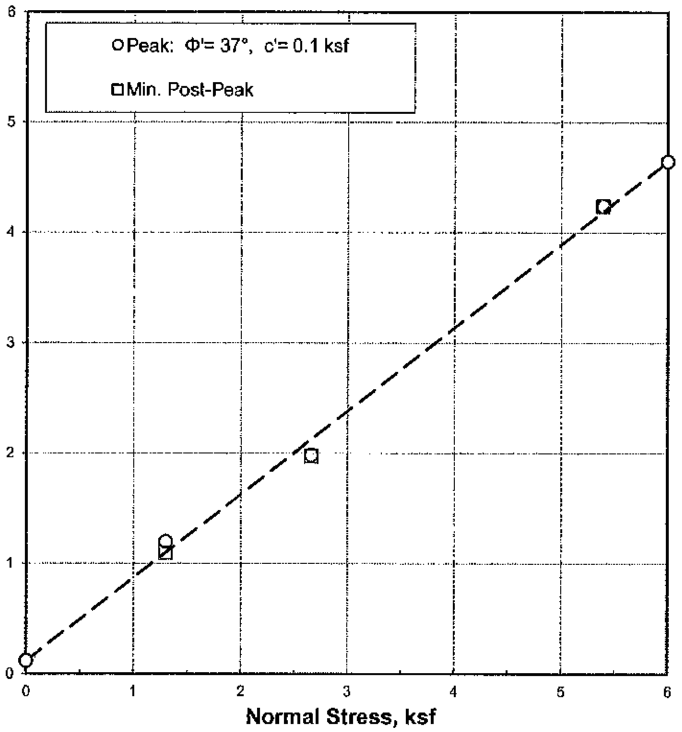


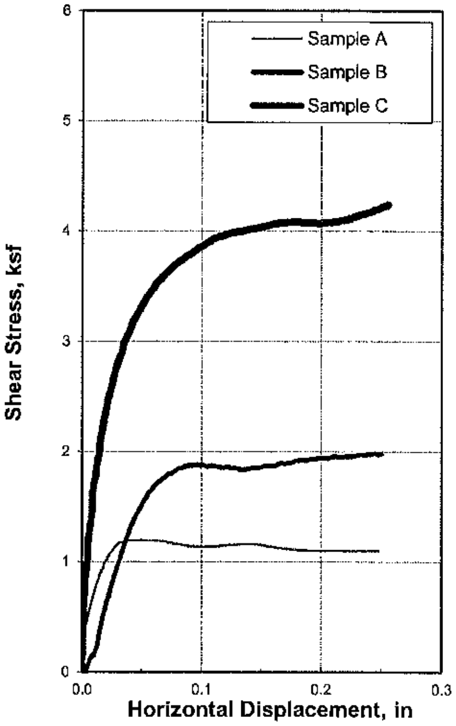
SAMPLE ID	Boring Number:	DH-01			
	Sample Number:	3a			
	Sample Depth:	15.5 ft			
	USCS Classification:	Silty SAND (SM): dark yellowish brown, moist			
	Specimen	A	B	C	D
INITIAL	Water Content, %	7.8%	7.8%	7.8%	
	Dry Unit Weight, pcf	105.8	104.8	105.8	
	Saturation, %	36%	36%	36%	
	Void Ratio	0.56	0.58	0.56	
	Diameter, in	2.42	2.42	2.42	
	Height, in	1.00	1.00	1.00	
FINAL	Water Content, %	20.2%	20.1%	19.9%	
	Dry Unit Weight, pcf	107.6	107.8	104.0	
	Void Ratio	0.54	0.53	0.59	
TEST SUMMARY	Displacement at Peak, in	0.06	0.25	0.21	
	Displacement Rate, in/min	0.001	0.001	0.001	
	Normal Stress, ksf	0.9	1.8	3.6	
	Peak Shear Stress, ksf	0.83	1.48	2.83	
	Min. Post-Peak Stress, ksf	0.79	1.48	2.80	
REMARKS	Test Method: ASTM D3080				

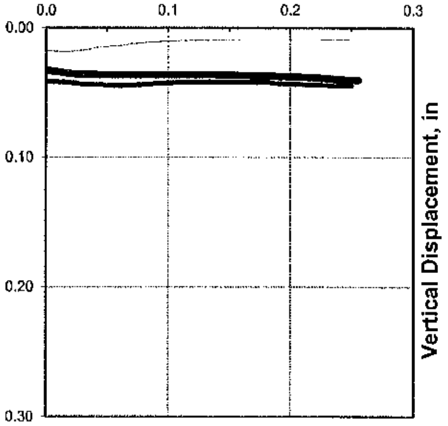
CLASSIFICATION	Sieve Size	% Passing
	3/8-in. (9.5mm)	---
	#4 (4.75mm)	---
	#16 (1.18mm)	---
	#30 (0.6mm)	---
	#100 (0.150mm)	---
	#200 (0.075mm)	---
	Atterberg Limits	
	Liquid Limit, %	---
	Plastic Limit, %	---
	Plasticity Index, %	---
	Estimated Gs	2.65
	k_{avg} 20°C, cm/sec	---

DIRECT SHEAR TEST RESULTS

Montecito Street Bridge Replacement
Santa Barbara, California







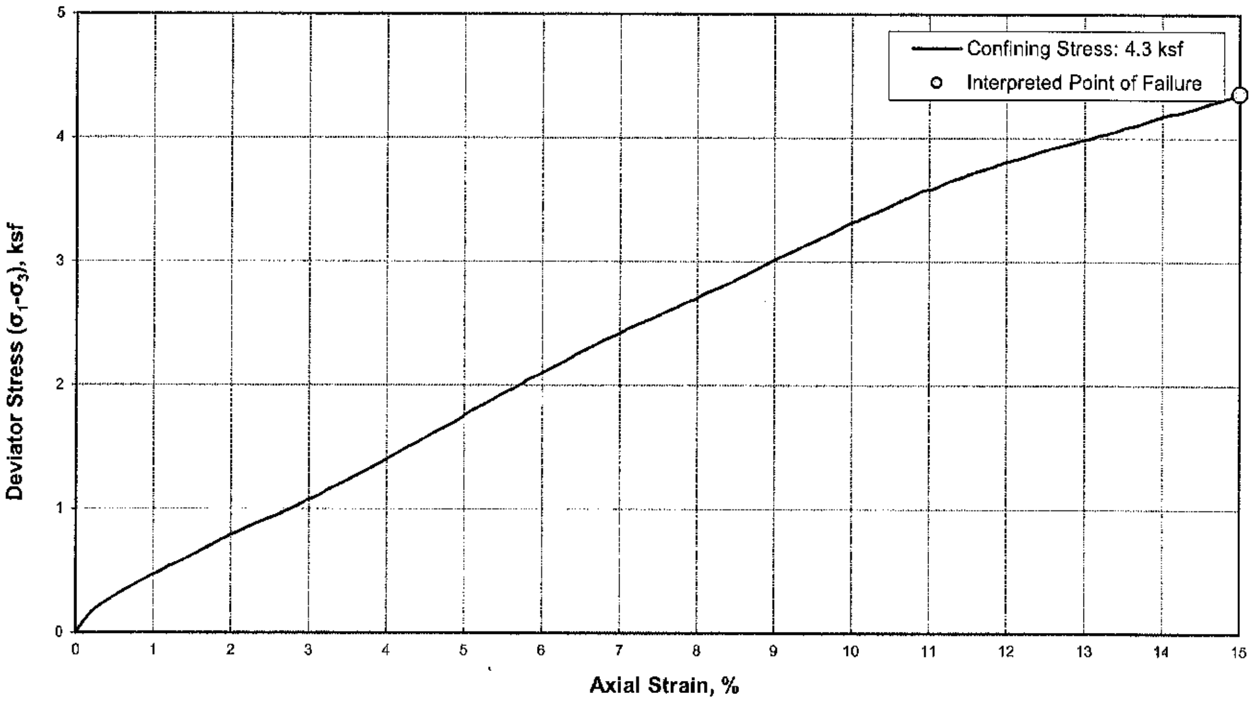
SAMPLE ID	Boring Number:	DH-02
	Sample Number:	5a
	Sample Depth:	25.5 ft
	USCS Classification:	Silty SAND (SM): dark yellowish brown, moist

	Specimen	A	B	C	D
INITIAL	Water Content, %	8.9%	8.9%	8.9%	
	Dry Unit Weight, pcf	110.7	110.5	112.3	
	Saturation, %	48%	48%	50%	
	Void Ratio	0.49	0.50	0.47	
	Diameter, in	2.42	2.42	2.42	
	Height, in	1.00	1.00	1.00	
FINAL	Water Content, %	17.7%	17.3%	16.1%	
	Dry Unit Weight, pcf	112.5	113.6	115.9	
	Void Ratio	0.47	0.46	0.43	
TEST SUMMARY	Displacement at Peak, in	0.05	0.24	0.26	
	Displacement Rate, in/min	0.001	0.001	0.001	
	Normal Stress, ksf	1.3	2.7	5.4	
	Peak Shear Stress, ksf	1.20	1.98	4.24	
	Min. Post-Peak Stress, ksf	1.10	1.97	4.24	
REMARKS	Test Method: ASTM D3080				

	Sieve Size	% Passing
CLASSIFICATION	3/8-in. (9.5mm)	---
	#4 (4.75mm)	---
	#16 (1.18mm)	---
	#30 (0.6mm)	---
	#100 (0.150mm)	---
	#200 (0.075mm)	---
	Atterberg Limits	
	Liquid Limit, %	---
	Plastic Limit, %	---
	Plasticity Index, %	---
	Estimated Gs	2.65
	k_{avg} 20°C, cm/sec	---

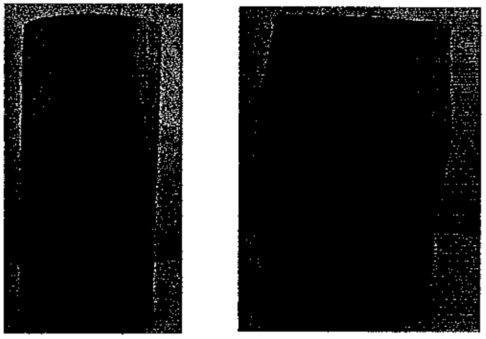
DIRECT SHEAR TEST RESULTS

Montecito Street Bridge Replacement
Santa Barbara, California



SAMPLE ID	Boring Number:	DH-01
	Sample Number:	12b
	Sample Depth:	61.0 ft
	USCS Classification:	Clayey SAND (SC): yellowish brown, moist
SAMPLE PROPERTIES	Water Content, %	19.5%
	Dry Unit Weight, pcf	113.4
	Saturation, %	113%
	Void Ratio	0.46
	Diameter, in	2.42
	Height, in	5.23

SAMPLE IMAGES

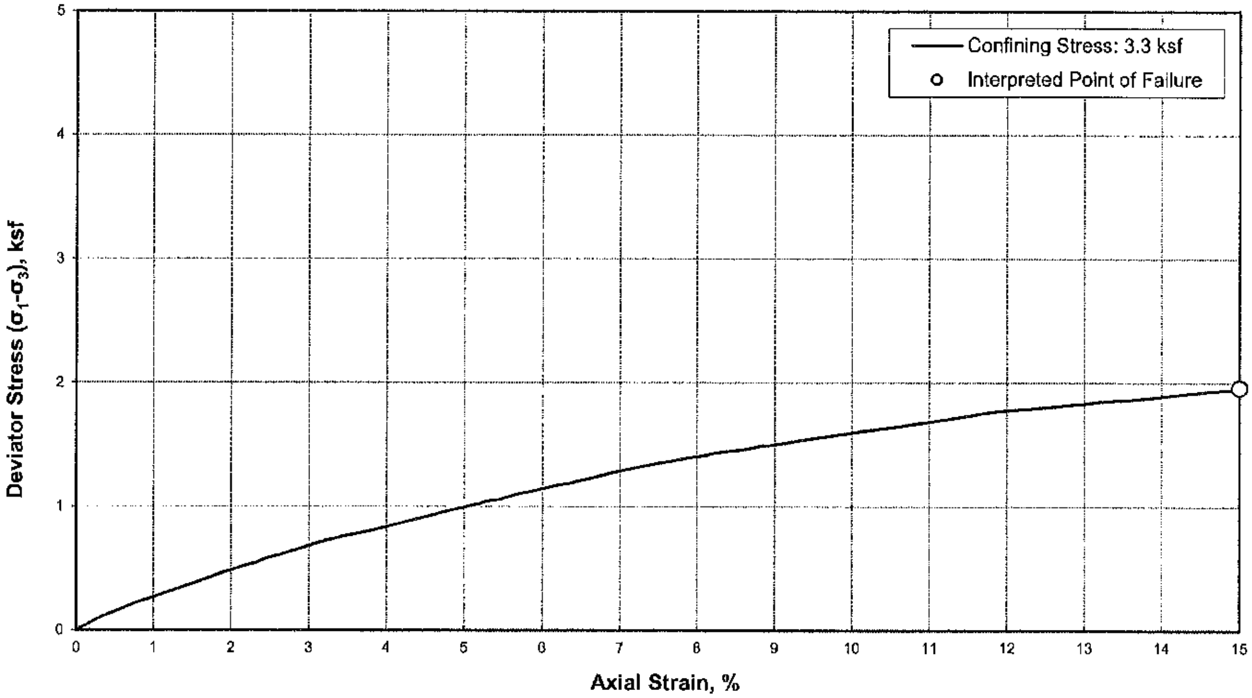


CLASSIFICATION	Sieve Size	% Passing	Other Parameters	
	3/8-in. (9.5mm)	---	Liquid Limit	---
	#4 (4.75mm)	---	Plastic Limit	---
	#16 (1.18mm)	---	Plasticity Index	---
	#30 (0.6mm)	---	Estimated Gs	2.65
	#100 (0.150mm)	---	S_u from T_v, ksf	---
	#200 (0.075mm)	---	S_u from PP, ksf	---

TEST SUMMARY	Maximum Deviator Stress, ksf	4.4
	Undrained Shear Strength, ksf	2.2
	Axial Strain at Failure, %	15.0
	Strain Rate, %/min	0.7
	Cell Pressure, ksf	4.3
	Tested By:	JB
	Date Tested:	5/13/15
REMARKS	Test Method: ASTM 2850	

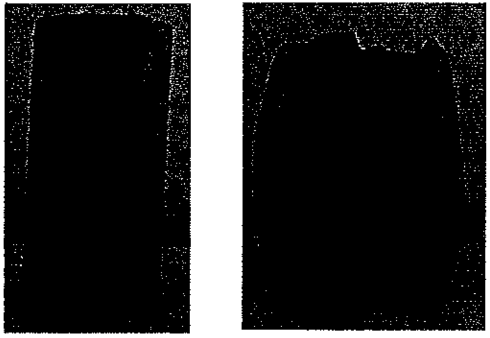
UNCONSOLIDATED, UNDRAINED TRIAXIAL TEST

Montecito Street Bridge Replacement
Santa Barbara, California



SAMPLE ID	Boring Number:	DH-02
	Sample Number:	8a
	Sample Depth:	42.5 ft
	USCS Classification:	Clayey SAND (SC): yellowish brown, moist
SAMPLE PROPERTIES	Water Content, %	19.4%
	Dry Unit Weight, pcf	114.0
	Saturation, %	114%
	Void Ratio	0.45
	Diameter, in	2.41
	Height, in	5.12

SAMPLE IMAGES

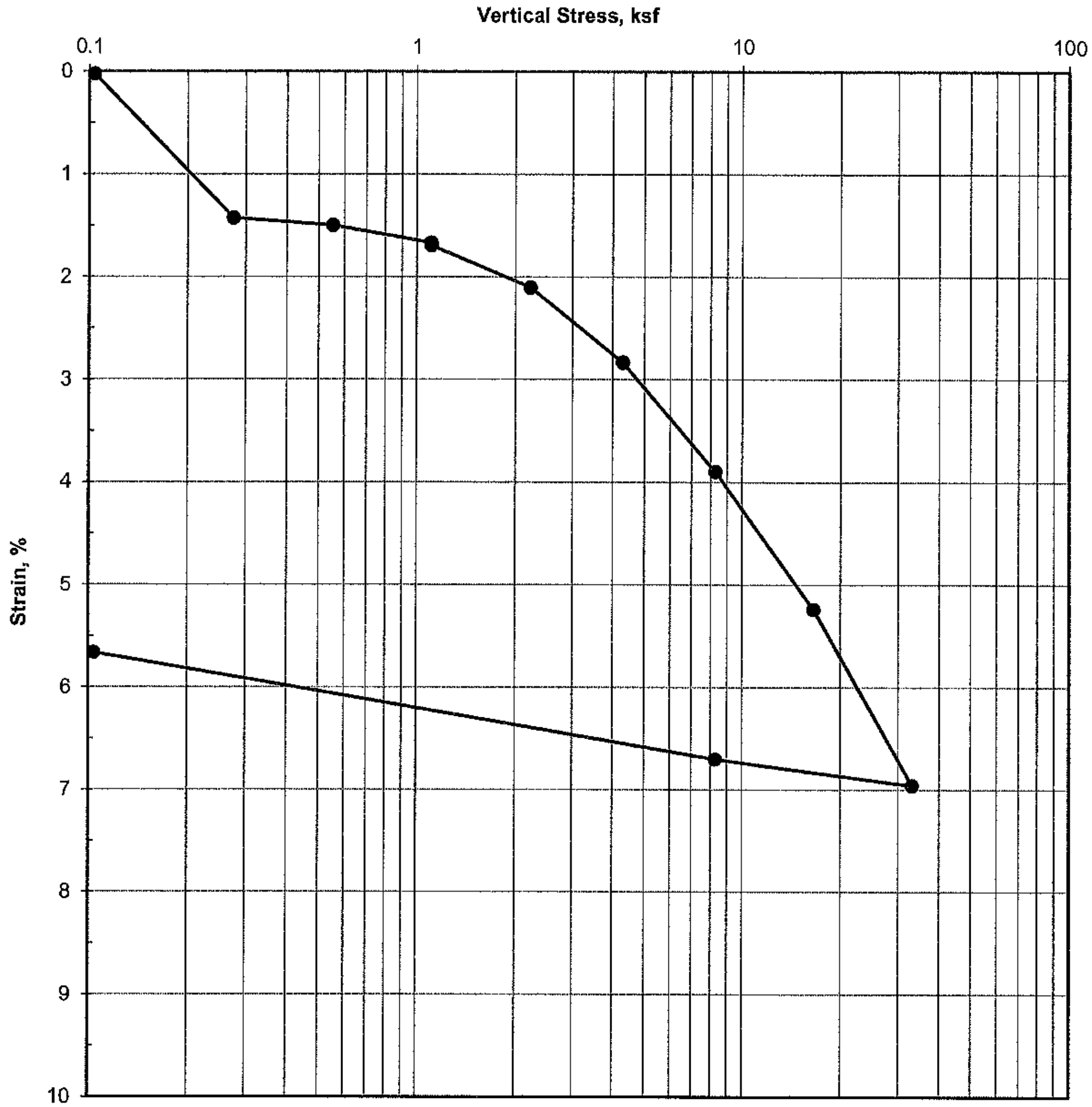


CLASSIFICATION	Sieve Size	% Passing	Other Parameters	
	3/8-in. (9.5mm)	---	Liquid Limit	---
	#4 (4.75mm)	---	Plastic Limit	---
	#16 (1.18mm)	---	Plasticity Index	---
	#30 (0.6mm)	---	Estimated Gs	2.65
	#100 (0.150mm)	---	S_u from T_v, ksf	---
	#200 (0.075mm)	---	S_u from PP, ksf	---

TEST SUMMARY	Maximum Deviator Stress, ksf	2.0
	Undrained Shear Strength, ksf	1.0
	Axial Strain at Failure, %	15.0
	Strain Rate, %/min	0.9
	Cell Pressure, ksf	3.3
	Tested By:	JB
	Date Tested:	5/13/15
REMARKS	Test Method: ASTM 2850	

UNCONSOLIDATED, UNDRAINED TRIAXIAL TEST

Montecito Street Bridge Replacement Project
Santa Barbara, California

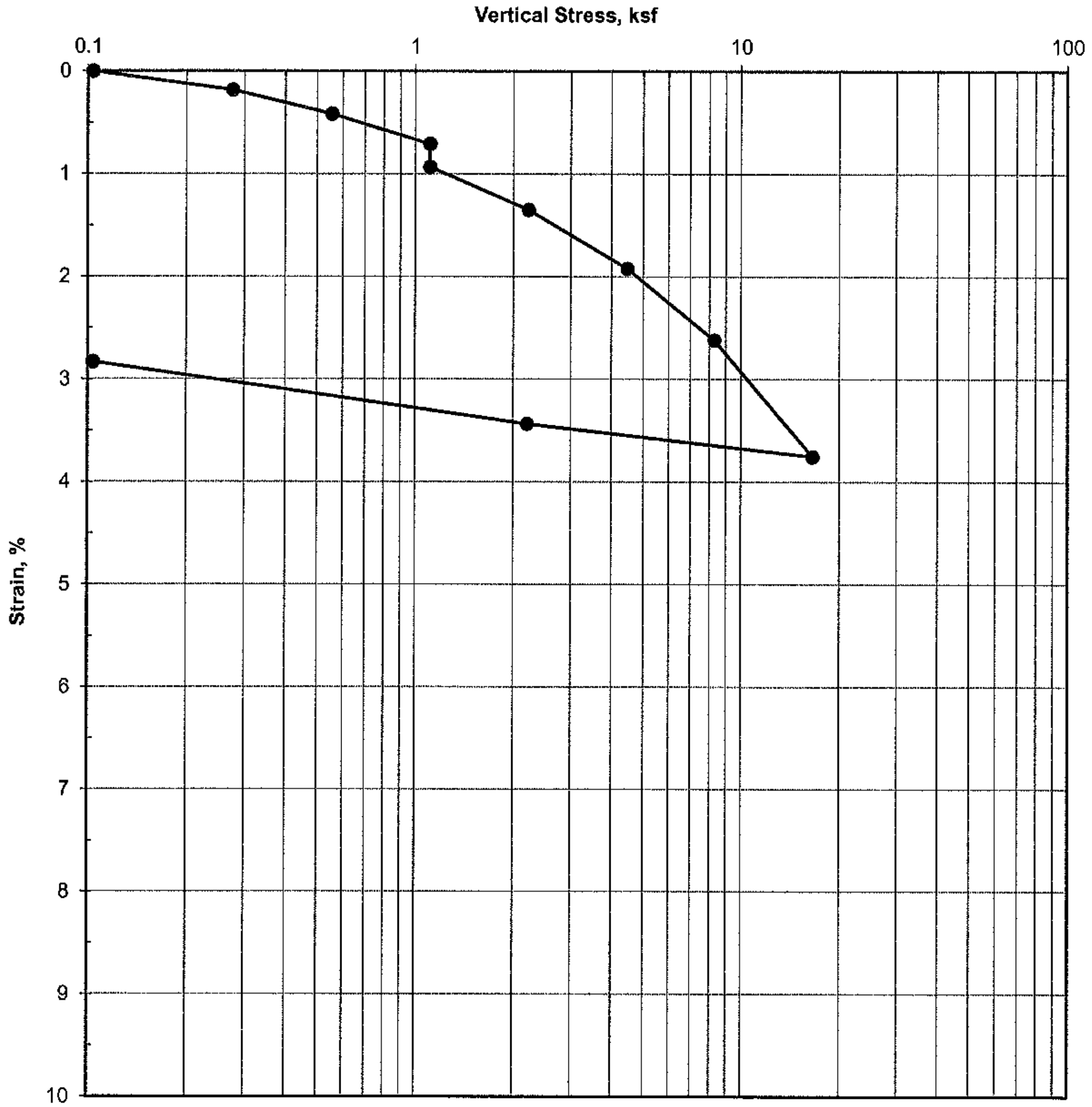


SAMPLE ID	Boring, Sample #, Depth	DH-01 , #12a , 60.5 ft	
	USCS Classification:	Clayey SAND (SC): yellowish brown	
PROPERTIES		Initial	Final
	Water Content, %	17.6%	13.4%
	Dry Unit Weight, pcf	113.8	120.7
	Saturation, %	103%	96%
	Void Ratio	0.45	0.37
	Diameter, in	2.42	2.42
	Height, in	0.82	0.77

SUMMARY	Preconsolidation Pressure, ksf	---
	Inundation Increment, ksf	1.11
	Liquid Limit	---
	Plastic Limit	---
	Plasticity Index	---
	Passing #200	---
	Estimated Gs	2.65
REMARKS	Test Method: D2435	

CONSOLIDATION

Montecito Street Bridge Replacement
Santa Barbara, California



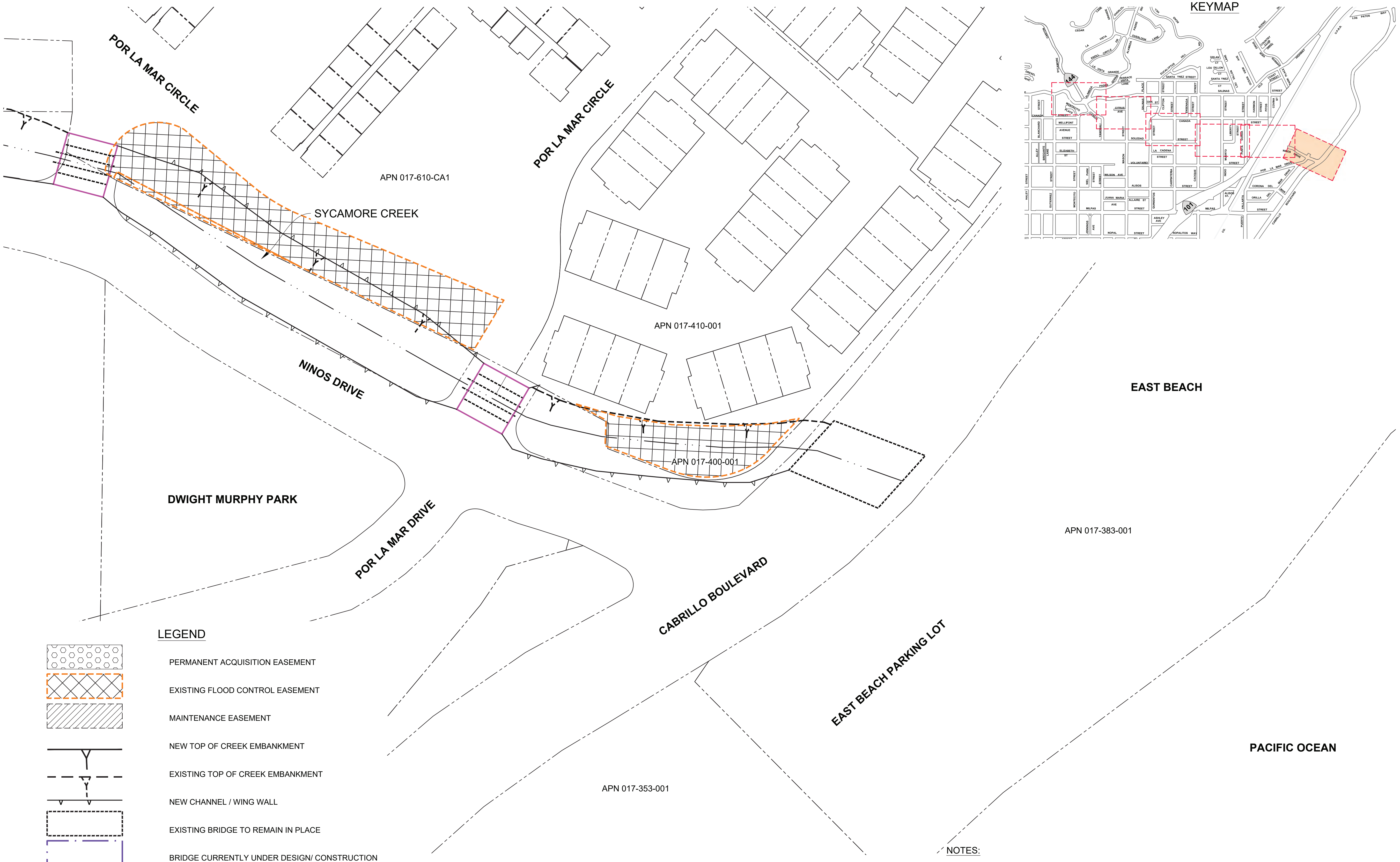
SAMPLE ID	Boring, Sample #, Depth	DH-02 , #5b , 26.0 ft	
	USCS Classification:	Silty SAND (SM): yellowish brown	
PROPERTIES		Initial	Final
	Water Content, %	11.1%	15.4%
	Dry Unit Weight, pcf	109.8	113.0
	Saturation, %	58%	88%
	Void Ratio	0.51	0.46
	Diameter, in	2.42	2.42
	Height, in	0.82	0.80

SUMMARY	Preconsolidation Pressure, ksf	---
	Inundation Increment, ksf	1.11
	Liquid Limit	---
	Plastic Limit	---
	Plasticity Index	---
	Passing #200	---
	Estimated Gs	2.65
REMARKS	Test Method: D2435	

CONSOLIDATION

Montecito Street Bridge Replacement
Santa Barbara, California

Appendix C – Right of Way Exhibits



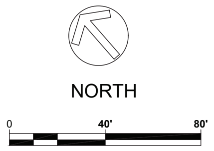
LEGEND

⬡	PERMANENT ACQUISITION EASEMENT
▨	EXISTING FLOOD CONTROL EASEMENT
▨	MAINTENANCE EASEMENT
─┬─	NEW TOP OF CREEK EMBANKMENT
─ ─┬─ ─	EXISTING TOP OF CREEK EMBANKMENT
─┬─	NEW CHANNEL / WING WALL
▭	EXISTING BRIDGE TO REMAIN IN PLACE
▭	BRIDGE CURRENTLY UNDER DESIGN/ CONSTRUCTION
▭	PROPOSED BRIDGE TO BE REPLACED
─ · · ─	SYCAMORE CREEK (FEMA BASELINE)
─ · ─	PARCEL LINES (GIS DATA)

REACH 1 - POR LA MAR CIRCLE TO THE PACIFIC OCEAN
SCALE: 1" = 40'

NOTES:

1. This exhibit shows the approximate area of parcels within the project limits. Parcel lines were created from GIS data and must be verified for final project configuration.
2. See Right of Way Maps in City Office for complete R/W information.



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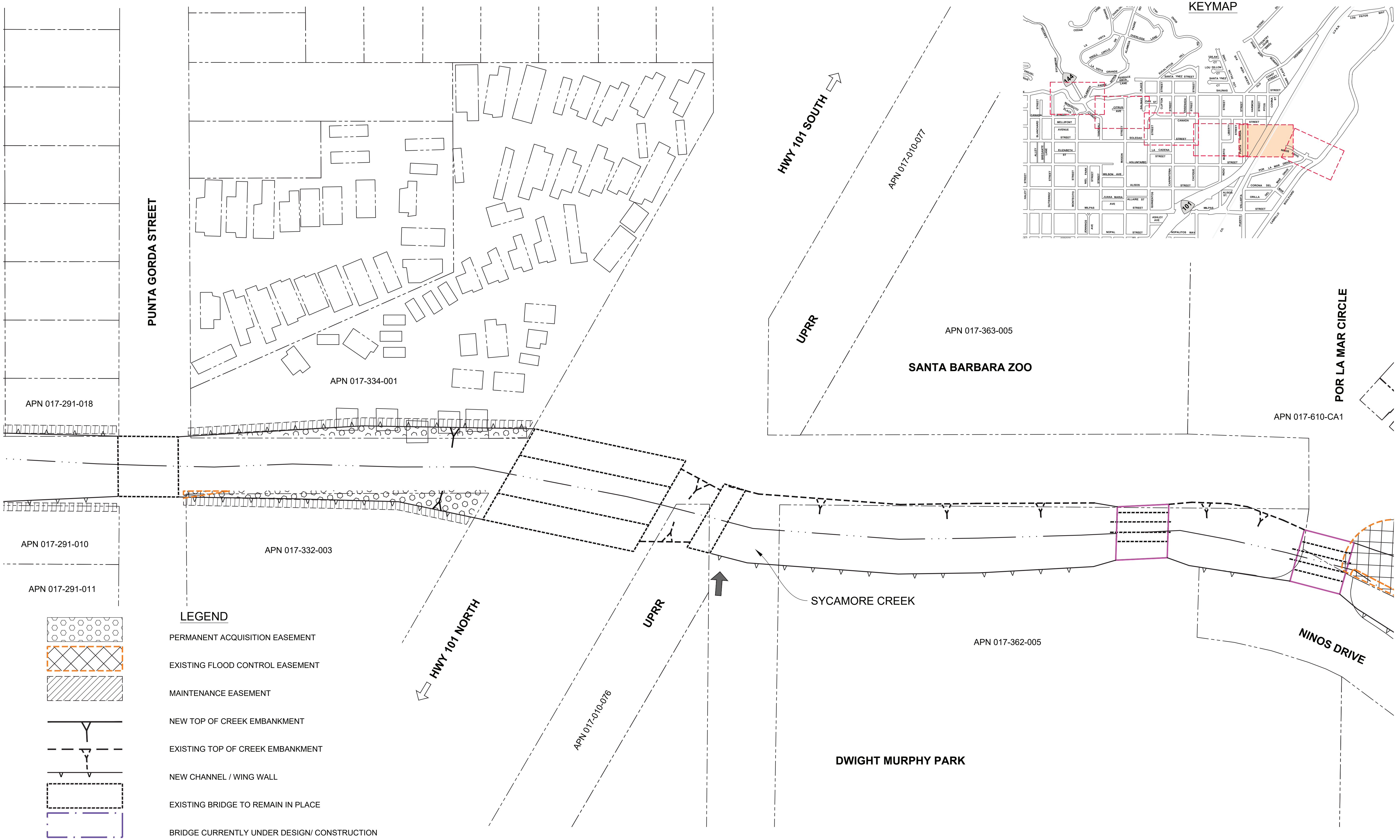
SYCAMORE CREEK PROJECT STUDY REPORT
RIGHT OF WAY MAPPING
REACH 1 - POR LA MAR CIRCLE TO THE PACIFIC OCEAN

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

3/5/2018 3:20:43 PM

SHT. 1 OF 6



LEGEND

○	PERMANENT ACQUISITION EASEMENT
☒	EXISTING FLOOD CONTROL EASEMENT
▨	MAINTENANCE EASEMENT
─Y─	NEW TOP OF CREEK EMBANKMENT
- -Y- -	EXISTING TOP OF CREEK EMBANKMENT
─┴─	NEW CHANNEL / WING WALL
☐	EXISTING BRIDGE TO REMAIN IN PLACE
☐	BRIDGE CURRENTLY UNDER DESIGN/ CONSTRUCTION
☐	PROPOSED BRIDGE TO BE REPLACED
— · · —	SYCAMORE CREEK (FEMA BASELINE)
— · —	PARCEL LINES (GIS DATA)
⬅	PROPOSED MAINTENANCE ACCESS

REACH 2 - PUNTA GORDA STREET POR LA MAR CIRCLE
SCALE: 1" = 40'

NOTES:

1. This exhibit shows the approximate area of parcels within the project limits. Parcel lines were created from GIS data and must be verified for final project configuration.
2. See Right of Way Maps in City Office for complete R/W information.

NORTH

0 40' 80'

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Goleta, CA 93117

SYCAMORE CREEK PROJECT STUDY REPORT
RIGHT OF WAY MAPPING
REACH 2 - PUNTA GORDA STREET TO POR LA MAR CIRCLE

SHT. 2 OF 6

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
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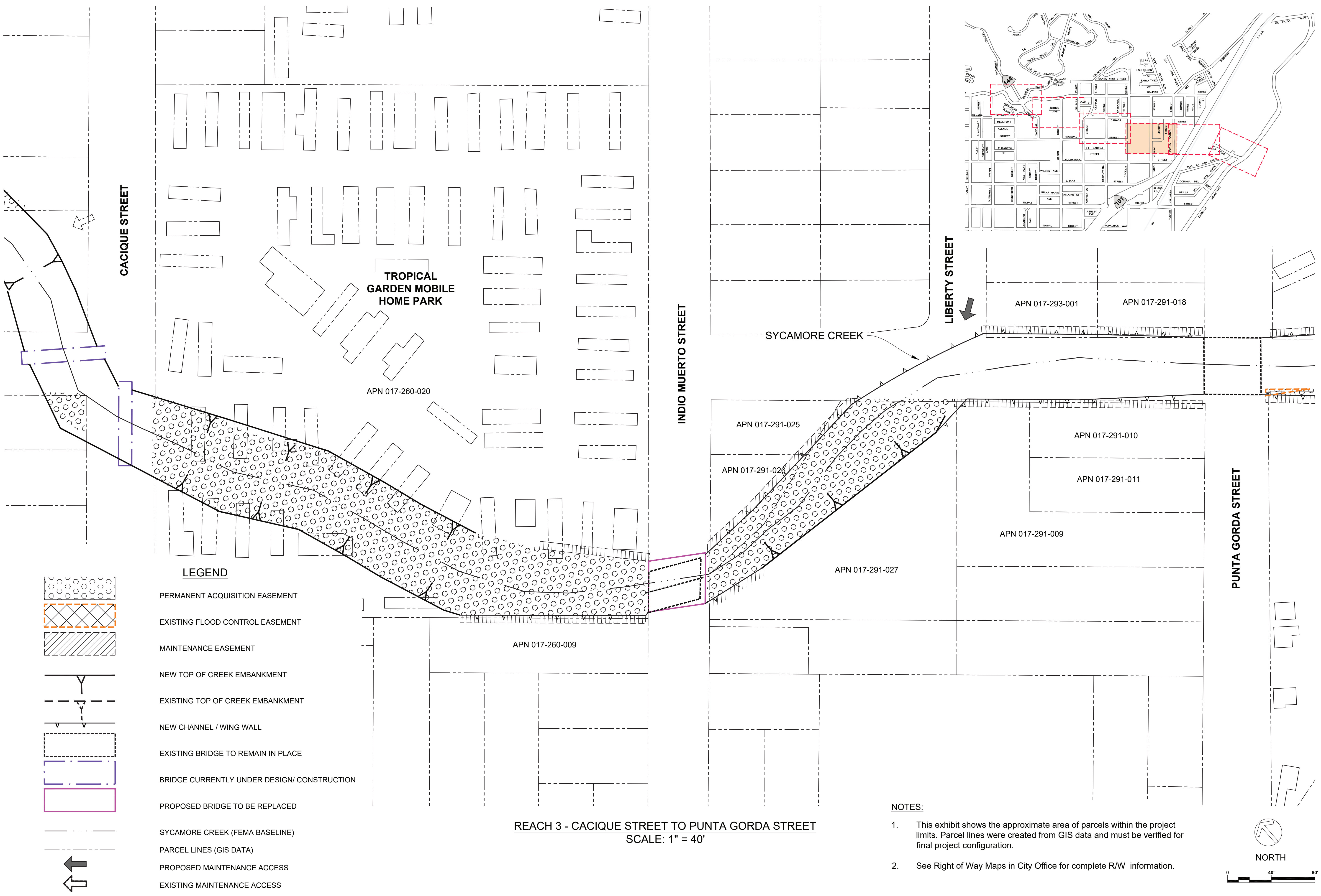

REACH 3 - CACIQUE STREET TO PUNTA GORDA STREET
SCALE: 1" = 40'

NOTES:

1. This exhibit shows the approximate area of parcels within the project limits. Parcel lines were created from GIS data and must be verified for final project configuration.
2. See Right of Way Maps in City Office for complete R/W information.

SANTA BARBARA COUNTY WATER AGENCY

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SYCAMORE CREEK PROJECT STUDY REPORT
RIGHT OF WAY MAPPING
REACH 3 - CACIQUE STREET TO PUNTA GORDA STREET

SHT. 3 OF 6

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

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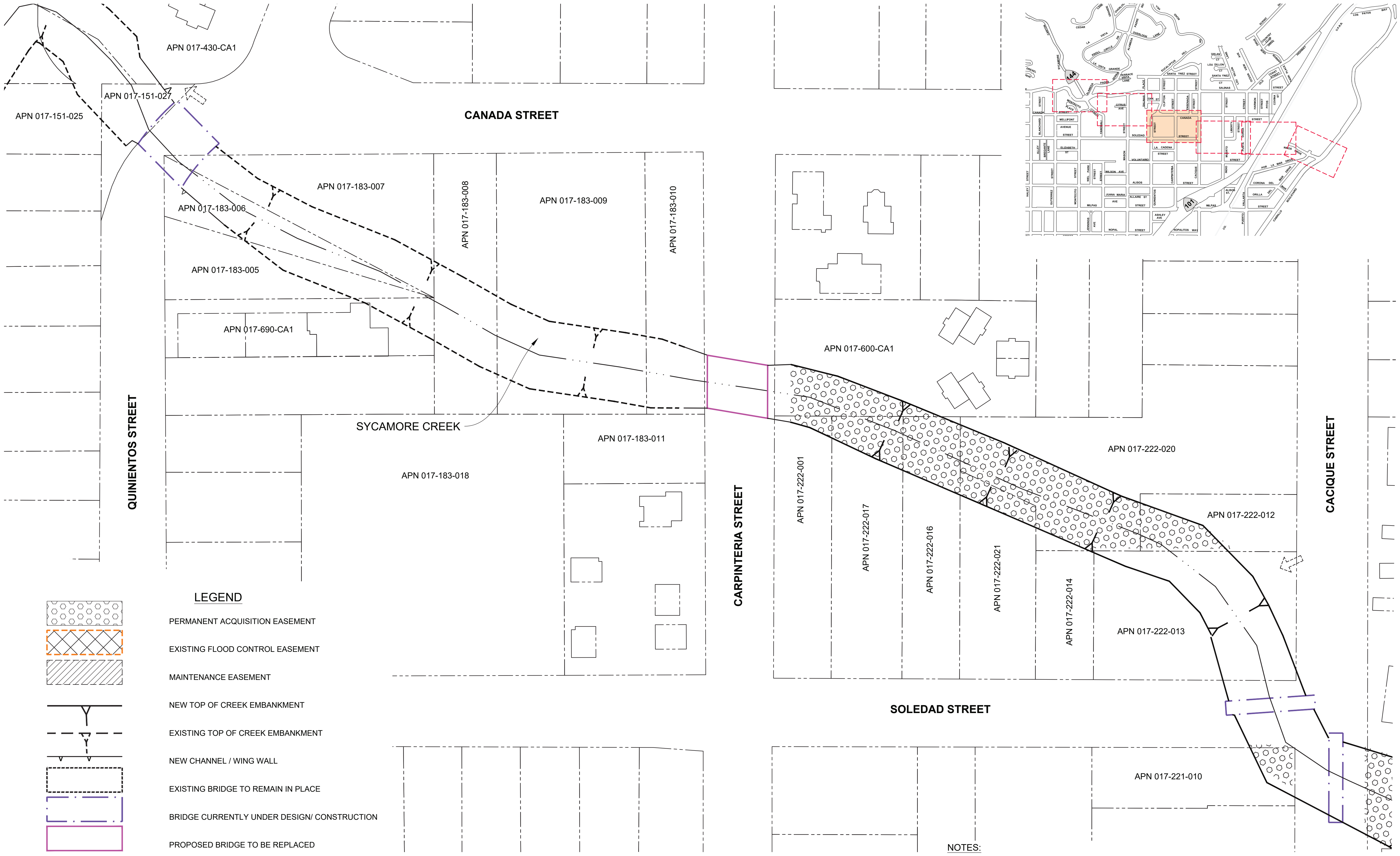

LEGEND

○○○	PERMANENT ACQUISITION EASEMENT
⊠	EXISTING FLOOD CONTROL EASEMENT
▨	MAINTENANCE EASEMENT
——Y——	NEW TOP OF CREEK EMBANKMENT
– – Y – –	EXISTING TOP OF CREEK EMBANKMENT
——v——	NEW CHANNEL / WING WALL
⬚	EXISTING BRIDGE TO REMAIN IN PLACE
⬚	BRIDGE CURRENTLY UNDER DESIGN/ CONSTRUCTION
▭	PROPOSED BRIDGE TO BE REPLACED
—— · · ——	SYCAMORE CREEK (FEMA BASELINE)
– · – · –	PARCEL LINES (GIS DATA)
⬅	PROPOSED MAINTENANCE ACCESS
⇦	EXISTING MAINTENANCE ACCESS

REACH 4 - QUINIENTOS STREET TO CACIQUE STREET
SCALE: 1" = 40'

NOTES:

1. This exhibit shows the approximate area of parcels within the project limits. Parcel lines were created from GIS data and must be verified for final project configuration.
2. See Right of Way Maps in City Office for complete R/W information.

NORTH

0 40' 80'

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Goleta, CA 93117

SYCAMORE CREEK PROJECT STUDY REPORT
RIGHT OF WAY MAPPING
REACH 4 - QUINIENTOS STREET TO CACIQUE STREET

SHT. 4 OF 6

0 1 2
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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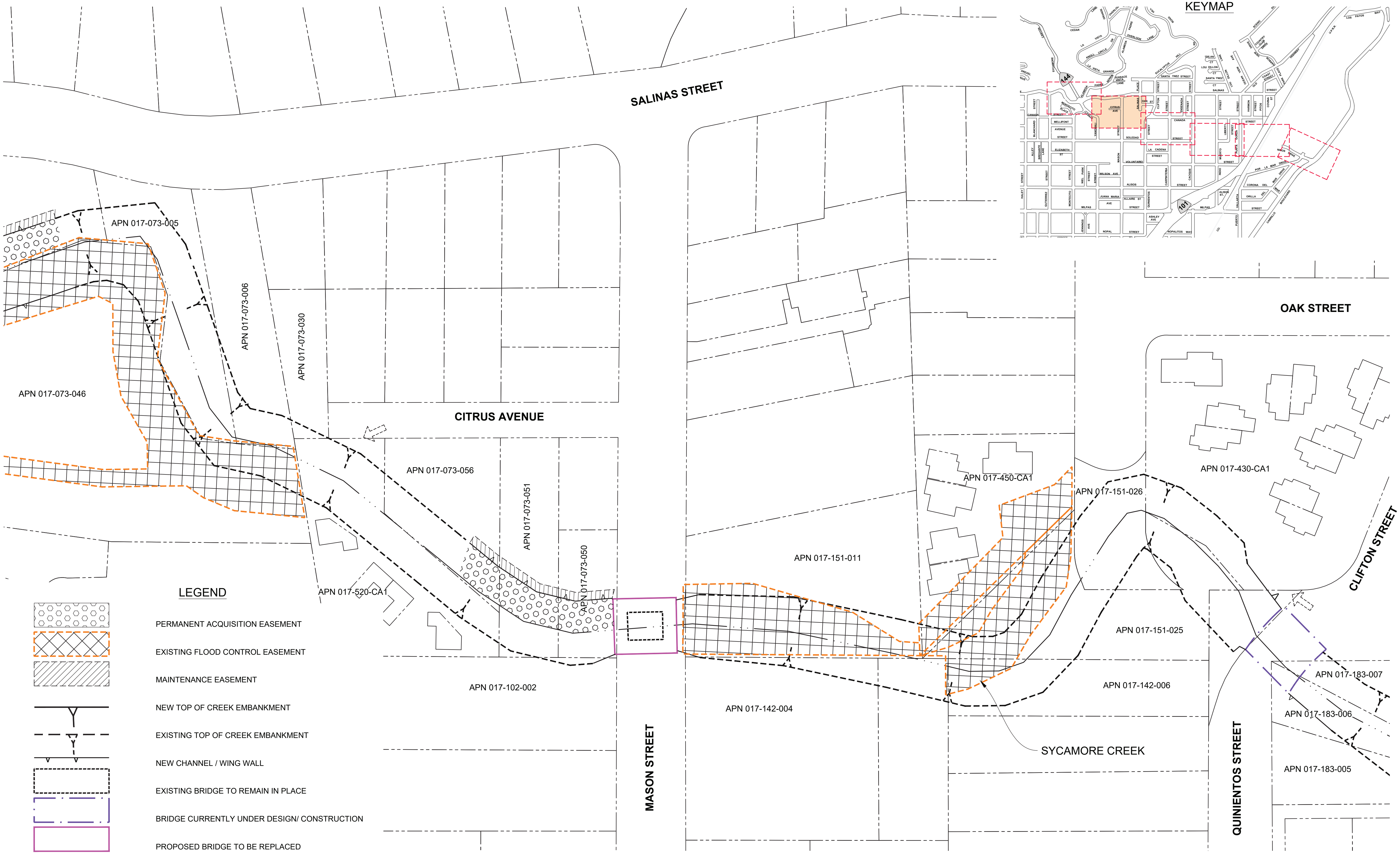

LEGEND

○	PERMANENT ACQUISITION EASEMENT
▨	EXISTING FLOOD CONTROL EASEMENT
▨	MAINTENANCE EASEMENT
—Y—	NEW TOP OF CREEK EMBANKMENT
- -Y- -	EXISTING TOP OF CREEK EMBANKMENT
—v—v—	NEW CHANNEL / WING WALL
☐	EXISTING BRIDGE TO REMAIN IN PLACE
☐	BRIDGE CURRENTLY UNDER DESIGN/ CONSTRUCTION
☐	PROPOSED BRIDGE TO BE REPLACED
— · · —	SYCAMORE CREEK (FEMA BASELINE)
- - -	PARCEL LINES (GIS DATA)
⬅	PROPOSED MAINTENANCE ACCESS
⇦	EXISTING MAINTENANCE ACCESS

REACH 5 - CITRUS AVENUE TO QUINIENTOS STREET
SCALE: 1" = 40'

NOTES:

1. This exhibit shows the approximate area of parcels within the project limits. Parcel lines were created from GIS data and must be verified for final project configuration.
2. See Right of Way Maps in City Office for complete R/W information.

NORTH

0 40' 80'

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SYCAMORE CREEK PROJECT STUDY REPORT
RIGHT OF WAY MAPPING
REACH 5 - CITRUS AVENUE TO QUINIENTOS STREET

0 1 2
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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LEGEND

◌	PERMANENT ACQUISITION EASEMENT
▦	EXISTING FLOOD CONTROL EASEMENT
▨	MAINTENANCE EASEMENT
─┬─	NEW TOP OF CREEK EMBANKMENT
– –┬– –	EXISTING TOP OF CREEK EMBANKMENT
─┬─	NEW CHANNEL / WING WALL
⬚	EXISTING BRIDGE TO REMAIN IN PLACE
⬚	BRIDGE CURRENTLY UNDER DESIGN/ CONSTRUCTION
▭	PROPOSED BRIDGE TO BE REPLACED
— · · —	SYCAMORE CREEK (FEMA BASELINE)
- - -	PARCEL LINES (GIS DATA)
⬅	PROPOSED MAINTENANCE ACCESS
⇦	EXISTING MAINTENANCE ACCESS

REACH 6 - YANONALI STREET TO CITRUS AVENUE
SCALE: 1" = 40'

NOTES:

1. This exhibit shows the approximate area of parcels within the project limits. Parcel lines were created from GIS data and must be verified for final project configuration.

2. See Right of Way Maps in City Office for complete R/W information.

NORTH

0 40' 80'

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SYCAMORE CREEK PROJECT STUDY REPORT
RIGHT OF WAY MAPPING
REACH 6 - YANONALI STREET TO CITRUS AVENUE

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

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Appendix D – Channel Configuration Exhibits

SYCAMORE CREEK PROJECT STUDY REPORT
CREEK CONFIGURATION
REACH 1 - POR LA MAR CIRCLE TO PACIFIC OCEAN

Bengal Engineering
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Goleta, CA 93117

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

LEGEND

NEW TOP OF CREEK EMBANKMENT

EXISTING TOP OF CREEK EMBANKMENT

NEW CHANNEL / WING WALL

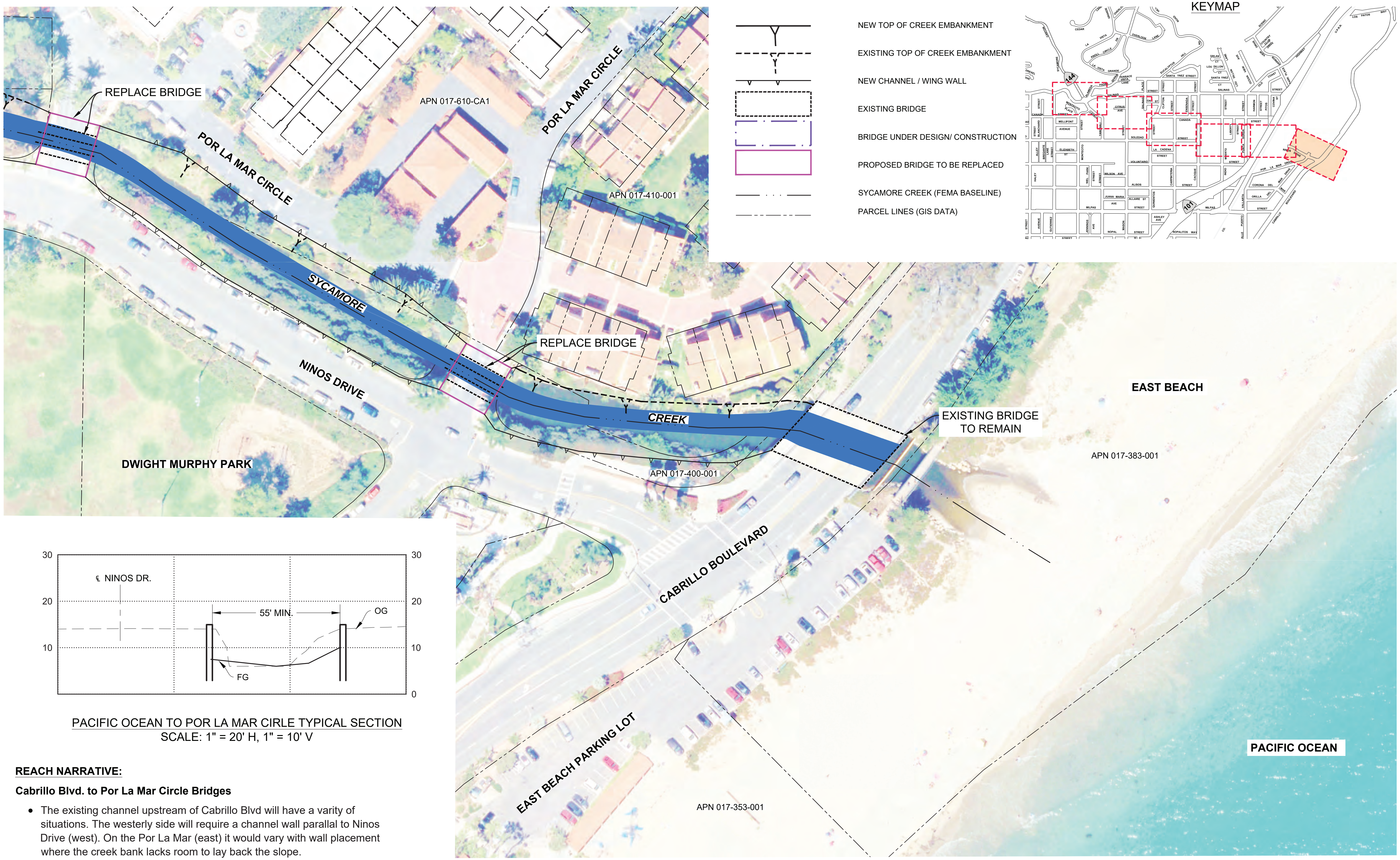
EXISTING BRIDGE

BRIDGE UNDER DESIGN/ CONSTRUCTION

PROPOSED BRIDGE TO BE REPLACED

SYCAMORE CREEK (FEMA BASELINE)

PARCEL LINES (GIS DATA)



PACIFIC OCEAN TO POR LA MAR CIRLE TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V

REACH 1- POR LA MAR CIRCLE TO PACIFIC OCEAN
SCALE: 1" = 40'

NORTH

0 40' 80'

REACH NARRATIVE:

Cabrillo Blvd. to Por La Mar Circle Bridges

- The existing channel upstream of Cabrillo Blvd will have a varity of situations. The westerly side will require a channel wall parallal to Ninos Drive (west). On the Por La Mar (east) it would vary with wall placement where the creek bank lacks room to lay back the slope.
- Both of the existing three-span Por La Mar Circle bridges will be replaced with single-span bridges designed to accommodate the 3000 CFS target conveyance.

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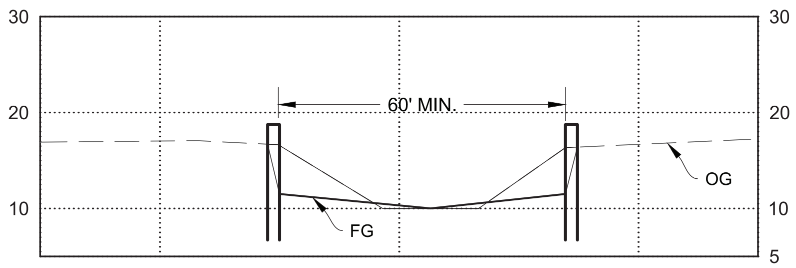


HWY 101 TO PUNTA GORDA ST. TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V

LEGEND

NEW TOP OF CREEK EMBANKMENT

EXISTING TOP OF CREEK EMBANKMENT

NEW CHANNEL / WING WALL

EXISTING BRIDGE

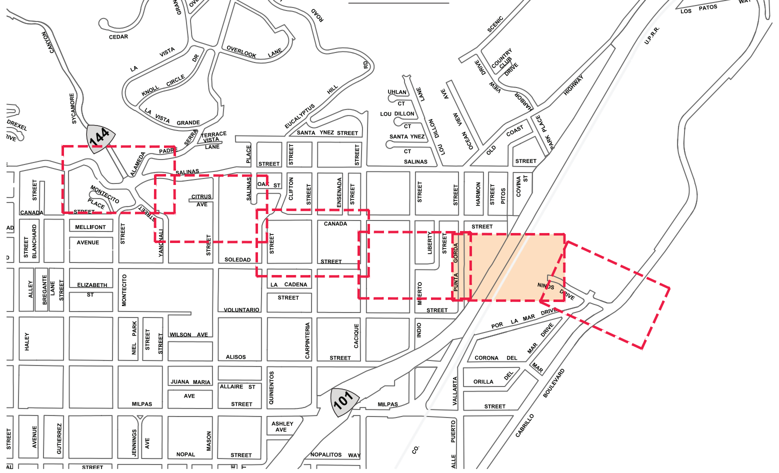
BRIDGE UNDER DESIGN/ CONSTRUCTION

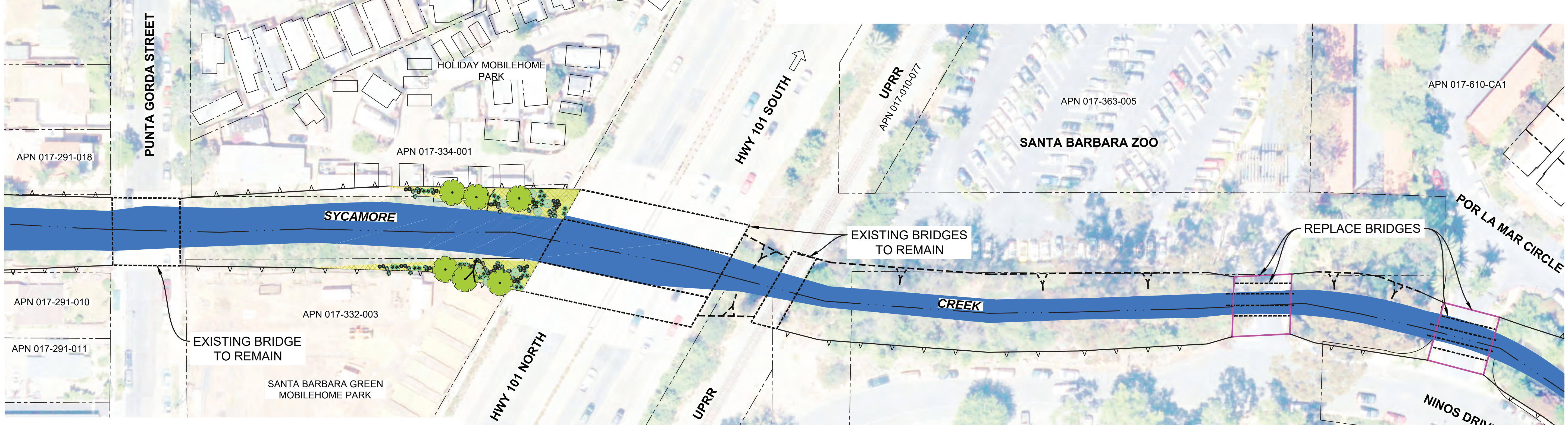
PROPOSED BRIDGE TO BE REPLACED

SYCAMORE CREEK (FEMA BASELINE)

PARCEL LINES (GIS DATA)

KEYMAP





REACH NARRATIVE:

Por La Mar Circle to the Zoo Bridge

- The existing three-span “Zoo Bridge” will be replaced with a single-span bridge designed to accommodate the 3000 CFS target conveyance.
- The existing channel will require walls on the west to contain the target conveyance but could retain existing sloping vegetated banks.

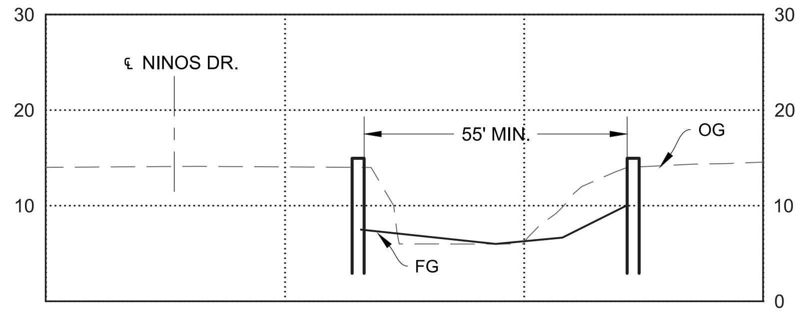
UPRR to Hwy 101 Bridge

- The existing channel will remain in generally the current configuration. The channel will have retain the existing sloping vegetated banks.

Hwy 101 to Punta Gorda St. Bridge

- Proceeding upstream toward the Punta Gorda St. bridge , the channel cross section will transition from vegetated slopes to vertical channel walls because of nearby buildings which restrict the project footprint.
- The downstream portion of this reach, is wider to match the upstream side of the Hwy 101 bridge. Because of the wider existing 101 bridge an opportunity for landscaping may be available within the channel.

REACH 2 - PUNTA GORDA ST. TO POR LA MAR CIRCLE
SCALE: 1" = 40'



POR LA MAR CIRCLE TO HWY 101 TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V

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SYCAMORE CREEK PROJECT STUDY REPORT
CREEK CONFIGURATION
REACH 2 - PUNTA GORDA ST. TO POR LA MAR CIRCLE

SHT. 2 OF 6

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2

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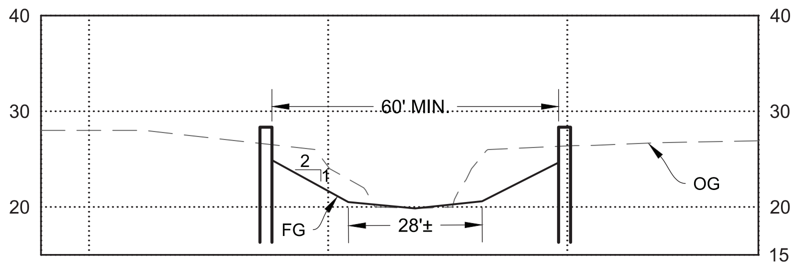
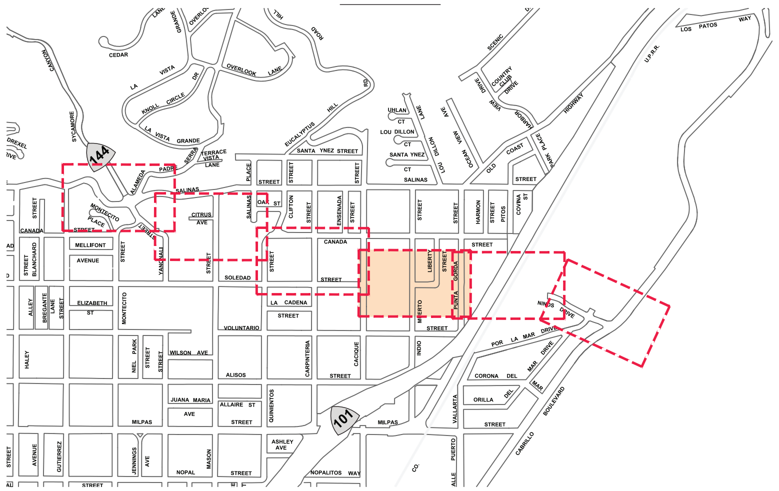


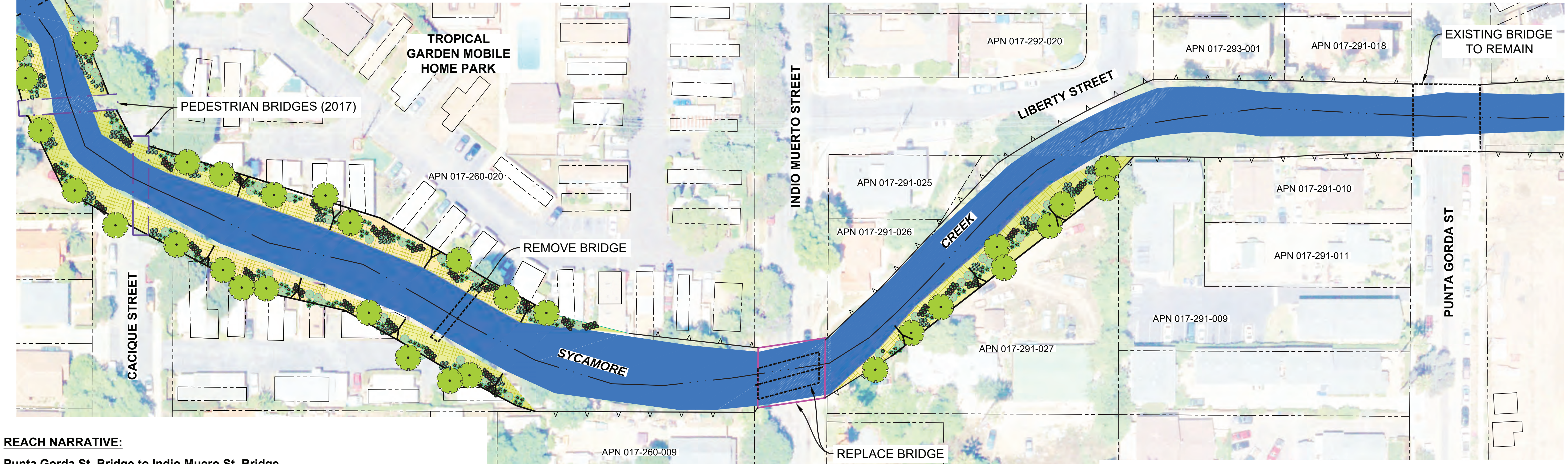
INDIO MUERTO ST. TO SOLEDAD ST. TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V

LEGEND

- NEW TOP OF CREEK EMBANKMENT
- EXISTING TOP OF CREEK EMBANKMENT
- NEW CHANNEL / WING WALL
- EXISTING BRIDGE
- BRIDGE UNDER DESIGN/ CONSTRUCTION
- PROPOSED BRIDGE TO BE REPLACED
- SYCAMORE CREEK (FEMA BASELINE)
- PARCEL LINES (GIS DATA)

KEYMAP





REACH NARRATIVE:

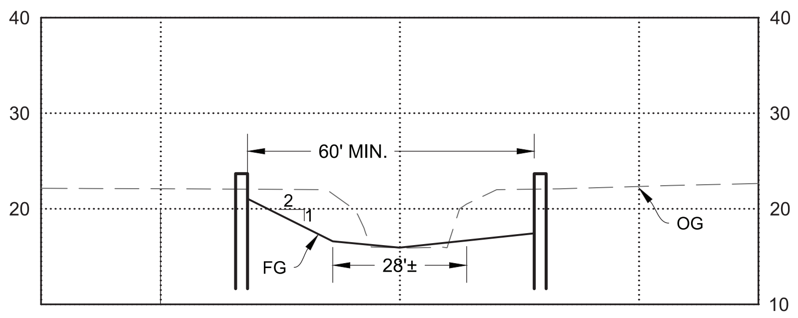
Punta Gorda St. Bridge to Indio Muero St. Bridge

- The east bank will be supported by a vertical wall to reduce the project footprint because of nearby buildings and roads.
- The west bank will be supported by a vertical retaining wall from the Punta Gorda St. Bridge to near Liberty St. where the channel could transition to vegetated slope, which could then continue upstream to a new wall near the Indio Muerto Bridge. Where required vertical walls would contain sloped embankments.

Indio Muero St. Bridge to Soledad St. Bridge

- The Indio Muerto St. Bridge will be replaced to accommodate the target conveyance.
- This greater section presents some opportunity for vegetated channel slopes. Where required vertical walls would contain sloped embankments.

REACH 3 - CACIQUE ST. TO PUNTA GORDA ST.
SCALE: 1" = 40'



LIBERTY ST. TO INDIO MUERTO ST. TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V

NORTH

0 40' 80'

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SYCAMORE CREEK PROJECT STUDY REPORT
CREEK CONFIGURATION
REACH 3 - CACIQUE ST. TO PUNTA GORDA ST.

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
0 1 2

SHT. 3 OF 6

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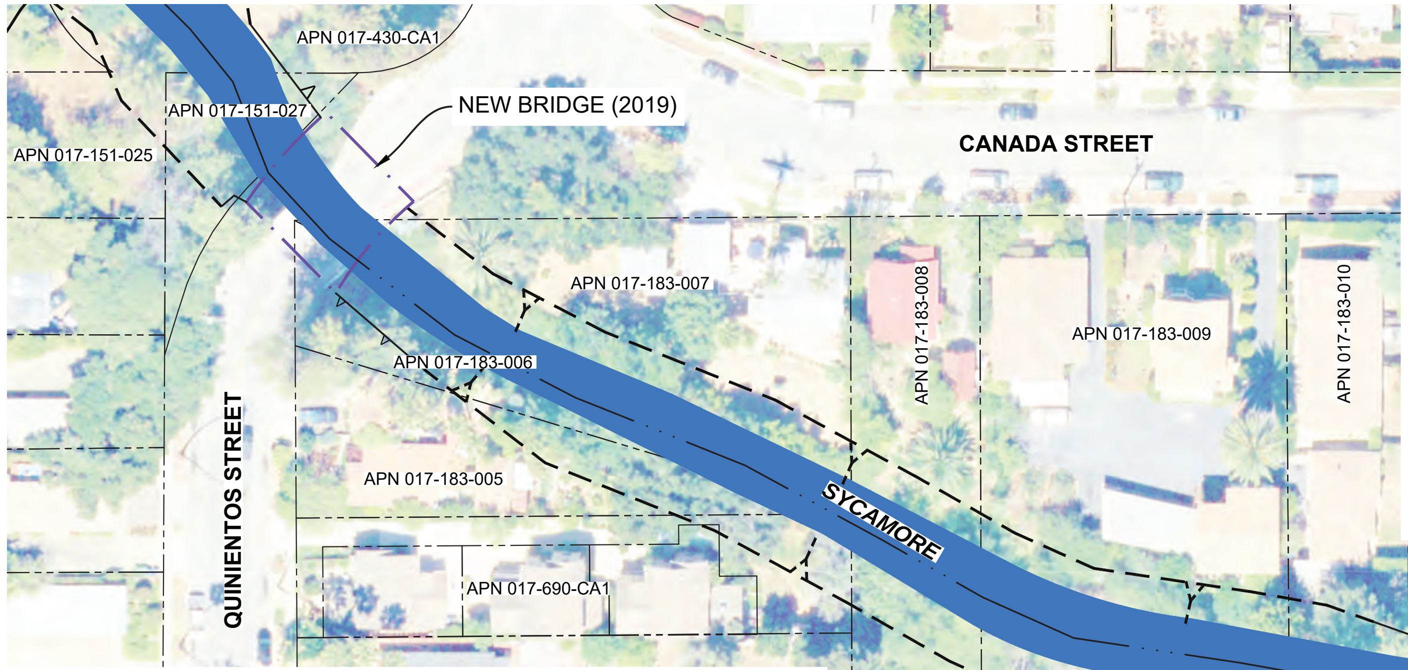
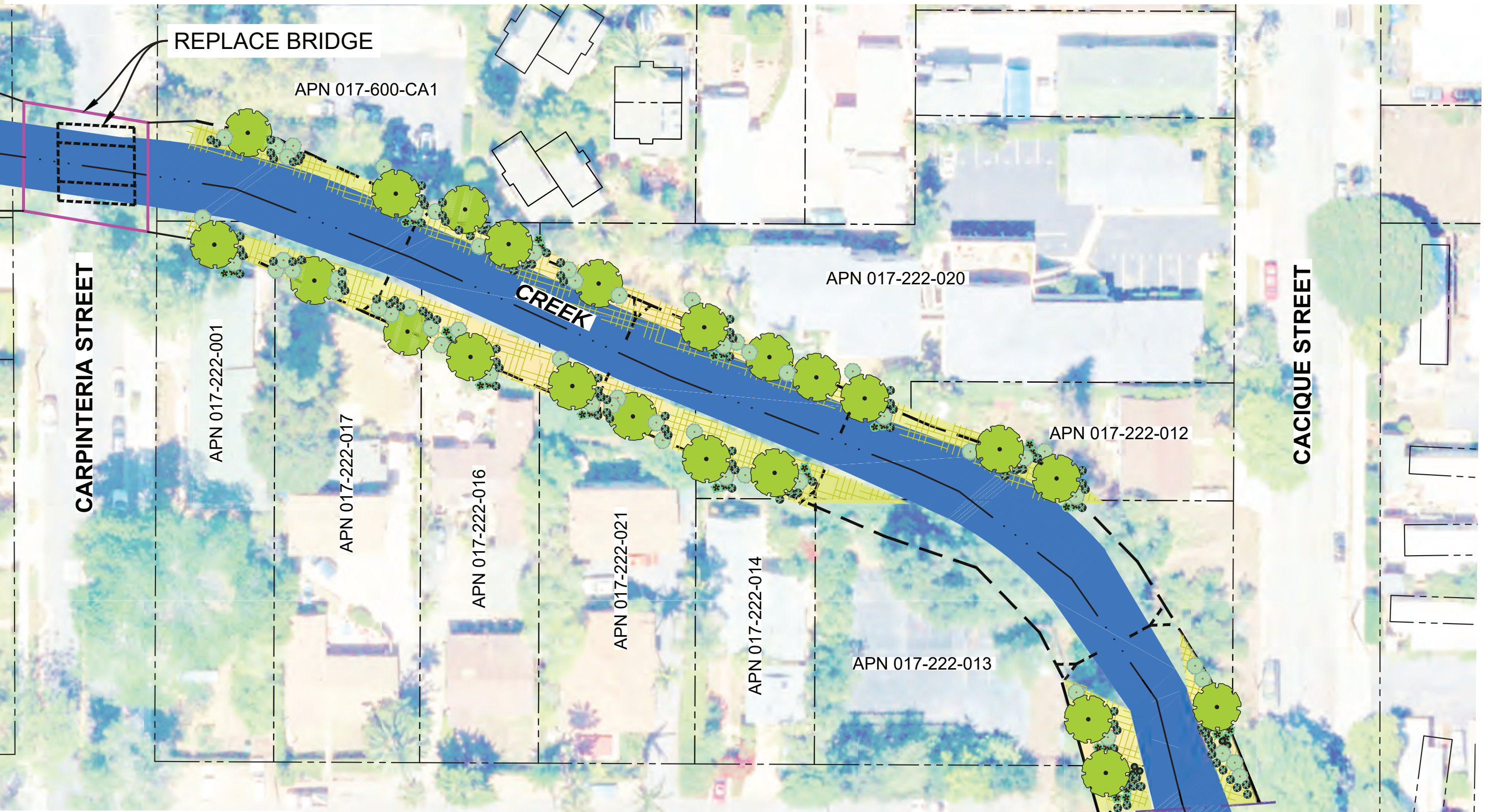
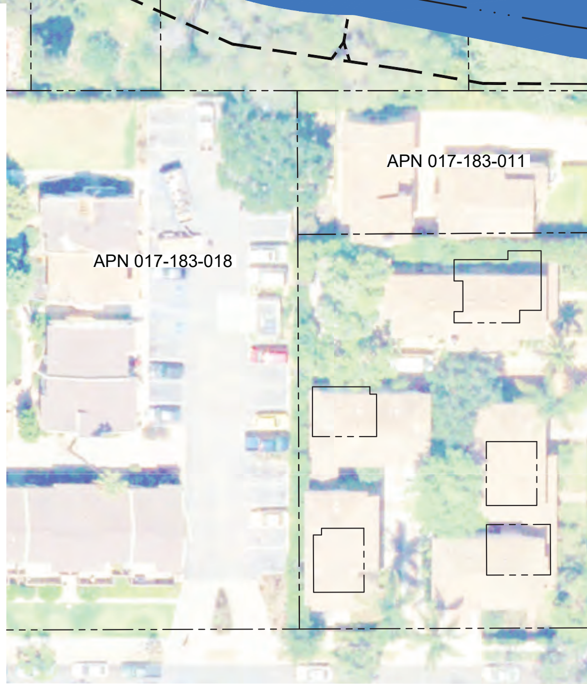
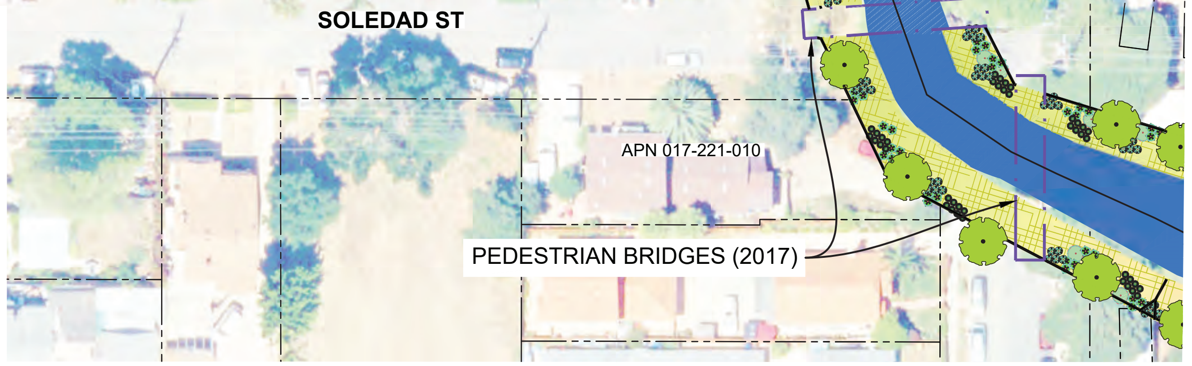








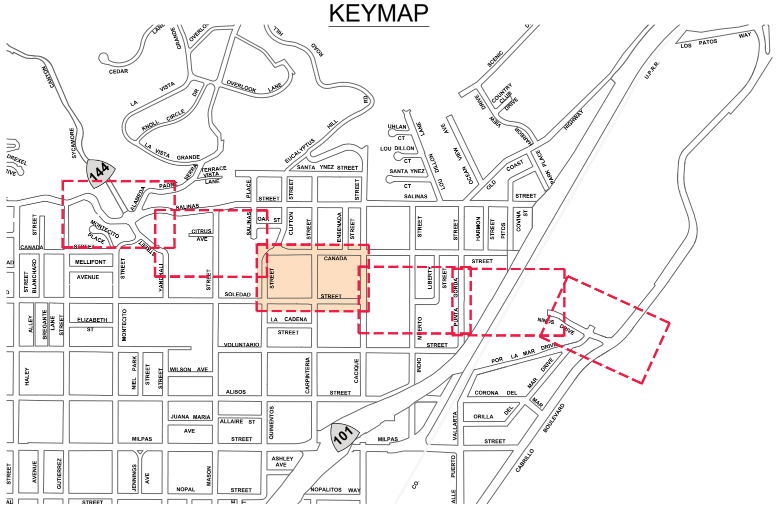
REACH 4 - QUINIENTOS ST. TO CACIQUE ST.
SCALE: 1" = 40'

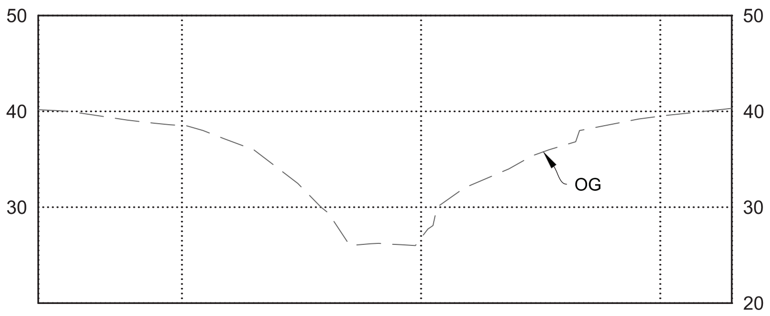
NORTH
0 40' 80'

LEGEND

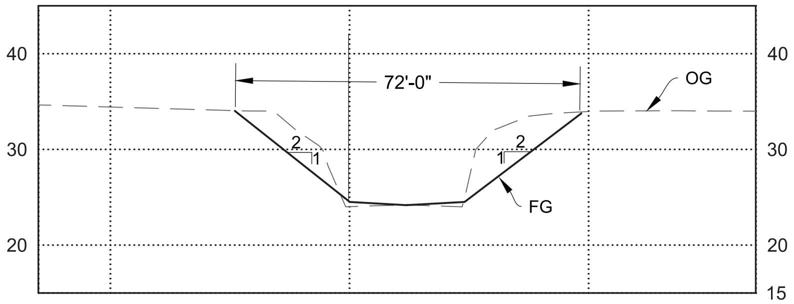
- NEW TOP OF CREEK EMBANKMENT
- EXISTING TOP OF CREEK EMBANKMENT
- NEW CHANNEL / WING WALL
- EXISTING BRIDGE
- BRIDGE UNDER DESIGN/ CONSTRUCTION
- PROPOSED BRIDGE TO BE REPLACED
- SYCAMORE CREEK (FEMA BASELINE)
- PARCEL LINES (GIS DATA)

KEYMAP





CARPINTERIA ST. TO QUINIENTOS ST. TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V



SOLEDAD ST. TO CARPINTERIA ST. TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V

REACH NARRATIVE:

Soledad St. to Carpinteria St. Bridge

- The channel between the two new pedestrian bridges at Cacique / Soledad Sts., and a portion of the channel about 100-feet upstream of Soledad St. will be widened to accommodate design flow.
- The channel upstream from this widening will be widened in specific location and replaced vegetated slopes.
- The Carpinteria St. Bridge will be replaced to accommodate design flows.

Carpinteria St. Bridge to Quineintos St. Bridge

- The channel upstream of the Carpinteria St. Bridge will be left as-is with vegetated slopes.

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Goleta, CA 93117

SYCAMORE CREEK PROJECT STUDY REPORT
CREEK CONFIGURATION
REACH 4 - QUINIENTOS ST. TO CACIQUE ST.

SHT. 4 OF 6

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*FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES*

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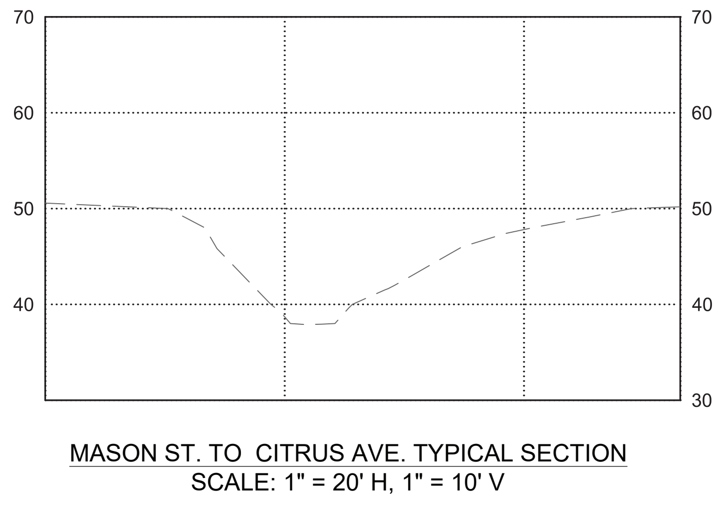
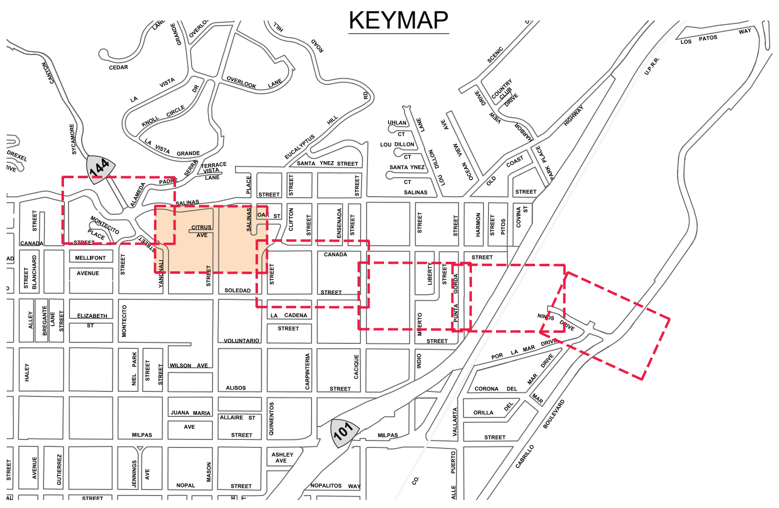
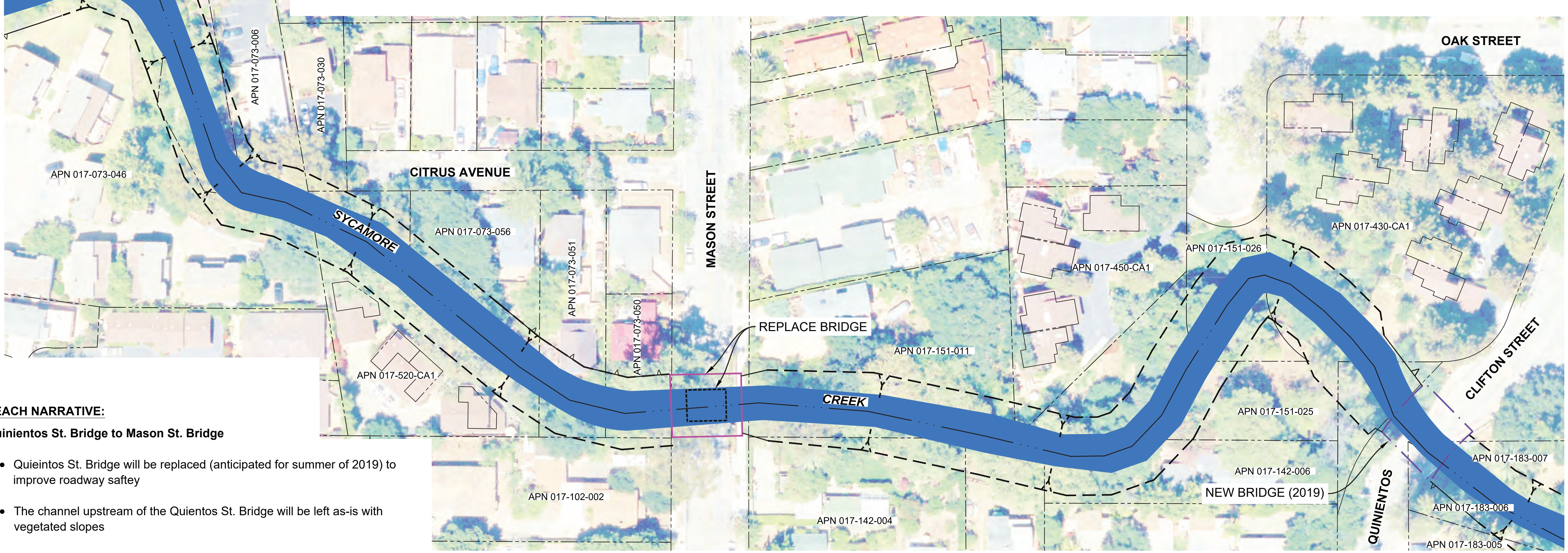


MASON ST. TO CITRUS AVE. TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V

LEGEND

- NEW TOP OF CREEK EMBANKMENT
- EXISTING TOP OF CREEK EMBANKMENT
- NEW CHANNEL / WING WALL
- EXISTING BRIDGE
- BRIDGE UNDER DESIGN/ CONSTRUCTION
- PROPOSED BRIDGE TO BE REPLACED
- SYCAMORE CREEK (FEMA BASELINE)
- PARCEL LINES (GIS DATA)





REACH 5 - CITRUS AVE. TO QUINIENTOS ST.
SCALE: 1" = 40'

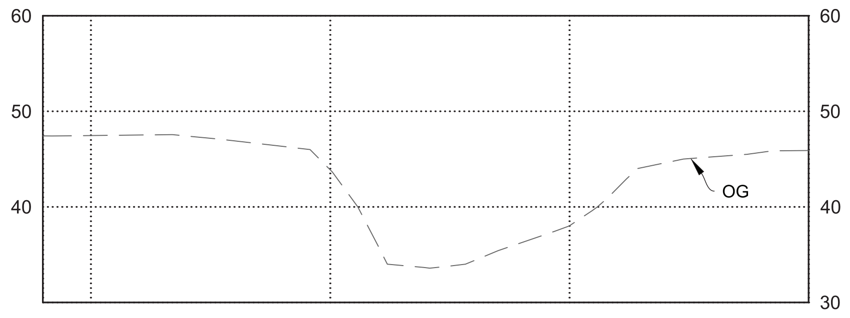
REACH NARRATIVE:

Quinientos St. Bridge to Mason St. Bridge

- Quieintos St. Bridge will be replaced (anticipated for summer of 2019) to improve roadway saftey
- The channel upstream of the Quientos St. Bridge will be left as-is with vegetated slopes
- The Mason St. Bridge (steel plate arch) should be replaced with a longer span bridge to convey design flows and improve roadway safety.

Mason St. Bridge to North End of Citrus Ave.

- Immediately upstream of the Mason Street Bridge a wall will be required to protect low elevations of the surrounding ground.
- The existing channel upstream of Mason Street bridge will remain with vegetated slopes.



QUINIENTOS ST. TO MASON ST. TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V

NORTH
0 40' 80'

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ORIGINAL SCALE IS IN INCHES

SYCAMORE CREEK PROJECT STUDY REPORT
CREEK CONFIGURATION
REACH 5 - CITRUS AVE. TO QUINIENTOS ST.

SHT. 5 OF 6

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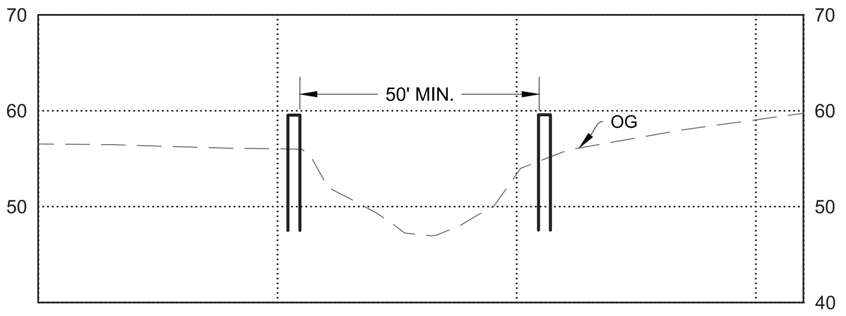
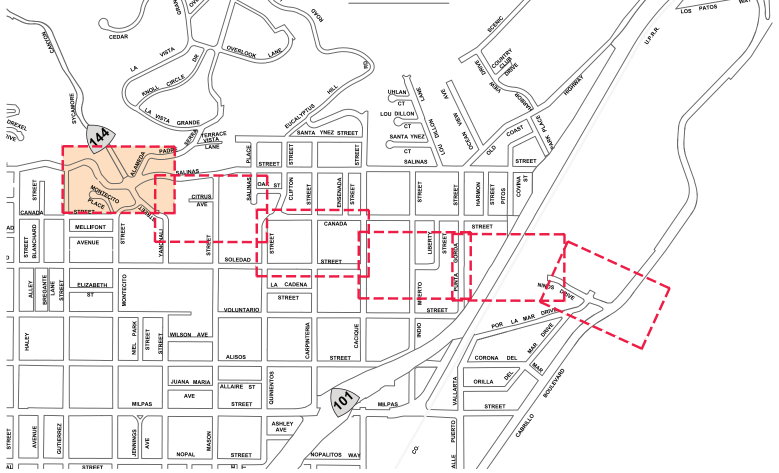


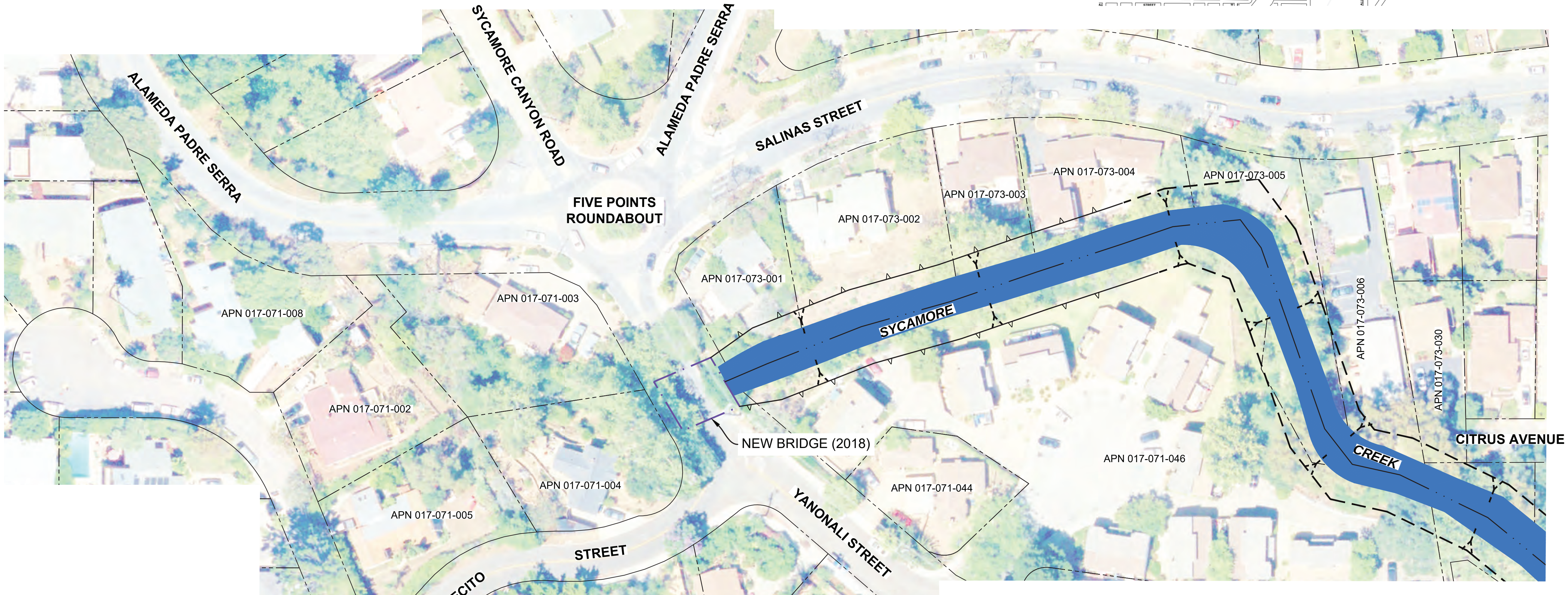
DOWNSTREAM OF YANONALI ST. BRIDGE TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V

LEGEND

- NEW TOP OF CREEK EMBANKMENT
- EXISTING TOP OF CREEK EMBANKMENT
- NEW CHANNEL / WING WALL
- EXISTING BRIDGE
- BRIDGE UNDER DESIGN/ CONSTRUCTION
- PROPOSED BRIDGE TO BE REPLACED
- SYCAMORE CREEK (FEMA BASELINE)
- PARCEL LINES (GIS DATA)

KEYMAP



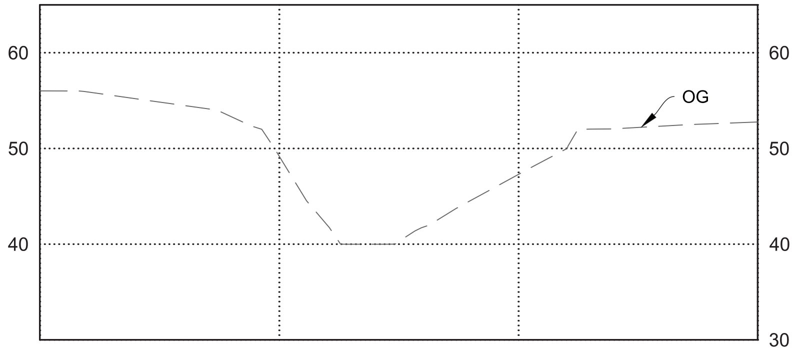


REACH 6 - YANONALI ST. TO CITRUS AVE.
SCALE: 1" = 40'

REACH NARRATIVE:

North End of Citrus Ave. to Alameda Padre Serra

- The existing channel upstream of the north end of Citrus Ave. will remain with vegetated slopes.
- Downstream of the new Yanonali Bridge walls will be required to protect low surrounding elevations.
- The Yanonali Bridge is proposed to be replaced in 2018. The replacement of the bridge appear to improve conditions to reduce the need for channel improvements.



CITRUS AVE. TO YANONALI ST. TYPICAL SECTION
SCALE: 1" = 20' H, 1" = 10' V

NORTH

0 40' 80'

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Goleta, CA 93117

SYCAMORE CREEK PROJECT STUDY REPORT
CREEK CONFIGURATION
REACH 6 - YANONALI ST. TO CITRUS AVE.

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

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SHT. 6 OF 6

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Appendix E – Project Costs

Sycamore Creek
Project Study Report
Engineer's Estimate Summary

		%	Quantity	Unit	Unit rate	Cost
1	**Earthwork**					
	Subtotal Earthwork					**$1,163,050**
	a. Earthwork price reflect confined area and limited production. It is assumed fill of borrow can be reprocessed from excavate materials.					
2	**Pavement Structural Section**					
	Subtotal Pavement Structural Section					**$70,300**
	a.Asphalt prices are costly and can fluctuate more than other materials. Staging and limited production will increase unit cost of base and paving substantially.					
3	**Drainage (Modify Existing Drainage + new)**					
	Subtotal Drainage					**$248,000**
	Estimated drainage.					
4	**Specialty Items**					
	Subtotal Specialty Items					**$8,119,420**
	a. Retaining wall costs can vary extensively do to complexity of structure and façade treatments.					
		%	**Quantity**	**Unit**	**Unit rate**	**Cost**
5	**Traffic Items**					
	Subtotal Traffic Items					**$174,000**
	Subtotal Items 1 through 5					**$9,774,770**
6	**Minor Items**	20%				**$1,954,954**
7	**Mobilization**	20%				**$2,345,945**
8a	**Supplemental Work**	20%				**$2,345,945**
8b	**Contingency**	20%				**$2,345,945**
8	**Subtotal - Channel Improvements**					**$18,767,558**
9	**Structures Items**					
	Bridge Structures	na	LS	LS	LS	$32,300,000
	Structures - Mobilization	10%				$3,230,000
	Structures - Contingency	10%				$3,553,000
	Railroad Related Costs	na	LS	LS	LS	$100,000
	Subtotal Structures Items (STS cost + 5%)					**$41,142,150**
	Subtotal Construction					**$53,102,246**
10	**Utility Reloc** (Budget)					
	Subtotal Utilities					**$600,000**
11	**Env Mitigation (Structure)** (budget)	na	LS	LS	LS	
	Subtotal Environmental Mitigation Structure.					**$1,000,000**
12	**Right of Way**					
	Permanent 'Creek' (Budget)		70,740	SF	$10	$707,400
	Permanent 'Developable' (Budget)		20,175	SF	$55	$1,109,636
	Permanent 'Maintenance' (Budget)		16,310	SF	$35	$570,850
	TCE		LS	LS	LS	$300,000
	Subtotal - R/W					**$2,687,886**
	Right of Way costs are very rough "place holders".					
	Total Capital =Items "Subtotal Construction"+9+10+11+12					
	Total Capital--Construction Cost					**$76,157,691**

3/6/2018

Sycamore Creek
Project Study Report
Engineer's Estimate - Reach 1- Por La Mar to Pacific Ocean

		%	Quantity	Unit	Unit rate	Cost
1	**Earthwork**					
	Channel Excavation (see "a" below):	na	4,100	CY	$ 35	$143,500
	Clear and Grubbing (not incl. bridge removals)	na	LS	LS	$25,000	$25,000
	Remove existing AC and C&G	na	1,650	SF	$5	$8,250
	Develop Water Supply	na	LS	LS	LS	$10,000
	Subtotal Earthwork					**$186,750**

a. Earthwork price reflect confined area and limited production. It is assumed fill of borrow can be reprocessed from excavate materials.

2	**Pavement Structural Section**					
	Asphalt Pavement (HMA) (see "a" below)	na	30	TON	$300	$9,000
	Aggregate Base	na	70	CY	$70	$4,900
	Subtotal Pavement Structural Section					**$13,900**

a.Asphalt prices are costly and can fluctuate more than other materials. Staging and limited production will increase unit cost of base and paving substantially.

3	**Drainage (Modify Existing Drainage + new)**					
	Drop Inlets ("Plain" DI's; No Special Filtering)	na	2	EA	$20,000	$40,000
	Storm Drain (24" RCP, Class III)	na	100	LF	$120	$12,000
	Subtotal Drainage					**$52,000**

Estimated drainage

4	**Specialty Items**					
	Bridge Removals	na	2	LS	LS	$80,000
	Retaining Walls (None: Assume Slopes are feasible)	na	700	LF	$1,200	$840,000
	Minor Concrete (Curb and Gutter)	na	750	LF	$30	$22,500
	Minor Concrete (Sidewalk)	na	360	SF	$15	$5,400
	Minor Concrete (Cross gutter)	na	375	SF	$20	$7,500
	Highway Planting (not Restoration)	na	LS	LS	LS	$15,000
	Landscape Restoration Planting	na	LS	LS	LS	$25,000
	Erosion Control	na	LS	LS	LS	$7,000
	Rock Slope/Scour Protection (budget figure)	na	LS	LS	LS	$70,000
	Water Pollution Control (prepare & implement)	na	LS	LS	LS	$30,000
	Cofferdam and Water Diversion	na	LS	LS	LS	$260,000
	Hazardous Waste Mitigation work (unknown)	na	0	na	$0	$0
	Environmental Mitigation (budget figure)	na	LS	LS	LS	$200,000
	Permeant Fencing	na	0	na	LS	$50,000
	APE/ ESA temporary Fencing	na	LS	LS	LS	$25,000
	Mitigation: Cultural Resources	na	LS	LS	LS	$50,000
	Subtotal Specialty Items					**$1,687,400**

a. Retaining wall costs can vary extensively do to complexity of structure and façade treatments.

		%	Quantity	Unit	Unit rate	Cost
5	**Traffic Items**					
	Roadside Signs	LS	1	LS	LS	$5,000
	Traffic Control System (Detours)	na	LS	LS	LS	$35,000
	Subtotal Traffic Items					**$40,000**
	Subtotal Items 1 through 5					**$1,980,050**
6	**Minor Items**	20%				**$396,010**
7	**Mobilization**	20%				**$475,212**
8a	**Supplemental Work**	20%				**$475,212**
8b	**Contingency**	20%				**$475,212**
8	**Subtotal - Channel Improvements**					**$3,801,696**
9	**Structures Items**					
	Bridge Structures (2 x Por La Mar Cir.)	na	LS	LS	LS	$9,000,000
	Structures - Mobilization	10%				$900,000
	Structures - Contingency	10%				$990,000
	Railroad Related Costs	na	LS	LS	LS	$0
	Subtotal Structures Items (STS cost + 5%)					**$11,434,500**
	Subtotal Construction					**$12,801,696**
10	**Utility Reloc** (Budget)					
	Utilities Exist On site: This budget is for City-Owned					
	Relocate City Water	na	LS	LS	LS	$100,000
	Relocate City Sewer	na	LS	LS	LS	$100,000
	Verizon, Cox, Gas- Relocation cost paid by others					**$0**
	Subtotal Utilities					**$200,000**
11	**Env Mitigation (Structure)** (budget)	na	LS	LS	LS	
	Subtotal Environmental Mitigation Structure.					**$250,000**
12	**Right of Way**					
	Permanent 'Creek' (Budget)		0	SF	$10	$0
	Permanent 'Developable' (Budget)		0	SF	$55	$0
	Permanent 'Maintenance' (Budget)		0	SF	$35	$0
	TCE (Budget)		LS	LS	LS	$50,000
	Subtotal - R/W					**$50,000**

Right of Way costs are very rough "place holders".
Total Capital =Items "Subtotal Construction"+9+10+11+12

	Total Capital--Construction Cost		**$17,103,392**

3/6/2018

Sycamore Creek
Project Study Report
Engineer's Estimate - Reach 2 - Punta Gorda to Por La Mar

		%	Quantity	Unit	Unit rate	Cost
1	**Earthwork**					
	Channel Excavation (see "a" below):	na	3,600	CY	$ 35	$126,000
	Clear and Grubbing (not incl. bridge removals)	na	LS	LS	$25,000	$25,000
	Remove existing AC and C&G	na	360	SF	$5	$1,800
	Develop Water Supply	na	LS	LS	LS	$10,000
	Subtotal Earthwork					**$162,800**
	a. Earthwork price reflect confined area and limited production.					
2	**Pavement Structural Section**					
	Asphalt Pavement (HMA) (see "a" below)	na	10	TON	$300	$3,000
	Aggregate Base	na	20	CY	$70	$1,400
	Subtotal Pavement Structural Section					**$4,400**
	a.Asphalt prices are costly and can fluctuate more than other materials. Staging and limited production will increase unit cost of base and paving substantially.					
3	**Drainage (Modify Existing Drainage + new)**					
	Drop Inlets ("Plain" DI's; No Special Filtering)	na	2	EA	$20,000	$40,000
	Storm Drain (24" RCP, Class III)	na	100	LF	$120	$12,000
	Subtotal Drainage					**$52,000**
	Estimated drainage					
4	**Specialty Items**					
	Bridge Removal	na	LS	LS	LS	$40,000
	Retaining Walls (None: Assume Slopes are feasible)	na	950	LF	$1,200	$1,140,000
	Minor Concrete (Curb and Gutter)	na	120	LF	$30	$3,600
	Minor Concrete (Sidewalk)	na	480	SF	$18	$8,640
	Highway Planting (not Restoration)	na	LS	LS	LS	$20,000
	Landscape Restoration Planting	na	LS	LS	LS	$40,000
	Erosion Control	na	LS	LS	LS	$10,000
	Rock Slope/Scour Protection (budget figure)	na	LS	LS	LS	$100,000
	Water Pollution Control (prepare & implement)	na	LS	LS	LS	$30,000
	Cofferdam and Water Diversion	na	LS	LS	LS	$200,000
	Hazardous Waste Mitigation work (unknown)	na	0	na	$0	$0
	Environmental Mitigation (budget figure)	na	LS	LS	LS	$200,000
	Permeant Fencing	na	0	na	LS	$50,000
	APE/ ESA temporary Fencing	na	LS	LS	LS	$25,000
	Mitigation: Cultural Resources	na	LS	LS	LS	$50,000
	Subtotal Specialty Items					**$1,917,240**
		%	**Quantity**	**Unit**	**Unit rate**	**Cost**
5	**Traffic Items**					
	Roadside Signs	LS	1	LS	LS	$5,000
	Traffic Control System (Detours)	na	LS	LS	LS	$35,000
	Subtotal Traffic Items					**$40,000**
	Subtotal Items 1 through 5					**$2,176,440**
6	**Minor Items**	20%				**$435,288**
7	**Mobilization**	20%				**$522,346**
8a	**Supplemental Work**	20%				**$522,346**
8b	**Contingency**	20%				**$522,346**
8	**Subtotal - Channel Improvements**					**$4,178,765**
9	**Structures Items**					
	Bridge Structure (S.B. Zoo)	na	LS	LS	LS	$5,000,000
	Subtotal					$5,000,000
	Structures - Mobilization	10%				$500,000
	Structures - Contingency	10%				$550,000
	Railroad Related Costs	na	LS	LS	LS	$100,000
	Subtotal Structures Items (STS cost + 5%)					**$6,457,500**
	Subtotal Construction					**$9,178,765**
10	**Utility Reloc** (Budget)					
	Utilities Exist On site: This budget is for City-Owned					
	Relocate City Water	na	LS	LS	LS	$100,000
	Relocate City Sewer	na	LS	LS	LS	$100,000
	Verizon, Cox, Gas- Relocation cost paid by others					**$0**
	Subtotal Utilities					**$200,000**
11	**Env Mitigation (Structure)** (budget)	na	LS	LS	LS	
	Subtotal Environmental Mitigation Structure.					**$250,000**
12	**Right of Way**					
	Permanent 'Creek' (Budget)		4,200	SF	$10	$42,000
	Permanent 'Developable' (Budget)		0	SF	$55	$0
	Permanent 'Maintenance' (Budget)		3,800	SF	$35	$133,000
	TCE (Budget)		LS	LS	LS	$50,000
	Subtotal - R/W					**$225,000**
	Right of Way costs are very rough "place holders".					
	Total Capital =Items "Subtotal Construction"+9+10+11+12					
	Total Capital--Construction Cost					**$14,032,530**

Sycamore Creek
Project Study Report
Engineer's Estimate - Reach 3 - Cacique to Punta Gorda

		%	Quantity	Unit	Unit rate	Cost
1	**Earthwork**					
	Channel Excavation (see "a" below):	na	14,000	CY	$ 30	$420,000
	Clear and Grubbing (not incl. bridge removals)	na	LS	LS	$40,000	$40,000
	Remove existing AC and C&G	na	100	SF	$5	$500
	Remove existing creek walls/concrete slopes	na	LS	LS	LS	$25,000
	Develop Water Supply	na	LS	LS	LS	$10,000
	Subtotal Earthwork					**$495,500**
	a. Earthwork price reflect confined area and limited production.					
2	**Pavement Structural Section**					
	Asphalt Pavement (HMA) (see "a" below)	na	10	TON	$300	$3,000
	Aggregate Base	na	20	CY	$70	$1,400
	Subtotal Pavement Structural Section					**$4,400**
	a.Asphalt prices are costly and can fluctuate more than other materials. Staging and limited production will increase unit cost of base and paving substantially.					
3	**Drainage (Modify Existing Drainage + new)**					
	Drop Inlets ("Plain" DI's; No Special Filtering)	na	2	EA	$20,000	$40,000
	Storm Drain (24" RCP, Class III)	na	100	LF	$120	$12,000
	Subtotal Drainage					**$52,000**
	Estimated drainage					
4	**Specialty Items**					
	Bridge Removal	na	LS	LS	LS	$40,000
	Pedestrian Bridge Removal	na	LS	LS	LS	$10,000
	Retaining Walls (None: Assume Slopes are feasible)	na	1,057	LF	$1,200	$1,268,400
	Minor Concrete (Curb and Gutter)	na	130	LF	$30	$3,900
	Minor Concrete (Sidewalk)	na	360	SF	$18	$6,480
	Highway Planting (not Restoration)	na	LS	LS	LS	$20,000
	Landscape Restoration Planting	na	LS	LS	LS	$80,000
	Erosion Control	na	LS	LS	LS	$20,000
	Rock Slope/Scour Protection (budget figure)	na	LS	LS	LS	$240,000
	Water Pollution Control (prepare & implement)	na	LS	LS	LS	$30,000
	Cofferdam and Water Diversion	na	LS	LS	LS	$120,000
	Hazardous Waste Mitigation work (unknown)	na	0	na	$0	$0
	Environmental Mitigation (budget figure)	na	LS	LS	LS	$200,000
	Permeant Fencing	na	0	na	LS	$50,000
	APE/ ESA temporary Fencing	na	LS	LS	LS	$25,000
	Mitigation: Cultural Resources	na	LS	LS	LS	$50,000
	Subtotal Specialty Items					**$2,163,780**

		%	Quantity	Unit	Unit rate	Cost
5	**Traffic Items**					
	Roadside Signs	LS	1	LS	LS	$2,000
	Traffic Control System (Detours)	na	LS	LS	LS	$25,000
	Subtotal Traffic Items					**$27,000**
	Subtotal Items 1 through 5					**$2,742,680**
6	**Minor Items**	20%				**$548,536**
7	**Mobilization**	20%				**$658,243**
8a	**Supplemental Work**	20%				**$658,243**
8b	**Contingency**	20%				**$658,243**
8	**Subtotal - Channel Improvements**					**$5,265,946**
9	**Structures Items**					
	Bridge Structure (Indio Muerto St.)	na	LS	LS	LS	$5,500,000
	Subtotal					$5,500,000
	Structures - Mobilization	10%				$550,000
	Structures - Contingency	10%				$605,000
	Railroad Related Costs	na	LS	LS	LS	$0
	Subtotal Structures Items (STS cost + 5%)					**$6,987,750**
	Subtotal Construction					**$10,765,946**
10	**Utility Reloc** (Budget)					
	Utilities Exist On site: This budget is for City-Owned					
	Relocate City Water	na	LS	LS	LS	$100,000
	Relocate City Sewer	na	LS	LS	LS	$100,000
	Verizon, Cox, Gas- Relocation cost paid by others					$0
	Subtotal Utilities					**$200,000**
11	**Env Mitigation (Structure)** (budget)	na	LS	LS	LS	
	Subtotal Environmental Mitigation Structure.					**$250,000**
12	**Right of Way**					
	Permanent 'Creek' (Budget)		47,640	SF	$10	$476,400
	Permanent 'Developable' (Budget)		8,575	SF	$55	$471,636
	Permanent 'Maintenance' (Budget)		6,610	SF	$35	$231,350
	TCE (Budget)		LS	LS	LS	$50,000
	Subtotal - R/W					**$1,229,386**
	Right of Way costs are very rough "place holders".					
	Total Capital =Items "Subtotal Construction"+9+10+11+12					
	Total Capital--Construction Cost					**$17,711,277**

Sycamore Creek
Project Study Report
Engineer's Estimate - Reach 4 - Quinientos to Cacique

		%	Quantity	Unit	Unit rate	Cost
1	**Earthwork**					
	Channel Excavation (see "a" below):	na	2,300	CY	$ 40	$92,000
	Clear and Grubbing (not incl. bridge removals)	na	LS	LS	$40,000	$40,000
	Remove existing AC and C&G	na	100	SF	$5	$0
	Remove existing creek walls/concrete slopes	na	LS	LS	LS	$25,000
	Develop Water Supply	na	LS	LS	LS	$0
	Subtotal Earthwork					**$157,000**
	a. Earthwork price reflect confined area and limited production.					
2	**Pavement Structural Section**					
	Asphalt Pavement (HMA) (see "a" below)	na	0	TON	$300	$0
	Aggregate Base	na	0	CY	$70	$0
	Subtotal Pavement Structural Section					**$0**
	a.Asphalt prices are costly and can fluctuate more than other materials. Staging and limited production will increase unit cost of base and paving substantially.					
3	**Drainage (Modify Existing Drainage + new)**					
	Drop Inlets ("Plain" DI's; No Special Filtering)	na	0	EA	$20,000	$0
	Storm Drain (24" RCP, Class III)	na	0	LF	$120	$0
	Subtotal Drainage					**$0**
	Estimated drainage					
4	**Specialty Items**					
	Bridge Removal	na	LS	LS	LS	$40,000
	Pedestrian Bridge Removal	na	LS	LS	LS	$0
	Retaining Walls (None: Assume Slopes are feasible)	na	0	LF	$1,200	$0
	Minor Concrete (Curb and Gutter)	na	0	LF	$30	$0
	Minor Concrete (Sidewalk)	na	0	SF	$18	$0
	Highway Planting (not Restoration)	na	LS	LS	LS	$0
	Landscape Restoration Planting	na	LS	LS	LS	$50,000
	Erosion Control	na	LS	LS	LS	$12,000
	Rock Slope/Scour Protection (budget figure)	na	LS	LS	LS	$120,000
	Water Pollution Control (prepare & implement)	na	LS	LS	LS	$10,000
	Cofferdam and Water Diversion	na	LS	LS	LS	$80,000
	Hazardous Waste Mitigation work (unknown)	na	0	na	$0	$0
	Environmental Mitigation (budget figure)	na	LS	LS	LS	$200,000
	Permanent Fencing	na	0	na	LS	$0
	APE/ ESA temporary Fencing	na	LS	LS	LS	$0
	Mitigation: Cultural Resources	na	LS	LS	LS	$0
	Subtotal Specialty Items					**$512,000**
5	**Traffic Items**					
	Roadside Signs	LS	1	LS	LS	$2,000
	Traffic Control System (Detours)	na	LS	LS	LS	$25,000
	Subtotal Traffic Items					**$27,000**
	Subtotal Items 1 through 5					**$696,000**
6	**Minor Items**	20%				**$139,200**
7	**Mobilization**	20%				**$167,040**
8a	**Supplemental Work**	20%				**$167,040**
8b	**Contingency**	20%				**$167,040**
8	**Subtotal - Channel Improvements**					**$1,336,320**
9	**Structures Items**					
	Bridge Structure (Carpinteria St.)	na	LS	LS	LS	$6,400,000
	Subtotal					$6,400,000
	Structures - Mobilization	10%				$640,000
	Structures - Contingency	10%				$704,000
	Railroad Related Costs	na	LS	LS	LS	$0
	Subtotal Structures Items (STS cost + 5%)					**$8,131,200**
	Subtotal Construction					**$8,131,200**
10	**Utility Reloc** (Budget)					
	Utilities Exist On site: This budget is for City-Owned					
	Relocate City Water	na	LS	LS	LS	$0
	Relocate City Sewer	na	LS	LS	LS	$0
	Verizon, Cox, Gas- Relocation cost paid by others					$0
	Subtotal Utilities					**$0**
11	**Env Mitigation (Structure)** (budget)	na	LS	LS	LS	
	Subtotal Environmental Mitigation Structure.					**$250,000**
12	**Right of Way**					
	Permanent 'Creek' (Budget)		11,400	SF	$10	$114,000
	Permanent 'Developable' (Budget)		7,600	SF	$55	$418,000
	Permanent 'Maintenance' (Budget)			SF	$35	$0
	TCE (Budget)		LS	LS	LS	$50,000
	Subtotal - R/W					**$582,000**
	Right of Way costs are very rough "place holders".					
	Total Capital =Items "Subtotal Construction"+9+10+11+12					
	Total Capital--Construction Cost					**$10,299,520**

Sycamore Creek
Project Study Report
Engineer's Estimate - Reach 5 - Citrus to Quinientos

		%	Quantity	Unit	Unit rate	Cost
1	**Earthwork**					
	Channel Excavation (see "a" below):	na	300	CY	$ 10	$3,000
	Clear and Grubbing (not incl. bridge removals)	na	LS	LS	$40,000	$40,000
	Remove existing AC and C&G	na	100	SF	$5	$0
	Remove existing creek walls/concrete slopes	na	LS	LS	LS	$30,000
	Develop Water Supply	na	LS	LS	LS	$0
	Subtotal Earthwork					**$73,000**

a. Earthwork price reflect confined area and limited production.

2	**Pavement Structural Section**					
	Asphalt Pavement (HMA) (see "a" below)	na	0	TON	$300	$0
	Aggregate Base	na	0	CY	$70	$0
	Subtotal Pavement Structural Section					**$0**

a.Asphalt prices are costly and can fluctuate more than other materials. Staging and
limited production will increase unit cost of base and paving substantially.

3	**Drainage (Modify Existing Drainage + new)**					
	Drop Inlets ("Plain" DI's; No Special Filtering)	na	0	EA	$20,000	$0
	Storm Drain (24" RCP, Class III)	na	0	LF	$120	$0
	Subtotal Drainage					**$0**

Estimated drainage

4	**Specialty Items**					
	Retaining Walls (None: Assume Slopes are feasible)	na	120	LF	$1,200	$144,000
	Minor Concrete (Curb and Gutter)	na	0	LF	$30	$0
	Minor Concrete (Sidewalk)	na	0	SF	$18	$0
	Highway Planting (not Restoration)	na	LS	LS	LS	$0
	Landscape Restoration Planting	na	LS	LS	LS	$10,000
	Erosion Control	na	LS	LS	LS	$10,000
	Rock Slope/Scour Protection (budget figure)	na	LS	LS	LS	$20,000
	Water Pollution Control (prepare & implement)	na	LS	LS	LS	$15,000
	Hazardous Waste Mitigation work (unknown)	na	0	na	$0	$0
	Environmental Mitigation (budget figure)	na	LS	LS	LS	$200,000
	Permanent Fencing	na	0	na	LS	$15,000
	APE/ ESA temporary Fencing	na	LS	LS	LS	$0
	Mitigation: Cultural Resources	na	LS	LS	LS	$0
	Subtotal Specialty Items					**$414,000**

		%	Quantity	Unit	Unit rate	Cost
5	**Traffic Items**					
	Roadside Signs	LS	1	LS	LS	$1,000
	Traffic Control System (Detours)	na	LS	LS	LS	$12,000
	Subtotal Traffic Items					**$13,000**
	Subtotal Items 1 through 5					**$500,000**
6	**Minor Items**	20%				**$100,000**
7	**Mobilization**	20%				**$120,000**
8a	**Supplemental Work**	20%				**$120,000**
8b	**Contingency**	20%				**$120,000**
8	**Subtotal - Channel Improvements**					**$960,000**
9	**Structures Items**					
	Bridge Structure (Mason St.)	na	LS	LS	LS	$6,400,000
	Subtotal					$6,400,000
	Structures - Mobilization	10%				$640,000
	Structures - Contingency	10%				$704,000
	Railroad Related Costs	na	LS	LS	LS	$0
	Subtotal Structures Items (STS cost + 5%)					**$8,131,200**
	Subtotal Construction					**$9,091,200**
10	**Utility Reloc** (Budget)					
	Utilities Exist On site: This budget is for City-Owned					
	Relocate City Water	na	LS	LS	LS	
	Relocate City Sewer	na	LS	LS	LS	
	Verizon, Cox, Gas- Relocation cost paid by others					$0
	Subtotal Utilities					**$0**
11	**Env Mitigation (Structure)** (budget)	na	LS	LS	LS	
	Subtotal Environmental Mitigation Structure.					**$0**
12	**Right of Way**					
	Permanent 'Creek' (Budget)		3,000	SF	$10	$30,000
	Permanent 'Developable' (Budget)		1,000	SF	$55	$55,000
	Permanent 'Maintenance' (Budget)		1,100	SF	$35	$38,500
	TCE (Budget)		LS	LS	LS	$50,000
	Subtotal - R/W					**$173,500**

Right of Way costs are very rough "place holders".
Total Capital =Items "Subtotal Construction"+9+10+11+12

	Total Capital--Construction Cost					**$10,224,700**

Sycamore Creek
Project Study Report
Engineer's Estimate - Reach 6 - Yanonali to Citrus

		%	Quantity	Unit	Unit rate	Cost
1	**Earthwork**					
	Channel Excavation (see "a" below):	na	1,200	CY	$ 40	$48,000
	Clear and Grubbing (not incl. bridge removals)	na	LS	LS	$40,000	$40,000
	Remove existing AC and C&G	na	100	SF	$5	$0
	Remove existing creek walls/concrete slopes	na	LS	LS	LS	$0
	Develop Water Supply	na	LS	LS	LS	$0
	Subtotal Earthwork					**$88,000**
	a. Earthwork price reflect confined area and limited production.					
2	**Pavement Structural Section**					
	Asphalt Pavement (HMA) (see "a" below)	na	0	TON	$300	$0
	Aggregate Base	na	0	CY	$70	$0
	Subtotal Pavement Structural Section					**$0**
	a.Asphalt prices are costly and can fluctuate more than other materials. Staging and limited production will increase unit cost of base and paving substantially.					
3	**Drainage (Modify Existing Drainage + new)**					
	Drop Inlets ("Plain" DI's; No Special Filtering)	na	4	EA	$20,000	$80,000
	Storm Drain (24" RCP, Class III)	na	100	LF	$120	$12,000
	Subtotal Drainage					**$92,000**
	Estimated drainage					
4	**Specialty Items**					
	Bridge Removal	na	LS	LS	LS	$0
	Pedestrain Bridge Removal	na	LS	LS	LS	$0
	Retaining Walls (None: Assume Slopes are feasible)	na	750	LF	$1,200	$900,000
	Minor Concrete (Curb and Gutter)	na	0	LF	$30	$0
	Minor Concrete (Sidewalk)	na	0	SF	$18	$0
	Highway Planting (not Restoration)	na	LS	LS	LS	$0
	Landscape Restoration Planting	na	LS	LS	LS	$35,000
	Erosion Control	na	LS	LS	LS	$15,000
	Rock Slope/Scour Protection (budget figure)	na	LS	LS	LS	$100,000
	Water Pollution Control (prepare & implement)	na	LS	LS	LS	$15,000
	Cofferdam and Water Diversion	na	LS	LS	LS	$80,000
	Hazardous Waste Mitigation work (unknown)	na	0	na	$0	$0
	Environmental Mitigation (budget figure)	na	LS	LS	LS	$200,000
	Permenant Fencing	na	0	na	LS	$80,000
	APE/ ESA temporary Fencing	na	LS	LS	LS	$0
	Mitigation: Cultural Resources	na	LS	LS	LS	$0
	Subtotal Specialty Items					**$1,425,000**
5	**Traffic Items**					
	Roadside Signs	LS	1	LS	LS	$2,000
	Traffic Control System (Detours)	na	LS	LS	LS	$25,000
	Subtotal Traffic Items					**$27,000**
	Subtotal Items 1 through 5					**$1,632,000**
6	**Minor Items**	20%				**$326,400**
7	**Mobilzation**	20%				**$391,680**
8a	**Supplemental Work**	20%				**$391,680**
8b	**Contingency**	20%				**$391,680**
8	**Subtotal - Channel Improvements**					**$3,133,440**
9	**Structures Items**					
	Bridge Structure	na	LS	LS	LS	
	Subtotal Construction					**$3,133,440**
10	**Utility Reloc** (Budget)					
	Utilities Exist On site: This budget is for City-Owned					
	Relocate City Water	na	LS	LS	LS	$0
	Relocate City Sewer	na	LS	LS	LS	$0
	Verizon, Cox, Gas- Relocation cost paid by others					**$0**
	Subtotal Utilities					
11	**Env Mitigation (Structure)** (budget)	na	LS	LS	LS	
	Subtotal Environmental Mitigation Structure.					
12	**Right of Way**					
	Permanent 'Creek' (Budget)		4,500	SF	$10	$45,000
	Permanent 'Developable' (Budget)		3,000	SF	$55	$165,000
	Permanent 'Maintenance' (Budget)		4,800	SF	$35	$168,000
	TCE (Budget)		LS	LS	LS	$50,000
	Subtotal - R/W					**$428,000**
	Right of Way costs are very rough "place holders".					
	Total Capitial =Items "Subtotal Construction"+9+10+11+12					
	Total Capital--Construction Cost					**$6,694,880**

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1. Department of the Army, Los Angeles District, Corps of Engineers, Los Angeles, California, June 1974. Flood Plain Information Montecito Streams vicinity of Montecito Santa Barbara, California.

2. Committee on Natural Disasters Commission on Sociotechnical Systems National Research Center and the Environmental Quality Laboratory California Institute of Technology, Sept. 17-18, 1980, Storms, Floods, and Debris Flows in Southern California and Arizona 1978 and 1980.

3. Penfield and Smith, Nov. 21, 2003, Flood Capacity Master Plan for Sycamore Creek, Santa Barbara, California.

4. Questa Engineering Corporation, August 4, 2005, Existing Conditions Study of the Arroyo Burro, Mission, Sycamore, and Laguna Creek Watersheds.