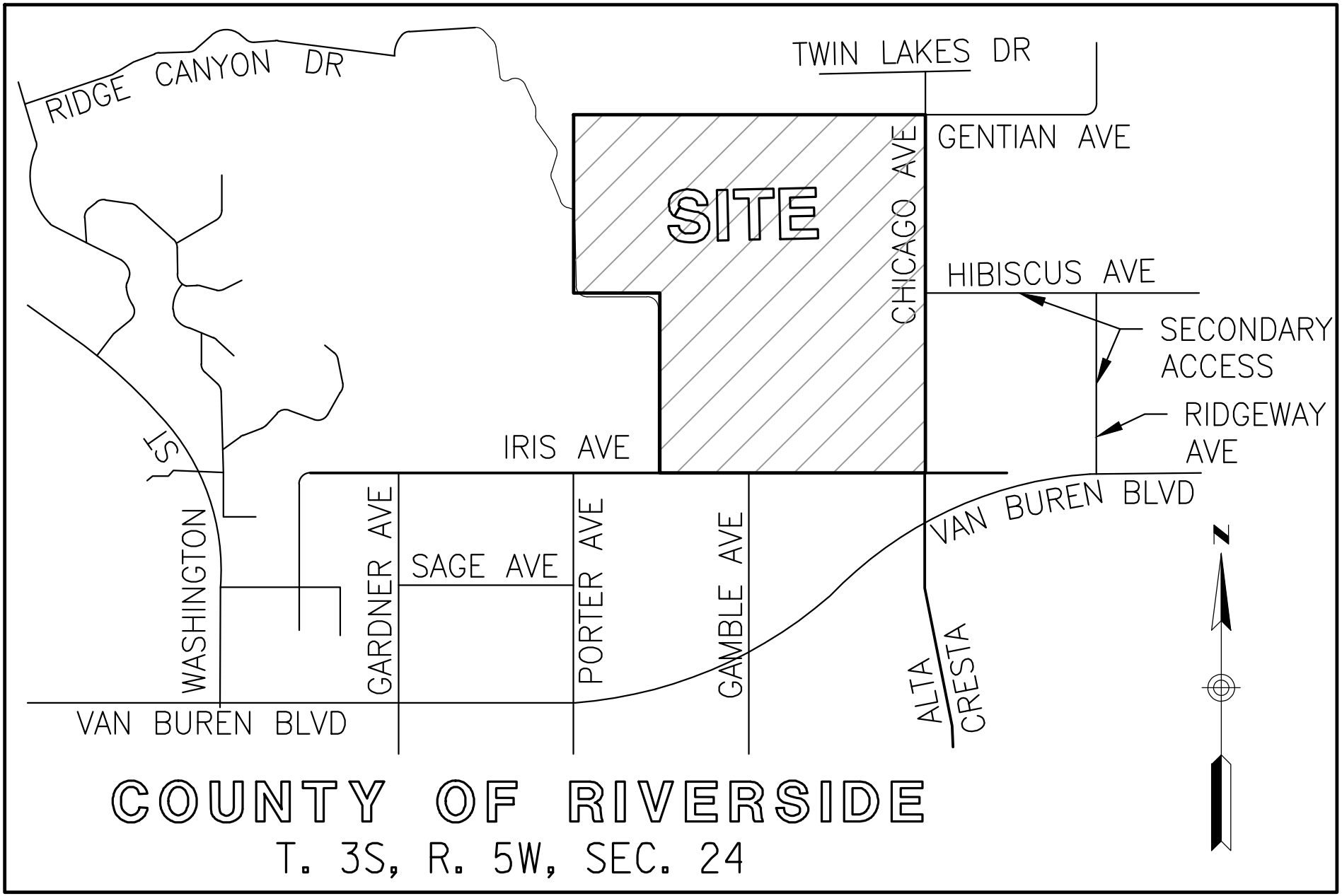
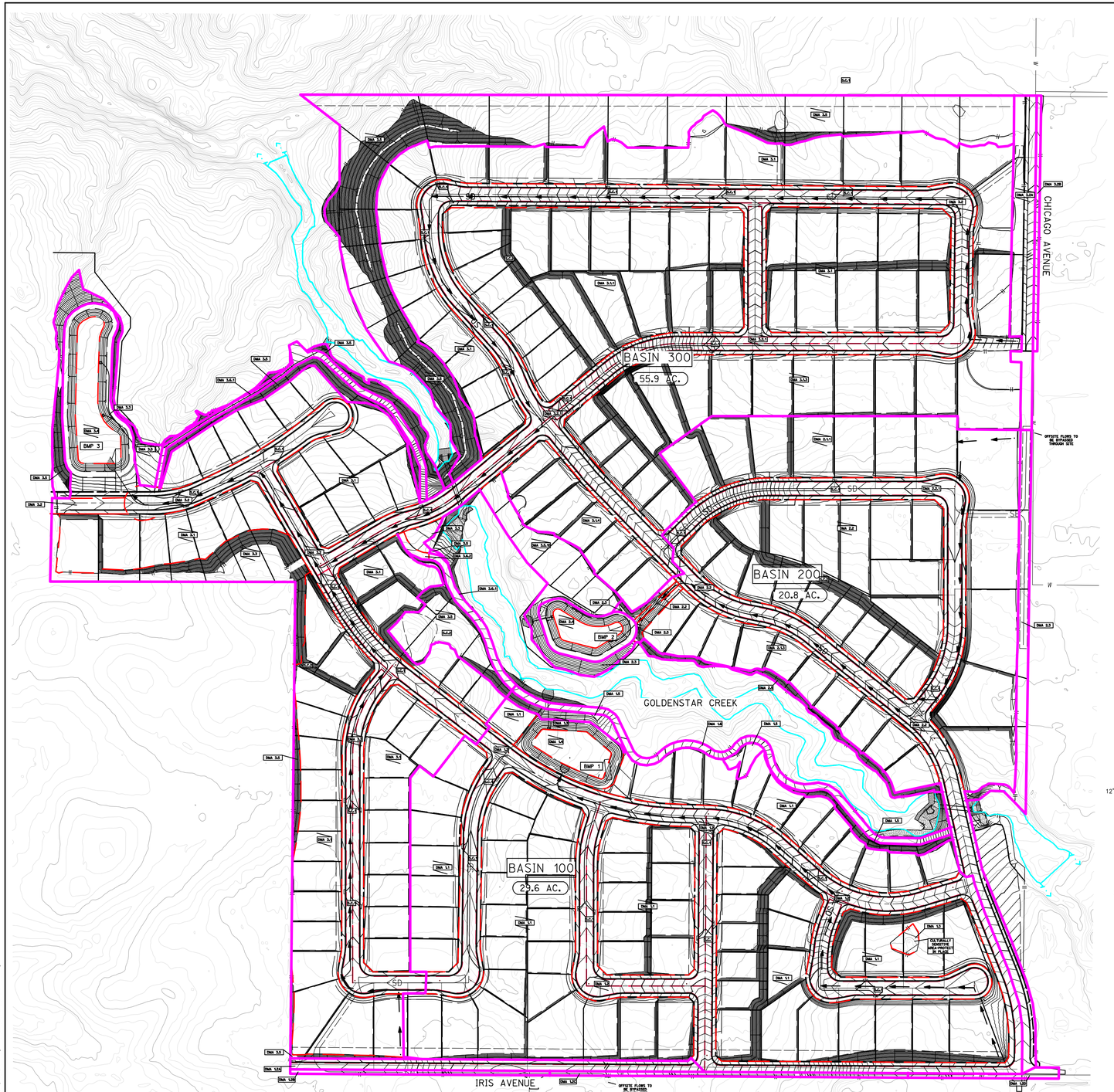


Vicinity Map

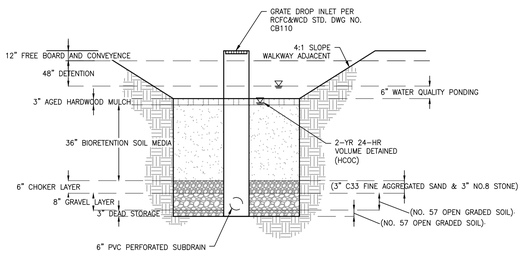
Not to scale



SOURCE CONTROL ID (S.C.)	SOURCE CONTROL
S.C. 1	ON-SITE STORM DRAIN INLETS
S.C. 2	LANDSCAPE/OUTDOOR PESTCIDE USE

DMA	AREA (SF)	AREA (AC)	LANDUSE/SURFACE TYPES	%IMPERVIOUS	IMPERVIOUS AREA DRAINING TO BMP (SF)	IMPERVIOUS AREA DRAINING TO BMP (AC)	PERVIOUS AREA DRAINING TO BMP (SF)	PERVIOUS AREA DRAINING TO BMP (AC)	AREA DRAINING TO BMP (AC)
1.1	906,955	20.8	DETACHED RESIDENTIAL	55%	498,825	11.5	408,130	9.4	20.8
1.2	342,254	7.9	ROAD SURFACE/SIDEWALK	100%	342,254	7.9	0	0.0	7.9
1.3	23,248	0.5	ORNAMENTAL LANDSCAPING	10%	2,325	0.1	20,923	0.5	0.5
1.4	17,683	0.4	BMP WQ	100%	17,683	0.4	0	0	0.4
1.5	25,822	0.6	VEGETATED SLOPE	SELF-TREATING	-	-	-	-	-
1.6	26,509	0.6	DECOMPOSED GRANITE	SELF-TREATING	-	-	-	-	-
DMA 1 TOTALS	1,342,471	30.8	-	64%	861,087	19.8	429,053	9.8	29.6
2.1	642,705	14.8	DETACHED RESIDENTIAL	55%	353,488	8.1	289,217	6.6	14.8
2.2	186,243	4.3	ROAD SURFACE/SIDEWALK	100%	186,243	4.3	0	0.0	4.3
2.3	60,152	1.4	ORNAMENTAL LANDSCAPING	10%	6,015	0.1	54,137	1.2	1.4
2.4	14,541	0.3	BMP WQ	100%	14,541	0.3	0	0.0	0.3
2.5	13,789	0.3	VEGETATED SLOPE	SELF-TREATING	-	-	-	-	-
DMA 2 TOTALS	917,430	21.1	-	61%	560,287	12.9	343,354	7.9	20.8
3.1	1,749,449	40.2	DETACHED RESIDENTIAL	55%	962,197	22.1	787,252	18.1	40.2
3.2	547,759	12.6	ROAD SURFACE/SIDEWALK	100%	547,759	12.6	0	0.0	12.6
3.3	103,694	2.4	ORNAMENTAL LANDSCAPING	10%	10,369	0.2	93,325	2.1	2.4
3.4	30,760	0.7	BMP WQ SURFACE	100%	30,760	0.7	0	0.0	0.7
3.5	469,592	10.8	VEGETATED SLOPE	SELF-TREATING	-	-	-	-	-
3.6.1	26,135	0.6	DECOMPOSED GRANITE	SELF-TREATING	-	-	-	-	-
3.6.2	1,967	0.0	DECOMPOSED GRANITE	40%	787	0.0	1,180	0.0	0.0
DMA 3 TOTALS	2,929,356	67.2	-	53%	1,551,872	35.6	881,757	20.2	55.9
TOTALS =	5,189,257	119.1	-	57%	2,973,246	68.3	1,654,164	38.0	106.3

TYPICAL BMP SECTION
(REFER TO SHEET 4 OF TTM FOR LOCATION SPECIFIC SECTIONS)



BIORETENTION BASIN DETAIL
N.T.S.

NOTES

1. GOLDENSTAR CREEK AND ADJACENT SLOPES ARE CONSIDERED SELF-TREATING AREA.
2. IRIS AVENUE STREET IMPROVEMENTS INCLUDING DMA 1.2A, 1.2B, 1.2C, AND 1.2D DO NOT DRAIN TO BMP 1. HOWEVER, BMP 1 HAS BEEN SIZED FOR ADDITIONAL AREA EQUAL TO THE DMA 1.2A, 1.2B, 1.2C, AND 1.2D AREA PER DISCUSSION WITH COUNTY OF RIVERSIDE ON APRIL 6, 2023.
3. CHICAGO AVENUE STREET IMPROVEMENTS INCLUDING DMA 3.2A AND 3.2B DO NOT DRAIN TO BMP 3. HOWEVER, BMP 3 HAS BEEN SIZED FOR ADDITIONAL AREA EQUAL TO THE DMA 3.2A, AND 3.2B AREA PER DISCUSSION WITH COUNTY OF RIVERSIDE ON APRIL 6, 2023.
4. THIS SITE PLAN IS PRELIMINARY IN NATURE. FINAL DESIGN ELEMENTS OF BASIN SUCH AS OVERFLOWS, FENCING, ETC. TO BE INCLUDED WITH THE FINAL DESIGN EFFORT. EXCESS TREATMENT AREA AND VOLUME IS PROVIDED IN THE PROPOSED BMPS TO ACCOMMODATE MINOR CHANGES FOR SETBACKS AND RAMPS WITH THE FINAL DESIGN EFFORT IF NECESSARY.

LEGEND

BASIN ID — BASIN 200
MAJOR DMA BOUNDARY
MINOR DMA BOUNDARY
DMA AREA — 5.6 AC.
DMA LABEL — DMA 2.1
BMP LABEL — BMP 2
PROPOSED 100-YEAR WATER SURFACE ELEVATION
FLOWPATH

GRAPHIC SCALE: 1"=150'

WATER QUALITY MANAGEMENT PLAN
EXHIBIT FOR
ARROYO VISTA
TTM 38510
PRELIMINARY ENGINEERING

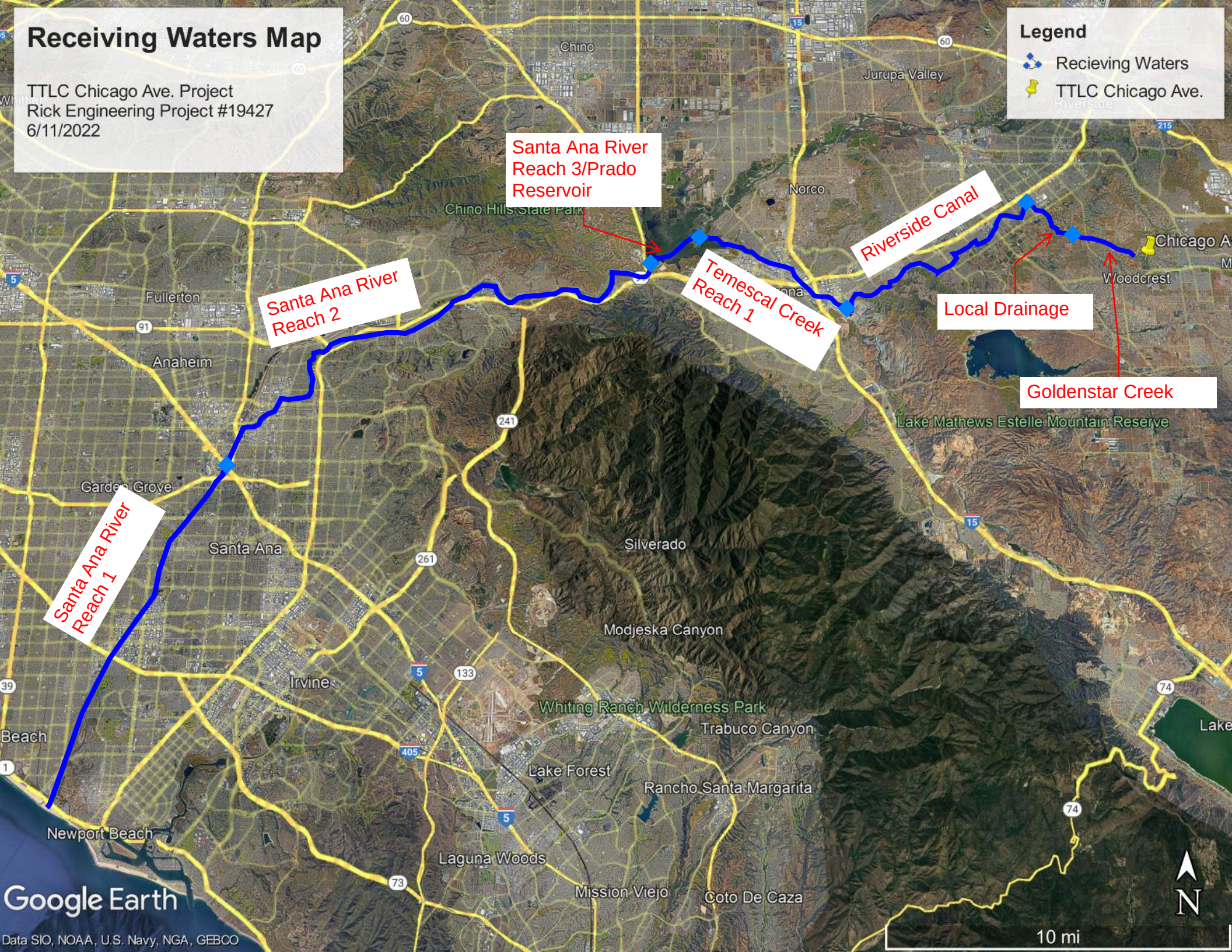
SHEET 1 OF 1
J-19427

DATE: 07/11/2022
REVISED: 12/23/2023
REVISED: 05/08/2024

RICK ENGINEERING COMPANY
1770 IOWA AVE, SUITE 100
RIVERSIDE, CA 92507
951.782.0707
rickengineering.com

\\rickeng.com\projects\J19000\19427-ChicagoAve_IOV\Bluebeam\19427-WQMP.dwg 2024-05-07 - 4:36PM - tnoseberg
Attorney Expressly Reserved, 2024

NOT FOR CONSTRUCTION – EXHIBIT FOR WATER QUALITY MANAGEMENT PLAN REPORT ONLY


Receiving Waters Map
TTLC Chicago Ave. Project
Rick Engineering Project #19427
6/11/2022
Legend
Recieving Waters
TTLC Chicago Ave.
Santa Ana River Reach 3/Prado Reservoir
Riverside Canal
Temescal Creek Reach 1
Santa Ana River Reach 2
Local Drainage
Goldenstar Creek
Santa Ana River Reach 1
Chino
Jurupa Valley
Norco
Chino Hills State Park
Chicago A
Woodcrest
Fullerton
Anaheim
Lake Mathews Estelle Mountain Reserve
Garden Grove
Santa Ana
Silverado
Modjeska Canyon
Irvine
Whiting Ranch Wilderness Park
Trabuco Canyon
Lake Forest
Rancho Santa Margarita
Newport Beach
Laguna Woods
Mission Viejo
Coto De Caza
Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
N
10 mi

Appendix 2: Construction Plans

Grading and Drainage Plans

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

UPDATED GEOTECHNICAL EVALUATION
PROPOSED SINGLE-FAMILY RESIDENTIAL DEVELOPMENT
APNS 245-300-001 AND -004
NORTHWEST OF IRIS AVENUE AND CHICAGO AVENUE
WOODCREST AREA OF RIVERSIDE COUNTY, CALIFORNIA

PREPARED FOR

TTLC MANAGEMENT, INC., AN ARIZONA CORPORATION
2942 CENTURY PLACE, SUITE 121
COSTA MESA, CALIFORNIA 92626

PREPARED BY

GEOTEK, INC.
1548 NORTH MAPLE STREET
CORONA, CALIFORNIA 92878

PROJECT NO. 2855-CR **SEPTEMBER 21, 2021**

GEOTEK

GeoTek, Inc.
1548 North Maple Street, Corona, California 92878
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

September 21, 2021
Project No. 2855-CR

TTLC Management, Inc., an Arizona Corporation
2942 Century Place, Suite 121
Costa Mesa, California 92626

Attention: Mr. Michael Torres

Subject: Updated Geotechnical Evaluation
Proposed Single-Family Residential Development
APN 245-300-001 and -004
Northwest of Iris Avenue and Chicago Avenue
Woodcrest Area of Riverside County, California

Dear Mr. Torres:

GeoTek, Inc. (GeoTek) is pleased to provide the results of this updated geotechnical evaluation for the subject project located north of Iris Avenue and west of Chicago Avenue, in the Woodcrest area of Riverside County, California. This report presents the results of GeoTek's evaluation and discussion of findings.

Based upon review, it is GeoTek's opinion that site development appears feasible from a geotechnical viewpoint. Final site development and grading plans should be reviewed by this firm as they become available, as it will be necessary to provide appropriate recommendations for intended specific site development as those plans become refined.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call GeoTek.

Respectfully submitted,
GeoTek, Inc.

Edward H. LaMont
CEG 1892, Exp. 07/31/22
Principal Geologist

Bruce C. Hick
GE 3133, Exp. 12/31/22
Project Engineer

Kyle R. McHargue
PG 9790, Exp. 02/28/22
Project Geologist

Distribution: (1) Addressee via email

G:\Projects\2851 to 2900\2855CR The True Life Companies NW Iris Ave & Chicago Ave Woodcrest\Geo\2855-CR Updated Geotechnical Evaluation APN 245-300-001 and -004 GEO.doc

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ENCLOSURES

Figure 1 – Site Location Map

Figures 2 – Exploration Location Map

Appendix A – Exploration Logs, Laboratory Test Results and Seismic Refraction Survey Data by Earth Strata (2015)

Appendix B – Logs of Exploratory Trenches by GeoTek

Appendix C – Laboratory Test Results by GeoTek

Appendix D – Seismic Refraction Survey Results by GeoTek

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1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to evaluate the general geotechnical conditions on the site and provide updated geotechnical recommendations as deemed appropriate. Services for this study included the following:

- Research and review of available geologic and geotechnical data, and past reports pertinent to the site,
- Perform a reconnaissance of the site,
- Excavation of eleven (11) exploratory trenches to assess the general subsurface soil and bedrock conditions and rock hardness at the property,
- A seismic refraction survey, performed by a subconsultant, to further evaluate rock excavatability,
- Collection of bulk samples of the onsite materials for laboratory testing,
- Laboratory testing,
- Review and evaluation of site seismicity, and
- Compilation of this updated geotechnical evaluation report which presents GeoTek's findings, conclusions, and recommendations for the site development.

The intent of this report is to aid in the evaluation of the site for future development from a geotechnical perspective. The professional opinions and geotechnical information contained in this report will likely need to be updated based on review of final site development plans. These should be provided to GeoTek for review when available.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The project site consists of two parcels of land identified as Riverside County Assessor's Parcel Numbers (APNs) 245-300-001 (119.0-acres) and 245-300-001 (19.99-acres) (See Figure 1). The site is located at the northwest corner of Iris Avenue and Chicago Avenue, in the Woodcrest area of Riverside County, California. The majority of the property is currently

gently-rolling vacant land that was previously utilized as an agricultural orchard. The orchard trees, including visible tree stumps, appeared to have been removed at the time of the field exploration. In addition, there currently is a single-family residence and three outbuildings in the east-central portion of the site. The northwest portion of the subject site is hillside terrain that is currently vacant and does not appear to have been utilized as an agricultural orchard.

There is an existing incised drainage course trending southeast to northwest that meanders through the central portion of the site. Furthermore, several granitic bedrock outcrops were visible throughout the central and northwest portions of the property.

The subject site is bounded by residential development and vacant land to the north; Chicago Avenue, followed by residential development to the east; Iris Avenue, followed by residential development to the south; and vacant land to the west.

2.2 PROPOSED DEVELOPMENT

The *Master Plan*, prepared by Urban Arena and dated August 10, 2021 ("Chicago 139"), indicates that the site development will consist of the construction of 276 single-family residences, a neighborhood park, open spaces, interior streets, and underground utilities. In addition, a pedestrian bridge over the drainage course and multi-purposes trails are proposed. The existing drainage channel will remain undeveloped and will act as a natural drainage course (see Figure 2).

It is anticipated that the residential structures will be one and/or two stories in height utilizing conventional shallow footings with slab-on-grade. Sewage disposal is to be by a public sewer system.

The inclusion and/or location of water quality basins are not known at this time. As such, infiltration testing was not included in this evaluation.

If site development differs from the assumptions made herein, the recommendations included in this report should be subject to further review and evaluation. Final site development plans should be reviewed by GeoTek when they become available. Additional geotechnical field exploration, analyses, and recommendations may be necessary upon review of site development plans.

3. REPORT REVIEW

On April 27, 2015, Earth-Strata, Inc. (Earth-Strata) issued a *Revised Preliminary Geotechnical Interpretive Report* (Earth-Strata, 2015a) for a portion of the subject site. Earth-Strata's report pertained exclusively to APN 245-300-001 (See Figure 1). Earth-Strata's subsurface investigation consisted of the excavation of eight (8) hollow-stem auger borings to a maximum depth of 10 feet. Additionally, a backhoe was utilized to excavate 18 test pits to a maximum depth of 6 feet throughout the development areas. Earth-Strata indicated that their explorations encountered "surficial" deposits (topsoil), quaternary-age alluvium and Cretaceous-age Tonalite bedrock of the Val Verde Formation within the proposed site development area. The alluvium was encountered to the maximum depth explored and generally consisted of silty sand (SM soil type based upon the Unified Soil Classification System). The tonalite bedrock was generally found to be moderately hard to very hard and typically weathered in the upper 1 to 4 feet.

Earth-Strata concluded that there are no known faults that project through the site and the site is not located within an Alquist-Priolo Earthquake Fault Zone. No landslides were identified on the site by Earth-Strata.

Earth-Strata concluded that the subject property is considered suitable for the proposed development and offered numerous earthwork recommendations. The consultant stated that the near surface earth materials except in areas of rock outcrops will be readily excavated with conventional earth moving equipment. However, the consultant noted that sewer lines may be in excess of 25 feet deep on the west portion of the site and should be further investigated with seismic refraction lines.

Groundwater was not encountered by Earth-Strata during their subsurface exploration. However, water was noted within the drainage channel that trends through the middle of the project site.

Earth-Strata recommended the removal of topsoil, alluvial materials and artificial fill down to competent bedrock. Removals were anticipated to be about 2 to 4 feet deep across much of the site, with localized areas up to 6 to 8 feet within the orchard areas. Properly constructed fill slopes and cut slopes up to 20 feet high with inclinations of 2:1 (horizontal:vertical) are considered to be grossly stable.

The evaluation estimated a shrinkage factor of 5 to 10 percent for the artificial fill and 0 to 5 percent for the bedrock. No shrinkage values were given for the alluvial materials. Earth-Strata stated the subsidence is estimated to be negligible to 0.01 feet.
The Earth Strata report estimated that the on-site materials have a "very low" to "low" expansion index and recommended confirmation after grading. Soils were encountered to have "negligible" soluble sulfate contents and to be "corrosive" to "very corrosive" to common metallic components. Earth-Strata recommended that additional corrosion testing be conducted at the completion of the site grading.

Earth-Strata provided geotechnical parameters for design of both conventionally reinforced shallow foundations and post-tensioned slab systems for soils having "very low" to "low" expansion index potential.

Copies of the excavation logs, seismic refraction lines, and laboratory test results by Earth-Strata are included in Appendix A. The locations of Earth-Strata's excavations are shown on Figure 2.

On June 8, 2015, Earth-Strata issued a *Seismic Refraction Survey* (Earth-Strata, 2015b) for a portion of the subject site. Earth-Strata's report pertained exclusively to APN 245-300-001 (See Figure 1). Earth-Strata completed a total of four (4) seismic refraction survey lines each totaling 150 feet in length. The seismic line locations are shown on Figure 2.

Earth-Strata concluded that minor excavation difficulties are to be expected in the uppermost 2 feet to 10 feet. However, areas of surficial bedrock outcropping may require more significant excavation techniques. Within the areas of seismic line 1, areas as shallow as 2 feet to 5 feet and as deep as 40 feet are expected to be excavated with moderately difficult conditions utilizing appropriately sized good working equipment.

Earth-Strata concluded that locally areas referred to as "floaters" and/or "corestones" should be expected and will likely cause difficult excavation conditions. Placement of infrastructure within these areas may require some breaking and/or light blasting to obtain desired grades. Additionally, Earth-Strata concluded that areas with seismic velocities less than 6,800 feet per second (fps) are generally noted to be within the threshold for conventional ripping.

Copies of the seismic refraction survey data by Earth-Strata are included in Appendix A.

4. FIELD EXPLORATION AND LABORATORY TESTING

4.1 FIELD EXPLORATION

To supplement the existing subsurface exploration by Earth-Strata and to assess previously unexplored areas of the proposed development, GeoTek excavated nine (9) exploratory trenches on August 30, 2021. The trenches extended to depths ranging from about 5 to 14 feet below existing grades and were excavated to log the subsurface materials and examine the rippability and/or hardness of localized areas throughout the site. The trenches were excavated by a backhoe.

A seismic refraction survey was conducted on August 12, 2021 by a subconsultant (Subsurface Surveys & Associates, Inc.). The seismic refraction survey involved the recording and measuring of man-made energy waves from seven (7) seismic refraction and tomography lines placed in site areas where deep excavations are proposed, as discussed with the project civil engineer. The seismic survey summary report is included in Appendix D of this report.

The approximate locations of GeoTek's site explorations are shown on the Exploration Location Map, Figure 2. Logs of the explorations by Earth Strata, in addition to the trenches and seismic refraction lines by GeoTek, are provided in Appendices A and B, respectively.

4.2 LABORATORY TESTING

Laboratory testing was performed on selected bulk and relatively undisturbed soil and bedrock samples collected during the field exploration. The purpose of the laboratory testing was to confirm the field classification of the subsurface materials encountered and to evaluate the soil/bedrock physical properties for use in the engineering design and analysis. GeoTek's test results along with a brief description and relevant information regarding testing procedures are included in Appendix C.

5. GEOLOGIC AND SOILS CONDITIONS

5.1 REGIONAL SETTING

The subject property is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. It extends from the point of contact with the Transverse Ranges geomorphic province, southerly to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Several major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are mostly found near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province, and the San Jacinto fault borders the province adjacent the Colorado Desert province.

More specific to the subject property, the site is located within a large structural mass known as the Perris Block of the Peninsula Ranges providence. The Perris Block is a relatively stable mass of granitic bedrock that in places is overlain by alluvium and thin sedimentary and volcanic units. After formation of granitic rocks, the Perris Block experienced vertical movements that produced nearly flat erosional surfaces. Sediments emanating from the elevated portions of the Perris Block filled low lying areas of the region. The project area is in an area geologically mapped by others to be underlain by granitic bedrock (tonalite, Dibblee, T.W. and Minch, J.A., 2004).

No active faults are shown in the immediate site vicinity on the maps reviewed for the area. The site is not located within an Earthquake Fault Zone (Alquist-Priolo) as designated by the State of California. The Riverside County website (https://gis.countyofriverside.us/) has designated the site as "not in a fault zone", "not in a fault line", "not in a liquefaction area", and "not in a subsidence area".

5.2 EARTH MATERIALS

A brief description of the earth materials reported to be on the site by Earth-Strata (2015) and encountered in GeoTek's explorations is presented in the following sections.

5.2.1 Disturbed Soil/Undocumented Fill/Topsoils

Earth-Strata and GeoTek observations noted the presence of topsoil and disturbed soil/undocumented fill ("surficial") soils throughout the site. The surficial soils generally consist of silty and clayey sands and sandy silts (SM, SC, and ML soil types based upon the Unified Soil Classification System) which are predominately brown in color and loose/very soft to medium dense/stiff in consistency. The thickness of the surficial soils ranged from about 1 to 3 feet. However, the composition and thickness of the on-site surficial soils could be highly variable.

5.2.2 Quaternary Alluvium

Quaternary-aged alluvium was encountered in most of the Earth-Strata and GeoTek explorations. These alluvial deposits consist predominately of brown, fine to coarse-grained sands, silty sands, clayey sands and sandy silts (SP, SM, SC and ML soil types). These deposits were found to be in a loose/soft to medium dense/stiff state. The thickness of the alluvium ranged up to approximately 7 feet near the toes of slopes and 8 feet in the drainage courses.

5.2.3 Cretaceous Val Verde Tonalite

The Val Verde Tonalite was mapped within the site and underlies the surficial and alluvial deposits. Tonalite has a similar chemical composition to gabbro but includes a higher percentage of quartz. The Val Verde Tonalite was generally noted to be light gray to yellowish tan and was found to be in a moderately hard to very hard state. The bedrock was generally massive and lacks significant structural planes. Typically, the upper approximate three to four feet of the bedrock was found to be moderately to severely weathered and not as hard. The weathered granitic material consisted of massive, slightly friable fine to very coarse-grained sand when excavated ("Decomposed Granite" (DG)). The bedrock becomes less weathered with depth. Most of GeoTek's trench excavations were terminated due to refusal in the tonalite.

As part of GeoTek's services for this report, a seismic refraction survey was performed by Subsurface Surveys & Associates, Inc. on the site. As part of this survey, seven (7) seismic lines were recorded at various site locations. The results of the seismic refraction survey are presented in Appendix D.

GeoTek's seismic refraction survey performed within planned deep cut areas or areas with deep utilities proposed, as shown on Figure 2, identified three layers of subsurface materials. The uppermost zone comprises alluvial soil (colluvium) and is estimated to extend up to 10 feet below grade. The middle layer was noted to correspond to weathered bedrock with velocities ranging from 3,027 to 4,408 feet per second (fps). The bottom layer was noted to comprise slightly weathered to unweathered bedrock. Results of the seismic refraction survey are provided in Appendix C.

Earth-Strata's seismic refraction survey was performed within APN 245-300-001, as shown on Figure 2, identified three major layers of subsurface materials. The uppermost zone comprises alluvial and colluvium and/or completely weathered bedrock and was estimated to extend up to 10 feet below grade. This layer was estimated to be excavatable with only minor difficulties. However, localized boulders should be anticipated based on surficial exposures which may require more significant excavation techniques.

The middle layer, which starts as shallow as 2 to 5 feet and extended in excess of 40 feet below existing grade, consists of slightly to highly weathered bedrock. This layer is expected to be excavated with moderate conditions, assuming appropriately sized good working equipment. Isolated floaters (i.e., boulders, corestones, etc.) should be expected to be present within this second layer which could produce somewhat difficult conditions locally. Placement of infrastructure within this layer may require some breaking and/or light blasting to obtain desired grades.

The third layer starts at depths of 2 to 30 feet below existing grade, consists of moderately to unweathered bedrock. Placement of infrastructure within this layer may require some localized blasting to obtain desired grades. Results of Earth-Strata's seismic refraction survey are provided in Appendix A.

Based on the results of laboratory testing by Earth-Strata and GeoTek, the surficial soils are considered to have a "very low" (0-20) to "low" (21-50) expansion potential (ASTM D 4829). Based on the laboratory test results, the near surface soils have a soluble sulfate content of less than 0.1 percent (ASTM D 4327). The test results are provided in Appendix A (Earth-Strata) and Appendix C (GeoTek).

Detailed logs of the subsurface conditions of the site are presented in Appendix A (Earth-Strata) and Appendix B (GeoTek).

5.3 SURFACE WATER AND GROUNDWATER

5.3.1 Surface Water

Surface water was not noted during GeoTek's field investigation. However, water was observed within the drainages during Earth Strata's field exploration. If encountered during earthwork construction, surface water on this site is the result of precipitation or possibly some minor surface run-off from immediately surrounding properties. Overall site area drainage is generally to the north/northwest, as directed by site topography. As previously

discussed, a "blue-line" drainage trends northwest through the central portion of the site. Provisions for surface drainage will need to be accounted for by the project civil engineer.

5.3.2 Groundwater

Groundwater was encountered at a depth of approximately 6.5 feet below the existing ground surface in Trench T-5 at the time of exploration. This groundwater appears to be the result of a perched condition. Groundwater was not encountered in any other trenches excavated by GeoTek for this project. Groundwater was not encountered by Earth Strata (2015a) to an explored depth of 10 feet. The California Department of Water Resources, Water Data Library indicates that the presence of various groundwater wells within a one-mile radius from the site. Records for these wells show depths to groundwater in excess of 100 feet. Based on the above, groundwater is not anticipated to be a factor during the site grading. However, seasonal perched groundwater may be encountered during grading within portions of the site.

5.4 FAULTING AND SEISMICITY

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is in a seismically active region. No active or potentially active fault is known to exist at this site nor is the site situated within a State of California designated *"Alquist-Priolo"* Earthquake Fault Zone (Bryant and Hart, 2007; CGS, 1986).

The County of Riverside has designated the site as "not in a fault zone" and "not in a fault line." The nearest known active faults are the Elsinore fault zone and the San Jacinto fault zone located approximately 11.4 and 11.2 miles to the southwest and northeast of the site, respectively.

5.4.1 Seismic Design Parameters

The site is located at approximately 33.8902 North Latitude and -117.3516 West Longitude. A Site Class "C" is considered appropriate due to the presence of shallow bedrock across the site. Site spectral accelerations (S_a and S_1), for 0.2 and 1.0 second periods for a Class "C" site, were determined from the SEAOC/OSHPD web interface that utilizes the USGS web services and retrieves the seismic design data and presents that information in a report format. The results are presented in the following table:

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_S	1.5g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.562g
Site Coefficient for Site Class "C", F_a	1.2
Site Coefficient for Site Class "C", F_v	1.438
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.8g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.809g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	1.2g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.539g
Site Modified Peak Ground Acceleration, PGA_M	0.6g

Final selection of the appropriate seismic design coefficients should be made by the project structural engineer based upon the local practices and ordinances, expected building response and desired level of conservatism.

5.4.2 Surface Fault Rupture

The site is in a seismically active region; however, no active or potentially active fault is known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone (Bryant and Hart, 2007). No faults are identified on geologic maps readily available and reviewed by this firm for the immediate study area. The nearest known active faults are the Elsinore fault zone and the San Jacinto fault zone located approximately 11.4 and 11.2 miles to the southwest and northeast of the site, respectively.

5.4.3 Liquefaction and Seismically Induced Settlement

The County of Riverside has designated the site as being "not in a liquefaction area" and "not in a subsidence area".

Liquefaction is not considered to be a hazard at the subject site due the lack of a true groundwater level within the site, presence of shallow bedrock, and proposed remedial grading. Also, the potential for seismically induced settlement at the property is considered to be nil to very low due to the presence of shallow bedrock and proposed remedial grading.

5.4.4 Other Seismic Hazards

Evidence of ancient landslides or slope instabilities at this site was not observed during the field investigation. Thus, the potential for landslides is considered negligible.

The potential for secondary seismic hazards such as a seiche or tsunami is considered negligible due to site elevation and distance to an open body of water.

As previously discussed, bedrock (tonalite) outcrops are present on portions of the site. As previously noted, the tonalite is generally massive and lacks significant structural planes. In addition, the site topography is relatively gentle with a moderate slope to the north/northwest. Based upon this condition, the rock fall hazard at the site is not a design consideration for this project.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 GENERAL

Development of the site appears feasible from a geotechnical viewpoint. The following recommendations should be incorporated into the design and construction phases of development.

6.2 EARTHWORK CONSIDERATIONS

6.2.1 General

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the County of Riverside, the 2019 California Building Code (CBC), and recommendations contained in this report. The General Grading Guidelines included in Appendix E outline general procedures and do not anticipate all site-specific situations. In the event of conflict, the recommendations presented in the text of this report should supersede those contained in Appendix E.

Final site grading plans should be reviewed by this office when they become available. Additional recommendations will likely be offered subsequent to review of these plans.

6.2.2 Site Clearing

Site preparation should start with removal of any existing improvements, deleterious materials, and vegetation within the planned development areas of the site. These materials should be properly disposed of off-site.

6.2.3 Remedial Grading

The trenches excavated during this evaluation and likely the previous trenches performed by Earth Strata were backfilled without compaction effort. All trench backfill should be entirely removed and replaced with engineered compacted fill.

All topsoil, disturbed soil/undocumented fill ("surficial") soils, loose alluvium, and highly weathered bedrock should be removed to expose competent native materials. Competent native materials are defined as either relatively dense alluvium, which is relatively uniform, not visibly porous, and having an in-place compaction of at least 85 percent of the soil's maximum dry density (per ASTM D 1557 test procedures) or firm, unyielding bedrock. Estimated removal depths are anticipated to range from 2 to 4 feet within "bedrock" areas and 6 to 8 feet within "alluvial" areas.

Actual depths of removals should be determined in the field based on observation and in-place density testing. A representative of this firm should observe and approve the bottom of all excavations. As a minimum, removals should extend down and away from foundation elements at a 1:1 (horizontal:vertical) projection to the recommended removal depth, or a minimum of five feet laterally, whichever is greater. The bottom of the removals should be graded to drain toward the front of the lot at a gradient of at least two percent.

Project rough grading will create fill, cut/fill transition and cut building pads. All pads in fill should be overexcavated such that the pads are underlain by at least five feet of engineered fill and over-excavation bottoms should slope to drain to the adjacent street of suitable direction so ponding of water is not likely. In addition, the minimum fill thickness should be at least one-half of the maximum fill thickness under the pad, up to a maximum of 15 feet. The lateral extent of this recommendation should include an area of at least 5 feet beyond the building limits.

The cut portions of transition (i.e., cut/fill) pads should be overexcavated a minimum of five feet below proposed grades or to a depth of one-half the maximum fill thickness.

All building pads in cut areas exposing tonalite bedrock should be overexcavated to a minimum depth of three feet below proposed grade and replaced with engineered fill.

The base of all project footings should be underlain by at least 24 inches of engineered compacted fill.

In order to facilitate footing excavation and installation of house services, consideration should be given to over-excavating cut lots to a minimum depth of five feet below proposed finished grades. It is recommended that the entire lot be over-excavated. It is also recommended that utility alignments be over-excavated to at least one foot below the depth of the lowest underground utility.

To prevent potential differential settlement, the cut portions of transition (i.e., cut/fill) lots should be over-excavated a minimum of five feet below proposed grades or to a depth of one-half of the maximum fill thickness on the lot, whichever is greater. The horizontal extent of over-excavation could comprise the entire lot or extend at least five feet outside the structural area, or a distance equal to the depth of over-excavation below the bottom of the structural elements, whichever is greater. Over-excavation bottoms should be graded to drain toward the front of the lot (two percent minimum).

The approved removal/over-excavation bottom exposed should then be scarified to a depth of about six inches, be moisture conditioned to slightly above the soil's optimum moisture content and then be compacted to at least 90 percent of the soil's maximum dry density as determined by ASTM D 1557 test procedures. Compaction should be confirmed by testing.

6.2.4 Excavation Characteristics

As previously discussed, excavation up to approximately 25 feet or less will be needed for localized areas of infrastructure (sewer line) construction. Based upon results of GeoTek's and Earth Strata's exploration, backhoe and drill rigs met shallow refusal in bedrock. In addition, bedrock outcrops were present on portions of the site.

As part of GeoTek's services for this report, a seismic refraction survey was performed by Subsurface Surveys & Associates, Inc. on the site. As part of this survey, seven (7) seismic lines were recorded at various site locations. The results of the seismic refraction survey are presented in Appendix D. Earth-Strata's seismic refraction survey was performed within APN 245-300-001, as shown on Figure 2. The results of Earth Strata's seismic refraction survey are presented in Appendix A.

A brief discussion of the results of the seismic refraction surveys performed by Earth Strata and GeoTek was provided in Section 5.2.3. of this report. Much of the rock at the site is extremely hard and relatively unfractured, with bedrock outcrops present on the site. Some blasting or special excavation techniques will likely be required to complete the proposed project grading and infrastructure construction.

The above evaluation of rock hardness is based on review of previous studies performed for the site and the recently performed seismic refraction survey. It should be realized that the ability of any particular contractor to excavate the materials encountered will vary based on factors that may or may not be considered in the evaluation. All methods available to evaluate rock hardness and associated rippability are interpretive to some extent. As such, experience and judgment are primary factors in such evaluations.

Utility excavation is expected to be challenging due to the presence of hard rock. Extensive blasting or special excavation techniques should be anticipated to perform the utility infrastructure of this project. It is recommended that utility corridors within streets be over-excavated to at least 1 foot below the deepest utility and backfilling with compacted soil. Oversized rocks (>6 inches) should be anticipated on this site and hard floaters/corestones may be encountered at varying depths during grading and/or blasting operations. A caving or loosening of bedrock often known as "overbreak" of utility trench excavations is expected in excavations into the tonalite bedrock.

Overexcavation of street areas underlain by bedrock during rough grading should be considered to prevent significant trenching difficulties associated with utility installations. The overexcavation should extend to a depth of at least one foot below the deepest planned utility and then be backfilled with properly compacted fill.

Excavation of alluvial deposits to the design elevations is expected to be feasible with heavy-duty grading equipment in good operating condition. All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with local and Cal-OSHA guidelines. Temporary excavations within the on-site materials should be stable at 1:1 (horizontal:vertical) inclinations for cuts less than ten feet in height.

Based on the soils encountered in the various site explorations, site earth materials can be categorized as OSHA Soil Type C. It is recommended that temporary slopes greater than four feet in height not be constructed at inclinations steeper than 1:1 (horizontal:vertical). Flatter inclinations may be needed depending on the field conditions. Temporary construction slopes should be periodically examined by a competent person, per OSHA requirements, to look of evidence of instability.

6.2.5 Canyon Subdrains

Subdrains are recommended within the bottom of the existing major drainage swales/canyons in areas where the depth of fill will exceed 10 feet in thickness. The subdrains should consist of 6-inch diameter (subdrain length less than 500 feet) or 8-inch diameter (lengths greater than

500 feet) Schedule 40 perforated PVC pipe encapsulated within 9 cubic feet of suitable drainage material (¾ inch open graded rock, or equivalent) surrounded by a filter fabric, such as Mirafi 140N, or equivalent. Where possible, the subdrains should be installed within the bottom of the canyon cleanouts. The subdrains should be installed with a minimum 1 percent gradient sloping to an approved outlet. The final 10 feet of pipe, where connecting to an outlet, should consist of solid PVC pipe. A subdrain detail is shown on Plate E-1 in Appendix E.

6.2.6 Slope Construction

Cut slopes constructed in bedrock at maximum gradients of 2:1 (horizontal:vertical), in accordance with industry standards, are anticipated to be both grossly and surficially stable. Cut slopes constructed at maximum gradients of 2:1 (horizontal:vertical) in suitable alluvial soils, in accordance with industry standards, are anticipated to be both grossly and surficially stable. An engineering geologist should observe all cut slopes. Cut slopes should expose competent bedrock (defined as tonalite) or suitable alluvium. If adverse structure or incompetent materials are exposed and identified in the cut slopes, stabilization fills may be recommended. Where alluvial soils are present over bedrock in the cut slope, the alluvial portion of the slope should be reconstructed as a surficial stability fill.

Swales should be constructed at the top of all cut slopes to collect and divert drainage away from the slope face. Drainage should be directed to an approved drainage discharge location. Swales should be constructed with concrete, shotcrete or approved non-erosive material. Swales should be cleaned of loose soil and debris on an on-going basis.

Fill slopes constructed at maximum gradients of 2:1 (horizontal:vertical), in accordance with industry standards, are anticipated to be both grossly and surficially stable. Where fill is to be placed against sloping terrain with gradients of 5:1 (horizontal:vertical) or steeper, the sloping ground surface should be benched to remove loose and disturbed surface soil to assure that the new fill is placed in direct contact with competent bedrock and to provide horizontal surfaces for fill placement. A 10- to 15-foot-wide keyway should be constructed at the toe of the fill slope areas extending at least 2 to 3 feet vertically into competent natural material.

The base of the keyways and benches should be sloped back into the hillside at a gradient of at least two percent. The base of the benches should be evaluated by a representative of GeoTek prior to processing. Upon approval, the exposed materials should be moistened to at least the optimum moisture content and densified to a relative compaction of at least 90 percent of maximum dry density as determined by ASTM D 1557 test procedures.

Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction and then roll the final slope to provide a dense, erosion resistant surface.

Berms should be constructed and maintained at the top of all slopes to divert drainage away from the slope faces. An abatement program to control ground-burrowing rodents should be implemented and maintained. Burrowing rodents can decrease the long-term performance of slopes.

6.2.7 Engineered Fill

The onsite materials are considered suitable for reuse as engineered fill provided the materials are free from vegetation, roots, and rock/hard lumps greater than six inches in maximum dimension.

Prior to placing fill, the approved exposed subgrade should then be scarified to a depth of about 12 inches, be moisture conditioned to slightly above the soil's optimum moisture content and then be compacted to at least 90 percent of maximum dry density as determined by ASTM D 1557 test procedures.

The undercut areas should be brought to final subgrade elevations with fill materials that are placed and compacted in general accordance with minimum project standards. Engineered fill should be placed in six- to eight-inch loose lifts, moisture conditioned to slightly above optimum moisture content, and compacted to a minimum relative compaction of 90 percent as determined by ASTM D 1557 test procedures. If engineered fill depths exceed 50 feet, the engineered fill below a depth of 50 feet from finish grade should be compacted to a minimum relative compaction of 95 percent as determined by ASTM D 1557. Fills deeper than 30 feet from finish grade should be compacted to a minimum relative compaction of 93 percent. Placement of engineered fill should be observed and tested on a full-time basis by a GeoTek representative during grading activities.

The site excavations noted that the bedrock generally breaks down to sand and gravel with trace of boulders and cobbles up to 2 feet in maximum dimension. Occasional cobbles and boulders were also encountered in the deeper portions of the alluvium. Oversized materials (greater than six inches) should be placed scattered (windrows) on site as detailed in Appendix E and Figure E-4. Alternatively, oversized rock could be disposed of offsite or stockpiled on site and crushed for future use.

6.2.8 Trench Excavations and Backfill

Temporary trench excavations within the on-site materials should be stable at 1:1 (h:v) inclinations for short durations during construction and where cuts do not exceed ten feet in height. It is anticipated that temporary cuts to a maximum height of four feet can be excavated vertically.

Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should be compacted to at least 90 percent relative compaction (as determined per ASTM D 1557 test procedures). Under-slab trenches should also be compacted to project specifications. Where applicable, based on jurisdictional requirements, the top 12 inches of backfill below subgrade for road pavements should be compacted to at least 95 percent relative compaction. On-site materials may not be suitable for use as bedding material but should be suitable as backfill provided particles larger than six inches are removed.

Compaction should be achieved with a mechanical compaction device. Ponding or jetting of trench backfill is not recommended. If backfill soils have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

6.2.9 Shrinkage and Bulking

Several factors will impact earthwork balancing on the site, including shrinkage, subsidence, trench spoil from utilities and footing excavations, as well as the accuracy of topography.

Shrinkage is primarily dependent upon the degree of compactive effort achieved during construction. For planning purposes, a shrinkage factor of 5 to 10 percent may be considered for the alluvium. Bedrock materials may bulk up to 10 percent or possibly more. Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the conclusion of site earthwork construction.

Due to the presence of relatively shallow bedrock across the site, subsidence is expected to be negligible.

6.3 DESIGN RECOMMENDATIONS

6.3.1 Foundation Design Criteria

Foundation design criteria for a conventional foundation system, in general conformance with the 2019 CBC, are presented herein. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Based on the results of laboratory testing (GeoTek and Earth Strata, 2015a), the on-site materials are classified as having "very low" (0≤EI≤20) to "low" (21≤EI≤50) expansion potential per ASTM D 4829. Additional laboratory testing should be performed at the completion of site grading to verify the expansion potential of the near-surface soils.

The foundation elements for the proposed structures should bear entirely in engineered fill soils as recommended in this report. Foundations should be designed in accordance with the *2019 California Building Code* (CBC). A summary of the foundation design recommendations is presented in the following table:

MINIMUM DESIGN REQUIREMENTS FOR CONVENTIONALLY REINFORCED FOUNDATIONS		
Design Parameter	"Very Low" Expansion Potential (0≤EI≤20)	"Low" Expansion Potential (21≤EI≤50)
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	One- and two-story – 12	One- and two-story - 12
Minimum Foundation Width (Inches)*	One-and two-story – 12	One- and two-story – 15
Minimum Slab Thickness (Inches)	4 - Actual	4 - Actual
Minimum Slab Reinforcing	6" x 6" – W1.4/W1.4 welded wire fabric placed in middle of slab	6" x 6" – W2.9/W2.9 welded wire fabric or No. 3 reinforcing bars placed at 18 o.c. each way placed in middle of slab
Minimum Reinforcement for Continuous Footings, Grade Beams, and Retailing Wall Footings	Two No. 4 reinforcing bars, one placed near the top and one near the bottom	Two No. 4 reinforcing bars, one placed near the top and one near the bottom
Effective Plasticity Index**	0 – design value	35 – design value
Presaturation of Subgrade Soil (Percent of Optimum/Depth in Inches)	Minimum 100% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete	Minimum of 110% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete

*Code minimums per Table 1809.7 of the 2016 CBC
**Effective plasticity index should be verified at the completion of remedial grading

It should be noted that the criteria provided are based on soil support characteristics only. The structural engineer should design the slab and beam reinforcement based on actual loading conditions.

An allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design of continuous and perimeter footings 12 inches deep and 12 inches wide, and pad footings 24 inches square and 12 inches deep. This value may be increased by 300 psf for each additional 12 inches in depth and by 300 psf for each additional 12 inches in width to a maximum value of 3,500 psf. Additionally, an increase of one-third may be applied when considering short-term live loads (e.g., seismic and wind loads).

The recommended allowable bearing capacity is based on an estimated maximum post-construction settlement of 1-inch. Differential settlement of about one-half of the total settlement over a horizontal distance of 40 feet could result. Seismically induced settlement is expected to be negligible. The project structural engineer, foundation engineer, and earth retention structure designer should incorporate these settlement estimates into the design, as appropriate.

The passive earth pressure may be computed as an equivalent fluid having a density of 300 psf per foot of depth, to a maximum earth pressure of 3,500 psf for footings founded on engineered fill. A coefficient of friction between soil and concrete of 0.35 may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

A grade beam, a minimum of 12 inches wide and 12 inches deep, should be utilized across large entrances. The base of the grade beam should be at the same elevation as the bottom of the adjoining footings.

A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these are provided in the 2019 California Green Building Standards Code (CALGreen) Section 4.505.2, the 2019 CBC Section 1907.1 and ACI 360R-10. The vapor retarder design and construction should also meet the requirements of ASTM E 1643. A portion of the vapor retarder design should be the implementation of a moisture vapor retardant membrane.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as the result of construction related punctures (e.g., stake penetrations, tears, punctures from walking on the aggregate layer, etc.). These occurrences should be limited as

much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. It is GeoTek's opinion that a minimum ten mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and atmospheric conditions.

Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e., thickness, composition, strength, and permeance) to achieve the desired performance level. Consideration should be given to consulting with an individual possessing specific expertise in this area for additional evaluation.

It is recommended that control joints be placed in two directions spaced approximately 24 to 36 times the thickness of the slab in inches. These joints are a widely accepted means to control cracks and should be reviewed by the project structural engineer.

6.3.2 Miscellaneous Foundation Recommendations

To minimize moisture penetration beneath the slab-on-grade areas, utility trenches should be backfilled with engineered fill, lean concrete, or concrete slurry where they intercept the perimeter footing or thickened slab edge.

Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.

6.3.3 Foundation Setbacks

Where applicable, the following setbacks should apply to all foundations. Any improvements not conforming to these setbacks may be subject to lateral movements and/or differential settlements:

- The outside bottom edge of all footings should be set back a minimum of H/3 (where H is the slope height) from the face of any descending slope. The setback should be at least 5 feet and need not exceed 40 feet.

- The outside bottom edge of all footings should be set back a minimum of H/2 (where H is the slope height) from the face of any ascending slope. The setback should be at least 7 feet and need not to exceed 15 feet. Where a retaining wall is constructed at the toe of the slope, the height of the slope should be measured from top of the wall to the top of the slope.
- The bottom of all footings for structures near retaining walls should be deepened so as to extend below a 1:1 (h:v) projection upward from the bottom inside edge of the wall footing.
- The bottom of any proposed foundations for structures should be deepened so as to extend below a 1:1 (h:v) projection upward from the bottom of the nearest excavation.

6.4 RETAINING WALL DESIGN AND SITE CONSTRUCTION

6.4.1 General Design Criteria

Recommendations presented herein may apply to typical masonry or concrete vertical walls retaining up to six feet of soil. Additional review and recommendations should be requested for higher walls.

Retaining wall foundations embedded a minimum of 12 inches below the lowest adjacent grade and should rest on at least 24 inches of compacted fill. Wall footings should be designed using an allowable bearing capacity of 2,000 psf. An increase of one-third may be applied when considering short-term live loads (e.g., seismic and wind loads). The passive earth pressure may be computed as an equivalent fluid having a density of 300 psf per foot of depth, to a maximum earth pressure of 3,500 psf. A coefficient of friction between soil and concrete of 0.35 may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

An equivalent fluid pressure approach may be used to compute the horizontal active pressure against the wall. The appropriate fluid unit weights are given in the table below for specific slope gradients of retained materials.

ACTIVE EARTH PRESSURES	
Surface Slope of Retained Materials (H:V)	Equivalent Fluid Pressure (PCF) Native Materials*
Level	42
2:1	65

*The design pressures assume the native backfill material has an expansion index less than or equal to 20. Backfill zone includes area between the back of the wall and footing to a plane (1:1 h:v) up from the bottom of the wall foundation to the ground surface.

The above equivalent fluid weights do not include superimposed loading conditions such as expansive soils, vehicular traffic, structures, seismic conditions or adverse geologic conditions.

For walls with more than 6 feet of compacted backfill, a seismic force must also be included into the wall design. For proposed earth retention structures an earthquake-induced equivalent fluid pressure of 15 pcf should be included into the wall design. This earthquake pressure was determined using the Seed and Whitman method. This seismic pressure can be assumed to be a conventional triangular distribution.

6.4.2 Restrained Retaining Walls

Any retaining wall that will be restrained prior to placing backfill or walls that have male or reentrant corners should be designed for at-rest soil conditions using an equivalent fluid pressure of 65 pcf, plus any applicable surcharge loading. For areas having male or reentrant corners, the restrained wall design should extend a minimum distance equal to twice the height of the wall laterally from the corner, or as otherwise determined by the structural engineer.

6.4.3 Wall Backfill and Drainage

Retaining wall backfill should be free of deleterious and/or oversized materials and should have and expansion index of less than 20. Retaining walls should be provided with an adequate pipe and gravel back drain system to help prevent buildup of hydrostatic pressures. Backdrains should consist of a four-inch diameter perforated collector pipe (Schedule 40, SDR 35, or approved equivalent) embedded in a minimum of one-cubic foot per linear foot of ¾□to 1-inch clean crushed rock or an approved equivalent, wrapped in filter fabric (Mirafi 140N or an approved equivalent). The drain system should be connected to a suitable outlet. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

Retaining wall backfill should be placed in lifts no greater than eight inches in thickness and compacted to a minimum of 90 percent relative compaction as determined by ASTM D 1557 test procedures. The wall backfill should also include a minimum one-foot wide section of ¾- to 1-inch clean crushed rock (or an approved equivalent). The rock should be placed immediately adjacent to the back of the wall and extend up from a back drain to within approximately 24 inches of the finish grade. The rock should be separated from the earth with filter fabric. The upper 24 inches should consist of compacted on-site soil.

As an alternative to the drain rock and fabric, Miradrain 2000, or approved equivalent, may be used behind the retaining wall. The Miradrain 2000 should extend from the base of the wall to within two feet of the ground surface. The subdrain should be placed at the base of the wall in direct contact with the Miradrain 2000.

The presence of other materials might necessitate revision to the parameters provided and modification of the wall designs. Proper surface drainage needs to be provided and maintained. Walls from two to four feet in height may be drained using localized gravel packs behind weep holes at eight feet maximum spacing (e.g., approximately 1.5 cubic feet of gravel in a woven plastic bag). Weep holes should be provided or the head joints omitted in the first course of block extended above the ground surface. However, nuisance water may still collect in front of the wall.

Drain outlets should be maintained over the life of the project and should not be obstructed or plugged by adjacent improvements.

6.4.3.1 Other Design Considerations

- Wall design should consider the additional surcharge loads from superjacent slopes and/or footings, where appropriate.
- No backfill should be placed against concrete until minimum design strengths are evident by compression tests of cylinders.
- The retaining wall footing excavations, backcuts, and backfill materials should be approved by the project geotechnical engineer or their authorized representative.
- Positive separations should be provided in garden walls at horizontal distances not exceeding 20 feet.

6.4.4 Pavement Design Considerations

No on-site earth material has been tested to determine a preliminary R-Value for pavement design. A R-Value of 40 is assumed for the determination of preliminary pavement sections for

this report. The final design should be based on R-Value testing of the soil subgrade following completion of rough grading operations. Project streets should be designed in accordance with County of Riverside requirements when final Traffic Indices and R-Value test results of the subgrade soil are completed.

Pavement design for proposed on-site and off-site street improvements was conducted per Caltrans *Highway Design Manual* guidelines for flexible pavements. Based on traffic indices (TIs) generally associated with this type of project and using a design R-value of 40, the following preliminary sections were calculated:

PRELIMINARY PAVEMENT SECTIONS			
TI	R-Value	Thickness of Asphalt Concrete (inches)	Thickness of Aggregate Base (inches)
5.5 (Access Road and Local Street)	40	3*	6
6.5 (Enhanced Local Street at School or Park)		4*	6*
7.0 (Collector)		4*	8
8.5 (Secondary Highway)		5*	9
9.0 (Major Highway)		5*	10

*Minimum pavement structural section per County of Riverside Standards

The TIs used in the above pavement analysis and design were designated by Riverside County for the indicated street types and should provide a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance. Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from the paving may result in premature pavement failure. Traffic parameters used for design were selected based upon engineering judgment and not upon information furnished to us such as an equivalent wheel load analysis or a traffic study.

The recommended pavement sections provided are intended as a minimum guideline and final selection of pavement cross section parameters should be made by the project civil engineer, based upon the local laws and ordinates, expected subgrade and pavement response, and desired level of conservatism. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. Final pavement design should be checked by testing of soils exposed at subgrade (the upper 12 inches) after final grading has been completed.

Asphalt concrete and aggregate base should conform to current Caltrans Standard Specifications Section 39 and 26-1.02, respectively. As an alternative, asphalt concrete can conform to Section 203-6 of the current Standard Specifications for Public Work (Green Book). Crushed aggregate base or crushed miscellaneous base can conform to Section 200-2.2 and 200-2.4 of the Green Book, respectively. Pavement base should be compacted to at least 95 percent of the ASTM D1557 laboratory maximum dry density (modified proctor).

All pavement installation, including preparation and compaction of subgrade, compaction of base material, placement and rolling of asphaltic concrete, should be done in accordance with County of Riverside specifications, and under the observation and testing of GeoTek and a County Inspector where required. Jurisdictional minimum compaction requirements in excess of the aforementioned minimums may govern.

Deleterious material, excessive wet or dry pockets, oversized rock fragments, and other unsuitable yielding materials encountered during grading should be removed. Once existing compacted fill are brought to the proposed pavement subgrade elevations, the subgrade should be proof rolled in order to check for a uniform and unyielding surface. The upper 12 inches of pavement subgrade soils should be scarified, moisture conditioned at or near optimum moisture content, and recompacted to at least 95 percent of the laboratory maximum dry density as determined by ASTM D1557 test procedures. If loose or yielding materials are encountered during construction, additional evaluation of these areas should be carried out by GeoTek. All pavement section changes should be properly transitioned.

6.4.5 Soil Corrosivity

The soil resistivity at this site was tested in the laboratory on two samples collected during the field investigation. The results of the testing indicate that the on-site soils are considered "extremely corrosive" (804 ohm-cm) (Roberge, 2000) to buried ferrous metal in accordance with current standards used by corrosion engineers. It is recommended that a corrosion engineer be consulted to provide recommendations for the protection of buried ferrous metal at this site.

6.4.6 Soil Sulfate Content

The sulfate content was determined in the laboratory on two samples collected during the field investigation. The results indicate that the water-soluble sulfate results are less than 0.1 percent by weight, which is considered "negligible" as per ACI 318. Based on the test results and Table 4.3.1 of ACI 318, no special recommendations for concrete are required for this project due to soil sulfate exposure.

Additional soil sampling, laboratory testing and analysis regarding soil corrosion and soil sulfate content should be conducted following completion of the project rough grading operation.

6.4.7 Import Soils

Import soils should have expansion characteristics similar to the on-site soils. GeoTek also recommends that the proposed import soils be tested for expansion and sulfate potential. GeoTek should be notified a minimum of 72 hours prior to importing so that appropriate sampling and laboratory testing can be performed.

6.4.8 Concrete Flatwork

6.4.8.1 Exterior Concrete Slabs, Sidewalks, and Driveways

Exterior concrete slabs, sidewalks and driveways should be designed using a four-inch minimum thickness. No specific reinforcement is required from a geotechnical perspective. However, some shrinkage and cracking of the concrete should be anticipated as a result of typical mix designs and curing practices commonly utilized in industrial construction.

Sidewalks and driveways may be under the jurisdiction of the governing agency. If so, jurisdictional design and construction criteria would apply, if more restrictive than the recommendations presented in this report.

Subgrade soils should be pre-moistened prior to placing concrete. The subgrade soils below exterior flatwork with "very low" expansive soils should be pre-saturated to a minimum of 100 percent of optimum moisture content or 110 percent of optimum moisture for "low" expansive soils to a depth of at least 12 inches.

All concrete installation, including preparation and compaction of subgrade, should be done in accordance with the County of Riverside specifications, and under the observation and testing of GeoTek and a County inspector, if necessary.

6.4.8.2 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are hairline to more than 1/8 inch in width. Most cracks in concrete, while unsightly, do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete can also undergo chemical processes that are dependent upon a wide range of variables, which are difficult, at best, to control. Concrete, while seemingly a stable material, is subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point for the stresses that develop. These joints are a widely accepted means to control cracks but are not always effective. Control joints are more effective the more closely spaced they are. GeoTek suggests that control joints be placed in two orthogonal directions and located a distance apart approximately equal to 24 to 36 times the slab thickness.

6.5 POST CONSTRUCTION CONSIDERATIONS

6.5.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, and slope stability is significantly reduced by overly wet conditions. Positive surface drainage away from graded slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Controlling surface drainage and runoff and maintaining a suitable vegetation cover can minimize erosion. Plants selected for landscaping should be lightweight, deep-rooted types that require little water and are capable of surviving the prevailing climate.

Overwatering should be avoided. Care should be taken when adding soil amendments to avoid excessive watering. Leaching as a method of soil preparation prior to planting is not recommended. An abatement program to control ground-burrowing rodents should be implemented and maintained. This is critical as burrowing rodents can decreased the long-term performance of slopes.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundations. This type of

landscaping should be avoided. Due to the presence of high expansive soils, irrigation should be minimized adjacent to the buildings. Planters within 30 feet of the buildings should be above ground and underlain by a concrete slab. Waterproofing of the foundation and/or subdrains may be warranted and advisable. We could discuss these issues, if desired, when plans are made available.

6.5.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times, as directed by the project civil engineer. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground adjacent to the footings and floor-slabs. Pad drainage should be directed toward approved areas and not be blocked by other improvements.

Roof gutters should be installed that will direct the collected water at least 20 feet from the buildings.

It is the owner's responsibility to maintain and clean drainage devices on or contiguous to their lot. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

6.6 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

It is recommended that site grading, specifications, retaining wall/shoring plans and foundation plans be reviewed by this office prior to construction to check for conformance with the recommendations contained in this report. Additional recommendations may be necessary based on these reviews. It is also recommended that GeoTek representatives be present during site grading and foundation construction to check for proper implementation of the geotechnical recommendations. The owner/developer should have GeoTek's representative perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of on-site and import materials for fill placement and collect soil samples for laboratory testing when necessary.
- Observe the fill for uniformity during placement including utility trenches.

- Test the fill for field density and relative compaction.
- Test the near-surface soils to verify proper moisture content.
- Observe and probe foundation excavations to confirm suitability of bearing materials.

If requested, a construction observation and compaction report can be provided by GeoTek, which can comply with the requirements of the governmental agencies having jurisdiction over the project. It is recommended that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained.

7. LIMITATIONS

This evaluation does not and should in no way be construed to encompass any areas beyond the specific area of proposed construction as indicated to us by the client. Further, no evaluation of any existing site improvements is included. The scope of this report is based on GeoTek's understanding of the project and the client's needs, GeoTek's proposal (Proposal No. P-0705721-CR) dated July 21, 2021 and geotechnical engineering standards normally used on similar projects in this region.

The materials observed on the project site appear to be representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during site construction. Site conditions may vary due to seasonal changes or other factors. GeoTek, Inc. assumes no responsibility or liability for work, testing or recommendations performed or provided by others.

Since the recommendations contained in this report are based on the site conditions observed and encountered, and laboratory testing, GeoTek's conclusions and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty is expressed or implied. Standards of practice are subject to change with time.

8. SELECTED REFERENCES

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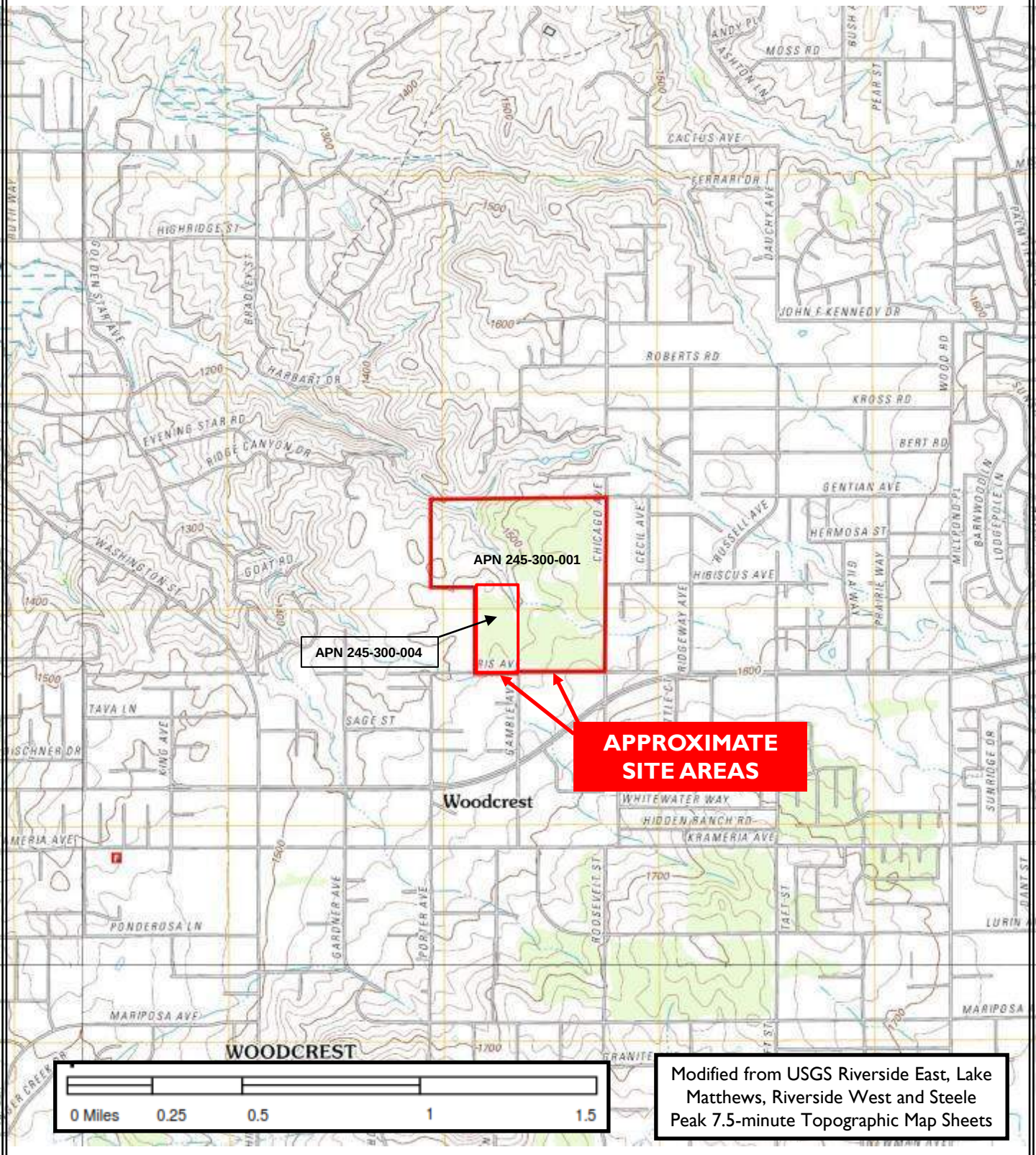

Modified from USGS Riverside East, Lake Matthews, Riverside West and Steele Peak 7.5-minute Topographic Map Sheets

TTLC Management an Arizona Corp.
Assessor's Parcel Numbers 245-300-001 and -004
Woodcrest Area of Riverside County, California

Project No. 2855-CR

NORTH

Figure 1

Site Location Map

GEOTEK

TTLC Management an Arizona Corp.
Proposed Single-Family Residential Development
NW of Iris Avenue and Chicago Avenue
Woodcrest Area of Riverside County, California

GeoTek Project No. 2855-CR

NORTH

200 ft.
SCALE

Figure 2

Exploration Location Map

GEOTEK

APPENDIX A

EXPLORATION LOGS, LABORATORY TEST RESULTS AND SEISMIC REFRACTION SURVEY DATA BY EARTH-STRATA (2015a)

Updated Geotechnical Evaluation
Proposed Single-Family Residential Development
Woodcrest, Riverside County, California
Project No. 2855-CR

GEOTEK

Geotechnical Boring Log B-1

Date: March 25, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; light orange brown, dry to slightly moist, medium dense
	70	1	105.1	10.3		**Cretaceous Val Verde Tonalite (Kvt)**
					SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5	50/4"	2	81.4	19.6	SC	Clayey SAND; light grey, moist, grainitic bedrock
						Dark grey, moist, coarse, very hard
10						End of Boring at 10 feet
						No Groundwater
15						
20						
25						
30						

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Geotechnical Boring Log B-2

Date: March 25, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SC	Clayey SAND; reddish brown, dry
						Cretaceous Val Verde Tonalite (Kvt)
	68	1	118.6	8.9	SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5	50/8"	2	91.6	4.6		
10						End of Boring at 10 feet
						No Groundwater
15						
20						
25						
30						

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Geotechnical Boring Log B-3

Date: March 31, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					ML	Sandy SILT; light brown, dense
						Cretaceous Val Verde Tonalite (Kvt)
5					SC	Clayey Sandstone; light tan brown, moist, hard to very hard
						End of Boring at 5.5 feet
						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log B-4

Date: March 31, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
						Sandy SILT; light brown, dense
	88/10"	1				**Cretaceous Val Verde Tonalite (Kvt)**
					SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5						
10						End of Boring at 10 feet
						No Groundwater
15						
20						
25						
30						

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Geotechnical Boring Log B-5

Date: March 31, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
						Sandy SILT; light brown, dense
						Cretaceous Val Verde Tonalite (Kvt)
	96/8"	1			SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5						
						End of Boring at 7.5
						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log B-6

Date: March 31, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					ML	Sandy SILT; light brown, dense
						Cretaceous Val Verde Tonalite (Kvt)
	110/3"	1			SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5						
	50/1"	2				
						End of Boring at 6 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log B-7

Date: March 31, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: GWG**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
						Sandy SILT; light brown, dense
						Cretaceous Val Verde Tonalite (Kvt)
	50/4"	1			SM	Silty SAND (weathered bedrock);
5						
10						End of Boring at 10 feet
						No Groundwater
15						
20						
25						
30						

Geotechnical Boring Log B-8

Date: March 31, 2015	**Project Name: P& F Prpoerty** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: DV**
Drilling Company: Drilling It	**Type of Rig: CME 45B**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
						Sandy SILT; reddish brown, dense
						Cretaceous Val Verde Tonalite (Kvt)
	50/2"	1			SC	Clayey Sandstone; light tan brown, moist, hard to very hard
5						
						End of Boring at 6 feet
						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-1

Date: March 27, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, slightly moist, with weathered rock
						Tonalite (Kvt):
5					SP	Sand with SILT and weathered rock, gravel size; grey and light brown
						End of Boring at 6 feet
						No Groundwater
						`
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-2

Date: March 28, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, medium dense
						Tonalite (Kvt):
					SP	SAND with fine GRAVEL (weathered rock); light grey
5						End of Boring at 4.9 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-3

Date: March 28, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil**
					SM	Silty SAND; reddish brown, dry, medium dense
						Tonalite (Kvt):
					SP	Sand with fine GRAVEL; light grey, dry, weatherd bedrock
						End of Boring at 4 feet
5						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-4

Date: March 28, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, medium dense
						Tonalite (Kvt):
5					SP	SAND with SILT; reddish brown, dry, medium dense
						End of Boring at 6 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-5

Date: March 27, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose to medium dense
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey with black spots, very dense
5						End of Boring at 4.7 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-6

Date: March 27, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey, dry, very dense
5						End of Boring 5 feet
						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-7

Date: March 27, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Mini Excavator**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; brown, dry, medium dense
						Tonalite (Kvt):
					SP	SAND (weathered bedrock) with gravel; light grey, very dense
						End of Boring at 2.5 feet
5						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-8

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; Reddish brown, dry, loose
5						**Tonalite (Kvt):**
					SP	SAND (weathered bedrock); light grey, dry, very dense
						End of Boring at 5.1 feet
						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-9

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
5						**Tonalite (Kvt):**
					SP	SAND (weathered bedrock); light grey, hard, dry, very dense
						End of Boring at 6 feet
						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-10

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
5					SP	SAND (wethered bedrock); light grey, hard, dry, very dense
						End of Boring at 5 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-11

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
					SP	SAND (wethered bedrock); light grey, hard, dry, very dense
						End of Boring at 2.1 feet
5						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-12

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, loose, moist
						Tonalite (Kvt):
5					SP	SAND (weathered bedrock); light grey, moist, very dense
						End of Boring at 5 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-13

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey, moist, very dense
						End of Boring at 3.8 feet
5						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-14A

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; brown, dry, hard, medium-dense
					SP	**Tonalite (Kvt):**
						SAND (weathered bedrock); brown, dry, very dense
5						End of Boring at 3 feet
						No Groundwater
10						
15						
20						
25						
30						

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Geotechnical Boring Log TP-14

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
5					SP	SAND (weathered bedrock); light grey, hard, dry, very dense
						End of Boring at 6 feet
						No Groundwater
10						
15						
20						
25						
30						

Geotechnical Boring Log TP-15

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey, hard, dry, very dense
5						End of Boring at 5 feet
						No Groundwater
10						
15						
20						
25						
30						

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Earth - Strata, Inc.
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Geotechnical Boring Log TP-16

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
						Tonalite (Kvt):
					SP	SAND (weathered bedrock); light grey, hard, dry, very dense
5						End of Boring at 3.2 feet
						No Groundwater
10						
15						
20						
25						
30						

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Earth - Strata, Inc.
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Geotechnical Boring Log TP-17

Date: April 7, 2015	**Project Name: P & F Properties** **Page: 1 of 1**
Project Number: 15735-10A	**Logged By: SMP**
Drilling Company: Drilling It	**Type of Rig: Backhoe**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft):	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Number	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Topsoil:**
					SM	Silty SAND; reddish brown, dry, loose
5						**Tonalite (Kvt):**
					SP	SAND (weathered bedrock); light grey, hard, dry, very dense
						End of Boring at 5.2 feet
						No Groundwater
10						
15						
20						
25						
30						

APPENDIX C

LABORATORY PROCEDURES AND TEST RESULTS

APPENDIX C

Laboratory Procedures and Test Results

Laboratory testing provided quantitative and qualitative data involving the relevant engineering properties of the representative earth materials selected for testing. The representative samples were tested in general accordance with American Society for Testing and Materials (ASTM) procedures and/or California Test Methods (CTM).

Soil Classification: Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488. Upon completion of laboratory testing, exploratory logs and sample descriptions were reconciled to reflect laboratory test results with regard to ASTM D 2487.

Moisture and Density Tests: For select samples moisture content was determined using the guidelines of ASTM D 2216 and dry density determinations were made using the guidelines of ASTM D 2937. These tests were performed on relatively undisturbed samples and the test results are presented on the exploratory logs.

Maximum Density Tests: The maximum dry density and optimum moisture content of representative samples were determined using the guidelines of ASTM D 1557. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
B-1 @ 0 to 2 feet	Olive Brown SAND with SILT	133.0	7.5
B-2 @ 0 to 2 feet	Dark Yellowish Brown Silty SAND with trace CLAY	127.0	8.0
TP-1 @ 0 to 3 feet	Dark Brown Silty SAND	125.0	11.5
TP-1 @ 4 to 5 feet	Olive Brown Silty SAND	108.5	10.0

Expansion Index: The expansion potential of representative samples was evaluated using the guidelines of ASTM D 4829. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	EXPANSION INDEX	EXPANSION POTENTIAL
B-1 @ 0 to 2 feet	Olive Brown SAND with SILT	0	Very Low
B-2 @ 0to 2 feet	Dark Yellowish Brown Silty SAND with trace CLAY	7	Very Low
TP-1 @ 0 to 3 feet	Dark Brown Silty SAND	29	Low
TP-1 @ 4 to 5 feet	Olive Brown Silty SAND	7	Very Low

Minimum Resistivity and pH Tests: Minimum resistivity and pH Tests of select samples were performed using the guidelines of CTM 643. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	pH	MINIMUM RESISTIVITY (ohm-cm)
B-1 @ 0 to 2 feet	Olive Brown SAND with SILT	7.3	1,000
B-2 @ 0 to 2 feet	Dark Yellowish Brown Silty SAND with trace CLAY	7.1	440
TP-1 @ 0 to 3 feet	Dark Brown Silty SAND	7.2	400
TP-1 @ 4 to 5 feet	Olive Brown Silty SAND	7.8	1,100

Soluble Sulfate: The soluble sulfate content of select samples was determined using the guidelines of CTM 417. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	SULFATE CONTENT (% by weight)	SULFATE EXPOSURE
B-1 @ 0 to 2 feet	Olive Brown SAND with SILT	0.002	Negigible
B-2 @ 0 to 2 feet	Dark Yellowish Brown Silty SAND with trace CLAY	0.029	Negigible
TP-1 @ 0 to 3	Dark Brown Silty SAND	0.002	Negigible
TP-1 @ 4 to 5 feet	Olive Brown Silty SAND	0.002	Negigible

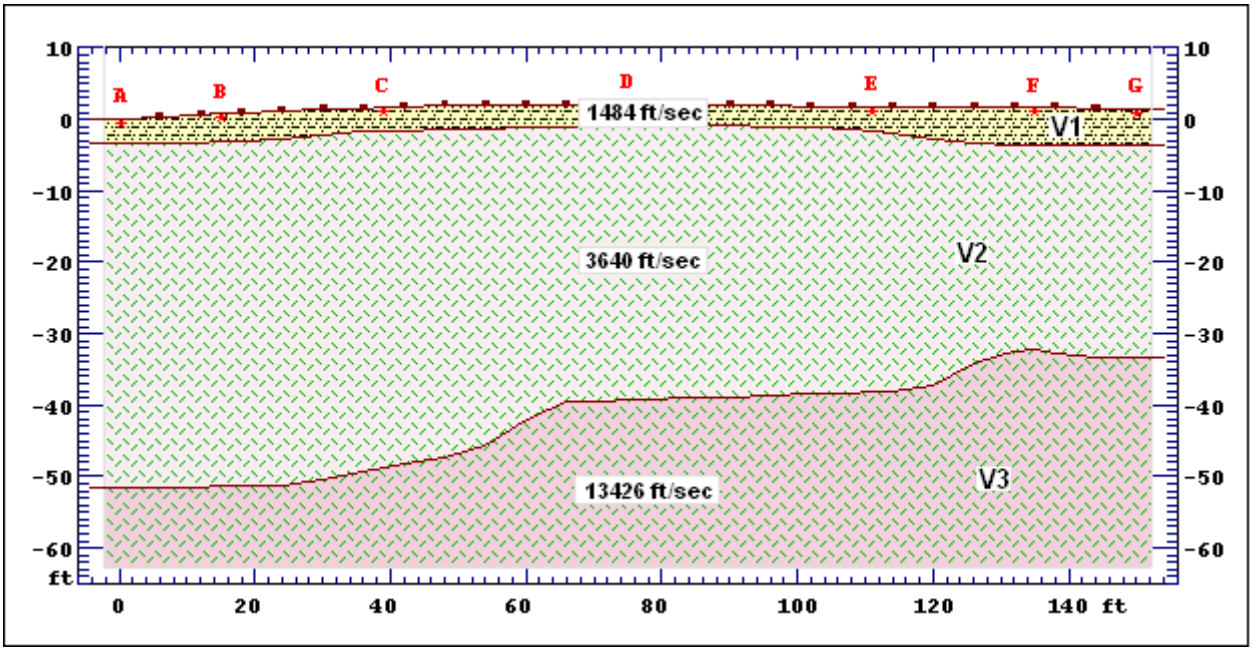
Chloride Content: Chloride content of select samples was determined using the guidelines of CTM 422. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	CHLORIDE CONTENT (ppm)
B-1 @ 0 to 2 feet	Olive Brown SAND with SILT	50
B-2 @ 0 to 2 feet	Dark Yellowish Brown Silty SAND with trace CLAY	70
TP-1 @ 0 to 3 feet	Dark Brown Silty SAND	60
TP-1 @ 4 to 5 feet	Olive Brown Silty SAND	20

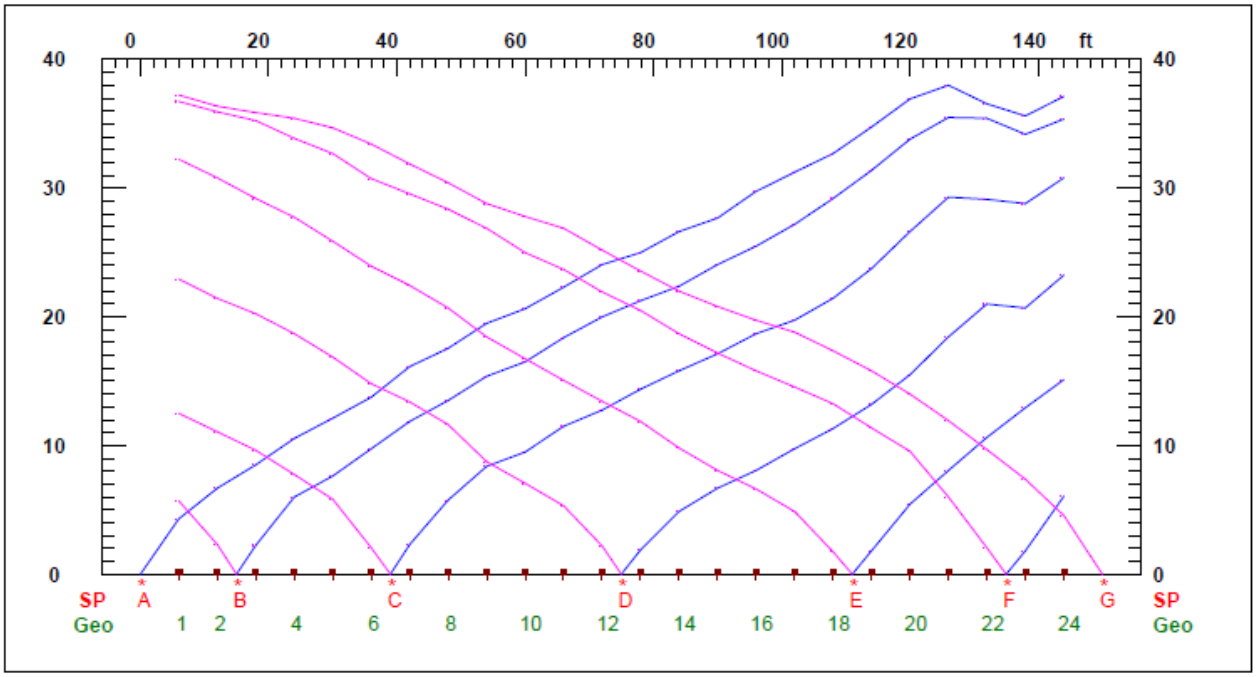
SEISMIC LINE S-1

< South - North >

LAYER VELOCITY MODEL



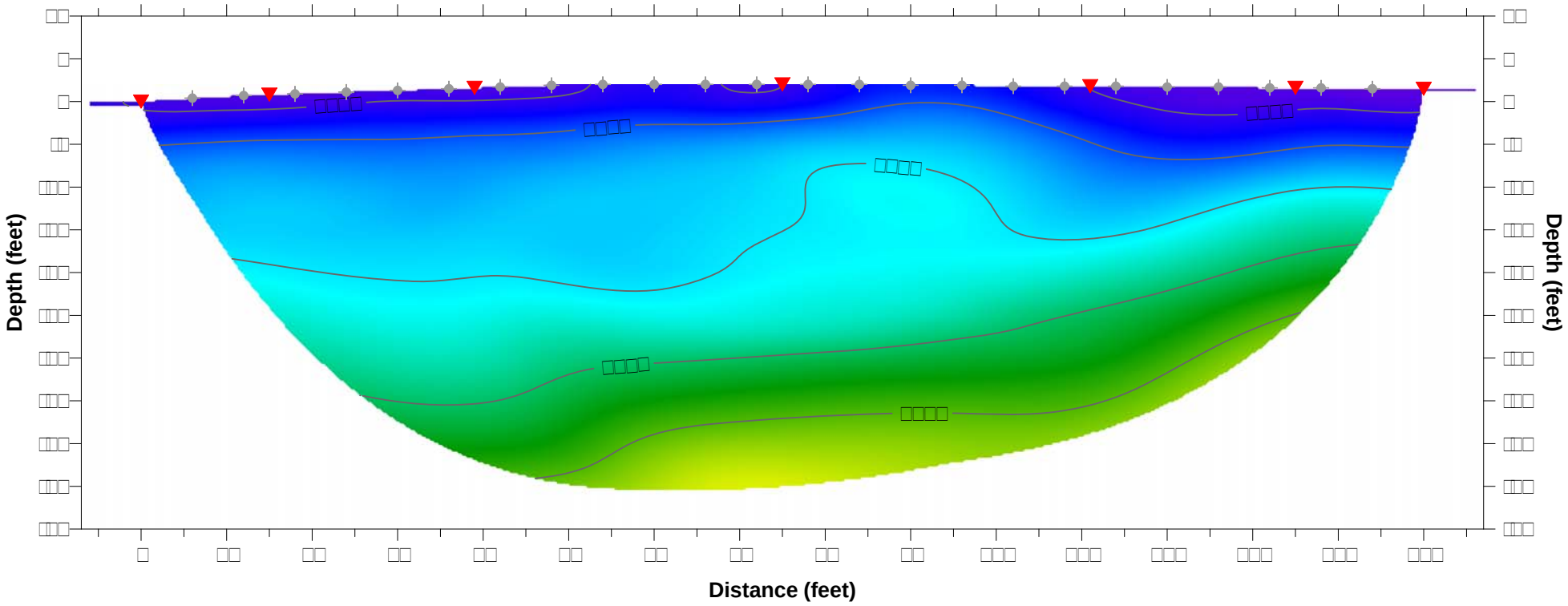
TIME-DISTANCE PLOT



SEISMIC LINE S-1

← South - North →

REFRACTION TOMOGRAPHIC MODEL



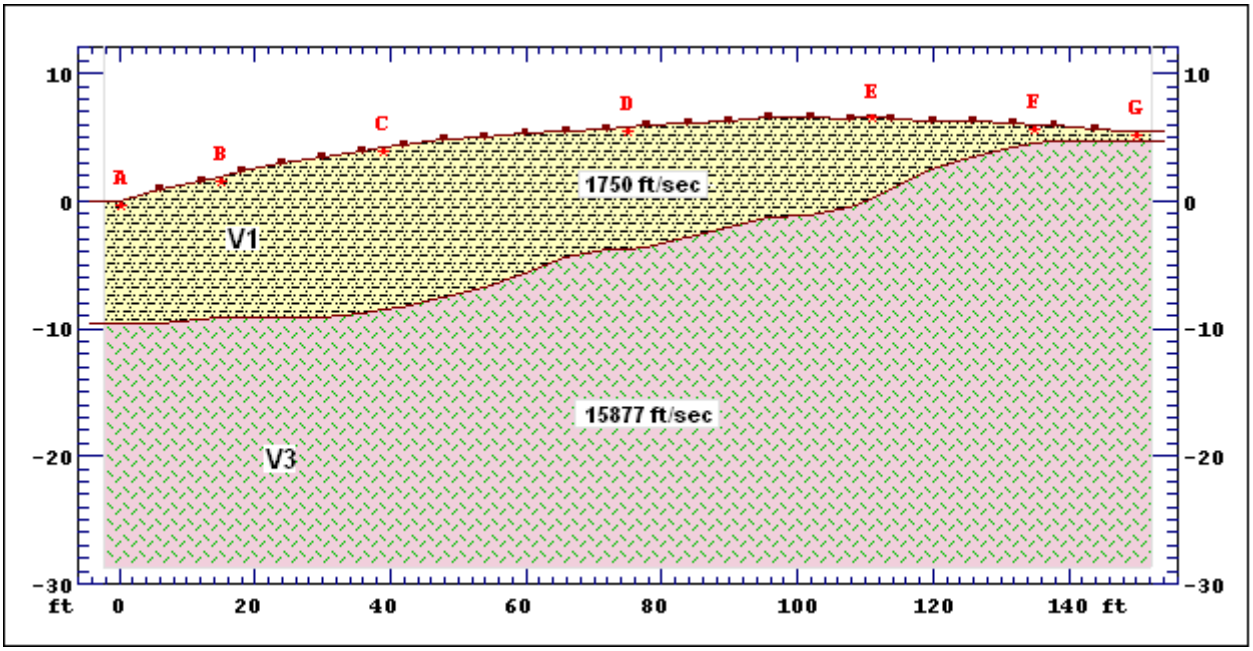
SCALE: 1" = 18' (Horizontal & Vertical)

RMS error 1.4 %, Rayfract Version 3.33

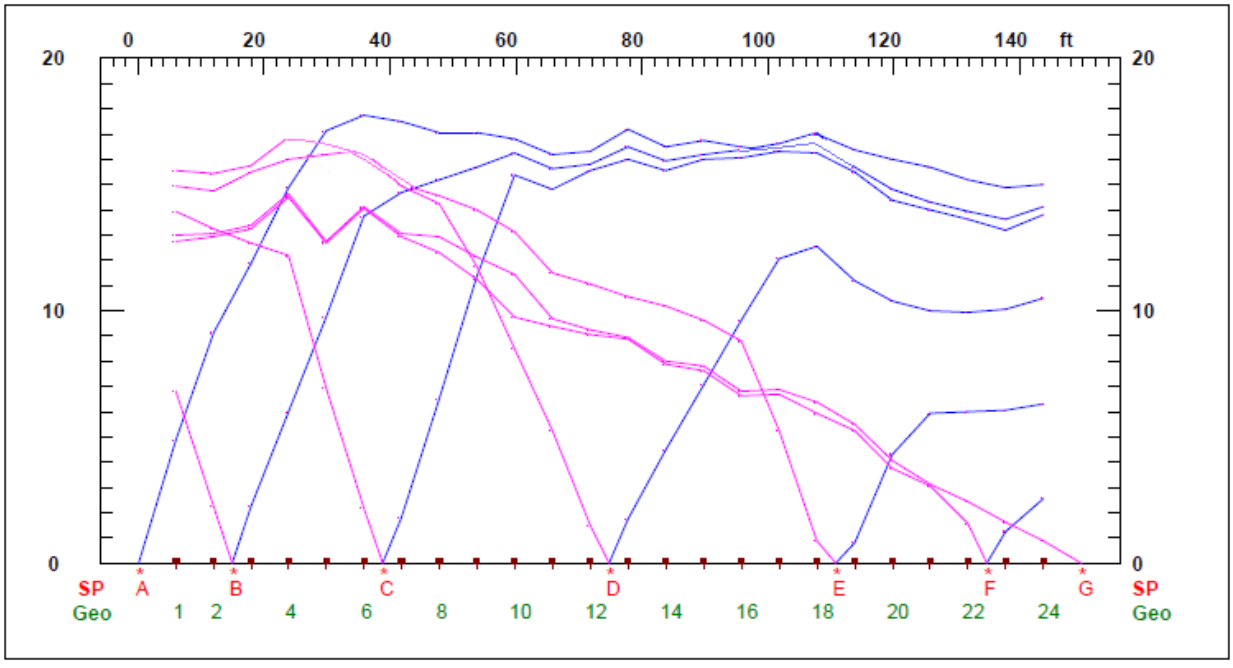
SEISMIC LINE S-2

< South - North >

LAYER VELOCITY MODEL



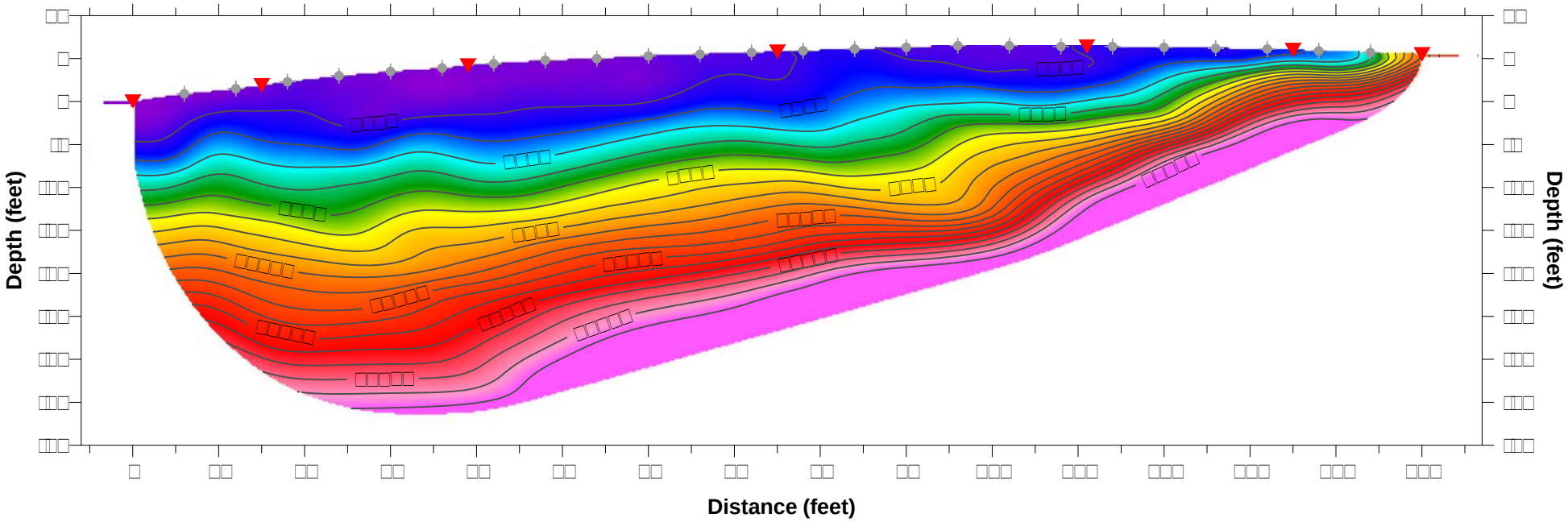
TIME-DISTANCE PLOT



SEISMIC LINE S-2

← South - North →

REFRACTION TOMOGRAPHIC MODEL



Seismic Source

Geophone Receiver

P-Wave Velocity (feet/second)

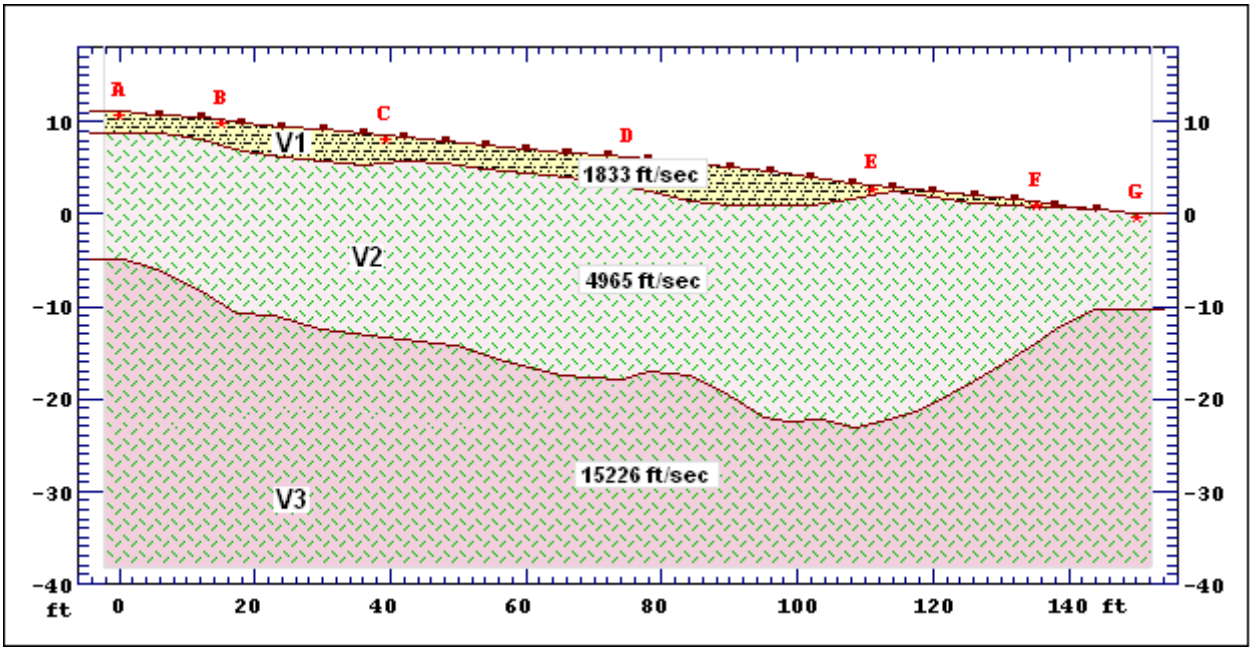
SCALE: 1" = 18' (Horizontal & Vertical)

RMS error 2.9 %, Rayfract Version 3.33

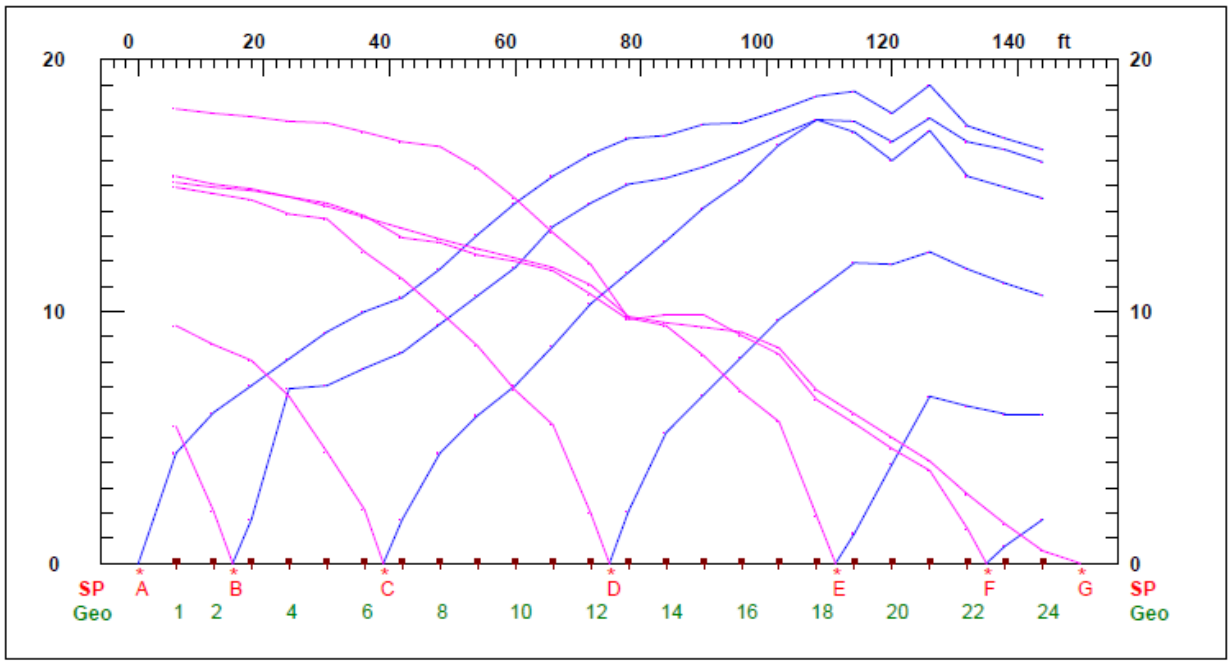
SEISMIC LINE S-3

< South - North >

LAYER VELOCITY MODEL



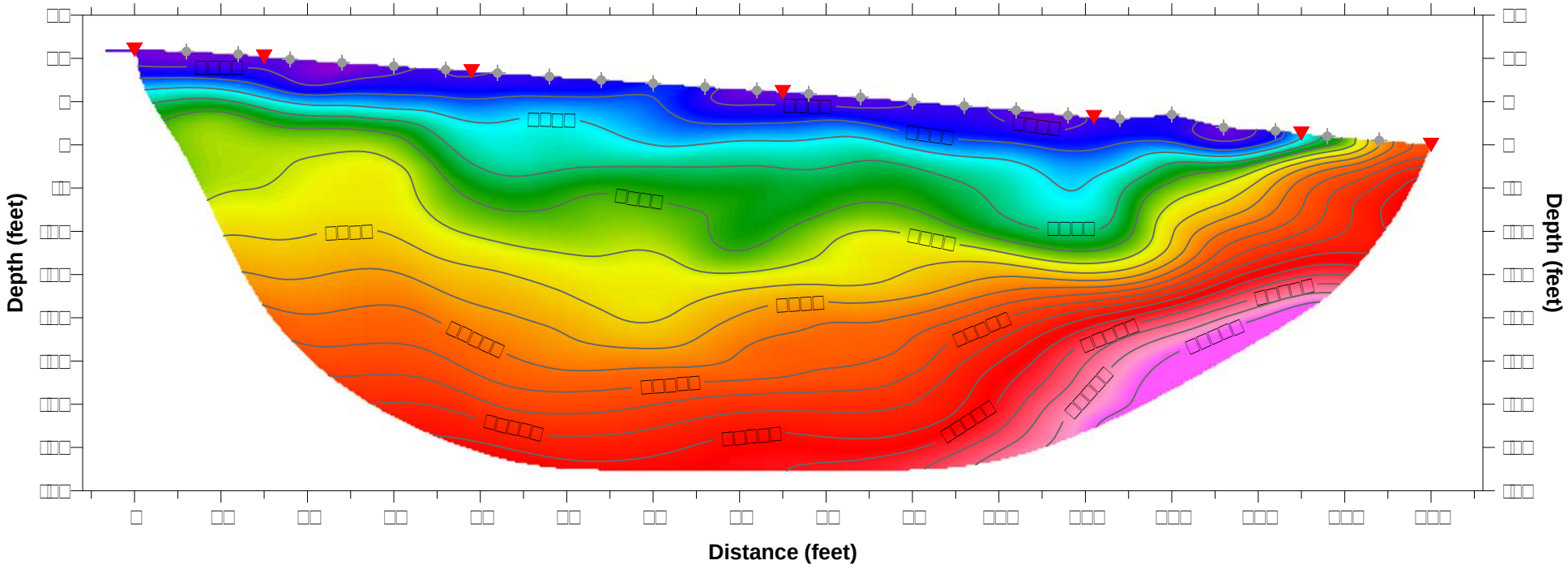
TIME-DISTANCE PLOT



SEISMIC LINE S-3

← South - North →

REFRACTION TOMOGRAPHIC MODEL



▼ Seismic Source

✦ Geophone Receiver

P-Wave Velocity (feet/second)

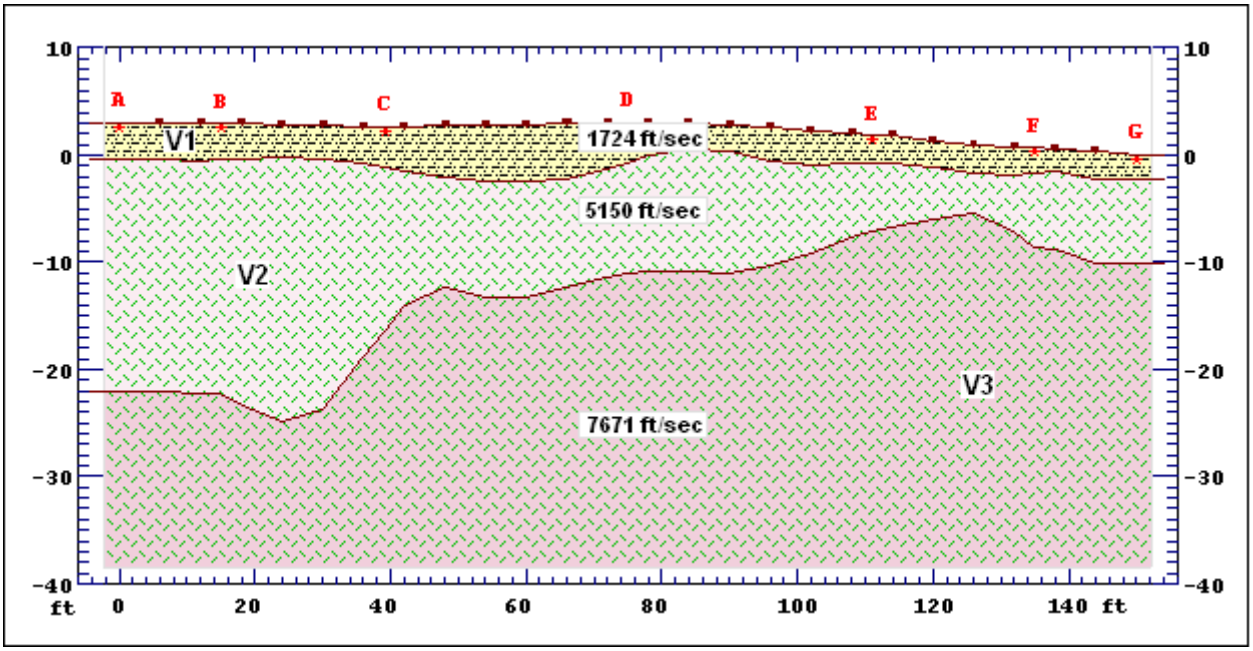
SCALE: 1" = 18' (Horizontal & Vertical)

RMS error 2.4 %, Rayfract Version 3.33

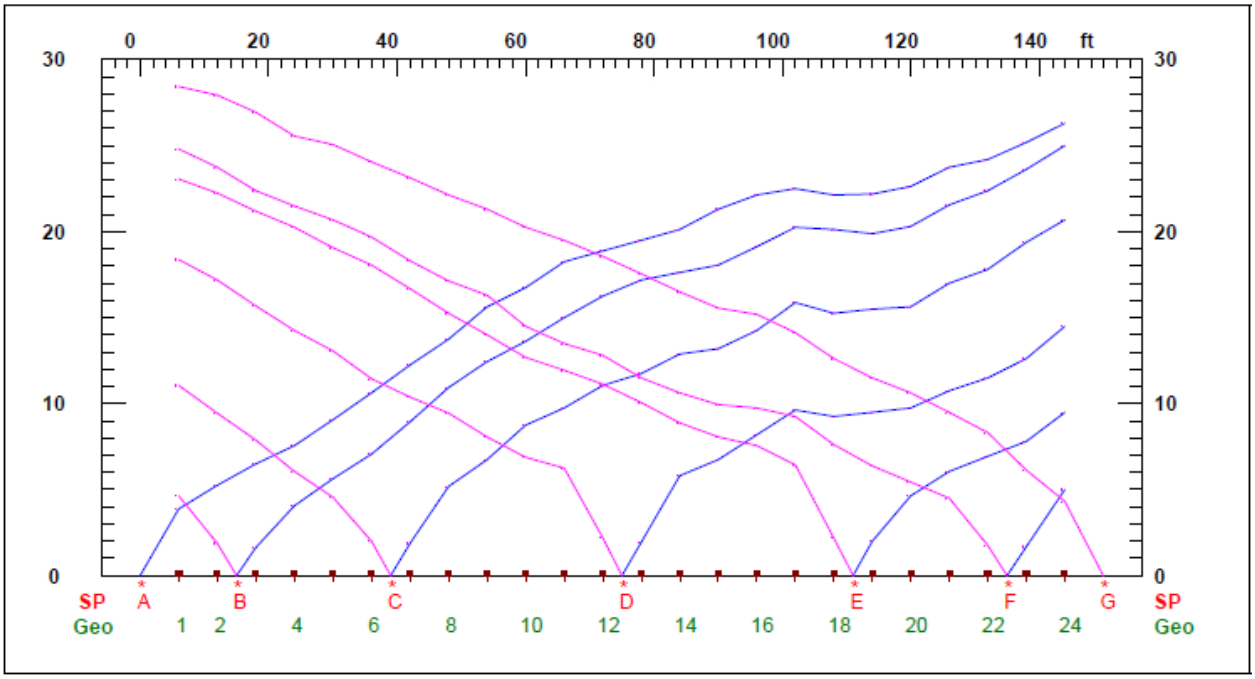
SEISMIC LINE S-4

< West - East >

LAYER VELOCITY MODEL



TIME-DISTANCE PLOT



Additionally, as presented below on Figure 1, the Caterpillar D9R Ripper Performance Chart (Caterpillar, 2012) has been provided for reference.

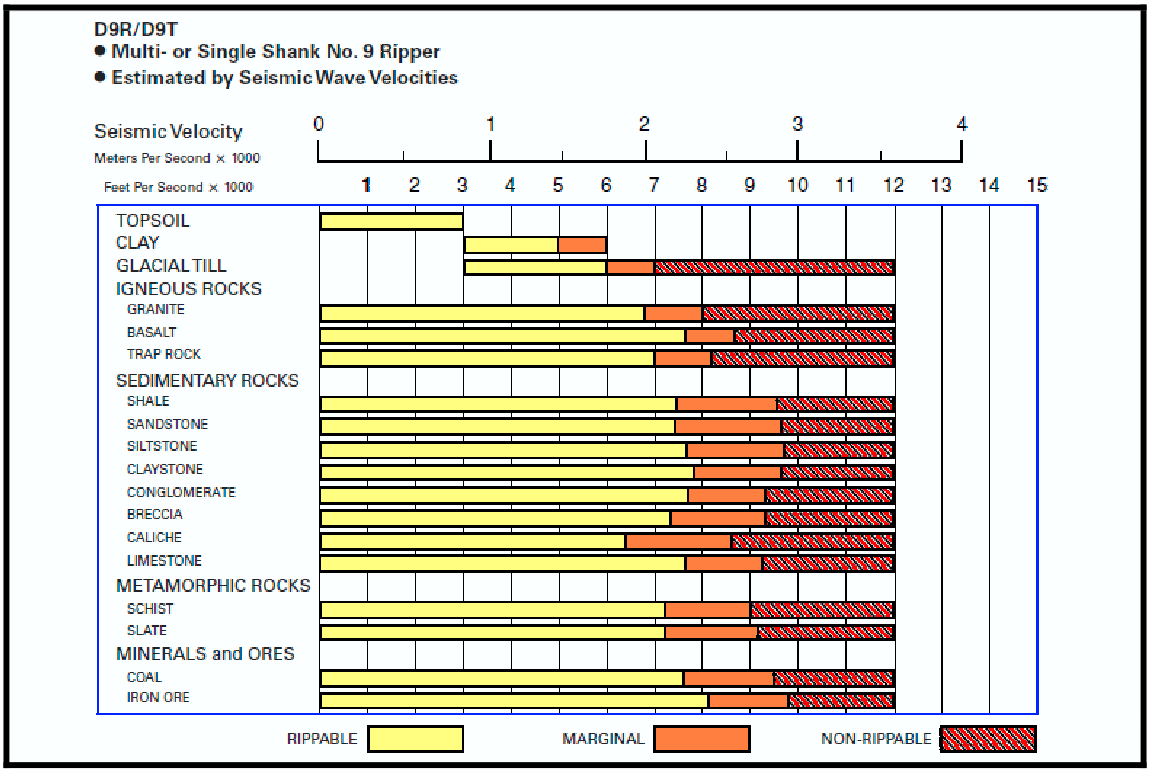
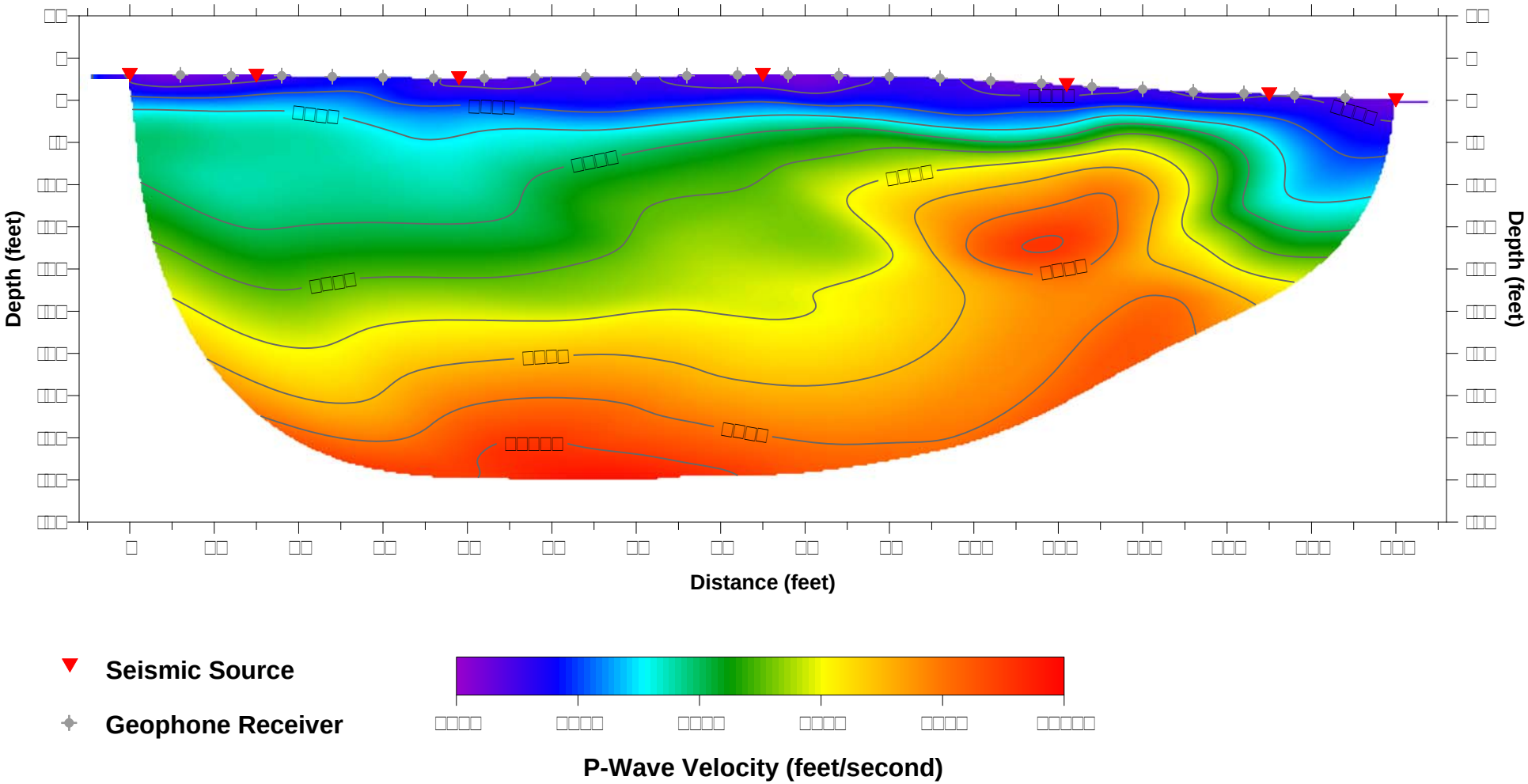


FIGURE 1- Caterpillar D9R Ripper Performance Chart

SEISMIC LINE S-4

← East - West →

REFRACTION TOMOGRAPHIC MODEL



SCALE: 1" = 18' (Horizontal & Vertical)

RMS error 1.5 %, Rayfract Version 3.33

APPENDIX B

Generalized Rippability Characteristic of Bedrock

GENERALIZED RIPPABILITY CHARACTERISTICS OF BEDROCK

A summary of the generalized rippability characteristics of bedrock based on a compilation of rippability performance charts prepared by Caterpillar, Inc. (2004), Caltrans (Stephens, 1978), and Santi (2006), has been provided to aid in evaluating potential excavation difficulties with respect to the seismic velocities obtained along the local areas surveyed. These seismic velocity ranges and rippability potentials have been tabulated below for reference.

TABLE 1- CATERPILLAR RIPPABILITY CHART (D9 Ripper)

Granitic Rock Velocity	Rippability
< 6,800	Rippable
6,800 – 8,000	Moderately Rippable
> 8,000	Non-Rippable

Additionally, we have provided the Caltrans Rippability Chart as presented below within Table 2 for comparison. These values are from published Caltrans studies (Stephens, 1978) that are based on their experience which are more conservative than Caterpillar's rippability charts. It should be noted that the type of bedrock was not indicated.

TABLE 2- STANDARD CALTRANS RIPPABILITY CHART

Velocity (feet/sec ±)	Rippability
< 3,500	Easily Ripped
3,500 – 5,000	Moderately Difficult
5,000 – 6,600	Difficult Ripping / Light Blasting
> 6,600	Blasting Required

Table 3 is partially modified from the "Engineering Behavior from Weathering Grade" as presented by Santi (2006), which also provides velocity ranges with respect to rippability potentials, along with other rock engineering properties that may be pertinent.

TABLE 3- SUMMARY OF ROCK ENGINEERING PROPERTIES

ENGINEERING PROPERTY:	Slightly Weathered	Moderately Weathered	Highly Weathered	Completely Weathered
Excavatability	Blasting necessary	Blasting to rippable	Generally rippable	Rippable
Slope Stability	½ :1 to 1:1 (H:V)	1:1 (H:V)	1:1 to 1.5:1 (H:V)	1.5:1 to 2:1 (H:V)
Schmidt Hammer Value	51 – 56	37 – 48	12 – 21	5 – 20
Seismic Velocity (fps)	8,200 – 13,125	5,000 – 10,000	3,300 – 6,600	1,650 – 3,300

APPENDIX B

LOGS OF EXPLORATORY TRENCHES BY GEOTEK

Updated Geotechnical Evaluation
Proposed Single-Family Residential Development
Woodcrest, Riverside County, California
Project No. 2855-CR

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

Bulk Samples (Large)
These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

Bulk Samples (Small)
These are plastic bag samples which are normally airtight and contain less than 5 pounds in weight of earth materials collected from the field by means of hand digging or exploratory cuttings. These samples are primarily used for determining natural moisture content and classification indices.

B – TRENCH LOG LEGEND

The following abbreviations and symbols often appear in the classification and description of soil and rock on the logs of trenches:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
……..	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
———	Thick solid line denotes end of the trench

(Additional denotations and symbols are provided on the logs of trenches)

GeoTek, Inc.

LOG OF EXPLORATORY TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	**TRENCH NO.: T-1** / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Rel. Comp. (%)	Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty m-c SAND with some clay, light brown, slightly moist				
				Alluvium				
			SC	Clayey m-c SAND, red-brown, very moist				
5				**Granitic Bedrock** Tonalite, red-yellow, slightly moist, relatively easy to excavate - Becomes hard to excavate, 2-3 scratches for 1/4 bucket				
10				**TRENCH TERMINATED AT 10 FEET DUE TO REFUSAL** No groundwater encountered Trench backfilled with soil cuttings				
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing: ND = Nuclear Density Test; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	TRENCH NO.: T-2 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Rel. Comp. (%)	Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty m-c SAND with some clay, light brown, slightly moist, some pvc pipe				
				Alluvium				
			SM	Silty m-c SAND with some clay, light brown, moist, some granite fragments				
				Granitic Bedrock				
				Tonalite, excavates as m-c SAND, moist, yellowish tan, relatively easy to excavate				
5				-Becomes gray @ 5.0 feet				
10								
				TRENCH TERMINATED AT 13 FEET				
				No groundwater encountered				
15				Trench backfilled with soil cuttings				

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing: ND = Nuclear Density Test; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

TRENCH NO.: T-3

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f SAND, light brown, slightly moist, loose, some rootlets				
	X			**Alluvium**				Expansion Index = 17
			ML	Sandy SILT with some clay, red-brown, moist to very moist				Corrosion Testing
								Remolded Shear Test
								Maximum Density Test
				Granitic Bedrock				
				Tonalite, excavates as m-c sand, yellowish tan, relatively easy to excavate				
5								
				- Becomes medium hard to excavate, 2-3 scratches for 1/2 bucket				
10								
				TRENCH TERMINATED AT 10.5 FEET				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
15								

LEGEND

Sample type: ---Ring; ---Large Bulk; ---Water Table

Lab testing: ND = Nuclear Density Test; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

TRENCH NO.: T-4

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f SAND, light brown, dry to slightly moist, loose, some rootlets				
				Alluvium				
			SM	Silty f SAND, brown, moist, some rootlets				
				Granitic Bedrock				
				Tonalite, excavates as m-c sand, orange black, easy to medium hard to excavate				
5								
10								
				TRENCH TERMINATED AT 14.0 FEET				
15				No groundwater encountered Trench backfilled with soil cuttings				

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing: ND = Nuclear Density Test; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	TRENCH NO.: T-5 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Rel. Comp. (%)	Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f SAND, light brown, dry to slightly moist, loose, some rootlets				
				Alluvium				
			SM	Silty f SAND, brown, moist, some rootlets				
			SP	F-m SAND with some silt and clay, moderate brown, very moist				
5		▽		**Granitic Bedrock** Tonalite, excavates as m-c sand, black-gray, Relatively easy to excavate				
10				**TRENCH TERMINATED AT 8.0 FEET** Groundwater encountered at 6.5 feet Trench backfilled with soil cuttings				
15								

LEGEND

Sample type: ---Ring ---Large Bulk ▽ ---Water Table

Lab testing: ND = Nuclear Density Test; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	TRENCH NO.: T-6 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f-m SAND with some clay, light brown, slightly moist, some rootlets				
				Alluvium				
			SM	Silty f-m SAND with some clay, brown, moist, some rootlets				
			SC	Clayey m-c SAND with some granitic fragments, red-brown, moist				
5				**Granitic Bedrock**				
				Tonalite, red-brown, moist, very hard to excavate				
				TRENCH TERMINATED AT 5 FEET DUE TO REFUSAL				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
10								
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing: ND = Nuclear Density Test; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	TRENCH NO.: T-7 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f-m SAND with some clay, light brown, slightly moist, some rootlets				
				Alluvium				
			SM	Silty f-m SAND with some clay and granite fragments, brown, moist, some rootlets and cobbles				Expansion Index = 0
	X		SC	Clayey m-c SAND, red-brown, very moist				Corrosion Testing
								Remolded Shear Test
								Maximum Density Test
				-Becomes yellowish red-brown				
5				**Granitic Bedrock**				
				Tonalite, yellow-tan, moist, easy to excavate				
				- Becomes hard to excavate, 3 scratches for 1/4 bucket				
10				**TRENCH TERMINATED AT 10.5 FEET**				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing: ND = Nuclear Density Test; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

TRENCH NO.: T-8

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Rel. Comp. (%)	Laboratory Testing: Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f SAND, light brown, dry to slightly moist, loose, some rootlets				
				Alluvium				
			SC	Clayey f-m SAND with some silt, red-brown, moist				
				Granitic Bedrock				
				Tonalite, excavates as m-c sand, yellowish tan, easy to excavate				
5				- Becomes hard to excavate, 2-3 scratches for 1/4 bucket				
				TRENCH TERMINATED AT 7.0 FEET DUE TO REFUSAL				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
10								
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing: ND = Nuclear Density Test; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY TRENCH

CLIENT:	TTLC Management Inc., An Arizona Corp.	**LOGGED BY:**	DA
PROJECT NAME:	Proposed Single-Family Residential Development	**EQUIPMENT:**	Backhoe
PROJECT NO.:	2855-CR	**DATE:**	8/30/2021
LOCATION:	Woodcrest, CA		

Depth (ft)	SAMPLES: Sample Type	SAMPLES: DCP Blow Count	USCS Symbol	TRENCH NO.: T-9 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Rel. Comp. (%)	Others
				Disturbed Soil/Undocumented Fill				
			SM	Silty f SAND, light brown, dry to slightly moist, loose, some rootlets				
				Alluvium				
			SM-SC	Silty f SAND with clay, red-brown, moist				
				Granitic Bedrock				
				Tonalite, excavates as m-c sand, black-orange, easy to excavate				
5								
10				**TRENCH TERMINATED AT 10.0 FEET**				
				No groundwater encountered				
				Trench backfilled with soil cuttings				
15								

LEGEND

Sample type: ---Ring ---Large Bulk ---Water Table

Lab testing: ND = Nuclear Density Test; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

APPENDIX C

LABORATORY TEST RESULTS BY GEOTEK

Updated Geotechnical Evaluation
Proposed Single-Family Residential Development
Woodcrest, Riverside County, California
Project No. 2855-CR

GEOTEK

SUMMARY OF LABORATORY TESTING

Direct Shear
Shear testing was performed in a direct shear machine of the strain-control type in general accordance with ASTM D 3080 test procedures. The rate of deformation was approximately 0.035 inch per minute. The sample was sheared under varying confining loads in order to determine the coulomb shear strength parameters, angle of internal friction and cohesion. The tests were performed on soil samples remolded to approximately 90 percent of maximum dry density as determined by ASTM D 1557 test procedures. The shear test results are presented in Appendix C.

Expansion Index
Expansion Index testing was performed on two soil samples. Testing was performed in general accordance with ASTM Test Method D 4829. The results of the testing are provided below and in Appendix C.

Trench No.	Depth (ft.)	Description	Expansion Index	Classification
T-3	1-2	Sandy Silt with Clay	17	Very Low
T-7	2-3	Silty Sand with Clay	0	Very Low

Moisture-Density Relationship
Laboratory testing was performed on two samples collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil type was determined in general accordance with ASTM Test D 1557 test procedures. The results of the testing are provided in Appendix C.

Sulfate Content, Resistivity and Chloride Content
Testing to determine the water-soluble sulfate content was performed by others in general accordance with ASTM D4327 test procedures. Resistivity testing was completed by others in general accordance with ASTM G187 test procedures. Testing to determine the chloride content was performed by others in general accordance with ASTM D4327 test procedures. The results of the testing are provided below and in Appendix B.

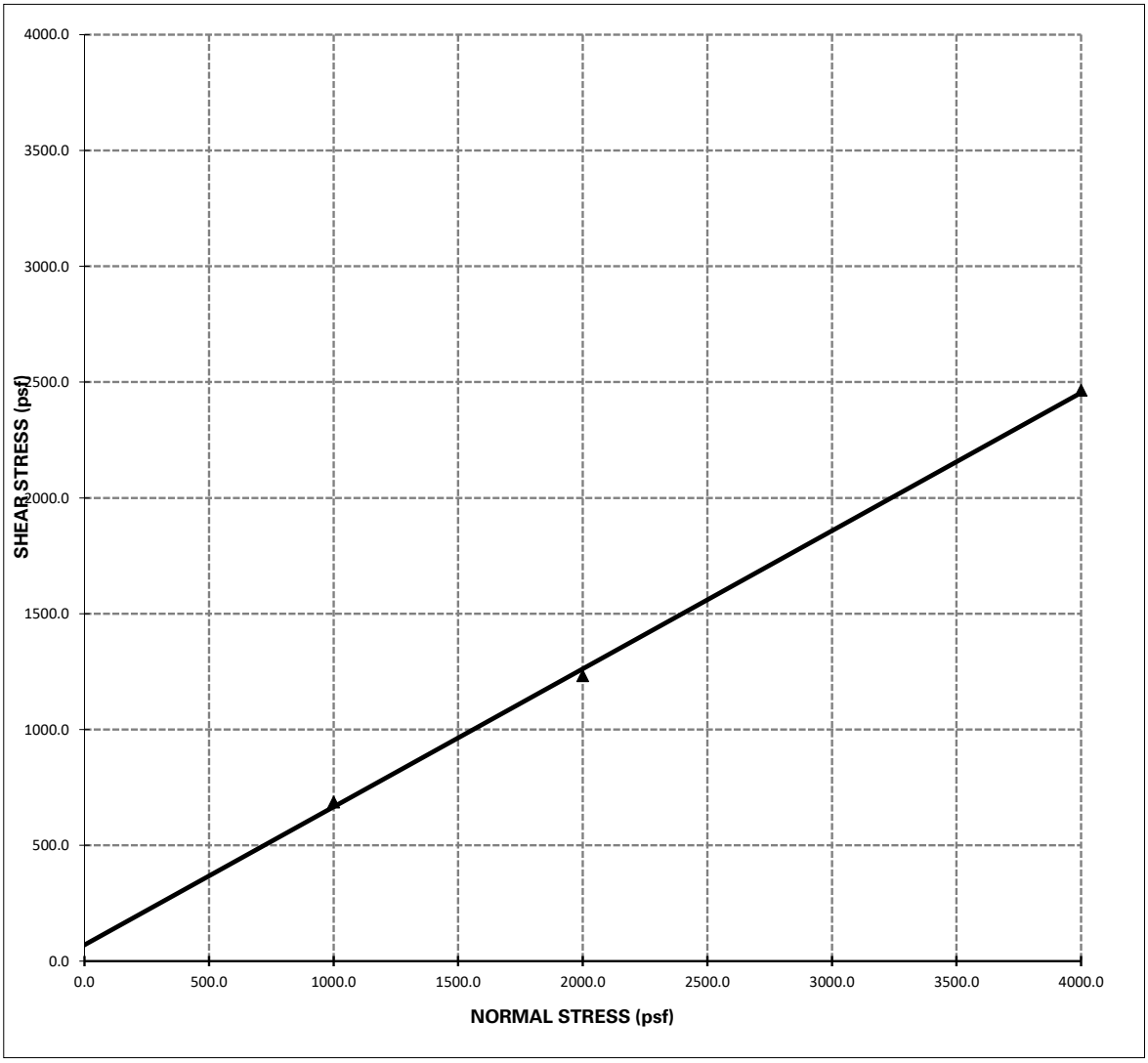
Trench No.	Depth (ft.)	pH ASTM D4972	Chloride ASTM D4327 (mg/kg)	Sulfate ASTM D4327 (% by weight)	Resistivity ASTM G187 (ohm-cm)
T-3	1-2	7.7	135.9	0.0278	804
T-7	2-3	8.3	15.5	0.0047	3,685

GEOTEK

DIRECT SHEAR TEST

Project Name:	The True Life Comapanies	***Sample Location:***	T3 @ 1-2'
Project Number:	2855-CR	***Date Tested:***	9/15/2021

PEAK VALUE



Shear Strength: **Φ = 31 °** , **C = 70 psf**

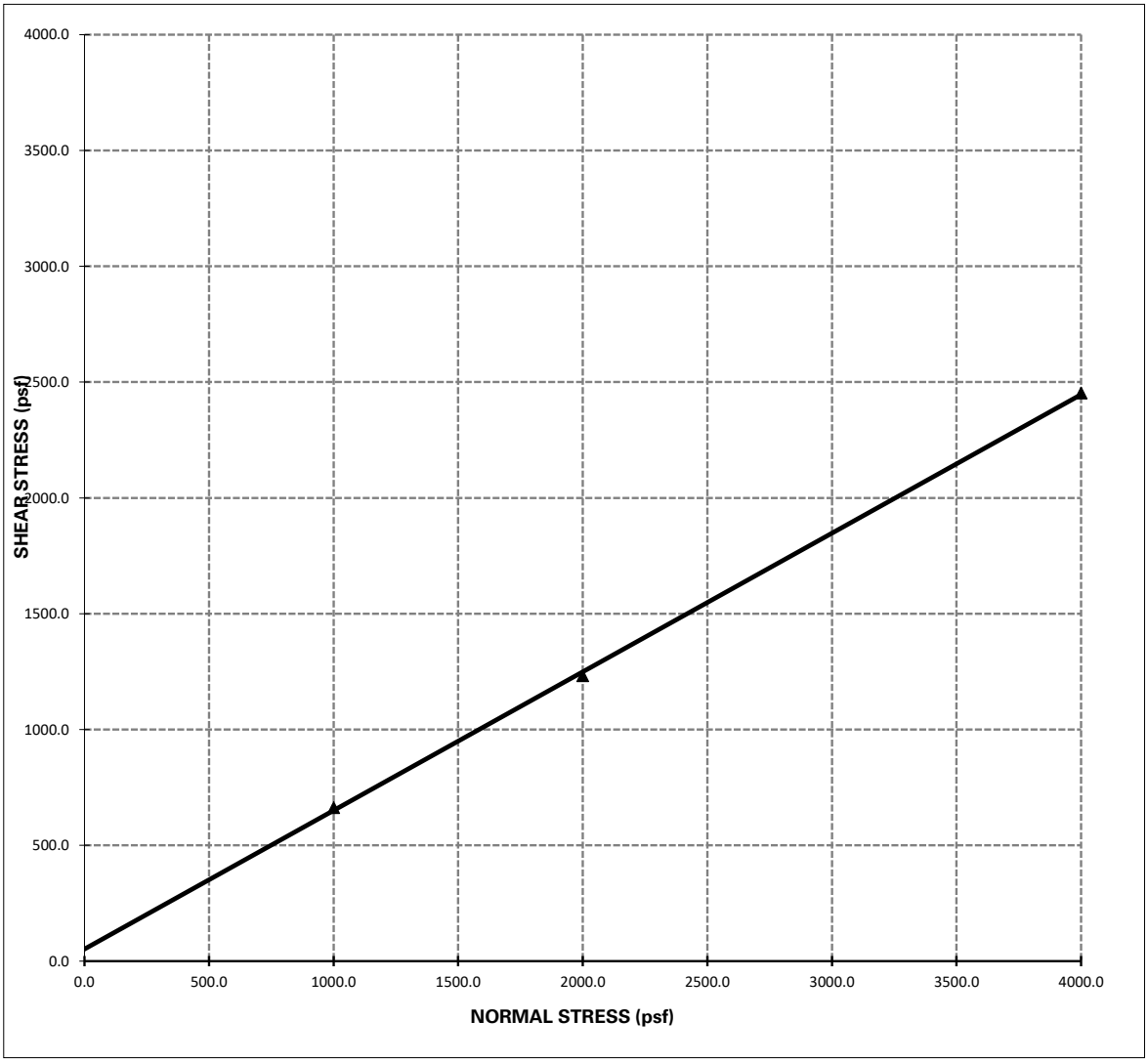
Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

DIRECT SHEAR TEST

Project Name:	The True Life Comapanies	***Sample Location:***	T3 @ 1-2'
Project Number:	2855-CR	***Date Tested:***	9/15/2021



Shear Strength: Φ = **31°** **C = 52 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

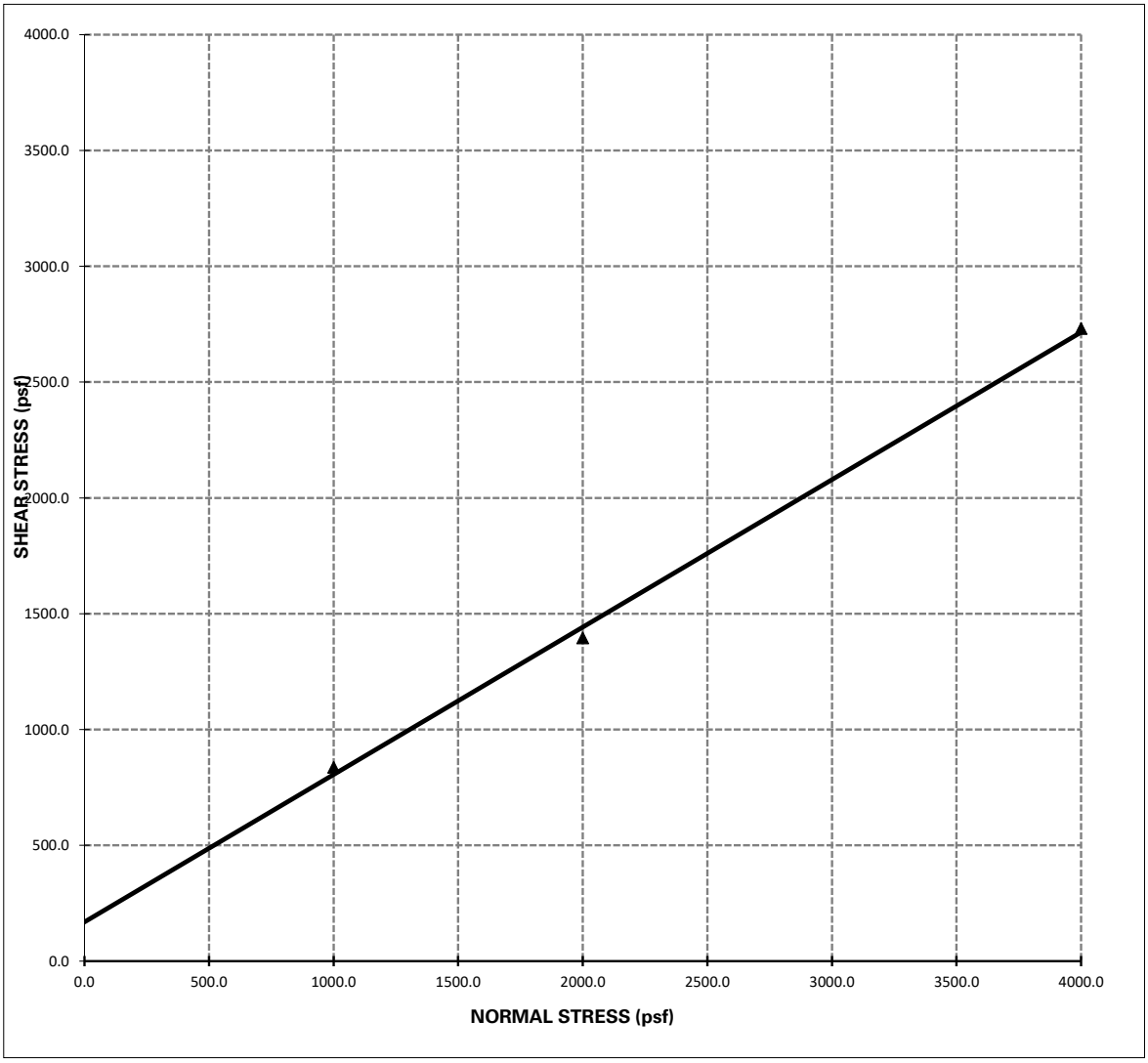
2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

DIRECT SHEAR TEST

Project Name:	The True Life Comapanies	***Sample Location:***	T7 @ 2-3'
Project Number:	2855-CR	***Date Tested:***	9/15/2021

PEAK VALUE



Shear Strength: Φ = **32** ° , **C = 169 psf**

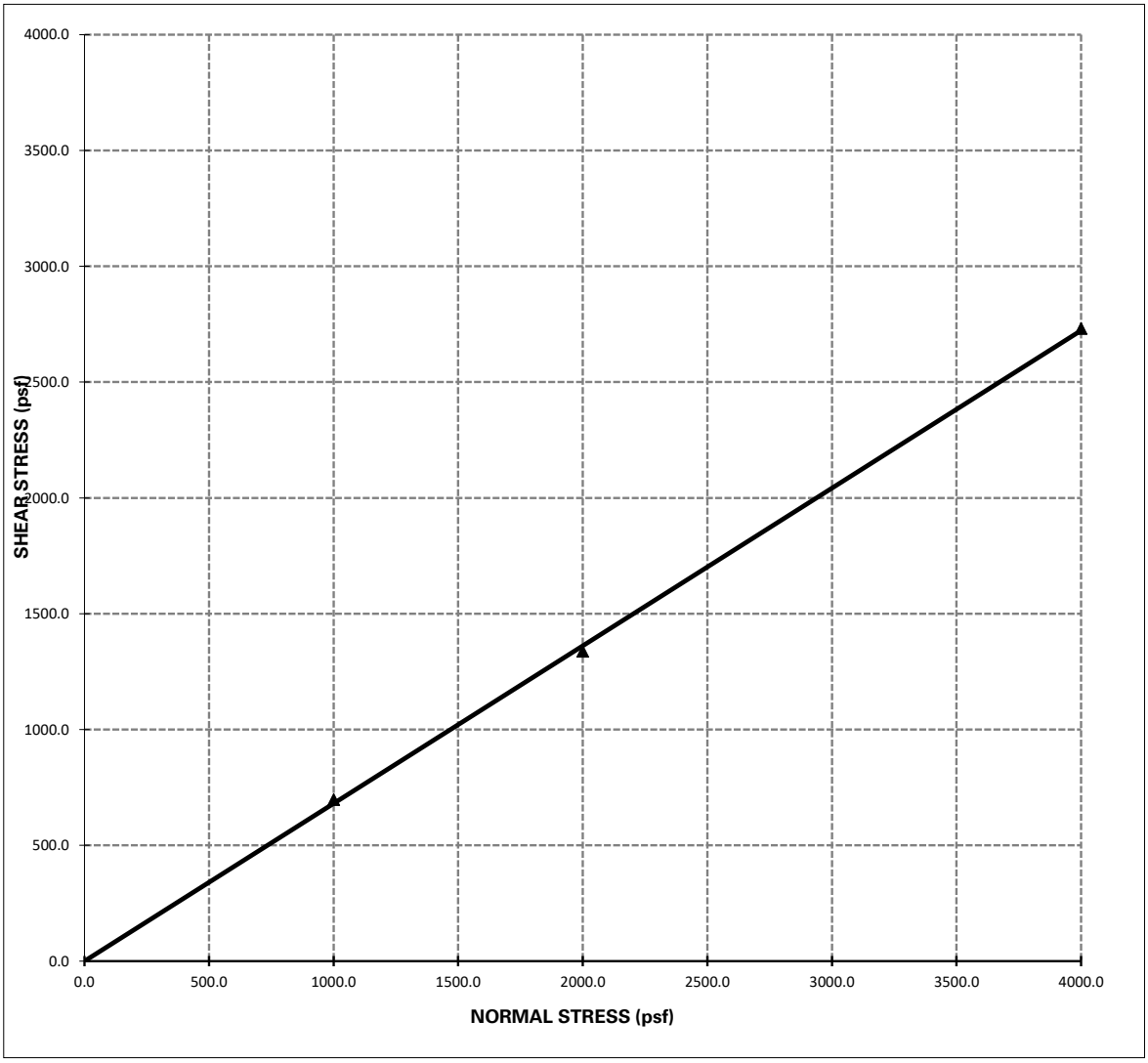
Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

DIRECT SHEAR TEST

Project Name:	The True Life Comapanies	***Sample Location:***	T7 @ 2-3'
Project Number:	2855-CR	***Date Tested:***	9/15/2021



Shear Strength: Φ = **34** ° , **C = 0 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	T□□ Tr□□ □i□□ □ □□□ □□ni□□	***Tested/ Checked By:***	E□ □□□ N□ □□r□n□
Project Number:	□□□□□□□R	***Date Tested:***	□□□□□□□□□□
Project Location:	N□ Iri□A□□ □ □ □i□□□□□ A□□□□□ □□□d□r□□□	***Sample Source:***	T□ □ □□□□
		Sample Description:	

Rin□ □□_____ Rin□ Di□□ □ _□□□□□"_ Rin□ □ □□□□"

DENSITY DETERMINATION

A	□ □i□□□□□□□□□□ □□□□□□d □□□□ □□□□ □ rin□ □□□□ □	□□□□□□
B	□ □i□□□□□□rin□ □□□□ □	□□□□□□
C	N□□□□ □i□□□□□□□□□□□ □□□□ □□□□ □	**409.9**
D	□ □□D□n□i□□□□□□ □□□□□ □□□ □□□□□□□□□□	**123.6**
E	Dr□D□n□i□□□□□□ □□□□□ □D□□□F□	**113.5**

SATURATION DETERMINATION

F	M□i□□□r□ □ □n□□n□□□	□□□
G	□□□□i□□ □r□□i□□□□□□□□ □d	**2.70**
H	□ni□□ □□□□□□ □□□r □ □□°C, (pcf)	**62.4**
I	□ □□□□r□□i□n	**49.6**

READINGS

DATE	TIME	READIN□	
□□□□□□□□□□		□□□□□□	Ini□□□
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FINAL MOISTURE

Fin□□□ □i□□□□□□□□ □□□ □□□ □ □□r□	□ M□i□□□r□
□□□□□□	**16.3**

EXPANSION INDEX = 17

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	T□□ Tr□□ □i□□ □ □□□ □□ni□□	***Tested/ Checked By:***	R□ □□□ N□ □ □r□n□
Project Number:	□□□□□□□R	***Date Tested:***	□□□□□□□□□□
Project Location:	N□ Iri□A□□ □ □ □i□□□□□ A□□□□□ □□□d□r□□□	***Sample Source:***	T□ □ □□□□
		Sample Description:	

Rin□ □□_____ Rin□ Di□□ □ ____□□□□" Rin□ □ □□□□"

DENSITY DETERMINATION

A	□ □i□□□□□□□□□□ □□□□□□d □□□□ □□□□ □ rin□ □□□□ □	□□□□□□
B	□ □i□□□□□□rin□ □□□□ □	□□□□□□
C	N□□□□ □i□□□□□□□□□□□ □□□□ □□□□ □	**407.9**
D	□ □□D□n□i□□□□□□ □□□□□ □□□ □□□□□□□□□□	**123.0**
E	Dr□ D□n□i□□□□□□ □□□□□ □D□□□F□	**112.9**

SATURATION DETERMINATION

F	M□i□□□r□ □ □n□□n□□□	□□□
G	□□□□i□i□ □r□□i□□□□□□□□ □d	**2.70**
H	□ni□□ □□□□□□ □□□r □ □□°C, (pcf)	**62.4**
I	□ □□□□r□i□n	**49.3**

READINGS			
DATE	TIME	READIN□	
□□□□□□□□□□		□□□□□□	Ini□i□□
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FINAL MOISTURE	
Fin□□□ □i□□□□□□□□ □□□ □□□ □ □□r□	□ M□i□□□r□
□□□□□□	**10.3**

EXPANSION INDEX = 0

GEOTEK

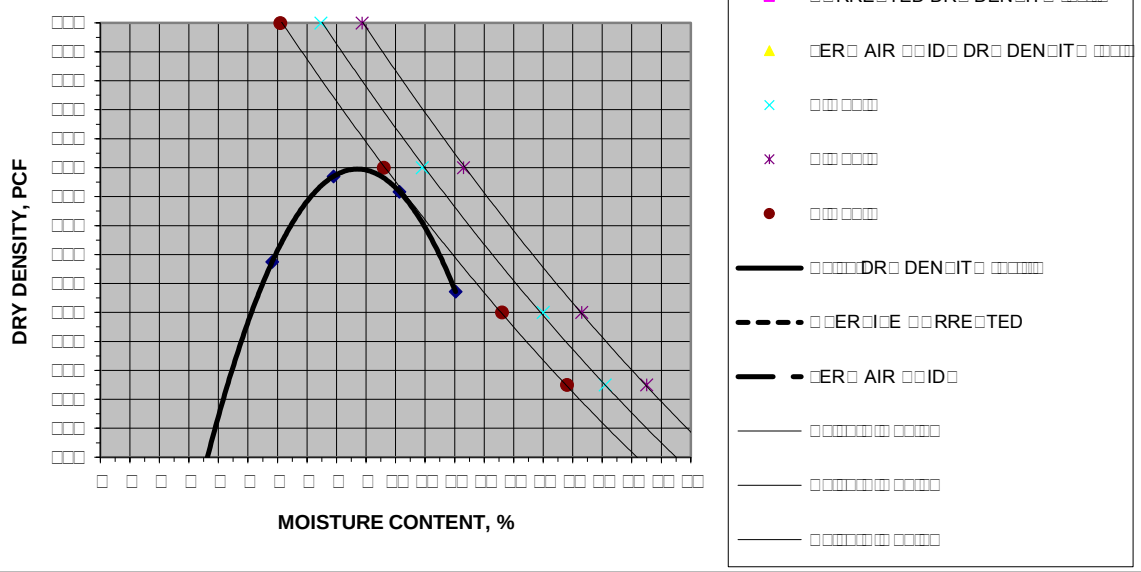
MOISTURE/DENSITY RELATIONSHIP

Client: T□□ Tr□□ □i□□ □ □□ □□ni□□
Project: N□ Iri□A□□□□ □ □i□□□□ A□□□
Location: □ □□d□r□□□
Material Type: R□ddi□□ □r□□n □i□□ □□nd
Material Supplier: □
Material Source: □
Sample Location: T□ □ □□□□
□
Sampled By: DA
Received By: R□
Tested By: AD
Reviewed By: R□

Job No.: □□□□□□R
Lab No.: □□r□n□
Date Sampled: □□□□□□□□□
Date Received: □□□□□□□□□
Date Tested: □□□□□□□□□
Date Reviewed: □□□□□□□□□

Test Procedure: A□TM D□□□□ **Method:** A
Oversized Material (%): □□□ **Correction Required:** ☐ yes ☒ no

MOISTURE/DENSITY RELATIONSHIP CURVE



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf □□□□□ **@ Optimum Moisture, %** □□□
Corrected Maximum Dry Density, pcf **@ Optimum Moisture, %**

MATERIAL DESCRIPTION

Grain Size Distribution:

□ □r□□□□r□□□in□d □n N□□□□
□ □□nd □□□□in□N□□□□R□□□in□d □n N□□□□□□
□ □i□□□nd □□□□ □□□□in□N□□□□□□

Atterberg Limits:

□i□□id □i□i□□□
□□□□i□ □i□i□□□
□□□□i□i□□Ind□□□□

Classification:

□ni□□d □□i□□ □ □□□□i□□□i□n□
AA□□T□ □□i□□ □ □□□□i□□□i□n□

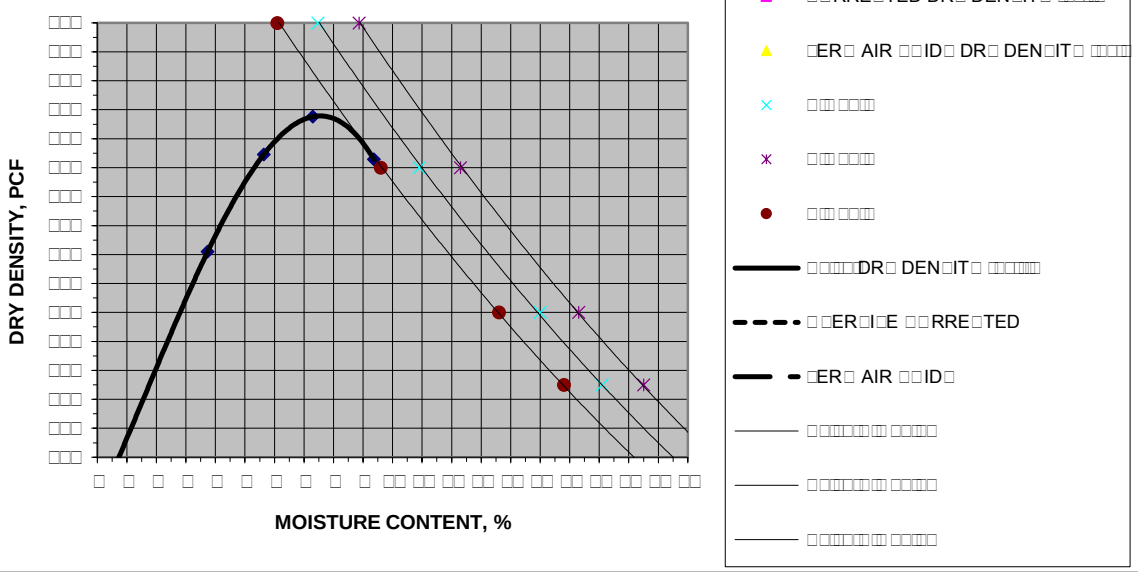
GEOTEK

MOISTURE/DENSITY RELATIONSHIP

Client: T□□ Tr□□ □i□□ □ □□ □□ni□□ **Job No.:** □□□□□□R
Project: N□ Iri□A□□□□ □ □i□□□□ A□□□ **Lab No.:** □□r□n□
Location: □ □□d□r□□□
Material Type: R□ddi□□ □r□□n □i□□ □□nd
Material Supplier: □
Material Source: □
Sample Location: T□ □ □□□□
□
Sampled By: DA **Date Sampled:** □□□□□□□□□
Received By: R□ **Date Received:** □□□□□□□□□
Tested By: AD **Date Tested:** □□□□□□□□□
Reviewed By: R□ **Date Reviewed:** □□□□□□□□□

Test Procedure: A□TM D□□□□ **Method:** A
Oversized Material (%): □□□ **Correction Required:** ___ yes x no

MOISTURE/DENSITY RELATIONSHIP CURVE



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf □□□□ **@ Optimum Moisture, %** □□□
Corrected Maximum Dry Density, pcf **@ Optimum Moisture, %**

MATERIAL DESCRIPTION

Grain Size Distribution:

□ □r□□□□r□□□in□d □n N□□□□
□ □□nd □□□□in□ N□□□□R□□□in□d □n N□□□□□□
□ □i□□□nd □□□□ □□□□in□ N□□□□□□

Atterberg Limits:

□i□□id □i□i□□□
□□□□i□ □i□i□□□
□□□□i□i□□ Ind□□□

Classification:

□ni□□d □□i□□ □ □□□□i□□□i□n□
AA□□T□ □□i□□ □ □□□□i□□□i□n□

Results Only Soil Testing for NW of Iris Ave Chicago Ave, Woodcrest

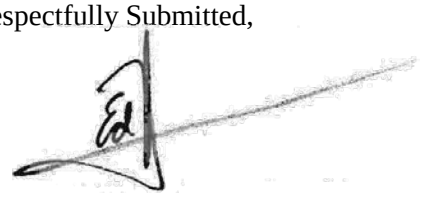
September 9, 2021

Prepared for:

Kyle McHargue
GeoTek, Inc.
1548 North Maple Street
Corona, CA 92280
kmchargue@geotekusa.com

Project X Job#: S210908G
Client Job or PO#: 2855-CR The True Life Companies

Respectfully Submitted,



Eduardo Hernandez, M.Sc., P.E.
Sr. Corrosion Consultant
NACE Corrosion Technologist #16592
Professional Engineer
California No. M37102
ehernandez@projectxcorrosion.com

Soil Analysis Lab Results

Client: GeoTek, Inc.
Job Name: NW of Iris Ave Chicago Ave, Woodcrest
Client Job Number: 2855-CR The True Life Companies
Project X Job Number: S210908G
September 9, 2021

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM D4972	ASTM G200	ASTM D4658	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd | Minimum		**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^{--}	**Phosphate** PO_4^{3-}
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
2855-CR T3	1-2	277.8	0.0278	135.9	0.0136	4,221	804	7.7	164	<0.01	404.9	9.1	0.07	229.0	1.2	40.7	148.7	4.8	2.9
2855-CR T7	2-3	46.7	0.0047	15.5	0.0015	9,380	3,685	8.3	116	0.01	35.0	2.6	ND	66.6	1.5	25.2	53.4	2.3	14.9

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract
PPM = mg/kg (soil) = mg/L (Liquid)

Project X
Corrosion Engineering
Corrosion Control - Soil, Water, and Metallurgy Lab

Lab Request Sheet Chain of Custody
Phone: (213) 928-7213 · Fax (951) 226-1720 · www.projectxcorrosion.com

Ship Samples To: 29990 Technology Dr, Suite 13, Murrieta, CA 92563

Project X Job Number: S210908G Geotek 2855-CR NW of Iris Ave 2 Full

IMPORTANT: Please complete Project and Sample Identification Data as you would like it to appear in report & include this form with samples.

Company Name:	Geotek USA	**Contact Name:**	Kyle McHargue
Mailing Address:	1548 N. Maple St. Corona, CA 92880	**Phone No:**	951-206-5443
Accounting Contact:		**Contact Email:**	KmcHargue@geotekusa.com
Client Project No:	The True Life Companies	**Invoice Email:**	
P.O. #:		**Project Name:**	NW of Iris Ave. Chicago Ave., Woodcrest

(Business Days) Turn Around Time: 3-5 Day Standard [X] | 3 Day Guarantee 50% mark-up [ ] | 24 Hr RUSH 100% mark-up [ ]

Results By: ☐ Phone ☐ Fax ☒ Email

Date & Received by : 09/08/21

Special Instructions:

ANALYSIS REQUESTED (Please circle)

Default Method: ASTM G187 | ASTM G51 | ASTM D4327 | ASTM D4327 | ASTM G200

Full Corrosion Series

Geo Quad

	SAMPLE ID - BORE #	DESCRIPTION	DEPTH (ft)	DATE COLLECTED
59	1	2855-CR	T3	1-2	BULK
60	2	2855-CR	T7	2-3	BULK
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				

Geo Quad: Soil Resistivity (ASTM G187) | pH (ASTM G51) | Sulfate (ASTM D4327) | Chloride (ASTM D4327)

Full Corrosion Series: Redox Potential (ASTM D4327) | Sulfide (ASTM D6919) | Ammonia (ASTM D6919) | Nitrate (ASTM D4327) | Flouride (ASTM D4327) | Phosphate (ASTM D4327) | Lithium (ASTM D6919) | Sodium (ASTM D6919) | Potassium (ASTM D6919) | Magnesium (ASTM D6919) | Calcium (ASTM D6919) | BiCarbonate (SM 2320B)

Full Corrosion Series: ✓ ✓

Reports: Soil Corrosivity Evaluation Report | Water Corrosivity Mini Report

*Req: Min. 3 Samples, site map, and groundwater info

Moisture Content (ASTM D2216) | Total Alkalinity (SM 2320B) | Thermal Resistivity | Metallurgical Analysis | Langelier Index | Puckorius Index | XRF Elemental Analysis | Water Hardness

APPENDIX D

SEISMIC REFRACTION SURVEY RESULTS BY GEOTEK

Updated Geotechnical Evaluation
Proposed Single-Family Residential Development
Woodcrest, Riverside County, California
Project No. 2855-CR

GEOTEK

Subsurface Surveys & Associates, Inc.
2075 Corte Del Nogal, Suite W Carlsbad, CA 92011
Phone: (760) 476-0492 Fax: (760) 476-0493

GeoTek. Inc.
1548 North Maple Street
Corona, CA 92880

August 23, 2021

Attn: Kyle McHargue

Re: Seismic Survey Summary Report
Woodcrest Project, Riverside County

This report covers the results of a seismic refraction survey performed at the Woodcrest Project Site, located northwest of the intersection of Iris Ave and Chicago Ave, in Riverside County, California. The purpose of the survey was to measure the compressional wave velocity of bedrock for rippability assessment and to provide cross sections showing thickness of the weathered zone and depth to the unweathered interface. This should be useful for planning cuts, grading, and other earthwork.

The field work was conducted on August 12, 2021. Seven seismic lines were recorded at locations selected by GeoTek. A survey location map is provided on Figure 1 that shows the position and orientation of the traverses.

GEOLOGIC SETTING

A review of the "Geologic Map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California ", (USGS Open File Report 2006-1217, 2006) indicates the survey area is underlain by Val Verde tonalite (Kvt) of Cretaceous age. This rock unit is described as relatively homogeneous and massive to well foliated.

DATA ACQUISITION AND FIELD METHODS

Seismic refraction data were recorded with a Bison 9024 signal enhancement seismograph and 28 Hz geophones. The standard spread layout used 24 geophones with a 7-foot spacing which provided a line length of 168 feet. Each spread used five shotpoints, one off each end (5-foot offset) and three within the interior of the spread. Depth of investigation was approximately 40-45 feet.

Compressional wave energy was created by sledge hammer impacts on a metal plate. The signal enhancement feature of the seismograph allowed returns from repeated hits to be stacked, thus improving the signal. Each record was stored digitally on an internal hard disk and printed copies of each seismogram were made in the field on thermal paper. Example field records are shown on Figure 2.

Relative elevations of all shotpoints and geophones were determined by differential leveling with a hand level. Geophone 1 (distance = 0 ft.) at the beginning of each line was assigned a elevation value of 0.0 feet. This datum point served as the reference elevation for all other measurements.

Labeled wooden stakes were placed at the beginning and end of each spread and a Garmin handheld GPS receiver was used to record the latitude and longitude coordinates of the stakes. The coordinates were used to make the location map shown on Figure 1.

SEISMIC REFRACTION METHOD

The refraction method involves measuring the total time for compressional waves to travel from a shotpoint through the subsurface to a set of geophones placed linearly along the ground. Based on Snell's Law, when two or more layers are present with increasingly higher acoustic velocity, waves become critically refracted across the layer boundaries and begin traveling at the speed of the underlying layer. The advancing waves then generate new wavefronts back to the ground surface. The first surge of energy hitting the geophone is termed the "first arrival" and is depicted on the seismogram as a high angle deflection along each trace.

Recognition of direct wave arrivals (non-refracted) verses refracted waves is a key element of refraction interpretation. To assist this process, the first arrival times measured from the seismic records are plotted on graphs of time verses distance called Time-Distance graphs. An example T-D graph from Line 1 is shown on Figure 3. Based on changes in slope on the graphs, a preliminary layer number (i.e. 1, 2, 3) is assigned to each segment of the graph. The layer assignments together with time, distance and elevation data are input to a computer for additional processing.

DATA REDUCTION AND VELOCITY DETERMINATION

Processing and interpretation of this data set was accomplished with “SIPT2", an interactive inversion modeling program developed by James Scott for the U.S. Bureau of Mines. The inversion algorithm uses the delay time method to construct a first pass depth model. The model is then adjusted by an iterative ray tracing process that attempts to minimize the discrepancies between the total travel times calculated along ray paths and the observed travel times measured in the field.

This program calculates refractor velocity in two ways. First, apparent velocities from each shot are determined by the inverse slope of a best fit (least squares) line through datum-corrected travel times. True velocity is estimated from the apparent velocities by using the following equation:

$$Vt = 2(Vu \times Vd)/(Vu + Vd)$$

where Vt = true velocity
Vu = apparent up dip velocity
Vd = apparent down dip velocity

The second method uses a more sophisticated set of equations (the Hobson-Overton formula) developed by the Canadian Geological Survey. The final velocity assigned to the refractor is a weighted average of the results of the two methods. The weighting is based on the number of arrival times used in the computations.

SUMMARY OF RESULTS

Results from refraction analysis show a three layer solution beneath all lines (see Figures 5-11). Velocities posted on the cross sections represent averages as described in the previous section. Therefore, minor localized changes in velocity may occur along any profile. A description of the layers is provided below and a cross section summary is shown in Table 1.

Layer 1 - is mostly colluvium with rock fragments and alluvium in low lying areas. Thickness is generally less than 10 feet.

Layer 2 - is interpreted to be weathered bedrock. The velocity range is 3027-4408 ft/sec. Based on the Cat rippability chart shown on Figure 4, this range is considered easily rippable with a D-9 Cat.

Layer 3 - represents slightly weathered to unweathered bedrock.

Table 1. Cross Section Summary Velocity in (ft/sec), Depth in (feet)

Line	Velocity Layer 1	Velocity Layer 2	Velocity Layer 3	Depth Range Layer 2/3 Interface
1	1370	3199	8634	20 - 29
2	1490	4408	12494	5 - 26
3	1699	4345	14636	5 - 13
4	1334	3027	8423	29 - 40
5	1345	3273	10696	13 - 22
6	1471	4018	7011	26 - 37
7	1424	4265	8568	20 - 28

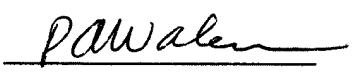
Weathering tends to be gradational for most granitic rock types and usually produces a gradual increase in velocity with depth. Consequently, variation of $\pm$ 10% from the posted averages may occur between the top and bottom of Layer 2.

Figure 4 presents a rippability chart (courtesy of Caterpillar Tractor Co.) for a D9R Ripper. Bar graphs show the relationship between seismic compressional wave velocity and ripper

performance for various rock types in three categories: rippable, marginal, and non-rippable. Granitic rocks are listed as marginally rippable at approximately 6800 ft/sec and are considered non-rippable above 8000 ft/sec. This chart is provided only as a guide and should not be considered absolute. Other geologic factors that may influence bedrock rippability at this site include changes in composition of the bedrock and the presence of fractures and joints.

All data acquired during this survey is considered confidential and is available for review by your staff at any time. We appreciate the opportunity to participate in this project.

Please call if there are any questions.



Phillip A. Walen
Senior Geophysicist
CA Registration No. GP917

Seismic Survey Location Map

Woodcrest Area -- Riverside County

All seismic lines are
168 feet in length.

Figure 1

Example Seismic Field Records

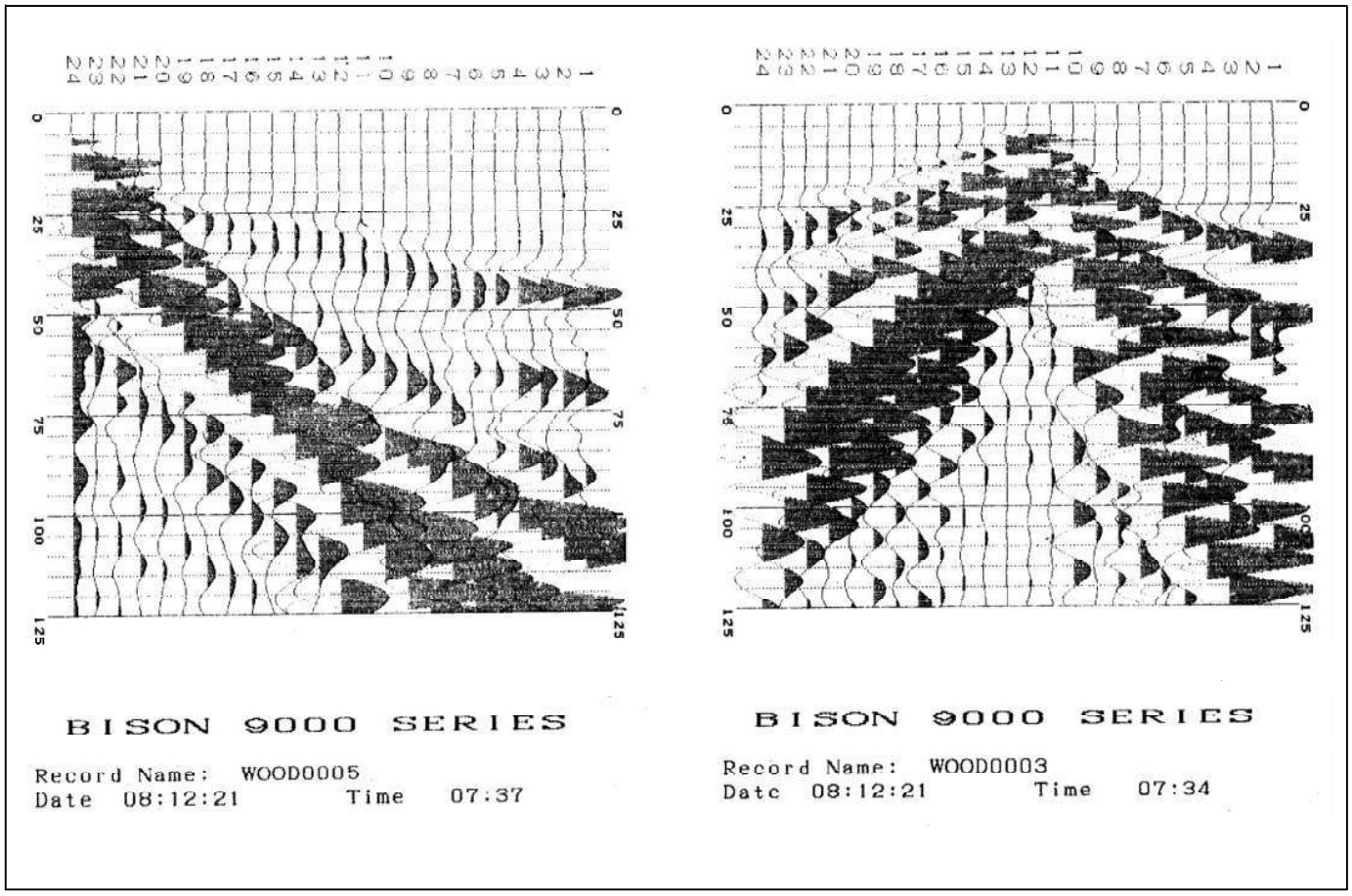


Figure 2

Example Time-Distance Graph -- Line 1

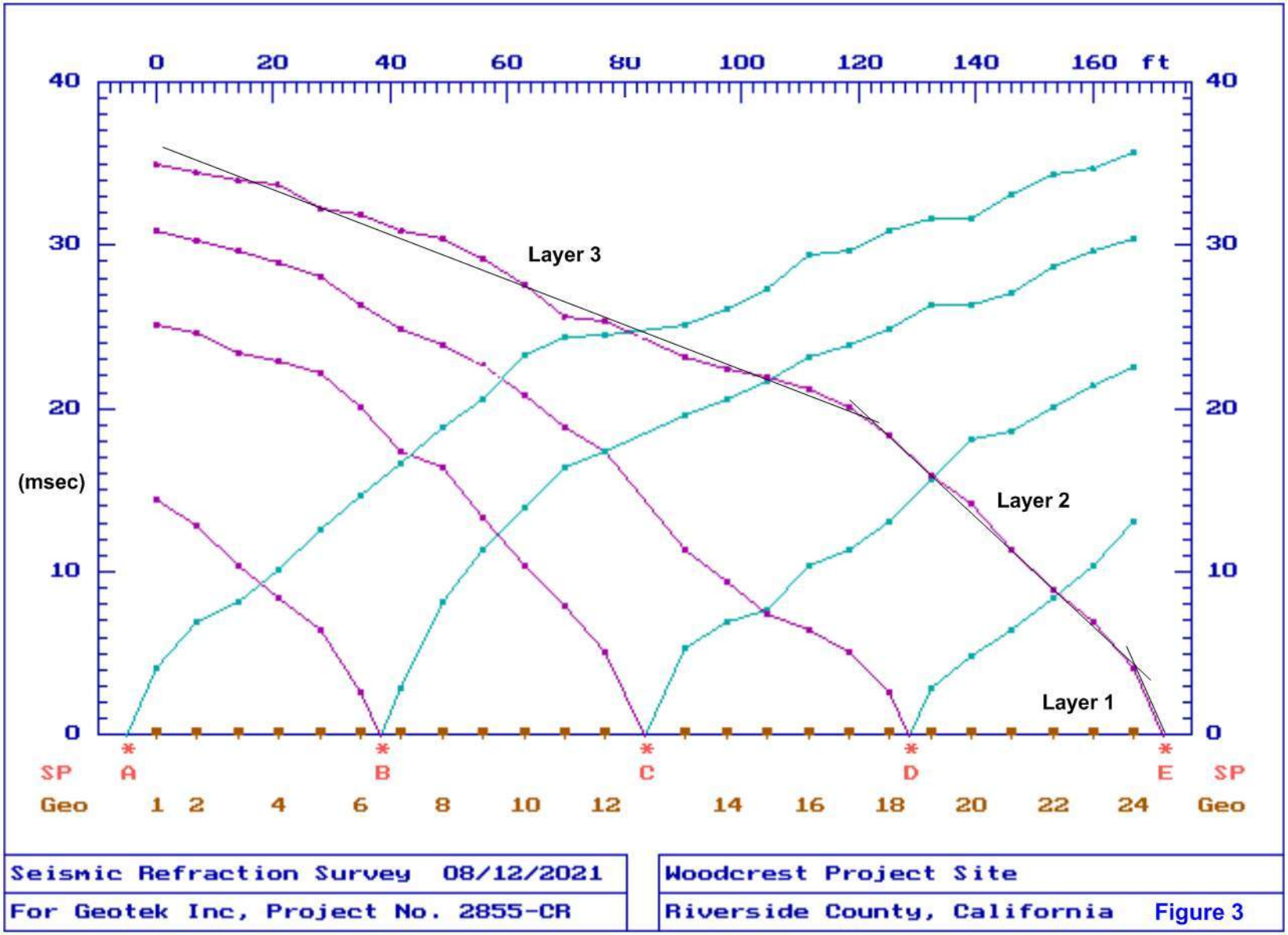


Figure 3

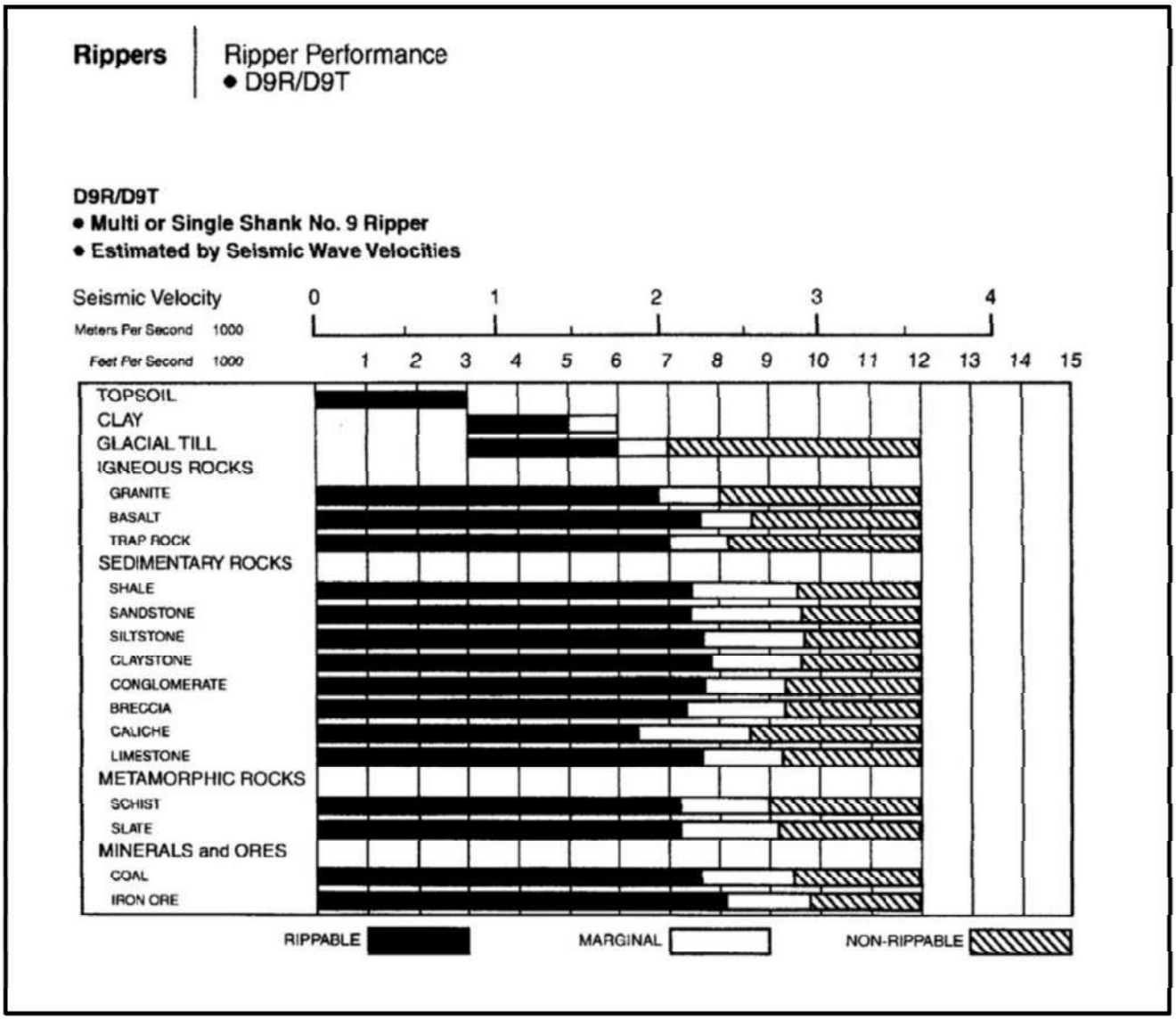
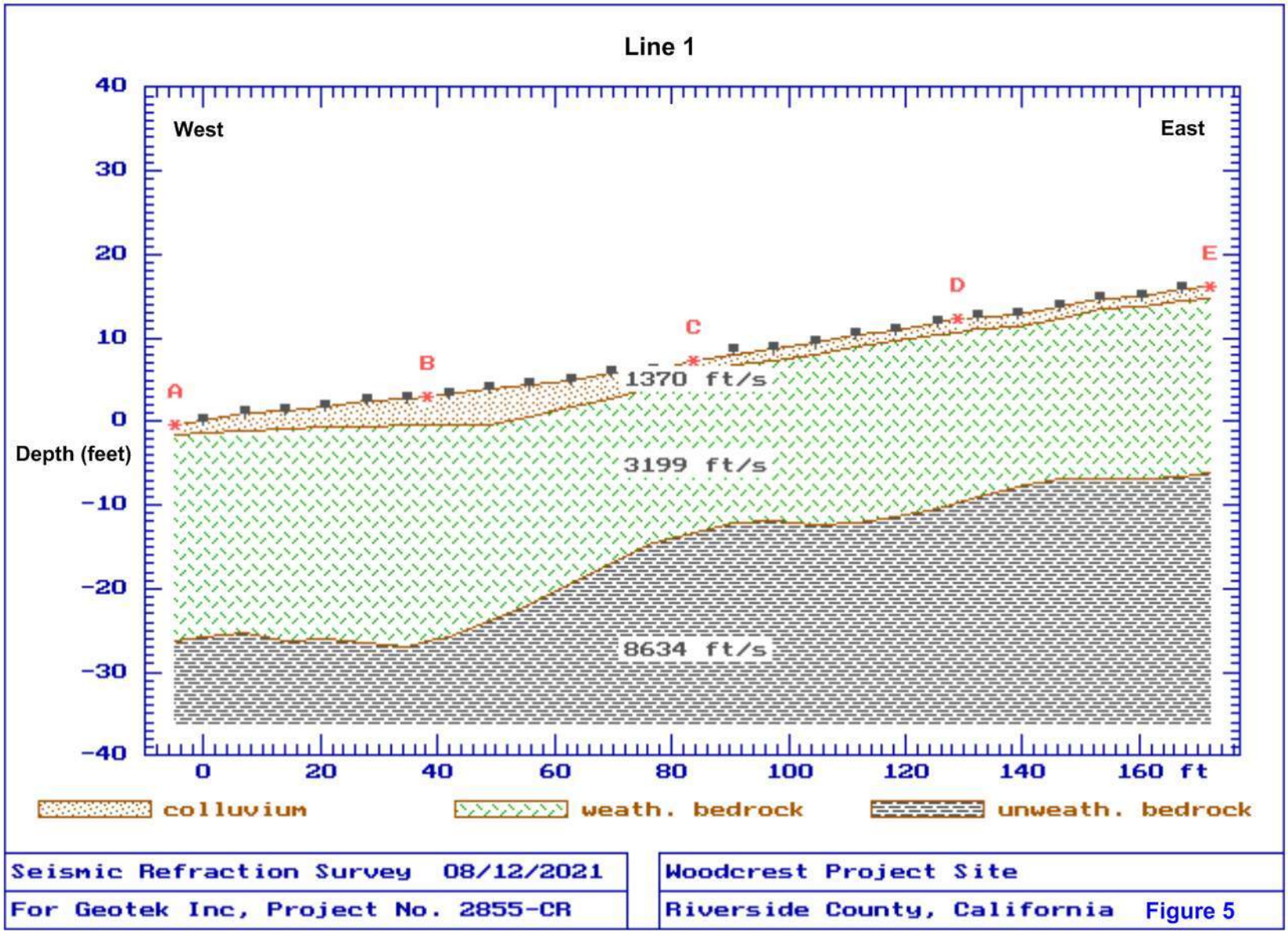
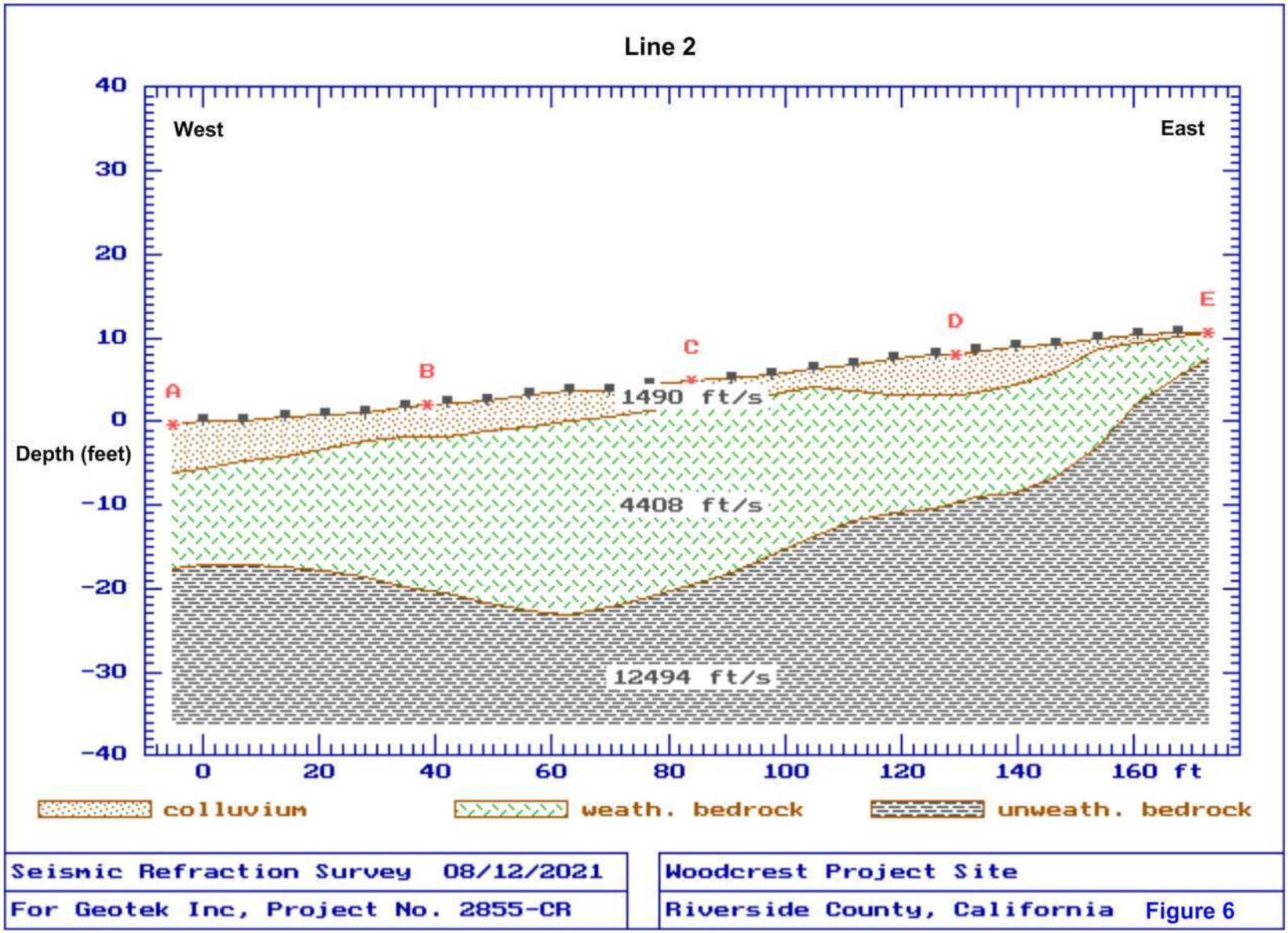
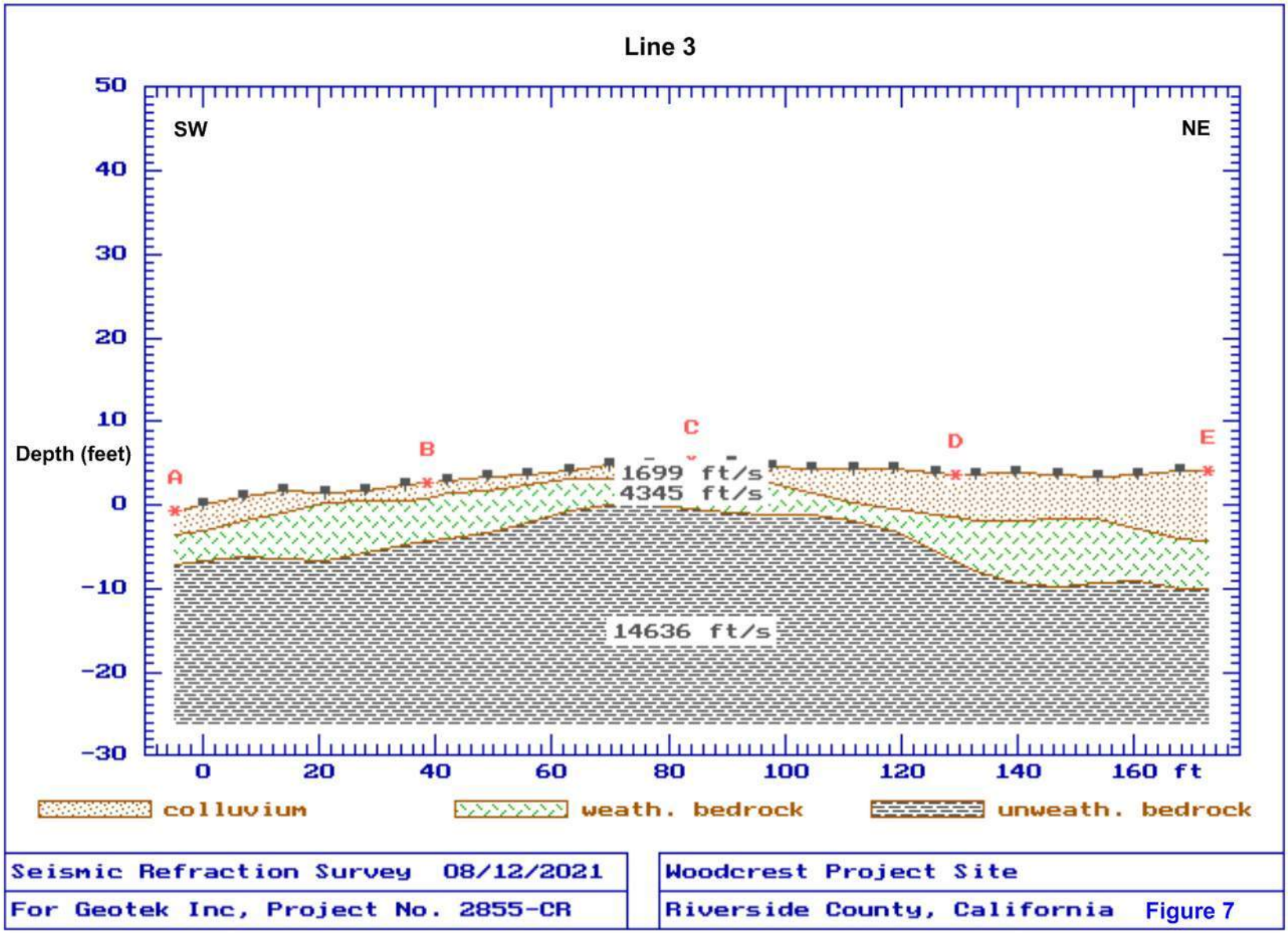

Rippers
Ripper Performance
• D9R/D9T
D9R/D9T
• Multi or Single Shank No. 9 Ripper
• Estimated by Seismic Wave Velocities
Seismic Velocity
Meters Per Second 1000
Feet Per Second 1000
0 1 2 3 4
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TOPSOIL
CLAY
GLACIAL TILL
IGNEOUS ROCKS
GRANITE
BASALT
TRAP ROCK
SEDIMENTARY ROCKS
SHALE
SANDSTONE
SILTSTONE
CLAYSTONE
CONGLOMERATE
BRECCIA
CALICHE
LIMESTONE
METAMORPHIC ROCKS
SCHIST
SLATE
MINERALS and ORES
COAL
IRON ORE
RIPPABLE
MARGINAL
NON-RIPPABLE

Figure 4


Line 1
West
East
Depth (feet)
40
30
20
10
0
-10
-20
-30
-40
0
20
40
60
80
100
120
140
160 ft
A
B
C
D
E
1370 ft/s
3199 ft/s
8634 ft/s
colluvium
weath. bedrock
unweath. bedrock
Seismic Refraction Survey 08/12/2021
For Geotek Inc, Project No. 2855-CR
Woodcrest Project Site
Riverside County, California
Figure 5


Line 2
West
East
Depth (feet)
40
30
20
10
0
-10
-20
-30
-40
0
20
40
60
80
100
120
140
160 ft
A
B
C
D
E
1490 ft/s
4408 ft/s
12494 ft/s
colluvium
weath. bedrock
unweath. bedrock
Seismic Refraction Survey 08/12/2021
For Geotek Inc, Project No. 2855-CR
Woodcrest Project Site
Riverside County, California
Figure 6

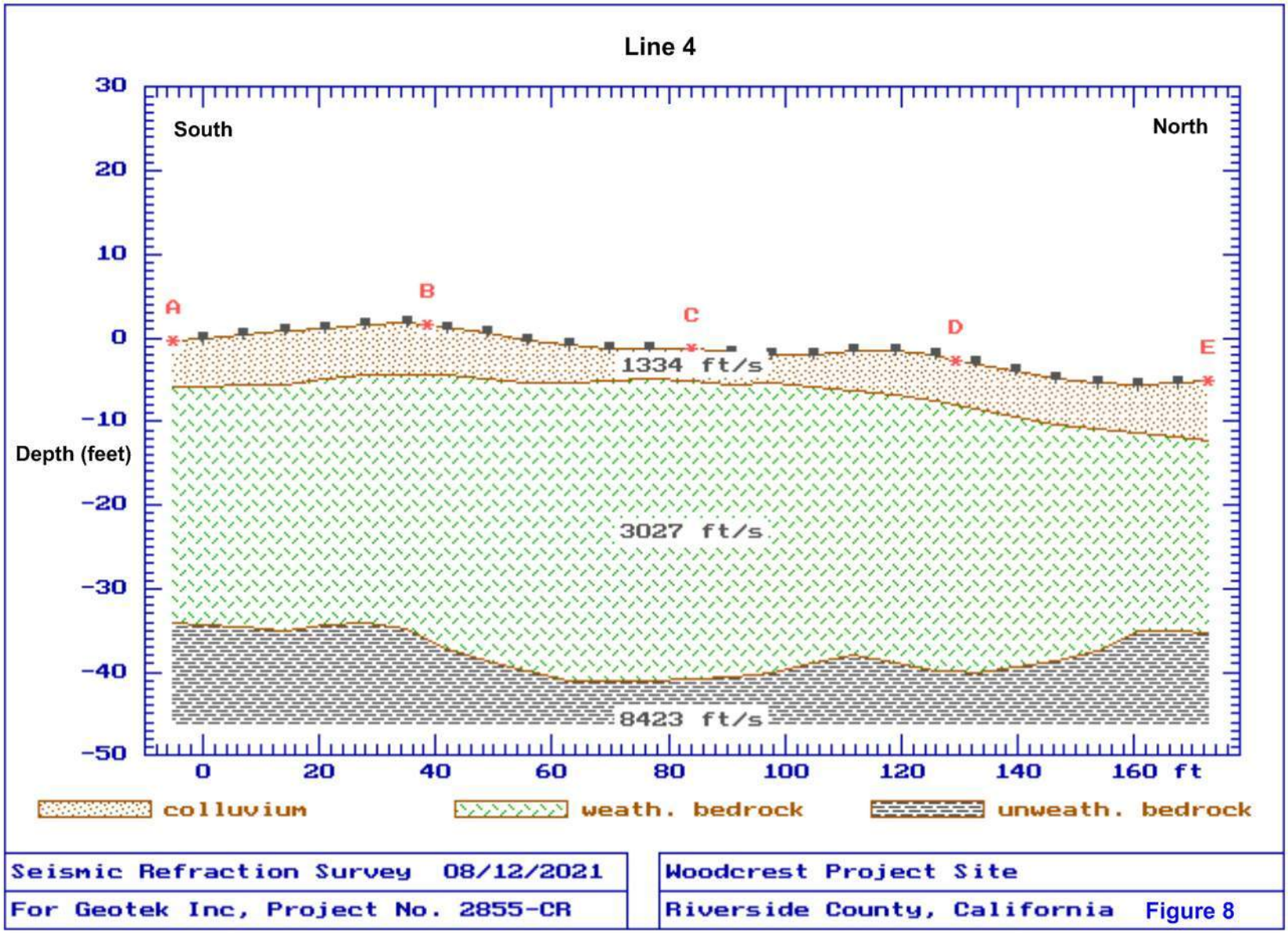


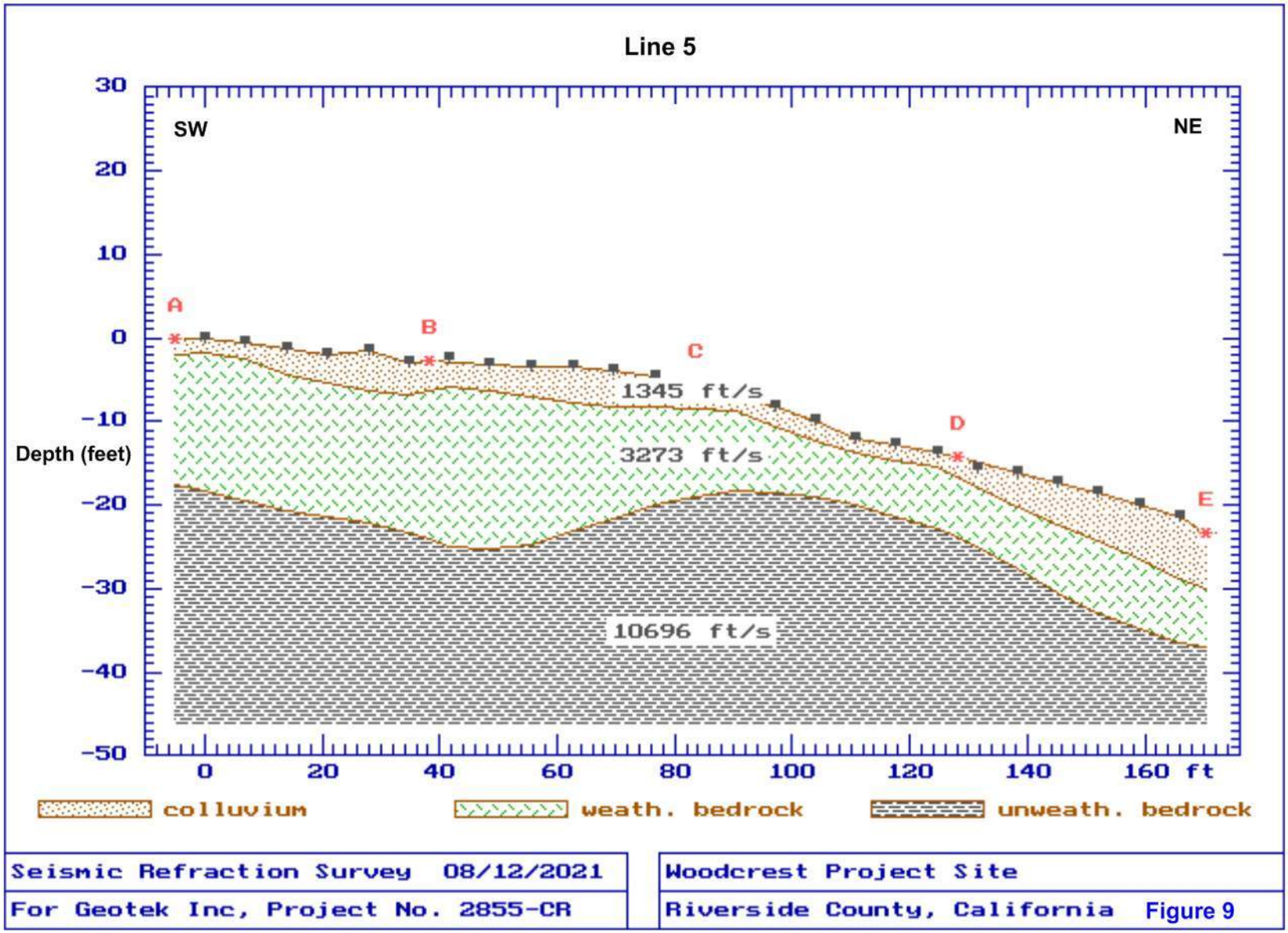
Seismic Refraction Survey 08/12/2021

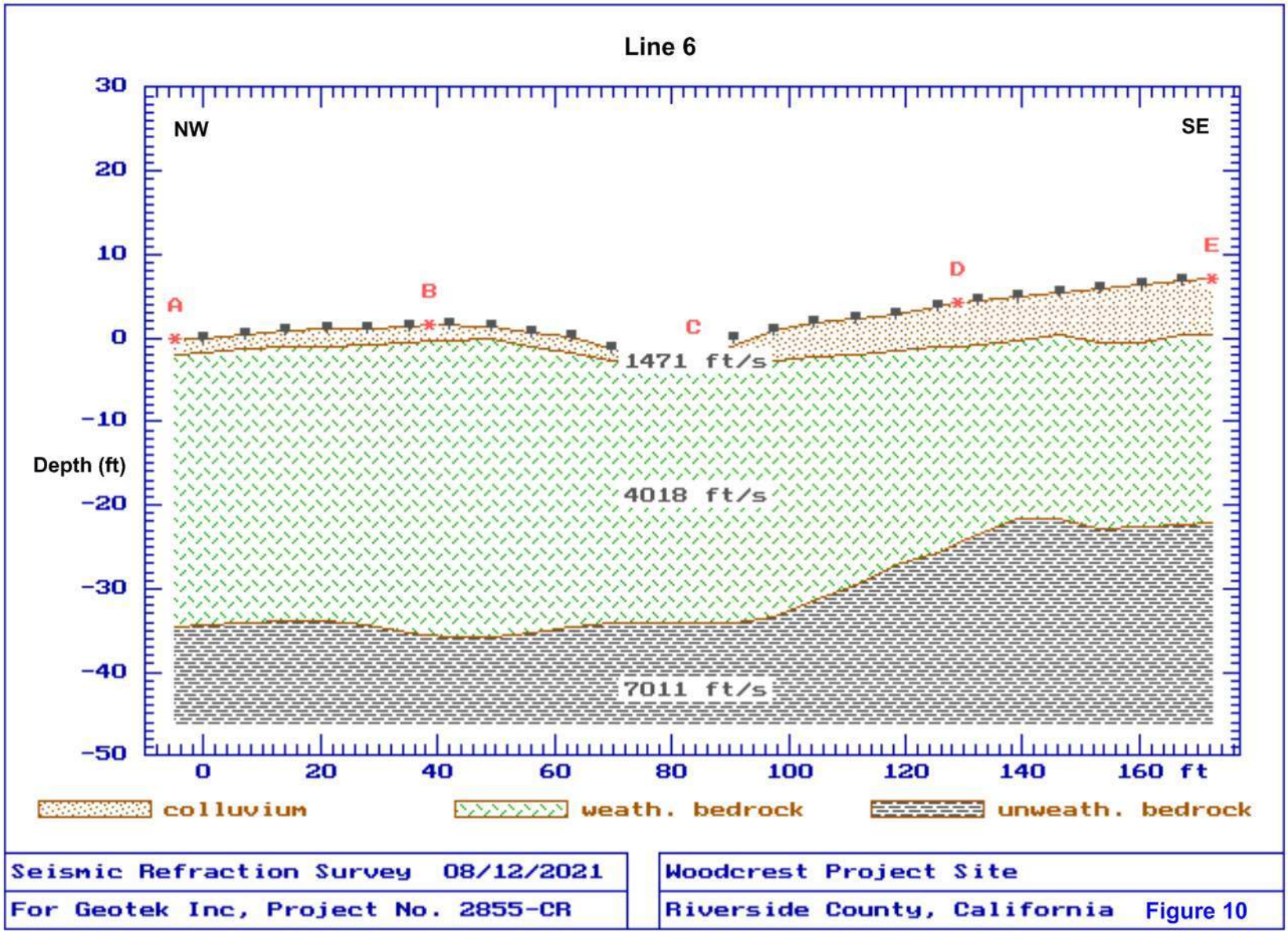
For Geotek Inc, Project No. 2855-CR

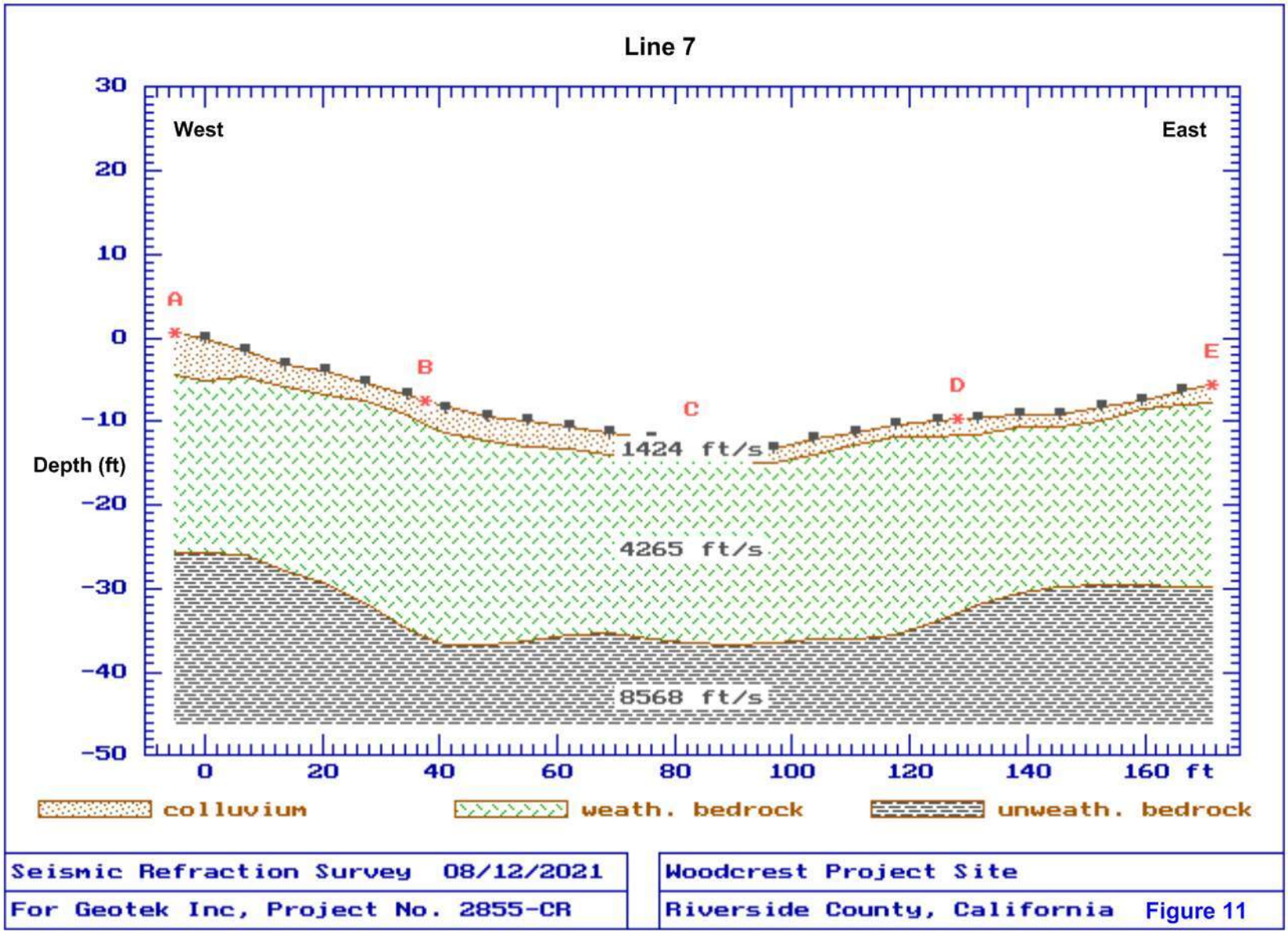
Woodcrest Project Site

Riverside County, California Figure 7


Line 4
South
North
A
B
C
D
E
1334 ft/s
3027 ft/s
8423 ft/s
Depth (feet)
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
160 ft
colluvium
weath. bedrock
unweath. bedrock
Seismic Refraction Survey 08/12/2021
For Geotek Inc, Project No. 2855-CR
Woodcrest Project Site
Riverside County, California
Figure 8


Line 5
SW
NE
A
B
C
D
E
1345 ft/s
3273 ft/s
10696 ft/s
Depth (feet)
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
160 ft
colluvium
weath. bedrock
unweath. bedrock
Seismic Refraction Survey 08/12/2021
For Geotek Inc, Project No. 2855-CR
Woodcrest Project Site
Riverside County, California
Figure 9


Line 6
NW
SE
A
B
C
D
E
1471 ft/s
4018 ft/s
7011 ft/s
Depth (ft)
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
160 ft
colluvium
weath. bedrock
unweath. bedrock
Seismic Refraction Survey 08/12/2021
For Geotek Inc, Project No. 2855-CR
Woodcrest Project Site
Riverside County, California
Figure 10


Line 7
West
East
A
B
C
D
E
1424 ft/s
4265 ft/s
8568 ft/s
Depth (ft)
30
20
10
0
-10
-20
-30
-40
-50
0
20
40
60
80
100
120
140
160 ft
colluvium
weath. bedrock
unweath. bedrock
Seismic Refraction Survey 08/12/2021
For Geotek Inc, Project No. 2855-CR
Woodcrest Project Site
Riverside County, California
Figure 11

APPENDIX E

GENERAL GRADING GUIDELINES

Updated Geotechnical Evaluation
Proposed Single-Family Residential Development
Woodcrest, Riverside County, California
Project No. 2855-CR

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the California Building Code, CBC (2019) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.
5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.

6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of topsoil, alluvium and colluvium as well as weathered or creep effected bedrock, should be removed unless otherwise specifically indicated in the text of this report.
2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).

2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:
    a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.
    b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.
4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
    a) They are not placed in concentrated pockets;
    b) There is a sufficient percentage of fine-grained material to surround the rocks;
    c) The distribution of the rocks is observed by, and acceptable to, our representative.
5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal. On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.
6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.
2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.
3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.
4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.
5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.
2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractors procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractors attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

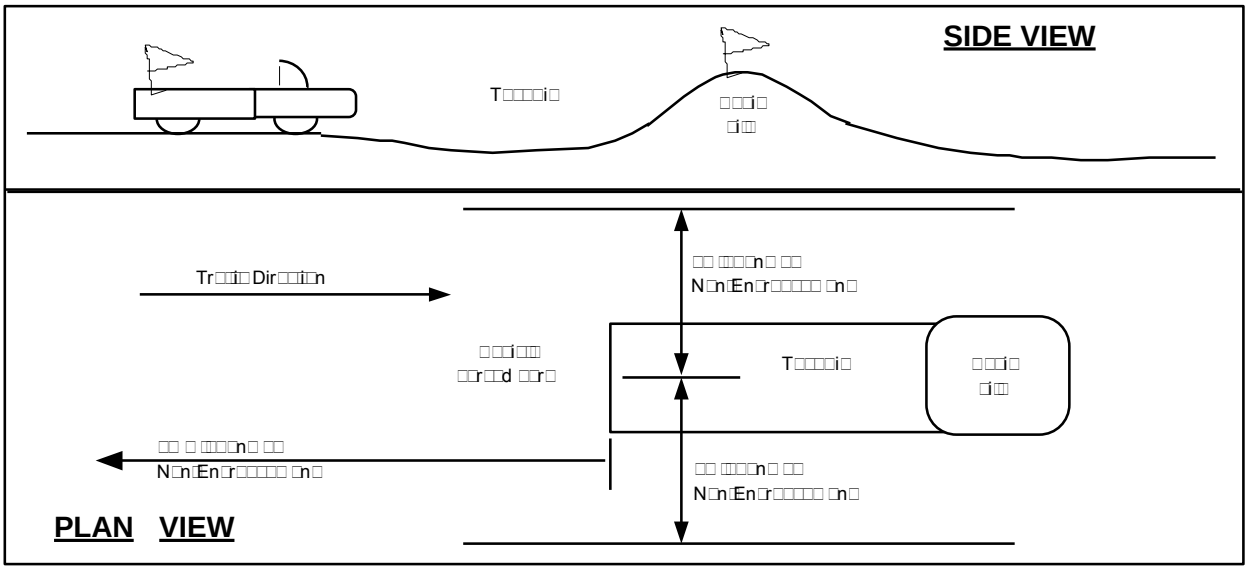
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

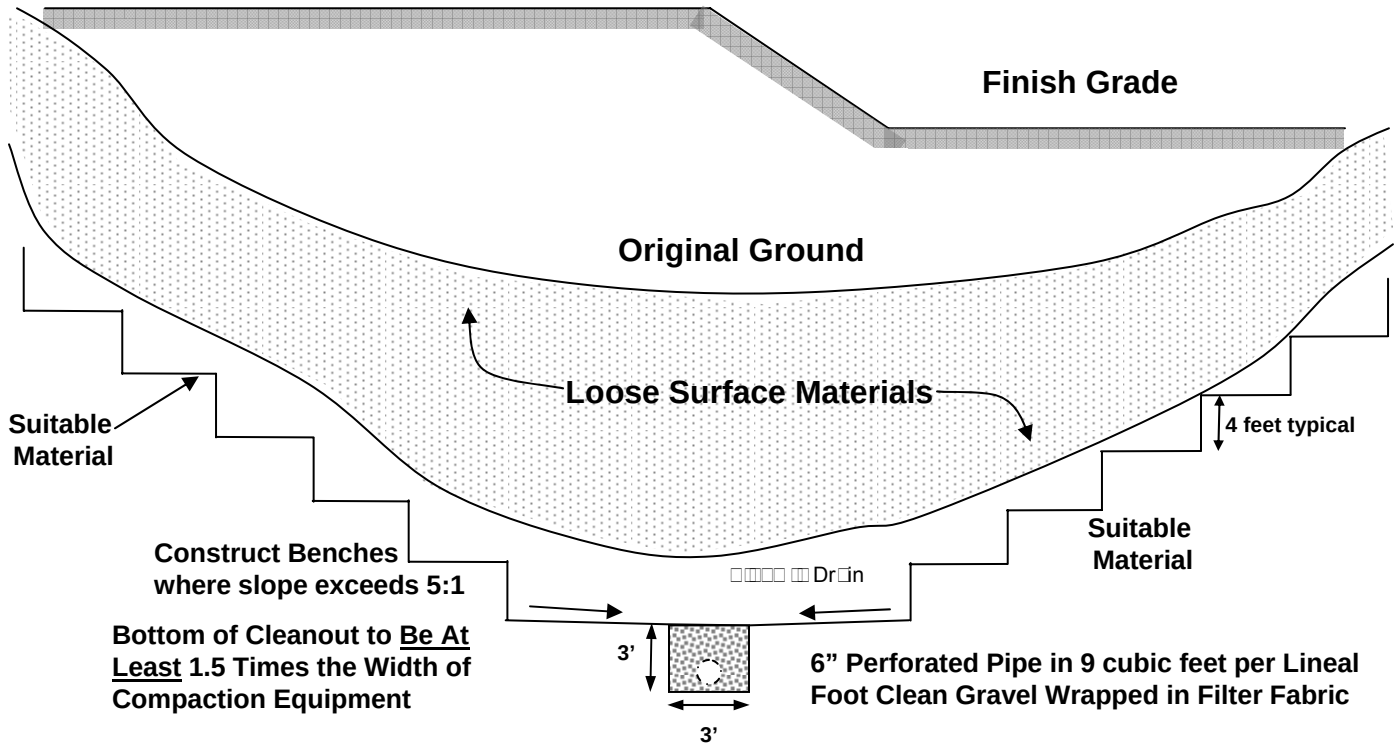
In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

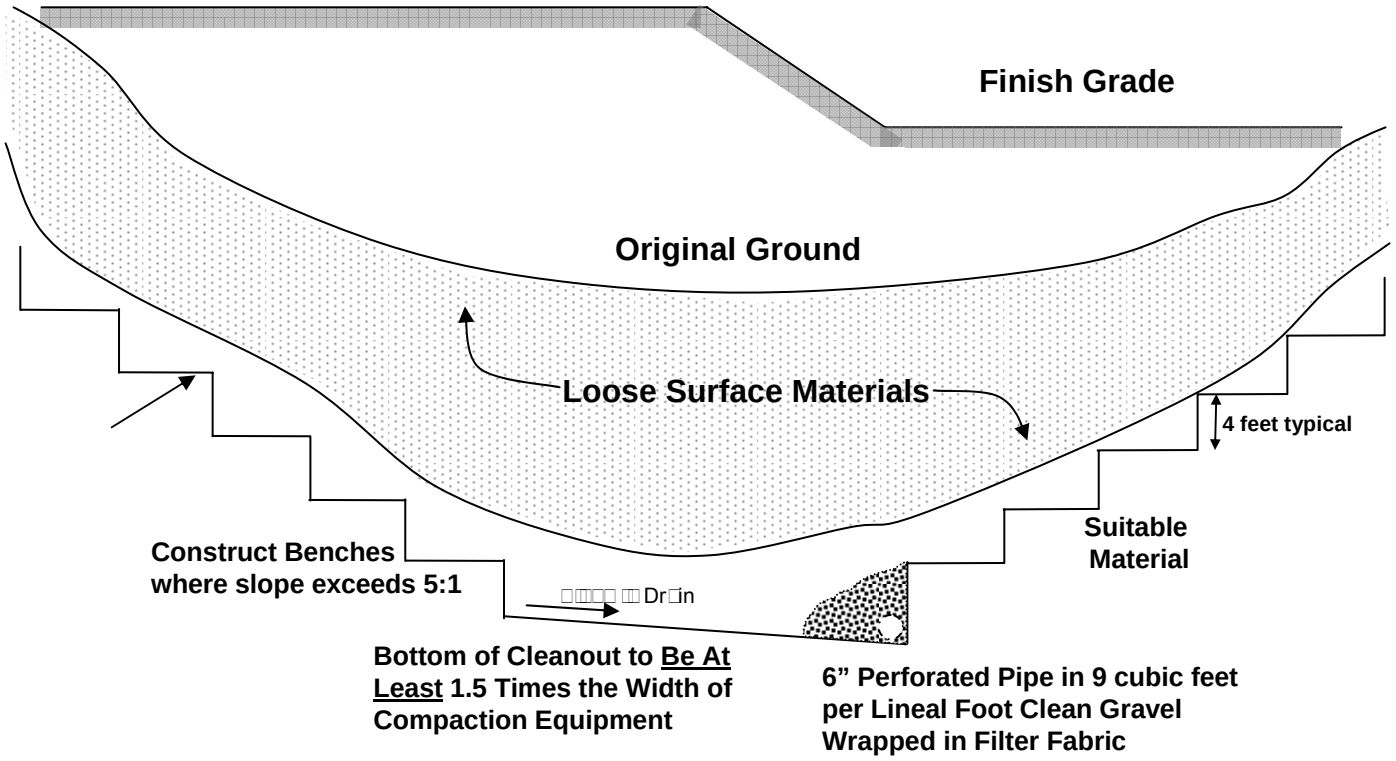
In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

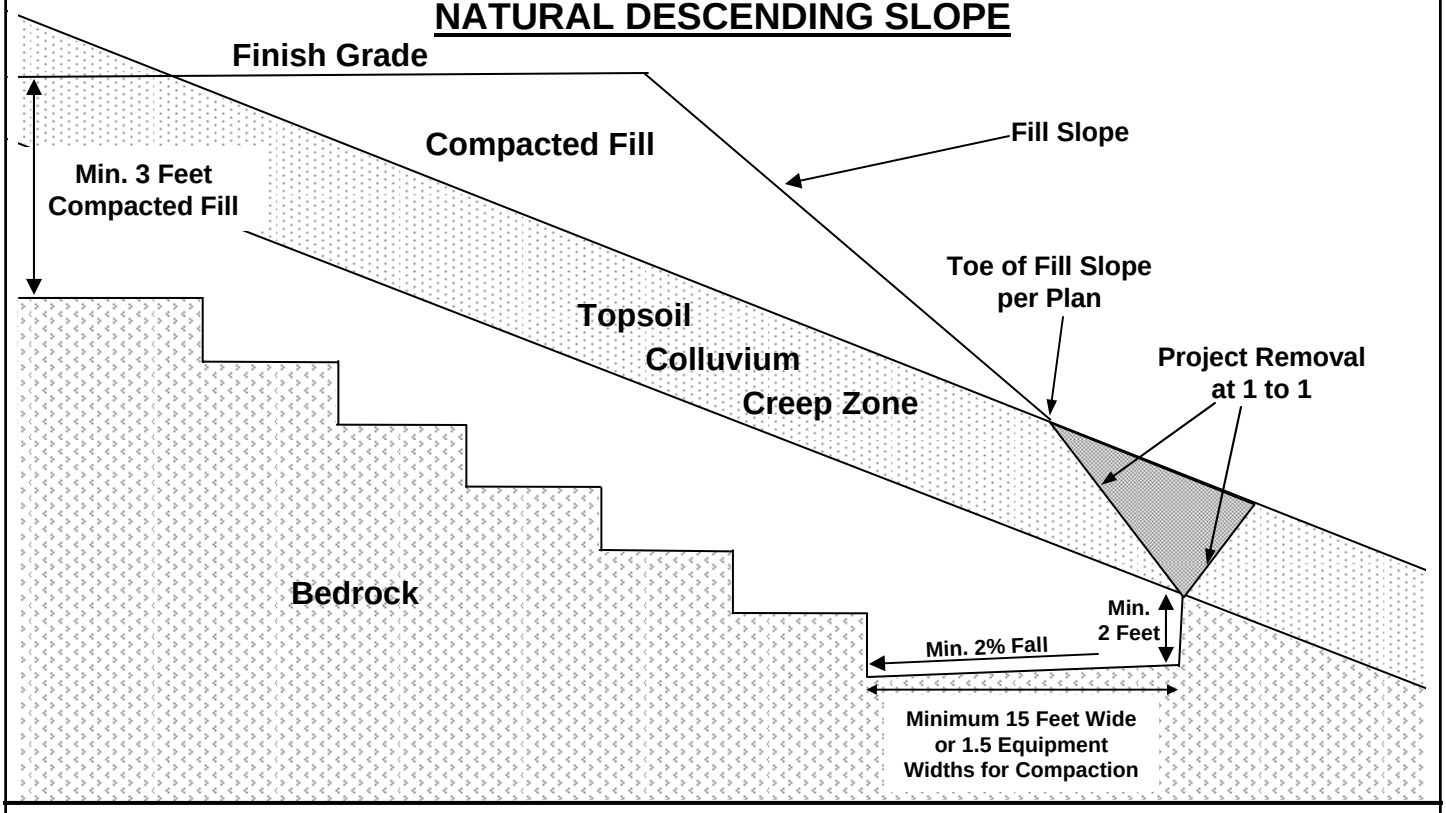
ALTERNATES



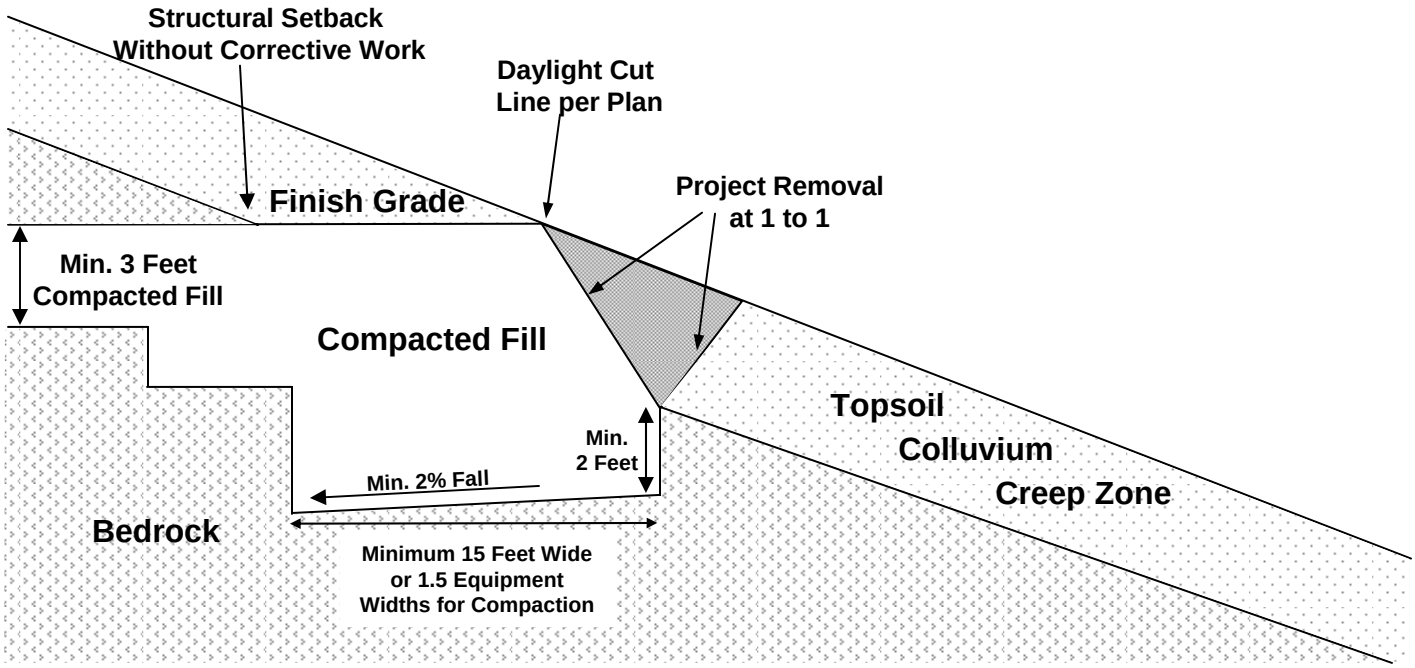


GEOTEK

TYPICAL FILL SLOPE OVER NATURAL DESCENDING SLOPE

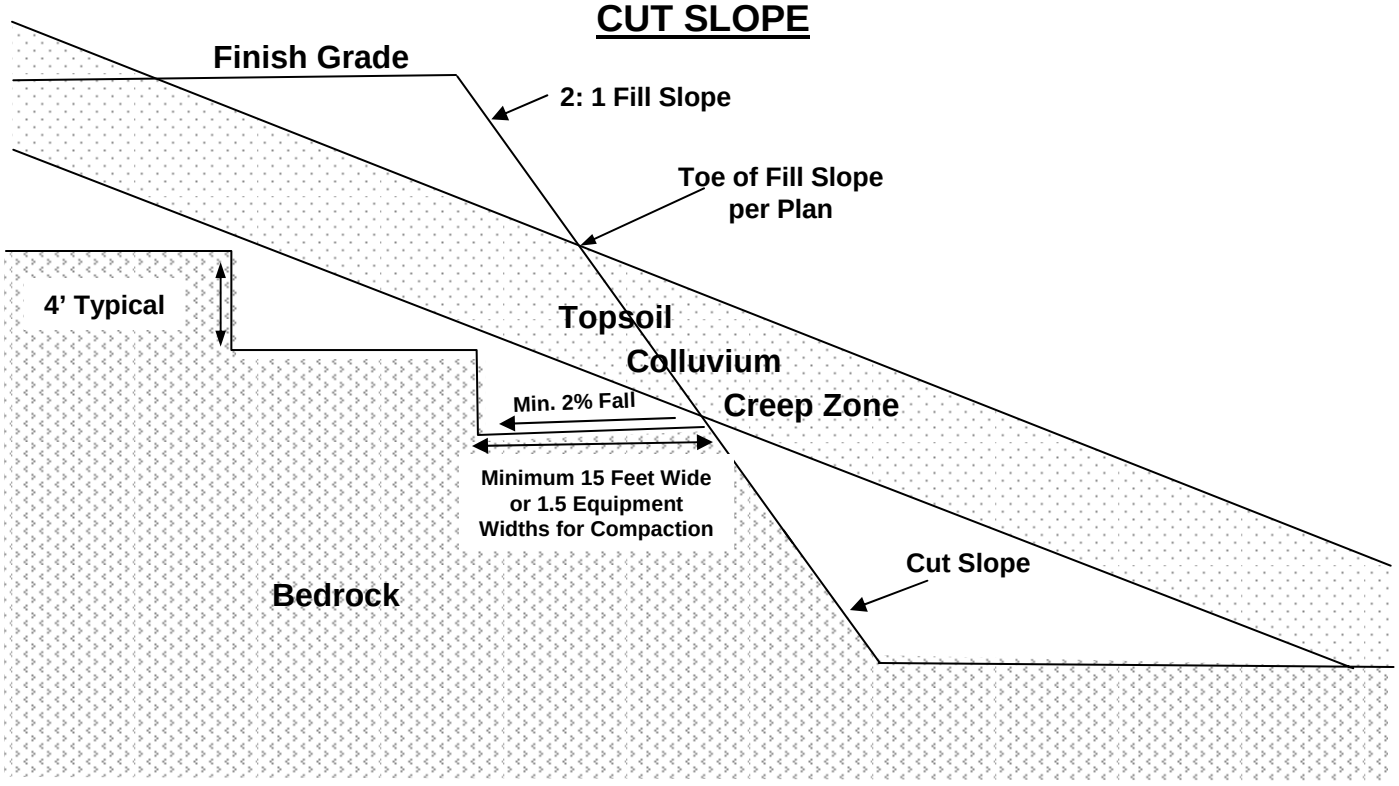


DAYLIGHT CUT AREA OVER NATURAL DESCENDING SLOPE



GEOTEK

TYPICAL FILL SLOPE OVER CUT SLOPE



TYPICAL FILL SLOPE

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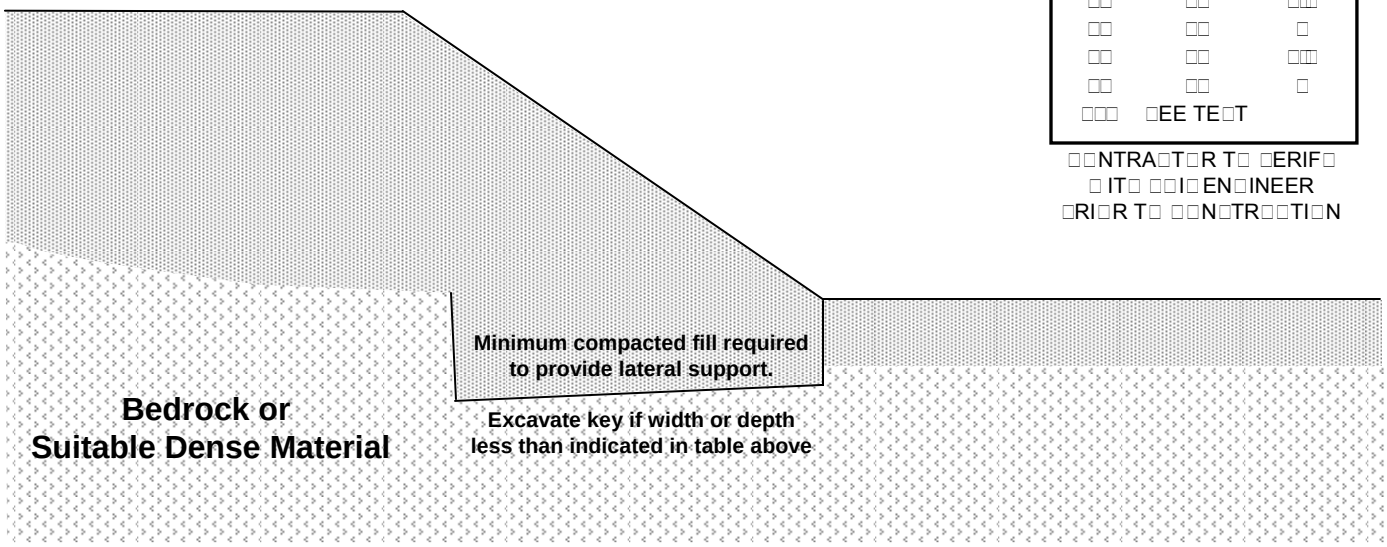

GEOTEK

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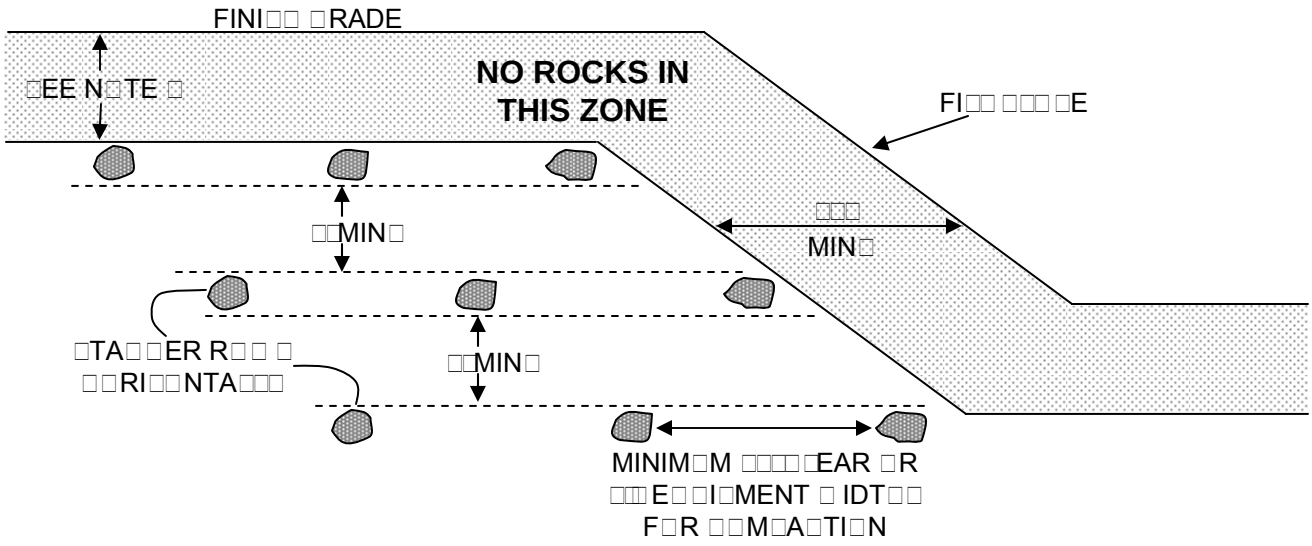
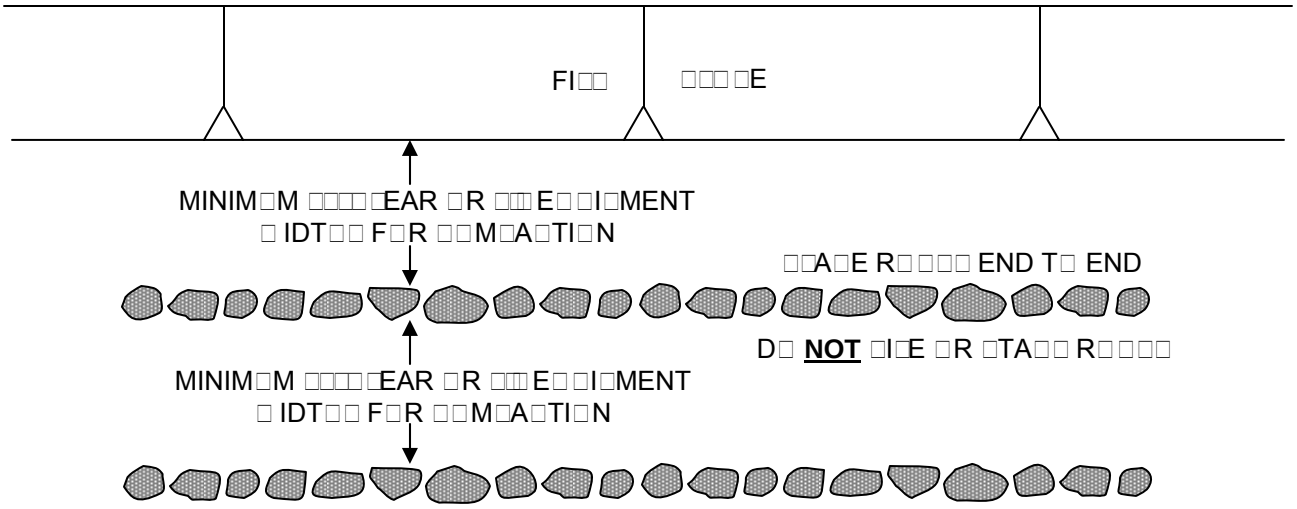
CROSS SECTIONAL VIEW



PLAN VIEW



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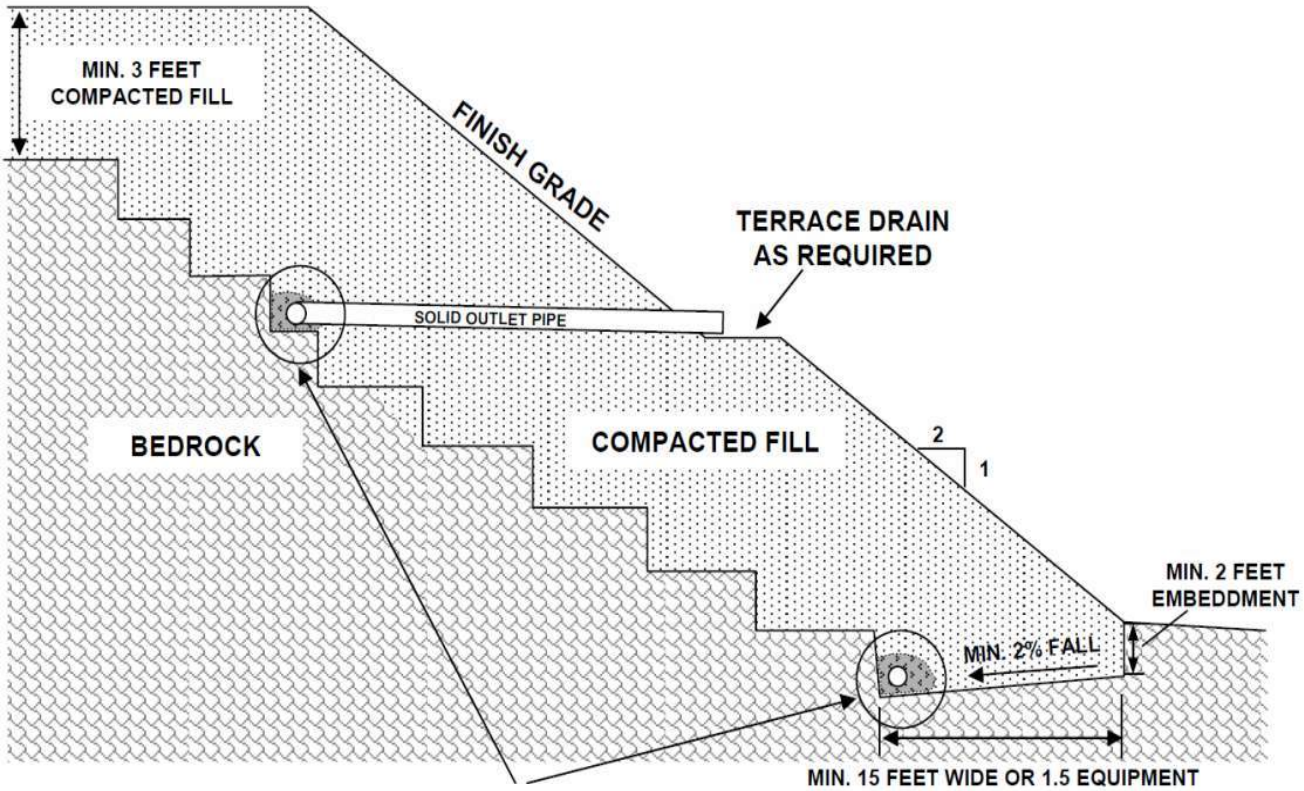
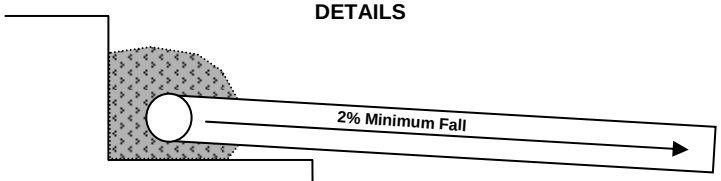


BACKDRAIN DETAILS



4" diameter perforated drain pipe (Schedule 40 PVC or equivalent) in 6 cubic feet per lineal foot clean gravel wrapped in filter fabric

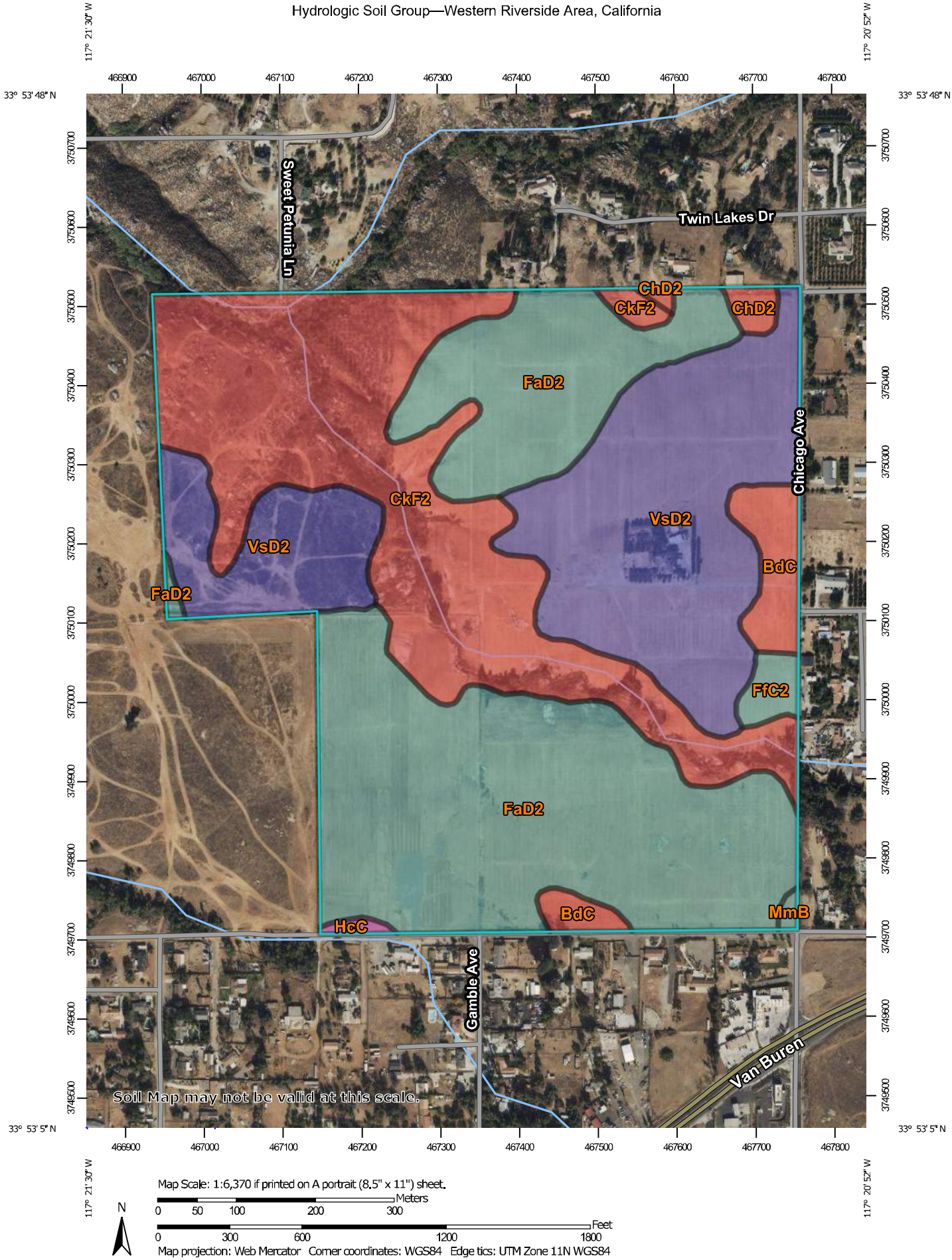
4" diameter solid outlet pipe (Schedule 40 PVC or equivalent) laterals to slope face or storm drain system at maximum 100 foot maximum intervals

Note: Additional backdrains may be recommended

HEEL DRAIN DETAILS

6" diameter perforated drain pipe in 6 cubic feet per lineal foot clean gravel wrapped in filter fabric, outlet pipe to gravity flow with 2% minimum fall

GEOTEK



Map Scale: 1:6,370 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

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MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Western Riverside Area, California
Survey Area Data: Version 14, Sep 13, 2021

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

Date(s) aerial images were photographed: Nov 15, 2020—Feb 6, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BdC	Bonsall fine sandy loam, 2 to 8 percent slopes	D	4.5	3.2%
ChD2	Cieneba sandy loam, 8 to 15 percent slopes, eroded	D	1.0	0.7%
CkF2	Cieneba rocky sandy loam, 15 to 50 percent slopes, eroded	D	40.5	28.3%
FaD2	Fallbrook sandy loam, 8 to 15 percent slopes, eroded	C	56.7	39.7%
FfC2	Fallbrook fine sandy loam, 2 to 8 percent slopes, eroded	C	1.4	1.0%
HcC	Hanford coarse sandy loam, 2 to 8 percent slopes	A	0.4	0.2%
MmB	Monserate sandy loam, 0 to 5 percent slopes	C	0.3	0.2%
VsD2	Vista coarse sandy loam, 8 to 15 percent slopes, eroded	B	38.2	26.7%
Totals for Area of Interest			**143.1**	**100.0%**

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Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: Rick Engineering — Date: 4/10/2023

Designed by: TR — Case No:

Company Project Number/Name: 19427

BMP Identification

BMP NAME / ID: DMA 1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.53 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
DMA 1.1	906955	Mixed Surface Types	0.55	0.37	337840.5			
DMA 1.2	342254	Concrete or Asphalt	1	0.89	305290.6			
DMA 1.3	23248	Ornamental Landscaping	0.1	0.11	2567.9			
DMA 1.4	17683	BMP WQ Surface	1	0.89	15773.2			
	1290140	Total			661472.2	0.53	29215	136562

Notes:

Bioretention Facility - Design Procedure	BMP ID 1	Legend:	Required Entries / Calculated Cells

Company Name: Rick Engineering — Date: 4/10/2023

Designed by: TR — County/City Case No.:

Design Volume

Enter the area tributary to this feature — A_T = 29.6 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP} = 29,215 ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 3.0 ft

Top Width of Bioretention Facility, excluding curb — w_T = 67.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.79 ft

Minimum Surface Area, A_m

$$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$$

A_M = 16,326 ft^2

Proposed Surface Area — A= 17,683 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0.5 %

6" Check Dam Spacing — 0 feet

Describe Vegetation:

Notes: Basin designed for a tributary area larger than 10 acres per fact sheet 3.7 "Guidance for Larger Bioretention/Biofiltration BMP Facilities" per discussion with county staff on 4/6/2023.

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Rick Engineering	Date	12/23/2022
Designed by	TR	Case No	19427
Company Project Number/Name	Chicago Ave		

BMP Identification

BMP NAME / ID: 200

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.53 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA 2.1	*642705*	*Mixed Surface Types*	*0.55*	*0.37*	*239407.5*			
DMA 2.2	*186243*	*Concrete or Asphalt*	*1*	*0.89*	*166128.8*			
DMA 2.3	*60152*	*Ornamental Landscaping*	*0.1*	*0.11*	*6644.3*			
DMA 2.4	*14541*	*BMP WQ Surface*	*1*	*0.89*	*12970.6*			

Bioretention Facility - Design Procedure	BMP ID 2	Legend:	Required Entries / Calculated Cells

Company Name:	Rick Engineering	Date:	4/10/2023
Designed by:	TR	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	20.8	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	18,610	ft^3

Type of Bioretention Facility Design

- ○ Side slopes required (parallel to parking spaces or adjacent to walkways)
- ◉ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	3.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	110.0	ft

Total Effective Depth, d_E

$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.583$ → d_E = 1.88 ft

Minimum Surface Area, A_m

$$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$$

A_M = 9,881 ft^2

Proposed Surface Area	A=	10,247	ft^2
Minimum Required Length of Bioretention Facility, L	L =	94.0	ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0.5	%
6" Check Dam Spacing		0	feet

Describe Vegetation:

Notes: 7" of WQ Ponding to be used, De = 1.88, Min Surface Area = 9,881 ft^2

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: Rick Engineering — Date: 4/10/2023

Designed by: TR — Case No:

Company Project Number/Name:

BMP Identification

BMP NAME / ID: 300

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.53 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
DMA 3.1	1749449	Mixed Surface Types	0.55	0.37	651669.3			
DMA 3.2	547759	Concrete or Asphalt	1	0.89	488601			
DMA 3.3	103694	Ornamental Landscaping	0.1	0.11	11453.8			
DMA 3.4	30760	BMP WQ Surface	1	0.89	27437.9			
DMA 3.6.1	1967	Decomposed Granite	0.4	0.28	550.2			
	2433629	Total			1179712.2	0.53	52104	221195

Notes:

Bioretention Facility - Design Procedure	BMP ID 3	Legend:	Required Entries / Calculated Cells

Company Name:	Rick Engineering	Date:	4/10/2023
Designed by:	TR	County/City Case No.:	

Design Volume

Enter the area tributary to this feature	A_T=	55.9	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	52,104	ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	3.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	75.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.79	ft
Minimum Surface Area, A_m $A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$	A_M =	29,098	ft^2
Proposed Surface Area	A=	29,500	ft^2

Bioretention Facility Properties

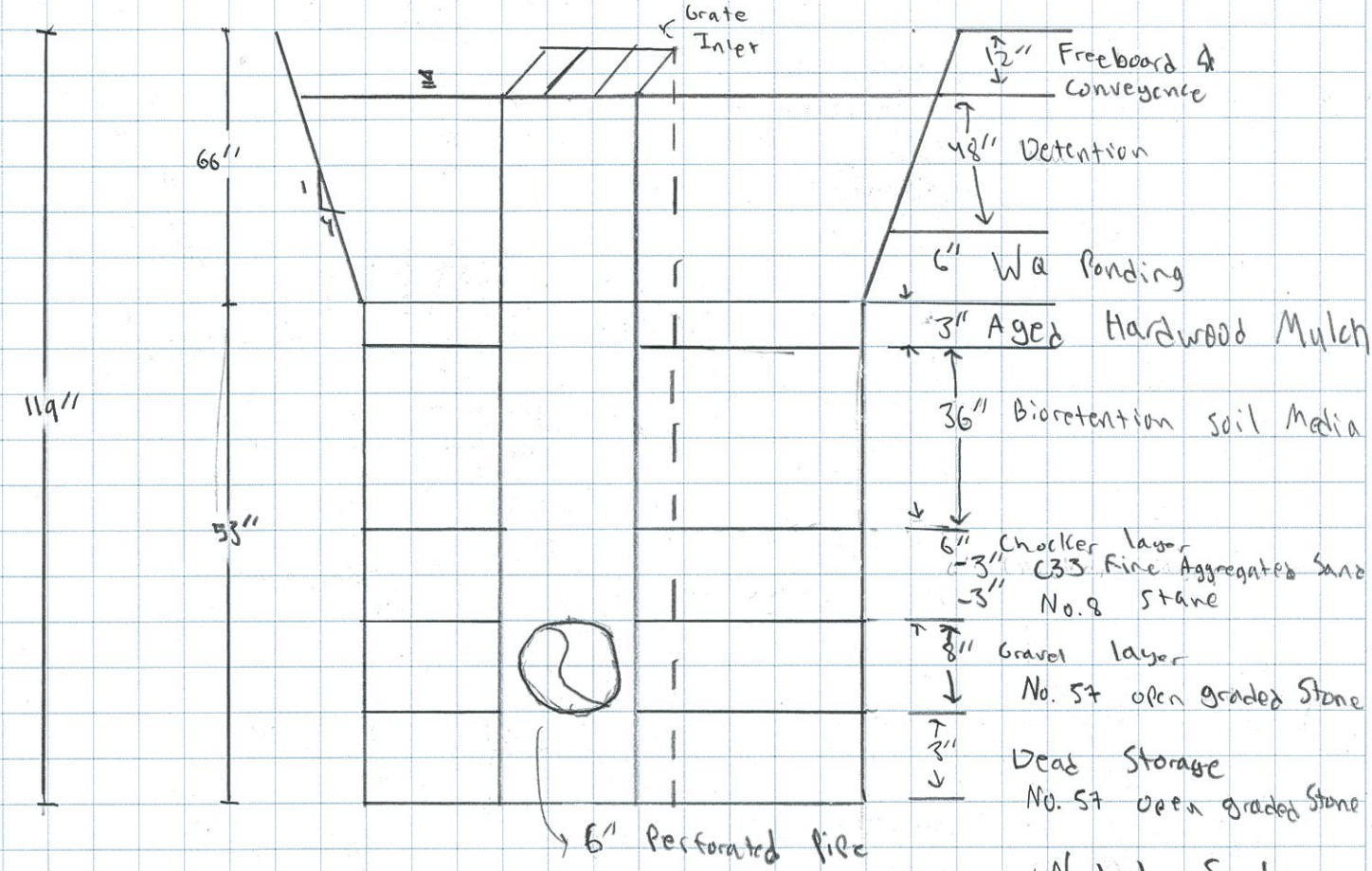
Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0.5	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: Basin designed for a tributary area larger than 10 acres per fact sheet 3.7 "Guidance for Larger Bioretention/Biofiltration BMP Facilities" per discussion with county staff on 4/6/2023.

RICK ENGINEERING COMPANY™
5620 Friars Road
San Diego, CA 92110-2596
Tel: (619) 291-0707
Fax: (619) 291-4165

Date 12/08/2022
Job No. 19427
Page
Done By TR
Checked By

Chicago Avenue Typical Bioretention BMP Cross Section



* Not to Scale
* Working Copy
* Not for Construction

BMP 1 - South of creek
Min Req Volume: 30,000 ft³
Min Req Bottom Surface Area: 16500 ft²
At 4:1 side slopes, typical required top footprint: 20400 ft²

BMP 2 - North of Creek
Min Req Volume: 18900 ft³
Min Req Bottom Surface Area: 10,800 ft²
At 4:1 side slopes typical required top footprint: 12800 ft²

BMP 3 - New Basin to Northeast
Min Req. Volume: 5300 ft³
Min. Req. Bottom Surface Area: 29,500 ft²
At 4:1 side slopes, typical required top footprint: 33,900 ft²

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent(2)
Natural or Agriculture	0 - 10	0
Single Family Residential: (3)		
40,000 S. F. (1 Acre) Lots	10 - 25	20
20,000 S. F. (½ Acre) Lots	30 - 45	40
7,200 - 10,000 S. F. Lots	45 - 55	50
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 -100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas.

3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.

RCFC & WCD
HYDROLOGY MANUAL

IMPERVIOUS COVER FOR DEVELOPED AREAS

PLATE D-5.6

Note provided: “Basin designed for a tributary area larger than 10 acres per fact sheet 3.7 “Guidance for Large Bioretention/Biofiltration BMP Facilities” per discussion with County staff on 4/6/2023”

3.7 Guidance for Large Bioretention/Biofiltration BMP Facilities

No BMP worksheet is provided. For use, include designs on the WQMP site map with a cross section. Adequate details on the grading plans are required to demonstrate the project design incorporates all of the applicable design criteria.

Applicability	Large sites, multi-parcel sites, BMPs treating greater than 5 acres This fact sheet is intended to be used in combination with Fact Sheet 3.4, 3.5, or 3.6 to provide guidance for how to scale up the design of small scale features to larger scale basins
LID BMPs	Bioretention, Biofiltration with Partial Infiltration, and Biofiltration with No Infiltration

Limits on Use and Applicability

This fact sheet provides guidance for the design, installation, and maintenance of regional scale bioretention/biofiltration Best Management Practices (BMPs) for large multi-parcel projects. The requirements included in this fact sheet are in addition to, those specified in the LID BMP Handbook Fact Sheets for Bioretention (3.4), Biofiltration with Partial Infiltration (3.5), and Biofiltration with No Infiltration (3.6). The user will still need to refer to those fact sheets. This fact sheet then provides additional or overriding criteria for facilities that are designed at a larger scale. These additional criteria are necessary to address unique design challenges associated with larger facilities.

Use of regional scale facilities is at the discretion of the Copermittee. Before continuing with design of regional scale facilities, PDPs shall consult with the Copermittee with jurisdiction over the project site.

Categories of Regional Bioretention/Biofiltration Facilities

The same categories of regional bioretention/biofiltration facilities apply at a regional scale and need to be selected based on the feasibility criteria at the location.

- Bioretention (full infiltration) – Fact Sheet 3.4
- Biofiltration with partial infiltration – Fact Sheet 3.5
- Biofiltration (no infiltration/limited infiltration) – Fact Sheet 3.6

Using a regional facility does not preclude the requirement to evaluate infiltration feasibility criteria. Large facilities require a thorough and detailed assessment of the sites underlying infiltration rates and geotechnical environment. Refer to the Santa Margarita Watershed WQMP for complete feasibility analysis requirements.

Basic Design Requirements and Provisions

Basin Guidelines

All regional facilities shall be designed in accordance with the “Basin Guidelines” included in Appendix C of the LID BMP Handbook. Section 1 of the “Basin Guidelines” presents guidelines

and standards for the design and maintenance of water quality basins used within Riverside County including provisions for:

- General Criteria
- Geotechnical Reports
- Basin Grading Parameters
- Setbacks
- Outlet Structures and Spillways
- Maintenance Access
- Landscaping
- Fencing, and
- Additional Requirements

Site Geotechnical Investigation

A site-specific geotechnical investigation is required to determine subsurface conditions, infiltration rates, the seasonal high ground water elevation (SHGWE), and impacts to site environs as listed in the Feasibility Criteria. The investigation must be conducted by or under direct supervision of a State of California-licensed engineering geologist, geotechnical engineer, or civil engineer with experience in geotechnical engineering, and in compliance with the *SMR WQMP*. The Geotechnical Report shall meet the minimum requirements of the "Basin Guidelines" and provide the following additional information:

- Infiltration rates (in accordance with the "Infiltration Testing Guidelines" included in Appendix A)
- Seasonal high groundwater levels
- Potential for groundwater mounding below the facility or down gradient
- Geotechnical hazards
- Other impacts to site environs, such as water balance impacts on biological resources
- Utilities

Summary of BMP Design Parameters

The BMP design parameters contained in the respective fact sheets for Bioretention, Biofiltration with Partial Infiltration, and Biofiltration with No Infiltration apply to the design of large scale facilities of the same type; however, additional criteria also apply. Table 1 below provides a summary of the standard and augmented design components required for large scale facilities. Where augmented components are specified, additional design criteria are provided in this fact sheet to augment the criteria in the standard fact sheets.

Table 1. Design Requirements for BMP Components

Component	Design Requirements
Pretreatment	Augmented
Cross Section Geometry	Augmented
Overflow	Augmented
Engineered Soil Media	Standard
Subsurface Storage Layer	Standard
Underdrain	Augmented
Energy Dissipation	Augmented
Internal Flow Distribution	Augmented
Media Properties and Outlet Control	Augmented
Landscaping	Standard
Vector Control	Standard
Maintenance Access	Augmented
Construction Considerations	Augmented
Sizing	Standard

Augmented Design Requirements for Regional Scale Facilities

This section contains the augmented design parameters and requirements that are unique to Large Bioretention/Biofiltration Facilities. These provisions help to maintain BMP function and performance in larger facilities and provide additional storage and routing options that are not applicable to smaller scale facilities.

Cross Section Geometry

The following design parameters for regional scale facilities shall be used in place of the corresponding parameters for standard facilities:

- The ponding depth above the engineered soil media shall not exceed 3 feet or the maximum depth that can be drained in 72 hours. A shorter drawdown time may be specified if necessary to support the selected vegetation.
- The engineered soil media shall be a minimum of 2 feet deep.
- Side slopes shall conform to the Basin Guidelines in Appendix C.

Pretreatment

Pretreatment shall be provided in order to reduce the sediment load entering the facility and to maintain the infiltration/filtration rate of the basin. This is more critical for regional facilities as they tend to be deeper and therefore have a larger sediment load per unit area of media.

Where feasible, the following pre-treatment approach is recommended:

- Stabilization or bypass of all exposed soil areas in the watershed.

- Use of a manufactured pre-treatment system with a GULD certification for "pre-treatment" or "basic treatment" per Washington State TAPE Program. Currently approved products: are here: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html. Use Internet Explorer for this web page.

The minimum pretreatment mechanism shall be a sedimentation basin or forebay with a volume equivalent to 20 percent of the BMP volume and shall be separated by a berm with a height of at least half of the total ponding depth of the facility.

Overflow

Regional facilities shall conform to the requirements included in the "Basin Guidelines" (Appendix C). These guidelines provide guidance for the design of outlet structures and spillways.

Underdrain

Hydraulic calculations shall be used to determine necessary size of underdrains. It should not be assumed that the 6-inch diameter default for smaller systems will be adequate for larger systems. Subdrains shall be sloped with positive drainage of at least 0.5%.

Rigid non-perforated observation pipes with a diameter equal to the underdrain diameter shall be connected to the underdrain every 50 feet to provide a clean-out port as well as an observation well to monitor dewatering rates.

- The wells/cleanouts shall be connected to the underdrain with the appropriate manufactured connections.
- The wells/cleanouts shall extend 6 inches above the top elevation of the bioretention facility mulch, and shall be capped with a lockable screw cap. Cleanouts may be integrated with vents, in which case the vent should extend above the facility high water line.
- The ends of underdrain pipes not terminating in an observation well/cleanout shall be capped.

Energy Dissipation

Energy dissipation must be provided to prevent erosion of the engineered soil media layer. Internal erosion is a greater risk for larger BMPs due to the higher flow rates and velocities routed to them. Energy dissipation is required meeting the following provisions:

1. All significant inlets shall enter the sediment forebay, if a sediment forebay is provided as the required pretreatment device. Significant inlets include any piped, channeled or conveyed inlets. If a forebay is not provided, a stilling well is recommended.
2. Energy dissipation shall be provided at each inlet to the facility (including curb-cuts) and shall be engineered to control the velocity of inflows to less than 2 feet per second to prevent scour of the media bed.

3. Woody plants (trees, shrubs, etc.) shall not be placed directly in the entrance flow path, but may be used in other portions of the regional facility.

Side Slope Erosion Control

Side slopes of regional facilities can contribute large sediment loads if not full stabilized prior to commissioning of the system. The design and construction phasing shall demonstrate how side slopes will be stabilized to minimize erosion. Example design approaches include:

- Revegetation with dense grass, including irrigation
- Flexible soil armoring grid products combined with revegetation

Flow Distribution System

An internal flow distribution system should be considered to convey pre-treated inflows more evenly across the media bed. This helps avoid scour caused by concentrated flow of water over the media surface near the inlet. It is also desirable to avoid short circuiting[1]. Example design approaches for flow distribution include:

- Design a distribution channel or perforated pipe around a portion of the perimeter (1/2 to 2/3 of the perimeter of the system) and internal to the facility, where needed, to distribute flows within the facility.
- A distribution channel could consist of shallow swale (3 to 6 inches deep) in the media bed, armored with turf reinforcement matting, other geotextile, or cobbles, to withstand higher velocities.
- The distribution system should be designed to drain completely between storm events.

Media Bed Hydraulics and Outlet Control

The following design approach for media outlet control should be considered to help improve filtration processes and media longevity for systems that are designed as biofiltration (with or without partial infiltration)

1. An outlet-controlled underdrain system, consisting of an orifice or other flow control device that controls the rate at which water discharges from the system underdrain.[2]

---

[1] Short-circuiting of flows refers to a disproportionately high fraction of the total filtration occurring in the immediate vicinity of the inlet. These conditions are undesirable as this can overwhelm biological functions and treatment processes in the areas receiving the majority of the flow and result in lower treatment performance on average.

[2] When an outlet-controlled underdrain is used, the rate of flow through the media is controlled by the rate that water can discharge from the underdrain orifice rather than the filtration rate of the media. The filtration rate of the media may vary spatially and will change with time. The use of an outlet controlled underdrain promotes more uniform infiltration across the media bed and longer average contact time with the biofiltration media. It also allows

2. When an outlet control is used, the initial media permeability may be higher (20 to 80 in/hr).

3. The outlet control is then designed such that the average infiltration rate through the media (i.e., the rate at which water passes through the media; as controlled by the outlet, not by the saturated hydraulic conductivity of the media) is approximately 2.5 to 5 in/hr.

4. The facility must drain freely to an acceptable discharge point.

5. If the design configuration has potential for trapped air in the underdrain system to interfere with infiltration through the media bed (i.e., an "airlock"), it may be necessary to vent at an elevation above the high water line.

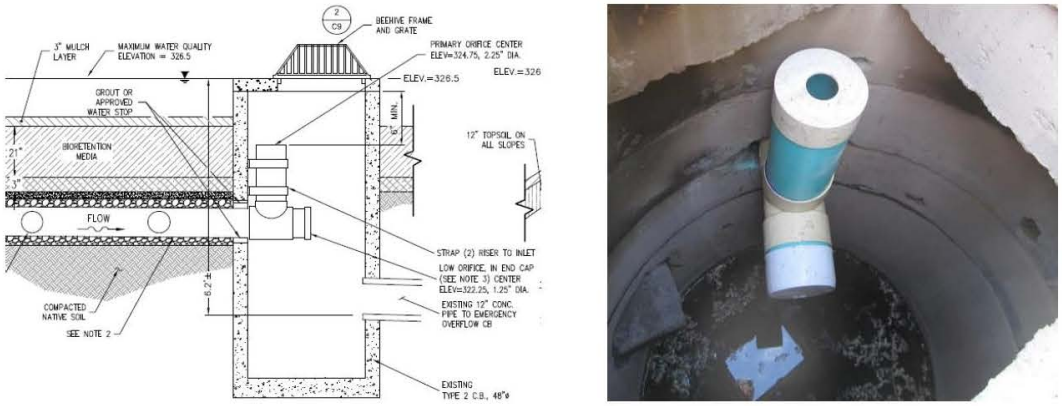


Figure 1. Example Outlet Control Structure

Design for LID and Hydromodification Control

Large bioretention/biofiltration basins can be designed for both LID and hydromodification control. Figure 2 shows schematics of how LID and hydromodification designs can be integrated.

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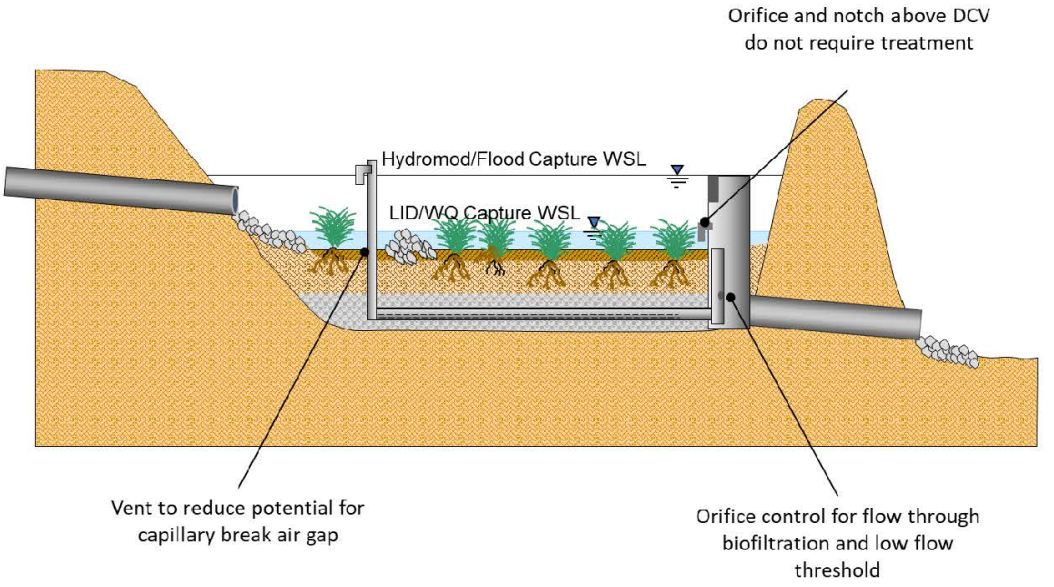
the biofiltration media to be designed with a higher initial saturated hydraulic conductivity, such that a greater degree of clogging can occur before maintenance of the media bed is required.



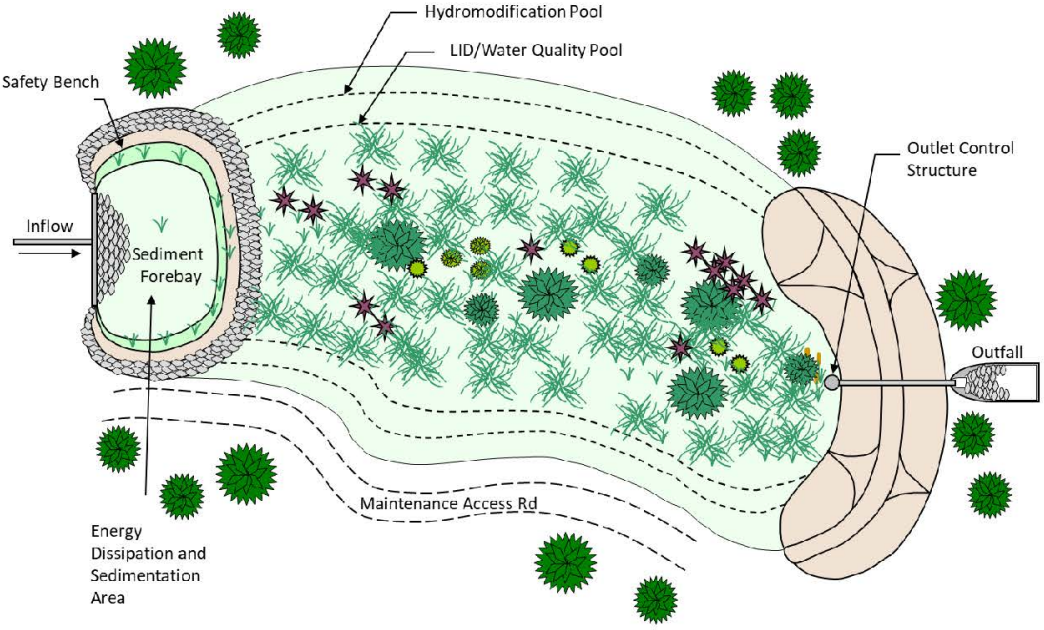
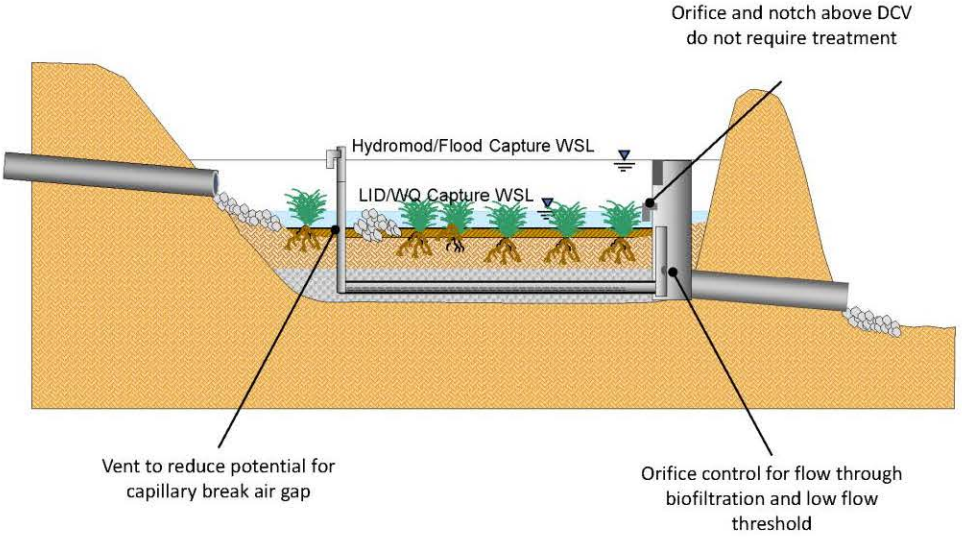
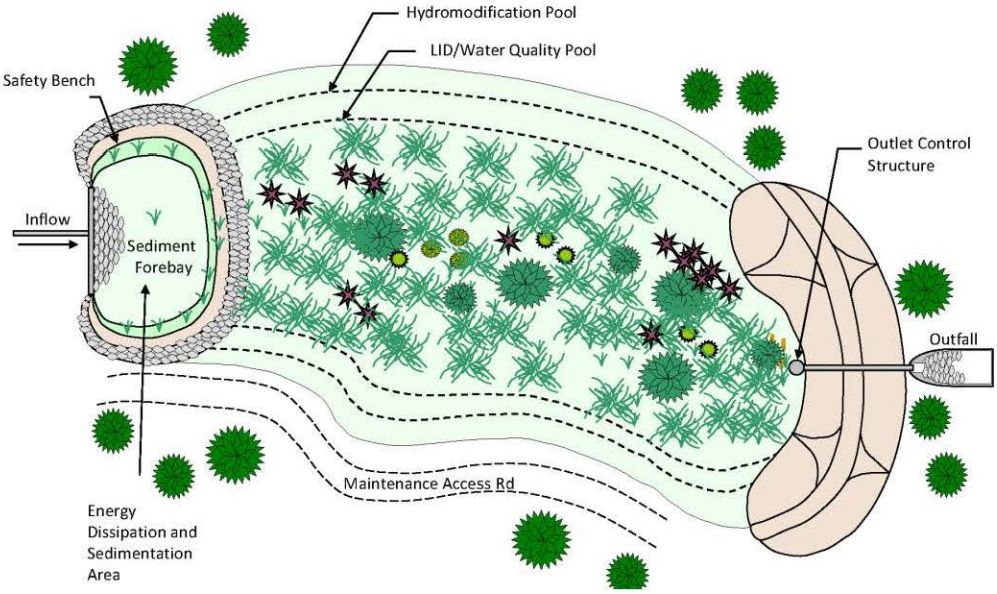


Figure 2. Example Schematic of Combination LID/Hydromodification Basin

Maintenance Access

Access for maintenance activities shall be provided as outlined in the "Basin Guidelines."


Orifice and notch above DCV
do not require treatment
Hydromod/Flood Capture WSL
LID/WQ Capture WSL
Vent to reduce potential for
capillary break air gap
Orifice control for flow through
biofiltration and low flow
threshold


Hydromodification Pool
LID/Water Quality Pool
Safety Bench
Outlet Control
Structure
Inflow
Sediment
Forebay
Outfall
Maintenance Access Rd
Energy
Dissipation and
Sedimentation
Area

2

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

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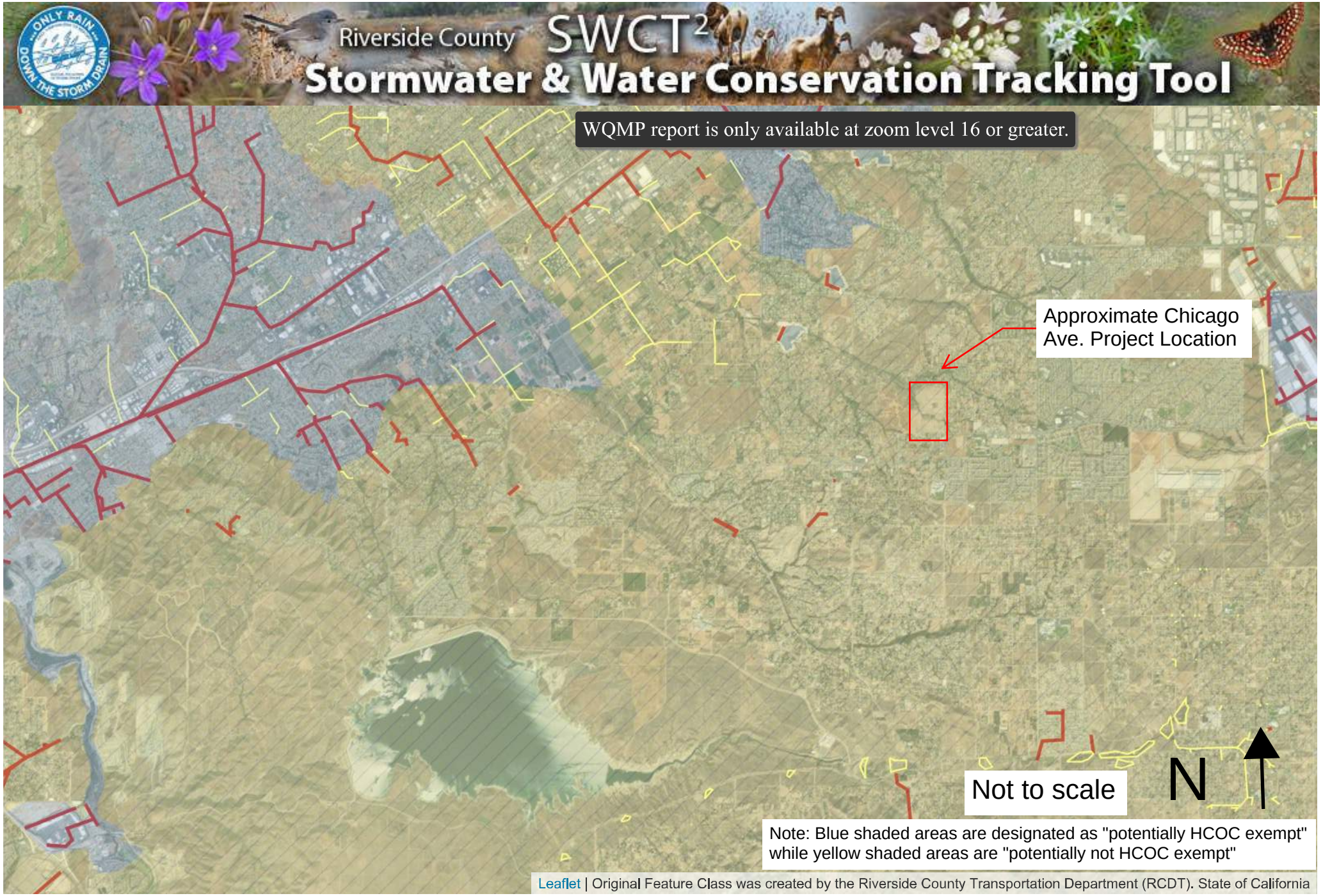
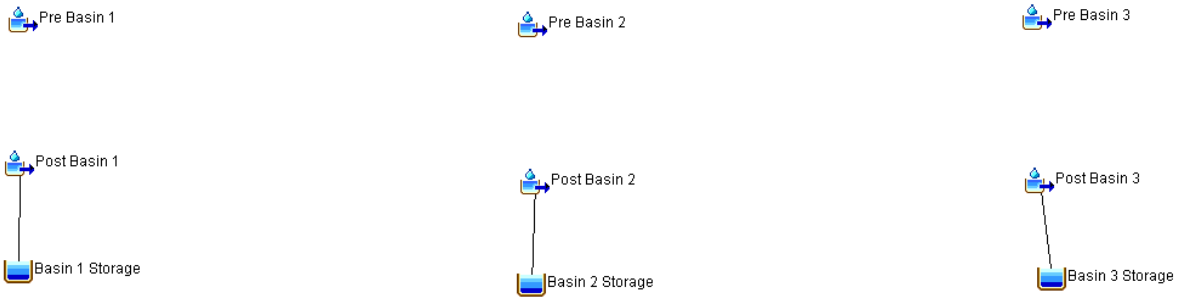


Arroyo Vista JN-19427 HEC-HMS Detention Results 5/7/2024

HEC-HMS Basin Configuration



10-Year 24 Hour Storm Event

Global Summary

Global Summary Results for Run "3 Basin 10yr 24hr"

Project: ChicagoAve_updated Simulation Run: 3 Basin 10yr 24hr

Start of Run: 01Jan2000, 00:00
End of Run: 04Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Routed 3 Basins
Meteorologic Model: 3 Basin 10yr 24hr Post
Control Specifications: 72 hr

Show Elements: All Elements Volume Units: IN ACRE-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
Pre Basin 1	0.0462	4.2	01Jan2000, 13:30	0.98
Pre Basin 2	0.0312	2.8	01Jan2000, 13:30	0.66
Pre Basin 3	0.0855	7.7	01Jan2000, 13:30	1.82
Post Basin 1	0.0462	6.5	01Jan2000, 13:30	1.81
Basin 1 Storage	0.0462	4.0	01Jan2000, 15:00	1.81
Post Basin 2	0.0312	4.3	01Jan2000, 13:30	1.22
Basin 2 Storage	0.0312	2.8	01Jan2000, 14:50	1.22
Post Basin 3	0.0855	11.4	01Jan2000, 13:30	3.34
Basin 3 Storage	0.0855	7.0	01Jan2000, 15:20	3.34

Basin 100 Results

Summary Results for Reservoir "Basin 1 Storage"

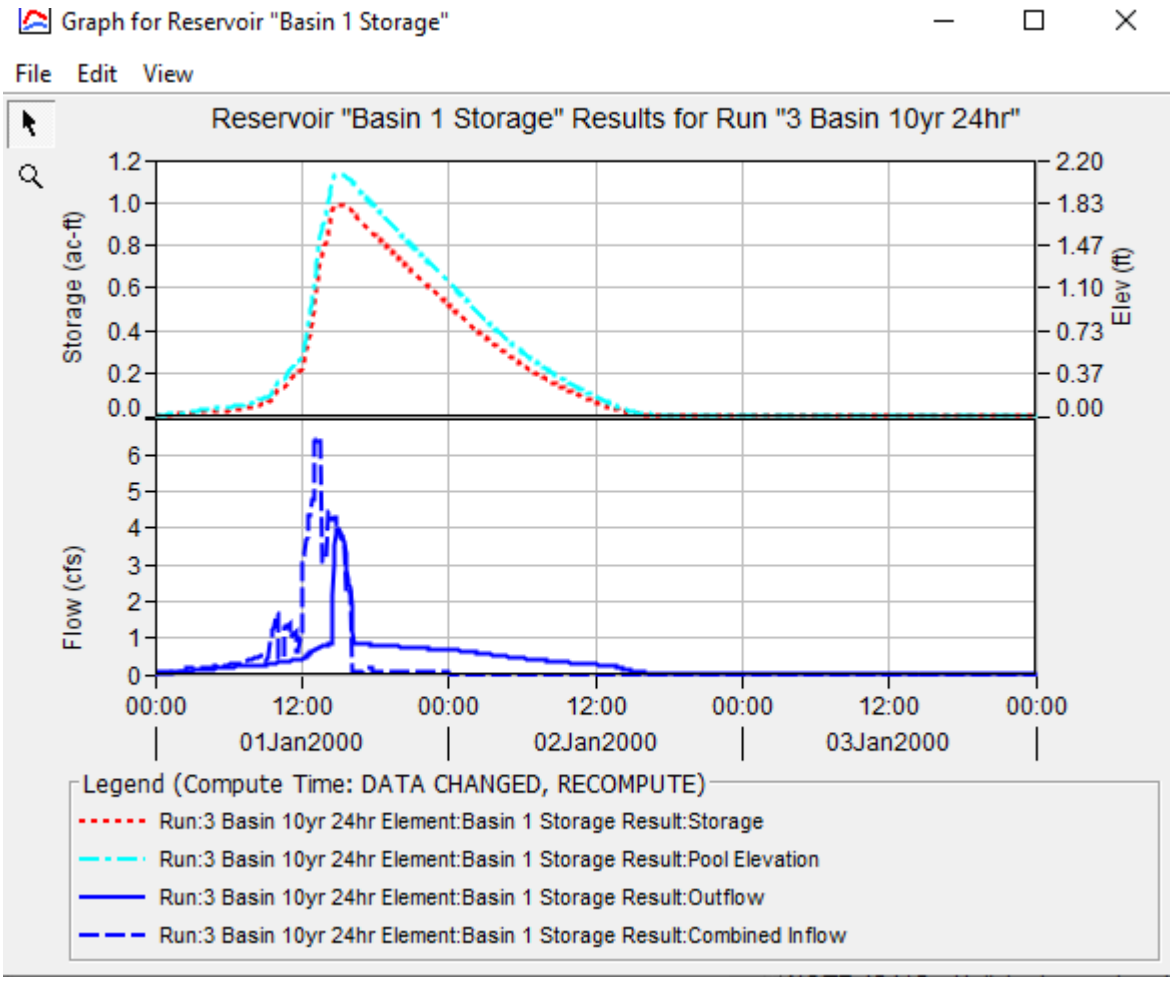
Project: ChicagoAve_updated Simulation Run: 3 Basin 10yr 24hr
Reservoir: Basin 1 Storage

Start of Run:	01Jan2000, 00:00	Basin Model:	Routed 3 Basins
End of Run:	04Jan2000, 00:00	Meteorologic Model:	3 Basin 10yr 24hr Post
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	72 hr

Volume Units: ○ IN ◉ ACRE-FT

Computed Results

Peak Inflow:	6.5 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 13:30
Peak Discharge:	4.0 (CFS)	Date/Time of Peak Discharge:	01Jan2000, 15:00
Inflow Volume:	1.81 (ACRE-FT)	Peak Storage:	0.99 (ACRE-FT)
Discharge Volume:	1.81 (ACRE-FT)	Peak Elevation:	2.1 (FT)



Basin 200 Results

Summary Results for Reservoir "Basin 2 Storage"

Project: ChicagoAve_updated Simulation Run: 3 Basin 10yr 24hr
Reservoir: Basin 2 Storage

Start of Run:	01Jan2000, 00:00	Basin Model:	Routed 3 Basins
End of Run:	04Jan2000, 00:00	Meteorologic Model:	3 Basin 10yr 24hr Post
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	72 hr

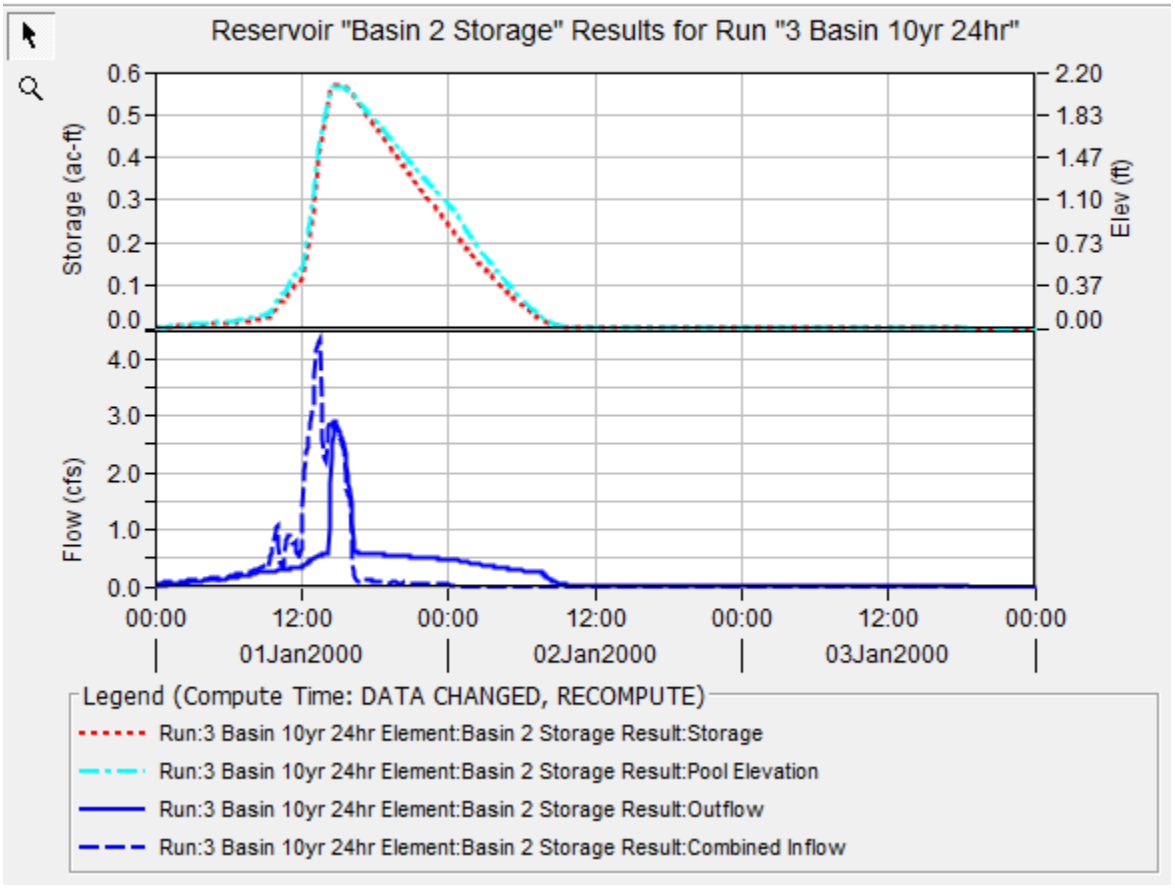
Volume Units: ○ IN ◉ ACRE-FT

Computed Results

Peak Inflow:	4.3 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 13:30
Peak Discharge:	2.8 (CFS)	Date/Time of Peak Discharge:	01Jan2000, 14:50
Inflow Volume:	1.22 (ACRE-FT)	Peak Storage:	0.57 (ACRE-FT)
Discharge Volume:	1.22 (ACRE-FT)	Peak Elevation:	2.1 (FT)

Graph for Reservoir "Basin 2 Storage"

File Edit View



Basin 300 Results

Summary Results for Reservoir "Basin 3 Storage"

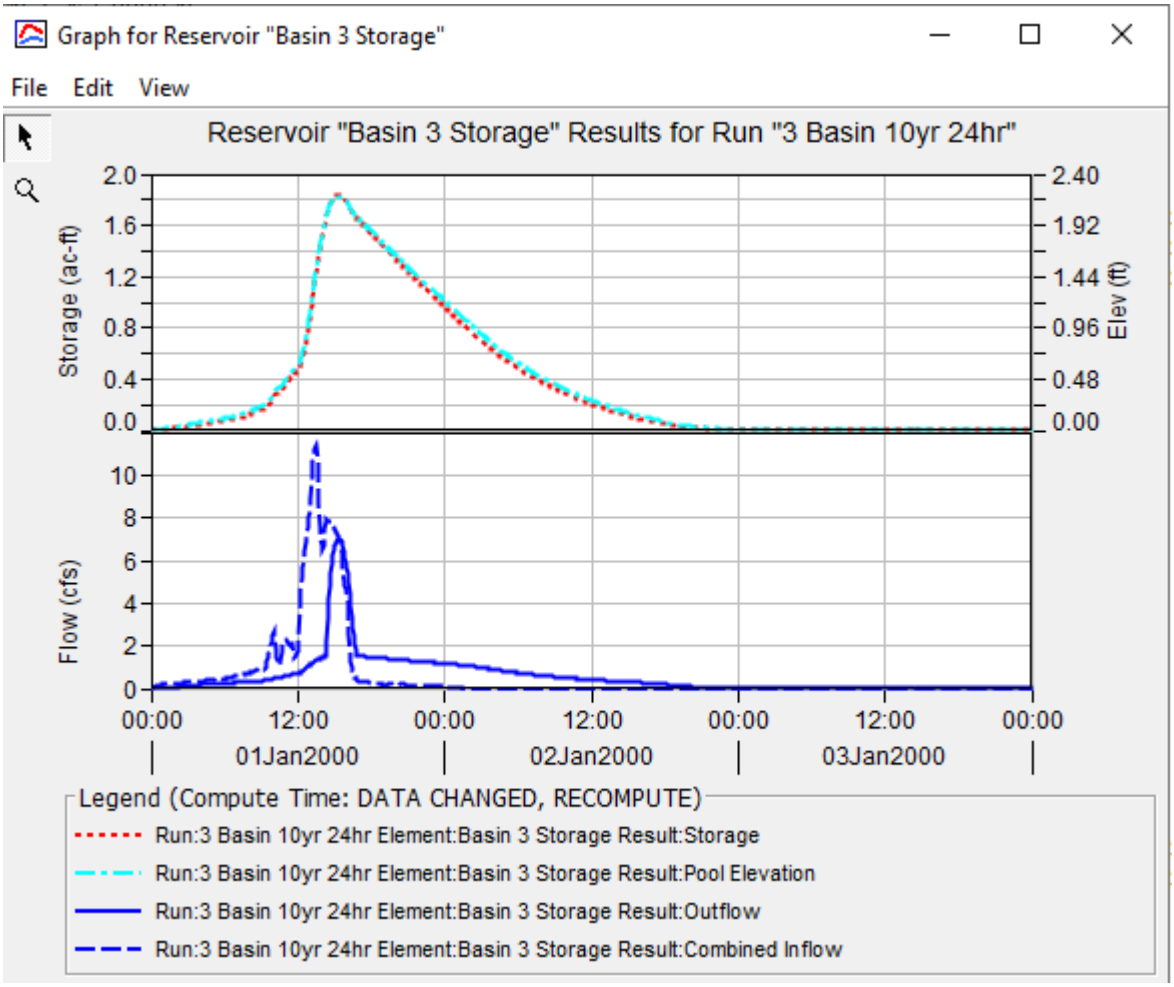
Project: ChicagoAve_updated Simulation Run: 3 Basin 10yr 24hr
Reservoir: Basin 3 Storage

Start of Run:	01Jan2000, 00:00	Basin Model:	Routed 3 Basins
End of Run:	04Jan2000, 00:00	Meteorologic Model:	3 Basin 10yr 24hr Post
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	72 hr

Volume Units: ○ IN ◉ ACRE-FT

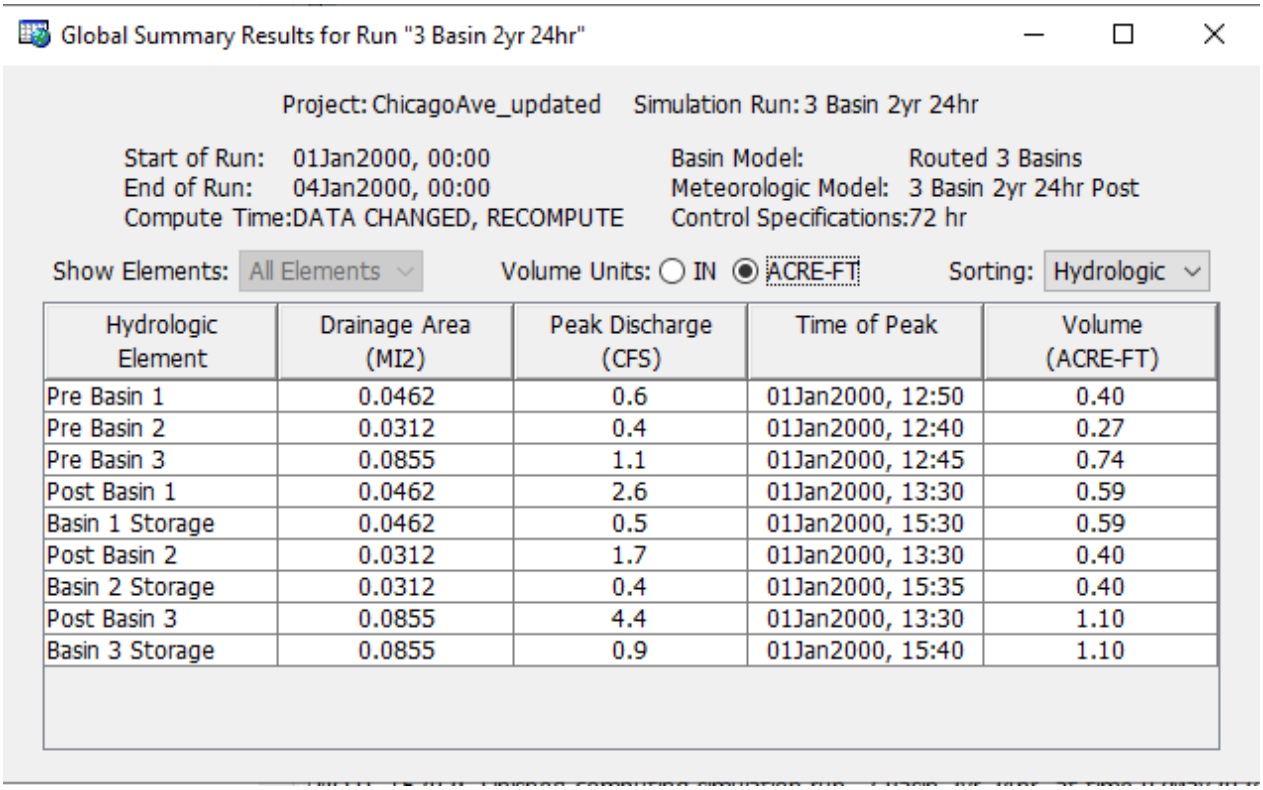
Computed Results

Peak Inflow:	11.4 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 13:30
Peak Discharge:	7.0 (CFS)	Date/Time of Peak Discharge:	01Jan2000, 15:20
Inflow Volume:	3.34 (ACRE-FT)	Peak Storage:	1.83 (ACRE-FT)
Discharge Volume:	3.34 (ACRE-FT)	Peak Elevation:	2.2 (FT)



2 Year Storm Event

Global Summary



Global Summary Results for Run "3 Basin 2yr 24hr"

Project: ChicagoAve_updated Simulation Run: 3 Basin 2yr 24hr

Start of Run: 01Jan2000, 00:00
End of Run: 04Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Routed 3 Basins
Meteorologic Model: 3 Basin 2yr 24hr Post
Control Specifications: 72 hr

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
Pre Basin 1	0.0462	0.6	01Jan2000, 12:50	0.40
Pre Basin 2	0.0312	0.4	01Jan2000, 12:40	0.27
Pre Basin 3	0.0855	1.1	01Jan2000, 12:45	0.74
Post Basin 1	0.0462	2.6	01Jan2000, 13:30	0.59
Basin 1 Storage	0.0462	0.5	01Jan2000, 15:30	0.59
Post Basin 2	0.0312	1.7	01Jan2000, 13:30	0.40
Basin 2 Storage	0.0312	0.4	01Jan2000, 15:35	0.40
Post Basin 3	0.0855	4.4	01Jan2000, 13:30	1.10
Basin 3 Storage	0.0855	0.9	01Jan2000, 15:40	1.10

Basin 100 Results

Summary Results for Reservoir "Basin 1 Storage"

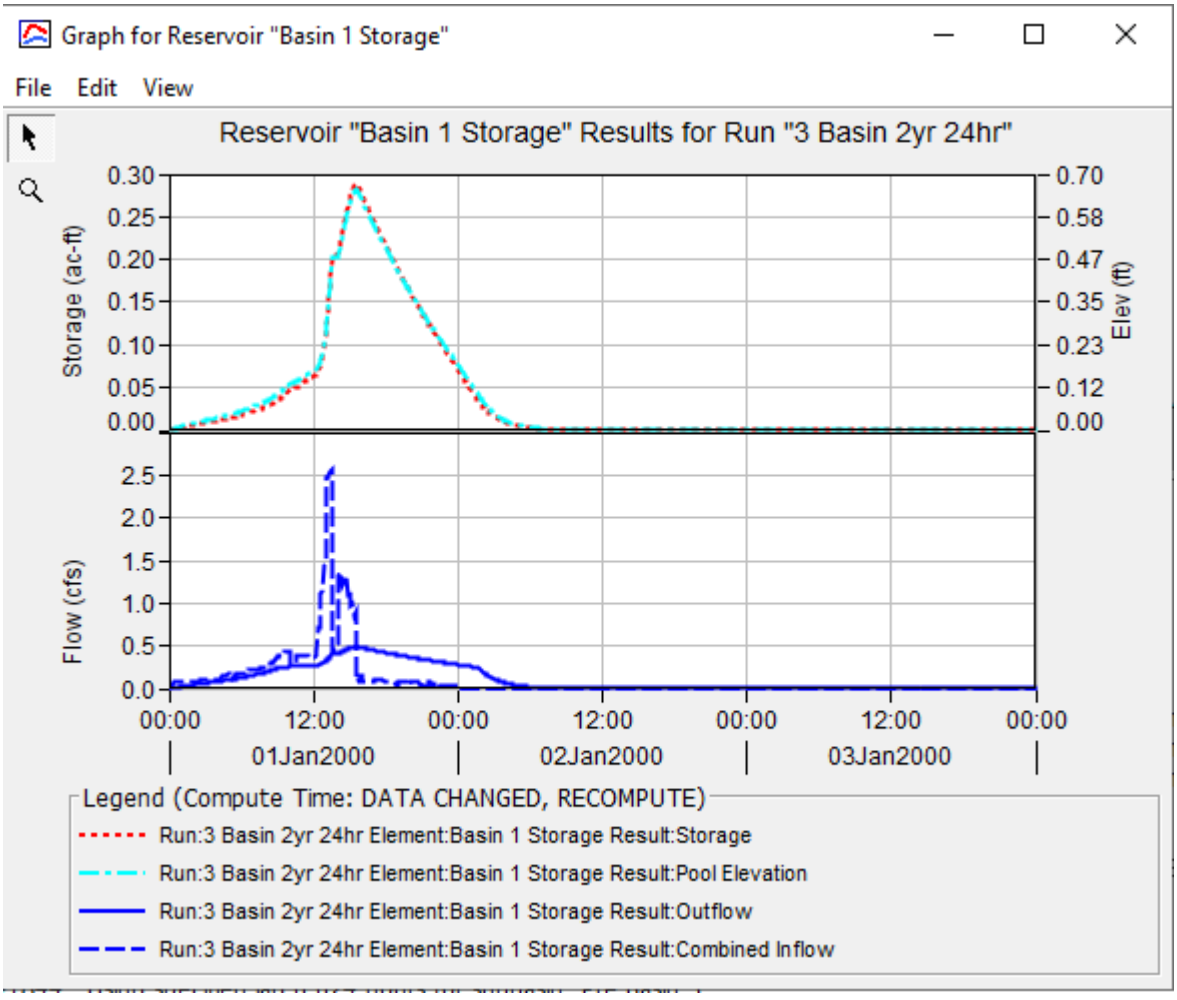
Project: ChicagoAve_updated Simulation Run: 3 Basin 2yr 24hr
Reservoir: Basin 1 Storage

Start of Run:	01Jan2000, 00:00	Basin Model:	Routed 3 Basins
End of Run:	04Jan2000, 00:00	Meteorologic Model:	3 Basin 2yr 24hr Post
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	72 hr

Volume Units: ○ IN ◉ ACRE-FT

Computed Results

Peak Inflow:	2.6 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 13:30
Peak Discharge:	0.5 (CFS)	Date/Time of Peak Discharge:	01Jan2000, 15:30
Inflow Volume:	0.59 (ACRE-FT)	Peak Storage:	0.29 (ACRE-FT)
Discharge Volume:	0.59 (ACRE-FT)	Peak Elevation:	0.7 (FT)



Basin 200 Results

Summary Results for Reservoir "Basin 2 Storage"

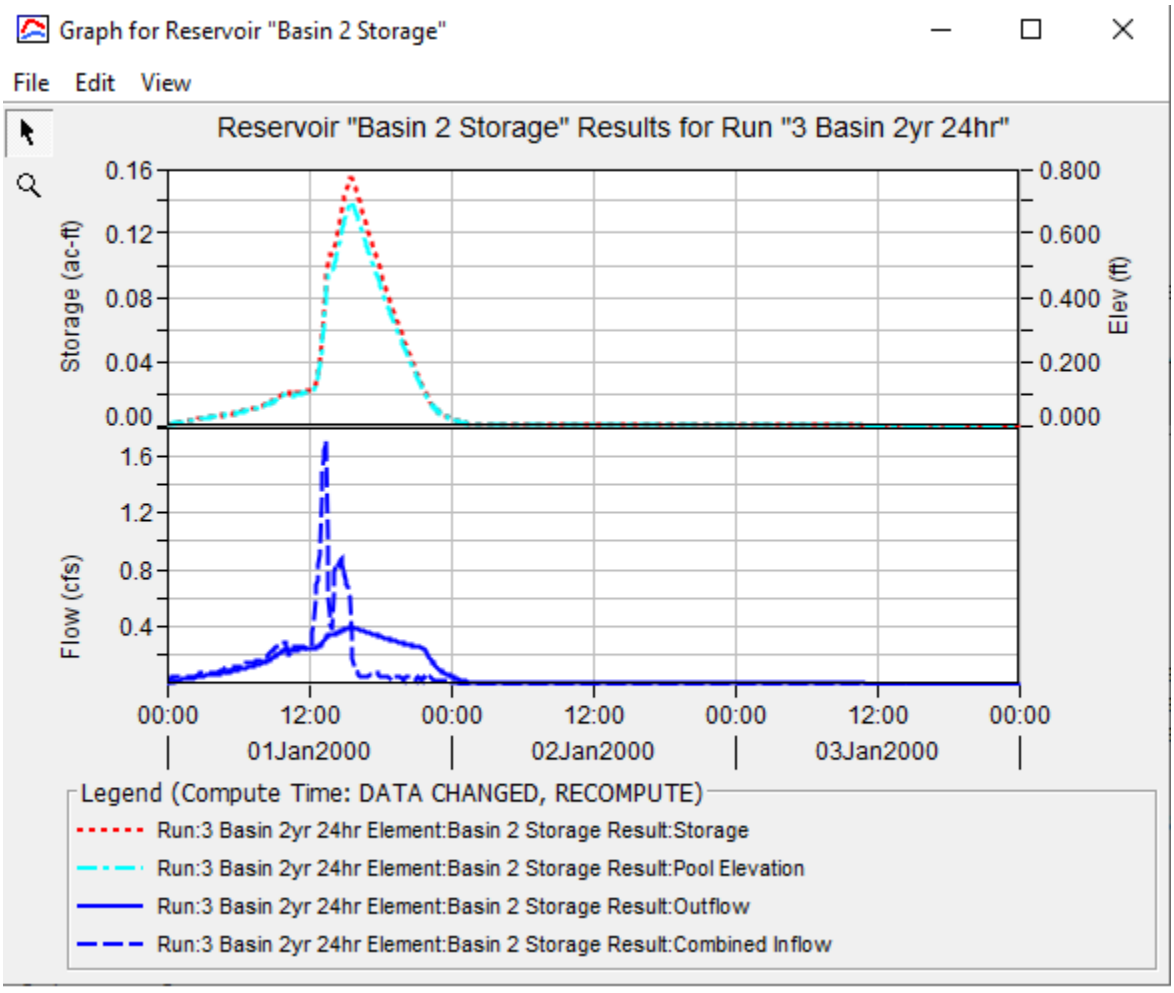
Project: ChicagoAve_updated Simulation Run: 3 Basin 2yr 24hr
Reservoir: Basin 2 Storage

Start of Run:	01Jan2000, 00:00	Basin Model:	Routed 3 Basins
End of Run:	04Jan2000, 00:00	Meteorologic Model:	3 Basin 2yr 24hr Post
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	72 hr

Volume Units: ○ IN ◉ ACRE-FT

Computed Results

Peak Inflow:	1.7 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 13:30
Peak Discharge:	0.4 (CFS)	Date/Time of Peak Discharge:	01Jan2000, 15:35
Inflow Volume:	0.40 (ACRE-FT)	Peak Storage:	0.15 (ACRE-FT)
Discharge Volume:	0.40 (ACRE-FT)	Peak Elevation:	0.7 (FT)



Basin 300 Results

Summary Results for Reservoir "Basin 3 Storage"

Project: ChicagoAve_updated Simulation Run: 3 Basin 2yr 24hr
Reservoir: Basin 3 Storage

Start of Run:	01Jan2000, 00:00	Basin Model:	Routed 3 Basins
End of Run:	04Jan2000, 00:00	Meteorologic Model:	3 Basin 2yr 24hr Post
Compute Time:	DATA CHANGED, RECOMPUTE	Control Specifications:	72 hr

Volume Units: ○ IN ◉ ACRE-FT

Computed Results

Peak Inflow:	4.4 (CFS)	Date/Time of Peak Inflow:	01Jan2000, 13:30
Peak Discharge:	0.9 (CFS)	Date/Time of Peak Discharge:	01Jan2000, 15:40
Inflow Volume:	1.10 (ACRE-FT)	Peak Storage:	0.61 (ACRE-FT)
Discharge Volume:	1.10 (ACRE-FT)	Peak Elevation:	0.8 (FT)

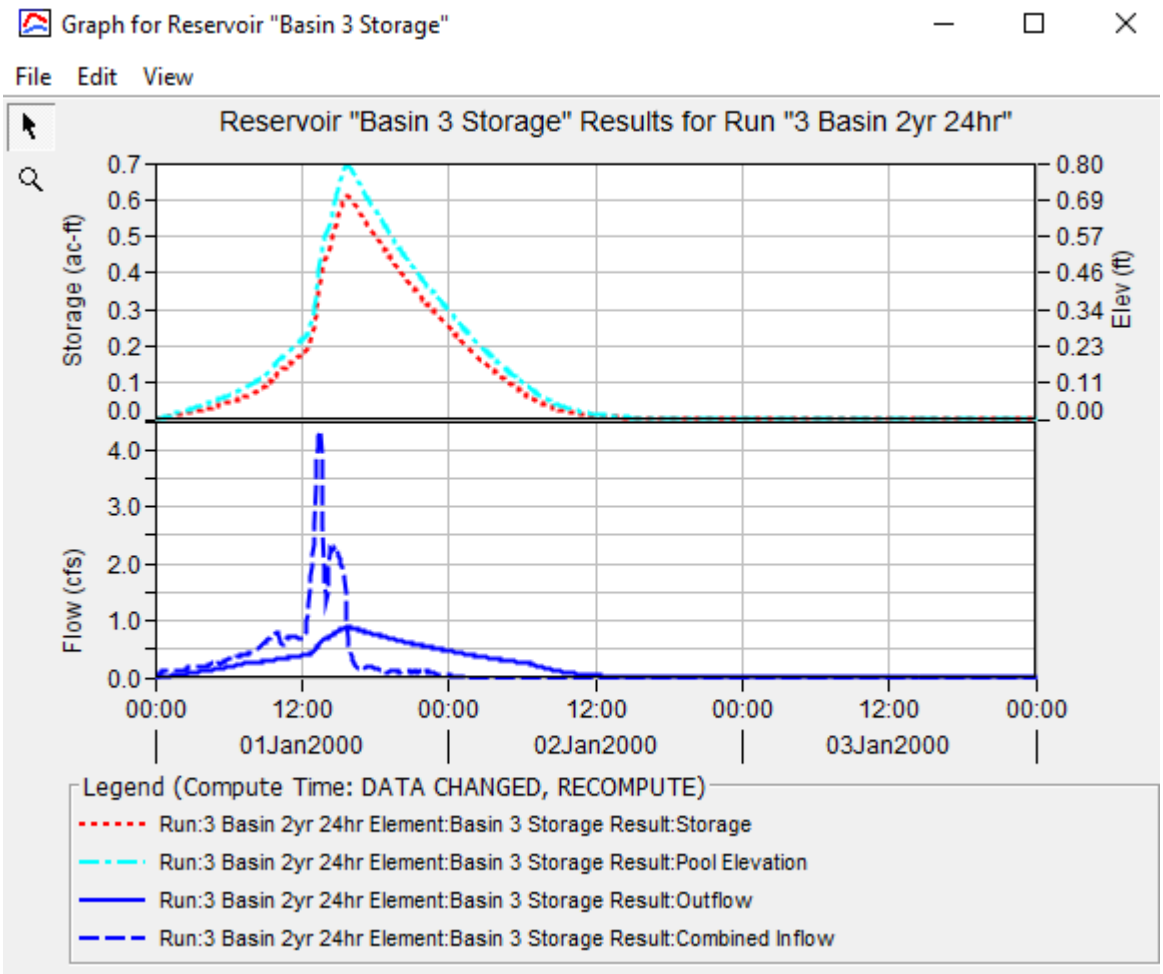


Table 4.1 - Detention Summary for the 10-Year and 2-year 24 Hour Storm Events

		Pre-Project Flow Rate (cfs)	Post-Project Flow Rate (Undetained) (cfs)	Post-Project Flow Rate (Detained) (cfs)	Post-Project Peak Storage (acre-feet)
Basin 100	2YR	0.6	2.6	0.5	0.29
	10 YR	4.2	6.5	4.0	0.99
Basin 200	2 YR	0.4	1.7	0.4	0.15
	10 YR	2.8	4.3	2.8	0.57
Basin 300	2 YR	1.1	4.4	0.9	0.61
	10 YR	7.7	11.4	7.0	1.83

Notes:

1. Peak Storages obtained from HEC-HMS. Outputs and RCFC Preprocessor inputs provided in appendix D.

A summary of the proposed basin storage is summarized in table 4.2 below.

Table 4.2 - Proposed Basin Summary

	Tributary Area (acre)	Minimum volume from 2-year, 24-hour storm event (Acre-feet)	Minimum volume from 10-year, 24-hour storm event (Acre-feet)	Provided Detention Volume (acre-feet)[1]
Basin 100	28.6	0.40	0.98	2.13
Basin 200	19.9	0.27	0.66	1.34
Basin 300	56.6	0.74	1.82	3.69

Notes:

1. Provided Detention Volume is calculated reserving 1 foot of freeboard depth within the proposed basin footprint.

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☑ A. On-site storm drain inlets	☐ Locations of inlets.	☑ Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.	☑ Maintain and periodically repaint or replace inlet markings. ☑ Provide stormwater pollution prevention information to new site owners, lessees, or operators. ☑ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com ☑ Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
☐ B. Interior floor drains and elevator shaft sump pumps		☐ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	☐ Inspect and maintain drains to prevent blockages and overflow.
☐ C. Interior parking garages		☐ State that parking garage floor drains will be plumbed to the sanitary sewer.	☐ Inspect and maintain drains to prevent blockages and overflow.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ **D1. Need for future indoor & structural pest control**		☐ **Note building design features that discourage entry of pests.**	☐ **Provide Integrated Pest Management information to owners, lessees, and operators.**
☑ **D2. Landscape/ Outdoor Pesticide Use**	☐ **Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained.** ☐ **Show self-retaining landscape areas, if any.** ☐ **Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)**	☑ **State that final landscape plans will accomplish all of the following.** ☑ **Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.** ☑ **Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.** ☑ **Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.** ☑ **Consider using pest-resistant plants, especially adjacent to hardscape.** ☑ **To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.**	☑ **Maintain landscaping using minimum or no pesticides.** ☑ **See applicable operational BMPs in "What you should know for…..Landscape and Gardening" at http://rcflood.org/stormwater/Downloads/LandscapeGardenBrochure.pdf** ☑ **Provide IPM information to new owners, lessees and operators.**

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☑ **E.** Pools, spas, ponds, decorative fountains, and other water features.	☑ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)	If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	☑ See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://rcflood.org/stormwater/
☐ **F.** Food service	☐ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ☐ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	☐ Describe the location and features of the designated cleaning area. ☐ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	☐ See the brochure, "The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at http://rcflood.org/stormwater/ Provide this brochure to new site owners, lessees, and operators.
☐ **G.** Refuse areas	☐ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ☐ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. ☐ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	☐ State how site refuse will be handled and provide supporting detail to what is shown on plans. ☐ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	State how the following will be implemented: ☐ Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ H. Industrial processes.	☐ Show process area.	☐ If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	☐ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at http://rcflood.org/stormwater/

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ I. Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)	☐ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area. ☐ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ☐ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with therequirements of Hazardous Materials Programs for: • Hazardous Waste Generation • Hazardous Materials Release Response and Inventory • California Accidental Release (CalARP) • Aboveground Storage Tank • Uniform Fire Code Article 80 Section 103(b) & (c) 1991 • Underground Storage Tank www.cchealth.org/groups/hazmat /	☐ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ J. Vehicle and Equipment Cleaning	☐ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shutoff to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	☐ If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ☐ Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/ ☐Car dealerships and similar may rinse cars with water only.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ **K. Vehicle/Equipment Repair and Maintenance**	☐ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater. ☐ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ☐ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	☐ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ☐ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ☐ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the Stormwater Control Plan, note that all of the following restrictions apply to use the site: ☐ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains. ☐ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ☐ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment. Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ L. Fuel Dispensing Areas	☐ Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable. ☐ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.		☐ The property owner shall dry sweep the fueling area routinely. ☐ See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

[6] The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ **M. Loading Docks**	☐ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. ☐ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ☐ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		☐ Move loaded and unloaded items indoors as soon as possible. ☐ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☐ N. Fire Sprinkler Test Water		☐ Provide a means to drain fire sprinkler test water to the sanitary sewer.	☐ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
☐ O. Miscellaneous Drain or Wash Water or Other Sources ☐ Boiler drain lines ☐ Condensate drain lines ☐ Rooftop equipment ☐ Drainage sumps ☑ Roofing, gutters, and trim. ☐ Other sources		☐ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☐ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☐ Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ☐ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ☑ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff. ☐ Include controls for other sources as specified by local reviewer.	

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Shown on WQMP Drawings	3 Permanent Controls—Listed in WQMP Table and Narrative	4 Operational BMPs—Included in WQMP Table and Narrative
☑ P. Plazas, sidewalks, and parking lots.			☑ Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Appendix 9: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

Not Applicable for Preliminary WQMP

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

3.5 Bioretention Facility

Type of BMP	LID – Bioretention
Treatment Mechanisms	Infiltration, Evapotranspiration, Evaporation, Biofiltration
Maximum Drainage Area	This BMP is intended to be integrated into a project's landscaped area in a distributed manner. Typically, contributing drainage areas to Bioretention Facilities range from less than 1 acre to a maximum of around 10 acres.
Other Names	Rain Garden, Bioretention Cell, Bioretention Basin, Biofiltration Basin, Landscaped Filter Basin, Porous Landscape Detention

Description

Bioretention Facilities are shallow, vegetated basins underlain by an engineered soil media. Healthy plant and biological activity in the root zone maintain and renew the macro-pore space in the soil and maximize plant uptake of pollutants and runoff. This keeps the Best Management Practice (BMP) from becoming clogged and allows more of the soil column to function as both a sponge (retaining water) and a highly effective and self-maintaining biofilter. In most cases, the bottom of a Bioretention Facility is unlined, which also provides an opportunity for infiltration to the extent the underlying onsite soil can accommodate. When the infiltration rate of the underlying soil is exceeded, fully biotreated flows are discharged via underdrains. Bioretention Facilities therefore will inherently achieve the maximum feasible level of infiltration and evapotranspiration and achieve the minimum feasible (but highly biotreated) discharge to the storm drain system.

Siting Considerations

These facilities work best when they are designed in a relatively level area. Unlike other BMPs, Bioretention Facilities can be used in smaller landscaped spaces on the site, such as:

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

Landscaped areas on the site (such as may otherwise be required through minimum landscaping ordinances), can often be designed as Bioretention Facilities. This can be accomplished by:

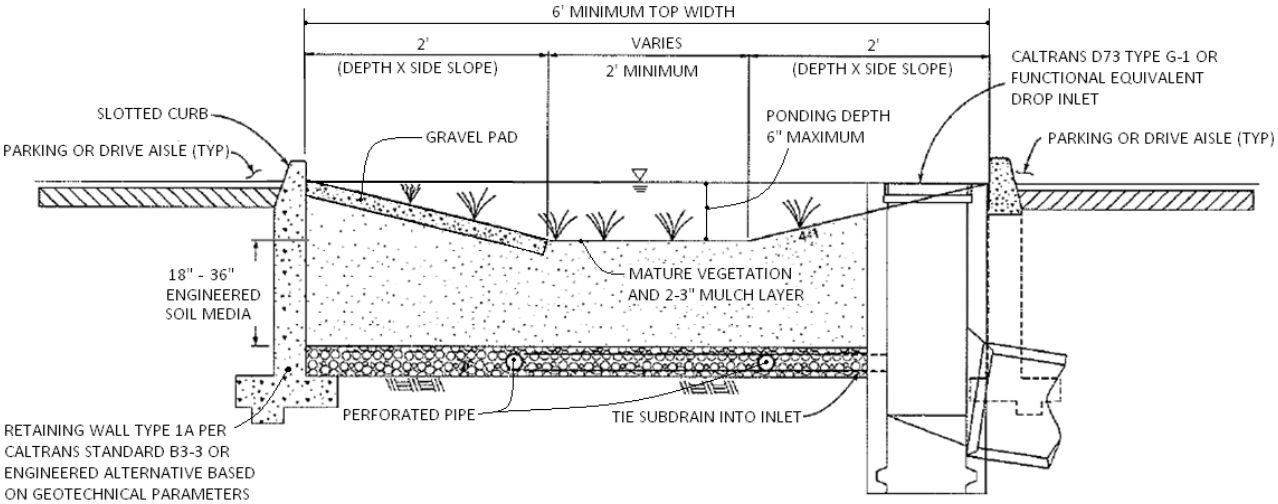
- *Depressing* landscaped areas below adjacent impervious surfaces, rather than elevating those areas
- Grading the site to direct runoff from those impervious surfaces *into* the Bioretention Facility, rather than away from the landscaping
- Sizing and designing the depressed landscaped area as a Bioretention Facility as described in this Fact Sheet

Bioretention Facilities should however not be used downstream of areas where large amounts of sediment can clog the system. Placing a Bioretention Facility at the toe of a steep slope should also be avoided due to the potential for clogging the engineered soil media with erosion from the slope, as well as the potential for damaging the vegetation.

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

- Vegetated area
- 18' minimum depth of engineered soil media
- 12' minimum gravel layer depth with 6' perforated pipes (added flow control features such as orifice plates may be required to mitigate for HCOC conditions)



While the 18-inch minimum engineered soil media depth can be used in some cases, it is recommended to use 24 inches or a preferred 36 inches to provide an adequate root zone for the chosen plant palate. Such a design also provides for improved removal effectiveness for nutrients. The recommended ponding depth inside of a Bioretention Facility is 6 inches; measured from the flat bottom surface to the top of the water surface as shown in Figure 1.

Because this BMP is filled with an engineered soil media, pore space in the soil and gravel layer is assumed to provide storage volume. However, several considerations must be noted:

- Surcharge storage above the soil surface (6 inches) is important to assure that design flows do not bypass the BMP when runoff exceeds the soil's absorption rate.
- In cases where the Bioretention Facility contains engineered soil media deeper than 36 inches, the pore space within the engineered soil media can only be counted to the 36-inch depth.
- A maximum of 30 percent pore space can be used for the soil media whereas a maximum of 40 percent pore space can be use for the gravel layer.

Figure 1: Standard Layout for a Bioretention Facility

Engineered Soil Media Requirements

The engineered soil media shall be comprised of 85 percent mineral component and 15 percent organic component, by volume, drum mixed prior to placement. The mineral component shall be a Class A sandy loam topsoil that meets the range specified in Table 1 below. The organic component shall be nitrogen stabilized compost[1], such that nitrogen does not leach from the media.

Table 1: Mineral Component Range Requirements

Percent Range	Component
70-80	Sand
15-20	Silt
5-10	Clay

The trip ticket, or certificate of compliance, shall be made available to the inspector to prove the engineered mix meets this specification.

Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways, Bioretention Facilities shall be planted with a combination of small trees, densely planted shrubs, and natural grasses. Grasses shall be native or ornamental; preferably ones that do not need to be mowed. The application of fertilizers and pesticides should be minimal. To maintain oxygen levels for the vegetation and promote biodegradation, it is important that vegetation not be completely submerged for any extended period of time. Therefore, a maximum of 6 inches of ponded water shall be used in the design to ensure that plants within the Bioretention Facility remain healthy.

A 2 to 3-inch layer of standard shredded aged hardwood mulch shall be placed as the top layer inside the Bioretention Facility. The 6-inch ponding depth shown in Figure 1 above shall be measured from the top surface of the 2 to 3-inch mulch layer.

Curb Cuts

To allow water to flow into the Bioretention Facility, 1-foot-wide (minimum) curb cuts should be placed approximately every 10 feet around the perimeter of the Bioretention Facility. Figure 2 shows a curb cut in a Bioretention Facility. Curb cut flow lines must be at or above the V_{BMP} water surface level.

[1] For more information on compost, visit the US Composting Council website at: http://compostingcouncil.org/

Figure 2: Curb Cut located in a Bioretention Facility

To reduce erosion, a gravel pad shall be placed at each inlet point to the Bioretention Facility. The gravel should be 1- to 1.5-inch diameter in size. The gravel should overlap the curb cut opening a minimum of 6 inches. The gravel pad inside the Bioretention Facility should be flush with the finished surface at the curb cut and extend to the bottom of the slope.

In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet. See Figure 3.

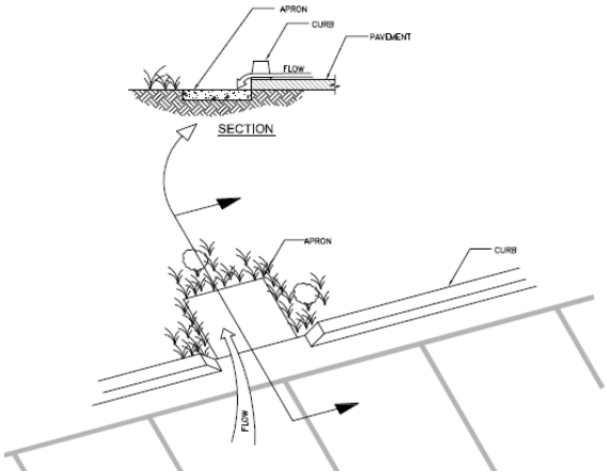


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

It is recommended that Bioretention Facilities be level. In the event the facility site slopes and lacks proper design, water would fill the lowest point of the BMP and then discharge from the basin without being treated. To ensure that the water will be held within the Bioretention Facility on sloped sites, the BMP must be terraced with nonporous check dams to provide the required storage and treatment capacity.

The terraced version of this BMP shall be used on non-flat sites with no more than a 3 percent slope. The surcharge depth cannot exceed 0.5 feet, and side slopes shall not exceed 4:1. Table 2 below shows the spacing of the check dams, and slopes shall be rounded up (i.e., 2.5 percent slope shall use 10' spacing for check dams).

Table 2: Check Dam Spacing

6" Check Dam Spacing	
Slope	**Spacing**
1%	*25'*
2%	*15'*
3%	*10'*

Roof Runoff

Roof downspouts may be directed towards Bioretention Facilities. However, the downspouts must discharge onto a concrete splash block to protect the Bioretention Facility from erosion.

Retaining Walls

It is recommended that Retaining Wall Type 1A, per Caltrans Standard B3-3 or equivalent, be constructed around the entire perimeter of the Bioretention Facility. This practice will protect the sides of the Bioretention Facility from collapsing during construction and maintenance or from high service loads adjacent to the BMP. Where such service loads would not exist adjacent to the BMP, an engineered alternative may be used if signed by a licensed civil engineer.

Side Slope Requirements

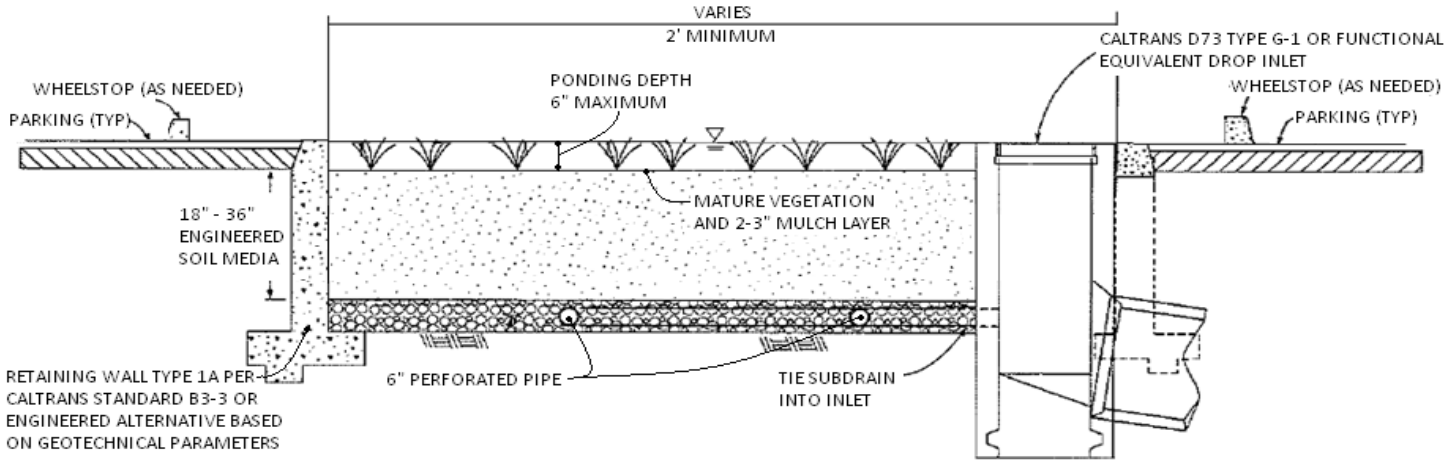
Bioretention Facilities Requiring Side Slopes

The design should assure that the Bioretention Facility does not present a tripping hazard. Bioretention Facilities proposed near pedestrian areas, such as areas parallel to parking spaces or along a walkway, must have a gentle slope to the bottom of the facility. Side slopes inside of a Bioretention Facility shall be 4:1. A typical cross section for the Bioretention Facility is shown in Figure 1.

Bioretention Facilities Not Requiring Side Slopes

Where cars park perpendicular to the Bioretention Facility, side slopes are not required. A 6-inch maximum drop may be used, and the Bioretention Facility must be planted with trees and shrubs to prevent pedestrian access. In this case, a curb is not placed around the Bioretention Facility,

but wheel stops shall be used to prevent vehicles from entering the Bioretention Facility, as shown in Figure 4.



Planter Boxes

Bioretention Facilities can also be placed above ground as planter boxes. Planter boxes must have a minimum width of 2 feet, a maximum surcharge depth of 6 inches, and no side slopes are necessary. Planter boxes must be constructed so as to ensure that the top surface of the engineered soil media will remain level. This option may be constructed of concrete, brick, stone or other stable materials that will not warp or bend. Chemically treated wood or galvanized steel, which has the ability to contaminate stormwater, should not be used. Planter boxes must be lined with an impermeable liner on all sides, including the bottom. Due to the impermeable liner, the inside bottom of the planter box shall be designed and constructed with a cross fall, directing treated flows within the subdrain layer toward the point where subdrain exits the planter box, and subdrains shall be oriented with drain holes oriented down. These provisions will help avoid excessive stagnant water within the gravel underdrain layer. Similar to the in-ground Bioretention Facility versions, this BMP benefits from healthy plants and biological activity in the root zone. Planter boxes should be planted with appropriately selected vegetation.

Figure 5: Planter Box
Source: LA Team Effort

Overflow

An overflow route is needed in the Bioretention Facility design to bypass stored runoff from storm events larger than V_{BMP} or in the event of facility or subdrain clogging. Overflow systems must connect to an acceptable discharge point, such as a downstream conveyance system as shown in Figure 1 and Figure 4. The inlet to the overflow structure shall be elevated inside the Bioretention Facility to be flush with the ponding surface for the design capture volume (V_{BMP}) as shown in Figure 4. This will allow the design capture volume to be fully treated by the Bioretention Facility, and for larger events to safely be conveyed to downstream systems. The overflow inlet shall **not** be located in the entrance of a Bioretention Facility, as shown in Figure 6.

Underdrain Gravel and Pipes

An underdrain gravel layer and pipes shall be provided in accordance with Appendix B – Underdrains.

Figure 6: Incorrect Placement of an Overflow Inlet.

Inspection and Maintenance Schedule

The Bioretention Facility area shall be inspected for erosion, dead vegetation, soggy soils, or standing water. The use of fertilizers and pesticides on the plants inside the Bioretention Facility should be minimized.

Schedule	Activity
Ongoing	• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities. • Remove trash and debris • Replace damaged grass and/or plants • Replace surface mulch layer as needed to maintain a 2-3 inch soil cover.
After storm events	• Inspect areas for ponding
Annually	• Inspect/clean inlets and outlets

Bioretention Facility Design Procedure

1) Enter the area tributary, A_T, to the Bioretention Facility.

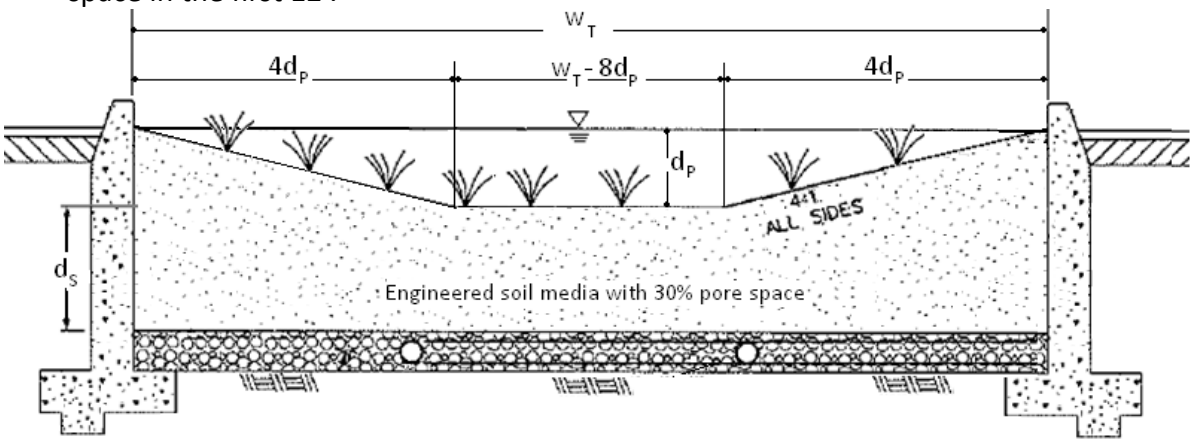
2) Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

3) Select the type of design used. There are two types of Bioretention Facility designs: the standard design used for most project sites that include side slopes, and the modified design used when the BMP is located perpendicular to the parking spaces or with planter boxes that do not use side slopes.

4) Enter the depth of the engineered soil media, d_S. The minimum depth for the engineered soil media can be 18' in limited cases, but it is recommended to use 24' or a preferred 36' to provide an adequate root zone for the chosen plant palette. Engineered soil media deeper than 36' will only get credit for the pore space in the first 36'.

5) Enter the top width of the Bioretention Facility.

6) Calculate the total effective depth, d_E, within the Bioretention Facility. The maximum allowable pore space of the soil media is 30% while the maximum allowable pore space for the gravel layer is 40%. Gravel layer deeper than 12' will only get credit for the pore space in the first 12'.



a. For the design with side slopes the following equation shall be used to determine the total effective depth. Where, d_P is the depth of ponding within the basin.

$$d_E(\text{ft}) = \frac{0.3 \times \left[\left(w_T(\text{ft}) \times d_S(\text{ft})\right) + 4\left(d_P(\text{ft})\right)^2\right] + 0.4 \times 1(\text{ft}) + d_P(\text{ft})\left[4d_P(\text{ft}) + \left(w_T(\text{ft}) - 8d_P(\text{ft})\right)\right]}{w_T(\text{ft})}$$

This above equation can be simplified if the maximum ponding depth of 0.5' is used. The equation below is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = (0.3 \times d_S(\text{ft}) + 0.4 \text{ x } 1(\text{ft})) - \left(\frac{0.7\ (\text{ft}^2)}{w_T(\text{ft})}\right) + 0.5(\text{ft})$$

b. For the design without side slopes the following equation shall be used to determine the total effective depth:

$$d_E(\text{ft}) = d_P(\text{ft}) + [(0.3) \times d_S(\text{ft}) + (0.4) \times 1(\text{ft})]$$

The equation below, using the maximum ponding depth of 0.5', is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = 0.5\ (\text{ft}) + [(0.3) \times d_S(\text{ft}) + (0.4) \times 1(\text{ft})]$$

7) Calculate the minimum surface area, A_M, required for the Bioretention Facility. This does not include the curb surrounding the Bioretention Facility or side slopes.

$$A_M(\text{ft}^2) = \frac{V_{BMP}(\text{ft}^3)}{d_E\ (\text{ft})}$$

8) Enter the proposed surface area. This area shall not be less than the minimum required surface area.

9) Verify that side slopes are no steeper than 4:1 in the standard design, and are not required in the modified design.

10) Provide the diameter, minimum 6 inches, of the perforated underdrain used in the Bioretention Facility. See Appendix B for specific information regarding perforated pipes.

11) Provide the slope of the site around the Bioretention Facility, if used. The maximum slope is 3 percent for a standard design.

12) Provide the check dam spacing, if the site around the Bioretention Facility is sloped.

13) Describe the vegetation used within the Bioretention Facility.

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Plaza and Sidewalk Cleaning SC-71

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. This fact sheet describes good housekeeping practices that can be incorporated into the municipality's existing cleaning and maintenance program.

Approach

Pollution Prevention

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).

Suggested Protocols

Surface Cleaning

- Regularly broom (dry) sweep sidewalk, plaza and parking lot areas to minimize cleaning with water.
- Dry cleanup first (sweep, collect, and dispose of debris and trash) when cleaning sidewalks or plazas, then wash with or without soap.
- Block the storm drain or contain runoff when cleaning with water. Discharge wash water to landscaping or collect water and pump to a tank or discharge to sanitary sewer if allowed. (Permission may be required from local sanitation district.)

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- Block the storm drain or contain runoff when washing parking areas, driveways or drive-throughs. Use absorbents to pick up oil; then dry sweep. Clean with or without soap. Collect water and pump to a tank or discharge to sanitary sewer if allowed. Street Repair and Maintenance.

Graffiti Removal

- Avoid graffiti abatement activities during rain events.
- Implement the procedures under Painting and Paint Removal in SC-70 Roads, Streets, and Highway Operation and Maintenance fact sheet when graffiti is removed by painting over.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a dirt or landscaped area after treating with an appropriate filtering device.
- Plug nearby storm drain inlets and vacuum/pump wash water to the sanitary sewer if authorized to do so if a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound). Ensure that a non-hazardous cleaning compound is used or dispose as hazardous waste, as appropriate.

Surface Removal and Repair

- Schedule surface removal activities for dry weather if possible.
- Avoid creating excess dust when breaking asphalt or concrete.
- Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up as much material as possible.
- Designate an area for clean up and proper disposal of excess materials.
- Remove and recycle as much of the broken pavement as possible to avoid contact with rainfall and stormwater runoff.
- When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet completely with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site.
- Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Wash water should be directed to landscaping or collected and pumped to the sanitary sewer if allowed.

Concrete Installation and Repair

- Schedule asphalt and concrete activities for dry weather.

- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place san bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- Protect applications of fresh concrete from rainfall and runoff until the material has dried.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.
- Clean parking lots on a regular basis with a street sweeper.

Training

- Provide regular training to field employees and/or contractors regarding surface cleaning and proper operation of equipment.
- Train employee and contractors in proper techniques for spill containment and cleanup.
- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Limitations related to sweeping activities at large parking facilities may include current sweeper technology to remove oil and grease.
- Surface cleaning activities that require discharges to the local sewering agency will require coordination with the agency.
- Arrangements for disposal of the swept material collected must be made, as well as accurate tracking of the areas swept and the frequency of sweeping.

Requirements

Costs

- The largest expenditures for sweeping and cleaning of sidewalks, plazas, and parking lots are in staffing and equipment. Sweeping of these areas should be incorporated into street sweeping programs to reduce costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Community education, such as informing residents about their options for recycling and waste disposal, as well as the consequences of littering, can instill a sense of citizen responsibility and potentially reduce the amount of maintenance required by the municipality.

Additional BMPs that should be considered for parking lot areas include:

- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Structural BMPs such as storm drain inlet filters can be very effective in reducing the amount of pollutants discharged from parking facilities during periods of rain.

References and Resources

Bay Area Stormwater Management Agencies Association (BASMAA). 1996. Pollution From Surface Cleaning Folder http://www.basmaa.org

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

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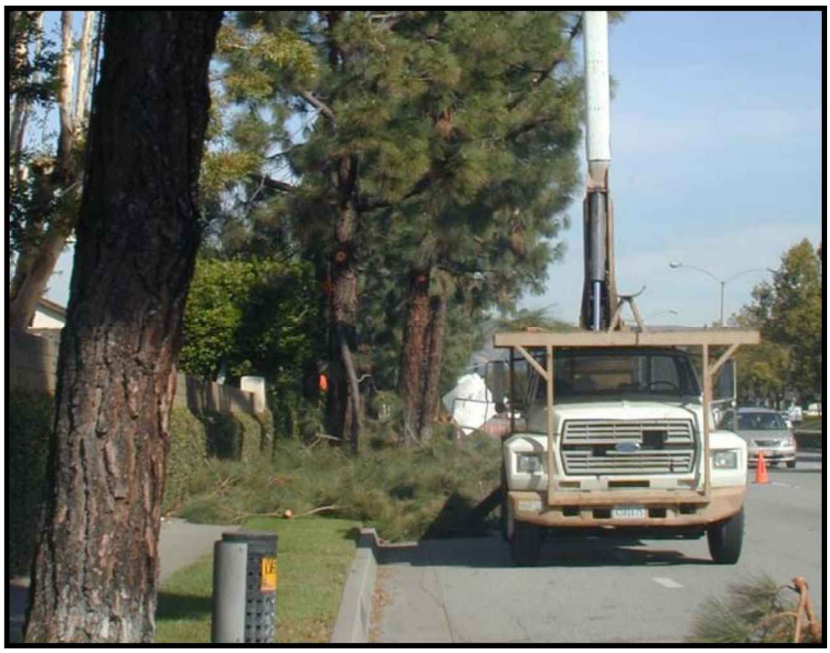
Landscape Maintenance SC-73



Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	☑

Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

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- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.
- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.
- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.
- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.
- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a know in location
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.
- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.
- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program http://www.ocwatersheds.com/StormWater/swp_introduction.asp

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

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Hydraulic Analysis Report for Goldenstar Creek

RICK Job No. 19427
December 29, 2022
Revised: May 8, 2024

RICK

HYDRAULIC ANALYSIS REPORT
FOR
GOLDENSTAR CREEK

RICK Job No. 19427

-DRAFT-

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December 29, 2022
Revised: May 8, 2024

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HYDRAULIC ANALYSIS
FOR
GOLDENSTAR CREEK

REVISION PAGE

May 8, 2024

This report presents revisions to the December 29, 2022 report pursuant to the emailed response c comments received as part of the 1st plan check review by Riverside County Flood Control and Water Conservation District on the Hydraulic Analysis for Goldenstar Creek. Responses by Rick Engineering are shown below **in bold.**

1. Per the provided cross-sections in the hydraulic report, it looks like there are multiple areas where grading is proposed within or very near to the creek. Due to the project's proximity to the floodplain and per our erosion hazard setback requirements for minor watercourses, with a 100-year flowrate less than 500 cfs, the setback shall be a minimum of 25 feet from the limits of the 100-year water surface elevation. Should you wish to build within the erosion hazard setback area, adequate scour protection such as riprap revetment shall be provided and shown on future exhibits. If proposing to armor the watercourse or channel banks, they shall be publicly maintained. Any such facility shall meet District standards including required maintenance access roads.
   o An erosion hazard zone can be defined as an area where erosion may potentially result in damage to a resource. A "resource" may be inclusive of private or public houses, buildings, apartments, fences, utilities, infrastructure, or other feature of appreciable value**.**

   Noted. Grading is not proposed in the 100-yr flood extents and no "resources" are proposed to be put in the erosion hazard zone.

2. Although the Hydraulic Report was adequate to address some of our concerns regarding the basin location and floodplain limits. In order to provide appropriate future administration of County Ordinance No. 458, the following items shall be submitted to the District for review and approval: a. A floodplain analysis consisting of HEC-RAS calculations, cross sections, maps, reports, and other data prepared to the satisfaction of the District for the purpose of revising the effective SFHA limits. b. Exhibits showing the pre-development and post-development SFHA limits. All hydrologic and hydraulic models, maps and mapping data must be submitted electronically to the District for review and approval.

Noted. The proposed and existing SFHA limits have been included on the hydraulic workmap included in Appendix 2. Electronic copies of the hydraulic models have been included as attachments. Hydrologic backup information for offsite bypass and onsite systems in included in the Drainage Study and Hydrologic backup information for Goldenstar Creek is included in Appendix 4 of the Hydraulic Analysis.

3. The proposed basins on Lot C and D should be revised to meet our LID Handbook requirements (https://rcwatershed.org/permittees/riverside-county-lid-bmp-handbook/#93-98-1-lid-bmp-design-handbook). The embankment side slopes proposed for Lot C and D are both shown as 2:1 slopes which is not acceptable for embankments constructed from fill and should be no steeper than 4:1.

   Basins have been revised to meet LID handbook requirements with 4:1 side slopes. See Appendix 6 of the WQMP for additional information.

4. The inlet structures for both proposed culverts beneath Chicago Ave and Street "E" shall be redesigned to meet the width of the 100-year floodplain limits upstream of the culvert crossings. This will adequately collect and funnel all flows into the proposed culverts. This redesign may increase the disturbed area within the creek.

   Noted. Culvert inlet structure design has been revised to adequately collect and funnel all flows into the proposed culverts.

5. Maintenance access ramps down to the inlet and outlet structures of both culverts should also be shown on any future submittals. Please provide information regarding the operation and maintenance of any proposed flood control facilities including basins and culverts. Adding the maintenance access may also increase the disturbed area within the creek.

   Maintenance access has been provided and will be included in future submittals.

INTRODUCTION

This report presents the hydrologic and hydraulic analysis of the future single-family development Arroyo Vista project. The project site is located north of Van Buren Boulevard on Iris Avenue, west of Chicago Ave, and south of Gentian Avenue in the County of Riverside, California. The site is approximately 140.8 acres. This area incorporates all onsite areas, including the portions of the creek that run through the site. The total offsite tributary area to the outlet of the site is approximately 335 acres. The Vicinity Map shown below as Figure 1 displays the location of the Development.

The reach of the waterbody referred to as Goldenstar Creek by the Santa Ana Regional Water Quality Control Board included in this study extends from the eastern site boundary to the northwestern, where it confluences with a larger unnamed drainage from the north. The primary purpose of this preliminary hydraulic analysis is to assess potential impacts to the water surface elevations within the Goldenstar Creek as a result of the project improvements and to size drainage structures for road crossings. The project has prepared and compared the results of the pre-project and post-project hydraulic capacity ("capacity run") hydraulic models for the project-specific reach of the Goldenstar Creek.

This document includes a summary of the hydrologic information for the site and hydraulic analysis of the proposed improvements adjacent to and across the channel. The calculations included in this document demonstrate the performance of the channel under conditions reflective of the proposed changes in comparison to the existing channel condition.

Design History

It is understood that the Goldenstar Creek in the vicinity of the Chicago Ave project area has historically been agricultural use and has remained undeveloped. The creek drops approximately 125 vertical feet along approximately 3,400 linear feet of channel through the project. Large rock outcroppings are visible via aerial imagery along the side slopes and bottom of the existing creek.

Topography

The topographic information used to develop the hydraulic model within the Chicago Ave Improvements is based project specific topography on the NVD-29 vertical datum developed from an aerial survey conducted by Rick Engineering Company. Cross sections for this hydraulic analysis were created using this topography for existing conditions. Cross sections for proposed conditions were created using this topography combined with project improvement grading elevations.

HYDROLOGIC DATA

Existing and proposed hydrologic calculations for the pre-project and post-project conditions have been conducted in the separate report titled “Drainage Study for Arroyo Vista,” dated May 8, 2024 (and any subsequent versions thereafter) prepared by Rick Engineering Company (Job Number 19427). Contributing offsite flows were also analyzed, resulting in a total tributary area of 335 acres and a peak 100-year flow rate at the end of the downstream project boundary of approximately 534 cubic feet per second (cfs) in the proposed condition. This area includes three flow paths entering the site on the eastern boundary and one flow path entering from the southern boundary. Offsite tributary flows associated with the project location confluence with Goldenstar Creek in both the existing and proposed condition before draining to the northwest corner. The peak flow rate in the Goldenstar Creek used for hydraulic analysis is relatively unchanged between existing and proposed conditions. Post-project Hydrology Maps and hydrologic calculations utilized for the Goldenstar Creek hydraulic model have been provided in Appendix 4.

HYDRAULIC ANALYSIS

The GeoHECRAS computer modeling software was used as a supplemental tool to help build the hydraulic model and the HEC-RAS v.6.2 computer program was used (as the main engine) to execute the hydraulic calculations. The HEC-RAS program is intended for calculating water surface elevations (WSELs) and velocities for supercritical, subcritical,

and mixed flow regimes in natural or man-made channels. The effects of the various obstructions such as culverts may be considered in the computations.

Analyses have been performed to determine the hydraulic characteristics of the existing and proposed conditions within the project-specific reach of Goldenstar Creek.

Manning's n Values

Manning's n-values for the model were based on observations of the channel condition upstream supplemented with site visits performed by Rick Engineering staff. The overbanks consist of light vegetation with many boulder sections. The bottom of the channel contains heavy vegetation with a few marshy habitats. Supporting photos of the channel in the existing condition are included as Appendix 1. The Manning's n value assigned to the cross-sections for hydraulic analysis as specified in the table below are considered to be reflective of a heavily vegetated condition to determine a conservative water surface elevation to check the freeboard provided for the proposed infrastructure and structures.

At this point, it is not known if or where onsite environmental mitigation areas would be proposed in the channel. It is anticipated that if environmental mitigation areas were to be designated in the future, the hydraulic analyses would not need to be revised as the Manning's n value used for the analysis reflects a condition where vegetation would not be cleared or mowed, consistent with an unmaintained channel bottom and/or environmental mitigation area.

Table 1 - Modeled Manning's "n" Values

	"Capacity Condition" Manning's n
Location	
Channel banks and bottom	0.15
Overbanks	0.15

Model Extents and Boundary Conditions

In effort to determine the impacts of proposed improvements of the Arroyo Vista development, the HEC-RAS model extends approximately 200 linear feet upstream of the eastern boundary of the proposed development. To determine the upstream starting water surface elevation, the initial cross section water surface elevation is determined via a normal depth calculation based on a slope of 0.03.

The downstream limit of the model terminates just upstream of the confluence of Goldenstar Creek and a larger tributary from the northeast of the site. To determine the downstream water surface elevation, a normal depth calculation based on a slope of 0.01 is assigned as a boundary condition. The limit of the model is sufficiently downstream to establish the water surface elevation throughout the project. The extent of the analysis is considered to be sufficient to estimate the water surface elevation and velocity through the project area and determine if there are impacts to upstream properties.

Existing Condition Model

The existing condition model reflects the most recently surveyed channel configuration and is intended to study the existing configuration of the portion of Goldenstar Creek running through the project.

a. Existing ***Condition Model – Capacity***

HEC-RAS Files:

The following HEC-RAS files reflect the Existing Capacity Condition hydraulic model for Goldenstar Creek at Arroyo Vista. It includes roughness values that reflect a heavily vegetated and unmaintained state of the channel, as presented by Table 1:

	File:	Title:
Project:	19427_TTLC.prj	19427_TTLC
Plan:	19427_TTLC.p02	Existing_Capacity
Geometry:	19427_TTLC.g02	Existing_Capacity
Flow:	19427_TTLC.f02	Goldenstar - Flow

Proposed Condition Models

The following models were created for design purposes where the adjacent banks have been redefined at varying side slopes and includes the proposed road crossings via culverts.

b. Proposed Condition Model –Capacity

HEC-RAS Files:

The following HEC-RAS files reflect the Proposed Capacity Condition hydraulic model for Goldenstar Creek at Arroyo Vista. It includes roughness values that reflect a heavily vegetated and unmaintained state of the channel, as presented by Table 1. The results of this model may be used to check the capacity of the channel.:

	File:	Title:
Project:	19427_TTLC.prj	19427_TTLC
Plan:	19427_TTLC.p05	Proposed_Capacity_Box
Geometry:	19427_TTLC.g05	Proposed _Capacity_Box
Flow:	19427_TTLC.f01	Goldenstar - Flow_Proposed_Undetained

HYDRAULIC RESULTS

As previously discussed, hydraulic models were created in the GeoHECRAS modeling software and the HEC-RAS v.6.2 program was used to evaluate the hydraulic impacts to Goldenstar Creek of the proposed improvements. The resulting 100-year storm event model output may be found in Appendix 3.

Freeboard

For the channel span adjacent to the proposed development, the minimum amount of freeboard protecting the adjacent properties is approximately 6.5 feet at cross section 4284. The proposed culvert crossings at river stations 4215 and 2159 are not overtopped and have a minimum amount of freeboard of approximately 4 feet and 5 feet, respectively.

Riprap Sizing

Tractive forces and velocities should be considered to determine the minimum riprap size with final design of the culverts and proposed slopes within the floodplain.

Downstream Impacts

Upon comparison of the existing and proposed models, the average channel velocity and WSE downstream of the proposed project is unchanged during the 100 year storm event. Therefore no adverse effects due to the proposed channel improvements are anticipated to the downstream channel from a hydraulic standpoint.

Upstream Impacts

The results of the Proposed Capacity Condition Model indicate that there would be a maximum increase to the water surface elevation of approximately 3.5 feet to the existing water surface elevation at the cross-section 4284 during a 100-year storm event. The proposed condition flow regime matches with the existing condition flow regime at cross-section 4453. The resulting change in water surface elevation does not impact existing upstream structures. Therefore, no adverse effects due to the proposed channel improvements are anticipated to the upstream channel from a hydraulic standpoint.

CONCLUSION

This report presents a hydraulic analysis for a reach of the Goldenstar Creek in support of the proposed Arroyo Vista development project. The HEC-RAS v.6.2 computer program was used (as the main engine) to execute the hydraulic calculations. A maximum increase to water surface elevation of approximately 3.5 feet is indicated by this analysis located within the project reach due to the proposed improvements, specifically the upstream culvert crossing. No adverse effects due to the proposed channel improvements are anticipated to the upstream or downstream channel from a hydraulic standpoint. Freeboard along the banks adjacent to the channel is anticipated to be in excess of 5 feet, and no overtopping is anticipated of the proposed culverts or the proposed pads.

Appendix 1

HEC-RAS Backup Information

Image Date: 1/26/2022

Existing Channel Photos – Arroyo Vista
JN 19427

Image Date: 1/26/2022

Existing Channel Photos – Arroyo Vista
JN 19427

Image Date: 1/26/2022

Existing Channel Photos – Arroyo Vista
JN 19427

Image Date: 1/16/2015

Existing Channel Photos – Arroyo Vista
JN 19427

Image Date: 1/16/2015

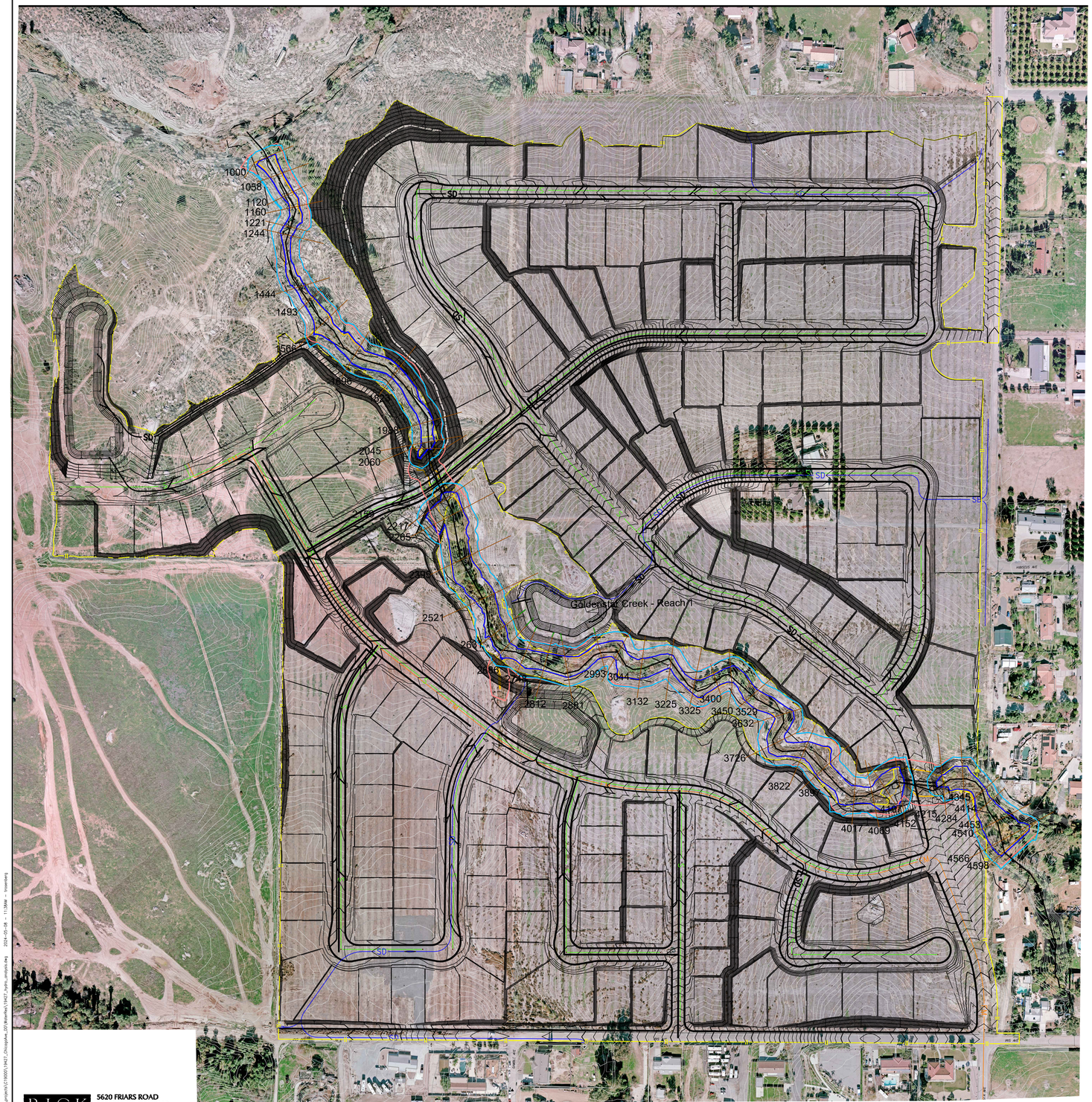
Existing Channel Photos – Arroyo Vista
JN 19427

Image Date: 1/16/2015

Existing Channel Photos – Arroyo Vista
JN 19427

Appendix 2

HEC-RAS Workmap



LEGEND:

- DWR AWARDNESS FLOODPLAIN
- APPROXIMATE HEC-RAS 100-YEAR FLOODPLAIN
- APPROXIMATE HEC-RAS 100-YEAR PRE-PROJECT FLOODPLAIN
- HEC-RAS CROSS SECTION
- CHANNEL BANK STATION
- APPROXIMATE PRE-PORJECT HEC-RAS100-YEAR FLOODPLAIN 25 FT OFFSET
- APPROXIMATE HEC-RAS 100-YEAR FLOODPLAIN 25 FT OFFSET
- PROPOSED GRADING DAYLIGHT LINE
- INEFFECTIVE FLOW AREA

N

150 75 0 150 300 450

GRAPHIC SCALE: 1"=150'

RICK ENGINEERING COMPANY
5620 FRIARS ROAD
SAN DIEGO, CA 92110
619.291.0707
(FAX)619.291.4165

HYDRAULIC MAP FOR ARROYO VISTA PRELIMINARY ENGINEERING

(PRE & POST-PROJECT)

J-19427

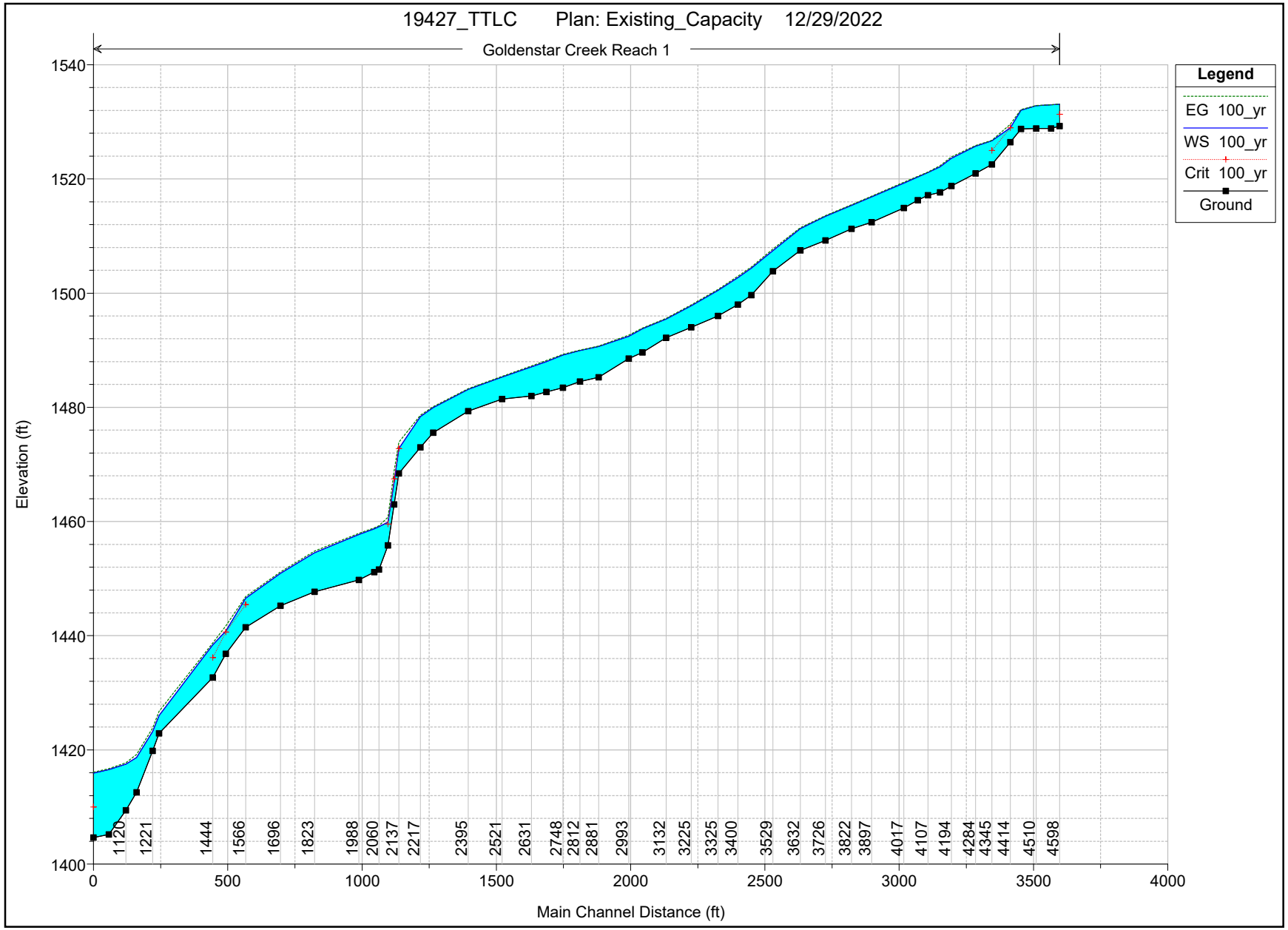
DATE: 02/12/2022
REVISED: 05/08/2024

© 2024 Rick Engineering Company

NOT FOR CONSTRUCTION – EXHIBIT FOR DRAINAGE STUDY REPORT ONLY

Appendix 3

HEC-RAS Output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Goldenstar Creek Reach 1
Legend
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WS 100_yr
Crit 100_yr
Ground
Elevation (ft)
Main Channel Distance (ft)
1540
1520
1500
1480
1460
1440
1420
1400
0
500
1000
1500
2000
2500
3000
3500
4000
1120
1221
1444
1566
1696
1823
1988
2060
2137
2217
2395
2521
2631
2748
2812
2881
2993
3132
3225
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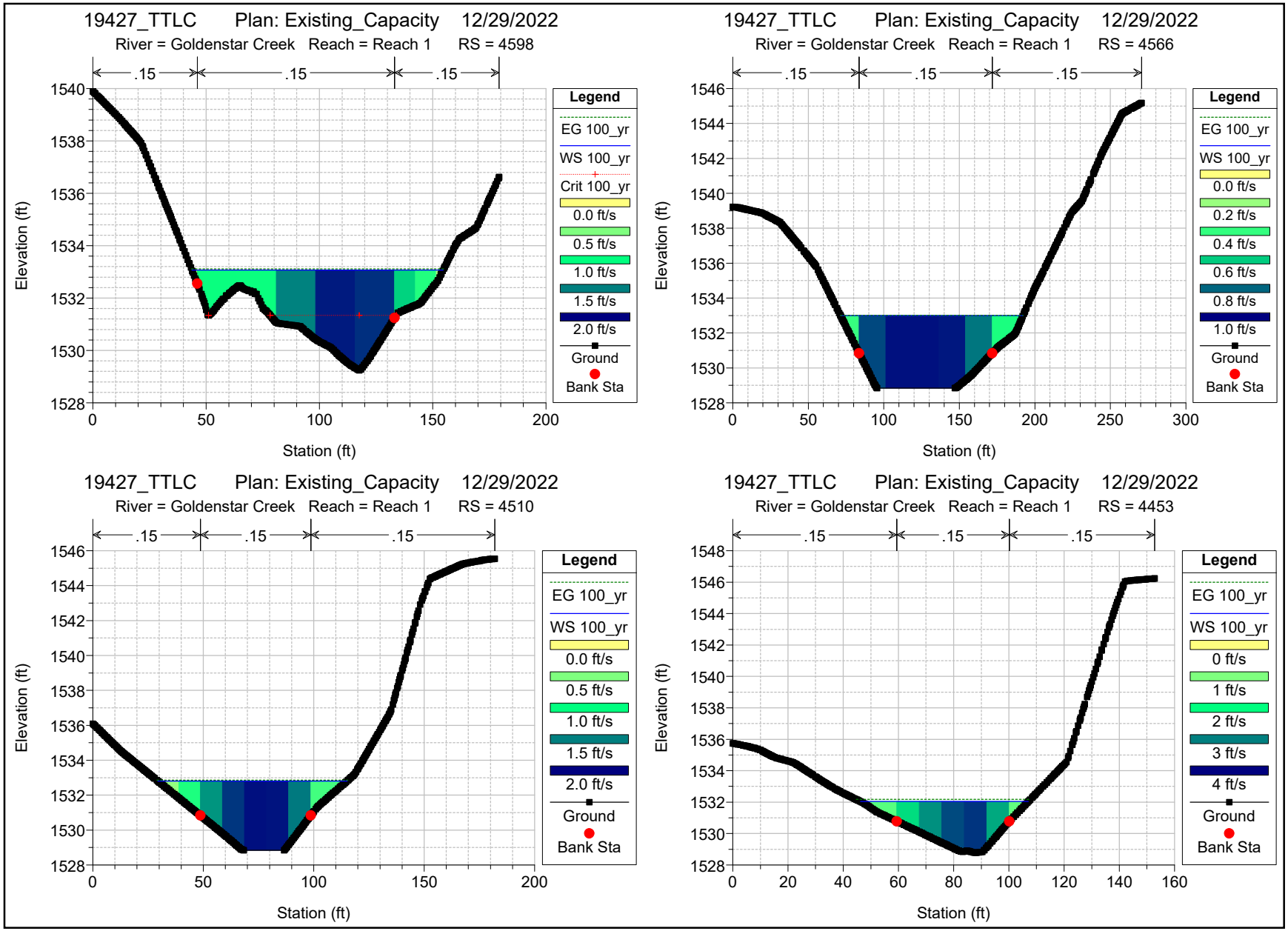
4510
4598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.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 4566
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 4510
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 4453
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
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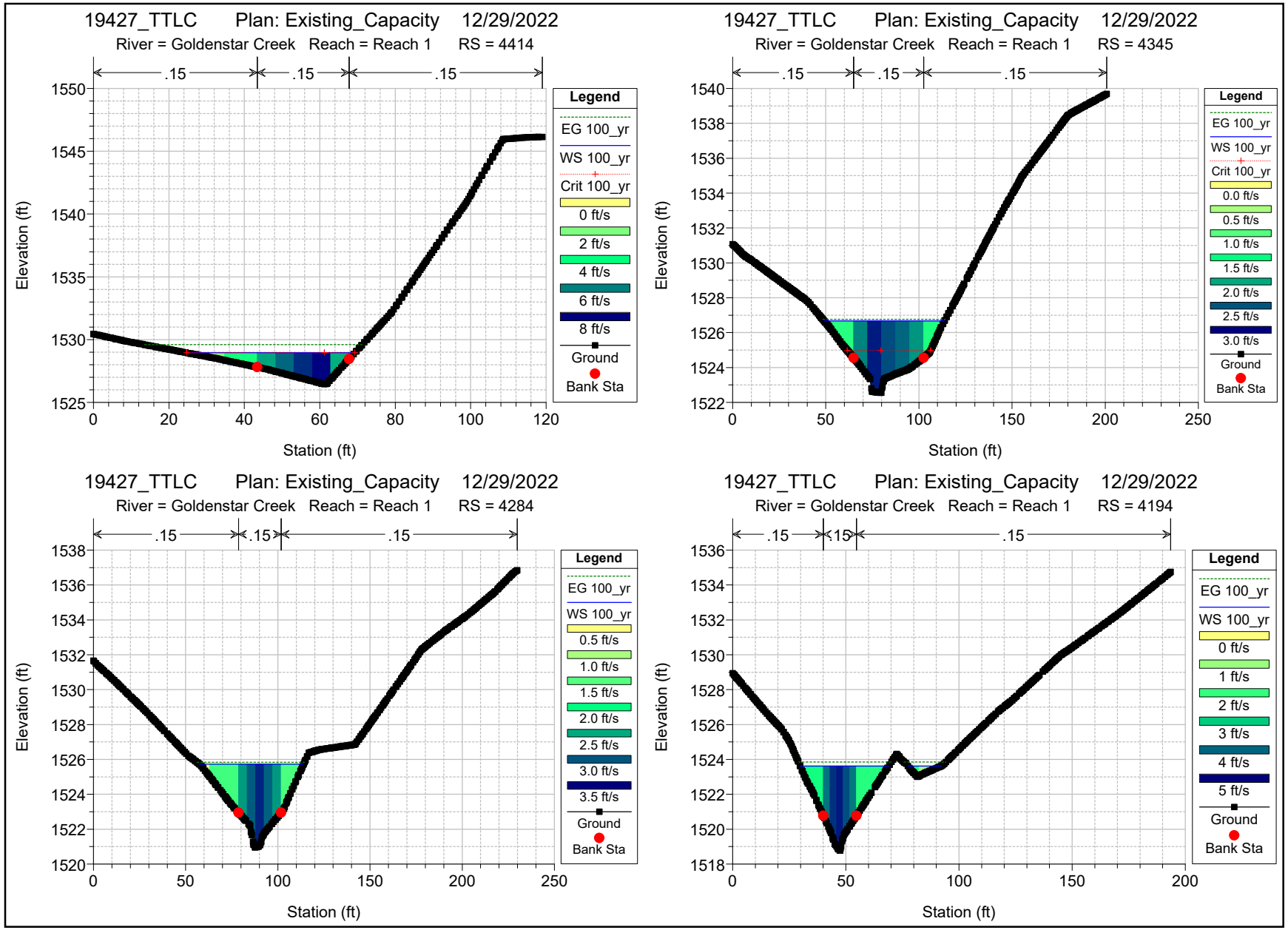
4 ft/s
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
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River = Goldenstar Creek Reach = Reach 1 RS = 4345
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Elevation (ft)
Station (ft)
Legend
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WS 100_yr
Crit 100_yr
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0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta
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Station (ft)
Legend
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2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
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River = Goldenstar Creek Reach = Reach 1 RS = 4194
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
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WS 100_yr
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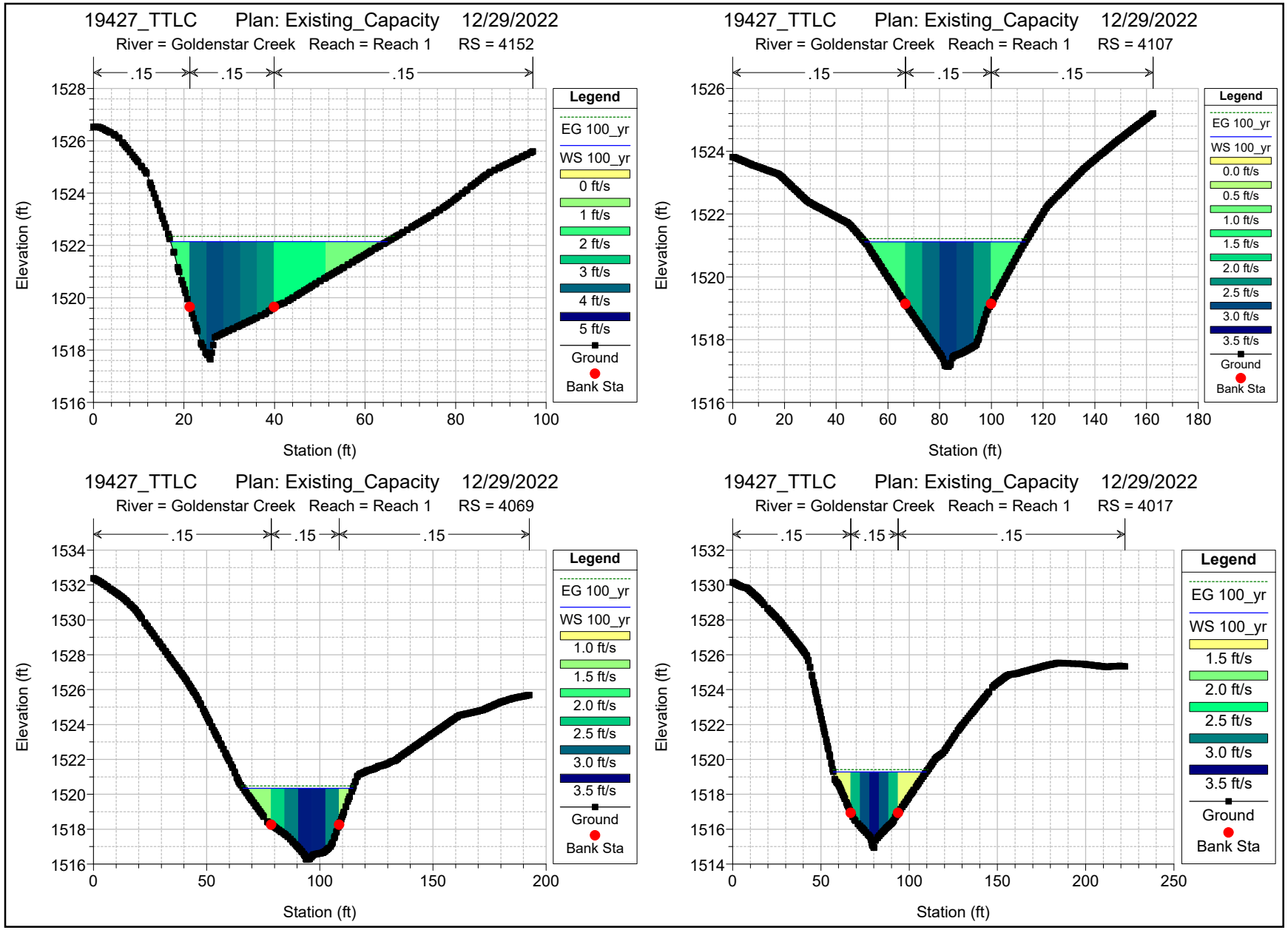
4 ft/s
5 ft/s
Ground
Bank Sta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Station (ft)
Legend
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WS 100_yr
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1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
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Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
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0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 4069
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
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River = Goldenstar Creek Reach = Reach 1 RS = 4017
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
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WS 100_yr
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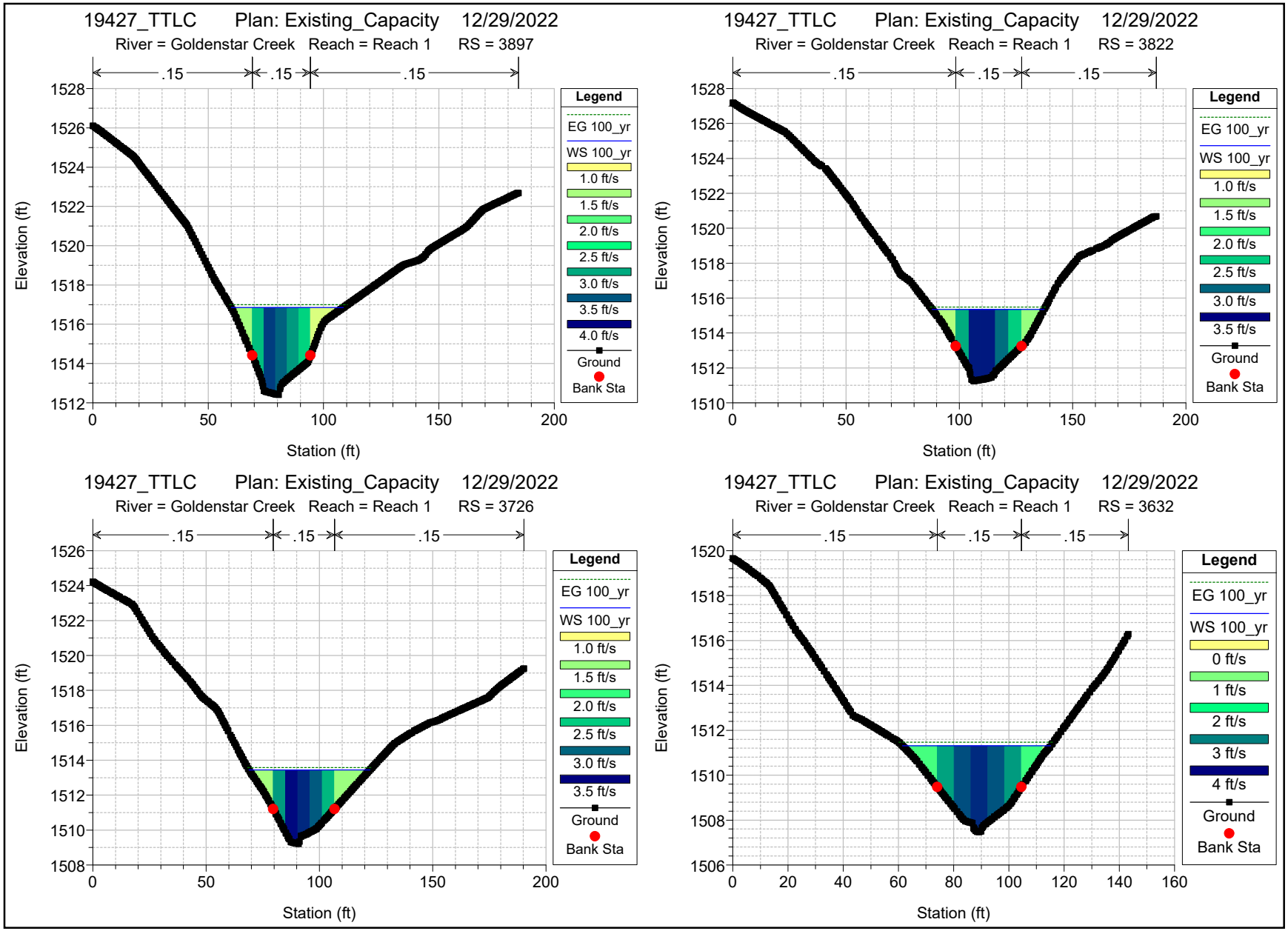
3.5 ft/s
Ground
Bank Sta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4.0 ft/s
Ground
Bank Sta
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.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
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2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
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River = Goldenstar Creek Reach = Reach 1 RS = 3726
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
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WS 100_yr
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2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
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.15 .15 .15
Elevation (ft)
Station (ft)
Legend
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WS 100_yr
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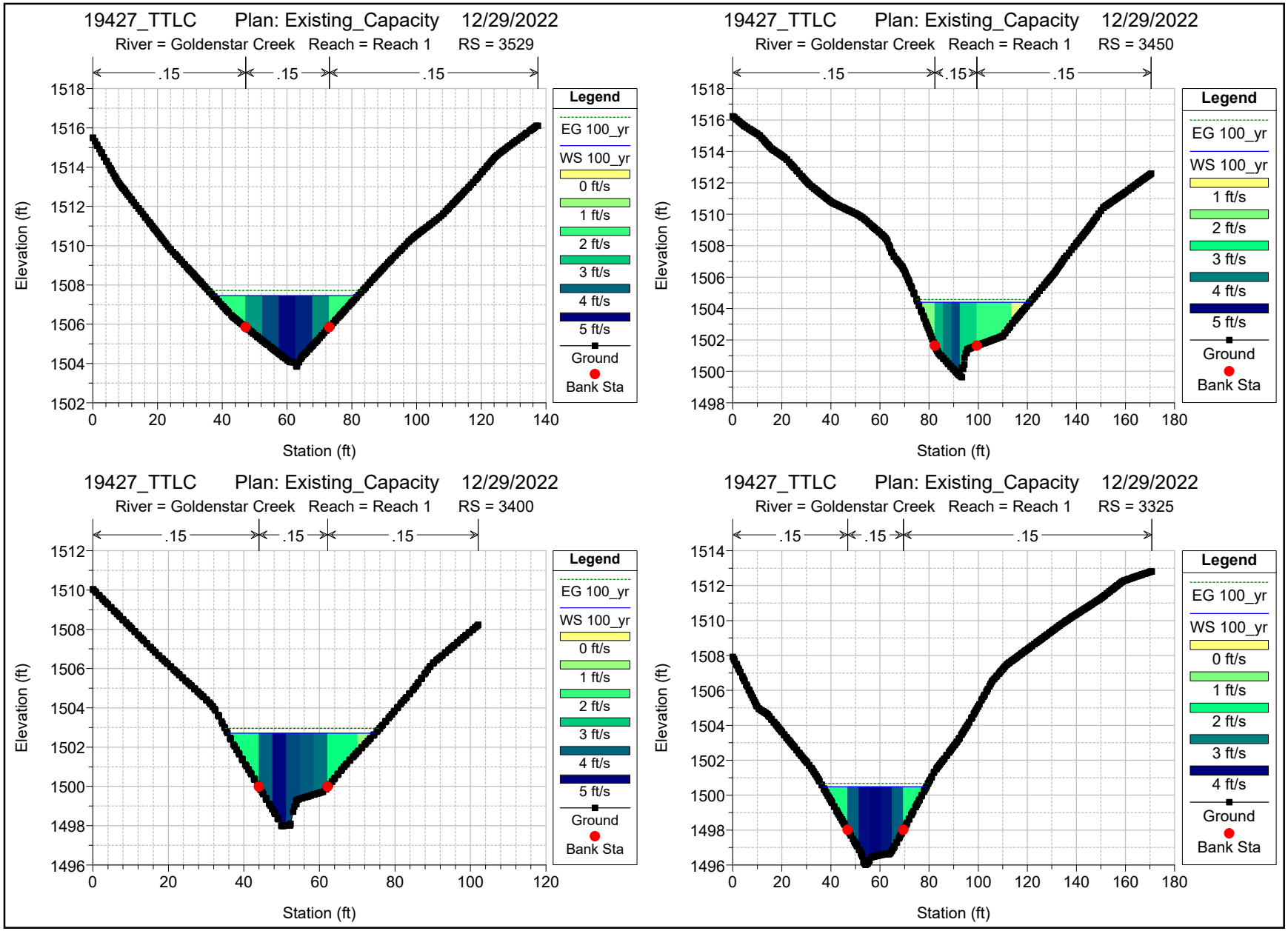
4 ft/s
Ground
Bank Sta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Legend
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WS 100_yr
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3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 3450
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
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Station (ft)
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Ground
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Station (ft)
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WS 100_yr
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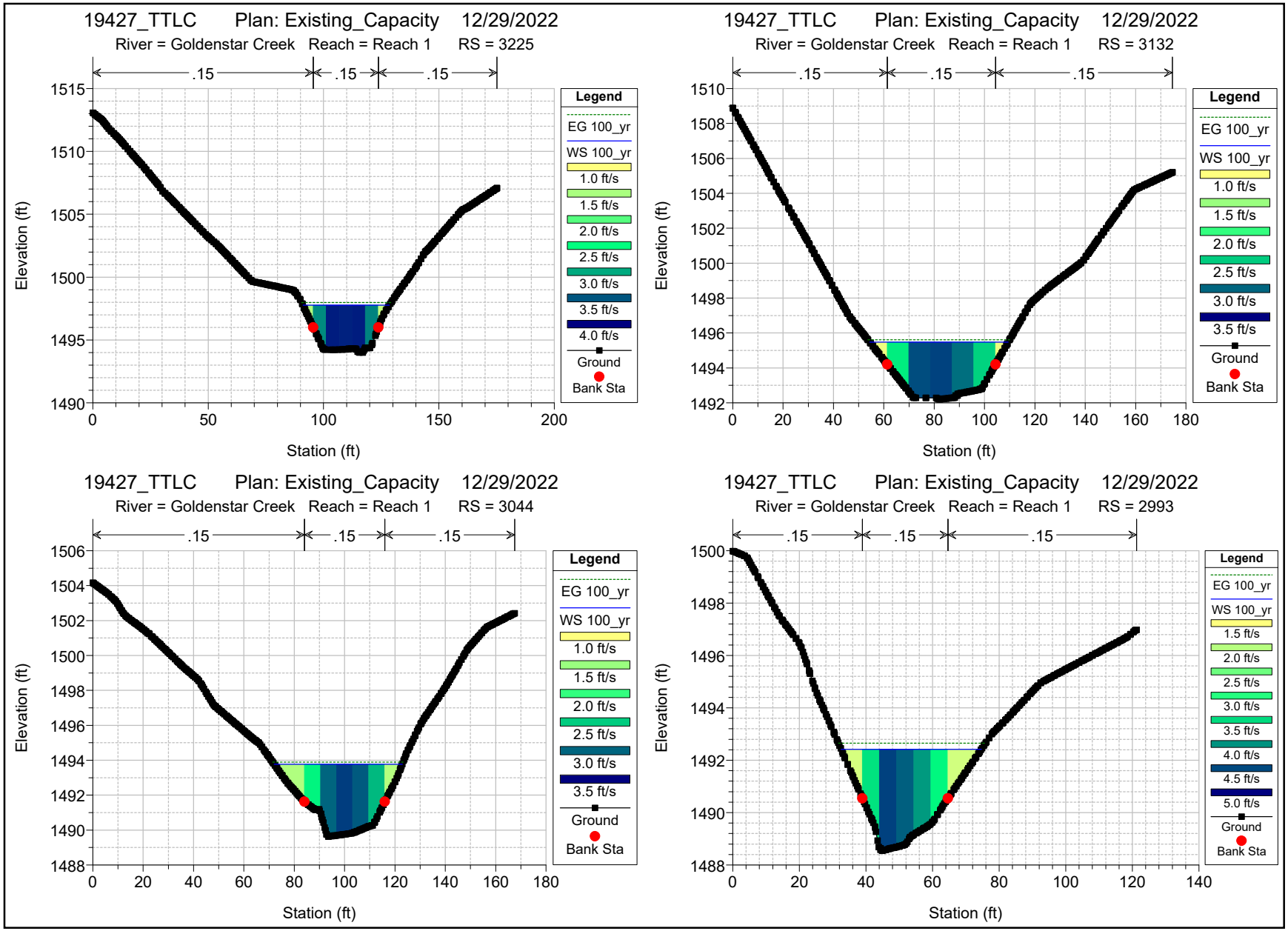
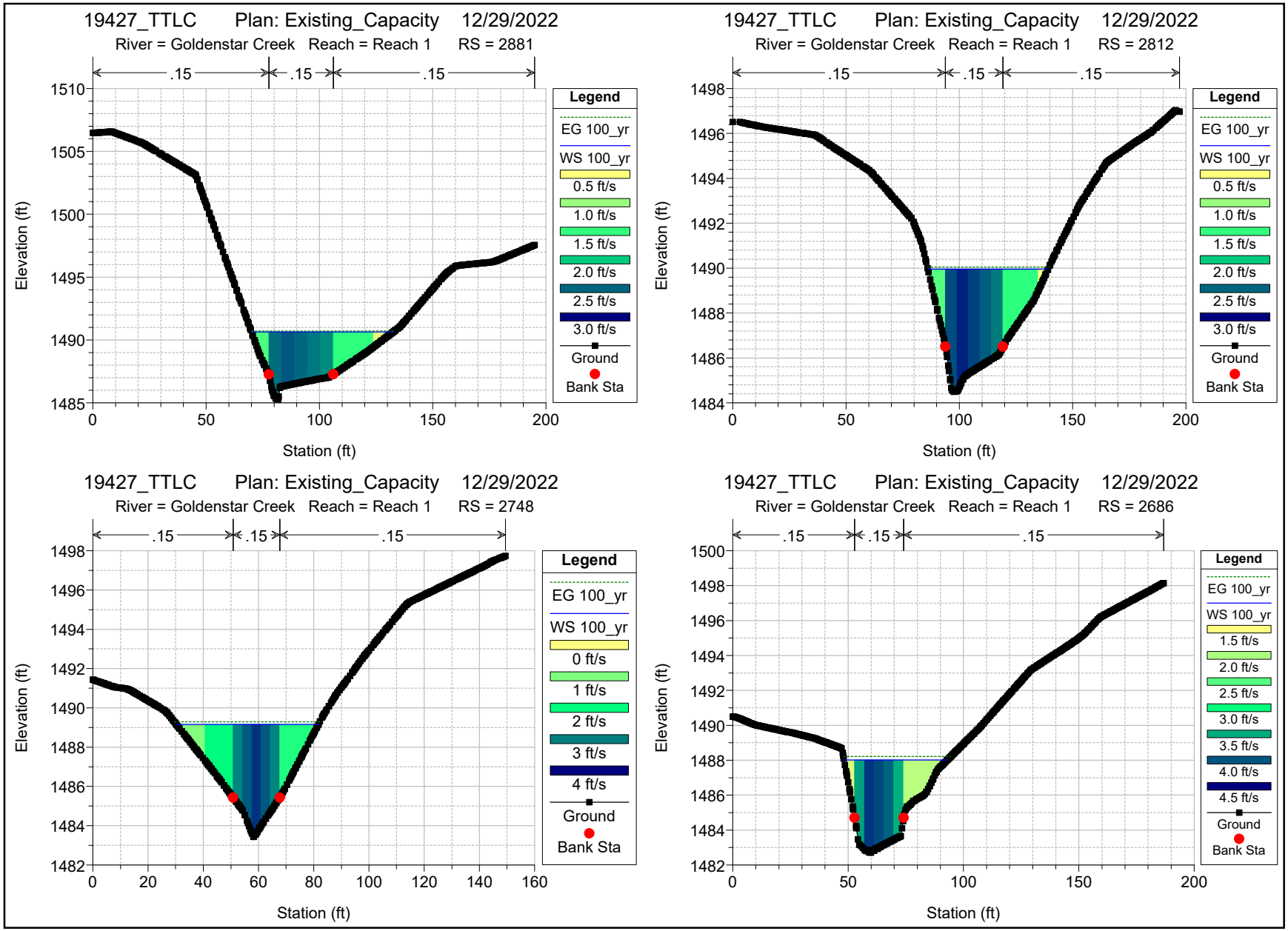
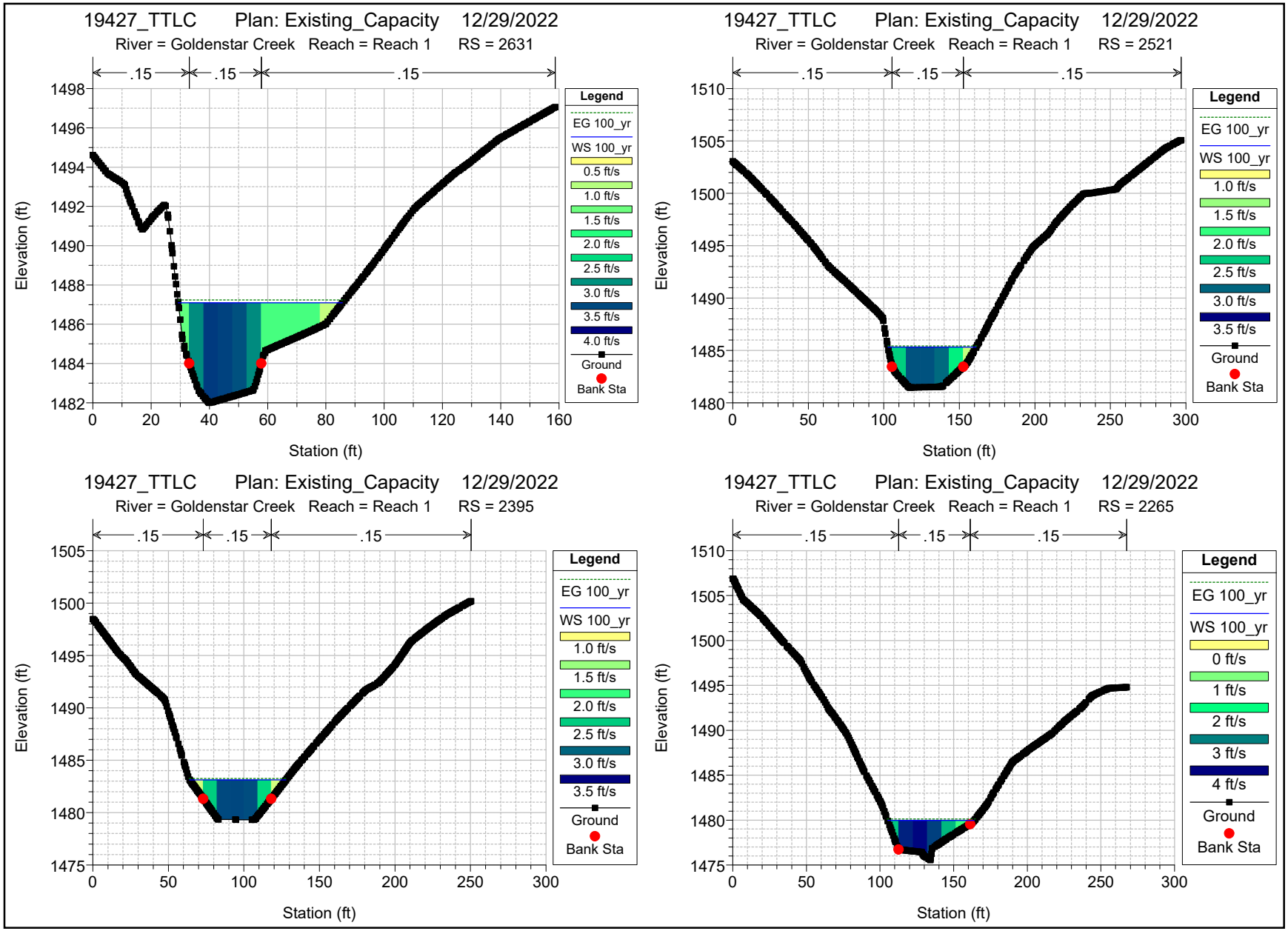
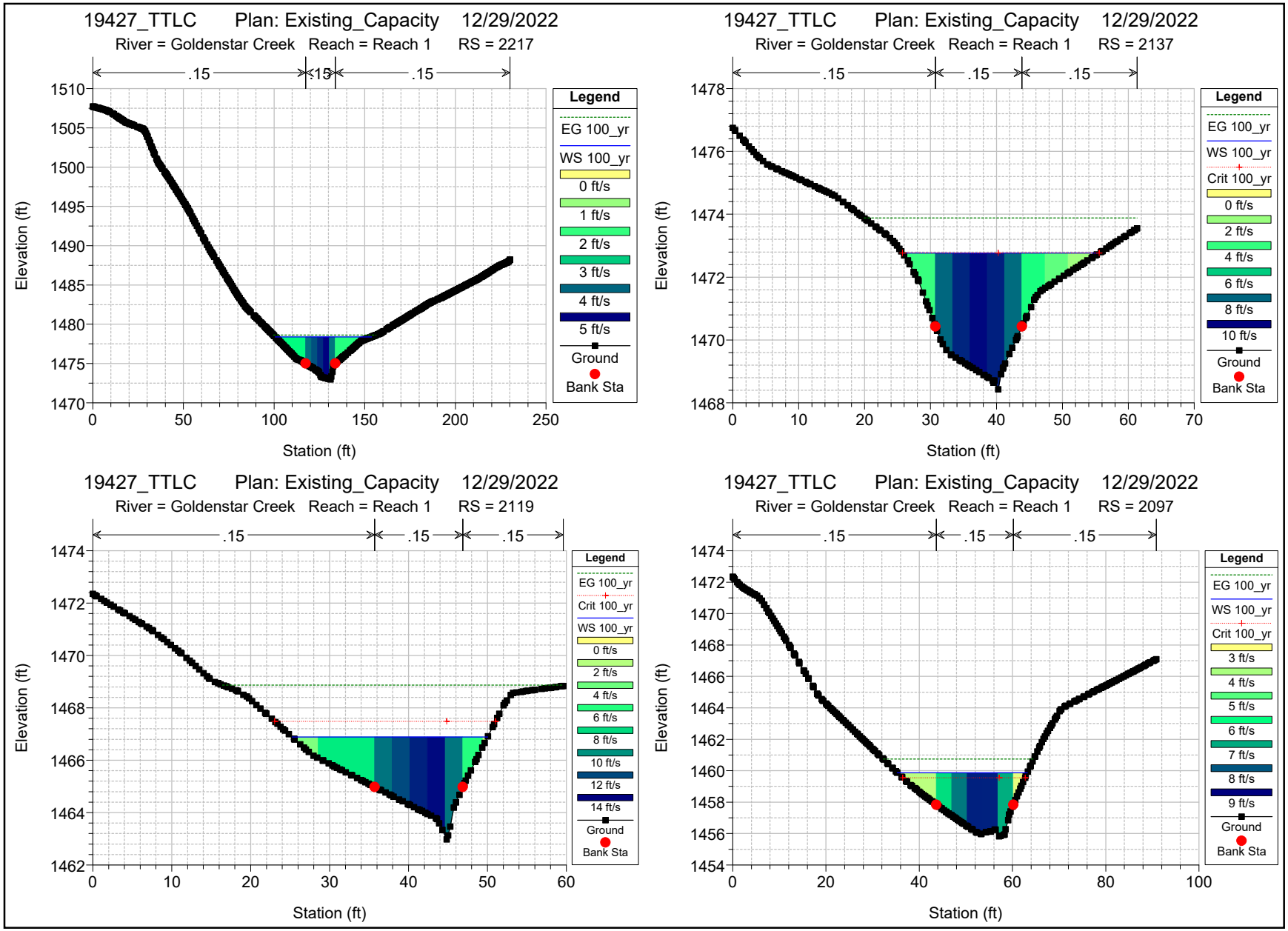
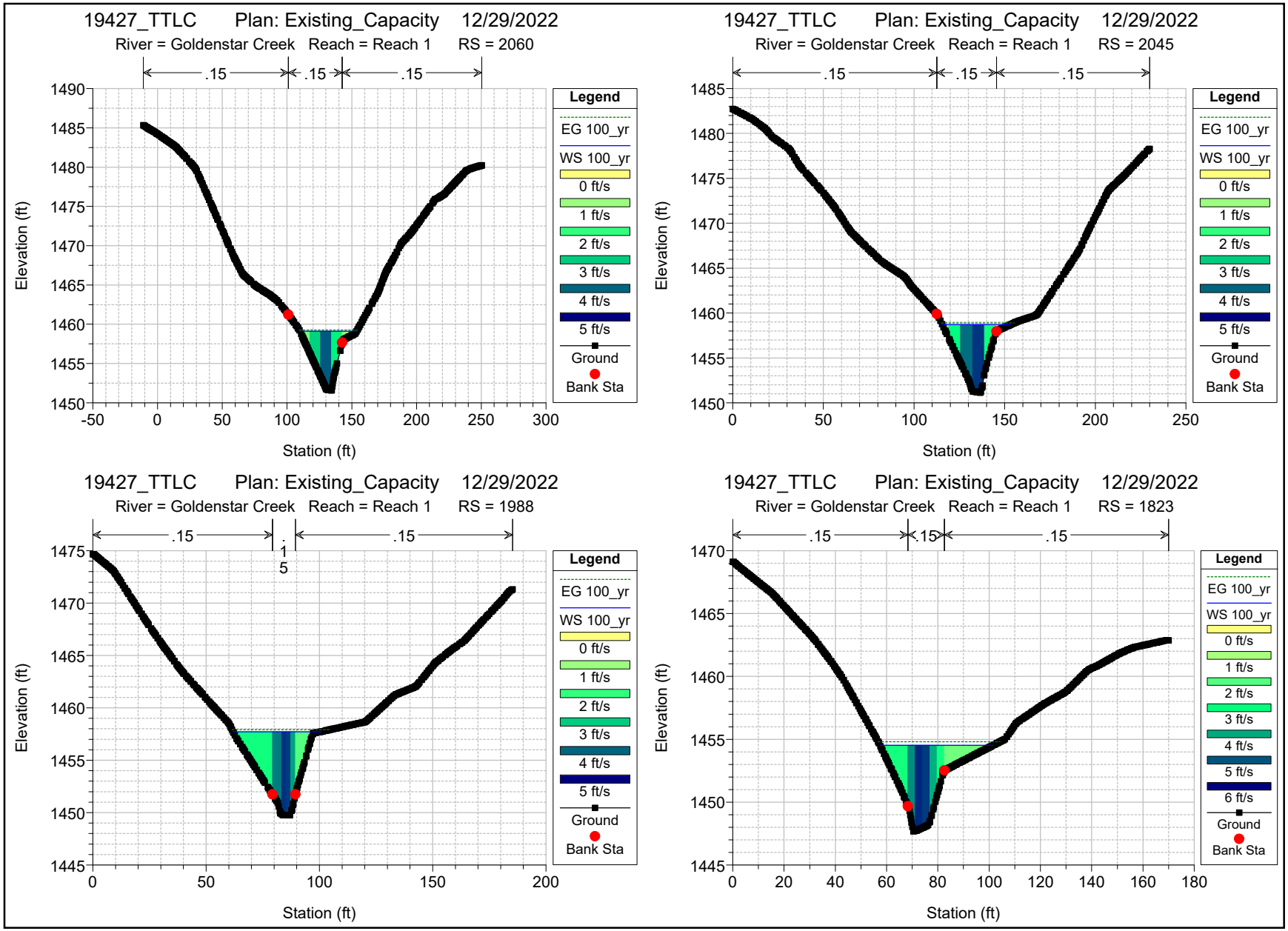
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta

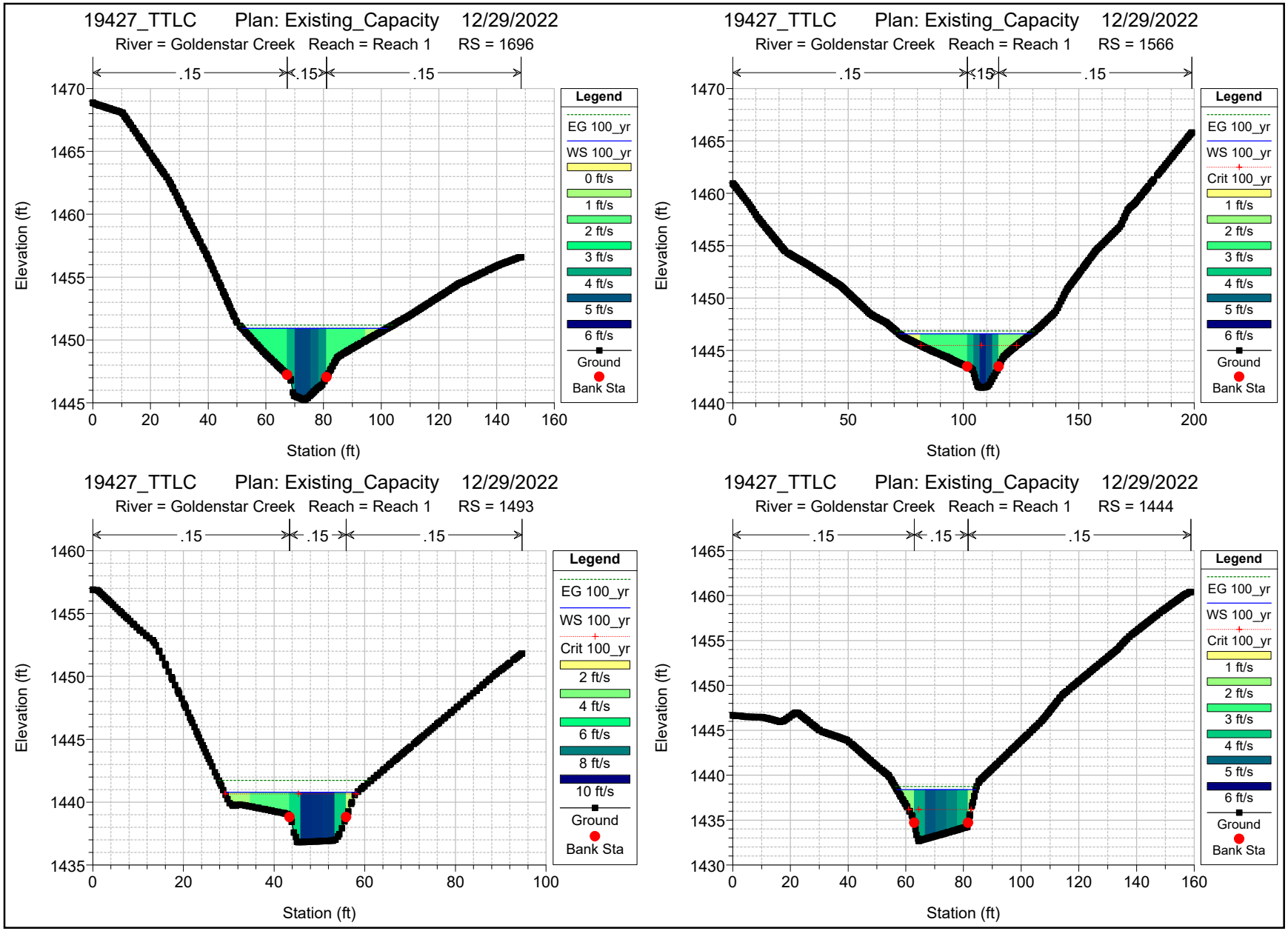

19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 3225
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 3132
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 3044
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2993
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
5.0 ft/s
Ground
Bank Sta

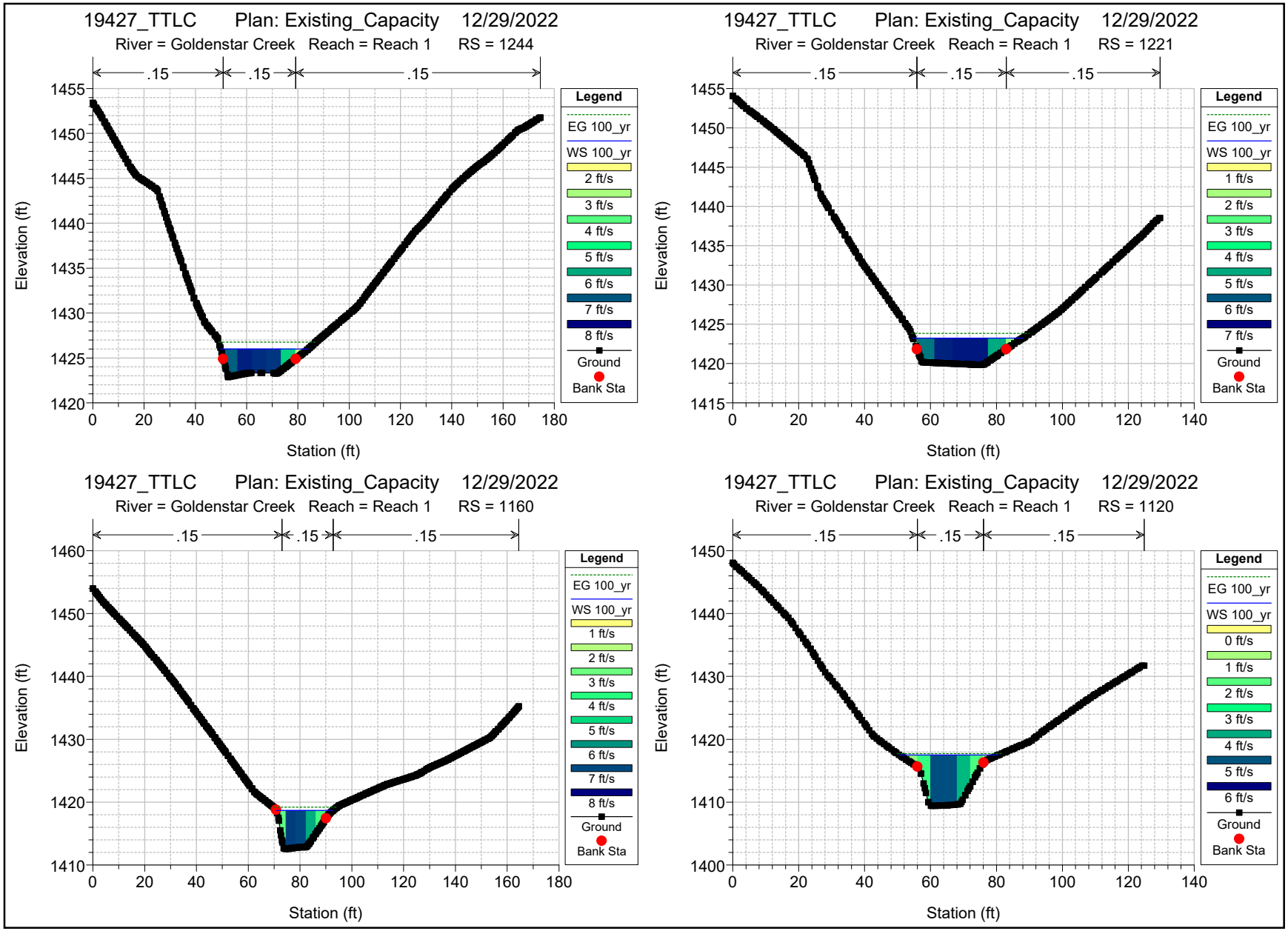

19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2881
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2812
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2748
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2686
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
Ground
Bank Sta

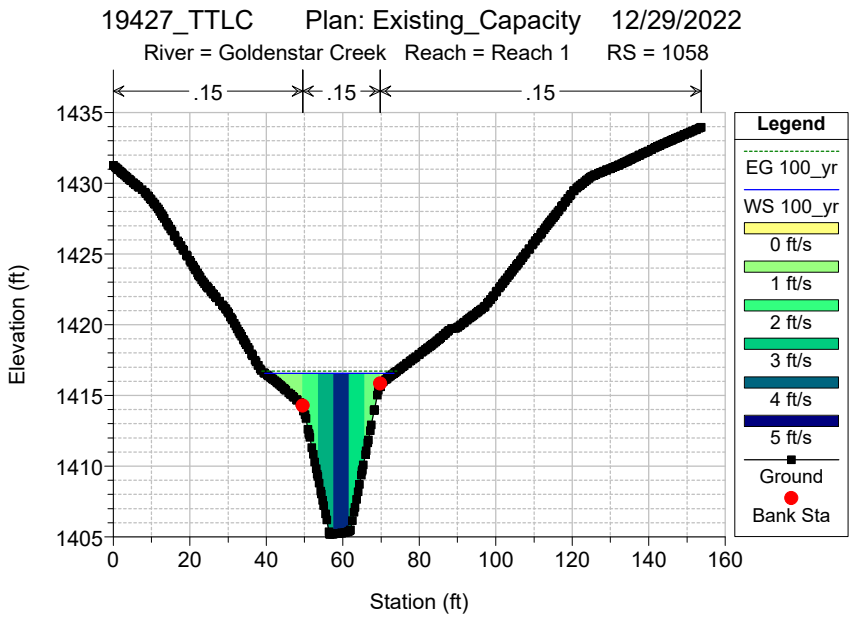

19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2631
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2521
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2395
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2265
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta

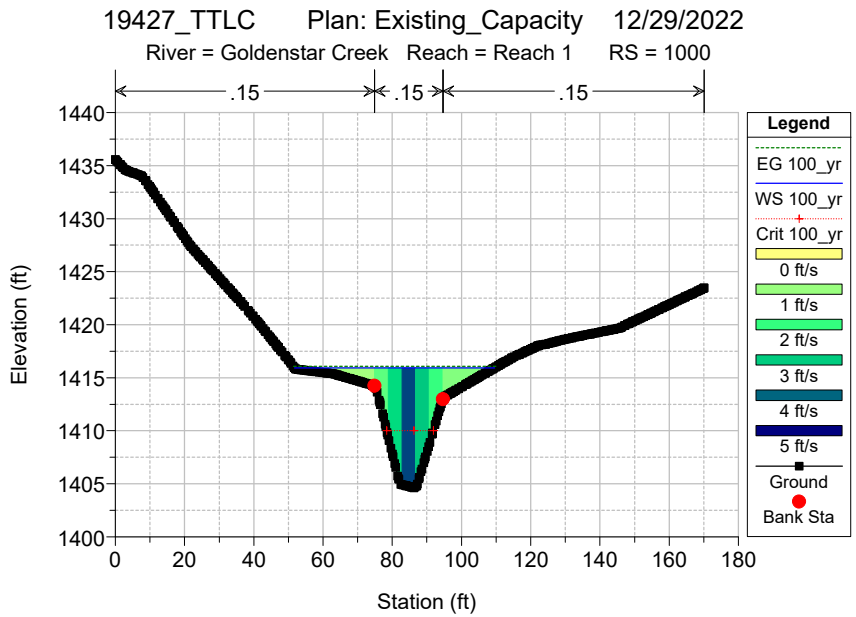

19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2217
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2137
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2119
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
Crit 100_yr
WS 100_yr
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
14 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2097
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
Ground
Bank Sta


19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2060
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 2045
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1988
.15
.1
5
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1823
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta


19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1696
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1566
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1493
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1444
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta

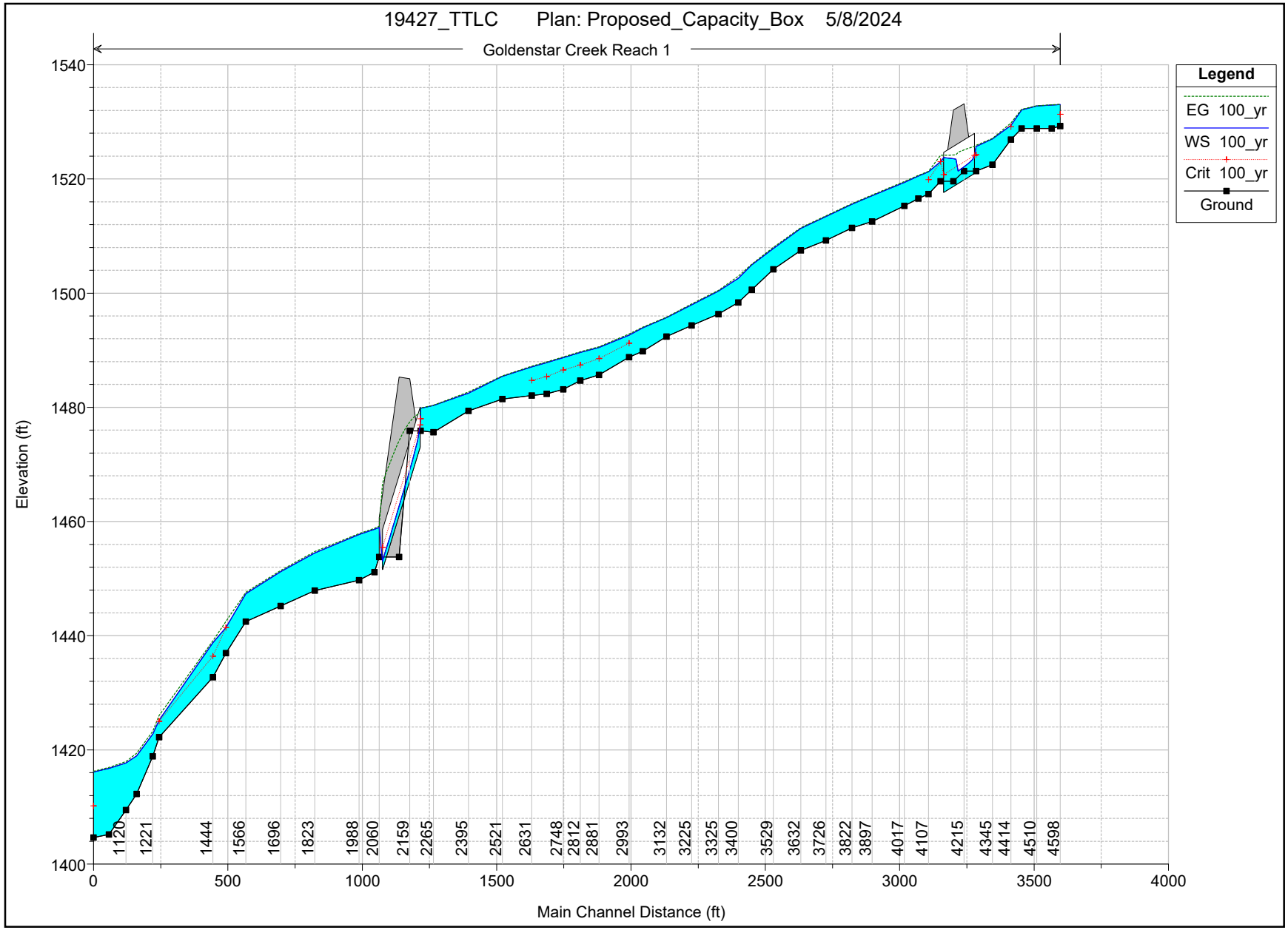

19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1244
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1221
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1160
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
Ground
Bank Sta
19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1120
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta

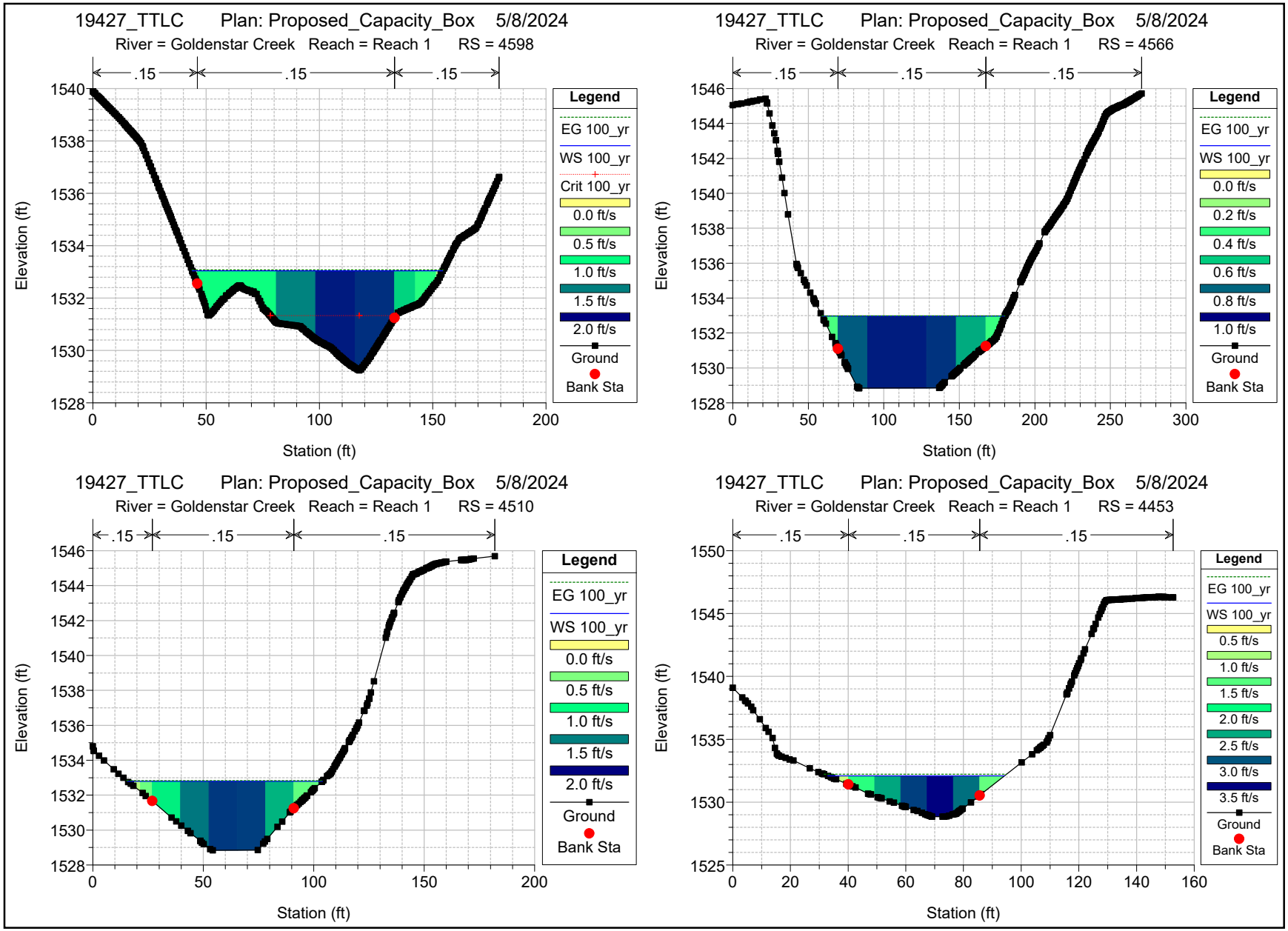

19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1058
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta

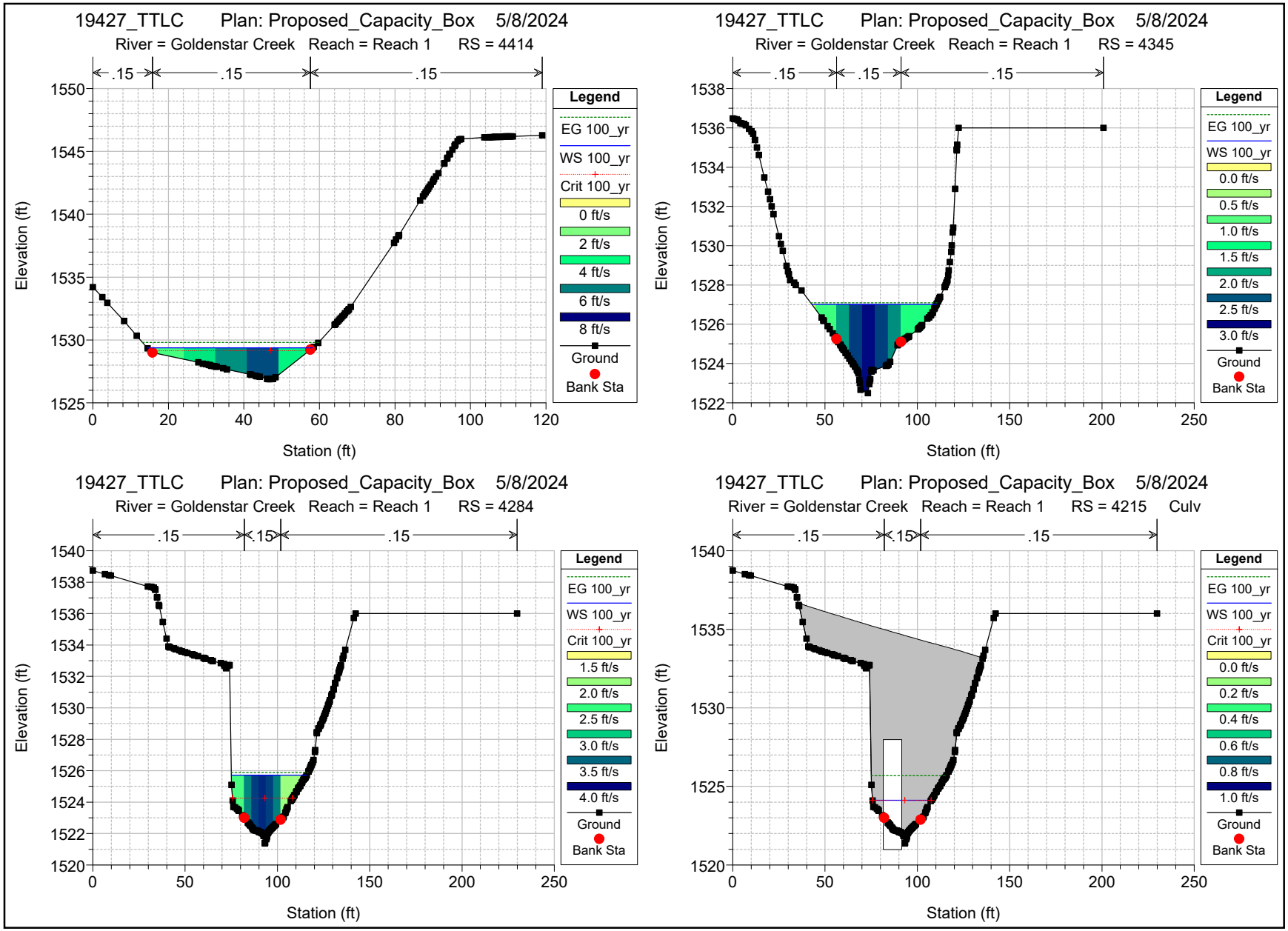

19427_TTLC Plan: Existing_Capacity 12/29/2022
River = Goldenstar Creek Reach = Reach 1 RS = 1000
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta

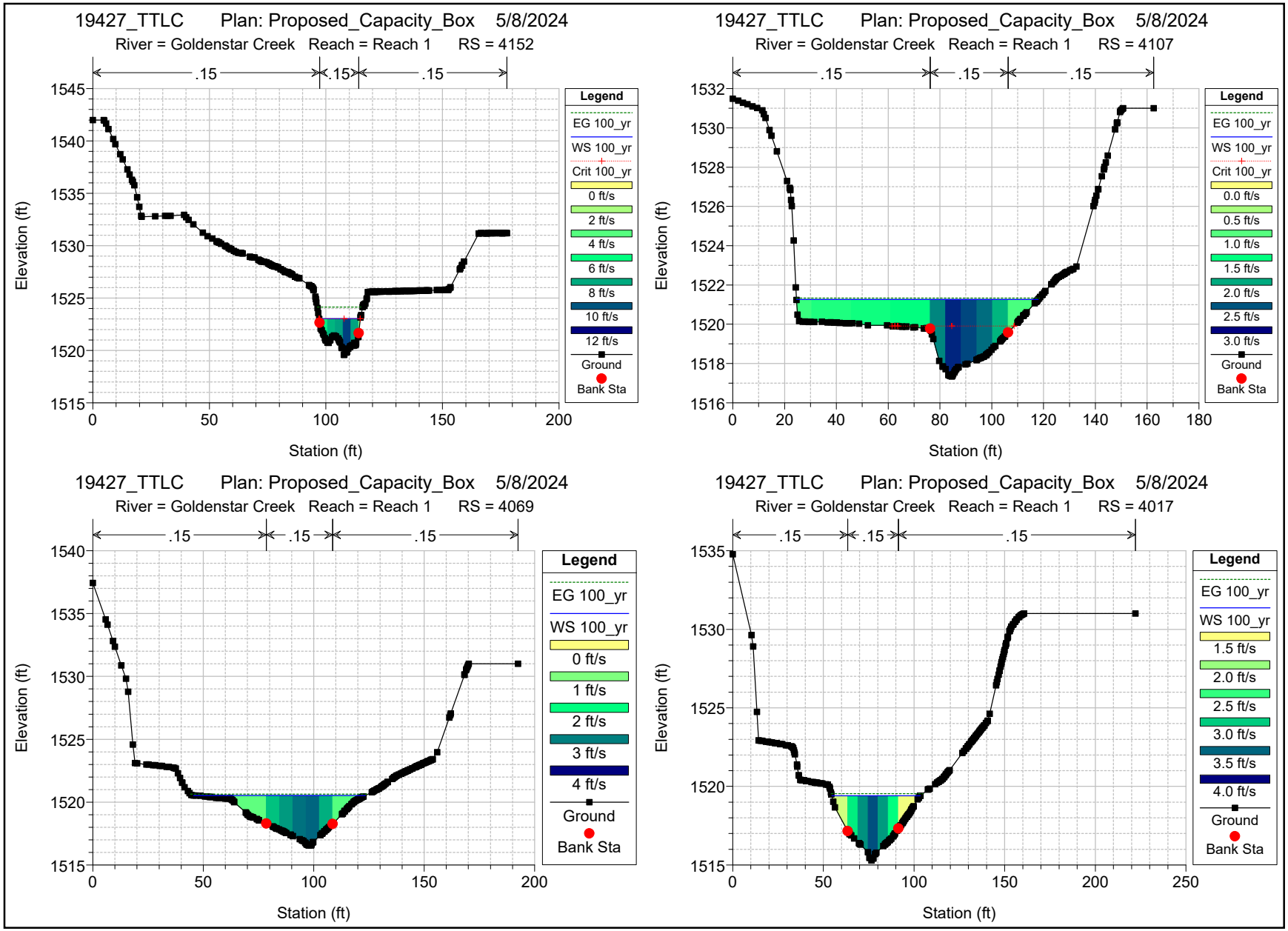
HEC-RAS Plan: Exist_Capacity River: Goldenstar Creek Reach: Reach 1 Profile: 100_yr

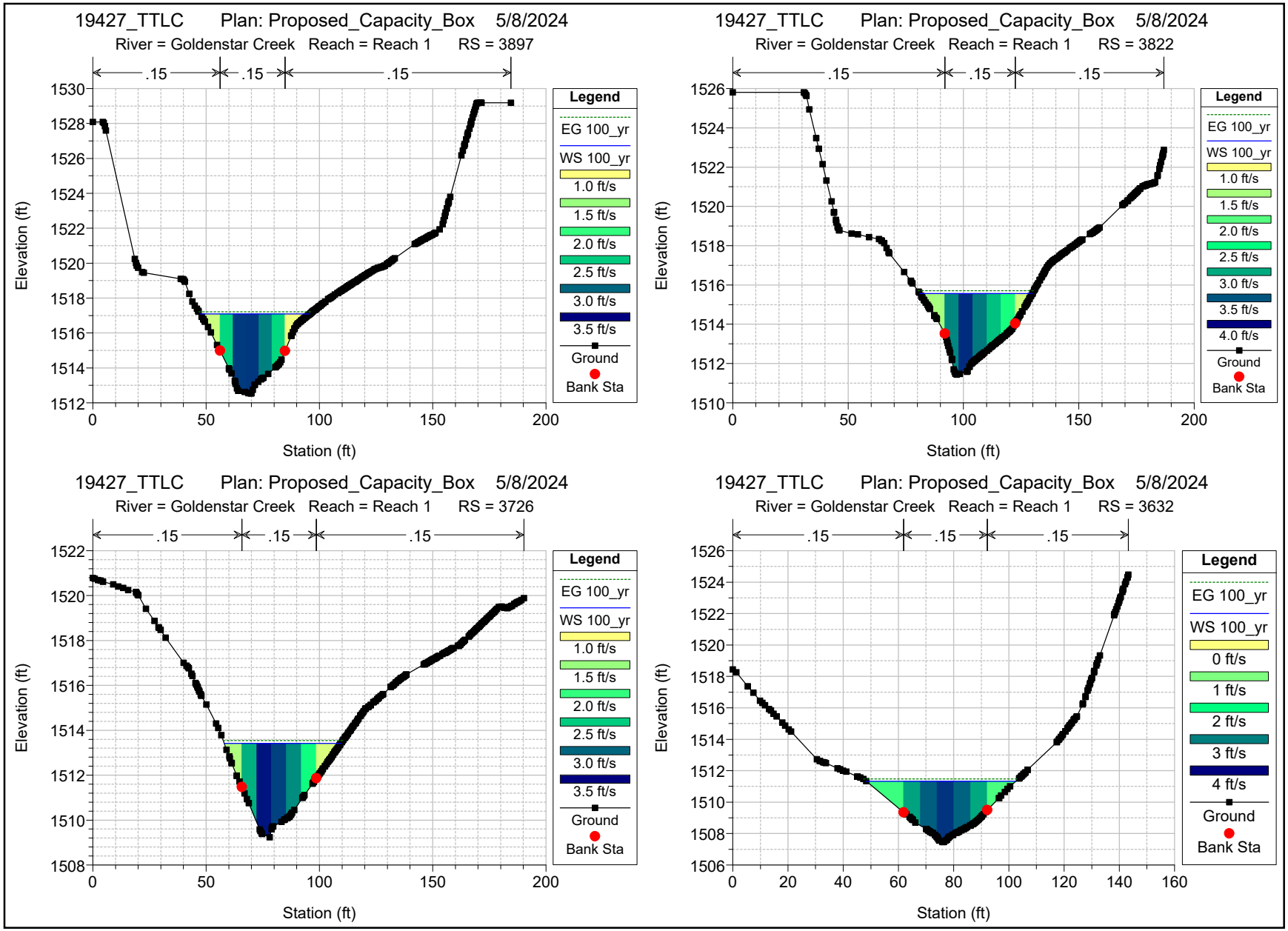
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	4598	100_yr	315.00	1529.24	1533.05	1531.33	1533.09	0.009531	1.58	207.54	110.63	0.19
Reach 1	4566	100_yr	315.00	1528.84	1532.97		1532.98	0.001444	0.91	368.66	120.59	0.08
Reach 1	4510	100_yr	315.00	1528.84	1532.79		1532.83	0.006296	1.74	199.51	85.32	0.17
Reach 1	4453	100_yr	315.00	1528.78	1532.02		1532.16	0.029950	3.06	110.47	60.51	0.35
Reach 1	4414	100_yr	315.00	1526.45	1528.93	1528.93	1529.58	0.227288	6.73	52.43	44.18	0.90
Reach 1	4345	100_yr	345.00	1522.55	1526.81	1525.05	1526.90	0.014362	2.53	152.80	66.39	0.25
Reach 1	4284	100_yr	345.00	1520.95	1525.86		1525.98	0.016007	2.99	139.49	58.75	0.27
Reach 1	4194	100_yr	345.00	1518.77	1523.75		1523.98	0.033528	4.38	101.74	56.80	0.39
Reach 1	4152	100_yr	345.00	1517.65	1522.27		1522.47	0.033833	4.02	104.61	49.29	0.38
Reach 1	4107	100_yr	345.00	1517.14	1521.24		1521.36	0.017378	2.83	139.10	64.37	0.28
Reach 1	4069	100_yr	345.00	1516.26	1520.48		1520.62	0.020321	3.11	122.27	49.62	0.30
Reach 1	4017	100_yr	345.00	1514.93	1519.42		1519.56	0.020551	3.18	125.30	53.96	0.30
Reach 1	3897	100_yr	345.00	1512.41	1516.98		1517.14	0.019858	3.30	119.60	50.90	0.30
Reach 1	3822	100_yr	345.00	1511.25	1515.48		1515.62	0.019986	3.13	123.02	50.74	0.30
Reach 1	3726	100_yr	345.00	1509.21	1513.56		1513.70	0.020026	3.17	125.35	54.73	0.30
Reach 1	3632	100_yr	345.00	1507.47	1511.44		1511.60	0.025661	3.32	116.82	55.50	0.33
Reach 1	3529	100_yr	345.00	1503.85	1507.53		1507.82	0.056318	4.48	86.12	45.61	0.48
Reach 1	3450	100_yr	345.00	1499.63	1504.40		1504.58	0.028951	3.79	109.27	45.72	0.35
Reach 1	3400	100_yr	345.00	1497.98	1502.70		1502.95	0.036722	4.30	93.60	39.11	0.40
Reach 1	3325	100_yr	345.00	1496.01	1500.48		1500.67	0.026028	3.69	105.88	42.19	0.34
Reach 1	3225	100_yr	345.00	1494.00	1497.77		1497.97	0.028295	3.61	100.23	37.47	0.35
Reach 1	3132	100_yr	345.00	1492.20	1495.48		1495.61	0.022364	2.87	125.01	55.04	0.31
Reach 1	3044	100_yr	345.00	1489.63	1493.77		1493.89	0.017057	2.89	130.37	50.84	0.28
Reach 1	2993	100_yr	345.00	1488.54	1492.36		1492.61	0.039898	4.09	92.42	41.59	0.41
Reach 1	2881	100_yr	345.00	1485.26	1490.48		1490.56	0.010131	2.42	166.23	61.11	0.22
Reach 1	2812	100_yr	345.00	1484.50	1489.79		1489.88	0.010071	2.58	154.76	51.95	0.22
Reach 1	2748	100_yr	370.00	1483.43	1488.82		1488.98	0.019891	3.64	126.24	48.28	0.31
Reach 1	2686	100_yr	370.00	1482.70	1487.66		1487.82	0.017734	3.43	123.55	41.62	0.29
Reach 1	2631	100_yr	370.00	1482.00	1486.91		1487.02	0.012081	2.86	153.08	55.28	0.24
Reach 1	2521	100_yr	460.00	1481.45	1485.31		1485.44	0.016951	2.85	167.66	58.40	0.28
Reach 1	2395	100_yr	460.00	1479.32	1483.13		1483.25	0.017651	2.92	167.29	63.77	0.28
Reach 1	2265	100_yr	460.00	1475.56	1479.95		1480.13	0.034485	3.42	138.49	58.73	0.38
Reach 1	2217	100_yr	460.00	1473.00	1478.39		1478.62	0.028566	4.35	134.00	53.12	0.36
Reach 1	2137	100_yr	460.00	1468.43	1472.76	1472.76	1473.89	0.174250	8.97	60.14	29.82	0.86
Reach 1	2119	100_yr	460.00	1462.98	1466.89	1467.48	1468.87	0.467064	12.20	44.02	24.77	1.31
Reach 1	2097	100_yr	460.00	1455.83	1459.88	1459.55	1460.74	0.139128	7.75	65.70	27.90	0.76
Reach 1	2060	100_yr	460.00	1451.59	1459.11		1459.27	0.017323	3.22	147.96	43.84	0.27
Reach 1	2045	100_yr	460.00	1451.14	1458.70		1458.90	0.023041	3.62	129.22	37.44	0.31
Reach 1	1988	100_yr	460.00	1449.75	1457.73		1457.91	0.013521	4.01	150.50	38.87	0.26
Reach 1	1823	100_yr	460.00	1447.67	1454.52		1454.80	0.028158	4.64	121.63	44.08	0.35
Reach 1	1696	100_yr	460.00	1445.23	1450.94		1451.20	0.028307	4.66	129.58	50.49	0.37
Reach 1	1566	100_yr	470.00	1441.46	1446.60	1445.50	1446.88	0.039471	5.00	126.11	57.38	0.42
Reach 1	1493	100_yr	470.00	1436.81	1440.88		1441.78	0.141018	8.20	67.74	29.75	0.75
Reach 1	1444	100_yr	470.00	1432.69	1438.35	1436.22	1438.70	0.032046	4.85	105.35	27.24	0.39
Reach 1	1244	100_yr	470.00	1422.88	1425.88		1426.60	0.157198	6.85	70.34	33.64	0.78
Reach 1	1221	100_yr	470.00	1419.83	1423.08		1423.64	0.099821	6.08	79.49	32.55	0.64
Reach 1	1160	100_yr	470.00	1412.55	1418.41		1418.91	0.063399	5.68	83.42	20.93	0.48
Reach 1	1120	100_yr	470.00	1409.41	1417.20		1417.44	0.022005	3.98	121.67	27.82	0.29
Reach 1	1058	100_yr	470.00	1405.18	1416.28		1416.43	0.011688	3.11	157.10	30.96	0.20
Reach 1	1000	100_yr	470.00	1404.63	1415.67	1409.79	1415.80	0.010006	3.01	175.63	52.39	0.19

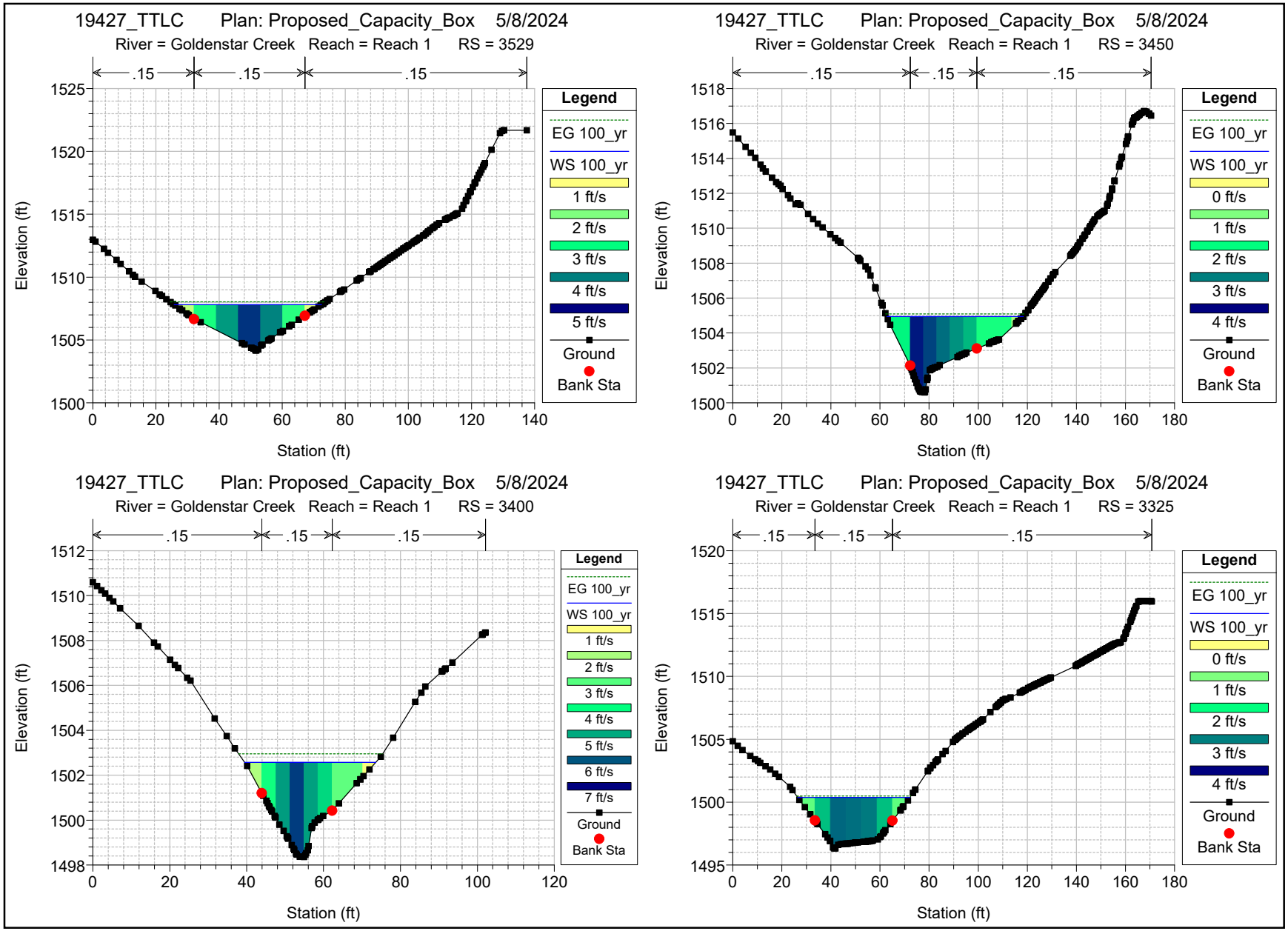

19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
Goldenstar Creek Reach 1
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
Ground
Elevation (ft)
Main Channel Distance (ft)
1540
1520
1500
1480
1460
1440
1420
1400
0
500
1000
1500
2000
2500
3000
3500
4000
1120
1221
1444
1566
1696
1823
1988
2060
2159
2265
2395
2521
2631
2748
2812
2881
2993
3132
3225
3325
3400
3529
3632
3726
3822
3897
4017
4107
4215
4345
4414
4510
4598

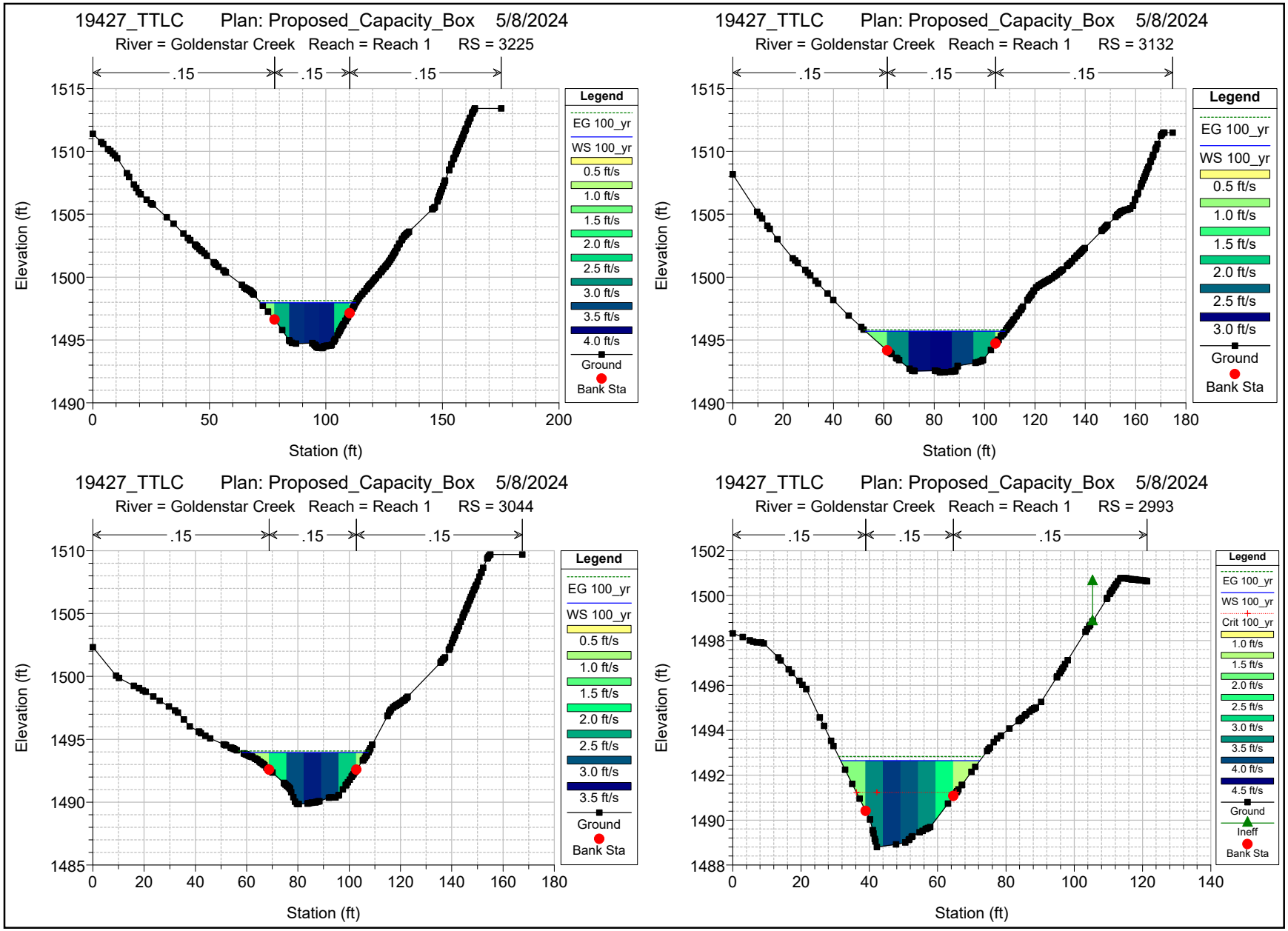

19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4598
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4566
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4510
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4453
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta

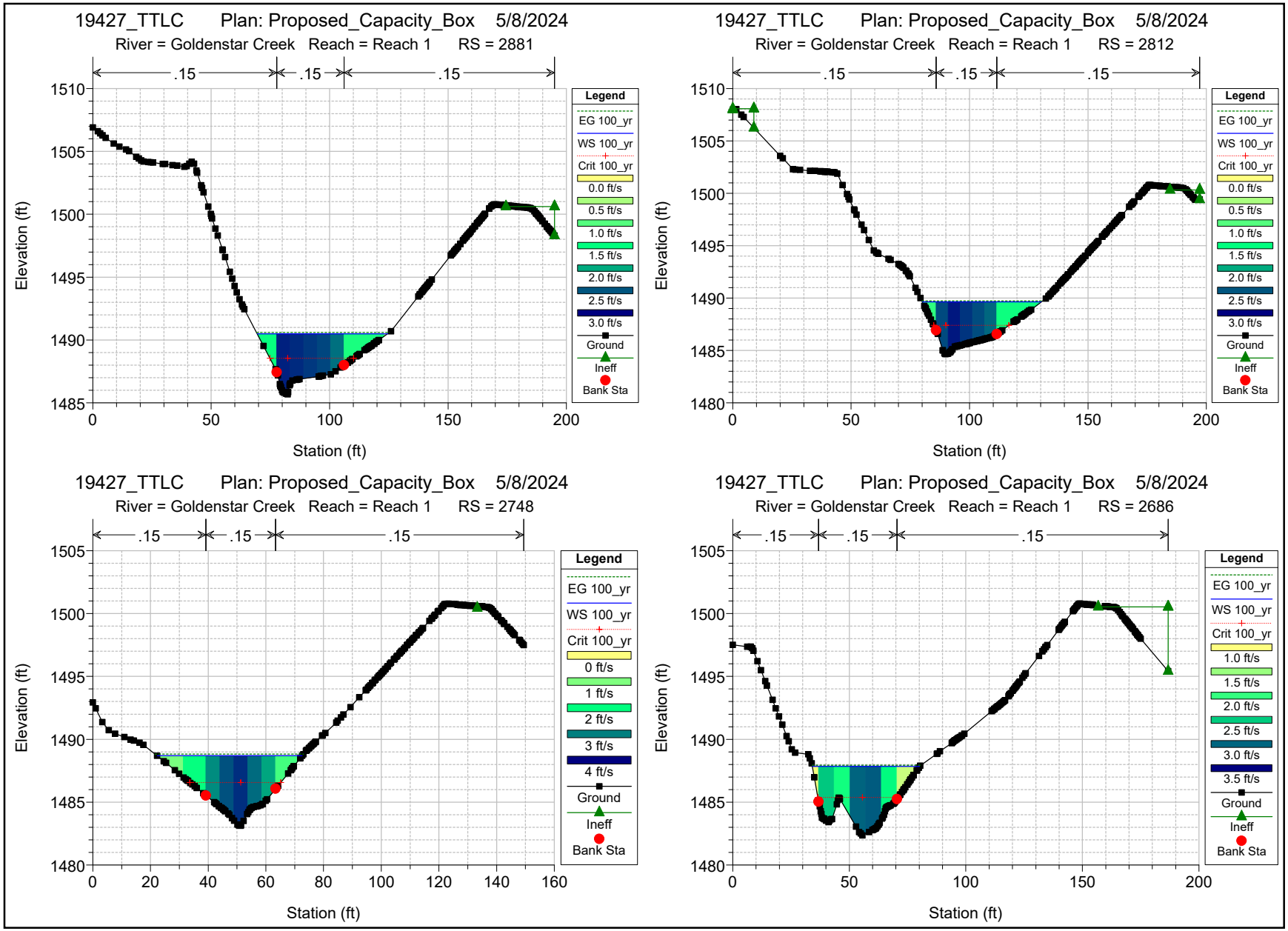

19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4414
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4345
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4284
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4215 Culv
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta

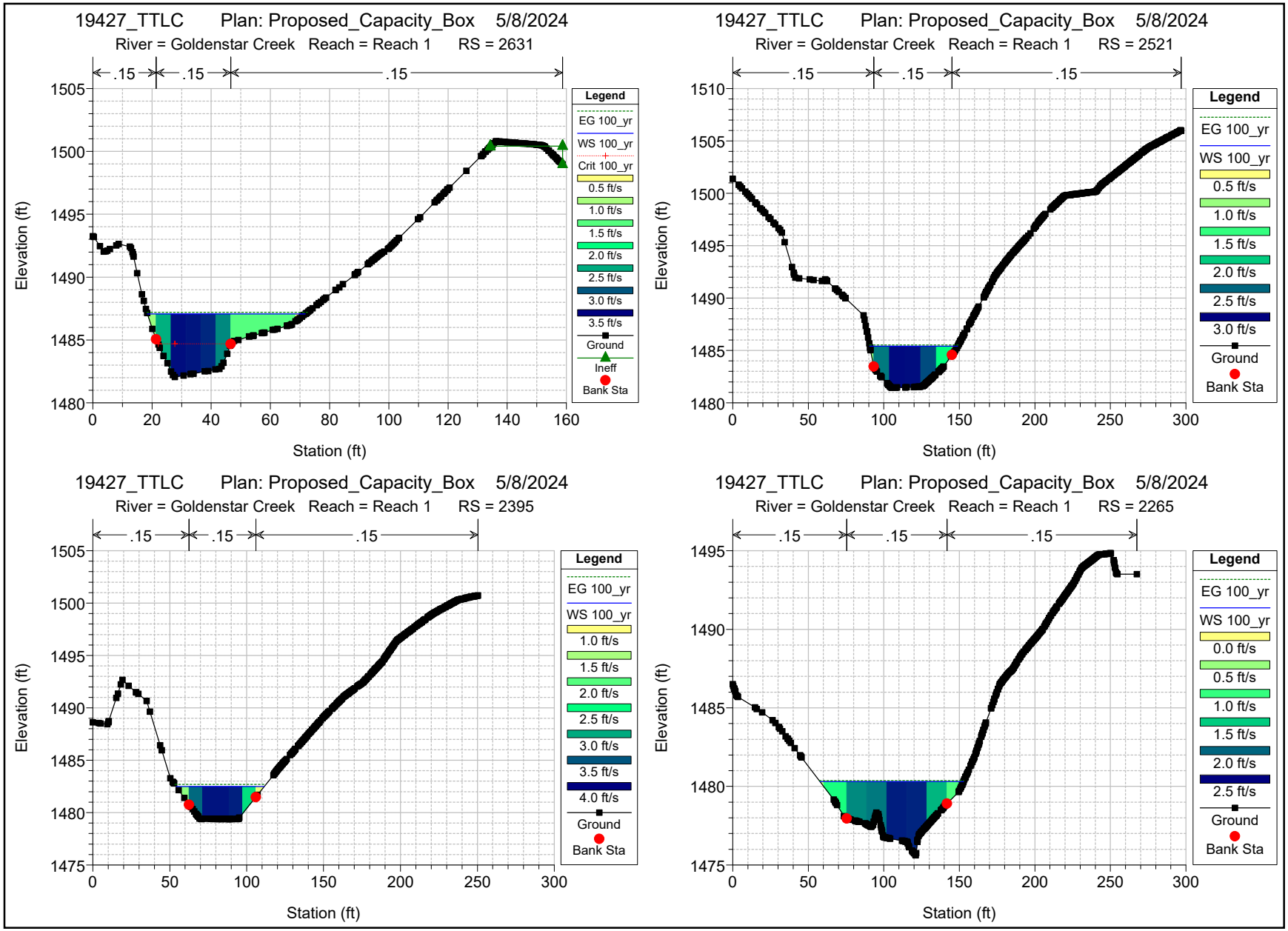

19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4152
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4107
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4069
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 4017
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Bank Sta

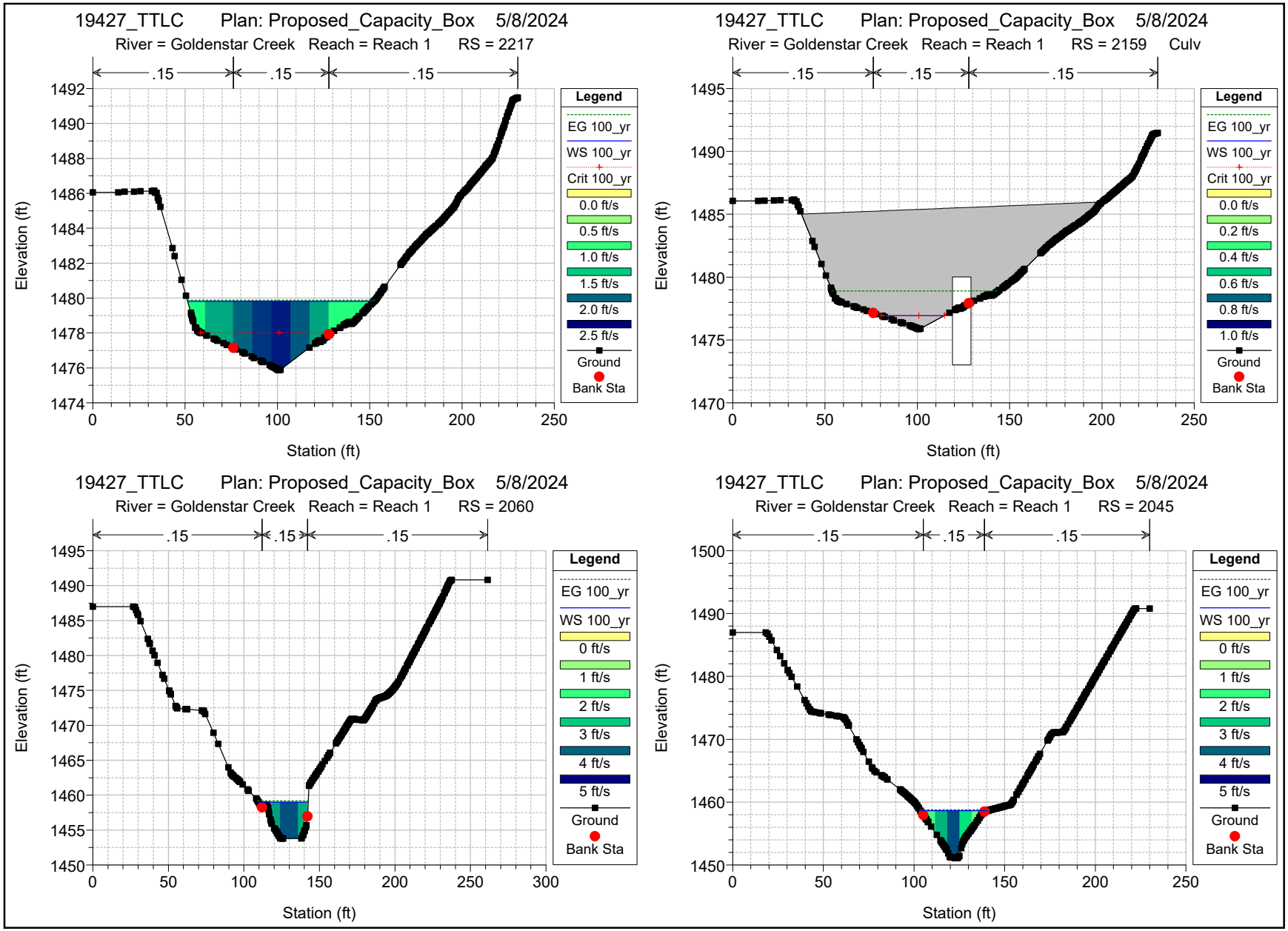

19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3897
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3822
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3726
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3632
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta

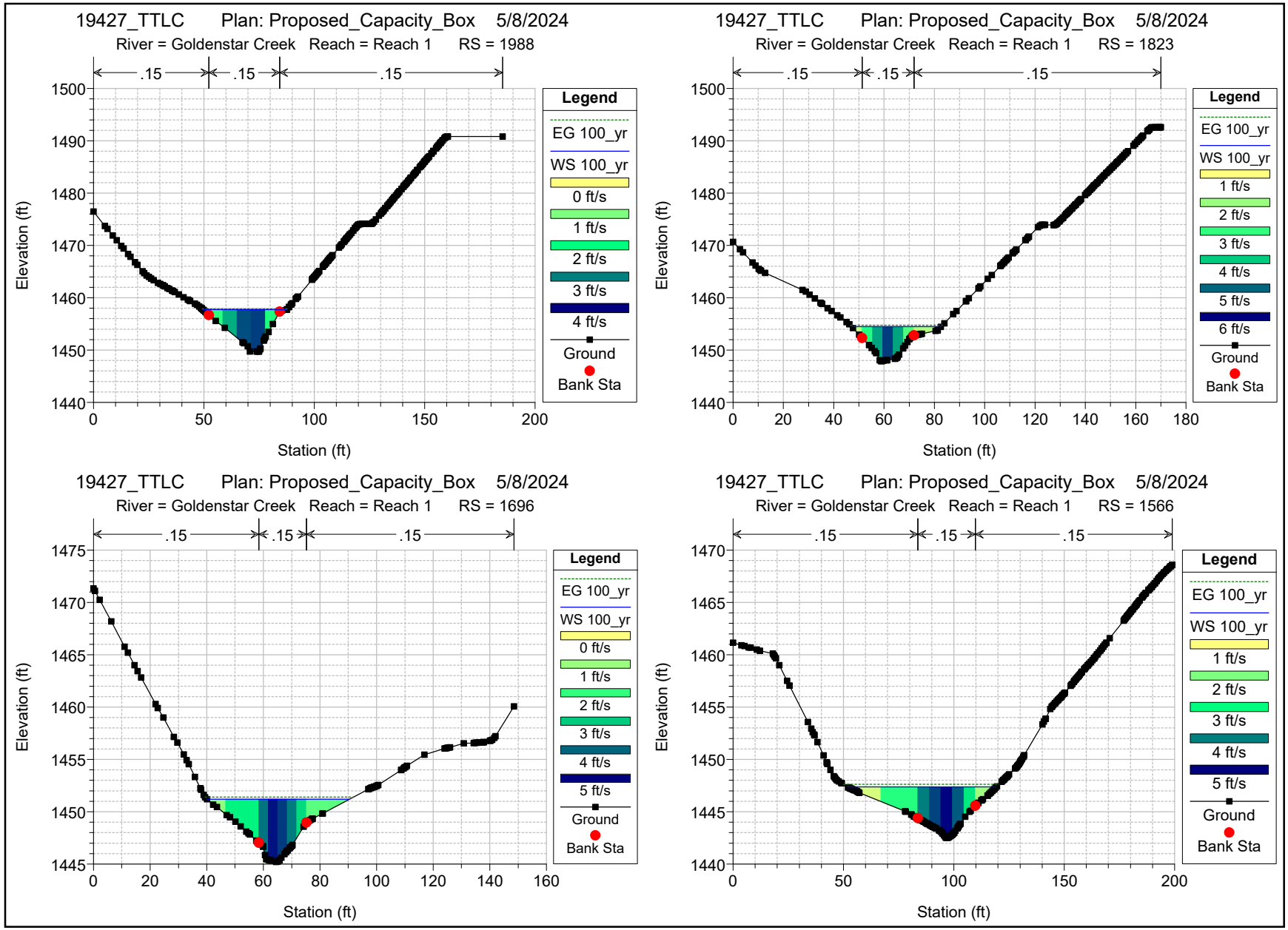

19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3529
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3450
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3400
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3325
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta

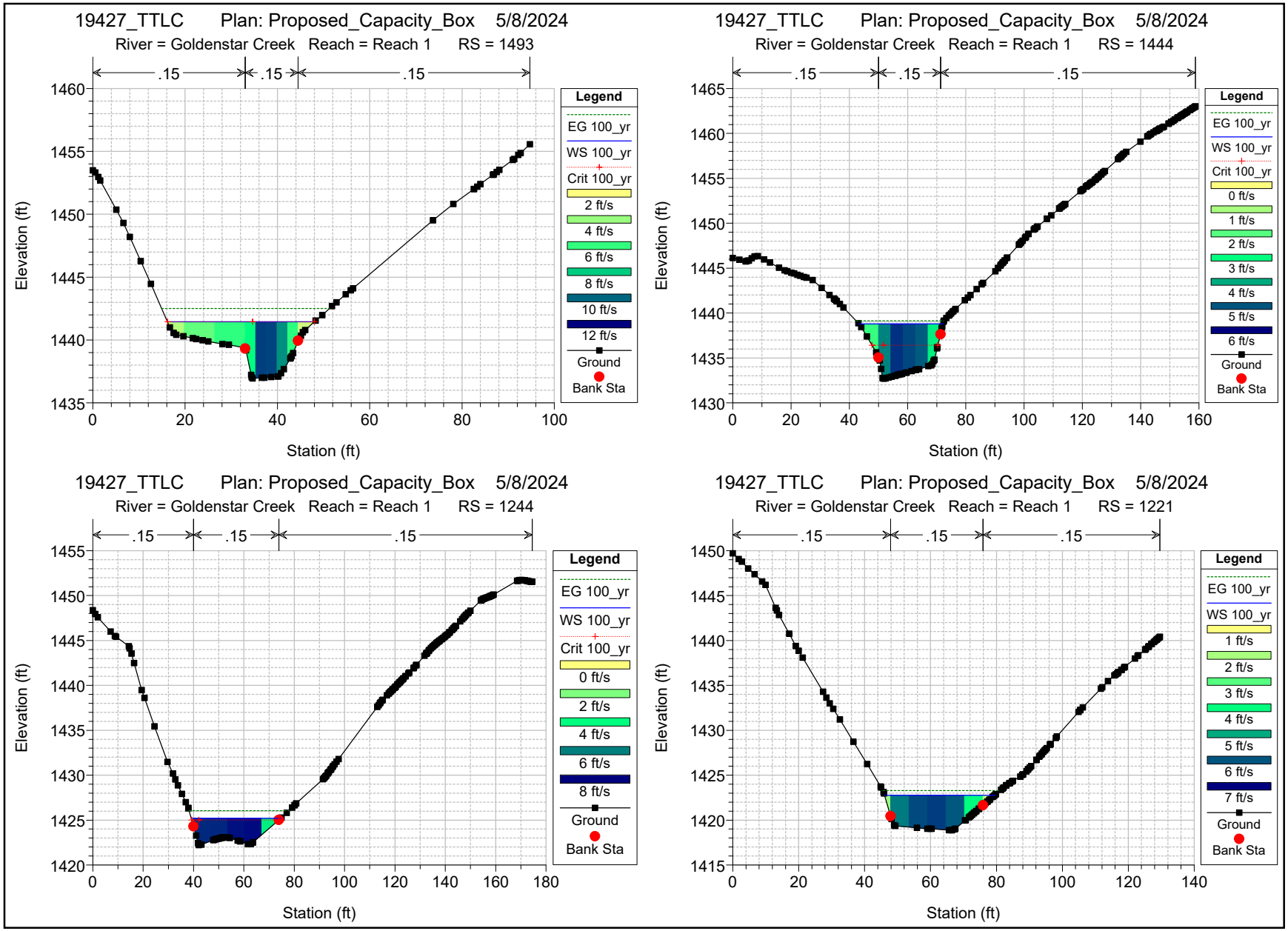

19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3225
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3132
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 3044
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2993
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
Ground
Ineff
Bank Sta

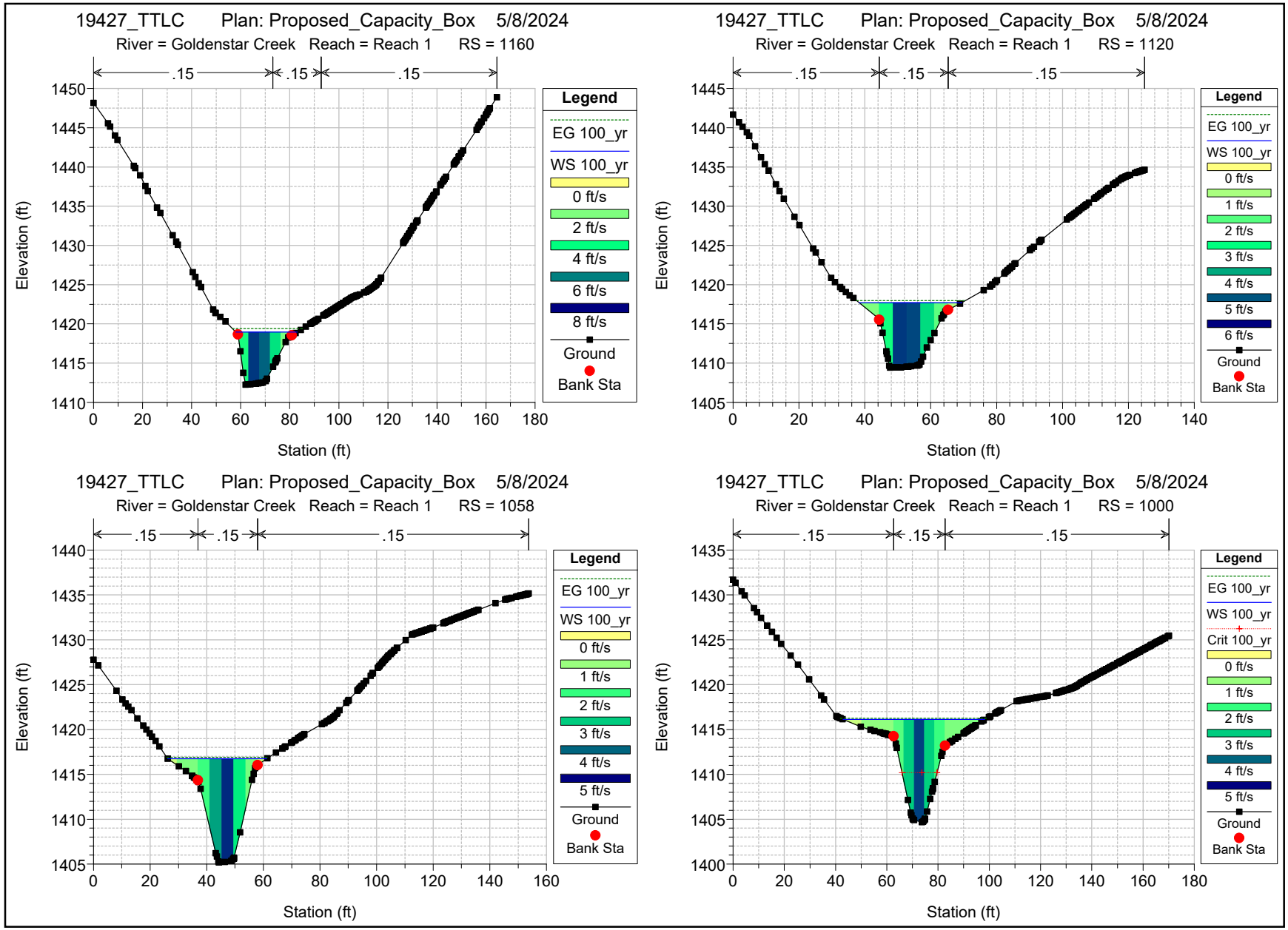

19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2881
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Ineff
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2812
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Ineff
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2748
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Ineff
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2686
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Ineff
Bank Sta


19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2631
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Ineff
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2521
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2395
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2265
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
Ground
Bank Sta


19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2217
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2159 Culv
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2060
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 2045
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta


19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1988
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1823
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1696
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1566
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta


19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1493
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1444
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1244
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1221
.15 .15 .15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta

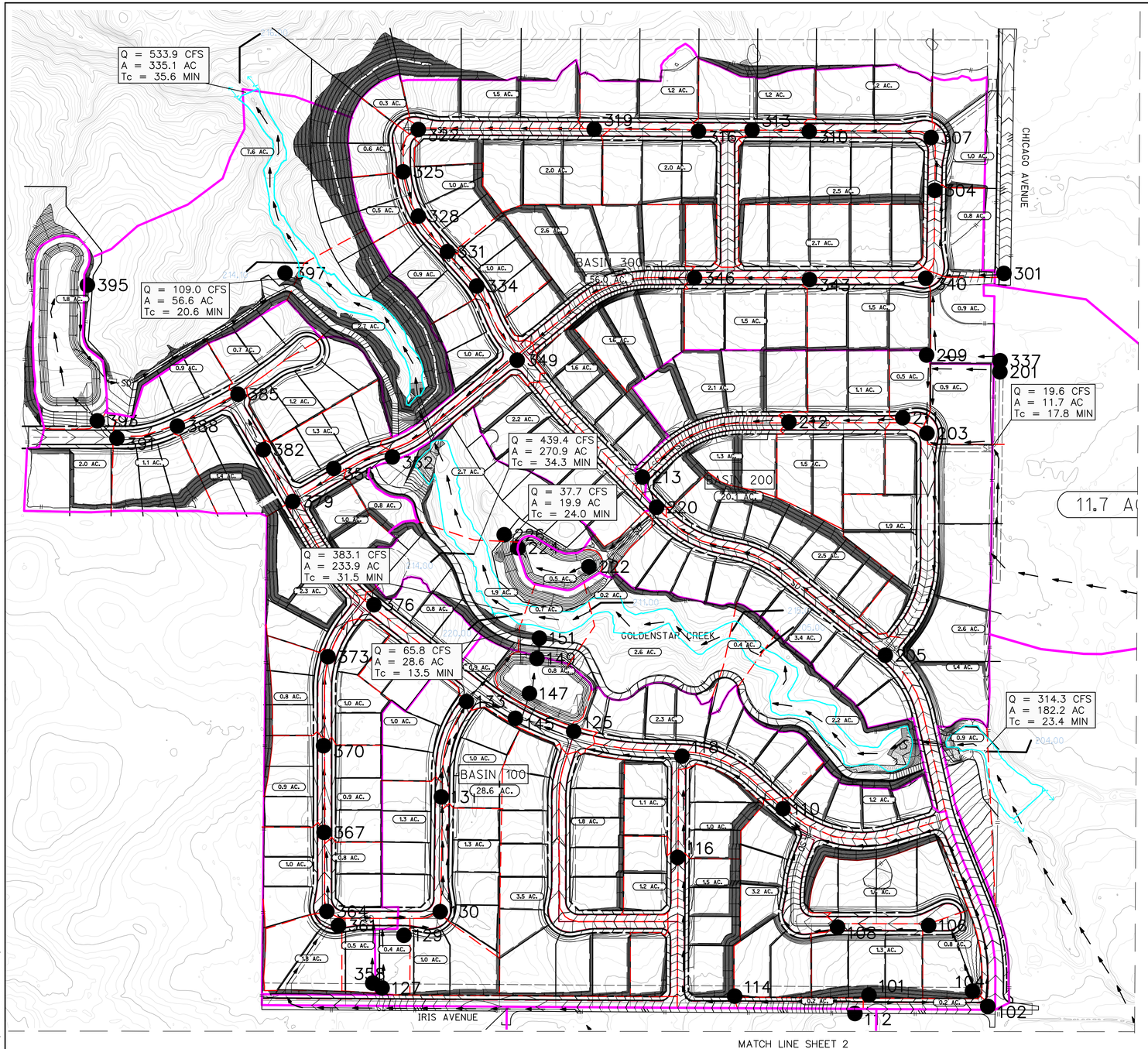

19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1160
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1120
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1058
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta
19427_TTLC Plan: Proposed_Capacity_Box 5/8/2024
River = Goldenstar Creek Reach = Reach 1 RS = 1000
.15
.15
.15
Elevation (ft)
Station (ft)
Legend
EG 100_yr
WS 100_yr
Crit 100_yr
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Bank Sta

HEC-RAS Plan: Cap_Box River: Goldenstar Creek Reach: Reach 1 Profile: 100_yr

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	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	4598	100_yr	315.00	1529.24	1533.04	1531.33	1533.08	0.009621	1.59	206.92	110.57	0.19
Reach 1	4566	100_yr	315.00	1528.84	1532.97		1532.98	0.001427	0.87	373.95	121.07	0.08
Reach 1	4510	100_yr	315.00	1528.84	1532.80		1532.84	0.005616	1.56	212.36	88.35	0.16
Reach 1	4453	100_yr	315.00	1528.84	1532.08		1532.21	0.029398	2.93	112.71	61.24	0.34
Reach 1	4414	100_yr	315.00	1526.88	1529.37	1529.15	1529.81	0.187073	5.35	59.11	43.79	0.80
Reach 1	4345	100_yr	315.00	1522.50	1527.00		1527.10	0.015539	2.56	140.01	67.42	0.26
Reach 1	4284	100_yr	315.00	1521.37	1525.71	1524.26	1525.88	0.026600	3.60	101.45	40.85	0.34
Reach 1	4215		Culvert									
Reach 1	4152	100_yr	315.00	1519.59	1523.03	1523.03	1524.14	0.298815	8.48	37.50	17.66	1.01
Reach 1	4107	100_yr	315.00	1517.34	1521.26	1519.91	1521.33	0.014781	2.43	163.02	93.36	0.25
Reach 1	4069	100_yr	315.00	1516.56	1520.53		1520.64	0.019138	2.88	132.01	76.79	0.29
Reach 1	4017	100_yr	315.00	1515.28	1519.40		1519.54	0.023505	3.19	110.22	48.80	0.32
Reach 1	3897	100_yr	315.00	1512.54	1517.09		1517.21	0.016314	2.90	119.07	48.42	0.27
Reach 1	3822	100_yr	315.00	1511.43	1515.56		1515.71	0.024832	3.19	107.59	48.81	0.33
Reach 1	3726	100_yr	315.00	1509.24	1513.41		1513.54	0.020240	2.94	116.49	51.46	0.30
Reach 1	3632	100_yr	315.00	1507.47	1511.33		1511.47	0.024371	3.16	111.84	54.15	0.32
Reach 1	3529	100_yr	315.00	1504.17	1507.81		1508.03	0.048959	3.79	86.79	46.73	0.44
Reach 1	3450	100_yr	315.00	1500.60	1504.94		1505.09	0.028222	3.27	111.04	55.65	0.34
Reach 1	3400	100_yr	315.00	1498.36	1502.58		1502.95	0.069834	5.17	68.66	34.20	0.53
Reach 1	3325	100_yr	315.00	1496.32	1500.37		1500.49	0.018549	2.92	115.37	45.71	0.29
Reach 1	3225	100_yr	315.00	1494.36	1497.95		1498.13	0.031345	3.43	95.08	40.92	0.36
Reach 1	3132	100_yr	315.00	1492.41	1495.69		1495.80	0.019976	2.67	122.96	55.47	0.29
Reach 1	3044	100_yr	315.00	1489.84	1493.94		1494.07	0.019347	2.89	114.96	49.17	0.29
Reach 1	2993	100_yr	315.00	1488.80	1492.65	1491.23	1492.84	0.030686	3.64	94.24	40.75	0.36
Reach 1	2881	100_yr	315.00	1485.68	1490.50	1488.55	1490.59	0.013910	2.65	135.57	55.06	0.25
Reach 1	2812	100_yr	315.00	1484.67	1489.63	1487.40	1489.72	0.011837	2.63	137.30	50.16	0.23
Reach 1	2748	100_yr	385.00	1483.13	1488.68	1486.56	1488.82	0.016329	3.21	139.05	50.23	0.28
Reach 1	2686	100_yr	385.00	1482.35	1487.83	1485.37	1487.94	0.012136	2.67	152.75	45.99	0.23
Reach 1	2631	100_yr	385.00	1482.06	1487.07	1484.70	1487.20	0.015180	3.10	143.79	53.38	0.27
Reach 1	2521	100_yr	440.00	1481.44	1485.41		1485.52	0.015371	2.64	169.23	58.11	0.26
Reach 1	2395	100_yr	440.00	1479.39	1482.49		1482.69	0.035652	3.62	127.43	57.20	0.39
Reach 1	2265	100_yr	440.00	1475.62	1480.31		1480.37	0.010392	2.07	227.55	95.05	0.21
Reach 1	2217	100_yr	440.00	1475.88	1479.82	1478.02	1479.88	0.010118	2.11	234.70	100.99	0.21
Reach 1	2159		Culvert									
Reach 1	2060	100_yr	440.00	1453.79	1458.98		1459.20	0.024939	3.69	120.32	32.84	0.33
Reach 1	2045	100_yr	440.00	1451.12	1458.62		1458.79	0.019131	3.24	136.31	36.62	0.28
Reach 1	1988	100_yr	440.00	1449.72	1457.74		1457.88	0.013273	2.94	151.35	38.07	0.24
Reach 1	1823	100_yr	440.00	1447.89	1454.48		1454.76	0.028761	4.31	111.89	35.61	0.35
Reach 1	1696	100_yr	440.00	1445.20	1451.20		1451.41	0.023834	4.09	132.89	50.32	0.33
Reach 1	1566	100_yr	535.00	1442.48	1447.38		1447.62	0.034956	4.31	150.38	67.52	0.40
Reach 1	1493	100_yr	535.00	1436.94	1441.45	1441.45	1442.51	0.180497	9.09	70.48	31.82	0.82
Reach 1	1444	100_yr	535.00	1432.70	1438.78	1436.41	1439.12	0.031970	4.75	118.98	28.81	0.37
Reach 1	1244	100_yr	535.00	1422.23	1425.21	1425.02	1426.04	0.203158	7.29	73.80	35.63	0.87
Reach 1	1221	100_yr	535.00	1418.87	1422.77		1423.28	0.072029	5.75	95.84	33.43	0.56
Reach 1	1160	100_yr	535.00	1412.26	1418.95		1419.42	0.057196	5.50	97.88	25.03	0.46
Reach 1	1120	100_yr	535.00	1409.44	1417.71		1417.97	0.023286	4.19	133.42	31.20	0.30
Reach 1	1058	100_yr	535.00	1405.19	1416.75		1416.91	0.012105	3.26	172.85	34.99	0.21
Reach 1	1000	100_yr	535.00	1404.66	1416.13	1410.18	1416.27	0.010015	3.11	199.33	55.30	0.20

Appendix 4

Hydrologic Backup Information



LEGEND

- MAJOR DRAINAGE BOUNDARY
- MINOR DRAINAGE BOUNDARY
- FLOWPATH
- ACREAGE — 2.5 AC.
- NODE
- ONSITE DRAINAGE NODE ID — 301
- BASIN ID — BASIN 300
- PROPOSED 100-YEAR WSE OF GOLDENSTAR CREEK — 204.00
- GOLDENSTAR CREEK DRAINAGE NODE/ID

150 75 0 150 300 450

GRAPHIC SCALE: 1"=150'

NOTES

1. SEE PRE-PROJECT DRAINAGE EXHIBIT FOR OFFSITE HYDROLOGY.
2. SEE POST-PROJECT DRAINAGE EXHIBIT FOR ONSITE HYDROLOGY.

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DRAINAGE STUDY MAP FOR
GOLDENSTAR CREEK

PRELIMINARY ENGINEERING
POST-PROJECT

SHEET 1 OF 2 DATE: 05/08/2024
J-19427

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NOT FOR CONSTRUCTION – EXHIBIT FOR DRAINAGE STUDY REPORT ONLY

Q100 = 533.9 CFS
A = 335.1 AC
Tc = 35.6 MIN

Q100 = 109.0 CFS
A = 56.6 AC
Tc = 20.6 MIN

Q100 = 439.4 CFS
A = 270.9 AC
Tc = 34.3 MIN

Q100 = 37.7 CFS
A = 19.9 AC
Tc = 24.0 MIN

Q100 = 383.1 CFS
A = 233.9 AC
Tc = 31.5 MIN

Q100 = 65.8 CFS
A = 28.6 AC
Tc = 13.5 MIN

BASIN 300
56.6 AC.

BASIN 200
20.1 AC.

BASIN 100
28.6 AC.

OFFSITE BY-PASS
TO NODE 220
Q100 = 19.6 CFS
A = 11.7 AC
Tc = 17.8 MIN

11.7 A

GOLDENSTAR CREEK
UPSTREAM BOUNDARY
CONDITION
Q100 = 314.3 CFS
A = 182.2 AC
Tc = 23.4 MIN

CHICAGO AVENUE

GOLDENSTAR CREEK

IRIS AVENUE

MATCH LINE SHEET 2

MATCH LINE SHEET 2

LEGEND

MAJOR DRAINAGE BOUNDARY	
MINOR DRAINAGE BOUNDARY	
FLOWPATH	
ACREAGE	2.5 AC.
NODE	
ONSITE DRAINAGE NODE ID	301
BASIN ID	BASIN 300
PROPOSED 100-YEAR WSE OF GOLDENSTAR CREEK	
GOLDENSTAR CREEK DRAINAGE NODE/ID	204.00

150 75 0 150 300 450
GRAPHIC SCALE: 1"=150'

NOTES

1. SEE PRE-PROJECT DRAINAGE EXHIBIT FOR OFFSITE HYDROLOGY.
2. SEE POST-PROJECT DRAINAGE EXHIBIT FOR ONSITE HYDROLOGY.

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DRAINAGE STUDY MAP FOR
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PRELIMINARY ENGINEERING
POST-PROJECT

SHEET 1 OF 2 DATE: 05/08/2024
J-19427

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******************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                    (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-2014 Advanced Engineering Software (aes)
                    (Rational Tabling Version 21.0)
                Release Date: 06/01/2014  License ID 1261

                          Analysis prepared by:

                         RICK ENGINEERING COMPANY
                             5620 Friars Road
                          San Diego, California 92110
                        619-291-0707   Fax 619-291-4165

 ************************* DESCRIPTION OF STUDY *************************
* CHICAGO AVENUE                                                        *
* PROPOSED CONDITION RATIONAL METHOD FOR  GOLDENSTAR CREEK 100 YEAR EVENT  *
* JN# 19427 05/08/2024                                                  *
 ************************************************************************

  FILE NAME: CAGSCP00.RAT
  TIME/DATE OF STUDY: 09:10 05/08/2024
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  1.630
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.704
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.840
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.240
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.4685655
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.4625021
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.240
  SLOPE OF INTENSITY DURATION CURVE = 0.4625
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   25.0     18.5    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0180
```

```
  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth = -0.10 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  23.40   RAIN INTENSITY(INCH/HOUR) =  1.92
  TOTAL AREA(ACRES) =   182.20   TOTAL RUNOFF(CFS) =    314.30

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1529.00  DOWNSTREAM(FEET) =   1509.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   803.00   CHANNEL SLOPE =  0.0249
  CHANNEL BASE(FEET) =    7.00   "Z" FACTOR =   4.300
  MANNING'S FACTOR = 0.100   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.798
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7216
  SOIL CLASSIFICATION IS "D"
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     316.31
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.85
  AVERAGE FLOW DEPTH(FEET) =   3.63   TRAVEL TIME(MIN.) =   3.48
  Tc(MIN.) =   26.88
  SUBAREA AREA(ACRES) =     3.10       SUBAREA RUNOFF(CFS) =    4.02
  TOTAL AREA(ACRES) =      185.3         PEAK FLOW RATE(CFS) =     318.32

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  3.64   FLOW VELOCITY(FEET/SEC.) =   3.86
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    205.00 =     803.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    215.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1509.00  DOWNSTREAM(FEET) =   1503.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   110.00   CHANNEL SLOPE =  0.0545
  CHANNEL BASE(FEET) =    4.50   "Z" FACTOR =   5.400
  MANNING'S FACTOR = 0.100   MAXIMUM DEPTH(FEET) =  10.00
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.786
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7207
 SOIL CLASSIFICATION IS "D"
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     318.58
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.92
 AVERAGE FLOW DEPTH(FEET) =   3.07   TRAVEL TIME(MIN.) =   0.37
 Tc(MIN.) =   27.25
 SUBAREA AREA(ACRES) =     0.40       SUBAREA RUNOFF(CFS) =    0.51
 TOTAL AREA(ACRES) =      185.7         PEAK FLOW RATE(CFS) =     318.84

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  3.07   FLOW VELOCITY(FEET/SEC.) =   4.93
 LONGEST FLOWPATH FROM NODE      0.00 TO NODE    215.00 =     913.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    215.00 TO NODE    211.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1503.00  DOWNSTREAM(FEET) =   1492.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   447.00   CHANNEL SLOPE =  0.0246
 CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   4.200
 MANNING'S FACTOR = 0.100   MAXIMUM DEPTH(FEET) =  10.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.731
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7161
 SOIL CLASSIFICATION IS "D"
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     320.45
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.87
 AVERAGE FLOW DEPTH(FEET) =   3.78   TRAVEL TIME(MIN.) =   1.92
 Tc(MIN.) =   29.18
 SUBAREA AREA(ACRES) =     2.60       SUBAREA RUNOFF(CFS) =    3.22
 TOTAL AREA(ACRES) =      188.3         PEAK FLOW RATE(CFS) =     322.06

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  3.79   FLOW VELOCITY(FEET/SEC.) =   3.88
 LONGEST FLOWPATH FROM NODE      0.00 TO NODE    211.00 =    1360.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    211.00 TO NODE    220.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1492.00  DOWNSTREAM(FEET) =   1488.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   190.00   CHANNEL SLOPE =  0.0211
 CHANNEL BASE(FEET) =    3.20   "Z" FACTOR =   5.300
 MANNING'S FACTOR = 0.100   MAXIMUM DEPTH(FEET) =  10.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.706
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7140
```

```
  SOIL CLASSIFICATION IS "D"
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     322.49
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.48
  AVERAGE FLOW DEPTH(FEET) =   3.89   TRAVEL TIME(MIN.) =   0.91
  Tc(MIN.) =   30.08
  SUBAREA AREA(ACRES) =     0.70       SUBAREA RUNOFF(CFS) =    0.85
  TOTAL AREA(ACRES) =      189.0         PEAK FLOW RATE(CFS) =     322.91

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  3.89   FLOW VELOCITY(FEET/SEC.) =   3.48
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    220.00 =    1550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   30.08
  RAINFALL INTENSITY(INCH/HR) =   1.71
  TOTAL STREAM AREA(ACRES) =   189.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    322.91

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  13.50   RAIN INTENSITY(INCH/HOUR) =  2.47
  TOTAL AREA(ACRES) =    28.60   TOTAL RUNOFF(CFS) =     56.80

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.50
  RAINFALL INTENSITY(INCH/HR) =   2.47
  TOTAL STREAM AREA(ACRES) =    28.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     56.80

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
```

```
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  19.00   RAIN INTENSITY(INCH/HOUR) =  2.11
  TOTAL AREA(ACRES) =    14.40   TOTAL RUNOFF(CFS) =     23.20

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    220.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   19.00
  RAINFALL INTENSITY(INCH/HR) =   2.11
  TOTAL STREAM AREA(ACRES) =    14.40
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.20

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      322.91    30.08        1.706        189.00
      2       56.80    13.50        2.472         28.60
      3       23.20    19.00        2.111         14.40

 ********************************WARNING*********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 ************************************************************************

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      218.19    13.50       2.472
      2      275.63    19.00       2.111
      3      380.88    30.08       1.706

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     380.88   Tc(MIN.) =   30.08
  TOTAL AREA(ACRES) =      232.0
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    220.00 =    1550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    214.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1488.00  DOWNSTREAM(FEET) =   1484.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   273.00   CHANNEL SLOPE =  0.0147
  CHANNEL BASE(FEET) =    3.20   "Z" FACTOR =   5.300
  MANNING'S FACTOR = 0.100   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.670
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7108
  SOIL CLASSIFICATION IS "D"
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     382.01
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.17
  AVERAGE FLOW DEPTH(FEET) =   4.48   TRAVEL TIME(MIN.) =   1.44
  Tc(MIN.) =   31.52
  SUBAREA AREA(ACRES) =     1.90       SUBAREA RUNOFF(CFS) =    2.26
  TOTAL AREA(ACRES) =      233.9         PEAK FLOW RATE(CFS) =     383.13

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  4.48   FLOW VELOCITY(FEET/SEC.) =   3.17
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    214.00 =    1823.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    214.00 TO NODE    214.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   31.52
  RAINFALL INTENSITY(INCH/HR) =   1.67
  TOTAL STREAM AREA(ACRES) =   233.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    383.13

****************************************************************************
  FLOW PROCESS FROM NODE    214.00 TO NODE    214.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==========================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  24.00   RAIN INTENSITY(INCH/HOUR) =  1.89
  TOTAL AREA(ACRES) =    19.90   TOTAL RUNOFF(CFS) =     37.70

****************************************************************************
  FLOW PROCESS FROM NODE    214.00 TO NODE    214.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   24.00
  RAINFALL INTENSITY(INCH/HR) =   1.89
  TOTAL STREAM AREA(ACRES) =    19.90
```

```
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     37.70

****************************************************************************
  FLOW PROCESS FROM NODE    214.00 TO NODE    214.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  22.80   RAIN INTENSITY(INCH/HOUR) =  1.94
  TOTAL AREA(ACRES) =    11.70   TOTAL RUNOFF(CFS) =     19.60

****************************************************************************
  FLOW PROCESS FROM NODE    214.00 TO NODE    214.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   22.80
  RAINFALL INTENSITY(INCH/HR) =   1.94
  TOTAL STREAM AREA(ACRES) =    11.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.60

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      383.13    31.52        1.670        233.90
      2       37.70    24.00        1.894         19.90
      3       19.60    22.80        1.940         11.70

 **********************************WARNING***********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 ****************************************************************************

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      332.56    22.80       1.940
      2      348.57    24.00       1.894
      3      433.24    31.52       1.670

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     433.24   Tc(MIN.) =   31.52
  TOTAL AREA(ACRES) =      265.5
```

```
 LONGEST FLOWPATH FROM NODE      0.00 TO NODE    214.00 =    1823.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    214.00 TO NODE    214.10 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1484.00  DOWNSTREAM(FEET) =   1448.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   913.00   CHANNEL SLOPE =  0.0394
 CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   2.800
 MANNING'S FACTOR = 0.100   MAXIMUM DEPTH(FEET) =  10.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.606
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7049
 SOIL CLASSIFICATION IS "D"
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     436.30
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.43
 AVERAGE FLOW DEPTH(FEET) =   4.39   TRAVEL TIME(MIN.) =   2.80
 Tc(MIN.) =   34.32
 SUBAREA AREA(ACRES) =     5.40       SUBAREA RUNOFF(CFS) =    6.11
 TOTAL AREA(ACRES) =      270.9         PEAK FLOW RATE(CFS) =     439.35

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  4.41   FLOW VELOCITY(FEET/SEC.) =   5.44
 LONGEST FLOWPATH FROM NODE      0.00 TO NODE    214.10 =    2736.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    214.10 TO NODE    214.10 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   34.32
 RAINFALL INTENSITY(INCH/HR) =   1.61
 TOTAL STREAM AREA(ACRES) =   270.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    439.35

****************************************************************************
 FLOW PROCESS FROM NODE    214.10 TO NODE    214.10 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  20.60   RAIN INTENSITY(INCH/HOUR) =  2.03
 TOTAL AREA(ACRES) =    56.60   TOTAL RUNOFF(CFS) =    109.00

****************************************************************************
 FLOW PROCESS FROM NODE    214.10 TO NODE    214.10 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
================================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   20.60
  RAINFALL INTENSITY(INCH/HR) =   2.03
  TOTAL STREAM AREA(ACRES) =    56.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    109.00

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1      439.35    34.32        1.606        270.90
      2      109.00    20.60        2.033         56.60

 **********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 ***************************************************************************

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1      372.71    20.60       2.033
      2      525.43    34.32       1.606

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     525.43   Tc(MIN.) =   34.32
  TOTAL AREA(ACRES) =      327.5
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    214.10 =    2736.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    214.10 TO NODE    216.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1448.00  DOWNSTREAM(FEET) =   1402.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   556.00   CHANNEL SLOPE =  0.0827
  CHANNEL BASE(FEET) =    6.00   "Z" FACTOR =   2.800
  MANNING'S FACTOR = 0.100   MAXIMUM DEPTH(FEET) =  10.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.580
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7024
  SOIL CLASSIFICATION IS "D"
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     529.65
```

```
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.53
  AVERAGE FLOW DEPTH(FEET) =   4.05   TRAVEL TIME(MIN.) =   1.23
  Tc(MIN.) =   35.55
  SUBAREA AREA(ACRES) =     7.60       SUBAREA RUNOFF(CFS) =    8.43
  TOTAL AREA(ACRES) =      335.1         PEAK FLOW RATE(CFS) =     533.87

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  4.07   FLOW VELOCITY(FEET/SEC.) =   7.54
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    216.00 =    3292.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      335.1  TC(MIN.) =     35.55
  PEAK FLOW RATE(CFS)   =     533.87
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Arroyo Vista

NOISE IMPACT ANALYSIS

COUNTY OF RIVERSIDE

PREPARED BY:

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JUNE 23, 2025

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LIST OF ABBREVIATED TERMS

(1)	Reference
ADT	Average Daily Traffic
Calveno	California Vehicle Noise
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dBA	A-weighted decibels
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
INCE	Institute of Noise Control Engineering
L_{eq}	Equivalent continuous (average) sound level
L_{max}	Maximum level measured over the time interval
L_{min}	Minimum level measured over the time interval
mph	Miles per hour
NR	Noise Reduction
Project	Arroyo Vista
REMEL	Reference Energy Mean Emission Level
STC	Sound Transmission Class

EXECUTIVE SUMMARY

Urban Crossroads, Inc. has prepared this noise study to determine the noise exposure and the necessary noise abatement measures for the proposed residential development Arroyo Vista ("Project"). The Project site is located on the northwest corner of Chicago Avenue and Iris Avenue in the Woodcrest area of unincorporated County of Riverside. This analysis conservatively assesses the development of 233 single-family residential dwelling units, while the Project proposes a slightly smaller development of 231 single-family dwelling units. This noise impact analysis was prepared to satisfy the County of Riverside noise level standards and ensure that adequate noise abatement measures are incorporated into the Project's development. In addition, recommendations for exterior and interior noise abatement are identified based on the latest Project site and grading plans.

EXTERIOR NOISE ABATEMENT

According to the County of Riverside 65 dBA CNEL exterior noise level standard for residential land uses, the on-site unmitigated exterior noise levels are considered normally acceptable for the proposed dwelling units. The on-site traffic noise level impacts indicate that the outdoor living areas adjacent to Chicago Avenue and Iris Avenue will experience unshielded exterior noise levels ranging from 61.3 to 64.2 dBA CNEL. Therefore, no mitigation would be required, and exterior noise impacts would be *less than significant.*

INTERIOR NOISE ABATEMENT

The interior noise level analysis shows that this interior areas would require a 16.3 to 19.2 dBA CNEL reduction to comply with the County of Riverside 45 dBA CNEL standard, which is greater than the minimum 12 dBA reduction with windows open and will require a windows-closed condition and mechanical ventilation (e.g., air conditioning). The Project intends to provide each unit in the development with mechanical ventilation, thus the windows can be kept in a closed position as required. Based on standard construction techniques, interior noise standards can be satisfied using standard windows and construction techniques. Therefore, no mitigation would be required to satisfy the County of Riverside 45 dBA CNEL interior noise level standards, and interior noise impacts would be *less than significant.*

OFF-SITE TRAFFIC NOISE ANALYSIS

Traffic generated by the operation of the proposed Project will influence the traffic noise levels in surrounding off-site areas. To quantify the traffic noise increases on the surrounding off-site areas, the changes in traffic noise levels on twenty-three roadway segments surrounding the Project site were calculated based on the change in the average daily traffic (ADT) volumes. The traffic noise levels provided in this analysis are based on the traffic forecasts found in *Arroyo Vista Traffic Impact Analysis*. (1) To assess the off-site noise level impacts associated with the proposed Project, noise contour boundaries were developed for Existing, Existing Plus Project, Existing plus Ambient Growth plus Project plus Cumulative (EAPC) (2030) Project Buildout, and Horizon Year (2045) traffic conditions.

The Existing exterior traffic noise levels are expected to range from 41.0 to 76.6 dBA CNEL. The Existing plus Project conditions will range from 41.0 to 76.6 dBA CNEL. The Project off-site traffic noise level increases will range from less than 0.1 to 8.2 dBA CNEL. Based on the traffic noise level increases, land uses adjacent to Gamble Avenue, south of Iris Avenue (segment #8), are predicted to experience a significant (8.2 dBA CNEL) noise level increase due to unmitigated Project-related traffic noise levels. However, the overall traffic noise levels along this segment are predicted to be 52.6 dBA CNEL. Based on the existing measured noise levels in the vicinity of Gamble Avenue, the ambient noise level is 56.7 dBA CNEL. Accounting for the measured existing ambient noise level, the Project would result in a traffic noise level increase of less than 2.0 dBA. Therefore, the Project-related traffic noise level increases along all segments would be *less than significant*.

The EAC Year 2030 without Project exterior noise levels are expected to range from 41.0 to 77.8 dBA CNEL. The EAPC Year 2030 with Project conditions will range from 41.0 to 77.8 dBA CNEL. Under this scenario, the Project off-site traffic noise level increases will range from less than 0.1 to 6.4 dBA CNEL. Similar to the existing condition, the traffic noise level increases at land uses adjacent to Gamble Avenue, south of Iris Avenue (segment #8), are predicted to be *significant* (6.4 dBA CNEL). However, similar to Existing plus Project traffic noise levels, the overall traffic noise level along this segment is predicted to be 53.0 dBA CNEL. Based on the existing measured noise levels in the vicinity of Gamble Avenue, the ambient noise level is 56.7 dBA CNEL. Accounting for the measured existing ambient noise level, the Project would result in a traffic noise level increase of less than 2.0 dBA. Therefore, Project-related traffic noise level increases would be *less than significant*.

The Horizon Year 2045 without Project exterior noise levels are expected to range from 41.0 to 78.4 dBA CNEL. The Horizon Year 2045 with Project conditions will range from 41.0 to 78.6 dBA CNEL. The Project off-site traffic noise level increases will range from less than 0.1 to 6.1 dBA CNEL. Similar to the existing and EAPC 2030 conditions, the traffic noise level increases at land uses adjacent to Gamble Avenue, s/o Iris Avenue (segment 8), are predicted to be *significant* (6.1 dBA CNEL). However, similar to Existing plus Project traffic noise levels, the overall traffic noise level along this segment is predicted to be 53.1 dBA CNEL. Based on the existing measured noise levels in the vicinity of Gamble Avenue, the ambient noise level is 56.7 dBA CNEL. Accounting for the measured existing ambient noise level, the Project would result in a traffic noise level increase of less than 2.0 dBA. Therefore, Project-related traffic noise level increases would be *less than significant*.

Therefore, the analysis shows that the Project-related traffic noise level increases would be less than significant.

OPERATIONAL NOISE ANALYSIS

The Arroyo Vista residential development is not expected to include any specific type of operational noise levels beyond the typical noise sources associated with similar residential land uses in the Project study area, such as people and children, parking lot activity, garage doors, small air conditioners, and trash collection, and is considered a noise-sensitive receiving land use.

However, there is the potential for operational noise impacts due to ground mounted air conditioners (HVAC) at adjacent residential land uses.

To assess the noise impacts of potential air conditioners, Urban Crossroads modeled typical 1- to 5-ton air conditioners on each lot at the approximate location of the units. Based on modeling, the daytime hourly noise levels at the off-site receiver locations are expected to range from 29.6 to 35.5 dBA $L_{eq.}$ The nighttime hourly noise levels at the off-site receiver locations are expected to range from 26.8 to 32.8 dBA L_{eq}. The operational noise levels associated with Arroyo Vista Project will not exceed the County of Riverside 55 dBA L_{ed} daytime and 45 dBA L_{eq} nighttime exterior noise level standards at all nearby receiver locations. Additionally, the Project will generate a daytime and nighttime operational noise level increases ranging from 0.0 to 04 dBA L_{eq} at the nearest receiver locations. Therefore, operational noise impacts of the Project are considered *less than significant*.

CONSTRUCTION AND ROCK CRUSHING NOISE ANALYSIS

Using sample reference noise levels to represent the planned construction and rock crushing activities at the Arroyo Vista site, this analysis estimates the Project-related construction noise levels at nearby sensitive receiver locations. Since the County of Riverside General Plan and County Code of Ordinances do not identify specific construction noise level thresholds, an hourly average L_{eq} threshold is identified based on the Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment Manual* for noise sensitive residential use. The Project-related construction and rock crushing activities noise levels are expected to range from 56.4 to 61.3 dBA L_{eq} and will satisfy the 80 dBA L_{eq} construction noise level threshold at all receiver locations. Additionally, construction activities are planned to typically occur between 7:00 a.m. and 5:00 p.m. and would comply with the County of Riverside limitation on allowable hours of construction per Section 9.52.020. Therefore, based on the results of this analysis, all nearby sensitive receiver locations will experience *less than significant* impacts due to Project construction noise levels.

CONSTRUCTION AND ROCK CRUSHING VIBRATION

Construction and rock crushing activities can result in varying degrees of ground vibration, depending on the equipment and methods used, distance to the affected structures and soil type. It is expected that ground-borne vibration from Project construction activities would cause only intermittent, localized intrusion. Ground-borne vibration levels resulting from typical construction activities occurring within the Project site were estimated by data published by the Federal Transit Administration (FTA). At the nearest receivers Project construction vibration velocity levels are estimated to reach up to 0.02 in/sec PPV. Based on maximum acceptable continuous vibration threshold of 0.30 PPV (in/sec), the typical Project construction vibration levels will not exceed the County of Riverside thresholds at properties located adjacent to the Project site and vibration impacts would be *less than significant*.

BLASTING NOISE ANALYSIS

Blasting associated with Project construction would occur on-site and near residential homes. While some blasting noise will be noticeable by nearby residents, the recommended construction

noise and vibration recommendations identified in this report will reduce the worst-case noise levels calculated using RCNM. RCNM reference noise level for explosive blasting equipment is 94 dBA L_{max} at a distance of 50 feet. (2) Since the County of Riverside General Plan and County Code of Ordinances do not identify specific construction noise level limits for blasting activities, the Office of Surface Mining Reclamation and Enforcement (OSMRE) and the Code of Federal Regulations (CFR) Airblast Limits (30 CFR 816.67(b)) (3) are used to represents an appropriate threshold for determining potential impacts due to blasting-related noise levels. The noise levels at the individual receiver locations, will approach 70.2 dBA L_{max} and will not exceed the CFR maximum noise level of 129 dBA L_{max} noise level threshold and blasting noise impacts would be *less than significant*.

BLASTING VIBRATION ANALYSIS

Blasting operations can have unacceptable noise and vibration impacts if not conducted correctly. Excessive levels of structural vibration due to ground vibration from blasting can cause substantial damage to structures. Therefore, Noise-1 is required to mitigate potential vibration impacts. With the implementation of the identified controls vibration levels from blasting activities at sensitive receivers would be *less than significant*.

CONSTRUCTION BLASTING NOISE AND VIBRATION ABATEMENT MEASURES

Though blasting noise and vibration is temporary, intermittent and of short duration, and will not present any long-term impacts, the following practices would reduce any noise and vibration level increases produced by blasting activities to the nearby noise-sensitive residential land uses:

The following practices would reduce any noise and vibration level impacts produced by the proposed blasting activities at the nearby noise-sensitive residential land uses:

MM Noise-1: Blasting Limitations.

Prior to approval of any grading permits that require blasting activities and a blasting permit, the Project Applicant shall prepare and submit for County review and approval of a Blasting Noise and Vibration Monitoring and Abatement Plan ("Noise and Vibration Abatement Plan"). The required Noise and Vibration Abatement Plan shall include the name and qualifications of the person(s) responsible for monitoring and reporting blast vibrations. In addition, the Noise and Vibration Abatement Plan shall require a minimum of three seismographs for monitoring peak ground vibration and air-overpressure. The Noise and Vibration Abatement Plan also shall require that equipment and its use shall conform fully to the standards developed by the Vibration Section of the International Society of Explosive Engineers (ISEE). For all blasts, the Noise and Vibration Abatement Plan shall require monitoring of ground motion and air-overpressure at the nearest residential properties or other structure of concern. The Noise and Vibration Abatement Plan also shall specify a minimum trigger level for monitoring of 0.05 in/s for ground motion and 120 dB for air-overpressure. Additionally, the Noise and Vibration Abatement Plan shall require regular reporting of blasting and measurements to Riverside County, and shall include a copy of the instrument/software-generated blast monitoring report at each instrument location that includes measured peak particle velocity in inches per second, peak air-overpressure in linear-

scale decibels, and vibration and air-overpressure event plots, with date and time of event recording. In addition, the Noise and Vibration Abatement Plan shall include the following requirements:

- Prior to commencement of any blasting, a pre-blast survey of the conditions of all existing property and aboveground utilities located within 300 feet of any potential blasting areas shall be conducted. The pre-blast survey shall include a photographic record of all visible and accessible structures, facilities, utilities, or other improvements. The survey shall document the interior and exterior conditions of all residential property and associated structures located within 500 feet of blasting areas. If property owners refuse surveys, provide copies of certified-mail letters documenting attempts to provide the survey by a third-party professional survey company. The required surveys shall include a description of the interior and exterior condition of the various structures examined. Descriptions shall include the locations of any cracks, damage, or other existing defects and shall include information needed to identify and describe the defect, if any, and to evaluate the construction operations on the defect. Survey records shall include photos of all cracks and other damaged, weathered, or otherwise deteriorated structural conditions. If necessary, macro lenses and flash illumination shall be used to ensure defects are shown clearly in the photographs. Photos shall contain an accurate date stamp. No blasting shall occur prior to completion of surveys of surrounding residential properties. Surveys also shall be repeated at facilities or properties where damage concerns have been expressed by individual residents, property owners, or other concerned parties. Details of any observed changes to surveyed structures and documenting photos shall be reported and submitted to Riverside County.
- Blasting only shall be allowed Monday through Friday only between the hours of 8:00 a.m. and 5:00 p.m.
- No blasting shall occur closer than 100 feet from residential structures. In the event that non-rippable materials are encountered within 100 feet from any residential structure, alternative methods shall be employed to reduce blasting-related noise and vibration impacts. Alternative rock blasting within 100 feet of residential homes may include methods such as the drilling of holes in the largest area of rock, inserting expansive grout or small charges into each whole to fragment the rock into smaller pieces, and then crushing the pieces for transport or other use.
- No more than a total of 2,000 pounds of explosive shall be detonated each day, excluding detonators.
- All blasts located within 500 feet of any structures or above ground utilities shall be covered with woven steel cable or steel-cable and rubber-tire blasting mats with a minimum weight of 30 pounds per square foot. Woven polypropylene or similar weed-barrier fabric, covered with at least 6 inches of soil or sand shall be placed over blast areas to protect initiators before mats are placed. Mats shall be overlapped at least 3 feet and shall completely cover the blast area and extend at least three feet beyond the blast area in all directions. If any flyrock or blasted material is thrown more than 10 feet or half the distance to the nearest structure, whichever is less, blasting shall be suspended until the County's has approved a revised blasting plan showing revisions to assure adequate ground movement control.
- Before blasts are covered, all loose soils above the blast shall be removed where feasible. Remaining ground located within 20 feet of the blast shall be thoroughly wetted with water to suppress airborne dust. Sand or soils placed over weed-barrier fabric shall be similarly wetted before placing blast mats.

- If specified vibration limits are exceeded, blasting operations shall cease immediately and a revised blasting plan shall be submitted to the County. Blasting shall not resume until a revised blasting plan has been reviewed and the Contractor has expressed in writing the conditions that will be applied to further blasting work.

Project grading and blasting contractors shall be required to ensure compliance with the Noise and Vibration Abatement Plan requirements and shall permit periodic inspection of the construction site by County of Riverside staff or its designee to confirm compliance. The requirements of the Noise and Vibration Abatement Plan also shall be specified in bid documents issued to prospective construction contractors. Riverside County shall review all monitoring reports to ensure compliance with the Noise and Vibration Abatement Plan and shall have the authority to stop all blasting activities on site if it is determined that blasting activities are not being conducted in conformance with Noise and Vibration Abatement Plan and/or the above-listed requirements.

SUMMARY OF CEQA SIGNIFICANCE FINDINGS

The results of this Arroyo Vista Noise Impact Analysis are summarized below based on the significance criteria in Section 4 of this report consistent with Appendix G of the California Environmental Quality Act (CEQA) Guidelines. (4). Table ES-1 shows the findings of significance for each potential noise and/or vibration impact under CEQA before and after any required mitigation measures.

TABLE ES-1: SUMMARY OF CEQA SIGNIFICANCE FINDINGS

Analysis	Report Section	Significance Findings	
		Unmitigated	Mitigated
On-Site Traffic Noise	7	*Less Than Significant*	-
Off-Site Traffic Noise	8	*Less Than Significant*	-
Operational Noise	10	*Less Than Significant*	-
Construction & Rock Crushing Noise	11	*Less Than Significant*	-
Construction & Rock Crushing Vibration		*Less Than Significant*	-
Blasting Noise		*Less Than Significant*	-
Blasting Vibration		*Significant*	*Less Than Significant*

1 INTRODUCTION

This noise analysis has been completed to determine the noise impacts associated with the development of the proposed Arroyo Vista ("Project"). This noise study briefly describes the proposed Project, provides information regarding noise fundamentals, sets out the local regulatory setting, presents the study methods and procedures noise analysis, evaluates the potential noise impacts from operation and construction of the Project, and as necessary, identifies mitigation measures to reduce impacts.

1.1 SITE LOCATION

The Project site is located on the northwest corner of Chicago Avenue and Iris Avenue in the Woodcrest area of unincorporated County of Riverside, as shown on Exhibit 1-A. The closest major airport is the Riverside Municipal Airport located roughly 9.8 miles northwest of the Project site.

1.2 PROJECT DESCRIPTION

The Project consists of the development of 231 single family detached residential dwelling units and associated improvements. The Project is anticipated to be developed in two phases with a Project buildout in 2030, as shown on Exhibit 1-B. This analysis conservatively assesses the development of 233 single-family residential dwelling units.

EXHIBIT 1-A: LOCATION MAP

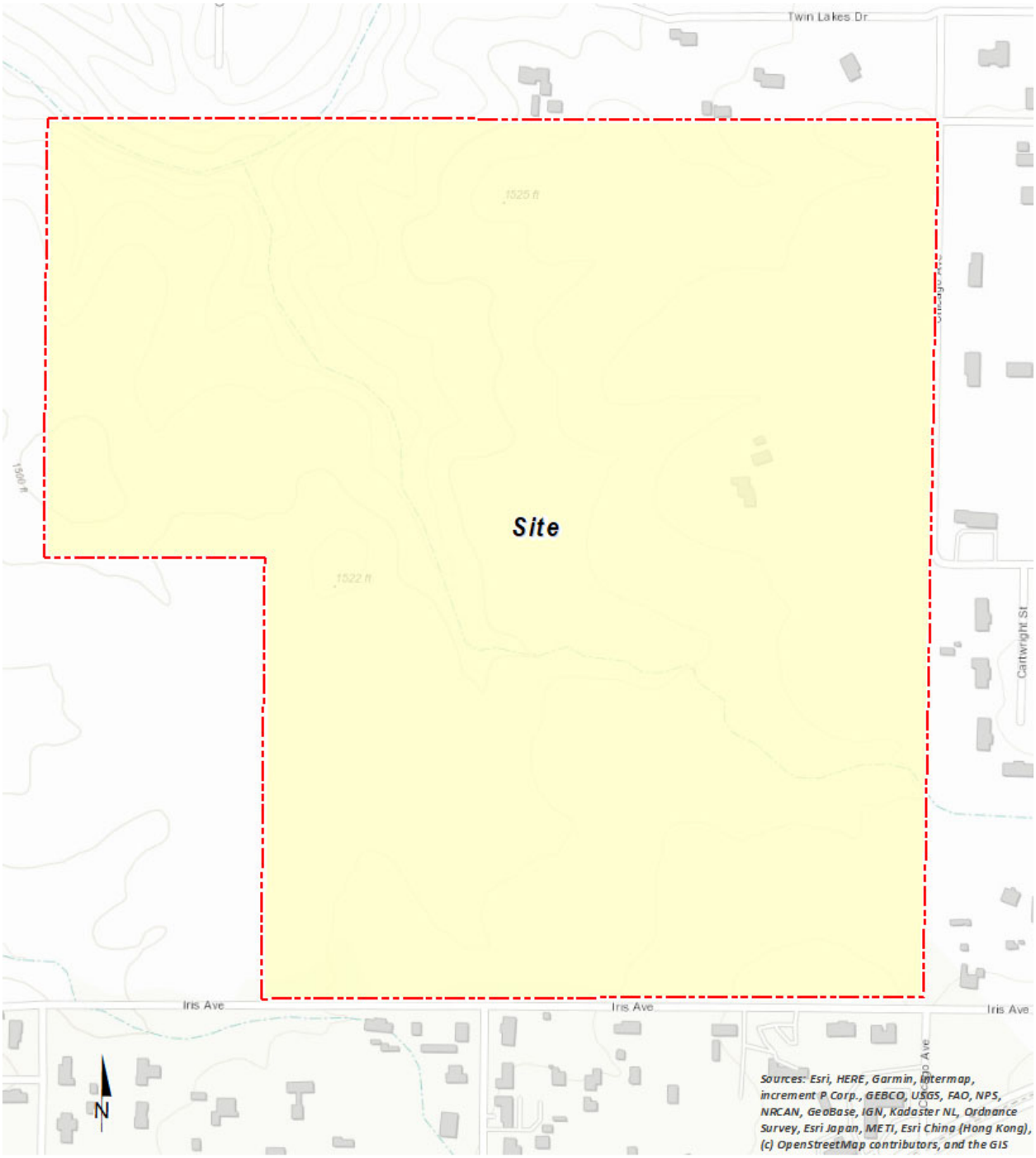
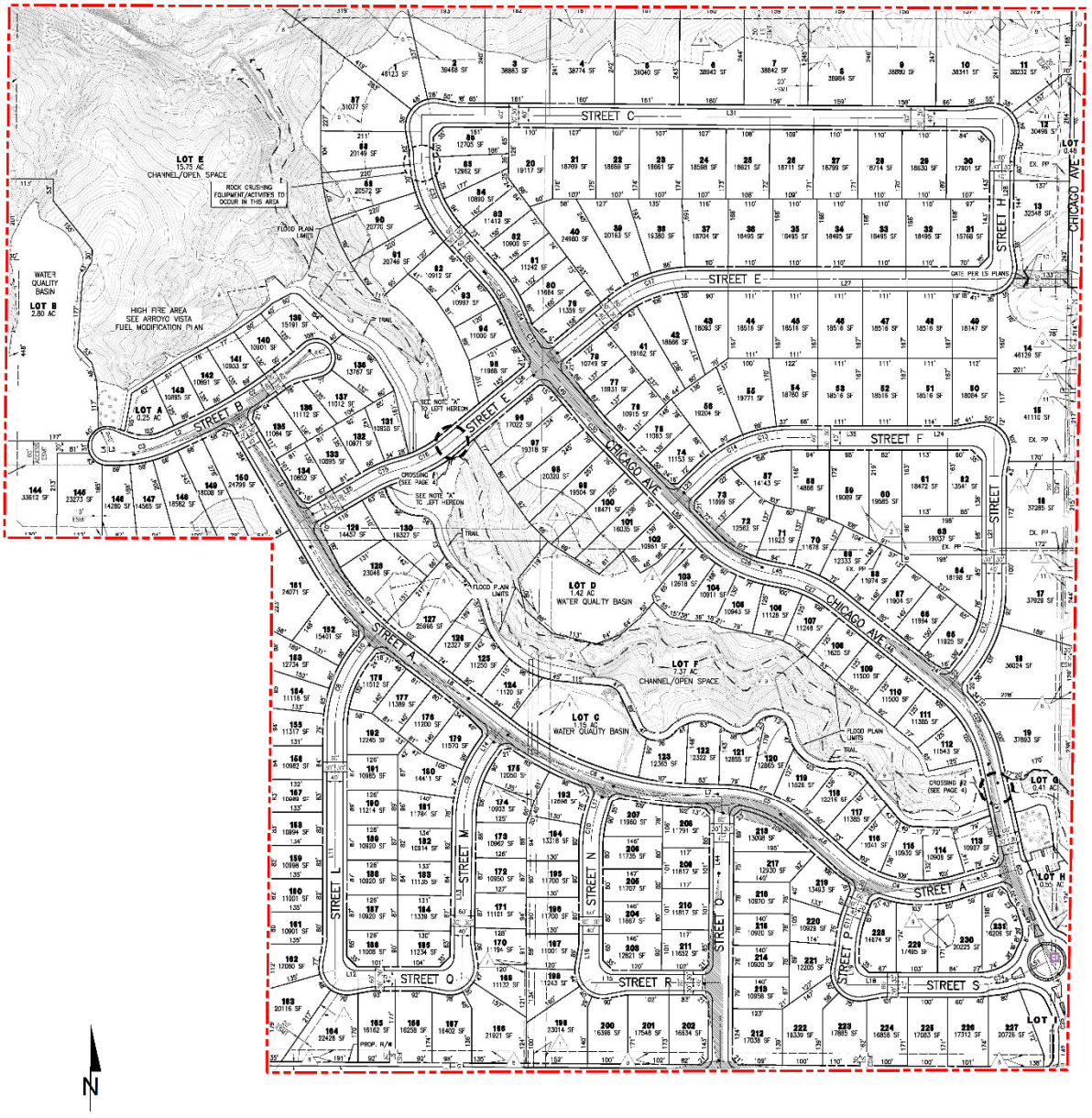


EXHIBIT 1-B: SITE PLAN



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2 FUNDAMENTALS

Noise has been simply defined as "unwanted sound." Sound becomes unwanted when it interferes with normal activities, when it causes actual physical harm or when it has adverse effects on health (5). Noise is measured on a logarithmic scale of sound pressure level known as a decibel (dB). A-weighted decibels (dBA) approximate the subjective response of the human ear to broad frequency noise source by discriminating against very low and very high frequencies of the audible spectrum. They are adjusted to reflect only those frequencies which are audible to the human ear. Exhibit 2-A presents a summary of the typical noise levels and their subjective loudness and effects that are described in more detail below.

EXHIBIT 2-A: TYPICAL NOISE LEVELS

COMMON OUTDOOR ACTIVITIES	COMMON INDOOR ACTIVITIES	A - WEIGHTED SOUND LEVEL dBA	SUBJECTIVE LOUDNESS	EFFECTS OF NOISE
THRESHOLD OF PAIN		140	INTOLERABLE OR DEAFENING	HEARING LOSS
NEAR JET ENGINE		130		
		120		
JET FLY-OVER AT 300m (1000 ft)	ROCK BAND	110		
LOUD AUTO HORN		100	VERY NOISY	
GAS LAWN MOWER AT 1m (3 ft)		90		
DIESEL TRUCK AT 15m (50 ft), at 80 km/hr (50 mph)	FOOD BLENDER AT 1m (3 ft)	80		SPEECH INTERFERENCE
NOISY URBAN AREA, DAYTIME	VACUUM CLEANER AT 3m (10 ft)	70	LOUD	
HEAVY TRAFFIC AT 90m (300 ft)	NORMAL SPEECH AT 1m (3 ft)	60		
QUIET URBAN DAYTIME	LARGE BUSINESS OFFICE	50	MODERATE	SLEEP DISTURBANCE
QUIET URBAN NIGHTTIME	THEATER, LARGE CONFERENCE ROOM (BACKGROUND)	40		
QUIET SUBURBAN NIGHTTIME	LIBRARY	30	FAINT	NO EFFECT
QUIET RURAL NIGHTTIME	BEDROOM AT NIGHT, CONCERT HALL (BACKGROUND)	20		
	BROADCAST/RECORDING STUDIO	10	VERY FAINT	
LOWEST THRESHOLD OF HUMAN HEARING	LOWEST THRESHOLD OF HUMAN HEARING	0		

Source: Environmental Protection Agency Office of Noise Abatement and Control, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA/ONAC 550/9-74-004) March 1974.

2.1 RANGE OF NOISE

Since the range of intensities that the human ear can detect is so large, the scale frequently used to measure intensity is a scale based on multiples of 10, the logarithmic scale. The scale for measuring intensity is the decibel scale. Each interval of 10 decibels indicates a sound energy ten times greater than before, which is perceived by the human ear as being roughly twice as loud. (6) The most common sounds vary between 40 dBA (very quiet) to 100 dBA (very loud). Normal conversation at three feet is roughly at 60 dBA, while loud jet engine noises equate to 110 dBA

at approximately 100 feet, which can cause serious discomfort. (7) Another important aspect of noise is the duration of the sound and the way it is described and distributed in time.

2.2 NOISE DESCRIPTORS

Environmental noise descriptors are generally based on averages, rather than instantaneous, noise levels. The most commonly used figure is the equivalent level (L_{eq}). Equivalent sound levels are not measured directly but are calculated from sound pressure levels typically measured in A-weighted decibels (dBA). The equivalent sound level (L_{eq}) represents a steady state sound level containing the same total energy as a time varying signal over a given sample period and is commonly used to describe the "average" noise levels within the environment.

To describe the time-varying character of environmental noise, the statistical or percentile noise descriptors L_{50}, L_{25}, L_8 and L_2, are commonly used. The percentile noise descriptors are the noise levels equaled or exceeded during 50 percent, 25 percent, 8 percent, and 2 percent of a stated time. Sound levels associated with the L_2 and L_8 typically describe transient or short-term events, while levels associated with the L_{50} describe the steady state (or median) noise conditions. While the L_{50} describes the median noise levels occurring 50 percent of the time, the L_{eq} accounts for the total energy (average) observed for the entire hour. Therefore, the L_{eq} noise descriptor is generally 1-2 dBA higher than the L_{50} noise level.

Peak hour or average noise levels, while useful, do not completely describe a given noise environment. Noise levels lower than peak hour may be disturbing if they occur during times when quiet is most desirable, namely evening and nighttime (sleeping) hours. To account for this, the Community Noise Equivalent Level (CNEL), representing a composite 24-hour noise level is utilized. The CNEL is the weighted average of the intensity of a sound, with corrections for time of day, and averaged over 24 hours. The time of day corrections require the addition of 5 decibels to dBA L_{eq} sound levels in the evening from 7:00 p.m. to 10:00 p.m., and the addition of 10 decibels to dBA L_{eq} sound levels at night between 10:00 p.m. and 7:00 a.m. These additions are made to account for the noise sensitive time periods during the evening and night hours when sound appears louder. CNEL does not represent the actual sound level heard at any time, but rather represents the total sound exposure. The County of Riverside relies on the 24-hour CNEL level to assess land use compatibility with transportation related noise sources.

2.3 SOUND PROPAGATION

When sound propagates over a distance, it changes in level and frequency content. The way noise reduces with distance depends on the following factors.

2.3.1 GEOMETRIC SPREADING

Sound from a localized source (i.e., a stationary point source) propagates uniformly outward in a spherical pattern. The sound level attenuates (or decreases) at a rate of 6 dB for each doubling of distance from a point source. Highways consist of several localized noise sources on a defined path and hence can be treated as a line source, which approximates the effect of several point sources. Noise from a line source propagates outward in a cylindrical pattern, often referred to

as cylindrical spreading. Sound levels attenuate at a rate of 3 dB for each doubling of distance from a line source. (6)

2.3.2 GROUND ABSORPTION

The propagation path of noise from a highway to a receptor is usually very close to the ground. Noise attenuation from ground absorption and reflective wave canceling adds to the attenuation associated with geometric spreading. Traditionally, the excess attenuation has also been expressed in terms of attenuation per doubling of distance. This approximation is usually sufficiently accurate for distances of less than 200 ft. For acoustically hard sites (i.e., sites with a reflective surface between the source and the receptor, such as a parking lot or body of water), no excess ground attenuation is assumed. For acoustically absorptive or soft sites (i.e., those sites with an absorptive ground surface between the source and the receptor such as soft dirt, grass, or scattered bushes and trees), an excess ground attenuation value of 1.5 dB per doubling of distance is normally assumed. When added to the cylindrical spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dB per doubling of distance from a line source. (8)

2.3.3 ATMOSPHERIC EFFECTS

Receptors located downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Sound levels can be increased at large distances (e.g., more than 500 feet) due to atmospheric temperature inversion (i.e., increasing temperature with elevation). Other factors such as air temperature, humidity, and turbulence can also have significant effects. (6)

2.3.4 SHIELDING

A large object or barrier in the path between a noise source and a receptor can substantially attenuate noise levels at the receptor. The amount of attenuation provided by shielding depends on the size of the object and the frequency content of the noise source. Shielding by trees and other such vegetation typically only has an “out of sight, out of mind” effect. That is, the perception of noise impact tends to decrease when vegetation blocks the line-of-sight to nearby resident. However, for vegetation to provide a substantial, or even noticeable, noise reduction, the vegetation area must be at least 15 feet in height, 100 feet wide and dense enough to completely obstruct the line-of sight between the source and the receiver. This size of vegetation may provide up to 5 dBA of noise reduction. The FHWA does not consider the planting of vegetation to be a noise abatement measure. (8)

2.4 NOISE CONTROL

Noise control is the process of obtaining an acceptable noise environment for an observation point or receptor by controlling the noise source, transmission path, receptor, or all three. This concept is known as the source-path-receptor concept. In general, noise control measures can be applied to these three elements.

2.5 NOISE BARRIER ATTENUATION

Effective noise barriers can reduce noise levels by 10 to 15 dBA, cutting the loudness of traffic noise in half. A noise barrier is most effective when placed close to the noise source or receptor. Noise barriers, however, do have limitations. For a noise barrier to work, it must be high enough and long enough to block the path of the noise source. (8)

2.6 LAND USE COMPATIBILITY WITH NOISE

Some land uses are more tolerant of noise than others. For example, schools, hospitals, churches, and residences are more sensitive to noise intrusion than are commercial or industrial developments and related activities. As ambient noise levels affect the perceived amenity or livability of a development, so too can the mismanagement of noise impacts impair the economic health and growth potential of a community by reducing the area's desirability as a place to live, shop and work. For this reason, land use compatibility with the noise environment is an important consideration in the planning and design process. The FHWA encourages State and Local government to regulate land development in such a way that noise-sensitive land uses are either prohibited from being located adjacent to a highway, or that the developments are planned, designed, and constructed in such a way that noise impacts are minimized. (9)

2.8 COMMUNITY RESPONSE TO NOISE

Community responses to noise may range from registering a complaint by telephone or letter, to initiating court action, depending upon everyone's susceptibility to noise and personal attitudes about noise. Several factors are related to the level of community annoyance including:

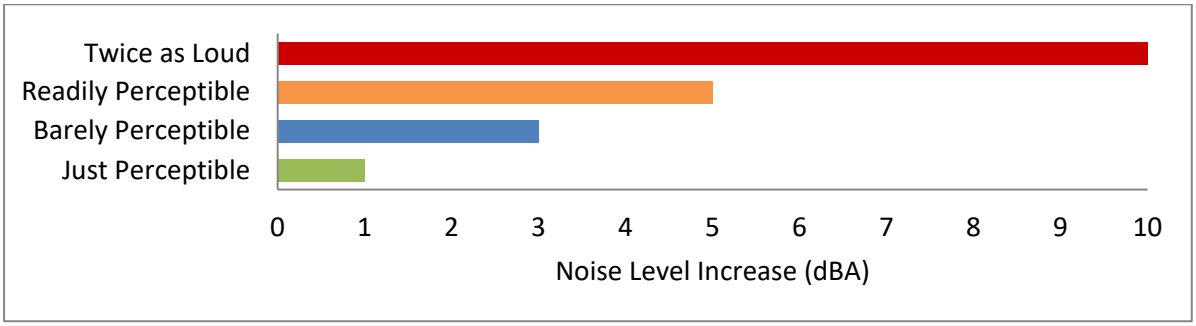
- Fear associated with noise producing activities;
- Socio-economic status and educational level;
- Perception that those affected are being unfairly treated;
- Attitudes regarding the usefulness of the noise-producing activity;
- Belief that the noise source can be controlled.

Approximately ten percent of the population has a very low tolerance for noise and will object to any noise not of their making. Consequently, even in the quietest environment, some complaints will occur. Another twenty-five percent of the population will not complain even in very severe noise environments. Thus, a variety of reactions can be expected from people exposed to any given noise environment. (10) Surveys have shown that about ten percent of the people exposed to traffic noise of 60 dBA will report being highly annoyed with the noise, and each increase of one dBA is associated with approximately two percent more people being highly annoyed. When traffic noise exceeds 60 dBA or aircraft noise exceeds 55 dBA, people may begin to complain. (10)

Despite this variability in behavior on an individual level, the population can be expected to exhibit the following responses to changes in noise levels as shown on Exhibit 2-B. An increase or decrease of 1 dBA cannot be perceived except in carefully controlled laboratory experiments,

a change of 3 dBA is considered *barely perceptible*, and changes of 5 dBA are considered *readily perceptible*. (11)

EXHIBIT 2-B: NOISE LEVEL INCREASE PERCEPTION



2.9 VIBRATION

Per the Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment Manual*, vibration is the periodic oscillation of a medium or object. The rumbling sound caused by the vibration of room surfaces is called structure-borne noise. Sources of ground-borne vibrations include natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) or human-made causes (e.g., explosions, machinery, traffic, trains, construction equipment). Vibration sources may be continuous, such as factory machinery, or transient, such as explosions. As is the case with airborne sound, ground-borne vibrations may be described by amplitude and frequency.

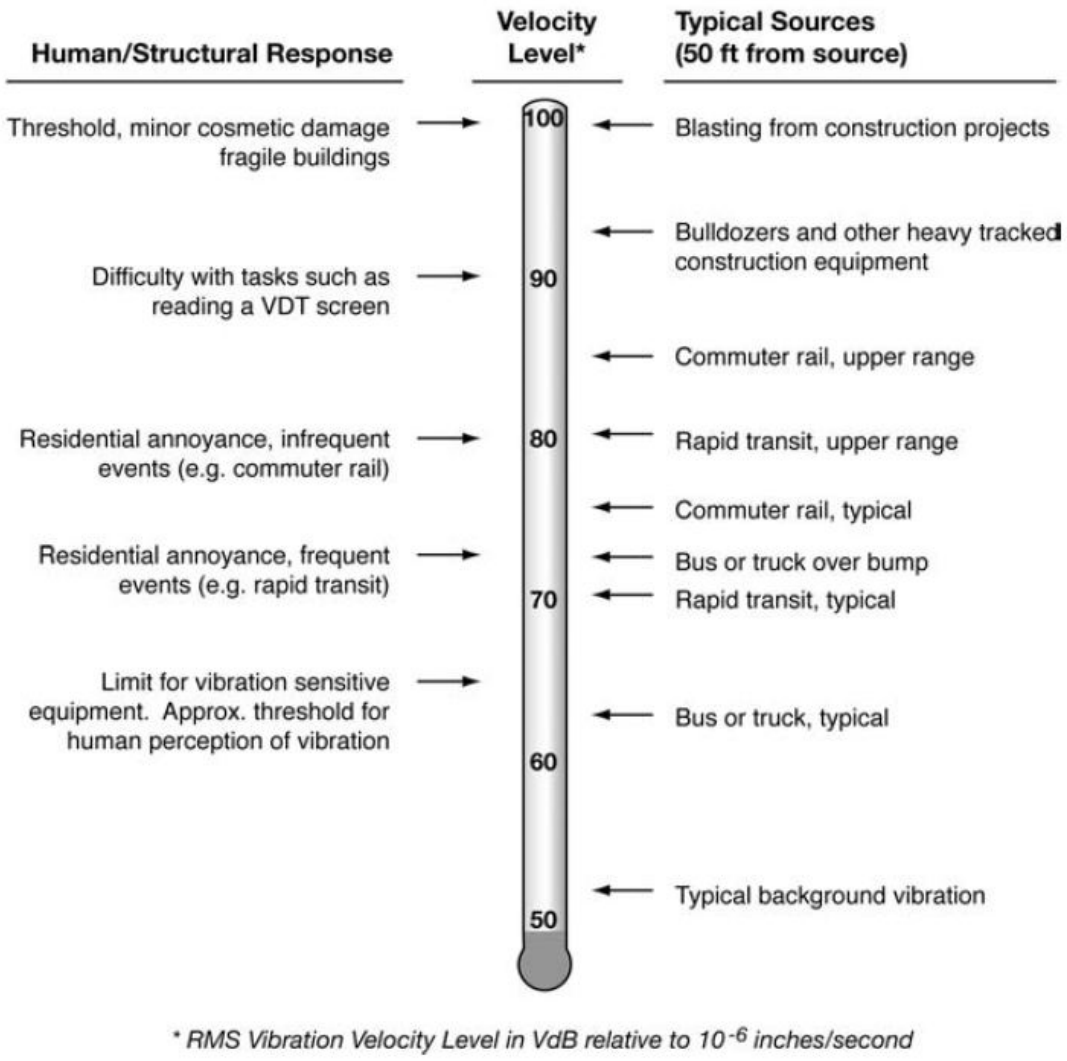
Additionally, in contrast to airborne noise, ground-borne vibration outdoors is not a common environmental problem and annoyance from ground-borne vibration is almost exclusively an indoor phenomenon (4). Therefore, the effects of vibrations should only be evaluated at a structure and the effects of the building structure on the vibration should be considered. Wood-frame buildings, such as typical residential structures, are more easily excited by ground vibration than heavier buildings. In contrast, large masonry buildings with spread footings have a low response to ground vibration (4). In general, the heavier a building is, the lower the response will be to the incident vibration energy. However, all structurers reduce vibration levels due to the coupling of the building to the soil.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal (4). The PPV is most frequently used to describe vibration impacts to buildings but is not always suitable for evaluating human response (annoyance) because it takes some time for the human body to respond to vibration signals. Instead, the human body responds to average vibration amplitude often described as the root mean square (RMS). The RMS amplitude is defined as the average of the squared amplitude of the signal and is most frequently used to describe the effect of vibration on the human body (4). However, the RMS amplitude and PPV are related mathematically, and the RMS amplitude of equipment is typically calculated from the PPV reference level. The RMS amplitude is approximately 70% of the PPV (12). Thus, either can be used on the description of vibration impacts.

While not universally accepted, vibration decibel notation (VdB) is another vibration notation developed and used by the FTA in their guidance manual to describe vibration levels and provide a background of common vibration levels and set vibration limits (13). Decibel notation (VdB) serves to reduce the range of numbers used to describe vibration levels and is used in this report to describe vibration levels.

As stated in the FTA guidance manual, the background vibration-velocity level in residential areas is generally 50 VdB. Ground-borne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels. Typical outdoor sources of perceptible ground-borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the ground-borne vibration is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration-velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings. Exhibit 2-C illustrates common vibration sources and the human and structural response to ground-borne vibration.

EXHIBIT 2-C: TYPICAL LEVELS OF GROUND-BORNE VIBRATION



** RMS Vibration Velocity Level in VdB relative to 10^{-6} inches/second*

Source: Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment Manual*.

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3 REGULATORY SETTING

To limit population exposure to physically and/or psychologically damaging as well as intrusive noise levels, the federal government, the State of California, various county governments, and most municipalities in the state have established standards and ordinances to control noise. In most areas, automobile and truck traffic is the major source of environmental noise. Traffic activity generally produces an average sound level that remains constant with time. Air and rail traffic, and commercial and industrial activities are also major sources of noise in some areas. Federal, state, and local agencies regulate different aspects of environmental noise. Federal and state agencies generally set noise standards for mobile sources such as aircraft and motor vehicles, while regulation of stationary sources is left to local agencies.

3.1 CALIFORNIA NOISE REQUIREMENTS

California regulates freeway noise, sets standards for sound transmission, provides occupational noise control criteria, identifies noise standards, and provides guidance for local land use compatibility. State law requires that each county and city adopt a General Plan that includes a Noise Element which is to be prepared per guidelines adopted by the Governor's Office of Planning and Research (OPR). (14) The purpose of the Noise Element is to *limit the exposure of the community to excessive noise levels*. In addition, the California Environmental Quality Act (CEQA) requires that all known environmental effects of a project be analyzed, including environmental noise impacts.

3.2 CALIFORNIA BUILDING CODE

California's noise insulation standards for all residential units are codified in the California Code of Regulations (CCR), Title 24, Building Standards Administrative Code, Chapter 12, Section 1206. These noise standards are applied to new construction that contains dwelling units or sleeping units, such as residential and hotel or motel uses, in California for controlling interior noise levels resulting from exterior noise sources. For new buildings, the acceptable interior noise limit is 45 dBA CNEL in habitable rooms (15).

3.3 COUNTY OF RIVERSIDE GENERAL PLAN NOISE ELEMENT

The County of Riverside has adopted a Noise Element of the General Plan to control and abate environmental noise, and to protect the citizens of the County of Riverside from excessive exposure to noise. (16) The Noise Element specifies the maximum allowable exterior noise levels for new developments impacted by transportation noise sources such as arterial roads, freeways, airports and railroads. In addition, the Noise Element identifies several polices to minimize the impacts of excessive noise levels throughout the community and establishes noise level requirements for all land uses. To protect County of Riverside residents from excessive noise, the Noise Element contains the following policies related to the Project:

N 1.1 Protect noise-sensitive land uses from high levels of noise by restricting noise-producing land uses from these areas. If the noise-producing land use cannot be relocated, then noise buffers such as setbacks, landscaping, or block walls shall be used.

N 1.3 Consider the following uses noise-sensitive and discourage these uses in areas in excess of 65 CNEL:

- *Schools*
- *Hospitals*
- *Rest Homes*
- *Long Term Care Facilities*
- *Mental Care Facilities*
- *Residential Uses*
- *Libraries*
- *Passive Recreation Uses*
- *Places of Worship*

N 1.5 Prevent and mitigate the adverse impacts of excessive noise exposure on the residents, employees, visitors, and noise-sensitive uses of Riverside County.

N 4.1 Prohibit facility-related noise, received by any sensitive use, from exceeding the following worst-case noise levels:

a. 45 dBA 10-minute L_{eq} between 10:00 p.m. and 7:00 a.m.;

b. 65 dBA 10-minute L_{eq} between 7:00 a.m. and 10:00 p.m.

N 13.1 Minimize the impacts of construction noise on adjacent uses within acceptable standards.

N 13.2 Ensure that construction activities are regulated to establish hours of operation in order to prevent and/or mitigate the generation of excessive or adverse impacts on surrounding areas.

N 13.3 Condition subdivision approval adjacent to developed/occupied noise-sensitive land uses (see policy N 1.3) by requiring the developer to submit a construction-related noise mitigation plan to the [County] for review and approval prior to issuance of a grading permit. The plan must depict the location of construction equipment and how the noise from this equipment will be mitigated during construction of this project, through the use of such methods as:

i. Temporary noise attenuation fences;

ii. Preferential location and equipment; and

iii. Use of current noise suppression technology and equipment.

N 14.1 Enforce the California Building Standards that sets standards for building construction to mitigate interior noise levels to the tolerable 45 CNEL limit. These standards are utilized in conjunction with the Uniform Building Code by the County's Building Department to ensure that noise protection is provided to the public. Some design features may include extra-dense insulation, double-paned windows, and dense construction materials.

N 16.3 Prohibit exposure of residential dwellings to perceptible ground vibration from passing trains as perceived at the ground or second floor. Perceptible motion shall be presumed to be a motion velocity of 0.01 inches/second over a range of 1 to 100 Hz.

To ensure noise-sensitive land uses are protected from high levels of noise (N 1.1), Table N-1 of the Noise Element identifies guidelines to evaluate proposed developments based on exterior and interior noise level limits for land uses and requires a noise analysis to determine needed mitigation measures if necessary. The Noise Element identifies residential use as a noise-sensitive land use (N 1.3) and discourages new development in areas with transportation related levels of 65 dBA CNEL or greater existing ambient noise levels. To prevent and mitigate noise impacts for its residents (N 1.5), County of Riverside requires exterior noise attenuation measures

for sensitive land use exposed to transportation related noise levels higher than 65 dBA CNEL. In addition, the County of Riverside had adopted an interior noise level limit of 45 dBA CNEL (N 14.1).

Policy N 4.1 of the Noise Element sets a stationary-source exterior noise limit to not to be exceeded for a cumulative period of more than ten minutes in any hour of 65 dBA L_{eq} for daytime hours of 7:00 a.m. to 10:00 p.m., and 45 dBA L_{eq} during the noise-sensitive nighttime hours of 10:00 p.m. to 7:00 a.m. To prevent high levels of construction noise from impacting noise-sensitive land uses, policies N 13.1 through 13.3 identify construction noise mitigation requirements for new development located near existing noise-sensitive land uses. Policy 16.3 establishes the vibration perception threshold for rail-related vibration levels, used in this analysis as a threshold for determining potential vibration impacts due to Project construction. (16)

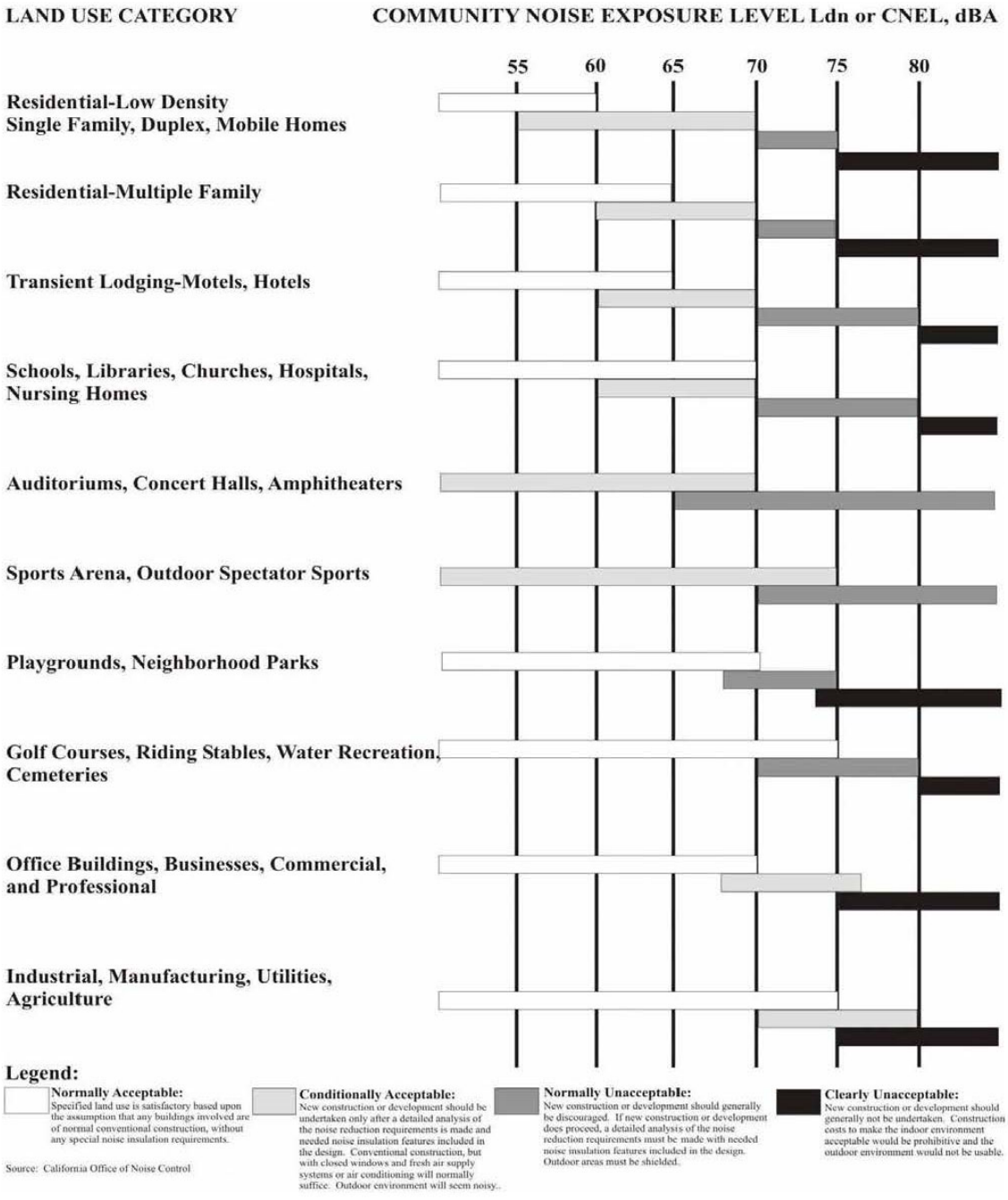
3.2.1 LAND USE COMPATIBILITY GUIDELINES

The noise criteria identified in the County of Riverside Noise Element (Table N-1) are guidelines to evaluate the land use compatibility of transportation related noise. The compatibility criteria, shown on Exhibit 3-A, provides the County with a planning tool to gauge the compatibility of land uses relative to existing and future exterior noise levels. The *Land Use Compatibility for Community Noise Exposure* matrix describes categories of compatibility and not specific noise standards. The Arroyo Vista land use is considered *normally acceptable* with unmitigated exterior noise levels of less than 60 dBA CNEL. For *conditionally acceptable* exterior noise levels, approaching 70 dBA CNEL for residential land uses, *new construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and the needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice*. (16)

3.2.2 COUNTY OF RIVERSIDE STATIONARY NOISE STANDARDS

The County of Riverside has set hourly average L_{eq} exterior noise limits to control the stationary-source noise associated with the development of the proposed Arroyo Vista. The County considers noise generated using motor vehicles to be a stationary noise source when operated on private property such as at a loading dock. These facility-related noises, as projected to any portion of any surrounding property containing a *habitable dwelling, hospital, school, library or nursing home*, must not exceed the following worst-case noise levels. Policy N 4.1 of the County of Riverside General Plan Noise Element sets a stationary-source average L_{eq} exterior noise limit not to be exceeded for a cumulative period of more than ten minutes in any hour of 65 dBA L_{eq} for daytime hours of 7:00 a.m. to 10:00 p.m., and 45 dBA L_{eq} during the noise-sensitive nighttime hours of 10:00 p.m. to 7:00 a.m. (16)

EXHIBIT 3-A: LAND USE COMPATIBILITY FOR COMMUNITY NOISE EXPOSURE



Source: County of Riverside General Plan Noise Element, Table N-1.

The County of Riverside County Code of Ordinances Section 9.52.040 *General sound level standards* identify lower, more restrictive exterior noise level standards, which for the purpose of this report, are used to evaluate potential Project-related operational noise level limits instead of the higher General Plan exterior noise level standards previously identified. The County of Riverside County Code of Ordinances identifies exterior noise level limits of 55 dBA L_{eq} during the daytime hours of 7:00 a.m. to 10:00 p.m., and 45 dBA L_{eq} during the noise-sensitive nighttime hours of 10:00 p.m. to 7:00 a.m. for noise-sensitive uses. (17) The County of Riverside County Code of Ordinances Noise Ordinance is included in Appendix 3.1.

Based on several discussions with the County of Riverside Department of Environmental Health (DEH), Office of Industrial Hygiene (OIH), it is important to recognize that the County of Riverside County Code of Ordinances noise level standards, incorrectly identify maximum noise level (L_{max}) standards that should instead reflect the maximum hourly average noise levels (L_{eq}). Moreover, the County of Riverside DEH OIH's April 15th, 2015 *Requirements for determining and mitigating, non-transportation noise source impacts to residential properties* also identifies operational (stationary-source) noise level limits using the L_{eq} metric, consistent with the direction of the County of Riverside General Plan guidelines and standards provided in the Noise Element. Therefore, this report has been prepared consistent with direction of the County of Riverside DEH OIH guidelines and standards using the average L_{eq} noise level metric for stationary-source (operational) noise level evaluation.

3.3 CONSTRUCTION NOISE STANDARDS

To control noise impacts associated with the construction of the proposed Project, the County of Riverside has established limits to the hours of operation. Section 9.52.020 of the County's Noise Regulation ordinance indicates that noise associated with any private construction activity located within one-quarter of a mile from an inhabited dwelling is considered exempt between the hours of 6:00 a.m. and 6:00 p.m., during the months of June through September, and 7:00 a.m. and 6:00 p.m., during the months of October through May. (17) Neither the County's General Plan nor County Code of Ordinances establish numeric maximum acceptable construction source noise levels at potentially affected receivers for CEQA analysis purposes. Therefore, a numerical construction threshold based on Federal Transit Administration (FTA) *Transit Noise and Vibration Impact Assessment Manual* is used for analysis of daytime construction impacts, as discussed below.

According to the FTA, local noise ordinances are typically not very useful in evaluating construction noise. They usually relate to nuisance and hours of allowed activity, and sometimes specify limits in terms of maximum levels, but are generally not practical for assessing the impact of a construction project. Project construction noise criteria should account for the existing noise environment, the absolute noise levels during construction activities, the duration of the construction, and the adjacent land use. Due to the lack of standardized construction noise thresholds, the FTA provides guidelines that can be considered reasonable criteria for construction noise assessment. The FTA considers a daytime exterior construction noise level of 80 dBA L_{eq} as a reasonable threshold for noise sensitive residential land use. (18 p. 179)

3.4 CONSTRUCTION VIBRATION STANDARDS

Construction activity can result in varying degrees of ground-borne vibration, depending on the equipment and methods used, distance to the affected structures and soil type. Construction vibration is generally associated with pile driving and rock blasting. Other construction equipment such as air compressors, light trucks, hydraulic loaders, etc., generates little or no ground vibration. (4) To analyze vibration impacts originating from the operation and construction of the Arroyo Vista, vibration-generating activities are appropriately evaluated against standards established under the Municipal Code if such standards exist. However, the County of Riverside does not identify specific construction vibration level limits. Therefore, for analysis purposes, the Caltrans *Transportation and Construction Vibration Guidance Manual*, (12 p. 38) Table 19, vibration damage are used in this noise study to assess potential temporary construction-related impacts at adjacent building locations. The nearest noise sensitive buildings adjacent to the Project site can best be described as "older residential structures" with a maximum acceptable continuous vibration threshold of 0.3 PPV (in/sec).

3.7 CONSTRUCTION BLASTING STANDARDS

The construction of the proposed Project will include blasting of hard rock areas, which is a major source of potential noise and vibration impacts to nearby residential receivers. Since the County of Riverside General Plan and County Code of Ordinances do not identify specific construction noise level limits for blasting activities, the Office of Surface Mining Reclamation and Enforcement (OSMRE) and the Code of Federal Regulations (CFR) Airblast Limits (30 CFR 816.67(b)) are used. Section 816.2 of Title 30 of the CFR indicates that the blasting regulations are intended to ensure that all surface mining activities are conducted in a manner which preserves and enhances environmental and other values in accordance with the Act. (2) While the OSMRE regulates mining activities, the blasting activities at the Project site represent surface mining activities which, to satisfy California Environmental Quality Act (CEQA) guidelines, must demonstrate that they do not adversely affect the existing environment. Therefore, the OSMRE blasting regulations are applied to the blasting activities anticipated at the Project site. For mining operations, which require larger blasts than that of the Project, the lowest noise level threshold identified in the CFR is a maximum noise level 129 dBA L_{max} for blasting activity measured at the location of any dwelling, public building, school, church, or community or institutional building outside the permit area. (3) The L_{max} threshold used in the noise analysis is suitable for single-event noise levels, such as blasting activities, since other noise regulations in L_{eq} (energy average), for example, average out a reference noise level over a given time period which reduces the single-event noise level over a longer period of time. The L_{max}, therefore, allows for the shorter-duration single-event noise levels to be evaluated against an appropriate threshold.

4 SIGNIFICANCE CRITERIA

The following significance criteria are based on currently adopted guidance provided by Appendix G of the California Environmental Quality Act (CEQA) Guidelines. (19) For the purposes of this report, impacts would be potentially significant if the Project results in or causes:

A. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

B. Generation of excessive ground-borne vibration or ground-borne noise levels?

C. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

4.1 NOISE LEVEL INCREASES (THRESHOLD A)

Noise level increases resulting from the Project are evaluated based on the Appendix G CEQA Guidelines. Under CEQA, consideration must be given to the magnitude of the increase, the existing baseline ambient noise levels, and the location of receivers to determine if a noise increase represents a significant adverse environmental impact. This approach recognizes that there is no single noise increase that renders the noise impact significant. (20) This is primarily because of the wide variation in individual thresholds of annoyance and differing individual experiences with noise. Thus, an important way of determining a person's subjective reaction to a new noise is the comparison of it to the existing environment to which one has adapted—the so-called ambient environment.

The Federal Interagency Committee on Noise (FICON) (21) developed guidance to be used for the assessment of project-generated increases in noise levels that consider the ambient noise level. The FICON recommendations are based on studies that relate aircraft noise levels to the percentage of persons highly annoyed by aircraft noise. Although the FICON recommendations were specifically developed to assess aircraft noise impacts, these recommendations are often used in environmental noise impact assessments involving the use of cumulative noise exposure metrics, such as the average-daily noise level (CNEL) and equivalent continuous noise level (Leq). In general, the more a new noise level exceeds the previously existing ambient noise level, the less acceptable the new noise level will typically be judged.

As previously stated, the approach used in this noise study recognizes that there is no single noise increase that renders a noise impact significant, based on a 2008 California Court of Appeal ruling on Gray v. County of Madera. (20) For example, if the ambient noise environment is quiet (<60 dBA) and the new noise source greatly increases the noise levels, an impact may occur if the noise criteria may be exceeded. Therefore, for this analysis, a readily perceptible 5 dBA or greater project-related noise level increase is considered a significant impact when the without project noise levels are below 60 dBA. Per the FICON, in areas where the without project noise levels range from 60 to 65 dBA, a 3 dBA barely perceptible noise level increase appears to be appropriate for most people. When the without project noise levels already exceed 65 dBA, any

increase in community noise louder than 1.5 dBA or greater is considered a significant impact if the noise criteria for a given land use is exceeded, since it likely contributes to an existing noise exposure exceedance.

The FICON guidance provides an established source of criteria to assess the impacts of substantial temporary or permanent increase in baseline ambient noise levels. Based on the FICON criteria, the amount to which a given noise level increase is considered acceptable is reduced when the without Project (baseline) noise levels are already shown to exceed certain land-use specific exterior noise level criteria. The specific levels are based on typical responses to noise level increases of 5 dBA or readily perceptible, 3 dBA or barely perceptible, and 1.5 dBA depending on the underlying without Project noise levels for noise-sensitive uses. These levels of increases and their perceived acceptance are consistent with guidance provided by both the Federal Highway Administration (22 p. 9) and Caltrans (11 p. 2_48).

4.2 VIBRATION (THRESHOLD B)

As described in Section 3.4, the vibration impacts originating from the construction of the Arroyo Vista, vibration-generating activities are appropriately evaluated using standards established by the Caltrans *Transportation and Construction Vibration Guidance Manual*, Table 19. The Caltrans' vibration thresholds for building damage are used in this noise study to assess potential operational and temporary construction-related impacts at adjacent building locations. A maximum acceptable continuous vibration threshold of 0.3 PPV (in/sec) is used to describe the nearest residential buildings adjacent to the Project site.

4.3 CEQA GUIDELINES NOT FURTHER ANALYZED (THRESHOLD C)

CEQA Noise Threshold C applies when there are nearby public and private airports and/or air strips and focuses on land use compatibility of the Project to nearby airports and airstrips. The Project site is not located within two miles of an airport or airstrip. The closest major airport is March Air Force Base located roughly 4.2 miles east of the Project site. The noise level contours of March Airforce Base are shown in Exhibit 4-1. As shown, the Project site would be outside the 60 dBA CNEL noise level contour and thus would not be exposed to excessive noise levels from airport operations, and therefore, impacts are considered *less than significant,* and no further noise analysis is conducted in relation to Appendix G to the CEQA Guidelines, Noise Threshold C.

4.4 SIGNIFICANCE CRITERIA SUMMARY

Noise impacts shall be considered significant if any of the following occur as a direct result of the proposed development. Table 4-1 shows the significance criteria summary matrix that includes the allowable criteria used to identify potentially significant incremental noise level increases.

TABLE 4-1: SIGNIFICANCE CRITERIA SUMMARY

Analysis	Condition(s)	Significance Criteria	
		Daytime	**Nighttime**
On-Site Traffic[1]	Exterior Noise Level Criteria	65 dBA CNEL	
	Interior Noise Level Standard	45 dBA CNEL	
Off-Site Traffic[2]	If ambient is < 60 dBA CNEL	≥ 5 dBA CNEL Project increase	
	If ambient is 60 - 65 dBA CNEL	≥ 3 dBA CNEL Project increase	
	If ambient is > 65 dBA CNEL	≥ 1.5 dBA CNEL Project increase	
Operational	Exterior Noise Level Standards[3]	55 dBA L_{eq}	45 dBA L_{eq}
	If ambient is < 60 dBA Leq[1]	≥ 5 dBA L_{eq} Project increase	
	If ambient is 60 - 65 dBA Leq[1]	≥ 3 dBA L_{eq} Project increase	
	If ambient is > 65 dBA Leq[1]	≥ 1.5 dBA L_{eq} Project increase	
Construction	Noise Level Threshold[4]	80 dBA L_{eq}	
	Vibration Level Threshold[5]	0.30 in/sec PPV	

[1] County of Riverside General Plan Noise Element.
[2] FICON, 1992.
[3] County of Riverside County Code of Ordinances, Section 9.52.040.
[4] Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual.
[5] Fdowudqv#Wudqvsruwdwrq#Ddg#Frqvwuxfwrq#Ylevudwrq#P dqxdo/#Dsuld#5353#Wdedn#<.
"Daytime" = 7:00 a.m. to 10:00 p.m.; "Nighttime" = 10:00 p.m. to 7:00 a.m.

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5 EXISTING NOISE LEVEL MEASUREMENTS

To assess the existing noise level environment, 24-hour noise level measurements were taken at five locations in the Project study area. The receiver locations were selected to describe and document the existing noise environment within the Project study area. Exhibit 5-A shows the Project site and the noise level measurement locations. To fully describe the existing noise conditions, noise level measurements were collected by Urban Crossroads, Inc. on Wednesday, March 23, 2022. Appendix 5.1 includes study area photos.

5.1 MEASUREMENT PROCEDURE AND CRITERIA

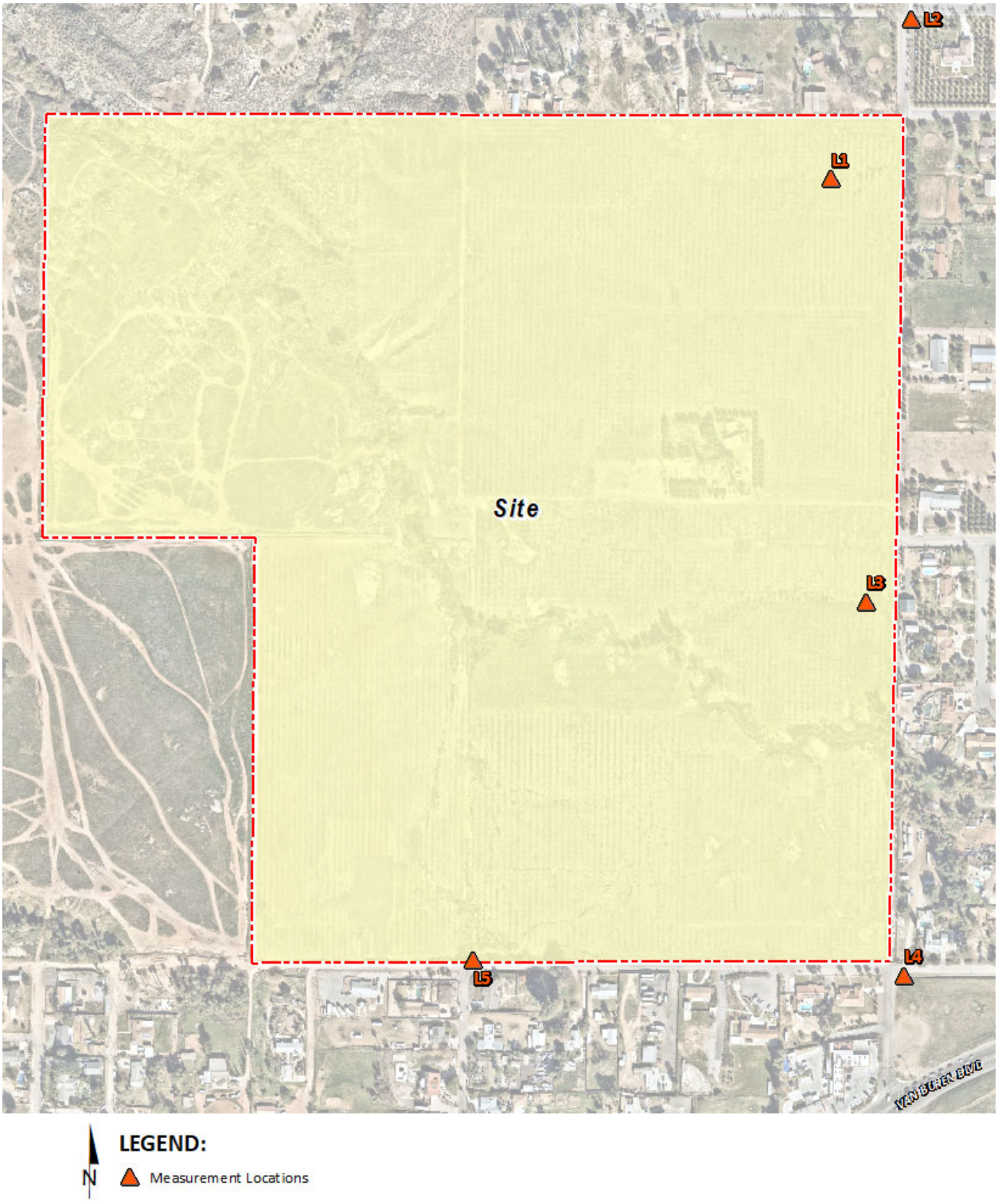
To describe the existing noise environment, the hourly noise levels were measured during typical weekday conditions over a 24-hour period. By collecting individual hourly noise level measurements, it is possible to describe the daytime and nighttime hourly noise levels and calculate the 24-hour CNEL. The long-term noise readings were recorded using Piccolo Type 2 integrating sound level meter and dataloggers. The Piccolo sound level meters were calibrated using a Larson-Davis calibrator, Model CAL 150. All noise meters were programmed in "slow" mode to record noise levels in "A" weighted form. The sound level meters and microphones were equipped with a windscreen during all measurements. All noise level measurement equipment satisfies the American National Standards Institute (ANSI) standard specifications for sound level meters ANSI S1.4-2014/IEC 61672-1:2013. (23)

5.2 NOISE MEASUREMENT LOCATIONS

The long-term noise level measurements were positioned as close to the nearest sensitive receiver locations as possible to assess the existing ambient hourly noise levels surrounding the Project site. Both Caltrans and the FTA recognize that it is not reasonable to collect noise level measurements that can fully represent every part of a private yard, patio, deck, or balcony normally used for human activity when estimating impacts for new development projects. This is demonstrated in the Caltrans general site location guidelines which indicate that, *sites must be free of noise contamination by sources other than sources of interest. Avoid sites located near sources such as barking dogs, lawnmowers, pool pumps, and air conditioners unless it is the express intent of the analyst to measure these sources*. (6) Further, FTA guidance states, t*hat it is not necessary nor recommended that existing noise exposure be determined by measuring at every noise-sensitive location in the project area. Rather, the recommended approach is to characterize the noise environment for clusters of sites based on measurements or estimates at representative locations in the community*. (18)

Based on recommendations of Caltrans and the FTA, it is not necessary to collect measurements at each individual building or residence, because each receiver measurement represents a group of buildings that share acoustical equivalence. (18) In other words, the area represented by the receiver shares similar shielding, terrain, and geometric relationship to the reference noise source. Receivers represent a location of noise sensitive areas and are used to estimate the future noise level impacts. Collecting reference ambient noise level measurements at the nearby sensitive receiver locations allows for a comparison of the before and after Project noise levels

EXHIBIT 5-A: NOISE MEASUREMENT LOCATIONS



and is necessary to assess potential noise impacts due to the Project's contribution to the ambient noise levels.

5.3 NOISE MEASUREMENT RESULTS

The noise measurements presented below focus on the average or equivalent sound levels (L_{eq}). The equivalent sound level (L_{eq}) represents a steady state sound level containing the same total energy as a time varying signal over a given sample period. Table 5-1 identifies the hourly daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) noise levels at each noise level measurement location. Appendix 5.2 provides a summary of the existing hourly ambient noise levels.

TABLE 5-1: 24-HOUR AMBIENT NOISE LEVEL MEASUREMENTS

Location[1]	Description	Energy Average Noise Level (dBA Leq)[2]		CNEL
		Daytime	Nighttime	
L1	Located northeast on the Project site near the existing residence at 17975 Twin Lakes Drive.	46.3	42.4	50.0
L2	Located northeast of the Project site near an existing residence at 18019 Twin Lakes Drive.	51.0	46.8	54.2
L3	Located east of the Project site near the existing residence at 15795 Cartwright Street.	44.6	42.3	49.4
L4	Located in the southeast corner of the Project site near an existing residence at 18010 Iris Avenue	55.0	53.0	60.0
L5	Located south of the Project site near an existing residence at 16016 Gamble Avenue	55.0	48.2	56.7

[1] See Exhibit 5-A for the noise level measurement locations.
[2] Energy (logarithmic) average levels. The long-term 24-hour measurement worksheets are included in Appendix 5.2.
"Daytime" = 7:00 a.m. to 10:00 p.m.; "Nighttime" = 10:00 p.m. to 7:00 a.m.

Table 5-1 provides the (energy average) noise levels used to describe the daytime and nighttime ambient conditions. These daytime and nighttime energy average noise levels represent the average of all hourly noise levels observed during these time periods expressed as a single number. Appendix 5.2 provides summary worksheets of the noise levels for each hour as well as the minimum, maximum, L_1, L_2, L_5, L_8, L_{25}, L_{50}, L_{90}, L_{95}, and L_{99} percentile noise levels observed during the daytime and nighttime periods. The background ambient noise levels in the Project study area are dominated by the transportation-related noise associated with nearby surface streets. This includes the auto and heavy truck activities on study area roadway segments near the noise level measurement locations.

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6 METHODS AND PROCEDURES

The following section outlines the methods and procedures used to model and analyze the future traffic noise environment.

6.1 FHWA TRAFFIC NOISE PREDICTION MODEL

The estimated roadway noise impacts from vehicular traffic were calculated using a computer program that replicates the Federal Highway Administration (FHWA) Traffic Noise Prediction Model- FHWA-RD-77-108. (24) The FHWA Model arrives at a predicted noise level through a series of adjustments to the Reference Energy Mean Emission Level (REMEL). In California the national REMELs are substituted with the California Vehicle Noise (Calveno) Emission Levels. (25) Adjustments are then made to the REMEL to account for: the roadway classification (e.g., collector, secondary, major or arterial), the roadway active width (i.e., the distance between the center of the outermost travel lanes on each side of the roadway), the total average daily traffic (ADT), the travel speed, the percentages of automobiles, medium trucks, and heavy trucks in the traffic volume, the roadway grade, the angle of view (e.g., whether the roadway view is blocked), the site conditions ("hard" or "soft" relates to the absorption of the ground, pavement, or landscaping), and the percentage of total ADT which flows each hour throughout a 24-hour period.

6.2 ON-SITE TRAFFIC NOISE PREDICTION MODEL INPUTS

The on-site roadway parameters including the average daily traffic (ADT) volumes used for this study are presented on Table 6-1. Based on the County of Riverside General Plan Circulation Element Map, Chicago Avenue and Iris Avenue are classified as one (1) lane Collectors. Future average daily traffic volumes, shown on Table 6-1, were obtained from the Arroyo Vista Traffic Analysis prepared by Urban Crossroads on June 18, 2025. (26) Consistent with the County of Riverside Office of Industrial Hygiene noise study requirements, (27) soft site conditions were used to analyze the potential on-site traffic noise impacts for the Project study area.

Table 6-2 presents the time-of-day vehicle splits by vehicle type and roadway classification, and Table 6-3 presents the total traffic flow distributions (vehicle mixes) used for this analysis which were obtained from the County of Riverside Office of Industrial Hygiene noise study requirements. The vehicle mix provides the hourly distribution percentages of automobiles for input into the FHWA Model based on roadway types. The vehicle splits are shown on Tables 6-2 are reported as a percentage of the overall percentage.

TABLE 6-1: ON-SITE ROADWAY PARAMETERS

Roadway	Lanes	Classification[1]	Maximum Daily Traffic Volume[2]	Posted Speed Limit (mph)[3]	Site Conditions
Chicago Av.	2	Collector	8,000	25	Soft
Iris Av.	2	Collector	8,000	30	Soft

[1] County of Riverside Circulation Element Table C-1 July 2020
[2] County of Riverside Circulation Element Figure C-3, 2013
[3] Posted speed limit.

TABLE 6-2: TIME OF DAY VEHICLE SPLITS (SECONDARY, COLLECTOR)

Time Period	Vehicle Type		
	Autos	Medium Trucks	Heavy Trucks
Daytime (7am-7pm)	77.5%	84.8%	86.5%
Evening (7pm-10pm)	12.9%	4.9%	2.7%
Nighttime (10pm-7am)	9.6%	10.3%	10.8%
Total:	100.0%	100.0%	100.0%

Source: County of Riverside Office of Industrial Hygiene - Secondary, Collector

TABLE 6-3: DISTRIBUTION OF TRAFFIC FLOW BY VEHICLE TYPE (VEHICLE MIX)

Roadway Classification	Total % Traffic Flow[1]			Total
	Autos	Medium Trucks	Heavy Trucks	
All Roadways	97.42%	1.84%	0.74%	100.00%

[1] Source: County of Riverside Office of Industrial Hygiene - Secondary, Collector

To predict the future noise environment at each lot within the Project site, coordinate information was collected to identify the noise transmission path between the noise source and receiver. The coordinate information is based on the Project site plan showing the plotting of each lot, as shown in Exhibit 1-B. The site plan is used to identify the relationship between the roadway centerline elevation, the pad elevation and the centerline distance to the noise barrier, and the building façade. The first-floor exterior noise level receivers were placed five feet above the pad elevation, or three feet above the pad elevation when the barrier height exceeds six feet per County of Riverside Office of Industrial Hygiene noise study guidelines. Second-floor receivers were placed 14 feet above the pad elevation.

6.3 OFF-SITE TRAFFIC NOISE PREDICTION MODEL INPUTS

Table 6-4 identifies the eighteen off-site study area roadway segments, the distance from the centerline to adjacent land use based on the functional roadway classifications per the County of Riverside General Plan Circulation Element, and the posted vehicle speeds. Consistent with the Traffic Analysis prepared by Urban Crossroads, Inc. for the Project, (1) the off-site traffic noise analysis includes the following traffic scenarios.

- Existing Conditions Without Project: This scenario refers to the existing present-day noise conditions (as of April 2025) without the proposed Project.
- Existing plus Project Conditions – Project Buildout: This scenario refers to the existing present-day noise conditions with the proposed Project. It should be noted that this scenario would not actually occur, as full occupancy of Phase 1 of the proposed Project is not expected to occur until 2028 while the "Existing" conditions evaluated in the NIA reflects existing traffic as of April 2025, when traffic count data was collected.
- Existing plus Ambient Growth plus Cumulative (EAC) 2030 Conditions Without Project: This scenario includes near-term noise conditions from ambient growth and cumulative developments without traffic from the proposed Project.
- Existing plus Ambient Growth plus Project plus Cumulative (EAPC) (2030) Conditions – Project Buildout: This scenario includes Project-related traffic, ambient growth, and all cumulative projects identified in the Project's traffic analysis.
- Horizon Year (2045) Conditions Without Project: This scenario refers to cumulative horizon year noise conditions without traffic from the proposed Project.
- Horizon Year (2045) Conditions With Project: This scenario includes all horizon year noise conditions including traffic from the proposed Project.

The average daily traffic (ADT) volumes used for this study are presented on Table 6-5. Table 6-2 and Table 6-3 provide the time of day (daytime, evening, and nighttime) vehicle splits used for calculating CNEL values.

TABLE 6-4: OFF-SITE ROADWAY PARAMETERS

ID	Roadway	Segment	Receiving Land Use[1]	Classification[2]	Right Of Way	Vehicle Speed (mph)
1	Van Buren Bl.	n/o Victoria Av.	Sensitive	Urban Arterial	152'	45
2	Van Buren Bl.	s/o Victoria Av.	Sensitive	Urban Arterial	152'	55
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	Sensitive	Secondary	100'	55
4	Washington St.	n/o Van Buren Bl.	Sensitive	Arterial	88'	45
5	Washington St.	s/o Van Buren Bl.	Sensitive	Arterial	88'	35
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	Sensitive	Local	60'	25
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	Sensitive	Local	60'	25
8	Gamble Av.	s/o Iris Av.	Sensitive	Local	60'	25
9	Wood Rd.	n/o Van Buren Bl.	Sensitive	Secondary	100'	40
10	Wood Rd.	s/o Van Buren Bl.	Sensitive	Secondary	100'	40
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	Sensitive	Secondary	100'	50
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	Sensitive	Secondary	100'	50
13	Victoria Av.	w/o Van Buren Bl.	Sensitive	Collector	74'	45
14	Victoria Av.	e/o Van Buren Bl.	Non-Sensitive	Collector	74'	40
15	Van Buren Bl.	w/o Washington St.	Non-Sensitive	Urban Arterial	152'	50
16	Van Buren Bl.	e/o Washington St.	Non-Sensitive	Urban Arterial	152'	50
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	Sensitive	Urban Arterial	152'	50
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	Sensitive	Urban Arterial	152'	50
19	Van Buren Bl.	e/o Wood Rd.	Non-Sensitive	Urban Arterial	152'	50
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	Sensitive	Urban Arterial	152'	50
21	Iris Av.	w/o Gamble Av.	Sensitive	Local	60'	30
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	Sensitive	Local	60'	30
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	Sensitive	Local	60'	30

[1] Based on a review of existing aerial imagery.

TABLE 6-5: AVERAGE DAILY TRAFFIC VOLUMES

ID	Roadway	Segment	Average Daily Traffic Volumes[1]					
			Existing		EACP (2030)		Horizon (2045)	
			Without Project	With Project	Without Project	With Project	Without Project	With Project
1	Van Buren Bl.	n/o Victoria Av.	30,281	30,787	33,838	34,344	41,126	41,632
2	Van Buren Bl.	s/o Victoria Av.	39,758	40,484	47,454	48,180	51,843	52,569
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	26,488	27,236	32,803	33,551	35,727	36,475
4	Washington St.	n/o Van Buren Bl.	15,725	15,879	20,811	20,965	24,184	25,338
5	Washington St.	s/o Van Buren Bl.	9,192	9,280	11,032	11,120	12,047	12,135
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	1,122	2,662	1,122	2,662	1,363	2,903
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	2,835	2,945	3,131	3,241	3,444	3,554
8	Gamble Av.	s/o Iris Av.	117	777	196	856	215	875
9	Wood Rd.	n/o Van Buren Bl.	9,239	9,349	9,239	9,349	12,618	12,728
10	Wood Rd.	s/o Van Buren Bl.	12,370	12,590	13,657	13,877	17,833	18,053
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	19,588	19,764	19,588	19,764	28,156	28,332
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	12,051	12,117	13,305	13,371	17,456	17,522
13	Victoria Av.	w/o Van Buren Bl.	10,090	10,200	10,090	10,200	12,254	12,364
14	Victoria Av.	e/o Van Buren Bl.	5,757	5,867	5,757	5,867	6,992	7,102
15	Van Buren Bl.	w/o Washington St.	28,697	29,445	32,255	33,003	38,410	39,158
16	Van Buren Bl.	e/o Washington St.	35,562	36,552	40,485	41,475	48,133	49,103
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	35,550	35,880	35,550	35,880	43,175	43,505
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	33,813	34,913	33,813	34,913	41,066	42,166
19	Van Buren Bl.	e/o Wood Rd.	31,982	32,752	31,982	32,752	40,274	41,044
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	29,513	30,041	29,513	30,041	35,843	36,371
21	Iris Av.	w/o Gamble Av.	35	35	35	35	43	43
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	177	397	177	397	215	435
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	154	154	154	154	187	187

[1] Arroyo Vista Traffic Analysis, Urban Crossroads, Inc.

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7 ON-SITE TRAFFIC NOISE IMPACTS

This on-site exterior noise impact analysis has been completed to determine the traffic noise exposure and to identify potential necessary noise abatement measures for the Project. The primary source of noise impacts to the Project site will be traffic noise from Chicago Avenue and Iris Avenue. The Project will also experience some background traffic noise from the Project's internal local streets, however, due to low traffic volume/speed, traffic noise from these roads will not make a significant contribution to the noise environment.

7.1 ON-SITE EXTERIOR NOISE ANALYSIS

Using the FHWA traffic noise prediction model and the parameters outlined in Tables 6-1 to 6-4, the expected future exterior noise levels for individual lots were calculated. Table 7-1 presents a summary of future exterior noise levels in the outdoor living areas (backyards) within the Project site. The on-site traffic noise level impacts indicate that the outdoor living areas adjacent to Chicago Avenue and Iris Avenue will experience unshielded exterior noise levels ranging from 61.3 to 64.2 dBA CNEL. This noise analysis shows that the Project will satisfy the County of Riverside 65 dBA CNEL exterior noise level standards for residential land uses. The on-site traffic noise analysis calculations are provided in Appendix 7.1.

TABLE 7-1: FUTURE EXTERIOR NOISE LEVELS (CNEL)

Lot	Roadway	Unmitigated Exterior Noise Level (dBA CNEL)[1]			
		1st Floor	2nd Floor	3rd Floor	4th Floor
11	Chicago Av.	61.3	62.3	61.9	61.3
227	Iris Av.	64.2	64.0	63.6	63.0
200		64.2	64.1	63.7	63.2
165		62.9	62.7	62.3	61.9

[1] Exterior noise level calculations are included Appendix 5.1.

7.2 ON-SITE INTERIOR NOISE ANALYSIS

Since exterior noise levels will exceed 60 dBA CNEL, the Project is considered "conditionally acceptable", which requires new construction or development to conduct a detailed analysis of the noise reduction requirements and include the needed noise insulation features in the Project design. According to the County of Riverside, conventional construction, with closed windows and fresh air supply systems or air conditioning, will normally provide 25 dBA; thus, noise levels up to 70 dBA CNEL will typically comply with the 45 dBA CNEL interior standard. Therefore, to verify that the future interior noise levels will comply, the exterior noise levels were calculated at the first -and second-floor building façades, and the interior noise levels were calculated based on standard construction techniques with windows closed.

7.2.1 NOISE REDUCTION METHODOLOGY

The interior noise level is the difference between the predicted exterior noise level at the building façade and the noise reduction of the structure. Typical building construction will provide a Noise Reduction (NR) of approximately 12 dBA with "windows open" and a minimum 25 dBA noise reduction with "windows closed." (28) (29) However, sound leaks, cracks and openings within the window assembly can greatly diminish its effectiveness in reducing noise. Several methods are used to improve interior noise reduction, including: [1] weather-stripped solid core exterior doors; [2] upgraded dual glazed windows; [3] mechanical ventilation/air conditioning; and [4] exterior wall/roof assemblies free of cutouts or openings.

7.2.2 INTERIOR NOISE LEVEL ASSESSMENT

Tables 7-2 and 7-3 show that the lots facing Chicago Avenue and Iris Avenue will experience future unmitigated noise levels ranging from 61.3 to 64.2 dBA CNEL at the first-floor building façade, and 62.3 to 64.1 dBA CNEL at the second-floor building façade. The interior noise level analysis shows that the interior noise areas would require a 16.3 to 19.2 dBA CNEL reduction to comply with the County of Riverside 45 dBA CNEL interior noise level standard, which is greater than the minimum 12 dBA reduction with windows open and will require a windows-closed condition and mechanical ventilation (e.g., air conditioning). The Project Applicant intends to provide each unit in the development with mechanical ventilation, thus the windows can be kept in a closed position. Based on standard construction techniques, interior noise standards can be satisfied using standard windows and construction techniques. Therefore, the Project will satisfy the County of Riverside 45 dBA CNEL interior noise level standards for residential development.

TABLE 7-2: FIRST FLOOR INTERIOR NOISE IMPACTS (CNEL)

Lot	Noise Level at Façade[1]	Required Interior NR[2]	Estimated Interior NR[3]	Upgraded Windows[4]	Interior Noise Level[5]	Threshold	Threshold Exceeded?
11	61.3	16.3	25.0	No	36.3	45	No
227	64.2	19.2	25.0	No	39.2	45	No
200	64.2	19.2	25.0	No	39.2	45	No
165	62.9	17.9	25.0	No	37.9	45	No

[1] Exterior noise level at the facade with a windows closed condition requiring a means of mechanical ventilation (e.g. air conditioning).
[2] Noise reduction required to satisfy the 45 dBA CNEL interior noise standards.
[3] Estimated minimum interior noise reduction in first-floor bedrooms.
[4] Does the required interior noise reduction trigger upgraded with a minimum STC rating of greater than 27?
[5] Estimated interior noise level with minimum STC rating for all windows.
"NR" = Noise reduction

TABLE 7-3: SECOND FLOOR INTERIOR NOISE IMPACTS (CNEL)

Lot	Noise Level at Façade[1]	Required Interior NR[2]	Calculated Interior NR[3]	Upgraded Windows[4]	Interior Noise Level[5]	Threshold	Threshold Exceeded?
11	62.3	17.3	25.0	No	37.3	45	No
227	64.0	19.0	25.0	No	39.0	45	No
200	64.1	19.1	25.0	No	39.1	45	No
165	62.7	17.7	25.0	No	37.7	45	No

[1] Exterior noise level at the facade with a windows closed condition requiring a means of mechanical ventilation (e.g. air conditioning).
[2] Noise reduction required to satisfy the 45 dBA CNEL interior noise standards.
[3] Estimated minimum interior noise reduction in second floor bedrooms.
[4] Does the required interior noise reduction trigger upgraded with a minimum STC rating of greater than 27?
[5] Estimated interior noise level with minimum STC rating for all windows.
"NR" = Noise reduction

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8 OFF-SITE TRANSPORTATION NOISE IMPACTS

To assess the off-site transportation CNEL noise level impacts associated with the proposed Project, noise contours were developed based on the *Arroyo Vista Traffic Analysis* (1). Noise contour boundaries represent the equal levels of noise exposure and are measured in CNEL from the center of the roadway. Noise contours were developed for the following traffic scenarios:

- Existing Conditions Without Project: This scenario refers to the existing present-day noise conditions (as of April 2025) without the proposed Project.
- Existing plus Project Conditions – Project Buildout: This scenario refers to the existing present-day noise conditions with the proposed Project. It should be noted that this scenario would not actually occur, as full occupancy of Phase 1 of the proposed Project is not expected to occur until 2028 while the "Existing" conditions evaluated in the NIA reflects existing traffic as of April 2025, when traffic count data was collected.
- Existing plus Ambient Growth plus Cumulative (EAC) 2030 Conditions Without Project: This scenario includes near-term noise conditions from ambient growth and cumulative developments without traffic from the proposed Project.
- Existing plus Ambient Growth plus Project plus Cumulative (EAPC) (2030) Conditions – Project Buildout: This scenario includes Project-related traffic, ambient growth, and all cumulative projects identified in the Project's traffic analysis.
- Horizon Year (2045) Conditions Without Project: This scenario refers to cumulative horizon year noise conditions without traffic from the proposed Project.
- Horizon Year (2045) Conditions With Project: This scenario includes all horizon year noise conditions including traffic from the proposed Project.

8.1 TRAFFIC NOISE CONTOURS

Noise contours were used to assess the Project's incremental 24-hour dBA CNEL traffic-related noise impacts at land uses adjacent to roadways conveying Project traffic. The noise contours represent the distance to noise levels of a constant value and are measured from the center of the roadway for the 70, 65, and 60 dBA CNEL noise levels. The noise contours do not consider the effect of any existing noise barriers or topography that may attenuate ambient noise levels. In addition, because the noise contours reflect modeling of vehicular noise on area roadways, they appropriately do not reflect noise contributions from the surrounding stationary noise sources within the Project study area.

Tables 8-1 through 8-4 present a summary of the exterior dBA CNEL traffic noise levels. Roadway segments are analyzed in each of the following timeframes: Existing without and with Project conditions, Cumulative 2030 without and with Project conditions, and Horizon Year 2045 without and with Project conditions. Appendix 8.1 includes a summary of the dBA CNEL traffic noise level contours for each of the traffic scenarios.

TABLE 8-1: EXISTING WITHOUT PROJECT NOISE CONTOURS

ID	Road	Segment	Receiving Land Use[1]	CNEL at Nearest Receiving Land Use (dBA)[2]	Distance to Contour from Centerline (Feet)		
					70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
1	Van Buren Bl.	n/o Victoria Av.	Sensitive	71.0	RW	190	410
2	Van Buren Bl.	s/o Victoria Av.	Sensitive	74.2	RW	312	671
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	Sensitive	74.8	104	223	481
4	Washington St.	n/o Van Buren Bl.	Sensitive	76.6	120	260	559
5	Washington St.	s/o Van Buren Bl.	Sensitive	72.3	RW	135	292
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	Sensitive	54.2	RW	RW	RW
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	Sensitive	58.2	RW	RW	RW
8	Gamble Av.	s/o Iris Av.	Sensitive	44.4	RW	RW	RW
9	Wood Rd.	n/o Van Buren Bl.	Sensitive	67.4	RW	RW	156
10	Wood Rd.	s/o Van Buren Bl.	Sensitive	68.7	RW	RW	189
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	Sensitive	72.9	RW	167	361
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	Sensitive	70.8	RW	121	261
13	Victoria Av.	w/o Van Buren Bl.	Sensitive	70.5	RW	86	186
14	Victoria Av.	e/o Van Buren Bl.	Non-Sensitive	66.9	RW	RW	107
15	Van Buren Bl.	w/o Washington St.	Non-Sensitive	71.8	RW	216	465
16	Van Buren Bl.	e/o Washington St.	Non-Sensitive	72.7	RW	249	537
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	Sensitive	72.7	RW	249	537
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	Sensitive	72.5	RW	241	519
19	Van Buren Bl.	e/o Wood Rd.	Non-Sensitive	72.3	RW	232	500
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	Sensitive	71.9	RW	220	474
21	Iris Av.	w/o Gamble Av.	Sensitive	41.0	RW	RW	RW
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	Sensitive	48.0	RW	RW	RW
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	Sensitive	47.4	RW	RW	RW

[1] Based on a review of existing aerial imagery.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the nearest receiving land use.
"RW" = Location of the respective noise contour falls within the right-of-way of the road.

TABLE 8-2: EXISTING WITH PROJECT NOISE CONTOURS

ID	Road	Segment	Receiving Land Use[1]	CNEL at Nearest Receiving Land Use (dBA)[2]	Distance to Contour from Centerline (Feet)		
					70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
1	Van Buren Bl.	n/o Victoria Av.	Sensitive	71.1	RW	193	415
2	Van Buren Bl.	s/o Victoria Av.	Sensitive	74.3	RW	315	679
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	Sensitive	74.9	106	228	490
4	Washington St.	n/o Van Buren Bl.	Sensitive	76.6	121	261	563
5	Washington St.	s/o Van Buren Bl.	Sensitive	72.4	RW	136	293
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	Sensitive	58.0	RW	RW	RW
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	Sensitive	58.4	RW	RW	RW
8	Gamble Av.	s/o Iris Av.	Sensitive	52.6	RW	RW	RW
9	Wood Rd.	n/o Van Buren Bl.	Sensitive	67.4	RW	RW	157
10	Wood Rd.	s/o Van Buren Bl.	Sensitive	68.7	RW	RW	191
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	Sensitive	72.9	RW	168	363
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	Sensitive	70.8	RW	122	262
13	Victoria Av.	w/o Van Buren Bl.	Sensitive	70.6	RW	87	187
14	Victoria Av.	e/o Van Buren Bl.	Non-Sensitive	67.0	RW	RW	108
15	Van Buren Bl.	w/o Washington St.	Non-Sensitive	71.9	RW	220	473
16	Van Buren Bl.	e/o Washington St.	Non-Sensitive	72.9	RW	254	547
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	Sensitive	72.8	RW	251	540
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	Sensitive	72.7	RW	246	530
19	Van Buren Bl.	e/o Wood Rd.	Non-Sensitive	72.4	RW	236	508
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	Sensitive	72.0	RW	223	480
21	Iris Av.	w/o Gamble Av.	Sensitive	41.0	RW	RW	RW
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	Sensitive	51.6	RW	RW	RW
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	Sensitive	47.4	RW	RW	RW

[1] Based on a review of existing aerial imagery.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the nearest receiving land use.
"RW" = Location of the respective noise contour falls within the right-o[f-way of the road.]

TABLE 8-3: EAPC (2030) WITHOUT PROJECT NOISE CONTOURS

ID	Road	Segment	Receiving Land Use[1]	CNEL at Nearest Receiving Land Use (dBA)[2]	Distance to Contour from Centerline (Feet)		
					70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
1	Van Buren Bl.	n/o Victoria Av.	Sensitive	71.5	RW	205	442
2	Van Buren Bl.	s/o Victoria Av.	Sensitive	75.0	163	351	755
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	Sensitive	75.7	120	258	555
4	Washington St.	n/o Van Buren Bl.	Sensitive	77.8	145	313	674
5	Washington St.	s/o Van Buren Bl.	Sensitive	73.1	RW	153	329
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	Sensitive	54.2	RW	RW	RW
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	Sensitive	58.7	RW	RW	RW
8	Gamble Av.	s/o Iris Av.	Sensitive	46.6	RW	RW	RW
9	Wood Rd.	n/o Van Buren Bl.	Sensitive	67.4	RW	RW	156
10	Wood Rd.	s/o Van Buren Bl.	Sensitive	69.1	RW	RW	202
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	Sensitive	72.9	RW	167	361
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	Sensitive	71.2	RW	129	279
13	Victoria Av.	w/o Van Buren Bl.	Sensitive	70.5	RW	86	186
14	Victoria Av.	e/o Van Buren Bl.	Non-Sensitive	66.9	RW	RW	107
15	Van Buren Bl.	w/o Washington St.	Non-Sensitive	72.3	RW	234	503
16	Van Buren Bl.	e/o Washington St.	Non-Sensitive	73.3	RW	272	585
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	Sensitive	72.7	RW	249	537
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	Sensitive	72.5	RW	241	519
19	Van Buren Bl.	e/o Wood Rd.	Non-Sensitive	72.3	RW	232	500
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	Sensitive	71.9	RW	220	474
21	Iris Av.	w/o Gamble Av.	Sensitive	41.0	RW	RW	RW
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	Sensitive	48.0	RW	RW	RW
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	Sensitive	47.4	RW	RW	RW

[1] Based on a review of existing aerial imagery.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the nearest receiving land use.
"RW" = Location of the respective noise contour falls within the right-of-way of the road.

TABLE 8-4: EAPC (2030) WITH PROJECT NOISE CONTOURS

ID	Road	Segment	Receiving Land Use[1]	CNEL at Nearest Receiving Land Use (dBA)[2]	Distance to Contour from Centerline (Feet)		
					70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
1	Van Buren Bl.	n/o Victoria Av.	Sensitive	71.5	RW	207	446
2	Van Buren Bl.	s/o Victoria Av.	Sensitive	75.0	164	354	763
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	Sensitive	75.8	121	262	563
4	Washington St.	n/o Van Buren Bl.	Sensitive	77.8	146	314	677
5	Washington St.	s/o Van Buren Bl.	Sensitive	73.1	RW	154	331
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	Sensitive	58.0	RW	RW	RW
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	Sensitive	58.8	RW	RW	RW
8	Gamble Av.	s/o Iris Av.	Sensitive	53.0	RW	RW	RW
9	Wood Rd.	n/o Van Buren Bl.	Sensitive	67.4	RW	RW	157
10	Wood Rd.	s/o Van Buren Bl.	Sensitive	69.2	RW	RW	204
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	Sensitive	72.9	RW	168	363
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	Sensitive	71.2	RW	130	280
13	Victoria Av.	w/o Van Buren Bl.	Sensitive	70.6	RW	87	187
14	Victoria Av.	e/o Van Buren Bl.	Non-Sensitive	67.0	RW	RW	108
15	Van Buren Bl.	w/o Washington St.	Non-Sensitive	72.4	RW	237	511
16	Van Buren Bl.	e/o Washington St.	Non-Sensitive	73.4	RW	276	595
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	Sensitive	72.8	RW	251	540
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	Sensitive	72.7	RW	246	530
19	Van Buren Bl.	e/o Wood Rd.	Non-Sensitive	72.4	RW	236	508
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	Sensitive	72.0	RW	223	480
21	Iris Av.	w/o Gamble Av.	Sensitive	41.0	RW	RW	RW
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	Sensitive	51.6	RW	RW	RW
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	Sensitive	47.4	RW	RW	RW

[1] Based on a review of existing aerial imagery.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the nearest receiving land use.
"RW" = Location of the respective noise contour falls within the right-of-way of the road.

TABLE 8-5: HORIZON (2045) WITHOUT PROJECT NOISE CONTOURS

ID	Road	Segment	Receiving Land Use[1]	CNEL at Nearest Receiving Land Use (dBA)[2]	Distance to Contour from Centerline (Feet)		
					70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
1	Van Buren Bl.	n/o Victoria Av.	Sensitive	72.3	RW	233	503
2	Van Buren Bl.	s/o Victoria Av.	Sensitive	75.3	173	372	801
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	Sensitive	76.1	127	273	588
4	Washington St.	n/o Van Buren Bl.	Sensitive	78.4	161	346	745
5	Washington St.	s/o Van Buren Bl.	Sensitive	73.5	RW	162	349
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	Sensitive	55.1	RW	RW	RW
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	Sensitive	59.1	RW	RW	RW
8	Gamble Av.	s/o Iris Av.	Sensitive	47.0	RW	RW	RW
9	Wood Rd.	n/o Van Buren Bl.	Sensitive	68.7	RW	RW	191
10	Wood Rd.	s/o Van Buren Bl.	Sensitive	70.2	RW	112	241
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	Sensitive	74.4	RW	213	459
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	Sensitive	72.4	RW	155	334
13	Victoria Av.	w/o Van Buren Bl.	Sensitive	71.4	RW	98	212
14	Victoria Av.	e/o Van Buren Bl.	Non-Sensitive	67.8	RW	RW	122
15	Van Buren Bl.	w/o Washington St.	Non-Sensitive	73.1	RW	262	565
16	Van Buren Bl.	e/o Washington St.	Non-Sensitive	74.1	RW	305	657
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	Sensitive	73.6	RW	284	611
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	Sensitive	73.4	RW	274	591
19	Van Buren Bl.	e/o Wood Rd.	Non-Sensitive	73.3	RW	271	583
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	Sensitive	72.8	RW	251	540
21	Iris Av.	w/o Gamble Av.	Sensitive	41.9	RW	RW	RW
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	Sensitive	48.9	RW	RW	RW
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	Sensitive	48.3	RW	RW	RW

[1] Based on a review of existing aerial imagery.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the nearest receiving land use.
"RW" = Location of the respective noise contour falls within the right-of-way of the road.

TABLE 8-6: HORIZON (2045) WITH PROJECT NOISE CONTOURS

ID	Road	Segment	Receiving Land Use[1]	CNEL at Nearest Receiving Land Use (dBA)[2]	Distance to Contour from Centerline (Feet)		
					70 dBA CNEL	65 dBA CNEL	60 dBA CNEL
1	Van Buren Bl.	n/o Victoria Av.	Sensitive	72.4	RW	235	507
2	Van Buren Bl.	s/o Victoria Av.	Sensitive	75.4	174	375	809
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	Sensitive	76.1	128	276	596
4	Washington St.	n/o Van Buren Bl.	Sensitive	78.6	166	357	769
5	Washington St.	s/o Van Buren Bl.	Sensitive	73.5	RW	163	351
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	Sensitive	58.3	RW	RW	RW
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	Sensitive	59.2	RW	RW	RW
8	Gamble Av.	s/o Iris Av.	Sensitive	53.1	RW	RW	RW
9	Wood Rd.	n/o Van Buren Bl.	Sensitive	68.8	RW	RW	193
10	Wood Rd.	s/o Van Buren Bl.	Sensitive	70.3	RW	113	243
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	Sensitive	74.5	RW	214	461
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	Sensitive	72.4	RW	155	335
13	Victoria Av.	w/o Van Buren Bl.	Sensitive	71.4	RW	99	213
14	Victoria Av.	e/o Van Buren Bl.	Non-Sensitive	67.8	RW	RW	123
15	Van Buren Bl.	w/o Washington St.	Non-Sensitive	73.2	RW	266	573
16	Van Buren Bl.	e/o Washington St.	Non-Sensitive	74.1	RW	309	666
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	Sensitive	73.6	RW	285	614
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	Sensitive	73.5	RW	279	602
19	Van Buren Bl.	e/o Wood Rd.	Non-Sensitive	73.4	RW	274	591
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	Sensitive	72.8	RW	253	545
21	Iris Av.	w/o Gamble Av.	Sensitive	41.9	RW	RW	RW
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	Sensitive	51.9	RW	RW	RW
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	Sensitive	48.3	RW	RW	RW

[1] Based on a review of existing aerial imagery.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the nearest receiving land use.
"RW" = Location of the respective noise contour falls within the right-of-way of the road.

8.2 EXISTING TRAFFIC NOISE LEVEL INCREASES

Table 8-1 shows the Existing without Project conditions CNEL noise levels. The Existing without Project exterior noise levels are expected to range from 41.0 to 76.6 dBA CNEL, without accounting for any noise attenuation features such as noise barriers or topography. Table 8-2 shows the Existing plus Project conditions will range from 41.0 to 76.6 dBA CNEL. Table 8-7 shows that the Project off-site traffic noise level increases will range from 0.0 to 8.2 dBA CNEL. The land uses adjacent to the study area roadway of Gamble Avenue south of Iris Avenue (Segment #8) would experience significant noise level increases due to unmitigated Project-related traffic noise level increases. Traffic noise increases along all other segments would be less than significant.

While Table 8-7 indicates a substantial increase in existing noise levels, the data presented in Table 8-2 show that with the addition of Project traffic, sensitive receptors along this roadway segment would only be exposed to traffic-related noise of 52.6 dBA CNEL. As indicated in Table N-1 of the General Plan Noise Element, residential uses are considered "Normally Acceptable" at noise levels up to 60 dBA CNEL; thus, the Project's traffic-related noise increases along this segment of Gamble Avenue would not expose nearby sensitive receptors to unacceptable noise levels.

Additionally, the "No Project" noise levels presented in Table 8-1 show lower noise levels along Gamble Avenue than the noise measurements that Urban Crossroads collected and presented in Table 5-1. The existing noise measurements collected by Urban Crossroads near the intersection of Iris Avenue and Gamble Avenue (Location L5) shows an existing ambient noise level of 56.7 dBA CNEL, whereas the data presented in Table 8-1 shows that traffic-related noise along this segment of Gamble without the addition of Project traffic would be 44.4 dBA. (56.7 dBA CNEL) in evaluating Project-related traffic noise levels (52.6 dBA CNEL), noise level increases due to Project traffic along this roadway segment would be less than 2.0 dBA CNEL, which would be below the significance criteria. Furthermore, the scenario in which Project traffic is added to existing traffic volumes would not actually occur, as Phase 1 of the Project would not be fully constructed and operated until 2028, while the "Existing" conditions evaluated in the NIA reflects existing traffic as of April 2025, when traffic count data was collected. Thus, this scenario is provided for information purposes only in order to fully analyze all of the traffic scenarios identified in the Project's Traffic Study. Accordingly, and for the reasons noted above, Project-related traffic increases under Existing plus Project conditions would be *less than significant*.

8.3 EAPC (2030) TRAFFIC NOISE LEVEL INCREASES

Table 8-3 presents the EAPC Year 2030 without Project conditions CNEL noise levels. The EAPC Year 2030 without Project exterior noise levels are expected to range from 41.0 to 77.8 dBA CNEL, without accounting for any noise attenuation features such as noise barriers or topography. Table 8-4 shows the EAPC Year 2030 with Project conditions will range from 41.0 to 77.8 dBA CNEL. Table 8-8 shows that the Project off-site traffic noise level increases will range from 0.0 to 6.4 dBA CNEL. As with the Exiting plus Project condition, land uses adjacent to the study area roadway of Gamble Avenue south of Iris Avenue (Segment #8) would experience significant noise

level increases due to unmitigated Project-related traffic noise level increases. Traffic noise increases along all other segments would be less than significant.

Although Project-related traffic noise increases along Segment #8 would exceed the identified threshold of significance, the data presented in Table 8-4 indicates that with the addition of Project traffic, sensitive receptors along this roadway segment only would be exposed to traffic-related noise of 53.0 dBA CNEL. As indicated in Table N-1 of the General Plan Noise Element, residential uses are considered "Normally Acceptable" at noise levels up to 60 dBA CNEL; thus, the Project's traffic-related noise increases along this segment of Gamble Avenue would not expose nearby sensitive receptors to unacceptable noise levels.

In addition, as with the existing conditions, the existing noise level measurements collected by Urban Crossroads near the intersection of Iris Avenue and Gamble Avenue (Location L5) shows an existing ambient noise level of 56.7 dBA CNEL, whereas the data presented in Table 8-3 shows that traffic-related noise along this segment of Gamble without the addition of Project traffic would be 46.6 dBA. Thus, accounting for the measured ambient noise levels (56.7 dBA CNEL) in evaluating Project-related traffic noise levels (53.0 dBA CNEL), noise level increases due to Project traffic along this roadway segment would be less than 2.0 dBA CNEL, which would be below the significance criteria. Therefore, project-related traffic noise increases under EAPC (2030) conditions would be *less than significant*.

8.4 HORIZON (2045) TRAFFIC NOISE LEVEL INCREASES

Table 8-5 presents the Horizon Year 2045 without Project conditions CNEL noise levels. The Horizon Year 2045 without Project exterior noise levels are expected to range from 41.0 to 78.4 dBA CNEL, without accounting for any noise attenuation features such as noise barriers or topography. Table 8-6 shows that the Horizon Year 2045 with Project conditions will range from 41.0 to 78.4 dBA CNEL. Table 8-9 shows that the Project off-site traffic noise level increases will range from less than 0.1 to 6.1 dBA CNEL. Based on the significance criteria for off-site traffic noise presented in Table 4-1, land uses adjacent to the study area roadway of Gamble Avenue south of Iris Avenue (Segment #8) would experience significant noise level increases due to unmitigated Project-related traffic noise level increases. Traffic noise increases along all other segments would be less than significant.

Although Project-related traffic noise increases along Segment #8 would exceed the identified threshold of significance, the data presented in Table 8-4 indicates that with the addition of Project traffic, sensitive receptors along this roadway segment only would be exposed to traffic-related noise of 53.1 dBA CNEL. As indicated in Table N-1 of the General Plan Noise Element, residential uses are considered "Normally Acceptable" at noise levels up to 60 dBA CNEL; thus, the Project's traffic-related noise increases along this segment of Gamble Avenue would not expose nearby sensitive receptors to unacceptable noise levels.

As with the previous analysis, the existing noise level measurements collected by Urban Crossroads near the intersection of Iris Avenue and Gamble Avenue (Location L5) shows an existing ambient noise level of 56.7 dBA CNEL, whereas the data presented in Table 8-3 shows that traffic-related noise along this segment of Gamble without the addition of Project traffic would be 46.6 dBA. Thus, accounting for the measured ambient noise levels (56.7 dBA CNEL) in

evaluating Project-related traffic noise levels (53.1 dBA CNEL), noise level increases due to Project traffic along this roadway segment would be less than 2.0 dBA CNEL, which would be below the significance criteria. Therefore, project-related traffic noise increases under EAPC (2030) conditions would be *less than significant*.

TABLE 8-7: EXISTING WITH PROJECT TRAFFIC NOISE INCREASES

ID	Road	Segment	Receiving Land Use[1]	CNEL at Receiving Land Use (dBA)[2]			Noise-Sensitive Land Use?	Incremental Noise Level Increase Threshold[3]	
				No Project	With Project	Project Addition		Limit	Exceeded?
1	Van Buren Bl.	n/o Victoria Av.	Sensitive	71.0	71.1	0.1	Yes	1.5	No
2	Van Buren Bl.	s/o Victoria Av.	Sensitive	74.2	74.3	0.1	Yes	1.5	No
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	Sensitive	74.8	74.9	0.1	Yes	1.5	No
4	Washington St.	n/o Van Buren Bl.	Sensitive	76.6	76.6	0.0	Yes	1.5	No
5	Washington St.	s/o Van Buren Bl.	Sensitive	72.3	72.4	0.0	Yes	1.5	No
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	Sensitive	54.2	58.0	3.8	Yes	5.0	No
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	Sensitive	58.2	58.4	0.2	Yes	5.0	No
8	Gamble Av.	s/o Iris Av.	Sensitive	44.4	52.6	8.2	Yes	5.0	**Yes**
9	Wood Rd.	n/o Van Buren Bl.	Sensitive	67.4	67.4	0.1	Yes	1.5	No
10	Wood Rd.	s/o Van Buren Bl.	Sensitive	68.7	68.7	0.1	Yes	1.5	No
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	Sensitive	72.9	72.9	0.0	Yes	1.5	No
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	Sensitive	70.8	70.8	0.0	Yes	1.5	No
13	Victoria Av.	w/o Van Buren Bl.	Sensitive	70.5	70.6	0.0	Yes	1.5	No
14	Victoria Av.	e/o Van Buren Bl.	Non-Sensitive	66.9	67.0	0.1	Yes	1.5	No
15	Van Buren Bl.	w/o Washington St.	Non-Sensitive	71.8	71.9	0.1	Yes	1.5	No
16	Van Buren Bl.	e/o Washington St.	Non-Sensitive	72.7	72.9	0.1	Yes	1.5	No
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	Sensitive	72.7	72.8	0.0	Yes	1.5	No
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	Sensitive	72.5	72.7	0.1	Yes	1.5	No
19	Van Buren Bl.	e/o Wood Rd.	Non-Sensitive	72.3	72.4	0.1	Yes	1.5	No
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	Sensitive	71.9	72.0	0.1	Yes	1.5	No
21	Iris Av.	w/o Gamble Av.	Sensitive	41.0	41.0	0.0	Yes	5.0	No
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	Sensitive	48.0	51.6	3.5	Yes	5.0	No
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	Sensitive	47.4	47.4	0.0	Yes	5.0	No

[1] Based on a review of existing aerial imagery. Noise sensitive uses limited to existing residential land uses.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the receiving land use.
[3] Does the Project create an incremental noise level increase exceeding the significance criteria (Table 4-1)?

TABLE 8-8: EAPC 2030 WITH PROJECT TRAFFIC NOISE INCREASES

ID	Road	Segment	Receiving Land Use[1]	CNEL at Receiving Land Use (dBA)[2]			Noise-Sensitive Land Use?	Incremental Noise Level Increase Threshold[3]	
				No Project	With Project	Project Addition		Limit	Exceeded?
1	Van Buren Bl.	n/o Victoria Av.	Sensitive	71.5	71.5	0.0	Yes	1.5	No
2	Van Buren Bl.	s/o Victoria Av.	Sensitive	75.0	75.0	0.0	Yes	1.5	No
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	Sensitive	75.7	75.8	0.1	Yes	1.5	No
4	Washington St.	n/o Van Buren Bl.	Sensitive	77.8	77.8	0.0	Yes	1.5	No
5	Washington St.	s/o Van Buren Bl.	Sensitive	73.1	73.1	0.0	Yes	1.5	No
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	Sensitive	54.2	58.0	3.8	Yes	5.0	No
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	Sensitive	58.7	58.8	0.1	Yes	5.0	No
8	Gamble Av.	s/o Iris Av.	Sensitive	46.6	53.0	6.4	Yes	5.0	**Yes**
9	Wood Rd.	n/o Van Buren Bl.	Sensitive	67.4	67.4	0.0	Yes	1.5	No
10	Wood Rd.	s/o Van Buren Bl.	Sensitive	69.1	69.2	0.1	Yes	1.5	No
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	Sensitive	72.9	72.9	0.0	Yes	1.5	No
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	Sensitive	71.2	71.2	0.0	Yes	1.5	No
13	Victoria Av.	w/o Van Buren Bl.	Sensitive	70.5	70.6	0.1	Yes	1.5	No
14	Victoria Av.	e/o Van Buren Bl.	Non-Sensitive	66.9	67.0	0.1	No	n/a	No
15	Van Buren Bl.	w/o Washington St.	Non-Sensitive	72.3	72.4	0.1	No	3.0	No
16	Van Buren Bl.	e/o Washington St.	Non-Sensitive	73.3	73.4	0.1	No	3.0	No
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	Sensitive	72.7	72.8	0.1	Yes	1.5	No
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	Sensitive	72.5	72.7	0.2	Yes	1.5	No
19	Van Buren Bl.	e/o Wood Rd.	Non-Sensitive	72.3	72.4	0.1	No	3.0	No
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	Sensitive	71.9	72.0	0.1	Yes	1.5	No
21	Iris Av.	w/o Gamble Av.	Sensitive	41.0	41.0	0.0	Yes	5.0	No
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	Sensitive	48.0	51.6	3.6	Yes	5.0	No
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	Sensitive	47.4	47.4	0.0	Yes	5.0	No

[1] Based on a review of existing aerial imagery. Noise sensitive uses limited to existing residential land uses.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the receiving land use.
[3] Does the Project create an incremental noise level increase exceeding the significance criteria (Table 4-1)?

TABLE 8-9: HORIZON 2045 WITH PROJECT TRAFFIC NOISE INCREASES

ID	Road	Segment	Receiving Land Use[1]	CNEL at Receiving Land Use (dBA)[2]			Noise-Sensitive Land Use?	Incremental Noise Level Increase Threshold[3]	
				No Project	With Project	Project Addition		Limit	Exceeded?
1	Van Buren Bl.	n/o Victoria Av.	Sensitive	72.3	72.4	0.1	Yes	1.5	No
2	Van Buren Bl.	s/o Victoria Av.	Sensitive	75.3	75.4	0.1	Yes	1.5	No
3	Mockingbird Canyon Rd.	s/o Van Buren Bl.	Sensitive	76.1	76.1	0.0	Yes	1.5	No
4	Washington St.	n/o Van Buren Bl.	Sensitive	78.4	78.6	0.2	Yes	1.5	No
5	Washington St.	s/o Van Buren Bl.	Sensitive	73.5	73.5	0.0	Yes	1.5	No
6	Chicago Av./Alta Cresta Av.	n/o Van Buren Bl.	Sensitive	55.1	58.3	3.2	Yes	5.0	No
7	Chicago Av./Alta Cresta Av.	s/o Van Buren Bl.	Sensitive	59.1	59.2	0.1	Yes	5.0	No
8	Gamble Av.	s/o Iris Av.	Sensitive	47.0	53.1	6.1	Yes	5.0	**Yes**
9	Wood Rd.	n/o Van Buren Bl.	Sensitive	67.4	67.4	0.0	Yes	1.5	No
10	Wood Rd.	s/o Van Buren Bl.	Sensitive	69.1	69.2	0.1	Yes	1.5	No
11	Trautwein Rd./Cole Av.	n/o Van Buren Bl.	Sensitive	72.9	72.9	0.0	Yes	1.5	No
12	Trautwein Rd./Cole Av.	s/o Van Buren Bl.	Sensitive	71.2	71.2	0.0	Yes	1.5	No
13	Victoria Av.	w/o Van Buren Bl.	Sensitive	70.5	70.6	0.1	Yes	1.5	No
14	Victoria Av.	e/o Van Buren Bl.	Non-Sensitive	66.9	67.0	0.1	No	n/a	No
15	Van Buren Bl.	w/o Washington St.	Non-Sensitive	72.3	72.4	0.1	No	3.0	No
16	Van Buren Bl.	e/o Washington St.	Non-Sensitive	73.3	73.4	0.1	No	3.0	No
17	Van Buren Bl.	w/o Chicago Av./Alta Cresta Av.	Sensitive	72.7	72.8	0.1	Yes	1.5	No
18	Van Buren Bl.	e/o Chicago Av./Alta Cresta Av.	Sensitive	72.5	72.7	0.2	Yes	1.5	No
19	Van Buren Bl.	e/o Wood Rd.	Non-Sensitive	72.3	72.4	0.1	No	3.0	No
20	Van Buren Bl.	e/o Trautwein Rd./Cole Av.	Sensitive	71.9	72.0	0.1	Yes	1.5	No
21	Iris Av.	w/o Gamble Av.	Sensitive	41.0	41.0	0.0	Yes	5.0	No
22	Iris Av.	w/o Chicago Av./Alta Cresta Av.	Sensitive	48.0	51.6	3.6	Yes	5.0	No
23	Iris Av.	e/o Chicago Av./Alta Cresta Av.	Sensitive	47.4	47.4	0.0	Yes	5.0	No

[1] Based on a review of existing aerial imagery. Noise sensitive uses limited to existing residential land uses.
[2] The CNEL is calculated at the boundary of the right-of-way of each roadway and the property line of the receiving land use.
[3] Does the Project create an incremental noise level increase exceeding the significance criteria (Table 4-1)?

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9 SENSITIVE RECEIVER LOCATIONS

To assess the potential for long-term operational and short-term construction noise impacts, the following sensitive receiver locations, as shown on Exhibit 9-A, were identified as representative locations for analysis. Sensitive receivers are generally defined as locations where people reside or where the presence of unwanted sound could otherwise adversely affect the use of the land. Noise-sensitive land uses are generally considered to include schools, hospitals, single-family dwellings, mobile home parks, churches, libraries, and recreation areas. Moderately noise-sensitive land uses typically include multi-family dwellings, hotels, motels, dormitories, out-patient clinics, cemeteries, golf courses, country clubs, athletic/tennis clubs, and equestrian clubs. Land uses that are considered relatively insensitive to noise include business, commercial, and professional developments. Land uses that are typically not affected by noise include: industrial, manufacturing, utilities, agriculture, undeveloped land, parking lots, warehousing, liquid and solid waste facilities, salvage yards, and transit terminals.

To describe the potential off-site Project noise levels, five receiver locations in the vicinity of the Project site were identified. All distances are measured from the Project site boundary to the outdoor living areas (e.g., private backyards) or at the building façade, whichever is closer to the Project site. The selection of receiver locations is based on FHWA guidelines and is consistent with additional guidance provided by Caltrans and the FTA, as previously described in Section 5.2. Other sensitive land uses in the Project study area that are located at greater distances than those identified in this noise study will experience lower noise levels than those presented in this report due to the additional attenuation from distance and the shielding of intervening structures. Distance is measured in a straight line from the Project boundary to each receiver location.

R1: Location R1 represents existing noise sensitive residence at 17795 Twin Lakes Drive., approximately 75 feet north of the Project site. Receiver R1 is placed in the private outdoor living area (backyard) facing the project site. A 24-hour noise measurement was taken near this location, L1, to describe the existing ambient noise environment.

R2: Location R2 represents the existing noise sensitive residence at 18019 Twin Lakes Drive, approximately 187 feet northeast of the Project site. Receiver R1 is placed in the private outdoor living area (backyard) facing the project site A 24-hour noise measurement was taken near this location, L2, to describe the existing ambient noise environment.

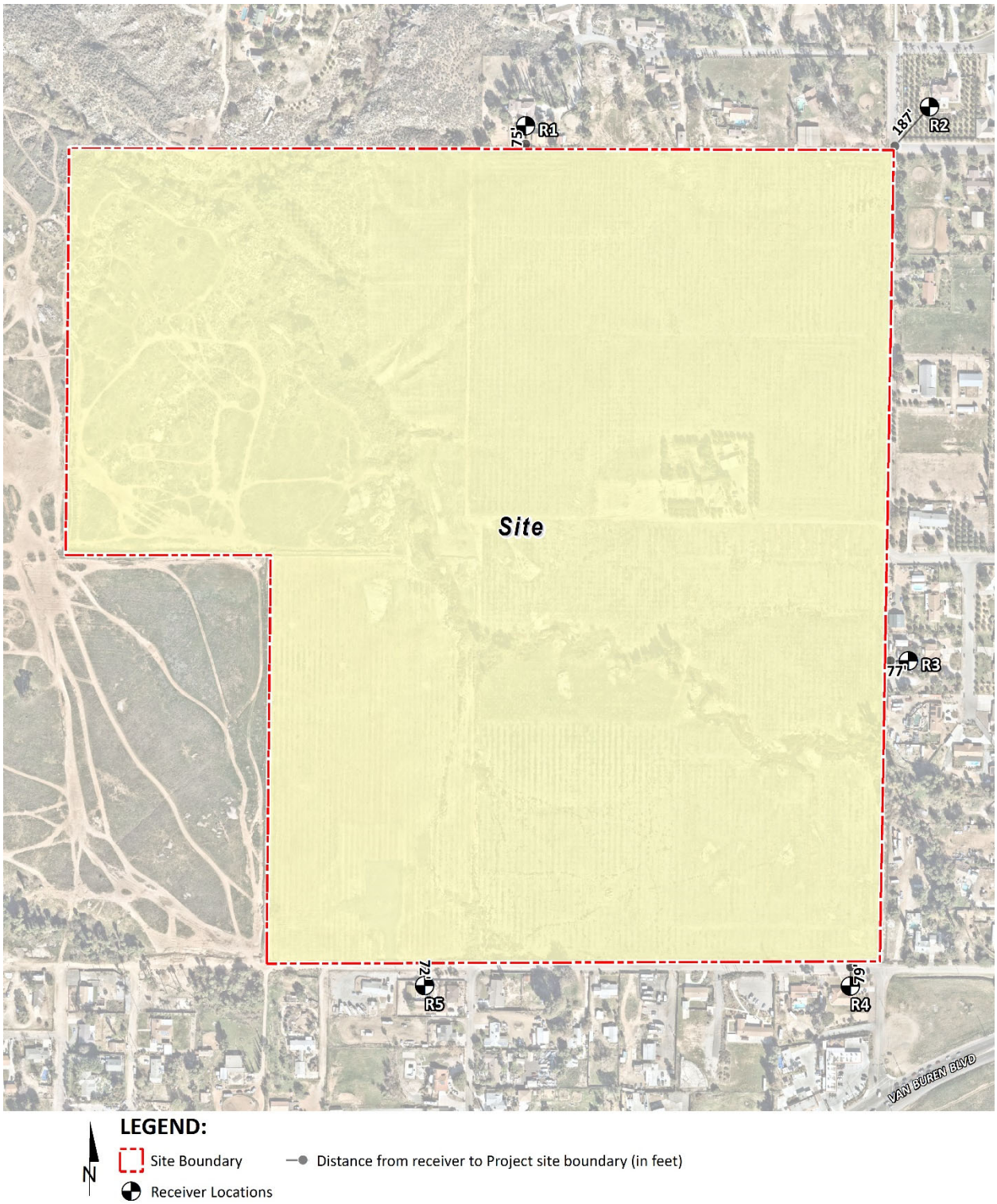
R3: Location R3 represents the existing noise sensitive residence at 15795 Cartwright Street, approximately 77 feet east of the Project site. Receiver R3 is placed in the private outdoor living area (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L3, to describe the existing ambient noise environment.

R4: Location R4 represents the existing noise sensitive residence at 17975 Iris Avenue, approximately 79 feet south of the Project site. Receiver R4 is placed in the private outdoor living area (front yard) facing the Project site. A 24-hour noise measurement was taken near this location, L4, to describe the existing ambient noise environment.

R5: Location R5 represents the existing noise sensitive residence at 16015 Gamble Avenue, approximately 72 feet west of the Project site. Receiver R5 is placed in the private

outdoor living area (backyard) facing the Project site. A 24-hour noise measurement was taken near this location, L5, to describe the existing ambient noise environment.

EXHIBIT 9-A: RECEIVER LOCATIONS



10 OPERATIONAL NOISE IMPACTS

The Project has not been designed beyond lot lines at this stage of Project development. The proposed development is considered a noise-sensitive receiving land use and is not expected to include any specific type of operational noise levels beyond those typically associated with residential land uses in the Project study area, such as people and children, parking lot activity, garage doors, small air conditioners, and trash collection, and is considered a noise-sensitive receiving land use. However, to be conservative, this section analyzes the potential operational noise impacts resulting from the operation of air conditioning units associated with the Project, as shown on Exhibit 10-A.

10.1 OPERATIONAL NOISE SOURCES

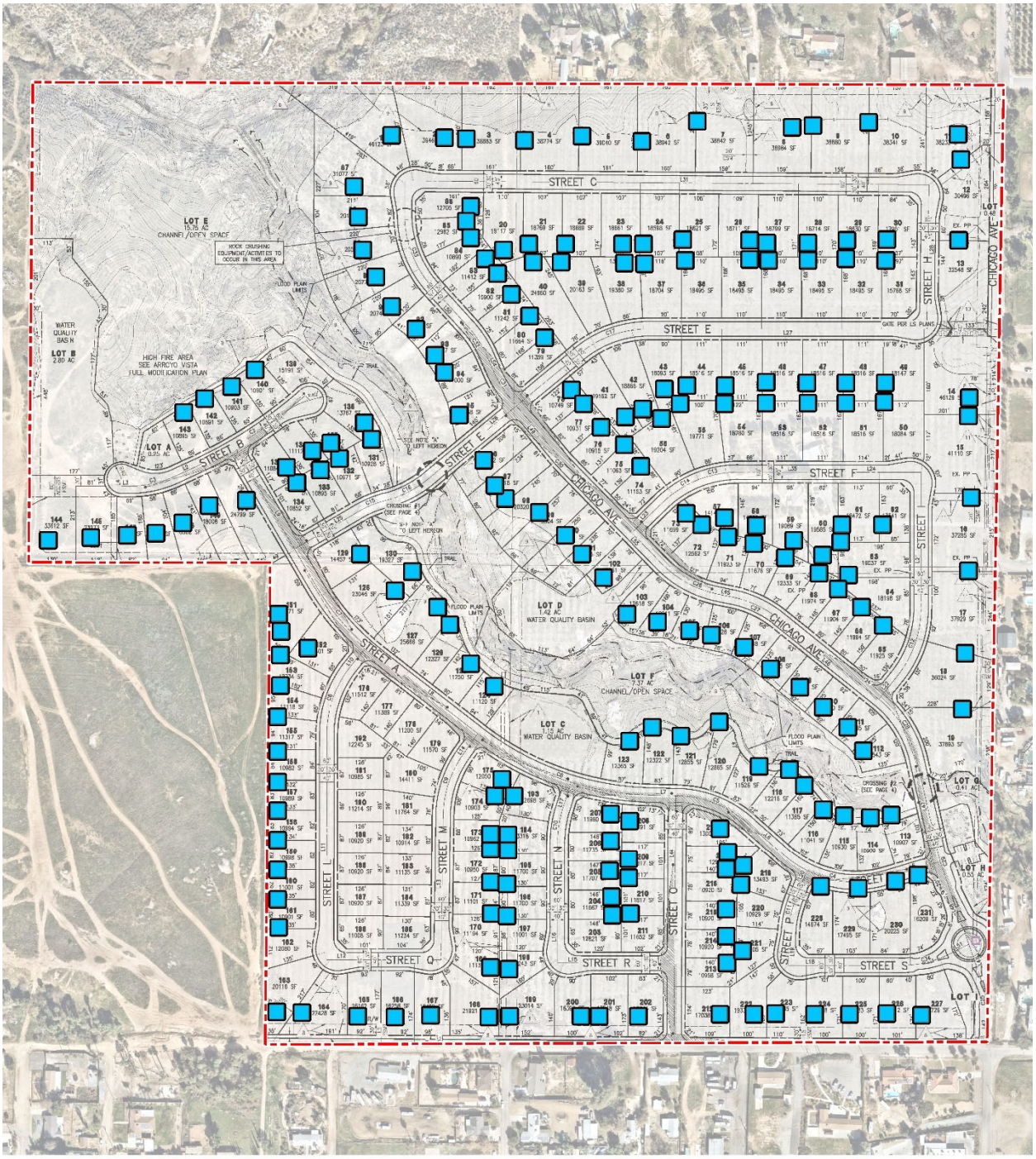
The County of Riverside has set stationary-source hourly average L_{eq} exterior noise limits to control air conditioning units associated with the development of the proposed Arroyo Vista. These air conditioning-related noises, as projected to any portion of any surrounding property containing a *habitable dwelling, hospital, school, library or nursing home*, must not exceed the following worst-case noise levels.

Policy N 4.1 of the County of Riverside General Plan Noise Element sets a stationary-source average L_{eq} exterior noise limit not to be exceeded for a cumulative period of more than ten minutes in any hour of 65 dBA L_{eq} for daytime hours of 7:00 a.m. to 10:00 p.m., and 45 dBA L_{eq} during the noise-sensitive nighttime hours of 10:00 p.m. to 7:00 a.m. (16)

The County of Riverside County Code Section 9.52.040 *General sound level standards* (included in Appendix 3.1) identify lower, more restrictive exterior noise level standards, which for the purpose of this report, are used to evaluate potential Project-related operational noise level limits instead of the higher the General Plan exterior noise level standards previously identified. The County of Riverside County Code identifies exterior noise level limits of 55 dBA L_{eq} during the daytime hours of 7:00 a.m. to 10:00 p.m., and 45 dBA L_{eq} during the noise-sensitive nighttime hours of 10:00 p.m. to 7:00 a.m. for most noise-sensitive uses. (17)

Based on several discussions with the County of Riverside Department of Environmental Health (DEH), Office of Industrial Hygiene (OIH), it is important to recognize that the County of Riverside County Code noise level standards, incorrectly identify maximum noise level (L_{max}) standards that should instead reflect the average L_{eq} noise levels. Moreover, the County of Riverside DEH OIH's April 15th, 2015, *Requirements for determining and mitigating, non-transportation noise source impacts to residential properties* also identifies operational (stationary-source) noise level limits using the L_{eq} metric, consistent with the direction of the County of Riverside General Plan guidelines and standards provided in the Noise Element. Therefore, this report has been prepared consistent with direction of the County of Riverside DEH OIH guidelines and standards using the average L_{eq} noise level metric for stationary-source (operational) noise level evaluation.

EXHIBIT 10-A: STATIONARY NOISE SOURCE LOCATIONS



10.2 REFERENCE NOISE LEVELS

To assess the noise levels created by the air conditioning units, reference noise levels from a Carrier model 25HBC5 were used as representative of the air conditioning units that could be used on the Project and have a range of capacity from 1.5 tons to 5 tons. According to the product data sheet a Carrier model 25HBC5, which produces a maximum sound power level of 76 dBA, see Appendix 10.1, as shown in Table 10-1.

While operating at full power air conditioners operate approximately 15-30 minutes out of an hour in multiple cycles during the nighttime as compared to the daytime where the units typically operate 20-40 minutes in multiple cycles, depending on the ambient temperature. For purposes of this analysis, it was assumed the air conditioners would operate 45 minutes out of an hour during the day and 30 minutes out of an hour at night. The acoustic center of each unit will be located three feet above ground elevation. As the final location of air conditioning units has not been finalized, the units were placed generally located in the side yard of each lot.

TABLE 10-1: REFERENCE NOISE LEVELS

Noise Source	Noise Source Height (Feet)	Min./Hour[2]		Reference Noise Level (dBA L_{eq})		Sound Power Level (dBA)[6]
		Day	Night	@ Ref. Dist.	@ 50 Feet	
Air Conditioning Units[1]	3'	45	30	77.2	44.4	76.0

[1] Carrier 25HBC5 air conditioning unit, Appendix 10.1.
[2] Anticipated duration (minutes within the hour) of noise activity during typical hourly conditions expected at the Project site.
"Daytime" = 7:01 a.m. to 10:00 p.m.; "Nighttime" = 10:01 p.m. to 7:00 a.m.

10.3 CADNAA NOISE PREDICTION MODEL

To fully describe the exterior operational noise levels from the Project, Urban Crossroads, Inc. developed a noise prediction model using the CadnaA (Computer Aided Noise Abatement) computer program. CadnaA can analyze multiple types of noise sources using the spatially accurate Project site plan, georeferenced Nearmap aerial imagery, topography, buildings, and barriers in its calculations to predict outdoor noise levels. Using the ISO 9613-2 protocol, CadnaA will calculate the distance from each noise source to the noise receiver locations, using the ground absorption, distance, and barrier/building attenuation inputs to provide a summary of noise level at each receiver and the partial noise level contributions by noise source.

Consistent with the ISO 9613-2 protocol, the CadnaA noise prediction model relies on the reference sound power level (L_w) to describe individual noise sources. While sound pressure levels (e.g., L_{eq}) quantify in decibels the intensity of given sound sources at a reference distance, sound power levels (L_w) are connected to the sound source and are independent of distance. Sound pressure levels vary substantially with distance from the source and diminish because of intervening obstacles and barriers, air absorption, wind, and other factors. Sound power is the acoustical energy emitted by the sound source and is an absolute value that is not affected by the environment. The operational noise level calculations provided in this noise study account

for the distance attenuation provided due to geometric spreading, when sound from a localized stationary source (i.e., a point source) propagates uniformly outward in a spherical pattern. A default ground attenuation factor of 0.5 was used in the noise analysis to account for mixed ground representing a combination of hard and soft surfaces. Appendix 10.1 includes the detailed noise model inputs.

10.4 PROJECT OPERATIONAL NOISE LEVELS

Using the reference noise levels to represent the proposed Project operations that include air condition units, Urban Crossroads, Inc. calculated the operational source noise levels that are expected to be generated at the Project site and the Project-related noise level increases that would be experienced at each of the sensitive receiver locations. Table 10-2 shows the Project operational noise levels during the daytime hours of 7:01 a.m. to 10:00 p.m. The daytime hourly noise levels at the off-site receiver locations are expected to range from 29.6 to 35.5 dBA L_{eq}.

TABLE 10-2: DAYTIME PROJECT OPERATIONAL NOISE LEVELS

Noise Source[1]	Operational Noise Levels by Receiver Location (dBA L_{eq})				
	R1	R2	R3	R4	R5
Air Conditioning Units	33.7	29.6	34.5	32.9	35.5
Total (All Noise Sources)	**33.7**	**29.6**	**34.5**	**32.9**	**35.5**

[1] See Exhibit 10-A for the noise source locations. CadnaA noise model calculations are included in Appendix 10.2.

Table 10-3 shows the Project operational noise levels during the nighttime hours of 10:01 p.m. to 7:00 a.m. The nighttime hourly noise levels at the off-site receiver locations are expected to range from 26.8 to 32.8 dBA L_{eq}.

TABLE 10-3: NIGHTTIME PROJECT OPERATIONAL NOISE LEVELS

Noise Source[1]	Operational Noise Levels by Receiver Location (dBA L_{eq})				
	R1	R2	R3	R4	R5
Air Conditioning Units	31.0	26.8	31.8	30.2	32.8
Total (All Noise Sources)	**31.0**	**26.8**	**31.8**	**30.2**	**32.8**

[1] See Exhibit 10-A for the noise source locations. CadnaA noise model calculations are included in Appendix 10.2.

10.5 PROJECT OPERATIONAL NOISE LEVEL COMPLIANCE

To demonstrate compliance with local noise regulations, the Project-only operational noise levels are evaluated against exterior noise level thresholds based on the County of Riverside exterior noise level standards at nearby noise-sensitive receiver locations. Table 10-4 shows the operational noise levels associated with Arroyo Vista Project will not exceed the County of Riverside 55 dBA L_{eq} daytime and 45 dBA L_{eq} nighttime exterior noise level standards at all nearby receiver locations. Therefore, the operational noise impacts are considered *less than significant* at the nearby noise-sensitive receiver locations.

TABLE 10-4: OPERATIONAL NOISE LEVEL COMPLIANCE

Receiver Location[1]	Project Operational Noise Levels (dBA L_{eq})[2]		Exterior Noise Level Standards (dBA L_{eq})[3]		Noise Level Standards Exceeded?[4]	
	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
R1	33.7	31.0	55	45	No	No
R2	29.6	26.8	55	45	No	No
R3	34.5	31.8	55	45	No	No
R4	32.9	30.2	55	45	No	No
R5	35.5	32.8	55	45	No	No

[1] See Exhibit 9-A for the receiver locations.
[2] Proposed Project operational noise levels as shown on Tables 10-2 and 10-3.
[3] Exterior noise level standard for residential land use as shown on Table 4-1.
[4] Do the estimated Project operational noise source activities exceed the noise level standards?
[5] Non-residential land use with no expected nighttime occupancy.
"Daytime" = 7:01 a.m. to 10:00 p.m.; "Nighttime" = 10:01 p.m. to 7:00 a.m.

10.6 PROJECT OPERATIONAL NOISE LEVEL INCREASES

To describe the Project operational noise level increases, the Project operational noise levels are combined with the existing ambient noise levels measurements for the nearby receiver locations potentially impacted by Project operational noise sources. Since the units used to measure noise, decibels (dB), are logarithmic units, the Project-operational and existing ambient noise levels cannot be combined using standard arithmetic equations. (6) Instead, they must be logarithmically added using the following base equation:

$$SPL_{Total} = 10\log_{10}[10^{SPL1/10} + 10^{SPL2/10} + \ldots 10^{SPLn/10}]$$

Where "SPL1," "SPL2," etc. are equal to the sound pressure levels being combined, or in this case, the Project-operational and existing ambient noise levels. The difference between the combined Project and ambient noise levels describes the Project noise level increases to the existing ambient noise environment. Noise levels that would be experienced at receiver locations when Project-source noise is added to the daytime and nighttime ambient conditions are presented on Tables 10-5 and 10-6, respectively. As indicated on Table 10-5, the Project will generate a daytime operational noise level increases ranging from 0.0 to 0.4 dBA L_{eq} at the nearest receiver locations. Table 10-6 shows that the Project will generate a nighttime operational noise level increases ranging from 0.0 to 0.4 dBA L_{eq} at the nearest receiver locations. Project-related operational noise level increases will satisfy the operational noise level increase significance criteria presented in Table 4-1, and the increases at the sensitive receiver locations will be *less than significant.*

TABLE 10-5: DAYTIME PROJECT OPERATIONAL NOISE LEVEL INCREASES

Receiver Location[1]	Total Project Operational Noise Level[2]	Measurement Location[3]	Reference Ambient Noise Levels[4]	Combined Project and Ambient[5]	Project Increase[6]	Increase Criteria[7]	Increase Criteria Exceeded?
R1	33.7	L1	46.3	46.5	0.2	5	No
R2	29.6	L2	51.0	51.0	0.0	5	No
R3	34.5	L3	44.6	45.0	0.4	5	No
R4	32.9	L4	55.0	55.0	0.0	5	No
R5	35.5	L5	55.0	55.0	0.0	5	No

[1] See Exhibit 9-A for the receiver locations.
[2] Total Project daytime operational noise levels as shown on Table 10-2.
[3] Reference noise level measurement locations as shown on Exhibit 10-A.
[4] Observed daytime ambient noise levels as shown on Table 5-1.
[5] Represents the combined ambient conditions plus the Project activities.
[6] The noise level increase expected with the addition of the proposed Project activities.
[7] Significance increase criteria as shown on Table 4-1.

TABLE 10-6: NIGHTTIME OPERATIONAL NOISE LEVEL INCREASES

Receiver Location[1]	Total Project Operational Noise Level[2]	Measurement Location[3]	Reference Ambient Noise Levels[4]	Combined Project and Ambient[5]	Project Increase[6]	Increase Criteria[7]	Increase Criteria Exceeded?
R1	31.0	L1	42.4	42.7	0.3	5	No
R2	26.8	L2	46.8	46.8	0.0	5	No
R3	31.8	L3	42.3	42.7	0.4	5	No
R4	30.2	L4	53.0	53.0	0.0	5	No
R5	32.8	L5	48.2	48.3	0.1	5	No

[1] See Exhibit 9-A for the receiver locations.
[2] Total Project nighttime operational noise levels as shown on Table 10-3.
[3] Reference noise level measurement locations as shown on Exhibit 10-A.
[4] Observed daytime ambient noise levels as shown on Table 5-1.
[5] Represents the combined ambient conditions plus the Project activities.
[6] The noise level increase expected with the addition of the proposed Project activities.
[7] Significance increase criteria as shown on Table 4-1.

11 CONSTRUCTION IMPACTS

This section analyzes potential impacts resulting from the short-term construction activities associated with the development of the Project. Exhibits 11-A (General Construction), 11-B (Rock Crushing), and 11-C (Blasting) show the noise source locations in relation to the nearest sensitive receiver locations previously described in Section 9.

Section 9.52.020 of the County of Riverside Code, states that construction activities are exempted from the noise ordinance if located ¼ mile or greater from inhabited dwelling units; or if with a quarter mile, it occurs between the hours of 6:00 a.m. to 6:00 p.m. Monday through Friday from June 1st to September 30th, 7:00 a.m. to 6:00 p.m. Monday through Friday from October 1st to May 30th. In addition, since the County of Riverside has not established a numeric maximum acceptable construction source noise levels at potentially affected receivers for CEQA analysis purposes, a numerical construction threshold based on Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual is used for analysis of daytime construction impacts. The FTA considers a daytime exterior construction noise level of 80 dBA Leq as a reasonable threshold for noise sensitive residential land use. (18 p. 179)

11.1 CONSTRUCTION NOISE LEVELS

Noise generated by the Project construction equipment will include a combination of trucks, power tools, concrete mixers, and portable generators that when combined can reach high levels. The number and mix of construction equipment are expected to occur in the following stages:

- Site Preparation
- Grading
- Rock Crushing
- Building Construction
- Paving
- Architectural Coating

11.2 CONSTRUCTION REFERENCE NOISE LEVELS

To describe construction noise activities, this construction noise analysis was prepared using reference construction equipment noise levels from the Federal Highway Administration (FHWA) published the Roadway Construction Noise Model (RCNM), which includes a national database of construction equipment reference noise emission levels. (2) The RCNM equipment database, provides a comprehensive list of the noise generating characteristics for specific types of construction equipment. In addition, the database provides an acoustical usage factor to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during a construction operation. The reference noise level summary shown in Table 11-1 describes construction activity noise levels with multiple pieces of equipment operating simultaneously. Rock crushing and includes source noise levels for a hoe ram or breaker representing a percussion hammer fitted to an excavator for breaking rock and a rock crushing activity including jaw crushers, a cone crusher, screens, and a conveyor system (30).

EXHIBIT 11-A: CONSTRUCTION NOISE SOURCE AND RECEIVER LOCATIONS

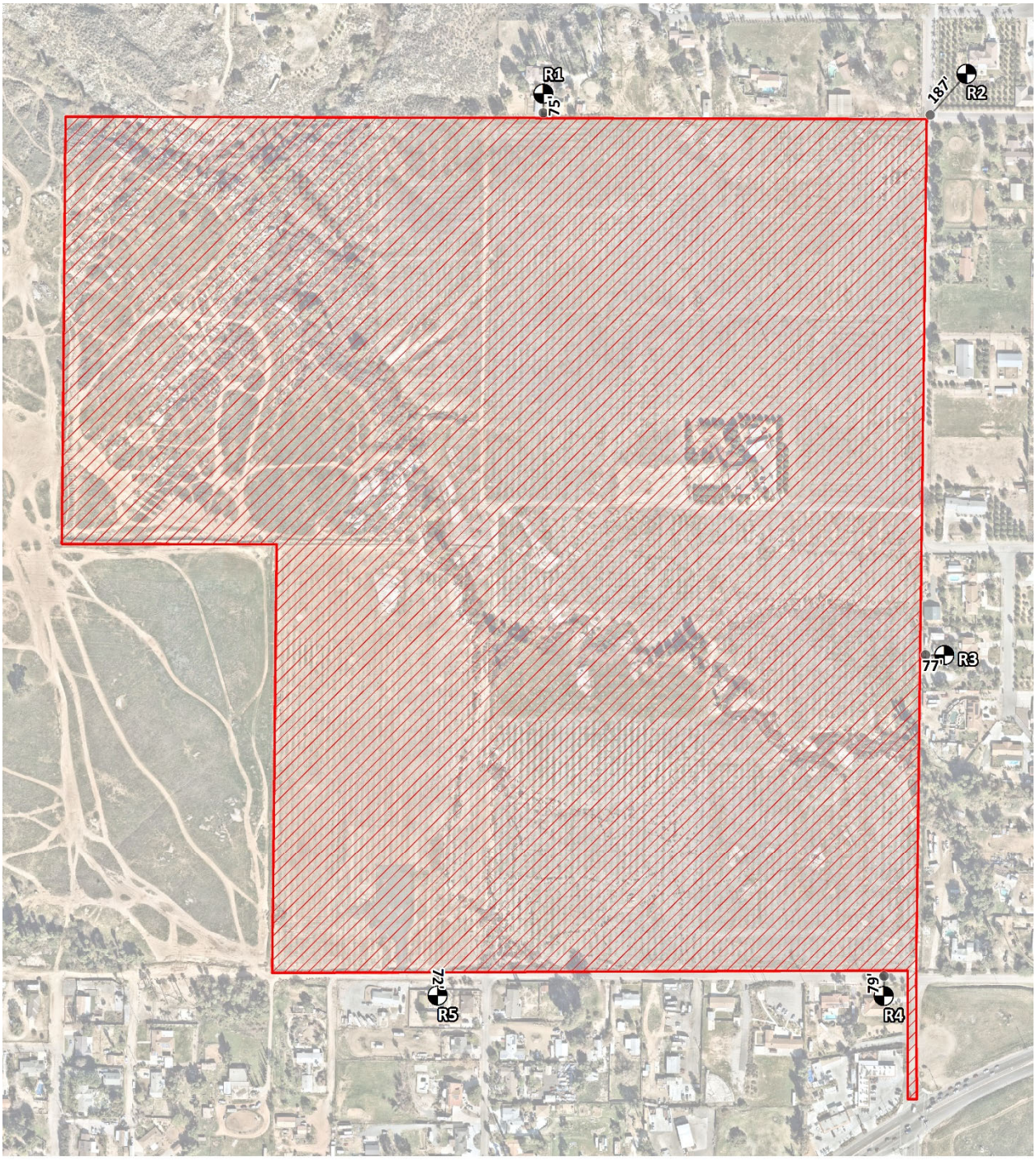


EXHIBIT 11-B: ROCK CRUSHING ACTIVITY AND RECEIVER LOCATIONS

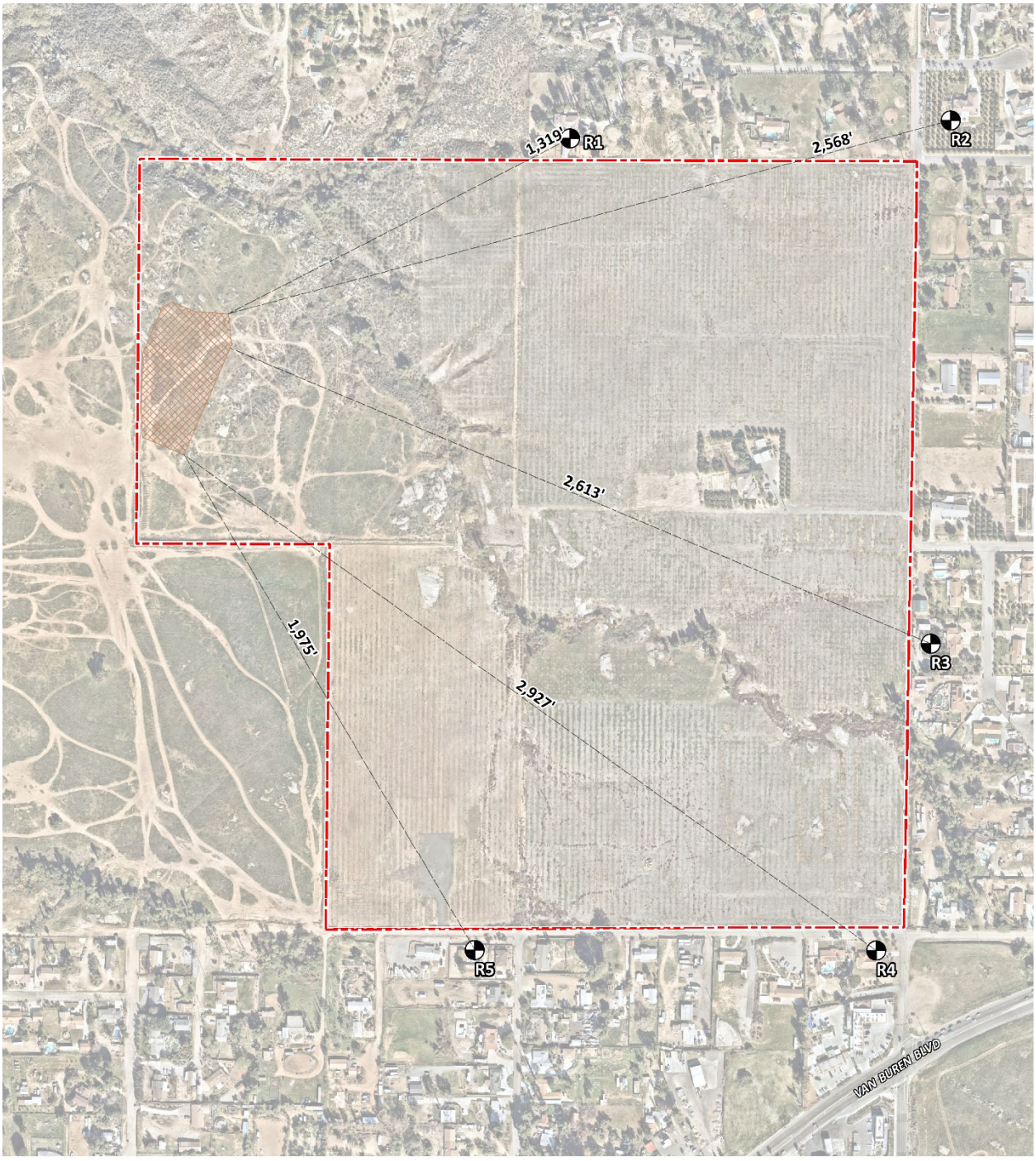


EXHIBIT 11-C: BLASTING ACTIVITY AND RECEIVER LOCATIONS

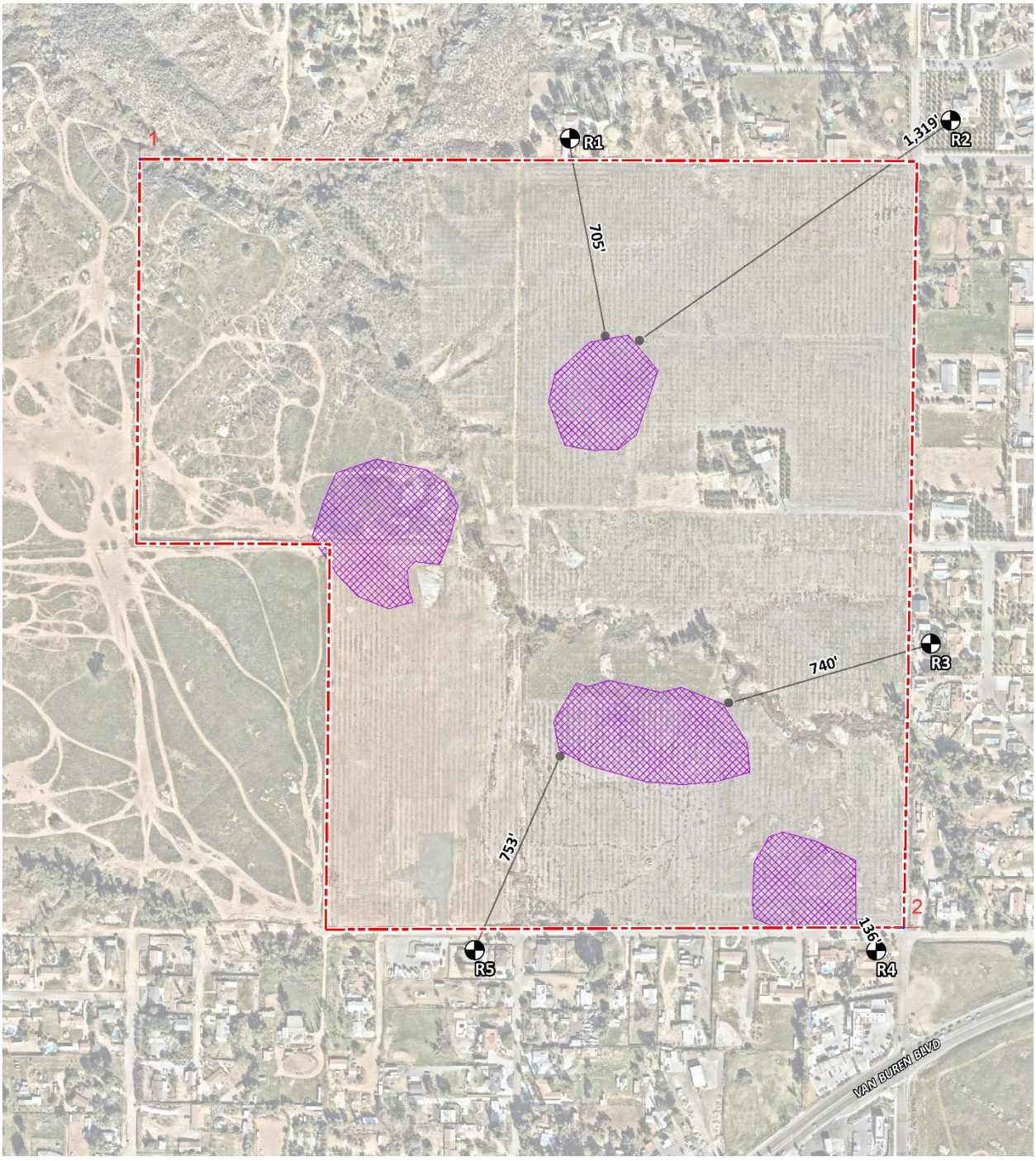


TABLE 11-1: CONSTRUCTION REFERENCE NOISE LEVELS

Construction Stage	Reference Construction Equipmnet[1]	Reference Noise Level @ 50 Feet (dBA L_{eq})	Composite Reference Noise Level (dBA L_{eq})	Reference Power Level (dBA L_w)
Demolition	Concrete Saw	83	86.8	118.4
	Grapple (on backhoe)	83		
	Gradall	79		
Site Preparation	Tractor	80	84.0	115.6
	Backhoe	74		
	Grader	81		
Grading	Scraper	80	83.3	114.9
	Excavator	77		
	Dozer	78		
Rock Crushing	Rock Crusher[2]	89	89.8	121.4
	Front End Loader	75		
	Hydra Break Ram	80		
Building Construction	Crane	73	80.6	112.2
	Generator	78		
	Front End Loader	75		
Paving	Paver	74	77.8	109.5
	Dump Truck	72		
	Roller	73		
Architectural Coating	Man Lift	68	76.2	107.8
	Compressor (air)	74		
	Generator (<25kVA)	70		
Blasting	Blasting	94	94.1	125.7
	Rock Drill	74		
	Front End Loader	75		

[1] FHWA Road Construction Noise Model.
[2] University District Rock Crusher Conditional Use Permit, San Marcos

11.3 CONSTRUCTION NOISE ANALYSIS

Using the reference construction equipment noise levels and the CadnaA noise prediction model, calculations of the Project construction noise level impacts at the nearby sensitive receiver locations were completed. To assess a reasonable worst-case construction scenario Project rock crushing is assumed to be conducted during site preparation and grading stages. However, this analysis conservatively combines rock crushing noise with all construction stages.

To account for the dynamic nature of construction activities, the Project construction noise analysis models the typical construction equipment as combination of the highest reference level as multiple moving points within the construction area (Project site boundary). Rock crushing

activity is modeled simultaneously with general construction activities as a stationary activity. Construction impacts are based on the highest noise level calculated at each receiver location. As shown on Table 11-2, the overall construction noise levels are expected to range from 45.8 to 61.3 dBA L_{eq}, and the highest construction levels are expected to range from 56.4 to 61.3 dBA L_{eq} at the nearby receiver locations. Appendix 11.1 includes the detailed CadnaA construction noise model inputs.

TABLE 11-2: CONSTRUCTION EQUIPMENT NOISE LEVEL SUMMARY

Receiver Location[1]	Construction Noise Levels (dBA L_{eq})						
	Demolition	Site Preparation	Grading	Building Construction	Paving	Architectural Coating	Highest Levels[2]
R1	61.3	58.5	57.8	55.1	52.3	50.7	61.3
R2	56.4	53.6	52.9	50.2	47.4	45.8	56.4
R3	60.3	57.5	56.8	54.1	51.3	49.7	60.3
R4	59.3	56.5	55.8	53.1	50.3	48.7	59.3
R5	60.4	57.6	56.9	54.2	51.4	49.8	60.4

[1] Construction noise source and receiver locations are shown on Exhibit 11-A.
[2] Construction noise level calculations based on distance from the project site boundaries (construction activity area) to nearby receiver locations. CadnaA construction noise model inputs are included in Appendix 11.1.

11.4 CONSTRUCTION NOISE LEVEL COMPLIANCE

To evaluate whether the Project will generate potentially significant short-term noise levels at nearest receiver locations, a construction-related daytime noise level threshold of 80 dBA L_{eq} is used as a reasonable threshold to assess the daytime construction noise level impacts. The construction noise analysis shows that the nearest receiver locations will satisfy the reasonable daytime 80 dBA L_{eq} significance threshold during Project construction activities as shown on Table 11-3. Therefore, the noise impacts due to Project construction noise are considered *less than significant* at all receiver locations.

TABLE 11-3: CONSTRUCTION NOISE LEVEL COMPLIANCE

Receiver Location[1]	Construction Noise Levels (dBA L_{eq})		
	Highest Construction Noise Levels[2]	Threshold[3]	Threshold Exceeded?[4]
R1	61.3	80	No
R2	56.4	80	No
R3	60.3	80	No
R4	59.3	80	No
R5	60.4	80	No

[1] Noise receiver locations are shown on Exhibits 11-A and 11-B.
[2] Highest construction noise level operating at the Project site boundary to nearby receiver locations (Table 11-2).
[3] Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual.
[4] Do the estimated Project construction noise levels exceed the construction noise level threshold?

11.5 CONSTRUCTION VIBRATION IMPACTS

Construction activity can result in varying degrees of ground vibration, depending on the equipment and methods used, distance to the affected structures and soil type. It is expected that ground-borne vibration from Project construction activities would cause only intermittent, localized intrusion. Ground-borne vibration levels resulting from typical construction activities occurring within the Project site were estimated by data published by the Federal Transit Administration (FTA). (18) Ground vibration levels associated with various types of construction equipment are summarized in Table 11-4. Based on the representative vibration levels presented for various construction equipment types, it is possible to estimate the potential Project construction vibration levels using the following vibration assessment methods defined by Caltrans. To calculate the vibration of equipment at distance Caltrans provides the following equation: $PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$

TABLE 11-4: VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment	PPV (in/sec) at 25 feet
Small bulldozer	0.003
Crane	0.008
Jackhammer	0.035
Loaded Trucks	0.076
Large bulldozer	0.089
Hoe Ram (Breaker)	0.089

Caltrans, Transportation and Construction Vibration Guidance Manual, 2020.

Using the vibration source level of construction equipment provided on Table 11-4 and the construction vibration assessment methodology published by the FTA, it is possible to estimate the Project vibration impacts. Table 11-5 presents the expected Project related vibration levels at the nearby receiver locations. At distances ranging from 72 to 187 feet from Project construction activities, construction vibration velocity levels are estimated to range from less than 0.01 to 0.02 in/sec PPV and will not exceed the County of Riverside threshold of 0.30 in/sec PPV at off-site receivers, as shown in Table 11-5. Therefore, the Project-related vibration impacts are considered *less than significant*.

11.6 ROCK CRUSHING CONSTRUCTION REFERENCE NOISE LEVELS

An additional analysis was completed to assess potential noise level impacts due to on-site rock crushing activities planned near the western project site boundary. Exhibit 11-B shows the location of the planned rock crushing activity area in relation to the nearest receiver locations. The rock crushing construction noise analysis was prepared using reference construction equipment noise levels from the Federal Highway Administration (FHWA) published in the Roadway Construction Noise Model (RCNM), which includes a national database of construction equipment reference noise emission levels (2). Table 11-1 provides a summary of the reference average L_{eq} noise levels used to describe rock crushing construction activities.

TABLE 11-5: PROJECT GENERAL CONSTRUCTION VIBRATION LEVELS

Receiver Location[1]	Distance to Const. Activity (Feet)[2]	Typical Construction Vibration Levels PPV (in/sec)[3]						Thresholds PPV (in/sec)[4]	Thresholds Exceeded?[5]
		Small bulldozer	Crane	Jack-hammer	Loaded Trucks	Large Bulldozer	Highest Vibration Level		
R1	75'	0.00	0.00	0.01	0.01	0.02	0.02	0.30	No
R2	187'	0.00	0.00	0.00	0.00	0.00	0.00	0.30	No
R3	77'	0.00	0.00	0.01	0.01	0.02	0.02	0.30	No
R4	79'	0.00	0.00	0.01	0.01	0.02	0.02	0.30	No
R5	72'	0.00	0.00	0.01	0.02	0.02	0.02	0.30	No

[1] Construction receiver locations are shown on Exhibit 11-A.
[2] Distance from receiver location to Project construction boundary.
[3] Based on the Vibration Source Levels of Construction Equipment (Table 11-4).
[4] Caltrans 2020.
[5] Does the peak vibration exceed the acceptable vibration thresholds?
"PPV" = Peak Particle Velocity

The reference noise level summary describes construction activity noise levels with multiple pieces of construction equipment operating simultaneously in the same location and includes source noise levels for a rock crusher unit with conveyor and screens, a loader for loading the rock, and a hoe ram/breaker/hydraulic hammer fitted to an excavator for breaking rock. This is considered conservative since this equipment is typically spaced further apart, and occurs in different locations. A default ground attenuation factor of 0.5 was used in the CadnaA noise prediction model to account for mixed ground representing a combination of hard and soft surfaces.

11.6 ROCK CRUSHING CONSTRUCTION REFERENCE NOISE LEVELS

An additional analysis was completed to assess potential noise level impacts due to on-site rock crushing activities planned near the western project site boundary. Exhibit 11-B shows the location of the planned rock crushing activity area in relation to the nearest receiver locations. The rock crushing construction noise analysis was prepared using reference construction equipment noise levels from the Federal Highway Administration (FHWA) published in the Roadway Construction Noise Model (RCNM), which includes a national database of construction equipment reference noise emission levels (2). Table 11-1 provides a summary of the reference average L_{eq} noise levels used to describe rock crushing construction activities. The reference noise level summary describes construction activity noise levels with multiple pieces of construction equipment operating simultaneously in the same location and includes source noise levels for a rock crusher unit with conveyor and screens, a loader for loading the rock, and a hoe ram/breaker/hydraulic hammer fitted to an excavator for breaking rock. This is considered conservative since this equipment is typically spaced further apart, and occurs in different locations. A default ground attenuation factor of 0.5 was used in the CadnaA noise prediction model to account for mixed ground representing a combination of hard and soft surfaces.

11.7 ROCK CRUSHING CONSTRUCTION NOISE ANALYSIS AND COMPLIANCE

Using the reference RCNM rock crushing construction equipment noise levels and the CadnaA noise prediction model, calculations of the Project construction noise level impacts at the nearest sensitive receiver locations were completed. As shown in Table 11-7, the rock crushing construction noise levels are estimated to range from 49.0 to 55.7 dBA L_{eq} at the nearest receiver locations. The rock crushing construction noise analysis shows that the nearest receiver locations will satisfy the reasonable daytime 80 dBA L_{eq} significance threshold. Therefore, the noise impacts due to the Project's rock crushing activity are considered *less than significant* at all receiver locations. Appendix 11.2 includes the detailed CadnaA rock crushing construction equipment noise model inputs.

TABLE 11-6: ROCK CRUSHING EQUIPMENT NOISE LEVEL SUMMARY

Receiver Location[1]	Rock Cushing Noise Levels (dBA L_{eq})		
	Noise Levels[2]	Threshold[3]	Threshold Exceeded?[4]
R1	55.7	80	No
R2	50.1	80	No
R3	50.3	80	No
R4	49.0	80	No
R5	52.4	80	No

[1] Noise receiver locations are shown on Exhibit 11-A.
[2] CadnaA construction noise model inputs are included in Appendix 11.2.
[3] Federal Transit Administration, Transit Noise and Vibration Impact Assessment Manual.
[4] Do the estimated Project construction noise levels exceed the construction noise level threshold?

11.8 ROCK CRUSHING CONSTRUCTION VIBRATION ANALYSIS AND COMPLIANCE

Using the vibration source level of construction equipment list provided on Table 10-4 that includes source levels for a rock crusher unit with conveyor and screens, a loader for loading the rock, and a hoe ram/breaker/hydraulic hammer fitted to an excavator for breaking rockand the construction vibration assessment methodology published by the FTA, it is possible to estimate the Project rock crushing construction vibration impacts. Table 10-8 presents the expected rock crushing construction equipment vibration levels when the equipment with the highest reference vibration activity operates at the closest point from the edge of the rock crushing activity to each receiver location.

At distances ranging from 1,319 feet to 2.927 from the Project rock crushing construction activities as shown on Exhibit 11-B, construction vibration levels are estimated to be less than 0.01 PPV (in/sec) and will be below the 0.3 in/sec PPV threshold for vibration at all receiver locations. Therefore, the Project-related vibration impacts are considered *less than significant* during Project rock crushing construction activities at the Project site.

TABLE 11-7: ROCK CRUSHING EQUIPMENT VIBRATION LEVELS

Receiver Location[1]	Distance to Const. Activity (Feet)[2]	Typical Construction Vibration Levels PPV (in/sec)[3]						Thresholds PPV (in/sec)[4]	Thresholds Exceeded?[5]
		Small bulldozer	Crane	Jack-hammer	Loaded Trucks	Large Bulldozer	Highest Vibration Level		
R1	1,319'	0.00	0.00	0.00	0.00	0.00	0.00	0.30	No
R2	2,568'	0.00	0.00	0.00	0.00	0.00	0.00	0.30	No
R3	2,613'	0.00	0.00	0.00	0.00	0.00	0.00	0.30	No
R4	2,927'	0.00	0.00	0.00	0.00	0.00	0.00	0.30	No
R5	1,975'	0.00	0.00	0.00	0.00	0.00	0.00	0.30	No

[1] Construction receiver locations are shown on Exhibit 11-A.
[2] Distance from receiver location to Project construction boundary.
[3] Based on the Vibration Source Levels of Construction Equipment (Table 11-4).
[4] County of Riverside General Plan.
[5] Does the peak vibration exceed the acceptable vibration thresholds?
"PPV" = Peak Particle Velocity

11.9 BLASTING NOISE ANALYSIS

A blasting contractor would be required to complete all blasting-related activities in compliance with applicable regulations of the Riverside County Sheriff's Department, the U.S. Bureau of Mines, the California Division of Occupational Safety and Health (Cal-OHSA), the Department of Homeland Security, and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). As required by law a licensed blasting contractor would be responsible for performing and supervising all blasting activities, including the following:

- Drill pattern design;
- Pre-blast inspection;
- Loading of explosives;
- Pre-blast notifications and warning signaling;
- Blasting safety procedures;
- Blasting site security;
- Post-blast inspections and re-entry procedures; and
- Blast log and history.

Explosives used for blasting usually consist of a primer, secondary explosive, and an initiator. The blasting contractor would most likely use a high explosive Ammonia Gelatin as a primer for each shot and ammonium nitrate mixed with fuel oil (ANFO) as the primary blasting agent. Non-electric blasting caps are typically used to initiate the blasting agent. The charges are time delayed by at least 8-milliseconds. Delays between charges are used to decouple changes and reduce vibration.

Pattern blasting is a common technique used in blasting for construction. This method is used when rock materials occur over a wide area. Pattern blasting involves drilling holes in a pre-

designed pattern. The depth and spacing of holes is controlled to provide the maximum fracture with the minimum amount of ground shaking.

Blasting patterns typically consist of drill holes between two and five inches in diameter. Depth of the drill holes would be determined by the blasting contractor and is specific to each application. Blasting patterns on construction sites typically range from three feet by three feet to 12 feet by 12 feet.

The Blasting Engineer would control blasting-induced vibration and noise. General control measures include:

- Stemming shall be of uniform size in order to ensure consistency between individual shots;
- The weight of explosives used per delay shall be determined by adherence to the Scaled Distance Equation;
- Independent delays shall be used for each blast hole to control vibration; and
- Blasting shall not take place when wind velocity equals or exceeds 15 miles per hour. A licensed blasting contractor will determine wind speed through the use of a recording anemometer located a minimum of ten feet above ground level.

In addition, ground vibrations and air overpressure shall be monitored during each blast for compliance with the limits by the U.S. Bureau of Mines. Following each blast, seismographs shall be checked to ensure that the blasting has not exceeded relevant standards. The relevant standards are as follows:

- Pursuant to 30 CFR Ch. VII, §816.67(b)(1)(i) of U.S. Bureau of Mines publication RI8485, airblasts shall not exceed 133 dB at the location of any dwelling, public building, school, church, or community or institutional building outside the permit area.
- Pursuant to 30 CFR Ch. VII, §816.67(d)(2)(i) of U.S. Bureau of Mines publication RI8508, the maximum ground vibration shall not exceed the limits in said section at the location of any dwelling, public building, school, church, or community or institutional building outside the permit area.

To evaluate the potential noise levels from blasting activities during Project construction, the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) reference noise level of 94 dBA L_{max} is used at a reference distance of 50 feet. (2) Each blast represents a point-source of noise which attenuates at a rate of 6 dB for each doubling of distance from the source. The closest residential homes to the Project construction area are represented by receiver location R1 at a distance of 136 feet. With the distance attenuation from the closest blasting activities, the unmitigated noise levels at nearby receiver locations would range from approximately 70.2 dBA L_{max} based on the RCNM reference noise level, as shown in Table 11-6. However, since the type of blasting techniques planned within the Project site are unknown at the time of this analysis, the noise levels presented at the nearby sensitive receiver locations represent the worst-case conditions based on the RCNM reference noise level.

TABLE 11-8: BLASTING CONSTRUCTION NOISE LEVELS

Receiver Location	Distance To Construction Activity (Feet)[2]	Construction Noise Level (dBA L_{max})
R1	705'	61.1
R2	1,319'	57.1
R3	740'	62.4
R4	136'	70.2
R5	753'	61.8

[1] FHWA Roadway Construction Noise Model.
[2] Distance from the nearest point of construction activity to the nearest receiver.
[3] Point (stationary) source drop off rate of 6.0 dBA per doubling of distance.

The County of Riverside General Plan and County Code of Ordinances do not identify specific construction noise level limits for blasting activities. Therefore, the OSMRE and CFR lowest maximum Airblast Limit (30 CFR 816.67(b)) of 129 dBA L_{max} at nearby sensitive uses is used in this analysis as discussed in Section 3.7. (3) Based on the reference blasting noise level, the closest residential receiver will experience noise levels approaching 70.2 dBA L_{max} over the course of the blast, which will likely occur for only a few seconds. While some blasting noise may be noticeable by nearby residents, the single-event, temporary noise levels generated by the blast will not exceed the OSMRE and the CFR standards for airblasts. Therefore, the noise levels due to blasting activities will result in a *less than significant* noise impact.

11.10 BLASTING VIBRATION IMPACTS

Blasting operations can have unacceptable noise and vibration impacts if not conducted correctly. Excessive levels of structural vibration due to ground vibration from blasting can cause substantial damage to structures. A blasting contractor would be required to complete all blasting-related activities in compliance with applicable regulations of the Riverside County Sheriff's Department, the U.S. Bureau of Mines, the California Division of Occupational Safety and Health (Cal-OHSA), the Department of Homeland Security, and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF), which have many requirements for the safe handling, use, and storage of explosives and recommend various measures and controls, including, but not limited to monitoring and reporting of each blast to verify no damage has occurred at nearby structures, notifications to surrounding neighbors, limitations on the amounts and times blast may occur.

Detonating as little as 25 pounds of explosives may be perceived up to 500 feet from a charge. Therefore, without vibration controls and measures, blasting could exceed thresholds at the areas near existing residential homes surrounding the Project site, shown on Exhibit 11-C. Noise-1 would mitigate potential vibration impacts. With the implementation of the identified vibration controls blasting activities at sensitive receivers would be *less than significant*.

11.10.1 BLASTING VIBRATION MITIGATION MEASURES

The following practices would reduce any vibration level impacts produced by the proposed blasting activities at the nearby noise-sensitive residential land uses:

MM Noise-1: Blasting Limitations

Prior to approval of any grading permits that require blasting activities and a blasting permit, the Project Applicant shall prepare and submit for County review and approval of a Blasting Noise and Vibration Monitoring and Abatement Plan ("Noise and Vibration Abatement Plan"). The required Noise and Vibration Abatement Plan shall include the name and qualifications of the person(s) responsible for monitoring and reporting blast vibrations. In addition, the Noise and Vibration Abatement Plan shall require a minimum of three seismographs for monitoring peak ground vibration and air-overpressure. The Noise and Vibration Abatement Plan also shall require that equipment and its use shall conform fully to the standards developed by the Vibration Section of the International Society of Explosive Engineers (ISEE). For all blasts, the Noise and Vibration Abatement Plan shall require monitoring of ground motion and air-overpressure at the nearest residential properties or other structure of concern. The Noise and Vibration Abatement Plan also shall specify a minimum trigger level for monitoring of 0.05 in/s for ground motion and 120 dB for air-overpressure. Additionally, the Noise and Vibration Abatement Plan shall require regular reporting of blasting and measurements to Riverside County, and shall include a copy of the instrument/software-generated blast monitoring report at each instrument location that includes measured peak particle velocity in inches per second, peak air-overpressure in linear-scale decibels, and vibration and air-overpressure event plots, with date and time of event recording. In addition, the Noise and Vibration Abatement Plan shall include the following requirements:

- Prior to commencement of any blasting, a pre-blast survey of the conditions of all existing property and aboveground utilities located within 300 feet of any potential blasting areas shall be conducted. The pre-blast survey shall include a photographic record of all visible and accessible structures, facilities, utilities, or other improvements. The survey shall document the interior and exterior conditions of all residential property and associated structures located within 500 feet of blasting areas. If property owners refuse surveys, provide copies of certified-mail letters documenting attempts to provide the survey by a third-party professional survey company. The required surveys shall include a description of the interior and exterior condition of the various structures examined. Descriptions shall include the locations of any cracks, damage, or other existing defects and shall include information needed to identify and describe the defect, if any, and to evaluate the construction operations on the defect. Survey records shall include photos of all cracks and other damaged, weathered, or otherwise deteriorated structural conditions. If necessary, macro lenses and flash illumination shall be used to ensure defects are shown clearly in the photographs. Photos shall contain an accurate date stamp. No blasting shall occur prior to completion of surveys of surrounding residential properties. Surveys also shall be repeated at facilities or properties where damage concerns have been expressed by individual residents, property owners, or other concerned parties. Details of any observed changes to surveyed structures and documenting photos shall be reported and submitted to Riverside County.
- Blasting only shall be allowed Monday through Friday only between the hours of 8:00 a.m. and 5:00 p.m.

- No blasting shall occur closer than 100 feet from residential structures. In the event that non-rippable materials are encountered within 100 feet from any residential structure, alternative methods shall be employed to reduce blasting-related noise and vibration impacts. Alternative rock blasting within 100 feet of residential homes may include methods such as the drilling of holes in the largest area of rock, inserting expansive grout or small charges into each whole to fragment the rock into smaller pieces, and then crushing the pieces for transport or other use.
- No more than a total of 2,000 pounds of explosive shall be detonated each day, excluding detonators.
- All blasts located within 500 feet of any structures or above ground utilities shall be covered with woven steel cable or steel-cable and rubber-tire blasting mats with a minimum weight of 30 pounds per square foot. Woven polypropylene or similar weed-barrier fabric, covered with at least 6 inches of soil or sand shall be placed over blast areas to protect initiators before mats are placed. Mats shall be overlapped at least 3 feet and shall completely cover the blast area and extend at least three feet beyond the blast area in all directions. If any flyrock or blasted material is thrown more than 10 feet or half the distance to the nearest structure, whichever is less, blasting shall be suspended until the County's has approved a revised blasting plan showing revisions to assure adequate ground movement control.
- Before blasts are covered, all loose soils above the blast shall be removed where feasible. Remaining ground located within 20 feet of the blast shall be thoroughly wetted with water to suppress airborne dust. Sand or soils placed over weed-barrier fabric shall be similarly wetted before placing blast mats.
- If specified vibration limits are exceeded, blasting operations shall cease immediately and a revised blasting plan shall be submitted to the County. Blasting shall not resume until a revised blasting plan has been reviewed and the Contractor has expressed in writing the conditions that will be applied to further blasting work.

Project grading and blasting contractors shall be required to ensure compliance with the Noise and Vibration Abatement Plan requirements and shall permit periodic inspection of the construction site by County of Riverside staff or its designee to confirm compliance. The requirements of the Noise and Vibration Abatement Plan also shall be specified in bid documents issued to prospective construction contractors. Riverside County shall review all monitoring reports to ensure compliance with the Noise and Vibration Abatement Plan, and shall have the authority to stop all blasting activities on site if it is determined that blasting activities are not being conducted in conformance with Noise and Vibration Abatement Plan and/or the above-listed requirements.

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13 CERTIFICATION

The contents of this noise study report represent an accurate depiction of the noise environment and impacts associated with the proposed Arroyo Vista Project. The information contained in this noise study report is based on the best available data at the time of preparation. If you have any questions, please contact me directly at (619) 788-1971.

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EDUCATION

Bachelor of Science in Urban and Regional Planning
California Polytechnic State University, Pomona • June 2000

PROFESSIONAL AFFILIATIONS

ASA – Acoustical Society of America
APA – American Planning Association
AWMA – Air and Waste Management Association
INCE – Institute of Noise Control Engineers

PROFESSIONAL CERTIFICATIONS

INCE Membership – Certification, June 2024
Approved Acoustical Consultant • County of San Diego
FHWA Traffic Noise Model of Training • November 2004
CadnaA Basic and Advanced Training Certificate • October 2008.

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APPENDIX 3.1:

COUNTY OF RIVERSIDE OFFICE OF INDUSTRIAL HYGIENE NOISE STUDY REQUIREMENTS

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Chapter 9.52 - NOISE REGULATION

Sections:

9.52.010 - Intent.

At certain levels, sound becomes noise and may jeopardize the health, safety or general welfare of Riverside County residents and degrade their quality of life. Pursuant to its police power, the board of supervisors declares that noise shall be regulated in the manner described in this chapter. This chapter is intended to establish county-wide standards regulating noise. This chapter is not intended to establish thresholds of significance for the purpose of any analysis required by the California Environmental Quality Act and no such thresholds are established.

(Ord. 847 § 1, 2006)

9.52.020 - Exemptions.

Sound emanating from the following sources is exempt from the provisions of this chapter:

A. Facilities owned or operated by or for a governmental agency;

B. Capital improvement projects of a governmental agency;

C. The maintenance or repair of public properties;

D. Public safety personnel in the course of executing their official duties, including, but not limited to, sworn peace officers, emergency personnel and public utility personnel. This exemption includes, without limitation, sound emanating from all equipment used by such personnel, whether stationary or mobile;

E. Public or private schools and school-sponsored activities;

F. Agricultural operations on land designated "Agriculture" in the Riverside County general plan, or land zoned A-l (light agriculture), A-P (light agriculture with poultry), A-2 (heavy agriculture), A-D (agriculture-dairy) or C/V (citrus/vineyard), provided such operations are carried out in a manner consistent with accepted industry standards. This exemption includes, without limitation, sound emanating from all equipment used during such operations, whether stationary or mobile;

G. Wind energy conversion systems (WECS), provided such systems comply with the WECS noise provisions of Riverside County Ordinance No. 348;

H. Private construction projects located one-quarter of a mile or more from an inhabited dwelling;

I. Private construction projects located within one-quarter of a mile from an inhabited dwelling,

provided that:

1. Construction does not occur between the hours of six p.m. and six a.m. during the months of June through September, and
2. Construction does not occur between the hours of six p.m. and seven a.m. during the months of October through May;

J. Property maintenance, including, but not limited to, the operation of lawnmowers, leaf blowers, etc., provided such maintenance occurs between the hours of seven a.m. and eight p.m.;

K. Motor vehicles, other than off-highway vehicles. This exemption does not include sound emanating from motor vehicle sound systems;

L. Heating and air conditioning equipment;

M. Safety, warning and alarm devices, including, but not limited to, house and car alarms, and other warning devices that are designed to protect the public health, safety, and welfare;

N. The discharge of firearms consistent with all state laws.

(Ord. 847 § 2, 2006)

9.52.030 - Definitions.

As used in this chapter, the following terms shall have the following meanings:

"Audio equipment" means a television, stereo, radio, tape player, compact disc player, mp3 player, I-POD or other similar device.

"Decibel (dB)" means a unit for measuring the relative amplitude of a sound equal approximately to the smallest difference normally detectable by the human ear, the range of which includes approximately one hundred thirty (130) decibels on a scale beginning with zero decibels for the faintest detectable sound. Decibels are measured with a sound level meter using different methodologies as defined below:

1. "A-weighting (dBA)" means the standard A-weighted frequency response of a sound level meter, which de-emphasizes low and high frequencies of sound in a manner similar to the human ear for moderate sounds.
2. "Maximum sound level (L_{max})" means the maximum sound level measured on a sound level meter.

"Governmental agency" means the United States, the state of California, Riverside County, any city within Riverside County, any special district within Riverside County or any combination of these agencies.

"Land use permit" means a discretionary permit issued by Riverside County pursuant to Riverside County Ordinance No. 348.

"Motor vehicle" means a vehicle that is self-propelled.

"Motor vehicle sound system" means a stereo, radio, tape player, compact disc player, mp3 player, I-POD or other similar device.

"Noise" means any loud, discordant or disagreeable sound.

"Occupied property" means property upon which is located a residence, business or industrial or manufacturing use.

"Off-highway vehicle" means a motor vehicle designed to travel over any terrain.

"Public or private school" means an institution conducting academic instruction at the preschool, elementary school, junior high school, high school, or college level.

"Public property" means property owned by a governmental agency or held open to the public, including, but not limited to, parks, streets, sidewalks, and alleys.

"Sensitive receptor" means a land use that is identified as sensitive to noise in the noise element of the Riverside County general plan, including, but not limited to, residences, schools, hospitals, churches, rest homes, cemeteries or public libraries.

"Sound-amplifying equipment" means a loudspeaker, microphone, megaphone or other similar device.

"Sound level meter" means an instrument meeting the standards of the American National Standards Institute for Type 1 or Type 2 sound level meters or an instrument that provides equivalent data.

(Ord. 847 § 3, 2006)

9.52.040 - General sound level standards.

No person shall create any sound, or allow the creation of any sound, on any property that causes the exterior sound level on any other occupied property to exceed the sound level standards set forth in Table 1.

TABLE 1

Sound Level Standards (Db L_{max})

GENERAL PLAN FOUNDATION COMPONENT	GENERAL PLAN LAND USE DESIGNATION	GENERAL PLAN LAND USE DESIGNATION NAME	DENSITY	MAXIMUM DECIBEL LEVEL	
				7 am—10 pm	10 pm—7 am

Community Development	EDR	Estate Density Residential	2 AC	55	45
	VLDR	Very Low Density Residential	1 AC	55	45
	LDR	Low Density Residential	1/2 AC	55	45
	MDR	Medium Density Residential	2—5	55	45
	MHDR	Medium High Density Residential	5—8	55	45
	HDR	High Density Residential	8—14	55	45
	VHDR	Very High Density Residential	14—20	55	45
	H'TDR	Highest Density Residential	20+	55	45
	CR	Retail Commercial		65	55
	CO	Office Commercial		65	55
	CT	Tourist Commercial		65	55
	CC	Community Center		65	55
	LI	Light Industrial		75	55
	HI	Heavy Industrial		75	75

	BP	Business Park		65	45
	PF	Public Facility		65	45
	SP	Specific Plan-Residential		55	45
		Specific Plan-Commercial		65	55
		Specific Plan-Light Industrial		75	55
		Specific Plan-Heavy Industrial		75	75
Rural Community	EDR	Estate Density Residential	2 AC	55	45
	VLDR	Very Low Density Residential	1 AC	55	45
	LDR	Low Density Residential	1/2 AC	55	45
Rural	RR	Rural Residential	5 AC	45	45
	RM	Rural Mountainous	10 AC	45	45
	RD	Rural Desert	10 AC	45	45
Agriculture	AG	Agriculture	10 AC	45	45
Open Space	C	Conservation		45	45
	CH	Conservation Habitat		45	45

	REC	Recreation		45	45
	RUR	Rural	20 AC	45	45
	W	Watershed		45	45
	MR	Mineral Resources		75	45

(Ord. 847 § 4, 2006)

9.52.050 - Sound level measurement methodology.

Sound level measurements may be made anywhere within the boundaries of an occupied property. The actual location of a sound level measurement shall be at the discretion of the enforcement officials identified in Section 9.52.080 of this chapter. Sound level measurements shall be made with a sound level meter. Immediately before a measurement is made, the sound level meter shall be calibrated utilizing an acoustical calibrator meeting the standards of the American National Standards Institute. Following a sound level measurement, the calibration of the sound level meter shall be re-verified. Sound level meters and calibration equipment shall be certified annually.

(Ord. 847 § 5, 2006)

9.52.060 - Special sound sources standards.

The general sound level standards set forth in Section 9.52.040 of this chapter apply to sound emanating from all sources, including the following special sound sources, and the person creating, or allowing the creation of, the sound is subject to the requirements of that section. The following special sound sources are also subject to the following additional standards, the failure to comply with which constitutes separate violations of this chapter:

A. Motor Vehicles.

1. Off-Highway Vehicles.

a. No person shall operate an off-highway vehicle unless it is equipped with a USDA-qualified spark arrester and a constantly operating and properly maintained muffler. A muffler is not considered constantly operating and properly maintained if it is equipped with a cutout, bypass or similar device.

b. No person shall operate an off-highway vehicle unless the noise emitted by the vehicle

is not more than ninety-six (96) dBA if the vehicle was manufactured on or after January 1, 1986 or is not more than one hundred one (101) dBA if the vehicle was manufactured before January 1, 1986. For purposes of this subsection, emitted noise shall be measured a distance of twenty (20) inches from the vehicle tailpipe using test procedures established by the Society of Automotive Engineers under Standard J-1287.

2. Sound Systems. No person shall operate a motor vehicle sound system, whether affixed to the vehicle or not, between the hours of ten p.m. and eight a.m., such that the sound system is audible to the human ear inside any inhabited dwelling. No person shall operate a motor vehicle sound system, whether affixed to the vehicle or not, at any other time such that the sound system is audible to the human ear at a distance greater than one hundred (100) feet from the vehicle.

B. Power Tools and Equipment. No person shall operate any power tools or equipment between the hours of ten p.m. and eight a.m. such that the power tools or equipment are audible to the human ear inside an inhabited dwelling other than a dwelling in which the power tools or equipment may be located. No person shall operate any power tools or equipment at any other time such that the power tools or equipment are audible to the human ear at a distance greater than one hundred (100) feet from the power tools or equipment.

C. Audio Equipment. No person shall operate any audio equipment, whether portable or not, between the hours of ten p.m. and eight a.m. such that the equipment is audible to the human ear inside an inhabited dwelling other than a dwelling in which the equipment may be located. No person shall operate any audio equipment, whether portable or not, at any other time such that the equipment is audible to the human ear at a distance greater than one hundred (100) feet from the equipment.

D. Sound-Amplifying Equipment and Live Music. No person shall install, use or operate sound-amplifying equipment, or perform, or allow to be performed, live music unless such activities comply with the following requirements. To the extent that these requirements conflict with any conditions of approval attached to an underlying land use permit, these requirements shall control:

1. Sound-amplifying equipment or live music is prohibited between the hours of ten p.m. and eight a.m.

2. Sound emanating from sound-amplifying equipment or live music at any other time shall not be audible to the human ear at a distance greater than two hundred (200) feet from the equipment or music.

(Ord. 847 § 6, 2006)

9.52.070 - Exceptions.

Exceptions may be requested from the standards set forth in Section 9.52.040 or 9.52.060 of this chapter and may be characterized as construction-related, single-event or continuous-events exceptions.

A. Application and Processing.

1. Construction-Related Exceptions. An application for a construction-related exception shall be made to and considered by the director of building and safety on forms provided by the building and safety department and shall be accompanied by the appropriate filing fee. No public hearing is required.
2. Single-Event Exceptions. An application for a single-event exception shall be made to and considered by the planning director on forms provided by the planning department and shall be accompanied by the appropriate filing fee. No public hearing is required.
3. Continuous-Events Exceptions. An application for a continuous-events exception shall be made to the planning director on forms provided by the planning department and shall be accompanied by the appropriate filing fee. Upon receipt of an application for a continuous-events exception, the planning director shall set the matter for public hearing before the planning commission, notice of which shall be given as provided in Section 18.26c of Riverside County Ordinance No. 348. Notwithstanding the above, an application for a continuous-events exception that is associated with an application for a land use permit shall be processed concurrently with the land use permit in the same manner that the land use permit is required to be processed.

B. Requirements for Approval. The appropriate decisionmaking body or officer shall not approve an exception application unless the applicant demonstrates that the activities described in the application would not be detrimental to the health, safety or general welfare of the community. In determining whether activities are detrimental to the health, safety or general welfare of the community, the appropriate decisionmaking body or officer shall consider such factors as the proposed duration of the activities and their location in relation to sensitive receptors. If an exception application is approved, reasonable conditions may be imposed to minimize the public detriment, including, but not limited to, restrictions on sound level, sound duration and operating hours.

C. Appeals. The director of building and safety's decision on an application for a construction-related exception is considered final. The planning director's decision on an application for a single-event exception is considered final. After making a decision on an application for a continuous-events exception, the appropriate decisionmaking body or officer shall mail notice of the decision to the applicant. Within ten (10) calendar days after the mailing of such notice, the applicant or an interested person may appeal the decision to the board of supervisors. Upon receipt of an appeal and payment of the appropriate appeal fee, the clerk of the board

shall set the matter for hearing not less than five days nor more than thirty (30) days thereafter and shall give written notice of the hearing in the same manner as notice of the hearing was given by the appropriate hearing officer or body. The board of supervisors shall render its decision within thirty (30) days after the appeal hearing is closed.

D. Effect of a Pending Continuous-Events Exception Application. For a period of one hundred eighty (180) days from the effective date of this chapter, no person creating any sound prohibited by this chapter shall be considered in violation of this chapter if the sound is related to a use that is operating pursuant to an approved land use permit, if an application for a continuous-events exception has been filed to sanction the sound and if a decision on the application is pending.

(Ord. 847 § 7, 2006)

9.52.080 - Enforcement.

The Riverside County sheriff and code enforcement shall have the primary responsibility for enforcing this chapter; provided, however, the sheriff and code enforcement may be assisted by the public health department. Violations shall be prosecuted as described in Section 9.52.100 of this chapter, but nothing in this chapter shall prevent the sheriff, code enforcement or the department of public health from engaging in efforts to obtain voluntary compliance by means of warnings, notices, or educational programs.

(Ord. 847.1 § 1, 2007: Ord. 847 § 8, 2006)

9.52.090 - Duty to cooperate.

No person shall refuse to cooperate with, or obstruct, the enforcement officials identified in Section 9.52.080 of this chapter when they are engaged in the process of enforcing the provisions of this chapter. This duty to cooperate may require a person to extinguish a sound source so that it can be determined whether sound emanating from the source violates the provisions of this chapter.

(Ord. 847 § 9, 2006)

9.52.100 - Violations and penalties.

Any person who violates any provision of this chapter once or twice within a one hundred eighty (180) day period shall be guilty of an infraction. Any person who violates any provision of this chapter more than twice within a one hundred eighty (180) day period shall be guilty of a misdemeanor. Each day a violation is committed or permitted to continue shall constitute a separate offense and shall be punishable as such. Penalties shall not exceed the following amounts:

A. For the first violation within a one hundred eighty (180) day period, the minimum mandatory

fine shall be five hundred dollars ($500.00).

B. For the second violation within a one hundred eighty (180) day period, the minimum mandatory fine shall be seven hundred fifty dollars ($750.00).

C. For any further violations within a one hundred eighty (180) day period, the minimum mandatory fine shall be one thousand dollars ($1,000.00) or imprisonment in the county jail for a period not exceeding six months, or both.

(Ord. 847 § 10, 2006)

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APPENDIX 5.1:

STUDY AREA PHOTOS

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JN: 14577 Study Area Photos

L1_E
33, 53' 38.250000"117, 20' 57.850000"

L1_N
33, 53' 38.290000"117, 20' 57.820000"

L1_S
33, 53' 38.280000"117, 20' 57.820000"

L1_W
33, 53' 38.240000"117, 20' 57.850000"

L2_E
33, 53' 43.240000"117, 20' 54.970000"

L2_N
33, 53' 43.220000"117, 20' 54.970000"

JN: 14577 Study Area Photos

L2_S
33, 53' 43.270000"117, 20' 54.970000"

L2_W
33, 53' 43.220000"117, 20' 54.970000"

L3_E
33, 53' 25.270000"117, 20' 56.450000"

L3_N
33, 53' 25.230000"117, 20' 56.400000"

L3_S
33, 53' 25.320000"117, 20' 56.480000"

L3_W
33, 53' 25.230000"117, 20' 56.450000"

JN: 14577 Study Area Photos

L4_E
33, 53' 13.710000"117, 20' 54.780000"

L4_N
33, 53' 13.730000"117, 20' 54.860000"

L4_S
33, 53' 13.680000"117, 20' 54.780000"

L4_W
33, 53' 13.680000"117, 20' 54.860000"

L5_E
33, 53' 14.000000"117, 21' 10.760000"

L5_N
33, 53' 14.070000"117, 21' 10.790000"

JN: 14577 Study Area Photos

L5_S
33, 53' 14.010000"117, 21' 10.760000"

L5_W
33, 53' 14.030000"117, 21' 10.790000"

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APPENDIX 5.2:

NOISE LEVEL MEASUREMENT WORKSHEETS

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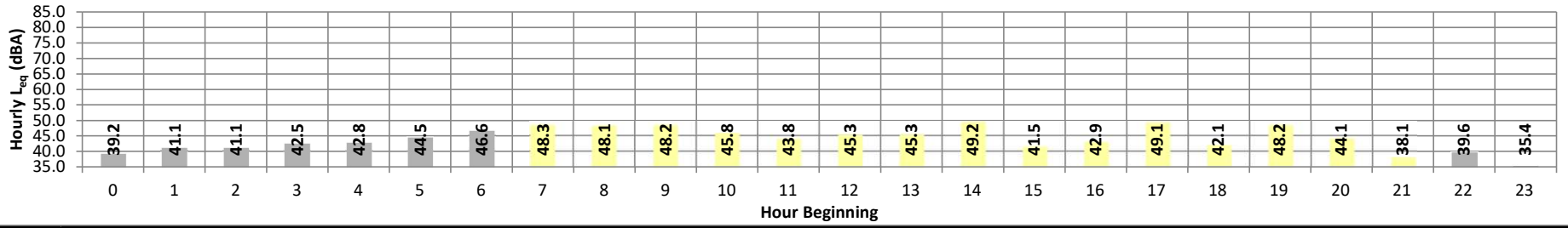
24-Hour Noise Level Measurement Summary

Date: Wednesday, March 23, 2022 *Location:* L1 - Located north of the Project site near single-family *Meter:* Piccolo II *JN:* 14577

Project: Chicago 139 *Source:* residence at 17975 Twin Lakes Drive. *Analyst:* A. Khan

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	39.2	46.5	34.8	45.9	45.5	44.0	42.8	39.5	37.3	35.4	35.1	34.9	39.2	10.0	49.2
	1	41.1	49.0	34.6	47.9	47.1	45.7	44.9	42.0	39.3	35.9	35.3	34.8	41.1	10.0	51.1
	2	41.1	47.2	36.7	46.4	45.8	44.6	44.0	41.9	40.0	37.7	37.3	36.9	41.1	10.0	51.1
	3	42.5	49.0	38.3	48.0	47.3	46.0	45.3	43.3	41.6	39.3	38.9	38.4	42.5	10.0	52.5
	4	42.8	49.0	39.0	48.0	47.2	46.1	45.4	43.5	41.9	39.9	39.5	39.1	42.8	10.0	52.8
	5	44.5	50.1	40.8	49.7	49.3	48.2	47.3	45.1	43.6	41.6	41.3	41.0	44.5	10.0	54.5
	6	46.6	51.3	43.8	50.9	50.4	49.4	48.8	47.1	46.1	44.5	44.3	43.9	46.6	10.0	56.6
Day	7	48.3	53.2	45.2	52.7	52.1	51.0	50.5	48.9	47.7	46.0	45.7	45.3	48.3	0.0	48.3
	8	48.1	54.0	44.2	53.5	52.8	51.7	51.0	49.0	47.0	45.0	44.7	44.3	48.1	0.0	48.1
	9	48.2	56.4	41.6	55.8	55.1	53.6	52.5	48.9	45.4	42.7	42.2	41.7	48.2	0.0	48.2
	10	45.8	53.4	39.6	52.6	51.9	50.4	49.6	46.8	44.3	40.5	40.1	39.7	45.8	0.0	45.8
	11	43.8	51.2	37.1	50.6	50.0	49.0	48.1	45.0	41.5	38.0	37.6	37.2	43.8	0.0	43.8
	12	45.3	55.3	34.5	54.7	54.0	52.2	50.9	44.2	39.5	35.5	35.2	34.8	45.3	0.0	45.3
	13	45.3	54.7	34.8	53.9	53.1	52.0	51.1	45.4	39.8	35.7	35.3	35.0	45.3	0.0	45.3
	14	49.2	59.5	34.4	58.8	57.4	55.5	54.7	50.3	39.7	35.6	35.1	34.5	49.2	0.0	49.2
	15	41.5	48.1	33.7	47.6	47.1	46.0	45.5	43.0	40.1	34.5	34.1	33.8	41.5	0.0	41.5
	16	42.9	50.3	34.9	49.5	48.6	47.7	47.1	44.6	41.2	35.5	35.3	35.0	42.9	0.0	42.9
	17	49.1	57.0	36.1	56.7	56.3	55.5	54.2	50.8	43.5	37.2	36.7	36.3	49.1	0.0	49.1
	18	42.1	49.1	35.2	48.5	48.1	47.5	46.7	43.3	39.4	35.9	35.6	35.3	42.1	0.0	42.1
	19	48.2	56.5	36.0	56.0	55.5	54.2	53.8	49.2	42.2	37.3	36.7	36.2	48.2	5.0	53.2
	20	44.1	50.7	33.8	50.2	49.9	49.4	48.9	46.2	40.9	34.7	34.2	33.9	44.1	5.0	49.1
	21	38.1	42.9	34.6	42.7	42.4	41.7	41.2	39.2	36.9	35.1	34.9	34.7	38.1	5.0	43.1
Night	22	39.6	44.9	34.8	44.6	44.3	43.8	43.2	41.0	37.7	35.4	35.2	34.9	39.6	10.0	49.6
	23	35.4	40.4	32.7	40.0	39.6	38.6	38.0	35.8	34.5	33.2	33.0	32.8	35.4	10.0	45.4

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	38.1	42.9	33.7	42.7	42.4	41.7	41.2	39.2	36.9	34.5	34.1	33.8
	Max	49.2	59.5	45.2	58.8	57.4	55.5	54.7	50.8	47.7	46.0	45.7	45.3
Energy Average		46.3	Average:		52.3	51.6	50.5	49.7	46.3	41.9	37.9	37.6	37.2
Night	Min	35.4	40.4	32.7	40.0	39.6	38.6	38.0	35.8	34.5	33.2	33.0	32.8
	Max	46.6	51.3	43.8	50.9	50.4	49.4	48.8	47.1	46.1	44.5	44.3	43.9
Energy Average		42.4	Average:		46.8	46.3	45.1	44.4	42.1	40.2	38.1	37.8	37.4

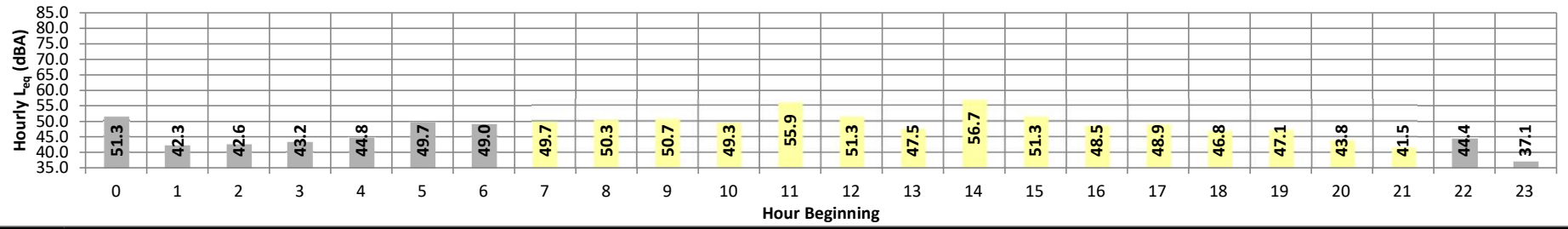
L_{eq} (dBA)		
24-Hour	Daytime (7am-10pm)	Nighttime (10pm-7am)
45.2	46.3	42.4
CNEL		50.0

24-Hour Noise Level Measurement Summary

Date: Wednesday, March 23, 2022 *Location:* L2 - Located northeast of the Project site near single-family *Meter:* Piccolo II *JN:* 14577

Project: Chicago 139 *Source:* residence at 18019 Twin Lakes Drive. *Analyst:* A. Khan

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	51.3	62.6	36.8	61.9	61.7	60.8	58.8	44.9	40.1	37.6	37.3	36.9	51.3	10.0	61.3
	1	42.3	49.5	36.6	48.6	47.9	46.5	45.8	43.2	40.9	37.8	37.3	36.8	42.3	10.0	52.3
	2	42.6	48.7	38.9	47.8	47.1	46.2	45.5	43.4	41.7	39.6	39.4	39.0	42.6	10.0	52.6
	3	43.2	48.3	40.5	47.5	46.9	45.8	45.2	43.8	42.7	41.2	40.9	40.6	43.2	10.0	53.2
	4	44.8	51.5	40.8	50.9	50.2	48.8	47.9	45.2	43.6	41.6	41.3	40.9	44.8	10.0	54.8
	5	49.7	60.9	41.6	60.5	59.9	57.0	53.6	47.2	44.2	42.3	42.0	41.7	49.7	10.0	59.7
	6	49.0	75.9	44.1	75.5	74.8	71.9	67.0	51.2	46.9	44.8	44.6	44.2	49.0	10.0	59.0
Day	7	49.7	57.1	46.2	56.8	56.5	55.1	53.4	49.0	48.1	46.9	46.6	46.3	49.7	0.0	49.7
	8	50.3	58.4	45.9	57.8	57.4	55.7	54.4	50.0	48.2	46.6	46.2	46.0	50.3	0.0	50.3
	9	50.7	58.4	45.3	58.0	57.5	56.1	54.8	51.0	48.6	46.1	45.8	45.4	50.7	0.0	50.7
	10	49.3	58.7	43.5	58.0	57.0	54.6	53.2	49.2	46.9	44.4	44.0	43.6	49.3	0.0	49.3
	11	55.9	69.2	40.6	69.0	68.1	64.2	59.2	49.1	44.8	41.6	41.2	40.7	55.9	0.0	55.9
	12	51.3	62.4	38.0	61.9	61.5	59.5	57.2	48.9	44.0	39.1	38.6	38.1	51.3	0.0	51.3
	13	47.5	57.5	37.7	57.0	56.4	54.5	52.7	47.2	42.2	38.6	38.2	37.8	47.5	0.0	47.5
	14	56.7	68.6	37.7	68.3	68.0	65.6	61.6	50.4	43.5	39.2	38.7	37.9	56.7	0.0	56.7
	15	51.3	61.7	40.8	61.5	60.9	58.1	56.7	50.7	44.7	41.7	41.3	41.0	51.3	0.0	51.3
	16	48.5	58.6	41.4	58.2	57.6	55.1	53.3	47.0	44.7	42.3	42.0	41.5	48.5	0.0	48.5
	17	48.9	57.5	41.3	57.0	56.2	54.3	53.4	49.6	45.3	42.1	41.7	41.4	48.9	0.0	48.9
	18	46.8	56.4	39.8	55.9	55.1	53.9	52.8	45.9	43.0	40.6	40.2	39.9	46.8	0.0	46.8
	19	47.1	56.8	38.4	56.3	56.0	54.8	53.1	45.8	42.0	39.1	38.8	38.5	47.1	5.0	52.1
	20	43.8	51.0	36.4	50.8	50.4	49.3	48.3	44.8	41.4	37.4	37.0	36.5	43.8	5.0	48.8
	21	41.5	49.1	37.8	48.7	48.3	46.9	45.5	41.4	39.5	38.3	38.1	37.9	41.5	5.0	46.5
Night	22	44.4	54.5	38.5	54.0	53.4	51.4	48.2	43.2	40.7	39.2	38.9	38.7	44.4	10.0	54.4
	23	37.1	41.8	35.0	41.2	40.7	39.5	39.0	37.6	36.5	35.5	35.3	35.1	37.1	10.0	47.1

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	41.5	49.1	36.4	48.7	48.3	46.9	45.5	41.4	39.5	37.4	37.0	36.5
	Max	56.7	69.2	46.2	69.0	68.1	65.6	61.6	51.0	48.6	46.9	46.6	46.3
Energy Average		51.0	Average:		58.4	57.8	55.8	54.0	48.0	44.4	41.6	41.2	40.8
Night	Min	37.1	41.8	35.0	41.2	40.7	39.5	39.0	37.6	36.5	35.5	35.3	35.1
	Max	51.3	75.9	44.1	75.5	74.8	71.9	67.0	51.2	46.9	44.8	44.6	44.2
Energy Average		46.8	Average:		54.2	53.6	52.0	50.1	44.4	41.9	40.0	39.7	39.3

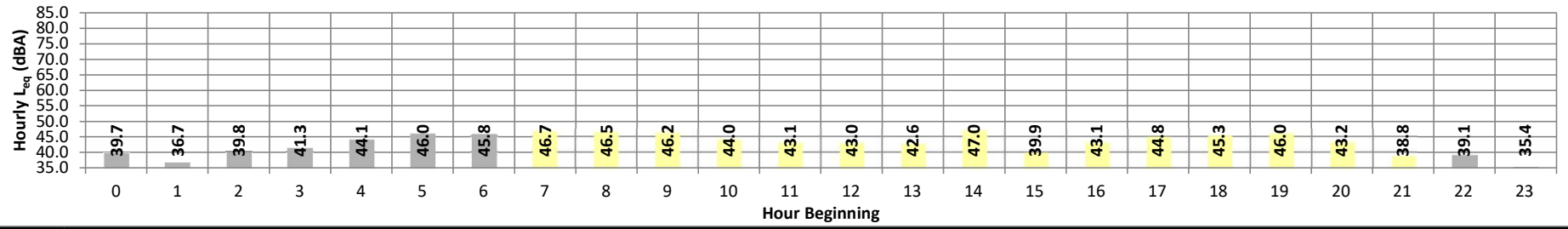
L_{eq} (dBA)		
24-Hour	Daytime (7am-10pm)	Nighttime (10pm-7am)
49.8	51.0	46.8
CNEL		54.2

24-Hour Noise Level Measurement Summary

Date: Wednesday, March 23, 2022 | *Location:* L3 - Located east of the Project site near single-family | *Meter:* Piccolo II | *JN:* 14577

Project: Chicago 139 | *Source:* residence at 15765 Cartwright Street. | *Analyst:* A. Khan

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	39.7	45.3	35.9	44.9	44.5	43.5	42.8	40.5	38.6	36.6	36.3	36.0	39.7	10.0	49.7
	1	36.7	40.9	34.2	40.6	40.3	39.4	39.0	37.3	36.2	34.7	34.5	34.3	36.7	10.0	46.7
	2	39.8	44.9	36.6	44.5	44.0	43.0	42.4	40.5	39.0	37.4	37.0	36.7	39.8	10.0	49.8
	3	41.3	45.2	38.2	44.9	44.5	43.7	43.3	42.0	40.9	39.0	38.7	38.3	41.3	10.0	51.3
	4	44.1	48.0	40.9	47.7	47.4	46.7	46.3	44.9	43.6	41.7	41.4	41.1	44.1	10.0	54.1
	5	46.0	50.2	42.0	49.9	49.7	49.1	48.7	47.0	45.5	43.0	42.6	42.1	46.0	10.0	56.0
	6	45.8	49.6	42.9	49.3	48.9	48.2	47.8	46.5	45.4	43.8	43.4	43.0	45.8	10.0	55.8
Day	7	46.7	51.1	43.8	50.7	50.3	49.4	48.9	47.2	46.1	44.6	44.3	43.9	46.7	0.0	46.7
	8	46.5	51.5	42.8	51.0	50.6	49.8	49.2	47.3	45.6	43.6	43.3	42.9	46.5	0.0	46.5
	9	46.2	52.5	41.0	52.0	51.6	50.5	49.7	47.3	44.9	42.0	41.6	41.1	46.2	0.0	46.2
	10	44.0	49.8	39.3	49.2	48.6	47.6	47.1	45.3	42.6	40.2	39.9	39.4	44.0	0.0	44.0
	11	43.1	50.6	37.0	49.8	49.0	47.7	46.9	44.0	41.5	38.0	37.6	37.1	43.1	0.0	43.1
	12	43.0	50.9	34.2	50.3	49.7	48.1	47.3	44.0	40.7	35.0	34.6	34.3	43.0	0.0	43.0
	13	42.6	50.0	34.9	49.5	48.9	47.8	47.0	44.0	39.8	35.8	35.5	35.1	42.6	0.0	42.6
	14	47.0	53.8	34.8	53.4	53.0	52.3	51.6	49.6	43.8	36.7	36.1	35.1	47.0	0.0	47.0
	15	39.9	46.6	33.6	46.1	45.7	44.7	44.1	41.1	38.2	34.2	34.0	33.7	39.9	0.0	39.9
	16	43.1	51.4	36.1	50.7	50.1	48.7	47.7	43.8	40.2	36.9	36.6	36.3	43.1	0.0	43.1
	17	44.8	52.6	37.1	52.0	51.7	50.5	49.6	45.2	41.6	38.4	37.8	37.3	44.8	0.0	44.8
	18	45.3	53.2	36.0	52.8	52.6	51.9	51.2	46.1	40.5	36.7	36.4	36.1	45.3	0.0	45.3
	19	46.0	54.5	36.2	54.1	53.6	52.7	51.5	45.7	41.3	37.0	36.7	36.3	46.0	5.0	51.0
	20	43.2	49.6	34.5	49.2	48.7	48.1	47.6	45.2	40.7	35.7	35.0	34.6	43.2	5.0	48.2
	21	38.8	43.7	35.4	43.3	43.0	42.4	42.0	40.1	37.5	36.0	35.7	35.5	38.8	5.0	43.8
Night	22	39.1	45.4	34.9	44.8	44.4	43.3	42.3	40.2	37.5	35.5	35.3	35.0	39.1	10.0	49.1
	23	35.4	40.3	33.0	39.9	39.5	38.4	37.7	35.9	34.5	33.4	33.3	33.1	35.4	10.0	45.4

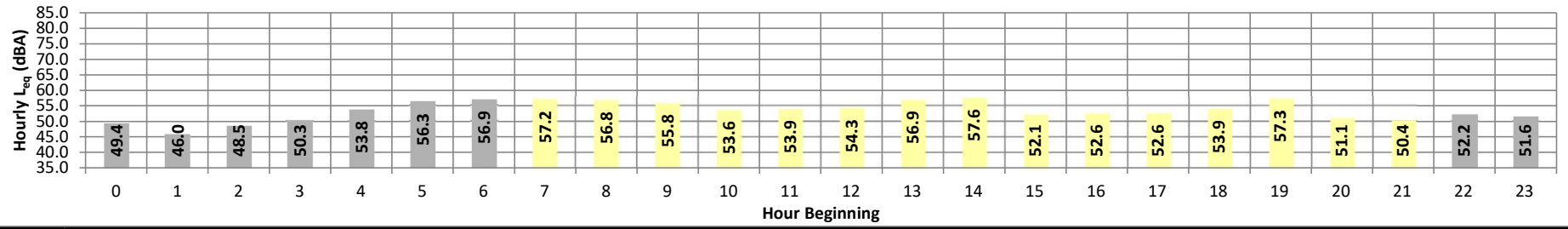
Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	38.8	43.7	33.6	43.3	43.0	42.4	42.0	40.1	37.5	34.2	34.0	33.7
	Max	47.0	54.5	43.8	54.1	53.6	52.7	51.6	49.6	46.1	44.6	44.3	43.9
Energy Average		44.6	Average:		50.3	49.8	48.8	48.1	45.1	41.7	38.1	37.7	37.2
Night	Min	35.4	40.3	33.0	39.9	39.5	38.4	37.7	35.9	34.5	33.4	33.3	33.1
	Max	46.0	50.2	42.9	49.9	49.7	49.1	48.7	47.0	45.5	43.8	43.4	43.0
Energy Average		42.3	Average:		45.2	44.8	43.9	43.4	41.6	40.1	38.3	38.1	37.7

L_{eq} (dBA)		
24-Hour	*Daytime (7am-10pm)*	*Nighttime (10pm-7am)*
43.8	**44.6**	**42.3**
CNEL		**49.4**

24-Hour Noise Level Measurement Summary

Date: Wednesday, March 23, 2022 *Location:* L4 - Located southeast of the Project site near single-family *Meter:* Piccolo II *JN:* 14577
Project: Chicago 139 *Source:* residence at 17975 Iris Avenue. *Analyst:* A. Khan

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	*Hour*	*L_{eq}*	*L_{max}*	*L_{min}*	*L1%*	*L2%*	*L5%*	*L8%*	*L25%*	*L50%*	*L90%*	*L95%*	*L99%*	*L_{eq}*	*Adj.*	*Adj. L_{eq}*
Night	0	49.4	57.2	42.4	56.9	56.5	55.0	53.7	49.9	47.4	43.6	43.0	42.5	49.4	10.0	59.4
	1	46.0	53.1	38.8	52.8	52.5	51.2	50.2	46.7	44.1	40.2	39.6	38.9	46.0	10.0	56.0
	2	48.5	55.9	41.1	55.6	55.3	54.2	53.0	49.3	45.9	42.3	41.8	41.2	48.5	10.0	58.5
	3	50.3	56.2	43.8	55.9	55.5	54.5	53.9	51.3	49.0	45.2	44.6	43.9	50.3	10.0	60.3
	4	53.8	60.6	46.9	60.3	60.0	59.0	58.0	54.4	52.0	48.5	47.8	47.1	53.8	10.0	63.8
	5	56.3	63.6	49.6	63.3	63.1	61.9	60.3	56.5	54.6	51.1	50.5	49.8	56.3	10.0	66.3
	6	56.9	63.7	50.1	63.4	63.1	62.1	61.3	58.2	54.5	51.4	50.8	50.2	56.9	10.0	66.9
Day	7	57.2	65.0	52.1	64.5	63.8	62.1	60.9	57.5	55.4	53.1	52.7	52.3	57.2	0.0	57.2
	8	56.8	65.7	51.1	65.3	64.6	62.4	60.5	56.6	54.7	52.2	51.8	51.3	56.8	0.0	56.8
	9	55.8	65.1	49.5	64.6	63.4	61.1	59.6	55.7	53.6	50.8	50.3	49.7	55.8	0.0	55.8
	10	53.6	60.0	48.4	59.7	59.3	58.1	57.3	54.2	52.3	49.5	49.0	48.6	53.6	0.0	53.6
	11	53.9	62.3	46.8	61.9	61.4	59.9	58.7	53.8	50.9	48.0	47.5	47.0	53.9	0.0	53.9
	12	54.3	64.4	46.0	64.1	63.5	60.8	58.9	53.0	50.3	47.1	46.6	46.2	54.3	0.0	54.3
	13	56.9	68.9	46.9	68.1	67.5	64.4	61.3	53.9	51.1	48.2	47.6	47.1	56.9	0.0	56.9
	14	57.6	67.3	44.6	67.0	66.3	64.5	63.0	57.5	51.1	46.2	45.5	44.8	57.6	0.0	57.6
	15	52.1	59.7	45.4	59.3	58.9	57.8	56.7	52.5	49.6	46.5	46.0	45.6	52.1	0.0	52.1
	16	52.6	60.9	44.3	60.6	60.1	58.5	57.1	53.2	49.4	45.5	44.9	44.5	52.6	0.0	52.6
	17	52.6	61.6	44.9	61.1	60.5	58.8	57.4	52.5	49.5	46.1	45.5	45.0	52.6	0.0	52.6
	18	53.9	65.5	43.4	64.9	63.9	61.3	59.1	52.3	48.1	44.4	43.9	43.5	53.9	0.0	53.9
	19	57.3	68.3	43.4	68.0	67.6	65.4	62.9	55.1	49.7	45.0	44.1	43.5	57.3	5.0	62.3
	20	51.1	59.0	42.4	58.7	58.3	57.2	56.1	51.9	47.8	43.7	43.1	42.5	51.1	5.0	56.1
	21	50.4	59.0	42.5	58.7	58.3	56.9	55.2	50.2	47.3	43.6	43.0	42.6	50.4	5.0	55.4
Night	22	52.2	61.7	43.3	61.4	60.8	59.1	56.7	51.8	48.2	44.5	43.9	43.5	52.2	10.0	62.2
	23	51.6	63.5	41.4	62.7	62.0	57.4	55.4	49.9	46.9	42.9	42.2	41.6	51.6	10.0	61.6

Timeframe	*Hour*	*L_{eq}*	*L_{max}*	*L_{min}*	*L1%*	*L2%*	*L5%*	*L8%*	*L25%*	*L50%*	*L90%*	*L95%*	*L99%*
Day	Min	50.4	59.0	42.4	58.7	58.3	56.9	55.2	50.2	47.3	43.6	43.0	42.5
	Max	57.6	68.9	52.1	68.1	67.6	65.4	63.0	57.5	55.4	53.1	52.7	52.3
Energy Average		55.0	Average:		63.1	62.5	60.6	59.0	54.0	50.7	47.3	46.8	46.3
Night	Min	46.0	53.1	38.8	52.8	52.5	51.2	50.2	46.7	44.1	40.2	39.6	38.9
	Max	56.9	63.7	50.1	63.4	63.1	62.1	61.3	58.2	54.6	51.4	50.8	50.2
Energy Average		53.0	Average:		59.1	58.7	57.2	55.8	52.0	49.2	45.5	44.9	44.3

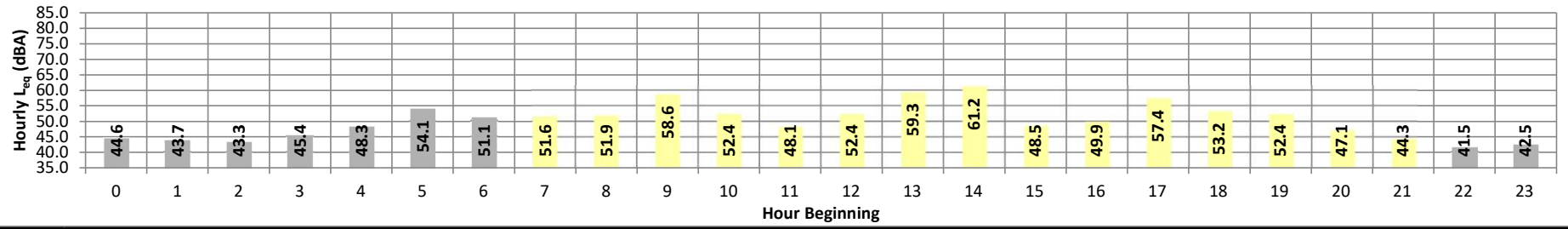
L_{eq} (dBA)		
24-Hour	*Daytime (7am-10pm)*	*Nighttime (10pm-7am)*
54.3	**55.0**	**53.0**
CNEL		**60.0**

24-Hour Noise Level Measurement Summary

Date: Wednesday, March 23, 2022 | *Location:* L5 - Located south of the Project site near single-family | *Meter:* Piccolo II | *JN:* 14577

Project: Chicago 139 | *Source:* residence at 16016 Gamble Avenue. | *Analyst:* A. Khan

Hourly L_{eq} dBA Readings (unadjusted)



Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%	L_{eq}	Adj.	Adj. L_{eq}
Night	0	44.6	54.5	38.4	53.8	52.9	50.2	48.1	44.2	42.1	39.4	39.0	38.6	44.6	10.0	54.6
	1	43.7	53.8	36.6	53.4	52.8	50.2	47.9	42.7	39.9	37.4	37.1	36.7	43.7	10.0	53.7
	2	43.3	49.6	38.3	49.2	48.8	47.8	46.8	44.0	41.8	39.2	38.8	38.4	43.3	10.0	53.3
	3	45.4	51.0	40.3	50.6	50.1	49.0	48.4	46.5	44.4	41.3	40.8	40.4	45.4	10.0	55.4
	4	48.3	54.1	43.4	53.8	53.3	52.1	51.4	49.3	47.4	44.6	44.1	43.5	48.3	10.0	58.3
	5	54.1	63.6	47.7	63.2	62.6	60.4	57.8	53.3	51.3	48.8	48.3	47.8	54.1	10.0	64.1
	6	51.1	57.4	46.5	57.0	56.7	55.3	54.3	51.4	49.9	47.6	47.1	46.7	51.1	10.0	61.1
Day	7	51.6	56.7	48.0	56.3	55.8	54.9	54.1	52.2	50.8	49.0	48.6	48.1	51.6	0.0	51.6
	8	51.9	60.4	47.1	60.1	59.3	56.9	55.2	51.7	50.1	48.0	47.7	47.3	51.9	0.0	51.9
	9	58.6	67.7	47.6	66.9	66.1	64.5	63.4	59.3	54.9	51.2	50.4	48.3	58.6	0.0	58.6
	10	52.4	61.6	44.0	60.8	60.2	58.7	57.5	52.5	48.8	45.4	44.8	44.2	52.4	0.0	52.4
	11	48.1	57.2	41.0	56.9	56.4	54.2	52.2	47.8	45.3	42.2	41.8	41.2	48.1	0.0	48.1
	12	52.4	64.2	37.4	63.8	62.9	61.0	58.6	48.4	43.2	39.5	38.1	37.5	52.4	0.0	52.4
	13	59.3	71.8	38.1	71.2	70.4	68.1	65.5	52.6	44.8	39.0	38.6	38.2	59.3	0.0	59.3
	14	61.2	73.7	37.3	73.4	72.4	69.3	66.4	55.3	47.2	39.4	38.2	37.4	61.2	0.0	61.2
	15	48.5	60.6	37.0	60.3	59.6	56.6	53.3	44.6	41.0	37.8	37.5	37.1	48.5	0.0	48.5
	16	49.9	60.7	38.9	60.3	59.6	57.4	55.4	48.4	43.6	39.7	39.4	39.0	49.9	0.0	49.9
	17	57.4	70.0	41.1	69.3	68.2	65.5	62.7	53.1	48.2	43.6	42.4	41.3	57.4	0.0	57.4
	18	53.2	65.1	38.9	64.2	63.3	61.8	57.8	51.1	44.2	40.1	39.6	39.0	53.2	0.0	53.2
	19	52.4	60.7	39.9	60.0	59.5	58.6	57.6	52.7	49.1	43.7	42.1	40.5	52.4	5.0	57.4
	20	47.1	57.2	36.6	56.8	56.2	53.7	51.8	47.1	42.5	37.6	37.1	36.7	47.1	5.0	52.1
	21	44.3	56.6	36.9	56.1	54.6	50.9	47.7	41.7	39.2	37.6	37.3	37.1	44.3	5.0	49.3
Night	22	41.5	49.3	36.5	48.9	48.3	46.7	45.4	41.8	39.4	37.2	37.0	36.7	41.5	10.0	51.5
	23	42.5	53.7	35.2	53.1	52.1	48.9	46.5	41.1	38.6	35.9	35.6	35.3	42.5	10.0	52.5

Timeframe	Hour	L_{eq}	L_{max}	L_{min}	L1%	L2%	L5%	L8%	L25%	L50%	L90%	L95%	L99%
Day	Min	44.3	56.6	36.6	56.1	54.6	50.9	47.7	41.7	39.2	37.6	37.1	36.7
	Max	61.2	73.7	48.0	73.4	72.4	69.3	66.4	59.3	54.9	51.2	50.4	48.3
Energy Average		55.0	Average:		62.4	61.6	59.5	57.3	50.6	46.2	42.3	41.6	40.9
Night	Min	41.5	49.3	35.2	48.9	48.3	46.7	45.4	41.1	38.6	35.9	35.6	35.3
	Max	54.1	63.6	47.7	63.2	62.6	60.4	57.8	53.3	51.3	48.8	48.3	47.8
Energy Average		48.2	Average:		53.7	53.1	51.2	49.6	46.0	43.9	41.3	40.9	40.5

L_{eq} (dBA)		
24-Hour	Daytime (7am-10pm)	Nighttime (10pm-7am)
53.5	55.0	48.2
CNEL		56.7

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APPENDIX 7.1:

ON-SITE TRAFFIC NOISE CALCULATIONS

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FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: □□□□□□rd N□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□i□□□□ A□□ *Job Number:* □□□□□
Lot No: □□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□
Centerline Dist. to Barrier:	□□□ □□□
Centerline Dist. to Observer:	□□□ □□□
Barrier Distance to Observer:	□□□ □□□
Observer Height (Above Pad):	□□ □□□
Pad Elevation:	□□□□□ □□□
Road Elevation:	□□□□□ □□□
Barrier Elevation:	□□□□□ □□□
Road Grade:	□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□	□□□□	□□□
Heavy Trucks:	□□□□	□□□	□□□□	□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□	
Medium Trucks:	□□□□□□□	
Heavy Trucks:	□□□□□□□	*Grade Adjustment:* □□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*0.00*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-0.09*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-1.23*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: □□□□□□rd N□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Lot No: □□□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□□	
Medium Trucks:	□□□□□□□□	
Heavy Trucks:	□□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-0.18*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-0.52*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-2.04*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: □□□□□□rd N□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Lot No: □□□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□□	
Medium Trucks:	□□□□□□□□	
Heavy Trucks:	□□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-0.12*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-0.46*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-2.09*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: □□□□□□rd N□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Lot No: □□□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□□	
Medium Trucks:	□□□□□□□□	
Heavy Trucks:	□□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-0.05*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-0.19*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-0.97*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: □□□□□□rd □ i□□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□i□□□□ A□□ *Job Number:* □□□□□
Lot No: □□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□□	
Medium Trucks:	□□□□□□□□	
Heavy Trucks:	□□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*0.00*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-0.09*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-1.23*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: Backya rd w ith Wall
Road Name: Iri A.
Lot No: 227

Project Name: Arr Vista
Job Number: 14577
Analyst: B. M dd

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	8,000 veh icles
Peak Hour Percentage:	10%
Peak Hour Volume:	800 veh icles
Vehicle Speed:	30 mph
Near/Far Lane Distance:	12 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.
Centerline Dist. to Barrier:	22. feet
Centerline Dist. to Observer:	40. feet
Barrier Distance to Observer:	18. feet
Observer Height (Above Pad):	5. feet
Pad Elevation:	1,566. feet
Road Elevation:	1,565. feet
Barrier Elevation:	1,566. feet
Road Grade:	0. %

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	Day	Evening	Night	Daily
Autos:	75.5%	14.0%	10.5%	97.42%
Medium Trucks:	48.9%	2.2%	48.9%	1.84%
Heavy Trucks:	47.3%	5.4%	47.3%	0.74%

Noise Source Elevations (in feet)

Autos:	1,565.0		
Medium Trucks:	1 67		
Heavy Trucks:	1,573.0	*Grade Adjustment:*	0.0

Lane Equivalent Distance (in feet)

Autos:	34.00
Medium Trucks:	33.67
Heavy Trucks:	33.52

FHWA Noise Model Calculations

VehicleType	REMEL	Traffic Flow	Distance	Finite Road	Fresnel	Barrier Atten	Berm Atten
Autos:	62.5	-1.1	.4	-1.2	*-0.18*	0.00	.00
Medium Trucks:	73.1	8	2		*-0.52*	0 0	0 0
Heavy Trucks:	78.7	-22.3	2.5	-1.2	*-2.04*	0.00	0.00

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	Leq Peak Hour	Leq Day	Leq Evening	Leq Night	Ldn	CNEL
Autos:	62.	60.	59.	53.	61.	62.
Medium Trucks:	56.	52.	44.	53.	59.	59.
Heavy Trucks:	57	53	50	54	61	61
Vehicle Noise:	64.	61.	59.	58.	65.	65.

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	Leq Peak Hour	Leq Day	Leq Evening	Leq Night	Ldn	CNEL
Autos:	62.	60.	59.	53.	61.	62.
Medium Trucks:	56.	52.	44.	53.	59.	59.
Heavy Trucks:	57.	53.	50.	54.	61.	61.
Vehicle Noise:	64.	61.	59.	58.	65.	65.

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FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: Backya rd w ith Wall
Road Name: Iri A.
Lot No: 200

Project Name: Arr Vista
Job Number: 14577
Analyst: B. M dd

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	8,000 veh icles
Peak Hour Percentage:	10%
Peak Hour Volume:	800 veh icles
Vehicle Speed:	30 mph
Near/Far Lane Distance:	12 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.
Centerline Dist. to Barrier:	20. feet
Centerline Dist. to Observer:	40. feet
Barrier Distance to Observer:	20. feet
Observer Height (Above Pad):	5. feet
Pad Elevation:	1,521. feet
Road Elevation:	1,522. feet
Barrier Elevation:	1,522. feet
Road Grade:	0. %

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	Day	Evening	Night	Daily
Autos:	75.5%	14.0%	10.5%	97.42%
Medium Trucks:	48.9%	2.2%	48.9%	1.84%
Heavy Trucks:	47.3%	5.4%	47.3%	0.74%

Noise Source Elevations (in feet)

Autos:	1,522.5		
Medium Trucks:	1 24		
Heavy Trucks:	1,530.5	*Grade Adjustment:*	0.0

Lane Equivalent Distance (in feet)

Autos:	33.64
Medium Trucks:	33.48
Heavy Trucks:	33.76

FHWA Noise Model Calculations

VehicleType	REMEL	Traffic Flow	Distance	Finite Road	Fresnel	Barrier Atten	Berm Atten
Autos:	62.5	-1.1	.4	-1.2	*-0.12*	0.00	.00
Medium Trucks:	73.1	8	2		*-0.46*	0 0	0 0
Heavy Trucks:	78.7	-22.3	2.4	-1.2	*-2.09*	0.00	0.00

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	Leq Peak Hour	Leq Day	Leq Evening	Leq Night	Ldn	CNEL
Autos:	62.	60.	59.	53.	61.	62.
Medium Trucks:	56.	52.	44.	53.	59.	59.
Heavy Trucks:	57	53	50	54	61	61
Vehicle Noise:	64.	61.	59.	58.	65.	65.

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	Leq Peak Hour	Leq Day	Leq Evening	Leq Night	Ldn	CNEL
Autos:	62.	60.	59.	53.	61.	62.
Medium Trucks:	56.	52.	44.	53.	59.	59.
Heavy Trucks:	57.	53.	50.	54.	61.	61.
Vehicle Noise:	64.	61.	59.	58.	65.	65.

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FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: Backya rd w ith Wall
Road Name: Iri A.
Lot No: 165

Project Name: Arr Vista
Job Number: 14577
Analyst: B. M dd

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	8,000 veh icles
Peak Hour Percentage:	10%
Peak Hour Volume:	800 veh icles
Vehicle Speed:	30 mph
Near/Far Lane Distance:	12 feet

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	0.
Centerline Dist. to Barrier:	30. feet
Centerline Dist. to Observer:	50. feet
Barrier Distance to Observer:	20. feet
Observer Height (Above Pad):	5. feet
Pad Elevation:	1,511. feet
Road Elevation:	1,507. feet
Barrier Elevation:	1,511. feet
Road Grade:	0. %

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	15
Medium Trucks (2 Axles):	15
Heavy Trucks (3+ Axles):	15

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	75.5%	14.0%	10.5%	97.42%
Medium Trucks:	48.9%	2.2%	48.9%	1.84%
Heavy Trucks:	47.3%	5.4%	47.3%	0.74%

Noise Source Elevations (in feet)

Autos:	1,507.3		
Medium Trucks:	1 09		
Heavy Trucks:	1,515.3	*Grade Adjustment:*	0.0

Lane Equivalent Distance (in feet)

Autos:	44.44
Medium Trucks:	44.05
Heavy Trucks:	43.59

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	62.5	-1.1	.6	-1.2	*-0.05*	0.00	.00
Medium Trucks:	73.1	8	0		*-0.19*	0 0	0 0
Heavy Trucks:	78.7	-22.3	0.7	-1.2	*-0.97*	0.00	0.00

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	60.	58.	57.	51.	59.	60.
Medium Trucks:	54.	50.	42.	51.	57.	57.
Heavy Trucks:	56	52	48	53	59	59
Vehicle Noise:	62.	60.	58.	56.	63.	64.

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	60.	58.	57.	51.	59.	60.
Medium Trucks:	54.	50.	42.	51.	57.	57.
Heavy Trucks:	56.	52.	48.	53.	59.	59.
Vehicle Noise:	62.	60.	58.	56.	63.	64.

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FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: Fir□□F□□□r □ i□□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □i□□□□ A□□ *Job Number:* □□□□□
Lot No: □□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□	
Medium Trucks:	□□□□□□□	
Heavy Trucks:	□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*0.05*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-0.02*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-1.02*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: Fir□□F□□□r □ i□□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Lot No: □□□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□□	
Medium Trucks:	□□□□□□□□	
Heavy Trucks:	□□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-0.07*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-0.33*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-1.82*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: Fir□□F□□□r □ i□□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Lot No: □□□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□	
Medium Trucks:	□□□□□□□	
Heavy Trucks:	□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-0.06*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-0.37*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-2.06*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: Fir□□F□□□r □ i□□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Lot No: □□□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□□	
Medium Trucks:	□□□□□□□□	
Heavy Trucks:	□□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□	*0.00*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□□	□□□□□	*-0.07*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□□	□□□□□	*-0.78*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: □□□□nd F□□□r □ i□□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□i□□□□ A□□ *Job Number:* □□□□□
Lot No: □□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□□	
Medium Trucks:	□□□□□□□□	
Heavy Trucks:	□□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-0.14*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-0.51*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-2.57*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: □□□□nd F□□□r □ i□□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Lot No: □□□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□□	
Medium Trucks:	□□□□□□□□	
Heavy Trucks:	□□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-0.83*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-1.53*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-4.13*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: □□□□nd F□□□r □ i□□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Lot No: □□□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□□	
Medium Trucks:	□□□□□□□□	
Heavy Trucks:	□□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-0.74*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-1.49*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□□	□□□□	□□□□□	*-4.30*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□F□□r□□r□ □□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL (CALVENO) - v10/31/19

Scenario: □□□□nd F□□□r □ i□□ □ □□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Lot No: □□□ *Analyst:* □□M□dd□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□□ □□□□
Observer Height (Above Pad):	□□□□ □□□□
Pad Elevation:	□□□□□□□ □□□□
Road Elevation:	□□□□□□□ □□□□
Barrier Elevation:	□□□□□□□ □□□□
Road Grade:	□□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□□□□	
Medium Trucks:	□□□□□□□□	
Heavy Trucks:	□□□□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□	*-0.55*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□□	□□□□□	*-0.97*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□□	□□□□□	*-2.57*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Mitigated Noise Levels (with Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

□ □dn□□d□□□F□□r□□r□ □□□□□□□

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APPENDIX 8.1:

OFF-SITE TRAFFIC NOISE LEVEL CALCULATIONS

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FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□

Road Segment: n□□ □i□□□ri□A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□

Road Segment: □□□ □i□□□ri□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□
Road Name: M□□□in□□ird □□n□□n Rd□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.65*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.87*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.43*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□□in□□□n □□□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.61*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.50*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□□in□□□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.61*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.50*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□

Road Name: □□i□□□□ A□□□A□□□ □r□□□□ A□□ *Job Number:* □□□□□□

Road Segment: n□□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□□
Peak Hour Volume:	□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□□	□□
CNEL:	□	□	□□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□
Road Name: □□i□□□□ A□□A□□□ □r□□□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□□	□□	□□
CNEL:	□	□□	□□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□

Road Name: □ □□ □□□ A□□ *Job Number:* □□□□□

Road Segment: □□□ lri□A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□
CNEL:	□	□	□	□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□d Rd□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□d Rd□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□
Road Name: Tr□□□□ □in Rd□□□ □□□ A□□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□
Road Name: Tr□□□□ □in Rd□□□ □□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□

Road Name: □i□□□ri□ A□□ *Job Number:* □□□□□

Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.56*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.61*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□

Road Name: □i□□□ri□ A□□ *Job Number:* □□□□□

Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.56*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.61*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□

Road Segment: □□□ □ □□□in□□□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □ □□□in□□□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□

Road Segment: □□□ □□i□□□□ A□□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□

Road Segment: □□□ □ □i□□□□ A□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □ □□d Rd□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□in□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□

Road Segment: □□□ Tr□□□□ □in Rd□□□ □□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Road Segment: □□□ □ □□ □□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□	
Medium Trucks:	□□□□□	
Heavy Trucks:	□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□
CNEL:	□	□	□	□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□

Road Name: Iri□A□□ *Job Number:* □□□□□

Road Segment: □□□ □□i□□□□ A□□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□□
CNEL:	□	□	□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□i□□in□ *Project Name:* Arr□□□ □i□□□

Road Name: Iri□A□□ *Job Number:* □□□□□

Road Segment: □□□ □ □i□□□□ A□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□
CNEL:	□	□	□	□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□

Road Segment: n□□ □i□□□ri□A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□

Road Segment: □□□ □i□□□ri□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□	
Medium Trucks:	□□□□□	
Heavy Trucks:	□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□□	□□□□□	*-4.73*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□□	□□□□□	*-4.88*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□□	□□□□□	*-5.25*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□
Road Name: M□□□in□□ird □□n□□n Rd□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.65*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.87*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.43*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□□in□□□n □□□ *Job Number:* □□□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.61*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.50*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□□in□□□n □□□ *Job Number:* □□□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.61*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.50*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □□i□□□□ A□□A□□□ □r□□□□ A□□ *Job Number:* □□□□□

Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□□	□□	□□
CNEL:	□	□□	□□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□i□□□□ A□□A□□□ □r□□□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□□	□□	□□
CNEL:	□	□□	□□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□ □□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ lri□A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□	
Medium Trucks:	□□□□□	
Heavy Trucks:	□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□□
CNEL:	□	□	□□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□d Rd□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □ □□d Rd□ *Job Number:* □□□□□

Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□
Road Name: Tr□□□□ □in Rd□□□ □□□ A□□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□
Road Name: Tr□□□□ □in Rd□□□ □□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □i□□□ri□ A□□ *Job Number:* □□□□□

Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.56*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.61*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □i□□□ri□ A□□ *Job Number:* □□□□□

Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.56*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.61*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□

Road Segment: □□□ □ □□□in□□□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□

Road Segment: □□□ □ □□□in□□□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□

Road Segment: □□□ □□i□□□□ A□□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□

Road Segment: □□□ □ □i□□□□ A□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□

Road Segment: □□□ □ □□d Rd□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□

Road Segment: □□□ Tr□□□□ □in Rd□□□ □□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Road Segment: □□□ □ □□ □□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□
CNEL:	□	□	□	□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: Iri□A□□ *Job Number:* □□□□□

Road Segment: □□□ □□i□□□□ A□□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□□
CNEL:	□	□	□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: E□□ *Project Name:* Arr□□□ □i□□□

Road Name: Iri□A□□ *Job Number:* □□□□□

Road Segment: □□□ □ □i□□□□ A□□A□□ □r□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□
Peak Hour Percentage:	□□□□
Peak Hour Volume:	□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□ □□□
Centerline Dist. to Observer:	□□□ □□□
Barrier Distance to Observer:	□□□ □□□
Observer Height (Above Pad):	□□□ □□□
Pad Elevation:	□□□ □□□
Road Elevation:	□□□ □□□
Road Grade:	□□□
Left View:	□□□ d□□r□□□
Right View:	□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□	□□□	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□

Noise Source Elevations (in feet)

Autos:	□□□		
Medium Trucks:	□□□		
Heavy Trucks:	□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□
Medium Trucks:	□□□
Heavy Trucks:	□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□	□□□	□□□	□□□	*-4.49*	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□	*-4.86*	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□	*-5.77*	□□□	□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□	□□□	□□□	□□□	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□	□□□	□□□
Vehicle Noise:	□□□	□□□	□□□	□□□	□□□	□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□
CNEL:	□	□	□	□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: n□□ □i□□□ri□A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □i□□□ri□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: M□□□in□□ird □□n□□n Rd□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.65*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.87*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.43*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□□in□□□n □□□ *Job Number:* □□□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.61*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.87*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.50*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□□in□□□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□
Centerline Dist. to Observer:	□□□□ □□□
Barrier Distance to Observer:	□□□ □□□
Observer Height (Above Pad):	□□□ □□□
Pad Elevation:	□□□ □□□
Road Elevation:	□□□ □□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.61*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.50*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□i□□□□ A□□A□□ □r□□□□ A□□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□□	□□
CNEL:	□	□	□□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□i□□□□ A□□A□□ □r□□□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□□	□□	□□
CNEL:	□	□□	□□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□ □□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ lri□A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□	
Medium Trucks:	□□□□□	
Heavy Trucks:	□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□
CNEL:	□	□	□	□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□d Rd□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□d Rd□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: Tr□□□□ □in Rd□□□ □□□ A□□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: Tr□□□□ □in Rd□□□ □□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □i□□□ri□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.56*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.61*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □i□□□ri□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.56*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.61*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □ □□□in□□□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □ □□□in□□□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □□i□□□□ A□□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □ □i□□□□ A□□A□□ □r□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □ □□d Rd□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: □□□ Tr□□□□ □in Rd□□□ □□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Road Segment: □□□ □ □□ □□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□	
Medium Trucks:	□□□□□	
Heavy Trucks:	□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□
CNEL:	□	□	□	□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Road Segment: □□□ □□i□□□□ A□□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□	
Medium Trucks:	□□□□□	
Heavy Trucks:	□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□□
CNEL:	□	□	□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Road Segment: □□□ □ □i□□□□ A□□A□□ □r□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□
Peak Hour Percentage:	□□□□
Peak Hour Volume:	□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□ □□□
Centerline Dist. to Observer:	□□□ □□□
Barrier Distance to Observer:	□□□ □□□
Observer Height (Above Pad):	□□□ □□□
Pad Elevation:	□□□ □□□
Road Elevation:	□□□ □□□
Road Grade:	□□□
Left View:	□□□ d□□r□□□
Right View:	□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□	□□□	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□

Noise Source Elevations (in feet)

Autos:	□□□	
Medium Trucks:	□□□	
Heavy Trucks:	□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□
Medium Trucks:	□□□
Heavy Trucks:	□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□	□□□	□□□	□□□	*-4.49*	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□	*-4.86*	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□	*-5.77*	□□□	□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□	□□□	□□□	□□□	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□	□□□	□□□
Vehicle Noise:	□□□	□□□	□□□	□□□	□□□	□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□
CNEL:	□	□	□	□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□
Road Segment: n□□□ □i□□□ri□A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□□
Peak Hour Volume:	□□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□
Road Segment: □□□ □i□□□ri□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: M□□□in□□ird □□n□□n Rd□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.65*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.87*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.43*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□□in□□□n □□□ *Job Number:* □□□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.61*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.87*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.50*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□□in□□□n □□□ *Job Number:* □□□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.61*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.50*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□i□□□□ A□□A□□ □r□□□□ A□□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□□	□□	□□
CNEL:	□	□□	□□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□i□□□□ A□□A□□□ □r□□□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□□	□□	□□
CNEL:	□	□□	□□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□ □□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ lri□A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□
Peak Hour Percentage:	□□□□
Peak Hour Volume:	□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□ □□□
Centerline Dist. to Observer:	□□□ □□□
Barrier Distance to Observer:	□□□ □□□
Observer Height (Above Pad):	□□□ □□□
Pad Elevation:	□□□ □□□
Road Elevation:	□□□ □□□
Road Grade:	□□□
Left View:	□□□ d□□r□□□
Right View:	□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	Day	Evening	Night	Daily
Autos:	□□□	□□□	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□

Noise Source Elevations (in feet)

Autos:	□□□	
Medium Trucks:	□□□	
Heavy Trucks:	□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□
Medium Trucks:	□□□
Heavy Trucks:	□□□

FHWA Noise Model Calculations

VehicleType	REMEL	Traffic Flow	Distance	Finite Road	Fresnel	Barrier Atten	Berm Atten
Autos:	□□□	□□□	□□□	□□□	-4.49	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□	-4.86	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□	-5.77	□□□	□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	Leq Peak Hour	Leq Day	Leq Evening	Leq Night	Ldn	CNEL
Autos:	□□□	□□□	□□□	□□□	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□	□□□	□□□
Vehicle Noise:	□□□	□□□	□□□	□□□	□□□	□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	65 dBA	60 dBA	55 dBA
Ldn:	□	□	□□	□□
CNEL:	□	□	□□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□d Rd□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □ □□d Rd□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: Tr□□□□ □in Rd□□□ □□□ A□□ *Job Number:* □□□□□
Road Segment: n□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: Tr□□□□ □in Rd□□□ □□□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.65*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.43*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□	□□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □i□□□ri□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.56*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.61*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □i□□□ri□ A□□ *Job Number:* □□□□□
Road Segment: □□□ □□n □□r□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.56*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.87*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.61*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□	□□□	□□□
CNEL:	□□	□□	□□□	□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□
Road Segment: □□□ □ □□□in□□□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□
Road Segment: □□□ □ □□□in□□□n □□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□
Road Segment: □□□ □□i□□□□ A□□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□□
Peak Hour Volume:	□□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□	
Medium Trucks:	□□□□	
Heavy Trucks:	□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□
Road Segment: □□□ □ □i□□□□ A□□A□□ □r□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□
Road Segment: □□□ □ □□d Rd□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□□	□□□	□□□	□□□□□
CNEL:	□□□	□□□	□□□	□□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: □□n □□r□n □□□ *Job Number:* □□□□□□
Road Segment: □□□ Tr□□□□ □in Rd□□□ □□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□□□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□	□□□□	□□□□	*-4.73*	□□□□	□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-4.88*	□□□□	□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□	*-5.25*	□□□□	□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□□	□□□	□□□	□□□
CNEL:	□□□	□□□	□□□	□□□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□

Road Name: Iri□A□□ *Job Number:* □□□□□

Road Segment: □□□ □ □□ □□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□	□□□□□	□□□□□

Noise Source Elevations (in feet)

Autos:	□□□□□	
Medium Trucks:	□□□□□	
Heavy Trucks:	□□□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□□
Medium Trucks:	□□□□□□
Heavy Trucks:	□□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□
CNEL:	□	□	□	□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□
Road Name: Iri□A□□ *Job Number:* □□□□□
Road Segment: □□□ □□i□□□□ A□□□A□□□ □r□□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□ □□□i□□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□□ □□□□
Centerline Dist. to Observer:	□□□□ □□□□
Barrier Distance to Observer:	□□□ □□□□
Observer Height (Above Pad):	□□□ □□□□
Pad Elevation:	□□□ □□□□
Road Elevation:	□□□ □□□□
Road Grade:	□□□□
Left View:	□□□□ d□□r□□□
Right View:	□□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	*Day*	*Evening*	*Night*	*Daily*
Autos:	□□□□□	□□□□□	□□□□	□□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□

Noise Source Elevations (in feet)

Autos:	□□□□		
Medium Trucks:	□□□□		
Heavy Trucks:	□□□□	*Grade Adjustment:*	□□□

Lane Equivalent Distance (in feet)

Autos:	□□□□□
Medium Trucks:	□□□□□
Heavy Trucks:	□□□□□

FHWA Noise Model Calculations

VehicleType	*REMEL*	*Traffic Flow*	*Distance*	*Finite Road*	*Fresnel*	*Barrier Atten*	*Berm Atten*
Autos:	□□□□□	□□□□□	□□□□	□□□□□	*-4.49*	□□□□□	□□□□□
Medium Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-4.86*	□□□□□	□□□□□
Heavy Trucks:	□□□□□	□□□□□	□□□□	□□□□□	*-5.77*	□□□□□	□□□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	*Leq Peak Hour*	*Leq Day*	*Leq Evening*	*Leq Night*	*Ldn*	*CNEL*
Autos:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Medium Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Heavy Trucks:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□
Vehicle Noise:	□□□□	□□□□	□□□□	□□□□	□□□□	□□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	*65 dBA*	*60 dBA*	*55 dBA*
Ldn:	□	□	□	□□
CNEL:	□	□	□	□□

T□□□d□□□A□ri□□□□□□□□□

FHWA-RD-77-108 HIGHWAY NOISE PREDICTION MODEL

Scenario: EA□□ □□□□□□□ *Project Name:* Arr□□□ □i□□□

Road Name: Iri□A□□ *Job Number:* □□□□□

Road Segment: □□□ □ □i□□□□ A□□A□□ □r□□□ A□□

SITE SPECIFIC INPUT DATA

Highway Data

Average Daily Traffic (Adt):	□□□ □□□i□□□
Peak Hour Percentage:	□□□□□
Peak Hour Volume:	□□ □□□i□□□
Vehicle Speed:	□□ □ □□
Near/Far Lane Distance:	□□ □□□

Site Data

Barrier Height:	**0.0 feet**
Barrier Type (0-Wall, 1-Berm):	□□□
Centerline Dist. to Barrier:	□□□ □□□
Centerline Dist. to Observer:	□□□ □□□
Barrier Distance to Observer:	□□□ □□□
Observer Height (Above Pad):	□□□ □□□
Pad Elevation:	□□□ □□□
Road Elevation:	□□□ □□□
Road Grade:	□□□
Left View:	□□□ d□□r□□□
Right View:	□□□ d□□r□□□

NOISE MODEL INPUTS

Site Conditions (Hard = 10, Soft = 15)

Autos:	□□
Medium Trucks (2 Axles):	□□
Heavy Trucks (3+ Axles):	□□

Vehicle Mix

VehicleType	Day	Evening	Night	Daily
Autos:	□□□	□□□	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□

Noise Source Elevations (in feet)

Autos:	□□□	
Medium Trucks:	□□□	
Heavy Trucks:	□□□	*Grade Adjustment:* □□□

Lane Equivalent Distance (in feet)

Autos:	□□□
Medium Trucks:	□□□
Heavy Trucks:	□□□

FHWA Noise Model Calculations

VehicleType	REMEL	Traffic Flow	Distance	Finite Road	Fresnel	Barrier Atten	Berm Atten
Autos:	□□□	□□□	□□□	□□□	-4.49	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□	-4.86	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□	-5.77	□□□	□□□

Unmitigated Noise Levels (without Topo and barrier attenuation)

VehicleType	Leq Peak Hour	Leq Day	Leq Evening	Leq Night	Ldn	CNEL
Autos:	□□□	□□□	□□□	□□□	□□□	□□□
Medium Trucks:	□□□	□□□	□□□	□□□	□□□	□□□
Heavy Trucks:	□□□	□□□	□□□	□□□	□□□	□□□
Vehicle Noise:	□□□	□□□	□□□	□□□	□□□	□□□

Centerline Distance to Noise Contour (in feet)

	70 dBA	65 dBA	60 dBA	55 dBA
Ldn:	□	□	□	□
CNEL:	□	□	□	□

T□□□d□□□A□ri□□□□□□□□□