ADVANCED GeoServices
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August 19, 2013 2013-3007-01

Mr. Bill Veile
California Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826-3200

RE: Responses to August 14, 2013 Comments
Stormwater Management System Replacement Plan
Exide Technologies, Vernon, California

Dear Mr. Veile:

Advanced GeoServices, on behalf of Exide Technologies, submits one (1) copy of the revised Stormwater Management System Replacement Plan. The revisions were prepared in response to DTSC's August 14, 2013 email. For your convenience, your comment is presented in bold followed by our response.

Comment 1: Section 2.2: lead is not the only contaminant-of-concern, any soils contaminated with Site COCs (e.g., antimony, arsenic, cad, zinc, VOCs, dioxins/furans...etc.) that exceed DTSC-approved action or cleanup level should be removed.

Response: We acknowledge and agree that lead is not the only COC for the Site and for that reason Exide has already agreed to conduct soil sampling for additional parameters beyond lead. The Emergency Measures Interim Response Work Plan identifies the field and laboratory analysis to be completed and specifies that the results are being screened against the California Human Health Screening Levels (CHHSL), where available, and against the USEPA Regional Screening Levels (RSL) when no CHHSL exists. While soil sample results are being compared against CHHSLs and RSLs, pursuant to the discussions and agreement between DTSC and Exide, field determinations regarding the completeness of emergency removal will be based on lead only, except where subsoil is visibly stained from discharges attributable to the stormwater system.

Comment 2: Section 3.3: Exide states that the new pipeline installation depths "will be similar to or slightly deeper" than the existing piping. If the replacement piping (plus backfill) extends to, or below, the 10-ft max depth stated in the IM Workplan, then Exide may need to collect deeper samples (at or below 10 ft bgs) below the existing piping to characterize the soil and/or determine whether the soil can be used as backfill or how it should be managed/disposed. This goes for any new piping/sumps that does not replace

an existing run or existing sump/catch basin. Soil sampling will also need to be conducted following the SAP contained in Exide's Interim Measures Work Plan dated July 12, 2013 (and following our conditional approval letter dated July 26, 2013) within any areas of the Site where these new underground features will be installed.

Response: As shown on Figures 4-3 and 4-4, proposed piping is within 10 feet of ground surface; therefore, soils excavated for proposed pipe installation will be characterized during the Pre-Removal Sampling event discussed in the Emergency Response Interim Measures Work Plan. As shown in the ERIMWP SAP Plate 1, pre-removal sampling will be conducted along sections of proposed piping where existing piping is not present, with the exception of the West Yard where sufficient RFI data is available to understand the soils along the proposed pipe alignment. No revisions are required.

Comment 3: Under 'Restoration Plan', I would recommend that Exide exercise extra caution around monitoring wells when they trench or replace the hardscape. For instance, well MW-10 sits in the SW corner of the North Yard and may lie close to, or within, a large area proposed for concrete restoration. Exide should also protect any wells that occur within 3-5 feet of any active trenching. Any wells that occur close to excavation areas may need to be evaluated following the work to make sure that the well integrity has not been compromised. Any wells that have been compromised will need to be abandoned and replaced ASAP.

Response: Section 2.2 has been revised to indicate that monitoring wells will be protected during the work, including those wells within 3 to 5 feet of any active trenching. Any damaged wells will be evaluated and repaired or replaced at the completion of work.

Comment 4: Note: The Response to Comments letter has been stamped with a license that expired (6/30/13) prior to when the letter was issued (7/12/13). However, the SW replacement plan shows Paul's license to be current. The RTC letter should be updated.

Response: Mr. Stratman's engineering license was renewed prior to the June 30, 2013 expiration. The expiration date is June 30, 2015. The cover letter inadvertently had an incorrect date.

Please note that the following revisions have also been made to the plan:

- Specification 312000 has been revised to indicate that the Contractor is responsible for compaction testing.
- Sheet 4 has been revised to reflect recent survey information and measurements for Unit 46. Modifications to the existing stainless steel sump will be made based on this recent survey information.

If you have any questions, please contact Jen DiJoseph at (610) 840-9189 or Paul Stratman at (610) 840-9122.

Sincerely,

ADVANCED GEOSERVICES

Jennifer W. DiJoseph
Associate Project Consultant

Paul G. Stratman, P.E.
Senior Project Consultant

REGISTERED PROFESSIONAL ENGINEER
PAUL GERARD STRATMAN
NO. C61595
EXP 6/30/15
CIVIL
STATE OF CALIFORNIA

JWD:PGS:vm

Enclosure

cc: Rizgar Ghazi, DTSC – hard copy
Peter Ruttan, DTSC – hard copy
Fred Ganster, Exide – electronic
John Hogarth, Exide – electronic
Ed Mopas, Exide – electronic
Christine Graessle, Exide – electronic
Randolph Visser, Shepard Mullin – electronic
Juan Cano
Jen DiJoseph

STORMWATER MANAGEMENT SYSTEM
REPLACEMENT PLAN

Prepared for:
EXIDE TECHNOLOGIES
Vernon, California

STORMWATER MANAGEMENT SYSTEM REPLACEMENT PLAN

Prepared for:

EXIDE TECHNOLOGIES
Vernon, California

Prepared by:

ADVANCED GEOSERVICES
West Chester, Pennsylvania

Project No. 2013-3007-01
May 31, 2013
Revised July 12, 2013
Revised August 19, 2013

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CERTIFICATION STATEMENT

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

Design Engineer: _____ Date: 8/19/13

Paul G. Stratman, P.E.
Advanced GeoServices Corp.
1055 Andrew Drive, Suite A
West Chester, PA 19380

REGISTERED PROFESSIONAL ENGINEER
PAUL GERARD STRATMAN
NO. C61595
EXP. 6/30/15
CIVIL
STATE OF CALIFORNIA

1.0 INTRODUCTION

1.1 GENERAL

This Stormwater Management System Replacement Plan (SMSRP) was prepared in response to the Agreement between Exide Technologies (Exide) and the Department of Toxic Substances Control (DTSC) regarding necessary actions required by Exide as part of DTSC approval for re-opening the Vernon Facility. The SMSRP addresses installation of the replacement storm sewer system following removal of the existing storm sewer system piping and structures as described in the Emergency Response Interim Measures Work Plan for the Stormwater Management System. The SMSRP was prepared by Advanced GeoServices on behalf of Exide Technologies.

1.2 SITE LOCATION

The Exide facility (Facility) is located at 2700 South Indiana Street as shown on Figure 1-1. The Facility occupies a total area of approximately 15 acres, which is bounded by East 26th Street towards the north and Bandini Boulevard towards the south. A 1.5 +/- acre parcel, with approximately 190-ft of frontage along the north side of Bandini Boulevard and 345 ft of frontage along the east side of South Indiana Street, is occupied by the Main Office Building and employee parking area. The remaining 13.5 +/- acres, extends along the west side of South Indiana Street between Bandini Boulevard and East 26th Street and includes the active manufacturing areas. Additional information regarding the Facility location and configuration is available in the Emergency Response Interim Measures Work Plan for the Stormwater Management System.

1.3 BACKGROUND

Details of the existing stormwater management system were summarized in the Storm Sewer Inspection Report dated March 5, 2013 (Advanced GeoServices). The existing stormwater system includes manholes/inlets and piping which the DTSC has determined is ancillary to RCRA Interim Status tank (Unit 46, “Pump Sump”). That report identified several areas of

damage, a couple of suspect areas and system wear and tear in the approximately 3,500 feet system that prompted DTSC to issue an Order for Temporary Suspension and Accusation for Suspension of Exide's Interim Status (Suspension Order).

The existing stormwater system is currently being isolated utilizing temporary controls to eliminate the entry of liquids at the manholes/inlets. The temporary isolation is discussed further in the Temporary Stormwater Management Plan dated May 16, 2013, revised May 20, 2013. The Temporary Stormwater Management Plan was conditionally approved by DTSC on May 16, 2013 and shall be operational during implementation of the Emergency Response Interim Measures Work Plan for the Stormwater Management System and the SMSRP.

Existing roof drains generally discharge to the ground surface, then the stormwater flows to an manhole/inlet. Underground roof drains are identified in the Emergency Response Interim Measures Work Plan for the Stormwater Management System to be relocated to above-grade. Any unidentified underground roof drains encountered during the work will also be relocated above-grade.

1.4 RCRA PERMITTING STATUS

The Replacement System is proposed for inclusion as ancillary equipment for the Interim Status Unit 46. Pursuant to the Agreement between Exide and DTSC, Exide will prepare and submit a request for Temporary Authorization for implementation of the SMSRP following DTSC's approval of the SMSRP according to California Code of Regulations, Title 22, Chapter 20, Article 4. A Class 2 Interim Status Modification for the SMSRP will also be submitted within 30 days after the issuance of the Temporary Authorization according to California Code of Regulations, Title 22, Chapter 20, Article 4.

2.0 SITE PREPARATION

2.1 NOTIFICATIONS

Exide will prepare and submit an application for a City of Vernon Building Permit to complete the required stormwater management system installation

A temporary occupancy permit will be required from BNSF – Los Angeles Junction Railway Company for work in the railroad right-of-way that bisects the facility.

2.2 REMOVAL OF EXISTING SYSTEM AND SOILS

Removal of the existing system and surrounding soils will be conducted in accordance with the Interim Measures Work Plan for the Stormwater Management System. Additional excavation in lead contaminated soils will also be completed as necessary to achieve the design subgrade elevations for the replacement system piping and structures before removal of the enclosure and placement of the geotextile layer.

Monitoring wells will be protected during the work, including those wells within 3 to 5 feet of any active trenching. Any damaged wells will be evaluated and repaired or replaced at the completion of work.

2.3 AIR MONITORING

Work activities involving the management of lead impacted soils (soils containing lead at concentrations >320 mg/kg) to be conducted under the Interim Measures Work Plan for the Stormwater Management System are subject to South Coast Air Quality Management District (SCAQMD) Rules 403, 1420 and 1420.1 and Exide's 1420.1 Compliance Plan dated January 2012. Activities completed as part of this SMSRP will occur after completion of the Interim Measures for the Stormwater Management System (i.e., after the open excavation areas have been covered with a non-woven geotextile fabric). The geotextile fabric is being placed for the

specific intent of protecting potential lead contaminated soils (those soils with total lead concentrations >320 mg/kg) remaining after removal of the existing piping system from wind erosion and contribution to ambient air concentrations. Once the fabric is installed within a work zone, the expectation is that installation of the replacement system can proceed without the use of enclosures or other measures described in Exide's 1420.1 Compliance Plan. The fabric will remain in-place over those areas with lead contaminated soils. Typical construction dust suppression methods such as water sprays will be used during backfilling activities. The South Coast Air Quality Management District has indicated that use of geotextile in the bottom of excavation and water sprays during backfilling area adequate for compliance with the facility's 1420.1 Compliance Plan.

2.3.1 Facility Perimeter

24-hour air monitoring will be conducted at the existing facility air monitoring locations for each working day involving the operation of construction equipment during installation of the replacement system. Air monitor locations and procedures are provided in the facility's Ambient Air Monitoring Plan included as Appendix B of the Interim Measures Work Plan for the Stormwater Management System.

2.3.2 Work Area Perimeter

Continuous real-time particulate (dust) monitoring will be conducted during the work at two locations: one at either end of the pipe sections being completed on that particular day. Monitoring will be conducted using an aerosol monitor such as a DustTrak Aerosol Monitor or equivalent. Manufacturer's information for the DustTrak monitor is provided in Appendix C of the Interim Measures Work Plan for the Stormwater Management System. Readings will be taken continuously with an hourly average and compared to the action levels. Field staff will spot check the monitor on an approximately hourly basis and will record the observations in the field log book. Data will be downloaded from the data logger on the monitor at the end of the working period each day. The aerosol monitor will be calibrated and maintained as recommended by the manufacturer.

The air monitoring performance standard will be 0.15 μg/m^3 for lead (NAAQS) and 3.0x10^{-3} μg/m^3 for arsenic (USEPA RSL). The action level for real-time particulate (dust) will be calculated for each pipe segment using the concentrations observed in post-excavation sampling. The calculation used will be:

$$Total\ Allowable\ Particulate\ (\mu g/m^3) = \frac{particulate\ concentration\ action\ level\ (\mu g/m^3)}{particulate\ of\ concern\ concentration\ (expressed\ numerically)}$$

3.0 PRIMARY CONVEYANCE SYSTEM

3.1 DESIGN ELEMENTS

The replacement storm sewer design has been prepared in accordance with the applicable requirements of Title 22, Article 10 (Tank System), Sections 66264.192 "Design and Installation of New Tank Systems or Components" and 66264.193 "Containment and Detection of Releases Design". A summary of how the proposed primary containment system design meets the requirements is provided in the following subsections.

3.2 DESIGN AND INSTALLATION OF NEW TANK SYSTEMS OR COMPONENTS (§66264.192)

The proposed design is for ancillary equipment components (inlets, trench drains and piping) necessary to convey storm water runoff from various locations around the Facility to the Pump Sump (Interim Status Unit 46). All sumps, piping and trench drains are equipped with secondary containment and leak detection as discussed further in Section 4.0. The primary containment components are constructed with High Density Polyethylene (HDPE) and will be located below grade as depicted on the attached design drawings. Each component is manufactured to be installed and operated in a manner consistent with their intended purpose. Support will be provided by structural soil fill placed and compacted to achieve a uniform stable subgrade, or concrete cast-in-place around the pipe. Existing above grade piping east of Inlet H will be maintained as shown on the design drawings and will discharge into a proposed inlet. The existing pipe is steel. Requirements for system installation, including placement, compaction and evaluation of supporting soil fill materials are provided in the Specifications provided in Appendix A.

The proposed system has been designed under the direct supervision of a California Registered Professional Civil Engineer experienced in storm sewer system design, foundation and soils evaluation. A Certification Statement is provided at the front of this document.

The design criteria and site conditions utilized for the proposed design are as follows:

i. Design Storm Event – 25 Year 24-hour Rainfall Event Modified Rational Method
ii. Traffic Loading – American Association of State Highway Transportation Officials (AASHTO) H-20 (32,000 lbs/axle)
iii. Subsurface Soil Conditions – Quaternary Alluvium. Poorly graded dry to moist sand, silty sand and gravel, and stiff low-plasticity cohesive soils (Sladden Engineering, February 2012). Unsaturated soil conditions (depth to groundwater >70 feet). Minimum assumed bearing capacity 3,000 psf.
iv. The stormwater runoff has a pH conditions between 6 and 9 (Standard Units) and will contain suspended solids that have tested characteristically hazardous for lead and arsenic and could contain elevated concentrations of other metals. The materials to be managed in the proposed stormwater system are stormwater runoff, wash waters and sediment, none of which is consider reactive, corrosive or possess other characteristics that would represent a compatibility concern.

3.3 REPLACEMENT SYSTEM INSTALLATION

The vertical and horizontal alignment of the proposed system is presented on Sheets 1, 2 and 3. As shown the proposed alignment follows the current alignment over the majority of the Facility and installation depths will be similar to slightly deeper. As a result the proposed alignment will be excavated during removal of the existing pipe and surrounding soils under the Interim Measures Work Plan for the Stormwater Management System. Where the proposed alignment deviates from the current alignment, the proposed alignment will be excavated/remediated to facilitate to the lines and grades depicted on the Sheets and required by the Agreement.

Excavation activities involving the removal and handling of potentially contaminated soils will be completed in accordance with the requirements of the Interim Measures Work Plan for the Stormwater Management System and must be completed in a partially enclosed (minimum 3 sided) structure with dust suppression (wetting) and total particulate monitoring. The completed excavation will be covered with a non-woven geotextile before the enclosure can be removed

from the completed area. Contaminated soils will be removed to the required lateral and vertical extents per the Interim Measures Work Plan for the Stormwater Management System prior to replacement of the Stormwater Management System.

Pipe installation shall begin with confirmation that completed excavations are sufficiently deep to accommodate the proposed subgrade required for the pipe bedding material. Where excavation depths exceed required subgrade, the excavation shall be brought back to grade utilizing imported fill materials or clean soils (as defined in the Interim Measures Work Plan for the Stormwater Management System) segregated from contaminated soil during pipe removal and soil remediation. Vertical and horizontal controls shall be established by a California Licensed Professional Surveyor and maintained during construction using laser levels, robotic GPS units and similar devices operated by experienced and competent Contractor personnel. Installation activities will begin at Interim Status Unit 46 (South Yard) and Inlet H (West Yard), and work upstream.

Proposed structures will be backfilled using granular soil fill materials meeting the geotechnical properties identified in the attached Specifications (Appendix A). The QA/QC representative will visually observe soil placement and compaction activities for consistency with the requirements of the specifications and to ensure the compacted materials are visually stable and meet required compaction criteria. Compaction testing will be conducted as indicated in the Specifications.

Pressure testing using air (positive pressure) or potable water (hydrostatic) shall be conducted on the HDPE carrier pipes and manholes and above grade piping to ensure integrity of field welds and materials. Pressure testing procedures are provided in Specification Section 312700 (Storm Drainage) contained in Appendix A. Testing shall be conducted prior to placement of the storm sewer system into service.

A full-time quality control/quality assurance (QA/QC) representative shall be on-site during installation of the Replacement System to monitor construction activities for compliance with the proposed design and good construction practices. The QA/QC representative shall be in regular

communication with the Design Engineer to review and discuss progress, discuss interpretation of the design, and review and approve shop drawings and Contractor submittals. The Design Engineer shall visit the project periodically over the construction period to review and observe progress and execution of the work.

The QA/QC Representative shall compile results of the installation and testing in a completion report reviewed and approved by the Design Engineer. The certified completion report shall be submitted to DTSC within 30 days following completion of construction.

3.4 DESIGN CALCULATIONS

Hydrologic and hydraulic calculations are provided as Appendix B. The calculations show the contributing drainage areas and runoff conditions for surface water flow to each inlet structure; hydraulic performance for the proposed pipe sizes and materials of construction; and strength calculations (crushing calculations) for the proposed piping material for an assumed worst case diameter, burial depth and traffic load.

As shown, the proposed system is adequately sized to collect and convey stormwater runoff from a 25-year 24-hour design storm event and the proposed pipe will be capable of supporting AASHTO H-20 vehicular loads.

3.5 PERIMETER DRAINAGE CONTROLS

As indicated in the facility's Stormwater Pollution Prevention Plan dated October 16, 2012, stormwater collection measures will be installed at the Bandini Boulevard, East 26th Street and South Indiana Street entrances. The collection measures at these entrances will be Dura-Slot trenches with piping as shown on the design drawings. In addition, sumps will be installed west of the West Yard truck scale, and the north side of the Blue Lead Warehouse. The collection measures at each of the entrances will gravity drain to the proposed stormwater inlets. The sump west of the truck scale will gravity drain to the Dura-Slot trench at the Bandini Boulevard entrance. The sump along the north side of the Blue Lead Warehouse will be a blind sump

equipped with a pump to transfer captured runoff above ground to the front of the Warehouse Building. The purpose of the stormwater collection measures is to prevent stormwater from discharging from the facility.

4.0 LEAK DETECTION SYSTEM

As the proposed stormwater system is ancillary to Interim Status Unit 46, the proposed stormwater system, including inlets/manholes and underground piping, has secondary containment and leak detection in accordance with CCR 66264.193 (b) and (c). Above grade piping is not required to have secondary containment per CCR 66264.193(f)(1) if it is inspected on a daily basis.

Primary containment at inlets is provided by the HDPE manhole. Secondary containment is provided by the concrete manhole. Primary containment at piping is provided by the HDPE pipe. Secondary containment at piping is provided by a 60-mil Ethylene Propylene Diene Terpolymer (EPDM) based non-reinforced membrane wrap installed around the pipe and drainage layer.

Leakage from the primary manhole would be contained in the secondary manhole. Leakage from the primary pipe would be contained within the secondary pipe containment and would drain through the leak collection layer to the down-slope manhole. The leak collection layer around the pipes is a single-sided geocomposite which is sloped parallel to the pipe towards the down-slope manhole. Pipe slopes are provided on Sheet 3.

Electronic leak detection probes will be installed at each manhole with control wiring run to centrally located control panels. The wiring will penetrate the manhole sidewall through a water-tight penetration as shown on Sheet 4. The leak detection probes will be capable of detecting a leak in the primary or secondary containment structure or the presence of the release of waste or accumulated liquid in the secondary containment system within 24 hours. If the leak detection probes alarm that liquids are present between the primary and secondary manholes, the accumulated liquids will be removed by facility personnel within 24 hours. The liquids will be accessed via the 12-inch diameter solid cover in the top of the manhole. Liquid removed from the leak detection system will be transferred to the on-site Wastewater Treatment Plant for treatment.

The stormwater system was designed, and will be installed and operated to prevent any migration of stormwater out of the system into the soil, groundwater, or surface water at any time during the use of the system. HDPE pipe and EPDM joints will be water tight. The leak detection system will be capable of detecting and collecting releases and accumulated liquids until the collected material is removed.

The piping and manhole materials are polyethylene and concrete, which are compatible with the wastes in the system. The piping and manholes have sufficient strength and thickness to prevent failure owing to pressure gradients (including static head and external hydrological forces), and physical contact with the stormwater to which it is exposed. The piping and manholes have also been designed to withstand H-20 traffic loading. Failure due to climatic conditions is not a concern as the system will be below-grade. The secondary containment will be supported by the bedding material within which the system is installed.

5.0 PRE-PLANNING AND LAYOUT

Prior to ordering precast concrete secondary containment structures for the storm sewer replacement construction and prior to removal of the exiting storm sewer system, a California Licensed Professional Surveyor will confirm topographic elevations at the top, bottom and existing pipe invert of Interim Status Unit 46 (Sump Pump), and ground surface elevations at the proposed railroad crossing and finished lead warehouse floor. The Surveyor shall also field mark the alignment and structure locations of the proposed replacement system, including existing ground surface elevation, for review by the Design Engineer. The Surveyor shall establish construction benchmarks for use during construction at two locations in the North Yard, and one location each in the South and West Yard. Selection of actual locations will be made in consultation with the Design Engineer.

The Design Engineer will review the results of the field survey for consistency with the information utilized during development of the Replacement Plan design. Most critical will be confirmation of the starting invert elevation for the storm sewer piping beginning at the Pump Sump and top of grate elevation for those inlet structures proposed to replace existing structures. The Design Engineer will utilize field survey results to make minor changes in the vertical and horizontal alignment of the proposed system to avoid conflicts with existing utilities, optimize inlet locations based on surrounding topographic conditions and finalize vertical dimensions of the precast concrete secondary containment structures.

Installation of the replacement system will begin at the Pump Sump in the South Yard and at Inlet H in the West Yard, and progress up-slope along the pipe run, as each pipe run between proposed structures is fully accessible for pipe installation. The California Licensed Professional Surveyor will provide the vertical and horizontal controls necessary for Contractor reference during construction of the proposed structures within the pipe run.

6.0 SCHEDULE

Installation of the Replacement System will be completed by 150 days after DTSC approval of this Work Plan, unless an alternate time frame is approved between DTSC and Exide. The sequence of Replacement System installation will be dictated by the progression of removal of the stormwater management system, which is expected to be as follows:

- Inlet H to K and J. Inlet H to G to F.
- Pump Sump (Unit 46) to Inlets E, D, D-1. Stop at south side of railroad tracks.
- Pump Sump (Unit 46) to 15" diameter HDPE pipe at concrete drainage channel.
- Crossing beneath railroad, once BNSF approval is received.
- North side of railroad track to MH-6, to Proposed MH-6A, MH-7, MH-2 and CL-16.
- Inlets at RMPS Loading Dock and West of Corridor.
- MH-2 to MH-1. EX-18 to EX-17 to CL-2 to MH-1.
- Proposed alignment MH-2 to CL-2.
- CL-14 to CL-5 to CL-6 to CL-15.
- Inlet D to C to B to A.

Excavations within the Finished Lead Warehouse MH-1 to CL-14 will be scheduled to occur over a weekend to minimize disruption to shipping vehicles.

7.0 HEALTH AND SAFETY

Health and safety procedures, including the use of personal protective equipment, will be implemented by the Contractor during the work. All contractors which conduct work at the facility are required to comply with the General Environmental, Health and Safety Rules and Regulations for Contractors and Subcontractors Working at Exide Technologies dated November 30, 2011 provided in Appendix C.

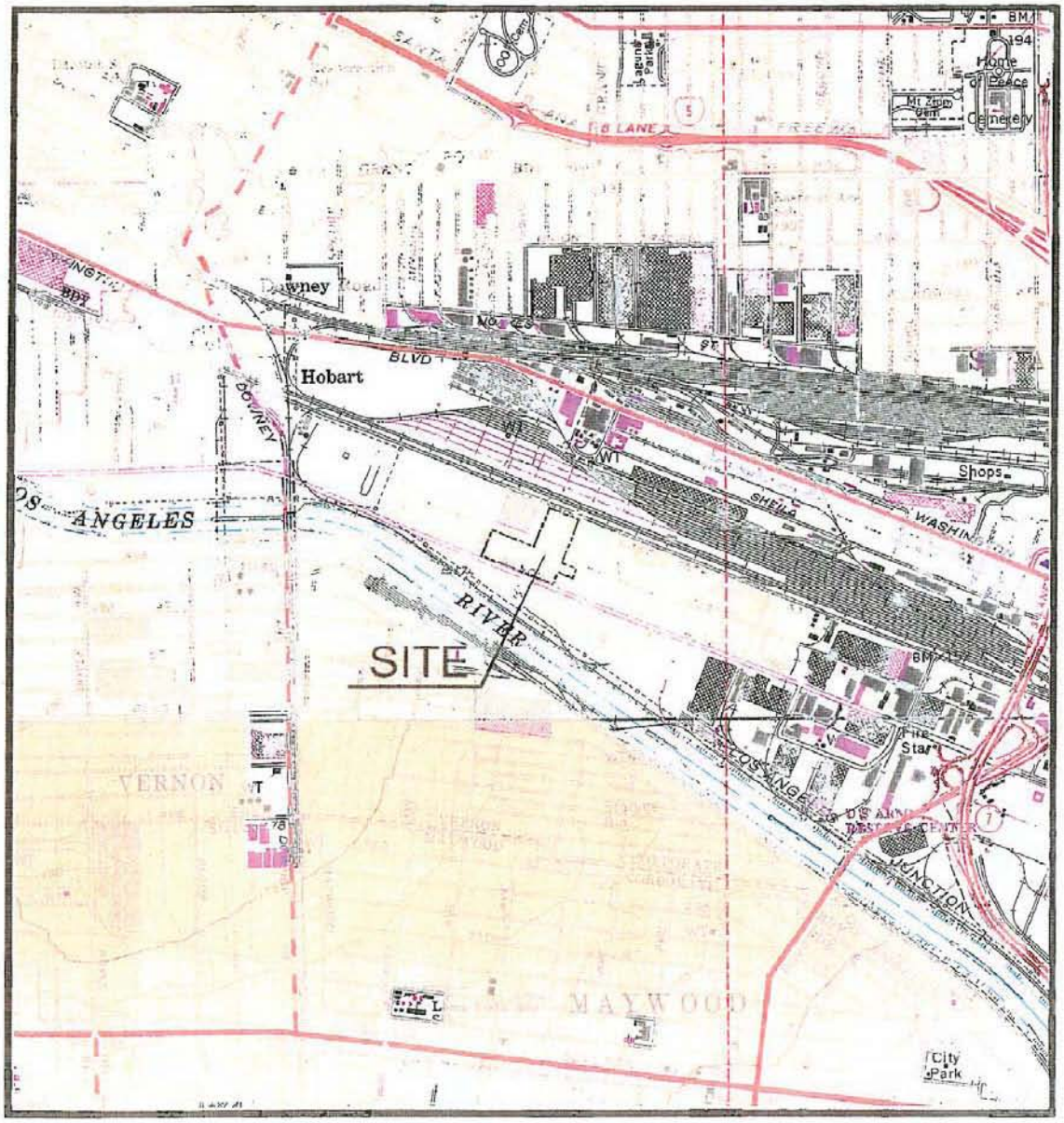
8.0 COST ESTIMATE

A cost estimate for installation of the replacement stormwater system is provided in Appendix D.

9.0 MODIFICATIONS

Exide may request a modification of this plan to DTSC for review and approval if conditions warrant.

FIGURES



NOTE:

1. ADAPTED FROM LAKE ENGINEERING FIGURE 1.1 FROM PART B APPLICATION, MAY 2002.

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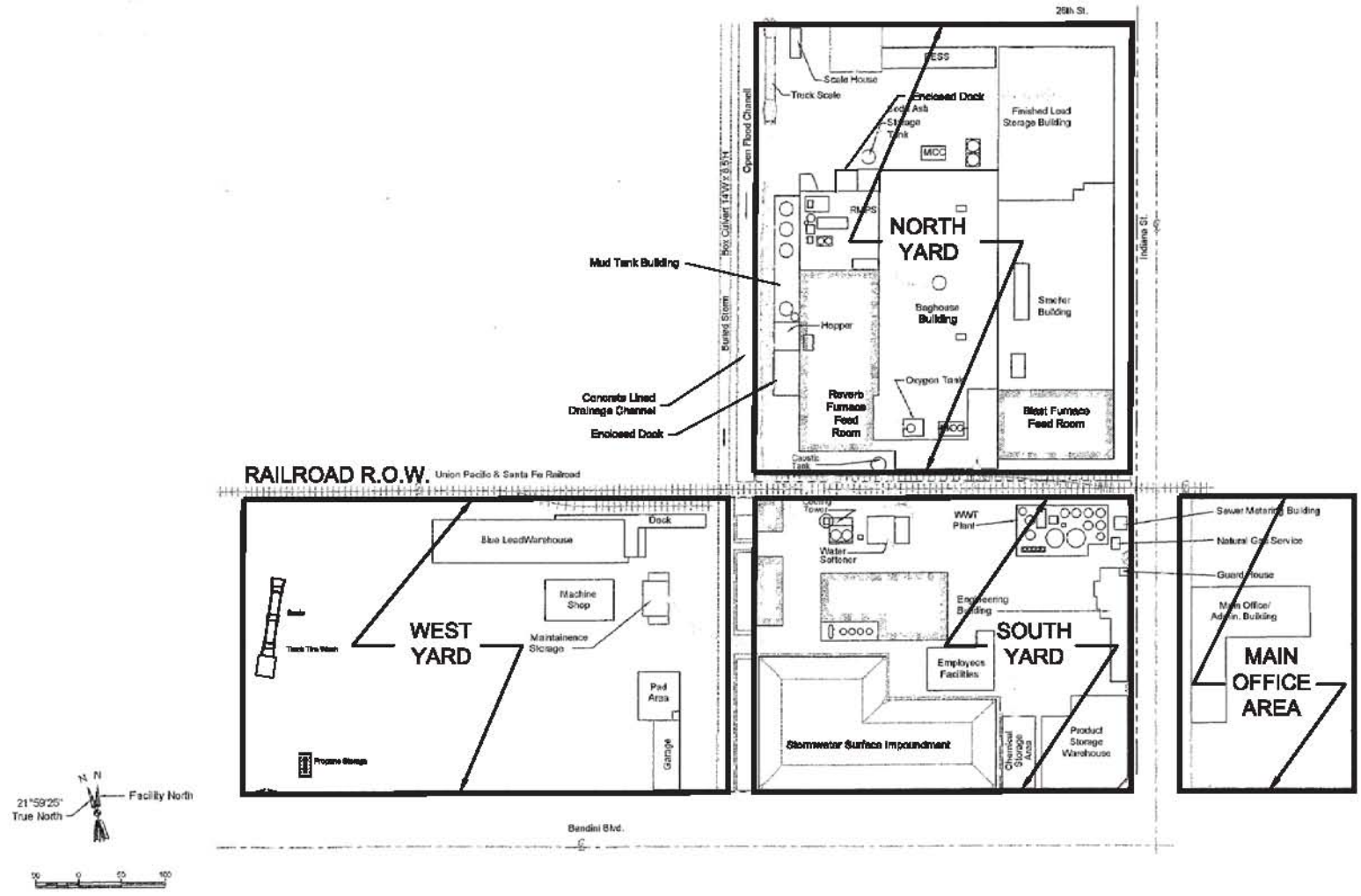
FACILITY LOCATION MAP

EXIDE TECHNOLOGIES
VERNON, CALIFORNIA

SCALE:	N.T.S.	FIGURE 1-1
PROJECT NUMBER: 2013-2967-01		
DATE:		



NOTE:

1. ADAPTED FROM LAKE ENGINEERING FIGURE 2.6 FROM PART B APPLICATION, MAY 2002.

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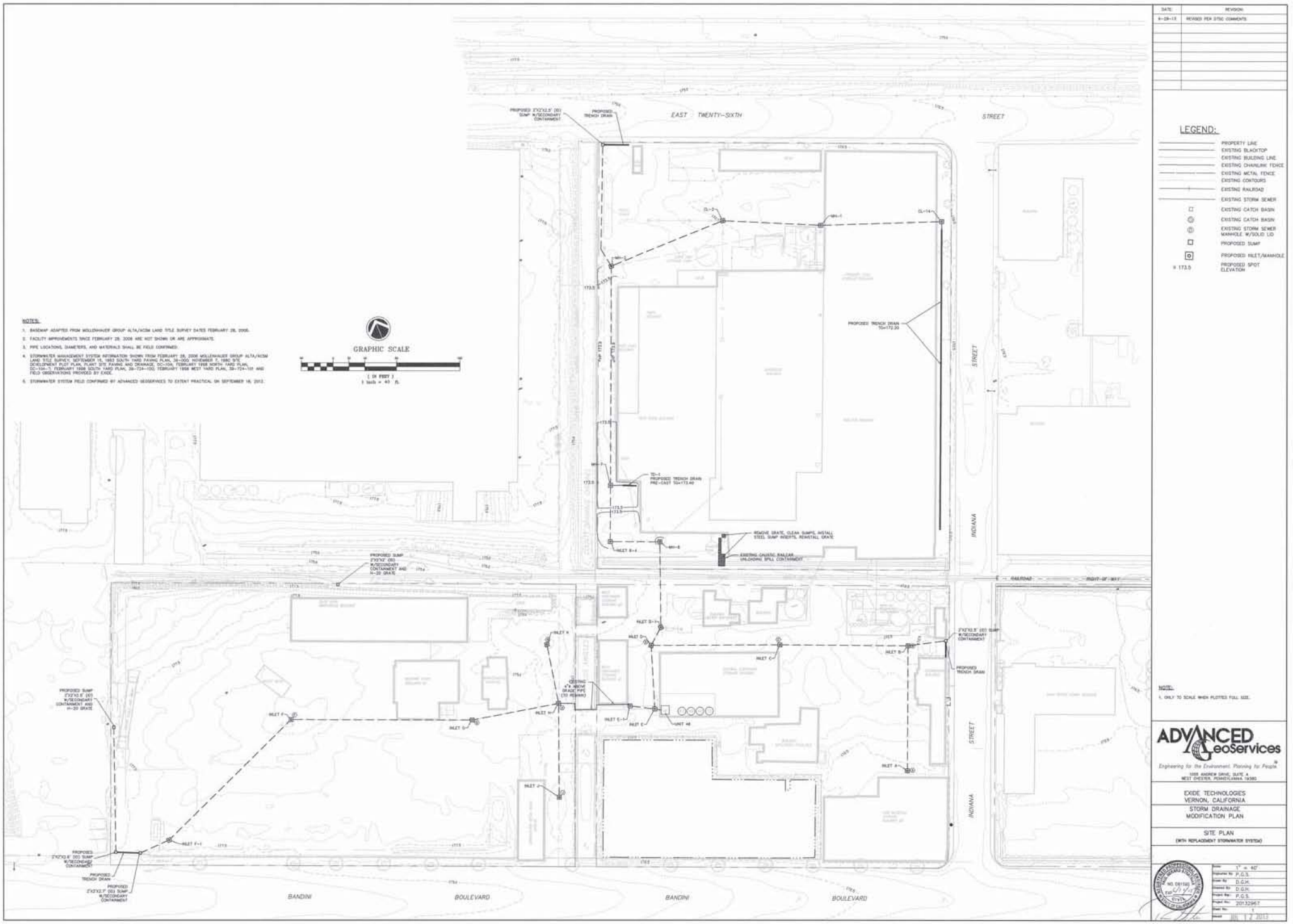
GENERAL SITE LAYOUT

Exide Technologies
Vernon, California

SCALE: N.T.S.	Figure 1-2
PROJECT NUMBER: 8015-2007-01	
DATE:	

P:\Projects\2001\8015\2007-01 - Exide Vernon Interim Status Suspension\Cad\Figure 1-2 Site Layout.dwg, Figure 1-1

SHEETS



NOTES:

1. BASEMAP ADAPTED FROM MOLLENHAUER GROUP ALTA/ACSM LAND TITLE SURVEY DATED FEBRUARY 28, 2008.
2. FACILITY IMPROVEMENTS SINCE FEBRUARY 28, 2008 ARE NOT SHOWN OR ARE APPROXIMATE.
3. PIPE LOCATIONS, DIAMETERS, AND MATERIALS SHALL BE FIELD CONFIRMED.
4. STORMWATER MANAGEMENT SYSTEM INFORMATION SHOWN FROM FEBRUARY 28, 2008 MOLLENHAUER GROUP ALTA/ACSM LAND TITLE SURVEY; SEPTEMBER 15, 1983 SOUTH YARD PAVING PLAN, 38-1000 NOVEMBER 7, 1980 S/S DEVELOPMENT PLOT PLAN, PLANT SITE PAVING AND DRAINAGE, DC-104, FEBRUARY 1958 NORTH YARD PLAN, DC-104-1, FEBRUARY 1958 SOUTH YARD PLAN, 38-724-102, FEBRUARY 1958 WEST YARD PLAN, 38-724-101 AND FIELD OBSERVATIONS PROVIDED BY EXIDE.
5. STORMWATER SYSTEM FIELD CONFIRMED BY ADVANCED GEOSERVICES TO EXTENT PRACTICAL ON SEPTEMBER 18, 2012.

GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

DATE:	REVISION:
6-28-13	REVISED PER DTSC COMMENTS

LEGEND:

- PROPERTY LINE
- EXISTING BLACKTOP
- EXISTING BUILDING LINE
- EXISTING CHAINLINK FENCE
- EXISTING METAL FENCE
- EXISTING CONTOURS
- EXISTING RAILROAD
- EXISTING STORM SEWER
- EXISTING CATCH BASIN
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE W/SOLID LID
- PROPOSED SUMP
- PROPOSED INLET/MANHOLE
- 173.5 PROPOSED SPOT ELEVATION

NOTE:

1. ONLY TO SCALE WHEN PLOTTED FULL SIZE.

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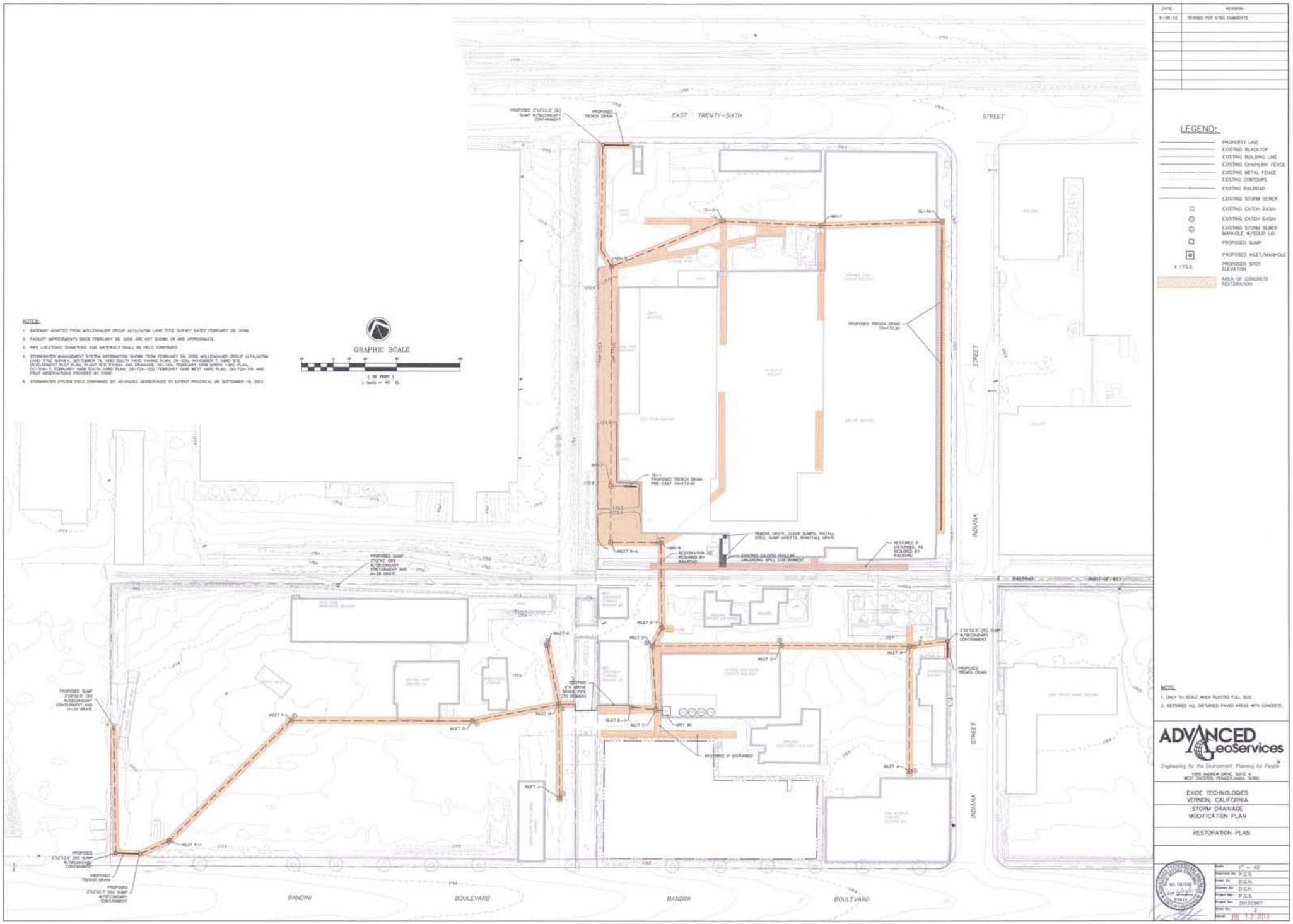
EXIDE TECHNOLOGIES
VERNON, CALIFORNIA
STORM DRAINAGE MODIFICATION PLAN

SITE PLAN
(WITH REPLACEMENT STORMWATER SYSTEM)

Scale:	1" = 40'
Engineer No:	P.G.S.
Drawn By:	D.G.H.
Checked By:	D.G.H.
Project Eng.:	P.G.S.
Project No.:	20132967
Sheet No.:	1
Dated:	JUL 12 2013



NOTES:

1. BASEMAP ADAPTED FROM MOLLENHAUER GROUP ALTA/ACSM LAND TITLE SURVEY DATED FEBRUARY 28, 2006.
2. FACILITY IMPROVEMENTS SINCE FEBRUARY 28, 2006 ARE NOT SHOWN OR ARE APPROXIMATE.
3. PIPE LOCATIONS, DIAMETERS, AND MATERIALS SHALL BE FIELD CONFIRMED.
4. STORMWATER MANAGEMENT SYSTEM INFORMATION SHOWN FROM FEBRUARY 28, 2006 MOLLENHAUER GROUP ALTA/ACSM LAND TITLE SURVEY; SEPTEMBER 15, 1983 SOUTH YARD PAVING PLAN, 39-200; NOVEMBER 7, 1980 SITE DEVELOPMENT PLOT PLAN, PLANT SITE PAVING AND DRAINAGE, DC-10A; FEBRUARY 1968 NORTH YARD PLAN, DC-10H-1; FEBRUARY 1998 SOUTH YARD PLAN, 39-72A-100; FEBRUARY 1998 WEST YARD PLAN, 39-73A-100 AND FIELD OBSERVATIONS PROVIDED BY EXIDE.
5. STORMWATER SYSTEM FIELD CONFIRMED BY ADVANCED GEOSERVICES TO EXTENT PRACTICAL ON SEPTEMBER 18, 2013.

DATE:	REVISION:
9-28-13	REVISED PER DTSC COMMENTS

LEGEND:

- PROPERTY LINE
- EXISTING BLACKTOP
- EXISTING BUILDING LINE
- EXISTING CHAINLINK FENCE
- EXISTING METAL FENCE
- EXISTING CONTOURS
- EXISTING RAILROAD
- EXISTING STORM SEWER
- EXISTING CATCH BASIN
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE W/SOLID LID
- PROPOSED SUMP
- PROPOSED INLET/MANHOLE
- 173.5 PROPOSED SPOT ELEVATION
- AREA OF CONCRETE RESTORATION

NOTE:

1. ONLY TO SCALE WHEN PLOTTED FULL SIZE.
2. RESTORED ALL DISTURBED PAVED AREAS WITH CONCRETE.

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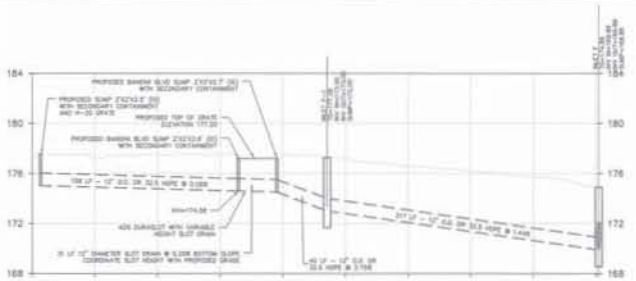
WEST CHESTER, PENNSYLVANIA 19380

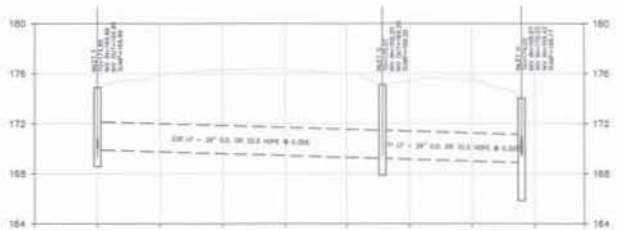
EXIDE TECHNOLOGIES
VERNON, CALIFORNIA
STORM DRAINAGE MODIFICATION PLAN

RESTORATION PLAN

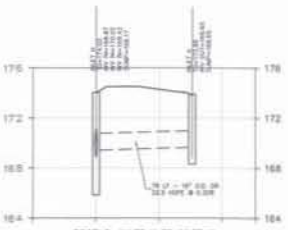
Scale:	1" = 40'
Engineer In Charge:	P.G.S.
Drawn By:	D.G.H.
Checked By:	D.G.H.
Project Mgr.:	P.G.S.
Project No.:	2013.2367
Sheet No.:	2
Dated:	10.1.2013



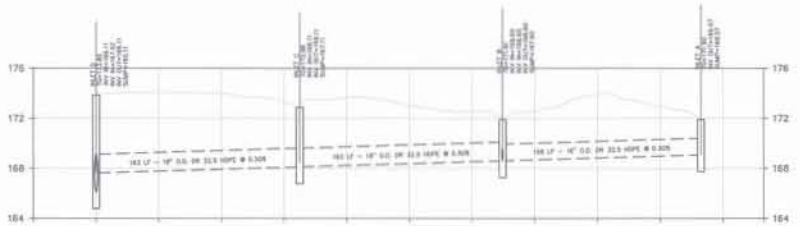
PROFILE: PROPOSED BANDINI BLVD SUMP TO INLET F
SCALE: 1"=40' HOR
1"=4' VERT



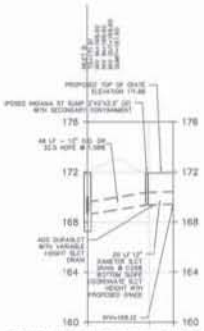
PROFILE: INLET F TO INLET H
SCALE: 1"=40' HOR
1"=4' VERT



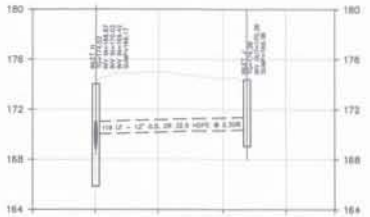
PROFILE: INLET H TO INLET K
SCALE: 1"=40' HOR
1"=4' VERT



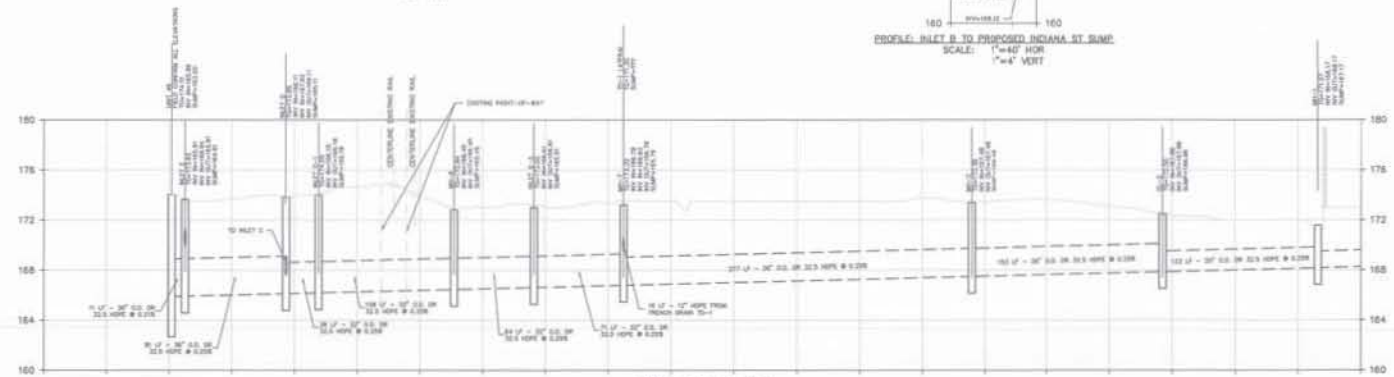
PROFILE: INLET D TO INLET A
SCALE: 1"=40' HOR
1"=4' VERT



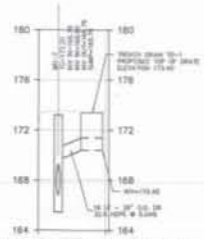
PROFILE: INLET B TO PROPOSED INDIANA ST SUMP
SCALE: 1"=40' HOR
1"=4' VERT



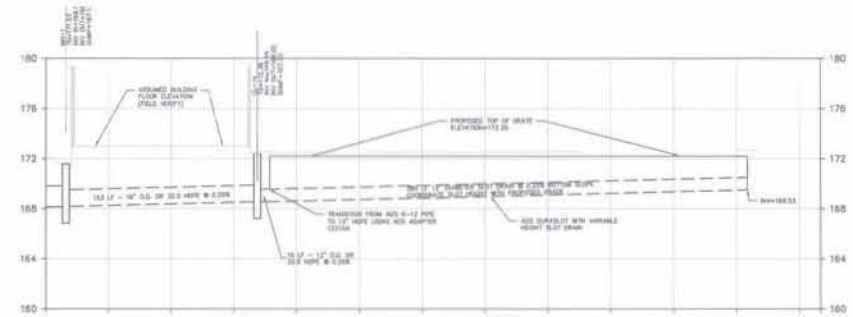
PROFILE: INLET H TO INLET J
SCALE: 1"=40' HOR
1"=4' VERT



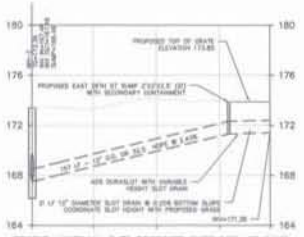
PROFILE: UNIT 46 TO MH-1
SCALE: 1"=40' HOR
1"=4' VERT



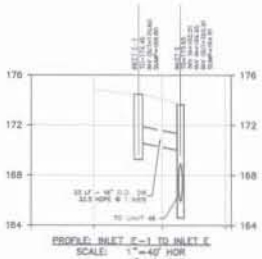
PROFILE: INLET MH-7 TO TRENCH DRAIN TD-1
SCALE: 1"=40' HOR
1"=4' VERT



PROFILE: MH-1 TO TRENCH DRAIN
SCALE: 1"=40' HOR
1"=4' VERT



PROFILE: INLET MH-2 TO PROPOSED EAST 26TH ST SUMP
SCALE: 1"=40' HOR
1"=4' VERT



PROFILE: INLET F-1 TO INLET E
SCALE: 1"=40' HOR
1"=4' VERT

DATE	REVISION
9-28-12	REVISED PER VTSC COMMENTS

ADVANCED GeoServices

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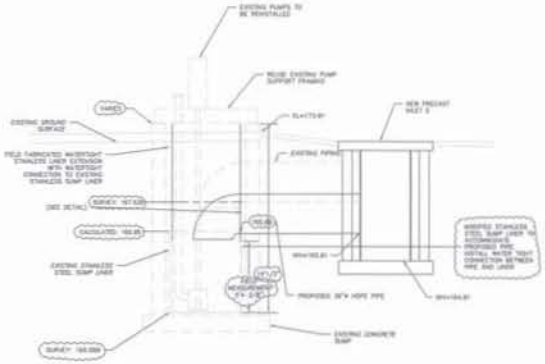
WEST CHESTER, PENNSYLVANIA 19380

EXIDE TECHNOLOGIES
VERNON, CALIFORNIA
STORM DRAINAGE
MODIFICATION PLAN

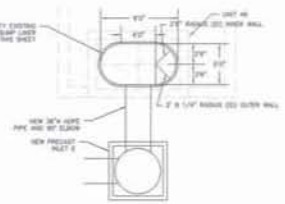
UTILITY PROFILES
AND DETAILS

Scale:	AS NOTED
Designed By:	D.G.N.
Drawn By:	D.G.N.
Checked By:	D.G.N.
Project No.:	P.D.S.
Project No.:	2012298.7
Sheet No.:	3
Date:	JUL 2 2013

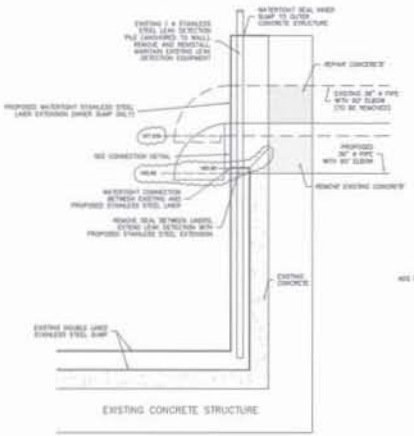


ELEVATION: REVISED UNIT 46 STRUCTURE

NOTE: CONTRACTOR SHALL FIELD CONFIRM EXISTING ELEVATIONS PRIOR TO WORK

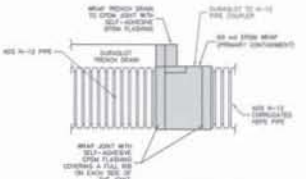


PLAN: REVISED UNIT 46 STRUCTURE

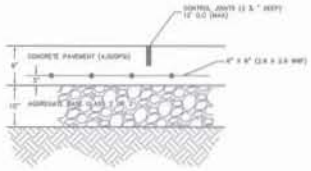


EXISTING CONCRETE STRUCTURE

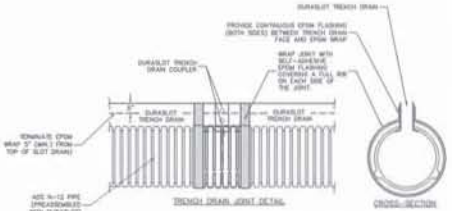
UNIT 46 DETAIL



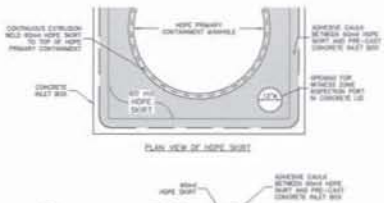
TRENCH DRAIN TO CORRUGATE HDPE PIPE JOINT DETAIL



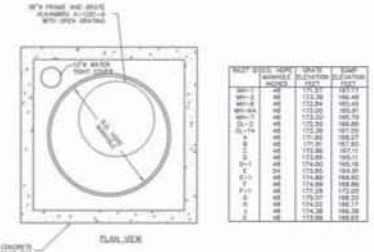
NEW CONCRETE PAVEMENT SECTION



DURASLOT TRENCH DRAIN JOINT DETAIL

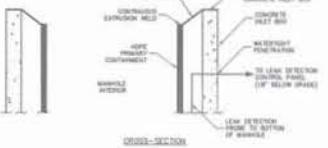


PLAN VIEW OF HDPE SKIRT

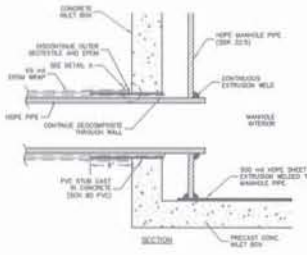


PLAN VIEW

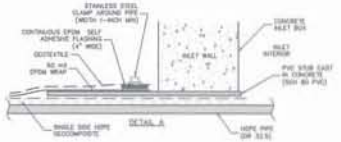
INLET STEEL HDPE MANHOLE	GRATE ELEVATION (TOP)	SUMP ELEVATION (INV)
MH-1	48	170.31	157.11
MH-2	48	172.76	160.46
MH-3	48	172.94	160.63
MH-4A	48	173.20	160.91
MH-7	48	173.20	160.79
D-2	48	173.50	160.88
D-1/4	48	173.29	157.51
A	48	171.83	156.27
B	48	171.91	157.60
C	48	172.86	157.11
D	48	173.66	159.11
D-1	48	174.00	160.19
E	48	173.85	164.97
E-1	48	174.80	166.80
F	48	174.89	168.89
F-1	48	177.28	172.03
G	48	178.07	168.27
H	48	174.02	166.17
I	48	174.28	166.28
J	48	173.66	168.66



CROSS-SECTION

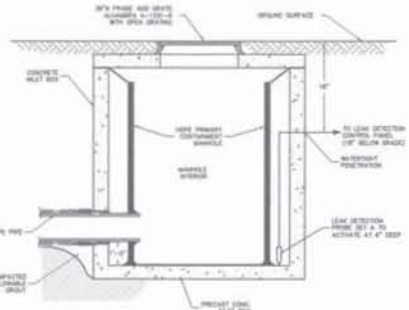


SECTION

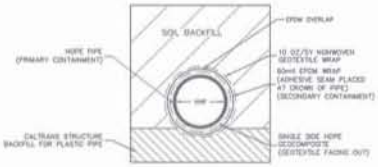


DETAIL A

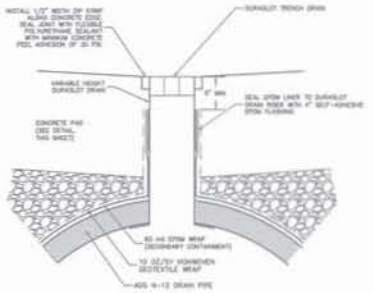
CONCRETE INLET/HDPE MANHOLE DETAIL



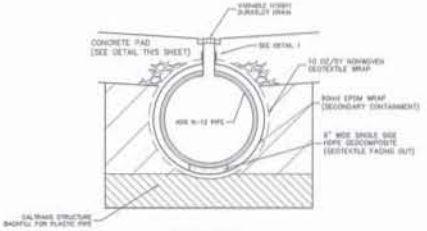
CONCRETE INLET/HDPE MANHOLE CROSS SECTION



PIPE TRENCH CROSS SECTION



TRENCH DRAIN DETAIL 1



CROSS SECTION

TRENCH DRAIN

DATE:	REVISION:
8-08-13	REVISED PER DTSC COMMENTS
8-19-13	REVISED UNIT 46 DETAILS

NOTE:

1. ONLY TO SCALE WHEN PLOTTED FULL SIZE.

ADVANCED GeoServices

Engineering for the Environment, Planning for People

1055 ANDREW DRIVE, SUITE A
WEST CHESTER, PENNSYLVANIA 19380

EXIDE TECHNOLOGIES
VERNON, CALIFORNIA

STORM DRAINAGE MODIFICATION PLAN

DETAILS

Scale:	AS NOTED
Engineer:	P.G.S.
Drawn By:	D.G.H.
Checked By:	D.G.H.
Project Mgr:	P.G.S.
Project No.:	2013.2987
Sheet No.:	6
Date:	AUG 19 2013

APPENDIX A

Specifications

SECTION 01545

HEALTH AND SAFETY

PART 1: GENERAL

1.1 Description

The work covered by this section shall include, but not be limited to, the development and implementation of a Health and Safety Program related to implement construction related componenets of the Interim Measures Work Plan for Stormwater Management System Removal and the Stormwater Management System Replacement Plan. The Contractor will be responsible for all Health and Safety for employees, subcontractors, suppliers and visitors related to the Stormwater Management System Removal and Replacement. The Contractor shall provide all expertise, supervision, labor, materials, and equipment necessary to develop, prepare, and implement the Health and Safety Program as detailed in this Section.

The facility is an active hazardous waste recycling facility with existing security measures and health and safety procedures. The Contractor and its subcontractors shall also conduct work in accordance with *General Environmental, Health & Safety Rules and Regulations for Contractors and Subcontractor Working at Exide Technologies*.

The Contractor shall develop and implement all necessary precautions for the safety of, and provide the necessary protection to prevent damage, injury or loss to:

- All employees and subcontractors participating in performance of the Work.
- All facility employees, contractors, equipment and structures.
- All nearby residents, periodic visitors and passersby in the nearby surrounding area.
- All components of the work, any materials to be used or incorporated in the work, and any equipment to be employed in the execution of the work, whether on- or off-site.
- Other property on or adjacent to the project Site including surface waters, groundwater, soil, air, trees, shrubs, lawns, sidewalks, pavements, roadways, structures and utilities not designated for removal or replacement in the course of construction.

1.2 Related Sections

All sections of this Specification.

1.3 References

- OSHA 29 CFR 1910 and 1926.
- Article 6 (Excavations) of Cal-OSHA Construction Safety Orders
- 8 CCR 5192
- 8 CCR 1532.1
- Chapter 6.5 of Health and Safety Code 25100
- Chapter 6.8 of Health and Safety Code 25300
- Health and Safety Code 25187.1(a)
- Health and Safety Code 25200.1.5(g)(3)(A-E)
- National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300)
- 40 CFR 300.430(b)(6)
- 40 CFR 311.1 and 311.2
- Health and Safety Code 25355.5(a)(1)(B)
- Health and Safety Code 25355.5(a)(1)(C)
- Health and Safety Code 25356.1(d)
- Health and Safety Code 25356.1(h)(3)(A-D)
- Health and Safety Code 25358.3(b)(1)
- Health and Safety Code 25395.25(b)
- DTSC EO #93-006
- DTSC EO #95-006
- DTSC EO 95-007
- DTSC Permit Writer's Instructions, Closure Plan Chapter 3.17

1.4 Definitions

OSHA - Occupational Safety and Health Administration

1.5 Submittals

The Contractor shall prepare and submit a Health and Safety Plan (HASP) for review and comment by the Engineer and Owner. The Engineer will provide the Plan for review and comment by DTSC. As part of the Health and Safety Program to be implemented by the Contractor and as specified herein, submittals are also required for the documentation of normal Health and Safety procedures during the duration of the project.

PART 2: PRODUCTS

2.1 Health and Safety Program

The Contractor' Corporate Health and Safety Program shall meet the requirements of 8 CCR. The program shall include:

- Medical Surveillance Program;
- Hazard Communication Program;
- Hearing Conservation Program;

- Respiratory Protection Program; and,
- Personal Protective Equipment Program.

2.2 Health and Safety Plan

The Contractor shall prepare a written site-specific Health and Safety Plan which is applicable to all components of the work. The plan shall be based upon the requirements and guidelines described herein. The Contractor's Health and Safety Plan will apply to all personnel within the work area including the Owner, Engineer, the Contractor, subcontracted personnel, visitors, and regulatory officials. Subcontractors shall accept and comply with the Contractor's Health and Safety Plan. The Contractor may include additional information as appropriate. The Health and Safety Plan shall have a table of contents and numbered pages and shall follow the outline provided below. Site-specific information shall be contained in the main body of the Health and Safety Plan. Only supplementary information shall be placed in an appendix.

The Health and Safety Plan shall meet, at a minimum, the following regulatory requirements:

- OSHA Standards and Regulations contained in Title 29, Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 1926);
- Article 6 (Excavations) of Cal-OSHA Construction Safety Orders;
- 8 California Code of Regulations (CCR) 5192; and,
- 8 CCR 1532.1, including but not limited to medical surveillance, exposure determinations, PPE and training.

In addition, the plan must include at a minimum, the following information using the outline provided below. If an item is not applicable, the Contractor shall clearly state the item is not applicable and why.

Health and Safety Plan Outline

1. Facility background/Work Plan

   1.1 Facility Background: Provide a description of the facility identifying the current and/or former site activities or processes including hazardous materials used and waste streams generated. Summarize any past characterization activities and/or data.

   1.2 Work Plan: The work plans associated with the work activities are the Interim Measures Work Plan and Stormwater Management System Replacement Plan. Provide a description of the project, including the work tasks, objectives and the personnel requirements. Identify the extent to which subcontractors (if any) will be used. Identify the anticipated duration of planned field activities. Summarize the information regarding known or suspected hazardous waste disposal on-site. Include the waste's location, physical state, chemical characteristics, and range of concentrations found to date by matrix (soil, water, air).

2. Key Personnel and Responsibilities: Identify the Health and Safety Coordinator and assistant health and safety personnel by name and specific assignments for the project. Summarize the operational and health and safety responsibilities of each key person identified. Describe the extent of the Health and Safety Coordinator's authority to correct health and safety problems. Summarize the Health and Safety Coordinator's responsibilities and authorities as discussed in Section 3.2.

3. A safety and health risk or hazard analysis for each task and operation found in the work plan. The completion of a comprehensive safety and health risk analysis for each site task will result in the identification of all physical, chemical and biological hazards associated with each task. Protective protocols are then selected which will minimize exposure of site personnel to these hazards. An effective approach to complete a comprehensive job safety and health or hazard analysis is to break each site task into a series of smaller tasks and completely evaluate them for employee exposure to physical, chemical and biological hazards. Once the hazards have been identified, measures to minimize employee exposure to the hazards are outlined. Table format is acceptable. The analysis shall include the following:

    3.1 A preliminary evaluation of the site's characteristics performed prior to site entry.

    3.2 An evaluation of the known or suspected contaminants and conditions that may pose inhalation, skin absorption/contact or ingestion hazards. Include information describing the chemical and physical properties (i.e., vapor pressure, vapor density, molecular weight, ionization potential, and lower and upper explosive limit, etc.). Additionally, include relevant occupational exposure limits (OELs) [i.e., permissible exposure levels (PELs), ceiling values, short-term exposure limits (STELs), threshold limit values (TLVs), recommended exposure values (RELs), and immediately dangerous to life and health values (IDLHs)]. If the cited OEL has a skin notation, this information must also be included.

    3.3 An evaluation of known or potential safety hazards associated with each task.

    3.4 An overview of the following information:

        a. Size and location of the site.

        b. Description of the operation and tasks to be performed.

        c. Approximate duration of the operation and each task.

        d. Site topography, site accessibility and special features (e.g. underground or aboveground utilities, structures, tanks, etc.).

e. Known or suspected pathways of contaminant dispersion pertinent to the operation and tasks performed.

f. Safety and health hazards expected on the site

4. Employee training assignments to assure compliance with 8 CCR 5192(e) (Training)

4.1 Training Requirements for On-Site Personnel:

4.1.1 All employees working on-site who may be exposed to hazardous substances, health hazards, or safety hazards, and their supervisors and managers responsible for on-site activities must have met the following requirements prior to the start of operations at the site:

a. 40-hour minimum hazardous materials safety and health course, and

b. 24 hours of supervised on the job training,

c. An eight (8) hour minimum refresher course if the 40-hour minimum training was acquired more than one year prior to the start of site operations, or

d. Equivalent work experience (which can be documented) demonstrating a knowledge of safety and healthful work practices, or

e. A combination of prior training and work experience (which can be documented), sufficient to satisfy the 40-hour minimum requirement and have completed 24 hours of supervised on the job training.

4.1.2 If acceptable to the Owner, workers on-site only occasionally for a specific limited task (such as land surveying) and who are unlikely to be exposed over permissible and published exposure limits shall have received a minimum of 24 hours of instruction off-site, and a minimum of one day actual field experience with a trained, experienced supervisor.

4.1.3 On-site management and supervisors directly responsible for or who supervise employees engaged in site operations shall have also received eight (8) hours minimum training in managing such site operations prior to the start of site activities.

4.1.4 Employees who have been designated as responsible for responding to on-site emergencies shall have received additional training in how to respond to such expected emergencies prior to the start of site operations.

4.1.5 Employees who have not received the required training prior to the start of site operations are not to engage in site operations until such training has been completed.

4.2 Employee Training Program:

4.2.1 The Contractor shall make available to the Owner, Engineer and DTSC upon request a summary of the hazardous materials safety and health training program and a list of elements and topics covered.

4.2.2 Documentation of training shall be readily available for review on-site, by Owner, Engineer and DTSC.

4.3 Site Specific Training: The Contractor shall perform a pre-entry site-specific safety training for personnel prior to their participation in field activities. Additionally, safety briefings must be performed with adequate frequency to provide an awareness of planned operations and Health and Safety Plan requirements.

Note that OSHA requires that specialized training be given when handling specific materials, and that personnel be trained in the hazards specific to their job. Provide a brief summary of all applicable training which may be required for the project (i.e., lead, asbestos, PPE, noise, crane operation, etc.).

5. Personal protective equipment (PPE) to be used by employees for each of the site tasks and operations being conducted as required by the PPE program found within 8 CCR 5192 (g):

5.1 Engineering and Work Practice Controls: Engineering and dust controls are identified in the Interim Measures Work Plan. The Contractor must consider the need to apply engineering and/or work practice controls as a means of protecting personnel in the performance of site-specific tasks. Other examples include:

- Wetting soils to limit the emission of fugitive particulate matter.
- Portable sunshades may be erected over work areas where

personnel are performing soil and/or groundwater sampling activities.

- Portable fans and/or blowers may be utilized to move airborne contaminants from the immediate work zone. This action may allow site personnel to continue work in a lower level of protection thereby increasing employee efficiency and simultaneously reducing the potential for the development of heat-related disorders. Caution must be taken when fans are employed to move airborne contaminants from the work area to verify that no individuals may be impacted "downwind" of the site activities.

5.1.1 When practical, engineering controls shall be implemented to reduce and maintain employee exposures to or below safe levels for those tasks demonstrating known or suspected hazards.

5.1.2 Work practice controls shall next be applied when engineering controls are impractical and shall be incorporated as site-specific standard operating procedures (SOP) for personal precautions and routine operations. Examples of easy-to-implement work practice controls include:

- Pre-labeling and staging of sampling containers and equipment prior to donning PPE. This measure reduces the time spent in PPE and may minimize the potential for the development of heat-related disorders.

- Instructing employees to avoid walking through, kneeling on, touching or placing equipment and/or supplies on potentially contaminated surfaces.

5.2 Personal Protective Equipment and Levels of Protection

5.2.1 The Contractor shall use personal protective equipment (PPE) only when engineering and/or work practice controls have been deemed impractical or insufficient to protect employees during site operations. Minimum PPE requirements are provided in Section 2.4.

5.2.2 The Contractor shall select PPE based on an evaluation of performance characteristics (i.e., consultation of permeation, penetration and degradation performance charts), site-specific tasks, and known or suspected hazards and shall assemble the PPE into levels of protection (LOP) or ensembles appropriate for the site. The Contractor is referred to 8 CCR 5192, Appendix B [General Description and Discussion of the Levels of Protection

and Protective Gear (Non-Mandatory)], for additional information describing PPE LOP.

5.2.3. Include the rationale for PPE selection, action levels and the criteria used for upgrading/downgrading of PPE. The Contractor shall supply all PPE for the work.

5.2.4. The Contractor shall include in the HASP a list of components for each protective ensemble, the LOP selected for each task, and any contaminant action levels to be followed in LOP decision making.

5.2.5. The Contractor shall establish a PPE program addressing the following elements:

a. Site hazards:

b. PPE selection,

c. PPE use,

d. Duration of site operations,

e. PPE maintenance and storage,

f. PPE decontamination,

g. PPE training and proper fit,

h. Donning and doffing procedures,

i. PPE inspection,

j. PPE in-use monitoring,

k. Evaluation of program effectiveness, and

l. Heat stress and temperature limitations.

5.3 Respiratory Protective Equipment: Upon request, the employer shall provide a copy of their respiratory protection program to the Owner, Engineer and DTSC.

Cal-OSHA requires employers to establish and implement a written respiratory protection program with worksite-specific procedures in any workplace where respiratory protection is required to protect the health of an employee, or when respiratory protection is required by the employer. Site-specific HASPs contain the critical worksite-specific procedures

which stipulate how respiratory protective equipment will be safely and effectively used on the job site.

At a minimum the HASP must address the following information pertaining to respiratory protection:

1) Unless an end-of-service-life indicator (ESLI) is available for the contaminant(s) of concern, a change-out schedule must be provided for personnel utilizing air-purifying respirators for protection against gases and vapors. The rationale for how the change-out schedule was derived must be provided.

2) Air monitoring protocols must also be identified so that the use concentrations required in the determination of a change-out schedule can be verified. Instrumentation relative-response factors must also be incorporated into the air monitoring protocols.

3) All personnel who will utilize respiratory protective equipment must have completed a medical evaluation in accordance with the requirements of 8 CCR 5144(e).

4) All personnel who will utilize respiratory protective equipment must have successfully completed a qualitative or quantitative respirator fit test within the last year.

5) A discussion of how respiratory protective devices shall be maintained in a hygienic and functional manner during the course of field activities must be included.

6) If supplied-air respirators will be utilized, a discussion of breathing air quality and use procedures must be provided.

6. Medical surveillance requirements in accordance with the program found within 8 CCR 5192(f) (Medical Surveillance):

6.1 Medical Surveillance Program

The Contractor shall establish and implement a medical surveillance program (MSP) as required by 8 CCR 5192(f) for employees engaged in on-site operations.

6.1.1 The MSP shall include physical examinations administered by a licensed physician, knowledgeable in occupational medicine. The Contractor shall include in the Health and Safety Plan a statement from the occupational physician performing the medical monitoring certifying that the subject employees have the physical

ability to perform their assignments while using respiratory protection, if necessary.

6.1.2 If the MSP is included in a corporate health and safety program, a summary of it should be included as an appendix to the HASP.

6.1.3 The Contractor shall address the need for specialized biological monitoring in the HASP and include a description of those provisions.

6.2 Retention of Medical Records

6.2.1. The Contractor shall retain all medical records and personnel exposure monitoring data for an appropriate period as described in 8 CCR 3204(d).

6.3 Employee Heat and Cold Stress Monitoring

As dictated by seasonal conditions, the Contractor shall implement an employee heat or cold-stress monitoring program during site operations and shall incorporate the program into the site HASP.

6.3.1 The program shall include employee awareness of the signs and symptoms of heat or cold stress, preventive measures, and employee parameters to be monitored.

6.3.2 The Contractor shall, when appropriate, maintain a daily heat or cold stress log on all employees on-site engaging in field activities and shall describe the log in the site HASP.

6.3.3 As needed, a discussion of heat-stress monitoring protocols (i.e., pulse-monitoring, aural temperature monitoring, oral temperature monitoring, work-rest schedules, etc.) should be included in the HASP. If temperature action levels are referenced, specify how these values will be quantified at the job site.

6.4 Heat Illness Prevention

6.4.1 A minimum of one quart per employee per hour of potable water must be available on-site. Employees must be encouraged to consume water frequently throughout the work shift.

6.4.2 Shade must be provided to personnel when the temperature exceeds 85 F. Please refer to 8 CCR 3395(d) for a detailed description of providing shade to employees.

6.4.3 When temperatures reach or exceed 95 F, employers shall implement the following procedures to the extent practicable:

- Ensure that employees have effective communication measures in place to contact supervisors as needed.
- Ensure that employees are observed for alertness and signs and symptoms of heat illness.
- Ensure that employees are reminded of the importance of drinking plenty of water throughout the work shift.
- Ensure that new employees are closely supervised during the first 14 days of employment. Refer to 8 CCR 3395(e)(4) for additional information.

6.4.4 Prior to an employee or supervisor starting work which might reasonably be expected to result in exposure to the risk of heat illness they must receive training addressing the topics found in 8 CCR 3395(f).

7. Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.

7.1 Air Monitoring Program: The Contractor shall establish and implement a site-specific air-monitoring program for personnel to identify areas of elevated airborne contaminant concentrations and to determine the level of the concentrations relative to background. The Contractor shall provide the personnel, instruments, and materials necessary to perform such air monitoring and identify the individual responsible for administering the program. The program shall be included in the HASP. Site-specific air-monitoring for the facility perimeter will be conducted by Exide on a daily basis during construction. Work area perimeter monitoring for dust shall be as provided in the Interim Measures Work Plan.

7.1.1 The Contractor must incorporate the following information into the air-monitoring program:

a. The specific type, make, and model of instrument(s) selected for use. If a photoionization detector (PID) is to be used, the specific lamp voltage must be identified.

b. Relative response factors for the instruments of choice must be incorporated into any action level(s) derived for the site,

c. Air monitoring for particulate-bound contaminants shall be performed by employing a real-time particulate monitoring device. This monitoring can be accomplished via: 1) a conservative approach, assuming that all particulate matter detected by the instrumentation represents a specific contaminant or 2) by utilizing the following formula to establish action levels.

$$Total\ Dust\ Action\ Level\ (in\ mg/m^3) = \frac{(10^6 mg/kg)(EL\ mg/m^3)}{(Conc.\ mg/kg)(Safety\ Factor)}$$

Where:
10^6 = Conversion factor.
EL = Exposure limit of the contaminant of concern, e.g., its PEL, REL, or TLV in mg/m^3.

Conc. = Soil concentration for the contaminant of concern in mg/kg.

Safety Factor = A number between one and ten, used to account for the degree of confidence in the characterization data (a safety factor of ten would represent a poor degree of confidence).

The safety factor is based upon the following assumptions: 1) The concentration of the contaminant in the airborne dust is the same as its concentration in the soil; 2) The soil data depicts a representative worst-case scenario, and 3) The monitoring instrument used accurately measures the ambient concentration of particulate matter in the air.

d. Air-monitoring action levels must be developed which indicate when levels of protection (LOPs) will be upgraded/downgraded, exclusion zones expanded, or when the job will be shutdown. The rationale for how each action level was derived must also be provided.

e. Method of instrument calibration, including calibration standard.

f. Manner and frequency of field calibration checks.

g. The location(s), minimum number and frequency of air monitoring shall be specified.

7.1.2 The Contractor must discuss the frequency of air measurements and the tasks or locations to be monitored.

7.2 Personnel Air Sampling

The Contractor shall develop and implement a personnel air-sampling program during the project.

7.2.1 The sampling plan must include the sampling and action levels, rationale and methodologies.

7.2.2 Special considerations shall be given to intrusive or high-risk tasks and the potential for exposure to those performing such tasks.

7.2.3 The Contractor shall provide all necessary sampling devices, pumps, collection media, and support equipment to perform the sampling per the program. The sampling devices and pumps must be approved for use in combustible or flammable atmospheres.

7.2.4 The sampling devices, pumps, collection media, and any necessary support equipment shall be appropriately assembled into a sampling train, and each resultant sampling train shall be flow calibrated as a complete system before and after each day's use against a primary standard.

7.2.5 The Contractor shall maintain a daily sampling record as part of the air-sampling program. The record must include, as a minimum, the following:

a. Name of person collecting sample.

b. Time sample was collected.

c. Collection date.

d. Sample identification number.

e. Location sampled.

f. Task sampled.

g. Duration of each sample collected.

h. Ambient temperature and humidity of sampling period.

i. Pre- and post- sampling train flow calibration.

j. Any pertinent comments.

7.2.6 The laboratory selected for sample analysis should be accredited by the American Industrial Hygiene Association for the analysis required. Sampling and analytical methods of NIOSH or OSHA must be used preferentially when such methods are available for the samples collected and all appropriate QA and QC provisions regarding sample collection, transport, and holding times must be followed.

7.3 Records Retention and Data Reporting

7.3.1 The Contractor shall retain all personnel exposure sampling results in accordance with the requirements set forth in 8 CCR 3204. The Contractor shall follow all other pertinent provisions of that regulation.

7.3.2 Upon request, the Contractor shall submit to the Owner, Engineer and DTSC, in writing, the analytical results from any area and personnel samples collected within 30 working days of the collection of each sample. Sample flow rates in liters per minute (lpm) and sampling periods in minutes for each sample collected must be reported with the analytical results. Sample locations or tasks and identification numbers shall also be reported.

7.3.3 The Contractor shall maintain a daily air-monitoring log and include, as a minimum, the following information:

a. Monitoring date

b. Location and/or task monitored

c. Wind speed, ambient temperature and humidity

d. Instrument used and settings

e. Instrument readings

f. Pertinent comments or information

g. Instrument calibration checks.

h. Identification of equipment changes during the work shift.

i. Rationale for any equipment changes throughout the work shift.

7.3.4 If requested, the Contractor shall report verbally all data resulting from daily air monitoring to the Owner, Engineer and on-site DTSC representative, at a minimum, at the end of the work period. If at any time the instrumentation indicates an adverse change in conditions, the Health and Safety Coordinator must notify the Owner, Engineer and DTSC representative immediately and follow-up this reporting in writing by the close of business on that day.

8. Site control measures in accordance with the site control program required by 8 CCR 5192(d) (Site Control):

8.1 The Contractor shall be responsible for conducting operations at the work area in such a controlled fashion as to reduce the possibility of contact with any contaminants present and to prevent the spread of contaminants by personnel or equipment leaving the work area.

8.2 As needed, the Contractor shall delineate work zones in which specific operations or tasks will occur and shall institute specific site and work area entry and decontamination procedures at designated control points. Three (3) work zones may need to be established to perform this work. An exclusion/ contamination zone, a contamination/reduction zone and a support/clean zone. A map or diagram showing the proposed work zones and a description of the work area control plan may be included in the HASP. It is understood that the final location of these zones will be determined by actual site conditions.

8.3 The Contractor shall include any standard operating procedures pertaining to site control in the HASP and shall incorporate plans for routine and emergency communications appropriate for the site and project.

8.4 The Contractor shall also maintain a daily visitor log. This log can include:

a. Personnel visiting the work area

b. Affiliation

c. Date

d. Arrival time

e. Departure time

f. Purpose of visit

9. Decontamination procedures in accordance with 8 CCR 5192(k) (Decontamination)

9.1 Personnel and Equipment Requirements

All personnel and equipment exiting the Exclusion/Contamination zone must be decontaminated prior to entering the Support/Clean zone. The Contractor's decontamination activities shall be compliant with facility decontamination procedures. This decontamination must be performed in order to prevent contamination from being transferred into clean areas and contaminating or exposing unprotected personnel. Decontamination procedures shall be monitored by the Health and Safety Coordinator to determine their effectiveness.

9.1.1 The Contractor shall develop and implement personnel and equipment decontamination procedures appropriate for the site and include those procedures into the site HASP. The procedures shall include the necessary equipment and number of steps to achieve the objective, provisions for any personnel protection, and a diagram outlining the steps or stations in the procedures.

9.1.2 The procedures must ensure adequate containment and removal of any decontamination solutions and spent disposable protective apparel.

9.1.3 Provisions shall be made to facilitate personal hygiene at breaks and following daily operations.

10. An emergency response plan meeting the requirements of 8 CCR 5192(l) (Emergency Response by Employees at Uncontrolled Hazardous Waste Sites), for safe and effective responses to emergencies, including the necessary PPE and other equipment.

10.1 Emergency Response Plan

10.1.1 The Contractor shall develop and implement an emergency response plan (ERP) to handle anticipated on-site emergencies prior to the start of site operations. The ERP shall be incorporated into the site HASP as a separate section of that document and shall be periodically reviewed and, as necessary, amended to keep it current with new or changing site conditions or information.

10.1.2 The ERP shall address, as a minimum, the following:

a. Pre-planning of site operations to prevent emergencies.

b. Personnel roles and lines of authority and communication.

c. Key person at the site authorized and responsible for implementing the plan.

d. Emergency recognition and control measures.

e. Evacuation routes and procedures.

f. Safe distances and places of refuge.

g. Emergency security and site control measures.

h. Decontamination.

i. Emergency medical treatment and first aid.

j. Emergency alerting and response procedures.

k. Site communications.

l. Site diagram showing general layout, work zones, and prevailing weather conditions.

m. Procedures for reporting incidents to pertinent local, state, and federal agencies.

n. A list of emergency contacts including the name, location, telephone number and route of the nearest medical facility that will provide emergency medical services if needed.

o. Measures to review and follow up on site responses.

p. Emergency and personal protective equipment kept at the site for emergencies.

q. Describe the onsite means of contacting emergency services (cellular telephone, telephone, radio, etc.).

r. Procedures for post-emergency measures including storage, treatment and disposal of hazardous substances, and emergency equipment maintenance, and documentation of emergency events.

10.2 Local Emergency Contacts

10.2.1 Prior to the start of site operations, the Contractor shall attend any and all meetings necessary with local officials and/or those responsible for local emergency management and public safety (to include fire, police, and local health officials) for the purpose of coordinating the site-specific ERP with any emergency response efforts that would be performed by such agencies.

10.2.2 The Contractor shall contact the local medical facility selected for inclusion into the ERP to ensure that said facility is willing and is capable of providing the medical support necessary to satisfy those anticipated hazards and emergencies detailed in the ERP.

10.2.3 Provide a map and narrative describing the route to the newest emergency medical facility. Include a map identifying areas of safe refuge and places of assembly.

10.2.4 Provide a plan for emergency decontamination of injured workers.

11. Confined space entry procedures (8 CCR, Article 108, Confined Spaces)

All confined operations must be performed in accordance with facility procedures and the requirements of 8 CCR, Article 108, Confined Spaces. In the event that site activities will include the entry of permit-required confined spaces [as defined in 8 CCR 5157(b)], the following provisions will apply:

1) The employer must have a written confined space entry program;
2) A formalized permit system must be utilized to affect entry into permit-required confined spaces;
3) A dedicated entry permit must be completed for each space in accordance with the requirements of 8 CCR 5157(f);
4) Only individuals trained in confined space entry per 8 CCR 5157(g) shall be allowed to participate in such activities;
5) Authorized entrants, attendants, and entry supervisors shall understand the hazards posed to them and their responsibilities per 8 CCR 5157(h), (I), and (j), respectively;
6) Rescue and emergency service provisions shall be discussed in accordance with 8 CCR 5157(k).

12. A spill containment program in compliance with 8 CCR 5192(j) (Handling Drums and Containers)

12.1 Spill Containment Program

The Contractor shall establish and implement a spill containment program to isolate and contain the entire volume of any hazardous substances that

may spill during transfer from one container to another. A spill containment plan shall be incorporated into the HASP as a separate section of that document.

The spill containment program must meet the requirements of 8 CCR 5192(j).

12.2 It is important to note that specific requirements apply to handling, working around and opening drums and containers. Additional specific requirements apply to activities associated with laboratory waste packs. Contractors are referred to 8 CCR 5192(j) for a comprehensive discussion of these requirements.

13. Procedures for providing potable water and sanitary facilities to site personnel in accordance with 8 CCR 5192(n) and Sanitation at Temporary Workplaces

Describe the provisions that will be made to ensure proper sanitation facilities are available for site personnel.

Include provisions for:

13.1 Adequate washing facilities such as soap, water, towels and where appropriate showers.

13.2 Toilets and other sanitary facilities in numbers which will reasonably handle the projected number of project personnel.

13.3 Adequate stocks of potable water, provided in sanitary containers.

14. Safe drum and container handling procedures in accordance with 8 CCR 5192(j) (Handling Drums and Containers)

15. Procedures to verify that adequate illumination is afforded site personnel in accordance with 8 CCR 5192(n): A discussion of how minimum illumination shall be provided for site personnel must be included in accordance with the requirements of 8 CCR 5192(m). If all planned field activities are to be conducted during daylight hours and not within any structures at the site, please state as such.

16. Procedures for Preventing Accidents due to Proximity to Overhead Lines: If equipment such as drill rigs and backhoes/excavators are to be used during site activities, a discussion of overhead utility lines must be included within the HASP. This discussion must address how minimum safe distances specified within 8 CCR 2946, Table 2, will be maintained.

17. Underground Installations: 8 CCR 1541 requires that the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installation that reasonably may be expected to be encountered during excavation work, be determined prior to opening an excavation.

    Underground Services Alert (USA) must be advised a minimum of two working days prior to the initiation of any sub-surface work.

18. Excavation and Trenching Activities: All trenching and excavation activities must be completed in accordance with the provisions of 8 CCR, Article 6 (Excavations) of the Construction Safety Orders. A detailed discussion of how such activities will be conducted in a safe manner must be addressed within the HASP.

19. Emergency Eyewash and Shower Equipment: A discussion of how emergency eyewashes and/or showers shall be provided to site personnel must be included if site activities include the possibility of an employee's eyes or body coming into contact with a substance which can cause corrosion, severe irritation, or permanent tissue damage or which is toxic by absorption. All such equipment must meet the requirements of ANSI Z358.1-1981 incorporated into 8 CCR 5162 by reference.

20. Reporting: The Contractor shall prepare a daily safety log, including personnel air monitoring results, and a closeout safety report at the completion of construction.

The Contractor shall provide the Engineer with three (3) copies of the draft and final version of the Health and Safety Plan accompanied by a transmittal letter signed and dated by the Contractor and the Health and Safety Coordinator within 14 days of contract award. All work area personnel and visitors shall be required to read and sign the approved Health and Safety Plan.

A hard copy of the Health and Safety Plan shall be kept at the work area at all times.

2.3 Monitoring Equipment

The Contractor shall provide all medical and environmental monitoring equipment to be used at the work area. The Contractor shall maintain a photo-ionization detector (PID) or flame ionization detector (FID) at the work area at all times. This equipment shall meet the approval of DTSC, the Owner and the Engineer and be fully functional when use of the equipment is necessary.

2.4 Personal Protective Equipment

The Contractor shall supply all personal protective equipment (PPE) necessary to be in compliance with the Health and Safety Plan for all work area personnel including the Contractor, the Owner, the Engineer, regulatory officials and visitors. PPE shall include, but not be limited

to, cotton coveralls or Tyvek coveralls, gloves, booties, hard hats, and eye protection. Respirators, supplied air systems and sealing tape shall be included if required by project conditions. PPE shall be Level C (respirator, cotton coveralls, booties, hard hat, safety glasses and steel toe boots) for all personnel, including visitors, within the work area enclosure discussed in the Interim Measures Work Plan. South of the railroad tracks, PPE shall be Level D outside of the enclosure. North of the railroad tracks, PPE shall be Level C outside of the enclosure. The Contractor is responsible for daily washing and drying of cotton coveralls, including applicable utilities.

PART 3: EXECUTION

3.1 Submission of Plan

Upon receipt of the Notice of Contract Award, the Contractor shall submit the Health and Safety Plan to the Engineer and Owner within seven (7) days of the date of contract award. The Plan shall be signed and dated by the Contractor and by the Contractor's Health and Safety Coordinator.

The Engineer, Owner and DTSC will review the Health and Safety Plan and will transmit comments to the Contractor. It will be the responsibility of the Contractor to incorporate comments into the Health and Safety Plan. The Contractor will not be permitted to initiate work until the comments have been addressed and the Final Plan has been submitted and accepted. The comments on the Health and Safety Plan shall be relative to the Plan's compliance with the requirements of this Specification and existing facility rules and regulations and does not imply that all procedures are suitable for the required work. Suitability of the Plan for the work is the responsibility of the Contractor.

3.2 Implementation of Plan

Once the Health and Safety Plan has been finalized and accepted, requirements of the Health and Safety Plan shall be enforced.

The Contractor must provide an on-site Health and Safety Coordinator during all activities, appropriately trained and certified for supervisory responsibility in health and safety protection. An alternate Health and Safety Coordinator, with equal training, must be designated to serve when the Health and Safety Coordinator is not on-site. The Health and Safety Coordinator or alternate shall be on-site at all times when work is in progress, including during work by sub-contractors. The Health and Safety Coordinator shall serve no other major work activities nor hold any other major job title (i.e., the Health and Safety Coordinator shall not also be the QC Manager, Site Superintendent, Foreman, or Operator, for example).

It shall be the responsibility of the Contractor's Health and Safety Coordinator to ensure that all health and safety requirements are implemented per the Final Health and Safety Plan. The Coordinator will have control over the safe execution of the Contract while in progress. Should for any reason it be determined that the working conditions are unsafe, the Coordinator, at his/her discretion, can terminate the work. The Coordinator is in charge of personnel decontamination and emergency response measures. The Coordinator can evacuate the work

area if necessary. The Coordinator will evaluate monitoring data and make field decisions regarding safety and health.

The Health and Safety Coordinator will have the authority to implement the Health and Safety Plan, to act on all health and safety issues and matters, and to establish new controls, procedures or facilities as needed. If the Owner determines that the Contractor's Health and Safety Coordinator is not providing adequate health and safety controls, the Contractor shall provide alternate personnel subject to the approval of the Owner to serve as Health and Safety Coordinator.

3.3 Air Monitoring

Procedures for ambient air monitoring shall be as indicated in the Interim Measures Work Plan. Deviations from the Interim Measures Work Plan will not be allowed, unless written approval is provided by the Owner, Engineer, and DTSC.

3.4 Health and Safety Training

All personnel within the exclusion zone shall have 40-hour OSHA training compliant with 29 CFR 1910.120 and with current 8-hour refresher. This requirement applies to all personnel.

PART 4: MEASUREMENT AND PAYMENT

4.1 Measurement

The development and implementation of the Health and Safety Program shall not be measured.

4.2 Payment

All costs associated with development and implementation of the Health and Safety Program, including but not limited to plan preparation, full-time Health and Safety Officer, testing, analysis and PPE, shall be included in the Contractor’s bid and shall not be paid for on a per unit basis.

END OF SECTION

SECTION 02751

PIPE LEAK DETECTION SYSTEM

PART 1: GENERAL

1.1 Description

The work covered by this section includes installation of the leak detection system surrounding the storm water pipes. This includes manufacture, fabrication, packaging, delivery, testing and installation of all components, specifically the single-sided geocomposite comprised of geotextile/geonet.

1.2 Submittals

The Contractor shall submit Manufacturer's specifications and physical property information for the composite drainage layer (geocomposite) to the Engineer for approval.

PART 2: PRODUCTS

2.1 Geonet

The geonet shall be a high density polyethylene (HDPE) material with intersecting material strands creating a three dimensional structure which supports planar water flow. The geonet shall conform to the following requirements or the manufacturers' minimum published values, whichever is more restrictive:

Properties	Test Method	Required Value
Transmissivity (M^2/S), min.	ASTM D4716 i = 0.03 2000 psf	2×10^{-3}
Tensile Strength (lb/in), min.	ASTM D1682 or D4595	45

The minimum transmissivity for the geocomposite shall be 1.0×10^{-4} m^2/sec.

2.2 Geotextile

The geocomposite shall be a single sided geotextile/geonet composite. The geotextile bonded to the geonet shall be a non-woven material conforming to the following requirements. Geotextile shall be heat bonded to the geonet and extend a minimum distance of 6-inches beyond the geonet on both sides.

Properties	Test Method	Required Value
Grab Strength (lbs.), min.	ASTM D4632	160
Puncture Strength (lbs.), min.	ASTM D4833	95
Tear Strength (lbs.), min.	ASTM D4533	65
Mass per Unit Area (oz/sy), min.	ASTM D3776	6
Apparent Opening (US sieve No.)	ASTM D4751	70
Ply Adhesion (lbs/in)	ASTM D413	1.0

PART 3: EXECUTION

3.1 General

The work shall be coordinated with placement of the HDPE Drainage Pipe and may be conducted either inside the trench or outside the trench prior to placement of the pipe in the trench.

Geocomposite rolls delivered to the project site shall be stored in their original, unopened wrapping in a dry area and protected from precipitation and the direct heat of the sun, especially when stored for a long period of time. The materials shall be stored above the ground surface and beneath a roof or other protective covering. Rolls of geocomposite may be stored on-site for a maximum of 6 months prior to use. Rolls delivered to the Site greater than 6 months before use will be rejected

3.3 Geocomposite Leak Detection Layer

3.3.1 Placement and Connections

The Contractor shall keep the composite leak detection layer clean and free from debris. The geocomposite shall first be cut to the length of the pipe run and to the width of the pipe circumference plus 12 inches. The geonet shall be cut back 6 inches if the geotextile does not extend 6 inches past the geotextile on one side.

After the pipe is butt fuse welded for the full length of the pipe run, the pipe shall be laid on the geocomposite and the geocomposite wrapped around the pipe with the geotextile side out and connected as specified. The geocomposite shall be overlapped at least 6-inches and secured by plastic ties approximately every three (3) feet along the pipe length. Plastic ties shall be white or another bright color for easy inspection. Metallic ties shall not be allowed. The heads of the ties must fit completely into the geonet channel space so that the head of the tie does not intrude into

or against the HDPE pipe. The geotextile layers shall be lystered together after the geocomposite is connected and accepted by the Engineer.

At the inlet structures, the leak detection layer shall extend through the protruding PVC sleeve and terminate inside the pre-cast concrete inlet box as shown on the Drawings.

For the connection with the trench drain, the 6-inch wide geocomposite strip underlying the trench drain shall extend past the trench drain by at least six (6) inches and overlap into the leak detection layer surrounding the HDPE pipe section. The overlapping geonets shall be tied with white plastic ties and the head fit within the geonet. The geotextile layers shall be lystered together after the geonets are connected and accepted by the Engineer.

3.3.2 Repair

The leak detection layer will be reviewed by the Engineer prior to the placement of the EPDM secondary containment layer. Patching of the geocomposite shall be used to repair holes, tears, and defects. Patches shall provide 6" of overlap around the repaired area and shall be held in place with plastic ties. The leak detection layer shall be removed and replaced if areas with large defects are observed.

END OF SECTION

SECTION 02755

EPDM SECONDARY CONTAINMENT LAYER FOR PIPES

PART 1: GENERAL

1.1 Description

The work covered by this section includes furnishing the materials, equipment, labor and expertise required to supply, fabricate and install 60-mil non-reinforced, dusted ethylene propylene diene terpolymer (EPDM) geomembrane as secondary containment for the HDPE storm sewer pipes and concrete trench drains.

1.2 Submittals

The Contractor shall submit Manufacturer's Specifications and physical property information for the EPDM geomembrane to the Engineer for approval. The Contractor shall also submit the specifications for the Manufacturer's recommended adhesive strips for sealing seams and flashing to the Engineer and the proposed adhesive for fastening the geomembrane to the concrete trench drains.

1.3 Product Handling

Transportation, handling, off-loading, and storage of the geomembrane shall be the responsibility of the Contractor. The Contractor shall provide all necessary equipment and assure that personnel are properly trained for handling of the geomembrane. The Contractor shall be responsible for replacing any damaged or unacceptable material and removing defective material from the Site at no cost to the Owner.

Geomembrane rolls shall be stored in their original, unopened wrapping in a dry area which provides protection from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or any other damage. Rolls shall be stored not more than 3 high and on a prepared surface. The materials shall be stored above the ground surface and beneath a roof or other protective covering. Seriously damaged rolls, as determined by the Engineer, shall be rejected. Geomembrane rolls may be stored on-site for a maximum of 6 months prior to use. Rolls delivered to the Site greater than 6 months before use will be rejected

The geomembrane shall not be folded. Folded material shall be rejected.

PART 2: PRODUCTS

2.1 EPDM Raw Material

The EPDM geomembrane shall be produced from raw materials with no more than 3% post-consumer recycled material, and shall meet the requirements of ASTM D4637 for Type I non-reinforced EPDM single-ply roofing membranes.

2.2 EPDM Geomembrane Rolls

The geomembrane used at the Site in the cap shall be 60 mil dusted, non-reinforced EPDM. EPDM rolls shall meet the following requirements:

A. Condition: The geomembrane surface shall not have striations, roughness, pinholes, bubbles, staple marks, folds, or any other damage.

B. Properties: The geomembrane, as delivered to the Site, shall meet the following physical and index property requirements or the manufacturer's published minimum average roll values, whichever is more restrictive. Adherence to this requirement shall be made a condition of the material purchase order:

Required Material Properties of EPDM

Properties	Test Method	60 mil
Tolerance on Nominal Thickness, %	ASTM D412	10
Weight (kg/m^2), min.		1.9
Tensile Strength, psi	ASTM D412	1600
Elongation, ultimate min.	ASTM D412	465
Tear Strength (lbf/in), min.	ASTM D624 (Die C)	200

PART 3: EXECUTION

3.1 General

The 60-mil EPDM geomembrane shall be installed around the welded HDPE pipe and geocomposite leak detection system to provide secondary containment. Similarly, the geomembrane shall be installed below the leak detection system and on the sides of the trench drain extending at least 3 inches into the adjoining concrete pavement section.

3.2 Preparation

The Engineer and the Contractor shall inspect the installed geocomposite prior to placement of the geomembrane and confirm that the geotextile layer is facing out and the surface is dry, smooth and free of protruding objects.

3.3 Geomembrane Placement

Geomembrane placement shall not proceed at an ambient temperature below 0 degrees C (32 degrees F) or above 40 degrees C (104 degrees F). Ambient temperature shall be measured approximately one (1) foot above the pipe. Follow manufacturer's recommended procedures if the temperature is less than 5 degrees C (40 degrees F). Placement shall not be performed during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds. The Engineer shall be the sole judge as to whether or not placement conditions are acceptable.

Geomembrane Handling - The Contractor shall assure the following during placement:

1. Any equipment or tools used shall not damage the geomembrane by handling, trafficking, leakage of hydrocarbons, or other means.
2. The method used to unroll the geomembrane shall not cause scratches, crimps, cracks, or breaks in the geomembrane.

3.3.1 Geomembrane Placement on the Pipe

For the pipe, the installation may take place either inside or outside the trench. The geomembrane shall be laid on the ground lengthwise on top of the protective geotextile and cut to a width equal to the circumference of the geonet-wrapped pipe plus four (4) inches. The geomembrane shall be of sufficient length that seaming is not required over the length of the pipe run. The geonet-wrapped fused HDPE pipe shall be placed on the geomembrane and the geomembrane wrapped with at least three (3) inches of overlap. The geomembrane shall be sufficiently loose so that it can be placed on the outside of the PVC stub protruding from the inlet structures. The overlap shall be cleaned, primed and sealed following the manufacturer's instructions and using the manufacturer recommended adhesive seal strips. The overlap shall remain on top of the pipe at all times during installation of the pipe in the trench. The Contractor and the Engineer shall inspect the geomembrane wrap after sealing and note any areas where repair is required prior to installation of the geotextile wrap.

At the inlet boxes, the geonet-wrapped pipe shall be placed inside the PVC stub pipe and the EPDM membrane shall be placed on the outside of the stub pipe. A flashing strip shall be placed on top of the EPDM membrane and wrapped around the pipe following the manufacturer's instructions for installation of the flashing. Following installation of the protective geotextile as per Specification section 02759 and as shown on the drawings, a steel band clamp will be placed to attach the geotextile and EPDM geomembrane to the PVC pipe stub.

3.3.2 Installation at the Trench Drains

After excavation and preparation of the base and sidewalls for the trench drain as per Specification Section 312000, the Contractor and the Engineer shall inspect the subgrade to determine whether it is suitable for placement of the geomembrane. The subgrade shall be dry, smooth and without protruding objects or angular stones larger than ¾". A protective geotextile shall be used if the subgrade cannot be made sufficiently smooth to avoid puncture of the geomembrane when the trench drain is placed on it. The geomembrane shall be placed in the trench lengthwise with sufficient width that the geomembrane extends six (6) inches beyond both sides of the trench without longitudinal seaming. The geomembrane shall be placed such that it is in continuous contact with the subgrade without bridging or folds. The geomembrane shall not be placed in tension. The Contractor and the Engineer shall inspect the geomembrane for damage and note any areas requiring repair before proceeding with installation of the leak detection system and trench drain. Seams in the geomembrane should be avoided. The geomembrane shall extend at least two feet beyond the length of the trench drain to allow for sealing of the ends of the trench drain. If any seams are required to achieve the full length of the trench drain, the geomembrane shall be overlapped a minimum of six (6) inches with the top geomembrane in the overlap being the upgradient panel and sealed in accordance with the manufacturer's instructions.

Following installation of the geocomposite leak detection layer below the trench drain as shown on the Drawings and placement of the trench drain within the trench as specified in Section 312700, the geomembrane shall be adhered firmly to the sides of the aluminum drain slot following the geomembrane manufacturer's instructions. The geomembrane shall be terminated three (3) inches below the final top of pavement. If a protective geotextile was used between the geomembrane and the subgrade, excess material shall be cut after backfilling to the pavement subgrade at the level of the pavement subgrade taking care not to cut the geomembrane.

At the upgradient end of the trench drain, the geomembrane shall be wrapped over the end caps and sealed with adhesive strips in accordance with the manufacturer's instruction. At the downgradient end of the trench drain, the geomembrane shall be cut such that the geomembrane may be wrapped across the end cap for the drain slot and sealed with adhesive strip(s). The remaining geomembrane shall be wrapped around the pipe and sealed as per Section 3.3.1 of this Specification after the trench drain pipe has been attached to the HDPE pipe and the trench drain's geocomposite leak detection layer tied into the HDPE pipe's leak detection layer. Flashing shall be installed in accordance with the manufacturer's instruction where the geomembrane has been cut at the end of the drain slot. The HDPE pipe with geocomposite leak detection layer and EPDM shall be connected to the inlet structure as per Section 3.3.1 of this Specification.

3.3.3 Repair Procedures for the Geomembrane

Repair procedures are as follows:

1. Defective seams shall be repaired by reseaming or applying a cap strip.

2. Tears or holes shall be repaired by patching.
3. Cap strips shall be at least six (6) inches wide and must be centered over the repair location. Cap strips shall be of the same material as the geomembrane.
4. Patches shall be round or oval in shape, made of the same materials as the geomembrane, and extend a minimum of six (6) inches beyond all edges of the defect. Patches shall be applied following the manufacturer's instructions and sealed using the approved adhesive strips
5. Repairs shall be numbered and logged by the Contactor and Engineer. Logging shall include repair type, location, date of repair and evaluation of the quality of the repair.

END OF SECTION

SECTION 02759

PROTECTIVE GEOTEXTILE

PART 1: GENERAL

1.1 Description

The work covered by this section includes installation of the protective geotextile layer for the double-lined storm sewer pipe. Protective geotextile may be required for the trench drain construction as well depending on the subgrade condition. This includes manufacture, fabrication, packaging, delivery, testing and installation of all components.

1.2 Submittals

The Contractor shall submit Manufacturer's specifications and physical property information for the geotextile to the Engineer for approval.

PART 2: PRODUCTS

2.1 Geotextile

Geotextile shall be non-woven and shall meet the following requirements:

Properties	Test Method	Required Value
Grab Strength (lbs.), min.	ASTM D4632	270
Puncture Strength (lbs.), min.	ASTM D4833	165
Tear Strength (lbs.), min.	ASTM D4533	100
Mass per Unit Area (oz/sy), min.	ASTM D3776	10
Apparent Opening (US sieve No.), min.	ASTM D4751	100

PART 3: EXECUTION

3.1 General

The geotextile rolls delivered to the project site shall be stored in their original, unopened wrapping in a dry area and protected from precipitation and the direct heat of the sun, especially when stored for a long period of time. The materials shall be stored above the ground surface and beneath a roof or other protective covering. Geotextile may be stored on-site for a maximum of 6 months prior to use. Rolls delivered to the Site greater than 6 months before use will be rejected

3.2 Placement

3.2.1 Storm Sewer Pipe

The Contractor shall keep the geotextile clean and free from debris. Soils and debris shall be cleaned by the Contractor just prior to installation, as determined by the Engineer. The Contractor shall handle all rolls in a manner to ensure they are not damaged in any way. To prevent folds and wrinkles, tension should be kept on the materials when being deployed. The installation of the geotextile wrap on the pipes may occur either inside or outside the trench.

The geotextile shall be laid on the ground lengthwise and cut to a width equal to the circumference of the geomembrane/geonet-wrapped pipe plus six (6) inches. The geotextile shall be of sufficient length such that seaming is not required over the length of the pipe run. The geomembrane/geonet-wrapped fused HDPE pipe shall be placed on the geotextile and the geotextile wrapped with at least four (4) inches of overlap. The geotextile shall be sufficiently loose so that it can be placed on the outside of the PVC stub protruding from the inlet structures. The overlap shall be sewn or lystered as approved by the Engineer following the manufacturer's instructions. The overlap seam shall remain on top of the pipe at all times during installation of the pipe in the trench.

At the inlet boxes, the geotextile shall be placed on the outside of the stub pipe over the EPDM membrane with flashing strip. A steel band clamp shall be placed and tightened to attach the geotextile and EPDM geomembrane to the PVC pipe stub.

3.2.2 Trench Drain

If protective geotextile is required due to rough subgrade conditions, the geotextile shall be placed lengthwise in the trench with sufficient width such that the geotextile extends at least six (6) inches beyond the trench on both sides without longitudinal seaming. The geotextile shall be in firm contact with the subgrade without folds or bridging. Overlaps and seaming should be avoided. If the geotextile does not have sufficient length, the geotextile sections shall be overlapped a minimum of 18 inches with the top section being the upgradient section. Sewing or lystering is not required with a minimum of 18 inches of overlap.

3.2.3 Repair

Patching of the geotextile shall be used to repair holes, tears, and defects. Patches shall provide 6" of overlap around the repaired area and shall be held in place by lystering. Geotextile shall be removed if areas with large defects are observed. The Engineer shall determine the acceptability of the geotextile and any repairs.

END OF SECTION

SECTION 312000
EARTH MOVING

PART 1: GENERAL

1.1 Summary

A. Section Includes:

1. Preparing subgrades for pavements.
2. Excavating and backfilling for structures.
3. Subbase course for paving.
4. Excavating and backfilling for utility trenches.

1.2 Definitions

A. Satisfactory Fill Material: Clean, inorganic subsoils which are readily compactable and free from debris, roots, topsoil, frozen or organic material and rock larger than one-half (1/2) cubic foot. Fill Material shall be tested and approved by the Engineer for degree of compaction required by its intended use.

B. Unsuitable Fill Materials: Soil materials not capable of being compacted to density required, or soils containing rock material larger than one-half (1/2) cubic foot, debris, organic or frozen material, soils with moisture content beyond the limits noted in this Section, and materials not approved by the Engineer.

C. Load Bearing Fill: Load bearing fill is controlled fill constructed to support utilities, pavements, slopes, buildings or any structural elements which instability thereof would impart the intended usage. All fills placed under this Section and trench backfill work are considered load bearing fills.

D. Base Course: Aggregate layer placed between the subbase course and paving.

E. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

F. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

H. Structures: Slabs, manholes, inlet boxes, pipes, trench drains, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and a cement concrete pavement.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 Quality Assurance

A. Codes and Standards: The Contractor shall perform excavation work in compliance with the applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Services: The Engineer will perform soil testing and inspection services for quality control testing during earthwork operations.

1.4 Project Conditions

A. The Contractor shall verify existing grades, utility locations and elevations. The Contractor shall provide all surveying for grading and utilities, and appurtenances. If existing grades and utilities are at variance with drawings, the Contractor shall notify the Engineer and receive instructions prior to proceeding. The Contractor shall be responsible for the accuracy of his work and layout of all line and grade control for all earthwork construction.

B. Existing Utilities:

1. Prior to commencing any excavation whatsoever, the Contractor shall notify all utility companies having lines in the local project area by contacting Underground Service Alert. The Contractor shall engage the services of a competent utility locating service to field determine locations of existing private services. Contractor shall request that each utility, public or private, physically locate all of their respective lines occurring within the project site. Project site shall include lines to, taps at individual services, and utility mains located adjacent to the site. Locate existing underground utilities in area of work. If utilities are to remain in place, the Contractor is to provide adequate means of protection during the earthwork operations. All underground services are to be marked so as to be readily visible to the workmen. Markings are to be maintained by the Contractor through all phases of construction.
2. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, the Contractor shall consult with utility

owner immediately for directions, and advise both the Owner and the Engineer. The Contractor will cooperate with the Owner and utility companies in keeping respective services and facilities in operation, and repair any damaged utilities to the satisfaction of the utility owner, at no cost to the Owner.

3. The Contractor will not interrupt existing utilities serving facilities occupied and used by the Owner and others, except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.
4. The Contractor shall demolish and completely remove from the site existing underground utilities indicated to be removed; and shall coordinate with the utility companies for shut off of services if lines are active.

C. Use of Explosives: The use of explosives is **NOT** permitted.

D. It is understood the limits of work defined by the plans and specifications are to be followed, and no deviations are to be made without the consent of the Owner or Engineer.

E. The Contractor shall provide a water truck for dust control and shall cooperate with the Owner, state and local regulatory agencies, and the Engineer in the control of dust.

F. The Contractor shall be responsible for balancing the project earthwork quantities, including stockpiling on-site any excess material as directed by the Owner or Engineer for either possible re-use or for off-site disposal and importing any necessary fill material.

G. Protection:

1. Protect benchmarks and monuments; if disturbed or destroyed, the Contractor must pay to replace them at their original position.
2. Protect existing facilities and adjacent property. Prevent ponding or washing of water on the site and on adjacent property. Erect erosion and sedimentation control devices.
3. Protect areas outside the limits of construction from encroachment by construction personnel or equipment, regardless of property ownership. Access shall be by specific, written permission of the Owners.
4. Protect persons and property by barricading open excavations occurring as part of this work and post with warning lights.
5. In all aspects of construction including other sections of these specifications, the Contractor shall comply with prevailing regulations of the Federal Occupational Safety Hazard Act (OSHA) and Cal/OSHA in the performance, safety and protection of all construction.

    i. Sheeting and bracing shall be used as required for the safety of the work, other structures, the public and the Contractor's employees.

Sheeting and bracing shall be adequate and conform to the current regulations and rules of Cal/OSHA. These requirements are minimum requirements and additional sheeting and bracing may be required by the Owner or Engineer to suit field conditions. Any additional sheeting or bracing required shall not represent additional cost to the contract.

ii. The Contractor shall be responsible for the removal of the sheeting as the work progresses. All sheeting shall be arranged so that it may be withdrawn as the trenches are backfilled, without injury to the pipe and its appurtenances, and without injury to, or settlement of, adjacent structure and pavement. All voids created by withdrawal shall be immediately filled with sand or other satisfactory material and compacted by ramming or other methods satisfactory to the Engineer.

iii. The Contractor shall be responsible at all times for carrying out all excavation operations in a safe and prudent manner to protect all workmen and the public from unreasonable hazard.

iv. All utility installations outside of properly fenced construction areas shall be backfilled or plated with heavy duty (H20 loading) steel plates, during and at the end of the day. Plating shall be properly secured to prevent shifting by vehicles.

PART 2: PRODUCTS

2.1 Soil Materials

A. Load Bearing (Structural) Fill: Load bearing fill shall be used for support of pavements, manholes, inlets, trench drains and pipes. Load bearing fill shall consist of readily compactable on site soils which are free of trash, topsoil, ice, organic or frozen material and have been approved by the Engineer and DTSC for re-use. The moisture content of the load bearing fill shall be controlled to within 5 percent of the optimum moisture content by wetting, aeration or blending.

B. Imported Fill: If necessary, imported fill shall consist of predominantly granular, well graded soils with a maximum particle size of six (6) inches and less than forty (40) percent finer than the No. 200 sieve. The imported fill material shall be non-plastic. The moisture content of the imported fill shall be within five (5) percent of the optimum moisture content. The material shall be tested to determine compliance with the DTSC Information Advisory prior to being brought to the Site.

C. Site Fill: General site grading fill for non-load bearing areas, such as grass areas, shall consist of satisfactory soil fill material from excavations or off site borrow areas.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least ninety (90) percent passing a one and one half (1-1/2) inch sieve and not more than twelve (12) percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least ninety five (95) percent passing a one and one half (1-1/2) inch sieve and not more than eight (8) percent passing a No. 200 sieve.

PART 3: EXECUTION

3.1 Preparation

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 Excavation For Utility Trenches

A. Excavate trenches to indicated gradients, lines, depths, and elevations as provided by the Engineer.

B. Excavate trenches to the depth and dimensions provided by the Engineer. If the trench has been over-excavated at the direction of the Engineer, backfill the trench to the elevation shown on the pipe profile.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes. Remove projecting stones and sharp objects along trench subgrade.

3.3 Subgrade Inspection

A. Proof-roll subgrade below the pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without

3.4 Unauthorized Excavation

A. Unauthorized excavation consists of the removal of materials beyond the indicated subgrade elevations or dimensions without specific direction of the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.

Backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Engineer.

3.5 Storage of Soil Materials

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing as directed by the Owner or Engineer. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.6 Utility Trench Backfill

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Place and compact initial backfill of subbase material, free of particles larger than one (1) inch in any dimension, to a height of twelve (12) inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.7 Stability of Excavations

A. Slope sides of excavations to comply with the local codes and ordinances having jurisdiction. Shore and brace sides where sloping is not possible because of space restrictions or instability of the in-place material.

B. All excavations over four (4) feet deep shall be sloped, shored, sheeted, braced, or otherwise supported in accordance with OSHA regulations. When soil conditions are unstable, excavations less than four (4) feet deep also must be sloped,

supported or shored. The following minimum temporary slope criteria shall be adjusted as field conditions dictate:

1. Residual Soil and Fill: Maximum cut slope of forty five (45) degrees (1:1).
2. Decomposed Rock: Maximum cut slope of forty five (45) degrees (1:1).
3. Intact Rock: Maximum vertical cut face of five (5) feet; and remaining cut on a maximum gradient of two (2) vertical to one (1) horizontal).

C. All sides and slopes of excavations shall be maintained in a safe condition until the completion of backfilling.

D. The Contractor must take all measures to protect existing facilities from damage during contract work. If necessary, the Contractor shall provide materials and installation for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces. All materials are to be in good serviceable condition.

3.8 Compaction of Soil Backfills and Fills

A. Place backfill and fill soil materials in layers not more than eight (8) inches in loose depth for material compacted by heavy compaction equipment, and not more than four (4) inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 6398:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top twelve (12) inches of existing subgrade and each layer of backfill or fill soil material at ninety eight (98) percent.
2. Under walkways, scarify and recompact top six (6) inches below subgrade and compact each layer of backfill or fill soil material at ninety five (95) percent.
3. For utility trenches, including stormwater pipe, compact each layer of initial and final backfill soil material at ninety five (95) percent.

3.9 Grading

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus one (1) inch.
2. Walks: Plus or minus one (1) inch.
3. Pavements: Plus or minus one half (1/2) inch.

3.10 Subbase and Base Courses under Pavements

A. Place subbase course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course under pavements and walks as follows:

1. Shape subbase course to required crown elevations and cross-slope grades.
2. Place subbase course that exceeds six (6) inches in compacted thickness in layers of equal thickness, with no compacted layer more than six (6) inches thick or less than three (3) inches thick.
3. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than ninety five (95) percent of maximum dry unit weight according to ASTM D 1557.

3.11 Field Quality Control

A. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

D. Contractor shall provide compaction test reports with the daily report submitted to the Engineer.

3.12 Protection

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.13 Disposal of Surplus and Waste Materials

A. Place excess soil and waste materials, including contaminated soil, slag, and debris, in the location(s) and in the manner designated by the Engineer or Owner.

END OF SECTION

SECTION 312700

STORM DRAINAGE SYSTEM

PART 1: GENERAL

1.1 Related Documents

A. All materials and construction procedures shall be in accordance with the California Department of Transportation and City of Vernon standards. The publications listed below form a part of this specification to the extent referenced. These publications are referred to in the text by basic designation and abbreviations only.

1. California Department of Transportation, CALTrans 2010 Standard Specifications manual

1.2 Description

A. This work consists of furnishing all plant, labor, equipment, appliances and materials and performing all operations in connection with the construction of storm sewers, roof drains, and furnishing all tests required, complete, in accordance with specifications, applicable drawings, and contract drawings and contract documents.

1.3 Inspection

A. Shop Inspection: All materials furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications.

B. Field Inspection: All pipe and appurtenances shall be furnished and installed and tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the QA/QC Representative.

C. Disposition of Defective Material: All material found during the progress of the work, either before or after installation, to have cracks, flaws or other defects will be rejected by the Site Engineer. All defective materials furnished by the Contractor shall be promptly removed by the Contractor from the site.

PART 2: PRODUCTS

2.1 Materials

A. Backfill Material: Backfill shall consist of excavated material and shall be free from cinders, ashes, refuse, vegetable, or inorganic materials, boulders, rocks, stone or other material which, in the opinion of the Site Engineer, is unsuitable.

Backfill material shall conform to the requirements established under 312700-Earth Moving

B. Crushed Stone Backfill: Crushed stone backfill shall consist of material, obtained from crushing sound limestone or other rock and shall be free from excessive amounts of clay and other undesirable materials. All materials shall conform to California Department of Transportation, CALTrans 2010 Standard Specifications manual

C. Smooth Wall HDPE DR Pipe:

1. General: HDPE pipe, which does not conform to ASTM D3350, ASTM D 4976, ASTM F667, ASTM F894, ASTM F2306, or ASTM F2562 or to any other requirement specified herein, shall not be approved for installation.
2. Allowable ASTM Specifications: All material, manufacturing operations, testing, inspection, and making of HDPE pipe shall conform to the requirements of the appropriate allowable ASTM Standard Specifications, latest revision thereof, listed in Article References.
3. Wall thickness shall be as noted on the Drawings.

D. Trench Drain: Trench drains shall be corrugated polyethylene piping with smoothwall interior and modified to receive a variable height trench as shown on the Drawings.

E. Inlets: Unless otherwise specified, all materials and labor shall be in accordance with the California Department of Transportation, CALTrans 2010 Standard Specifications manual

F. Diameter of Pipe: The diameter indicated on the Drawings shall mean the inside diameter of the pipe, unless specifically noted on the Drawings.

G. Pipe and fittings shall be made of high-density, high-molecular weight polyethylene material meeting the requirements of cell classification 324420C or higher in accordance with ASTM D3350.

H. Fittings and Specials:

1. Elbows and fittings shall be mitered from pipe sections welded together on the interior and exterior at all junctions.
2. The pipe sections forming the miters shall be cut to fit with no gap.
3. Tolerances on the angle of all elbows shall be plus or minus 1 degree.
4. Flanged and mechanical Joint Adapters: Flanged and Mechanical Joint Adapters for HDPE DR pipe shall be PE 3608 HDPE, Cell Classification of 345464C as determined by ASTM D 3350 and mechanical joint adapters shall have a manufacturing standard of ASTM D 3261.

PART 3: EXECUTION

3.1 Laying Pipe

A. General: All pipe shall be laid to a uniform line and grade between manholes/inlets, with a firm and even bearing along the barrel of the pipe, butt fusion welded joints (HDPE SD Pipe) or banded mechanical joints (Corrugated HDPE trench drain). The interior of each pipe shall be cleaned of all foreign material before the next pipe is connected. Pipe laying shall commence at the lowest point and proceed upgrade unless approved by the Engineer in advance of the work. At the close of each day's work, and such other times when pipe is not being laid, the open end of the pipe shall be protected from objects or foreign material.

B. Pipe shall be installed in accordance with the manufacturer's recommendations for installing the type of pipe used, unless otherwise shown on the Drawings.

C. Pipelines shall be laid to the grades and alignment shown on the Drawings unless modified in writing by the Design Engineer. Variation from the prescribed grade and alignment shall not exceed one-tenth (0.10) foot, and the rate of departure from, or return to, the established grade or alignment shall be not more than one (1) inch in ten (10) feet, unless approved by Design Engineer. No deviation from grade shall cause a depression in the sewer invert that could retain fluids or solids greater than one-tenth (0.10) foot. Any pipe which is not in true alignment or which shows undue settlement after laying shall be adjusted or taken up and re-laid at Contractor's expense.

D. Pipe on which coatings have been damaged may be rejected at the site of the Work regardless of previous approvals.

E. Handling of Storm Sewer Line Materials Into Trench: Proper implements, tools and facilities satisfactory to the QA/QC Representative shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, jointing materials, etc., shall be carefully lowered into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to storm sewer line materials and/or workmen. Under no circumstances shall such materials be dropped or dumped into the trench. The Contractor may complete butt fusion welding and installation of secondary containment at the ground surface and lower the assembled sections into the ground provided such handling can be completed without damage to the pipe or secondary containment.

F. Pipe joints shall be made so as to form a concentric joint with the adjoining pipe to avoid sudden offsets of the flowline. Pipe sections shall be joined together in accordance with the manufacturer's recommendations.

G. Butt Fusion: Sections of smooth wall HDPE pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400-450 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records.

H. Sidewall Fittings for Smooth wall HDPE: Sidewall fittings for connection to smooth wall HDPE piping should be prefabricated by the manufacturer. Where Field fabricated fittings are approved by the Engineer, fabrication shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.

I. Fusion Welding: The minimum width of the surface extruded bead shall be 15mm. The surface extrusion welder shall be semi-automated and equipped with electronic controls which constantly monitor outputs for both preheat and HDPE extrudate. The unit shall be capable of pre-heating the sheet just prior to the casting of HDPE extrudate over the upper and lower section of the weld zone. The extrusion rod for the surface extruding welding shall be manufactured from the same resin type used in the manufacture of the membrane. All physical properties shall be identical to those possessed by the membrane raw material. The manufacturer shall provide certified test data with each batch of welding rod. All rod supplied shall be packed to prevent the ingress of moisture and other contaminates. If necessary the Installer shall also employ an apparatus specifically built for drying rod to ensure weld quality.

J. Mechanical HDPE Fittings: Bolted joining may be used where approved by the ENGINEER. Flange joining will be accomplished by using a HDPE flange adapter with a ductile iron back-up ring. Mechanical joint joining will be accomplished using either a molded mechanical joint adapter or the combination of a Sur-Grip Restrainer and Pipe Stiffener. Either mechanical joint joining method will have a ductile iron mechanical joint gland.

K. Obstructions not shown on the Drawings may be encountered during the progress of the Work. Should such an obstruction require an alteration to the pipe alignment or grade, Engineer will have authority to order a deviation from the Drawings, or Engineer may arrange for the removal, relocation, or reconstruction of any structure which obstructs the pipeline.

F. Pipe Clearance in Rocks: Ledge rock, boulders and large stones shall be removed to provide a clearance of at least six (6) inches below and eight (8) inches on each side of all pipe and fittings.

The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of such rock, boulder or stone.

3.2 Drainage Structures

A. Inlets shall be constructed as detailed and at the locations shown on the contract drawings. All materials and construction methods shall be in accordance with California Department of Transportation, CALTrans 2010 Standard Specifications manual, except where more stringent requirements are indicated.

B. HDPE manholes shall be constructed in accordance with Specifications for smooth wall HDPE pipe.

PART 4: FIELD QUALITY CONTROL

4.1 Storm Sewer Acceptance Testing: Prior to the request for inspection, it shall be the Contractor's responsibility to examine all completed pipe lines to ensure that they are laid to the proper alignment and grade and free from foreign material. The Contractor shall cooperate and furnish all assistance necessary to perform the tests and inspection as specified herein and as directed by the Site Engineer.

The Contractor shall replace or repair all defects in sections of sewers failing to meet the requirements of these tests.

4.2 Pipeline Testing: Air Pressure Testing: Gravity flow sewer systems shall be tested for leakage by a low pressure air test. The test procedure shall be, in general, as recommended by the Bay Area Committee on Air Testing, Berkeley, California. The test procedure shall be as follows:

1. The inside of the pipe shall be thoroughly cleaned, removing all debris and mortar. The sewer shall be thoroughly flushed with water to clean and wet the pipe.
2. The sewer shall be plugged at the upper and lower manholes by the use of inflatable air-tight plugs, one of which shall be equipped with an air hose to the pipe interior.
3. The test equipment shall consist of a compressor with an air bleed valve, a throttling valve, and a sensitive air pressure test gage with a gage cock. This equipment shall be connected with the air hose connection to the sewer.
4. If the sewer is laid in groundwater, the elevation of groundwater level shall be determined and compensations will be made in the test pressures at the direction of the Site Engineer.

5. Determine the test duration based on the table below (for sizes not listed, use next larger size):

Pipe Diameter (inches)	Test Period Duration (minutes)
8	4.0
10	5.0
12	6.0
16	7.0
18	8.5
24	11.5
30	14.0
36	17.0

6. Air shall be slowly added to the sewer until the pressure reaches 4.0 psi in excess of the groundwater head. After 5 minutes stabilization time, air shall be added as required. Plugs shall be checked for leaks. Pressure in the system should not exceed 5.0 psi.
7. When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi, commence the test. Record the drop in pressure for the test period. The test may be discontinued when the prescribed test time has been completed, even though 1.0 psi drop has not occurred.
8. If the groundwater level at the time of testing is above the pipe invert, add 0.43 psi of air per foot of water above the invert to the test air pressure range of 2.5 psi to 3.5 psi stated above.
9. If the pressure drop exceeds 1.0 psi during the test period, the test will be considered to have failed. Repair and retest the line.

4.3 Drainage Structure Testing: Hydrostatic Pressure Testing: Drainage structures located along the pipeline shall be tested for leakage by a low pressure hydrostatic test. The test procedure shall be as follows:

1. The inside of the drainage structure shall be thoroughly cleaned of foreign material.
2. The drainage structure shall be plugged by the use of inflatable water-tight plugs at all pipe penetrations.
3. Fill structure with water to the bottom of the concrete lid.
4. Measure loss over a 4-hour period.
5. A loss of ¼" or more during the test period shall be considered a failure.

END OF SECTION

APPENDIX B

Calculations

CALCULATION COVER SHEET

PROJECT NAME: Vernon

PROJECT NUMBER: 2013-2967

CALCULATIONS ATTACHED:

ID #	DESCRIPTION	DATE:
1	Hydrologic Modeling	5-21-2013

PERFORMED BY: _____ **DATE:** _____

CHECKED BY: _____ **DATE:** _____

PROJECT MANAGER REVIEW: _____ **DATE:** _____

COMMENTS: _____

STORMWATER RUNOFF NARRATIVE
Vernon Storm Sewer

PURPOSE: To calculate the following for post-development conditions:

1. Peak rate of runoff for the 25 year storm event
2. Storm sewer capacity for the proposed system

METHOD:

1. Use existing survey plan along with information from field visits to determine stormwater drainage areas.
2. Determine surface type, acreage, and runoff coefficients for each area.
3. Determine rainfall intensity, duration, and frequency curves.
4. Use rational method to determine cumulative peak flow rate in the proposed storm sewer system.
5. Use Manning's equation to determine pipe capacity

EQUATIONS AND REFERENCES

Manning's n values and runoff coefficients from *Open-Channel Hydraulics*, Chow, 1959.

Rainfall data obtained from Precipitation-Frequency Atlas of the United States, National Oceanic and Atmospheric Association, http://hdsc.new.noaa.gov/hdsc/pdfs.

Utilize Hydraflow Storm Sewers Extension Version 9 by Autodesk, Inc. to perform computations and pipe analysis.

ASSUMPTIONS

1. All areas are impervious and either roof area, concrete, or asphalt pavement.
2. Time of Concentration will be 5 minutes for all drainage areas.
3. All inlets are in a sump condition and do not bypass to other parts of the system.
4. Tailwater conditions do not control peak flow.

CALCULATIONS: see attached

CONCLUSION: Peak flow rates for existing conditions are summarized as follows:

Storm Event	Peak flow Rate
25-year	18.92 CFS

Based upon the attached calculations, we have shown that the storm drainage system has adequate capacity to convey the 25-year storm event without overtopping.

If $C = R^{1/6}/n$ is substituted in Chezy's formula, Manning's formula results. Manning's formula has proven most reliable in practice. This empirical formula, suitable for a fully rough turbulent flow, is given by

$$V = \frac{1.486}{n} R^{2/3} S^{1/2} \qquad \text{(English units)} \qquad [LT^{-1}] \qquad (10.11)$$

$$V = \frac{1}{n} R^{2/3} S^{1/2} \qquad \text{(Metric units)} \qquad [LT^{-1}] \qquad (10.12)$$

where n is the Manning's roughness coefficient. It depends on channel material, surface irregularities, variation in shape and size of the cross section, vegetation and flow conditions, channel obstruction, and degree of meandering. Chow (1959) has provided a detailed table and photographs of channels for values of n in different conditions. Typical values are summarized in Table 10.4.

TABLE 10.4 VALUES OF MANNING'S ROUGHNESS COEFFICIENT (For sheet flow see eq. 12.8)

Conduit material	Manning n
Closed conduits	
Asbestos-cement pipe	0.011–0.015
Brick	0.013–0.017
Cast iron pipe	
Cement-lined and seal coated	0.011–0.015
Concrete (monolithic)	
Smooth forms	0.012–0.014
Rough forms	0.015–0.017
Concrete pipe	0.011–0.015
Corrugated-metal pipe	
(½-in. × 2⅔-in. corrugations)	
Plain	0.022–0.026
Paved invert	0.018–0.022
Spun asphalt lined	0.011–0.015
Plastic pipe (smooth)	0.011–0.015
Vitrified clay	
Pipes	0.011–0.015
Liner plates	0.013–0.017
Open channels	
Lined channels	
Asphalt	0.013–0.017
Brick	0.012–0.018
Concrete	0.011–0.020
Rubble or riprap	0.020–0.035
Vegetal	0.030–0.40
Excavated or dredged	
Earth, straight and uniform	0.020–0.030
Earth, winding, fairly uniform	0.025–0.040
Rock	0.030–0.045
Unmaintained	0.050–0.14
Natural channels (minor streams,	
top width at flood stage < 100 ft)	
Fairly regular section	0.03–0.07
Irregular section with pools	0.04–0.10

NOAA Atlas 14, Volume 6, Version 2 LOS ANGELES-DUCOMMUN ST.
Station ID: 97-0703
Location name: Los Angeles, California, US*
Coordinates: 34.0525, -118.2369
Elevation:
Elevation (station metadata): 306 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.81 (1.51-2.18)	2.33 (1.94-2.81)	3.02 (2.52-3.67)	3.62 (2.99-4.43)	4.46 (3.56-5.66)	5.15 (4.01-6.67)	5.87 (4.45-7.80)	6.64 (4.88-9.08)	7.72 (5.45-11.1)	8.59 (5.84-12.8)
10-min	1.30 (1.09-1.57)	1.66 (1.39-2.01)	2.17 (1.81-2.63)	2.60 (2.14-3.17)	3.20 (2.55-4.06)	3.69 (2.87-4.78)	4.21 (3.19-5.59)	4.75 (3.50-6.52)	5.53 (3.90-7.92)	6.16 (4.19-9.15)
15-min	1.04 (0.876-1.26)	1.34 (1.12-1.62)	1.75 (1.46-2.12)	2.09 (1.73-2.56)	2.58 (2.06-3.27)	2.98 (2.32-3.86)	3.39 (2.57-4.51)	3.83 (2.82-5.25)	4.46 (3.14-6.38)	4.97 (3.38-7.38)
30-min	0.700 (0.586-0.844)	0.898 (0.750-1.09)	1.17 (0.974-1.42)	1.40 (1.16-1.71)	1.73 (1.38-2.19)	1.99 (1.55-2.58)	2.27 (1.72-3.02)	2.56 (1.89-3.51)	2.98 (2.10-4.27)	3.32 (2.26-4.93)
60-min	0.502 (0.420-0.607)	0.645 (0.539-0.780)	0.840 (0.700-1.02)	1.00 (0.830-1.23)	1.24 (0.988-1.57)	1.43 (1.11-1.85)	1.63 (1.24-2.17)	1.84 (1.36-2.52)	2.14 (1.51-3.07)	2.39 (1.62-3.54)
2-hr	0.361 (0.302-0.436)	0.468 (0.392-0.566)	0.613 (0.511-0.744)	0.734 (0.606-0.898)	0.904 (0.720-1.15)	1.04 (0.809-1.34)	1.18 (0.894-1.57)	1.32 (0.976-1.82)	1.53 (1.08-2.19)	1.70 (1.15-2.52)
3-hr	0.299 (0.250-0.361)	0.389 (0.325-0.470)	0.510 (0.425-0.618)	0.611 (0.504-0.747)	0.751 (0.598-0.952)	0.861 (0.671-1.12)	0.976 (0.741-1.30)	1.10 (0.808-1.50)	1.26 (0.890-1.81)	1.40 (0.948-2.07)
6-hr	0.209 (0.175-0.253)	0.274 (0.228-0.331)	0.359 (0.299-0.436)	0.430 (0.355-0.526)	0.529 (0.421-0.670)	0.606 (0.472-0.785)	0.685 (0.520-0.911)	0.768 (0.566-1.05)	0.882 (0.622-1.26)	0.973 (0.661-1.45)
12-hr	0.136 (0.114-0.164)	0.178 (0.149-0.215)	0.234 (0.195-0.284)	0.280 (0.232-0.343)	0.345 (0.275-0.437)	0.395 (0.308-0.512)	0.447 (0.339-0.595)	0.501 (0.370-0.687)	0.576 (0.407-0.826)	0.636 (0.432-0.944)
24-hr	0.088 (0.078-0.102)	0.116 (0.102-0.134)	0.153 (0.135-0.177)	0.184 (0.161-0.215)	0.227 (0.192-0.273)	0.260 (0.216-0.321)	0.295 (0.239-0.372)	0.332 (0.261-0.430)	0.382 (0.289-0.516)	0.423 (0.309-0.590)
2-day	0.054 (0.048-0.063)	0.073 (0.064-0.084)	0.098 (0.086-0.113)	0.118 (0.104-0.138)	0.147 (0.124-0.177)	0.169 (0.140-0.209)	0.192 (0.156-0.243)	0.217 (0.171-0.281)	0.250 (0.189-0.337)	0.276 (0.202-0.386)
3-day	0.041 (0.036-0.047)	0.056 (0.049-0.064)	0.076 (0.067-0.088)	0.092 (0.081-0.108)	0.115 (0.097-0.139)	0.133 (0.110-0.163)	0.151 (0.122-0.191)	0.170 (0.134-0.221)	0.197 (0.149-0.266)	0.218 (0.159-0.304)
4-day	0.033 (0.029-0.038)	0.046 (0.040-0.053)	0.062 (0.055-0.072)	0.076 (0.067-0.089)	0.095 (0.081-0.115)	0.110 (0.092-0.136)	0.126 (0.102-0.159)	0.142 (0.112-0.185)	0.165 (0.125-0.223)	0.183 (0.134-0.255)
7-day	0.022 (0.019-0.025)	0.030 (0.027-0.035)	0.041 (0.037-0.048)	0.051 (0.045-0.059)	0.064 (0.054-0.077)	0.075 (0.062-0.092)	0.086 (0.070-0.108)	0.098 (0.077-0.127)	0.114 (0.086-0.154)	0.128 (0.093-0.178)
10-day	0.017 (0.015-0.019)	0.023 (0.020-0.026)	0.031 (0.028-0.036)	0.039 (0.034-0.045)	0.049 (0.042-0.059)	0.058 (0.048-0.071)	0.066 (0.054-0.084)	0.076 (0.060-0.098)	0.089 (0.067-0.120)	0.100 (0.073-0.140)
20-day	0.010 (0.009-0.011)	0.014 (0.012-0.016)	0.019 (0.017-0.022)	0.024 (0.021-0.028)	0.030 (0.026-0.036)	0.035 (0.029-0.044)	0.041 (0.033-0.052)	0.047 (0.037-0.061)	0.056 (0.042-0.075)	0.063 (0.046-0.088)
30-day	0.008 (0.007-0.009)	0.011 (0.009-0.012)	0.015 (0.013-0.017)	0.019 (0.016-0.022)	0.024 (0.020-0.029)	0.028 (0.023-0.034)	0.032 (0.026-0.041)	0.037 (0.029-0.048)	0.044 (0.033-0.060)	0.050 (0.036-0.069)
45-day	0.006 (0.005-0.007)	0.008 (0.007-0.010)	0.012 (0.010-0.014)	0.015 (0.013-0.017)	0.019 (0.016-0.022)	0.022 (0.018-0.027)	0.025 (0.021-0.032)	0.029 (0.023-0.038)	0.034 (0.026-0.046)	0.039 (0.028-0.054)
60-day	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.010 (0.009-0.012)	0.012 (0.011-0.014)	0.016 (0.013-0.019)	0.019 (0.015-0.023)	0.021 (0.017-0.027)	0.024 (0.019-0.032)	0.029 (0.022-0.039)	0.032 (0.024-0.045)

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

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

Please refer to NOAA Atlas 14 document for more information.

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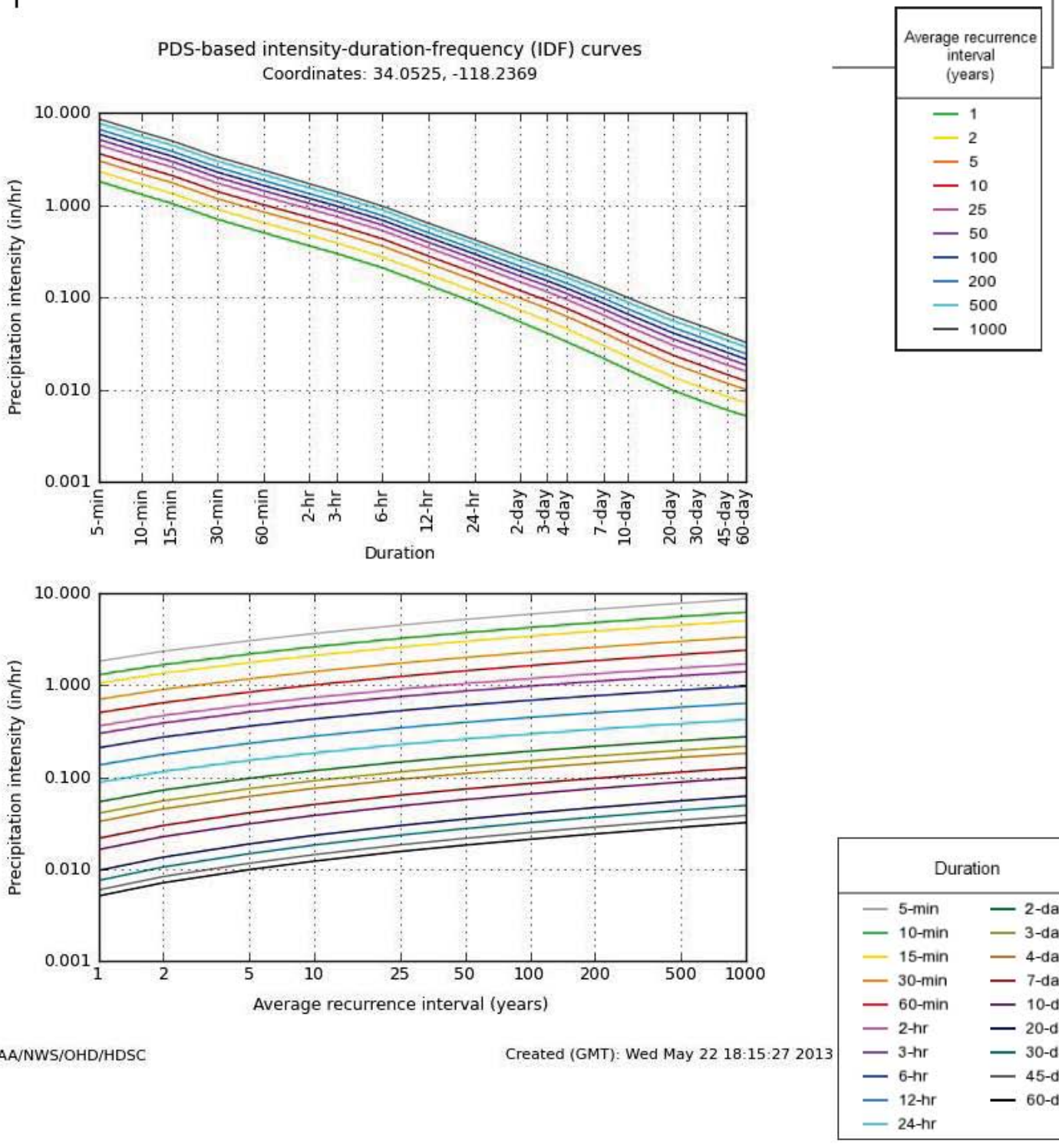
PF graphical



NOAA/NWS/OHD/HDSC

Created (GMT): Wed May 22 18:15:27 2013

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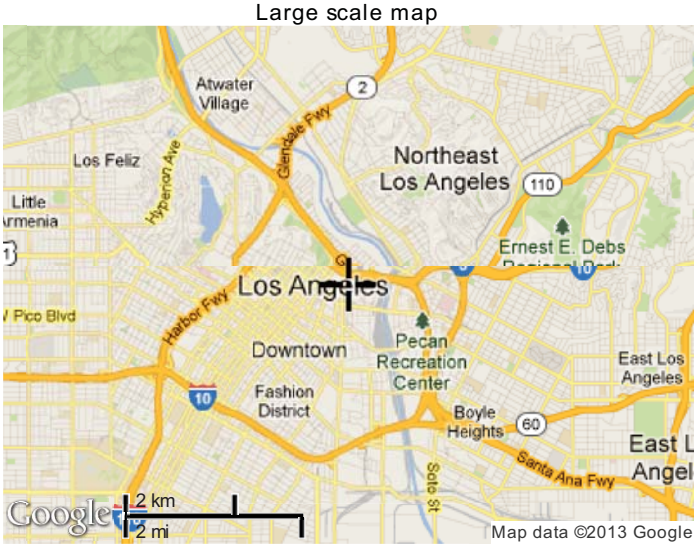
Maps & aerials

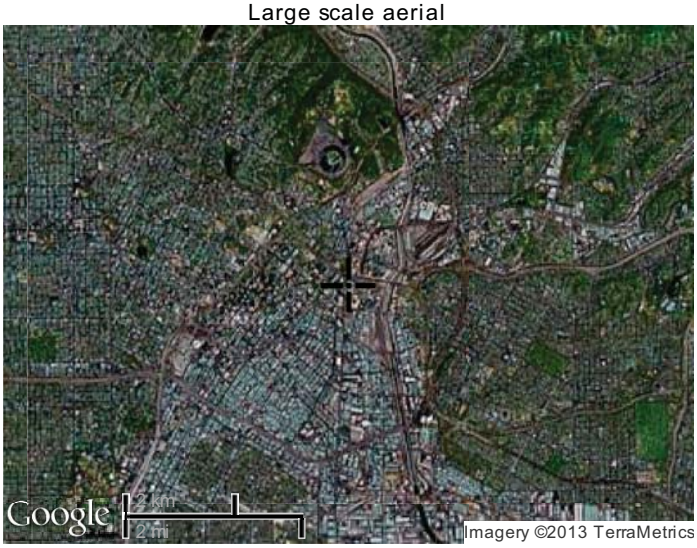
Small scale terrain

Large scale terrain

Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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Engineering for the Environment. Planning for People.™
1055 Andrew Drive, Suite A - West Chester, PA 19380
(610) 840-9100 - Fax (610) 840-9199

PROJECT:	VERNON STORM DRAINAGE		
SUBJECT:	Composite "C" Calculations - Rational Method		
SHEET:	1 OF 4	DATE:	5/22/2013
BY:			
CHK'D:			

The following Rational Method "C" values will be applied:

Land Cover	"C"
Impervious Areas	0.98
Lawn Areas	
Wooded Areas	
Gravel Areas	

DRAINAGE AREA ID: INLET A — Total Area: 0.77 AC

	Area (AC)	Area x "C"
Impervious Areas	0.77	0.75
Lawn Areas		0.00
Wooded Areas		0.00
Gravel Areas		0.00
	Composite "C":	0.98

DRAINAGE AREA ID: INLET B — Total Area: 0.53 AC

	Area (AC)	Area x "C"
Impervious Areas	0.53	0.52
Lawn Areas		0.00
Wooded Areas		0.00
Gravel Areas		0.00
	Composite "C":	0.98

DRAINAGE AREA ID: INLET C — Total Area: 0.57 AC

	Area (AC)	Area x "C"
Impervious Areas	0.57	0.56
Lawn Areas		0.00
Wooded Areas		0.00
Gravel Areas		0.00
	Composite "C":	0.98

DRAINAGE AREA ID: INLET D — Total Area: 0.01 AC

	Area (AC)	Area x "C"
Impervious Areas	0.01	0.01
Lawn Areas		0.00
Wooded Areas		0.00
Gravel Areas		0.00
	Composite "C":	0.98

DRAINAGE AREA ID: INLET D-1 — Total Area: 0.23 AC

	Area (AC)	Area x "C"
Impervious Areas	0.23	0.23
Lawn Areas		0.00
Wooded Areas		0.00
Gravel Areas		0.00
	Composite "C":	0.98

NOAA Atlas 14, Volume 6, Version 2 LOS ANGELES-DUCOMMUN ST.
Station ID: 97-0703
Location name: Los Angeles, California, US*
Coordinates: 34.0525, -118.2369
Elevation:
Elevation (station metadata): 306 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
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5-min	1.81 (1.51-2.18)	2.33 (1.94-2.81)	3.02 (2.52-3.67)	3.62 (2.99-4.43)	4.46 (3.56-5.66)	5.15 (4.01-6.67)	5.87 (4.45-7.80)	6.64 (4.88-9.08)	7.72 (5.45-11.1)	8.59 (5.84-12.8)
10-min	1.30 (1.09-1.57)	1.66 (1.39-2.01)	2.17 (1.81-2.63)	2.60 (2.14-3.17)	3.20 (2.55-4.06)	3.69 (2.87-4.78)	4.21 (3.19-5.59)	4.75 (3.50-6.52)	5.53 (3.90-7.92)	6.16 (4.19-9.15)
15-min	1.04 (0.876-1.26)	1.34 (1.12-1.62)	1.75 (1.46-2.12)	2.09 (1.73-2.56)	2.58 (2.06-3.27)	2.98 (2.32-3.86)	3.39 (2.57-4.51)	3.83 (2.82-5.25)	4.46 (3.14-6.38)	4.97 (3.38-7.38)
30-min	0.700 (0.586-0.844)	0.898 (0.750-1.09)	1.17 (0.974-1.42)	1.40 (1.16-1.71)	1.73 (1.38-2.19)	1.99 (1.55-2.58)	2.27 (1.72-3.02)	2.56 (1.89-3.51)	2.98 (2.10-4.27)	3.32 (2.26-4.93)
60-min	0.502 (0.420-0.607)	0.645 (0.539-0.780)	0.840 (0.700-1.02)	1.00 (0.830-1.23)	1.24 (0.988-1.57)	1.43 (1.11-1.85)	1.63 (1.24-2.17)	1.84 (1.36-2.52)	2.14 (1.51-3.07)	2.39 (1.62-3.54)
2-hr	0.361 (0.302-0.436)	0.468 (0.392-0.566)	0.613 (0.511-0.744)	0.734 (0.606-0.898)	0.904 (0.720-1.15)	1.04 (0.809-1.34)	1.18 (0.894-1.57)	1.32 (0.976-1.82)	1.53 (1.08-2.19)	1.70 (1.15-2.52)
3-hr	0.299 (0.250-0.361)	0.389 (0.325-0.470)	0.510 (0.425-0.618)	0.611 (0.504-0.747)	0.751 (0.598-0.952)	0.861 (0.671-1.12)	0.976 (0.741-1.30)	1.10 (0.808-1.50)	1.26 (0.890-1.81)	1.40 (0.948-2.07)
6-hr	0.209 (0.175-0.253)	0.274 (0.228-0.331)	0.359 (0.299-0.436)	0.430 (0.355-0.526)	0.529 (0.421-0.670)	0.606 (0.472-0.785)	0.685 (0.520-0.911)	0.768 (0.566-1.05)	0.882 (0.622-1.26)	0.973 (0.661-1.45)
12-hr	0.136 (0.114-0.164)	0.178 (0.149-0.215)	0.234 (0.195-0.284)	0.280 (0.232-0.343)	0.345 (0.275-0.437)	0.395 (0.308-0.512)	0.447 (0.339-0.595)	0.501 (0.370-0.687)	0.576 (0.407-0.826)	0.636 (0.432-0.944)
24-hr	0.088 (0.078-0.102)	0.116 (0.102-0.134)	0.153 (0.135-0.177)	0.184 (0.161-0.215)	0.227 (0.192-0.273)	0.260 (0.216-0.321)	0.295 (0.239-0.372)	0.332 (0.261-0.430)	0.382 (0.289-0.516)	0.423 (0.309-0.590)
2-day	0.054 (0.048-0.063)	0.073 (0.064-0.084)	0.098 (0.086-0.113)	0.118 (0.104-0.138)	0.147 (0.124-0.177)	0.169 (0.140-0.209)	0.192 (0.156-0.243)	0.217 (0.171-0.281)	0.250 (0.189-0.337)	0.276 (0.202-0.386)
3-day	0.041 (0.036-0.047)	0.056 (0.049-0.064)	0.076 (0.067-0.088)	0.092 (0.081-0.108)	0.115 (0.097-0.139)	0.133 (0.110-0.163)	0.151 (0.122-0.191)	0.170 (0.134-0.221)	0.197 (0.149-0.266)	0.218 (0.159-0.304)
4-day	0.033 (0.029-0.038)	0.046 (0.040-0.053)	0.062 (0.055-0.072)	0.076 (0.067-0.089)	0.095 (0.081-0.115)	0.110 (0.092-0.136)	0.126 (0.102-0.159)	0.142 (0.112-0.185)	0.165 (0.125-0.223)	0.183 (0.134-0.255)
7-day	0.022 (0.019-0.025)	0.030 (0.027-0.035)	0.041 (0.037-0.048)	0.051 (0.045-0.059)	0.064 (0.054-0.077)	0.075 (0.062-0.092)	0.086 (0.070-0.108)	0.098 (0.077-0.127)	0.114 (0.086-0.154)	0.128 (0.093-0.178)
10-day	0.017 (0.015-0.019)	0.023 (0.020-0.026)	0.031 (0.028-0.036)	0.039 (0.034-0.045)	0.049 (0.042-0.059)	0.058 (0.048-0.071)	0.066 (0.054-0.084)	0.076 (0.060-0.098)	0.089 (0.067-0.120)	0.100 (0.073-0.140)
20-day	0.010 (0.009-0.011)	0.014 (0.012-0.016)	0.019 (0.017-0.022)	0.024 (0.021-0.028)	0.030 (0.026-0.036)	0.035 (0.029-0.044)	0.041 (0.033-0.052)	0.047 (0.037-0.061)	0.056 (0.042-0.075)	0.063 (0.046-0.088)
30-day	0.008 (0.007-0.009)	0.011 (0.009-0.012)	0.015 (0.013-0.017)	0.019 (0.016-0.022)	0.024 (0.020-0.029)	0.028 (0.023-0.034)	0.032 (0.026-0.041)	0.037 (0.029-0.048)	0.044 (0.033-0.060)	0.050 (0.036-0.069)
45-day	0.006 (0.005-0.007)	0.008 (0.007-0.010)	0.012 (0.010-0.014)	0.015 (0.013-0.017)	0.019 (0.016-0.022)	0.022 (0.018-0.027)	0.025 (0.021-0.032)	0.029 (0.023-0.038)	0.034 (0.026-0.046)	0.039 (0.028-0.054)
60-day	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.010 (0.009-0.012)	0.012 (0.011-0.014)	0.016 (0.013-0.019)	0.019 (0.015-0.023)	0.021 (0.017-0.027)	0.024 (0.019-0.032)	0.029 (0.022-0.039)	0.032 (0.024-0.045)

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

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

ADVANCED GeoServices Engineering for the Environment. Planning for People.™ 1055 Andrew Drive, Suite A - West Chester, PA 19380 (610) 840-9100 - Fax (610) 840-9199	PROJECT: VERNON STORM DRAINAGE
	SUBJECT: Composite "C" Calculations - Rational Method
	SHEET: 4 OF 4 — DATE: 5/22/2013
	BY:
	CHK'D:

The following Rational Method "C" values will be applied:

Land Cover	"C"
Impervious Areas	0.98
Lawn Areas	
Wooded Areas	
Gravel Areas	

DRAINAGE AREA ID:	TRENCH DRAIN	Total Area:	0.66 AC
	Area (AC)	Area x "C"	
Impervious Areas	0.66	0.65	
Lawn Areas		0.00	
Wooded Areas		0.00	
Gravel Areas		0.00	
		Composite "C":	0.98

DRAINAGE AREA ID:		Total Area:	0.00 AC
	Area (AC)	Area x "C"	
Impervious Areas		0.00	
Lawn Areas		0.00	
Wooded Areas		0.00	
Gravel Areas		0.00	
		Composite "C":	#DIV/0!

DRAINAGE AREA ID:		Total Area:	0.00 AC
	Area (AC)	Area x "C"	
Impervious Areas		0.00	
Lawn Areas		0.00	
Wooded Areas		0.00	
Gravel Areas		0.00	
		Composite "C":	#DIV/0!

DRAINAGE AREA ID:		Total Area:	0.00 AC
	Area (AC)	Area x "C"	
Impervious Areas		0.00	
Lawn Areas		0.00	
Wooded Areas		0.00	
Gravel Areas		0.00	
		Composite "C":	#DIV/0!

DRAINAGE AREA ID:	INLET D-1	Total Area:	0.00 AC
	Area (AC)	Area x "C"	
Impervious Areas		0.00	
Lawn Areas		0.00	
Wooded Areas		0.00	
Gravel Areas		0.00	
		Composite "C":	#DIV/0!

ADVANCED GeoServices
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1055 Andrew Drive, Suite A - West Chester, PA 19380
(610) 840-9100 - Fax (610) 840-9199

PROJECT:	VERNON STORM DRAINAGE		
SUBJECT:	Composite "C" Calculations - Rational Method		
SHEET:	3 OF 4	DATE:	5/22/2013
BY:			
CHK'D:			

The following Rational Method "C" values will be applied:

Land Cover	"C"
Impervious Areas	0.98
Lawn Areas	
Wooded Areas	
Gravel Areas	

DRAINAGE AREA ID: INLET MH-2 — Total Area: 0.29 AC

	Area (AC)	Area x "C"
Impervious Areas	0.29	0.28
Lawn Areas		0.00
Wooded Areas		0.00
Gravel Areas		0.00
	Composite "C":	0.98

DRAINAGE AREA ID: INLET MH-6 — Total Area: 0.48 AC

	Area (AC)	Area x "C"
Impervious Areas	0.48	0.47
Lawn Areas		0.00
Wooded Areas		0.00
Gravel Areas		0.00
	Composite "C":	0.98

DRAINAGE AREA ID: INLET MH-7 — Total Area: 0.39 AC

	Area (AC)	Area x "C"
Impervious Areas	0.39	0.38
Lawn Areas		0.00
Wooded Areas		0.00
Gravel Areas		0.00
	Composite "C":	0.98

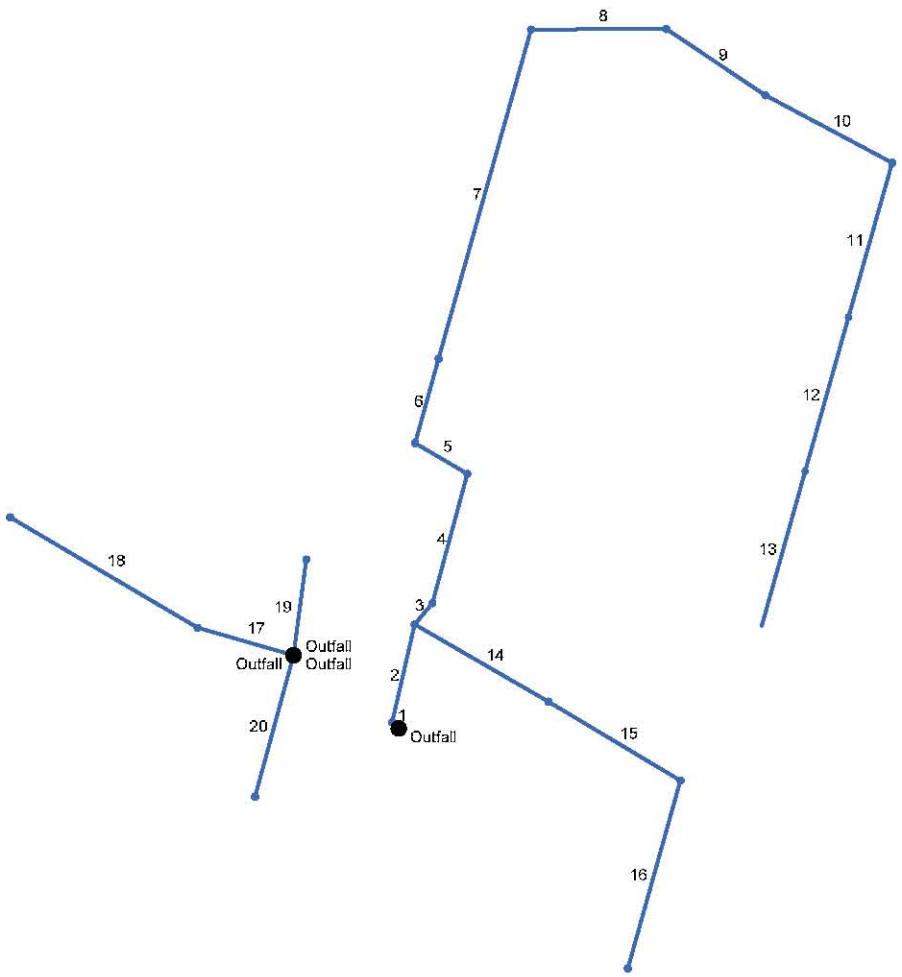
DRAINAGE AREA ID: INLET CL-2 — Total Area: 1.90 AC

	Area (AC)	Area x "C"
Impervious Areas	1.90	1.86
Lawn Areas		0.00
Wooded Areas		0.00
Gravel Areas		0.00
	Composite "C":	0.98

DRAINAGE AREA ID: INLET CL-14 — Total Area: 0.38 AC

	Area (AC)	Area x "C"
Impervious Areas	0.38	0.37
Lawn Areas		0.00
Wooded Areas		0.00
Gravel Areas		0.00
	Composite "C":	0.98

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Project File: Vernon Storm Sewer Design 5-28-2013 (revised pipe diameters).stm	Number of lines: 20	Date: 5/30/2013

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	INLET E TO UNIT 46	19.10	34	Cir	9.152	165.89	165.91	0.219	168.69	168.70	0.22	168.91	End	Grate
2	INLET D TO INLET E	18.58	34	Cir	80.524	165.91	166.11	0.248	168.91*	168.97*	0.21	169.18	1	Grate
3	INLET D1TO INLET D	14.02	30	Cir	25.929	166.11	166.18	0.270	169.18*	169.20*	0.10	169.30	2	Grate
4	MH-6 TO INLET D1	13.77	30	Cir	108.217	166.18	166.45	0.250	169.30*	169.37*	0.19	169.56	3	Grate
5	INLET 6A TO MH-6	12.75	30	Cir	63.698	166.45	166.61	0.251	169.56*	169.60*	0.16	169.76	4	Grate
6	MH-7 TO INLET 6A	12.71	30	Cir	71.000	166.61	166.79	0.254	169.76*	169.80*	0.05	169.85	5	Grate
7	MH-2 TO MH-7	12.28	24	Cir	277.000	166.79	167.48	0.249	169.85*	170.30*	0.32	170.62	6	Grate
8	CL-2 TO MH-2	11.84	24	Cir	152.851	167.48	167.86	0.249	170.62*	170.85*	0.15	171.00	7	Grate
9	MH-1 TO CL-2	6.62	19	Cir	123.361	167.86	168.17	0.251	171.00*	171.24*	0.09	171.33	8	Grate
10	CL-14 TO MH-1	3.18	15	Cir	152.740	168.17	168.55	0.249	171.33*	171.56*	0.16	171.71	9	Grate
11	CL-5 TO CL-14	2.10	12	Cir	130.000	168.55	168.88	0.254	171.71*	171.99*	0.06	172.05	10	Grate
12	CL-5 TO CL-14(2)	1.53	12	Cir	130.000	168.88	169.20	0.246	172.05*	172.20*	0.03	172.23	11	Grate
13	CL-5 TO CL-14(2)	0.84	12	Cir	130.000	169.20	169.53	0.254	172.23*	172.27*	0.02	172.29	12	Grate
14	INLET C TO INLET D	6.39	17	Cir	162.544	167.62	168.11	0.301	169.18*	169.69*	0.13	169.82	2	Grate
15	INLET B TO INLET C	4.74	17	Cir	161.703	168.11	168.60	0.303	169.82*	170.10*	0.22	170.32	14	Grate
16	INLET A TO INLET B	3.07	15	Cir	158.106	168.60	169.07	0.297	170.32*	170.53*	0.10	170.63	15	Grate
17	INLET G TO INLET H	11.49	24	Cir	110.998	168.87	169.20	0.297	170.90	171.03	0.11	171.14	End	Grate
18	INLET F TO INLET G	10.28	24	Cir	228.490	169.20	169.89	0.302	171.14	171.32	n/a	171.33 i	17	Grate
19	INLET K TO INLET H	3.23	15	Cir	75.981	169.42	169.65	0.303	170.67	170.76	0.12	170.89	End	Grate
20	INLET J TO INLET H	1.47	12	Cir	118.653	170.02	170.38	0.303	171.01	171.11	0.09	171.20	End	Grate

Project File: Vernon Storm Sewer Design 5-28-2013 (revised pipe diameters).stm

Number of lines: 20

Run Date: 5/31/2013

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; i - Inlet control.

Storm Sewer Tabulation

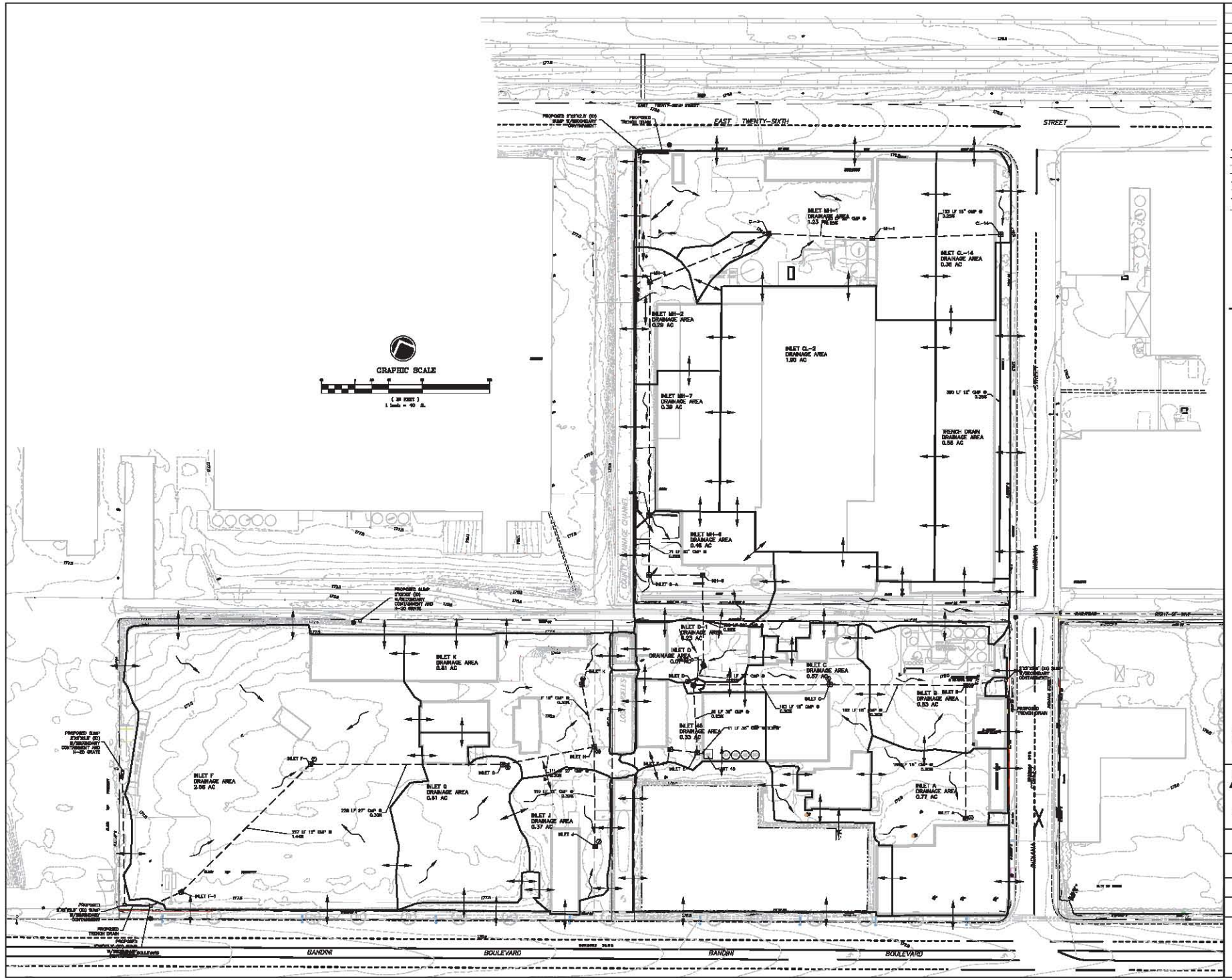
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	9.152	0.33	7.87	0.98	0.32	7.71	5.0	14.2	2.5	19.10	33.86	3.09	34	0.22	165.89	165.91	168.69	168.70	174.01	173.65	INLET E TO UNIT
2	1	80.524	0.01	7.54	0.98	0.01	7.39	5.0	13.7	2.5	18.58	36.09	3.01	34	0.25	165.91	166.11	168.91	168.97	173.65	173.85	INLET D TO INLE
3	2	25.929	0.23	5.66	0.98	0.23	5.55	5.0	13.6	2.5	14.02	27.48	2.87	30	0.27	166.11	166.18	169.18	169.20	173.85	174.00	INLET D1TO INL
4	3	108.217	0.48	5.43	0.98	0.47	5.32	5.0	12.9	2.6	13.77	26.42	2.82	30	0.25	166.18	166.45	169.30	169.37	174.00	172.81	MH-6 TO INLET D
5	4	63.698	0.10	4.95	0.98	0.10	4.85	5.0	12.5	2.6	12.75	26.51	2.61	30	0.25	166.45	166.61	169.56	169.60	172.81	172.67	INLET 6A TO MH-
6	5	71.000	0.39	4.85	0.98	0.38	4.75	5.0	12.1	2.7	12.71	26.63	2.61	30	0.25	166.61	166.79	169.76	169.80	172.67	173.10	MH-7 TO INLET 6
7	6	277.000	0.29	4.46	0.98	0.28	4.37	5.0	10.9	2.8	12.28	15.17	3.81	24	0.25	166.79	167.48	169.85	170.30	173.10	173.39	MH-2 TO MH-7
8	7	152.851	1.90	4.17	0.98	1.86	4.09	5.0	10.2	2.9	11.84	15.15	3.68	24	0.25	167.48	167.86	170.62	170.85	173.39	172.50	CL-2 TO MH-2
9	8	123.361	1.23	2.27	0.98	1.21	2.22	5.0	9.7	3.0	6.62	7.58	3.47	19	0.25	167.86	168.17	171.00	171.24	172.50	171.17	MH-1 TO CL-2
10	9	152.740	0.38	1.04	0.98	0.37	1.02	5.0	8.8	3.1	3.18	4.16	2.60	15	0.25	168.17	168.55	171.33	171.56	171.17	172.39	CL-14 TO MH-1
11	10	130.000	0.21	0.66	0.98	0.21	0.65	5.0	8.0	3.3	2.10	2.29	2.71	12	0.25	168.55	168.88	171.71	171.99	172.39	172.20	CL-5 TO CL-14
12	11	130.000	0.24	0.45	0.98	0.24	0.44	5.0	7.0	3.5	1.53	2.26	1.97	12	0.25	168.88	169.20	172.05	172.20	172.20	172.20	CL-5 TO CL-14(2)
13	12	130.000	0.21	0.21	0.98	0.21	0.21	5.0	5.0	4.1	0.84	2.29	1.08	12	0.25	169.20	169.53	172.23	172.27	172.20	172.20	CL-5 TO CL-14(2)
14	2	162.544	0.57	1.87	0.98	0.56	1.83	5.0	6.9	3.5	6.39	6.27	4.14	17	0.30	167.62	168.11	169.18	169.69	173.85	172.86	INLET C TO INLE
15	14	161.703	0.53	1.30	0.98	0.52	1.27	5.0	6.0	3.7	4.74	6.28	3.07	17	0.30	168.11	168.60	169.82	170.10	172.86	171.91	INLET B TO INLE
16	15	158.106	0.77	0.77	0.98	0.75	0.75	5.0	5.0	4.1	3.07	4.54	2.51	15	0.30	168.60	169.07	170.32	170.53	171.91	171.90	INLET A TO INLE
17	End	110.998	0.61	3.19	0.98	0.60	3.13	5.0	6.2	3.7	11.49	16.57	3.66	24	0.30	168.87	169.20	170.90	171.03	174.03	175.07	INLET G TO INLE
18	17	228.490	2.58	2.58	0.98	2.53	2.53	5.0	5.0	4.1	10.28	16.70	3.74	24	0.30	169.20	169.89	171.14	171.32	175.07	174.89	INLET F TO INLE
19	End	75.981	0.81	0.81	0.98	0.79	0.79	5.0	5.0	4.1	3.23	4.59	2.73	15	0.30	169.42	169.65	170.67	170.76	174.03	173.89	INLET K TO INLE
20	End	118.653	0.37	0.37	0.98	0.36	0.36	5.0	5.0	4.1	1.47	2.51	2.15	12	0.30	170.02	170.38	171.01	171.11	174.03	174.38	INLET J TO INLE

Project File: Vernon Storm Sewer Design 5-28-2013 (revised pipe diameters).stm

Number of lines: 20

Run Date: 5/31/2013

NOTES:Intensity = 8.91 / (Inlet time + 0.10) ^ 0.48; Return period =Yrs. 25 ; c = cir e = ellip b = box



DATE	REVISION

LEGEND:

- PROPERTY LINE
- EXISTING BLACKTOP
- EXISTING BUILDING LINE
- EXISTING CHAINLINK FENCE
- EXISTING METAL FENCE
- EXISTING CONTOURS
- EXISTING RAILROAD
- EXISTING STORM SEWER
- EXISTING CATCH BASIN
- EXISTING CATCH BASIN
- EXISTING STORM SEWER MANHOLE W/SOLID LID
- EXISTING CATCH BASIN
- EXISTING CATCH BASIN
- PROPOSED INLET/MANHOLE
- PROPOSED DRAINAGE DIVIDE
- PROPOSED DIRECTION OF STORMWATER FLOW

NOTE:

1. ONLY TO SCALE WHEN PLOTTED FULL SIZE.

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WEST CHESTER, PENNSYLVANIA 19380

EXIDE TECHNOLOGIES
VERNON, CALIFORNIA
STORM DRAINAGE
MODIFICATION PLAN

PROPOSED DRAINAGE AREAS PLAN

Scale	1" = 40'
Designed By	P.C.S.
Drawn By	D.G.H.
Checked By	D.G.H.
Project Mgr.	P.C.S.
Project No.	EDI.08967
Sheet No.	1
Issued	

CALCULATION COVER SHEET

PROJECT NAME: Exide Vernon Roposed Storm Sewer

PROJECT NUMBER: 2013 2967

CALCULATIONS ATTACHED:

ID #	DESCRIPTION	DATE:
	Pipe Crushing Calc	5/23/13

PERFORMED BY: JWD **DATE:** 5/23/13

CHECKED BY: _____ **DATE:** _____

PROJECT MANAGER REVIEW: _____ **DATE:** _____

COMMENTS: _____

PIPE DEFLECTION, %
(H20 Live Load)

Including a MOVING Wheel Load

DLF = 1.00 K = 0.100 PS = 50 psi E' = 1000 psi

Prism Load, Wp, Condition

Backfill Weight = 125 Lb / Ft ^ 3

(Note: If 'Over' is printed, the calculated deflection exceeded the allowable deflection)

Depth, Ft	Outside Diameter, ins. 12.750
2.00	1.36 %
4.00	0.94 %
6.00	1.01 %
8.00	1.09 %
10.00	1.27 %
12.00	1.52 %
14.00	1.78 %

EXTERNAL LOAD, Lb / Ft
(H20 Live Load)

Including a MOVING Wheel Load

Prism Load, Wp, Condition

Backfill Weight = 125 Lb / Ft ^ 3

Depth, Ft	Outside Diameter, ins. 12.750
2.00	1420.7
4.00	989.6
6.00	1053.4
8.00	1138.2
10.00	1328.1
12.00	1593.8
14.00	1859.4

External loads calculated using Modified Iowa formula.

PIPE DEFLECTION, %
(H20 Live Load)

Including a MOVING Wheel Load

DLF = 1.00 K = 0.100 PS = 34 psi E' = 1000 psi

Prism Load, Wp, Condition

Backfill Weight = 125 Lb / Ft ^ 3

(Note: If 'Over' is printed, the calculated deflection exceeded the allowable deflection)

Depth, Ft	Outside Diameter, ins. 24.000
2.00	1.41 %
4.00	0.98 %
6.00	1.04 %
8.00	1.13 %
10.00	1.31 %
12.00	1.58 %
14.00	1.84 %

EXTERNAL LOAD, Lb / Ft
(H20 Live Load)

Including a MOVING Wheel Load

Prism Load, Wp, Condition

Backfill Weight = 125 Lb / Ft ^ 3

Depth, Ft	Outside Diameter, ins. 24.000
2.00	2674.2
4.00	1862.7
6.00	1982.8
8.00	2142.5
10.00	2500.0
12.00	3000.0
14.00	3500.0

PIPE DEFLECTION, %
(H20 Live Load)

Including a MOVING Wheel Load

DLF = 1.00 K = 0.100 PS = 22 psi E' = 1000 psi

Prism Load, Wp, Condition

Backfill Weight = 125 Lb / Ft ^ 3

(Note: If 'Over' is printed, the calculated deflection exceeded the allowable deflection)

Depth, Ft	Outside Diameter, ins. 36.000
2.00	1.44 %
4.00	1.01 %
6.00	1.07 %
8.00	1.16 %
10.00	1.35 %
12.00	1.62 %
14.00	1.89 %

EXTERNAL LOAD, Lb / Ft
(H20 Live Load)

Including a MOVING Wheel Load

Prism Load, Wp, Condition

Backfill Weight = 125 Lb / Ft ^ 3

Depth, Ft	Outside Diameter, ins. 36.000
2.00	4011.3
4.00	2794.1
6.00	2974.2
8.00	3213.8
10.00	3750.0
12.00	4500.0
14.00	5250.0

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SHERMANDIXIE PRECAST UTILITY STRUCTURES

Industry News

Strength Versus Stiffness

An explanation of the biggest difference between rigid and flexible pipe systems.

CONCRETE PIPE (RIGID)
The strength of concrete pipe is designed by the engineer, built into the pipe at the plant and delivered on the truck ready to install. 90% of the structural strength required for a successful installation is provided by the concrete pipe. Only 10% is dependent upon the soil backfill placed by the contractor. Concrete pipe requires compacted bedding material only to the springline (halfway) of the pipe. A wide variety of on-site bedding and backfill material is permissible for RCP (AASHTO spec #17 & 27). No need to import expensive granular material. Concrete pipe has different pipe strength (classes) for different diameters and applications. Concrete compressive strengths are a minimum 4000 psi to as high as 6000+. With tensile strength 65,000+ psi.

HDPE PLASTIC PIPE (FLEXIBLE)
Low stiffness flexible plastic pipe has little, if any strength of it's own. It relies solely on the imported granular backfill material that the contractor must place and compact fully around the pipe to carry the live and dead loads. (ASTM spec #2321 & AASHTO spec #30). Plastic pipe offers only a one pipe stiffness per diameter approach to engineering. Notice in the chart below that as pipe diameter increases, the pipe stiffness (strength) decreases. Note 1: Sanitary sewer pipe requires a minimum pipe stiffness of 46 psi. Note 2: Strength of any plastic pipe decreases with age.

HDPE PIPE STIFFNESS	
Diameter	Stiffness
12"	50 psi
15"	42 psi
18"	40 psi
24"	34 psi
30"	28 psi
36"	22 psi
42"	19 psi
48"	17 psi
54"	16 psi
60"	14 psi

<< back

APPENDIX C

General Environmental, Health and Safety Rules and Regulations for Contractors and Subcontractors Working at Exide Technologies

VERNON, CA FACILITY

GENERAL ENVIRONMENTAL, HEALTH & SAFETY

RULES AND REGULATIONS FOR

CONTRACTORS AND SUBCONTRACTORS

WORKING AT

EXIDE TECHNOLOGIES

ORIGINAL DATE 11/30/2011

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It is Exide Technologies goal to maintain the highest standards of Environmental, Health and Safety protection. We will always strive to:

- Operate in a manner that protects the health and safety of our neighbors in the communities where we operate.
- Operate in a manner that protects the safety and health of all employees, contractors, and visitors to Exide facilities.
- Protect the environment and properly respond to any adverse environmental impacts caused by Exide operations.
- Operate in compliance with applicable environmental, health and safety laws.
- Integrate sound environmental, health & safety practices into daily business operations.
- Improve product safety and reduce the environmental impact of our products and manufacturing processes.
- Examine and continually improve Exide's environmental, health & safety management systems.

Continue to develop the environmental, health and safety expertise of all Exide employees. We are committed to meeting customer expectations in an environmentally sensitive manner in everything we do and everywhere we do it.

INTRODUCTION

Environmental, Health & Safety rules and regulations stated herein are minimum health & safety and environmental requirements for contractors and subcontractors working at Exide.

Additional health & safety and environmental rules and regulations may be required according to the nature of work performed.

To be considered for work at Exide, a bidding contractor must submit with a bid a signed copy of this booklet for his or her company and every proposed subcontractor. Once a signed copy has been received by Exide, future bids are not required to have a signed copy attached.

This submission will become part of any contract agreement and will certify that all contractor and subcontractor personnel have been informed and will comply with these requirements.

The cost of abiding by these requirements, including all required PPE, must be included in the bid and any contract price. No claims for added compensation arising from compliance will be considered by Exide after a contract for the work is made effective.

GENERAL CONTRACTOR RESPONSIBILITIES

1.0 COMPLIANCE AGREEMENT

1.1 Prior to executing work for Exide, a contractor must agree to comply with the following:

1.1.1 All Federal, State and Local safety and environmental requirements and regulations which apply to the work to be performed;

1.1.2 All requirements detailed in this document; and,

1.1.3 All additional requirements submitted in the documentation package including: Standard Articles for Fixed Price Construction Contract or Weighted Hourly Time and Materials Contract, whichever is applicable, the Notice to Third-Party employers at a Multi-Employer Work site and any Additional Rules, Regulations or Requirements of the **Vernon, CA Site.**

2.0 CONTRACTOR COMPLIANCE RESPONSIBILITIES

2.1 Contractors are responsible for all training and supervision of personnel necessary to comply with safety requirements described in Sections 1 and 9 of these rules.

2.2 Contractors are responsible for ensuring that all subcontractor personnel are trained and supervised to comply with safety requirements described in Sections 1 and 9 of these rules.

2.3 Contractor obligations to comply with the safety and environmental requirements described in Section 1 of these rules may be modified, only if, in the opinion of the Exide plant manager or designee, the work is sufficiently separated from existing Exide facilities and personnel so as to pose no danger to personnel or property. Any modifications must provide an equivalent degree of safety to contractor/subcontractor personnel and comply with all regulatory requirements. These modifications must be agreed to before any work begins and be documented as part of the contract agreement.

2.4 Contractors will immediately notify the appropriate Exide representative in the event of a regulatory inspection.

2.5 Contractors will immediately correct any safety and/or environmental discrepancies noted by Exide personnel. Failure to do so may result in work stoppage without additional compensation.

2.6 Contractors are responsible for providing all the equipment necessary to complete work specified by the contract. This requirement includes all safety equipment as well as equipment for completing the work.

3.0 SITE SECURITY

3.1 Contractor/subcontractor personnel will register daily at site entrance designated by Exide.

3.1.1. Sign-in of visitors is mandatory. Records are to be retained for a minimum of one year.

3.1.2. All visitors must sign out when leaving the premises.

3.2 Contractor/subcontractor personnel will park vehicle(s) in the space(s) assigned by Exide.

3.3 Firearms and ammunition are not allowed on Exide sites.

3.4 Cameras are permitted on site only with prior permission of the Exide Plant Manager and/or Assistant Plant Manager.

3.5 Contractors shall be responsible for securing their equipment and material and will not hold Exide liable for losses.

3.6 Contractors will not block exit doors or emergency equipment with their vehicles, trailers, etc.

4.0 PERSONAL PROTECTIVE EQUIPMENT

4.1 Contractor/subcontractor personnel are required to wear ANSI approved (Z87.1) industrial safety glasses with attached side shields at all times. If work will be outside, tinted glasses that meet the ANSI requirements will be permitted. It must be understood that upon entrance into any Exide production building or Maintenance Shop non-tinted glasses are required.

4.2 Clothing must consist of long sleeves and long pants are consistent with plant requirements for its employees.

4.3 Contractor/subcontractor personnel must wear substantial boots meeting the following requirements:

4.3.1 Meets or exceeds ANSI Z41-1991, MI/75, C/75 (maximum Impact and compression strength). Footwear meeting this requirement will be so marked on the inside of the upper or tongue.

4.3.2 All Contractor/subcontractor personnel working within the Plant or Laboratory areas, including outdoor areas of the Plant, will be required to wear steel-toed boots as a minimum.

4.4 The Exide representative will designate additional personal protective equipment which must be used to protect contractor personnel from the hazards of specific work prior to the bid process. (i.e., NFPA 70E energized work PPE, Permit Confined Space, etc.)

4.5 Respiratory protection equipment is required for work by contractor/subcontractor personnel in certain areas. All personnel wearing respiratory protection equipment must be clean-shaven at the start of the shift and free of facial hair that interferes with the proper sealing of a respirator. The only permissible facial hair is sideburns and mustaches which do not extend further than past the ends of the mouth or down to the upper portion of the jaw bone. The contractor is responsible for complying with governmental regulations with regard to training and fit-testing of contractor employees. Documentation will be provided prior to beginning the assignment for individuals that are medically approved to wear a respirator in accordance with 29 CFR1910.134.

4.6 The contractor/subcontractor is responsible for providing all personal protective equipment for their personnel.

5.0 ALCOHOLIC BEVERAGES AND CONTROLLED SUBSTANCES

5.1 Contractors will abide by Exide's policy to maintain a drug free work environment. The presence on the job site of employees of the contractor or subcontractor who are under the influence of drugs or alcohol is inconsistent with, and a violation of, the contractor's obligation to complete work in a safe and efficient manner.

5.2 The contractor will notify its employees, subcontractors and material/delivery personnel that contractors and their employees are not permitted to bring on to any Exide work site any alcoholic beverage or controlled dangerous substance, as that term is defined in the "Controlled Dangerous Substance Act", nor to enter any Exide work site while under the influence of alcohol or any controlled dangerous substances

5.3 The contractor will not permit or condone its employees or employees of its subcontractors and material/delivery personnel to bring any alcoholic beverage or any controlled dangerous substance onto any Exide work site, or to work while under the influence of alcohol or any controlled dangerous substance.

5.4 The contractor will remove from Exide's work site any of its employees found to be in possession of, or under the influence of any alcoholic beverage or any controlled dangerous substance while on Exide's work site, and will cause its subcontractors and material/delivery personnel to take similar action with respect to their employees. Any employee removed from an Exide work site pursuant to this provision shall not thereafter be allowed to enter an Exide work site.

5.5 Any contractor employee who has been seriously (OSHA Recordable or Lost Time) injured or who has caused serious injury to others shall be asked to

test for the presence of drugs (including alcohol). Failure of the contractor employee to submit to the drug/alcohol test is grounds for termination of that employee from work the Exide facility, and may result in termination of the contract.

5.6 The contractor's failure to comply with the provisions of Section 5 of this Standard shall constitute grounds for termination of this contract or purchasing agreements. As used herein, Exide's work site includes not only the portion of Exide 's property on which the contractor is performing services hereunder, but also all of Exide's adjacent property, including other areas of its plant, access roads, parking lots, etc.

6.0 ACCIDENTS AND INJURIES

6.1 The contractor is responsible for providing emergency first aid treatment for his or her personnel and must assure same for all subcontractor personnel.

6.2 In the event that an injury is beyond minor first aid there is a staffed plant dispensary where contractors can go for additional medical supplies or emergency services.

6.3 The contractor must immediately report all injuries, spills, fires, incidents which include property damage and potentially serious incidents including near misses to the Exide representative. The contractor must investigate all reportable cases and implement the steps necessary to prevent a recurrence. All investigations of reportable cases must be documented in writing and copies of investigation reports submitted to the Exide representative. A review meeting will be required with the Exide representative.

6.4 Injury records maintained by the contractor will include:

OSHA Form 301 -	Supplementary Record of Occupational Injuries and Illnesses;
OSHA Form 300 -	Log and Summary of Occupational Injuries and Illnesses.

7.0 PERMITS

7.1 A Safe Work Permit is required to keep track of all contractor and subcontractor work in all areas. Permits will be issued by an Exide Authorized Signer for the area where work is to be performed to ensure a safe and efficient job. Typically the area supervisor who has been trained is the appropriate authorized signer but if the work will be completed outside of a manufacturing area or is part of an engineering project, and project engineer(s) can act as the authorized signer if trained. All authorized signers shall serve to inform non-Exide personnel of the known fire, explosion, or toxic release hazards or other special conditions related to the work area and equipment. Failure to comply with the permit regulation shall be cause for immediate dismissal from the job site.

7.2 Additional permits are required for any contractor-subcontractor work in

operating areas of the plant. Some specific examples for which additional work permits are required include, but are not limited to:

7.2.1 Confined Space Entry Permit

7.2.2 Hot Work Permit required

7.2.3 Excavation/ Digging Permit

7.2.4 Lockout / Tagout will generate Safe Work Permit.

7.2.5 Overhead crane will generate a Safe Work Permit

7.2.6 Non SOP task

7.2.7 Fire Impairment

7.3 Safety Work permits will be issued on a shift basis. Generally, Exide's work shifts are from 7 AM to 3 PM, 3 PM to 11 PM and 11 PM to 7 AM. Adjustments to these hours may be made on a case by case basis, but in no case is a safety work permit valid for more than one shift.

7.4 It is imperative that the conditions noted on the permit(s) are exactly identical to the job conditions. When the nature or conditions of a job change in any way, or when new tools are required or different methods are employed to do the job other than those originally covered in the initial permit, WORK SHALL STOP IMMEDIATELY because the permit is invalid. The permit is only good for what it describes - no more and no less. Work cannot progress until the situation can be carefully analyzed and a new permit issued for the new conditions.

7.5 Communication is the key to enhancing the effectiveness of the work permit system. Operators, plant supervisors, contractor employees, contractor supervision and the Exide representative should all be aware of the permit process and the specific requirements of each permit. This then allows each to review the ongoing work and look for possible changing conditions or deviations during their daily work routine. Permits will be issued to contractor supervision only. The contractor supervision will distribute the permit to contractor employees performing that work. Contractor supervisors should also make sure contractor employees read the permit requirements. These permits must be posted in the work area. If the permit cannot be posted, it should be carried by one of the contractor workers in that area.

7.6 The contractor will comply with the specific Exide Vernon, CA site standards for Safety Work Permits, Energized Work, Lockout/Tagout, Hot Work, Line breaking and Confined Space Entry. Copies of these are available from the Exide representative.

7.7 All permits shall be turned into the H & S department at the end of each shift.

8.0 FIRE PROTECTION AND PREVENTION

8.1 When in or near an operating facility, Exide fire extinguishers may be employed by trained personnel in an emergency. Any use of extinguishing equipment shall be promptly reported to the Exide representative.

8.2 The contractor shall be responsible for the development of a fire protection program to be followed throughout all phases of the work and shall provide for the fire fighting equipment in accordance with regulations, these specifications and the requirements appropriate to the type of work being performed. This shall include, but not be limited to:

8.2.1 All fire fighting equipment provided by the contractor shall be conspicuously located, accessible, periodically inspected and maintained in good operating condition. Defective equipment shall be replaced immediately. The contractor shall give particular attention to training contractor personnel in the use of fire extinguishers and their limitations.

8.2.2 All compress gas cylinders shall be secured and stored properly

8.2.3 Additional employees, as needed, for fire watch.

8.2.4 Contactor shall have Maintenance or Project Manager or H & S cell number in case of emergency.

9.0 SAFETY TRAINING AND EDUCATION

9.1 The contractor shall instruct each employee in the recognition and corrections of at risk behaviors and at risk conditions.

9.2 The contractor shall acquaint each contractor employee with the safety and emergency equipment available and the procedures to be followed in each type of accident occurrence.

9.3 The Contractor shall provide its employees, agents and subcontractors training prior to starting the job. The training must, at a minimum, include the hazards of lead and the precautions necessary to prevent lead absorption. At a minimum up to date training documentation will be provided such as permit confined space, lockout/tagout, forklift, respirator training, etc. to the Health and Safety representative

9.4 All contractor personnel must receive an initial orientation by Health and Safety staff covering the safety and environmental procedures and the requirements of Exide. Contractor personnel will be required to sign a statement when they have received this orientation which states they will abide by all safety and environmental rules and regulations.

9.5 If, deemed necessary all contractor personnel shall attend a meeting to allow Exide to inform workers of present or expected plant conditions and safety related items.

10.0 SAFETY INSPECTIONS

10.1 At a minimum, the contractor shall check the work area daily at the beginning and at the end of each work shift (and after an extended break period such as lunch) to ensure safe working conditions (i.e., stable shoring, safe access and egress; all flames are extinguished, etc.).

10.2 The Exide representative and the contractor's supervisor will conduct and document periodic audits of the work area for unsafe acts and conditions.

11.0 HOUSEKEEPING AND HYGIENE

11.1 During the course of work, the contractor shall be responsible for properly organizing all activities on the job site to the extent that good housekeeping shall be practiced at all times. These shall include, but not be limited to:

11.1.1 As the job progresses, work areas must be kept clean at all times.

11.1.2 All materials, tools and equipment must be stored in a stable position to prevent rolling or falling. Materials and supplies shall be kept away from edges of floors, hoist ways, stairways and floor openings.

11.1.3 A safe access way to all work areas and storage areas must be maintained. All stairways, corridors, ladders, catwalks, ramps, passageways and work platforms shall be kept clear of loose material and trash.

11.1.4 Forms and scrap lumber with protruding nails and all other debris shall be cleared from work areas, passageways, and stairs and in and around buildings or other structures.

11.1.5 Combustible scrap and debris shall be removed at regular intervals. Safe means shall be provided to facilitate such removal.

11.1.6 If necessary, the contractor shall supply an adequate number of dumpsters to ensure a clean working area at all times. The contractor shall load and transport all refuse and debris to a suitable disposal site assigned by the Environmental Manager.

11.1.7 The contractor parking areas shall be maintained clean and free of paper and other debris at all times.

11.1.8 Beverages and Eating is not permitted in Production or Maintenance work areas or existing operating plant process areas. Drinking water is restricted except as specified by the Exide H & S representative.

11.1.9 Cords and hoses shall be strung at least 7' overhead when allowable or laid flat outside of walkways.

11.1.10 Tools and equipment shall not be strewn about where they might cause tripping or falling hazards and shall, at the end of each workday, be collected and stored in the tool room or craft gang boxes.

11.1.11 Each employee shall be instructed to practice required housekeeping as part of assigned duties.

11.1.12 The Contractor's employees, agents or subcontractors shall not leave the premises wearing this clothing. The Contractor shall make arrangements to properly package, transport, dispose or launder work clothing worn in the plant. If laundering, the persons or service provider that handles and launders the clothing shall be properly informed by Contractor of potential hazards.

11.1.13 All of Contractor's employees, agents and subcontractors must take a shower at the end of the workday, including washing their hair, prior to changing into clean clothing and leaving the premises.
All of Contractor's employees, agents and subcontractors must wash their hands and faces prior to eating and drinking. Tobacco products are prohibited on the facility, food or drinks are prohibited in the work area at any time. Food and drink may be present and consumed only in designated break rooms.

11.1.14 All of Contractor's employees, agents and subcontractors shall adhere to all Exide plant rules, including those set forth above, for entering break rooms and office areas, and rules.

12.0 MATERIAL HANDLING, STORAGE AND DISPOSAL

12.1 The contractor shall be responsible for using safe and environmentally sound methods of handling, storage, use and disposal of materials on the site. These shall include, but not be limited to:

12.1.1 All materials stored shall be stacked, braced, racked, blocked, interlocked or otherwise secured to prevent sliding, rolling, falling or collapse.

12.1.2 Rigging equipment for material handling shall be of the proper size and rating. All rigging equipment shall be inspected prior to use on each shift and as necessary during its use to ensure that it is safe. Defective rigging equipment shall be removed from service. All rigging equipment not in use shall be properly secured.

12.1.3 Disposal of debris or waste materials such as chemicals, oil, carcinogens, etc., shall comply with applicable plant environmental procedures, local ordinances and state regulations.

12.1.4 Storage locations for flammable materials (such as gasoline) for use by contractor(s) shall be in areas agreed to by the Exide representative. These areas shall be diked to retain spilled material and have an appropriately placed fire extinguisher.

12.2 The contractor shall take steps necessary to prevent discharging of lubricating oils and cleaning solvent onto the ground and/or into sewers and sewage disposal systems to prevent contaminating rivers, streams and the environment. These fluids (after use) shall be stored in properly labeled appropriate containers and disposed of in a legal manner conforming to all applicable regulations.

13.0 ELEVATED WORK

13.1.1 The use and erection of ladders and scaffolds shall comply with governmental regulations.

13.1.2 Approved full body safety harnesses must be worn when performing unprotected elevated work. (Note: Safety belts are no longer acceptable).

13.1.3 Unprotected, elevated work that is 4' or more above the lower level requires a personal fall arrest system.

14.0 EXCAVATIONS, TRENCHING AND SHORING

14.1 Excavations must be shored or sloped before entering, and protected according to governmental regulations.

14.2 Contact must be made with Exide Representative prior to any excavation.

14.3 The location and identification of underground utilities is the responsibility of Exide.

15.0 CONCRETE FORMS AND SHORING

15.1 All equipment and materials used in concrete construction and masonry work shall meet the appropriate requirements such as those in ANSI A10.9 Wall shoring shall also be designed to meet applicable federal and state codes, including OSHA 1926.701 in the U.S.

16.0 CRANE WORK

16.1 Contractors and/or subcontractors will be responsible for providing their Exide representative with a copy of a lift plan prior to the commencement of any rigging activities.

16.2 Mobilization of any crane must be communicated and coordinated through the Exide representative prior to arriving on site.

17.0 MISCELLANEOUS PROVISIONS

17.1 The contractor shall ensure that construction areas, aisles, stairs, ramps, runways, corridors, offices, shapes and storage areas where work is in progress shall be adequately lighted with either natural or artificial illumination.

17.2 All hand and power tools and similar equipment, whether furnished by the contractor or contractor employees, must be equipped with a GFCI and shall be maintained in a safe operating condition with all guards in place. Damaged tools shall be immediately repaired or replaced. Tools shall be used only for the purpose for which they were designed.

17.3 Loose clothing, rings and other jewelry shall not be worn around operating tools or machines. Sleeves will be kept buttoned.

17.4 The contractor is solely responsible for contractor equipment and goods. Exide Technologies is not responsible for any losses by theft or any other reason of the contractor's property.

17.5 The contractor will ensure no aluminum cans are brought onto the facility.

17.6 Any equipment moved or removed in the course of performing Work must be returned to its original condition/position prior to completion of the job, to include but not be limited to, guardrails, machine guards, doors, covers, seals, gaskets, lids, and the like.

17.7 Barricade tape in the plant consists of two colors, yellow and red. Yellow tape is caution tape. Yellow caution tape can be crossed if hazards are known. Red tape is danger tape. Red tape cannot be crossed until approval has been granted by the authorized signer or supervisor of the crew by informing you of hazards inside.

17.8 Pedestrian traffic shall be limited to only the assignment area of job task. Roaming around is restricted to avoid forklift, front end loaders, semi traffic, etc.

17.9 Gambling, fighting and horseplay are not permitted on Exide property.

17.10 Medical Blood Monitoring: The Contractor is solely responsible for arranging for and paying for medical monitoring of its employees, agents and subcontractors that work at Exide. Upon request, Exide may provide a list of then known medical monitoring service providers in the local area. By providing this list Exide is in no way certifying the suitability of the service providers to meet applicable requirements. A blood sample must be taken at regular intervals to indicate and document the amount of lead a worker has absorbed. Contractor shall provide a monthly update on Form EHSNA-106-B, to the Exide Plant H &S Manager to document blood lead levels of the Contractor’s employees, agents and subcontractors.

EXIDE RESPONSIBILITIES

1.0 ASSIGNMENT OF AN EXIDE REPRESENTATIVE

1.1 The name and contact information for the assigned Exide Representative will be the contact to all contractors and provide their cell number in case of emergency.

2.0 PRE-WORK AND WORK IN PROGRESS REQUIREMENTS

2.1 Prior to the start of work, the Exide representative will introduce and explain the following:

2.1.1 The requirements described in this booklet;

2.1.2 Any additional rules, regulations or requirements of the worksite;

2.1.3 The Notice to Third-Party Employers provided in the bid package;

2.1.4 Coordinating the issuing of safety work permits;

2.1.5 Completing the pre-work safety and environmental checklist;

2.2 During the course of work, the Exide representative will ensure the following:

2.2.1 Complete weekly audit of contractor and subcontractor safety and environmental performance; and,

2.2.2 Review all injuries, spills, fires and potentially serious incidents and including near miss incidents sustained by contractor personnel.

3.0 HAZARD COMMUNICATION

3.1 It is the Contractor's duty to comply with all federal, state, local and Exide environmental, health and safety regulations, including OSHA safety and health standards including, but not limited to, the OSHA Lead Standard, 29 CFR §1910.1025.

3.2 The contractor will provide a hazardous chemical inventory for contractor-supplied hazardous materials and corresponding Material Safety Data Sheets. Contractors are required to inform the Exide representative prior to bringing hazardous substances on site and to update the hazardous chemical inventory.

3.3 Contractors are required to strictly enforce container labeling. Labels are to include the identity of the substance and the appropriate hazard warning on all containers of hazardous substances as detailed in OSHA's Hazard Communication Standard 29CFR 1910.1200

4.0 PRE-WORK MEETING

4.1 Before work begins, the Exide Plant HS Manager, or a designated representative, shall meet with the Contractor and agree with the Contractor on the tasks to be performed at the facility, the number of employees, the potential exposures to lead and other hazardous materials, the time to be spent at the facility, protective equipment required, the medical monitoring program and reporting required, and other regulations and policies that apply to the Contractor's work.

5.0 TRAINING, PPE and MONITORING

5.1 Contractors are required to perform their own training, provide their own personal protective equipment, and conduct their own monitoring as required by the applicable standards. In exceptional situations where an independent contractor cannot practicably provide certain hygiene services such as showers, lockers or laundered work clothing, and it is performing work which may involve exposure to lead, arsenic, cadmium or other hazardous materials, Exide may provide use of its locker room, shower facilities and laundry service in exchange for the indemnities given in the Independent Contractor Agreement and for a monetary charge – the amount or rate for which shall be documented in the original contract; or, before work begins in a document similar to Form EHS-NA-106-C. Personal protective equipment, such as respirators, hard hats and eye protection, are required to be provided by the Contractor to its employees, agents and subcontractors. Unlike hygiene services such as showers and lockers, personal protective equipment shall never be provided (including, but not limited to, rental, sale or loan) by Exide to a Contractor, its agents, employees or subcontractors.

5.2 The Plant Engineering Manager or equivalent, shall ensure that an Exide representative of Supervisor level or higher, designated by the Engineering Manager, shall be present on-site at all times when Contractor's employees, agents or subcontractors are provided access to an Exide worksite.

6.0 ALUMINUM MATERIALS AND AEROSOL CANS

6.1 Large quantities of scrap materials from within Exide plants are transported and recycled at secondary lead smelters. When aluminum materials and aerosol cans come in contact with the high temperatures of smelting furnaces, an explosive condition can result. To ensure that these materials do not enter the feed material at smelters, Exide facility-wide standard safety rules generally prohibit Contractors from bringing aluminum materials and materials in aerosol cans onto the facility premises. This includes liquid beverage cans that may be brought in with personal lunches. By signing the Independent Contractor Agreement, Contractors working onsite at Exide facilities acknowledge that they have been notified and have notified their employees, agents and subcontractors that aluminum materials and aerosol cans are prohibited. Contractors who claim their employees, agents or subcontractors must work with Aluminum materials and do not have an alternative must give notice of this in writing to the Exide location manager prior to bringing such materials onsite. This notification shall certify that the Contractor will bear responsibility for

and will maintain control of and segregate any and all scrap aluminum materials and will place them in the accumulation area designated by Exide.

6.2 Contractors whose employees, agents or subcontractors are working with necessary materials in aerosol cans that do not have non-aerosol alternatives must obtain a written exception approval, prior to commencement of such Contractor services, to allow them to bring the aerosol cans onto the Exide premises. Contractors using approved materials in aerosol cans must incorporate their materials into the facility inventory and exchange program.

Please complete the information below certifying that you have received a copy of the contractor handbook and that you understand and will communicate the Environmental, Health & Safety and security requirements of the Exide Technologies, Vernon, California site.

Contract Company Name: _____

Signature: _____

Print Name: _____

Title: _____

Date: _____

(Authorized representative of contractor or subcontractor)

APPENDIX D

Cost Estimate

COST ESTIMATE
STORM SEWER REPLACEMENT WORK PLAN
EXIDE TECHNOLOGIES
VERNON, CALIFORNIA

Item	Quantity	Unit	Unit Cost	Extended Cost	Reference
Field Engineering					
Surveying	20	days	$ 1,500	$30,000	Similar project
Storm Sewer Replacement (all items installed)					
Mobilization/Demobilization	1	LS	$25,000	$25,000	Similar project
Precast Secondary Containment Structures (sealed, with PVC pipes)	21	each	$2,250	$47,250	Vendor quote
HDPE Manholes	21	each	$ 3,279	$68,859	Vendor quote
HDPE Pipe - 12"	764	LF	26.56	$20,292	Vendor quote
HDPE Pipe - 16"	452	LF	$40.63	$18,365	Vendor quote
HDPE Pipe - 18"	381	LF	$51.25	$19,526	Vendor quote
HDPE Pipe - 24"	963	LF	$83.13	$80,054	Vendor quote
HDPE Pipe - 30"	198	LF	$135	$26,730	est. from 24" price
HDPE Pipe - 36"	90		$160	$14,400	est. from 24" price
Trench Drain	502	LF	$169.00	$84,838	Vendor quote
60 mil EPDM Secondary Containment	3484	SY	$16.88	$58,810	Vendor quote
Geocomposite Leak Detection System	2020	SY	$2.52	$5,090	Vendor quote
10 oz Protective Geotextile	3484	SY	$2.24	$7,804	Vendor quote
Bore under Railroad with 36" DIP	40	LF	$704	$28,150	Means
Stainless Steel extension of Unit 46	1	LS	$10,000	$10,000	Similar project
Instrumentation	1	LS	$10,000	$10,000	Similar project
Driveway Sumps	6	each	$10,000	$60,000	Similar project
Trench Backfill	4000	CY	$15	$60,000	Similar project
Restoration					
Stone Subbase Class 3	5225	SY	$13	$65,313	Means
Concrete Pavement	5225	SY	$51.25	$267,781	Means
Sub-Total				$1,008,262	
QA/QC (15% of subtotal)				$151,239	
TOTAL				$1,159,502	

Note that the cost for placement of geotextile at bottom and sides of excavation and backfill to pipe subgrade is included in the cost estimate for stormsewer system removal and restoration (Appendix H of Comprehensive Removal Action Work Plan).