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Lake Las Vegas Lift Station

Conditional Letter of Map Revision

Henderson, Nevada

Technical Support Data Notebook

Prepared for

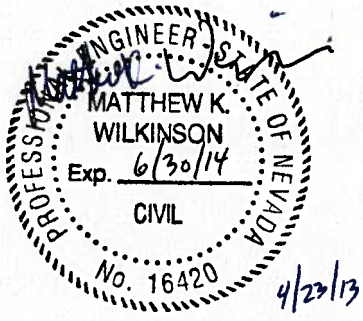


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April 2013

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Acronyms and Abbreviations

CFR 65.10	Title 44, Chapter 1 of the Code of Federal Regulations, Section 65.10, *Mapping of Areas Protected by Levees*
ac-ft	acre-ft
CCRFCD	Clark County Regional Flood Control District
CFR	Code of Federal Regulations
cfs	Cubic feet per second
COH	City of Henderson, Nevada
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
ft	feet
GIS	Geographic Information System
HEC-1	U.S. Army Corps of Engineers hydrologic modeling program
HEC-RAS	Hydrologic Engineering Centers River Analysis System
NAVD 88	North American Vertical Datum of 1988
NFIP	National Flood Insurance Program
NGVD 29	National Geodetic Vertical Datum of 1929
NHC	Northwest Hydraulic Consultants
SFHA	Special Flood Hazard Area
TSDN	Technical Support Data Notebook
USACE	U.S. Army Corps of Engineers

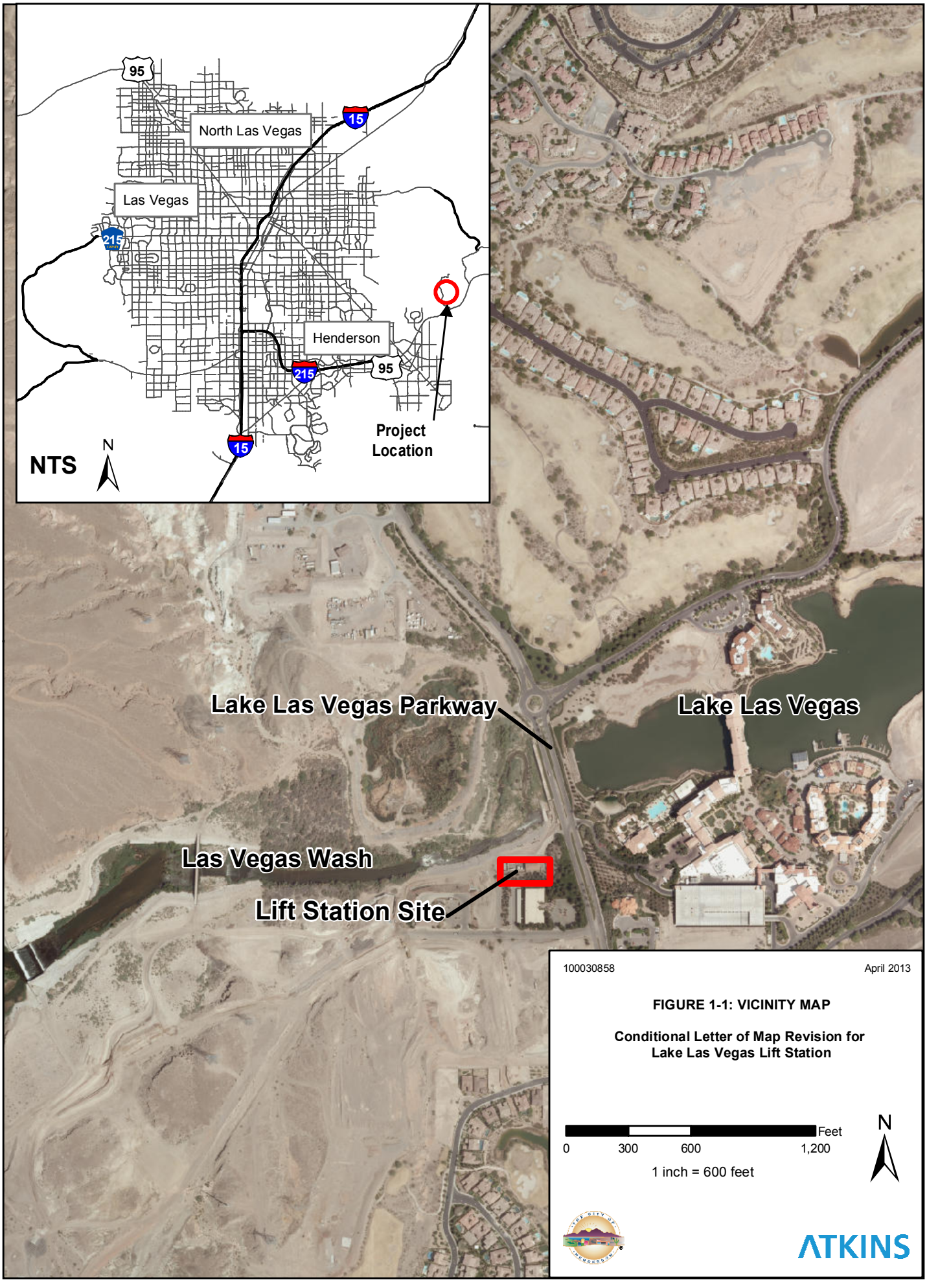
Section 1
Introduction

1.1. Project Overview

The purpose of this Conditional Letter of Map Revision (CLOMR) is to remove the Federal Emergency Management Agency (FEMA) Flood Zone AE located at a sewer lift station that this is owned and operated by the City of Henderson (COH), Nevada. The lift station is located within the City of Henderson on the upstream side of Lake Las Vegas Parkway on the south bank of the Las Vegas Wash. The site location is shown on **Figure 1-1: Vicinity Map.**

The lift station is protected by an existing and proposed floodwall that is located on three sides of the site. The lift station site is bounded on the fourth side by a steep hill that the floodwall ties into. The criteria for levees governs because the site is protected by a floodwall. This CLOMR request has analyzed a portion the Las Vegas Wash and will demonstrate/document that the existing and proposed floodwalls met the governing criteria that is found in Title 44, Chapter 1 of the Code of Federal Regulations, Section 65.10 (CFR 65.10), *Mapping Areas Protected by Levee Systems* and it is warranted to remove the flood zone AE located behind the floodwall within the lift station.

The effective FEMA flood zone is shown on the **Figure 1-2: Effective FEMA Flood Zone Map** which is reproduced form the Flood Insurance Rate Map (FIRM) panel 2610F dated November 16, 2011. It should be noted that in 2001 the COH constructed the floodwalls to protect the lift station site from the 1-percent-annual-chance flood (100-year) event. The flood zone for the Las Vegas Wash was re-mapped in 2011; however the analysis did not include the existing floodwall that protects the lift station. Recently the COH contracted with Atkins to provide engineering support to extend the floodwall and to retrofit the existing floodwall to take the demand load. This CLOMR proposes to revise the effective flood zone to reflect the existing and proposed floodwall. The Annotated FEMA Flood Zone is shown on **Figure 1-3: Annotated FEMA Flood Zone Map.**



100030858 April 2013

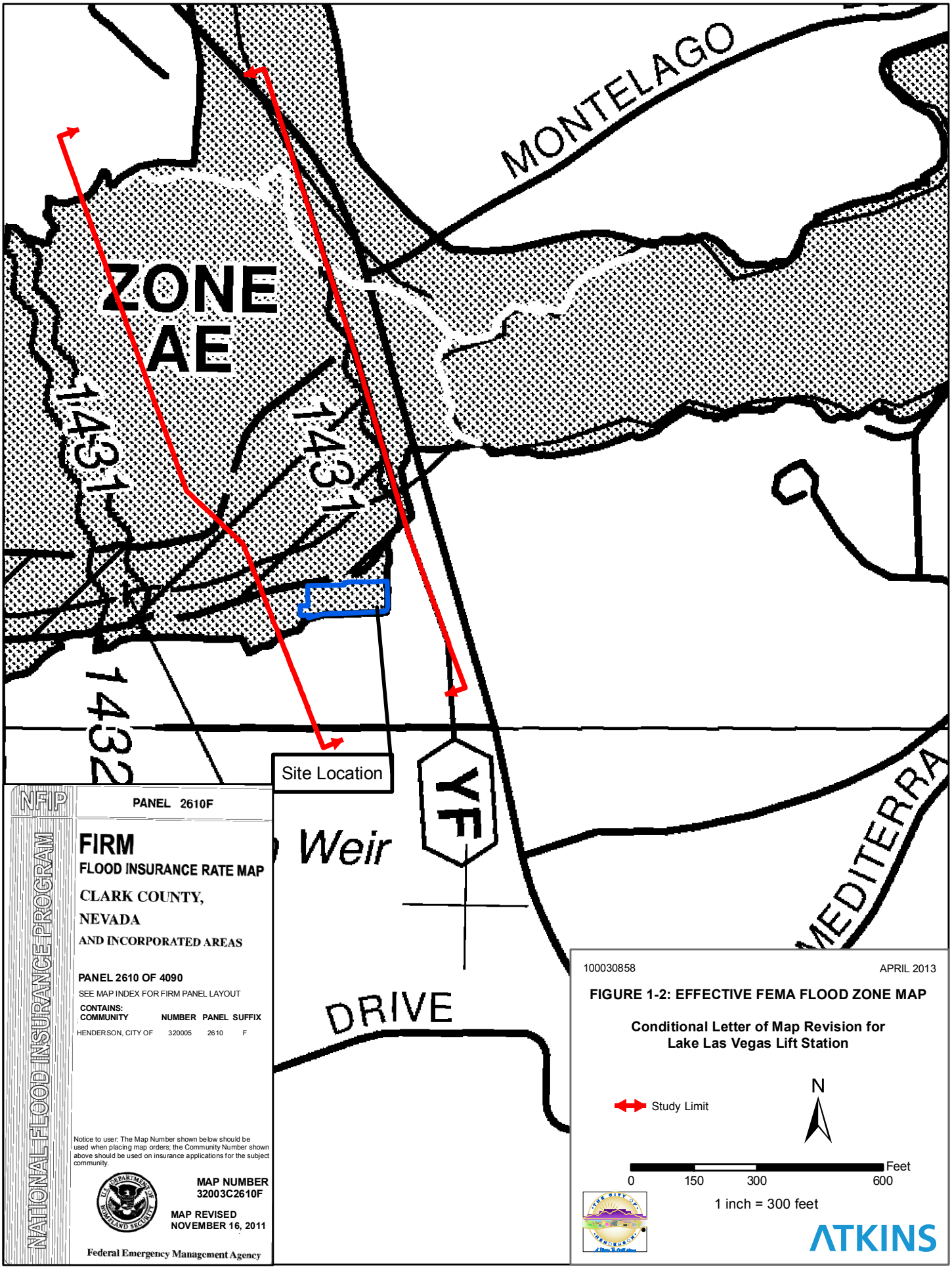
FIGURE 1-1: VICINITY MAP

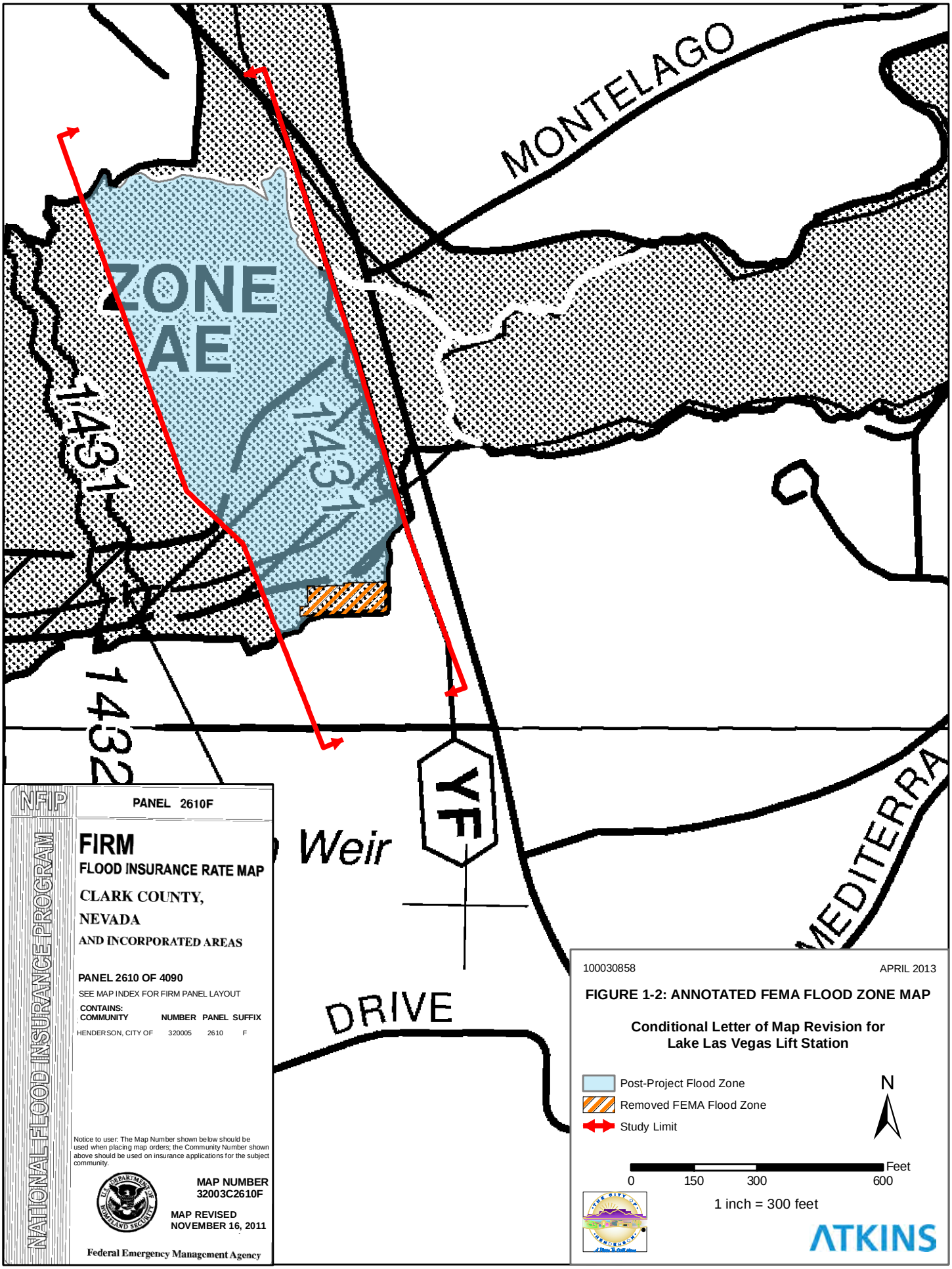
Conditional Letter of Map Revision for Lake Las Vegas Lift Station

Feet
0 300 600 1,200
1 inch = 600 feet

N

ATKINS


MONTELAGO
ZONE
AE
1431
1431
1431
1432
Site Location
YF
Weir
DRIVE
MEDITERRA
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 2610F
FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA
AND INCORPORATED AREAS
PANEL 2610 OF 4090
SEE MAP INDEX FOR FIRM PANEL LAYOUT
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
HENDERSON, CITY OF 320005 2610 F
Notice to user: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
32003C2610F
MAP REVISED
NOVEMBER 16, 2011
Federal Emergency Management Agency
100030858
APRIL 2013
FIGURE 1-2: EFFECTIVE FEMA FLOOD ZONE MAP
Conditional Letter of Map Revision for
Lake Las Vegas Lift Station
Study Limit
N
Feet
0 150 300 600
1 inch = 300 feet
ATKINS


MONTELAGO
ZONE AE
1431
1431
1431
1432
YF
Weir
DRIVE
MEDITERRA
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 2610F
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Notice to user: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
32003C2610F
MAP REVISED
NOVEMBER 16, 2011
Federal Emergency Management Agency
100030858
APRIL 2013
FIGURE 1-2: ANNOTATED FEMA FLOOD ZONE MAP
Conditional Letter of Map Revision for
Lake Las Vegas Lift Station
Post-Project Flood Zone
Removed FEMA Flood Zone
Study Limit
N
Feet
0
150
300
600
1 inch = 300 feet
ATKINS

1.2. Report Organization

As discussed above, this report has been prepared to document and describe the compliance determination for the floodwall and to present the basis for removing the flood zone (Zone AE) behind the proposed and existing floodwalls. The following is a basic outline of the information presented herein:

- Section 2 – Overview of applicable design criteria from CFR 65.10
- Section 3 – Hydrologic and hydraulic engineering analysis
- Section 4 – Geotechnical engineering analysis
- Section 5 – Structural engineering analysis

References are listed at the end of the report followed by the appendices. Essential portions of the appendices have been printed and included in hard copy format. Other supporting information and reference material has been provided electronically on a CD at the end of the report (in **Appendix VIII**) for practical purposes. An electronic version (PDF file) of the entire report is also included on the CD in **Appendix VIII**.

Section 2
Floodwall Minimum Design Criteria (Title 44 CFR 65.10)

FEMA is verifying that all levees/floodwalls recognized as providing protection from the base flood meet the requirements outlined in CFR 65.10. This section of the report presents a general overview of the design criteria in relation to the existing and proposed floodwall that protects the lift station.

Direct excerpts from CFR 65.10 are quoted throughout this section in *"italics"*. The specific paragraph letter/number from CFR 65.10 is shown in bold at the beginning of each excerpt. Below each excerpt is a brief summary discussion of the key considerations and conclusions related to the existing and proposed floodwalls that protect the lift station. More detailed documentation and engineering analysis is presented in subsequent sections of this report and/or in the appendices.

2.1. General

(a). *For purposes of the NFIP, FEMA will only recognize in its flood hazard and risk mapping effort those levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with the level of protection sought through the comprehensive flood plain management criteria established by §60.3 of this subchapter. Accordingly, this section describes the types of information FEMA needs to recognize, on NFIP maps, that a levee system provides protection from the base flood. This information must be supplied to FEMA by the community or other party seeking recognition of such a levee system at the time a flood risk study or restudy is conducted, when a map revision under the provisions of part 65 of this subchapter is sought based on a levee system, and upon request by the Administrator during the review of previously recognized structures. The FEMA review will be for the sole purpose of establishing appropriate risk zone determinations for NFIP maps and shall not constitute a determination by FEMA as to how a structure or system will perform in a flood event.*

2.2. Design Criteria

(b). *For levees to be recognized by FEMA, evidence that adequate design and operation and maintenance systems are in place to provide reasonable assurance that protection from the base flood exists must be provided. The following requirements must be met:*

2.2.1. Freeboard

Riverine Levees

(b)(1)(i). *Riverine levees must provide a minimum freeboard of three feet above the water-surface level of the base flood. An additional one foot above the minimum is required within 100 feet in either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted. An additional one-half foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, is also required.*

In order to verify that the existing and proposed floodwalls meet the above stated freeboard criteria Atkins revised the effective hydraulic model of the Las Vegas Wash with updated topography and floodwall geometry. Based on the results of the revised analysis reflecting the proposed condition, freeboard requirements are met. The available freeboard between the water surface elevation of the 1-

percent-annual-chance flood (100-year) event and the top of the floodwall is over four feet in all locations.

Refer to **Section 3** for more information on the hydraulic analysis and for the assessment of freeboard. The design plans for the floodwall are included in **Appendix VII.**

Exceptions

(b)(1)(ii). *Occasionally, exceptions to the minimum riverine freeboard requirement described in paragraph (b)(1)(i) of this section, may be approved. Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted to support a request for such an exception. The material presented must evaluate the uncertainty in the estimated base flood elevation profile and include, but not necessarily be limited to an assessment of statistical confidence limits of the 100-year discharge; changes in stage-discharge relationships; and the sources, potential, and magnitude of debris, sediment, and ice accumulation. It must be also shown that the levee will remain structurally stable during the base flood when such additional loading considerations are imposed. Under no circumstances will freeboard of less than two feet be accepted.*

Riverine Freeboard Exceptions are not anticipated for this floodwall system.

Coastal Levees and Exceptions

(b)(1)(iii). *For coastal levees, the freeboard must be established at one foot above the height of the one percent wave or the maximum wave run-up (whichever is greater) associated with the 100-year stillwater surge elevation at the site.*

(b)(1)(iv). *Occasionally, exceptions to the minimum coastal levee freeboard requirement described in paragraph (b)(1)(iii) of this section, may be approved. Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted to support a request for such an exception. The material presented must evaluate the uncertainty in the estimated base flood loading conditions. Particular emphasis must be placed on the effects of wave attack and overtopping on the stability of the levee. Under no circumstances, however, will a freeboard of less than two feet above the 100-year still water surge elevation be accepted.*

This requirement is not applicable for this floodwall system.

2.2.2. Closures

(b)(2). *All openings must be provided with closure devices that are structural parts of the system during operation and design according to sound engineering practice.*

The existing floodwall includes one opening and the new floodwall includes two openings. For all the openings a floodgate will be provided that is a structural part of the floodwall and the closure requirement is met. The design plans for the floodwall are included in **Appendix VII.**

2.2.3. Embankment Protection

(b)(3). *Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include, but are not limited to: Expected flow velocities (especially in constricted areas); expected wind and wave action; ice loading; impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment and foundation materials; levee alignment, bends, and transitions; and levee side slopes.*

This requirement is not applicable for this floodwall system.

2.2.4. Embankment and Foundation Stability

(b)(4). *Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability. An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in the U.S. Army Corps of Engineers (COE) manual, ''Design and Construction of Levees'' (EM 1110–2–1913, Chapter 6, Section II), may be used. The factors that shall be addressed in the analyses include: Depth of flooding, duration of flooding, embankment geometry and length of seepage path at critical locations, embankment and foundation materials, embankment compaction, penetrations, other design factors affecting seepage (such as drainage layers), and other design factors affecting embankment and foundation stability (such as berms).*

Geotechnical & Environmental Services Inc. (GES) was responsible for the assessment and evaluation of embankment and foundation stability. For more detailed information about their geotechnical evaluation, refer to **Section 4** and the Geotechnical Evaluation Report included in **Appendix IV**. The GES analysis concluded that the existing and proposed floodwall meets the geotechnical requirements of the levee criteria outlined in CFR 65.10 with regard to seepage conditions.

2.2.5. Settlement

(b)(5). *Engineering analyses must be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum standards set forth in paragraph (b)(1) of this section. This analysis must address embankment loads, compressibility of embankment soils, compressibility of foundation soils, age of the levee system, and construction compaction methods. In addition, detailed settlement analysis using procedures such as those described in the COE manual, ''Soil Mechanics Design— Settlement Analysis'' (EM 1100–2–1904) must be submitted.*

GES was responsible for the assessment and evaluation of settlement potential. For more detailed information about their geotechnical evaluation, refer to **Section 4** and the Geotechnical Evaluation Report in **Appendix IV**.

Based on the geotechnical evaluation, settlement is anticipated to be complete and therefore, freeboard will be maintained. An excerpt from GES's report discussing settlement is provided below as a summary:

"The site soils underlying the existing facility, including the existing CMU block screen wall, have been in place since approximately 1999. It is anticipated that any settlement due to structural loads has already occurred. Provided the fill at the site was placed under the structural loads has already occurred. Provided the fill at the site was placed under the supervision of a qualified geotechnical engineer and the recommendations in this evaluation are followed with adequate observation and testing, we anticipate that settlement due to structural loads from the new wall footings will be less than 1 inch." (Page 10 of 18)

2.2.6. Interior Drainage

(b)(6). *An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than one foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters.*

The interior drainage impacting the floodwall was analyzed and is discussed in detail in **Section 3**. The flow impacting each of the interior walls of the lift station was analyzed to determine that it meets the above criteria. The lift station walls were divided into three sections. The ponding water depths impacting the three wall sections are all less than one foot with the exception of a 32.8-foot long section of wall. This is considered insignificant because the area of 1 foot ponding is small (275 square feet) and the peak flow draining to this area is 1 cfs in the 100-year event.

It should be noted that there are no drainage facilities such as storm drains, drop inlets, or pump systems.

Refer to **Section 3** for more information about the interior drainage analysis. The design plans for the floodwall are included in **Appendix II.**

2.2.7. Other Design Criteria

(b)(7). *In unique situations, such as those where the levee system has relatively high vulnerability, FEMA may require that other design criteria and analyses be submitted to show that the levees provide adequate protection. In such situations, sound engineering practice will be the standard on which FEMA will base its determinations. FEMA will also provide the rationale for requiring this additional information.*

This requirement is not applicable for this floodwall system.

2.2.8. Operation Plans and Criteria

(c). *For a levee system to be recognized, the operational criteria must be as described below. All closure devices or mechanical systems for internal drainage, whether manual or automatic, must be operated in accordance with an officially adopted operation manual, a copy of which must be provided to FEMA by the operator when levee or drainage system recognition is being sought or when the manual for a previously recognized system is revised in any manner. All operations must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP.*

This criteria is met as the City of Henderson has adopted an operation and maintenance plan for the floodwall and the City is responsible for implementing the operation and maintenance plan. As stated in the City's cover letter, the City has adequate funding to execute the operation and maintenance plan. The City of Henderson is participating in the NFIP. A copy of the operation and maintenance plan is contained in **Appendix III**.

2.2.9. Closures

(c)(1). *Operation plans for closures must include the following:*

(c)(1)(i). *Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists for the completed operation of all closure structures, including necessary sealing, before floodwaters reach the base of the closure.*

(c)(1)(ii). *A formal plan of operation including specific actions and assignments of responsibility by individual name or title.*

(c)(1)(iii). *Provisions for periodic operation, at not less than one-year intervals, of the closure structure for testing and training purposes.*

This requirement been met. See the discussion above and the operation plan in **Appendix III**.

2.2.10. Interior Drainage Systems

(c)(2). *Interior drainage systems associated with levee systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof. These drainage systems will be recognized by FEMA on NFIP maps for flood protection purposes only if the following minimum criteria are included in the operation plan:*

(c)(2)(i). *Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system.*

This requirement is not applicable for this floodwall system, since there is no mechanized portion of the drainage system.

(c)(2)(ii). *A formal plan of operation including specific actions and assignments of responsibility by individual name or title.*

This requirement is not applicable for this floodwall system, since there is no mechanized portion of the drainage system.

(c)(2)(iii). *Provision for manual backup for the activation of automatic systems.*

This requirement is not applicable for this floodwall system, since there is no mechanized portion of the drainage system.

(c)(2)(iv). *Provisions for periodic inspection of interior drainage systems and periodic operation of any mechanized portions for testing and training purposes. No more than one year shall elapse between either the inspections or the operations.*

This requirement has been met. See discussion above (section 2.3) and the operation plan in **Appendix III**.

2.2.11. Other Operation Plans and Criteria

(c)(3). *Other operating plans and criteria may be required by FEMA to ensure that adequate protection is provided in specific situations. In such cases, sound emergency management practice will be the standard upon which FEMA determinations will be based.*

This requirement is not applicable for this levee system.

2.3. Maintenance Plans and Criteria

(d). *For levee systems to be recognized as providing protection from the base flood, the maintenance criteria must be as described herein. Levee systems must be maintained in accordance with an officially adopted maintenance plan, and a copy of this plan must be provided to FEMA by the owner of the levee system when recognition is being sought or when the plan for a previously recognized system is revised in any manner. All maintenance activities must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance. This plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained. At a minimum, maintenance plans shall specify the maintenance activities to be performed, the frequency of their performance, and the person by name or title responsible for their performance.*

This criteria is met as the City of Henderson has adopted an operation and maintenance plan for the floodwall and the City is responsible for implementing the operation and maintenance plan. As stated in the City's cover letter, the City has adequate funding to execute the operation and maintenance plan. A copy of the operation and maintenance plan is contained in **Appendix III**.

2.4. Compliance Determination Summary

The data and documentation presented in this report show that the floodwall complies with the structural requirements set forth in CFR 65.10 paragraphs (b)(1) through (7) and has been sealed by the professional engineers responsible for its development (refer to reports/calculations in appendices).

The compilation, review, and assessment of all necessary floodwall data and documentation were performed in close coordination with City of Henderson

staff. Error! Reference source not found. contains a checklist of the specific criteria required by FEMA to remove the flood zone behind the existing and proposed floodwall.

Table 2-1 CFR 65.10 Compliance Summary Table

44 CFR 65.10 Section Number	Criteria Description	Not Applicable	Acceptable	Unacceptable
Design Criteria (b)				
(b)(1)	3-ft minimum freeboard above BFE		X	
(b)(1)	Additional 1-ft freeboard within 100-ft of structures/constrictions	X		
(b)(1)	Additional 0.5-ft freeboard at upstream end of levee (tie-in)		X	
(b)(2)	All openings protected with closure devices		X	
(b)(3)	Embankment erosion protection analysis	X		
(b)(4)	Embankment and foundation stability analysis		X	
(b)(5)	Settlement analysis		X	
(b)(6)	Interior drainage analysis		X	
(b)(7)	Other design criteria and analyses (unique situations)	X		
Operation Plans and Criteria (c)				
Closures				
(c)(1)(i)	Documentation of flood warning system		X	
(c)(1)(ii)	Formal plan of operation		X	
(c)(1)(iii)	Provisions for periodic operation for testing/training (at least annual)		X	
Interior Drainage Systems				
(c)(2)(i)	Documentation of interior drainage flood warning system	X		
(c)(2)(ii)	Formal plan of operation for interior drainage		X	
(c)(2)(iii)	Provisions for manual backup for activation of automatic systems	X		
(c)(2)(iv)	Provisions for periodic operation for testing/training (at least annual)		X	
(c)(3)	Other operation plans and criteria required in specific situations	X		
Maintenance Plans and Criteria (d)				
(d)	Levee system maintained in accordance with officially adopted plan		X	
(d)	Copy of maintenance plan provided to FEMA		X	
(d)	Maintenance under jurisdiction of Federal/State/Community in NFIP		X	
(d)	Plan documents formal procedure to ensure structural integrity		X	
(d)	Plan specifies type of activities, frequency, and person responsible		X	
Certification Requirements (e)				
(e)	Certified as-built plans	X		

Section 3
Hydrologic and Hydraulic Engineering Analysis

This section includes a summary of the project topography, engineering analysis, and investigations that were performed to verify the flood zone AE can be removed due to the existing and proposed floodwalls.

3.1. Hydrologic Analysis

This section includes a summary of the hydrologic analysis developed for this CLOMR. It is separated between the hydrology for the floodplain analysis and the interior drainage.

3.1.1. Hydrologic Analysis for Floodplain Analysis

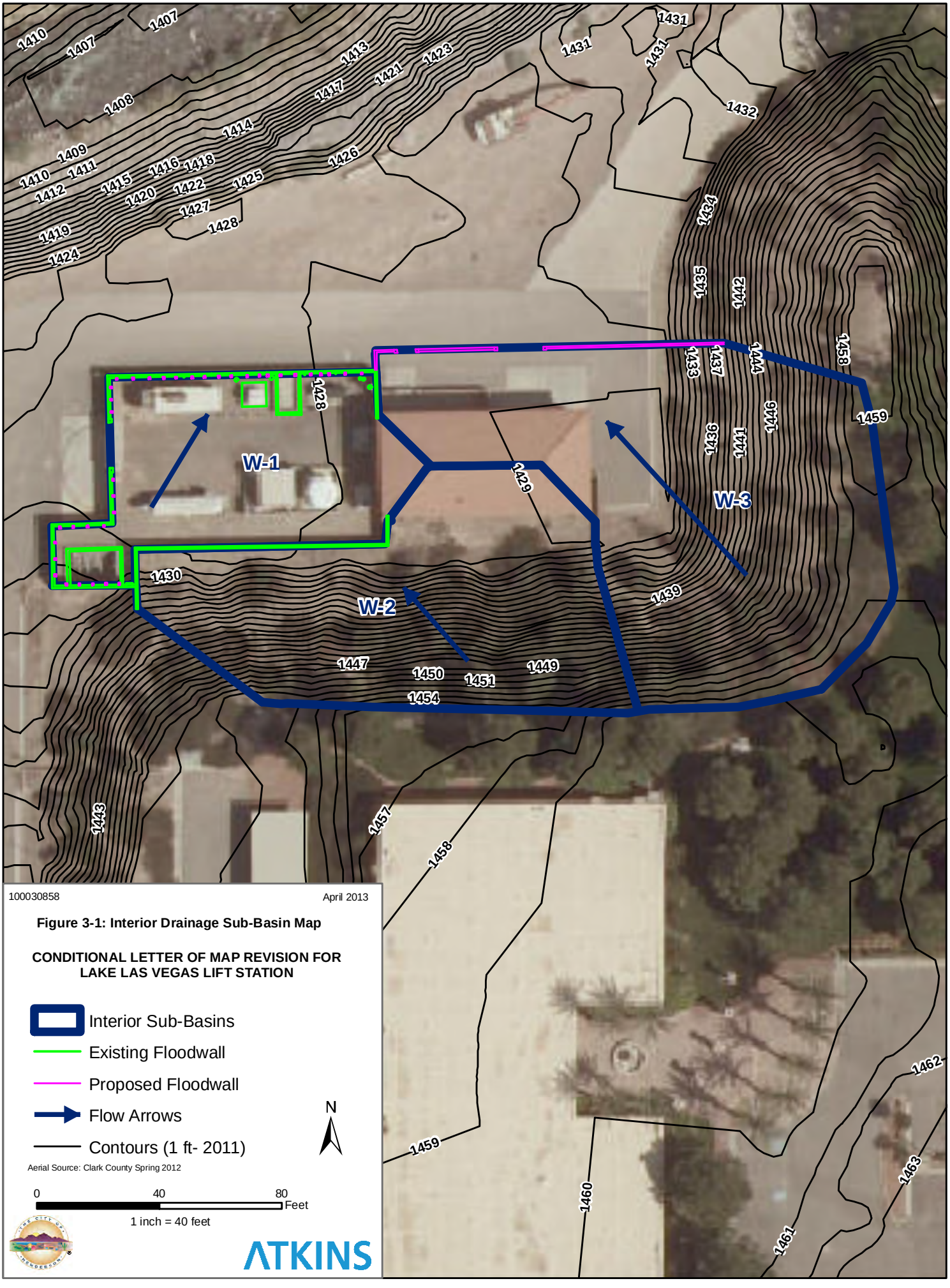
The flow developed in the hydrologic analysis for the FIS Las Vegas Wash Flood Hazard Mapping Restudy was used to perform the hydraulic analysis for this CLOMR study. **Appendix IV** includes excerpts from the Las Vegas Wash Flood Hazard Mapping Restudy that documents the flow used for the hydraulic model. The complete report is included on the Data CD included in **Appendix VIII**.

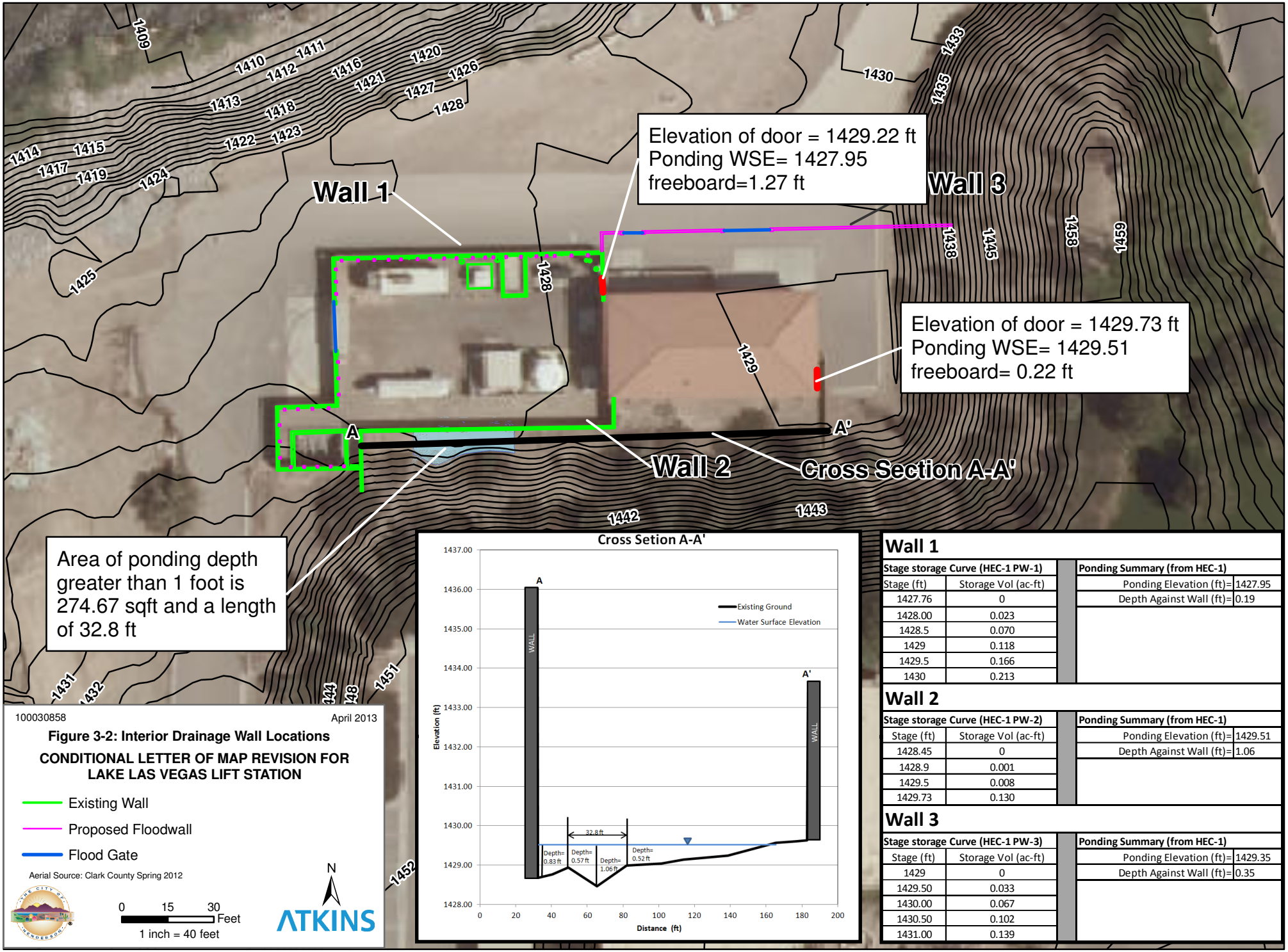
3.1.2. Hydrologic Analysis for Interior Drainage

The hydrologic analysis for the interior drainage included the following items.

- Delineated the (offsite and onsite) areas impacting the existing and proposed walls. A hydrologic model was developed to calculate the runoff impacting and ponding against the existing and proposed walls. **Figure 3-1: Interior Drainage Sub-Basins Map**, shows the drainage areas and the existing and proposed wall locations. The hydrologic calculations are included in **Appendix II**.

- A stage storage curve was calculated based on the topography in the area of the walls. This was done because the flood wall prevents the site from draining positively into the Las Vegas Wash. The stage storage curve was entered in the hydrologic model (HEC-1) and was used to calculate the water surface elevation at the three wall locations where water will pond. **Figure 3-2: Interior Drainage Wall Locations**, shows the wall locations, a summary of the stage storage curves and the water surface elevations for each location. It should be noted that water depth behind Wall 2 (see **Figure 3-2**) will be greater than 1 foot for a 32.8 foot long section. This area is shown on **Figure 3-2** with a cross section defining the area. Because, the ponding area greater than 1 foot deep is small (less than 1,600 square feet) the area will not be mapped and is considered insignificant.


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100030858
April 2013
Figure 3-1: Interior Drainage Sub-Basin Map
CONDITIONAL LETTER OF MAP REVISION FOR
LAKE LAS VEGAS LIFT STATION
Interior Sub-Basins
Existing Floodwall
Proposed Floodwall
Flow Arrows
Contours (1 ft- 2011)
N
Aerial Source: Clark County Spring 2012
0
40
80
Feet
1 inch = 40 feet
ATKINS



Wall 1

Stage storage Curve (HEC-1 PW-1)	
Stage (ft)	Storage Vol (ac-ft)
1427.76	0
1428.00	0.023
1428.5	0.070
1429	0.118
1429.5	0.166
1430	0.213

Ponding Summary (from HEC-1)	
Ponding Elevation (ft)=	1427.95
Depth Against Wall (ft)=	0.19

Wall 2

Stage storage Curve (HEC-1 PW-2)	
Stage (ft)	Storage Vol (ac-ft)
1428.45	0
1428.9	0.001
1429.5	0.008
1429.73	0.130

Ponding Summary (from HEC-1)	
Ponding Elevation (ft)=	1429.51
Depth Against Wall (ft)=	1.06

Wall 3

Stage storage Curve (HEC-1 PW-3)	
Stage (ft)	Storage Vol (ac-ft)
1429	0
1429.50	0.033
1430.00	0.067
1430.50	0.102
1431.00	0.139

Ponding Summary (from HEC-1)	
Ponding Elevation (ft)=	1429.35
Depth Against Wall (ft)=	0.35

100030858 April 2013

Figure 3-2: Interior Drainage Wall Locations

CONDITIONAL LETTER OF MAP REVISION FOR LAKE LAS VEGAS LIFT STATION

Existing Wall

Proposed Floodwall

Flood Gate

Aerial Source: Clark County Spring 2012

0 15 30 Feet

1 inch = 40 feet

N

ATKINS

3.2. Hydraulic Analysis

This section includes a summary of the hydraulic analysis developed for this CLOMR. The hydraulic analysis was separated into three sections which are: effective hydraulic analysis, pre-project hydraulic analysis, and post-project hydraulic analysis. The U.S. Army Corps of Engineers HEC-RAS version 4.1.0 was used to perform the hydraulic analysis. The HEC-RAS models are included in the data CD in **Appendix VIII** and the output from the models is included in **Appendix II**.

3.2.1. Effective Hydraulic Analysis

The Effective hydraulic model for the project area was referenced from the FIS for the Las Vegas Wash Flood Hazard Mapping Restudy. Because the lift station is a small site in comparison to the area studied in the Las Vegas Wash Flood Hazard Mapping Restudy the hydraulic model was truncated to just include the area around the site. The effective model was truncated at cross section 405.15 and the water surface elevations from the effective model were used as boundary conditions in the truncated effective model. **Table 3-1** shows a comparison of the water surface elevations of the effective model and the effective truncated model. **Figure 3-3: Pre-Project Hydraulic Workmap** shows the effective cross sections and the effective flood zone.

Table 3-1 Effective vs Truncated Effective Comparison Table

Cross-Section	Effecive Water surface Elevation (feet)	Truncated Effecive Water surface Elevation (feet)
14.48	1431.4	1431.4
182.42	1431.4	1431.4
405.15	1431.2	1431.2

3.2.2. Pre-Project Hydraulic Analysis

The pre-project hydraulic analysis revised the truncated effective hydraulic analysis so that it includes the existing floodwall around the lift station site. Cross section 182.42 was revised to show the floodwall. Cross sections 307.97 and 137.87 were added to the model to model the limits of the floodwall. The ineffective areas were updated in the project area. **Figure 3-3: Pre-Project Hydraulic Workmap** shows the revised flood zone and added cross sections.

It should be noted that cross section 307.97 and 137.87 were cut from a different topography source. The source of the topography was from aerial mapping that was conducted by AeroTech Mapping in June, 2011.The horizontal and vertical survey datums are summarized below. A digital copy of the topography data is included in the data CD in **Appendix VIII.**

BENCHMARK

COH BENCHMARK No. 635 (REVISION DATE: 2004)
2" ALUMINUM CAP IN THE TOP OF CURB ON THE EAST SIDE OF LAKE LAS VEGAS PARKWAY, 300'± NORTH OF THE CENTERLINE OF LAKE MEAD PARKWAY.

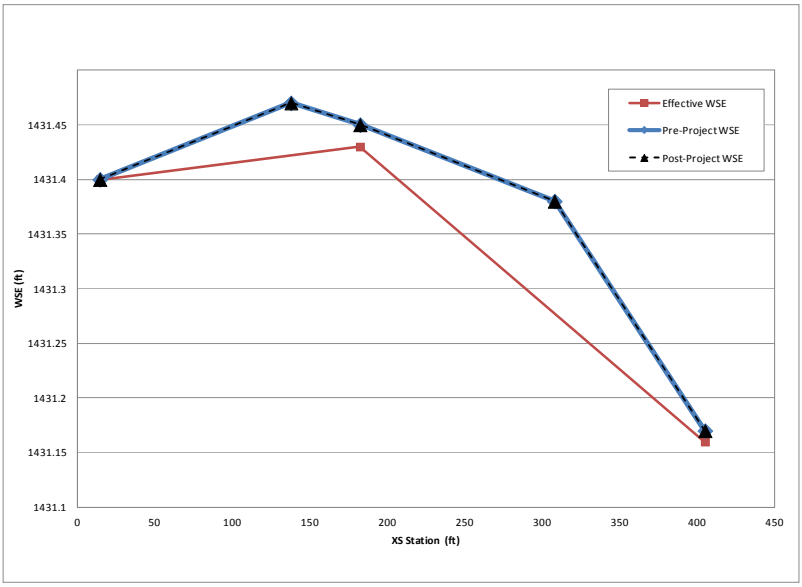
ELEVATION: 526.570 METERS (NAVD'88)
1727.59 FEET (NAVD'88)

3.2.3. Post-Project Hydraulic Analysis

The post-project hydraulic analysis updated the Pre-Project hydraulic analysis so that it includes the proposed floodwall around the lift station site. Cross section 182.42 was revised to show the limits of the floodwall. The ineffective areas were updated in the project area. **Figure 3-4: Post-Project Hydraulic Workmap** shows the revised flood zone. It should be noted that the floodway is unchanged from the effective analysis. **Table 3-2**, and the associated graph, below show a comparison of the water surface elevation between the Truncated Effective, Pre-Project, and Post-Project hydraulic analysis. The development of the proposed floodwall will not change the water surface elevation in the Las Vegas Wash.

Table 3-2 Water Surface Elevation Comparison Table (with graph)

Cross-section ID	Truncated Effective WSE (ft)	Pre-Project WSE (ft)	Post-Project WSE (ft)	Δ(Pre-Project WSE - Effective WSE)	Δ(Pre-Project WSE - Post-Project WSE)
405.15	1431.16	1431.17	1431.17	0.01	0
307.97	-	1431.38	1431.38	-	0
182.42	1431.43	1431.45	1431.45	0.02	0
137.87	-	1431.47	1431.47	-	0
14.48	1431.4	1431.4	1431.4	0	0



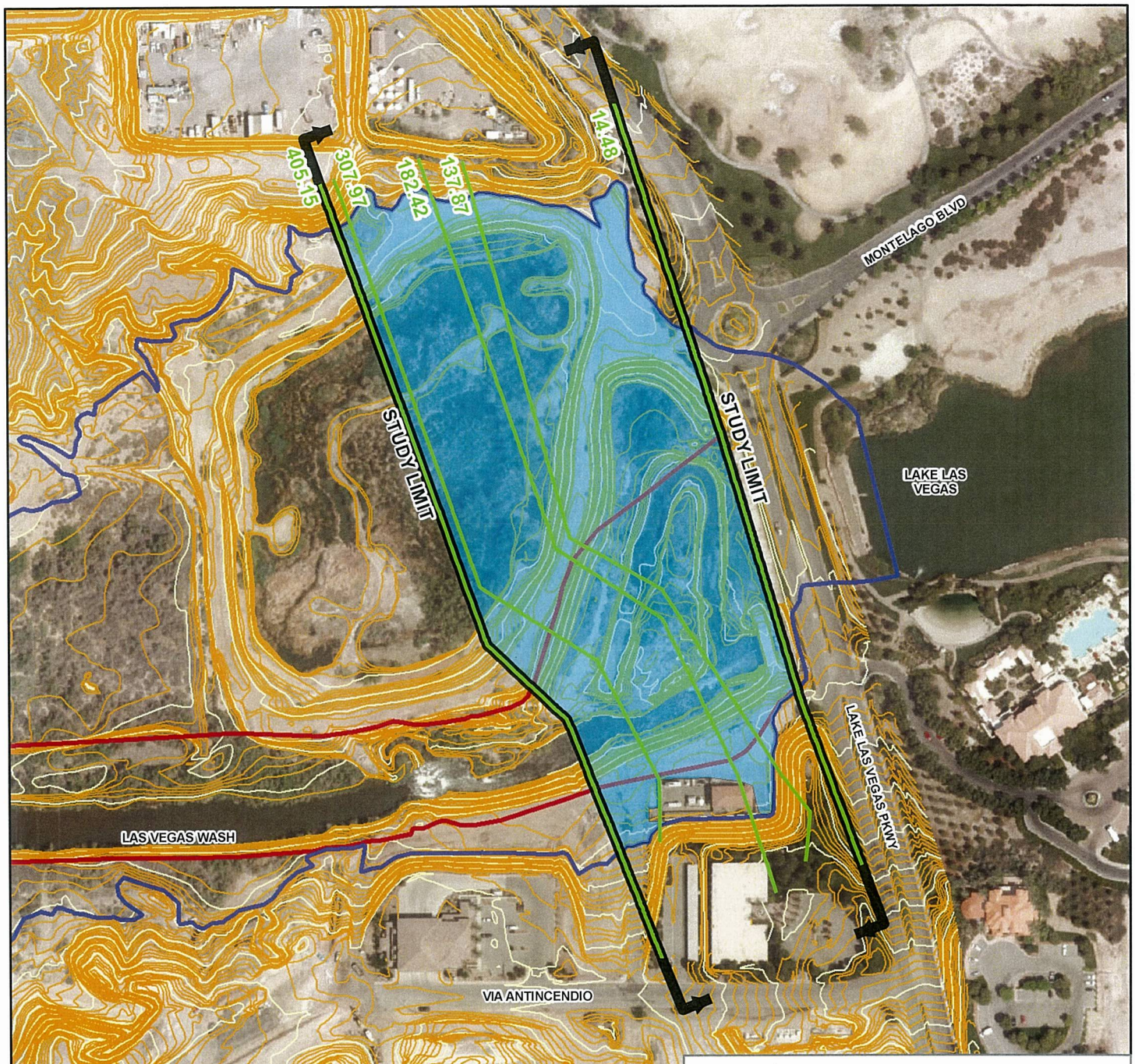


FIGURE 3-3: PRE-PROJECT HYDRAULIC WORKMAP

Conditional Letter of Map Revision for Lake Las Vegas Lift Station

- HEC RAS Cross-Sections
- Effective Flood Zone
- Pre-Project (Existing) Flood Zone
- Effective Floodway*
- Study Limit
- 5-ft Contours
- 1-ft Contours

* Effective Floodway does not change with the revisions made in the Pre-project analysis. Refer to Section XX of the report for more information on the Floodway

Aerial Source: Spring 2012

N

0 125 250 500 Feet

1 inch = 250 feet

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100030858 APRIL 2013

The pre-project topographic data is included on the data CD in Appendix VII.

I hereby certify that the topographic information used for the Pre-Project Hydraulic Modeling within this CLOMR substantially confirms with the current condition

Matt K. Wilkinson, P.E., CFM NV - 16420

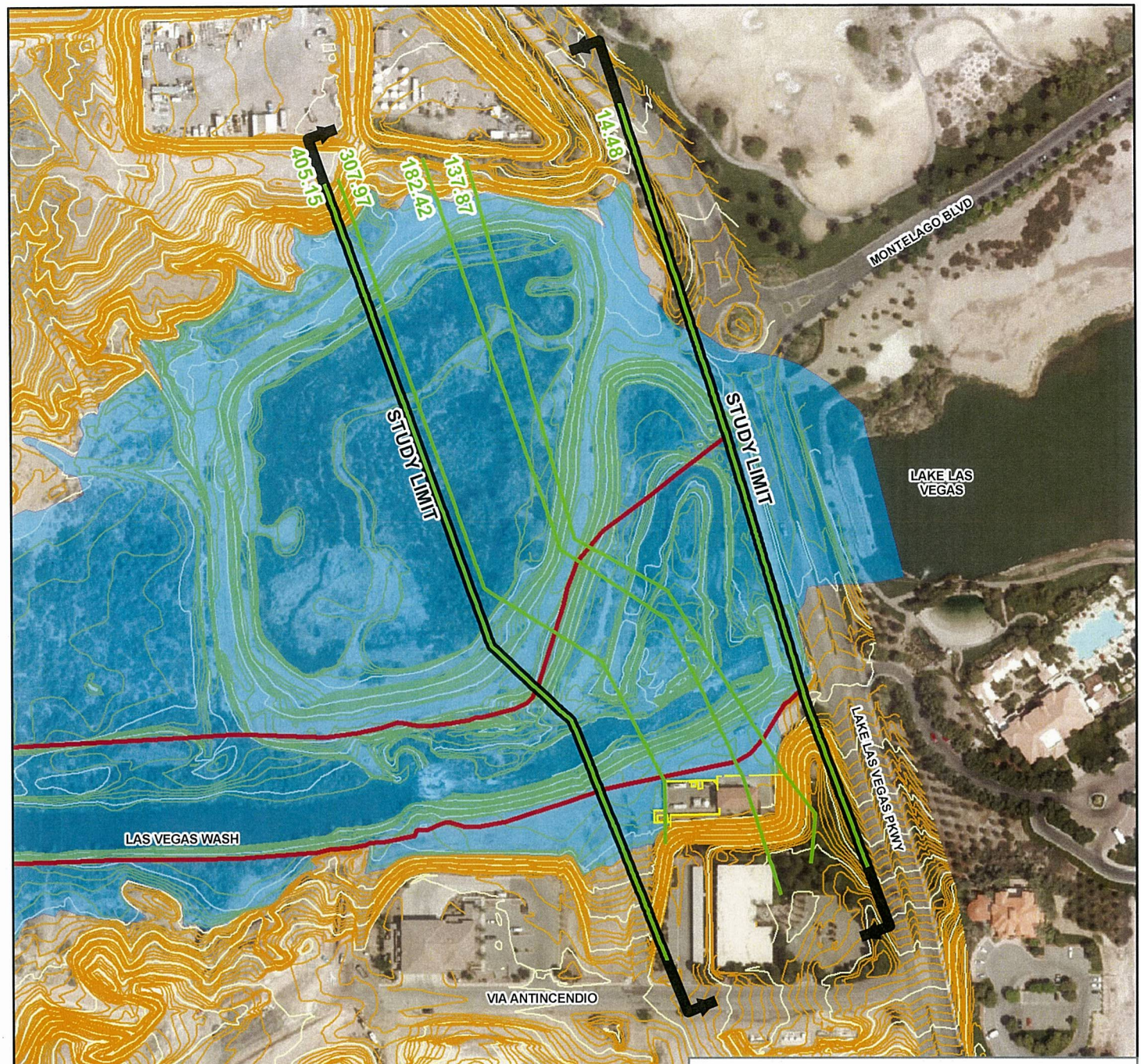


FIGURE 3-4: POST-PROJECT HYDRAULIC WORKMAP

Conditional Letter of Map Revision for Lake Las Vegas Lift Station

- HEC RAS Cross-Sections
- Post-Project Flood Zone
- Post Project Floodway
- Lift Station Floodwall
- Study Limit
- 5-ft Contours
- 1-ft Contours

Refer to the Improvement Plans provided in Appendix XX for the proposed wall elavations

Aerial Source: Spring 2012

N

Feet
0 125 250 500

1 inch = 250 feet

ATKINS

100030858 APRIL 2013

The post-project topographic data is included on the data CD in Appendix VIII.

I hereby certify that the topographic information used for the Post-Project Hydraulic Modeling within this CLOMR substantially confirms with the current condition

Matt K. Wilkinson, P.E., CFM NV - 16420

3.3. Sediment Transport

Sediment transport considerations were not considered since the Las Vegas Wash is a stable, regularly maintained Regional flood control facility. The Clark County Regional Flood Control District's Operation and Maintenance Plan is included in **Appendix III** of this report.

3.4. Freeboard Analysis

The freeboard analysis was performed to verify that the floodwall provides a minimum freeboard of three feet above the water-surface level of the base flood and an additional one-half foot of freeboard at the upstream end of the floodwall, as outlined in CFR 65.10.

The freeboard for the floodwall was computed at every cross section using the 100-year water surface elevation from the Post-Project Hydraulic model discussed in the **Section 3-2**. The results of the analysis show that the floodwall has more than 4 feet of freeboard along the entire length of the floodwall structure which is more than the freeboard requirements outlined in CFR 65.10. **Table 3-3** shows a summary of the top of floodwall elevation, water surface elevation, and freeboard. The proposed design plans for the proposed and existing floodwalls are included in **Appendix VII**.

Table 3-3 Freeboard Summary Table

Cross Section Station	Floodwall Elevation (ft)	Post-Project WSE (ft)	Freeboard (ft)
307.97	1436.17	1431.38	4.79
182.42	1436.26	1431.45	4.81
137.8763	1436.26	1431.47	4.79

Section 4
Geotechnical Engineering Analysis

This report section is an executive summary and should be read in conjunction with the attached Geotechnical Evaluation Report in **Appendix IV** for a more detailed description of the geotechnical evaluation performed by Geotechnical &environmental Services, INC (GES).

GES performed a geotechnical study for the Lake Las Vegas Lift Station Floodwall Improvement to obtain subsurface information for the floodwall and underlying foundation materials and to evaluate if the floodwall meets geotechnical requirements as outlined in 44 CFR Section 65.10. Specifically, the GES study focused on settlement and seepage according to 44 CFR 65.10, for the 100-year design water surface elevation. Based on results of the geotechnical analyses provided by GES, it is concluded that the existing floodwall retrofit and new floodwall configuration meets the minimum requirements for floodwall seepage and settlement set forth in the geotechnical requirements of 44 CFR 65.10.

Please refer to the Geotechnical Evaluation Report in **Appendix IV** for more detailed information.

Section 5
Structural Engineering Analysis

This report section is an executive summary and should be read in conjunction with the attached Structural Calculation Notebook included in **Appendix V** for a more detailed description of the Structural Analysis performed by Atkins.

The proposed floodwall and existing floodwall retrofit support piers were designed in accordance with strength design load and resistance factor design and allowable stress deign per the International Building Code 2009.

The following loads were considered: dead load, live load, wind load, and flood load. The live load used was 66 kips vactor truck, wind load was based on 90 mph and the flood load was based on a maximum water elevation of 1433.90 feet.

The floodwall consists of 8-inch concrete masonry blocks on a 1-foot x 8-inch concrete curb. The top of wall elevation matched the existing wall at elevation 1436.26.

The flood gate support pier consist of two 1-foot x 1-foot concrete piers and foundation to support a 6-foot x 7-foot gate and a 15-foot x 7-foot gate. Only one design for the 15-foot x 7-foot gate was performed to cover both cases.

The existing floodwall consisted of 8-inch concrete masonry block on top of a 1-foot 6-inch concrete curb. The existing foundation was able to take the demand load but not the existing floodwall. Because of this, the existing wall will be retrofitted using 8-inch x 9-inch counterforts. The counterforts were designed in critical sections at the top of the concrete curb and connected into existing wall using drill and epoxy dowels for shear transferring.

The analysis and design of the floodwall was performed using RetainPro 10 Version 10.12.4.18 supporting IBC 2009, ACI 318-05 and ACI 530-05 codes.

Please refer to the Structural Calculation Notebook in **Appendix V** for more detailed information.

Section 6
References

CCRFCD, 1999. Hydrologic Criteria and Drainage Design Manual. Adopted August 12, 1999.

FEMA, 2003. Guidelines and Specifications for Flood Hazard Mapping Partners. Appendix H - Guidance for Mapping of Areas Protected by Levee Systems. April 2003.

FEMA, 2009. Procedure Memorandum 52 – Guidance for Mapping Processes Associated with Levee Systems. April 24, 2009.

FEMA, 2009. Procedure Memorandum 53 – Guidance for Notification and Mapping of Expiring Provisionally Accredited Levee Designations. April 24, 2009.

Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations – "Mapping of Areas Protected by Levee Systems"

USACE, 2006. Levee Owner's Manual for Non-Federal Flood Control Works. Public Law 84-99. March 2006.

APPENDIX I

MT2 Forms

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

☒ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☐ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Example: 480301 480287	City of Katy Harris County	TX TX	48473C 48201C	0005D 0220G	02/08/83 09/28/90
320005	City of Henderson	NV	32003C	2610F	11/16/11

2. a. Flooding Source: Las Vegas Wash

   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)
   ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: CLOMR for Lake Las Vegas Lift Station

4. FEMA zone designations affected: AE (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

   a. The basis for this revision request is (check all that apply)

   ☒ Physical Change ☐ Improved Methodology/Data ☐ Regulatory Floodway Revision ☐ Base Map Changes
   ☐ Coastal Analysis ☒ Hydraulic Analysis ☐ Hydrologic Analysis ☐ Corrections
   ☐ Weir-Dam Changes ☒ Levee Certification ☐ Alluvial Fan Analysis ☐ Natural Changes
   ☐ New Topographic Data ☐ Other (Attach Description)

   Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures: ☐ Channelization ☒ Levee/Floodwall ☐ Bridge/Culvert

☐ Dam ☐ Fill ☐ Other (Attach Description)

6. ☒ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☒ Yes Fee amount: $6,050

☐ No, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm **for Fee Amounts and Exemptions.**

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Matthew K. Wilkinson, P.E., CFM	Company: Atkins North America, Inc.	
Mailing Address: 2270 Corporate Circle, Suite #200 Henderson, NV 89074	Daytime Telephone No.: 702-551-0345	Fax No.: 702-263-7200
	E-Mail Address: matthew.wilkinson@atkinsglobal.com	
Signature of Requester (required): Matthew K. Wilkinson	Date: 4/23/13	

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Albert J. Jankowiak, P.E., CFM, Project Engineer II	Community Name: City of Henderson	
Mailing Address: 240 Water Street, P.O. Box 95050, MSC 11 Henderson, NV 89009-5050	Daytime Telephone No.: 702-267-3024	Fax No.: 702-267-3051
	E-Mail Address: albert.jankowiak@cityofhenderson.com	
Community Official's Signature (required):	Date:	

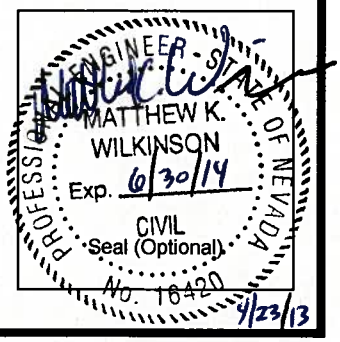
CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Matthew K. Wilkinson, P.E., CFM	License No.: NV 016420	Expiration Date: 6/30/14	
Company Name: Atkins North America, Inc.	Telephone No.: 702-551-0345	Fax No.: 702-263-7200	
Signature: Matthew K. Wilkinson	Date: 4/23/13	E-Mail Address: matthew.wilkinson@atkinsglobal.com	

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)	Required if ...
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☒ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans



U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

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ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Las Vegas Wash

Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☒ Not revised (skip to section B) ☐ No existing analysis ☐ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	Effective/FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☐ Precipitation/Runoff Model → Specify Model: _____
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Is the hydrology for the revised flooding source(s) affected by sediment transport? ☐ Yes ☐ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation..

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.)	
			Effective	Proposed/Revised
Downstream Limit*	Lake Las Vegas Parkway	14.48	1431.4	1431.4
Upstream Limit*	405.15' upstream of Lake Las Vegas Pkwy	405.15	1431.16	1431.17

*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS

3. Pre-Submittal Review of Hydraulic Models*

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4.

Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name: LLV Lift Station	Plan Name: Effective	File Name: LLV Lift Station	Plan Name: EffectiveFW	NAVD88
Corrected Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	
Existing or Pre-Project Conditions Model	File Name: LLV Lift Station	Plan Name: Pre-Project	File Name: LLV Lift Station	Plan Name: Pre-ProjectFW	NAVD88
Revised or Post-Project Conditions Model	File Name: LLV Lift Station	Plan Name: Post-Project	File Name: LLV Lift Station	Plan Name: Post-ProjectFW	NAVD88
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A **certified topographic work map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

☒ Digital Mapping (GIS/CADD) Data Submitted (preferred)

Topographic Information: Aerial mapping - local control NAVD88

Source: Aerotech Mapping 1' DTM Date: June 2, 2011

Accuracy: Class I, Photogrammetric Standard (ASPRS)

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM**, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☒ No

   a. For CLOMR requests, if either of the following is true, please submit **evidence of compliance with Section 65.12 of the NFIP regulations**:

      - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
      - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.

   b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? ☐ Yes ☒ No
      If Yes, please attach **proof of property owner notification and acceptance (if available)**. Elements of and examples of property owner notifications can be found in the MT-2 Form 2 Instructions.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

   If Yes, attach **evidence of regulatory floodway revision notification**. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. NO. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20598-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program; Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Las Vegas Wash

Note: Fill out one form for each flooding source studied.

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization.....complete Section B
Bridge/Culvert.....complete Section C
Dam.....complete Section D
Levee/Floodwall.....complete Section E
Sediment Transport.....complete Section F (if required)

Description Of Modeled Structure

1. Name of Structure: Floodwall at Lake Las Vegas Lift Station

   Type (check one): ☐ Channelization ☐ Bridge/Culvert ☒ Levee/Floodwall ☐ Dam

   Location of Structure: 150 feet upstream of Lake Las Vegas Parkway

   Downstream Limit/Cross Section: 137.87

   Upstream Limit/Cross Section: 307.97

2. Name of Structure: _____

   Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: _____

   Upstream Limit/Cross Section: _____

3. Name of Structure: _____

   Type (check one) ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: _____

   Downstream Limit/Cross Section: _____

   Upstream Limit/Cross Section: _____

NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.

B. CHANNELIZATION

Flooding Source: _____

Name of Structure: _____

1. Hydraulic Considerations

The channel was designed to carry _____ (cfs) and/or the _____-year flood.

The design elevation in the channel is based on (check one):

☐ Subcritical flow ☐ Critical flow ☐ Supercritical flow ☐ Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions

☐ Other locations (specify): _____

2. Channel Design Plans

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Accessory Structures

The channelization includes (check one):

☐ Levees [Attach Section E (Levee/Floodwall)] ☐ Drop structures ☐ Superelevated sections

☐ Transitions in cross sectional geometry ☐ Debris basin/detention basin [Attach Section D (Dam/Basin)] ☐ Energy dissipator

☐ Weir ☐ Other (Describe):

4. Sediment Transport Considerations

Are the hydraulics of the channel affected by sediment transport? ☐ Yes ☐ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source: _____

Name of Structure: _____

1. This revision reflects (check one):

☐ Bridge/culvert not modeled in the FIS

☐ Modified bridge/culvert previously modeled in the FIS

☐ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

☐ Dimensions (height, width, span, radius, length)
☐ Shape (culverts only)
☐ Material
☐ Beveling or Rounding
☐ Wing Wall Angle
☐ Skew Angle
☐ Distances Between Cross Sections
☐ Erosion Protection
☐ Low Chord Elevations – Upstream and Downstream
☐ Top of Road Elevations – Upstream and Downstream
☐ Structure Invert Elevations – Upstream and Downstream
☐ Stream Invert Elevations – Upstream and Downstream
☐ Cross-Section Locations

4. Sediment Transport Considerations

Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☐ No

If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

D. DAM/BASIN

Flooding Source: _____
Name of Structure: _____

1. This request is for (check one): ☐ Existing dam/basin ☐ New dam/basin ☐ Modification of existing dam/basin

2. The dam/basin was designed by (check one): ☐ Federal agency ☐ State agency ☐ Private organization ☐ Local government agency

   Name of the agency or organization: _____

3. The Dam was permitted as (check one): ☐ Federal Dam ☐ State Dam

   Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

   Permit or ID number _____ Permitting Agency or Organization _____

   a. ☐ Local Government Dam ☐ Private Dam

   Provided related drawings, specification and supporting design information.

4. Does the project involve revised hydrology? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).

   Was the dam/basin designed using critical duration storm? (must account for the maximum volume of runoff)

   ☐ Yes, provide supporting documentation with your completed Form 2.

   ☐ No, provide a written explanation and justification for not using the critical duration storm.

5. Does the submittal include debris/sediment yield analysis? ☐ Yes ☐ No

   If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why debris/sediment analysis was not considered?

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

FREQUENCY (% annual chance)	Stillwater Elevation Behind the Dam/Basin FIS	REVISED
10-year (10%)	_____	_____
50-year (2%)	_____	_____
100-year (1%)	_____	_____
500-year (0.2%)	_____	_____
Normal Pool Elevation	_____	_____

7. Please attach a copy of the formal Operation and Maintenance Plan

E. LEVEE/FLOODWALL

1. System Elements

a. This Levee/Floodwall analysis is based on (check one): ☒ upgrading of an existing levee/floodwall system ☒ a newly constructed levee/floodwall system ☐ reanalysis of an existing levee/floodwall system

b. Levee elements and locations are (check one):

☐ earthen embankment, dike, berm, etc. Station _____ to _____
☒ structural floodwall Station 307.97 to 137.87
☐ Other (describe): Station _____ to _____

c. Structural Type (check one): ☐ monolithic cast-in place reinforced concrete ☒ reinforced concrete masonry block ☐ sheet piling ☐ Other (describe): _____

d. Has this levee/floodwall system been certified by a Federal agency to provide protection from the base flood?

☐ Yes ☒ No

If Yes, by which agency? _____

e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

1. Plan of the levee embankment and floodwall structures. Sheet Numbers: S1.01, S2.01
2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers: Drawing included w/ form
3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. Sheet Numbers: Drawing included w/ form
4. A layout detail for the embankment protection measures. Sheet Numbers: n/a
5. Location, layout, and size and shape of the levee embankment features, foundation treatment, Floodwall structure, closure structures, and pump stations. Sheet Numbers: S1.01, S2.01

2. Freeboard

a. The minimum freeboard provided above the BFE is:

4.79 feet

Riverine

3.0 feet or more at the downstream end and throughout	☒ Yes	☐ No
3.5 feet or more at the upstream end	☒ Yes	☐ No
4.0 feet within 100 feet upstream of all structures and/or constrictions	☒ Yes	☐ No

Coastal

1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater).	☐ Yes	☐ No
2.0 feet above the 1%-annual-chance stillwater surge elevation	☐ Yes	☐ No

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE? ☐ Yes ☒ No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Closures

a. Openings through the levee system (check one): ☒ exists ☐ does not exist

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device
307.97	Right	180"W x 96"H	1428.0	Flood gate
182.42	Right	72"W x 84"H	1429.26	Flood gate
182.42	Right	180"W x 84"H	1429.26	Flood gate

(Extend table on an added sheet as needed and reference)

Note: Geotechnical and geologic data

In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers [USACE] EM-1110-2-1906 Form 2086.)

4. Embankment Protection

a. The maximum levee slope land side is: n/a - floodwall

b. The maximum levee slope flood side is: n/a - floodwall

c. The range of velocities along the levee during the base flood is: _____ (min.) to _____ (max.)

d. Embankment material is protected by (describe what kind): _____

e. Riprap Design Parameters (check one): ☐ Velocity ☐ Tractive stress
Attach references

Reach	Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
					D_{100}	D_{50}	Thickness	
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								

(Extend table on an added sheet as needed and reference each entry)

f. Is a bedding/filter analysis and design attached? ☐ Yes ☐ No

g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

Attach engineering analysis to support construction plans.

5. Embankment And Foundation Stability

a. Identify locations and describe the basis for selection of critical location for analysis:
n/a - floodwall

☒ Overall height: Sta.: 307.97, height 8.0 ft.

☒ Limiting foundation soil strength:

Strength ϕ = 32 degrees, c = 0 psf

Slope: SS = - (h) to - (v)

(Repeat as needed on an added sheet for additional locations)

b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):
n/a

c. Summary of stability analysis results:

E. LEVEE/FLOODWALL (CONTINUED)

5. Embankment And Foundation Stability (continued)

Case	Loading Conditions	Critical Safety Factor	Criteria (Min.)
I	End of construction	n/a	1.3
II	Sudden drawdown	n/a	1.0
III	Critical flood stage	n/a	1.4
IV	Steady seepage at flood stage	n/a	1.4
VI	Earthquake (Case I)	n/a	1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

d. Was a seepage analysis for the embankment performed? ☐ Yes ☐ No

If Yes, describe methodology used: n/a

e. Was a seepage analysis for the foundation performed? ☒ Yes ☐ No

f. Were uplift pressures at the embankment landside toe checked? ☒ Yes ☐ No

g. Were seepage exit gradients checked for piping potential? ☒ Yes ☐ No

h. The duration of the base flood hydrograph against the embankment is 1.33 hours.

Attach engineering analysis to support construction plans.

6. Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one): ☐ UBC (1988) ☒ Other (specify): IBC 2009

b. Stability analysis submitted provides for: ☒ Overturning ☒ Sliding If not, explain: _____

c. Loading included in the analyses were: ☒ Lateral earth @ P_A = n/a psf; P_p = 275 psf

☐ Surcharge-Slope @ _____, ☐ surface _____ psf

☒ Wind @ P_w = 20.3 psf

☐ Seepage (Uplift); _____ ☐ Earthquake @ P_{eq} = _____ %g

☐ 1%-annual-chance significant wave height: _____ ft.

☐ 1%-annual-chance significant wave period: _____ sec.

d. Summary of Stability Analysis Results: Factors of Safety.
Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5	Does not	control.		
Dead & Soil	1.5	1.5	n/a	n/a		
Dead, Soil, Flood, & Impact	1.5	1.5	2.9	1.63		
Dead, Soil, & Seismic	1.3	1.3	Does not	control.		

(Ref: FEMA 114 Sept 1986; USACE EM 1110-2-2502)
Note: (Extend table on an added sheet as needed and reference)

E. LEVEE/FLOODWALL (CONTINUED)

6. Floodwall And Foundation Stability (continued)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum	550	n/a
Maximum allowable	2,000	n/a

f. Foundation scour protection ☐ is, ☒ is not provided. If provided, attach explanation and supporting documentation:

Attach engineering analysis to support construction plans.

7. Settlement

a. Has anticipated potential settlement been determined and incorporated into the specified construction elevations to maintain the established freeboard margin? ☒ Yes ☐ No

b. The computed range of settlement is 0 ft. to 0.09 ft.

c. Settlement of the levee crest is determined to be primarily from : ☒ Foundation consolidation ☐ Embankment compression ☐ Other (Describe): _____

d. Differential settlement of floodwalls ☒ has ☐ has not been accommodated in the structural design and construction.

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: n/a acres
Draining to ponding area: 0.76 acres

b. Relationships Established

Ponding elevation vs. storage	☒ Yes	☐ No
Ponding elevation vs. gravity flow	☐ Yes	☒ No
Differential head vs. gravity flow	☐ Yes	☒ No

c. The river flow duration curve is enclosed: ☐ Yes ☒ No

d. Specify the discharge capacity of the head pressure conduit: n/a cfs

e. Which flooding conditions were analyzed?

• Gravity flow (Interior Watershed)	☐ Yes	☒ No
• Common storm (River Watershed)	☐ Yes	☒ No
• Historical ponding probability	☐ Yes	☒ No
• Coastal wave overtopping	☐ Yes	☒ No

If No for any of the above, attach explanation.

e. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. ☒ Yes ☐ No If No, attach explanation.

g. The rate of seepage through the levee system for the base flood is n/a cfs

h. The length of levee system used to drive this seepage rate in item g: n/a ft.

E. LEVEE/FLOODWALL (CONTINUED)

8. Interior Drainage (continued)

i. Will pumping plants be used for interior drainage? ☐ Yes ☒ No

If Yes, include the number of pumping plants: _____ For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic? ☐ Yes ☐ No

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104, and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquefaction ☐ is ☒ is not a problem

Hydrocompaction ☐ is ☒ is not a problem

Heave differential movement due to soils of high shrink/swell ☐ is ☒ is not a problem

b. For each of these problems, state the basic facts and corrective action taken:
See attached.

Attach supporting documentation

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure?
☐ Yes ☒ No Attach supporting documentation

d. Sediment Transport Considerations:

Was sediment transport considered? ☐ Yes ☒ No
If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why sediment transport was not considered.

10. Operational Plan And Criteria

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☒ Yes ☐ No

b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations?
☒ Yes ☐ No

c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations?
☒ Yes ☐ No If the answer is No to any of the above, please attach supporting documentation.

E. LEVEE/FLOODWALL (CONTINUED)

11. Maintenance Plan

Please attach a copy of the fomal maintenance plan for the levee/floodwall

12. Operations and Maintenance Plan

Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

CERTIFICATION OF THE LEVEE DOCUMENTION

This certification is to be signed and sealed by a licensed registered professional engineer authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.10(e) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Matthew K. Wilkinson, P.E., CFM License No.: NV 016420 Expiration Date: 6/30/14

Company Name: Atkins North America, Inc. Telephone No.: 702-551-0345 Fax No.: 702-263-7200

Signature: _____ Date: _____ E-Mail Address: matthew.wilkinson@atkinsglobal.com

F. SEDIMENT TRANSPORT

Flooding Source: _____

Name of Structure: _____

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or based on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume _____ acre-feet

Debris load associated with the base flood discharge: Volume _____ acre-feet

Sediment transport rate _____ (percent concentration by volume)

Method used to estimate sediment transport: _____

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: _____

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: _____

Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

ATTACHMENT

FEMA Form MT-2 Form 3 (Cont'd.)

E. LEVEE/FLOODWALL

6.d. Loading Conditions "Dead & Wind" and "Dead, Soil, & Seismic" do not control.

6.f. Not applicable.

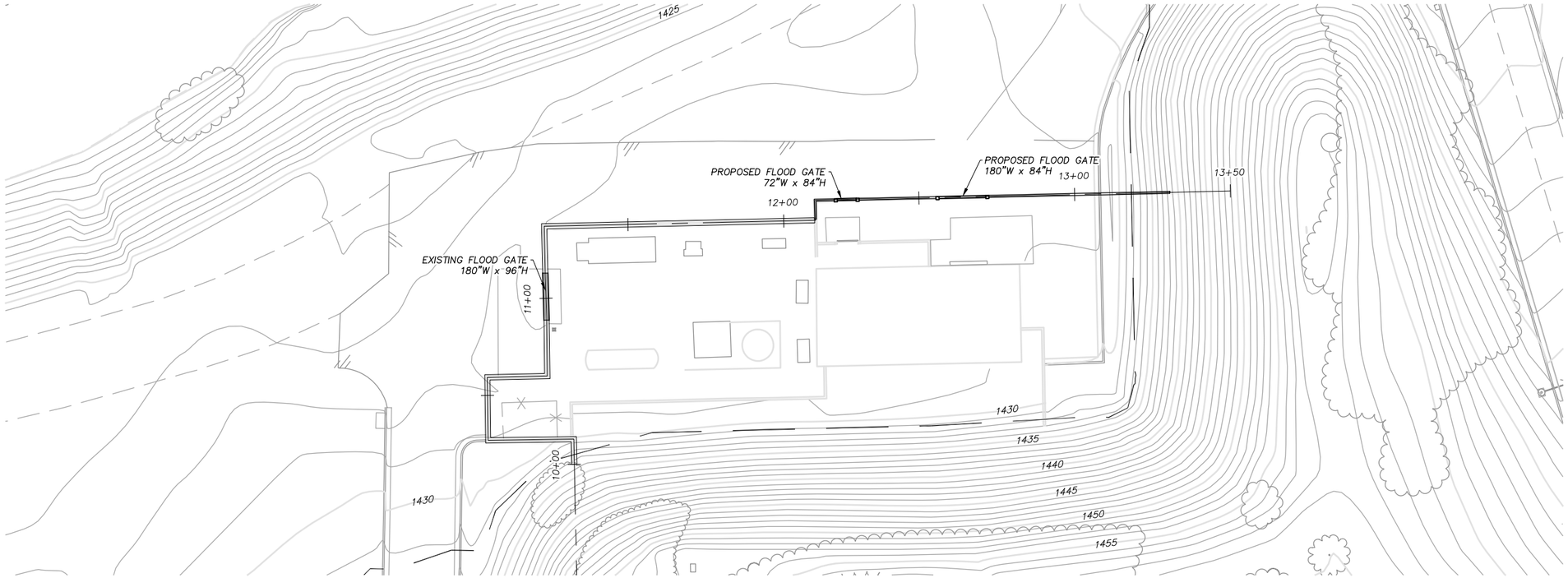
7.d. Per the geotechnical report (page 10), the anticipated settlement due to structural loads from the new wall footings will be less than 1 inch.

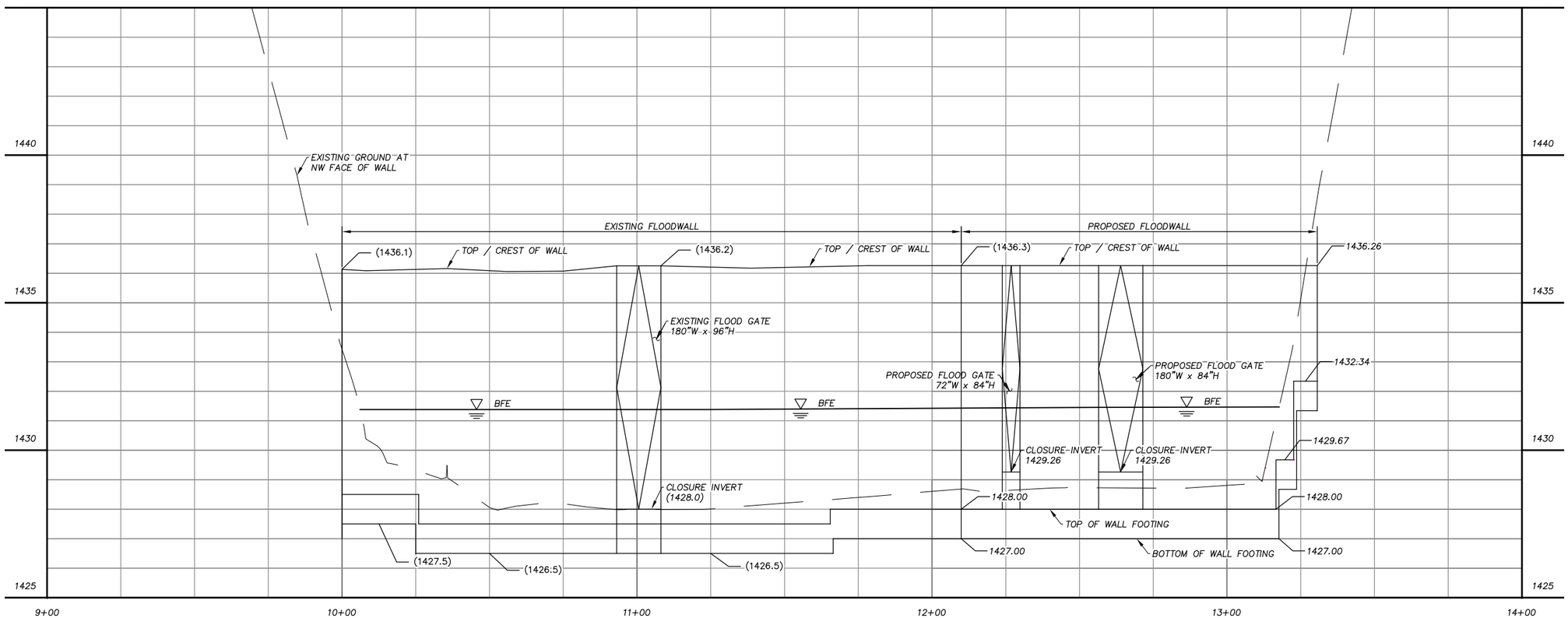
8.e. Which flooding conditions were analyzed? There are no gravity pipes or systems. There are no pumps. Minor ponding in a very small area (less than 0.8 acre).

8.f. No pumping. Minor ponding only.

9.b. For each of these problems, state the basic facts and corrective action taken: Based on the consistency of the soils encountered in the soil borings and the anticipated depth to groundwater the potential for liquefaction is low. Based on the blow counts obtained during the exploration the soils encountered in the borings consist of dense to very dense fill and are not anticipated to be subject to hydrocompaction. Soils encountered were dense to very dense and are granular and are not anticipated to have appreciable shrinkage or swells.

9.d. Sediment Transport considerations: Sediment transport was not considered since the Las Vegas Wash is a stable, regularly maintained Regional flood control facility. The Clark County Regional Flood Control District's Operation and Maintenance Plan is included in the report.





N

ATKINS

GRAPHIC SCALE

20 0 10 20 40

HORIZONTAL: 1"=40'
VERTICAL: 1"=4'

I HEREBY CERTIFY THAT THE INFORMATION SHOWN ON THIS FIGURE SUBSTANTIALLY CONFORMS TO EXISTING AND PROPOSED CONDITIONS.

MATTHEW K. WILKINSON, P.E., CFM
NV 16420

DATE

APPENDIX II

Engineering Analysis

Interior Drainage

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   15APR13  TIME  09:19:23  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*            (916) 756-1104            *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIDNS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITIDN OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK DUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATIDN
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

                        *DIAGRAM
 *** FREE ***
               1        ID
               2        ID    LAKE LAS VEGAS LIFT STATION CLOMR
               3        ID    INTERIOR DRAINAGE
               4        ID    INPUT FILE = 11v.PRN
               5        ID    INPUT FILE DATE = APRIL 2013
               6        ID    DESIGN STORM = 100-YEAR/10-YEAR 6-HOUR STORM
               7        ID    STORM DISTRIBUTION = SDN3
               8        ID    MODELED BY ATKINS (JACOB BEEDLE P.E.)
               9        ID    CHECKED BY ATKINS (MATTHEW WILKINSON  P.E.)
              10        ID    STORM CENTERING = NDNE
              11        ID
              12        IT       5       0       0     200
              13        IO       5       0       0
              14        IN       5       0       0
              15        JR    PREC       1
                        *

              16        KK     W-1
              17        BA 0.00020
              18        PB    3.15
              19        PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
              20        PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
              21        PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
              22        PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
              23        PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
              24        PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
              25        PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
              26        PC   0.998   0.999   1.000
              27        LS       0    85.0
              28        UD   0.051
                        *

              29        KK    PW-1
              30        KO       1
              31        RS       1    ELEV       0       0
              32        SV   0.000   0.023   0.070   0.118   0.166   0.213
              33        SE 1427.76    1428  1428.5    1429  1429.5    1430
              34        SQ     0.0     0.0     0.0     0.0     0.0 0.00001
                        *

              35        KK     W-2
              36        BA  .00052
              37        LS       0    67.6
              38        UD    0.05
                        *

              39        KK    PW-2
              40        KO       1
              41        RS       1    ELEV       0       0
              42        SV   0.000   0.001   0.008   0.130
              43        SE 1428.45  1428.9  1429.5 1429.73
              44        SQ     0.0     0.0     0.0 0.00001
                        *
```

1 HEC-1 INPUT PAGE 2

```
          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

              45        KK     W-3
              46        BA 0.00047
              47        LS       0    72.2
              48        UD    0.05
                        *

              49        KK    PW-3
              50        KO       1
              51        RS       1    ELEV       0       0
              52        SV   0.000   0.033   0.067   0.102   0.139
              53        SE    1429  1429.5    1430  1430.5    1431
              54        SQ     0.0     0.0     0.0     0.0 0.00001
                        *
              55        ZZ
```

1 SCHEMATIC DIAGRAM DF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    16        W-1
               V
               V
    29       PW-1
              .
              .
    35        .        W-2
              .         V
              .         V
    39        .       PW-2
```

```
                .          .
                .          .
   45           .          .        W-3
                .          .         V
                .          .         V
   49           .          .       PW-3

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN  1998               *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   15APR13  TIME  09:19:23  *
*                                      *
****************************************

****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*        DAVIS, CALIFORNIA 95616       *
*            (916) 756-1104            *
*                                      *
****************************************

                        LAKE LAS VEGAS LIFT STATION CLOMR
                        INTERIOR DRAINAGE
                        INPUT FILE = 11v.PRN
                        INPUT FILE DATE = APRIL 2013
                        DESIGN STORM = 100-YEAR/10-YEAR 6-HOUR STORM
                        STORM DISTRIBUTION = SDN3
                        MODELED BY ATKINS (JACOB BEEDLE P.E.)
                        CHECKED BY ATKINS (MATTHEW WILKINSON  P.E.)
                        STORM CENTERING = NONE

  13 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME         0000  STARTING TIME
                        NQ          200  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1    0  ENDING DATE
                    NDTIME         1635  ENDING TIME
                     ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL      .08 HOURS
                       TOTAL TIME BASE    16.58 HOURS

           ENGLISH UNITS
                DRAINAGE AREA          SQUARE MILES
                PRECIPITATION DEPTH    INCHES
                LENGTH, ELEVATION      FEET
                FLOW                   CUBIC FEET PER SECOND
                STORAGE VOLUME         ACRE-FEET
                SURFACE AREA           ACRES
                TEMPERATURE            DEGREES FAHRENHEIT

     JP           MULTI-PLAN OPTIDN
                     NPLAN          1  NUMBER OF PLANS

     JR           MULTI-RATIO OPTION
                     RATIOS OF PRECIPITATION
                    1.00

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

             **************
             *            *
  29 KK      *      PW-1  *
             *            *
             **************

  30 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          1  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

                HYDROGRAPH ROUTING DATA

  31 RS          STORAGE ROUTING
                      NSTPS          1  NUMBER OF SUBREACHES
                       ITYP       ELEV  TYPE OF INITIAL CONDITION
                     RSVRIC        .00  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

  32 SV          STORAGE          .0        .0        .1        .1        .2        .2

  33 SE          ELEVATION     1427.76   1428.00   1428.50   1429.00   1429.50   1430.00

  34 SQ          DISCHARGE         0.        0.        0.        0.        0.        0.

                                                        ***

*****************************************************************************************************************************************

                                                HYDROGRAPH AT STATION     PW-1
                                                   PLAN 1,   RATIO =  1.00

*****************************************************************************************************************************************

 DA MON HRMN ORD   OUTFLOW  STORAGE    STAGE *  DA MON HRMN ORD   OUTFLOW  STORAGE    STAGE *  DA MON HRMN ORD   OUTFLOW  STORAGE    STAGE
                                              *                                              *
  1    0000   1        0.       .0  1427.8 *   1    0535  68        0.       .0  1427.9 *   1    1110 135        0.       .0  1428.0
  1    0005   2        0.       .0  1427.8 *   1    0540  69        0.       .0  1427.9 *   1    1115 136        0.       .0  1428.0
  1    0010   3        0.       .0  1427.8 *   1    0545  70        0.       .0  1427.9 *   1    1120 137        0.       .0  1428.0
  1    0015   4        0.       .0  1427.8 *   1    0550  71        0.       .0  1428.0 *   1    1125 138        0.       .0  1428.0
  1    0020   5        0.       .0  1427.8 *   1    0555  72        0.       .0  1428.0 *   1    1130 139        0.       .0  1428.0
  1    0025   6        0.       .0  1427.8 *   1    0600  73        0.       .0  1428.0 *   1    1135 140        0.       .0  1428.0
  1    0030   7        0.       .0  1427.8 *   1    0605  74        0.       .0  1428.0 *   1    1140 141        0.       .0  1428.0
  1    0035   8        0.       .0  1427.8 *   1    0610  75        0.       .0  1428.0 *   1    1145 142        0.       .0  1428.0
  1    0040   9        0.       .0  1427.8 *   1    0615  76        0.       .0  1428.0 *   1    1150 143        0.       .0  1428.0
  1    0045  10        0.       .0  1427.8 *   1    0620  77        0.       .0  1428.0 *   1    1155 144        0.       .0  1428.0
  1    0050  11        0.       .0  1427.8 *   1    0625  78        0.       .0  1428.0 *   1    1200 145        0.       .0  1428.0
  1    0055  12        0.       .0  1427.8 *   1    0630  79        0.       .0  1428.0 *   1    1205 146        0.       .0  1428.0
  1    0100  13        0.       .0  1427.8 *   1    0635  80        0.       .0  1428.0 *   1    1210 147        0.       .0  1428.0
  1    0105  14        0.       .0  1427.8 *   1    0640  81        0.       .0  1428.0 *   1    1215 148        0.       .0  1428.0
  1    0110  15        0.       .0  1427.8 *   1    0645  82        0.       .0  1428.0 *   1    1220 149        0.       .0  1428.0
  1    0115  16        0.       .0  1427.8 *   1    0650  83        0.       .0  1428.0 *   1    1225 150        0.       .0  1428.0
  1    0120  17        0.       .0  1427.8 *   1    0655  84        0.       .0  1428.0 *   1    1230 151        0.       .0  1428.0
  1    0125  18        0.       .0  1427.8 *   1    0700  85        0.       .0  1428.0 *   1    1235 152        0.       .0  1428.0
  1    0130  19        0.       .0  1427.8 *   1    0705  86        0.       .0  1428.0 *   1    1240 153        0.       .0  1428.0
  1    0135  20        0.       .0  1427.8 *   1    0710  87        0.       .0  1428.0 *   1    1245 154        0.       .0  1428.0
  1    0140  21        0.       .0  1427.8 *   1    0715  88        0.       .0  1428.0 *   1    1250 155        0.       .0  1428.0
```

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0145	22	0.	.0	1427.8	1		0720	89	0.	.0	1428.0	1		1255	156	0.	.0	1428.0
1		0150	23	0.	.0	1427.8	1		0725	90	0.	.0	1428.0	1		1300	157	0.	.0	1428.0
1		0155	24	0.	.0	1427.8	1		0730	91	0.	.0	1428.0	1		1305	158	0.	.0	1428.0
1		0200	25	0.	.0	1427.8	1		0735	92	0.	.0	1428.0	1		1310	159	0.	.0	1428.0
1		0205	26	0.	.0	1427.8	1		0740	93	0.	.0	1428.0	1		1315	160	0.	.0	1428.0
1		0210	27	0.	.0	1427.8	1		0745	94	0.	.0	1428.0	1		1320	161	0.	.0	1428.0
1		0215	28	0.	.0	1427.8	1		0750	95	0.	.0	1428.0	1		1325	162	0.	.0	1428.0
1		0220	29	0.	.0	1427.8	1		0755	96	0.	.0	1428.0	1		1330	163	0.	.0	1428.0
1		0225	30	0.	.0	1427.8	1		0800	97	0.	.0	1428.0	1		1335	164	0.	.0	1428.0
1		0230	31	0.	.0	1427.8	1		0805	98	0.	.0	1428.0	1		1340	165	0.	.0	1428.0
1		0235	32	0.	.0	1427.8	1		0810	99	0.	.0	1428.0	1		1345	166	0.	.0	1428.0
1		0240	33	0.	.0	1427.8	1		0815	100	0.	.0	1428.0	1		1350	167	0.	.0	1428.0
1		0245	34	0.	.0	1427.8	1		0820	101	0.	.0	1428.0	1		1355	168	0.	.0	1428.0
1		0250	35	0.	.0	1427.8	1		0825	102	0.	.0	1428.0	1		1400	169	0.	.0	1428.0
1		0255	36	0.	.0	1427.8	1		0830	103	0.	.0	1428.0	1		1405	170	0.	.0	1428.0
1		0300	37	0.	.0	1427.8	1		0835	104	0.	.0	1428.0	1		1410	171	0.	.0	1428.0
1		0305	38	0.	.0	1427.8	1		0840	105	0.	.0	1428.0	1		1415	172	0.	.0	1428.0
1		0310	39	0.	.0	1427.8	1		0845	106	0.	.0	1428.0	1		1420	173	0.	.0	1428.0
1		0315	40	0.	.0	1427.8	1		0850	107	0.	.0	1428.0	1		1425	174	0.	.0	1428.0
1		0320	41	0.	.0	1427.8	1		0855	108	0.	.0	1428.0	1		1430	175	0.	.0	1428.0
1		0325	42	0.	.0	1427.8	1		0900	109	0.	.0	1428.0	1		1435	176	0.	.0	1428.0
1		0330	43	0.	.0	1427.8	1		0905	110	0.	.0	1428.0	1		1440	177	0.	.0	1428.0
1		0335	44	0.	.0	1427.9	1		0910	111	0.	.0	1428.0	1		1445	178	0.	.0	1428.0
1		0340	45	0.	.0	1427.9	1		0915	112	0.	.0	1428.0	1		1450	179	0.	.0	1428.0
1		0345	46	0.	.0	1427.9	1		0920	113	0.	.0	1428.0	1		1455	180	0.	.0	1428.0
1		0350	47	0.	.0	1427.9	1		0925	114	0.	.0	1428.0	1		1500	181	0.	.0	1428.0
1		0355	48	0.	.0	1427.9	1		0930	115	0.	.0	1428.0	1		1505	182	0.	.0	1428.0
1		0400	49	0.	.0	1427.9	1		0935	116	0.	.0	1428.0	1		1510	183	0.	.0	1428.0
1		0405	50	0.	.0	1427.9	1		0940	117	0.	.0	1428.0	1		1515	184	0.	.0	1428.0
1		0410	51	0.	.0	1427.9	1		0945	118	0.	.0	1428.0	1		1520	185	0.	.0	1428.0
1		0415	52	0.	.0	1427.9	1		0950	119	0.	.0	1428.0	1		1525	186	0.	.0	1428.0
1		0420	53	0.	.0	1427.9	1		0955	120	0.	.0	1428.0	1		1530	187	0.	.0	1428.0
1		0425	54	0.	.0	1427.9	1		1000	121	0.	.0	1428.0	1		1535	188	0.	.0	1428.0
1		0430	55	0.	.0	1427.9	1		1005	122	0.	.0	1428.0	1		1540	189	0.	.0	1428.0
1		0435	56	0.	.0	1427.9	1		1010	123	0.	.0	1428.0	1		1545	190	0.	.0	1428.0
1		0440	57	0.	.0	1427.9	1		1015	124	0.	.0	1428.0	1		1550	191	0.	.0	1428.0
1		0445	58	0.	.0	1427.9	1		1020	125	0.	.0	1428.0	1		1555	192	0.	.0	1428.0
1		0450	59	0.	.0	1427.9	1		1025	126	0.	.0	1428.0	1		1600	193	0.	.0	1428.0
1		0455	60	0.	.0	1427.9	1		1030	127	0.	.0	1428.0	1		1605	194	0.	.0	1428.0
1		0500	61	0.	.0	1427.9	1		1035	128	0.	.0	1428.0	1		1610	195	0.	.0	1428.0
1		0505	62	0.	.0	1427.9	1		1040	129	0.	.0	1428.0	1		1615	196	0.	.0	1428.0
1		0510	63	0.	.0	1427.9	1		1045	130	0.	.0	1428.0	1		1620	197	0.	.0	1428.0
1		0515	64	0.	.0	1427.9	1		1050	131	0.	.0	1428.0	1		1625	198	0.	.0	1428.0
1		0520	65	0.	.0	1427.9	1		1055	132	0.	.0	1428.0	1		1630	199	0.	.0	1428.0
1		0525	66	0.	.0	1427.9	1		1100	133	0.	.0	1428.0	1		1635	200	0.	.0	1428.0
1		0530	67	0.	.0	1427.9	1		1105	134	0.	.0	1428.0							

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	16.58-HR
(CFS)	(HR)				
		(CFS)			
0.	.00	0.	0.	0.	0.
		(INCHES) .000	.000	.000	.000
		(AC-FT) 0.	0.	0.	0.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	16.58-HR
(AC-FT)	(HR)				
0.	5.33	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	16.58-HR
(FEET)	(HR)				
1427.95	6.17	1427.95	1427.91	1427.91	1427.91

CUMULATIVE AREA = .00 SQ MI

```
39 KK      **************
           *            *
           *    PW-2    *
           *            *
           **************

40 KO      OUTPUT CONTROL VARIABLES
                IPRNT        1  PRINT CONTRDL
                IPLOT        0  PLOT CONTROL
                QSCAL        0.  HYDROGRAPH PLOT SCALE

           HYDROGRAPH ROUTING DATA

41 RS      STORAGE ROUTING
                NSTPS        1  NUMBER OF SUBREACHES
                 ITYP     ELEV  TYPE OF INITIAL CONDITION
               RSVRIC      .00  INITIAL CONDITION
                    X      .00 WORKING R AND D COEFFICIENT

42 SV        STORAGE        .0       .0       .0       .1

43 SE      ELEVATION    1428.45  1428.90  1429.50  1429.73

44 SQ      DISCHARGE         0.       0.       0.       0.
                                                      ***
```

HYDRDGRAPH AT STATION PW-2
PLAN 1, RATIO = 1.00

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	.0	1428.4	1		0535	68	0.	.0	1429.5	1		1110	135	0.	.0	1429.5
1		0005	2	0.	.0	1428.4	1		0540	69	0.	.0	1429.5	1		1115	136	0.	.0	1429.5
1		0010	3	0.	.0	1428.4	1		0545	70	0.	.0	1429.5	1		1120	137	0.	.0	1429.5
1		0015	4	0.	.0	1428.4	1		0550	71	0.	.0	1429.5	1		1125	138	0.	.0	1429.5
1		0020	5	0.	.0	1428.4	1		0555	72	0.	.0	1429.5	1		1130	139	0.	.0	1429.5
1		0025	6	0.	.0	1428.4	1		0600	73	0.	.0	1429.5	1		1135	140	0.	.0	1429.5
1		0030	7	0.	.0	1428.4	1		0605	74	0.	.0	1429.5	1		1140	141	0.	.0	1429.5
1		0035	8	0.	.0	1428.4	1		0610	75	0.	.0	1429.5	1		1145	142	0.	.0	1429.5
1		0040	9	0.	.0	1428.4	1		0615	76	0.	.0	1429.5	1		1150	143	0.	.0	1429.5
1		0045	10	0.	.0	1428.4	1		0620	77	0.	.0	1429.5	1		1155	144	0.	.0	1429.5
1		0050	11	0.	.0	1428.4	1		0625	78	0.	.0	1429.5	1		1200	145	0.	.0	1429.5
1		0055	12	0.	.0	1428.4	1		0630	79	0.	.0	1429.5	1		1205	146	0.	.0	1429.5
1		0100	13	0.	.0	1428.4	1		0635	80	0.	.0	1429.5	1		1210	147	0.	.0	1429.5
1		0105	14	0.	.0	1428.4	1		0640	81	0.	.0	1429.5	1		1215	148	0.	.0	1429.5
1		0110	15	0.	.0	1428.4	1		0645	82	0.	.0	1429.5	1		1220	149	0.	.0	1429.5
1		0115	16	0.	.0	1428.4	1		0650	83	0.	.0	1429.5	1		1225	150	0.	.0	1429.5
1		0120	17	0.	.0	1428.4	1		0655	84	0.	.0	1429.5	1		1230	151	0.	.0	1429.5
1		0125	18	0.	.0	1428.4	1		0700	85	0.	.0	1429.5	1		1235	152	0.	.0	1429.5

DA	MON	HRMN	DRD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	DRD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0130	19	0.	.0	1428.4	1		0705	86	0.	.0	1429.5	1		1240	153	0.	.0	1429.5
1		0135	20	0.	.0	1428.4	1		0710	87	0.	.0	1429.5	1		1245	154	0.	.0	1429.5
1		0140	21	0.	.0	1428.4	1		0715	88	0.	.0	1429.5	1		1250	155	0.	.0	1429.5
1		0145	22	0.	.0	1428.4	1		0720	89	0.	.0	1429.5	1		1255	156	0.	.0	1429.5
1		0150	23	0.	.0	1428.4	1		0725	90	0.	.0	1429.5	1		1300	157	0.	.0	1429.5
1		0155	24	0.	.0	1428.4	1		0730	91	0.	.0	1429.5	1		1305	158	0.	.0	1429.5
1		0200	25	0.	.0	1428.4	1		0735	92	0.	.0	1429.5	1		1310	159	0.	.0	1429.5
1		0205	26	0.	.0	1428.4	1		0740	93	0.	.0	1429.5	1		1315	160	0.	.0	1429.5
1		0210	27	0.	.0	1428.4	1		0745	94	0.	.0	1429.5	1		1320	161	0.	.0	1429.5
1		0215	28	0.	.0	1428.4	1		0750	95	0.	.0	1429.5	1		1325	162	0.	.0	1429.5
1		0220	29	0.	.0	1428.4	1		0755	96	0.	.0	1429.5	1		1330	163	0.	.0	1429.5
1		0225	30	0.	.0	1428.4	1		0800	97	0.	.0	1429.5	1		1335	164	0.	.0	1429.5
1		0230	31	0.	.0	1428.4	1		0805	98	0.	.0	1429.5	1		1340	165	0.	.0	1429.5
1		0235	32	0.	.0	1428.4	1		0810	99	0.	.0	1429.5	1		1345	166	0.	.0	1429.5
1		0240	33	0.	.0	1428.4	1		0815	100	0.	.0	1429.5	1		1350	167	0.	.0	1429.5
1		0245	34	0.	.0	1428.4	1		0820	101	0.	.0	1429.5	1		1355	168	0.	.0	1429.5
1		0250	35	0.	.0	1428.4	1		0825	102	0.	.0	1429.5	1		1400	169	0.	.0	1429.5
1		0255	36	0.	.0	1428.4	1		0830	103	0.	.0	1429.5	1		1405	170	0.	.0	1429.5
1		0300	37	0.	.0	1428.4	1		0835	104	0.	.0	1429.5	1		1410	171	0.	.0	1429.5
1		0305	38	0.	.0	1428.5	1		0840	105	0.	.0	1429.5	1		1415	172	0.	.0	1429.5
1		0310	39	0.	.0	1428.5	1		0845	106	0.	.0	1429.5	1		1420	173	0.	.0	1429.5
1		0315	40	0.	.0	1428.6	1		0850	107	0.	.0	1429.5	1		1425	174	0.	.0	1429.5
1		0320	41	0.	.0	1428.9	1		0855	108	0.	.0	1429.5	1		1430	175	0.	.0	1429.5
1		0325	42	0.	.0	1429.0	1		0900	109	0.	.0	1429.5	1		1435	176	0.	.0	1429.5
1		0330	43	0.	.0	1429.2	1		0905	110	0.	.0	1429.5	1		1440	177	0.	.0	1429.5
1		0335	44	0.	.0	1429.4	1		0910	111	0.	.0	1429.5	1		1445	178	0.	.0	1429.5
1		0340	45	0.	.0	1429.5	1		0915	112	0.	.0	1429.5	1		1450	179	0.	.0	1429.5
1		0345	46	0.	.0	1429.5	1		0920	113	0.	.0	1429.5	1		1455	180	0.	.0	1429.5
1		0350	47	0.	.0	1429.5	1		0925	114	0.	.0	1429.5	1		1500	181	0.	.0	1429.5
1		0355	48	0.	.0	1429.5	1		0930	115	0.	.0	1429.5	1		1505	182	0.	.0	1429.5
1		0400	49	0.	.0	1429.5	1		0935	116	0.	.0	1429.5	1		1510	183	0.	.0	1429.5
1		0405	50	0.	.0	1429.5	1		0940	117	0.	.0	1429.5	1		1515	184	0.	.0	1429.5
1		0410	51	0.	.0	1429.5	1		0945	118	0.	.0	1429.5	1		1520	185	0.	.0	1429.5
1		0415	52	0.	.0	1429.5	1		0950	119	0.	.0	1429.5	1		1525	186	0.	.0	1429.5
1		0420	53	0.	.0	1429.5	1		0955	120	0.	.0	1429.5	1		1530	187	0.	.0	1429.5
1		0425	54	0.	.0	1429.5	1		1000	121	0.	.0	1429.5	1		1535	188	0.	.0	1429.5
1		0430	55	0.	.0	1429.5	1		1005	122	0.	.0	1429.5	1		1540	189	0.	.0	1429.5
1		0435	56	0.	.0	1429.5	1		1010	123	0.	.0	1429.5	1		1545	190	0.	.0	1429.5
1		0440	57	0.	.0	1429.5	1		1015	124	0.	.0	1429.5	1		1550	191	0.	.0	1429.5
1		0445	58	0.	.0	1429.5	1		1020	125	0.	.0	1429.5	1		1555	192	0.	.0	1429.5
1		0450	59	0.	.0	1429.5	1		1025	126	0.	.0	1429.5	1		1600	193	0.	.0	1429.5
1		0455	60	0.	.0	1429.5	1		1030	127	0.	.0	1429.5	1		1605	194	0.	.0	1429.5
1		0500	61	0.	.0	1429.5	1		1035	128	0.	.0	1429.5	1		1610	195	0.	.0	1429.5
1		0505	62	0.	.0	1429.5	1		1040	129	0.	.0	1429.5	1		1615	196	0.	.0	1429.5
1		0510	63	0.	.0	1429.5	1		1045	130	0.	.0	1429.5	1		1620	197	0.	.0	1429.5
1		0515	64	0.	.0	1429.5	1		1050	131	0.	.0	1429.5	1		1625	198	0.	.0	1429.5
1		0520	65	0.	.0	1429.5	1		1055	132	0.	.0	1429.5	1		1630	199	0.	.0	1429.5
1		0525	66	0.	.0	1429.5	1		1100	133	0.	.0	1429.5	1		1635	200	0.	.0	1429.5
1		0530	67	0.	.0	1429.5	1		1105	134	0.	.0	1429.5							

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	16.58-HR
(CFS)	(HR)	(CFS)				
0.	.00		0.	0.	0.	0.
		(INCHES)	.000	.000	.000	.000
		(AC-FT)	0.	0.	0.	0.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	16.58-HR
(AC-FT)	(HR)				
0.	5.42	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	16.58-HR
(FEET)	(HR)				
1429.52	6.08	1429.52	1429.30	1429.30	1429.30

CUMULATIVE AREA = .00 SQ MI

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*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 49 KK    *     PW-3   *
          *            *
          **************

 50 KO        OUTPUT CONTROL VARIABLES
                    IPRNT          1  PRINT CONTROL
                    IPLOT          0  PLDT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

              HYDROGRAPH ROUTING DATA

 51 RS        STORAGE ROUTING
                   NSTPS          1  NUMBER OF SUBREACHES
                    ITYP       ELEV  TYPE OF INITIAL CONDITIDN
                  RSVRIC        .00  INITIAL CONDITION
                       X        .00 WORKING R AND D COEFFICIENT

 52 SV          STORAGE         .0       .0       .1       .1       .1

 53 SE          ELEVATION   1429.00  1429.50  1430.00  1430.50  1431.00

 54 SQ          DISCHARGE       0.       0.       0.       0.       0.
                                                              ***
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HYDRDGRAPH AT STATION PW-3
PLAN 1, RATIO = 1.00

DA	MON	HRMN	DRD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	DRD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	.0	1429.0	1		0535	68	0.	.0	1429.3	1		1110	135	0.	.0	1429.3
1		0005	2	0.	.0	1429.0	1		0540	69	0.	.0	1429.3	1		1115	136	0.	.0	1429.3
1		0010	3	0.	.0	1429.0	1		0545	70	0.	.0	1429.3	1		1120	137	0.	.0	1429.3
1		0015	4	0.	.0	1429.0	1		0550	71	0.	.0	1429.3	1		1125	138	0.	.0	1429.3
1		0020	5	0.	.0	1429.0	1		0555	72	0.	.0	1429.3	1		1130	139	0.	.0	1429.3
1		0025	6	0.	.0	1429.0	1		0600	73	0.	.0	1429.3	1		1135	140	0.	.0	1429.3
1		0030	7	0.	.0	1429.0	1		0605	74	0.	.0	1429.3	1		1140	141	0.	.0	1429.3
1		0035	8	0.	.0	1429.0	1		0610	75	0.	.0	1429.3	1		1145	142	0.	.0	1429.3
1		0040	9	0.	.0	1429.0	1		0615	76	0.	.0	1429.3	1		1150	143	0.	.0	1429.3
1		0045	10	0.	.0	1429.0	1		0620	77	0.	.0	1429.3	1		1155	144	0.	.0	1429.3
1		0050	11	0.	.0	1429.0	1		0625	78	0.	.0	1429.3	1		1200	145	0.	.0	1429.3
1		0055	12	0.	.0	1429.0	1		0630	79	0.	.0	1429.3	1		1205	146	0.	.0	1429.3
1		0100	13	0.	.0	1429.0	1		0635	80	0.	.0	1429.3	1		1210	147	0.	.0	1429.3
1		0105	14	0.	.0	1429.0	1		0640	81	0.	.0	1429.3	1		1215	148	0.	.0	1429.3
1		0110	15	0.	.0	1429.0	1		0645	82	0.	.0	1429.3	1		1220	149	0.	.0	1429.3

1	0115	16	0.	.0	1429.0	*	1	0650	83	0.	.0	1429.3	*	1	1225	150	0.	.0	1429.3
1	0120	17	0.	.0	1429.0	*	1	0655	84	0.	.0	1429.3	*	1	1230	151	0.	.0	1429.3
1	0125	18	0.	.0	1429.0	*	1	0700	85	0.	.0	1429.3	*	1	1235	152	0.	.0	1429.3
1	0130	19	0.	.0	1429.0	*	1	0705	86	0.	.0	1429.3	*	1	1240	153	0.	.0	1429.3
1	0135	20	0.	.0	1429.0	*	1	0710	87	0.	.0	1429.3	*	1	1245	154	0.	.0	1429.3
1	0140	21	0.	.0	1429.0	*	1	0715	88	0.	.0	1429.3	*	1	1250	155	0.	.0	1429.3
1	0145	22	0.	.0	1429.0	*	1	0720	89	0.	.0	1429.3	*	1	1255	156	0.	.0	1429.3
1	0150	23	0.	.0	1429.0	*	1	0725	90	0.	.0	1429.3	*	1	1300	157	0.	.0	1429.3
1	0155	24	0.	.0	1429.0	*	1	0730	91	0.	.0	1429.3	*	1	1305	158	0.	.0	1429.3
1	0200	25	0.	.0	1429.0	*	1	0735	92	0.	.0	1429.3	*	1	1310	159	0.	.0	1429.3
1	0205	26	0.	.0	1429.0	*	1	0740	93	0.	.0	1429.3	*	1	1315	160	0.	.0	1429.3
1	0210	27	0.	.0	1429.0	*	1	0745	94	0.	.0	1429.3	*	1	1320	161	0.	.0	1429.3
1	0215	28	0.	.0	1429.0	*	1	0750	95	0.	.0	1429.3	*	1	1325	162	0.	.0	1429.3
1	0220	29	0.	.0	1429.0	*	1	0755	96	0.	.0	1429.3	*	1	1330	163	0.	.0	1429.3
1	0225	30	0.	.0	1429.0	*	1	0800	97	0.	.0	1429.3	*	1	1335	164	0.	.0	1429.3
1	0230	31	0.	.0	1429.0	*	1	0805	98	0.	.0	1429.3	*	1	1340	165	0.	.0	1429.3
1	0235	32	0.	.0	1429.0	*	1	0810	99	0.	.0	1429.3	*	1	1345	166	0.	.0	1429.3
1	0240	33	0.	.0	1429.0	*	1	0815	100	0.	.0	1429.3	*	1	1350	167	0.	.0	1429.3
1	0245	34	0.	.0	1429.0	*	1	0820	101	0.	.0	1429.3	*	1	1355	168	0.	.0	1429.3
1	0250	35	0.	.0	1429.0	*	1	0825	102	0.	.0	1429.3	*	1	1400	169	0.	.0	1429.3
1	0255	36	0.	.0	1429.0	*	1	0830	103	0.	.0	1429.3	*	1	1405	170	0.	.0	1429.3
1	0300	37	0.	.0	1429.0	*	1	0835	104	0.	.0	1429.3	*	1	1410	171	0.	.0	1429.3
1	0305	38	0.	.0	1429.0	*	1	0840	105	0.	.0	1429.3	*	1	1415	172	0.	.0	1429.3
1	0310	39	0.	.0	1429.0	*	1	0845	106	0.	.0	1429.3	*	1	1420	173	0.	.0	1429.3
1	0315	40	0.	.0	1429.0	*	1	0850	107	0.	.0	1429.3	*	1	1425	174	0.	.0	1429.3
1	0320	41	0.	.0	1429.0	*	1	0855	108	0.	.0	1429.3	*	1	1430	175	0.	.0	1429.3
1	0325	42	0.	.0	1429.1	*	1	0900	109	0.	.0	1429.3	*	1	1435	176	0.	.0	1429.3
1	0330	43	0.	.0	1429.1	*	1	0905	110	0.	.0	1429.3	*	1	1440	177	0.	.0	1429.3
1	0335	44	0.	.0	1429.1	*	1	0910	111	0.	.0	1429.3	*	1	1445	178	0.	.0	1429.3
1	0340	45	0.	.0	1429.2	*	1	0915	112	0.	.0	1429.3	*	1	1450	179	0.	.0	1429.3
1	0345	46	0.	.0	1429.2	*	1	0920	113	0.	.0	1429.3	*	1	1455	180	0.	.0	1429.3
1	0350	47	0.	.0	1429.2	*	1	0925	114	0.	.0	1429.3	*	1	1500	181	0.	.0	1429.3
1	0355	48	0.	.0	1429.2	*	1	0930	115	0.	.0	1429.3	*	1	1505	182	0.	.0	1429.3
1	0400	49	0.	.0	1429.2	*	1	0935	116	0.	.0	1429.3	*	1	1510	183	0.	.0	1429.3
1	0405	50	0.	.0	1429.2	*	1	0940	117	0.	.0	1429.3	*	1	1515	184	0.	.0	1429.3
1	0410	51	0.	.0	1429.2	*	1	0945	118	0.	.0	1429.3	*	1	1520	185	0.	.0	1429.3
1	0415	52	0.	.0	1429.2	*	1	0950	119	0.	.0	1429.3	*	1	1525	186	0.	.0	1429.3
1	0420	53	0.	.0	1429.3	*	1	0955	120	0.	.0	1429.3	*	1	1530	187	0.	.0	1429.3
1	0425	54	0.	.0	1429.3	*	1	1000	121	0.	.0	1429.3	*	1	1535	188	0.	.0	1429.3
1	0430	55	0.	.0	1429.3	*	1	1005	122	0.	.0	1429.3	*	1	1540	189	0.	.0	1429.3
1	0435	56	0.	.0	1429.3	*	1	1010	123	0.	.0	1429.3	*	1	1545	190	0.	.0	1429.3
1	0440	57	0.	.0	1429.3	*	1	1015	124	0.	.0	1429.3	*	1	1550	191	0.	.0	1429.3
1	0445	58	0.	.0	1429.3	*	1	1020	125	0.	.0	1429.3	*	1	1555	192	0.	.0	1429.3
1	0450	59	0.	.0	1429.3	*	1	1025	126	0.	.0	1429.3	*	1	1600	193	0.	.0	1429.3
1	0455	60	0.	.0	1429.3	*	1	1030	127	0.	.0	1429.3	*	1	1605	194	0.	.0	1429.3
1	0500	61	0.	.0	1429.3	*	1	1035	128	0.	.0	1429.3	*	1	1610	195	0.	.0	1429.3
1	0505	62	0.	.0	1429.3	*	1	1040	129	0.	.0	1429.3	*	1	1615	196	0.	.0	1429.3
1	0510	63	0.	.0	1429.3	*	1	1045	130	0.	.0	1429.3	*	1	1620	197	0.	.0	1429.3
1	0515	64	0.	.0	1429.3	*	1	1050	131	0.	.0	1429.3	*	1	1625	198	0.	.0	1429.3
1	0520	65	0.	.0	1429.3	*	1	1055	132	0.	.0	1429.3	*	1	1630	199	0.	.0	1429.3
1	0525	66	0.	.0	1429.3	*	1	1100	133	0.	.0	1429.3	*	1	1635	200	0.	.0	1429.3
1	0530	67	0.	.0	1429.3	*	1	1105	134	0.	.0	1429.3	*						
						*							*						

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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	16.58-HR
+ (CFS)	(HR)	(CFS)				
+ 0.	.00		0.	0.	0.	0.
		(INCHES)	.000	.000	.000	.000
		(AC-FT)	0.	0.	0.	0.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	16.58-HR
+ (AC-FT)	(HR)				
0.	5.83	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	16.58-HR
+ (FEET)	(HR)				
1429.35	6.17	1429.34	1429.26	1429.26	1429.26

CUMULATIVE AREA = .00 SQ MI

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 1.00
HYDRDGRAPH AT					
+	W-1	.00	1	FLOW	0.
				TIME	3.50
ROUTED TO					
+	PW-1	.00	1	FLOW	0.
				TIME	.00
			** PEAK STAGES IN FEET **		
			1	STAGE	1427.95
				TIME	6.17
HYDROGRAPH AT					
+	W-2	.00	1	FLOW	0.
				TIME	3.50
ROUTED TO					
+	PW-2	.00	1	FLOW	0.
				TIME	.00
			** PEAK STAGES IN FEET **		
			1	STAGE	1429.52
				TIME	6.08
HYDROGRAPH AT					
+	W-3	.00	1	FLOW	1.
				TIME	3.50
ROUTED TO					
+	PW-3	.00	1	FLOW	0.
				TIME	.00
			** PEAK STAGES IN FEET **		
			1	STAGE	1429.35
				TIME	6.17

*** NORMAL END OF HEC-1 ***

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

ATKINS
File: SF4.XLS

LVV Lift Station CLOMR
INTERIOR DRAINAGE

BY: JRB
DATE: 4/2/13

SUB-BASIN DATA						INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc Check	Tlag	REMARKS
DESIG: (1)	DEV./EX. (D or E)	CN	K (2)	AREA Ac (3)	AREA Mi^2	INITIAL LENGTH Feet (4)	SLOPE % (5)	Ti Min (6)	TRAVEL LENGTH Feet (7)	SLOPE % (8)	V1 VELOCITY FPS (9a)	V2 VELOCITY FPS (9b)	Tt Min (10)	Min (13)	Min (14)	Tlag= 0.6Tc/60 Hours	MIN Tlag
W-1	D	85.0	0.7320	0.13	0.00020	24	0.7	3.7	145	0.7	1.7	2.6	1.4	5.1	10.9	**0.051**	
W-2	D	67.6	0.5023	0.33	0.00052	25	4.0	3.4	172	18.6	8.7	13.2	0.3	3.7	11.1	**0.037**	0.05
W-3	D	72.2	0.5630	0.30	0.00047	30	30.0	1.7	145	10.7	6.6	10.0	0.4	2.1	11.0	**0.021**	0.05

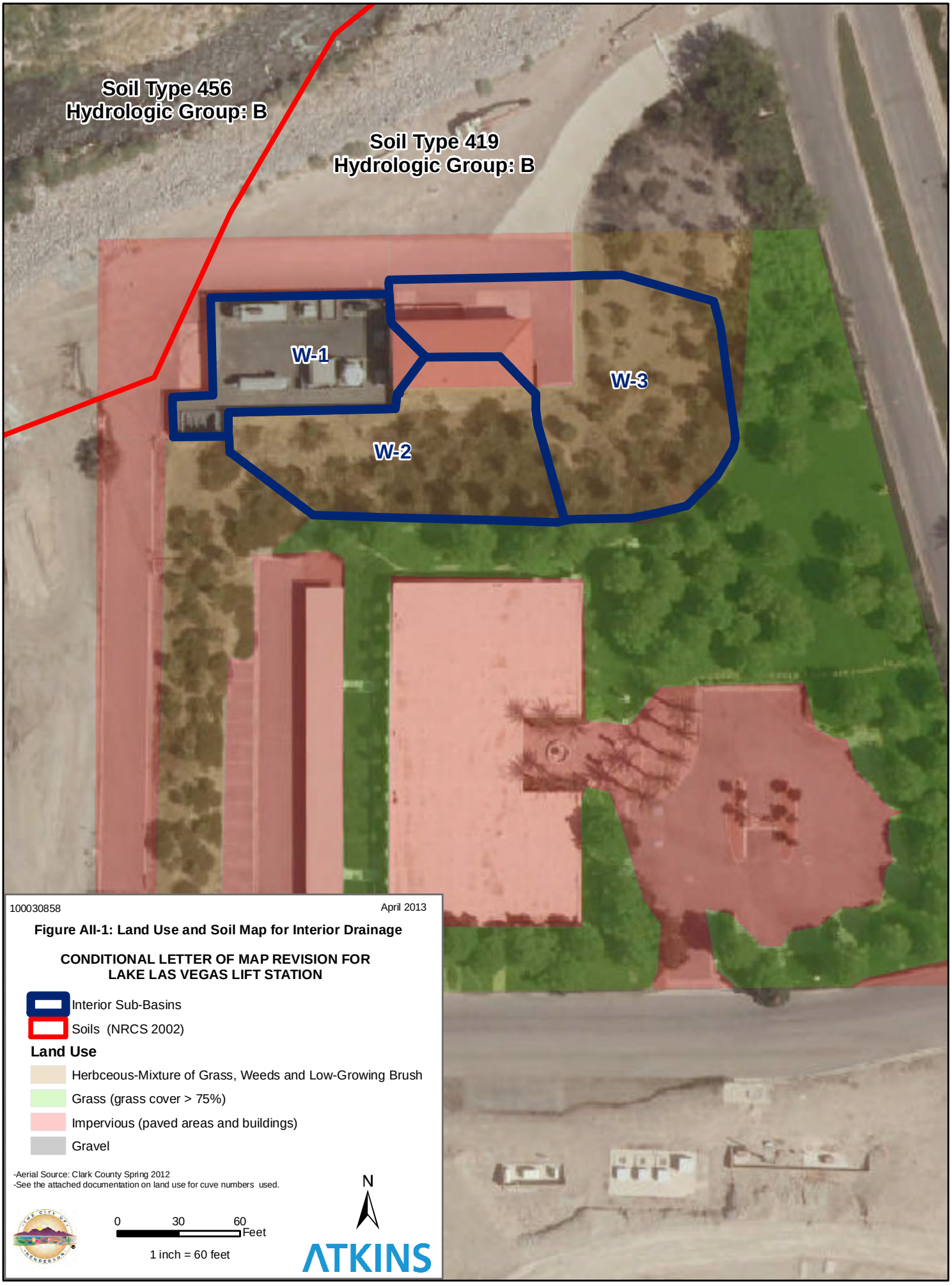
Tc = Ti + Tt Tlag = 0.6 Tc
Ti = 1.8 (1.1 - K) L^1/2 / S^1/3
K = 0.0132 (CN) - 0.39
Tc Check = L/180+10

For the travel time (Tt) calculations,
V1 applies to the first 500 feet of travel distance;
V2 applies to the remaining travel distance.

Existing V1 = 14.8*(S/100)^1/2 Developed V1 = 20.2*(S/100)^1/2
Existing V2 = 29.4*(S/100)^1/2 Developed V2 = 30.6*(S/100)^1/2

REFERENCE :

STANDARD FORM 4



100030858 April 2013

Figure AII-1: Land Use and Soil Map for Interior Drainage

CONDITIONAL LETTER OF MAP REVISION FOR LAKE LAS VEGAS LIFT STATION

Interior Sub-Basins

Soils (NRCS 2002)

Land Use

Herbceous-Mixture of Grass, Weeds and Low-Growing Brush

Grass (grass cover > 75%)

Impervious (paved areas and buildings)

Gravel

-Aerial Source: Clark County Spring 2012
-See the attached documentation on land use for cuve numbers used.

0 30 60 Feet

1 inch = 60 feet

N

ATKINS

Curve Number Calculation Summary

Basin	Area (ac)	Land Use	Hydrologic Soil Group	CN	CN
W-1	0.13	Gravel	B	85	85.0
Total Area =	**0.13**		**Composite CN=**		**85.0**
W-2	0.197	Herbceous-Mixture of grass, Weeds and Low-Growing Brush	B	62	37.0
W-2	0.057	Impervious	B	98	16.9
W-2	0.074	Open Space (Grass cover > 75%)	B	61	13.7
Total Area =	**0.33**		**Composite CN=**		**67.6**
W-3	0.209	Herbceous-Mixture of grass, Weeds and Low-Growing Brush	B	62	43.3
W-3	0.085	Impervious	B	98	27.9
W-3	0.005	Open Space (Grass cover > 75%)	B	61	1.0
Total Area =	**0.30**		**Composite CN=**		**72.2**

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
See Table 602A					
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

Revision	Date

RUNOFF CURVE NUMBERS
(SEMIARID RANGELANDS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition[2]	A[3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

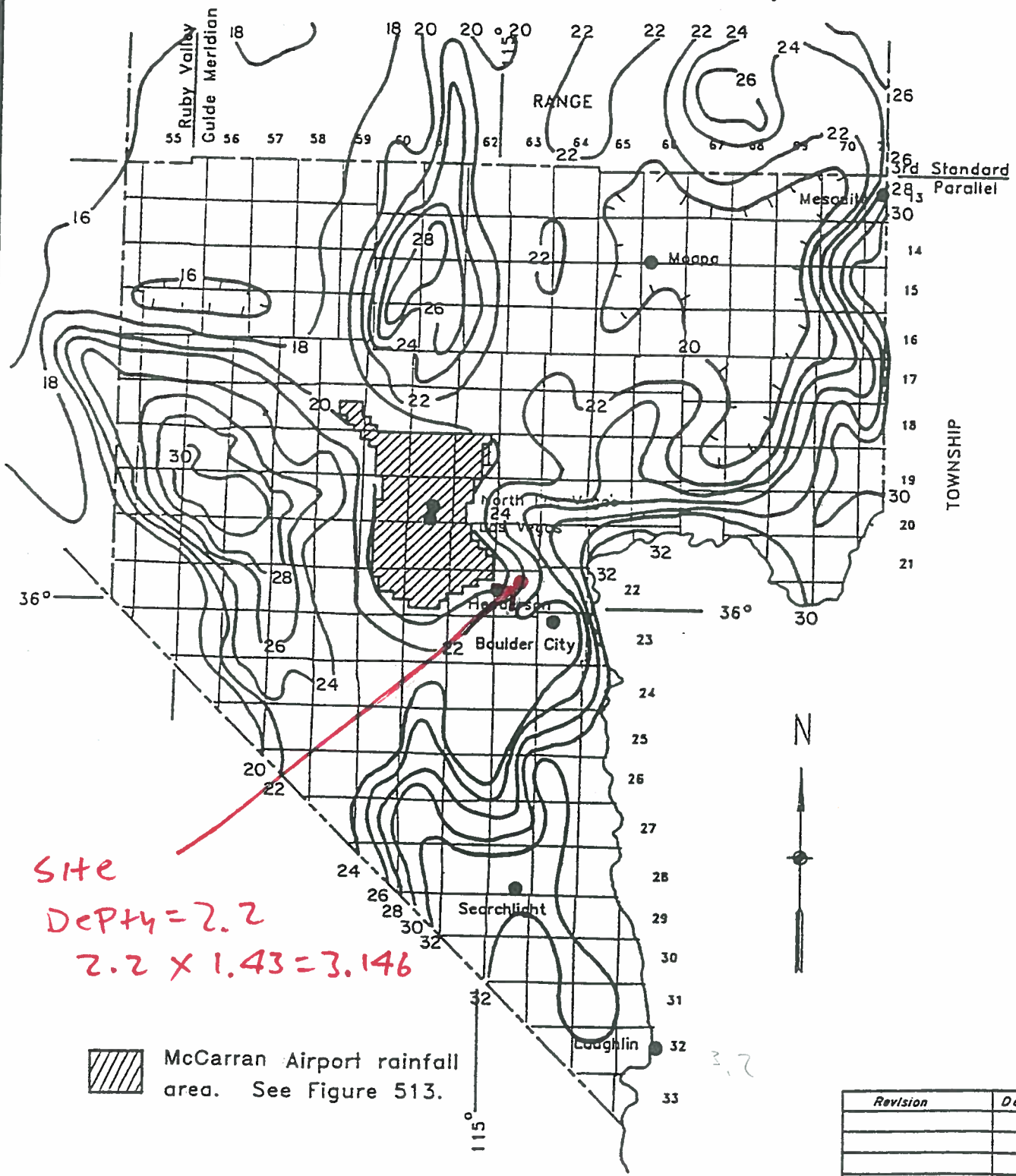
[1]Average runoff condition, and I_a = 0.2S.

[2]*Poor:* <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: >70% ground cover.

[3]Curve numbers for group A have been developed only for desert shrub.

Revision	Date

RAINFALL DEPTH-DURATION-FREQUENCY
100-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 506

PRECIPITATION ADJUSTMENT RATIOS

Recurrence Interval	Ratio to NOAA Atlas 2
2-year	1.00
5-year	1.16
10-year	1.24
25-year	1.33
50-year	1.39
100-year	1.43

NOTE:
1. Multiply the values obtained from the NOAA Atlas 2 by the above ratios to obtain the adjusted precipitation values.
2. NOAA Atlas 2 values for use with TR-55 shall not be adjusted by the above ratios.
3. Tables 505 and 506 require no adjustments.

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

Storm Time (In Minutes)	Percent of Total Storm Depth SDN3	SDN4	SDN5
0	0.0	0.0	0.0
5	2.0	2.0	2.0
10	5.7	5.8	5.9
15	7.0	7.5	8.0
20	8.7	9.9	11.0
25	10.8	12.6	14.4
30	12.4	13.7	15.0
35	13.0	14.5	16.0
40	13.0	14.9	16.8
45	13.0	15.1	17.1
50	13.0	15.5	18.0
55	13.0	15.6	18.2
60	13.0	15.9	18.7
65	13.3	16.2	19.0
70	14.0	16.9	19.7
75	14.2	17.2	20.2
80	14.8	17.9	21.0
85	15.8	18.9	22.0
90	17.2	20.1	23.0
95	18.1	21.1	24.1
100	19.0	22.0	25.0
105	19.7	22.8	25.9
110	19.9	23.2	26.5
115	20.0	24.0	28.0
120	20.1	24.6	29.0
125	20.4	25.2	30.0
130	21.4	26.0	30.5
135	22.9	26.9	30.9
140	24.1	27.6	31.0
145	24.9	28.3	31.7
150	25.1	28.6	32.1
155	25.6	29.2	32.7
160	27.0	30.2	33.3
165	27.8	31.2	34.6
170	28.1	32.1	36.1
175	28.3	33.2	38.1
180	29.5	35.2	40.8
185	32.2	37.6	43.0
190	35.2	41.5	47.7
195	40.9	46.2	51.4
200	49.9	53.0	56.1
205	59.0	61.0	63.0
210	71.0	71.0	71.0
215	74.4	73.2	72.0
220	78.1	75.6	73.1
225	81.2	78.2	75.2
230	81.9	79.9	77.9
235	83.5	81.3	79.0
240	85.1	82.3	79.5
245	85.6	83.0	80.4
250	86.0	83.5	81.0
255	86.8	84.4	82.0
260	87.6	85.1	82.6
265	88.8	86.4	84.0
270	91.0	88.5	85.9
275	92.6	90.8	88.9
280	93.7	92.4	91.0
285	95.0	94.4	93.8
290	97.0	96.8	96.6
295	97.6	97.3	97.0
300	98.2	97.8	97.4
305	98.5	98.2	97.9
310	98.7	98.4	98.1
315	98.9	98.6	98.3
320	99.0	98.8	98.5
325	99.3	99.1	98.9
330	99.3	99.2	99.0
335	99.4	99.3	99.2
340	99.5	99.4	99.3
345	99.8	99.7	99.6
350	99.8	99.8	99.7
355	99.9	99.9	99.9
360	100.0	100.0	100.0

Notes:
1. For drainage areas less than 8 square miles in size, use SDN 3.
2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
4. A graphical representation of these values is presented on **Figure 515**.

Revision	Date

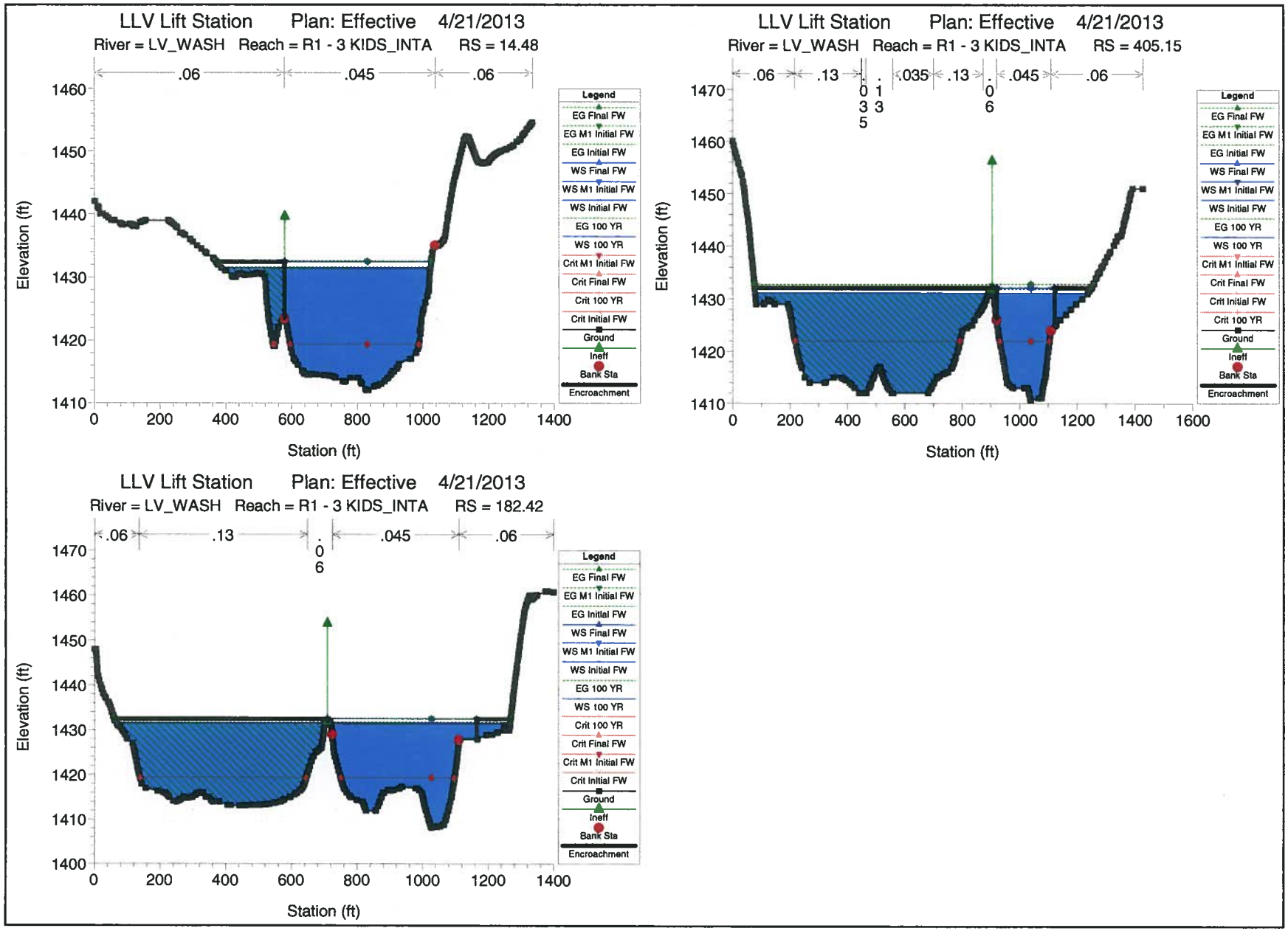
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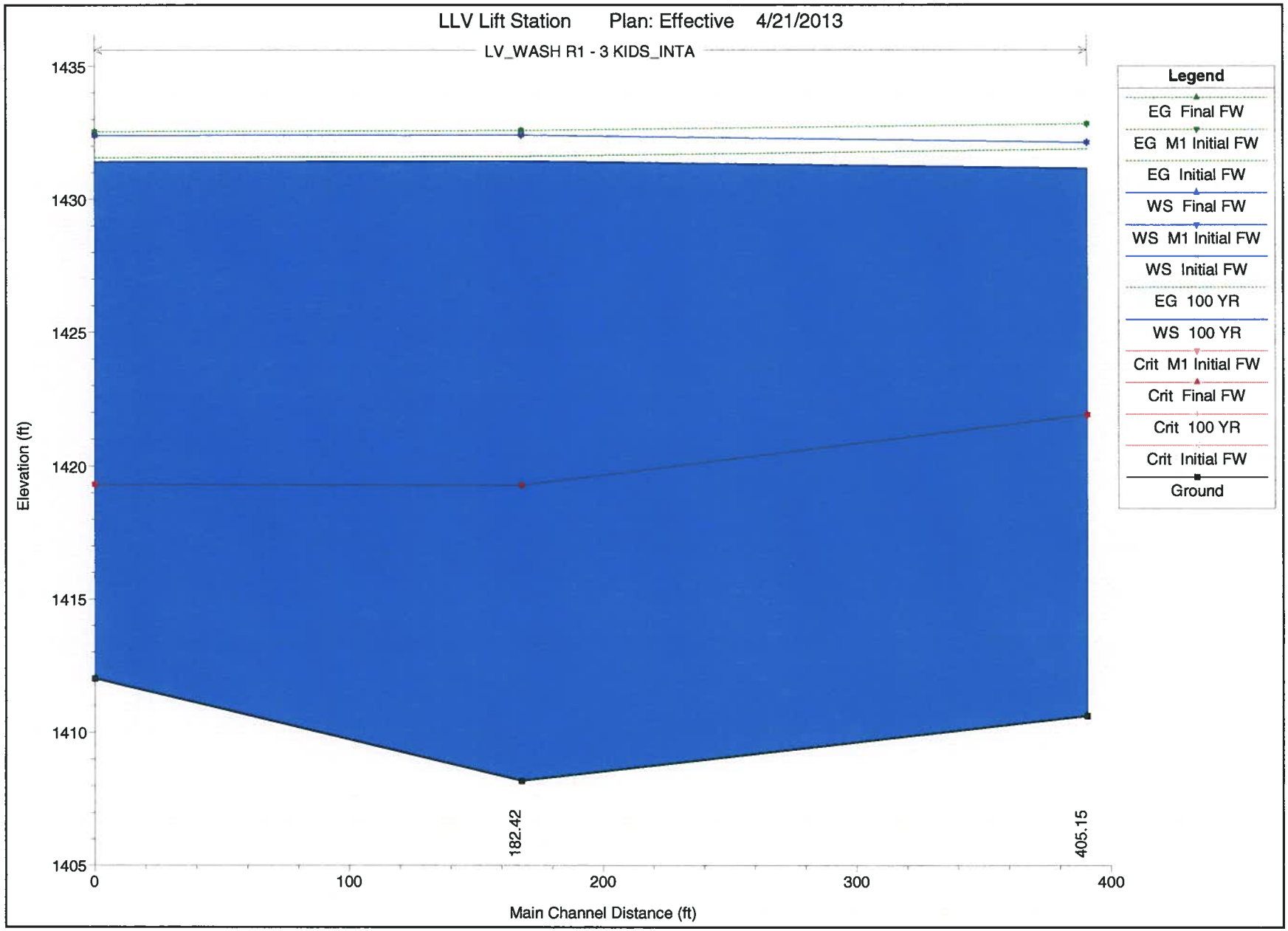
TABLE 503

Truncated Effective Hydraulic Analysis

HEC-RAS Plan: Effective River: LV_WASH Reach: R1 - 3 KIDS_INTA

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
R1 - 3 KIDS_INTA	405.15	100 YR	22530.00	1410.62	1431.16	1421.92	1431.89	0.001092	6.95	3591.01	1144.20	0.30
R1 - 3 KIDS_INTA	405.15	Final FW	22530.00	1410.62	1432.14	1421.93	1432.84	0.000958	6.76	3400.69	202.00	0.29
R1 - 3 KIDS_INTA	405.15	M1 Initial FW	22530.00	1410.62	1432.14	1421.93	1432.84	0.000958	6.76	3400.69	202.00	0.29
R1 - 3 KIDS_INTA	405.15	Initial FW	22530.00	1410.62	1432.14	1421.93	1432.84	0.000958	6.76	3400.69	202.00	0.29
R1 - 3 KIDS_INTA	182.42	100 YR	22530.00	1408.19	1431.43	1419.29	1431.62	0.000285	3.53	6703.59	1182.03	0.15
R1 - 3 KIDS_INTA	182.42	Final FW	22530.00	1408.19	1432.42	1419.29	1432.59	0.000235	3.34	6934.98	455.00	0.14
R1 - 3 KIDS_INTA	182.42	M1 Initial FW	22530.00	1408.19	1432.42	1419.29	1432.59	0.000235	3.34	6934.98	455.00	0.14
R1 - 3 KIDS_INTA	182.42	Initial FW	22530.00	1408.19	1432.42	1419.29	1432.59	0.000235	3.34	6934.98	455.00	0.14
R1 - 3 KIDS_INTA	14.48	100 YR	22530.00	1412.00	1431.40	1419.30	1431.56	0.000250	3.24	6951.28	635.20	0.14
R1 - 3 KIDS_INTA	14.48	Final FW	22530.00	1412.00	1432.40	1419.31	1432.54	0.000205	3.05	7395.69	446.31	0.13
R1 - 3 KIDS_INTA	14.48	M1 Initial FW	22530.00	1412.00	1432.40	1419.31	1432.54	0.000205	3.05	7395.69	446.31	0.13
R1 - 3 KIDS_INTA	14.48	Initial FW	22530.00	1412.00	1432.40	1419.30	1432.54	0.000205	3.05	7395.69	446.31	0.13


LLV Lift Station Plan: Effective 4/21/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 14.48
.06
.045
.06
Elevation (ft)
Station (ft)
LLV Lift Station Plan: Effective 4/21/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 405.15
.06
.13
.035
.13
.045
.06
Elevation (ft)
Station (ft)
LLV Lift Station Plan: Effective 4/21/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 182.42
.06
.13
.045
.06
Elevation (ft)
Station (ft)
Legend
EG Final FW
EG M1 Initial FW
EG Initial FW
WS Final FW
WS M1 Initial FW
WS Initial FW
EG 100 YR
WS 100 YR
Crit M1 Initial FW
Crit Final FW
Crit 100 YR
Crit Initial FW
Ground
Ineff
Bank Sta
Encroachment


LLV Lift Station Plan: Effective 4/21/2013
LV_WASH R1 - 3 KIDS_INTA
1435
1430
1425
1420
1415
1410
1405
Elevation (ft)
182.42
405.15
0
100
200
300
400
Main Channel Distance (ft)
Legend
EG Final FW
EG M1 Initial FW
EG Initial FW
WS Final FW
WS M1 Initial FW
WS Initial FW
EG 100 YR
WS 100 YR
Crit M1 Initial FW
Crit Final FW
Crit 100 YR
Crit Initial FW
Ground

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X     X
X     X  X        X           X   X     X   X    X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X     X    X       X
X     X  XXXXXX    XXXX        X    X    X    X   XXXXX
```

PROJECT DATA
Project Title: LLV Lift Station
Project File : LLVLiftStation.prj
Run Date and Time: 4/21/2013 2:30:42 PM

Project in English units

Project Description:
LDMR model for SNWA Reach of Las Vegas Wash
Lake Las Vegas to Flamingo Road

PLAN DATA

Plan Title: Effective
Plan File : x:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.p10

Geometry Title: Effective
Geometry File : x:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.g13

Flow Title : Effective
Flow File : x:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.f10

Plan Description:
Cross sections have stations based on flowpaths

Plan Summary Information:
Number of: Cross Sections = 3 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = LV_WASH Reach = R1 - 3 KIDS_INTA

RS	Profile	Method	Value1	Value2
3534.52	Final FW	1	268.84	799.78
3428.19	Final FW	1	184.84	675.14
3303.9	Final FW	1	175	681.33
3110.51	Final FW	1	106.67	595.13
2933.22	Final FW	1	81.13	550.43
2831.75	Final FW	1	112.09	595.75
2719.51	Final FW	1	117.89	522.54
2597.65	Final FW	1	129.29	485.99
2566.48	Final FW	1	140.17	472.39
2308.22	Final FW	1	191.02	479.86
2200.51	Final FW	1	115.11	504.66
2126.13	Final FW	1	77.05	455.91
2054.87	Final FW	1	173.18	509.91
1985.39	Final FW	1	219.98	535.95
1776.89	Final FW	1	289.27	612.49
1768.69	Final FW	1	305.68	614.81
1721.72	Final FW	1	321.35	626.05
1643.22	Final FW	1	343.46	603.47
1579.28	Final FW	1	352.91	588.59
1489.16	Final FW	1	360.58	564.14
1393.95	Final FW	1	649.8	844.02
1217.48	Final FW	1	731.58	927.85
1082.41	Final FW	1	762.56	966.73
997.53	Final FW	1	845.64	1052.3
856.62	Final FW	1	886.37	1078.76
695.28	Final FW	1	892.97	1085.63
659.78	Final FW	1	910.18	1080
603.12	Final FW	1	910	1091.6
405.15	Final FW	1	920	1122
182.42	Final FW	1	710	1165
14.48	Final FW	1	578.34	1038.31

River = LV_WASH Reach = R2 - DEMO_3KIDS

RS	Profile	Method	Value1	Value2
5023.61	Final FW	1	687.45	1147.76
4975.95	Final FW	1	687.83	1125.14
4848.28	Final FW	1	735.85	1029.87
4669.4	Final FW	1	690.18	963.11
4463.48	Final FW	1	565.77	876.59
4318.02	Final FW	1	468.96	816.38
4092.23	Final FW	1	391.2	735.13
3934.49	Final FW	1	374.34	693.94
3775.67	Final FW	1	328.65	704.21

River = LV_WASH Reach = R3 - TEMP_DEMO

RS	Profile	Method	Value1	Value2
9687.58	Final FW	1	546.13	1047.36
9501.16	Final FW	1	471.14	1054.98
9311.87	Final FW	1	452.81	1025.05
9149.04	Final FW	1	435.87	1027.34
9007.92	Final FW	1	483.36	1063.54
8823.15	Final FW	1	576.11	1143.85
8615.8	Final FW	1	657.3	1228.13
8458.89	Final FW	1	703.74	1299.64
8296.77	Final FW	1	874.3	1219.1
8089.02	Final FW	1	941.29	1178

7966.87	Final	FW	1	900.89	1169.97
7828.58	Final	FW	1	962.82	1148.98
7654.78	Final	FW	1	933.79	1144.06
7399.01	Final	FW	1	709.44	1246.36
7290.02	Final	FW	1	531.78	1154.35
7158.49	Final	FW	1	546.63	1157.93
7018.82	Final	FW	1	669.77	1262.5
6861.99	Final	FW	1	686.41	1204.2
6681.24	Final	FW	1	768.15	1142.98
6490.7	Final	FW	1	693.24	1035.82
6269.3	Final	FW	1	700.8	1118.66
6039.66	Final	FW	1	788.66	1365.65
5857.47	Final	FW	1	926.13	1391.04
5685.38	Final	FW	1	852.29	1387.36
5528.36	Final	FW	1	828.34	1396.71
5388.96	Final	FW	1	754.21	1338.22
5192.97	Final	FW	1	724.74	1298.7

River = LV_WASH Reach = R4 - C1_TEMP

RS	Profile	Method	Value1	Value2
13668.66	Final	FW	1	775.7	1096.21
13351.49	Final	FW	1	764.81	1153.44
13081.45	Final	FW	1	721.49	1298.1
12954.93	Final	FW	1	619.83	1261.67
12759.65	Final	FW	1	660.59	1401.94
12590.7	Final	FW	1	458.21	1199.39
12448.88	Final	FW	1	386.45	1182.43
12357.87	Final	FW	1	428.43	1194.45
12315.19	Final	FW	1	579.46	1364.47
11929.49	Final	FW	1	411.42	1243.98
11860.97	Final	FW	1	462	1226.4
11756.77	Final	FW	1	535.65	1208.73
11563.85	Final	FW	1	542.64	1141.29
11410.95	Final	FW	1	531.35	1049.93
11303.6	Final	FW	1	604.5	1137.33
11175.42	Final	FW	1	595.24	1097.71
10982.76	Final	FW	1	565.35	1006.14
10782.21	Final	FW	1	534.85	1060.54
10598.94	Final	FW	1	515.91	1028.32
10517.5	Final	FW	1	532.94	1043.71
10354.51	Final	FW	1	566.99	1056.19
10200.66	Final	FW	1	568.22	1034.57
9856.77	Final	FW	1	535.63	1045.23

River = LV_WASH Reach = R5 - COH_C1

RS	Profile	Method	Value1	Value2
18277.82	Final	FW	1	554.95	1419.63
18144.07	Final	FW	1	484.69	1391.66
17959.9	Final	FW	1	490	1290
17761.68	Final	FW	1	700	1319
17576.76	Final	FW	1	950	1405.7
17397	Final	FW	1	1035.45	1403.59
17185.45	Final	FW	1	1004.14	1343.11
16989.85	Final	FW	1	879.5	1213.98
16788.79	Final	FW	1	956.87	1229.06
16686.94	Final	FW	1	917.61	1312.01
16539.37	Final	FW	1	829.33	1398.93
16275.81	Final	FW	1	770.84	1317.15
16127.61	Final	FW	1	598.46	1185.06
15932.32	Final	FW	1	539.4	1078.97
15734.55	Final	FW	1	472.16	960.72
15566.37	Final	FW	1	430.57	868.51
15339.77	Final	FW	1	347.35	810.64
15119.36	Final	FW	1	409.93	898.7
14913.53	Final	FW	1	506.9	989.65
14737.95	Final	FW	1	539.84	1033.14
14547.73	Final	FW	1	589.4	1079.72
14333.93	Final	FW	1	605.25	1125.26
14236.79	Final	FW	1	682.85	1113.91
14078.75	Final	FW	1	675.9	1097.75
13924.58	Final	FW	1	732.06	1133.89

River = LV_WASH Reach = R6 - DUCK CR_COH

RS	Profile	Method	Value1	Value2
23625.36	Final	FW	1	460.01	823.06
23570.78	Final	FW	1	459.33	773.5
23522.44	Final	FW	1	478.45	754.83
23322.87	Final	FW	1	570.95	730.62
23128.2	Final	FW	1	583.26	790.8
22925.04	Final	FW	1	775.97	1044.56
22730.9	Final	FW	1	912.64	1144.28
22528.57	Final	FW	1	944.96	1342.58
22328.45	Final	FW	1	956.23	1432.04
22126.97	Final	FW	1	957.57	1382.39
21933.79	Final	FW	1	953.72	1392.98
21692.16	Final	FW	1	878.3	1345.47
21537.49	Final	FW	1	780.95	1239.52
21450.46	Final	FW	1	758.08	1195.88
21339.83	Final	FW	1	750	1093.5
21140.82	Final	FW	1	776.8	902.33
20941.54	Final	FW	1	696.48	866.03
20740.67	Final	FW	1	605.25	796.11
20539.76	Final	FW	1	559.63	767.56
20393.63	Final	FW	1	475.57	748.87
20142.43	Final	FW	1	393.96	754.57
20059.61	Final	FW	1	368.62	721.83
19945.85	Final	FW	1	401.21	731.02
19745.02	Final	FW	1	514.52	846.84
19547.49	Final	FW	1	620.32	990.52
19348.05	Final	FW	1	639.75	1132
19144.12	Final	FW	1	647.88	1216
18948.38	Final	FW	1	610.92	1242
18739.71	Final	FW	1	647.72	1319
18534.64	Final	FW	1	569.2	1350

River = LV_WASH Reach = R7 - DC1_DUC

RS	Profile	Method	Value1	Value2
26821.78	Final	FW	1	700.63	857.28
26714.15	Final	FW	1	701.11	832.21
26501.13	Final	FW	1	636.45	769.42
26314.53	Final	FW	1	673.73	798.42
26118.49	Final	FW	1	580.39	666.68
25915.07	Final	FW	1	314.98	497.87
25715.56	Final	FW	1	240.26	448.24
25514.32	Final	FW	1	209.75	421.76
25318.39	Final	FW	1	187.04	354.83
25114.49	Final	FW	1	174.44	326.4
24919.76	Final	FW	1	250.01	412.09
24716.26	Final	FW	1	292.68	513.29
24526.44	Final	FW	1	299.27	530.67
24344.71	Final	FW	1	276.45	580.38
24150.09	Final	FW	1	310.69	690.37
23917.65	Final	FW	1	332.02	
23775.21	Final	FW	1	406.14	

River = LV_WASH Reach = R8 - TROP_SPD2

RS	Profile	Method	Value1	Value2
30602.29	Final	FW	1	260.52	695.13
30435.56	Final	FW	1	342.12	750.89

30233.32	Final FW	1	344.92	738.39
30013.99	Final FW	1	317.53	773.51
29823.15	Final FW	1	301.92	877.72
29775.7*	Final FW	1	292.16	910.16
29728.2*	Final FW	1	282.41	945.51
29680.8*	Final FW	1	272.65	982.65
29633.31	Final FW	1	262.89	1022.89
29433.92	Final FW	1	278.71	1088.71
29383.9*	Final FW	1	295.92	1106.89
29334.0*	Final FW	1	313.12	1116.92
29284.0*	Final FW	1	330.33	1136.4
29234	Final FW	1	347.54	1139.32
28982.39	Final FW	1	511.35	1339.2
28834.67	Final FW	1	606.12	1446.51
28637.81	Final FW	1	642.55	1575.55
28460.25	Final FW	1	640.4	1525.61
28308.1	Final FW	1	635.8	1533.16
28108.01	Final FW	1	633.18	1533.18
27937.48	Final FW	1	610.74	1565.63
27908.4*	Final FW	1	609.2	1579.29
27879.2*	Final FW	1	614.65	1597.56
27850.12	Final FW	1	623.11	1615.44
27709.27	Final FW	1	645.22	1719.66
27446.45	Final FW	1	616.52	1792.77
27310.54	Final FW	1	650.2	1802.72
27111.62	Final FW	1	672.82	1907.89
26912.03	Final FW	1	688.37	1993.5

River = LV_WASH Reach = R9A - NC_TROP

RS	Profile	Method	Value1	Value2
31228.3	Final FW	1	290.89	637.38
31159.34	Final FW	1	272.62	591.38
31030.94	Final FW	1	331.08	613.31
30926.89	Final FW	1	371.51	637.13
30810.52	Final FW	1	427.4	738.86

River = LV_WASH Reach = R9 - MONSON_NC

RS	Profile	Method	Value1	Value2
33275.67	Final FW	1	0	236.67
33195.64	Final FW	1	0	280.13
33094.13	Final FW	1	0	303.09
33009.88	Final FW	1	0	375
32964.35	Final FW	1	214.99	400.89
32919.46	Final FW	1	212.69	413.26
32875.06	Final FW	1	200.16	400.39
32855.09	Final FW	1	197.78	397.13
32817.83	Final FW	1	214.29	392.29
32793.84	Final FW	1	219.09	392.04
32757.55	Final FW	1	221.63	370.82
32716.08	Final FW	1	242.39	363.39
32672.38	Final FW	1	251.5	346.67
32611.32	Final FW	1	240.26	324.92
32525.66	Final FW	1	210.56	299.9
32404.94	Final FW	1	181.4	276.61
32304.15	Final FW	1	199.35	318.09
32248.15	Final FW	1	194.83	361.81
32185.7	Final FW	1	195.84	400.61
32106.45	Final FW	1	124.08	327.56
32034.21	Final FW	1	141.03	334.83
31975.27	Final FW	1	93.75	322.92
31950.55	Final FW	1	93.65	318.52
31917.66	Final FW	1	107.27	310.1
31878.6	Final FW	1	141.81	332.61
31833.89	Final FW	1	167.36	338.35
31791.99	Final FW	1	183.21	338.23
31756.5	Final FW	1	199.1	341.67
31721.6	Final FW	1	202.43	343.71
31601.68	Final FW	1	233.29	355.61
31534.8	Final FW	1	203.84	297.72
31477.87	Final FW	1	239.16	291.58

River = LV_WASH Reach = R10 - SPL N_CHAN

RS	Profile	Method	Value1	Value2
33549.55	Final FW	1	583.32	954.51
33525.57	Final FW	1	527.29	998.98
33495.21	Final FW	1	529.79	978.62
33430.81	Final FW	1	468.9	953.89
33385.83	Final FW	1	381.42	919.17

River = LV_WASH Reach = R11 - CC_SPLT UP

RS	Profile	Method	Value1	Value2
34542.08	Final FW	1	443.04	1419.61
34419.98	Final FW	1	503.69	1482.75
34343.43	Final FW	1	578.26	1537.5
34289.28	Final FW	1	583.42	1554.26
34192.21	Final FW	1	609.52	1553.92
34072.36	Final FW	1	722.94	1642.44
33971.78	Final FW	1	757.64	1667.82
33876.1	Final FW	1	738.65	1650
33799.72	Final FW	1	727.69	1639.2

River = LV_WASH Reach = R12 - CLV_CC

RS	Profile	Method	Value1	Value2
39288.89	Final FW	1	2174.5	2411.81
39090.89	Final FW	1	2228.25	2459.64
38887.89	Final FW	1	2373.76	2613.03
38666.89	Final FW	1	2450.15	2735
38511.89	Final FW	1	2442.86	2769.46
38304.89	Final FW	1	2549.81	2949.81
38101.89	Final FW	1	2547.56	3038
37905.89	Final FW	1	2483.49	2985.28
37705.89	Final FW	1	2537.09	3355
37218.09	Final FW	1	160.81	810.22
37123.55	Final FW	1	139.69	818.08
36919.21	Final FW	1	155.72	904.02
36716.41	Final FW	1	166.36	1021.35
36517.68	Final FW	1	175.05	1088.56
36401.45	Final FW	1	248.92	1114.53
36362.53	Final FW	1	245.58	964.49
36333.25	Final FW	1	252.3	984.12
36220.66	Final FW	1	267.32	1022.14
36102.7	Final FW	1	327.3	1111.01
35922.39	Final FW	1	380.05	1237.36
35814.29	Final FW	1	428.26	1310.35
35693.31	Final FW	1	437.73	1349.2
35657.57	Final FW	1	435.82	1374.87
35621.86	Final FW	1	454.21	1384.13
35539.57	Final FW	1	448.69	1375.46
35434.41	Final FW	1	428.08	1370.41
35337.22	Final FW	1	410.15	1398.09
35157.56	Final FW	1	367.81	1411.66
35074.46	Final FW	1	393.18	1458.59
34972.61	Final FW	1	382.38	1466.6
34825.85	Final FW	1	438.62	1482.34
34709.3	Final FW	1	396.84	1399.4
34622.3	Final FW	1	417.36	1450.24

River = East Diversion Reach = EDC

RS	Profile	Method	Value1	Value2

3930.044	Final FW	1	184.2	329.08
3864.537	Final FW	1	177.3	321
3810.933	Final FW	1	165.85	308.49
3759.115	Final FW	1	159.86	325.2
3716.035	Final FW	1	153.35	325.16
3669.197	Final FW	1	153.73	325.64
3610.243	Final FW	1	158.45	319.14
3561.266	Final FW	1	144.72	293.04
3513.843	Final FW	1	145.44	281.31
3460.766	Final FW	1	134.91	258.12
3437.253	Final FW	1	134.99	249.38
3412.005	Final FW	1	129.89	233
3387.721	Final FW	1	123.29	226.75
3367.59	Final FW	1	110.26	223.73
3343.343	Final FW	1	100.13	226.48
3320.757	Final FW	1	95.46	234.72
3297.57	Final FW	1	145.35	294.94
3269.591	Final FW	1	120.49	269.66
3250.57	Final FW	1	100.6	245.6
3242.57	Final FW	1	101.37	243.96
3232.57	Final FW	1	101.87	239.96
3194.512	Final FW	1	101.02	241.33
3159.512	Final FW	1	98.4	240.08
3124.512	Final FW	1	103.67	238.83
3089.512	Final FW	1	110.59	232.75
3049.47	Final FW	1	110.66	234.66
3009.47	Final FW	1	103.04	239
2986.084	Final FW	1	90.37	227
2925.153	Final FW	1	86.51	220
2875.114	Final FW	1	94.49	217.92
2824.573	Final FW	1	91.75	216.86
2774.614	Final FW	1	93.49	216.65
2750.339	Final FW	1	104.59	217.07
2725.274	Final FW	1	105.73	214.85
2700.734	Final FW	1	113.83	220.96
2675.1	Final FW	1	97.06	229.2
2651.255	Final FW	1	84.22	233.81
2628.254	Final FW	1	74.79	240.4
2605.2	Final FW	1	73.18	246.47
2579.751	Final FW	1	70.13	246.37
2558.2	Final FW	1	73.62	230.87
2550.2	Final FW	1	81.79	235.24
2540.2	Final FW	1	82.72	234.22
2502.155	Final FW	1	84.09	234.57
2467.153	Final FW	1	89.35	230.19
2432.151	Final FW	1	91.07	223.36
2397.149	Final FW	1	90.03	220.45
2357.1	Final FW	1	97.69	215.49
2317.1	Final FW	1	111.84	221.71
2290.432	Final FW	1	107.57	223.21
2230.433	Final FW	1	99.58	213.59
2180.434	Final FW	1	83.84	208.1
2130.434	Final FW	1	109.46	224.77
2080.12	Final FW	1	129.58	242.87
2055.436	Final FW	1	142.24	246.29
2030.436	Final FW	1	152.82	250.49
2005.447	Final FW	1	156.37	247.46
1980.38	Final FW	1	138.42	251.26
1957.376	Final FW	1	129.6	251.11
1934.376	Final FW	1	120.11	262.1
1911.31	Final FW	1	118.67	271.78
1885.876	Final FW	1	122.72	270.26
1864.32	Final FW	1	119	272
1856.32	Final FW	1	122.47	271.31
1846.32	Final FW	1	122.83	271.82
1808.276	Final FW	1	139.99	270.61
1773.276	Final FW	1	136.74	265.72
1738.276	Final FW	1	130.61	258.66
1703.276	Final FW	1	136.18	260.35
1663.22	Final FW	1	130.47	256.42
1623.218	Final FW	1	137.18	260.99
1525.574	Final FW	1	118.94	248.2
1459.599	Final FW	1	157.36	264.55
1377.256	Final FW	1	191.76	300.21
1296.102	Final FW	1	73.14	191.74
1222.567	Final FW	1	88.92	193.31
1217.996	Final FW	1	89.28	194.58
1190.397	Final FW	1	86.36	188.33
1164.25	Final FW	1	82.72	194.96
1131.985	Final FW	1	70.74	188.52
1103.268	Final FW	1	61.33	192.41
1073.269	Final FW	1	55.7	184.09
1056.468	Final FW	1	49.63	3.1E+38
1040.31	Final FW	1	55.19	3.1E+38

River = LV_WASH ROB Reach = NC

RS	Profile	Method	Value1	Value2
2364.527	Final FW	1	60.09	526.12
2285.451	Final FW	1	70	532.84
2193.135	Final FW	1	110.3	537.73
2075.334	Final FW	1	93.36	484.18
1970.103	Final FW	1	36.2	401.3
1878.819	Final FW	1	20.19	366.45
1795.203	Final FW	1	38.42	371.02
1641.251	Final FW	1	24.9	415.35
1536.009	Final FW	1	22.13	429.36
1473.509	Final FW	1	11.45	445.54
1428.394	Final FW	1	34.06	436.83
1382.131	Final FW	1	47.02	415.69
1333.692	Final FW	1	56.79	417.64
1213.437	Final FW	1	100	440.95
1086.026	Final FW	1	151.26	449.5
972.757	Final FW	1	215.64	465.64
845.568	Final FW	1	246.41	481.56
744.470	Final FW	1	231.85	467.63
671.416	Final FW	1	226.55	460.77
592.936	Final FW	1	207.8	462.66
499.129	Final FW	1	202.2	454.26

River = split_duck Reach = split_duck

RS	Profile	Method	Value1	Value2
3349.45	Final FW	1	360.16	882.5
2997.7	Final FW	1	482.49	803.5
2975.11*	Final FW	1	486.31	793.74
2952.52*	Final FW	1	490.12	762.24
2929.94*	Final FW	1	493.94	795.93
2907.35*	Final FW	1	497.75	796.73
2884.765	Final FW	1	501.57	793.23
2726.695	Final FW	1	472.66	747.87
2472.072	Final FW	1	456.25	752.46
2199.47	Final FW	1	450	750
2003.557	Final FW	1	346.2	690
1803.297	Final FW	1	300	660
1603.511	Final FW	1	275.17	392.43
1578.86*	Final FW	1	267.67	395.85
1554.19*	Final FW	1	260.16	399.28
1529.52*	Final FW	1	252.65	402.7
1504.85*	Final FW	1	245.15	406.12
1480.18*	Final FW	1	237.65	409.55

1455.508	Final FW		1	230.14	412.97
1371.753	Final FW		1	261.09	453.42
1042.362	Final FW		1	253.29	399.13
928.171	Final FW		1	260.22	408.14
775.679	Final FW		1	234.75	471.42
679.381	Final FW		1	0	457.17
381.168	Final FW		1	0	289.13
249.718	Final FW		1	0	148.13

River = LV_WASH Reach = R1 - 3 KIDS_INTA

RS	Profile	Method	Value1	Value2
3534.52	M1 Initial FW	1	268.84	799.78
3428.19	M1 Initial FW	1	184.84	675.14
3303.9	M1 Initial FW	1	175	681.33
3110.51	M1 Initial FW	1	106.67	595.13
2933.22	M1 Initial FW	1	81.13	550.43
2831.75	M1 Initial FW	1		
2719.51	M1 Initial FW	1	117.89	522.54
2597.65	M1 Initial FW	1	129.29	485.99
2566.48	M1 Initial FW	1	140.17	472.39
2308.22	M1 Initial FW	1	191.02	479.86
2200.51	M1 Initial FW	1	115.11	504.66
2126.13	M1 Initial FW	1	77.05	455.91
2054.87	M1 Initial FW	1	173.18	509.91
1985.39	M1 Initial FW	1		
1776.89	M1 Initial FW	1	289.27	612.49
1768.69	M1 Initial FW	1	305.68	614.81
1721.72	M1 Initial FW	1	321.35	626.05
1643.22	M1 Initial FW	1	343.46	603.47
1579.28	M1 Initial FW	1	352.91	588.59
1489.16	M1 Initial FW	1	360.58	564.14
1393.95	M1 Initial FW	1	649.8	844.02
1217.48	M1 Initial FW	1	731.58	927.85
1082.41	M1 Initial FW	1	762.56	966.73
997.53	M1 Initial FW	1	845.64	1052.3
856.62	M1 Initial FW	1	886.37	1078.76
695.28	M1 Initial FW	1	892.97	1085.63
659.78	M1 Initial FW	1	910.18	1080
603.12	M1 Initial FW	1	910	1129
405.15	M1 Initial FW	1	920	1122
182.42	M1 Initial FW	1	710	1165
14.48	M1 Initial FW	1	578.34	1038.31

River = LV_WASH Reach = R2 - DEMO_3KIDS

RS	Profile	Method	Value1	Value2
5023.61	M1 Initial FW	1	687.45	1147.76
4975.95	M1 Initial FW	1	687.83	1125.14
4848.28	M1 Initial FW	1	735.85	1029.87
4669.4	M1 Initial FW	1	690.18	963.11
4463.48	M1 Initial FW	1	565.77	876.59
4318.02	M1 Initial FW	1	468.96	816.38
4092.23	M1 Initial FW	1	391.2	735.13
3934.49	M1 Initial FW	1	374.34	693.94
3775.67	M1 Initial FW	1	328.65	704.21

River = LV_WASH Reach = R3 - TEMP_DEMO

RS	Profile	Method	Value1	Value2
9687.58	M1 Initial FW	1	546.13	1047.36
9501.16	M1 Initial FW	1	471.14	1054.98
9311.87	M1 Initial FW	1	452.81	1025.05
9149.04	M1 Initial FW	1	435.87	1027.34
9007.92	M1 Initial FW	1	483.36	1063.54
8823.15	M1 Initial FW	1	576.11	1143.85
8615.8	M1 Initial FW	1	657.3	1228.13
8458.89	M1 Initial FW	1	703.74	1299.64
8296.77	M1 Initial FW	1	874.3	1219.1
8089.02	M1 Initial FW	1	941.29	1178
7966.87	M1 Initial FW	1	900.89	1169.97
7828.58	M1 Initial FW	1	962.82	1148.98
7654.78	M1 Initial FW	1	933.79	1144.06
7399.01	M1 Initial FW	1	709.44	1246.36
7290.02	M1 Initial FW	1	531.78	1154.35
7158.49	M1 Initial FW	1	546.63	1157.93
7018.82	M1 Initial FW	1	669.77	1262.5
6861.99	M1 Initial FW	1	686.41	1204.2
6681.24	M1 Initial FW	1	768.15	1142.98
6490.7	M1 Initial FW	1	693.24	1035.82
6269.3	M1 Initial FW	1	700.8	1118.66
6039.66	M1 Initial FW	1	788.66	1365.65
5857.47	M1 Initial FW	1	926.13	1391.04
5685.38	M1 Initial FW	1	852.29	1387.36
5528.36	M1 Initial FW	1	828.34	1396.71
5388.96	M1 Initial FW	1	754.21	1338.22
5192.97	M1 Initial FW	1	724.74	1298.7

River = LV_WASH Reach = R4 - C1_TEMP

RS	Profile	Method	Value1	Value2
13668.66	M1 Initial FW	1	775.7	1096.21
13351.49	M1 Initial FW	1	764.81	1153.44
13081.45	M1 Initial FW	1	721.49	1298.1
12954.93	M1 Initial FW	1	619.83	1261.67
12759.65	M1 Initial FW	1	660.59	1401.94
12590.7	M1 Initial FW	1	458.21	1199.39
12448.88	M1 Initial FW	1	386.45	1182.43
12357.87	M1 Initial FW	1	428.43	1194.45
12315.19	M1 Initial FW	1		
11929.49	M1 Initial FW	1	411.42	1243.98
11860.97	M1 Initial FW	1	462	1226.4
11756.77	M1 Initial FW	1	535.65	1208.73
11563.85	M1 Initial FW	1	542.64	1141.29
11410.95	M1 Initial FW	1	531.35	1049.93
11303.6	M1 Initial FW	1	604.5	1137.33
11175.42	M1 Initial FW	1	595.24	1097.71
10982.76	M1 Initial FW	1	565.35	1006.14
10782.21	M1 Initial FW	1		
10598.94	M1 Initial FW	1	515.91	1028.32
10517.5	M1 Initial FW	1	532.94	1043.71
10354.51	M1 Initial FW	1	566.99	1056.19
10200.66	M1 Initial FW	1	568.22	1034.57
9856.77	M1 Initial FW	1	535.63	1045.23

River = LV_WASH Reach = R5 - COH_C1

RS	Profile	Method	Value1	Value2
18277.82	M1 Initial FW	1	554.95	1419.63
18144.07	M1 Initial FW	1		
17959.9	M1 Initial FW	1	490	1290
17761.68	M1 Initial FW	1	700	1319
17576.76	M1 Initial FW	1	950	1405.7
17397	M1 Initial FW	1	1035.45	1403.59
17185.45	M1 Initial FW	1	1004.14	1343.11
16989.85	M1 Initial FW	1	879.5	1213.98
16788.79	M1 Initial FW	1	956.87	1229.06
16686.94	M1 Initial FW	1	917.61	1312.01
16539.37	M1 Initial FW	1	829.33	1398.93
16275.81	M1 Initial FW	1	770.84	1317.15
16127.61	M1 Initial FW	1	598.46	1185.06
15932.32	M1 Initial FW	1	539.4	1078.97
15734.55	M1 Initial FW	1	472.16	960.72
15566.37	M1 Initial FW	1	430.57	828.31

15339.77M1	Initial	FW	1	346.95	768.64
15119.36M1	Initial	FW	1	341.9	872.7
14913.53M1	Initial	FW	1	266.35	984.65
14737.95M1	Initial	FW	1	539.84	995.14
14547.73M1	Initial	FW	1	564.98	1017.22
14333.93M1	Initial	FW	1	579.57	1171
14236.79M1	Initial	FW	1	682.85	1113.91
14078.75M1	Initial	FW	1	675.9	1097.75
13924.58M1	Initial	FW	1	732.06	1133.89

River = LV_WASH Reach = R6 - DUCK CR_COH

RS	Profile		Method	Value1	Value2
23625.36M1	Initial	FW	1	479.11	823.06
23570.78M1	Initial	FW	1	465.83	773.5
23522.44M1	Initial	FW	1	478.45	754.83
23322.87M1	Initial	FW	1	570.95	730.62
23128.2 M1	Initial	FW	1	583.26	790.8
22925.04M1	Initial	FW	1	775.97	1044.56
22730.9 M1	Initial	FW	1	912.64	1144.28
22528.57M1	Initial	FW	1	944.96	1342.58
22328.45M1	Initial	FW	1	956.23	1432.04
22126.97M1	Initial	FW	1	957.57	1382.39
21933.79M1	Initial	FW	1	953.72	1337.98
21692.16M1	Initial	FW	1	878.3	1345.47
21537.49M1	Initial	FW	1	600.95	1215.02
21450.46M1	Initial	FW	1	567.48	1218.58
21339.83M1	Initial	FW	1	650	1250
21140.82M1	Initial	FW	1	776.8	902.33
20941.54M1	Initial	FW	1	696.48	866.03
20740.67M1	Initial	FW	1	610.25	750.91
20539.76M1	Initial	FW	1	559.63	733.16
20393.63M1	Initial	FW	1	475.57	748.87
20142.43M1	Initial	FW	1	393.96	747.57
20059.61M1	Initial	FW	1	368.62	718.33
19945.85M1	Initial	FW	1	401.21	716.32
19745.02M1	Initial	FW	1	514.52	785.64
19547.49M1	Initial	FW	1	620.32	912.32
19348.05M1	Initial	FW	1	698.25	1132
19144.12M1	Initial	FW	1	647.88	1216
18948.38M1	Initial	FW	1	610.92	1242
18739.71M1	Initial	FW	1	647.72	1319
18534.64M1	Initial	FW	1	569.2	1350

River = LV_WASH Reach = R7 - DC1_DUC

RS	Profile		Method	Value1	Value2
26821.78M1	Initial	FW	1	756.73	857.28
26714.15M1	Initial	FW	1	731.01	832.21
26501.13M1	Initial	FW	1	636.45	769.42
26314.53M1	Initial	FW	1	673.73	798.42
26118.49M1	Initial	FW	1	580.39	666.68
25915.07M1	Initial	FW	1	314.98	497.87
25715.56M1	Initial	FW	1	240.26	448.24
25514.32M1	Initial	FW	1	209.75	421.76
25318.39M1	Initial	FW	1	187.04	354.83
25114.49M1	Initial	FW	1	174.44	326.4
24919.76M1	Initial	FW	1	250.01	412.09
24716.26M1	Initial	FW	1	292.68	513.29
24526.44M1	Initial	FW	1	299.27	530.67
24344.71M1	Initial	FW	1	276.45	580.38
24150.09M1	Initial	FW	1	310.69	690.37
23917.65M1	Initial	FW	1	332.02	618.18
23775.21M1	Initial	FW	1	406.14	710.85

River = LV_WASH Reach = R8 - TROP_SPD2

RS	Profile		Method	Value1	Value2
30602.29M1	Initial	FW	1	260.52	637.63
30435.56M1	Initial	FW	1	342.12	755.89
30233.32M1	Initial	FW	1	344.92	723.39
30013.99M1	Initial	FW	1	317.53	773.51
29823.15M1	Initial	FW	1	301.92	861.92
29775.7*M1	Initial	FW	1	292.16	902.16
29728.2*M1	Initial	FW	1	282.41	942.41
29680.8*M1	Initial	FW	1	272.65	982.65
29633.31M1	Initial	FW	1	262.89	1022.89
29433.92M1	Initial	FW	1	278.71	1088.71
29383.9*M1	Initial	FW	1	295.92	1106.89
29334.0*M1	Initial	FW	1	313.12	1116.92
29284.0*M1	Initial	FW	1	330.33	1136.4
29234 M1	Initial	FW	1	347.54	1204.82
28982.39M1	Initial	FW	1	511.35	1395
28834.67M1	Initial	FW	1	606.12	1446.51
28637.81M1	Initial	FW	1	550.05	1400.05
28460.25M1	Initial	FW	1	571.4	1423.91
28308.1 M1	Initial	FW	1	635.8	1533.16
28108.01M1	Initial	FW	1	633.18	1533.18
27937.48M1	Initial	FW	1	610.74	1565.63
27908.4*M1	Initial	FW	1	616.2	1566.79
27879.2*M1	Initial	FW	1	621.65	1572.56
27850.12M1	Initial	FW	1	627.11	1578.94
27709.27M1	Initial	FW	1	677.22	1719.66
27446.45M1	Initial	FW	1	616.52	1792.77
27310.54M1	Initial	FW	1	650.2	1729.22
27111.62M1	Initial	FW	1	672.82	1731.19
26912.03M1	Initial	FW	1	688.37	1700

River = LV_WASH Reach = R9A - NC_TROP

RS	Profile		Method	Value1	Value2
31228.3 M1	Initial	FW	1	290.89	637.38
31159.34M1	Initial	FW	1	272.62	572.88
31030.94M1	Initial	FW	1	331.08	594.81
30926.89M1	Initial	FW	1	371.51	626.63
30810.52M1	Initial	FW	1	427.4	738.86

River = LV_WASH Reach = R9 - MONSON_NC

RS	Profile		Method	Value1	Value2
33275.67M1	Initial	FW	1	0	236.67
33195.64M1	Initial	FW	1	0	280.13
33094.13M1	Initial	FW	1	0	303.09
33009.88M1	Initial	FW	1	0	375
32964.35M1	Initial	FW	1	250.19	381.59
32919.46M1	Initial	FW	1	238.19	413.26
32875.06M1	Initial	FW	1	200.66	400.39
32855.09M1	Initial	FW	1	197.78	393.43
32817.83M1	Initial	FW	1	214.29	385.29
32793.84M1	Initial	FW	1	219.09	392.04
32757.55M1	Initial	FW	1	221.63	356.82
32716.08M1	Initial	FW	1	242.39	377.39
32672.38M1	Initial	FW	1	251.5	341.67
32611.32M1	Initial	FW	1	240.26	324.92
32525.66M1	Initial	FW	1	210.56	299.9
32404.94M1	Initial	FW	1	181.4	276.61
32304.15M1	Initial	FW	1	199.35	318.09
32248.15M1	Initial	FW	1	194.83	361.81
32185.7 M1	Initial	FW	1	195.84	400.61
32106.45M1	Initial	FW	1	124.08	327.56
32034.21M1	Initial	FW	1	141.03	334.83
31975.27M1	Initial	FW	1	93.75	322.92
31950.55M1	Initial	FW	1	93.65	318.52
31917.66M1	Initial	FW	1	107.27	310.1

31878.6 M1	Initial FW		1	141.81	332.61
31833.89M1	Initial FW		1	167.36	330.95
31791.99M1	Initial FW		1	183.21	338.23
31756.5 M1	Initial FW		1	199.1	341.67
31721.6 M1	Initial FW		1	202.43	325.71
31601.68M1	Initial FW		1	233.29	357.61
31534.8 M1	Initial FW		1	203.79	297.72
31477.87M1	Initial FW		1	239.16	291.16

River = LV_WASH Reach = R10 - SPL N CHAN

RS	Profile		Method	Value1	Value2
33549.55M1	Initial FW		1	583.32	954.51
33525.57M1	Initial FW		1	527.29	998.98
33495.21M1	Initial FW		1	529.79	978.62
33430.81M1	Initial FW		1	468.9	953.89
33385.83M1	Initial FW		1	381.42	919.17

River = LV_WASH Reach = R11 - CC_SPLT UP

RS	Profile		Method	Value1	Value2
34542.08M1	Initial FW		1	443.04	1340.41
34419.98M1	Initial FW		1	503.69	1402.75
34343.43M1	Initial FW		1	578.26	1517.5
34289.28M1	Initial FW		1	583.42	1552.29
34192.21M1	Initial FW		1	609.52	1510.57
34072.36M1	Initial FW		1	722.94	1625.8
33971.78M1	Initial FW		1	757.64	1667.82
33876.1 M1	Initial FW		1	738.65	1650
33799.72M1	Initial FW		1	727.69	1620

River = LV_WASH Reach = R12 - CLV_CC

RS	Profile		Method	Value1	Value2
39288.89M1	Initial FW		1	2174.5	2411.81
39090.89M1	Initial FW		1	2228.25	2459.64
38887.89M1	Initial FW		1	2373.76	2613.03
38666.89M1	Initial FW		1	2450.15	2735
38511.89M1	Initial FW		1	2442.86	2769.46
38304.89M1	Initial FW		1	2549.81	2949.81
38101.89M1	Initial FW		1	2547.56	3038
37905.89M1	Initial FW		1	2483.49	2985.28
37705.89M1	Initial FW		1	2537.09	3355
37218.09M1	Initial FW		1	160.81	838.22
37123.55M1	Initial FW		1	139.69	818.08
36919.21M1	Initial FW		1	155.72	904.02
36716.41M1	Initial FW		1	166.36	1043.35
36517.68M1	Initial FW		1	175.05	1088.56
36401.45M1	Initial FW		1	248.92	1124.53
36362.53M1	Initial FW		1	245.58	924.49
36333.25M1	Initial FW		1	252.3	942.12
36220.66M1	Initial FW		1	267.32	957.14
36102.7 M1	Initial FW		1	327.3	1111.01
35922.39M1	Initial FW		1	380.05	1251.36
35814.29M1	Initial FW		1	428.26	1310.35
35693.31M1	Initial FW		1	437.73	1331.2
35657.57M1	Initial FW		1	435.82	1348.37
35621.86M1	Initial FW		1	454.21	1344.13
35539.57M1	Initial FW		1	448.69	1375.46
35434.41M1	Initial FW		1	428.08	1370.41
35337.22M1	Initial FW		1	410.15	1398.09
35157.56M1	Initial FW		1	367.81	1384.16
35074.46M1	Initial FW		1	393.18	1405.79
34972.61M1	Initial FW		1	382.38	1466.6
34825.85M1	Initial FW		1	438.62	1482.34
34709.3 M1	Initial FW		1	396.84	1349.4
34622.3 M1	Initial FW		1	417.36	1385.24

River = East Diversion Reach = EDC

RS	Profile		Method	Value1	Value2
3930.044M1	Initial FW		1	184.2	329.08
3864.537M1	Initial FW		1	177.3	321
3810.933M1	Initial FW		1	165.85	308.49
3759.115M1	Initial FW		1	159.86	325.2
3716.035M1	Initial FW		1	153.35	325.16
3669.197M1	Initial FW		1	153.73	325.64
3610.243M1	Initial FW		1	158.45	319.14
3561.266M1	Initial FW		1	144.72	293.04
3513.843M1	Initial FW		1	145.44	281.31
3460.766M1	Initial FW		1	134.91	258.12
3437.253M1	Initial FW		1	134.99	249.38
3412.005M1	Initial FW		1	105.12	233
3387.721M1	Initial FW		1	96.51	226.75
3367.59 M1	Initial FW		1	110.26	223.73
3343.343M1	Initial FW		1	100.13	226.48
3320.757M1	Initial FW		1	95.46	234.72
3297.57 M1	Initial FW		1	145.35	294.94
3269.591M1	Initial FW		1	120.49	269.66
3250.57 M1	Initial FW		1	100.6	245.6
3242.57 M1	Initial FW		1	101.37	243.96
3232.57 M1	Initial FW		1	101.87	239.96
3194.512M1	Initial FW		1	101.02	241.33
3159.512M1	Initial FW		1	98.4	240.08
3124.512M1	Initial FW		1	103.67	238.83
3089.512M1	Initial FW		1	110.59	232.75
3049.47 M1	Initial FW		1	110.66	234.66
3009.47 M1	Initial FW		1	103.04	239
2986.084M1	Initial FW		1	90.37	227
2925.153M1	Initial FW		1	86.51	220
2875.114M1	Initial FW		1	94.49	217.92
2824.573M1	Initial FW		1	91.75	216.86
2774.614M1	Initial FW		1	93.49	216.65
2750.339M1	Initial FW		1	104.59	217.07
2725.274M1	Initial FW		1	82	214.85
2700.734M1	Initial FW		1	86.95	220.96
2675.1 M1	Initial FW		1	97.06	229.2
2651.255M1	Initial FW		1	84.22	233.81
2628.254M1	Initial FW		1	74.79	240.4
2605.2 M1	Initial FW		1	73.18	246.47
2579.751M1	Initial FW		1	70.13	246.37
2558.2 M1	Initial FW		1	73.62	230.87
2550.2 M1	Initial FW		1	81.79	235.24
2540.2 M1	Initial FW		1	82.72	234.22
2502.155M1	Initial FW		1	84.09	234.57
2467.153M1	Initial FW		1	89.35	230.19
2432.151M1	Initial FW		1	91.07	223.36
2397.149M1	Initial FW		1	90.03	220.45
2357.1 M1	Initial FW		1	97.69	215.49
2317.1 M1	Initial FW		1	111.84	221.71
2290.432M1	Initial FW		1	107.57	223.21
2230.433M1	Initial FW		1	99.58	213.59
2180.434M1	Initial FW		1	83.84	208.1
2130.434M1	Initial FW		1	109.46	224.77
2080.12 M1	Initial FW		1	129.58	242.87
2055.436M1	Initial FW		1	142.24	246.29
2030.436M1	Initial FW		1	130.61	250.49
2005.447M1	Initial FW		1	129.16	247.46
1980.38 M1	Initial FW		1	138.42	251.26
1957.376M1	Initial FW		1	129.6	251.11
1934.376M1	Initial FW		1	120.11	262.1
1911.31 M1	Initial FW		1	118.67	271.78
1885.876M1	Initial FW		1	122.72	270.26

1864.32 M1	Initial FW	1	119	272	
1856.32 M1	Initial FW	1	122.47	271.31	
1846.32 M1	Initial FW	1	122.83	271.82	
1808.276M1	Initial FW	1	139.99	270.61	
1773.276M1	Initial FW	1	136.74	265.72	
1738.276M1	Initial FW	1	130.61	258.66	
1703.276M1	Initial FW	1	136.18	260.35	
1663.22 M1	Initial FW	1	130.47	256.42	
1623.218M1	Initial FW	1	137.18	260.99	
1525.574M1	Initial FW	1	118.94	248.2	
1459.599M1	Initial FW	1	157.36	264.55	
1377.256M1	Initial FW	1	191.76	300.21	
1296.102M1	Initial FW	1	73.14	191.74	
1222.567M1	Initial FW	1	88.92	193.31	
1217.996M1	Initial FW	1	89.28	194.58	
1190.397M1	Initial FW	1	86.36	188.33	
1164.25 M1	Initial FW	1	82.72	194.96	
1131.985M1	Initial FW	1	70.74	188.52	
1103.268M1	Initial FW	1	61.33	192.41	
1073.269M1	Initial FW	1	55.7	184.09	
1056.468M1	Initial FW	1	49.63	3.1E+38	
1040.31 M1	Initial FW	1	55.19	3.1E+38	

River = LV_WASH ROB Reach = NC

RS	Profile	Method	Value1	Value2
2364.527M1	Initial FW	1	60.09	526.12
2285.451M1	Initial FW	1	70	532.84
2193.135M1	Initial FW	1	106.8	537.73
2075.334M1	Initial FW	1	51.16	484.18
1970.103M1	Initial FW	1	36.2	368.3
1878.819M1	Initial FW	1	20.69	346.45
1795.203M1	Initial FW	1	63.42	371.02
1641.251M1	Initial FW	1	84.9	415.35
1536.009M1	Initial FW	1	17.63	386.46
1473.509M1	Initial FW	1	11.45	388.04
1428.394M1	Initial FW	1	34.06	335.23
1382.131M1	Initial FW	1	88.02	415.69
1333.692M1	Initial FW	1	56.79	417.64
1213.437M1	Initial FW	1	100	445.95
1086.026M1	Initial FW	1	155.26	475.3
972.757 M1	Initial FW	1	142.14	442.14
845.568 M1	Initial FW	1	241.41	481.56
744.470 M1	Initial FW	1	231.85	422.43
671.416 M1	Initial FW	1	226.55	454.27
592.936 M1	Initial FW	1	207.8	425.66
499.129 M1	Initial FW	1	276.5	534.26

River = split_duck Reach = split_duck

RS	Profile	Method	Value1	Value2
3349.45 M1	Initial FW	1	300	725
2997.7 M1	Initial FW	1	482.49	790.5
2975.11*M1	Initial FW	1	486.31	747.24
2952.52*M1	Initial FW	1	490.12	758.74
2929.94*M1	Initial FW	1	493.94	770.23
2907.35*M1	Initial FW	1	497.75	781.73
2884.765M1	Initial FW	1	501.57	793.23
2726.695M1	Initial FW	1	472.66	747.87
2472.072M1	Initial FW	1	501.55	752.46
2199.47 M1	Initial FW	1	450	750
2003.557M1	Initial FW	1	386	690
1803.297M1	Initial FW	1	300	660
1603.511M1	Initial FW	1	275.17	392.43
1578.86*M1	Initial FW	1	267.67	395.85
1554.19*M1	Initial FW	1	260.16	399.28
1529.52*M1	Initial FW	1	252.65	402.7
1504.85*M1	Initial FW	1	245.15	406.12
1480.18*M1	Initial FW	1	237.65	409.55
1455.508M1	Initial FW	1	230.14	412.97
1371.753M1	Initial FW	1	261.09	453.42
1042.362M1	Initial FW	1	223.79	399.13
928.171 M1	Initial FW	1	227.22	408.14
775.679 M1	Initial FW	1	234.75	471.42
679.381 M1	Initial FW	1	154.45	430.17
381.168 M1	Initial FW	1	36.16	255.13
249.718 M1	Initial FW	1	13.3	148.13

River = LV_WASH Reach = R1 - 3 KIDS_INTA

RS	Profile	Method	Value1	Value2
3534.52	Initial FW	4	1	
3428.19	Initial FW	4	1	
3303.9	Initial FW	4	1	
3110.51	Initial FW	4	1	
2933.22	Initial FW	4	1	
2831.75	Initial FW	4	1	
2719.51	Initial FW	4	1	
2597.65	Initial FW	4	1	
2566.48	Initial FW	4	1	
2308.22	Initial FW	4	1	
2200.51	Initial FW	4	1	
2126.13	Initial FW	4	1	
2054.87	Initial FW	4	1	
1985.39	Initial FW	4	1	
1776.89	Initial FW	4	1	
1768.69	Initial FW	4	1	
1721.72	Initial FW	4	1	
1643.22	Initial FW	4	1	
1579.28	Initial FW	4	1	
1489.16	Initial FW	4	1	
1393.95	Initial FW	4	.8	
1217.48	Initial FW	4	.8	
1082.41	Initial FW	4	.8	
997.53	Initial FW	4	.8	
856.62	Initial FW	4	.8	
695.28	Initial FW	1	892.97	1085.63
659.78	Initial FW	1	910.18	1080
603.12	Initial FW	1	910	1129
405.15	Initial FW	1	920	1122
182.42	Initial FW	1	710	1165
14.48	Initial FW	4	1	

River = LV_WASH Reach = R2 - DEMO_3KIDS

RS	Profile	Method	Value1	Value2
5023.61	Initial FW	4	1	
4975.95	Initial FW	4	1	
4848.28	Initial FW	4	1	
4669.4	Initial FW	4	1	
4463.48	Initial FW	4	1	
4318.02	Initial FW	4	1	
4092.23	Initial FW	4	1	
3934.49	Initial FW	4	1	
3775.67	Initial FW	4	1	

River = LV_WASH Reach = R3 - TEMP_DEMO

RS	Profile	Method	Value1	Value2
9687.58	Initial FW	4	1	
9501.16	Initial FW	4	1	
9311.87	Initial FW	4	1	
9149.04	Initial FW	4	1	
9007.92	Initial FW	4	1	

8823.15	Initial FW	4	1	
8615.8	Initial FW	4	1	
8458.89	Initial FW	4	1	
8296.77	Initial FW	4	1	
8089.02	Initial FW	4	1	
7966.87	Initial FW	4	1	
7828.58	Initial FW	4	1	
7654.78	Initial FW	4	1	
7399.01	Initial FW	4	1	
7290.02	Initial FW	4	1	
7158.49	Initial FW	4	1	
7018.82	Initial FW	4	1	
6861.99	Initial FW	4	1	
6681.24	Initial FW	4	1	
6490.7	Initial FW	4	1	
6269.3	Initial FW	4	1	
6039.66	Initial FW	4	1	
5857.47	Initial FW	4	1	
5685.38	Initial FW	4	1	
5528.36	Initial FW	4	1	
5388.96	Initial FW	4	1	
5192.97	Initial FW	4	1	

River = LV_WASH Reach = R4 - C1_TEMP

RS	Profile	Method	Value1	Value2
13668.66	Initial FW	4	1	
13351.49	Initial FW	4	1	
13081.45	Initial FW	4	1	
12954.93	Initial FW	4	1	
12759.65	Initial FW	4	1	
12590.7	Initial FW	4	1	
12448.88	Initial FW	4	1	
12357.87	Initial FW	4	1	
12315.19	Initial FW	4	1	
11929.49	Initial FW	4	1	
11860.97	Initial FW	4	1	
11756.77	Initial FW	4	1	
11563.85	Initial FW	4	1	
11410.95	Initial FW	4	1	
11303.6	Initial FW	4	1	
11175.42	Initial FW	4	1	
10982.76	Initial FW	4	1	
10782.21	Initial FW	4	1	
10598.94	Initial FW	4	1	
10517.5	Initial FW	4	1	
10354.51	Initial FW	4	1	
10200.66	Initial FW	4	1	
9856.77	Initial FW	4	1	

River = LV_WASH Reach = R5 - CDH_C1

RS	Profile	Method	Value1	Value2
18277.82	Initial FW	4	1	
18144.07	Initial FW	4	1	
17959.9	Initial FW	1	490	1290
17761.68	Initial FW	1	700	1319
17576.76	Initial FW	1	950	1405.7
17397	Initial FW	4	1	
17185.45	Initial FW	4	1	
16989.85	Initial FW	4	.8	
16788.79	Initial FW	4	.8	
16686.94	Initial FW	4	.8	
16539.37	Initial FW	4	.8	
16275.81	Initial FW	4	.8	
16127.61	Initial FW	4	.8	
15932.32	Initial FW	4	.8	
15734.55	Initial FW	4	.8	
15566.37	Initial FW	4	.8	
15339.77	Initial FW	4	.8	
15119.36	Initial FW	4	.8	
14913.53	Initial FW	4	.8	
14737.95	Initial FW	4	.8	
14547.73	Initial FW	4	.8	
14333.93	Initial FW	4	.8	
14236.79	Initial FW	4	.8	
14078.75	Initial FW	4	.8	
13924.58	Initial FW	4	.8	

River = LV_WASH Reach = R6 - DUCK CR_COH

RS	Profile	Method	Value1	Value2
23625.36	Initial FW	4	1.2	
23570.78	Initial FW	4	1.2	
23522.44	Initial FW	4	1.2	
23322.87	Initial FW	4	1.2	
23128.2	Initial FW	4	1.2	
22925.04	Initial FW	4	1.2	
22730.9	Initial FW	4	1.2	
22528.57	Initial FW	4	1.2	
22328.45	Initial FW	4	1.2	
22126.97	Initial FW	4	1.2	
21933.79	Initial FW	4	1.2	
21692.16	Initial FW	4	1.2	
21537.49	Initial FW	4	1.2	
21450.46	Initial FW	4	1.2	
21339.83	Initial FW	1	650	1250
21140.82	Initial FW	4	1.2	
20941.54	Initial FW	4	1.2	
20740.67	Initial FW	4	1.2	
20539.76	Initial FW	4	1.2	
20393.63	Initial FW	4	.8	
20142.43	Initial FW	4	.8	
20059.61	Initial FW	4	.8	
19945.85	Initial FW	4	.8	
19745.02	Initial FW	4	.8	
19547.49	Initial FW	4	.8	
19348.05	Initial FW	1	698.25	1132
19144.12	Initial FW	1	647.88	1216
18948.38	Initial FW	1	610.92	1242
18739.71	Initial FW	1	647.72	1319
18534.64	Initial FW	1	569.2	1350

River = LV_WASH Reach = R7 - DC1_DUC

RS	Profile	Method	Value1	Value2
26821.78	Initial FW	1	756.73	857.28
26714.15	Initial FW	1	731.01	832.21
26501.13	Initial FW	1	636.45	769.42
26314.53	Initial FW	1	673.73	798.42
26118.49	Initial FW	1	580.39	666.68
25915.07	Initial FW	1	314.98	497.87
25715.56	Initial FW	1	240.26	448.24
25514.32	Initial FW	1	209.75	421.76
25318.39	Initial FW	1	187.04	354.83
25114.49	Initial FW	1	174.44	326.4
24919.76	Initial FW	1	250.01	412.09
24716.26	Initial FW	1	292.68	513.29
24526.44	Initial FW	1	299.27	530.67
24344.71	Initial FW	1	276.45	580.38
24150.09	Initial FW	1	310.69	690.37
23917.65	Initial FW	1	332.02	618.18
23775.21	Initial FW	1	406.14	710.85

River = LV_WASH Reach = R8 - TROP_SPD2

RS	Profile		Method	Value1	Value2
30602.29	Initial	FW	4	.8	
30435.56	Initial	FW	5	1	1.2
30233.32	Initial	FW	5	1	1.2
30013.99	Initial	FW	1	317.53	773.51
29823.15	Initial	FW	1	301.92	861.92
29775.7*	Initial	FW	1	292.16	902.16
29728.2*	Initial	FW	1	282.41	942.41
29680.8*	Initial	FW	1	272.65	982.65
29633.31	Initial	FW	1	262.89	1022.89
29433.92	Initial	FW	1	278.71	1088.71
29383.9*	Initial	FW	4	1	
29334.0*	Initial	FW	4	1	
29284.0*	Initial	FW	4	1	
29234	Initial	FW	4	1	
28982.39	Initial	FW	4	1	
28834.67	Initial	FW	5	1	1.2
28637.81	Initial	FW	1	550.05	1400.05
28460.25	Initial	FW	5	1	1.2
28308.1	Initial	FW	5	1	1.2
28108.01	Initial	FW	1	633.18	1533.18
27937.48	Initial	FW	5	.8	1.2
27908.4*	Initial	FW	5	1	1.2
27879.2*	Initial	FW	5	1	1.2
27850.12	Initial	FW	4	.8	
27709.27	Initial	FW	4	.8	
27446.45	Initial	FW	4	.8	
27310.54	Initial	FW	4	.8	
27111.62	Initial	FW	4	.8	
26912.03	Initial	FW	1	688.37	1700

River = LV_WASH Reach = R9A - NC_TROP

RS	Profile		Method	Value1	Value2
31228.3	Initial	FW	5	1	1.2
31159.34	Initial	FW	5	.8	1.2
31030.94	Initial	FW	5	1	1.2
30926.89	Initial	FW	5	1	1.2
30810.52	Initial	FW	5	1	1.2

River = LV_WASH Reach = R9 - MONSON_NC

RS	Profile		Method	Value1	Value2
33275.67	Initial	FW	1	0	236.67
33195.64	Initial	FW	1	0	280.13
33094.13	Initial	FW	1	0	303.09
33009.88	Initial	FW	1	0	375
32964.35	Initial	FW	4	1	
32919.46	Initial	FW	4	1	
32875.06	Initial	FW	4	1	
32855.09	Initial	FW	4	1	
32817.83	Initial	FW	4	1	
32793.84	Initial	FW	4	1	
32757.55	Initial	FW	4	1	
32716.08	Initial	FW	1	242.39	377.39
32672.38	Initial	FW	4	1	
32611.32	Initial	FW	4	1	
32525.66	Initial	FW	4	1	
32404.94	Initial	FW	4	1	
32304.15	Initial	FW	4	1	
32248.15	Initial	FW	4	1	
32185.7	Initial	FW	4	1	
32106.45	Initial	FW	4	1	
32034.21	Initial	FW	4	1	
31975.27	Initial	FW	4	1	
31950.55	Initial	FW	4	1	
31917.66	Initial	FW	4	.8	
31878.6	Initial	FW	4	.8	
31833.89	Initial	FW	4	.8	
31791.99	Initial	FW	4	.8	
31756.5	Initial	FW	4	.8	
31721.6	Initial	FW	5	1	
31601.68	Initial	FW	5	.8	1.2
31534.8	Initial	FW	5	1	1.2
31477.87	Initial	FW	5	1	1.2

River = LV_WASH Reach = R10 - SPL N CHAN

RS	Profile		Method	Value1	Value2
33549.55	Initial	FW	4	1	
33525.57	Initial	FW	4	1	
33495.21	Initial	FW	4	1	
33430.81	Initial	FW	4	1	
33385.83	Initial	FW	4	1	

River = LV_WASH Reach = R11 - CC_SPLT UP

RS	Profile		Method	Value1	Value2
34542.08	Initial	FW	4	.8	
34419.98	Initial	FW	4	1	
34343.43	Initial	FW	4	1	
34289.28	Initial	FW	4	1	
34192.21	Initial	FW	4	1	
34072.36	Initial	FW	4	1	
33971.78	Initial	FW	4	.8	
33876.1	Initial	FW	1	738.65	1650
33799.72	Initial	FW	1	727.69	1620

River = LV_WASH Reach = R12 - CLV_CC

RS	Profile		Method	Value1	Value2
39288.89	Initial	FW	1	2174.5	2411.81
39090.89	Initial	FW	1	2228.25	2459.64
38887.89	Initial	FW	1	2373.76	2613.03
38666.89	Initial	FW	1	2450.15	2735
38511.89	Initial	FW	1	2442.86	2769.46
38304.89	Initial	FW	1	2549.81	2949.81
38101.89	Initial	FW	1	2547.56	3038
37905.89	Initial	FW	1	2483.49	2985.28
37705.89	Initial	FW	1	2537.09	3355
37218.09	Initial	FW	4	1.2	
37123.55	Initial	FW	4	.8	
36919.21	Initial	FW	1	155.72	904.02
36716.41	Initial	FW	4	.8	
36517.68	Initial	FW	4	.8	
36401.45	Initial	FW	4	.8	
36362.53	Initial	FW	4	.8	
36333.25	Initial	FW	4	.8	
36220.66	Initial	FW	4	.8	
36102.7	Initial	FW	4	.8	
35922.39	Initial	FW	4	.8	
35814.29	Initial	FW	4	.8	
35693.31	Initial	FW	4	.8	
35657.57	Initial	FW	4	.8	
35621.86	Initial	FW	4	.8	
35539.57	Initial	FW	4	.8	
35434.41	Initial	FW	4	.8	
35337.22	Initial	FW	4	.8	
35157.56	Initial	FW	4	.8	
35074.46	Initial	FW	4	.8	
34972.61	Initial	FW	4	.8	
34825.85	Initial	FW	4	.8	

34709.3	Initial FW	4	.8	
34622.3	Initial FW	4	.8	

River = East Diversion Reach = EDC

RS	Profile	Method	Value1	Value2
3930.044	Initial FW	1	184.2	329.08
3864.537	Initial FW	1	177.3	321
3810.933	Initial FW	1	165.85	308.49
3759.115	Initial FW	1	159.86	325.2
3716.035	Initial FW	1	153.35	325.16
3669.197	Initial FW	1	153.73	325.64
3610.243	Initial FW	1	158.45	319.14
3561.266	Initial FW	1	144.72	293.04
3513.843	Initial FW	1	145.44	281.31
3460.766	Initial FW	1	134.91	258.12
3437.253	Initial FW	1	134.99	249.38
3412.005	Initial FW	1	105.12	233
3387.721	Initial FW	1	96.51	226.75
3367.59	Initial FW	1	110.26	223.73
3343.343	Initial FW	1	100.13	226.48
3320.757	Initial FW	1	95.46	234.72
3297.57	Initial FW	1	145.35	294.94
3269.591	Initial FW	1	120.49	269.66
3250.57	Initial FW	1	100.6	245.6
3242.57	Initial FW	1	101.37	243.96
3232.57	Initial FW	1	101.87	239.96
3194.512	Initial FW	1	101.02	241.33
3159.512	Initial FW	1	98.4	240.08
3124.512	Initial FW	1	103.67	238.83
3089.512	Initial FW	1	110.59	232.75
3049.47	Initial FW	1	110.66	234.66
3009.47	Initial FW	1	103.037	239
2986.084	Initial FW	1	90.37	227
2925.153	Initial FW	1	86.505	220
2875.114	Initial FW	1	94.49	217.92
2824.573	Initial FW	1	91.75	216.86
2774.614	Initial FW	1	93.49	216.65
2750.339	Initial FW	1	104.59	217.07
2725.274	Initial FW	1	81.997	214.85
2700.734	Initial FW	1	86.95	220.96
2675.1	Initial FW	1	97.06	229.2
2651.255	Initial FW	1	84.22	233.81
2628.254	Initial FW	1	74.79	240.4
2605.2	Initial FW	1	73.18	246.47
2579.751	Initial FW	1	70.13	246.37
2558.2	Initial FW	1	73.62	230.87
2550.2	Initial FW	1	81.79	235.24
2540.2	Initial FW	1	82.72	234.22
2502.155	Initial FW	1	84.09	234.57
2467.153	Initial FW	1	89.35	230.19
2432.151	Initial FW	1	91.07	223.36
2397.149	Initial FW	1	90.03	220.45
2357.1	Initial FW	1	97.69	215.49
2317.1	Initial FW	1	111.84	221.71
2290.432	Initial FW	1	107.57	223.21
2230.433	Initial FW	1	99.58	213.59
2180.434	Initial FW	1	83.84	208.1
2130.434	Initial FW	1	109.46	224.77
2080.12	Initial FW	1	129.58	242.87
2055.436	Initial FW	1	142.24	246.29
2030.436	Initial FW	1	130.61	250.49
2005.447	Initial FW	1	129.16	247.46
1980.38	Initial FW	1	138.42	251.26
1957.376	Initial FW	1	129.6	251.11
1934.376	Initial FW	1	120.11	262.1
1911.31	Initial FW	1	118.67	271.78
1885.876	Initial FW	1	122.72	270.26
1864.32	Initial FW	1	119	272
1856.32	Initial FW	1	122.47	271.31
1846.32	Initial FW	1	122.83	271.82
1808.276	Initial FW	1	139.99	270.61
1773.276	Initial FW	1	136.74	265.72
1738.276	Initial FW	1	130.61	258.66
1703.276	Initial FW	1	136.18	260.35
1663.22	Initial FW	1	130.47	256.42
1623.218	Initial FW	1	137.18	260.99
1525.574	Initial FW	1	118.94	248.2
1459.599	Initial FW	1	157.36	264.55
1377.256	Initial FW	1	191.76	300.21
1296.102	Initial FW	1	73.14	191.74
1222.567	Initial FW	1	88.92	193.31
1217.996	Initial FW	1	89.28	194.58
1190.397	Initial FW	1	86.36	188.33
1164.25	Initial FW	1	82.72	194.96
1131.985	Initial FW	1	70.74	188.52
1103.268	Initial FW	1	61.33	192.41
1073.269	Initial FW	1	55.7	184.09
1056.468	Initial FW	1	49.63	
1040.31	Initial FW	1	55.19	

River = LV_WASH ROB Reach = NC

RS	Profile	Method	Value1	Value2
2364.527	Initial FW	1	60.09	526.12
2285.451	Initial FW	1	70	532.84
2193.135	Initial FW	1	106.8	537.73
2075.334	Initial FW	4	.8	
1970.103	Initial FW	4	.8	
1878.819	Initial FW	4	.8	
1795.203	Initial FW	4	.8	
1641.251	Initial FW	4	.8	
1536.009	Initial FW	4	1	
1473.509	Initial FW	4	1	
1428.394	Initial FW	4	1	
1382.131	Initial FW	4	1	
1333.692	Initial FW	4	1	
1213.437	Initial FW	1	100	445.95
1086.026	Initial FW	1	155.26	475.3
972.757	Initial FW	1	142.14	442.14
845.568	Initial FW	4	1.2	
744.470	Initial FW	4	1.2	
671.416	Initial FW	4	1.2	
592.936	Initial FW	4	1.2	
499.129	Initial FW	4	1.2	

River = split_duck Reach = split_duck

RS	Profile	Method	Value1	Value2
3349.45	Initial FW	1	300	725
2997.7	Initial FW	1	482.49	790.5
2975.11*	Initial FW	4	.8	
2952.52*	Initial FW	4	.8	
2929.94*	Initial FW	4	.8	
2907.35*	Initial FW	4	.8	
2884.765	Initial FW	4	.8	
2726.695	Initial FW	4	.8	
2472.072	Initial FW	4	.8	
2199.47	Initial FW	1	450	750
2003.557	Initial FW	1	386	690
1803.297	Initial FW	1	300	660
1603.511	Initial FW	4	1	

```
1578.86*Initial FW            4       1
1554.19*Initial FW            4       1
1529.52*Initial FW            4       1
1504.85*Initial FW            4       1
1480.18*Initial FW            4       1
1455.508Initial FW            4       1
1371.753Initial FW            5       1     1.2
1042.362Initial FW            5       1     1.2
928.171 Initial FW            5       1     1.2
775.679 Initial FW            4     1.2
679.381 Initial FW            4     1.2
381.168 Initial FW            4     1.2
249.718 Initial FW            4     1.2
```

FLOW DATA

Flow Title: Effective
Flow File : x:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.f10

Flow Data (cfs)

River	Reach	RS	100 YR	Final FW	M1 Initial FW	Initial FW
LV_WASH	R1 - 3 KIDS_INTA	405.15	22530	22530	22530	22530

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
LV_WASH	R1 - 3 KIDS_INTA	100 YR		Known WS = 1431.4
LV_WASH	R1 - 3 KIDS_INTA	Final FW		Known WS = 1432.4
LV_WASH	R1 - 3 KIDS_INTA	M1 Initial FW		Known WS = 1432.4
LV_WASH	R1 - 3 KIDS_INTA	Initial FW		Known WS = 1432.4

GEOMETRY DATA

Geometry Title: Effective
Geometry File : x:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.g13

CROSS SECTION

RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA RS: 405.15

INPUT
Description:
Station Elevation Data num= 335

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1460.08	.39	1460	2.94	1459.28	3.95	1459	7.65	1458.24
8.62	1458	9.79	1457.77	14.16	1457	15.38	1456.73	19.31	1456
20.57	1455.74	26.16	1454.63	29.55	1454	31.14	1453.62	35.7	1452.41
37.13	1452	39.79	1451.12	40.3	1451	41.33	1450.39	41.83	1450
42.97	1449.42	43.72	1449	44.82	1448.38	45.54	1448	47.42	1447.27
48.04	1447	49.38	1446.54	50.74	1446	52.92	1445.28	53.9	1445
54.64	1444.61	55.67	1444	56.53	1443.51	57.39	1443	58.92	1442.18
59.21	1442	59.55	1441.81	60	1441.58	60.95	1441	61.3	1440.8
62.66	1440	63.34	1439.61	64.42	1439	65.41	1438.47	66.27	1438
67.4	1437.4	68.15	1437	69.23	1436.43	69.9	1436	70.67	1435.56
71.6	1435	73.03	1434.2	73.38	1434	74.02	1433.64	75.05	1433
76.03	1432.38	76.65	1432	78.26	1431	79.95	1430.06	80.05	1430
81.31	1429.23	81.69	1429	108.09	1429	109.59	1429.22	109.99	1429.24
110.41	1429.24	121.83	1429.87	125.21	1429.78	127.03	1429.74	133.24	1429.59
135.75	1429.51	146.11	1429	192.98	1429	196.12	1428.35	198.18	1428
200.57	1427.39	201.86	1427	202.53	1426.79	205.03	1426	205.57	1425.82
208.01	1425	209.46	1424.51	210.94	1424	212.74	1423.32	213.65	1423
214.23	1422.84	215.56	1422.48	217.29	1422	221.44	1421	225.63	1420
227.57	1419.54	229.73	1419	230.44	1418.84	233.98	1418	238.28	1417.37
240.42	1417	241.62	1416.79	252.08	1415	267.96	1414	320.14	1414
323.65	1414.09	323.8	1414.09	352.16	1415	379.32	1415	383.36	1414.83
385.03	1414.79	387.34	1414.72	394.59	1414.48	407.62	1414	415.09	1413.56
424.93	1413	440.85	1412	449.15	1412	464.38	1412	465.51	1412.1
475.7	1413	477.89	1413.27	480.14	1413.57	483.06	1414	488.09	1414.73
490.19	1415	493.76	1415.48	502.08	1416.33	505.93	1416.66	507.58	1416.79
508.43	1416.83	511.91	1417	514.01	1417	515.48	1416.81	520.14	1416
520.89	1415.85	522.87	1415.54	525.86	1415	528.88	1414.6	532.39	1414.16
534.02	1414	539	1413.35	541.36	1413	546.74	1412.63	555.11	1412.01
555.19	1412	559.41	1412	681.59	1412	689.16	1412.73	691.79	1413
695.74	1413.36	701.49	1413.92	702.3	1414	710.16	1414.82	711.34	1415
713.53	1415.08	720.71	1415.26	736.43	1415.7	741.42	1415.82	750.52	1416
761.16	1416.74	765.27	1417	769.37	1417.61	772.11	1418	772.85	1418.12
775.95	1418.64	778.13	1419	783.41	1419.96	783.65	1420	783.84	1420.04
786.61	1420.62	788.31	1421	791.78	1421.77	792.85	1422	793.46	1422.13
794.22	1422.31	796.66	1423	799.38	1423.78	799.86	1423.92	800.13	1424
816.29	1424.48	831.53	1424.97	832.58	1425	833.48	1425.08	843.01	1426
843.2	1426.02	853.73	1427	860.33	1427.47	864.39	1427.81	866.3	1428
867.15	1428.1	870.38	1428.4	873.01	1428.65	876.71	1429	882.53	1429.74
884.31	1430	889.23	1430.68	891.41	1431	892.04	1431.09	892.22	1431.12
895.45	1431.46	896.97	1431.54	897.99	1431.65	901.36	1431.79	903.88	1432
905.37	1432	907.37	1431.32	908.64	1431	909.25	1430.8	909.59	1430.79
911.82	1430	913.05	1429.37	913.82	1429	915.56	1428.18	915.89	1428
916.22	1427.83	917.87	1427	920.53	1426	920.8	1425.91	923.09	1425
925.18	1424.16	925.58	1424	926.02	1423.82	928.05	1423	929.13	1422.62
930.92	1422	933.95	1421.21	934.73	1421	938.39	1420.01	938.49	1419.98
941.9	1419	943.93	1418.45	945.25	1418	947.36	1417.26	948.17	1417
949.33	1416.62	951.04	1416	953.3	1415.21	953.85	1415	956.31	1414.2
956.77	1414	957.94	1413.95	965.76	1413.55	973.53	1413.18	974.95	1413.11
976.83	1413	1015.73	1413	1029.29	1413	1032.08	1412.25	1033.88	1411.81
1037.05	1411	1038.91	1410.62	1065.38	1411	1074.59	1411	1076.36	1411
1077.12	1411.39	1078.37	1412	1079.52	1412.54	1080.44	1413	1081.99	1413.41
1084.18	1414	1085.18	1414.24	1088.13	1415	1089.87	1415.57	1091.13	1416
1092.74	1416.85	1093.02	1417	1093.47	1417.25	1094.94	1418	1096.65	1418.99
1099.11	1420	1100.26	1420.48	1101.7	1421	1103.84	1421.94	1103.96	1421.99
1104.82	1422.8	1105.05	1423	1105.7	1423.13	1109.11	1424	1123.26	1424.88
1125.01	1425	1126.77	1425.1	1140.86	1426	1161.11	1427	1176.97	1428
1195.09	1428.98	1195.39	1429	1196.08	1429.03	1217.73	1430	1235.48	1431
1241.68	1431.49	1248.83	1432	1251.11	1432.27	1257.35	1432.88	1258.15	1432.96
1258.59	1433	1265.62	1433.93	1266.2	1434	1272.29	1434.77	1274.07	1435
1277.16	1435	1278.32	1435.21	1278.51	1435.24	1283.23	1436	1286.28	1436
1289.58	1436.34	1295.67	1437	1297.5	1437.18	1305.35	1438	1312.13	1438.69
1315.52	1439	1328.13	1440.2	1333.49	1441	1336.3	1441	1341.06	1441.78
1341.78	1441.91	1342.13	1441.96	1347.36	1441.96	1347.59	1442	1352.91	1442
1353.15	1442.03	1355.11	1442.45	1357.37	1443	1357.63	1443.07	1361.27	1444
1362.7	1444.34	1365.76	1445	1366.46	1445.14	1369.19	1445.66	1370.53	1445.92
1370.98	1446	1374.43	1446.87	1377.22	1447.58	1381.72	1448.77	1382.62	1449
1385.23	1449.69	1386.41	1450	1388.63	1450.19	1393.3	1451	1428.51	1451

Manning's n Values num= 9

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	215.56	.13	449.15	.035	465.51	.13	559.41	.035
701.49	.13	873.01	.06	920.53	.045	1109.11	.06		

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

```
        920.53 1109.11          228.48  222.73  224.83            .1        .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  904.66 1456.29       F
```

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	1431.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.72	Wt. n-Val.	0.060	0.045	0.060
W.S. Elev (ft)	1431.16	Reach Len. (ft)	228.48	222.73	224.83
Crit W.S. (ft)	1421.92	Flow Area (sq ft)	30.55	3113.81	446.65
E.G. Slope (ft/ft)	0.001092	Area (sq ft)	10597.90	3113.81	446.65
Q Total (cfs)	22530.00	Flow (cfs)	42.86	21648.96	838.18
Top Width (ft)	1144.20	Top Width (ft)	827.18	188.58	128.44
Vel Total (ft/s)	6.27	Avg. Vel. (ft/s)	1.40	6.95	1.88
Max Chl Dpth (ft)	20.54	Hydr. Depth (ft)	2.44	16.51	3.48
Conv. Total (cfs)	681734.1	Conv. (cfs)	1296.8	655074.8	25362.5
Length Wtd. (ft)	222.79	Wetted Per. (ft)	13.61	193.63	128.64
Min Ch El (ft)	1410.62	Shear (lb/sq ft)	0.15	1.10	0.24
Alpha	1.18	Stream Power (lb/ft s)	1428.51	0.00	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	89.47	49.59	2.92
C & E Loss (ft)	0.16	Cum SA (acres)	7.05	3.07	1.01

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
         This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Final FW

E.G. Elev (ft)	1432.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.060	0.045	0.060
W.S. Elev (ft)	1432.14	Reach Len. (ft)	228.48	222.73	224.83
Crit W.S. (ft)	1421.93	Flow Area (sq ft)	3.20	3297.74	99.74
E.G. Slope (ft/ft)	0.000958	Area (sq ft)	3.20	3297.74	99.74
Q Total (cfs)	22530.00	Flow (cfs)	1.53	22307.18	221.29
Top Width (ft)	202.00	Top Width (ft)	0.53	188.58	12.89
Vel Total (ft/s)	6.63	Avg. Vel. (ft/s)	0.48	6.76	2.22
Max Chl Dpth (ft)	21.52	Hydr. Depth (ft)	6.04	17.49	7.74
Conv. Total (cfs)	728027.4	Conv. (cfs)	49.4	720827.4	7150.6
Length Wtd. (ft)	222.75	Wetted Per. (ft)	6.51	193.63	20.25
Min Ch El (ft)	1410.62	Shear (lb/sq ft)	0.03	1.02	0.29
Alpha	1.03	Stream Power (lb/ft s)	1428.51	0.00	0.00
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.12	52.64	1.31
C & E Loss (ft)	0.16	Cum SA (acres)	0.09	3.07	0.27

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
         This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #M1 Initial FW

E.G. Elev (ft)	1432.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.060	0.045	0.060
W.S. Elev (ft)	1432.14	Reach Len. (ft)	228.48	222.73	224.83
Crit W.S. (ft)	1421.93	Flow Area (sq ft)	3.20	3297.74	99.74
E.G. Slope (ft/ft)	0.000958	Area (sq ft)	3.20	3297.74	99.74
Q Total (cfs)	22530.00	Flow (cfs)	1.53	22307.18	221.29
Top Width (ft)	202.00	Top Width (ft)	0.53	188.58	12.89
Vel Total (ft/s)	6.63	Avg. Vel. (ft/s)	0.48	6.76	2.22
Max Chl Dpth (ft)	21.52	Hydr. Depth (ft)	6.04	17.49	7.74
Conv. Total (cfs)	728027.4	Conv. (cfs)	49.4	720827.4	7150.6
Length Wtd. (ft)	222.75	Wetted Per. (ft)	6.51	193.63	20.25
Min Ch El (ft)	1410.62	Shear (lb/sq ft)	0.03	1.02	0.29
Alpha	1.03	Stream Power (lb/ft s)	1428.51	0.00	0.00
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.12	52.64	1.31
C & E Loss (ft)	0.16	Cum SA (acres)	0.09	3.07	0.27

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
         This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Initial FW

E.G. Elev (ft)	1432.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.060	0.045	0.060
W.S. Elev (ft)	1432.14	Reach Len. (ft)	228.48	222.73	224.83
Crit W.S. (ft)	1421.93	Flow Area (sq ft)	3.20	3297.74	99.74
E.G. Slope (ft/ft)	0.000958	Area (sq ft)	3.20	3297.74	99.74
Q Total (cfs)	22530.00	Flow (cfs)	1.53	22307.18	221.29
Top Width (ft)	202.00	Top Width (ft)	0.53	188.58	12.89
Vel Total (ft/s)	6.63	Avg. Vel. (ft/s)	0.48	6.76	2.22
Max Chl Dpth (ft)	21.52	Hydr. Depth (ft)	6.04	17.49	7.74
Conv. Total (cfs)	728027.4	Conv. (cfs)	49.4	720827.4	7150.6
Length Wtd. (ft)	222.75	Wetted Per. (ft)	6.51	193.63	20.25
Min Ch El (ft)	1410.62	Shear (lb/sq ft)	0.03	1.02	0.29
Alpha	1.03	Stream Power (lb/ft s)	1428.51	0.00	0.00
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.12	52.64	1.31
C & E Loss (ft)	0.16	Cum SA (acres)	0.09	3.07	0.27

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
         This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA   RS: 182.42

INPUT
Description:
Station Elevation Data   num=   422

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1448	3.96	1448	4.11	1447.83	4.55	1447.31	4.82	1447
5.24	1446.52	5.68	1446	5.91	1445.72	6.49	1445	7.32	1444.09
7.4	1444	7.6	1443.76	8.17	1443.11	8.26	1443	8.71	1442.82
10.84	1442	13.98	1441.05	14.1	1441.01	14.16	1441	14.29	1440.97
18.54	1440	21.11	1439.35	22.41	1439	26.18	1438.12	26.67	1438
31.96	1437.34	34.54	1437	41.06	1436.28	42.35	1436.12	43.26	1436
45.96	1435.59	48.6	1435	51.45	1434.34	52.95	1434	56.01	1433.29
57.29	1433	59.73	1432.44	60.92	1432.17	62.28	1432	67.65	1431.37
70.7	1431	71.92	1430.97	72.76	1430.9	78.48	1430.58	84.5	1430
88.23	1429.62	92.44	1429	98.03	1428.2	99.7	1428	115.91	1427
118.8	1426.07	119.05	1426	120.48	1425.55	121.83	1425.14	122.23	1425
122.95	1424.72	124.84	1424	127.1	1423.04	127.19	1423	127.32	1422.94
129.73	1422	131.21	1421.53	132.8	1421	134.21	1420.61	135.23	1420.31
136.3	1420	138.3	1419.41	139.79	1419	143.19	1418	143.83	1417.93
155.84	1417	192.55	1416.35	210.68	1416	215.96	1416	219.19	1415.68
223.16	1415.34	227.17	1415.05	227.48	1415.03	227.62	1415.02	227.93	1415
239.06	1414.17	239.98	1414.14	249.7	1414	250	1414	257.27	1414.31

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   259 1414.37   262.6 1414.56  270.53    1415  270.99 1415.02  272.68 1415.03
273.55    1415  278.06 1414.85  281.86 1414.84  288.39 1414.87  296.14    1415
296.57 1415.01  296.84 1415.03  305.52  1415.4  308.41 1415.61   316.1    1416
   330    1416   331.3 1415.82  339.64    1415  347.91    1415  355.09 1414.39
356.05 1414.27  359.73    1414  379.95    1414  405.58  1413.2  411.71 1413.19
413.46 1413.18  414.63 1413.18  441.06 1413.11  441.74  1413.1  448.12 1413.13
448.55 1413.14  456.49 1413.13  458.52 1413.15  472.49 1413.22  473.34 1413.22
481.79 1413.25  483.51 1413.26  497.25 1413.24  500.94 1413.27  503.31  1413.3
511.76  1413.3  516.43 1413.35  521.11 1413.37   531.7 1413.47  546.55 1413.67
554.29 1413.81   565.1 1413.97   566.8    1414  572.66 1414.29  576.73 1414.44
594.63    1415  594.88 1415.01   595.2 1415.03  595.46 1415.04  608.72 1415.57
614.22 1415.91  616.07    1416  624.08 1416.41  628.18 1416.69  632.54    1417
634.97 1417.38  637.54 1417.79  638.84    1418  640.43 1418.41  642.95 1419.04
643.17 1419.09  645.37 1419.62  646.98    1420  647.85 1420.22  648.25 1420.32
650.96    1421  651.17 1421.05   651.4  1421.1  653.34 1421.57  655.19    1422
655.55 1422.08  659.65    1423  660.33 1423.15  664.26    1424  665.88 1424.12
673.15    1425   675.4 1425.15  676.53 1425.21  677.92  1425.3  681.14 1425.47
685.66 1425.75  689.88 1425.97  690.08 1425.98  690.34    1426  691.08 1426.33
692.61    1427  693.12 1427.23  694.76    1428  695.48 1428.47  696.28    1429
696.86 1429.37  697.05 1429.49  697.87    1430  698.41 1430.35  699.52    1431
700.86 1431.43  704.28 1431.62  705.96 1431.84  708.01 1431.91  711.49 1431.96
711.99 1431.91  713.08 1431.89  714.07 1431.87  715.17 1431.73  717.15 1431.55
720.83    1431   721.5 1430.73  722.59    1430  723.04 1429.73  724.29    1429
724.62 1428.71  725.42    1428  726.49 1427.19  726.73    1427  727.27 1426.48
727.75    1426   727.9 1425.91  729.44    1425  732.76 1424.05  732.89 1424.02
732.95    1424  736.59 1423.03  736.81 1422.97  740.18    1422  743.49 1421.06
743.71    1421  744.12 1420.89  747.41    1420  749.92 1419.36  751.27    1419
753.73 1418.37  755.05    1418  756.67 1417.68   759.9    1417  762.36 1416.71
768.79    1416  776.52 1415.36   780.2    1415  781.25    1415  798.83 1414.42
816.09    1414  817.45    1414  820.55 1413.34  822.38    1413  823.28 1412.79
 823.7 1412.71  827.23    1412   856.3    1412  856.63 1412.05  857.38 1412.16
863.15    1413  866.78 1413.72  868.57    1414  872.46 1414.91  872.82    1415
873.53 1415.17  877.35    1416  881.01    1416  893.02 1416.61  894.54 1416.58
896.51 1416.59  898.54 1416.59  902.35 1416.53  903.99 1416.55  905.74 1416.56
 908.3 1416.59  910.46 1416.64  926.23  1416.9  926.71 1416.92  928.86    1417
934.93 1417.38  936.97 1417.32  979.13    1417  983.02    1417  989.95 1416.55
997.94    1416  998.91 1415.57 1000.62    1415  1001.2 1414.74 1002.51 1414.29
1003.37   1414  1005.2 1413.35 1006.81    1413 1009.33 1412.27 1010.46 1412.05
1010.69   1412 1013.61 1411.15 1014.49    1411 1017.83 1410.25 1018.92    1410
1020.31 1409.66 1022.08 1409.25 1022.68  1409.1 1023.15    1409 1025.47 1408.49
1026.23 1408.19 1026.38 1408.19 1036.55  1408.5 1039.55  1408.4 1041.19 1408.33
1052.22 1408.43 1060.02 1408.79 1062.78 1408.84 1064.15 1408.87 1064.69    1409
1068.44 1409.77 1069.52    1410 1071.45 1410.48 1073.38    1411 1076.78 1411.99
1076.85 1412.01    1080 1412.92 1080.27    1413 1083.67    1414 1086.87    1415
 1087.8 1415.41 1089.09    1416 1089.45 1416.16 1091.31    1417 1092.51 1417.51
1093.58    1418 1094.41 1418.37 1095.79    1419 1096.65 1419.42 1097.86    1420
 1098.6 1420.42  1099.6    1421  1100.8 1421.68 1101.37    1422 1101.96 1422.34
1103.09    1423 1104.28  1423.7 1104.78    1424 1105.16 1424.27 1106.21    1425
1107.52  1425.9 1107.67    1426 1107.87 1426.16 1108.59 1426.72 1108.99    1427
1110.46 1427.79 1110.76 1427.81 1111.07 1427.83 1111.72    1428 1166.39    1428
1192.82 1428.95 1194.65    1429  1211.2    1429 1226.07 1429.47 1228.56 1429.54
1246.59    1430 1248.16 1430.97 1248.23 1431.03 1248.47    1431 1250.06    1431
1250.49 1430.72 1251.85    1430 1263.69    1430 1264.79 1430.59 1265.67    1431
1266.45 1431.49 1268.17 1432.56 1268.85    1433 1270.42    1434 1271.03 1434.39
1271.82 1434.89 1271.98    1435 1272.35 1435.24 1273.54    1436 1274.79 1436.81
 1275.1    1437  1275.6 1437.32 1276.33  1437.8 1276.63    1438 1277.26 1438.38
1278.27    1439 1279.63 1439.83 1279.92    1440 1280.36 1440.26 1281.15 1440.72
1281.62    1441 1282.08 1441.26 1283.31    1442 1284.81 1442.82 1285.12    1443
1286.14 1443.64 1286.73    1444  1287.5 1444.44 1289.73 1445.74 1290.18    1446
1291.04 1446.48 1291.96    1447  1293.2 1447.69 1294.81 1448.58 1295.56    1449
1295.71 1449.08 1297.45    1450 1299.25 1450.94 1299.36    1451 1301.27    1452
 1301.4 1452.07 1303.24    1453 1304.49 1453.64  1305.2    1454 1305.86 1454.32
 1307.3    1455 1308.12  1455.4 1309.34    1456 1310.11 1456.37 1311.45    1457
1313.93  1457.6 1315.47    1458   1319 1458.71 1320.42    1459 1323.77 1459.64
1325.57    1460 1328.79    1460 1330.62 1459.24 1331.98 1459.12 1334.28 1459.32
1335.71 1459.43 1339.67 1459.61 1346.11    1460 1347.29 1460.04 1347.82 1460.06
1374.07  1460.9 1376.33 1460.94 1376.93 1460.97 1377.36 1460.98 1377.45 1460.98
1381.88 1460.94    1399 1460.72

Manning's n Values          num=        5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .06  135.23     .13  648.25     .06  724.29     .045 1110.46     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        724.29 1110.46             335.9  167.94  155.53             .1      .3
Ineffective Flow     num=        1
   Sta L   Sta R    Elev  Permanent
       0  709.31 1453.75       F

CROSS SECTION OUTPUT  Profile #100 YR

  E.G. Elev (ft)           1431.62    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               0.19    Wt. n-Val.                0.060     0.045      0.060
  W.S. Elev (ft)           1431.43    Reach Len. (ft)          335.90    167.94     155.53
  Crit W.S. (ft)           1419.29    Flow Area (sq ft)          5.41   6293.86     404.31
  E.G. Slope (ft/ft)       0.000285   Area (sq ft)            9130.71   6293.86     404.31
  Q Total (cfs)           22530.00    Flow (cfs)                 1.93  22210.56     317.51
  Top Width (ft)           1182.03    Top Width (ft)           639.97    386.17     155.89
  Vel Total (ft/s)            3.36    Avg. Vel. (ft/s)           0.36      3.53       0.79
  Max Chl Dpth (ft)          23.24    Hydr. Depth (ft)           0.86     16.30       2.59
  Conv. Total (cfs)       1335647.0    Conv. (cfs)              114.2   1316709.0    18823.1
  Length Wtd. (ft)          167.86    Wetted Per. (ft)           6.88     394.67     156.87
  Min Ch El (ft)           1408.19    Shear (lb/sq ft)           0.01      0.28       0.05
  Alpha                       1.09    Stream Power (lb/ft s)  1399.00      0.00       0.00
  Frctn Loss (ft)             0.04    Cum Volume (acre-ft)      37.73     25.54       0.72
  C & E Loss (ft)             0.01    Cum SA (acres)             3.21      1.60       0.28

Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Final FW

  E.G. Elev (ft)           1432.59    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               0.17    Wt. n-Val.                0.060     0.045      0.060
  W.S. Elev (ft)           1432.42    Reach Len. (ft)          335.90    167.94     155.53
  Crit W.S. (ft)           1419.29    Flow Area (sq ft)          16.70   6677.16     241.11
  E.G. Slope (ft/ft)       0.000235   Area (sq ft)               16.70   6677.16     241.11
  Q Total (cfs)           22530.00    Flow (cfs)                 6.71  22289.11     234.18
  Top Width (ft)            455.00    Top Width (ft)            14.29    386.17      54.54
  Vel Total (ft/s)            3.25    Avg. Vel. (ft/s)           0.40      3.34       0.97
  Max Chl Dpth (ft)          24.23    Hydr. Depth (ft)           1.17     17.29       4.42
  Conv. Total (cfs)       1468754.0    Conv. (cfs)              437.1   1453051.0    15266.5
  Length Wtd. (ft)          167.90    Wetted Per. (ft)          15.38     394.67      58.98
  Min Ch El (ft)           1408.19    Shear (lb/sq ft)           0.02      0.25       0.06
  Alpha                       1.05    Stream Power (lb/ft s)  1399.00      0.00       0.00
  Frctn Loss (ft)             0.04    Cum Volume (acre-ft)       0.06     27.14       0.43
  C & E Loss (ft)             0.01    Cum SA (acres)             0.06      1.60       0.10

Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #M1 Initial FW

  E.G. Elev (ft)           1432.59    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               0.17    Wt. n-Val.                0.060     0.045      0.060
  W.S. Elev (ft)           1432.42    Reach Len. (ft)          335.90    167.94     155.53
  Crit W.S. (ft)           1419.29    Flow Area (sq ft)          16.70   6677.16     241.11
  E.G. Slope (ft/ft)       0.000235   Area (sq ft)               16.70   6677.16     241.11
```

Q Total (cfs)	22530.00	Flow (cfs)	6.71	22289.11	234.18
Top Width (ft)	455.00	Top Width (ft)	14.29	386.17	54.54
Vel Total (ft/s)	3.25	Avg. Vel. (ft/s)	0.40	3.34	0.97
Max Chl Dpth (ft)	24.23	Hydr. Depth (ft)	1.17	17.29	4.42
Conv. Total (cfs)	1468754.0	Conv. (cfs)	437.1	1453051.0	15266.5
Length Wtd. (ft)	167.90	Wetted Per. (ft)	15.38	394.67	58.98
Min Ch El (ft)	1408.19	Shear (lb/sq ft)	0.02	0.25	0.06
Alpha	1.05	Stream Power (lb/ft s)	1399.00	0.00	0.00
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	0.06	27.14	0.43
C & E Loss (ft)	0.01	Cum SA (acres)	0.06	1.60	0.10

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Initial FW

E.G. Elev (ft)	1432.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.060	0.045	0.060
W.S. Elev (ft)	1432.42	Reach Len. (ft)	335.90	167.94	155.53
Crit W.S. (ft)	1419.29	Flow Area (sq ft)	16.70	6677.16	241.11
E.G. Slope (ft/ft)	0.000235	Area (sq ft)	16.70	6677.16	241.11
Q Total (cfs)	22530.00	Flow (cfs)	6.71	22289.11	234.18
Top Width (ft)	455.00	Top Width (ft)	14.29	386.17	54.54
Vel Total (ft/s)	3.25	Avg. Vel. (ft/s)	0.40	3.34	0.97
Max Chl Dpth (ft)	24.23	Hydr. Depth (ft)	1.17	17.29	4.42
Conv. Total (cfs)	1468754.0	Conv. (cfs)	437.1	1453051.0	15266.5
Length Wtd. (ft)	167.90	Wetted Per. (ft)	15.38	394.67	58.98
Min Ch El (ft)	1408.19	Shear (lb/sq ft)	0.02	0.25	0.06
Alpha	1.05	Stream Power (lb/ft s)	1399.00	0.00	0.00
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	0.06	27.14	0.43
C & E Loss (ft)	0.01	Cum SA (acres)	0.06	1.60	0.10

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA RS: 14.48

INPUT
Description:
Station Elevation Data num= 378

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1442	1.02	1442	9.72	1441.19	11.67	1441	11.87	1440.99
11.93	1440.98	12.31	1440.92	17.32	1440	24.4	1440	33.79	1439.72
42	1439.4	50.64	1439.02	50.95	1439.01	51.13	1439	60.12	1439
76.9	1438.6	81.58	1438.37	82.93	1438.4	85.35	1438.27	86.86	1438.23
106.73	1438.41	108.31	1438.39	109.46	1438.35	110.87	1438.27	115.37	1438.3
117.07	1438.22	118.45	1438	125.83	1438	138.69	1438.67	145.25	1438.78
147.29	1438.85	148.39	1438.86	154.03	1439	224.43	1439	228.38	1438.83
228.97	1438.82	230.74	1438.76	233.45	1438.66	236.02	1438.54	241.53	1438.3
247.51	1438	248.09	1438	250.66	1437.83	261.23	1437	265.49	1437
270.81	1436.78	275.22	1436.62	290.7	1436	291.02	1435.98	291.25	1435.97
299.05	1435.57	311.11	1435	324.97	1434.46	336.01	1434	341.05	1433.77
361.33	1433	363.37	1432.86	367.33	1432.56	370.74	1432.33	374.9	1432
379.12	1432	385.87	1431.44	398.07	1431	400.53	1431	417.88	1430.17
418.83	1430.12	419.95	1430.08	421.49	1430	429.21	1430	435.72	1430.39
437.74	1430.47	441.74	1430.57	449.05	1430.52	451.24	1430.48	456.58	1430.31
466.98	1430.38	468.31	1430.36	469.81	1430.35	470.23	1430.35	482.97	1430.44
490.69	1430.53	493.26	1430.6	494.49	1430.61	499.13	1430.58	502.41	1430.54
505.05	1430.58	510.07	1430.48	510.71	1430.46	518.18	1430.05	518.39	1430.04
518.89	1430	520.39	1429	521.01	1428.54	521.72	1428	521.96	1427.8
522.74	1427.14	522.91	1427	523.35	1426.68	524.35	1426	526.36	1425
528.36	1424	529.68	1423.43	530.63	1423	533.8	1422.05	533.91	1422.01
537.23	1421	537.58	1420.88	540.53	1420	542.11	1419.64	544.85	1419
548.18	1419	550.9	1419.81	551.53	1420	554.51	1420.89	554.88	1421
555.94	1421.31	558.28	1422	559.22	1422.12	569.03	1422.94	569.79	1423
572.27	1423.21	572.83	1423.23	573.24	1423.22	576.73	1423.37	578.34	1423.38
582.5	1423.08	582.74	1423.07	583.26	1423	586.45	1422.11	587.93	1421.55
589.67	1421	590.57	1420.73	593.02	1420	594.16	1419.72	597.97	1418.76
600.93	1418	605.89	1417.13	606.47	1417	606.78	1417	607.61	1416.92
611.94	1416.61	618.96	1416	631.54	1415.09	633.19	1415	634.83	1415
637.54	1414.72	638.2	1414.67	640.33	1414.6	648.03	1414.43	650.02	1414.43
651.39	1414.42	654.7	1414.52	661.83	1414.57	675.83	1414.48	696.48	1414.41
703.78	1414.36	712.41	1414.35	718.46	1414.31	725.26	1414.21	728.36	1414.14
733.01	1414	756.45	1413.38	758.86	1413.39	760.89	1413.36	764.18	1413.42
777.88	1414	799.31	1414	803.69	1414	811.32	1413.27	811.78	1413.23
814.25	1413	825.73	1412.15	826.96	1412	833.62	1412	850.35	1412.59
858.01	1412.77	860.19	1412.72	861.19	1412.72	861.76	1412.73	869.29	1413
872.61	1413	882.85	1413.45	883.36	1413.5	890.89	1413.85	892.47	1414
893.38	1414	900.45	1414.4	901.44	1414.49	904.23	1414.63	907.94	1415
911.54	1415	919.74	1415.45	921.57	1415.57	926.16	1416	926.44	1416.17
926.63	1416.18	960.26	1417	962.99	1417	979.33	1418	984.15	1418.64
984.34	1418.67	986.44	1418.936	986.95	1419	987.92	1419.35	989.87	1420
990.32	1421.48	992.25	1421.7	992.58	1421	992.82	1421.24	993.66	1422
993.92	1422.27	994.65	1423	995.57	1423.46	998.21	1424.27	1000.8	1424.74
1002.06	1425	1006.9	1425.96	1007.08	1426	1007.29	1426.04	1012.8	1427
1016.55	1427.73	1018.43	1428	1018.97	1428.8	1019.69	1429.66	1020.04	1430
1021.09	1430.76	1021.41	1431	1022.09	1431.36	1023.4	1432	1025.5	1432.67
1026.48	1433	1028.54	1433.7	1029.46	1434	1036.53	1434.82	1038.31	1435
1043.68	1435	1046.99	1435	1053.17	1435.24	1055.53	1435.4	1061.4	1435.7
1062.68	1435.74	1065	1436	1065.71	1436	1067.5	1436.46	1068.98	1436.87
1069.38	1437	1070.68	1437.45	1072.19	1438	1072.99	1438.29	1074.87	1439
1076.48	1439.54	1077.79	1440	1080.59	1440.89	1081.01	1441	1082.69	1441.47
1084.31	1442	1085.02	1442.23	1087.46	1443	1088.21	1443.25	1090.6	1444
1092.21	1444.54	1094	1445	1095.88	1445.46	1098.44	1446	1099.29	1446.2
1100.82	1446.47	1102.82	1446.8	1103.88	1447	1105.5	1447.32	1108.57	1448
1109.56	1448.26	1110.58	1448.5	1112.75	1449	1113.89	1449.31	1115.99	1449.69
1117.05	1449.87	1117.64	1450	1119.29	1450.36	1122.08	1451	1122.13	1451.01
1124.86	1451.7	1125.38	1451.76	1127.26	1452	1127.5	1452.02	1130.88	1452.37
1132.74	1452.34	1133.69	1452.34	1135.64	1452.31	1136.5	1452.31	1137.87	1452.29
1139.34	1452.26	1139.82	1452.26	1141.61	1452	1141.9	1451.96	1141.97	1451.95
1143.65	1451.73	1144.52	1451.6	1145.66	1451.45	1147.62	1451.15	1147.93	1451.11
1148.66	1451	1150.42	1450.74	1151.05	1450.66	1152.55	1450.44	1153.29	1450.35
1155.77	1450	1155.96	1449.97	1156.03	1449.96	1158.15	1449.65	1158.93	1449.54
1160.31	1449.36	1161.19	1449.23	1162.96	1449	1163.14	1448.97	1163.23	1448.96
1165.63	1448.66	1167.9	1448.37	1170.31	1448.32	1171.1	1448.31	1171.82	1448.29
1174.58	1448.24	1175.19	1448.23	1178.34	1448.17	1178.77	1448.16	1179.14	1448.15
1182.75	1448.08	1182.94	1448.08	1186.46	1448.12	1186.82	1448.12	1187.2	1448.13
1190.25	1448.17	1190.79	1448.17	1194.12	1448.21	1194.8	1448.22	1198.55	1448.26
1199.77	1448.27	1201.62	1448.41	1204.65	1448.68	1205.13	1448.72	1208.66	1448.95
1209.41	1449	1211.1	1449.1	1211.5	1449.12	1215.3	1449.3	1217.01	1449.36
1219.85	1449.48	1222.68	1449.58	1223.64	1449.61	1226.21	1449.72	1228.5	1449.79
1233.67	1449.92	1234.37	1449.94	1236.93	1450	1239.63	1450.07	1240.12	1450.07
1249.16	1450.27	1251.04	1450.27	1253.6	1450.32	1256.87	1450.37	1265.78	1450.63
1268.36	1450.71	1274.91	1450.89	1275.86	1450.93	1276.85	1451	1287.15	1451.55
1294.87	1451.83	1296.67	1451.91	1298.07	1452	1303.96	1452.57	1308.21	1452.81
1311.12	1453	1316.74	1453.47	1319.47	1453.63	1325.46	1454	1328.43	1454.25
1330.58	1454.36	1331.82	1454.43	1334.66	1454.65				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	578.34	.045	1038.31	.06

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
578.34 1038.31 54.23 14.48 13.53 .3 .5
Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	578.88	1439.6	F

CROSS SECTION OUTPUT Profile #100 YR

E.G. Elev (ft)	1431.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.		0.045	
W.S. Elev (ft)	1431.40	Reach Len. (ft)			
Crit W.S. (ft)	1419.30	Flow Area (sq ft)		6951.28	
E.G. Slope (ft/ft)	0.000250	Area (sq ft)	654.99	6955.62	
Q Total (cfs)	22530.00	Flow (cfs)		22530.00	
Top Width (ft)	635.20	Top Width (ft)	191.36	443.83	
Vel Total (ft/s)	3.24	Avg. Vel. (ft/s)		3.24	
Max Chl Dpth (ft)	19.40	Hydr. Depth (ft)		15.68	
Conv. Total (cfs)	1425640.0	Conv. (cfs)		1425640.0	
Length Wtd. (ft)		Wetted Per. (ft)		449.08	
Min Ch El (ft)	1412.00	Shear (lb/sq ft)		0.24	
Alpha	1.00	Stream Power (lb/ft s)	1334.66	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Final FW

E.G. Elev (ft)	1432.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.045	
W.S. Elev (ft)	1432.40	Reach Len. (ft)			
Crit W.S. (ft)	1419.31	Flow Area (sq ft)		7395.69	
E.G. Slope (ft/ft)	0.000205	Area (sq ft)		7400.57	
Q Total (cfs)	22530.00	Flow (cfs)		22530.00	
Top Width (ft)	446.31	Top Width (ft)		446.31	
Vel Total (ft/s)	3.05	Avg. Vel. (ft/s)		3.05	
Max Chl Dpth (ft)	20.40	Hydr. Depth (ft)		16.59	
Conv. Total (cfs)	1574495.0	Conv. (cfs)		1574495.0	
Length Wtd. (ft)		Wetted Per. (ft)		451.76	
Min Ch El (ft)	1412.00	Shear (lb/sq ft)		0.21	
Alpha	1.00	Stream Power (lb/ft s)	1334.66	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #M1 Initial FW

E.G. Elev (ft)	1432.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.045	
W.S. Elev (ft)	1432.40	Reach Len. (ft)			
Crit W.S. (ft)	1419.31	Flow Area (sq ft)		7395.69	
E.G. Slope (ft/ft)	0.000205	Area (sq ft)		7400.57	
Q Total (cfs)	22530.00	Flow (cfs)		22530.00	
Top Width (ft)	446.31	Top Width (ft)		446.31	
Vel Total (ft/s)	3.05	Avg. Vel. (ft/s)		3.05	
Max Chl Dpth (ft)	20.40	Hydr. Depth (ft)		16.59	
Conv. Total (cfs)	1574495.0	Conv. (cfs)		1574495.0	
Length Wtd. (ft)		Wetted Per. (ft)		451.76	
Min Ch El (ft)	1412.00	Shear (lb/sq ft)		0.21	
Alpha	1.00	Stream Power (lb/ft s)	1334.66	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Initial FW

E.G. Elev (ft)	1432.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.045	
W.S. Elev (ft)	1432.40	Reach Len. (ft)			
Crit W.S. (ft)	1419.30	Flow Area (sq ft)		7395.69	
E.G. Slope (ft/ft)	0.000205	Area (sq ft)		7400.57	
Q Total (cfs)	22530.00	Flow (cfs)		22530.00	
Top Width (ft)	446.31	Top Width (ft)		446.31	
Vel Total (ft/s)	3.05	Avg. Vel. (ft/s)		3.05	
Max Chl Dpth (ft)	20.40	Hydr. Depth (ft)		16.59	
Conv. Total (cfs)	1574495.0	Conv. (cfs)		1574495.0	
Length Wtd. (ft)		Wetted Per. (ft)		451.76	
Min Ch El (ft)	1412.00	Shear (lb/sq ft)		0.21	
Alpha	1.00	Stream Power (lb/ft s)	1334.66	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

SUMMARY OF MANNING'S N VALUES

River:LV_WASH

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7	n8	n9
R1 - 3 KIDS_INTA	405.15	.06	.13	.035	.13	.035	.13	.06	.045	.06
R1 - 3 KIDS_INTA	182.42	.06	.13	.06	.045	.06				
R1 - 3 KIDS_INTA	14.48	.06	.045	.06						

SUMMARY OF REACH LENGTHS

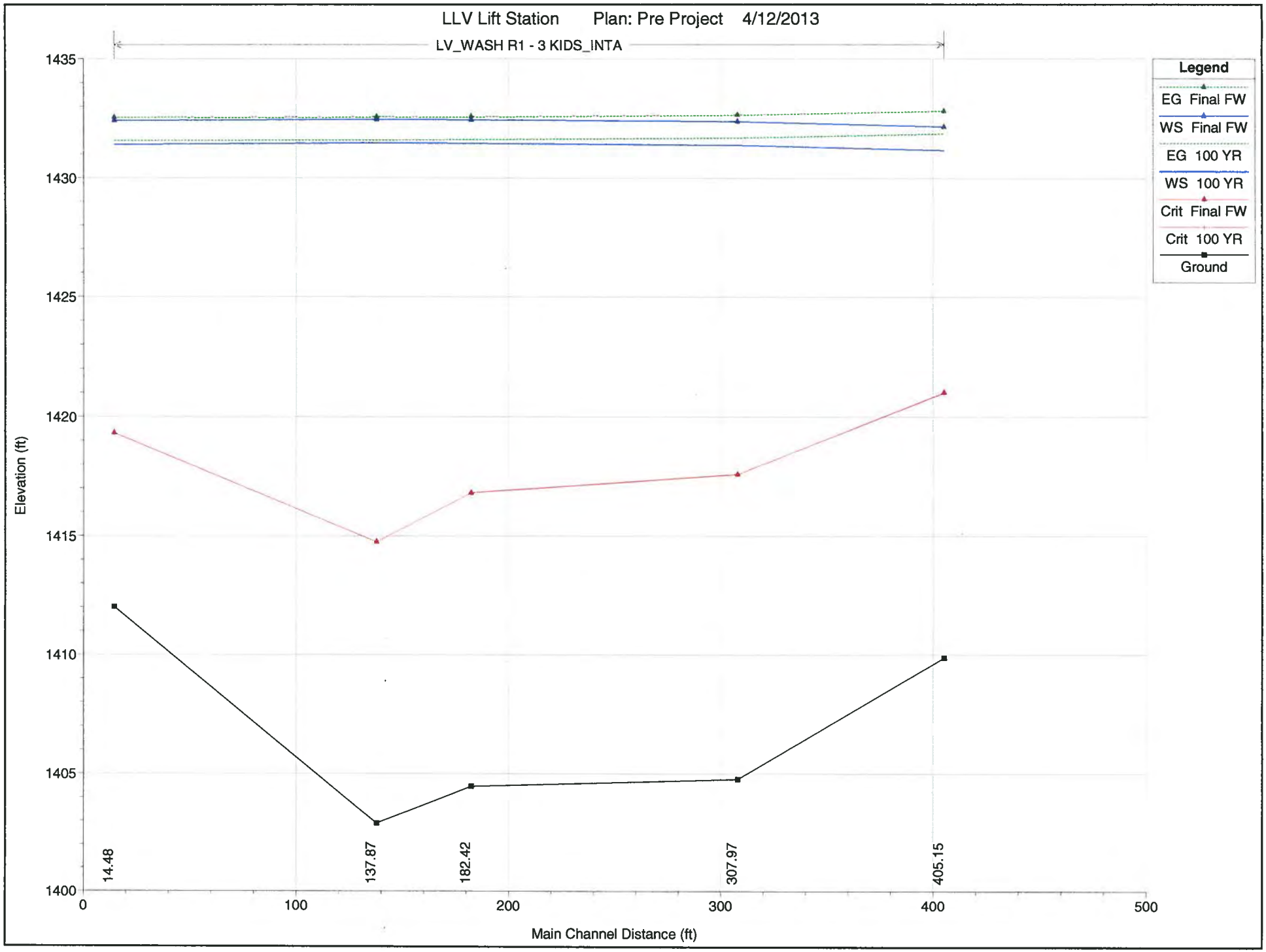
River: LV_WASH

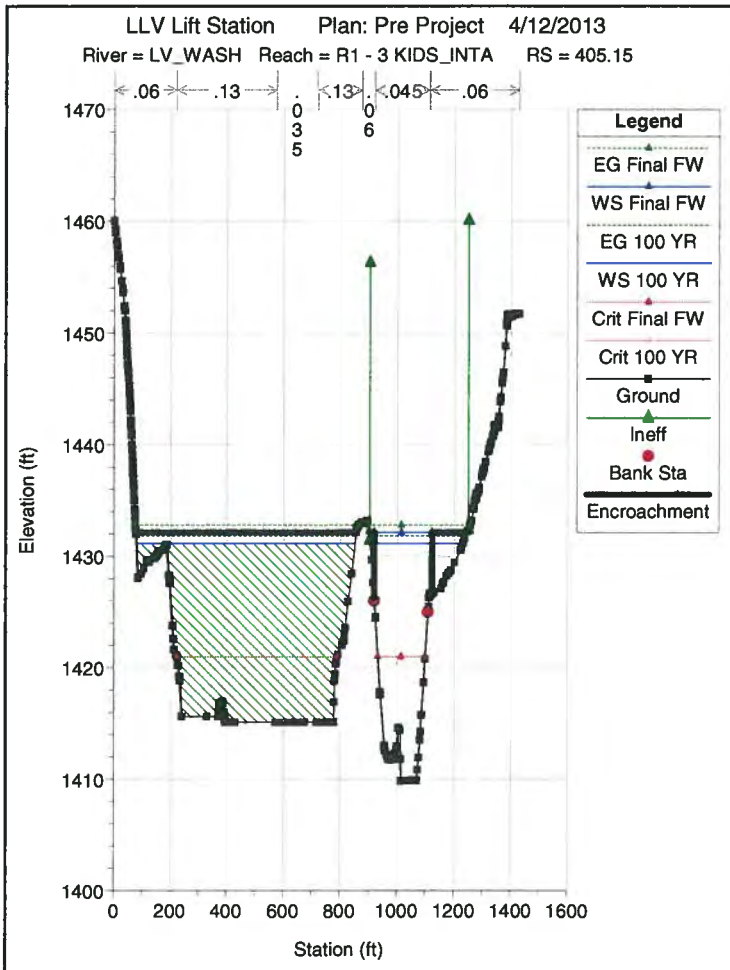
Reach	River Sta.	Left	Channel	Right
R1 - 3 KIDS_INTA	405.15	228.48	222.73	224.83
R1 - 3 KIDS_INTA	182.42	335.9	167.94	155.53
R1 - 3 KIDS_INTA	14.48	54.23	14.48	13.53

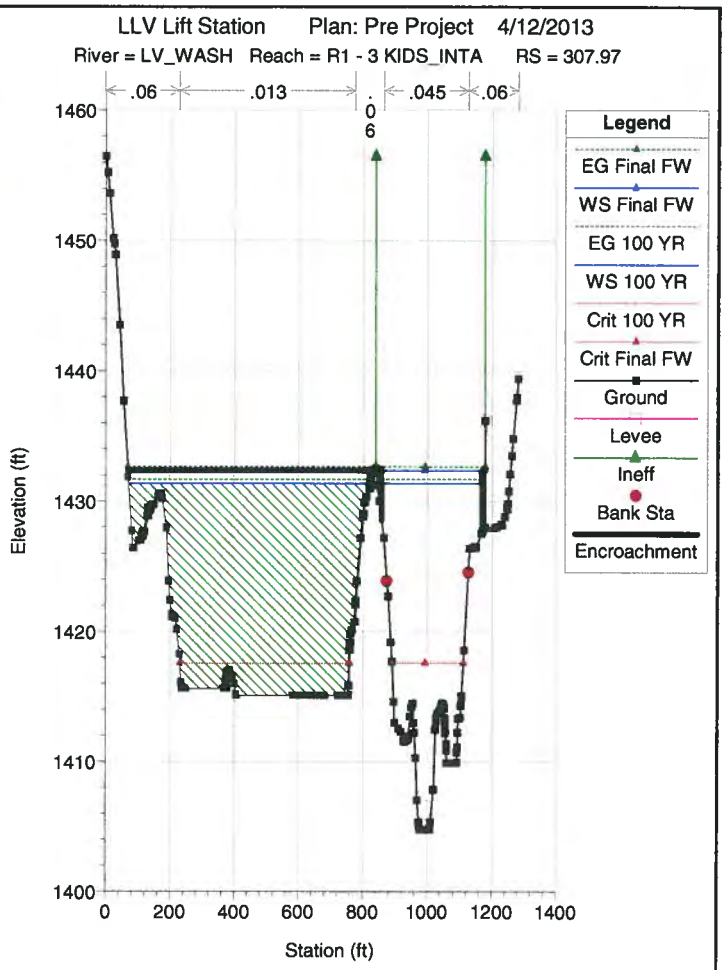
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: LV_WASH

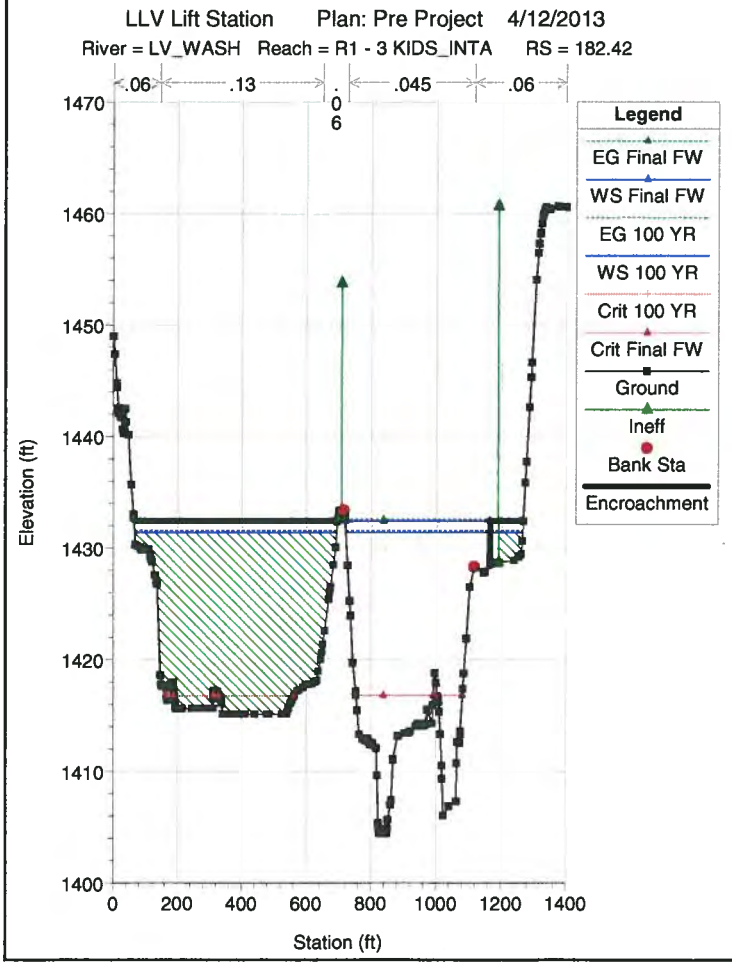
Reach	River Sta.	Contr.	Expan.
R1 - 3 KIDS_INTA	405.15	.1	.3
R1 - 3 KIDS_INTA	182.42	.1	.3
R1 - 3 KIDS_INTA	14.48	.3	.5

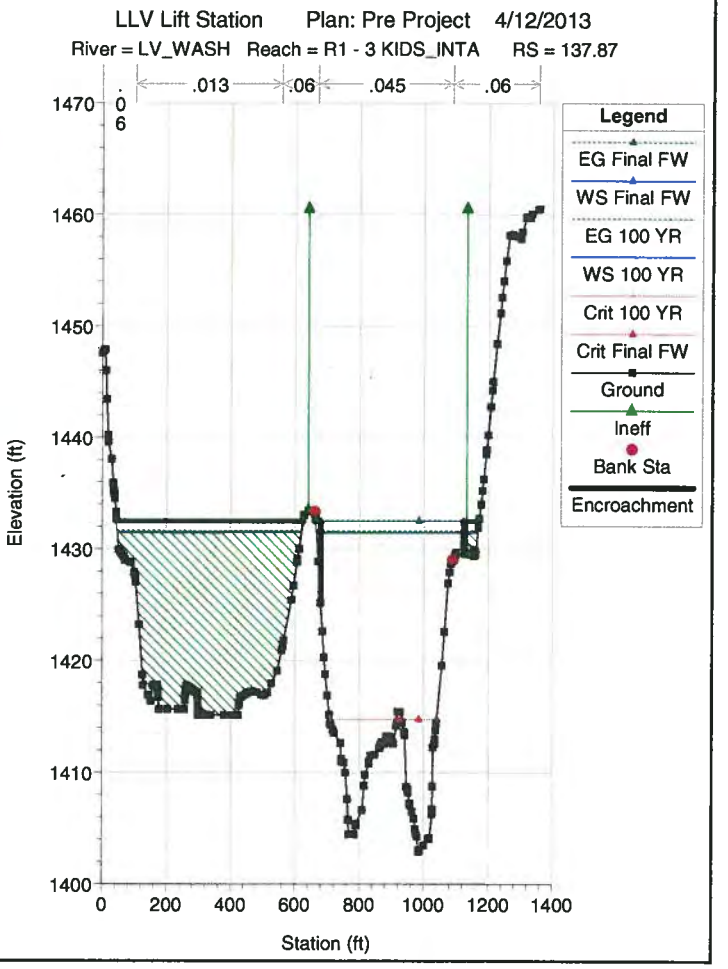
Pre-Project Hydraulic Analysis

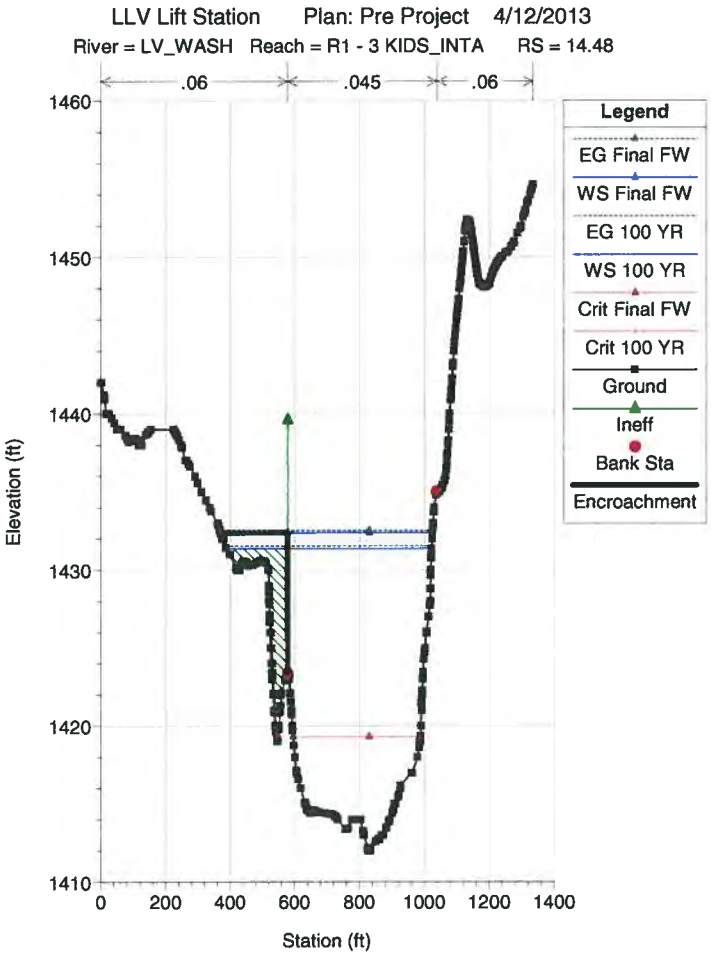

LLV Lift Station Plan: Pre Project 4/12/2013
LV_WASH R1 - 3 KIDS_INTA
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit Final FW
Crit 100 YR
Ground
Elevation (ft)
1435
1430
1425
1420
1415
1410
1405
1400
0
100
200
300
400
500
Main Channel Distance (ft)
14.48
137.87
182.42
307.97
405.15


LLV Lift Station Plan: Pre Project 4/12/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 405.15
.06 .13 .035 .13 .06 .045 .06
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit Final FW
Crit 100 YR
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


LLV Lift Station Plan: Pre Project 4/12/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 307.97
.06 .013 .06 .045 .06
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit 100 YR
Crit Final FW
Ground
Levee
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


LLV Lift Station Plan: Pre Project 4/12/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 182.42
.06 .13 .06 .045 .06
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit 100 YR
Crit Final FW
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


LLV Lift Station Plan: Pre Project 4/12/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 137.87
.06 .013 .06 .045 .06
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit 100 YR
Crit Final FW
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


LLV Lift Station Plan: Pre Project 4/12/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 14.48
.06
.045
.06
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit Final FW
Crit 100 YR
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1460
1450
1440
1430
1420
1410
0
200
400
600
800
1000
1200
1400
Station (ft)

HEC-RAS Plan: Pre Project River: LV_WASH Reach: R1 - 3 KIDS_INTA

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
R1 - 3 KIDS_INTA	405.15	100 YR	22530.00	1409.86	1431.17	1421.00	1431.86	0.000994	6.76	3631.18	1099.23	0.29
R1 - 3 KIDS_INTA	405.15	Final FW	22530.00	1409.86	1432.16	1421.02	1432.82	0.000861	6.52	3508.78	202.00	0.27
R1 - 3 KIDS_INTA	307.97	100 YR	22530.00	1404.76	1431.38	1417.59	1431.69	0.000382	4.51	5224.60	1085.43	0.18
R1 - 3 KIDS_INTA	307.97	Final FW	22530.00	1404.76	1432.38	1417.58	1432.66	0.000322	4.29	5487.42	312.00	0.17
R1 - 3 KIDS_INTA	182.42	100 YR	22530.00	1404.45	1431.45	1416.82	1431.61	0.000217	3.18	7256.84	1171.47	0.13
R1 - 3 KIDS_INTA	182.42	Final FW	22530.00	1404.45	1432.44	1416.80	1432.58	0.000183	3.01	7624.04	445.50	0.12
R1 - 3 KIDS_INTA	137.87	100 YR	22530.00	1402.89	1431.47	1414.75	1431.59	0.000148	2.78	8158.02	1073.55	0.11
R1 - 3 KIDS_INTA	137.87	Final FW	22530.00	1402.89	1432.46	1414.75	1432.57	0.000124	2.66	8535.18	443.00	0.10
R1 - 3 KIDS_INTA	14.48	100 YR	22530.00	1412.00	1431.40	1419.30	1431.56	0.000250	3.24	6951.28	635.20	0.14
R1 - 3 KIDS_INTA	14.48	Final FW	22530.00	1412.00	1432.40	1419.31	1432.54	0.000205	3.05	7395.69	446.31	0.13

HEC-RAS Plan: Pre Project River: LV_WASH Reach: R1 - 3 KIDS_INTA

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
R1 - 3 KIDS_INTA	405.15	100 YR	1431.86	1431.17	0.69	0.06	0.11	37.68	21914.49	577.83	1099.23
R1 - 3 KIDS_INTA	405.15	Final FW	1432.82	1432.16	0.66	0.05	0.11	1.45	22380.40	148.15	202.00
R1 - 3 KIDS_INTA	307.97	100 YR	1431.69	1431.38	0.31	0.04	0.05	147.07	22074.56	308.37	1085.43
R1 - 3 KIDS_INTA	307.97	Final FW	1432.66	1432.38	0.28	0.03	0.04	161.20	22040.01	328.79	312.00
R1 - 3 KIDS_INTA	182.42	100 YR	1431.61	1431.45	0.16	0.01	0.01		22344.02	185.98	1171.47
R1 - 3 KIDS_INTA	182.42	Final FW	1432.58	1432.44	0.14	0.01	0.01		22351.77	178.23	445.50
R1 - 3 KIDS_INTA	137.87	100 YR	1431.59	1431.47	0.12	0.02	0.00		22493.52	36.48	1073.55
R1 - 3 KIDS_INTA	137.87	Final FW	1432.57	1432.46	0.11	0.02	0.00		22480.04	49.96	443.00
R1 - 3 KIDS_INTA	14.48	100 YR	1431.56	1431.40	0.16				22530.00		635.20
R1 - 3 KIDS_INTA	14.48	Final FW	1432.54	1432.40	0.14				22530.00		446.31

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X     X
X     X  X        X            X   X    X    X    X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: LLV Lift Station
Project File : LLVLiftStation.prj
Run Date and Time: 4/12/2013 8:26:39 AM

Project in English units

Project Description:
LOMR model for SNWA Reach of Las Vegas Wash
Lake Las Vegas to Flamingo Road

PLAN DATA

Plan Title: Pre Project
Plan File : X:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.p11

Geometry Title: Pre Project
Geometry File : X:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.g14

Flow Title : Pre Project
Flow File : X:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.f11

Plan Oescription:
The flood wall is added at new XS307.97

Plan Summary Information:
Number of: Cross Sections = 5 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Dffset = 0
Right Offset = 0

River = LV_WASH Reach = R1 - 3 KIDS_INTA

RS	Profile	Method	Value1	Value2
405.15	Final FW	1	920	1122
307.97	Final FW	1	858	1170
182.42	Final FW	1	710	1165
137.87	Final FW	1	680	1123
14.48	Final FW	1	578.34	1038.31

River = LV_WASH Reach = R1 - 3 KIDS_INTA

RS	Profile	Method	Value1	Value2
405.15	M1 Initial FW	1	920	1122
307.97	M1 Initial FW	0	0	0
182.42	M1 Initial FW	1	710	1165
137.87	M1 Initial FW	0	0	0
14.48	M1 Initial FW	1	578.34	1038.31

River = LV_WASH Reach = R1 - 3 KIDS_INTA

RS	Profile	Method	Value1	Value2
405.15	Initial FW	1	920	1122
307.97	Initial FW	0	0	0
182.42	Initial FW	1	710	1165
137.87	Initial FW	0	0	0
14.48	Initial FW	4	1	

FLOW DATA

Flow Title: Pre Project
Flow File : X:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.f11

Flow Data (cfs)

River	Reach	RS	100 YR	Final FW	M1 Initial FW	Initial FW
LV_WASH	R1 - 3 KIDS_INTA	405.15	22530	22530	22530	22530

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
LV_WASH	R1 - 3 KIDS_INTA	100 YR		Known WS = 1431.4
LV_WASH	R1 - 3 KIDS_INTA	Final FW		Known WS = 1432.4
LV_WASH	R1 - 3 KIDS_INTA	M1 Initial FW		Known WS = 1432.4
LV_WASH	R1 - 3 KIDS_INTA	Initial FW		Known WS = 1432.4

GEOMETRY DATA

Geometry Title: Pre Project
Geometry File : X:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.g14

CROSS SECTION

RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA RS: 405.15

INPUT
Description:
Station Elevation Data num= 316

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1460.08	.39	1460	2.94	1459.28	3.95	1459	7.65	1458.24
8.62	1458	9.79	1457.77	14.16	1457	15.38	1456.73	19.31	1456
20.57	1455.74	26.16	1454.63	29.55	1454	31.14	1453.62	35.7	1452.41
37.13	1452	39.79	1451.12	40.3	1451	41.33	1450.39	41.83	1450
42.97	1449.42	43.72	1449	44.82	1448.38	45.54	1448	47.42	1447.27
48.04	1447	49.38	1446.54	50.74	1446	52.92	1445.28	53.9	1445
54.64	1444.61	55.67	1444	56.53	1443.51	57.39	1443	58.92	1442.18
59.21	1442	59.55	1441.81	60	1441.58	60.95	1441	61.3	1440.8
62.66	1440	63.34	1439.61	64.42	1439	65.41	1438.47	66.27	1438
67.4	1437.4	68.15	1437	69.23	1436.43	69.9	1436	70.67	1435.56
71.6	1435	73.03	1434.2	73.38	1434	74.02	1433.64	75.05	1433
76.03	1432.38	76.65	1432	84.51	1428.05	85.22	1428.1	96.55	1428.46
104.47	1428.93	116.12	1429.66	116.29	1429.68	121.71	1429.61	123.98	1429.5
140.55	1429.82	142.19	1429.84	142.62	1429.85	144.3	1429.92	146.04	1429.98
146.67	1430	148.34	1430.06	149.96	1430.12	150.15	1430.12	151.7	1430.18
153.16	1430.23	154.78	1430.29	156.42	1430.35	157.54	1430.38	159.09	1430.43
160.56	1430.48	174.59	1430.6	175.2	1430.61	175.65	1430.62	175.98	1430.62
176.23	1430.62	176.4	1430.63	177.38	1430.62	182.73	1431.01	184.4	1431.04
194.42	1428.31	195.66	1427.98	196.07	1427.8	196.62	1427.58	206.32	1423.79
209.64	1422.62	212.31	1421.66	220.2	1421.15	224	1420.96	227.22	1420.22
232.03	1419.23	232.93	1418.87	240.26	1415.65	328.84	1415.65	370.36	1415.65
371.04	1416.01	372.11	1416.62	372.16	1416.65	372.22	1416.65	373.25	1416.84
380.18	1416.94	383.75	1416.99	383.93	1416.99	384.49	1417	385.82	1416.84
390.3	1416.03	393.55	1415.35	394.72	1415.12	394.98	1415.12	395.12	1415.12
398.99	1415.12	400.53	1415.12	407.21	1415.12	408.57	1415.12	416.12	1415.12
418.55	1415.12	428.43	1415.12	573.25	1415.12	581.67	1415.12	586.27	1415.12
615.25	1415.12	623.43	1415.12	639.45	1415.12	642.75	1415.12	662.23	1415.12
672.68	1415.12	675.03	1415.12	718.08	1415.12	745.2	1415.12	746.29	1415.12
752.83	1415.12	753.86	1415.12	778.38	1415.12	779.53	1416.93	781.24	1418.84
782.96	1419.43	785.5	1420.39	786.82	1420.52	786.86	1420.53	786.91	1420.53
786.95	1420.54	787	1420.54	787.04	1420.55	787.08	1420.55	787.12	1420.55
787.15	1420.56	787.17	1420.56	793.47	1421.18	793.64	1421.22	806.9	1422.03
807.12	1422.06	807.34	1422.09	807.55	1422.12	812.97	1422.43	814.46	1422.49
816.29	1423.03	818.26	1423.61	828.15	1425.97	840.77	1428.45	857.14	1432.15
858.96	1432.53	860.19	1432.6	864.66	1432.77	866.52	1432.85	867.03	1432.85
877.67	1433.06	895.8	1433.18	896.31	1433.19	896.35	1433.18	896.56	1433.14
912.85	1429.7	917.02	1427.66	920.53	1426	924.42	1424.56	924.58	1424.47
940.64	1417.83	940.93	1417.7	941.08	1417.64	941.23	1417.62	941.3	1417.61
956.22	1413.04	957.15	1412.86	959.05	1412.58	965.7	1412.17	969.61	1411.89
970.55	1411.82	971.28	1411.8	974.74	1411.83	977.58	1411.75	985.56	1411.79
988.82	1411.98	992.46	1412.28	999.5	1412.86	999.97	1412.91	1000.08	1412.91
1000.21	1412.95	1000.29	1412.98	1003.95	1414.6	1005.74	1414.62	1010.62	1414.41
1013.22	1411.84	1014.66	1409.86	1041.94	1409.89	1055.83	1409.9	1069.36	1409.91
1072.59	1410.84	1076.03	1411.93	1080.82	1413.51	1082.98	1414.27	1086.43	1415.76
1093.39	1418.68	1098.54	1420.79	1109.111	1424.995	1110.38	1425.5	1112.49	1426.33
1114.69	1426.53	1116.01	1426.66	1116.76	1426.6	1117.86	1426.49	1122.07	1426.64
1126.02	1426.77	1126.83	1426.8	1129.3	1426.85	1152.77	1427.13	1159.23	1427.57
1162.86	1427.71	1173.39	1428.27	1178.59	1428.47	1182.46	1428.56	1187.63	1428.75
1187.75	1428.77	1200.26	1429.46	1222.38	1430.54	1225.82	1430.8	1230.97	1431.2
1235.55	1431.57	1248.31	1432.28	1255.97	1432.79	1260.13	1433.15	1260.48	1433.2
1268.07	1434.24	1268.4	1434.28	1268.54	1434.3	1268.99	1434.36	1273.69	1435.04
1275.41	1435.27	1276.59	1435.43	1278.18	1435.63	1278.35	1435.65	1278.57	1435.46
1278.88	1435.2	1279.2	1435.23	1284.13	1435.73	1286.49	1435.96	1288.47	1436.16
1297.57	1437.14	1300.79	1437.48	1301.48	1437.55	1302.08	1437.61	1303.08	1437.72
1304.13	1437.83	1304.73	1437.89	1310.31	1438.46	1320.85	1439.41	1321.61	1439.48
1322.48	1439.55	1324.37	1439.72	1327.92	1440.04	1330.24	1440.24	1335.69	1440.73
1337.45	1440.89	1340.94	1441.19	1341.08	1441.34	1341.46	1441.74	1342.48	1441.72
1343.91	1441.69	1346.26	1441.66	1347.89	1441.63	1348.82	1441.62	1349.94	1441.6
1353.62	1441.56	1355.66	1442.15	1357.01	1442.51	1362.05	1443.86	1362.55	1443.98
1363.64	1444.25	1368.91	1445.53	1370.87	1445.97	1372.73	1446.47	1379.4	1448.85
1384.55	1450.64	1385.63	1450.99	1386.98	1451.35	1387.57	1451.49	1388.15	1451.66
1398.42	1451.5	1402.67	1451.49	1410.43	1451.66	1412.95	1451.68	1416.11	1451.7
1416.79	1451.71	1418.38	1451.72	1420.8	1451.73	1424.07	1451.72	1427.29	1451.68
1428.51	1451.7								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	220.2	.13	573.25	.035	718.08	.13	877.67	.06
920.53	.045	1110.38	.06						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
920.53 1109.11 96.2 97.18 102.46 .1 .3
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	904.66	1456.29	F
1250	1428.51		F

CROSS SECTION

RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA RS: 307.97

INPUT
Description:
Station Elevation Data num= 207

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1456.46	5.72	1455.23	11.93	1453.63	22.43	1450.16	26.57	1449.73
29.98	1448.9	44.11	1443.5	55.98	1437.71	70.87	1431.86	82.72	1427.74
84.92	1426.42	107.29	1427	113.72	1427.3	115.13	1427.45	115.73	1427.51
116.64	1427.45	119.18	1427.69	132.15	1428.9	133.93	1429.26	134.45	1429.53
137.11	1429.42	139.21	1429.4	147.93	1429.75	166.37	1430.47	171.74	1430.55
174.12	1430.56	174.97	1430.44	176.3	1430.25	189.74	1427.98	197.07	1423.89
200.33	1422.42	205.69	1421.32	206.3	1421.14	214.57	1421.11	217.39	1421.03
221.03	1420.18	229.87	1418.26	235.14	1416.11	236.59	1415.65	244.6	1415.65
248.42	1415.65	368.6	1415.65	372.83	1415.65	374.74	1415.65	375.99	1415.65
376.41	1415.94	377.29	1416.37	377.31	1416.38	378.13	1416.84	382.5	1416.99
387.38	1417.06	390.2	1416.61	395.33	1416.45	401.41	1416.03	406.04	1415.2
406.34	1415.12	406.79	1415.12	584.06	1415.12	590.79	1415.12	596.37	1415.12
619.26	1415.12	625.74	1415.12	638.44	1415.12	642.62	1415.12	667.3	1415.12
680.51	1415.12	682.25	1415.12	722.85	1415.12	736.04	1415.12	755.05	1415.12
755.38	1415.12	756.04	1415.12	756.84	1415.86	759.73	1418.58	761.16	1419.15
762.79	1419.82	766.93	1420.12	775.11	1420.74	778.15	1422.1	778.77	1422.38
782.76	1423.88	794.25	1427.19	801.15	1428.81	802.3	1429.03	805.97	1429.93
811.62	1430.34	822.32	1431	823.35	1431.32	825.49	1431.88	828.65	1432.41
838.89	1432.51	841.4	1432.5	842.36	1432.16	844.32	1431.25	850.61	1430.02
864.72	1427.19	874.25	1423.87	878.47	1422.69	886.96	1419.17	890.6	1417.69
895.96	1414.59	898.5	1413	910.78	1412.55	918.75	1412.3	927.81	1411.62
929.13	1411.55	930.3	1411.55	936.62	1411.64	938.54	1411.67	941.13	1411.71
941.91	1411.91	947	1413.46	950.97	1414.18	954.32	1414.41	955.38	1414.48
958.53	1412.98	960.12	1412.22	964.19	1410.28	969.42	1407.02	973.77	1405.34
974.94	1405.15	976.28	1404.99	977.3	1404.76	981.7	1404.76	985.74	1404.76
988.26	1404.76	993.13	1404.76	995.88	1404.76	998.85	1404.76	1002.23	1404.76
1005.1	1404.76	1008.37	1404.76	1008.43	1404.76	1008.52	1404.76	1008.76	1404.76
1009.05	1404.85	1011.18	1405.34	1019.15	1407.8	1019.2	1407.82	1019.24	1407.84
1019.29	1407.86	1026.08	1412.46	1027.94	1413.08	1029	1413.36	1031.9	1413.71
1032.84	1413.71	1038.43	1413.92	1043.89	1414.25	1045.38	1414.25	1046.87	1414.48
1050.03	1414.39	1053.44	1414.09	1054.82	1413.33	1055.64	1412.76	1056.84	1412.19
1059.03	1411.37	1059.71	1410.85	1060.85	1409.86	1072.59	1409.88	1076.13	1409.89
1081.1	1409.9	1091.72	1409.91	1092.37	1410.7	1092.73	1411.09	1093.96	1412.22
1094.98	1413.29	1100.05	1413.37	1100.75	1413.37	1102.13	1413.38	1104.43	1414.31
1105.84	1414.87	1106.26	1415.05	1114.05	1418.56	1126.76	1424.53	1130.84	1426.39

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1140.96 1426.41 1146.46 1426.51 1147.49 1426.53  1149.3 1426.52 1150.93 1426.45
1167.47 1427.54 1167.49 1427.55 1167.51 1427.55 1171.95 1427.74  1177.5 1427.99
1177.61 1427.99 1178.13 1427.99 1178.13 1436.17 1179.73 1436.17 1179.73 1427.97
1208.73 1427.97 1215.49 1428.03 1228.93 1428.22 1231.68 1428.15 1239.71 1428.81
1247.09 1429.55  1248.7 1429.38 1250.16 1429.82 1250.43 1429.83 1253.15 1430.78
1257.35 1432.09  1262.4 1433.49 1266.26 1434.79 1276.84 1437.73 1277.55 1437.98
1282.93  1439.4 1282.96 1439.41

Manning's n Values         num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .06  229.87    .013  775.11     .06  864.72    .045 1126.76     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        874.25 1126.76             131.85  125.55  126.04             .1      .3
Ineffective Flow     num=       2
   Sta L    Sta R    Elev  Permanent
       0  838.89             F
 1177.61 1282.96             F
Right Levee     Station= 1179.73      Elevation= 1436.17

CROSS SECTION


RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA   RS: 182.42

INPUT
Description:
Station Elevation Data     num=     258
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1448.97     .34 1448.99    3.84 1447.38    9.96 1444.78     11 1444.41
   15.34 1442.54   16.21 1442.18   16.43 1442.09   16.95 1442.08   22.65 1441.72
   29.02  1440.6   31.54 1440.27   33.24 1440.68   37.29 1442.49    39.7 1441.29
   46.77 1440.14   55.19 1435.69   62.82 1433.02   63.69 1432.73   67.84 1430.31
   72.28 1430.21   83.53 1430.06   86.17 1429.93   87.33 1429.86  101.93  1429.9
  108.16 1429.92  114.59 1429.28  117.57 1428.98  119.79 1428.77  129.05  1427.6
  133.42 1427.07  134.62 1426.83  146.21 1418.64  147.91  1417.8  149.82 1417.67
  168.19 1416.39  171.95 1417.49  172.57 1417.71  177.72  1417.8  185.92 1417.97
  188.15 1417.34  189.84  1416.8  192.28 1416.12  193.62 1415.65  207.52 1415.65
  214.05 1415.65  245.39 1415.65  258.05 1415.65  282.07 1415.65  286.15 1415.65
  291.28 1415.65  295.61 1415.65  299.69 1415.65  303.92 1415.65  306.18 1415.65
  310.36 1415.65  311.85 1416.58  312.09  1416.8  312.18 1416.83  313.25 1417.26
  317.55 1417.21   319.6 1417.19  324.47 1417.13  326.63 1416.86  330.18  1416.7
  335.55 1416.46  336.72 1416.15  341.73 1415.12  346.18 1415.12  346.58 1415.12
  362.75 1415.12  365.94 1415.12  367.62 1415.12  370.26 1415.12  378.13 1415.12
  383.14 1415.12  392.17 1415.12  400.09 1415.12  406.41 1415.12  409.81 1415.12
  440.26 1415.12  478.74 1415.12   480.5 1415.12  484.45 1415.12  524.68 1415.12
  533.28 1415.12   534.8 1415.12  535.99 1415.14   538.9 1415.18  539.96 1415.32
  543.32 1415.63  543.82 1415.68  544.09 1415.72  549.75 1416.08  551.73 1416.19
  555.68 1416.43  556.49 1416.48  560.76 1416.71  563.42 1416.86  570.64 1417.22
  570.73 1417.22  570.84 1417.22  575.62 1417.29  588.88 1417.51   589.6 1417.52
  589.65 1417.52  589.83 1417.53  598.16 1417.79  605.34 1417.78  612.02 1417.85
  617.73 1417.86  625.78 1418.04  627.64 1418.05  631.33 1418.16  636.57 1418.97
  644.15 1420.02  646.98 1420.63   650.8 1421.39  655.98  1422.6  669.49 1425.45
  672.69 1426.12  674.59 1426.52  683.16  1428.5  690.08  1430.1  695.36 1432.39
     699 1432.77  701.59 1433.34  710.83 1433.36  716.04 1433.39  717.85 1433.02
  718.67 1432.86  727.47 1428.46  733.79 1425.27  736.25 1423.95  744.04 1419.69
  752.21 1417.17  753.45 1416.81   757.5 1415.46   763.9 1413.29  773.05 1412.89
  783.25 1412.76  786.55 1412.96  789.29 1412.91   791.5 1412.79  794.54  1412.6
  798.35 1412.38  803.64 1412.52  803.77 1412.53  805.18 1412.48  816.54 1412.09
  818.97 1409.61  823.35 1405.34  824.88 1404.86  826.18 1404.45  834.41 1404.45
  849.02 1404.45   850.1 1404.84  852.35 1405.66  860.16 1406.98  863.08  1407.4
  868.05    1411  868.18 1411.08  881.27 1413.14  881.33 1413.15  881.59 1413.16
  881.92 1413.16  883.41 1413.18  902.35  1413.4   903.3 1413.42  908.59 1413.42
  915.16 1413.42  915.96 1413.49  916.64 1413.52   920.9 1413.58  938.21 1414.08
  944.15 1414.25  945.34 1414.26  947.13 1414.27  948.45 1414.28  951.92 1414.23
  954.04 1414.22  957.91 1414.18  959.62 1414.15  960.59 1414.14  962.74 1414.11
   965.3 1414.16  967.03  1414.2  967.65 1414.21  968.67 1414.27  972.03 1415.51
  972.17 1415.53  972.39 1415.52  986.67 1414.27  989.93 1415.94  995.67 1418.78
  999.49 1417.93 1002.45 1416.65 1005.05 1416.69 1008.11 1416.21 1009.73 1415.31
 1012.91 1413.32 1017.51 1410.52 1019.11 1409.33 1022.66 1406.02 1040.07 1406.86
 1062.59 1407.28 1063.59 1410.72 1064.52 1412.61 1069.19 1412.57 1071.86 1412.51
 1073.83 1413.26 1074.49 1413.55 1082.47 1417.38 1085.66 1418.76 1092.87 1421.88
  1103.3  1426.5 1116.51 1428.22 1117.18 1428.31 1117.29 1428.33 1117.52 1428.32
 1119.18 1428.29 1145.51 1427.78 1148.46 1427.83 1149.83 1427.87 1170.55 1428.56
 1181.53 1428.72 1189.83 1428.72  1190.7 1428.72  1191.7 1428.72 1238.94 1428.92
  1250.8 1429.28 1252.79 1429.21 1257.22 1429.32 1260.87 1429.46 1263.88 1430.65
 1267.74 1432.42 1274.28 1435.86 1277.87 1437.73  1286.8 1442.62 1291.81  1445.3
 1294.11 1446.64 1307.08 1454.06 1313.42 1456.48 1315.49  1457.3 1319.87 1458.21
 1320.34 1458.31 1323.83 1459.11 1326.34 1459.74 1329.24 1460.03   1333 1460.38
 1336.26 1460.59 1345.13 1460.43 1348.95 1460.42 1374.44 1460.68 1382.39 1460.61
  1390.6 1460.61 1393.92 1460.62     1399 1460.57

Manning's n Values         num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .06  146.21     .13   650.8     .06  727.47    .045 1116.51     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        716.04 1117.29              43.46   44.55   57.38             .1      .3
Ineffective Flow     num=       2
   Sta L    Sta R    Elev  Permanent
       0  709.31 1453.75             F
  1190.7     1399                    F

CROSS SECTION


RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA   RS: 137.87

INPUT
Description:
Station Elevation Data     num=     267
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1447.54    5.42 1447.77    8.09  1447.9   10.64 1446.01   13.53  1443.4
   17.67 1440.19    18.2 1439.78   18.35 1439.67   18.87 1439.59   28.94 1438.03
   33.87 1435.91   34.61 1435.55   36.02 1435.19    37.4 1434.94   38.43  1434.5
   42.55 1433.31   43.97 1432.66   50.59 1429.96   55.67 1429.74   60.91 1429.53
   65.85 1429.35   69.38 1429.09   70.28 1429.01   85.64 1428.83   88.37 1428.77
   98.67 1427.91  101.94 1427.63  103.58 1427.05  114.36 1423.24  124.95 1418.71
  127.23  1417.8  142.01 1416.92  151.12 1416.39  158.19 1417.78   158.3 1417.81
  158.77 1417.81  159.39 1417.81  171.76 1417.83  172.48 1417.47  173.65 1416.97
  174.25 1416.73   176.4 1415.65  202.45 1415.65  236.43 1415.65  248.66 1415.65
  249.48 1415.65  255.32 1415.65  256.99 1416.42  258.36 1416.87  260.25 1417.19
  260.83 1417.36  262.33 1417.74  262.41 1417.76   265.9 1417.68  268.74 1417.62
  271.05 1417.57  272.98 1417.53  274.62  1417.5  276.05 1417.48  276.83 1417.46
  278.07 1417.44  279.17 1417.43  279.28 1417.42  280.17  1417.4  282.28 1417.35
  283.24 1417.33  284.39 1417.31  285.75 1417.29  289.23  1417.2  290.32 1417.19
  290.38 1417.19  295.71 1417.16  295.95 1417.07  296.53 1416.83  297.74 1416.31
  298.57  1415.6  298.99 1415.25  299.29 1415.12  311.01 1415.12  312.97 1415.12
  321.77 1415.12  325.51 1415.12  326.27 1415.12  336.91 1415.12  337.89 1415.12
  379.43 1415.12  404.05 1415.12  423.69 1415.12  426.01 1415.98  426.15 1416.08
  426.51 1416.16  428.83 1416.74  431.07 1416.75  432.46 1416.77  432.57 1416.77
  441.18 1416.89   448.9 1417.04  451.46 1417.07  456.11 1417.16  463.59 1417.23
  465.97 1417.24  466.61 1417.25  468.87 1417.26  483.04 1417.17  495.58 1416.96
  502.98 1416.88  506.57 1416.88  514.42 1417.14  527.25 1417.98  545.44 1419.08
  559.35 1420.93  561.56 1421.28  564.96 1421.82  589.26 1425.46  595.67 1426.72
  606.39 1428.84     608 1429.12  612.61    1430  627.64 1433.03  628.08 1433.04
  628.82 1433.06  641.07 1433.41  648.48 1433.38  652.48 1433.38  652.65 1433.38
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  661.6 1433.34  662.01 1433.24  664.66 1432.61  672.27 1428.88  679.58 1425.17
 685.25 1422.62  689.99  1420.3  694.32 1418.78  701.46 1416.87  707.42 1415.15
 710.17 1414.37   711.5 1414.27  717.62 1413.84  721.73 1413.54   741.3 1412.63
 744.96 1411.24  746.13 1410.97  752.83 1410.88  757.88 1409.99  763.71 1407.61
 765.97 1405.77  766.02 1405.73  766.04 1405.71  767.95 1404.45  777.53 1404.45
 784.81 1404.45  789.49 1405.25  789.99 1405.34   790.8 1405.42  809.42 1406.62
 815.67 1408.81  817.88 1409.78  829.77 1410.81  831.55    1411  835.26 1411.54
 848.69 1411.58  862.76 1412.16  864.72 1412.31  866.93 1412.47   868.3 1412.57
 869.83 1412.63  872.01 1412.73   875.1 1412.71  879.29 1412.57  881.42 1412.74
 884.66 1413.23  893.84  1413.2   899.7 1413.09  902.44 1412.76  906.82 1412.57
 915.05 1414.17  919.56 1415.45  926.11 1415.46  927.29 1415.43  933.33 1414.46
 933.77 1414.45  940.65  1413.6  941.49 1413.47  941.57 1413.38  941.66 1413.34
 947.37  1408.7  950.91 1408.51  952.63 1408.19  956.75 1407.18  957.02 1407.18
 957.35 1407.24  958.22 1407.04  965.38  1406.5     970 1405.87  973.67 1404.92
 976.84 1404.55  980.18 1404.24  984.06 1403.04  984.49 1402.89  987.14 1402.95
1000.99 1403.47 1015.68 1404.04 1016.98 1404.08 1018.21 1404.12 1018.76 1404.14
1026.28 1406.27 1026.74 1406.73 1027.27 1408.76 1028.16 1412.25 1033.47 1412.57
1035.12 1412.61 1035.14 1412.57 1035.95 1412.99 1036.01    1413 1037.66 1413.82
1039.42  1414.4  1056.6 1419.58  1064.2 1422.59 1074.93 1426.93 1080.34 1427.95
1084.26  1428.7 1090.03 1429.05 1097.21 1429.48 1099.67 1429.63 1101.07 1429.68
1126.14  1429.7 1126.91 1429.71 1128.88  1429.7 1133.99 1429.63 1142.52 1429.54
 1156.5 1429.39 1156.69 1429.76 1156.76 1429.89 1158.47 1429.76 1159.41 1429.69
 1160.9 1429.58 1169.02  1431.9 1171.89 1432.72 1177.48 1433.99 1181.83 1435.23
1185.46 1436.26 1193.53 1438.53 1194.65  1438.9  1199.3 1440.22 1207.33 1442.75
1211.87 1444.24 1214.33 1445.01  1226.2 1448.42 1236.68 1451.16 1241.52 1452.57
1246.87 1454.05 1253.82 1455.85 1265.08 1458.16 1267.45 1458.12 1273.29 1458.16
1275.92 1458.24 1290.84 1458.05 1300.44 1457.83 1304.58 1458.42 1304.65 1458.43
1304.97 1458.47 1317.12 1459.71 1318.61 1459.81 1330.56 1459.73 1335.71 1460.08
1355.55 1460.48  1358.8 1460.53

Manning's n Values         num=       5
     Sta   n Val     Sta   n Val     Sta    n Val     Sta    n Val     Sta   n Val
       0     .06  103.58    .013  559.35     .06  672.27     .045 1090.03     .06

Bank Sta: Left   Right     Lengths: Left Channel   Right     Coeff Contr.   Expan.
        661.6 1090.03            292.44  123.39   98.15              .1       .3
Ineffective Flow      num=       2
   Sta L    Sta R     Elev  Permanent
       0  641.07                F
 1133.03  1358.8                F

CROSS SECTION


RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA   RS: 14.48

INPUT
Description:
Station Elevation Data     num=     378
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0     1442     1.02     1442     9.72 1441.19    11.67     1441    11.87 1440.99
   11.93 1440.98    12.31 1440.92    17.32     1440     24.4     1440    33.79 1439.72
      42   1439.4    50.64 1439.02    50.95 1439.01    51.13     1439    60.12     1439
    76.9   1438.6    81.58 1438.37    82.93   1438.4    85.35 1438.27    86.86 1438.23
  106.73 1438.41   108.31 1438.39   109.46 1438.35   110.87 1438.27   115.37   1438.3
  117.07 1438.22   118.45     1438   125.83     1438   138.69 1438.67   145.25 1438.78
  147.29 1438.85   148.39 1438.86   154.03     1439   224.43     1439   228.38 1438.83
  228.97 1438.82   230.74 1438.76   233.45 1438.66   236.02 1438.54   241.53   1438.3
  247.51     1438   248.09     1438   250.66 1437.83   261.23     1437   265.49     1437
  270.81 1436.78   275.22 1436.62    290.7     1436   291.02 1435.98   291.25 1435.97
  299.05 1435.57   311.11     1435   324.97 1434.46   336.01     1434   341.05 1433.77
  361.33     1433   363.37 1432.86   367.33 1432.56   370.74 1432.33    374.9     1432
  379.12     1432   385.87 1431.44   398.07     1431   400.53     1431   417.88 1430.17
  418.83 1430.12   419.95 1430.08   421.49     1430   429.21     1430   435.72 1430.39
  437.74 1430.47   441.74 1430.57   449.05 1430.52   451.24 1430.48   456.58 1430.31
  466.98 1430.38   468.31 1430.36   469.81 1430.35   470.23 1430.35   482.97 1430.44
  490.69 1430.53   493.26   1430.6   494.49 1430.61   499.13 1430.58   502.41 1430.54
  505.05 1430.58   510.07 1430.48   510.71 1430.46   518.18 1430.05   518.39 1430.04
  518.89     1430   520.39     1429   521.01 1428.54   521.72     1428   521.96   1427.8
  522.74 1427.14   522.91     1427   523.35 1426.68   524.35     1426   526.36     1425
  528.36     1424   529.68 1423.43   530.63     1423    533.8 1422.05   533.91 1422.01
  537.23     1421   537.58 1420.88   540.53     1420   542.11 1419.64   544.85     1419
  548.18     1419    550.9 1419.81   551.53     1420   554.51 1420.89   554.88     1421
  555.94 1421.31   558.28     1422   559.22 1422.12   569.03 1422.94   569.79     1423
  572.27 1423.21   572.83 1423.23   573.24 1423.22   576.73 1423.37   578.34 1423.38
   582.5 1423.08   582.74 1423.07   583.26     1423   586.45 1422.11   587.93 1421.55
  589.67     1421   590.57 1420.73   593.02     1420   594.16 1419.72   597.97 1418.76
  600.93     1418   605.89 1417.13   606.47     1417   606.78     1417   607.61 1416.92
  611.94 1416.61   618.96     1416   631.54 1415.09   633.19     1415   634.83     1415
  637.54 1414.72    638.2 1414.67   640.33   1414.6   648.03 1414.43    650.02 1414.43
  651.39 1414.42    654.7 1414.52   661.83 1414.57   675.83 1414.48   696.48 1414.41
  703.78 1414.36   712.41 1414.35   718.46 1414.31   725.26 1414.21   728.36 1414.14
  733.01     1414   756.45 1413.38   758.86 1413.39   760.89 1413.36   764.18 1413.42
  777.88     1414   799.31     1414   803.69     1414   811.32 1413.27   811.78 1413.23
  814.25     1413   825.73 1412.15   826.96     1412   833.62     1412   850.35 1412.59
  858.01 1412.77   860.19 1412.72   861.19 1412.72   861.76 1412.73   869.29     1413
  872.61     1413   882.85 1413.45   883.36   1413.5   890.89 1413.85   892.47     1414
  893.38     1414   900.45   1414.4   901.44 1414.49   904.23 1414.63   907.94     1415
  911.54     1415   919.74 1415.45   921.57 1415.57   926.16     1416   926.44 1416.17
  926.63 1416.18   960.26     1417   962.99     1417   979.33     1418   984.15 1418.64
  984.34 1418.67   986.441418.936   986.95     1419   987.92 1419.35   989.87     1420
  990.32 1421.48   992.25   1421.7   992.58     1421   992.82 1421.24   993.66     1422
  993.92 1422.27   994.65     1423   995.57 1423.46   998.21 1424.27   1000.8 1424.74
1002.06     1425   1006.9 1425.96 1007.08     1426 1007.29 1426.04   1012.8     1427
1016.55 1427.73 1018.43     1428 1018.97   1428.8 1019.69 1429.66 1020.04     1430
1021.09 1430.76 1021.41     1431 1022.09 1431.36   1023.4     1432   1025.5 1432.67
1026.48     1433 1028.54   1433.7 1029.46     1434 1036.53 1434.82 1038.31     1435
1043.68     1435 1046.99     1435 1053.17 1435.24 1055.53   1435.4   1061.4   1435.7
1062.68 1435.74     1065     1436 1065.71     1436   1067.5 1436.46 1068.98 1436.87
1069.38     1437 1070.68 1437.45 1072.19     1438 1072.99 1438.29 1074.87     1439
1076.48 1439.54 1077.79     1440 1080.59 1440.89 1081.01     1441 1082.69 1441.47
1084.31     1442 1085.02 1442.23 1087.46     1443 1088.21 1443.25   1090.6     1444
1092.21 1444.54     1094     1445 1095.88 1445.46 1098.44     1446 1099.29   1446.2
1100.82 1446.47 1102.82   1446.8 1103.88     1447   1105.5 1447.32 1108.57     1448
1109.56 1448.26 1110.58   1448.5 1112.75     1449 1113.89 1449.31 1115.99 1449.69
1117.05 1449.87 1117.64     1450 1119.29 1450.36 1122.08     1451 1122.13 1451.01
1124.86   1451.7 1125.38 1451.76 1127.26     1452   1127.5 1452.02 1130.88 1452.37
1132.74 1452.34 1133.69 1452.34 1135.64 1452.31   1136.5 1452.31 1137.87 1452.29
1139.34 1452.26 1139.82 1452.26 1141.61     1452   1141.9 1451.96 1141.97 1451.95
1143.65 1451.73 1144.52   1451.6 1145.66 1451.45 1147.62 1451.15 1147.93 1451.11
1148.66     1451 1150.42 1450.74 1151.05 1450.66 1152.55 1450.44 1153.29 1450.35
1155.77     1450 1155.96 1449.97 1156.03 1449.96 1158.15 1449.65 1158.93 1449.54
1160.31 1449.36 1161.19 1449.23 1162.96     1449 1163.14 1448.97 1163.23 1448.96
1165.63 1448.66   1167.9 1448.37 1170.31 1448.32   1171.1 1448.31 1171.82 1448.29
1174.58 1448.24 1175.19 1448.23 1178.34 1448.17 1178.77 1448.16 1179.14 1448.15
1182.75 1448.08 1182.94 1448.08 1186.46 1448.12 1186.82 1448.12   1187.2 1448.13
1190.25 1448.17 1190.79 1448.17 1194.12 1448.21   1194.8 1448.22 1198.55 1448.26
1199.77 1448.27 1201.62 1448.41 1204.65 1448.68 1205.13 1448.72 1208.66 1448.95
1209.41     1449   1211.1   1449.1   1211.5 1449.12   1215.3   1449.3 1217.01 1449.36
1219.85 1449.48 1222.68 1449.58 1223.64 1449.61 1226.21 1449.72   1228.5 1449.79
1233.67 1449.92 1234.37 1449.94 1236.93     1450 1239.63 1450.07 1240.12 1450.07
1249.16 1450.27 1251.04 1450.27   1253.6 1450.32 1256.87 1450.37 1265.78 1450.63
1268.36 1450.71 1274.91 1450.89 1275.86 1450.93 1276.85     1451 1287.15 1451.55
1294.87 1451.83 1296.67 1451.91 1298.07     1452 1303.96 1452.57 1308.21 1452.81
1311.12     1453 1316.74 1453.47 1319.47 1453.63 1325.46     1454 1328.43 1454.25
1330.58 1454.36 1331.82 1454.43 1334.66 1454.65

Manning's n Values         num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .06  578.34    .045 1038.31     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        578.34 1038.31             54.23   14.48   13.53             .3      .5
Ineffective Flow      num=       1
   Sta L    Sta R    Elev  Permanent
       0  578.88  1439.6        F
```

SUMMARY OF MANNING'S N VALUES

River:LV_WASH

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
R1 - 3 KIDS_INTA	405.15	.06	.13	.035	.13	.06	.045	.06
R1 - 3 KIDS_INTA	307.97	.06	.013	.06	.045	.06		
R1 - 3 KIDS_INTA	182.42	.06	.13	.06	.045	.06		
R1 - 3 KIDS_INTA	137.87	.06	.013	.06	.045	.06		
R1 - 3 KIDS_INTA	14.48	.06	.045	.06				

SUMMARY OF REACH LENGTHS

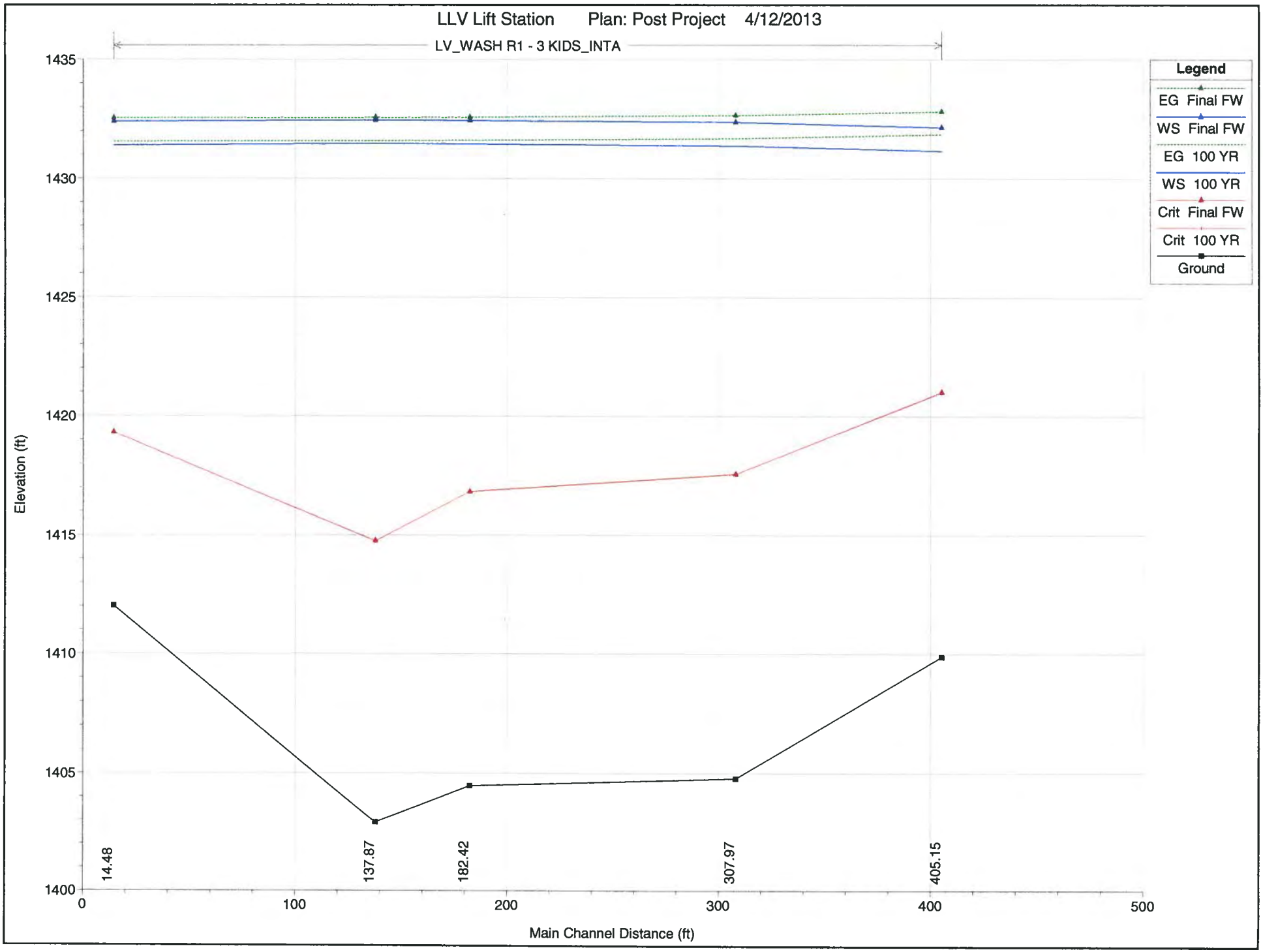
River: LV_WASH

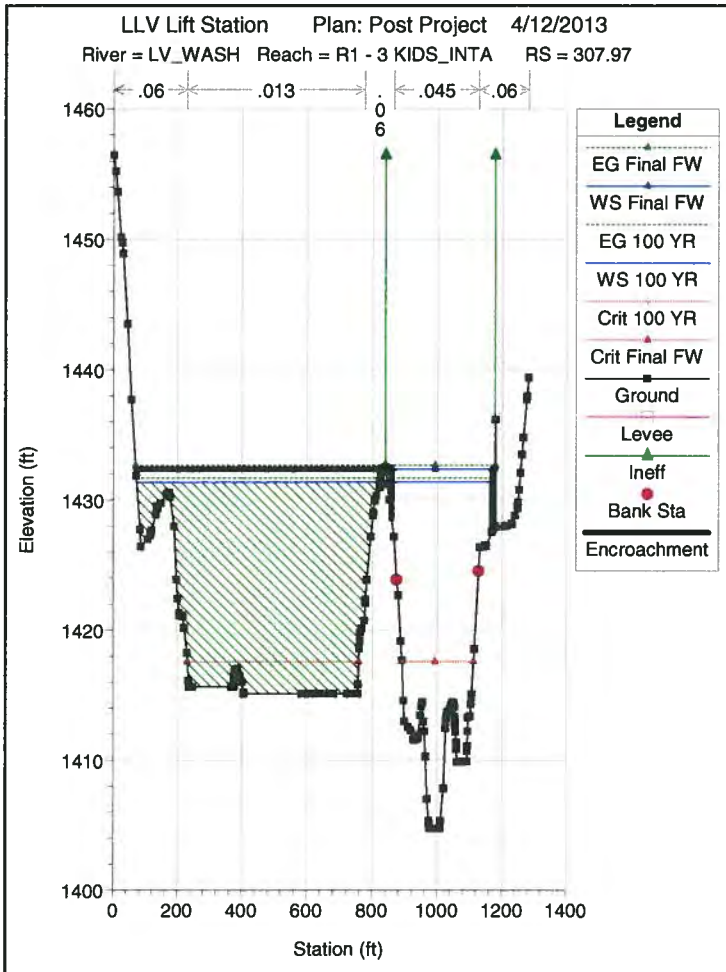
Reach	River Sta.	Left	Channel	Right
R1 - 3 KIDS_INTA	405.15	96.2	97.18	102.46
R1 - 3 KIDS_INTA	307.97	131.85	125.55	126.04
R1 - 3 KIDS_INTA	182.42	43.46	44.55	57.38
R1 - 3 KIDS_INTA	137.87	292.44	123.39	98.15
R1 - 3 KIDS_INTA	14.48	54.23	14.48	13.53

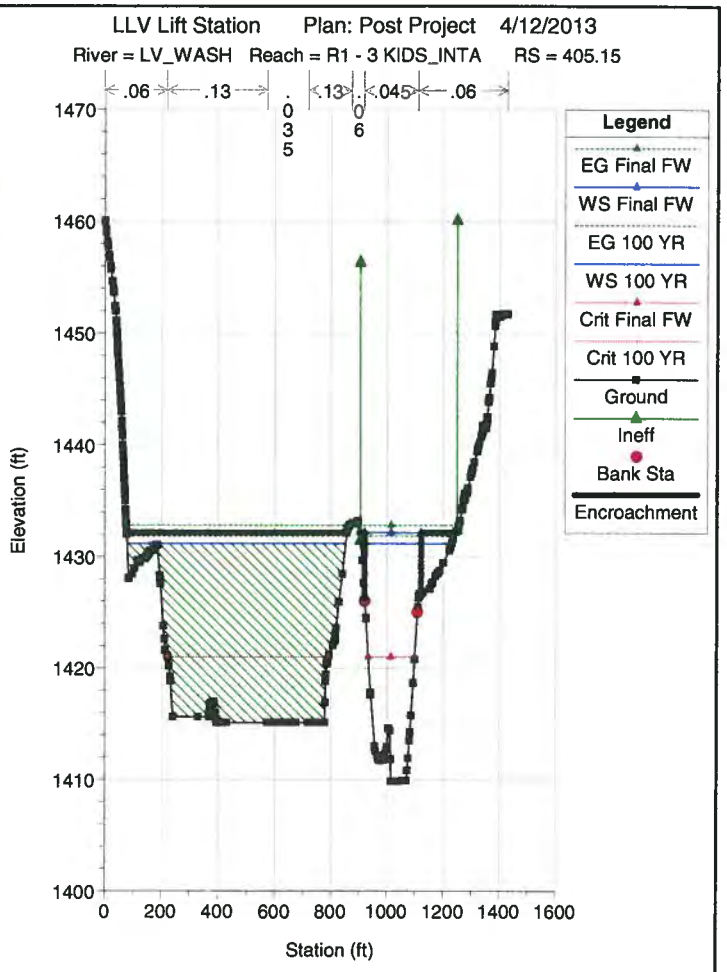
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: LV_WASH

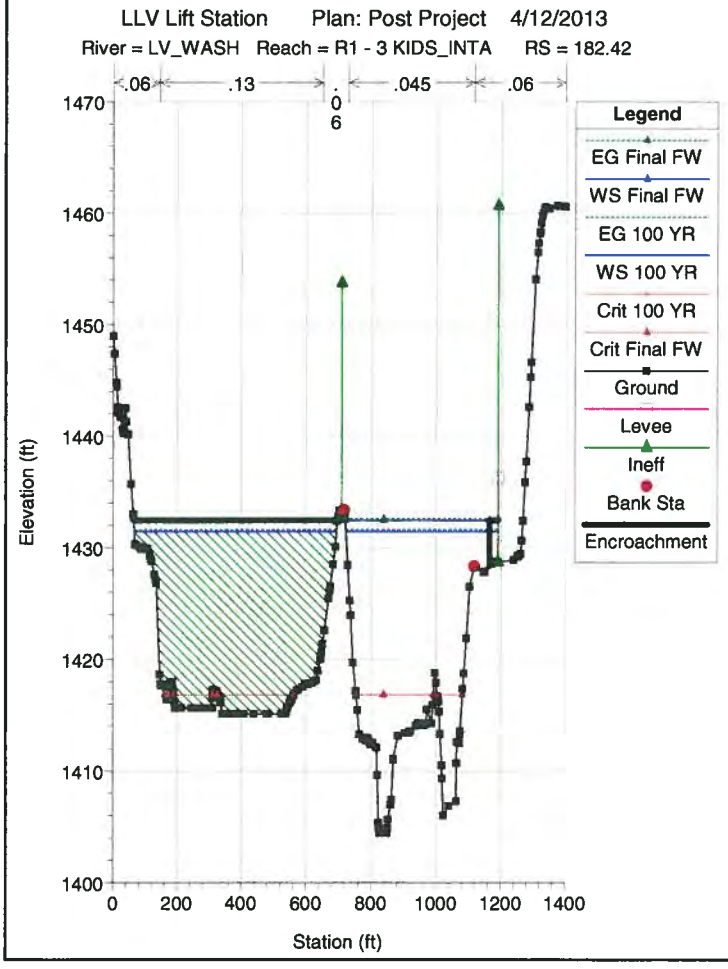
Reach	River Sta.	Contr.	Expan.
R1 - 3 KIDS_INTA	405.15	.1	.3
R1 - 3 KIDS_INTA	307.97	.1	.3
R1 - 3 KIDS_INTA	182.42	.1	.3
R1 - 3 KIDS_INTA	137.87	.1	.3
R1 - 3 KIDS_INTA	14.48	.3	.5

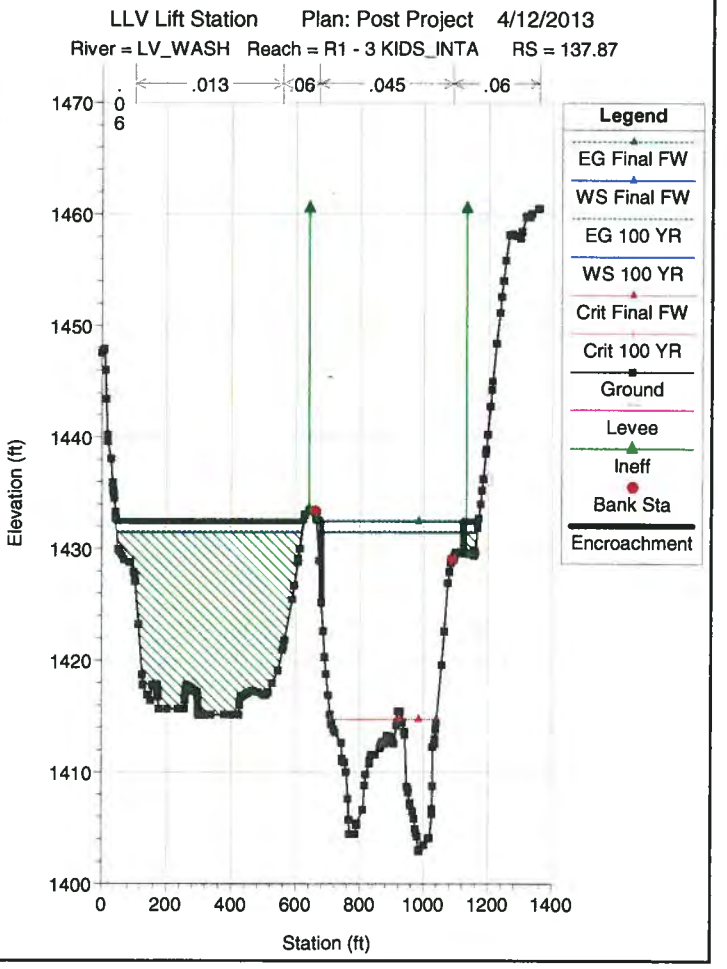
Post-Project Hydraulic Analysis

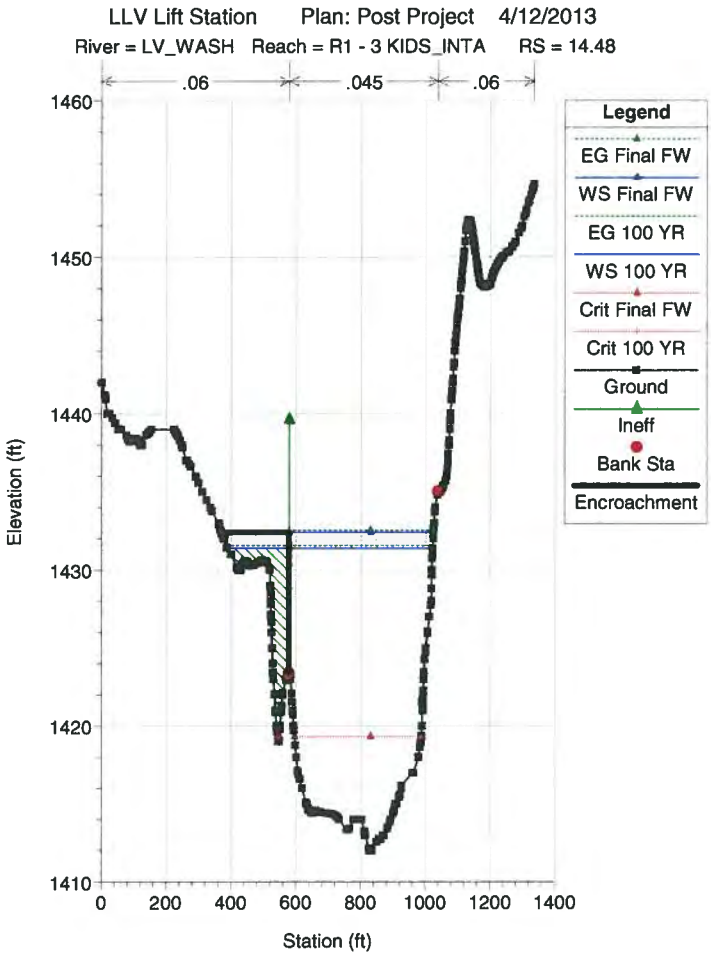

LLV Lift Station Plan: Post Project 4/12/2013
LV_WASH R1 - 3 KIDS_INTA
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit Final FW
Crit 100 YR
Ground
Elevation (ft)
1435
1430
1425
1420
1415
1410
1405
1400
0
100
200
300
400
500
Main Channel Distance (ft)
14.48
137.87
182.42
307.97
405.15


LLV Lift Station Plan: Post Project 4/12/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 307.97
.06 .013 .06 .045 .06
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit 100 YR
Crit Final FW
Ground
Levee
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


LLV Lift Station Plan: Post Project 4/12/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 405.15
.06 .13 .035 .13 .06 .045 .06
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit Final FW
Crit 100 YR
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


LLV Lift Station Plan: Post Project 4/12/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 182.42
.06 .13 .06 .045 .06
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit 100 YR
Crit Final FW
Ground
Levee
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


LLV Lift Station Plan: Post Project 4/12/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 137.87
.06 .013 .06 .045 .06
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit Final FW
Crit 100 YR
Ground
Levee
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


LLV Lift Station Plan: Post Project 4/12/2013
River = LV_WASH Reach = R1 - 3 KIDS_INTA RS = 14.48
.06
.045
.06
Legend
EG Final FW
WS Final FW
EG 100 YR
WS 100 YR
Crit Final FW
Crit 100 YR
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1460
1450
1440
1430
1420
1410
0
200
400
600
800
1000
1200
1400
Station (ft)

HEC-RAS Plan: Post Project River: LV_WASH Reach: R1 - 3 KIDS_INTA

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
R1 - 3 KIDS_INTA	405.15	100 YR	22530.00	1409.86	1431.17	1421.00	1431.86	0.000994	6.76	3631.18	1099.23	0.29
R1 - 3 KIDS_INTA	405.15	Final FW	22530.00	1409.86	1432.16	1421.02	1432.82	0.000861	6.52	3508.78	202.00	0.27
R1 - 3 KIDS_INTA	307.97	100 YR	22530.00	1404.76	1431.38	1417.59	1431.69	0.000382	4.51	5224.60	1085.43	0.18
R1 - 3 KIDS_INTA	307.97	Final FW	22530.00	1404.76	1432.38	1417.58	1432.66	0.000322	4.29	5487.42	312.00	0.17
R1 - 3 KIDS_INTA	182.42	100 YR	22530.00	1404.45	1431.45	1416.84	1431.61	0.000217	3.18	7256.84	1097.54	0.13
R1 - 3 KIDS_INTA	182.42	Final FW	22530.00	1404.45	1432.44	1416.84	1432.58	0.000183	3.01	7624.04	445.50	0.12
R1 - 3 KIDS_INTA	137.87	100 YR	22530.00	1402.89	1431.47	1414.74	1431.59	0.000148	2.78	8158.02	1073.55	0.11
R1 - 3 KIDS_INTA	137.87	Final FW	22530.00	1402.89	1432.46	1414.75	1432.57	0.000124	2.66	8535.18	443.00	0.10
R1 - 3 KIDS_INTA	14.48	100 YR	22530.00	1412.00	1431.40	1419.30	1431.56	0.000250	3.24	6951.28	635.20	0.14
R1 - 3 KIDS_INTA	14.48	Final FW	22530.00	1412.00	1432.40	1419.31	1432.54	0.000205	3.05	7395.69	446.31	0.13

HEC-RAS Plan: Post Project River: LV_WASH Reach: R1 - 3 KIDS_INTA

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
R1 - 3 KIDS_INTA	405.15	100 YR	1431.86	1431.17	0.69	0.06	0.11	37.68	21914.49	577.83	1099.23
R1 - 3 KIDS_INTA	405.15	Final FW	1432.82	1432.16	0.66	0.05	0.11	1.45	22380.40	148.15	202.00
R1 - 3 KIDS_INTA	307.97	100 YR	1431.69	1431.38	0.31	0.04	0.05	147.07	22074.56	308.37	1085.43
R1 - 3 KIDS_INTA	307.97	Final FW	1432.66	1432.38	0.28	0.03	0.04	161.20	22040.01	328.79	312.00
R1 - 3 KIDS_INTA	182.42	100 YR	1431.61	1431.45	0.16	0.01	0.01		22344.02	185.98	1097.54
R1 - 3 KIDS_INTA	182.42	Final FW	1432.58	1432.44	0.14	0.01	0.01		22351.77	178.23	445.50
R1 - 3 KIDS_INTA	137.87	100 YR	1431.59	1431.47	0.12	0.02	0.00		22493.52	36.48	1073.55
R1 - 3 KIDS_INTA	137.87	Final FW	1432.57	1432.46	0.11	0.02	0.00		22480.04	49.96	443.00
R1 - 3 KIDS_INTA	14.48	100 YR	1431.56	1431.40	0.16				22530.00		635.20
R1 - 3 KIDS_INTA	14.48	Final FW	1432.54	1432.40	0.14				22530.00		446.31

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X     X
X     X  X        X            X   X    X    X    X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: LLV Lift Station
Project File : LLVLiftStation.prj
Run Date and Time: 4/12/2013 8:27:29 AM

Project in English units

Project Description:
LOMR model for SNWA Reach of Las Vegas Wash
Lake Las Vegas to Flamingo Road

PLAN DATA

Plan Title: Post Project
Plan File : X:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.p12

Geometry Title: Post Project
Geometry File : X:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.g15

Flow Title : Post Project
Flow File : X:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.f12

Plan Description:
The flood wall is added at XSs 307.97; 182.42 and 137.87

Plan Summary Information:
Number of: Cross Sections = 5 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = LV_WASH Reach = R1 - 3 KIDS_INTA

RS	Profile	Method	Value1	Value2
405.15	Final FW	1	920	1122
307.97	Final FW	1	858	1170
182.42	Final FW	1	710	1165
137.87	Final FW	1	680	1123
14.48	Final FW	1	578.34	1038.31

River = LV_WASH Reach = R1 - 3 KIDS_INTA

RS	Profile	Method	Value1	Value2
405.15	M1 Initial FW	1	920	1122
307.97	M1 Initial FW	0	0	0
182.42	M1 Initial FW	1	710	1165
137.87	M1 Initial FW	0	0	0
14.48	M1 Initial FW	1	578.34	1038.31

River = LV_WASH Reach = R1 - 3 KIDS_INTA

RS	Profile	Method	Value1	Value2
405.15	Initial FW	1	920	1122
307.97	Initial FW	0	0	0
182.42	Initial FW	1	710	1165
137.87	Initial FW	0	0	0
14.48	Initial FW	4	1	

FLOW DATA

Flow Title: Post Project
Flow File : X:\Projects\100030858-LLVLSFloodWall\CLDMR\CD-Data\HEC-RAS\LLVLiftStation.f12

Flow Data (cfs)

River	Reach	RS	100 YR	Final FW	M1 Initial FW	Initial FW
LV_WASH	R1 - 3 KIDS_INTA	405.15	22530	22530	22530	22530

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
LV_WASH	R1 - 3 KIDS_INTA	100 YR		Known WS = 1431.4
LV_WASH	R1 - 3 KIDS_INTA	Final FW		Known WS = 1432.4
LV_WASH	R1 - 3 KIDS_INTA	M1 Initial FW		Known WS = 1432.4
LV_WASH	R1 - 3 KIDS_INTA	Initial FW		Known WS = 1432.4

GEOMETRY DATA

Geometry Title: Post Project
Geometry File : X:\Projects\100030858-LLVLSFloodWall\CLOMR\CD-Data\HEC-RAS\LLVLiftStation.g15

CROSS SECTION

RIVER: LV_WASH
REACH: R1 - 3 KIOS_INTA RS: 405.15

INPUT
Description:
Station Elevation Data num= 316

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1460.08	.39	1460	2.94	1459.28	3.95	1459	7.65	1458.24
8.62	1458	9.79	1457.77	14.16	1457	15.38	1456.73	19.31	1456
20.57	1455.74	26.16	1454.63	29.55	1454	31.14	1453.62	35.7	1452.41
37.13	1452	39.79	1451.12	40.3	1451	41.33	1450.39	41.83	1450
42.97	1449.42	43.72	1449	44.82	1448.38	45.54	1448	47.42	1447.27
48.04	1447	49.38	1446.54	50.74	1446	52.92	1445.28	53.9	1445
54.64	1444.61	55.67	1444	56.53	1443.51	57.39	1443	58.92	1442.18
59.21	1442	59.55	1441.81	60	1441.58	60.95	1441	61.3	1440.8
62.66	1440	63.34	1439.61	64.42	1439	65.41	1438.47	66.27	1438
67.4	1437.4	68.15	1437	69.23	1436.43	69.9	1436	70.67	1435.56
71.6	1435	73.03	1434.2	73.38	1434	74.02	1433.64	75.05	1433
76.03	1432.38	76.65	1432	84.51	1428.05	85.22	1428.1	96.55	1428.46
104.47	1428.93	116.12	1429.66	116.29	1429.68	121.71	1429.61	123.98	1429.5
140.55	1429.82	142.19	1429.84	142.62	1429.85	144.3	1429.92	146.04	1429.98
146.67	1430	148.34	1430.06	149.96	1430.12	150.15	1430.12	151.7	1430.18
153.16	1430.23	154.78	1430.29	156.42	1430.35	157.54	1430.38	159.09	1430.43
160.56	1430.48	174.59	1430.6	175.2	1430.61	175.65	1430.62	175.98	1430.62
176.23	1430.62	176.4	1430.63	177.38	1430.62	182.73	1431.01	184.4	1431.04
194.42	1428.31	195.66	1427.98	196.07	1427.8	196.62	1427.58	206.32	1423.79
209.64	1422.62	212.31	1421.66	220.2	1421.15	224	1420.96	227.22	1420.22
232.03	1419.23	232.93	1418.87	240.26	1415.65	328.84	1415.65	370.36	1415.65
371.04	1416.01	372.11	1416.62	372.16	1416.65	372.22	1416.65	373.25	1416.84
380.18	1416.94	383.75	1416.99	383.93	1416.99	384.49	1417	385.82	1416.84
390.3	1416.03	393.55	1415.35	394.72	1415.12	394.98	1415.12	395.12	1415.12
398.99	1415.12	400.53	1415.12	407.21	1415.12	408.57	1415.12	416.12	1415.12
418.55	1415.12	428.43	1415.12	573.25	1415.12	581.67	1415.12	586.27	1415.12
615.25	1415.12	623.43	1415.12	639.45	1415.12	642.75	1415.12	662.23	1415.12
672.68	1415.12	675.03	1415.12	718.08	1415.12	745.2	1415.12	746.29	1415.12
752.83	1415.12	753.86	1415.12	778.38	1415.12	779.53	1416.93	781.24	1418.84
782.96	1419.43	785.5	1420.39	786.82	1420.52	786.86	1420.53	786.91	1420.53
786.95	1420.54	787	1420.54	787.04	1420.55	787.08	1420.55	787.12	1420.55
787.15	1420.56	787.17	1420.56	793.47	1421.18	793.64	1421.22	806.9	1422.03
807.12	1422.06	807.34	1422.09	807.55	1422.12	812.97	1422.43	814.46	1422.49
816.29	1423.03	818.26	1423.61	828.15	1425.97	840.77	1428.45	857.14	1432.15
858.96	1432.53	860.19	1432.6	864.66	1432.77	866.52	1432.85	867.03	1432.85
877.67	1433.06	895.8	1433.18	896.31	1433.19	896.35	1433.18	896.56	1433.14
912.85	1429.7	917.02	1427.66	920.53	1426	924.42	1424.56	924.58	1424.47
940.64	1417.83	940.93	1417.7	941.08	1417.64	941.23	1417.62	941.3	1417.61
956.22	1413.04	957.15	1412.86	959.05	1412.58	965.7	1412.17	969.61	1411.89
970.55	1411.82	971.28	1411.8	974.74	1411.83	977.58	1411.75	985.56	1411.79
988.82	1411.98	992.46	1412.28	999.5	1412.86	999.97	1412.91	1000.08	1412.91
1000.21	1412.95	1000.29	1412.98	1003.95	1414.6	1005.74	1414.62	1010.62	1414.41
1013.22	1411.84	1014.66	1409.86	1041.94	1409.89	1055.83	1409.9	1069.36	1409.91
1072.59	1410.84	1076.03	1411.93	1080.82	1413.51	1082.98	1414.27	1086.43	1415.76
1093.39	1418.68	1098.54	1420.79	1109.111424.995		1110.38	1425.5	1112.49	1426.33
1114.69	1426.53	1116.01	1426.66	1116.76	1426.6	1117.86	1426.49	1122.07	1426.64
1126.02	1426.77	1126.83	1426.8	1129.3	1426.85	1152.77	1427.13	1159.23	1427.57
1162.86	1427.71	1173.39	1428.27	1178.59	1428.47	1182.46	1428.56	1187.63	1428.75
1187.75	1428.77	1200.26	1429.46	1222.38	1430.54	1225.82	1430.8	1230.97	1431.2
1235.55	1431.57	1248.31	1432.28	1255.97	1432.79	1260.13	1433.15	1260.48	1433.2
1268.07	1434.24	1268.4	1434.28	1268.54	1434.3	1268.99	1434.36	1273.69	1435.04
1275.41	1435.27	1276.59	1435.43	1278.18	1435.63	1278.35	1435.65	1278.57	1435.46
1278.88	1435.2	1279.2	1435.23	1284.13	1435.73	1286.49	1435.96	1288.47	1436.16
1297.57	1437.14	1300.79	1437.48	1301.48	1437.55	1302.08	1437.61	1303.08	1437.72
1304.13	1437.83	1304.73	1437.89	1310.31	1438.46	1320.85	1439.41	1321.61	1439.48
1322.48	1439.56	1324.37	1439.72	1327.92	1440.04	1330.24	1440.24	1335.69	1440.73
1337.45	1440.89	1340.94	1441.19	1341.08	1441.34	1341.46	1441.74	1342.48	1441.72
1343.91	1441.69	1346.26	1441.66	1347.89	1441.63	1348.82	1441.62	1349.94	1441.6
1353.62	1441.56	1355.66	1442.15	1357.01	1442.51	1362.05	1443.86	1362.55	1443.98
1363.64	1444.25	1368.91	1445.53	1370.87	1445.97	1372.73	1446.47	1379.4	1448.85
1384.55	1450.64	1385.63	1450.99	1386.98	1451.35	1387.57	1451.49	1388.15	1451.66
1398.42	1451.5	1402.67	1451.49	1410.43	1451.66	1412.95	1451.68	1416.11	1451.7
1416.79	1451.71	1418.38	1451.72	1420.8	1451.73	1424.07	1451.72	1427.29	1451.68
1428.51	1451.7								

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.06	220.2	.13	573.25	.035	718.08	.13	877.67	.06
920.53	.045	1110.38	.06						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
920.53 1109.11 96.2 97.18 102.46 .1 .3
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	904.66	1456.29	F
1250	1428.51		F

CROSS SECTION

RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA RS: 307.97

INPUT
Description:
Station Elevation Data num= 207

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1456.46	5.72	1455.23	11.93	1453.63	22.43	1450.16	26.57	1449.73
29.98	1448.9	44.11	1443.5	55.98	1437.71	70.87	1431.86	82.72	1427.74
84.92	1426.42	107.29	1427	113.72	1427.3	115.13	1427.45	115.73	1427.51
116.64	1427.45	119.18	1427.69	132.15	1428.9	133.93	1429.26	134.45	1429.53
137.11	1429.42	139.21	1429.4	147.93	1429.75	166.37	1430.47	171.74	1430.55
174.12	1430.56	174.97	1430.44	176.3	1430.25	189.74	1427.98	197.07	1423.89
200.33	1422.42	205.69	1421.32	206.3	1421.14	214.57	1421.11	217.39	1421.03
221.03	1420.18	229.87	1418.26	235.14	1416.11	236.59	1415.65	244.6	1415.65
248.42	1415.65	368.6	1415.65	372.83	1415.65	374.74	1415.65	375.99	1415.65
376.41	1415.94	377.29	1416.37	377.31	1416.38	378.13	1416.84	382.5	1416.99
387.38	1417.06	390.2	1416.61	395.33	1416.45	401.41	1416.03	406.04	1415.2
406.34	1415.12	406.79	1415.12	584.06	1415.12	590.79	1415.12	596.37	1415.12
619.26	1415.12	625.74	1415.12	638.44	1415.12	642.62	1415.12	667.3	1415.12
680.51	1415.12	682.25	1415.12	722.85	1415.12	736.04	1415.12	755.05	1415.12
755.38	1415.12	756.04	1415.12	756.84	1415.86	759.73	1418.58	761.16	1419.15
762.79	1419.82	766.93	1420.12	775.11	1420.74	778.15	1422.1	778.77	1422.38
782.76	1423.88	794.25	1427.19	801.15	1428.81	802.3	1429.03	805.97	1429.93
811.62	1430.34	822.32	1431	823.35	1431.32	825.49	1431.88	828.65	1432.41
838.89	1432.51	841.4	1432.5	842.36	1432.16	844.32	1431.25	850.61	1430.02
864.72	1427.19	874.25	1423.87	878.47	1422.69	886.96	1419.17	890.6	1417.69
895.96	1414.59	898.5	1413	910.78	1412.55	918.75	1412.3	927.81	1411.62
929.13	1411.55	930.3	1411.55	936.62	1411.64	938.54	1411.67	941.13	1411.71
941.91	1411.91	947	1413.46	950.97	1414.18	954.32	1414.41	955.38	1414.48
958.53	1412.98	960.12	1412.22	964.19	1410.28	969.42	1407.02	973.77	1405.34
974.94	1405.15	976.28	1404.99	977.3	1404.76	981.7	1404.76	985.74	1404.76
988.26	1404.76	993.13	1404.76	995.88	1404.76	998.85	1404.76	1002.23	1404.76
1005.1	1404.76	1008.37	1404.76	1008.43	1404.76	1008.52	1404.76	1008.76	1404.76
1009.05	1404.85	1011.18	1405.34	1019.15	1407.8	1019.2	1407.82	1019.24	1407.84
1019.29	1407.86	1026.08	1412.46	1027.94	1413.08	1029	1413.36	1031.9	1413.71
1032.84	1413.71	1038.43	1413.92	1043.89	1414.25	1045.38	1414.25	1046.87	1414.48
1050.03	1414.39	1053.44	1414.09	1054.82	1413.33	1055.64	1412.76	1056.84	1412.19
1059.03	1411.37	1059.71	1410.85	1060.85	1409.86	1072.59	1409.88	1076.13	1409.89
1081.1	1409.9	1091.72	1409.91	1092.37	1410.7	1092.73	1411.09	1093.96	1412.22
1094.98	1413.29	1100.05	1413.37	1100.75	1413.37	1102.13	1413.38	1104.43	1414.31
1105.84	1414.87	1106.26	1415.05	1114.05	1418.56	1126.76	1424.53	1130.84	1426.39

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1140.96 1426.41 1146.46 1426.51 1147.49 1426.53  1149.3 1426.52 1150.93 1426.45
1167.47 1427.54 1167.49 1427.55 1167.51 1427.55 1171.95 1427.74  1177.5 1427.99
1177.61 1427.99 1178.13 1427.99 1178.13 1436.17 1179.73 1436.17 1179.73 1427.97
1208.73 1427.97 1215.49 1428.03 1228.93 1428.22 1231.68 1428.15 1239.71 1428.81
1247.09 1429.55  1248.7 1429.38 1250.16 1429.82 1250.43 1429.83 1253.15 1430.78
1257.35 1432.09  1262.4 1433.49 1266.26 1434.79 1276.84 1437.73 1277.55 1437.98
1282.93  1439.4 1282.96 1439.41

Manning's n Values         num=       5
     Sta   n Val      Sta   n Val      Sta   n Val      Sta   n Val      Sta   n Val
       0     .06  229.87    .013  775.11     .06  864.72    .045 1126.76     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       874.25 1126.76           131.85  125.55  126.04             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  838.89                F
 1177.61 1282.96                F
Right Levee     Station= 1179.73      Elevation= 1436.17

CROSS SECTION


RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA   RS: 182.42

INPUT
Description:
Station Elevation Data    num=     258
      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
        0 1448.97      .34 1448.99     3.84 1447.38     9.96 1444.78       11 1444.41
    15.34 1442.54    16.21 1442.18    16.43 1442.09    16.95 1442.08    22.65 1441.72
    29.02  1440.6    31.54 1440.27    33.24 1440.68    37.29 1442.49     39.7 1441.29
    46.77 1440.14    55.19 1435.69    62.82 1433.02    63.69 1432.73    67.84 1430.31
    72.28 1430.21    83.53 1430.06    86.17 1429.93    87.33 1429.86   101.93  1429.9
   108.16 1429.92   114.59 1429.28   117.57 1428.98   119.79 1428.77   129.05 1427.6
   133.42 1427.07   134.62 1426.83   146.21 1418.64   147.91  1417.8   149.82 1417.67
   168.19 1416.39   171.95 1417.49   172.57 1417.71   177.72  1417.8   185.92 1417.97
   188.15 1417.34   189.84  1416.8   192.28 1416.12   193.62 1415.65   207.52 1415.65
   214.05 1415.65   245.39 1415.65   258.05 1415.65   282.07 1415.65   286.15 1415.65
   291.28 1415.65   295.61 1415.65   299.69 1415.65   303.92 1415.65   306.18 1415.65
   310.36 1415.65   311.85 1416.58   312.09  1416.8   312.18 1416.83   313.25 1417.26
   317.55 1417.21    319.6 1417.19   324.47 1417.13   326.63 1416.86   330.18  1416.7
   335.55 1416.46   336.72 1416.15   341.73 1415.12   346.18 1415.12   346.58 1415.12
   362.75 1415.12   365.94 1415.12   367.62 1415.12   370.26 1415.12   378.13 1415.12
   383.14 1415.12   392.17 1415.12   400.09 1415.12   406.41 1415.12   409.81 1415.12
   440.26 1415.12   478.74 1415.12    480.5 1415.12   484.45 1415.12   524.68 1415.12
   533.28 1415.12    534.8 1415.12   535.99 1415.14    538.9 1415.18   539.96 1415.32
   543.32 1415.63   543.82 1415.68   544.09 1415.72   549.75 1416.08   551.73 1416.19
   555.68 1416.43   556.49 1416.48   560.76 1416.71   563.42 1416.86   570.64 1417.22
   570.73 1417.22   570.84 1417.22   575.62 1417.29   588.88 1417.51    589.6 1417.52
   589.65 1417.52   589.83 1417.53   598.16 1417.79   605.34 1417.78   612.02 1417.85
   617.73 1417.86   625.78 1418.04   627.64 1418.05   631.33 1418.16   636.57 1418.97
   644.15 1420.02   646.98 1420.63    650.8 1421.39   655.98  1422.6   669.49 1425.45
   672.69 1426.12   674.59 1426.52   683.16  1428.5   690.08  1430.1   695.36 1432.39
      699 1432.77   701.59 1433.34   710.83 1433.36   716.04 1433.39   717.85 1433.02
   718.67 1432.86   727.47 1428.46   733.79 1425.27   736.25 1423.95   744.04 1419.69
   752.21 1417.17   753.45 1416.81    757.5 1415.46    763.9 1413.29   773.05 1412.89
   783.25 1412.76   786.55 1412.96   789.29 1412.91    791.5 1412.79   794.54  1412.6
   798.35 1412.38   803.64 1412.52   803.77 1412.53   805.18 1412.48   816.54 1412.09
   818.97 1409.61   823.35 1405.34   824.88 1404.86   826.18 1404.45   834.41 1404.45
   849.02 1404.45    850.1 1404.84   852.35 1405.66   860.16 1406.98   863.08  1407.4
   868.05     1411  868.18 1411.08   881.27 1413.14   881.33 1413.15   881.59 1413.16
   881.92 1413.16   883.41 1413.18   902.35  1413.4    903.3 1413.42   908.59 1413.42
   915.16 1413.42   915.96 1413.49   916.64 1413.52    920.9 1413.58   938.21 1414.08
   944.15 1414.25   945.34 1414.26   947.13 1414.27   948.45 1414.28   951.92 1414.23
   954.04 1414.22   957.91 1414.18   959.62 1414.15   960.59 1414.14   962.74 1414.11
    965.3 1414.16   967.03  1414.2   967.65 1414.21   968.67 1414.27   972.03 1415.51
   972.17 1415.53   972.39 1415.52   986.67 1414.27   989.93 1415.94   995.67 1418.78
   999.49 1417.93 1002.45 1416.65 1005.05 1416.69 1008.11 1416.21 1009.73 1415.31
  1012.91 1413.32 1017.51 1410.52 1019.11 1409.33 1022.66 1406.02 1040.07 1406.86
  1062.59 1407.28 1063.59 1410.72 1064.52 1412.61 1069.19 1412.57 1071.86 1412.51
  1073.83 1413.26 1074.49 1413.55 1082.47 1417.38 1085.66 1418.76 1092.87 1421.88
   1103.3  1426.5 1116.51 1428.22 1117.18 1428.31 1117.29 1428.33 1117.52 1428.32
  1119.18 1428.29 1145.51 1427.78 1148.46 1427.83 1149.83 1427.87 1170.55 1428.56
  1181.53 1428.72 1189.83 1428.72  1190.7 1428.72  1191.7 1428.72 1238.94 1428.92
   1250.8 1429.28 1252.79 1429.21 1257.22 1429.32 1260.87 1429.46 1263.88 1430.65
  1267.74 1432.42 1274.28 1435.86 1277.87 1437.73  1286.8 1442.62 1291.81  1445.3
  1294.11 1446.64 1307.08 1454.06 1313.42 1456.48 1315.49  1457.3 1319.87 1458.21
  1320.34 1458.31 1323.83 1459.11 1326.34 1459.74 1329.24 1460.03     1333 1460.38
  1336.26 1460.59 1345.13 1460.43 1348.95 1460.42 1374.44 1460.68 1382.39 1460.61
   1390.6 1460.61 1393.92 1460.62     1399 1460.57

Manning's n Values         num=       5
     Sta   n Val      Sta   n Val      Sta   n Val      Sta   n Val      Sta   n Val
       0     .06  146.21     .13   650.8     .06  727.47    .045 1116.51     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       716.04 1117.29            43.46   44.55   57.38             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  709.31 1453.75         F
  1190.7    1399                 F
Right Levee     Station=  1191.7      Elevation= 1436.26

CRDSS SECTION


RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA   RS: 137.87

INPUT
Description:
Station Elevation Data    num=     267
      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
        0 1447.54     5.42 1447.77     8.09  1447.9    10.64 1446.01    13.53  1443.4
    17.67 1440.19     18.2 1439.78    18.35 1439.67    18.87 1439.59    28.94 1438.03
    33.87 1435.91    34.61 1435.55    36.02 1435.19     37.4 1434.94    38.43  1434.5
    42.55 1433.31    43.97 1432.66    50.59 1429.96    55.67 1429.74    60.91 1429.53
    65.85 1429.35    69.38 1429.09    70.28 1429.01    85.64 1428.83    88.37 1428.77
    98.67 1427.91   101.94 1427.63   103.58 1427.05   114.36 1423.24   124.95 1418.71
   127.23  1417.8   142.01 1416.92   151.12 1416.39   158.19 1417.78    158.3 1417.81
   158.77 1417.81   159.39 1417.81   171.76 1417.83   172.48 1417.47   173.65 1416.97
   174.25 1416.73    176.4 1415.65   202.45 1415.65   236.43 1415.65   248.66 1415.65
   249.48 1415.65   255.32 1415.65   256.99 1416.42   258.36 1416.87   260.25 1417.19
   260.83 1417.36   262.33 1417.74   262.41 1417.76    265.9 1417.68   268.74 1417.62
   271.05 1417.57   272.98 1417.53   274.62   1417.5   276.05 1417.48   276.83 1417.46
   278.07 1417.44   279.17 1417.43   279.28 1417.42   280.17  1417.4   282.28 1417.35
   283.24 1417.33   284.39 1417.31   285.75 1417.29   289.23  1417.2   290.32 1417.19
   290.38 1417.19   295.71 1417.16   295.95 1417.07   296.53 1416.83   297.74 1416.31
   298.57  1415.6   298.99 1415.25   299.29 1415.12   311.01 1415.12   312.97 1415.12
   321.77 1415.12   325.51 1415.12   326.27 1415.12   336.91 1415.12   337.89 1415.12
   379.43 1415.12   404.05 1415.12   423.69 1415.12   426.01 1415.98   426.15 1416.08
   426.51 1416.16   428.83 1416.74   431.07 1416.75   432.46 1416.77   432.57 1416.77
   441.18 1416.89    448.9 1417.04   451.46 1417.07   456.11 1417.16   463.59 1417.23
   465.97 1417.24   466.61 1417.25   468.87 1417.26   483.04 1417.17   495.58 1416.96
   502.98 1416.88   506.57 1416.88   514.42 1417.14   527.25 1417.98   545.44 1419.08
   559.35 1420.93   561.56 1421.28   564.96 1421.82   589.26 1425.46   595.67 1426.72
   606.39 1428.84      608 1429.12   612.61     1430  627.64 1433.03   628.08 1433.04
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  628.82 1433.06  641.07 1433.41  648.48 1433.38  652.48 1433.38  652.65 1433.38
   661.6 1433.34  662.01 1433.24  664.66 1432.61  672.27 1428.88  679.58 1425.17
  685.25 1422.62  689.99  1420.3  694.32 1418.78  701.46 1416.87  707.42 1415.15
  710.17 1414.37   711.5 1414.27  717.62 1413.84  721.73 1413.54   741.3 1412.63
  744.96 1411.24  746.13 1410.97  752.83 1410.88  757.88 1409.99  763.71 1407.61
  765.97 1405.77  766.02 1405.73  766.04 1405.71  767.95 1404.45  777.53 1404.45
  784.81 1404.45  789.49 1405.25  789.99 1405.34   790.8 1405.42  809.42 1406.62
  815.67 1408.81  817.88 1409.78  829.77 1410.81  831.55    1411  835.26 1411.54
  848.69 1411.58  862.76 1412.16  864.72 1412.31  866.93 1412.47   868.3 1412.57
  869.83 1412.63  872.01 1412.73   875.1 1412.71  879.29 1412.57  881.42 1412.74
  884.66 1413.23  893.84  1413.2   899.7 1413.09  902.44 1412.76  906.82 1412.57
  915.05 1414.17  919.56 1415.45  926.11 1415.46  927.29 1415.43  933.33 1414.46
  933.77 1414.45  940.65  1413.6  941.49 1413.47  941.57 1413.38  941.66 1413.34
  947.37  1408.7  950.91 1408.51  952.63 1408.19  956.75 1407.18  957.02 1407.18
  957.35 1407.24  958.22 1407.04  965.38  1406.5     970 1405.87  973.67 1404.92
  976.84 1404.55  980.18 1404.24  984.06 1403.04  984.49 1402.89  987.14 1402.95
 1000.99 1403.47 1015.68 1404.04 1016.98 1404.08 1018.21 1404.12 1018.76 1404.14
 1026.28 1406.27 1026.74 1406.73 1027.27 1408.76 1028.16 1412.25 1033.47 1412.57
 1035.12 1412.61 1035.14 1412.57 1035.95 1412.99 1036.01    1413 1037.66 1413.82
 1039.42  1414.4  1056.6 1419.58  1064.2 1422.59 1074.93 1426.93 1080.34 1427.95
 1084.26  1428.7 1090.03 1429.05 1097.21 1429.48 1099.67 1429.63 1101.07 1429.68
 1126.14  1429.7 1126.91 1429.71 1128.88  1429.7 1133.99 1429.63 1142.52 1429.54
  1156.5 1429.39 1156.69 1429.76 1156.76 1429.89 1158.47 1429.76 1159.41 1429.69
  1160.9 1429.58 1169.02  1431.9 1171.89 1432.72 1177.48 1433.99 1181.83 1435.23
 1185.46 1436.26 1193.53 1438.53 1194.65  1438.9  1199.3 1440.22 1207.33 1442.75
 1211.87 1444.24 1214.33 1445.01  1226.2 1448.42 1236.68 1451.16 1241.52 1452.57
 1246.87 1454.05 1253.82 1455.85 1265.08 1458.16 1267.45 1458.12 1273.29 1458.16
 1275.92 1458.24 1290.84 1458.05 1300.44 1457.83 1304.58 1458.42 1304.65 1458.43
 1304.97 1458.47 1317.12 1459.71 1318.61 1459.81 1330.56 1459.73 1335.71 1460.08
 1355.55 1460.48  1358.8 1460.53

Manning's n Values         num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .06  103.58    .013  559.35     .06  672.27    .045 1090.03     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         661.6 1090.03             292.44  123.39   98.15            .1      .3
Ineffective Flow      num=       2
   Sta L   Sta R     Elev  Permanent
       0  641.07                F
 1133.03  1358.8                F
Right Levee     Station= 1193.53      Elevation= 1436.26

CROSS SECTION


RIVER: LV_WASH
REACH: R1 - 3 KIDS_INTA   RS: 14.48

INPUT
Description:
Station Elevation Data     num=     378
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0     1442     1.02     1442     9.72 1441.19    11.67     1441    11.87 1440.99
   11.93 1440.98    12.31 1440.92    17.32     1440     24.4     1440    33.79 1439.72
      42   1439.4    50.64 1439.02    50.95 1439.01    51.13     1439    60.12     1439
    76.9   1438.6    81.58 1438.37    82.93   1438.4    85.35 1438.27    86.86 1438.23
  106.73 1438.41   108.31 1438.39  109.46 1438.35  110.87 1438.27   115.37  1438.3
  117.07 1438.22   118.45     1438  125.83     1438  138.69 1438.67  145.25 1438.78
  147.29 1438.85   148.39 1438.86  154.03     1439  224.43     1439  228.38 1438.83
  228.97 1438.82   230.74 1438.76  233.45 1438.66  236.02 1438.54  241.53  1438.3
  247.51     1438  248.09     1438  250.66 1437.83  261.23     1437  265.49     1437
  270.81 1436.78   275.22 1436.62   290.7     1436  291.02 1435.98  291.25 1435.97
  299.05 1435.57   311.11     1435  324.97 1434.46  336.01     1434  341.05 1433.77
  361.33     1433  363.37 1432.86  367.33 1432.56  370.74 1432.33   374.9     1432
  379.12     1432  385.87 1431.44  398.07     1431  400.53     1431  417.88 1430.17
  418.83 1430.12   419.95 1430.08  421.49     1430  429.21     1430  435.72 1430.39
  437.74 1430.47   441.74 1430.57  449.05 1430.52  451.24 1430.48  456.58 1430.31
  466.98 1430.38   468.31 1430.36  469.81 1430.35  470.23 1430.35  482.97 1430.44
  490.69 1430.53   493.26   1430.6  494.49 1430.61  499.13 1430.58  502.41 1430.54
  505.05 1430.58   510.07 1430.48  510.71 1430.46  518.18 1430.05  518.39 1430.04
  518.89     1430  520.39     1429  521.01 1428.54  521.72     1428  521.96  1427.8
  522.74 1427.14   522.91     1427  523.35 1426.68  524.35     1426  526.36     1425
  528.36     1424  529.68 1423.43  530.63     1423   533.8 1422.05  533.91 1422.01
  537.23     1421  537.58 1420.88  540.53     1420  542.11 1419.64  544.85     1419
  548.18     1419   550.9 1419.81  551.53     1420  554.51 1420.89  554.88     1421
  555.94 1421.31   558.28     1422  559.22 1422.12  569.03 1422.94  569.79     1423
  572.27 1423.21   572.83 1423.23  573.24 1423.22  576.73 1423.37  578.34 1423.38
   582.5 1423.08   582.74 1423.07  583.26     1423  586.45 1422.11  587.93 1421.55
  589.67     1421  590.57 1420.73  593.02     1420  594.16 1419.72  597.97 1418.76
  600.93     1418  605.89 1417.13  606.47     1417  606.78     1417  607.61 1416.92
  611.94 1416.61   618.96     1416  631.54 1415.09  633.19     1415  634.83     1415
  637.54 1414.72   638.2 1414.67  640.33   1414.6  648.03 1414.43  650.02 1414.43
  651.39 1414.42   654.7 1414.52  661.83 1414.57  675.83 1414.48  696.48 1414.41
  703.78 1414.36   712.41 1414.35  718.46 1414.31  725.26 1414.21  728.36 1414.14
  733.01     1414  756.45 1413.38  758.86 1413.39  760.89 1413.36  764.18 1413.42
  777.88     1414  799.31     1414  803.69     1414  811.32 1413.27  811.78 1413.23
  814.25     1413  825.73 1412.15  826.96     1412  833.62     1412  850.35 1412.59
 858.01 1412.77   860.19 1412.72  861.19 1412.72  861.76 1412.73  869.29     1413
  872.61     1413  882.85 1413.45  883.36   1413.5  890.89 1413.85  892.47     1414
  893.38     1414  900.45   1414.4  901.44 1414.49  904.23 1414.63  907.94     1415
  911.54     1415  919.74 1415.45  921.57 1415.57  926.16     1416  926.44 1416.17
  926.63 1416.18   960.26     1417  962.99     1417  979.33     1418  984.15 1418.64
  984.34 1418.67   986.441418.936  986.95     1419  987.92 1419.35  989.87     1420
  990.32 1421.48   992.25   1421.7  992.58     1421  992.82 1421.24  993.66     1422
  993.92 1422.27   994.65     1423  995.57 1423.46  998.21 1424.27  1000.8 1424.74
 1002.06     1425  1006.9 1425.96 1007.08     1426 1007.29 1426.04  1012.8     1427
 1016.55 1427.73 1018.43     1428 1018.97   1428.8 1019.69 1429.66 1020.04     1430
 1021.09 1430.76 1021.41     1431 1022.09 1431.36  1023.4     1432  1025.5 1432.67
 1026.48     1433 1028.54   1433.7 1029.46     1434 1036.53 1434.82 1038.31     1435
 1043.68     1435 1046.99     1435 1053.17 1435.24 1055.53   1435.4  1061.4   1435.7
 1062.68 1435.74     1065     1436 1065.71     1436  1067.5 1436.46 1068.98 1436.87
 1069.38     1437 1070.68 1437.45 1072.19     1438 1072.99 1438.29 1074.87     1439
 1076.48 1439.54 1077.79     1440 1080.59 1440.89 1081.01     1441 1082.69 1441.47
 1084.31     1442 1085.02 1442.23 1087.46     1443 1088.21 1443.25  1090.6     1444
 1092.21 1444.54     1094     1445 1095.88 1445.46 1098.44     1446 1099.29  1446.2
 1100.82 1446.47 1102.82   1446.8 1103.88     1447  1105.5 1447.32 1108.57     1448
 1109.56 1448.26 1110.58   1448.5 1112.75     1449 1113.89 1449.31 1115.99 1449.69
 1117.05 1449.87 1117.64     1450 1119.29 1450.36 1122.08     1451 1122.13 1451.01
 1124.86   1451.7 1125.38 1451.76 1127.26     1452  1127.5 1452.02 1130.88 1452.37
 1132.74 1452.34 1133.69 1452.34 1135.64 1452.31   1136.5 1452.31 1137.87 1452.29
 1139.34 1452.26 1139.82 1452.26 1141.61     1452  1141.9 1451.96 1141.97 1451.95
 1143.65 1451.73 1144.52   1451.6 1145.66 1451.45 1147.62 1451.15 1147.93 1451.11
 1148.66     1451 1150.42 1450.74 1151.05 1450.66 1152.55 1450.44 1153.29 1450.35
 1155.77     1450 1155.96 1449.97 1156.03 1449.96 1158.15 1449.65 1158.93 1449.54
 1160.31 1449.36 1161.19 1449.23 1162.96     1449 1163.14 1448.97 1163.23 1448.96
 1165.63 1448.66  1167.9 1448.37 1170.31 1448.32  1171.1 1448.31 1171.82 1448.29
 1174.58 1448.24 1175.19 1448.23 1178.34 1448.17 1178.77 1448.16 1179.14 1448.15
 1182.75 1448.08 1182.94 1448.08 1186.46 1448.12 1186.82 1448.12  1187.2 1448.13
 1190.25 1448.17 1190.79 1448.17 1194.12 1448.21  1194.8 1448.22 1198.55 1448.26
 1199.77 1448.27 1201.62 1448.41 1204.65 1448.68 1205.13 1448.72 1208.66 1448.95
 1209.41     1449  1211.1   1449.1  1211.5 1449.12  1215.3  1449.3 1217.01 1449.36
 1219.85 1449.48 1222.68 1449.58 1223.64 1449.61 1226.21 1449.72  1228.5 1449.79
 1233.67 1449.92 1234.37 1449.94 1236.93     1450 1239.63 1450.07 1240.12 1450.07
 1249.16 1450.27 1251.04 1450.27  1253.6 1450.32 1256.87 1450.37 1265.78 1450.63
 1268.36 1450.71 1274.91 1450.89 1275.86 1450.93 1276.85     1451 1287.15 1451.55
 1294.87 1451.83 1296.67 1451.91 1298.07     1452 1303.96 1452.57 1308.21 1452.81
 1311.12     1453 1316.74 1453.47 1319.47 1453.63 1325.46     1454 1328.43 1454.25
 1330.58 1454.36 1331.82 1454.43 1334.66 1454.65
```

```
Manning's n Values         num=       3
     Sta    n Val      Sta    n Val     Sta    n Val
       0     .06   578.34     .045 1038.31     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        578.34 1038.31             54.23   14.48   13.53             .3      .5
Ineffective Flow      num=       1
   Sta L    Sta R    Elev  Permanent
       0   578.88  1439.6        F
```

SUMMARY DF MANNING'S N VALUES

River:LV_WASH

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7
R1 - 3 KIDS_INTA	405.15	.06	.13	.035	.13	.06	.045	.06
R1 - 3 KIDS_INTA	307.97	.06	.013	.06	.045	.06		
R1 - 3 KIDS_INTA	182.42	.06	.13	.06	.045	.06		
R1 - 3 KIDS_INTA	137.87	.06	.013	.06	.045	.06		
R1 - 3 KIDS_INTA	14.48	.06	.045	.06				

SUMMARY DF REACH LENGTHS

River: LV_WASH

Reach	River Sta.	Left	Channel	Right
R1 - 3 KIDS_INTA	405.15	96.2	97.18	102.46
R1 - 3 KIDS_INTA	307.97	131.85	125.55	126.04
R1 - 3 KIDS_INTA	182.42	43.46	44.55	57.38
R1 - 3 KIDS_INTA	137.87	292.44	123.39	98.15
R1 - 3 KIDS_INTA	14.48	54.23	14.48	13.53

SUMMARY DF CONTRACTION AND EXPANSION COEFFICIENTS
River: LV_WASH

Reach	River Sta.	Contr.	Expan.
R1 - 3 KIDS_INTA	405.15	.1	.3
R1 - 3 KIDS_INTA	307.97	.1	.3
R1 - 3 KIDS_INTA	182.42	.1	.3
R1 - 3 KIDS_INTA	137.87	.1	.3
R1 - 3 KIDS_INTA	14.48	.3	.5

APPENDIX III

Operations and Maintenance Manual

Lake Las Vegas Lift Station Floodwall Operations and Maintenance Manual

Lake Las Vegas Lift Station Floodwall Operations and Maintenance Manual

Operations Plan

Closures

It should be noted that flood gates at the lift station remain closed/sealed and locked at all times. The only exception is for routine maintenance that occurs during the work day. The flood gates are closed and locked at the end of the work day. There are security cameras located at lift station to monitor activity at the site.

Flood warning system and plan of action

The Clark County Regional Flood Control District (CCRFCD) operates a flood warning system: Flood Threat Recognition System (FTRS). CCRFCD collects hydrometeorologic data primarily for the purpose of detecting situations which could cause flooding. COH staff has access to warnings sent via email by CCRFCD FTRS.

The CCRFCD and USGS operate several gages within the Las Vegas Valley that give real-time water level and flow rate information. Two water level gages on the Las Vegas Wash upstream of the lift station will be used to warn of flood events. See Figure 1 for the location of these two gages. These two gages are described in the following table:

USGS Gage #	CCRFCD Gage #	Location	Distance upstream of lift station
094196784	4088	Las Vegas Wash at Vegas Valley Drive	8.0 miles
09419700	4543	Las Vegas Wash at Pabco Rd	3.0 miles

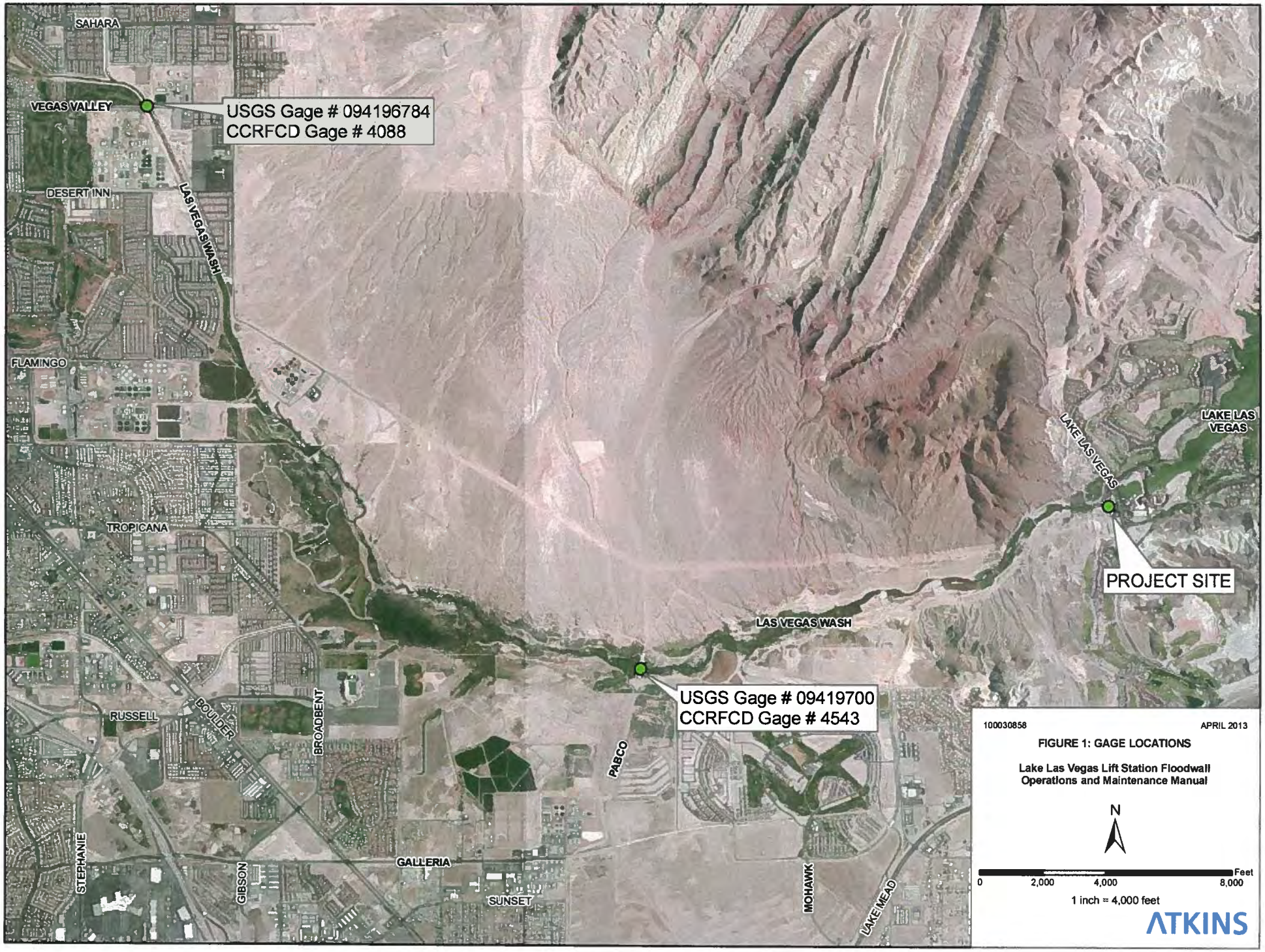
The supervisor will have automatic alerts sent to his email and cell phone (via text message) when the flow rates at either of the two gages reach 3,000 cfs.

Supervisor will then monitor the USGS water level at the two gages using the USGS web sites:

- http://waterdata.usgs.gov/nv/nwis/uv/?site_no=094196784&PARAmeter_cd=00065,00060
- http://waterdata.usgs.gov/nv/nwis/uv/?site_no=09419700&PARAmeter_cd=00065,00060

If the flow rate at either of these two gages reaches 5,000 cfs, then the supervisor will put field crew on alert and continue to monitor water levels. In addition, an automatic alert will be sent to the supervisor when the flow rates at either of the two gages reach 5,000 cfs.

If the flow rate at either of these two gages reaches 10,000 cfs, then the supervisor will send the field crew to the site to ensure flood gates are closed. In addition, an automatic alert will be sent to the supervisor when the flow rates at either of the two gages reach 10,000 cfs.


SAHARA
VEGAS VALLEY
USGS Gage # 094196784
CCRFCD Gage # 4088
DESERT INN
LAS VEGAS WASH
FLAMINGO
LAKE LAS VEGAS
LAKE LAS VEGAS
TROPICANA
PROJECT SITE
LAS VEGAS WASH
USGS Gage # 09419700
CCRFCD Gage # 4543
RUSSELL
BOULDER
BROADBENT
PABCO
STEPHANIE
GIBSON
GALLERIA
SUNSET
MOHAWK
LAKE MEAD
100030858
APRIL 2013
FIGURE 1: GAGE LOCATIONS
Lake Las Vegas Lift Station Floodwall
Operations and Maintenance Manual
N
0
2,000
4,000
8,000
Feet
1 inch = 4,000 feet
ATKINS

It should be noted that the 100-year flow is 22,500 cfs. By sending the field crews to the site when flows reach about half of the 100-year flow, there should be ample time to travel to the site and inspect and close the flood walls before flood waters reach the base of the structure.

The supervisor will also monitor the security cameras located on-site for evidence of rising water/ flooding.

Periodic operation of closures for testing and training purposes

Field crews will open and close each flood gate once every 6 months. See Appendix A for procedures on closing and opening flood gates

Interior Drainage Systems

The interior drainage system is a passive system, with no pipe penetrations through or under the floodwall. Runoff from small storm events will infiltrate or evaporate. After larger storm events, field crews will evacuate runoff water from sump locations provided on the land side of the floodwall using small, portable sump pumps.

The ponding areas and sump inlets will be cleaned after each storm event or every 6 months, and once every 6 months the field crew will remove debris and sediment from the sump inlets.

Once every 6 months the field crew will remove debris and sediment from area behind the lift station to maintain the volume of ponding in this location.

Maintenance Plan

Closures

There will be three flood gates integral with the floodwall once the project is complete (one existing, two proposed). See Figure 2 for the locations and the table below for the flood gate information:

Flood Gate ID	Size	Location
FG-1	180"W x 96" H	West wall
FG-2	72"W x 84"H	North wall – manway
FG-3	180"W x 84"H	North wall

The flood gates will be maintained and be in good repair. The following maintenance activities will be performed:

- Hose testing once a year by field crew (see Appendix A for hose test procedures)


FG-1
FG-2
FG-3
100030858
APRIL 2013
FIGURE 2: FLOOD GATE LOCATIONS
Lake Las Vegas Lift Station Floodwall
Operations and Maintenance Manual
Legend
Flood Gate
Existing Wall
Proposed Wall
N
0
20
40
80
Feet
1 inch = 40 feet
ATKINS

- Inspect lip seal gaskets for brittleness, cracking, tears, or other damage every 6 months by field crew
- Apply light coating of petroleum jelly once a year by field crew
- The flood gate manufacturer, Walz & Krenzer, Inc., has provided a maintenance manual which is included in Appendix A.

Interior Drainage Systems

Maintenance of interior drainage systems is outlined in the Operations Plan, above.

Masonry block and concrete surfaces

Field crews will visually inspect the floodwall yearly for cracking of masonry block and joints between blocks and concrete (see additional information in Appendix B). Spalling, scaling or cracking of concrete surfaces should be very minimal

Tilting, Sliding, and Settlement

Field crews will visually inspect the floodwall yearly for signs of settlement and tilting (see additional information in Appendix B). If large cracks are present or there is evidence of tilting, then a licensed engineer will inspect the floodwall.

Vegetation

Vegetation will be removed from both sides of the floodwall. This is critical at the upstream (west) and downstream (east) ends of the floodwall. Vegetation will be kept clear from 8' beyond underground toe and heel of floodwall.

Las Vegas Wash channel

The riprap that lines the bank of the Las Vegas Wash and the surrounding wash channel is maintained by SNWA.

Appendix A

TECHNICAL MANUAL

FOR

LIP SEAL FLOOD BARRIERS

LAKE LAS VEGAS

Customer: Lake Las Vegas Joint Venture

Walz & Krenzer, Inc.
91 Willenbrock Rd, Unit B4
Oxford, CT 06478
P: 203-267-5712
F: 203-267-5716

Rev. A
Date: 03/08/2011
WK Job No. 01-024

Description

The floodgates are stiffened aluminum panels that are designed to withstand the hydrostatic pressure of floodwater up to their full height. The panels are side hinged and can be quickly closed and secured. A neoprene "lip seal" gasket is mounted to the sides and bottom of each panel in order to create a watertight seal with the steel frame. Sliding latch bolts are located along the bottom and at the upper unhinged corner of each gate of to keep its in position in its frame. Panels are manufactured to drawings D-WK-840-40, D-WK-840-41 & D-WK-840-42.

Installation

1. Place the floodgate in the location where it will be mounted.
2. The bottom frame should be mounted on top of the ground surface. The bottom frame may not be embedded so it is flush with the ground surface because there would be no clearance for the bottom gasket when opening or closing the gate.
3. Examine the surfaces where the floodgate frame sits against the masonry and the ground. If there are any dips or irregularities in the masonry, the surface must be grouted or shimmed to provide a uniform mounting surface for the frame. NEVER PULL THE FRAME TO MATCH AN UNEVEN SURFACE.
4. Keep the panel attached to the frame. Use the side frames as a template to drill holes for the masonry anchor bolts (supplied by installer). See the Installation Notes on the drawings for quantities and recommended types of anchor bolts.
5. After the all of the surfaces have been leveled and the side frame holes have been drilled, apply a liberal coating of waterproof silicone sealant (supplied by installer) to the contacting surfaces.
6. Bolt the side frames in place.
7. Cut the temporary shipping clips with a grinder, which are tack welded to the frame and hold the panel in position. Now open the gate by sliding all of the latch bolts open and pulling on the opening device lever.
8. With the gate open, the bottom frame bolt holes will be accessible. Drill them and install flat head anchor bolts.
9. Adjust the height of the side roller on the larger gates if needed to support the weight of the gate as it approached the closed position.
10. Close and secure the gate and visually inspect to confirm that the lip seal gasket on the sides and bottom is in contact with the steel frame.

Operation –Closing Gate

1. Clean the frame of any debris that may have accumulated. Pay close attention to the corners. The lip seal gasket requires a clear, unobstructed surface to seal properly.

2. Rotate the door to the closed position.

3. Push the panel into place so that all of the panel stops are hard against the frame.

4. Slide the upper latch bolt and the larger bottom sliding bolts so that they are locked firmly into their holes. Rotate bolt so the handle is hard against the bottom of the stop pad. All latch bolts must be positively engaged otherwise structural failure of the panel may occur during flood conditions.

5. Examine the gasket thoroughly. Sometimes the gasket does not seat properly into the corner of the frame. Press the gasket corner firmly into each bottom corner with your fingers to help seat it. Light should not be visible between the gasket and the frame at any point along the sides, bottom or corners.

Operation –Opening Gate

1. Slide the upper latch bolt and the larger bottom sliding bolts so that they are held out of their holes. Rotate the bolts so their handles are supported by the tops of the stop pads.

2. Use the opening device leverage bar to overcome the gasket resistance and begin opening the gate.

3. Walk the gate to the fully open position.

Hose Testing

After installation is complete, close the gate. Standing 10 feet back from the front of the panel, use a garden hose with a nozzle to spray water at the gate. Concentrate the spray along the sides and bottom of the panel. Duration need not exceed 2 minutes. Inspect the backside of the gate. There should be no sign of leaking past the gasket along the sides or bottom.

If there is any sign of leakage investigate the gasket. Usually leakage is the result of a damaged gasket or the gasket not seating properly against the frame. Check the gasket is fully snapped into the gasket retainer. Retest the gate until leakage is eliminated. If the problem persists, contact Walz & Krenzer.

Each gate should be tested after installation. Each gate should also be tested at least once a year.

Maintenance and Storage

The floodgates require very little maintenance. The lip seal gaskets should be checked every 6 months for brittleness, cracking, tears or other damage, particularly at the sealing edge. The molded corners should be checked for separation from the rest of the gasket. Small breaks may be fixed with cyanocrylate adhesive (super glue). More serious damage may require replacement of the gasket. The gasket can be replaced easily by snapping it into and out of the aluminum gasket retainer.

Other components that are subject to wear are the hinge bushings and washers and the roller.

It is recommended that the floodgates be hose tested at least once a year to ensure that they are in the proper state of readiness. **A light coating of petroleum jelly applied annually may also extend the life of the gasket.**

Replacement Parts

Description	WK Part #
Lip Seal Gasket	A-WK-836-3
Molded Gasket Corner	A-WK-836-4
Large Gate Hinge Washer	C-WK-836-64-4
Large Gate hinge Bushing	C-WK-836-64-6
Small Gate Hinge Washer	C-WK-836-65-4
Small Gate hinge Bushing	C-WK-836-65-6
Roller	D-WK-836-11-1

Appendix B

US Army Corps
of Engineers ®

LEVEE OWNER'S MANUAL FOR NON-FEDERAL FLOOD CONTROL WORKS

THE REHABILITATION AND INSPECTION PROGRAM

PUBLIC LAW 84-99



MARCH 2006

2.16 Closure Structures (Levees and Floodwalls)

Closure structures must be in good repair. Placing equipment, stoplogs, sandbags, and other materials must be readily available at all times; stored nearby on the protected side of the levee, or stored on a trailer for quick transportation to the site. It's important that all components are clearly marked and that installation instructions and related procedures are readily available. You should regularly check your inventory of all components of the closure structure to ensure that stoplogs and other components will be there when you need them. Note that when aluminum stoplogs are stored, they should be supported along their entire length so they don't deform during extended periods of storage.



Figure 2.42 *ACCEPTABLE floodgate in a levee. (KS)*

2.17 Concrete Surfaces (Applicable to all concrete structures)

Visible cracking, scaling, or spalling are signs of concrete movement and stresses within the concrete. Cracks in concrete walls that aren't repaired are subject to freeze / thaw damage, which widens the gap and leads to additional spalling of the concrete. When examining any concrete flood control structures, spalling, scaling, or cracking should be very minimal. Figures 2.43 through 2.47, on the following page, show various degrees of cracking, spalling, and scaling.



Figure 2.43 *MINIMALLY ACCEPTABLE 1/8th inch crack extends through concrete floodwall and needs to be sealed to prevent further damage. (MN)*



Figure 2.44 *MINIMALLY ACCEPTABLE Vertical floodwall crack with spalling. The rating for this particular crack is Minimally Acceptable because the crack is still tight but there is some spalling occurring as well. (MN)*



Figure 2.45 *UNACCEPTABLE exposed rebar. Monolith joint separation with exterior spalling along the joint and interior spalling in the area of the rebar. (MN)*



Figure 2.46 *Detail of the crack in Figure 2.45, showing the exposed rebar that tied the two monoliths together. (MN)*

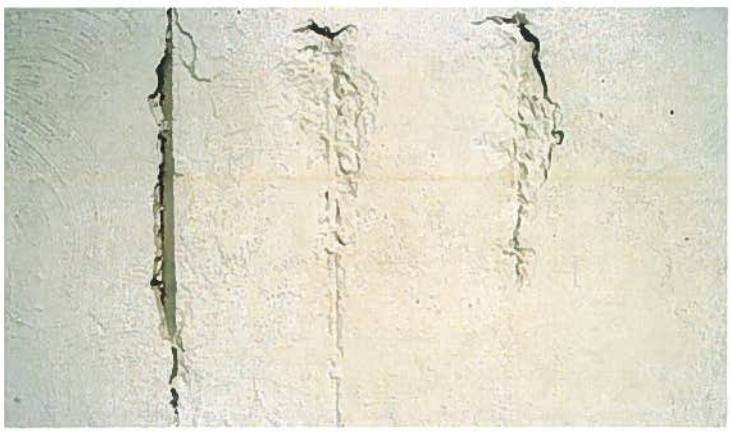


Figure 2.47 *MINIMALLY ACCEPTABLE floodwall. Exposed surface rebar resulting from poor construction practices. The public sponsor has painted over the rebar in an attempt to keep it from rusting. (MN)*

Fire and extreme heat can also be very damaging to concrete, and sponsors should discourage fires from being built beside concrete structures. Common grass or incidental fires are not typically a great concern, but repeated hot or large fires such as bon fires, camp fires, or brush fires can cause spalling in the concrete. Even though fire damage is not specifically listed in the Corps' FCW Inspection Guide (Appendix C), the related spalling, cracking, or other damage would be noted during an inspection and is something that should be taken seriously. If this type of damage is identified, efforts must be made immediately to stop fires near the FCW. Depending on the extent of the damage, the integrity of the structure should be investigated and repairs should be made as soon as possible.

Over time, concrete surfaces will weather, leaving the concrete rough to the touch, or will hold moisture on the surface. When this occurs consider applying a protective coating to the concrete to help prevent moisture from entering the structure. By applying a protective coating to the concrete surface and sealing the cracks the chances of freeze / thaw damage will be greatly reduced, increasing the life expectancy of the structure. Prior to the application of a concrete sealer the structure should be cleaned, existing cracks should be sealed with a flexible sealant, and any spalling repaired. Any sealer chosen for the concrete floodwall should be a water or solvent-based acrylic protective coating, which may be either clear or colored, and may be textured. A clear system should contain at least 23% solids by weight, and a colored system should contain at least 67% solids by weight and 46% solids by volume.

More serious damage such as spalling should be repaired as soon as it is identified, especially if steel reinforcing has been exposed. Perform concrete repairs with a polymer-modified Portland cement mortar that will provide a minimum or 2500-psi compressive strength in two hours. For repairs greater than 1 1/2 inches deep, add 3/8-inch clean-washed pea gravel so that aggregates don't result in variations of the physical properties of the mortar. Limestone gravel is not acceptable. All surfaces to be patched need to be structurally sound, clean, and free of loose debris, oils, vegetation, paints, sealants, and other contaminants. Remove all deteriorated concrete to a minimum of ¼-inch in depth. Cut edges should be square with the concrete surfaces, and not feathered. Surfaces should be sufficiently rough to ensure a good bond. Any existing reinforcing bars should be thoroughly cleaned. If required, existing concrete should be removed to fully expose the reinforcing bar. Sandblasting may be required to clean them thoroughly. All surfaces should be fully saturated and freestanding excess water should be removed before applying the repair material. The material should be placed in the prepared area starting from one side and working to the other side. For vertical areas, trowel the material in an upward motion over the repaired area. Successive applications must be troweled against the previously placed material just prior to hardening. Work the material firmly into the bottom and sides of the repair. Level the material to the desired thickness and close up edges of the repair with a trowel. Finish the material to match the existing concrete finish. Remove any material applied or spilled beyond the desired areas. All exposed surfaces should be thoroughly saturated with water immediately after finishing.

2.18 Tilting, Sliding, and Settlement (Applicable to all Concrete Structures)

If soil conditions were poor prior to construction or if there has been inadequate soil compaction, concrete structures (floodwalls, pump stations, and gate wells) will frequently show signs of settlement. As the structure settles it may begin tilting in the lateral or transverse directions, settle vertically, or may even begin to slide downhill, if constructed on a slope. As the pressure within the concrete builds cracking and large spalls will develop. If the movement is considerable like that shown in Figures 2.48 and 2.49, a licensed engineer should be contacted to determine the best approach to correct the problem, or to closely monitor the structure during high water to avoid a structural failure.



Figure 2.48 *MINIMALLY ACCEPTABLE floodwall. Monolith joint separation caused by settlement, no landward or riverward tilting. The opening is about 3 inches wide at the top but the rubber joint sealer is still intact and undamaged. This joint has since been repaired by bolting another joint sealer on the both sides of the wall and filling the void with an expandable joint sealer. (ND)*



Figure 2.49 *UNACCEPTABLE monolith movement in floodwall. The monolith shown in the photo has tilted about 6 inches riverward as well a vertically. Note the movement when compared to the adjoining monolith and the top cap. As the monolith moved considerable spalling has occurred along the joint. This project is monitored very closely during flood events. (ND)*



Figure 2.50 *ACCEPTABLE. decorative floodwall is in straight alignment, with no tilting or spalling, and all joints are tight together. (MN)*

Clark County Regional Flood Control District
Operations and Maintenance Manual

REGIONAL FLOOD CONTROL DISTRICT



OPERATIONS AND MAINTENANCE MANUAL

Adopted
September 9, 2010

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

OPERATIONS AND MAINTENANCE MANUAL

GALE WM. FRASER, II, P.E.
GENERAL MANAGER / CHIEF ENGINEER

www.regionalflood.org

The Operations and Maintenance Manual has been updated in accordance with Regional Flood Control District Board action on September 9, 2010. The Board adopted amendments to Chapter 1, Section 1.10 – Executive Summary: Maintenance Procedures and Inventory Procedures, Chapter 2, Section 2.20 – Authority, Section 2.30 – Responsibility, and Section 2.50 – Definitions, Chapter 3, Section 3.20 – Policies, Chapter 4, Section 4.25 – Certification of Compliance, 4.32 – Activities, Section 4.42 – Physical System, Performance Standards, Forms, and Appendix A and Appendix B.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

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CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 1
EXECUTIVE SUMMARY

1.10 EXECUTIVE SUMMARY

The Clark County Regional Flood Control District (District) was created under NRS 543 with responsibility to plan, construct and maintain drainage and flood control facilities throughout Clark County. In order to comply with NRS 543.340(4), this **Operations and Maintenance Manual** has been prepared through the cooperation and support of all of the affected member entities, which include Clark County and the incorporated cities within Clark County. The document sets forth both policies and procedures by which the maintenance of the drainage and flood control facilities will be achieved to assure their proper working order at the time of need. The overall goal of the maintenance program as adopted by the District Board is as follows:

> COMPLY WITH THE PROVISIONS OF NRS 543.340(4) AND ASSURE THAT FACILITIES IN THE MASTER PLAN ARE MAINTAINED IN A MANNER THAT MAXIMIZES THEIR USEFUL LIFE AND ENSURES THEIR OPERATION AT DESIGN CAPACITY DURING A STORM EVENT.

Nineteen policy statements have been adopted to support the above goal.

In order to achieve the goal, and to comply with the adopted policies, the following procedures have been developed in an open and very participatory manner.

Funding Procedure – Provides for a means by which the member entities can be paid for activities associated with maintenance of drainage and flood control facilities on the Master Plan provided they meet criteria as set forth in the manual.

Administrative Procedure – Provides for establishing standards and levels of service by which maintenance will be achieved. This procedure includes the steps and schedule by which an annual work plan is established and adopted by the District Board. It also provides for the certification of performance by each member entity in accordance with the annual interlocal contract. The ability for the member entity to contract maintenance activities to private contractors is also authorized under this procedure.

Maintenance Procedures – This procedure provides the specific activities under which the maintenance program is to be carried out as listed below:

ACTIVITY NUMBER	ACTIVITY NAME	WORK MEASURE UNIT
03	Facility Assessment and Inventory	Labor Hours
05	Inspect Channels	Miles
06	Inspect Levees/Detention and Debris Basins	Miles/Each
08	Species Survey and Removal	Labor Hours
10	Clean and Reshape Channels/Levees	Cubic Yards
15	Repair Lined Channel	Each
20	Erosion Control and Repair	Square Feet
21	Provide/Maintain Dust Control	Acres
25	Clean Detention/Debris Basins	Cubic Yards
35	Fence Repair	Linear Feet
40	Vegetation Control – Chemical	Acres
45	Vegetation Control – Mechanical	Acres
50	Maintain Access Road	Miles
55	Clean and Inspect Inlet/Outlet Structures	Each
60	Repair Inlet/Outlet Structures	Each
65	Clean Storm Sewer Lines	Linear Feet
70	Storm Sewer Repair	Repairs
75	Clean/Flush Culverts & Bridges	Each
80	Miscellaneous Work Activities	Labor Hours
85	Engineering	Labor Hours

A specific performance standard has been developed for each activity setting forth the following elements:

- The most effective crew size.
- The kinds and number of equipment required.
- The major types of material that should be used.
- Recommended procedures for performing the work.
- An estimate of expected average daily accomplishment with standard crew size, equipment, and procedures.
- Authorization and scheduling criteria.

Inventory Procedures – A critical element of any maintenance program is the identification and condition of the overall drainage and flood control system. In the case of this program, the inventory also identifies those facilities that are "eligible" for payment of maintenance activities, provided the work is a part of the annual plan.

Maintenance is an ongoing and very dynamic function of a successful drainage and flood control program. This **Operations and Maintenance Manual** sets forth an initial set of policies and procedures, including the various actions required to achieve the maintenance goal. The manual will need to be updated on a regular basis to reflect fiscal implications and the experience gained as the District continues to grow and to serve the citizens and taxpayers of Clark County.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 2
INTRODUCTION

2.10 BACKGROUND

The Clark County Regional Flood Control District (District) was established in 1986 to plan, construct, and maintain drainage and flood control facilities throughout Clark County. These responsibilities focus on alleviating the potential for flooding and protecting the lives and property of existing residents**,** future residents and visitors within the District's Service Area. The initial phases of the District's program succeeded in preparing a Master Plan, uniform design criteria, regulatory standards, and constructing facilities. As these areas have progressed, the District, along with other agencies and member entities in the County, has oriented its efforts towards assuring adequate maintenance of flood control facilities and conveyance systems. This orientation is consistent with the vital role maintenance plays in all comprehensive flood control programs. This **Operations and Maintenance Manual** has been prepared through the District with the support and cooperation of each affected member entity. It represents a commitment to uniform flood control system standards and establishes a blueprint for a cost effective and consistent maintenance program throughout the District's service area.

2.20 AUTHORITY

Nevada Revised Statute (NRS) 543 mandates that the District shall undertake programs for both construction and maintenance of flood control facilities. A commitment to building and maintaining flood control facilities within Clark County is reiterated in the District's **Uniform Regulations for the Control of Drainage** (Uniform Regulations) which states that capital improvements, operation, and maintenance are all interrelated parts of the District's overall flood control program. In accordance with NRS 543.340(4) and the Uniform Regulations, the District prepared an **Operations and Maintenance Manual**, which was adopted by the District Board on November 8, 1990. To reflect fiscal implications and experience gained, the manual was updated in 1995, 1999, 2003, 2005, 2007, and 2010.

2.30 RESPONSIBILITY

The District was formed, in part, to fund and coordinate the construction and maintenance of facilities to alleviate flooding and protect the life and property of citizens within the boundaries of the District. It is the responsibility of the District to prepare and update the Master Plan for the control of floods, and manage the District funds for the Control of Floods in a manner consistent with NRS 543.

2.40 APPROACH

The maintenance program must assure that the flood control projects funded by the District are maintained at a level which maximizes their useful life and assures that facilities operate to design capacity. As an interconnected network of conveyances and structures, failure of any flood control facility to operate properly may affect the performance of the overall system within a specific watershed.

Flood control facilities require regular maintenance if they are to be functional, visually attractive, and last through their design life. Accordingly, the development of a maintenance program is just as critical to the overall success of a comprehensive flood control effort as basin planning and regulation enforcement. As stormwater and flood control programs begin to address nonpoint pollution/water quality issues, the maintenance program will play an even greater role by enabling cost effective reductions in pollutant loadings to receiving waters. Finally, visibility of the program to the public, which a comprehensive maintenance program affords, is an important factor in demonstrating that flood control management is truly a full-time commitment and not simply a priority only after a storm event. The primary objectives of the District's maintenance program are:

- To develop a complete physical feature inventory for the system.
- To establish overall policies and levels of service.
- To develop operating procedures.

It is also critical that ongoing inspection and reporting procedures continue to assure all systems are ready when needed.

Due to the multiple jurisdictions involved with maintenance of the flood control system, a commitment to this program from all member entities within the service area of the Regional Flood Control District was essential. This commitment was made through the Maintenance Technical Committee during the development of the manual in 1990. It was also recognized that coordination of this maintenance program with state transportation programs was critical. The level and consistency of the long range commitment has a direct impact on how effective the resulting maintenance system becomes. This commitment begins with a credible **Operations and Maintenance Manual**.

An essential building block for a successful flood control maintenance program in Clark County is a complete physical feature inventory of the system. It is also important to note that no maintenance program is ever truly "complete". Rather, these programs are constantly evolving as inventories are defined and standards/costs are further refined. A similar evolution is anticipated for this program. The flexibility to adjust to this evolutionary process has been built into this manual.

2.50 DEFINITIONS

In addition to the definitions of terms and phrases set forth in other District documents, the following apply to operation and maintenance:

Acceptance for Maintenance: "Acceptance for Maintenance" means that a project funded by the District, member entity, or other public/private funds is a part of the Master Plan and has been constructed in accordance with District standards and therefore eligible for maintenance funding by the District.

Annual Budget: "Annual Budget" means the anticipated costs associated with completion of each activity outlined within the annual work plan submitted by each of the member entities, and ultimately approved by the District Board of Directors prior to the start of each fiscal year.

Annual Work Plan: "Annual Work Plan" means a plan submitted by each of the member entities setting forth the type and quantity of maintenance to be performed during the ensuing budget year in a form prescribed by the District specifically requesting funds for budgeting purposes.

Certification: "Certification" means the documentation which evidences that required maintenance by a member entity has been completed in accordance with established standards.

Funding Eligibility: Projects eligible for District maintenance funding are those identified in the Regional Flood Control District's Master Plan and any revisions, amendments, and/or changes subsequently approved. Only those facilities that exist as Master Plan Facilities or exist in the same alignment as a proposed Master Plan facility, and appurtenant facilities constructed as part of a regional facility within one-quarter mile of a Master Plan facility are eligible.

Maintenance Program: The "Maintenance Program" has been established by the Board to provide funding of, and establish performance standards and guidelines for, the maintenance of flood control facilities located throughout Clark County and the incorporated areas. The Program provides funding to member entities to perform maintenance of eligible flood control facilities. Subsequently, the District works with the member entities annually to develop Maintenance Work Plans. The work plans undertaken through the Maintenance Program and budgets are funded through the annual interlocal contracts between each member entity and the District. No matching funds are required, except in those cases where an arrangement has been made to cooperatively fund a particular field activity. Work is performed using a combination of private contractors and member entity maintenance staff. The Maintenance Program contains three broad categories of work:

1. Routine and/or Preventive Maintenance: "Routine and/or Preventive Maintenance" means work on existing facilities to keep them in proper working condition, including but not limited to, debris/sedimentation removal, vegetative control, and reshaping.

2. Restoration: "Restoration" means the repair to existing facilities after a storm event including erosion repair, fence replacement, repairing/replacing trash racks, inlets, storm sewer systems, major debris removal, and similar "one time" work activities.

3. Rehabilitation: "Rehabilitation" means rebuilding a facility and/or conveyance system after it is destroyed by an event or it has been determined that it is not operating according to the intent of the design documents on file at the District causing a safety or maintenance problem or it has deteriorated to the extent that it must be replaced "in kind" including replacing or modifying drop structures, reshaping channels, bank protection restoration, inlets, etc. In general, the rehabilitative projects are designed by consultants and the construction contracts are awarded through a bid process.

Maintenance Program Exclusions: "Exclusions" typically include local drainageway maintenance such as curb and gutter work, inlet maintenance, and repairs to small piped storm sewer systems, unless otherwise constructed as part of a regional facility and landscaping, irrigation systems, trails, bike paths, and other recreational or multi-use features that do not have a direct flood control or drainage function. Maintenance work exclusions also include repair or replacement of existing flood control Master Plan facilities which undergo catastrophic damage of more than one-half (1/2) mile. These types of catastrophic damages will generally be classified as capital improvements, and requests for capital improvement funds must be reprogrammed as a capital improvement project in accordance with District Policies and Procedures.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 3
POLICY STATEMENT

It is important that a maintenance policy statement be adopted which reflects the objectives of both the elected officials and the operations staff charged with its implementation. The initial policy document was prepared and reviewed by District staff and the Maintenance Committee. Following input from the group, it was reviewed by the respective Public Works Directors of all member entities and further revised to reflect their input. The document was then reviewed by the Technical Advisory Committee (TAC) and the Citizens Advisory Committee (CAC) before final adoption by the Board on November 8, 1990. To reflect fiscal implications and experience gained, the document is updated on a regular basis. The final adopted policy statement is as follows:

3.10 GOAL

Comply with the provisions of NRS 543.340 (4) and assure that facilities in the Master Plan are maintained in a manner that maximizes their useful life and ensures their operation at design capacity during a storm event.

3.20 POLICIES

1. Facilities eligible for maintenance funding shall be inspected on an annual basis, as a minimum, to assure proper maintenance has been provided.

2. In cases where funded maintenance by the lead member entity is not performed to the standards specified, the District shall perform or cause to be performed the maintenance necessary to assure proper operations of the facility. Costs incurred by the District shall be deducted from the amount authorized in the maintenance agreement between the lead member entity and the District.

3. Flood control facilities improved or constructed after adoption of this policy, must be designed in accordance with District criteria and standards to be eligible for maintenance funding.

4. Access to the facility must be guaranteed to the lead member entity and the District in order to be eligible for maintenance funding.

5. Maintenance and repairs to flood control facilities will be performed in a manner that will minimize the degradation of water quality.

6. The maintenance requirements applied to these facilities shall be based on the standards contained in the District's **Operations and Maintenance Manual**.

7. The lead member entity must develop an annual work plan to be eligible for maintenance funds. Upon completion of the work, the member entity must certify that the work was completed in accordance with the standards contained in the District's **Operations and Maintenance Manual**.

8. Maintenance funding is available only for repair, restoration, rehabilitation, or maintenance of existing facilities and is not intended to supplement the District's capital improvement program. For example, if the intent of the field activity is to increase the designed capacity of a facility or conveyance, then that function is capital in nature.

9. Copies of plans and specifications must be furnished to the District for review and approval prior to finalizing design when maintenance projects are awarded through a bid process or when maintenance projects will be to a design different from its original design. This review will be for the purpose of ensuring compliance with the District's Master Plan and regional objectives and will be used to update the inventory of existing facilities. As-built plans or record drawings will be provided to the District upon project completion and prior to project closeout.

10. Expenditures for repair and replacement of existing flood control Master Plan facilities which undergo catastrophic damage of one-half (1/2) mile or less will be classified as maintenance. These expenditures will be made from budgeted maintenance funds.

11. Expenditures for repair and replacement of existing flood control Master Plan facilities which undergo catastrophic damage of more than one-half (1/2) mile will generally be classified as capital improvements. Requests for capital improvement funds must be programmed as a capital improvement project in accordance with District Policies and Procedures.

12. Expenditures for removal of debris and sediment captured or deposited in a debris basin, detention basin or a linear flood control facility will be classified as maintenance. Necessary repairs to a debris or detention basin will also be classified as maintenance. These expenditures will be made from budgeted maintenance funds.

13. Expenditures for repair and replacement of non-improved or "earth lined" flood control facilities and features will be classified as maintenance. These expenditures will be made from budgeted maintenance funds.

14. A member entity may consider another option in lieu of repairing or rehabilitating facilities that have not been improved to Master Plan design specifications. This option is to build/implement the long-term solution for the damaged facility. Expediting the

implementation of the Master Plan may be a viable alternative that maximizes the use of available resources. This should be considered as an alternative if the long-term solution can be implemented in a timely manner. Requests for capital improvement funds to implement a Master Plan project must be programmed as a capital improvement project in accordance with District Policies and Procedures.

15. District funds may be provided for maintenance of Master Plan facilities by outside contractors under conditions when the use of such an approach is deemed the most efficient and cost effective by the lead member entity.

16. If a member entity receives funds from other sources for maintenance and repair of drainage and flood control facilities paid for by the District, the funds will be paid to the District. Examples of other sources include, but are not limited to, Federal Emergency Management Agency (FEMA) funds for repairs resulting from a designated disaster, and funding from developers for maintenance and repair of District facilities.

17. Member entities and their contractors are responsible for compliance with all local, state and federal laws in the execution of maintenance activities. The District will not be responsible for any fines and/or penalties caused by the actions or inactions of the member entity's employees, consultants, contractors, or agents.

18. Bridge structures, generally speaking, are not eligible for District funding unless it can be shown that the flood carrying aspects of the regional facility causes a safety or maintenance problem.

19. Member entities are responsible for maintenance of documentation demonstrating effective and diligent maintenance of levees accredited by FEMA as providing protection from a base flood in accordance with Title 44 Code of Federal Regulations (44CFR) part 65.10 and to make that documentation available to FEMA upon request should the levees need to be reaccredited.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 4
PROCEDURES

4.10 FUNDING PROCEDURES

4.11 Purpose

This element of the **Operations and Maintenance Manual** provides the member entities with procedures for the appropriation, expenditure and payment of funds to perform maintenance activities. A principle role of the District shall be to manage and disburse payments to the member entities for maintenance that is performed in compliance with the approved plans. (See Funding Flow Diagram.)

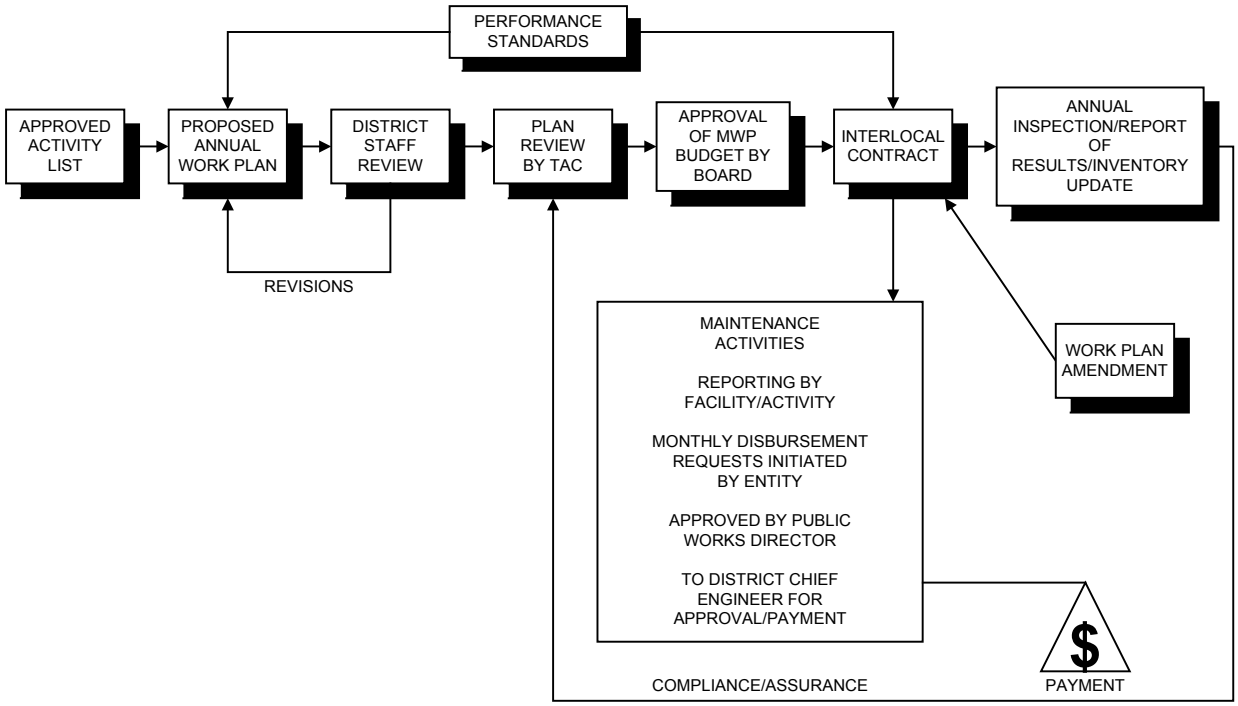
The District has authorized funding to assist the member entities with major drainageway maintenance in accordance with the priorities listed below:

- First priority: District owned facilities.
- Second priority: Facilities owned by member entities.
- Third priority: Facilities owned by other public agencies.
- Fourth priority: Facilities owned by others in which access has been guaranteed to the lead member entity and the District.
- Fifth priority: Unimproved drainageways.

4.12 Payment Procedures

Payment for work performed will be made in accordance with the annual interlocal contract executed as part of the approved work plan and the payment procedures outlined herein. The primary mechanism for payments shall occur through a purchase order established between the District and each member entity. In cases where the member entity directs the District to make payments to a contractor or supplier directly, the purchase orders will be established between the District and the contractor, consultant, or supplier, at the member entity's request. Unless otherwise contained within this manual, all District Policies and Procedures relating to disbursement of funds and payment to member entities apply.

Funding Flow Diagram



Disbursement requests (invoices) must be accompanied by a verification statement from the member entity that the work for which payment is due has been completed in accordance with the standards contained in this manual. The disbursement request must identify the Master Plan facility maintained, specific plan activity or activities for which payment is sought, and separately identify personnel, equipment, and other related costs. (See Disbursement / Amended Annual Budget Request Form, which can be obtained electronically from the District.) Administrative costs incurred by the member entity in the management of the interlocal contract are not payable to the member entity. Examples include cost accounting work, secretarial/clerical work, the preparation of requests for payment, and certification statements for work performed under the contract.

All invoices from the member entity requesting payment to the member entity or direct payment to the member entity contractor or vendor must first be submitted to and approved by the member entity's Public Works Director or other designated responsible person in charge of the project. The Chief Engineer or designated District staff will process and approve such payments within 30 days providing all invoices have appropriate backup, and the required approval has been obtained and terms of the interlocal contract have been satisfied.

Direct payments to contractors must originate from the member entity and include the following:

1. Invoice to the member entity from the contractor.
2. Certification of work performed by the contractor signed by the member entity, if applicable.
3. Disbursement / Amended Annual Budget Request Form.

Monthly and annual summaries of purchase order balances, budget status, and facility expenditures shall be prepared by the District as a part of the routine financial reporting procedures to the Board.

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM - FISCAL YEAR 20XX-XX

ENTITY: _____

[ ] Disbursement Request

Vendor Name: _____

Invoice Number: _____

Amount Requested: _____

RFCD Purchase Order #: _____

[ ] Amended Annual Budget Request

Approved: _____

General Manager/Chief Engineer Date

Clark County Regional Flood Control District

MWP Facility #:											
Facility Name:											
Master Plan Facility ID:											**ACTIVITY TOTAL**
03-Facility Assessment & Inv.											**0.00**
05-Chnl Insp											**0.00**
06-Levee/DB/Debris Insp.											**0.00**
08-Species Survey and Removal											**0.00**
10-Reshape Chnl/Levees											**0.00**
15-Chnl Repair											**0.00**
20-Erosion Control and Repair											**0.00**
21-Dust Control											**0.00**
25-Clean DB											**0.00**
35-Fence Repair											**0.00**
40-Vege Control - C											**0.00**
45-Vege Control - M											**0.00**
50-Access Rd											**0.00**
55-Clean In/Outlet											**0.00**
60-Repair In/Out											**0.00**
65-Clean Storm Drn											**0.00**
70-Sewer Repair											**0.00**
75-Clean Culverts											**0.00**
80-Misc Maint											**0.00**
85-Engr											**0.00**
Facility Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

I certify that the above described maintenance was/will be performed in accordance with the criteria/standards contained in the District's Operations and Maintenance Manual. Further, the information contained in this Request accurately reflects those costs incurred/to be incurred during the performance of this work.

_____

Project Manager Date

4.20 ADMINISTRATIVE PROCEDURES

4.21 Purpose

The purpose of this element of the **Operations and Maintenance Manual** is to provide specific procedures for establishing standards and levels of service, preparing the annual work plan, administrating the planning, approval and enforcement elements, and updating the manual over time. The principal role of the District shall be to review and approve annual maintenance work plans and monitor the performance of work activities. The principal role of the member entities shall be development of annual work plans that are consistent with the District's approved maintenance activity list; performance of the maintenance work set forth in the approved work plans; and the submittal of quarterly reports that summarize work performance while certifying compliance with maintenance activity performance standards as set forth in the **Operations and Maintenance Manual.**

4.22 Annual Work Plans

In accordance with the schedule on the following page, each member entity shall submit a proposed annual maintenance work plan to the Chief Engineer containing the following components:

Part I:	Maintenance Work Plan Summary – Summary of overall work plan listing specific projects (physical system inventory) and associated costs attributable to each. (See Appendix B, Exhibit A.)
Part II:	Facility map(s) which identify location of projects (physical system inventory) and planned maintenance work by project.
Part III:	Maintenance Work Program Annual Budget – Individual maintenance projects (physical system inventory) broken into maintenance activities to be completed, including narrative, and associated budgeted costs for all projects identified in Part I. (See Appendix B, Exhibit A.)

District staff shall review the proposed plans and work with the member entities to resolve any discrepancies found with District maintenance standards and policy objectives. After the initial staff review, the plans shall be forwarded to the Technical Advisory Committee (TAC) and Citizens Advisory Committee (CAC). Lastly, the plans will be submitted to the Board for final approval.

The activities in the work plan shall be consistent with the District's approved activity list for maintenance of flood control and drainage facilities. Work plans should also describe locally funded work activities that may be linked to the District maintenance work activities to show overlapping areas of responsibility for personnel and equipment. Where local personnel and equipment are going to be used to perform both District funded activities and locally funded

activities, the member entity will describe how these resources are to be managed and the procedures for tracking costs related to both sets of activities.

Member entities may contract for the performance of maintenance work activities. The proposed work plan must specify that a contractor is to be utilized and the time frame for selection of a contractor. In the event that maintenance work is performed under contract, the contract must specify that the District has the authority to inspect all work performed under the contract and approve or deny payments to contractors based on inspection findings.

All work performed must comply with District approved maintenance activity performance standards as set forth in subsequent sections of this Manual. The member entity is required, as a minimum, to inspect Master Plan facilities annually; including any maintenance work performed by member entities on Master Plan Facilities, and shall notify the District prior to the annual inspection of completed maintenance work. Member entities shall facilitate the inspection of maintenance work by the District. The District may withhold funding, require additional maintenance work, or seek repayment of disbursed funds when an inspection reveals that work activities were not performed in conformance with activity performance standards. The annual maintenance work plan schedule follows:

February 1	-	Submittal of preliminary work plan proposal and tentative budget to District staff for review, recommendations, and coordination with member entities. This is important for the following reasons: 1) Fiscal Year Budget Authority submittal and approval. 2) Prioritization of maintenance funding activities.
April 1	-	Submittal of tentative annual work plans, budgets, and interlocal contracts to District staff for review, recommendations, and coordination with member entities.
May (TAC deadline)	-	Submittal of the member entity's final annual work plans, budgets, and interlocal contracts to the TAC and CAC for approval.
June (Board meeting)	-	After receiving approval from the TAC and CAC, member entities' final annual work plans, budgets, and interlocal contracts are submitted to the Board of Directors for approval.
July 1	-	Beginning of maintenance plan contract period, which ends June 30.

Each member entity will submit quarterly reports indicating the status of the work completed under the current fiscal year's program. (See Quarterly Status Report Form.) The reports are due 30 days after the close of the quarter, and will be submitted to the Board for review. Also, each member entity shall submit an annual certification to the District stating that all work contained in the work plan and paid through the interlocal contract has been performed to the specifications established in this manual.

Quarterly Status Report

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
QUARTERLY STATUS REPORT - FY 20XX-XX

MWP Facility #: _____ Entity: _____

Facility Name: _____ Date Prepared: _____

MP Facility ID: _____ Quarter: _____

Force Account/ Contract	Activity	Approved Work Plan Amount ($)	Amended Work Plan Amount ($)	Expended To Date ($)	Percent Complete	Scheduled Completion Date
	03 Facility Assessment and Inventory					
	05 Inspect Channels					
	06 Inspect Levees/Detention and Debris Basins					
	08 Species Survey and Removal					
	10 Clean and Reshape Channels/Levees					
	15 Repair Lined Channel					
	20 Erosion Control and Repair					
	21 Provide/Maintain Dust Control					
	25 Clean Detention Debris Basins					
	35 Fence Repair					
	40 Vegetation Control – Chemical					
	45 Vegetation Control – Mechanical					
	50 Maintain Access Road					
	55 Clean & Inspect Inlet/Outlet Structures					
	60 Repair Inlet/Outlet Structures					
	65 Clean Storm Sewer Lines					
	70 Storm Sewer Repair					
	75 Clean/Flush Culverts & Bridges					
	80 Miscellaneous Work Activities					
	85 Engineering					
	TOTALS	$0.00	$0.00	$0.00	0%	
Delays or problem areas:						
Work completed during current quarter:						
Work to be completed during next quarter:						

Consultant/
Contractor: _____

Project
Manager: _____ Phone Number: _____

4.23 Approval of Annual Work Plan

The work plans received by the District will be reviewed and budget requests compiled into a summary showing the dollar amount by member entity for each of the priority areas set forth in Section 4.11. The Chief Engineer shall review the total maintenance budget requests against the District's proposed annual total budget for facility maintenance and make a recommendation to the District Board as to the amount of maintenance funds to be disbursed to each respective member entity based upon equity and need.

Once the Technical Advisory Committee has reviewed the maintenance work plans and budget appropriation recommendation, the Chief Engineer will forward the compiled summary to the Board for consideration and approval as a key element of the Annual District Budget.

The Chief Engineer's report to the District Board shall show both the budget requested by the member entity and the recommended amount to be appropriated, the report will also make comments on any adjustments made to the initial request.

4.24 Work Plan and Budget Amendments

Requests for amendments to approved work plans and budgets must be submitted to the Chief Engineer in writing. The amendment request must specify the work elements affected, describe the reasons for the amendment request, and describe the impact of the proposed amendment on the affected work plan objectives.

Formal approval of work plan and/or budget amendments requiring a reallocation of funds between facilities must be obtained from the Chief Engineer prior to submittal of payment requests. (See Disbursement / Amended Annual Budget Request Form.) The member entity shall also notify District staff of work plan and/or budget amendments within a facility. Requests requiring an increase in the overall work plan budget must be submitted to the Board for approval with a supplemental interlocal contract for the amended work in accordance with Chapter VI.A.2 of the District's **Policies and Procedures Manual**.

Amendment requests shall be reviewed by District staff and responded to in writing within 15 days of receipt of the original request.

4.25 Certification of Compliance

It is the intent of the District to rely to the maximum extent possible on the member entities to carry out the maintenance activities and comply with the procedures and standards set forth in this manual. The District shall from time to time inspect facilities funded by the District or those on the Master Plan to assure compliance with the interlocal contract. Each member entity shall submit an annual certification to the District stating that all work contained in the work plan and paid through the interlocal contract has been performed to the specifications established in this manual. This certification shall be signed by the person executing the interlocal contract or their designee. The certification should summarize proposed and actual plan accomplishments. It should also describe any major maintenance problems that have implications for the District as a whole, such as significant deterioration of major conveyance system components or the failure of system components to perform as intended, and suggest revisions to the activity list provisions. In addition, the certification will include a detailed maintenance report for debris basins, detention basins and levees (high hazard structures). The report will list all conditions requiring maintenance and how each was addressed accompanied by before and after photo documentation. For maintenance of levees accredited by FEMA as providing protection from the base flood, annual levee maintenance reports will be kept on file by the affected entity and made available to FEMA upon request demonstrating compliance with 44CFR part 65.10.

The certification and final payment requests shall be submitted to the District within 30 calendar days of the termination of the annual interlocal contract for maintenance funding.

Final Accounting Report

(ENTITY)
MAINTENANCE WORK PROGRAM
FINAL ACCOUNTING REPORT - FY 20XX-XX
As of (Current Date)

VENDOR	P.O. NUMBER	P.O. AMOUNT	TOTAL EXPENDED	P.O. BALANCE
Sample Vendor 1	1234567890 10	1,000.00	1,000.00	0.00
Sample Vendor 2	1234567890 20	1,000.00	500.00	500.00
Sample Vendor 3	1234567890 30	1,000.00	200.00	800.00
	Total	$3,000	$1,700	$1,300

FY XX-XX INTERLOCAL AMOUNT/BUDGET	4,000.00	Total Encumbered	3,000.00
Total Encumbered	3,000.00	Total Expended	1,700.00
Total Unencumbered	$1,000.00	Total Unexpended	$1,300.00

Total Authorized	**$4,000.00**
Expended	**$1,700.00**
REPROGRAM FOR MWP	**$2,300.00**

Regional Flood Control District **(Entity)**

RFCD Date Project Manager Date

I certify that the above described maintenance was performed in accordance with the criteria/standards contained in the District's Operations and Maintenance Manual. Further, the information contained in this Final Accounting Report accurately reflects those costs incurred during the performance of this work. If there are any maintenance problems that have implications for the District as a whole, such as significant deterioration of major conveyance system components or failure of system components to perform as intended, a detailed description will accompany this report as an attachment.

4.26 Interlocal Contract Document

The performance of work outlined in the approved maintenance plan shall be guided by an interlocal contract entered into annually between the District and each member entity. A sample contract is contained in Appendix B. Major provisions of the contract include: the adoption of the Board approved work plan as the document outlining the work to be performed; references to the performance standards, payment procedures, and plan amendment procedures outlined in this manual for governing maintenance work performance evaluations, and contract amendments; and a requirement for submittal of an annual certification of results.

4.27 Contract for Maintenance Performance

If, in the opinion of the member entity, it appears to be most cost effective (or due to an emergency) to utilize the services of private contractors to perform maintenance functions, the member entity shall solicit bids from qualified contractors in compliance with their statutory procedures for the necessary work. All contracts for maintenance services shall be bid on an annual basis or for a specific project location. The member entity will provide the District with copies of bid specifications and bid tabulations as well as copies of the respective contract documents. The member entity shall advise the District in advance that they intend to utilize a private contractor (may be included as part of annual work plan). They shall also provide a summary of work performed and a statement of inspection as part of the request for payment to the member entity or directly by the District to the contractor. All expenditures must comply with NRS 332, Local Government Purchasing Act, NRS 338, the Public Works Act, and all relevant statutes, rules, regulations, and policies.

4.30 MAINTENANCE PROCEDURES

4.31 Purpose

As a part of the overall operations and maintenance procedures adopted by the District, an outline for specific maintenance procedures has been developed. The accepted maintenance procedures are centered around specific elements of a management system for field maintenance, and include defined maintenance activities, standards, scheduling, and reporting procedures.

Due to the diversity in physical features among the various agencies involved, and the varied resources employed in maintenance activities, it is essential to treat these procedures as general guidelines which must be tailored to meet the situation at hand. It is also essential that these procedures remain dynamic, be actively reviewed, and periodically updated. An annual review is recommended.

4.32 Activities

Maintenance work activities identify all major maintenance work and include all activities which are performed frequently and in amounts that make them a significant part of the total work program. Each activity must be clearly defined so maintenance personnel at all levels of management uniformly understand the operation to be performed and the type of deficiency to be corrected.

Personnel who plan, schedule, perform, report, or evaluate maintenance work must know what each work activity means. Work activities are used for the following purposes:

- Planned maintenance work is identified in the annual maintenance work plan by activity name and number.
- Activity names and numbers are used for authorizing, assigning, and reporting work.
- Activity names and numbers are used on work scheduling guides and work performance summaries.

Work measurement units are established for the major maintenance activities. For example, "Acres Covered" is the work measurement unit for vegetation control while "Cubic Yards Removed" is the work unit for cleaning and reshaping channels. These measurement units are used to describe how much work is planned and to report how much work is accomplished for each activity.

For some activities, specific work measurement units--other than labor hours--would not be meaningful. For example, the miscellaneous maintenance activity includes a number of different operations. This activity cannot be measured by a common unit other than labor hours.

Following is the accepted maintenance Activity List for the District including work measure units.

ACTIVITY NUMBER	ACTIVITY NAME	WORK MEASURE UNIT
03	Facility Assessment and Inventory	Labor Hours
05	Inspect Channels	Miles
06	Inspect Levees/Detention and Debris Basins	Miles/Each
08	Species Survey and Removal	Labor Hours
10	Clean and Reshape Channels/Levees	Cubic Yards
15	Repair Lined Channel	Each
20	Erosion Control and Repair	Square Feet
21	Provide/Maintain Dust Control	Acres
25	Clean Detention/Debris Basins	Cubic Yards
35	Fence Repair	Linear Feet
40	Vegetation Control – Chemical	Acres
45	Vegetation Control – Mechanical	Acres
50	Maintain Access Road	Miles
55	Clean and Inspect Inlet/Outlet Structures	Each
60	Repair Inlet/Outlet Structures	Each
65	Clean Storm Sewer Lines	Linear Feet
70	Storm Sewer Repair	Repairs
75	Clean/Flush Culverts & Bridges	Each
80	Miscellaneous Work Activities	Labor Hours
85	Engineering	Labor Hours

4.33 Standards

"Performance Standards" have been established for each of the major maintenance work activities. These performance standards specify:

- The most effective crew size.
- The kinds and number of equipment required.
- The major types of material that should be used.
- Recommended procedures for performing the work.
- An estimate of expected average daily accomplishment with standard crew size, equipment and procedures.
- Authorization and scheduling criteria.

Following is an item-by-item description of the format of the performance standards.

1. Activity Identification/Date – The activity number and name are shown as well as the "effective date" of the performance standard--to be used when updating or replacing performance standards.

2. Description and Purpose – The Description and Purpose section of the performance standard explains the work activity and the kinds of defects to be corrected or reasons for doing the work.

3. Authorized By and Work Control Category – The level of management responsible for authorizing the work is identified. Certain activities requiring special equipment, coordination, or expertise are Engineer-authorized activities and should not be scheduled or performed without the Engineer's approval. The type of control to be placed on the quantity of work performed is identified. This control is unlimited or limited in terms of the amount of work done (accomplishment) or the amount of labor input (crew-day).

4. Performance Criteria – This section includes important information for the "scheduler" about when to schedule the work and for the crew leader to identify the work to be done.

5. Crew Size – The crew size outlines the numbers of personnel needed to do the work. The crew size is based on average conditions. Sometimes, there will be a need to add or delete people to satisfy special traffic safety conditions or hauling requirements.

6. Equipment – The basic requirements for major pieces of equipment are listed. Situations such as the breakdown or unavailability of equipment or special materials hauling requirements may require the addition, deletion or substitution of equipment.

7. Materials – The materials section includes a list of the major materials to be used for the activity.

8. Work Method – The work method outlines, step-by-step, the recommended procedures for performing the work. Each step should be performed in order to correctly maintain the feature as well as provide the quality of work desired.

9. Average Daily Production – The average daily production is an estimate of the amount of work a crew can accomplish during a day using the recommended crew size, equipment, materials and work method. This estimate is shown as a range and should be attainable over a period of time. Some days the accomplishment may be more or less than the estimate, but eventually, the average should fall in line.

10. Notes – Any other relevant, helpful information or instructions.

Use of Performance Standards

Maintenance supervisory personnel should become thoroughly familiar with these performance standards. It is important that the performance standards be used when making assignments and performing work. Some situations will require deviation from the performance standards--such as more or less flagmen or additional haul trucks. These situations are recognized, and crew leaders are expected to consider such situations when organizing and managing their activities.

Haul truck needs should be determined using factors such as haul distance and time estimates (spot, dump, load, and cycle times).

The performance standards also provide guidance and a measure for supervisors to use when evaluating work in progress and completed.

Field personnel are in the best position to identify new or better work methods or difficulties with the current performance standards. These suggestions for improvements or questions should be directed to the crew leader or supervisor.

The performance standards should be reviewed and updated annually. If other changes occur that require more frequent review and update or development, the performance standards can be changed to suit these needs.

4.34 Scheduling

The objectives of work scheduling are:

- To do the planned amount of work.
- To perform the work when it should be done.
- To do the work where it should be done.
- To use the proper people, equipment and supplies to do the work.
- To ensure to the extent possible that all flood control facilities are functioning at design capacity during a storm event, noting that Flash Flood Season is July through September.

Three tools are available to help supervisors meet these objectives. The WORK PROGRAM defines the estimated amount of work and the estimated labor-days required for each activity to provide the desired levels of service; a WORK CALENDAR helps to establish when the various activities should be done; and the PERFORMANCE STANDARDS provide information about quantity standards, personnel requirements and how much work can be done in a given time.

The annual work program establishes the kinds and amount of work to be done during the year and the resources that will be required to do that work. This annual plan needs to be broken into a monthly plan for effective scheduling of work and to permit timely evaluations of work program performance.

The process of "distributing" the annual work load throughout the year is done by allocating a part of the work (in labor-hours, by activity) to specific months. Some types of work -- emergency or service activities -- must be done throughout the year as the need arises. Other types of work must be done on a regularly scheduled basis -- such as preventive maintenance work. Finally, some types of work can be done during certain periods but can be shifted from one month to the other, and still other work can be done almost any time during the year.

These factors must be considered when distributing the different types of work. Preventive maintenance and other types of work which must be performed on a regularly scheduled basis are distributed so as to level labor power needs as much as possible. Finally, work which can be performed any time is distributed to those months with the fewest labor-days. In this way, staffing needs are kept as uniform as possible resulting in more efficient use of available labor power.

A work calendar lists -- activity by activity -- the labor-hours for each month. These labor-hours are used in conjunction with the work program annual work quantities for work scheduling and the preparation of periodic Activity Status Reports. (See Work Calendar Form.)

Once the work program and staffing levels have been set, the work load distribution can be finalized and the calendar prepared to summarize/communicate the planned monthly distribution of the work program.

Work scheduling is the process of using the work calendar and specific scheduling procedures to plan ahead, establish work priorities and accomplish the work.

The performance standards outlined in the previous sections apply to corrective and preventive maintenance activities. These procedures are not as rigid or foolproof as implied by the description. Equipment breakdowns, emergencies, or bad weather will disrupt a schedule -- but part of the scheduling process is to be aware that these situations will occur and to be prepared to respond with little or no difficulty. Because of these situations, supervisors should not expect to accomplish all of the work as scheduled. Generally, a supervisor can consider his/her scheduling efforts to be successful if 75 to 80 percent of the scheduled work is completed as planned.

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
WORK CALENDAR

MWP Facility #: _____ Entity: _____
Facility Name: _____ Fiscal Year: _____
MP Facility ID: _____ Date Prepared: _____

ACTIVITY		Monthly Distribution of Time (in hours)												Total Per
No.	Description	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Activity
03	Facility Assessment and Inventory													-
05	Inspect Channels													-
06	Inspect Levees/Detention and Debris Basins													-
08	Species Survey and Removel													-
10	Clean and Reshape Channels/Levees													-
15	Repair Lined Channel													-
20	Erosion Control and Repair													-
21	Provide/Maintain Dust Control													-
25	Clean Detention/Debris Basins													-
35	Fence Repair													-
40	Vegetation Control - Chemical													-
45	Vegetation Control - Mechanical													-
50	Maintain Access Road													-
55	Clean & Inspect Inlet/Outlet Structures													-
60	Repair Inlet/Outlet Structures													-
65	Clean Storm Sewer Lines													-
70	Storm Sewer Repair													-
75	Clean/Flush Culverts & Bridges													-
80	Miscellaneous Work Activities													-
85	Engineering													-
	Total Per Month	-	-	-	-	-	-	-	-	-	-	-	-	-

I certify that the above described maintenance will be performed in accordance with the criteria/standards contained in the District's Operations and Maintenance Manual. Further the information contained in this Work Calendar accurately reflects the time expected to be incurred during the performance of this work.

_____
Project Manager Date

Following are some additional hints or techniques to consider:

- It is not necessary to "formally schedule" the daily, routine activities. It is necessary, however, to regularly check the work reports and accomplishments to verify the distribution of work assignments. A periodic review and adjustment of the work assignments may be necessary to maintain a "balanced work load".
- It is usually best to prepare a schedule (and work assignments) assuming everything will work as planned -- no equipment breakdowns, no emergencies, etc. But make sure a backlog of "alternate" work is available so that little time is wasted when adjustments to the schedule must be made.
- Some guidelines for identifying alternate work:

    - Low priority work that needs to be done, but not necessarily during the next week or so.
    - Work that does not require special equipment or a lot of preparation time.
    - Preventive maintenance on light equipment.

Take time to estimate the amount of work needed and the number of hours required to do the work. Good estimates will improve the scheduling process significantly. The performance standards, inspections and sound judgment based on experience all help the estimating process.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
03	**FACILITY ASSESSMENT AND INVENTORY**	**09/09/10**

DESCRIPTION & PURPOSE

Assessment and inventory program to catalog existing facilities, assess condition of those facilities, and prioritize repairs.

AUTHORIZED BY	LIMITS ON WORK
Director of Public Works or designee	

PERFORMANCE CRITERIA

After completion of initial inventory, maintenance of database will be ongoing to keep records up to date and accurate. Continually assess system condition and maintenance priorities.

CREW SIZE	WORK METHOD
• Project Manager • Project Engineer • Survey Crew • CADD/GIS	1. Field locate existing RFCD facilities. 2. Assess condition and maintenance needs. 3. Catalog findings in a database. 4. Prioritize repairs based on assessment of needs.
EQUIPMENT	
• 1 Pickup • GPS Equipment • Traffic Control • Computer w/software • Video Inspection	
MATERIAL	**AVERAGE DAILY PRODUCTION**

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
05	**INSPECT CHANNELS**	**09/09/10**

DESCRIPTION & PURPOSE

Inspect both improved and unimproved flood channels for proper cross-section, sedimentation, debris accumulation and erosion damage, in order to schedule cleaning or repairs as needed.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Perform complete inspection of channels on an annual basis and after major storm events.

CREW SIZE	WORK METHOD
• 1 Crew Supervisor 1 **TOTAL**	1. Use safety devices, as required. 2. Visually inspect channels for cross-section, sediment, debris, erosion, and vegetation. 3. Prioritize a list of channels requiring maintenance. 4. Schedule cleaning of channels referring to prioritized list.
EQUIPMENT	
• 1 Pickup	
MATERIAL	AVERAGE DAILY PRODUCTION
	8 miles/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
06	**INSPECT LEVEES, DETENTION AND DEBRIS BASINS**	**09/09/10**

DESCRIPTION & PURPOSE

Inspect for proper cross-section, sedimentation, debris accumulation, erosion damage including piping, unwanted vegetation growth, depressions/rutting, bank caving, slope stability, and/or steepened slopes, cracking, animal burrowing, encroachments, and condition of erosion control measures in order to schedule cleaning or repairs as needed. Also perform post maintenance inspection to ensure all recommended maintenance was completed properly.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Perform complete inspection after major storm and earthquake events. Prepare complete findings and recommendations report, including characterization of all animal burrows found and supported by photographs of areas requiring maintenance. Report should also include results of post maintenance inspection.

CREW SIZE	WORK METHOD
• 1 Crew Supervisor 1 **TOTAL**	1. Use safety devices, as required. 2. Visually inspect for proper cross-section, sedimentation, debris accumulation, erosion damage including piping, unwanted vegetation growth, depressions/rutting, bank caving, slope stability, and/or steepened slopes, cracking, animal burrowing, encroachments, and condition of erosion control measures. 3. Photograph areas of distress identified in Part 2 with notation describing location on levee (e.g. stationing). 4. Prioritize a list of facilities requiring maintenance. 5. Schedule maintenance of levees referring to prioritized list.
EQUIPMENT	
• 1 Pickup	
MATERIAL	AVERAGE DAILY PRODUCTION
	8 miles/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
08	**SPECIES SURVEY AND REMOVAL**	**09/09/10**

DESCRIPTION & PURPOSE

In situations where maintenance activities could impact the desert tortoise or other protected species, a USFWS approved biologist will survey the work zone and recommend appropriate action for compliance with Biological Opinion 1-5-93-F-67R and all applicable laws.

Provides mitigation for potential embankment failure by piping through animal burrows.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Perform surveys/removals within 30 days prior to ground-disturbing activities. Burrows should be inspected by a qualified biologist to ensure that the burrow is not occupied, and then collapsed or filled in. Animal burrows that are identified should be thoroughly excavated and inspected, backfilled with compacted fill similar to material of the levee or other similar means (e.g.: pumped with flowable fill).

CREW SIZE	WORK METHOD
• 1 USFWS-approved biologist 1 **TOTAL**	1. Use safety devices, as required. 2. Visually inspect work areas for signs of protected species and burrows. 3. Ensure that burrows are not occupied then collapse or fill in burrow. 4. Tortoises shall be relocated to suitable habitat in accordance with Biological Opinion 1-5-93-F-67R and all applicable laws. 5. A brief report documenting the activities of the biologist will be prepared and submitted to RFCD with photo documentation.
EQUIPMENT	
• 1 Pickup • 1 fiber-optic scope	
MATERIAL	AVERAGE DAILY PRODUCTION
	1 work area/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
10	**CLEAN & RESHAPE CHANNELS/LEVEES**	**09/09/10**

DESCRIPTION & PURPOSE

Sediment and debris removal, and reshaping of unlined channels to restore adequate capacity. Reshaping of levee crests to eliminate depressions and rutting to eliminate potential to pond water and associated seepage damage. Reconstruction of areas where cracking of the embankment is evident and/or slope stability has been compromised.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Improved earth channels and levees should be scheduled for cleaning and re-profiling on an annual schedule, or as appropriate following a flood event. Natural channels on a 3-year cycle.

CREW SIZE	WORK METHOD
• 2 Equipment Operators • 1 Truck Driver • .5 Foreman 3.5 **TOTAL**	1. Set up safety devices as required. 2. Remove sediment and vegetation. 3. Load and haul removed material to proper disposal site. 4. Reshape channel/levee. 5. All fill should be compacted to a minimum of 95% of maximum dry density per ASTM D1557. Perform compaction tests following frequency guidelines in uniform Standard Specifications. 6. Clean up work site as necessary. 7. Remove safety devices.
EQUIPMENT	
• 1* 10 Wheel Dump Truck • 1 Scraper • 1 Gradall	
MATERIAL	AVERAGE DAILY PRODUCTION
• Disposal Fees	300 Cubic Yards/day

NOTES:

*Schedule sufficient trucks to insure maximum utilization of excavation equipment.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
15	**REPAIR LINED CHANNEL**	**09/09/10**

DESCRIPTION & PURPOSE

Repair of damaged concrete, rip rap, gabion, or other channel linings, retaining walls, etc., to restore to original condition and prevent further deterioration.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Repairs of channel linings, retaining walls, and other structures critical to the protection of a facility are to be scheduled immediately upon detection of damage.

CREW SIZE	WORK METHOD
• 1 Maintenance Foreman • 2 Maintenance Workers 3 **TOTAL**	1. Obtain safety equipment, materials, and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Clean and prepare damaged area. 4. Build and place forms as necessary. 5. Place and finish concrete. 6. Remove forms and back fill. 7. Clean up work site as necessary.
EQUIPMENT	
• Pickup • Flatbed Dump • Concrete Mixer	
MATERIAL	AVERAGE DAILY PRODUCTION
• Assorted lumber • 6-30 bags sacked concrete • 3-15 tons concrete gravel mix • 2-10 CY ready-mix concrete	1 Each/Day

NOTES:

Crew size and equipment may vary significantly depending on urgency, extent and complexity of repair.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
20	**EROSION CONTROL AND REPAIR**	**09/09/10**

DESCRIPTION & PURPOSE

Placement of rip rap, sand bags, or other erosion control materials and repair of damaged areas of erosion protection. The replacement and compaction of material removed by erosion, using hand tools or other methods, to restore flood control channels, supporting embankments, levees or access roads. This work is done to prevent further deterioration and eliminate potential erosion problems.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Work is to be scheduled when damage or deterioration is severe enough to present potential erosion problems and when damage has occurred which has affected or will affect the structural integrity of a channel embankment, levee, or access road. Erosion undercutting roadways, sidewalks, or prepared embankments/improvements shall be repaired immediately. Repair of undermined stabilizers shall be scheduled immediately.

CREW SIZE

- 2 Foreman
- 2 Equipment Operators
- 4 Maintenance Workers

8 **TOTAL**

EQUIPMENT

- 1 Truck Crane or Backhoe
- 1 Air Compressor w/compactor
- 1 1-Ton Dump Truck or Flatbed Truck
- 1 Pickup w/Water Tank or Auxiliary Spray Truck

WORK METHOD

1. Obtain safety equipment, materials and tools necessary for the day's work.
2. Begin applicable safety procedures and/or traffic control.
3. Shape work area to receive riprap, or other erosion control materials. Shape repair area to conform to adjacent areas.
4. Place material and grout where applicable. Place and compact fill material in lifts to a minimum of 95% of maximum dry density per ASTM D1557. Perform compaction tests following frequency guidelines in Uniform Standard Specifications.
5. Haul fill material from pre-determined source.
6. Remove debris and growth from damage location.
7. Back fill as necessary.
8. Clean up work site as necessary.

MATERIAL

- 20-50 Tons Rock for riprap (delivered)
- 5-12 yards ready mix concrete (if needed)
- 5,000-15,000 gal Water
- 15-30 Tons Select Fill Material

AVERAGE DAILY PRODUCTION

1,300 Square Feet/day
15 Cubic Yards

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
21	**PROVIDE / MAINTAIN DUST CONTROL**	**09/09/10**

DESCRIPTION & PURPOSE

Uniform application and maintenance of surface gravel, dust palliatives, or other alternative dust control measures to limit the emission of particulate matter into the ambient air.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Work is to be scheduled when loose sand, dust, or dust particles are found to exist in excess of acceptable limits. Select and apply approved dust control measure in a manner that will minimize the degradation of water quality.

CREW SIZE

- 1 Foreman – Part-time
- 1 Driver
- 1 Nozzle operator
- 1 – 2 laborers to protect surrounding area from overspray

4 – 5 **TOTAL**

EQUIPMENT

- 1 Spray Truck
- 1 Flatbed truck for delivery of bulk materials
- 1 Forklift to load bulk materials into tank on spray truck
- 1 Motor grader
- 1 Compactor

WORK METHOD

1. Obtain safety equipment, materials and tools necessary for the day's work.
2. Begin applicable safety procedures and/or traffic control.
3. Prepare surface area to receive palliative or other dust control measures with motor grader and compactor if required.
4. Palliative with pre-emergent herbicide requires preparation of soil surface.
5. Apply dust palliative to prepared surface.
6. Clean up work site as necessary.

MATERIAL

- Gravel
- Dust palliative (i.e. gypsum, fiber mulch)
- Water source
- Other alternative dust control measure

AVERAGE DAILY PRODUCTION

6 acres/day – open areas (i.e. detention basin)
3 acres/day – strip areas with fence (i.e. channel)

NOTES:

Control measures shall be implemented to limit the disturbance of open areas.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
25	**CLEAN DETENTION/DEBRIS BASINS**	**09/09/10**

DESCRIPTION & PURPOSE

Inspection and removal, by loader (including hauling and disposal), of sediment and debris deposited in detention and debris basins to restore full capacity and original shape.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Remove sediment when debris basins or dams detention capacity is reduced. Clean out is normally justified when the sedimentation reaches 1 to 2 feet in depth or as established by the design.

CREW SIZE	WORK METHOD
• 1 Foreman • 3 Equipment Operators • 1 Maintenance Worker 5 **TOTAL**	1. Obtain safety equipment, materials and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Prepare removal and disposal sites for access. 4. Stockpile material for removal. 5. Load material and haul to proper disposal site. 6. Shape dam or basin to desired line and grade. 7. Grade disposal site as necessary. 8. Clean up work site as necessary.
EQUIPMENT	
• 1 Pickup • 1 Loader • 2* Dump Trucks	
MATERIAL	AVERAGE DAILY PRODUCTION
• Disposal Fees	1,000 Cubic Yards/day

NOTES:

*Schedule sufficient trucks to insure maximum utilization of excavation equipment.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
35	**FENCE REPAIR**	**09/09/10**

DESCRIPTION & PURPOSE

The repair and/or re-establishment of downed or damaged fences to restore fence to proper condition and to provide right-of-way control.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Repair of downed or open fence areas to be performed upon detection. Repairs to damaged locations that remain partially functional are to be scheduled in priority with other work.

CREW SIZE	WORK METHOD
• 2 Maintenance Workers 2 **TOTAL**	1. Obtain safety equipment, materials and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Perform necessary repairs to: • Posts • Fabric • Top rail 4. Clean up work site as necessary.
EQUIPMENT	
• 1 Fence Truck • 1 Concrete Mixer (if needed)	
MATERIAL	AVERAGE DAILY PRODUCTION
• 40-50 Linear Ft Fence Fabric • Miscellaneous Hardware • 5 bags "Ready Crete"	100 Linear Feet/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
40	**VEGETATION CONTROL – CHEMICAL**	**09/09/10**

DESCRIPTION & PURPOSE

The application of herbicides, to designated areas, with a boom-mounted spray bar to prevent new growth and/or control existing vegetation, for the purpose of insuring the capacity and integrity of flood control facilities.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Spray pre-emergent herbicide and post-emergent herbicide annually to designated areas combining applications where possible. Select and apply herbicides in a manner to minimize the degradation of water quality.

CREW SIZE	WORK METHOD
• 2 Maintenance Workers 2 **TOTAL**	1. Set up safety devices as required. 2. Treat channel areas as required. 3. Remove safety devices. 4. Clean up work site as necessary.
EQUIPMENT	
• 1 Truck-mounted chemical tank with spray bar and hand sprayer.	
MATERIAL	**AVERAGE DAILY PRODUCTION**
• Pre 12.5-25 lb/Ac • Emerge Contact: 12.5-25 lb/Ac • Post Brush: 120 lb/Ac • Emerge Grass: 30 lb/Ac • Waterweed: 1 gal/Ac • Spreader: 1 gal/Ac • Water 200 gal/Ac	Acres

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
45	**VEGETATION CONTROL – MECHANICAL**	**09/09/10**

DESCRIPTION & PURPOSE

The mechanical removal of undesirable vegetation such as trees, brush and weeds to maintain detention, debris basins, levees and channels for the purpose of insuring the capacity and integrity of flood control facilities.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Work to be scheduled when vegetation growth is too high for effective spraying. All trees, located in riprapped areas, drainage channels and on or within 15 feet of the toe of a levee must be cut down, the root ball removed, the voids filled and compacted to original construction specifications unless specifically accounted for in the design. Tree growth in natural conveyance areas may be acceptable. Removal of vegetation in natural areas should be considered on a case by case basis in accordance with the purpose stated above and the character of the natural area.

CREW SIZE	WORK METHOD
• 1 Equipment Operator 1 **TOTAL**	1. Obtain safety equipment, materials, and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Mow, blade down, or turn under unwanted vegetation. 4. Clean up work site as necessary.
EQUIPMENT	
• 1 Mower or Grader • 1 Tilt Trailer (if needed) • 1 Pickup	
MATERIAL	AVERAGE DAILY PRODUCTION
	4 Acres/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
50	**MAINTAIN ACCESS ROADS**	**09/09/10**

DESCRIPTION & PURPOSE

Mechanical grading of access roads to remove minor ruts and erosion, and restore normal shape and cross slope, for access to flood control facilities.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

As needed prior to rainy season, or when the weather affects the road condition.

CREW SIZE	WORK METHOD
• 2 Equipment Operators • 1 Maintenance Workers 3 **TOTAL**	1. Obtain equipment and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Grade access roads: • Restoring X-section shape • Filling potholes • Grading out ruts • Restoring ditches and drainage. 4. Roll and compact regraded. 5. Clean up work site as necessary.
EQUIPMENT	
• 1 Grader • 0-1 Water Truck • 0-1 Roller • 1 Pickup	
MATERIAL	AVERAGE DAILY PRODUCTION
• 10,000 Gal Water (if needed)	.5 Mile/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
55	**CLEAN & INSPECT INLET/OUTLET STRUCTURES**	**09/09/10**

DESCRIPTION & PURPOSE

Cleaning and inspection of catch basins, inlets, sumps, grates, outflow and other structures to remove sediment and debris and to inspect for structural integrity and proper functioning.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Plan for structures to be inspected and cleaned a minimum of once per year. Annual cleaning shall be the major effort to allow thorough inspection of structure in order to schedule repairs.

CREW SIZE	WORK METHOD
• .25 Foreman • 2 Maintenance Workers 2.25 **TOTAL**	1. Perform daily vehicle P.M. check and check equipment. 2. Place signs/traffic control devices as required. 3. Locate truck in the best working position and as far off roadway as practical. 4. Remove grate. Then remove debris, trash & sediment from grate. 5. Loosen solids with spade if necessary. 6. Flush/vacuum basin. 7. Inspect structure visually to determine if further cleaning or repair is necessary. 8. Dispose of debris at proper disposal site. 9. Check and clean equipment after use. 10. Clean up work site as necessary.
EQUIPMENT	
• 1 1-Ton Truck • 1 Water Tanker (1500 gal) • -or- High Pressure Vacuum (Vactor) • Appropriate Hand Tools	
MATERIAL	AVERAGE DAILY PRODUCTION
• Water	15 Each/day

NOTES:

Structures that cannot be cleaned shall be reported to the Maintenance Supervisor for initiation of corrective action.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
60	**REPAIR INLET / OUTLET STRUCTURES**	**09/09/10**

DESCRIPTION & PURPOSE

Repair of catch basins, grates, inlets, control gates, outfalls, weirs, manholes, sumps, and other spot structures to restore elements to their original operational condition.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Based on detailed inspection of repair, replace components, or entire structure as conditions warrant. Plan repair of five percent (5%) of system structures per year.

CREW SIZE	WORK METHOD
• 1 Foreman • 2 Maintenance Workers 3 **TOTAL**	1. Obtain necessary safety equipment, tools, and materials. 2. Initiate applicable safety procedures and traffic control. 3. Remove and clean area of damage/failure. 4. Repair as necessary to original condition and test operation as appropriate. 5. Clean up work site as necessary.
EQUIPMENT	
• 1 Pickup • 1 Compressor w/accessories	
MATERIAL	AVERAGE DAILY PRODUCTION
• Concrete • Aggregates • Miscellaneous parts, as required	1 Each/day

NOTES:

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
65	**CLEAN STORM SEWER LINES**	**09/09/10**

DESCRIPTION & PURPOSE

The removal of debris of any type from within conduits by: flushing with water; the use of a sewer cleaning machine; or by physically entering the conduit and manually removing debris, to restore full capacity.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Plan cleaning of storm sewer lines on an average 5-year cycle. Specific areas may require annual cleaning while others will require less than 5-year cleaning.

CREW SIZE	WORK METHOD
• 1 Maintenance Foreman • 2 Maintenance Workers 3 **TOTAL**	1. Obtain safety equipment and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Remove debris from conduit. 4. Load debris and haul to designated disposal site if necessary. 5. Clean up work area as necessary.
EQUIPMENT	
• 1 Sewer Cleaner	
MATERIAL	AVERAGE DAILY PRODUCTION
• 0-5,000 Gallons Water	1,500 linear feet/day

NOTES:

Work should be scheduled whenever possible, in conjunction with annual cleaning of adjacent structures.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
70	**STORM SEWER LINE REPAIR**	**09/09/10**

DESCRIPTION & PURPOSE

Excavation and repair of storm sewer lines to eliminate blockages and repair failed pipes.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Priority of repairs:
1. Eliminate blockages and hazards to public safety;
2. Remove flow restrictions and repair damaged/failed pipe sections.

CREW SIZE	WORK METHOD
• 1 Foreman • 1 Equipment Operator • 2 Maintenance Workers 4 **TOTAL**	1. Set up warning signs and traffic control devices. 2. Take necessary measures to control flow -- providing uninterrupted service whenever possible. 3. Cut pavement and/or excavate to the extent required to determine necessary scope of repairs. 4. Remove flow restrictions, as necessary. 5. Back fill and compact in lifts to within 10 inches of surface. 6. Place select material (rock or shell) and compact to within 2 inches of surface* (See Note below.) 7. Coordinate density test and request repaving as required. 8. Remove signs and warning devices. 9. Clean up work site as necessary. 10. Record work accomplishment.
EQUIPMENT	
• 1 Dump Truck • 1 Backhoe/Util Tractor • Air Compressor w/accessories • Appropriate Hand Tools	
MATERIAL	AVERAGE DAILY PRODUCTION
• Pipe/fittings • Sand • Cement • Rock • Asphalt, as required	1 Repair/day

NOTES:

Verify location of other utilities prior to excavation. *Back fill specifications apply to paved areas. In easements and other unpaved areas, back fill and compact in 2-foot lifts to grade; re-sod as necessary. Install safety fence and secure job site at end of workday as required.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
75	**CLEAN / FLUSH CULVERTS & BRIDGES**	**09/09/10**

DESCRIPTION & PURPOSE

Cleaning/flushing of culverts and bridges to remove sediment and debris, and eliminate restriction to flow.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Plan for all culverts to be cleaned/flushed annually.

CREW SIZE

- 1 Maintenance Supervisor
- 1 Maintenance Worker

2 **TOTAL**

EQUIPMENT

- 1 1-Ton Dump Truck
- 1 Water Tanker (1500 gal)
- -or- High Pressure/Vacuum cleaner/Vactor
- Safety Equipment
- Appropriate Hand Tools

WORK METHOD

1. Place signs and safety devices.
2. Locate truck in best working position and as far off roadway as possible.
3. Clean out ends of culvert.
4. Flush culverts until flow is unrestricted.
5. Load excess material/debris into truck for disposal at proper disposal site.
6. Pick up signs and safety devices.
7. Clean up work site as necessary.

MATERIAL

- Water

AVERAGE DAILY PRODUCTION

5-7 Each/Day

NOTES:

1. Inform Maintenance Supervisor of any non-cleanable culverts or those that can only be partially cleaned.
2. Avoid damaging downstream property when flushing culverts.
3. Work should be scheduled, whenever possible, in conjunction with annual cleaning of adjacent structures.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
80	**MISCELLANEOUS WORK ACTIVITIES**	**09/09/10**

DESCRIPTION & PURPOSE

All work performed that is not described in previous activities. This includes, among others, activities such as catwalk repair, rodent control, pump maintenance, concrete spalled area repair, painting, trash pickup*, graffiti abatement, sign installation and maintenance.

AUTHORIZED BY	LIMITS ON WORK
Maintenance Supervisor	

PERFORMANCE CRITERIA

Plan 8 labor hours per channel mile per year for miscellaneous maintenance work.

CREW SIZE	WORK METHOD
• 1 Maintenance Worker 1 **TOTAL**	1. Obtain safety equipment, materials, and tools necessary for the day's work. 2. Begin applicable safety procedures and/or traffic control. 3. Clean up work site as necessary.
EQUIPMENT	
• 1 Pickup • Hand tools	
MATERIAL	**AVERAGE DAILY PRODUCTION**
• As required	8 Labor Hours

NOTES:

*Includes appliances, tires, car bodies, and other large objects dumped in channels/basins.

PERFORMANCE STANDARD

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ACTIVITY NUMBER	NAME	DATE
85	**ENGINEERING**	09/09/10

DESCRIPTION & PURPOSE

All work that is by nature engineering. This includes, among others, surveying, preparation of plans and specifications, as well as preparing and updating Emergency Action Plans.

AUTHORIZED BY	LIMITS ON WORK
Director of Public Works or designee	

PERFORMANCE CRITERIA

CREW SIZE	WORK METHOD
• N/A	1. As deemed most cost effective.
EQUIPMENT	
• N/A	
MATERIAL	**AVERAGE DAILY PRODUCTION**
• N/A	8 Hours/Day

NOTES:

4.35 Reporting

Comprehensive maintenance programs include procedures for reporting and summarizing work accomplished and labor-hours used for maintenance activities. This information enables managers and supervisors to compare actual performance with the planned work program. These planned-actual comparisons -- on a regular basis -- are essential for effective management and control of the work program.

The reporting procedures provide specific information:

- What Master Plan facility required work.
- What work was done by activity.
- How much of each activity was done.
- The labor-hours used to accomplish the work.

This information is used by managers in their effort to:

- Make sure the right kinds and amounts of maintenance work are done.
- Identify the problem areas and related corrective actions.
- Develop future work programs and budgets.
- Identify opportunities for improved productivity.

The work reporting process can consist of a simple form as outlined in the following section.

Daily Work Activity Report

The Daily Work Activity Report may be used to record and summarize: (1) the kinds and amounts of work performed by maintenance personnel, and (2) the number of labor-hours used to do that work. The report can be used to summarize all work activities. Each member entity may use its standard accounting/reporting procedures for the Daily Work Activity Report.

The Maintenance Supervisor or crew leader usually prepares the Daily Work Activity Report. The following are instructions for the completion of the sample report. (See Daily Work Activity Report Form.)

1. Identification Data – Fill in all blanks: the member entity, date, name of person preparing the report, and the names and employee numbers of all persons to perform work to be reported for the day. (The form provides for several combinations of activities and employees. If additional pages are needed, number the pages accordingly).

2. Master Plan Facility ID/Name – Enter the specific 4 letter-4 digit Master Plan Facility number and reach, which indicates the "from" and "to", if applicable. This number directly corresponds to the specific Master Plan location as identified on current Master Plan maps. Also, indicate the Facility Name.

3. MWP Facility Number – Enter the identifying Maintenance Work Plan facility number. (This number directly corresponds to the budget approved for the facility and will typically include a range of Master Plan facilities and reach.)

4. Activity Number – Enter the number of each activity performed. Use the Work Activity Directory or Performance Standards to complete the blank.

5. Employee Number – Enter the employee number of the person working a specific activity at the specific facility.

6. Hours Worked by Each Employee – Record the number of hours worked by each employee, by the appropriate activity. Record the time spent to the nearest quarter-hour. For example, record 1 hour and 45 minutes as 1.75 hours and 3 hours and 20 minutes as 3.25 hours.

7. Equipment Number – Enter the assigned equipment number for any mechanical equipment on which work was performed for preventive and corrective maintenance only.

8. Work Performed – Enter the location and a brief description of the work performed.

9. Accomplishment – Measure and record the amount of work done for each activity. Use the correct measurement unit for each activity. (See the Activity List in Section 4.32.) Record the amount of work done to the nearest whole unit. Record labor-hours to the nearest hour. For activities with labor-hours as the unit of measure, the "quantity" will be exactly the same as "total hours" for the activity.

10. Notes/Comments – Record any additional relevant information that may be of use in summarizing and analyzing work activity data.

The completed reports can be used for monthly summarization and report preparation, and serve as completion certification backup for the monthly force account payment billings.

REGIONAL FLOOD CONTROL DISTRICT
DAILY WORK ACTIVITY REPORT

ENTITY: _____

Employee Name:_____No._____

Date Work Performed:_____ 20____

Employee Name:_____No._____

Supervisor Name:_____

Employee Name:_____No._____

Employee Name:_____No._____

							Accomplishment	
MWP Facility Number	Master Plan Facility ID/Facility Name	Activity Number Worked	Employee Number	Hours Worked by Activity	Equip. Number Used	Work Performance (Location, Brief Description, Materials Used, Etc.)	Amount	Unit of Measure

NOTES/COMMENTS:_____
_____

The undersigned hereby certifies that the above described maintenance was performed in accordance with the criteria/standards contained in the District's Operations and Maintenance Manual. Further, the information contained herein accurately reflects the tiime and accomplishments reported during the performance of this work.

_____ _____ _____

Superivsor's Signature Date Title

Page ____ of ____

4.40 INVENTORY PROCEDURES

4.41 Purpose

The purpose of this element of the **Operations and Maintenance Manual** is to provide a record of the existing physical flood control system that is eligible for maintenance funding assistance by the District. The physical facilities that make up the collection and conveyance system have in many instances been paid for in whole or in part by the District, however, they are not owned, operated, or maintained by the District. If, however, the total flood control system does not function properly when needed, it is ultimately the responsibility of the District to determine why and to take corrective action. A critical key in assuring the system functions properly is an up-to-date inventory of the physical system.

4.42 Physical System

The member entities shall submit annual updates of the physical system inventory on the forms required by the District (See Appendix B, Exhibit A – Maintenance Work Plan Summary and Maintenance Work Program Annual Budget Form.)

4.43 Physical System Maps

The individual member entities shall submit to the District a physical system map(s) as part of the Annual Work Plan as discussed in Section 4.22, or more frequently as project completion dictates, reflecting the size, location and material elements of their drainage and flood control system. The map(s) shall reflect that portion that is on the Master Plan and also those systems that are eligible for Regional Flood Control District funding under the categories shown in Section 4.11 of this manual. Physical system maps shall be provided to the District in a form that is readily reproducible.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
OPERATIONS AND MAINTENANCE MANUAL

CHAPTER 5
EMERGENCY FUNDING PROCEDURES

5.10 EMERGENCY FUNDING PROCEDURES

5.11 Purpose

This element of the **Operations and Maintenance Manual** provides the member entities with procedures to perform emergency restoration and rehabilitation immediately following a flood event. A principal role of the District shall be to support the member entities efforts to: (1) secure funding from state, federal, member entity reserves and private sources; and (2) facilitate required immediate repairs to regional flood control facilities without delay.

Projects eligible for District emergency restoration and rehabilitation funding are those included in the member entity's approved or amended Maintenance Work Program.

5.12 Procedures

If the governing body elects to declare an emergency, then the District, in accordance with NRS 332.112 (Emergency Contracts) will authorize and process emergency purchase orders to the maximum limit of unexpended funds upon written request by the member entity.

APPENDIX A

KEY STATUTORY, REGULATORY AND POLICY REFERENCES

NEVADA REVISED STATUTES

1. CHAPTER 332 – PURCHASING: LOCAL GOVERNMENTS
2. CHAPTER 338 – PUBLIC WORKS
3. CHAPTER 543 – CONTROL OF FLOODS

UNIFORM REGULATIONS FOR THE CONTROL OF DRAINAGE

1. SECTION 12 – DESIGN/IMPROVEMENT STANDARDS
   a. 12.050 – Construction/Operation/Maintenance

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

1. SECTION 300 – DRAINAGE POLICY
   a. 303.10 – Drainage Facilities Maintenance
   b. 304.8 – Multiple Use Facilities

REGIONAL FLOOD CONTROL DISTRICT POLICIES AND PROCEDURES MANUAL

1. CHAPTER XI – FACILITY MAINTENANCE

REGIONAL FLOOD CONTROL DISTRICT BIOLOGICAL OPINION

1. Biological Opinion 1-5-93-F-67R

APPENDIX B

INTERLOCAL CONTRACT
ANNUAL MAINTENANCE WORK PROGRAM

THIS CONTRACT, made and entered into this ___ day of _____, 20____, by and between the [legal name of CITY or COUNTY], a political subdivision of the State of Nevada, hereinafter referred to as "CITY" (or "COUNTY"), and the CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT, hereinafter referred to as "DISTRICT".

W I T N E S S E T H:

WHEREAS, pursuant to Chapter 543 of the Nevada Revised Statutes, the DISTRICT may approve and fund projects to maintain flood control improvements; and

WHEREAS, pursuant to NRS 277.180 any one or more public agencies may contract with one or more other public agencies to perform any governmental service, activity or undertaking which any of the public agencies is authorized by law to perform; and

WHEREAS, the CITY (or COUNTY) desires to maintain flood control improvements within the CITY (or COUNTY) in accordance with the maintenance program set forth herein, and hereinafter referred to as "Project"; and

WHEREAS, the facilities upon which maintenance will be performed are facilities described in the DISTRICT'S Master Plan.

NOW, THEREFORE, in consideration of the covenants, conditions, agreements, and promises of the parties hereto, the DISTRICT authorizes the Project as it is mutually understood and agreed as follows:

SECTION I - SCOPE OF PROJECT

This Interlocal Contract applies to the maintenance of flood control facilities, which are identified in the DISTRICT'S Master Plan facilities including updates and amendments subsequently approved. The basic maintenance of the facilities will be in accordance with performance standards set forth in the current DISTRICT *Operations and Maintenance Manual*.

The Project is more specifically described in Exhibit "A" which is attached hereto and by this reference incorporated herein.

SECTION II - PROJECT COSTS

The DISTRICT agrees to make payment for Project costs within the limits specified below:

1. The Project costs shall not exceed $_____.

The amounts allocated to each individual facility within the Project must be specified in Exhibit "A". Any changes to said allocated amounts must be approved by the DISTRICT'S Chief Engineer in accordance with Section 4.24 of the DISTRICT *Operations and Maintenance Manual.*

A written request must be made to the DISTRICT and a Supplemental Interlocal Contract approved to increase the amount noted above prior to payment of any additional funds.

2. The CITY (or COUNTY) and DISTRICT will comply with Section 4.12 of the *Operations and Maintenance Manual.* In accordance with said manual the CITY (or COUNTY) shall submit invoices together with a detailed summary report of the maintenance service performed. The CITY (or COUNTY) shall submit an invoice voucher in the manner prescribed by the DISTRICT. The vouchers shall include such information as is necessary for the DISTRICT to determine the nature of all expenditures. Each voucher will clearly indicate that it is for services rendered in performance under this contract. Each voucher will also be accompanied by a written certification from the CITY (or COUNTY) stating that it is for performance of maintenance activities under this contract and is composed of completed elements set forth in the annual work program.

All invoices must be submitted for payment to:

Clark County Regional Flood Control District
Accounts Payable
600 S. Grand Central Parkway, Suite 300
Las Vegas, Nevada 89106-4511

Payment shall be considered timely if made by the DISTRICT within 30 days of receipt of the invoice. Pursuant to Section IV, Paragraph 8, the DISTRICT may, in its sole discretion, withhold payments to the CITY (or COUNTY) for services rendered if the CITY (or COUNTY)

fails to satisfactorily comply with any term or condition of this contract and/or the DISTRICT *Operations and Maintenance Manual.*

SECTION III - PROJECT TIME

The CITY (or COUNTY) agrees to perform the Project to the satisfaction of the DISTRICT between July 1, 20_____ and June 30, 20_____. The DISTRICT may grant extensions or terminate this contract and require all sums advanced to the CITY (or COUNTY) to be repaid if the CITY (or COUNTY) fails to perform by said date.

SECTION IV - GENERAL

1. The CITY (or COUNTY) will complete the Project as set forth in Exhibit "A". The CITY (or COUNTY) staff personnel responsible for coordination of work under this contract are as listed below:

(list names and titles of CITY or COUNTY staff)

It is understood that staff named above will be responsible for work coordination throughout the period of this contract unless the DISTRICT is informed in writing of changes in these personnel assignments.

2. The CITY (or COUNTY) will comply with the applicable provisions of the Local Government Purchasing Act, Chapter 332 and Public Works, Chapter 338, of the Nevada Revised Statutes.

3. Applicable portions of the current editions of the *Operations and Maintenance Manual*, *Policies and Procedures Manual*, *Hydrologic Criteria and Drainage Design Manual*, and *Uniform Regulations for the Control of Drainage* adopted by the DISTRICT will apply unless specifically superseded by this CONTRACT.

4. It is the intent of the DISTRICT that scheduling of maintenance and repair of drainage and flood control facilities in general and Master Plan Facilities specifically be coordinated among member entities. Therefore, in those cases where Master Plan approved, and DISTRICT-funded projects have regional flood control significance impacting more than one

member entity, the CITY (or COUNTY) will allow all impacted member entities an opportunity to review the maintenance schedule in order to coordinate maintenance efforts.

5. The Chief Engineer or designee of the DISTRICT shall be responsible for monitoring the performance of the CITY (or COUNTY), approval for payment of billings and expenses submitted by the CITY (or COUNTY) and the acceptance of any report provided by the CITY (or COUNTY). The CITY (or COUNTY) shall be responsible for monitoring performance of CITY (or COUNTY) staff or private contractors.

6. Accurate documentation of all work performed and payments made shall be maintained by the CITY (or COUNTY) for a period of three (3) years in hard copy form after final project approval and payments. Following the three year period, the CITY (or COUNTY) shall keep records for permanent storage in original form, in microfilm/fiche media, or an electronic format in accordance with the CITY (or COUNTY) Record Retention Schedule.

7. The CITY (or COUNTY) shall provide right of access to its facilities to the DISTRICT or Chief Engineer at all reasonable times, in order to monitor and evaluate performance, compliance, and/or quality assurance under this contract.

8. In the event the CITY (or COUNTY) fails to perform the maintenance according to the standards specified in this contract and the DISTRICT *Operations and Maintenance Manual*, the DISTRICT may perform or cause to be performed the maintenance necessary to assure proper operation of the facility. Costs incurred by the DISTRICT shall be reimbursed by the CITY (or COUNTY) or be deducted from the amount authorized by this contract. The DISTRICT may not exercise this right without giving the CITY (or COUNTY) specific written notice of the maintenance required and allowing the CITY (or COUNTY) 60 days within which to perform said maintenance. The notice required by this provision must be sent to:

insert name of City or County staff)
(insert title)
(insert title)

9. The records of the CITY (or COUNTY) and/or private contractors pertaining to the subject matter of this contract shall at all reasonable times be subject to inspection and audit by the DISTRICT or an Agent of the DISTRICT.

10. If any provision of this contract shall be deemed in conflict with any statute or rule of law, such provision shall be deemed modified to be in conformance with said statute or rule of law.

11. The CITY (or COUNTY), its employees, and representative shall at all times comply with all applicable laws, ordinances, statutes, rules, and regulations in effect at the time work is performed.

12. The CITY (or COUNTY) hereby agrees to reimburse the DISTRICT if funds are received from other sources for maintenance and repair of drainage and flood control facilities paid for by the DISTRICT.

13. The DISTRICT will not be responsible for any fines and/or penalties caused by the actions or inactions of CITY (or COUNTY) employees, consultants, contractors, or agents.

14. Any costs found to be improperly allocated to the Project will be refunded by the CITY (or COUNTY) to the DISTRICT.

15. It is specifically understood and agreed to by and between the parties hereto that it is not intended by any of the provisions of any part of this contract to create in the public or any member thereof a third party beneficiary hereunder, or to authorize anyone not a party to this contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of this contract.

16. Up to the limits set forth in NRS Chapter 41, the CITY (or COUNTY) will indemnify and defend the DISTRICT against and from any and all claims and demands of whatsoever nature which arises out of allegations of negligence or misconduct of CITY (or COUNTY) officers, employees or agents, related to or under this Contract which results from injury to or death of any persons whomsoever, or against and from damage to or loss or destruction of property.

17. This agreement shall be construed and interpreted in accordance with the laws of the State of Nevada.

/

/

/

IN WITNESS WHEREOF, the parties have caused this contract to be executed the day and year first above written.

Date of District Action: REGIONAL FLOOD CONTROL DISTRICT

_____ BY:_____
(Insert Chairman's Name), Chairman

ATTEST:

_____
(Insert Board Secretary's Name)
Secretary to the Board

Approved as to Form:

BY:_____
(Insert Chief Deputy District Attorney's Name)
Chief Deputy District Attorney

****

Date of Council Action: (CITY or COUNTY) OF _____
(or Commission Action)

BY:_____
ATTEST: (Insert Mayor/Board Chairman's Name), Title

_____
(Insert Name), (City or County Clerk)

EXHIBIT A

PART I

Maintenance Work Plan Summary – Summary of overall work plan listing specific projects (physical system inventory) and associated costs attributable to each. (See Maintenance Work Plan Summary.)

PART II

Facility map(s) which identify location of projects (physical system inventory) and planned maintenance work by project.

PART III

Maintenance Work Program Annual Budget – Individual maintenance projects (physical system inventory) broken into maintenance activities to be completed, including narrative and associated budgeted costs for all projects identified in Part I. (See Maintenance Work Program Annual Budget.)

(MEMBER ENTITY)
MAINTENANCE WORK PLAN SUMMARY
FISCAL YEAR 20XX-XX

Master Plan Facility ID	MWP Facility Number	Facility Description	Cost
		TOTAL	$ 0.00

Maintenance Work Program Annual Budget

REGIONAL FLOOD CONTROL DISTRICT
MAINTENANCE WORK PROGRAM
ANNUAL BUDGET - FY 20XX-XX

MWP Facility #: _____ Entity: _____

Facility Name: _____ Date Prepared: _____

MP Facility ID: _____

Force Account/ Contract	Activity	Requested Work Plan Amount ($)	Amended Work Plan Amount ($)	Percent Complete	Scheduled Completion Date
	03 Facility Assessment and Inventory				
	05 Inspect Channels				
	06 Inspect Levees/Detention and Debris Basins				
	08 Species Survey and Removal				
	10 Clean and Reshape Channels/Levees				
	15 Repair Lined Channel				
	20 Erosion Control and Repair				
	21 Provide/Maintain Dust Control				
	25 Clean Detention Debris Basins				
	35 Fence Repair				
	40 Vegetation Control - Chemical				
	45 Vegetation Control - Mechanical				
	50 Maintain Access Road				
	55 Clean & Inspect Inlet/Outlet Structures				
	60 Repair Inlet/Outlet Structures				
	65 Clean Storm Sewer Lines				
	70 Storm Sewer Repair				
	75 Clean/Flush Culverts & Bridges				
	80 Miscellaneous Work Activities				
	85 Engineering				
	TOTALS	$0.00	$0.00	0%	
Delays or problem areas:					
Work completed during prior fiscal year:					
Work to be completed during current fiscal year:					

Consultant/
Contractor: _____

Project
Manager: _____ Phone Number: _____

APPENDIX IV

Geotechnical Evaluation

GEOTECHNICAL EVALUATION
LAKE LAS VEGAS
LIFT STATION FLOOD WALL IMPROVEMENTS
1609 LAKE LAS VEGAS PARKWAY
HENDERSON, NEVADA

Project No. 20133164E1
April 15, 2013

Prepared for:
ATKINS
2270 Corporate Circle, Suite 200
Henderson, Nevada 89074

Prepared by:
GES
Geotechnical & Environmental Services, Inc.
7150 Placid Street
Las Vegas, Nevada 89119

GES
GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
We make the ground work for you... ®

PROVIDING
- Geotechnical Engineering
- Construction Materials Testing & Inspections
- Environmental Engineering
- Ground Source Heat Exchange
- Thermal Conductivity Testing
- IAS Accredited
- AASHTO Accredited Testing Laboratory

April 15, 2013
Project No. 20133164E1

Mr. Matt Wilkinson, P.E., CFM
ATKINS
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074

RE: Geotechnical Evaluation, Lake Las Vegas Lift Station Flood Wall Improvements, 1609 Lake Las Vegas Parkway, Henderson, Nevada

Dear Mr. Wilkinson:

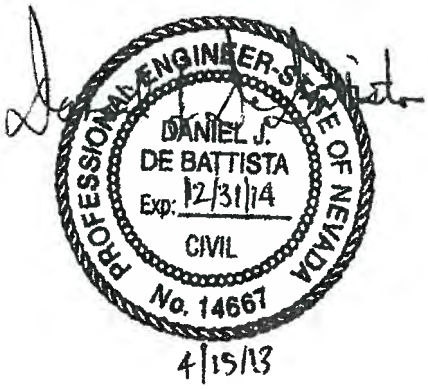
Geotechnical & Environmental Services, Inc. (GES) is pleased to present the Geotechnical Evaluation report for the proposed Lake Las Vegas Lift Station Flood Wall Improvements at 1609 Lake Las Vegas Parkway in Henderson, Nevada.

This report includes the findings of a geologic and background review, the findings of a field exploration, the results of laboratory testing programs and geotechnical analyses, and recommendations for flood wall improvements. Our study also included an analysis to evaluate the relevant geotechnical aspects recommended by FEMA for flood walls including settlement and seepage according to 44 CFR 65.10, for the 100-year design water surface elevation. Based on the results of our analyses, it is our opinion that the existing flood wall retrofit and new wall configuration meet the minimum requirements for flood wall seepage and settlement set forth in the geotechnical requirements of 44 CFR 65.10.

We appreciate this opportunity to provide our professional services. If you have any questions or comments regarding this information, please feel free to contact our office.

Sincerely,

Geotechnical & Environmental Services, Inc.



4/15/13

Paul E. Simpson, P.E.
Senior Staff Engineer

Daniel J. De Battista, P.E.
Engineering Manager

PES:DJD:si

Dist: 5 originals mailed to addressee
PDF e-mailed to addressee at matthew.wilkinson@atkinsglobal.com
cc to Project File

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GEOTECHNICAL EVALUATION
LAKE LAS VEGAS
LIFT STATION FLOOD WALL IMPROVEMENTS
1609 LAKE LAS VEGAS PARKWAY
HENDERSON, NEVADA

1. INTRODUCTION

This report presents the results of a geotechnical evaluation performed by Geotechnical & Environmental Services, Inc. (GES) for the Lake Las Vegas Lift Station Flood Wall Improvements project at 1609 Lake Las Vegas Parkway in Henderson, Nevada. Figure A-1 presents a vicinity map showing the approximate location of the site within the Las Vegas Valley. The following sections present the purpose and scope of our geotechnical evaluation, project and site descriptions, field exploration, groundwater, and laboratory testing.

1.1. PURPOSE AND SCOPE

The purpose of this geotechnical evaluation was to provide recommendations to aid in the design and construction of the proposed Lake Las Vegas Lift Station Flood Wall improvements, which includes retofit of an existing block wall and construction of a new block wall. In addition, GES analyzed the wall improvements to evaluate the relevant geotechnical aspects recommended by FEMA for flood walls, including seepage for the 100-year design water surface elevation and settlement, according to 44 CFR 65.10. The scope of this study included the review of a geotechnical report for the original construction of the project as well as referenced geologic literature and maps, performance of a subsurface exploration, including soil sampling, laboratory testing of selected soil samples, engineering analyses, and preparation of this report.

1.2. PROJECT DESCRIPTION

Our understanding of the project is based on a review of aerial photographs, 70% design drawings provided by ATKINS, and U.S. Army Corps of Engineers criteria described in engineering documents ETL 1110-2-569, EM 1110-2-2502, and EM 1110-2-1913, and our experience and familiarity with similar projects. Our design recommendations are based on the 2009 International Building Code (IBC) and the Southern Nevada Amendments (SNA) to the 2009 IBC.

We understand that the improvements to the existing Lake Las Vegas Lift Station will consist of the construction of a new concrete masonry unit (CMU) flood wall along the north side of the facility and the addition of concrete counterforts to the existing CMU wall along the north and

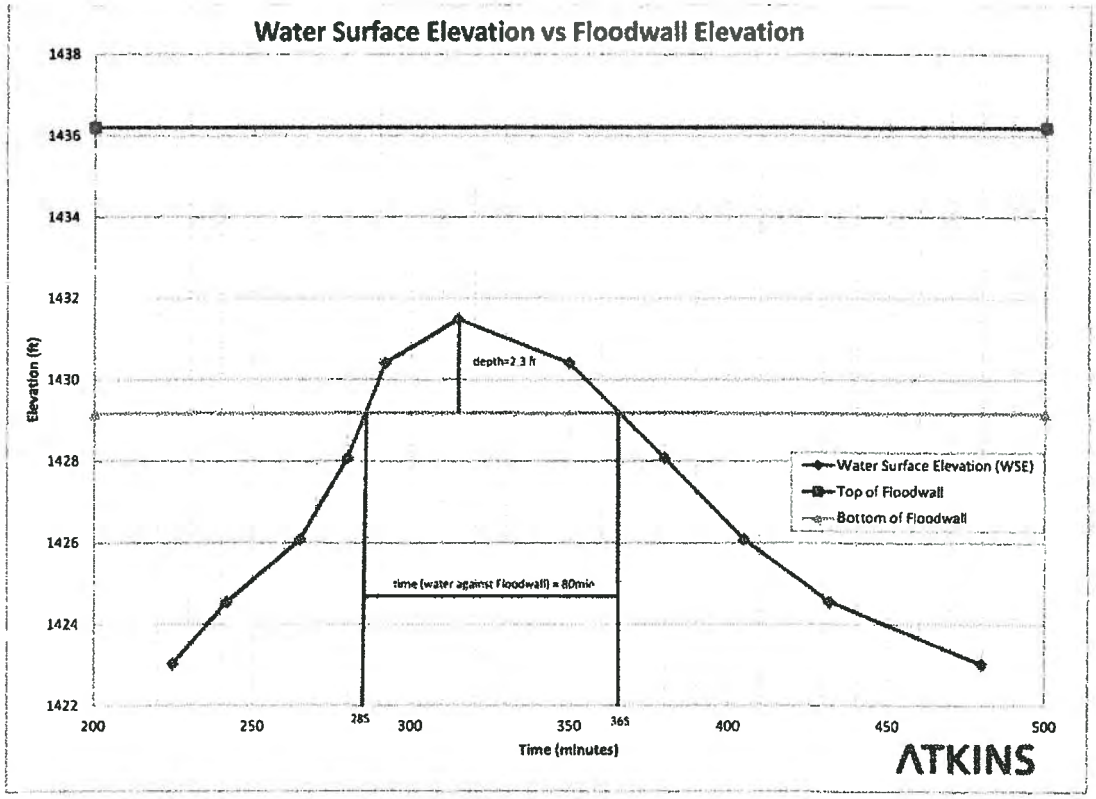
west side of the facility. The new CMU flood wall and the concrete counterforts for the existing wall will be reinforced with rebar.

The new wall will be constructed of 8-inch wide masonry block and will have a hinged flood gate to protect against flood waters. The top of the existing wall has an elevation of approximately 1,436 feet. The new wall will be constructed on conventionally reinforced concrete footings with turn-downed edges that will extend to a depth of approximately 3-1/2 feet below grade.

The existing wall will have approximately 37 reinforced concrete counterforts added. The counterforts will be approximately 8-inches by 9-inches in cross section and spaced along the existing wall at distances not exceeding 5-feet 4-inches. The counterforts will tie into the exiting wall and footings with dowels. The counterforts will be constructed from the top of the existing footings to heights of up to 7 feet.

It is anticipated that loads from the new CMU wall will be less than 2 kips per lineal foot and column loads from the concrete columns to be added to the existing CMU wall will be less than 2 kips. Final grades for the improvements are assumed to be within approximately 1 foot of existing site grades.

Based on the improvement plans (ATKINS, 2012), the site grades immediately adjacent to the facility are approximately 1,429 to 1,430 feet. Based on the figure below provided by Atkins, the new wall and retrofit for the existing wall will be designed for a maximum 100-year design surface water elevation of approximately 1,431.5 feet for a predicted maximum duration of 80 minutes. Seepage analyses performed by GES for this project utilized a water surface elevation of 1,432 feet and a daily flow water surface elevation of 1,406 feet for the Las Vegas Wash.



1.3. SITE DESCRIPTION

The project site is located predominantly on approximately 0.54 acres within Clark County Assessor's Parcel Number (APN) 160-22-411-018; a portion of the facility is also located on APN 160-22-410-037. The Lake Las Vegas Lift Station is presently located on the parcel, including a lift station building and storage/equipment yard, associated block screen walls, asphalt pavement, and concrete flatwork. The facility is located at least approximately 50 feet from the slope leading down to the Las Vegas Wash.

Based on a site reconnaissance and a comparison of original and existing grades, fill was apparently placed to bring the current site to grade. The site is bordered to the north by the Las Vegas Wash, to the east and south by inclined slopes with an office building beyond to the south, and to the west by vacant graded land with the Las Vegas Wash beyond. The facility sits above the rip-rap lined Las Vegas Wash atop a slope with a steepness of approximately 2.5:1.

1.4. FIELD EXPLORATION

Prior to performance of our subsurface exploration, GES reviewed a geotechnical report previously prepared for the facility (JA Cesare, 1996). Three borings were drilled for this study to depths of up to approximately 45 feet below grade (approximately elevation 1,370 feet). The borings were drilled at the original location of the facility northwest of the existing lift station site. The findings of the borings and recommendations from the original report were considered in formulating the conclusions and recommendations for the proposed lift station improvements.

GES evaluated the subsurface conditions below the site for the current improvements project by drilling two exploratory borings (B-1 and B-2) to depths of approximately 10 feet each. The total footage drilled was approximately 20 lineal feet. The purposes of the borings were to evaluate the soil conditions within the zone of influence of the existing and new wall foundation influence and to obtain samples for laboratory testing. The approximate boring locations are shown on Figure A-2.

Prior to drilling, the existing asphalt pavement surface at the boring locations was cored. The borings were drilled with a Diedrich D-120 truck-mounted drill rig using 7-inch nominal diameter hollow stem augers. Soil samples and penetration blow counts were obtained with a 3-inch outside diameter ring-lined drive sampler in general accordance with ASTM D 3550. The sampler was driven with a 140-pound automatic trip hammer falling about 30 inches. The penetration resistance (hammer blows) measured by driving the sampler was used to evaluate the density and consistency of the in-place soil. The boreholes were then backfilled with soil cuttings and the surface patched with cold patch.

A GES geologist directed and supervised the subsurface explorations, while maintaining detailed logs of the subsurface conditions, classifying the soils encountered, and obtaining soil samples. The soils encountered were classified in general accordance with the Unified Soil Classification System (USCS). A Key to Symbols and Terms utilized on the exploration logs is presented on Figure A-3. The exploration logs for borings advanced by GES are presented on Figures A-4 and A-5. The locations of the explorations performed were recorded using a hand-held GPS unit at the time the explorations were performed. The elevations for the existing ground surface at the boring locations were estimated based on improvement plans provided (Atkins, 2012).

1.5. GROUNDWATER

Groundwater was not encountered in explorations advanced at the project site to depths of approximately 10 feet below the ground surface. However, a review of the previously referenced report indicates that groundwater was previously encountered at elevations of between 1,402 to 1,406 feet in borings located to the northwest of the project site. The daily water surface elevation of the Las Vegas Wash is assumed to be at an elevation of approximately 1,406 feet based on the improvement plans provided.

A review of water wells listed on the State of Nevada Department of Conservation & Natural Resources, Division of Water Resources website indicates that historical groundwater levels in the area of the project site were recorded at depths of approximately 11 to 30 feet below the ground surface in 1996, however, the ground surface in the area of the project site varies greatly and after 1996 earthwork was performed at the project site including the apparent placement of fill. Based on the lack of groundwater in our borings and additional groundwater information as presented above, groundwater is not expected to affect the construction of the proposed wall improvements. Groundwater levels should be anticipated to fluctuate due to flood events, seasonal precipitation, groundwater withdrawal and recharge, irrigation practices, and potential future dewatering efforts within and/or near the subject site. A detailed evaluation of possible groundwater fluctuations is beyond the scope of this study.

1.6. LABORATORY TESTING

Laboratory testing was performed to classify and evaluate the physical and engineering properties of selected soil samples collected from the project site. A summary of the test results are tabulated below:

Table 1.6 – Laboratory Test Summary

Type of Test	Range of Results
In-Place Dry Density	96.4 to 121.1
In-Place Moisture Content	6.6 to 9.9
Liquid Limit	No-Value to 26
Plasticity Index	Non-Plastic to 11
Water Soluble Sulfate	0.03

The results of the laboratory testing are presented on the exploration logs in Appendix A and on test reports presented in Appendix B. Detailed descriptions of the laboratory tests performed are also presented in Appendix B.

2. DISCUSSION

The following sections describe the geology and seismicity of the site and the encountered subsurface materials and conditions.

2.1. GEOLOGY AND SEISMICITY

The project site is located along the Las Vegas Wash in the far southeastern portion of the Las Vegas Valley, a fault-bounded graben structure surrounded by mountain ranges. The Las Vegas Valley is physiographically characteristic of the Basin and Range Province with generally northwest-trending parallel mountain ranges and an intervening basin. Unlike many basins within the Basin and Range Province which are internally draining, the Las Vegas Valley is unique in that the basin drains through the Las Vegas Wash to Lake Mead and the Colorado River.

Tertiary and Quaternary unconsolidated alluvial deposits, derived from the surrounding mountain ranges, fill the valley. These deposits may be up to 4,000 feet thick near the center of the valley. The surrounding mountain ranges are comprised of sedimentary and igneous rocks. Alluvial fan deposits, consisting of sand and gravel, slope down from the mountain fronts towards the valley floor. Sediments are typically less coarse, grading from fine sand and silt to clay near the valley bottom. Beds of amorphous and crystalline gypsum are common. Zones of calcareous cemented deposits (caliche) are present at various locations and depths throughout the valley.

The U.S. National Oceanic and Atmospheric Administration Earthquake Catalog lists about 800 events of magnitude greater than or equal to 4 with epicenters within about 120 miles of Las Vegas. Only 19 events greater than or equal to magnitude 4 are estimated to have occurred during the 1881 through 1938 period in the southern Nevada region.

After about 1947, nuclear testing began at the Nevada Test Site. Therefore, many of the recorded earthquakes after about 1947 may be due to nuclear blasts occurring more than about 60 miles from the subject site. Several hundred earthquakes occurred from 1936 to 1965 near Hoover Dam, presumably due to filling of the Lake Mead reservoir, with 24 of these events reportedly greater than or equal to magnitude 4.

Based on a review of the Clark County Soil Guidelines Map, the project site is located in a previously mapped Special Geotechnical Consideration Area containing steep slopes (greater than

15%) and shallow bedrock, and potential drainage areas or recent sediment deposits, may also have solubility, clay swell, corrosion, gypsum salt, expansive or hydro-collapsible potential. Based on a review of the Clark County Expansive Soils Guidelines Map, the western portion of the project site is unmapped; the remainder of the project site is located in a previously mapped Special Geotechnical Consideration Area containing step slopes (greater than 15%). Based on a review of the City of Henderson Soils & Geological Characteristics map the site is located in an area previously mapped as Type C Soil: Active washes or recent sediment deposits (Potential for solubility, clay, swell, corrosion, gypsum salt, expansive or hydro-collapsible soils).

On the referenced USDA web soil survey, the project site is located within an area mapped as Gypwash-Callville-Carrizo association consisting of extremely gravelly fine sandy loam, gravelly fine sandy loam, extremely gravelly coarse sandy loam, stratified extremely gravelly gypsiferous coarse sandy loam to very gravelly gypsiferous sandy loam, very gravelly sandy loam, gravelly gypsiferous fine sandy loam, bedrock, extremely gravelly loamy sand, and stratified extremely gravelly coarse sand to very gravelly sand , to depths of up to 53 to 61 inches with 0 to 30 percent slopes.

The project site is located on the referenced Geologic Map of the Henderson Quadrangle, Nevada within areas of Modern Wash Deposits consisting of dominantly sandy pebble to cobble gravel, poorly to very poorly sorted, poorly to moderately stratified and non-indurated and Muddy Creek Formation consisting of coarse-grained facies comprises upper and lower portions of the formation in this area and consists of yellowish- to reddish-brown fanglomerate.

Based on a review of referenced geologic maps and literature, the nearest mapped fault is a Tertiary-age (1.6 million to 65 million years) fault located as close as approximately 50 feet west of the site. The nearest mapped Quaternary-age (last 1.6 million years) fault is the southern extent of the Frenchman Mountain fault approximately ¾-mile west of the site. Other mapped nearby Quaternary-age faults are the Eglington fault located approximately 18 miles northwest of the site, which geologists have debated may be potentially active. The nearest mapped Holocene-age (last 10,000 years) active fault is the Black Hills fault, located approximately 9 miles south of the site (USGS). The nearest previously mapped fissure zone is located approximately 8 miles southwest of the site near the intersection of Sunset Road and Arroyo Grande Boulevard. Based on our review of available geologic literature, it is our opinion that the potential for fault-related surface rupture at the site is negligible.

2.2. SUBSURFACE MATERIALS AND CONDITIONS

Based on a site reconnaissance, review of historic aerial photographs, our understanding of prior improvements at the site, and the findings of our borings, the prior site development likely included the placement of fill to reach the current site grades. Documentation of fill placement and compaction has not been provided for review. The fill at our boring locations was overlain by asphalt concrete over aggregate base. The aggregate base consisted of moist, dense silty gravel with sand. The approximate thicknesses of the asphalt and aggregate base layers were measured in the field. The approximate asphalt concrete and aggregate base thicknesses encountered in each of the borings are summarized in the following table:

Table 2.2 – Approximate Asphalt Concrete Pavement Thicknesses

Boring No.	Approximate Thickness of Asphalt (inches)	Approximate Thickness of Aggregate Base (inches)
B-1	4	8
B-2	3	9

The fill soils encountered under the described asphalt concrete pavement consisted of moist, medium dense to very dense clayey sand with few gravel overlying moist, dense to very dense silty sand with gravel encountered through the depth of the borings. The borings did not extend through the fill soils into native soils.

Documentation of the fill placement and compaction was not available for review during our evaluation. An evaluation of the fill at the site was beyond our scope of services.

Cemented soils were not encountered due to the depths of our borings not extending into native soils. However, the previous geotechnical explorations performed at the site by others indicated that caliche is present at an elevation of approximately 1,400 feet. Accordingly, any excavations at the project site deeper than approximately 1,400 feet might encounter cemented soils. Due to the inconsistent nature of cemented sand and gravel and caliche layers, medium hard to very hard and difficult to excavate soil horizons may be encountered beyond or between our boring locations at varying depths. A detailed excavatability or rippability evaluation is beyond the scope of this study. The contractor should perform the independent investigations necessary to determine the type of equipment required to perform the work.

2.3. SEEPAGE

Seepage beneath the proposed new wall foundations was analyzed using the finite element computer software program SEEP/W, a GeoStudio 2012 product. To evaluate seepage, a representative cross-section from the Las Vegas Wash to the slope south of the existing facility, which includes the proposed new wall, was analyzed. The cross-section orientation (A-A') is indicated on Figure A-2 and the cross-section profile is indicated on Figure C-1. The cross-section was analyzed using the following parameters for the soils:

Table 2.3. – Seepage Analysis Parameters

Property	Parameter
Porosity	0.40
Saturated Hydraulic Conductivity (ft/s)	8.2×10^{-5}
Residual Water Content (ft^3/ft^3)	0.02
Ratio of horizontal conductivity to vertical conductivity, K_h/K_v	1.0

The unsaturated hydraulic conductivity and volumetric water content functions utilized were based on software estimation methods and sample functions for representative materials. The simplified seepage model was considered using a homogeneous silty clay type material underlain by an impermeable caliche layer at an elevation of 1,400 feet based on the findings of the borings, review of the previous soils report, and results of laboratory testing. Saturated hydraulic conductivities were estimated using the measured soil properties and correlations. Steady state and transient analyses were performed for a water surface elevation of 1,432 feet against the wall. The transient condition was analyzed over a duration of 160 minutes, twice the time the flood water is predicted to be above the bottom of the flood wall. Based on the transient analysis, steady-state conditions would not occur for a period of up to approximately 5 days.

The results of the seepage analyses indicated that a maximum exit gradient of less than 0.3 could occur behind the new wall footing at the ground surface under steady state conditions. This maximum exit gradient value was determined by reviewing the individual exit gradients at independent nodes along the downstream ground surface. Based on the criteria provided in ETL 1110-2-569 where there is no history of seepage distress, a local vertical exit gradient of up to 0.5 could result in a light/no seepage condition and is acceptable without remediation. In addition, no seepage is anticipated to emanate behind the flood wall under the transient state condition within the analyzed 160 minute duration. A graphical summary of the steady state and transient seepage

analyses are presented on Figure A-3. The graphical results of the transient condition indicate the approximated wetting front during the flood condition within the 160 minute duration flooding event.

The seepage analysis conservatively did not account for the relatively impermeable asphalt pavement on the water side of the walls. The results of the seepage analysis do not account for maintenance deficiencies, such as animal burrows below/beneath the flood wall, potential preferential piping along utility trenches and within variable fill soils of higher hydraulic conductivity, and alteration to the existing ground surface geometry.

3. CONCLUSIONS

Based on the results of our analyses, it is our opinion that for the provided 100-year water surface elevation, the existing flood wall retrofit and new flood wall configuration meet the minimum requirements for flood wall seepage and settlement set forth in the geotechnical requirements of 44 CFR 65.10.

Based on the findings of our subsurface explorations and results of laboratory testing, it is our opinion that there are no known geologic or geotechnical conditions that would prevent construction of the proposed improvements at the project site. It is also our opinion that there are some geotechnical considerations that will affect site development as described below.

- Under steady state seepage conditions, a maximum local vertical exit gradient behind the new wall footing of less than 0.3 could occur for the provided 100-year design water surface elevation. Therefore, light to no seepage is anticipated to occur after steady state seepage conditions are realized, based on the ET 1110-2-569. However, steady state seepage conditions are estimated not to occur for a period of up to approximately 5 days.

- Under transient state seepage conditions for the provided 100-year design water surface elevation, the wetting front will not result in the emanation of water seepage behind the new wall footing during the analyzed duration of 160 minutes. Therefore, emanation of seepage is not anticipated to occur under transient conditions.

- The site soils underlying the existing facility, including the existing CMU block screen wall, have been in place since approximately 1999. It is anticipated that any settlement due to structural loads has already occurred. Provided the fill at the site was placed under the supervision of a qualified geotechnical engineer and the recommendations in this evaluation are followed with adequate observation and testing, we anticipate that settlement due to structural loads from the new wall footings will be less than 1 inch.

- Based on our understanding of the project and the results of our laboratory tests performed on the site soils, it is our opinion that soil materials at the site classify as Category 4a soils based on Table 1704.7 of the SNA to the 2009 IBC.

- Based on the consistency of the fill soils encountered at the project site, it is our opinion that the potential for liquefaction at the site is low.

- The tested native on-site soils have a negligible concrete sulfate exposure as determined by AWWA Standard Test Method 4500 E.

- Since deep subsurface information is not available for the site, a Site Class D, as defined in Section 1613.5.5 of the SNA to the 2009 IBC, is recommended for the project site.

- The site lies within an area previously mapped as a Site Class C by the City of Henderson Seismic Site Class Map and Clark County Seismic Shear Wave Velocity Map. However, since specific subsurface information to a depth of at least 100 feet at the site is not available and confirmation testing of the seismic site class was not performed as part of this or the previous study, a Seismic Site Class D as defined in Table 1613.5.2 of the 2009 IBC is recommended for the project site. At their own risk, a Site Class C may be chosen for design by the structural engineer. Seismic design parameters corresponding to both Site Class D and C and provided.

4. RECOMMENDATIONS

The following sections present recommendations concerning the proposed improvements at the project site. These recommendations are based upon our understanding of the project, the engineering properties of the tested on-site soils, the geologic conditions that are presented in this report, and the assumption that an adequate number of tests and observations will be made during construction to evaluate compliance with these recommendations.

4.1. EARTHWORK

The exposed soils beneath the proposed improvements, including foundations, slabs-on-grade, and pavements, should be scarified to provide a zone of at least 12 inches of structural fill. Scarified areas should be moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 95 percent of the maximum dry density, as determined by ASTM D 1557.

Excavated on-site soils may be used as structural fill and backfill provided that the soils have a remolded swell potential of less than 4 percent, have a solubility less than 2.00 percent, and are processed to remove materials larger than 3 inches in nominal dimension and all organic and other deleterious materials.

Imported materials used for structural fill should satisfy the following recommendations. Samples of materials proposed for use as imported structural fill should be submitted to the Geotechnical Engineer for testing and evaluation prior to being transported to the site.

- Imported fill materials should be similar to the on-site soils with less than 40 percent passing the No. 200 sieve and 100 percent passing the 3-inch sieve.
- Imported fill materials should have a liquid limit of less than 30 and plasticity index of less than 15.
- Imported fill materials should have a remolded swell potential of no more than 4 percent as determined per the procedure outlined in Section 1803.5.3.2 of the Southern Nevada Amendments to the 2009 International Building Code.
- Imported fill materials should contain less than 2.00 percent by dry weight soluble solids as determined by American Water Works Association (AWWA) standard test method 2540 C.
- Imported fill materials should contain less than 0.30 percent by dry weight soluble sulfate as determined by AWWA standard test method 4500 E.
- Imported fill materials should be free of debris, organic materials, and other deleterious materials.

Structural fill should be placed in loose lifts up to 8 inches thick, uniformly moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 95 percent of the maximum dry density as determined by ASTM D 1557.

In-place density and moisture tests should be performed in accordance with ASTM D 6938, or alternatively in accordance with ASTM D 1556. The test frequency should be at least one test per 50 cubic feet of fill material placed or at least 1 test per lift of fill material placed, whichever is greater.

4.2. EXCAVATION CONSIDERATIONS

Cemented soils were not encountered in our borings which did not extend through the previously placed fill. Excavations into native soils below the depths explored in our borings might encounter cemented soils. A detailed excavatability or rippability evaluation is beyond the scope of this study. The contractor should perform the independent investigations necessary to determine the type of equipment required to perform the work.

Excavations greater than 4 feet in depth into uncemented soils are not expected to stand vertically. Excavations greater than 4 feet in depth should be sloped back in accordance with the maximum allowable slope ratios presented in Appendix B to Subpart P of Occupational Safety and Health Standards for the Construction Industry (OSHA) 29 CFR, State of Nevada, Division of Occupational Safety and Health, Part 1926. The soil type definitions in Appendix A to Subpart P of OSHA 29 CFR, Part 1926 should be applied to soils encountered in excavations to determine the maximum allowable slope ratio. As an alternative to sloped excavation sidewalls, excavations

could be shored and braced. Shoring and bracing should be designed in accordance with Appendices C and D to Subpart P of OSHA 29 CFR, Part 1926. Safety of construction personnel is the responsibility of the contractor.

4.3. SPREAD FOOTING FOUNDATIONS

Footings supporting the proposed wall improvements should be founded entirely on a zone of properly compacted structural fill, as previously described. Spread footings should be established at least 12 inches below the lowest adjacent final compacted subgrade. Spread footings should be at least 18 inches wide. Footings that are founded entirely on a zone of properly compacted structural fill as previously described and that are at least 18 inches wide and embedded at least 12 inches may be designed based on an allowable net dead plus sustained live load bearing pressure of 2,000 pounds per square foot (psf). The allowable bearing pressures may be increased by one-third for temporary wind or seismic loads. The allowable bearing pressure presented above includes a factor of safety against generalized bearing capacity failure of at least 2.5.

The site soils underlying the existing facility, including the existing CMU block wall, have been in place since approximately 1999. It is anticipated that any settlement due to structural loads has already occurred. Provided the fill at the site was placed under the supervision of a qualified geotechnical engineer and the recommendations in this evaluation are followed with adequate observation and testing, we anticipate that settlement due to structural loads from the new wall footings will be less than 1 inch. Should structural loads exceed our limitations, GES should be provided the opportunity to re-evaluate our settlement estimates. Structural loads in excess of our limitations will likely result in increased settlement that may not be tolerable by the design of the structure.

Resistance to lateral loads may be estimated using both passive lateral earth support and friction developing between the footings and underlying soil. Resistance to lateral loads at least 3 feet above ground water may be calculated using passive lateral support based upon an equivalent fluid density of 275 pounds per cubic foot (with a maximum allowable passive pressure of 2,750 pounds per square foot). Resistance to lateral loads within 3 feet of or below ground water may be calculated using passive lateral support based upon an equivalent fluid density of 60 pounds per cubic foot (with a maximum allowable passive pressure of 600 pounds per square foot). An ultimate base coefficient of friction of 0.55 may be used. The values for the maximum allowable passive lateral earth pressure presented above include a factor of safety of 1.5. The value for the

ultimate base coefficient of friction is ultimate and does not include a factor of safety. Backfill placed against footings should be moisture conditioned and compacted as described for structural fill.

4.4. SEISMIC SITE CLASS

Based on review of the Clark County Seismic Shear Wave Velocity Map and City of Henderson Seismic Site Class Map, the project site is located in an area previously mapped as a Seismic Site Class C. However, confirmation testing of the seismic Site Class by GES via an independent geophysical study or subsurface exploration was not a part of our study. Accordingly, since deep subsurface information is not available, a seismic Site Class D, as defined in Table 1613.5.2 of the 2009 IBC may be assumed for design for this project as specified in the building code. At their own risk, a Site Class C may be chosen for design by the structural engineer. As appropriate, the following seismic design parameters based on the 2009 IBC for a seismic Site Class C (Table 4.4.-1) or D (Table 4.4.-2) may be utilized using representative site coordinates of 36.1019 degrees latitude and -114.9351 degrees longitude.

Table 4.4.-1 – Spectral Response Accelerations and Site Coefficients – Site Class C

Spectral Response Acceleration at Short Periods, S_s [1]	Spectral Response Acceleration at 1-Second Period, S_1 [2]	Spectral Response Coefficient at Short Periods, SD_s	Spectral Response Coefficient at 1-Second Period, SD_1
0.633g	0.187g	0.484g	0.201g

(1) Per Figure 1613.5(3) of the 2009 IBC
(2) Per Figure 1613.5(4) of the 2009 IBC

Table 4.4.-2 – Spectral Response Accelerations and Site Coefficients – Site Class D

Spectral Response Acceleration at Short Periods, S_s [1]	Spectral Response Acceleration at 1-Second Period, S_1 [2]	Spectral Response Coefficient at Short Periods, SD_s	Spectral Response Coefficient at 1-Second Period, SD_1
0.633g	0.187g	0.546g	0.256g

(1) Per Figure 1613.5(3) of the 2009 IBC
(2) Per Figure 1613.5(4) of the 2009 IBC

4.5. SOIL CORROSIVITY

Based on the results of chemical testing, the tested on-site soils have a negligible sulfate exposure as defined in Section 4.3 of ACI Publication 318 per Section 1904.3 of the 2009 IBC. Concrete that may directly or indirectly contact the on-site soils should contain Type V sulfate resistant cement, have a minimum 28-day compressive strength of 4,500 psi, and have a maximum water to cement ratio of 0.45.

We recommend that a Corrosion Engineer be consulted for protection recommendations for any buried metal pipe. Metal pipe may be protected by using cathodic protection or pipe coatings and wrappings, or, as an alternative, PVC pipe may be used if allowed by agency requirements.

5. LIMITATIONS

The recommendations contained in this report are based on field exploration, laboratory testing, research of pertinent maps and literature, and our understanding of the proposed construction. The soil data used in the preparation of this report were obtained from two borings performed at the site. It is possible that variation in the soil conditions will exist between the locations explored. Therefore, if any soil conditions are encountered at the site that are different from those outlined in this report, Geotechnical & Environmental Services, Inc. should be immediately notified so that we may review the situation that exists and make supplementary recommendations as needed. In addition, if the scope of the proposed construction, including the types of structures, anticipated loads and maximum cut and fill depths, changes from what is described in this report, our firm should be notified. A detailed excavatability or rippability evaluation is beyond the scope of this study.

The recommendations presented in this report are based on the assumption that an adequate number of tests and observations will be made during site construction to evaluate compliance with the recommendations. These tests and observations should be provided under the direction of a qualified Geotechnical Engineer. Such testing and observations should include but not be limited to the following:

- Review of site construction plans for conformance with the geotechnical evaluation
- Observation and testing during site preparation, grading, footing and other excavations, and placement of fill, aggregate base, and concrete
- Consultation as may be required during construction

Our services were performed using that degree of care and skill ordinarily exercised under similar circumstances by reputable engineering firms in this or similar localities. No other warranties, express or implied, are included or intended in this report.

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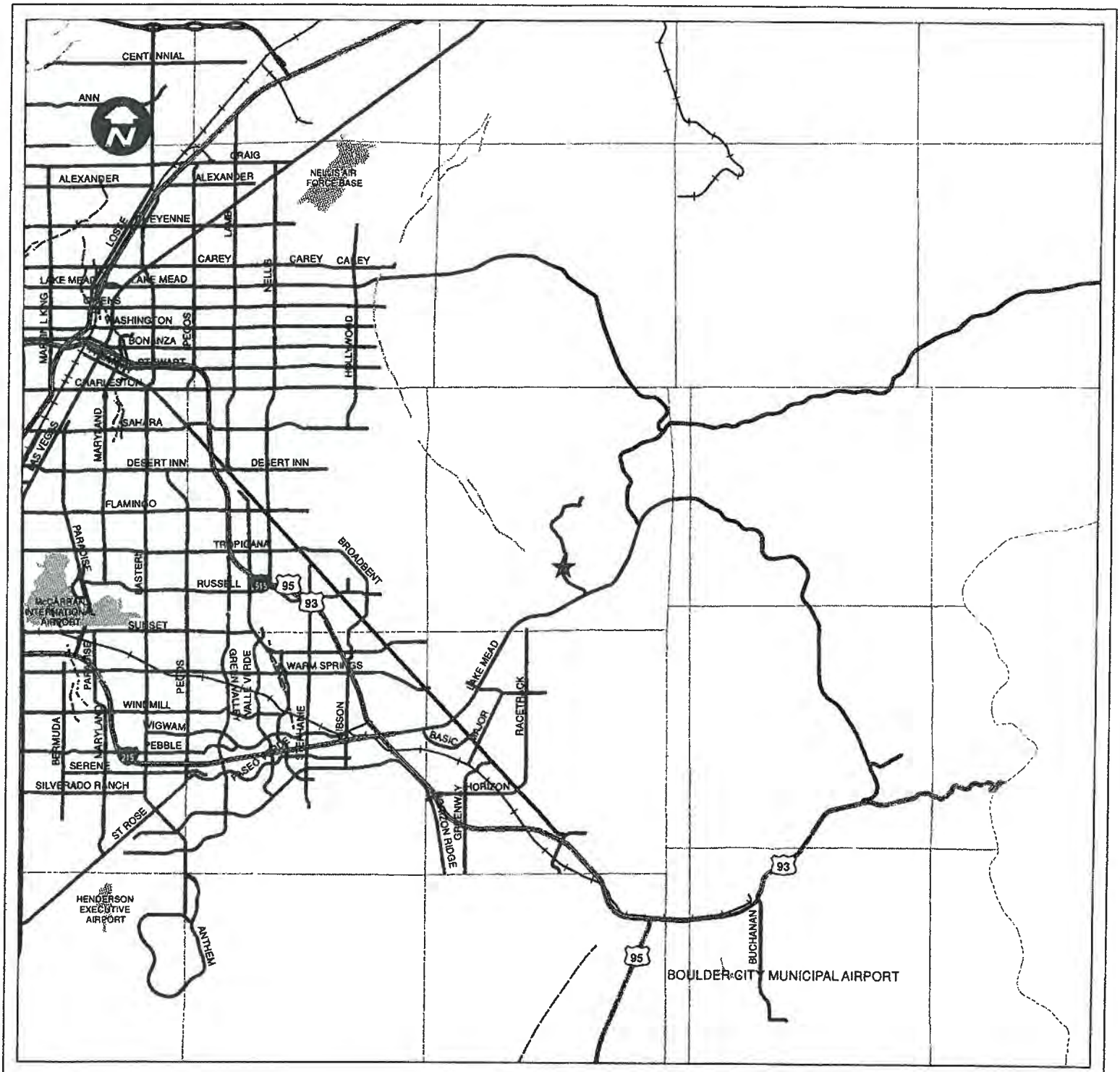
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APPENDIX A
SUBSURFACE STUDY



Legend

- Approximate Project Location
- Airports
- Township & Range
- Interstate
- Major Streets
- Railroad
- State Highway

Linear Faults (USGS, 2010)

- Class B
- Less than 1,600,000 years
- Less than 750,000 years
- Less than 130,000 years
- Less than 15,000 years
- Less than 150 years
- Unknown

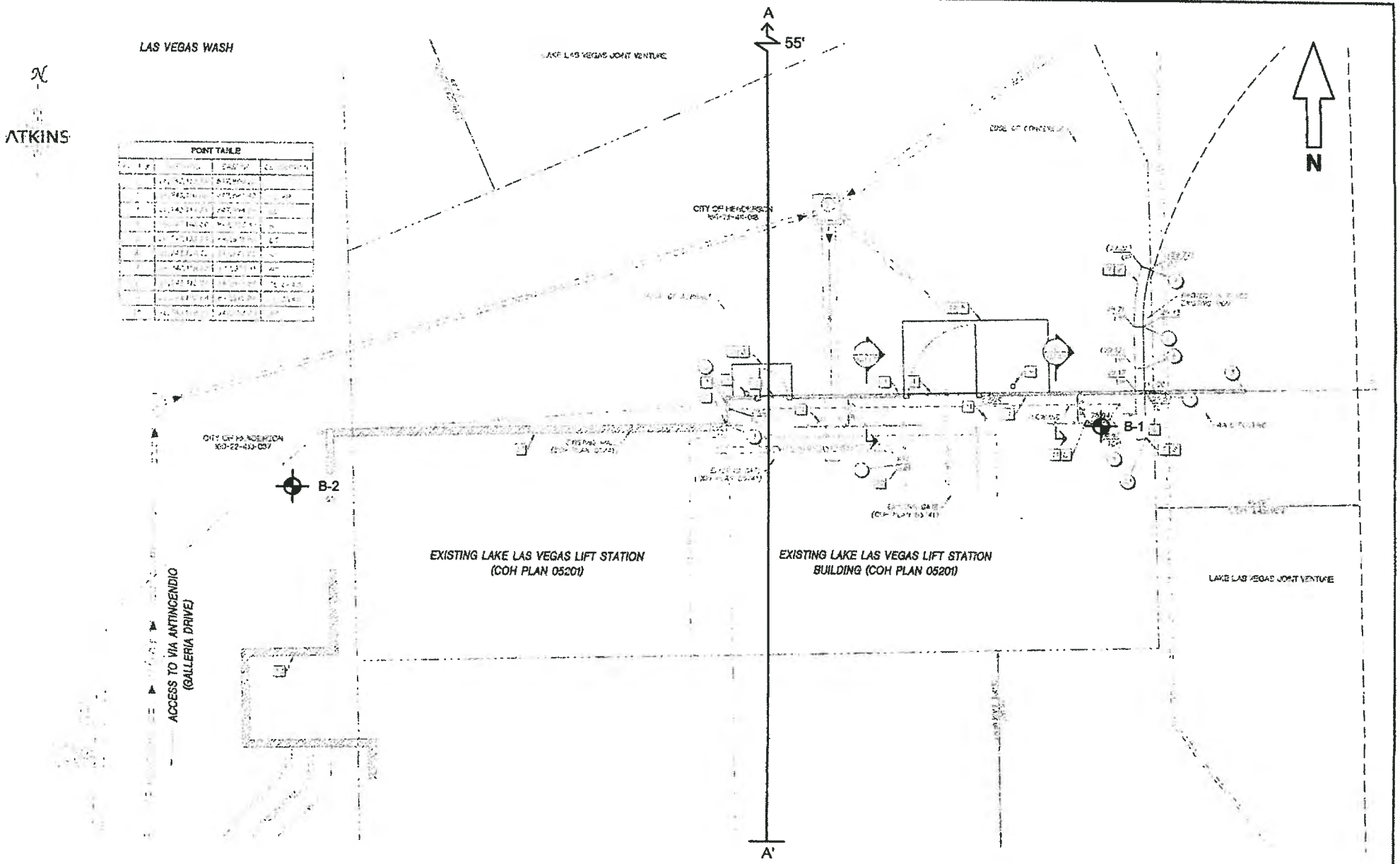
NOTE: Data presented on this map is a compilation of GIS Metadata extracted from a variety of sources. Major Streets, Airports, and Railroads is data obtained from the Southern Nevada GIS Management Office. This data is downloaded by GES for incorporation into drawings generated by GES. Data contained within this page is to be used for informational purposes only. GES has not modified the data contained herein and uses it as it is acquired from the respective agency.

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GES

VICINITY MAP
LAKE LAS VEGAS LIFT STATION
FLOOD WALL IMPROVEMENTS
HENDERSON, NEVADA

Drawn By:	Date Drawn:
AT	03/12/2013
Project No.	Figure No.
20133164E1	A-1

j:\JOBS:2013_jobs\20133164\E1\GIS\Maps\Figure A-1.mxd



LEGEND	
B-2	APPROXIMATE LOCATION OF BORING
A-A'	CROSS-SECTION ANALYZED FOR SEEPAGE

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
(702) 365-1001
7150 Placid Street
Las Vegas, NV 89119
www.gesnevada.com

REFERENCE: ATKINS, LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT: DATED DECEMBER 17, 2012

SCALE: 1"=30'

BORING LOCATION MAP
LAKE LAS VEGAS LIFT STATION FLOOD WALL IMPROVEMENTS
HENDERSON, NEVADA

DRAWN BY:	REVIEWED BY:	DATE DRAWN:
AT	DJD	03/13/2013
PROJECT NO. 20133164E1		FIGURE NO. A-2

KEY TO SYMBOLS AND TERMS

Terms used according to the Unified Soil Classification System

Consistency or Condition of Soils

Fine-Grained Soils (Silt and Clay): Major portion passing #200 sieve

California Sampler* (blows/foot)	SPT** (blows/foot)	Relative Consistency	Unconfined Compressive Strength (tsf)	Manual Manipulation
< 2	< 2	Very Soft	< 0.25	Thumb will penetrate soil more than 1 in.
2-5	2-4	Soft	0.25-0.50	Thumb will penetrate soil about 1 in.
5-10	4-8	Firm	0.50-1.00	Thumb will penetrate soil about ¼ in.
10-20	8-15	Stiff	1.00-2.00	Thumb will not indent soil but readily indented with thumbnail.
>20	>15	Very Stiff	>2.00	Thumbnail will not indent soil.

*ASTM D 3550 using a 140-pound hammer falling 30 inches.
**ASTM D 1586

Coarse-Grained Soils (Sand and Gravel): Major portion retained on #200 sieve

California Sampler* (blows/foot)	SPT** (blows/foot)	Relative Density	Behavior of ½-inch Diameter Probe Rod
0-7	0-4	Very Loose	Easily penetrated when pushed by hand.
7-18	4-10	Loose	Firmly penetrated when pushed by hand.
18-50	10-30	Medium Dense	Easily penetrated when driven by 1 lb. hammer.
50-90	30-50	Dense	Penetrated less than 1 inch when driven with a 1 lb. hammer.
>90	>50	Very Dense	Penetrated less than ¼ inch when driven with a 1 lb. hammer.

*ASTM D 3550 using a 140-pound hammer falling 30 inches.
**ASTM D 1586

Cementation	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

Caliche and Cemented Sand and Gravel: Materials classified as medium hard, hard, or very hard caliche or cemented sand and gravel should be treated as rock per Appendix K of the Southern Nevada Amendments to the 2000 International Building Code, published February 11, 2003.

Misc. Symbols

- Exploration continues
- Initial groundwater depth
- Final groundwater depth

Constituent Percentages

- Trace - < 5%
- Few - 5 to 10%
- Little - 15-25%
- Some - 30-45%
- Mostly - 50-100%

Moisture Condition

- Dry - Absence of moisture, dusty, dry to the touch
- Moist - Damp but no visible water
- Wet - Visible free water, usually soil is below water table

Strata Group Symbols

- Fill
- CL- Low plasticity clay
- CH - High plasticity clay
- CL-ML - Silty low plasticity clay
- ML - Silt
- MH - Elastic silt
- SC - Clayey sand
- SM - Silty sand
- SP - Poorly graded sand
- SW - Well - graded sand
- GC - Clayey Gravel
- GM - Silty gravel
- GP - Poorly graded gravel
- GW - Well - graded gravel
- CG - Cemented sand and gravel
- Caliche

Soil Sampler Symbols

- Bulk sample
- Sample from auger cutting
- California sampler
- Standard Penetration Test
- Shelby tube
- Air Knife

Notes

1. Subsurface explorations were performed using the equipment listed on the exploration logs.
2. Subsurface explorations were performed on the date(s) shown on the exploration logs.
3. Soil sampler(s) were driven with a 140 pound hammer falling 30 inches (unless otherwise noted in the text of this report).
4. The transitions between soil types shown on the exploration logs as occuring abruptly at particular depths may in actuality be a gradual progression from one soil type to the next.
5. Exploration logs are subject to the limitations, conclusions, and recomendations presented in this report.

GES

Disclaimer

This Key to Symbols is part of a report prepared by Geotechnical & Environmental Services, Inc. and should be used with the report. The descriptions on the exploration logs apply only at the specific exploration locations and at the time the explorations were made. They are not warranted to be representative of subsurface conditions at other locations or times.

Figure No. A-3

BORING LOG
B-1

PROJECT: Lake Las Vegas Lift Station Floodwall
PROJECT NO.: 20133164E1
BORING LOCATION: N: 36.1019, W: 114.9345
EXPLORATION DATE: 3/11/2013
EXPLORATION SIZE (dia.): 7" Nominal O.D. H.S.A.
EQUIPMENT: Truck-Mounted D-120 Drill Rig
ELEVATION: 1,429 Feet (Approximate)
LOGGED BY: Hammond/Thompson

INITIAL DEPTH TO WATER: Not Encountered
DATE MEASURED: N/A
FINAL DEPTH TO WATER: N/A
DATE MEASURED: N/A

ELEVATION/ DEPTH	SOIL & SAMPLE SYMBOLS	USCS	DESCRIPTION	PI	LL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL (%)	POCKET PENETROMETER (tsf)
1425 / 0	32 41 50/5	A/C	ASPHALT CONCRETE:						
		GM	Approximately 4" thick.						
		SC	AGGREGATE BASE: Brown silty GRAVEL with sand, moist, dense. Approximately 8" thick.	11	26	8.5	107.6		
1420 / 5	45 50/5		FILL:						
		SM	Brown clayey SAND, few gravel, moist, dense to very dense.	NP	NV	8.5	96.4		
			...less gravel.						
1415 / 10	34 50/4		FILL: Silty SAND with gravel, moist and dense to very dense.			6.6	97.7		
1410 / 15			END OF BORING AT 10.9 FEET						
1405 / 20									
1400 / 25									
1395 / 30									
35									

The descriptions contained within this exploration log apply only at the specific exploration location and at the time the exploration was made. It is not intended to be representative of subsurface conditions at other locations or times.

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Figure No. A-4

BORING LOG
B-2

PROJECT: Lake Las Vegas Lift Station Floodwall
PROJECT NO.: 20133164E1
BORING LOCATION: N: 36.1019, W: 114.9351
EXPLORATION DATE: 3/11/2013
EXPLORATION SIZE (dia.): 7" Nominal O.D. H.S.A.
EQUIPMENT: Truck-Mounted D-120 Drill Rig
ELEVATION: 1,428 Feet (Approximate)
LOGGED BY: Hammond/Thompson

INITIAL DEPTH TO WATER: Not Encountered
DATE MEASURED: N/A
FINAL DEPTH TO WATER: N/A
DATE MEASURED: N/A

ELEVATION/ DEPTH	SOIL & SAMPLE SYMBOLS	USCS	DESCRIPTION	PI	LL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL (%)	POCKET PENETROMETER (tsf)
1425 / 0		A/C	ASPHALT CONCRETE: Approximately 3" thick.						
	17 20 24	GM		9	24				
		SC	AGGREGATE BASE: Dark brown silty GRAVEL with sand, moist, dense. Approximately 9" thick.			9.1	108.9		
1420 / 5	45 43 50/6		FILL: Brown clayey SAND, few gravel, moist, medium dense. ...more gravel, dense. ...very dense.			9.8	116.4		
1415 / 10	22 24 32		...dense.						
		SM	FILL: Silty SAND with gravel, moist and dense.	NP	NV	9.9	121.1		
1410 / 15			END OF BORING AT 11.5 FEET						
1405 / 20									
1400 / 25									
1395 / 30									
35									

The descriptions contained within this exploration log apply only at the specific exploration location and at the time the exploration was made. It is not intended to be representative of subsurface conditions at other locations or times.

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Figure No. A-5

APPENDIX B
LABORATORY TEST RESULTS

GEOTECHNICAL EVALUATION
LAKE LAS VEGAS
LIFT STATION FLOOD WALL IMPROVEMENTS
1609 LAKE LAS VEGAS PARKWAY
HENDERSON, NEVADA

1. IN-PLACE MOISTURE CONTENT AND DENSITY

The in-place moisture content and density of relatively undisturbed soil samples obtained from the borings were measured in general accordance with ASTM D 2937. The in-place moisture content and density are a qualitative indication of soil consistency and compressibility. The results of these tests are presented on the boring logs (Figures A-4 through A-5) at the respective sampling depth.

2. PARTICLE SIZE DISTRIBUTION

Four particle size distribution tests were performed by sieve analysis in general accordance with ASTM D 6913. Basically, a sample is oven dried to a constant weight and sieved through a number of different sized sieves. The amount of material retained on each sieve is measured and the percent of material passing each sieve is computed. The test results are presented as the particle size distribution curves on Figures B-1 through B-4.

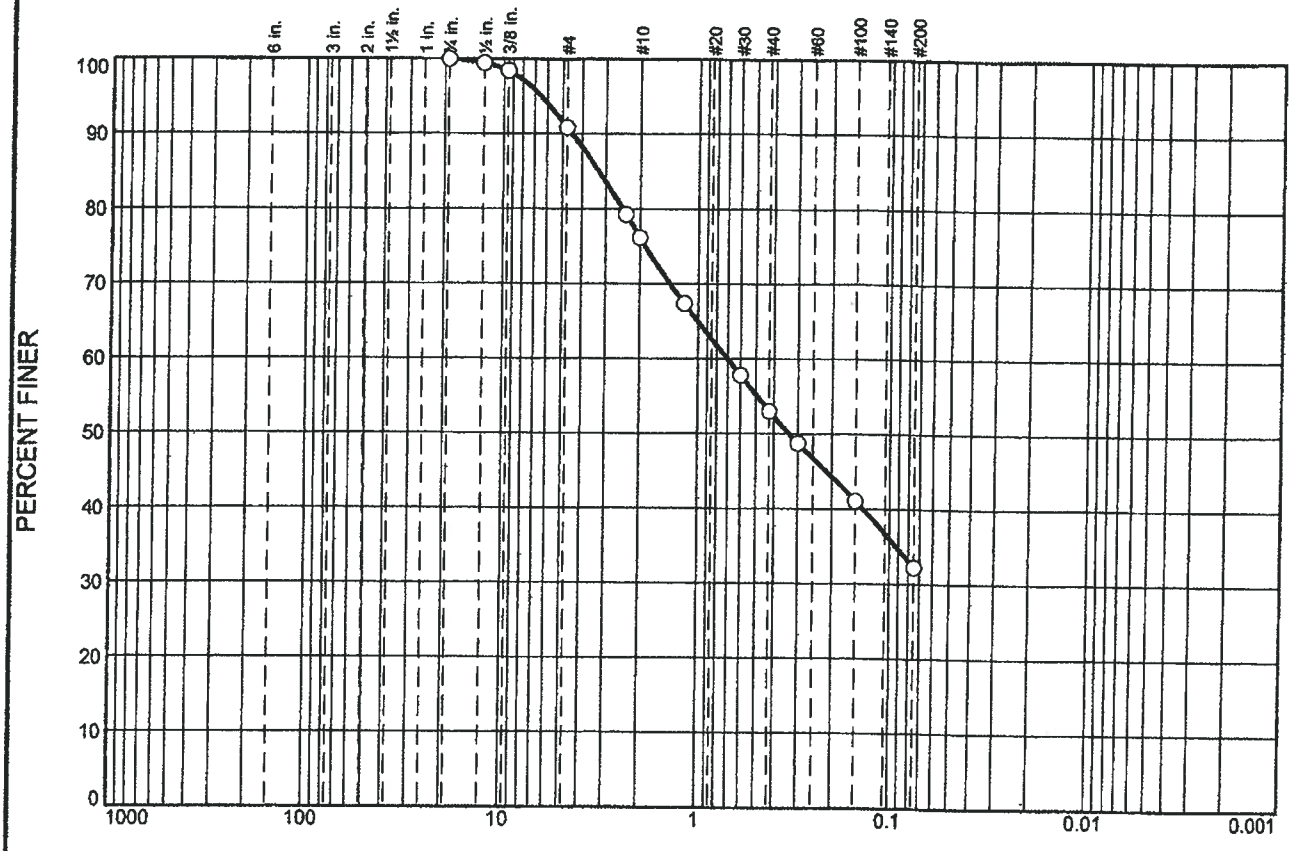
3. ATTERBERG LIMITS

Four Atterberg limit tests were performed in general accordance with ASTM D 4318. The results of the tests are shown on the exploration logs at the respective sampling depths and on Figure B-5.

4. WATER SOLUBLE SALT

Two tests were performed on selected soil samples to determine the contents of soluble sulfate. The tests were performed by Silver State Analytical Laboratories. The results of the tests are shown on Figures B-6 and B-7.

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.1	14.8	23.1	20.7	32.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	99.4		
.375	98.5		
#4	90.9		
#8	79.3		
#10	76.1		
#16	67.4		
#30	57.8		
#40	53.0		
#50	48.8		
#100	41.1		
#200	32.3		

* (no specification provided)

Soil Description

Clayey sand

Atterberg Limits

PL= 15 LL= 26 PI= 11

Coefficients

D_{90}= 4.4803 D_{85}= 3.2604 D_{60}= 0.7042
D_{50}= 0.3335 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-2-6(0)

Remarks

ASTM D6913

Location: BORING B-1 @ 1.0'-5.0'
Sample Number: B-1 **Depth:** 1.0'-5.0' **Date:** 03/18/13

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

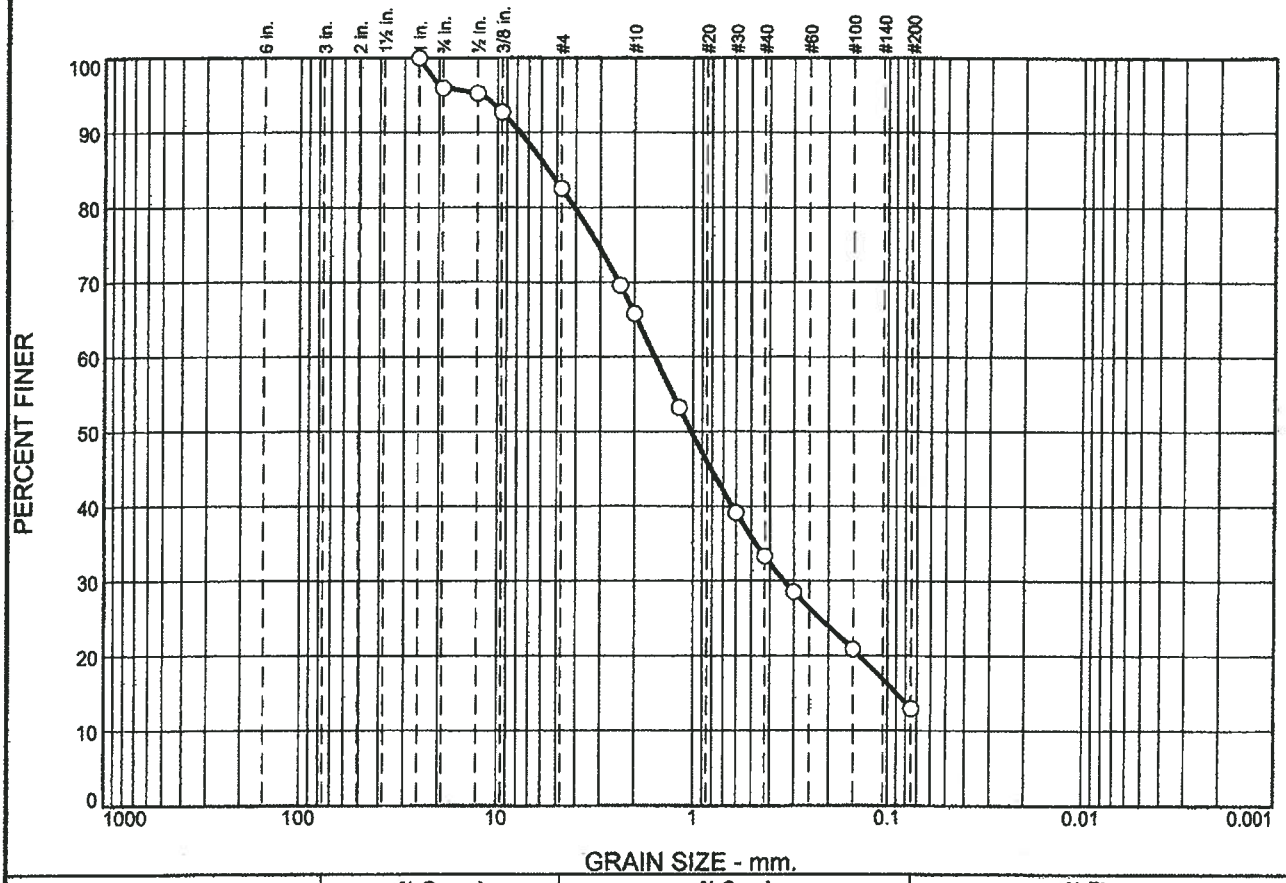
GES

Client: ATKINS
Project: LAKE LAS VEGAS LIFT STATION FLOOD WALL

Project No: 20133164E1 **Figure** B-1

Tested By: M. JANOFF

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.0	13.4	16.9	32.4	20.4	12.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	96.0		
.5	95.3		
.375	92.7		
#4	82.6		
#8	69.5		
#10	65.7		
#16	53.2		
#30	39.2		
#40	33.3		
#50	28.5		
#100	20.9		
#200	12.9		

* (no specification provided)

Soil Description

Silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 7.7295 D_{85}= 5.5270 D_{60}= 1.5709
D_{50}= 1.0222 D_{30}= 0.3365 D_{15}= 0.0895
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

ASTM D6913

Location: BORING B-1 @ 5.0'-5.9'
Sample Number: B-1 **Depth:** 5.0'-5.9' **Date:** 03/18/13

GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

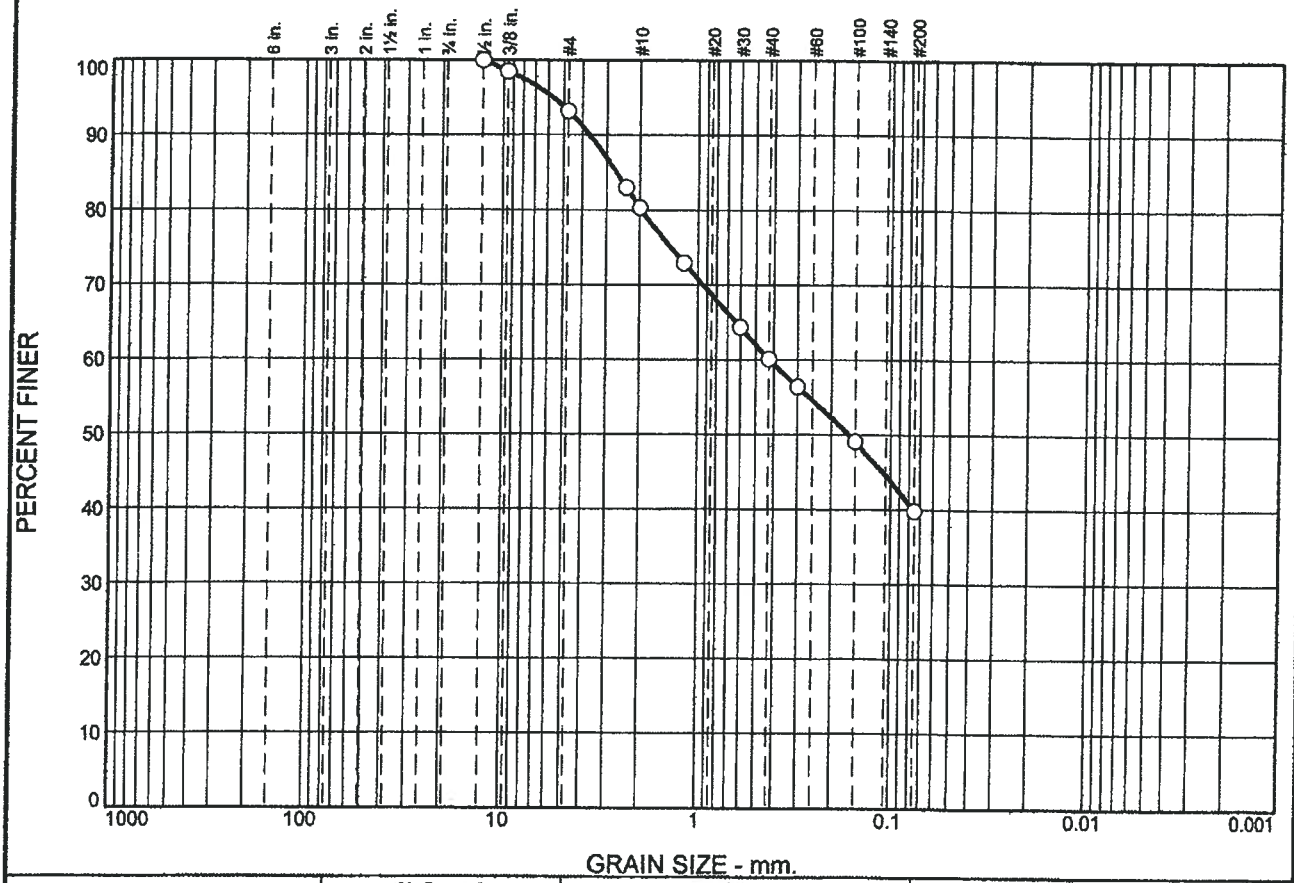
GES

Client: ATKINS
Project: LAKE LAS VEGAS LIFT STATION FLOOD WALL

Project No: 20133164E1 **Figure** B-2

Tested By: M. JANOFF

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	6.8	12.9	20.2	20.3	39.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	98.5		
#4	93.2		
#8	83.0		
#10	80.3		
#16	72.9		
#30	64.3		
#40	60.1		
#50	56.4		
#100	49.1		
#200	39.8		

* (no specification provided)

Soil Description

Clayey sand

Atterberg Limits

PL= 15 LL= 24 PI= 9

Coefficients

D_{90}= 3.6864 D_{85}= 2.6602 D_{60}= 0.4212
D_{50}= 0.1622 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-4(0)

Remarks

ASTM D6913

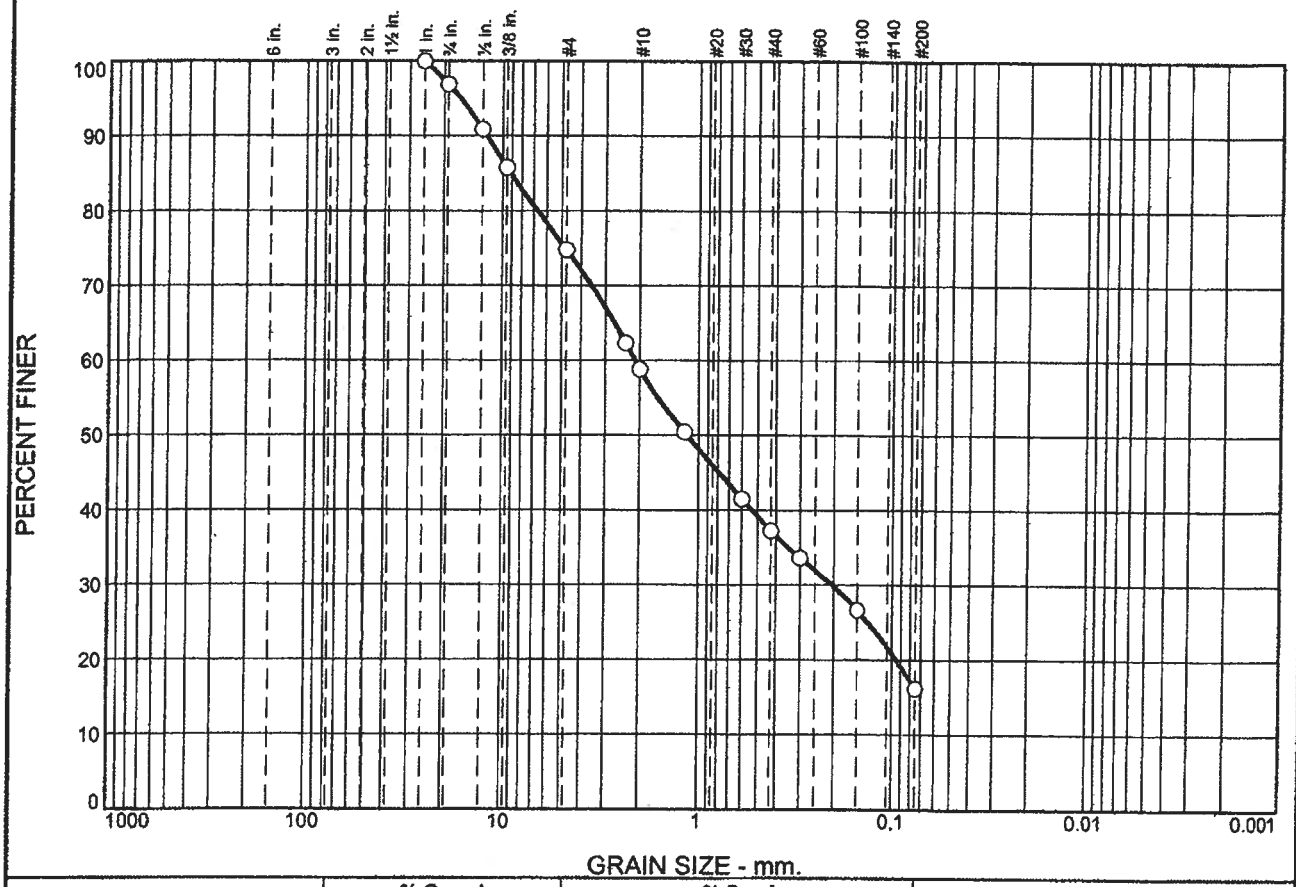
Location: BORING B-2 @ 1.0'-5.0'
Sample Number: B-2 **Depth:** 1.0'-5.0' **Date:** 03/18/13

GES GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Client: ATKINS
Project: LAKE LAS VEGAS LIFT STATION FLOOD WALL
Project No: 20133164E1 **Figure** B-3

Tested By: M. JANOFF

Particle Size Distribution Report



% Cobbles	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.1	22.1	16.0	21.5	21.1	16.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	96.9		
.5	90.9		
.375	85.7		
#4	74.8		
#8	62.3		
#10	58.8		
#16	50.4		
#30	41.5		
#40	37.3		
#50	33.6		
#100	26.7		
#200	16.2		

* (no specification provided)

Soil Description

Silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 12.0842 D_{85}= 9.1274 D_{60}= 2.1155
D_{50}= 1.1446 D_{30}= 0.2038 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

ASTM D6913

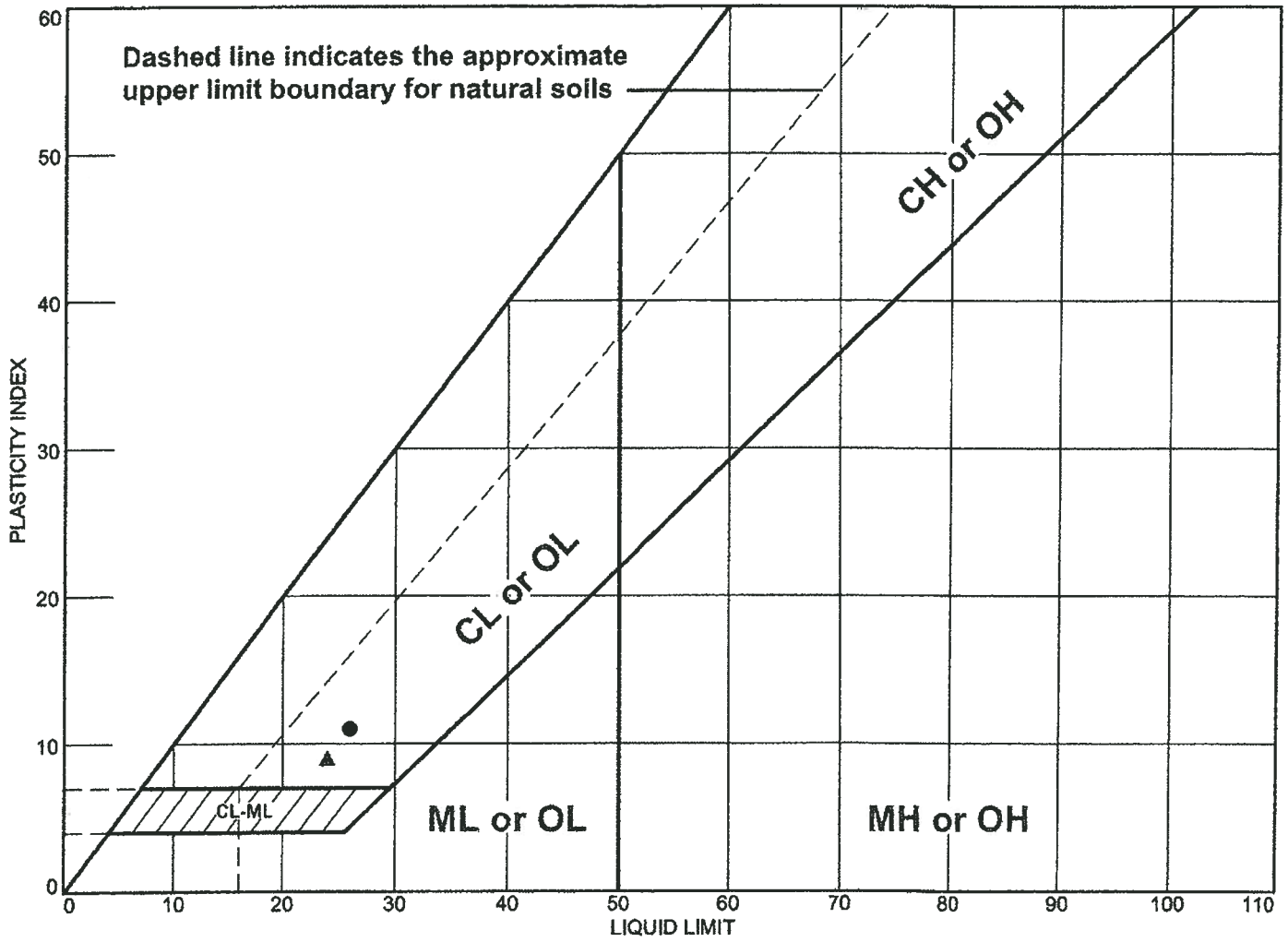
Location: BORING B-2 @ 10.5'-11.5'
Sample Number: B-2 **Depth:** 10.5'-11.5' **Date:** 03/18/13

GES GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Client: ATKINS
Project: LAKE LAS VEGAS LIFT STATION FLOOD WALL
Project No: 20133164E1 **Figure** B-4

Tested By: M. JANOFF

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Clayey sand	26	15	11	53.0	32.3	SC
■	Silty sand with gravel	NV	NP	NP	33.3	12.9	SM
▲	Clayey sand	24	15	9	60.1	39.8	SC
◆	Silty sand with gravel	NV	NP	NP	37.3	16.2	SM

Project No. 20133164E1 **Client:** ATKINS

Project: LAKE LAS VEGAS LIFT STATION FLOOD WALL

● **Loc.:** BORING B-1 @ 1.0'-5.0' **Depth:** 1.0'-5.0' **Sample No.:** B-1

■ **Loc.:** BORING B-1 @ 5.0'-5.9' **Depth:** 5.0'-5.9' **Sample No.:** B-1

▲ **Loc.:** BORING B-2 @ 1.0'-5.0' **Depth:** 1.0'-5.0' **Sample No.:** B-2

◆ **Loc.:** BORING B-2 @ 10.5'-11.5' **Depth:** 10.5'-11.5' **Sample No.:** B-2

Remarks:

● ASTM D4318

GES GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Figure B-5

Tested By: R. THOMPSON

SilverState
Analytical Laboratories

LABORATORY REPORT

DATE: March 19, 2013

REPORT NUMBER: 13-1173

CLIENT: GES
7150 Placid St
Las Vegas, NV 89119

PAGE: 1 of 1

CLIENT PROJECT: 20133164E1

CLIENT PO #:

ANALYST: SW

Sampled By: Client
Date Sampled: --
Time Sampled: --

Date Received: 03/18/13
Time Received: 1115

Sample ID: 13-020, B-1 @ 1.0'-5.0'

Analysis	Result	Unit	Method
Sulfate	0.03	%	SM 4500 E

Note: The results for each constituent denote the percentage (%) for that particular element which is soluble in a 1:5 (soil to water) extraction ratio and corrected for dilution.

REVIEWED BY:

John Sloan
Laboratory Director

3638 East Sunset Road, Suite 100 Las Vegas, NV 89120
Tel: 702-873-4478 Fax: 702-873-7967 www.ssalabs.com

Figure No. B-6

SilverState
Analytical Laboratories

LABORATORY REPORT

DATE: March 19, 2013

REPORT NUMBER: 13-1173

CLIENT: GES
7150 Placid St
Las Vegas, NV 89119

PAGE: 1 of 1

CLIENT PROJECT: 20133164E1

CLIENT PO #:

ANALYST: SW

Sampled By: Client
Date Sampled: --
Time Sampled: --

Date Received: 03/18/13
Time Received: 1115

Sample ID: 13-020, B-1 @ 1.0'-5.0'

Analysis	Result	Unit	Method
Sulfate	0.03	%	SM 4500 E

Note: The results for each constituent denote the percentage (%) for that particular element which is soluble in a 1:5 (soil to water) extraction ratio and corrected for dilution.

REVIEWED BY:

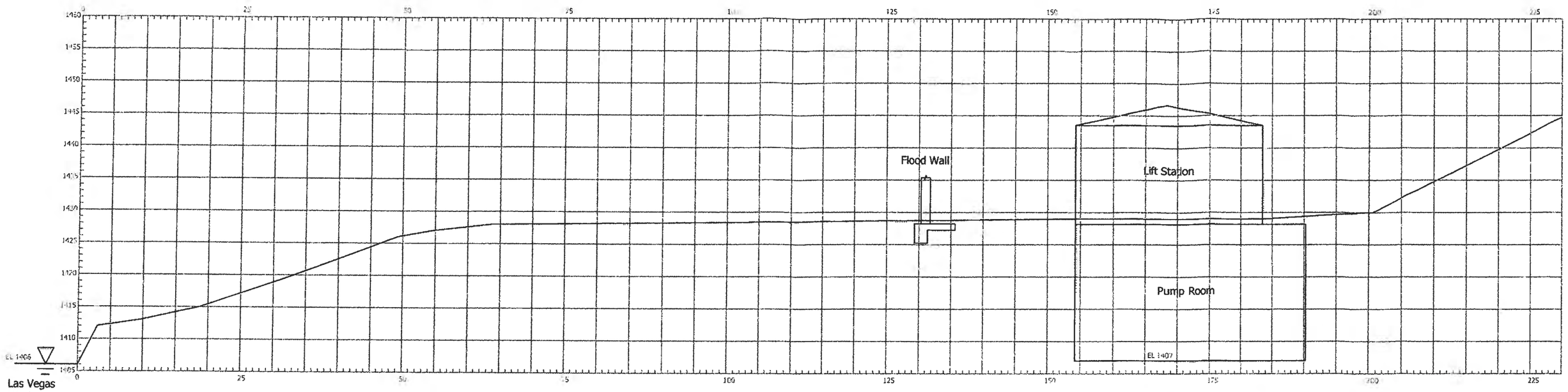
John Sloan
Laboratory Director

3638 East Sunset Road, Suite 100 Las Vegas, NV 89120
Tel: 702-873-4478 Fax: 702-873-7967 www.ssalabs.com

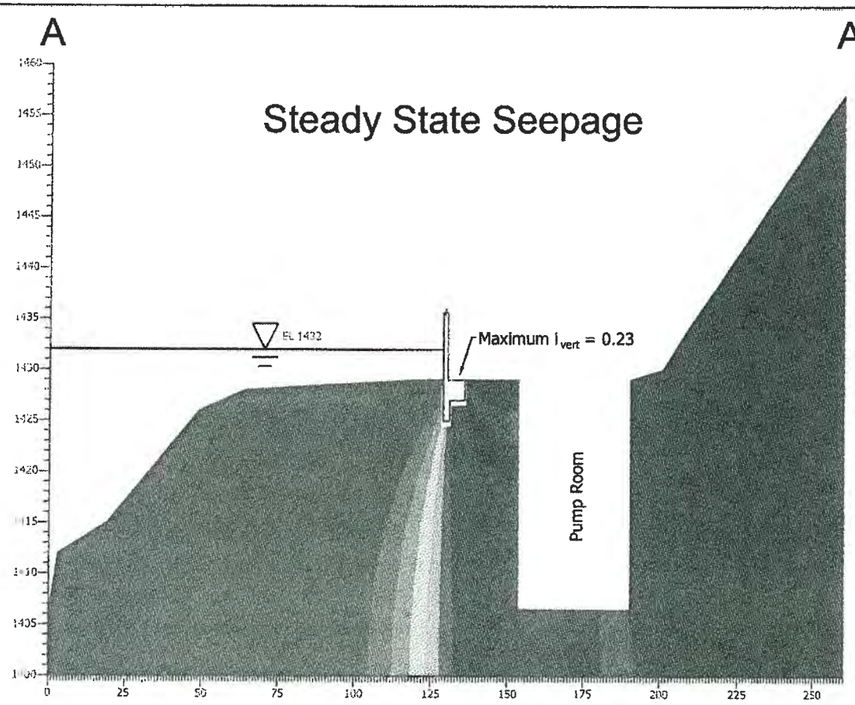
Figure No. B-7

APPENDIX C – SEEPAGE RESULTS

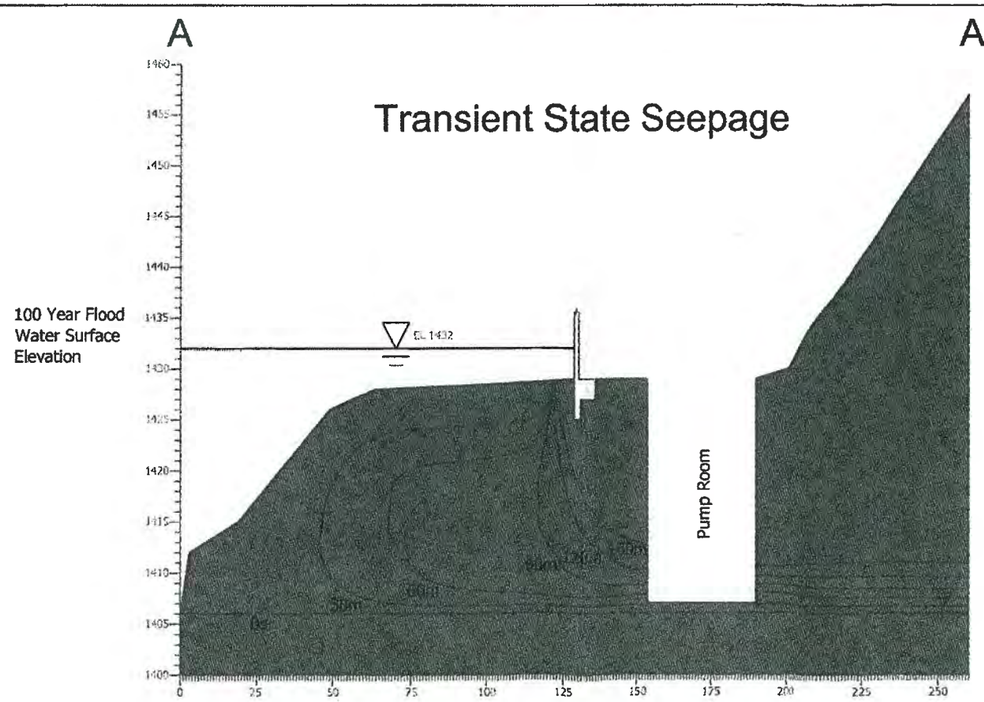
Cross-Section A-A'



Steady State Seepage



Transient State Seepage



SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: 1" = 15'

GES
GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
(702) 365-1001
7150 Placid Street
Las Vegas, NV 89119
www.gesnevada.com

STEADY STATE AND TRANSIENT SEEPAGE RESULTS
LAKE LAS VEGAS LIFT STATION FLOOD WALL IMPROVEMENTS
HENDERSON, NEVADA

DRAWN BY:	REVIEWED BY:	DATE DRAWN:		LEGEND
AT	DJD	04/15/2013		
PROJECT NO. 20133164E1			FIGURE NO. C-1	—— Time Dependent Wetting Front

APPENDIX V

Structural Calculation Notebook

Lake Las Vegas Flood Protection

Design For

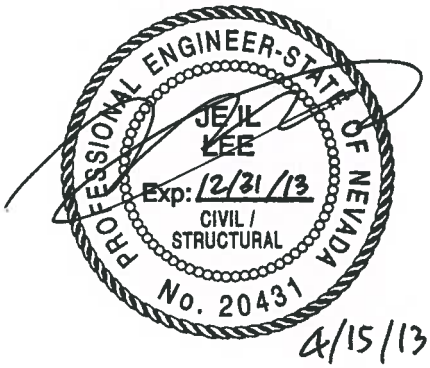
Exist. Flood Protection Wall Retrofit

Prepared for:

City of Henderson, Nevada

Prepared by:

ATKINS
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074-6382



Project No. 100032223
December, 2012

DESIGN CRITERIA

Codes:

International Building Code 2009 (IBC 2009)
Building Code Requirements for Structural Concrete (ACI 318-08)
Minimum Design Loads for Buildings and Other Structures (ASCE 7-05)

Materials:

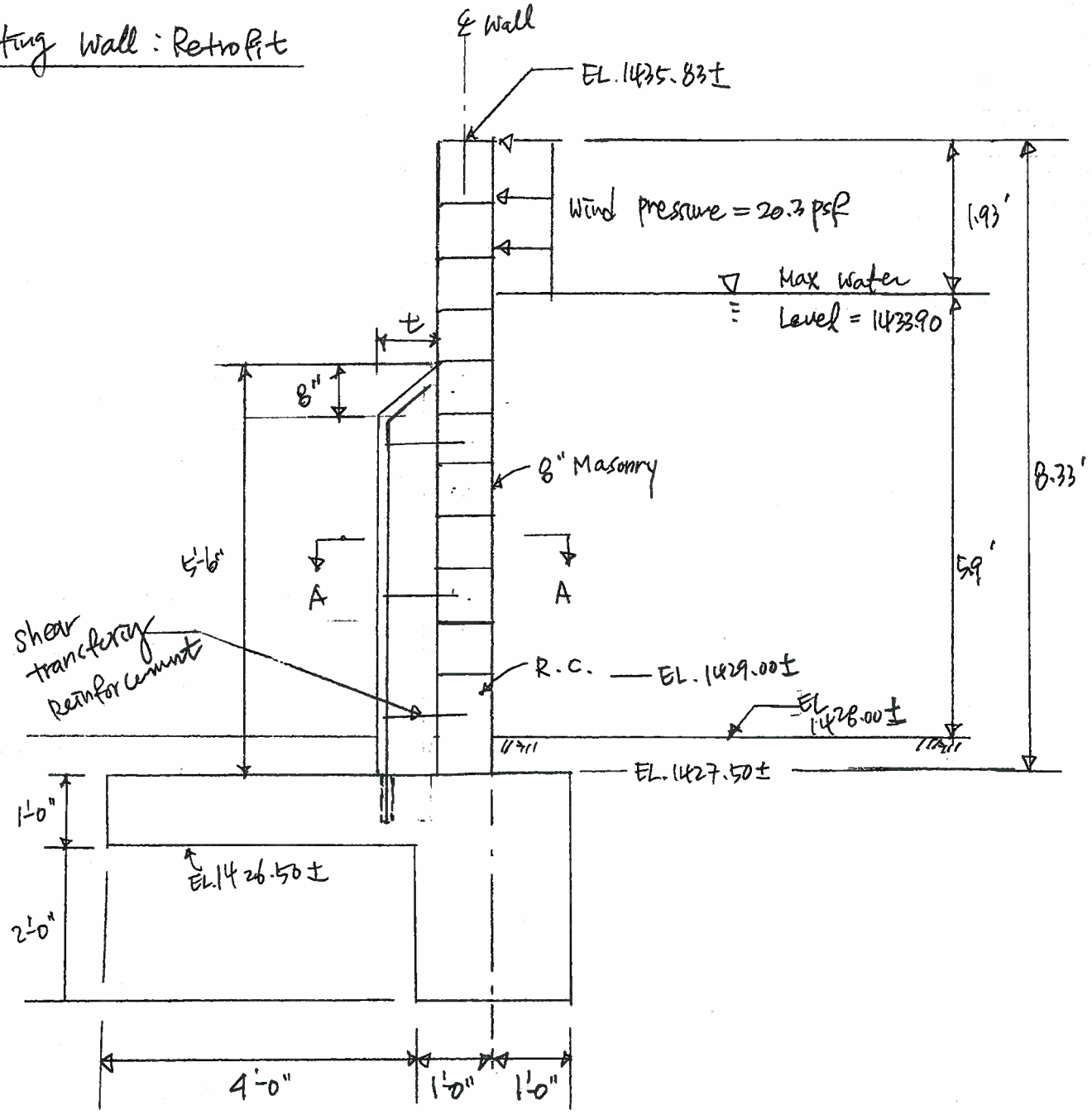
Concrete (Type V cement)	f'c = 3000 psi
Masonry (Split face)	f'm=1500 psi
Reinforcing Steel ASTM A-615 Grade 60	fy = 60,000 psi

Loads:

Water Pressure	62.4 pcf
Wind Pressure	20.3 psf

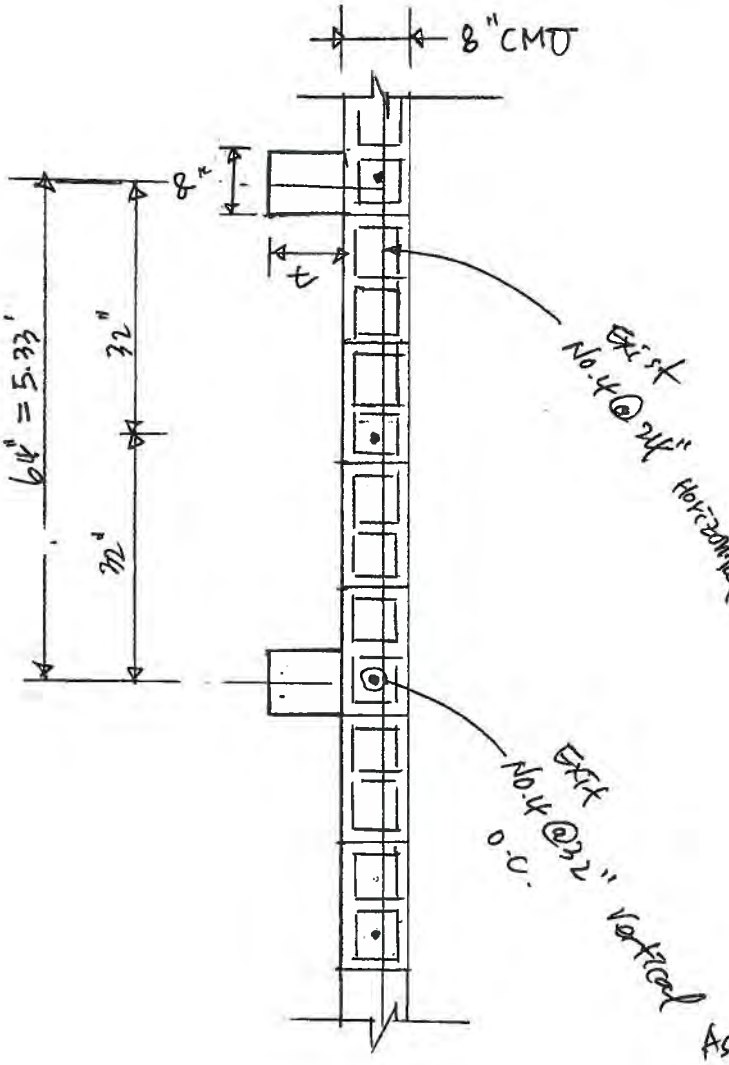
Subject: Lake Las Vegas Flood Wall Design Existing Wall Retrofit			ATKINS
Comp by: JL Check by: JC	Date: 12/03/12 Job Number: 100032222	Sheet Number:	#1

Existing Wall : Retrofit



Exist. Wall. (North Wall) see attached photo

Subject: Lake Las Vegas Floodwall Design Existing Wall Retrofit		ATKINS
Comp by: JL Check by: JC	Date: 12/03/12 Job Number: LD00322223	Sheet Number: #2



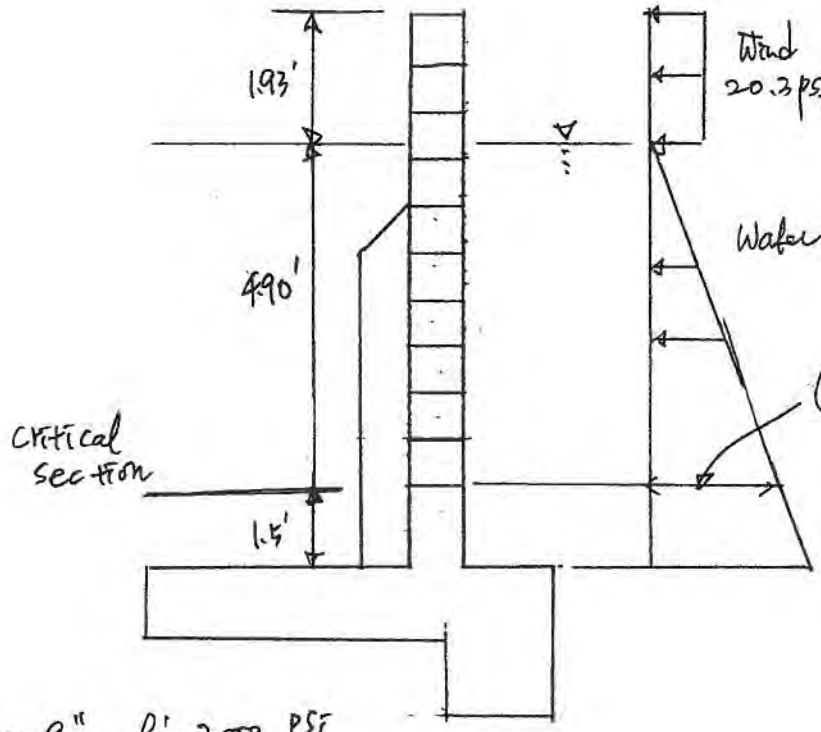
$A_s = 0.2\ in^2/(32"/12) = 0.075\ in^2/ft$

SEC. A-A

Subject:	Lake Las Vegas Flood wall Design Existing Wall Retrofit		
Comp by: JL	Date: 12/03/12	Sheet Number:	#3
Check by: JC	Job Number: 100032223		

ATKINS

Vertical Reinforcement



Try $t = 9''$, $f'_c = 3000$ psi

Shear $V_u = 1.6(108 \times 1.93') + 2.0(\frac{1}{2} \times 1630 \times 4.90)$ (1.6: Load Factor; 2.0: Load Factor)

$= 334 + 7987 = 8321$ #

Moment $M_u = 334 \times (4.9' + 1.93/2) + 7987 \times (4.90/3)$

$= 1959 + 13045 = 15004$ #-ft

$b = 8''$, $h = 8'' + 9'' = 17''$, $d = 17'' - 4'' = 13''$, $A_s = 0.075 \times 5.33' = 0.4\ in^2$

$$a = \frac{A_s \cdot f_y}{0.85 f'_c b} = \frac{(0.4)(60)}{0.85(3)(8'')} = 1.18''$$

$\phi M_n = \phi A_s f_y (d - a/2) = 0.9(0.4)(60)(13'' - 1.18/2) \times 10^3/12 = 22238$ #-ft

$> M_u$ O.K

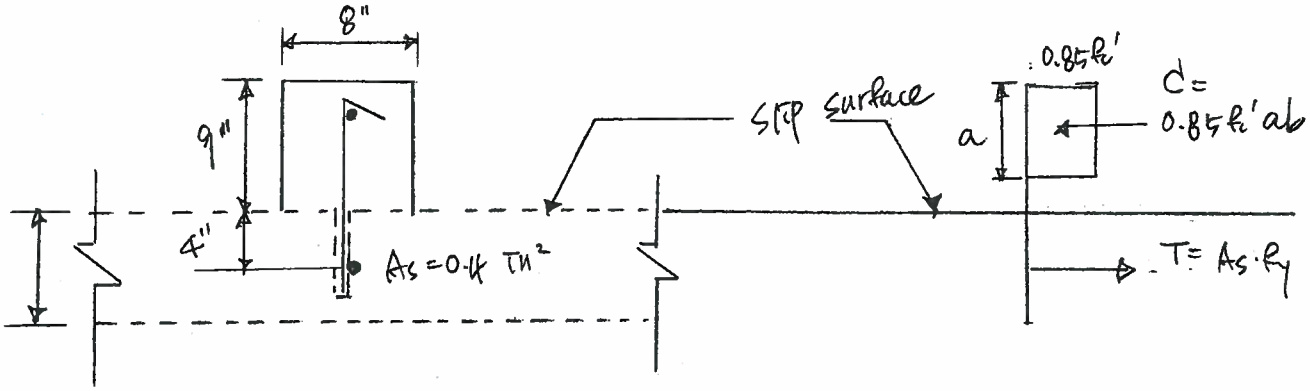
$\phi V_n = \phi \times 2.0\sqrt{f'_c}\, b \cdot d = 0.75 \times 2\sqrt{3000}\,(8")(13") = 8544\#$

(ACI 9.3.2.3) $> V_u$ O.K

Min. Reinforcement for pedestal (8" x 9")

$0.0018\, b \cdot h = 0.0018\,(8")(9") = 0.13\ in^2 \rightarrow$ use #4 Bar

Shear Transferring Reinforcement



Transferring shear $= A_s \cdot f_y = (0.4)(60) = 24^k$

Assume the shear/unit Length $= 24^k / 5.5' = 4.36\ k/ft$

per ACI 318 11.6, Shear friction will be

$V_n = A_{vf} \cdot f_y \cdot \mu$, $\mu = 0.6$ (concrete placed hardened concrete not intentionally roughened)

Try #4 @ 16" = 0.15 in^2/ft

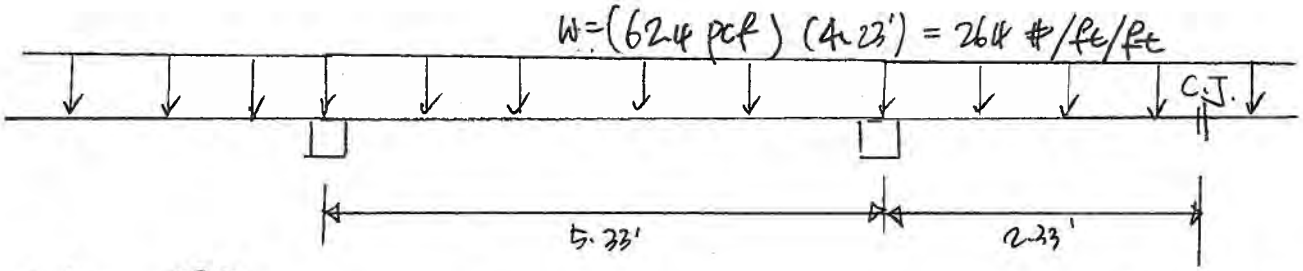
$\phi V_n = (0.75)(0.15 \times 60 \times 0.6) = 4.05\ k/ft \approx 4.36\ k/ft$ Say O.K

Subject:	Lake Las Vegas Floodwall Design Existing Wall Retrofit		
Comp by: JL Check by: JC	Date: 12/04/12 Job Number: 100032223	Sheet Number:	#5

ATKINS

Horizontal Reinforcement

Conservatively



Interior Span

$$M \simeq \frac{wl^2}{10} = \frac{(264)(5.33)^2}{10} = 750 \text{ \#-ft/ft}$$ (Controls)

Cantilever

$$M = \frac{(264)(2.33)^2}{2} = 718 \text{ \#-ft/ft}$$

$M_u = 2.0 \times 750 = 1500$ #-ft/ft

$A_{SH} = \#4@24'' = 0.1 \text{ in}^2/\text{ft}$

$f'_m = 1500$ PSI

$$a = \frac{A_s \cdot f_y}{0.85 f'_m b} = \frac{(0.1)(60)}{0.85(1.5)(12)} = 0.392''$$, $d = 4''$

$$\phi M_n = \phi A_s \cdot f_y (d - a/2) = 0.9(0.1)(60)(4 - 0.392/2)(10^3)/12$$

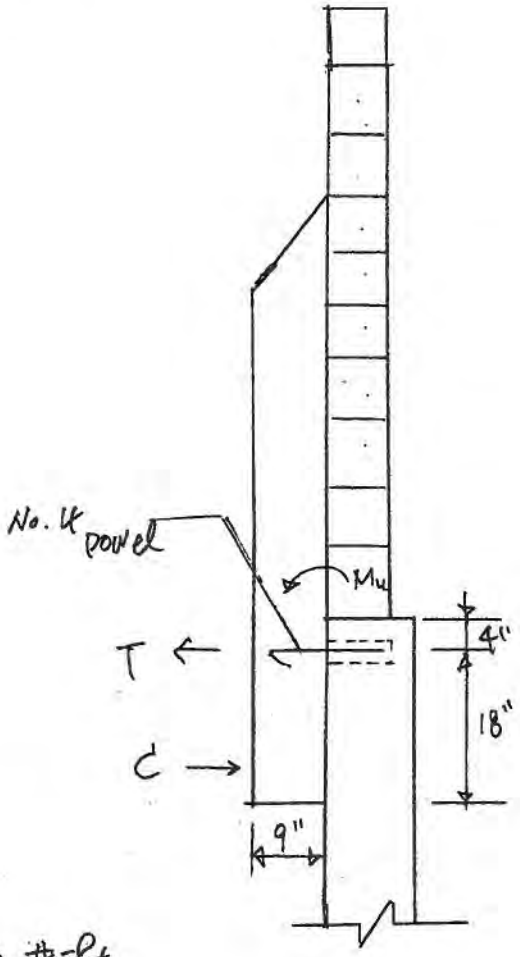
$= 1712$ #-ft/ft $> M_u = 1500$ #-ft/ft

O.K.

Subject: Lake Las Vegas Flood Wall Design Exist. Wall Retrofit		
Comp by: JL Check by: JC	Date: 12/06/12 Job Number: 100032223	Sheet Number:

ATKINS

pedestal on the wall



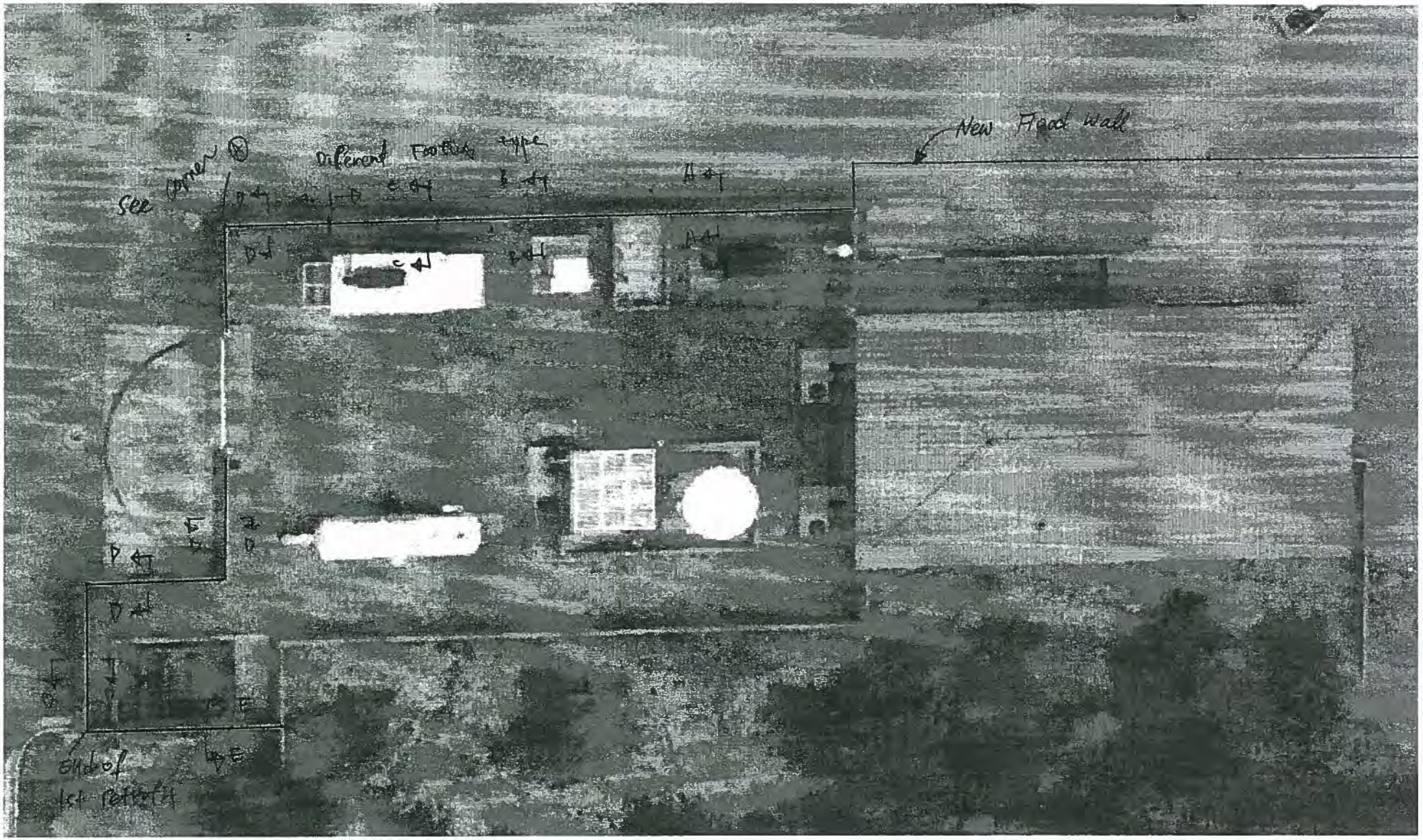
M_u = 15004 #-ft
(from previous calcs)

d = 18", b = 8", f_c' = 3 KSI, A_s = 0.2 IN^2

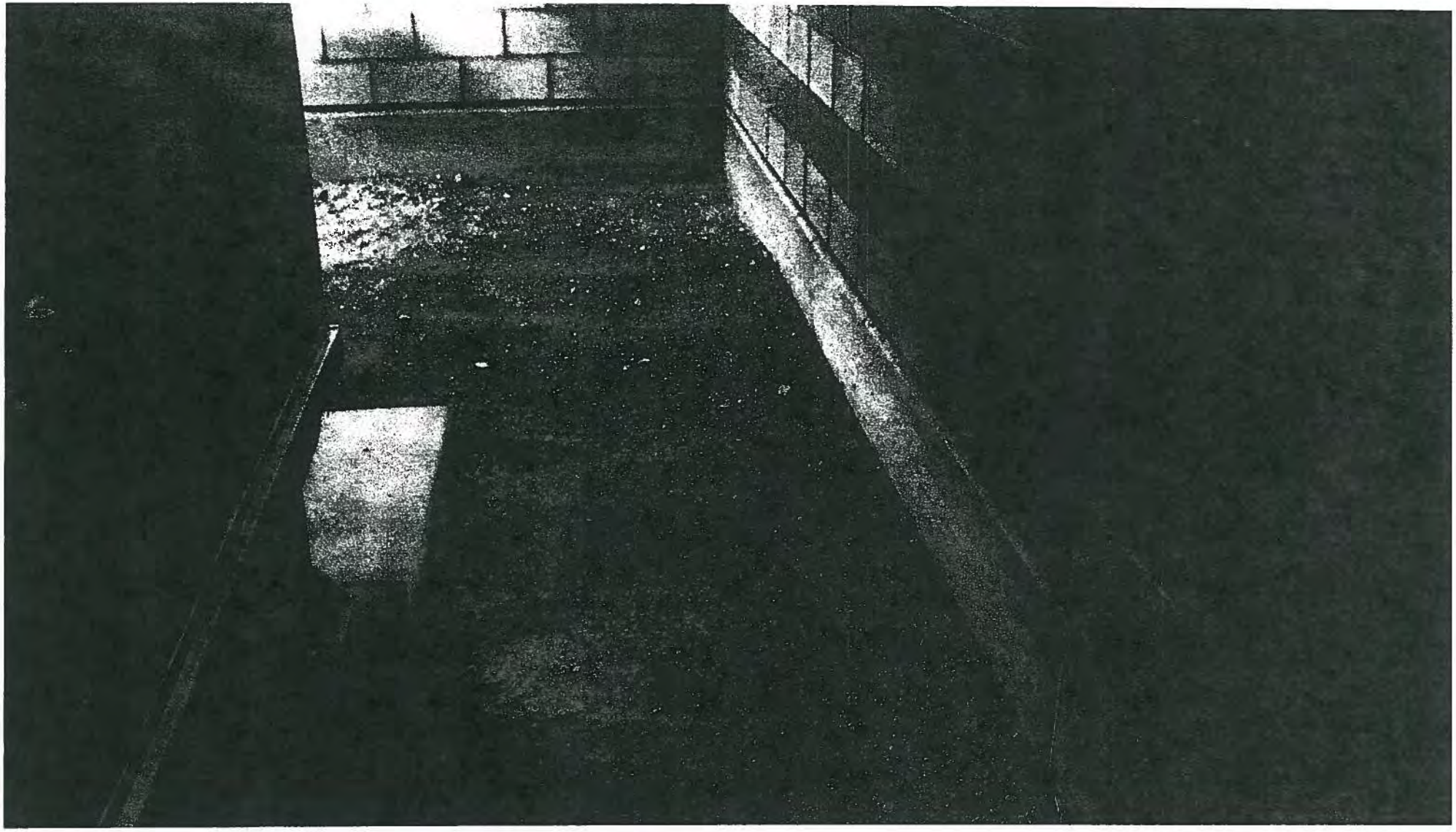
$$a = \frac{A_s \cdot f_y}{0.85 f_c' b} = \frac{(0.2)(60)}{0.85(3)(8)} = 0.588"$$

$$\phi M_n = \phi A_s \cdot f_y (d - a/2) = (0.9)(0.2 \times 60)(18" - 0.588/2)(10^3/12)$$
$$= 15935 \text{ \#-ft} > M_u \text{ o.k.}$$

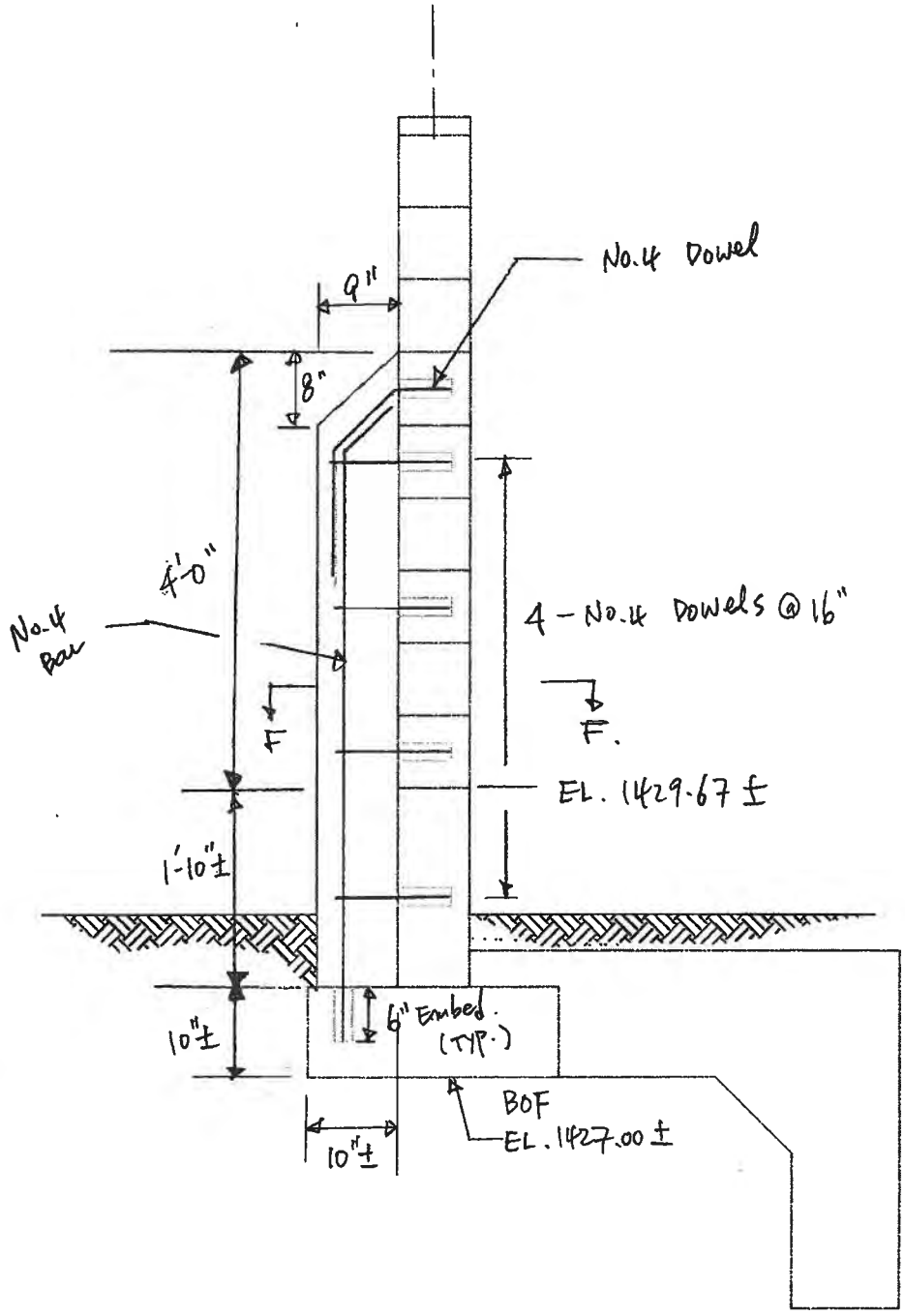
N


New Flood wall
See
Different Footing type
End of 1st retaining

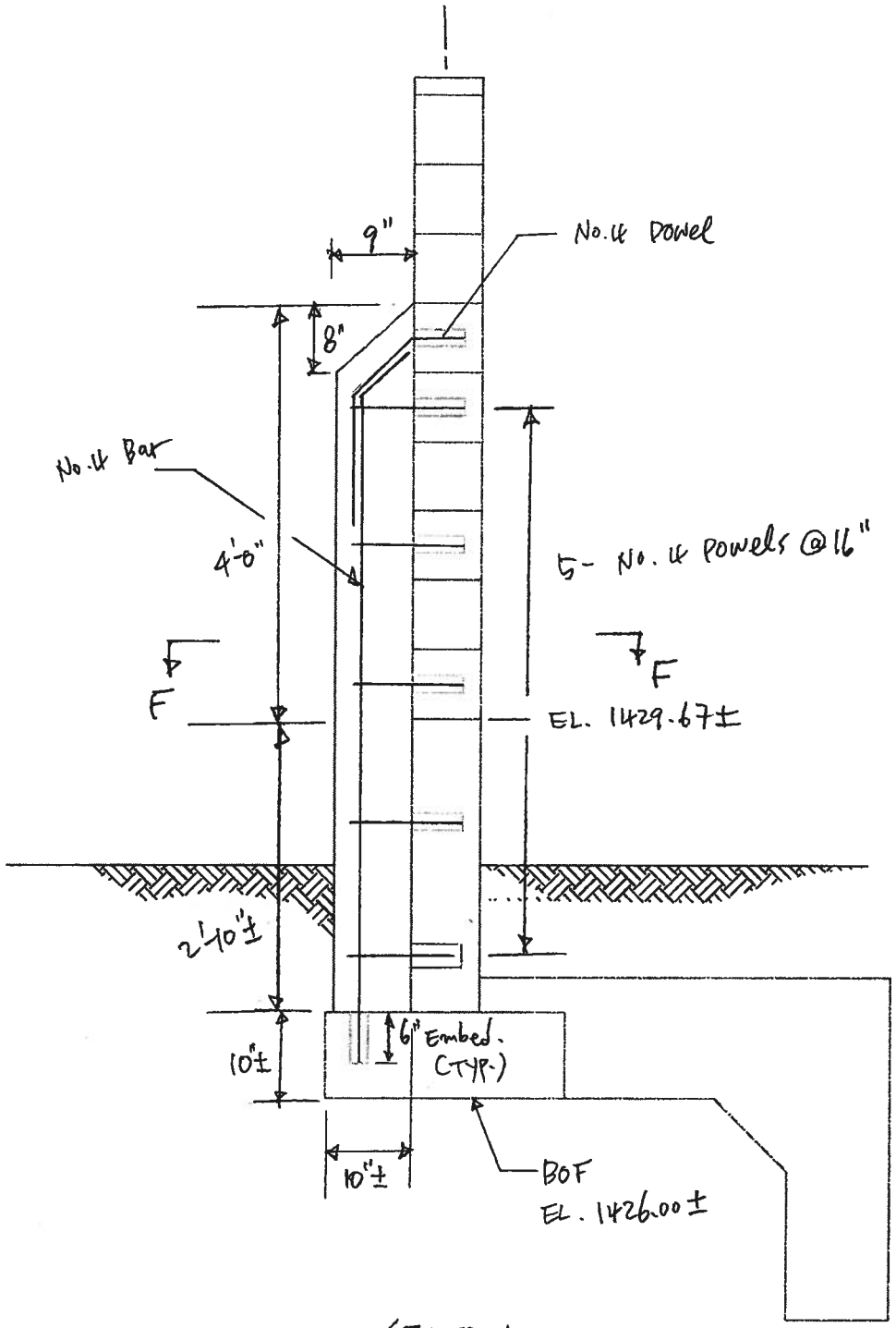
PLAN View



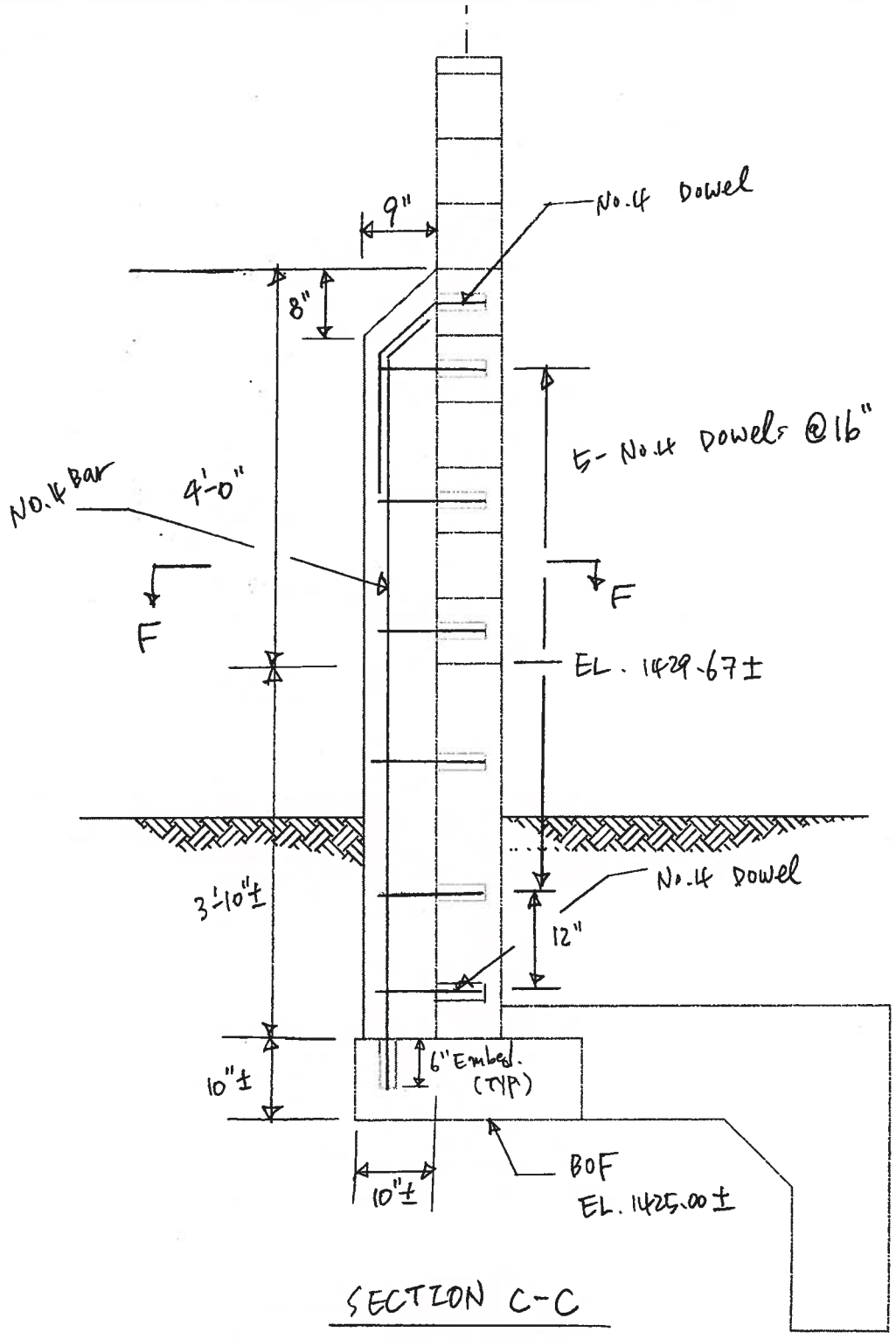
corner Ⓐ : Exit. Plan does not match to existing structure.


No.4 Dowel
9"
8"
4'-0"
No.4 Bar
4 - No.4 Dowels @ 16"
F
F
EL. 1429.67 ±
1'-10" ±
10" ±
6" Embed. (TYP.)
BOF
EL. 1427.00 ±
10" ±

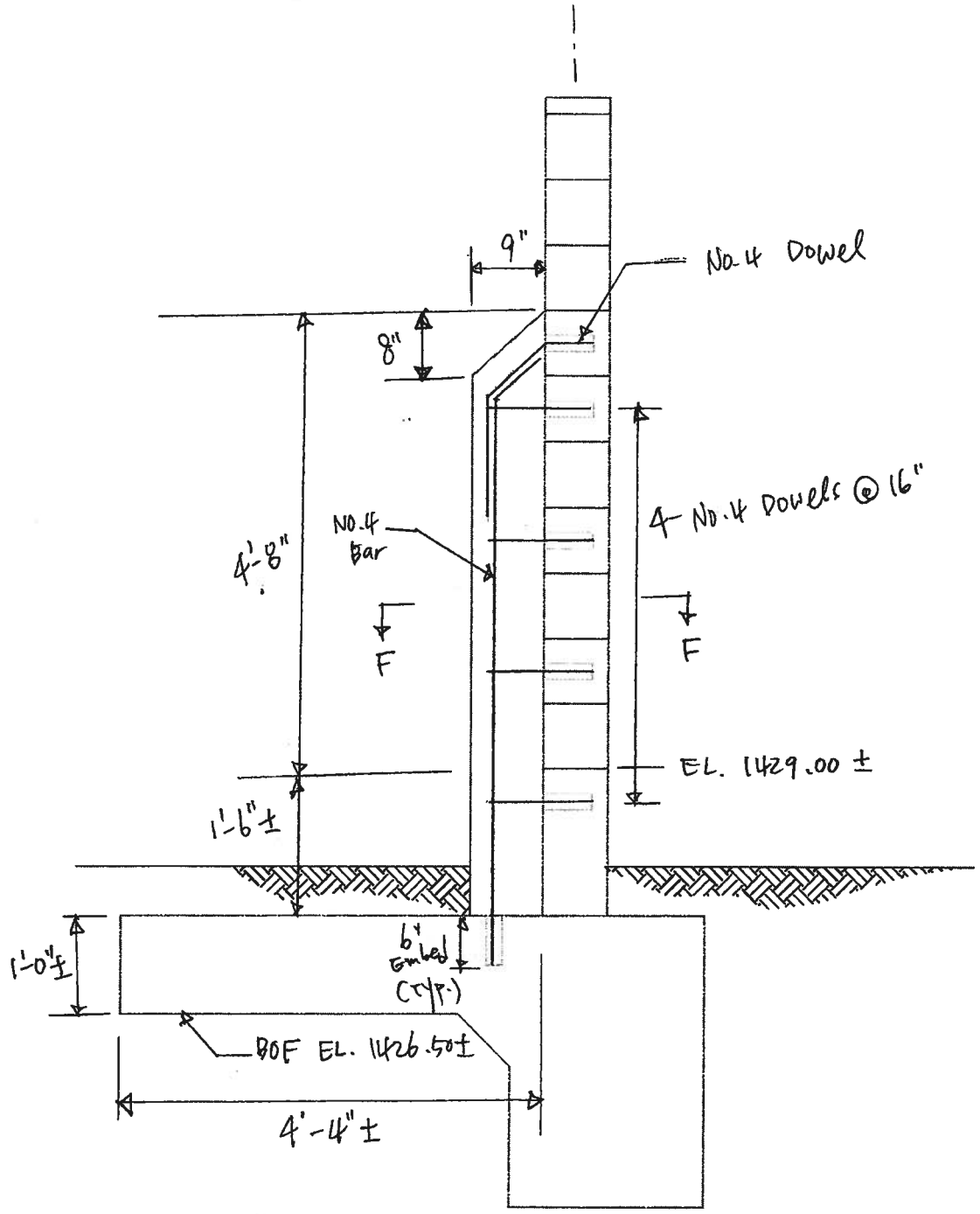
SECTION A-A


9"
No.4 Dowel
8"
No.4 Bar
4'-0"
5- No. 4 Dowels @16"
F
F
EL. 1429.67±
2'-10"±
6" Embed.
(TYP.)
10"±
10"±
BOF
EL. 1426.00±

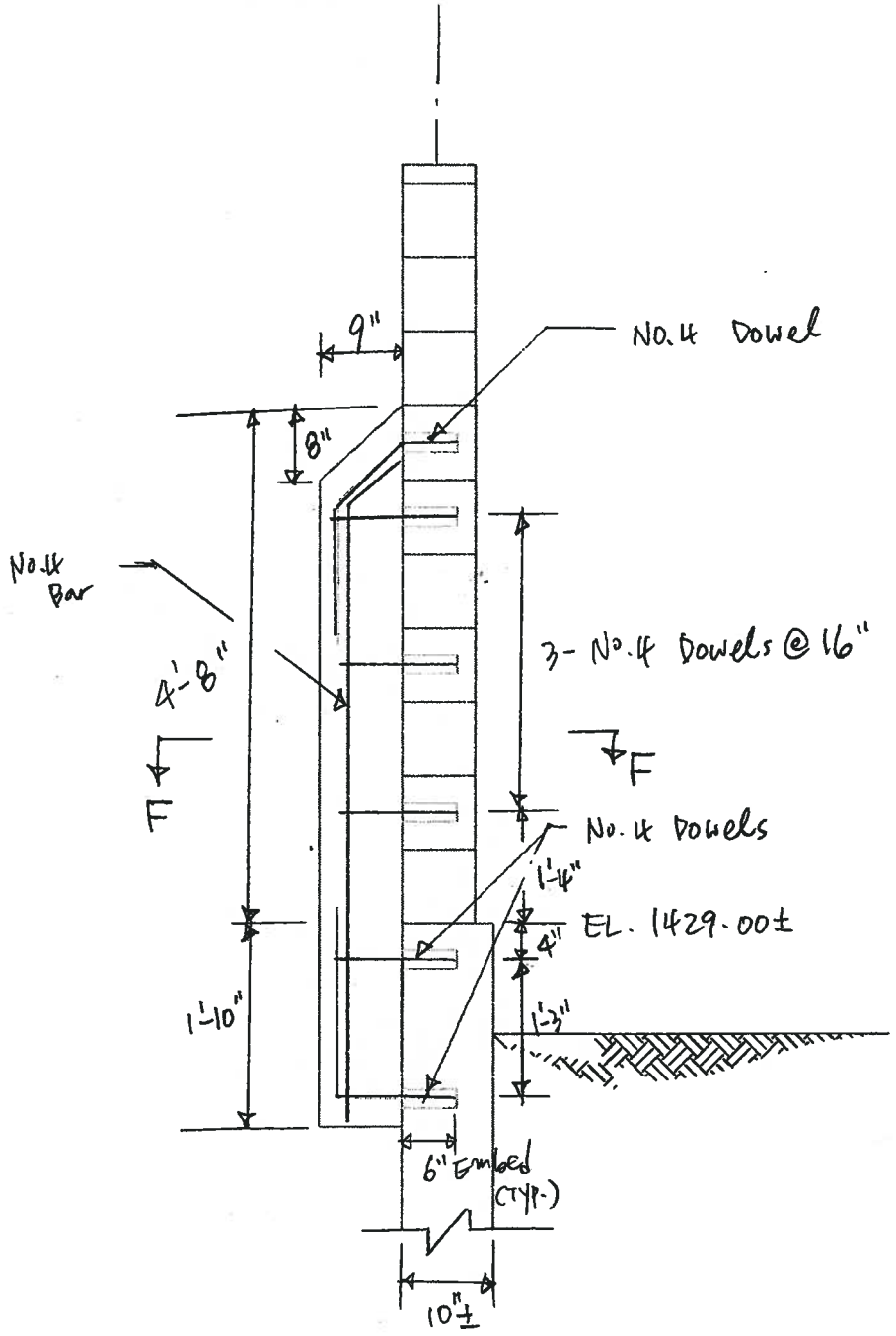
SECTION B-B


9"
No.4 Dowel
8"
5- No.4 Dowels @16"
No.4 Bar
4'-0"
F
F
EL. 1429.67±
3'-10"±
No.4 Dowel
12"
6" Embed. (TYP)
10"±
10"±
BOF
EL. 1425.00±

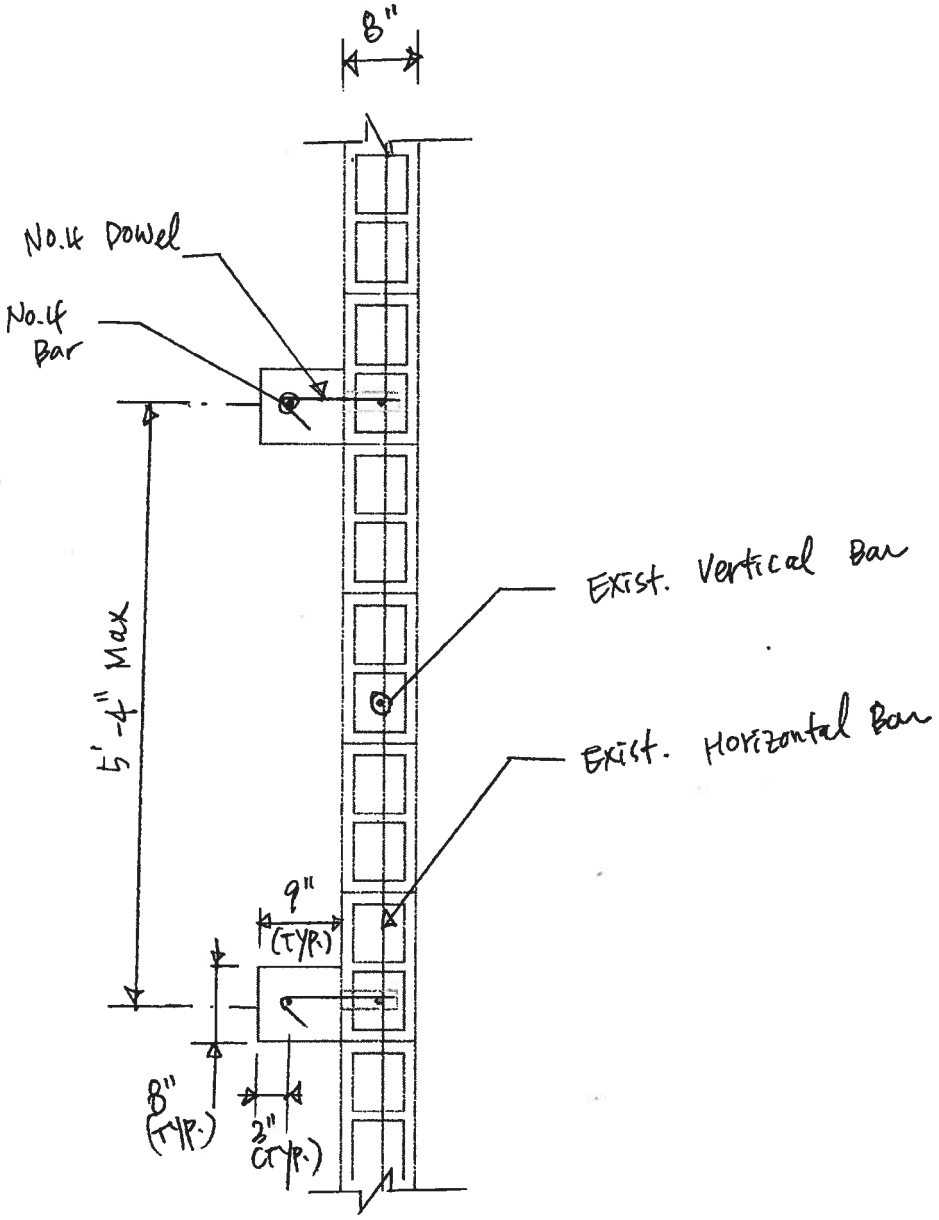
SECTION C-C


9"
No.4 Dowel
8"
4'-8"
No.4 Bar
F
4 No.4 Dowels @ 16"
F
EL. 1429.00 ±
1'-6" ±
1'-0" ±
6" Embed (Typ.)
BOF EL. 1426.50 ±
4'-4" ±

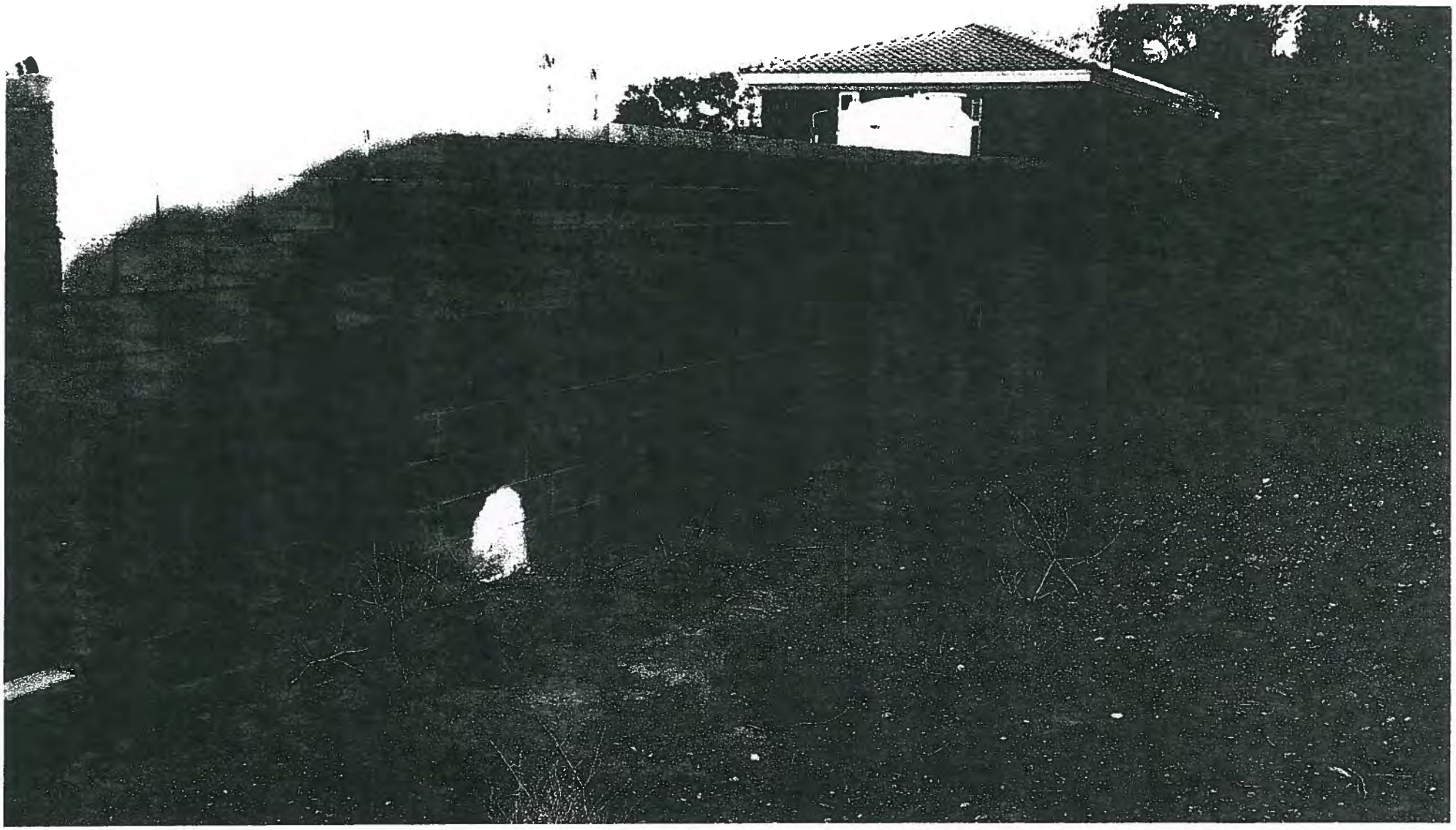
SECTION D-D

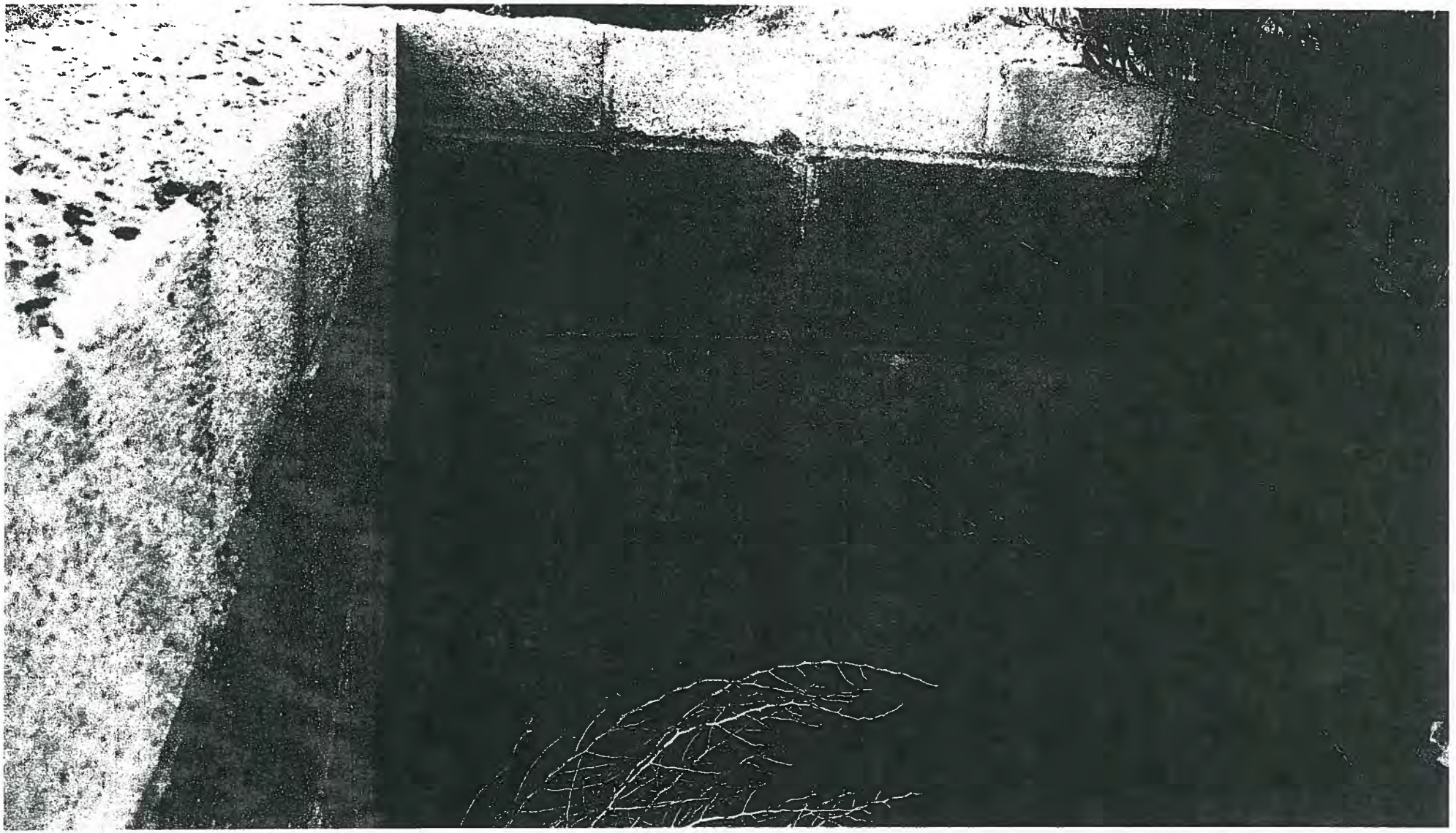

9"
No. 4 Dowel
8"
No. 4 Bar
4'-8"
F
3- No. 4 Dowels @ 16"
F
No. 4 Dowels
1'-4"
EL. 1429.00±
4"
1'-10"
1'-3"
6" Embed (TYP.)
10"±

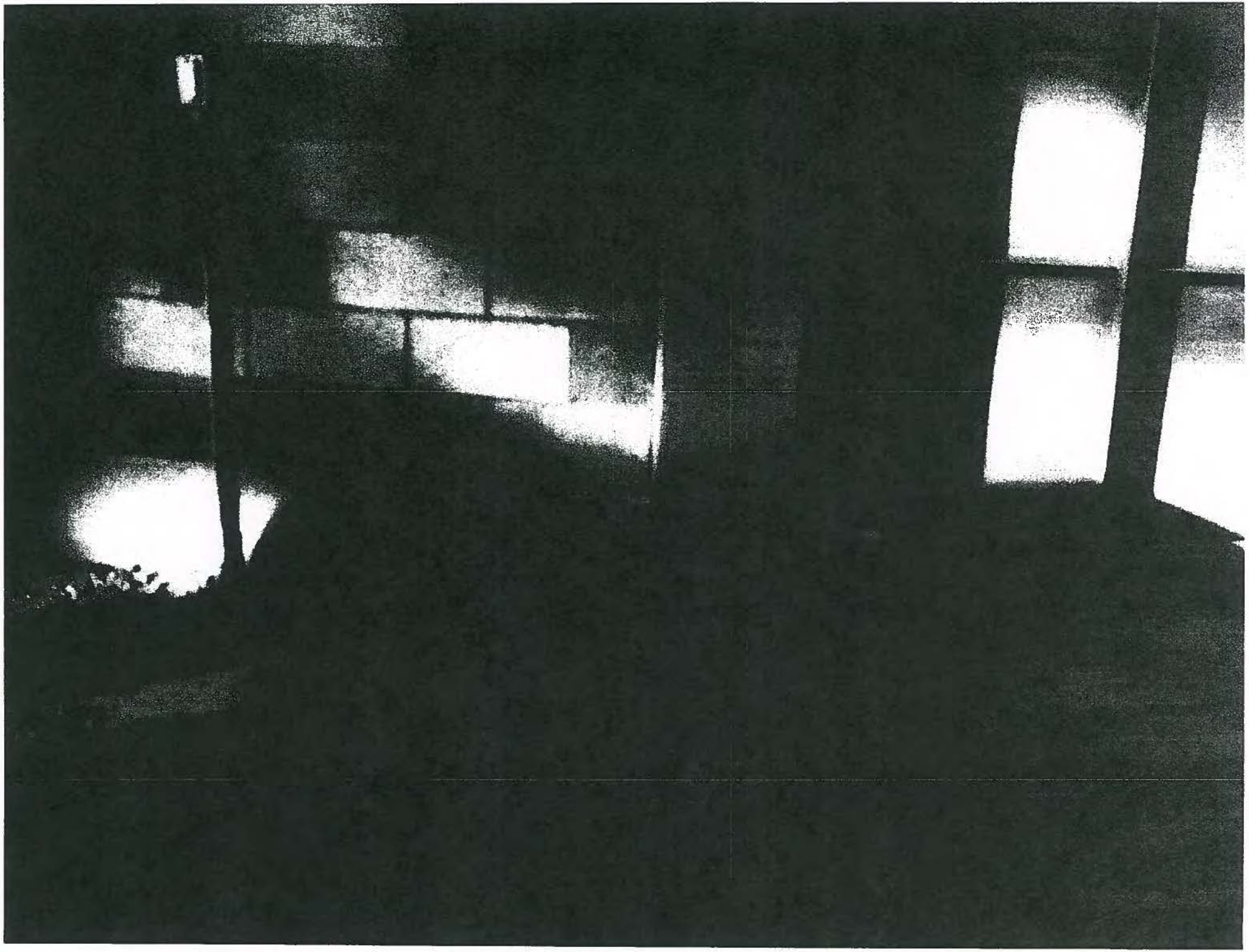
SECTION E-E

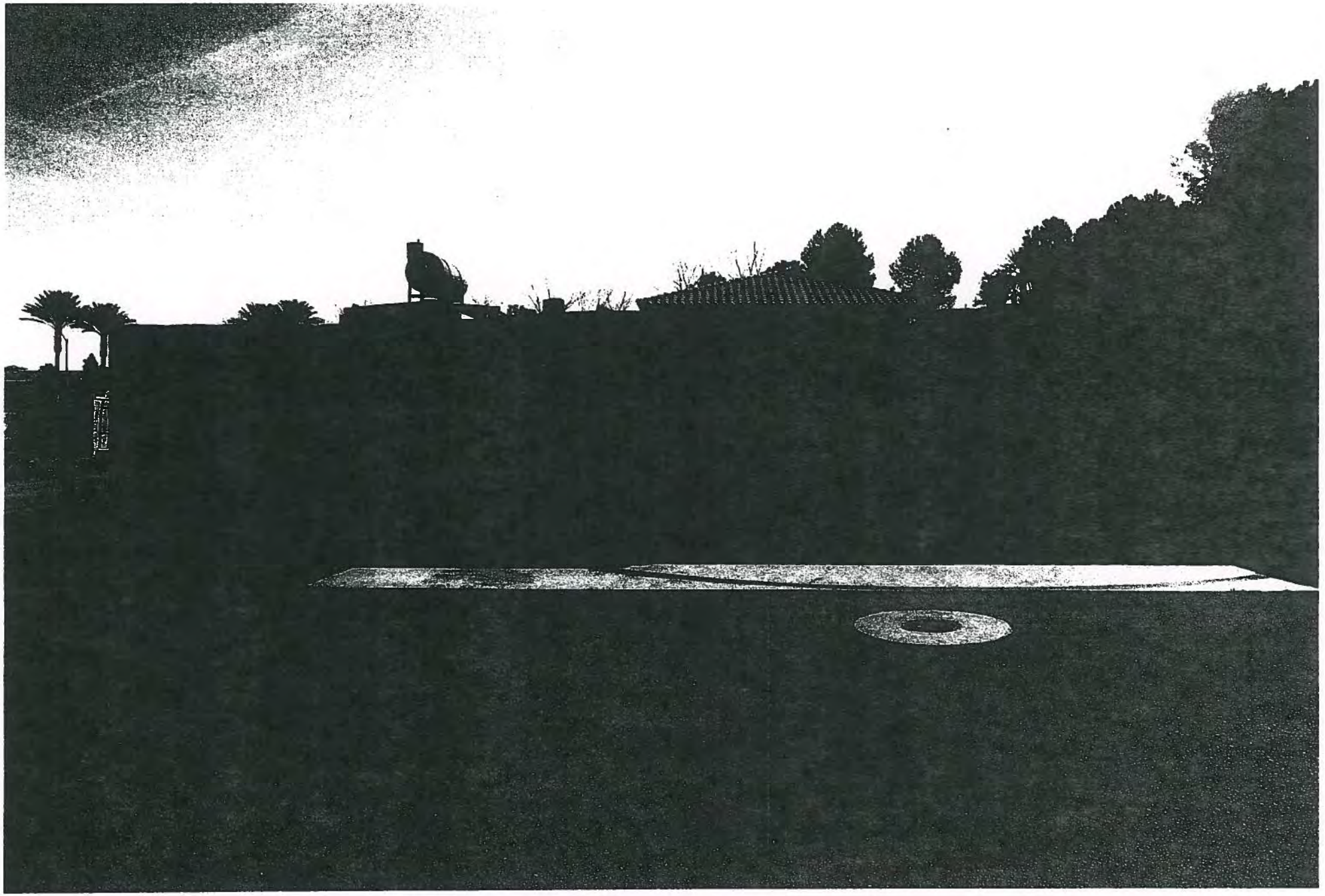

8"
No.4 Dowel
No.4 Bar
5'-4" Max
Exist. Vertical Bar
Exist. Horizontal Bar
9" (TYP.)
8" (TYP.)
3" (TYP.)

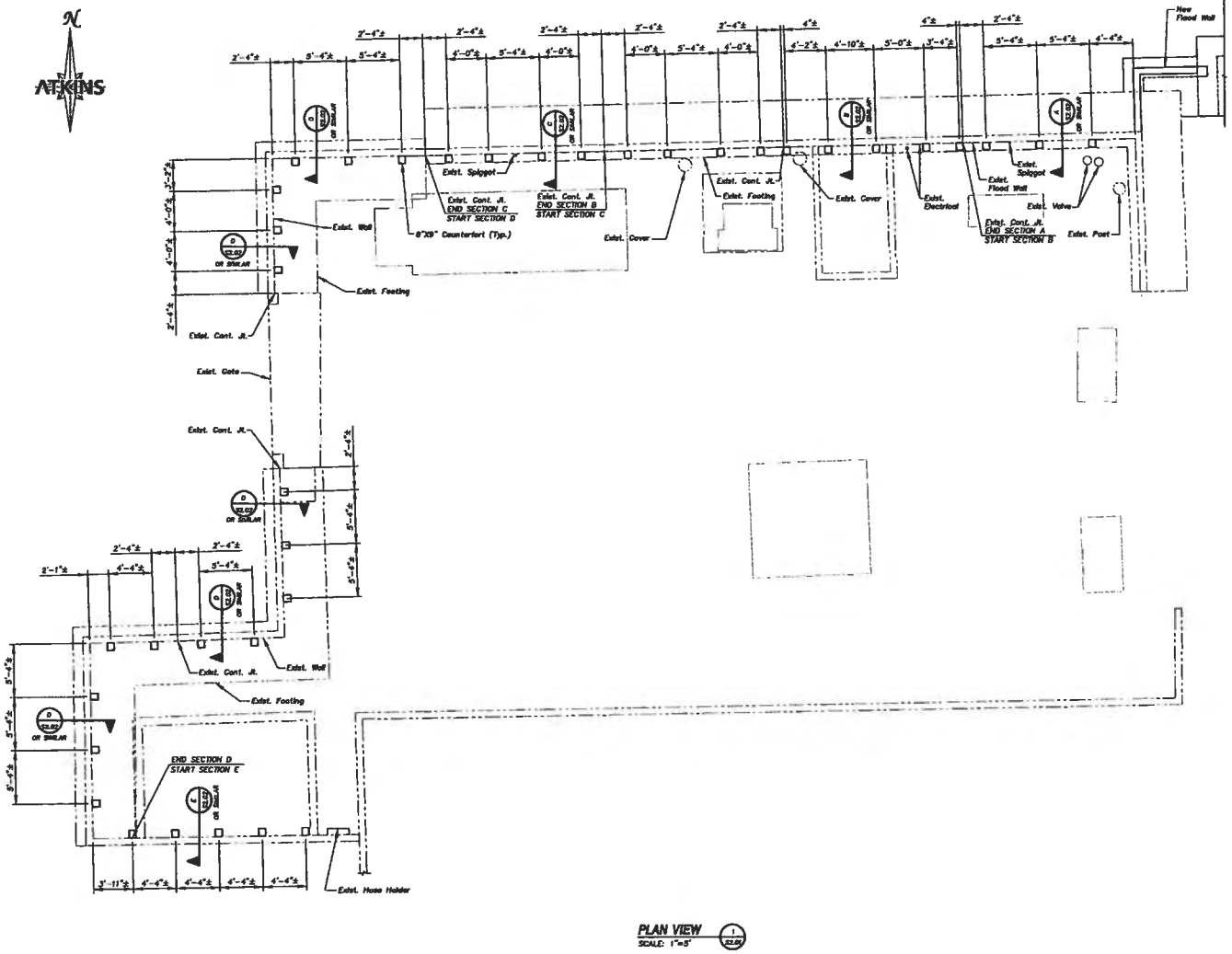
SECTION F-F











PLAN VIEW
SCALE: 1"=5'

GENERAL NOTES

1. REINFORCING STEEL SHALL CONFORM TO ASTM A-615, GRADE 60. FURNISH AND ERECT IN ACCORDANCE WITH ACI MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES, ACI 315, AND WELDING OF REINFORCING STEEL SHALL CONFORM TO AMERICAN WELDING SOCIETY STANDARDS FOR REINFORCING STEEL.
2. ALL CAST IN PLACE CONCRETE SHALL HAVE A MINIMUM STRENGTH OF 4000 PSI AT 28 DAYS USING TYPE V CEMENT PER ASTM C-150.
3. CONTRACTOR SHALL VERIFY ALL MASONRY CELLS ARE SOLID GROUT BEFORE DRILLING. IN CASE HOLLOW CELLS EXIST, CONTRACTOR SHALL GROUT THE CELLS WITH A MINIMUM STRENGTH OF 2000 PSI AT 28 DAYS USING TYPE V CEMENT PER ASTM C-150. SOLID GROUT ALL MASONRY UNIT CELLS TO THE TOP OF WALL. SPECIAL INSPECTION IS REQUIRED FOR DRILLED AND EPOXY DOWELS PER SECTION 1704 OF THE 2009 IBC.
4. ALL DIMENSIONS AND ELEVATIONS SHALL BE VERIFIED BEFORE BEGINNING CONSTRUCTION.
5. THE DISTANCE BETWEEN 8" X 8" COUNTERFORTS MAY BE ADJUSTED TO AVOID OBSTACLES NOT GREATER THAN 5'-4" MAXIMUM DISTANCE. THE DISTANCE FROM THE COUNTERFORT TO AN ADJACENT CMU WALL CONTROL JOINT SHALL NOT EXCEED 2'-4". CONTRACTOR SHALL VERIFY THE LOCATION OF ALL CONTROL JOINTS ALONG THE WALL AND AT THE CORNERS, IF ANY. REFER TO SECTION F ON SHEET S2.02.
6. UNLESS OTHERWISE NOTED, ALL CONSTRUCTION SHALL CONFORM TO IBC 2009, AND PCH STANDARD SPECIFICATIONS FOR CLARK COUNTY, NEVADA, BUILDING DEPARTMENT.
7. ALL WALLS ARE SUBJECT TO APPROVAL BY CITY OF HENDERSON, NEVADA, BUILDING DEPARTMENT.

NOTE: EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

Call Before You Dig
811
1-800-227-2600

ASSOCIATED
1-702-227-2929

1-702-455-5000

PCOH # 2012XXXXXX

XXXXX

REVISIONS			
REV.	DESCRIPTION	BY	DATE / APPROVAL

ATKINS
6385 Corporate Drive, Suite 100
Colorado Springs, CO 80919
Telephone: 719.593.0173
Fax: 719.593.0174

City of Henderson, Nevada

LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
EXISTING FLOOD WALL RETROFIT PLAN

JOB NO. 100030858
FILE NO. 30839-2201.DWG
SCALE: HORIZ.1"=5" VERT.1"=5"
DESIGNED BY: J. LEE
DRAWN BY: B. EVANS
CHECKED BY: J. CHANG
DATE RECEIVED 12, 2013

JOB NO. 100030858
DRAWING NO. 22
SHEET NO. 13
S2.01

X:\Projects\100030858-ZZ\43\Sheetfile\30839-2201.dwg Layout: C2D1 Dec 13, 2012 - 2:46pm

SECTION
SCALE: 1/2"=1'-0"

SECTION
SCALE: 1/2"=1'-0"

SECTION
SCALE: 1/2"=1'-0"

NOTE:

1. GRIND SMOOTH FACE OF EXISTING CMU WALL AND FOOTING TO PROVIDE A ROUGH CONTACT SURFACE.

SECTION
SCALE: 1/2"=1'-0"

SECTION
SCALE: 1/2"=1'-0"

SECTION
SCALE: 1/2"=1'-0"

NOTE: EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

811 1-800-227-2600

1-702-227-2929

1-702-433-5280

PCOH # 2012XXXXXX

XXXXX

REVISIONS

NO.	DESCRIPTION	BY	DATE	APPROVAL

ATKINS

City of Henderson, Nevada

LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
EXISTING FLOOD WALL RETROFIT DETAILS

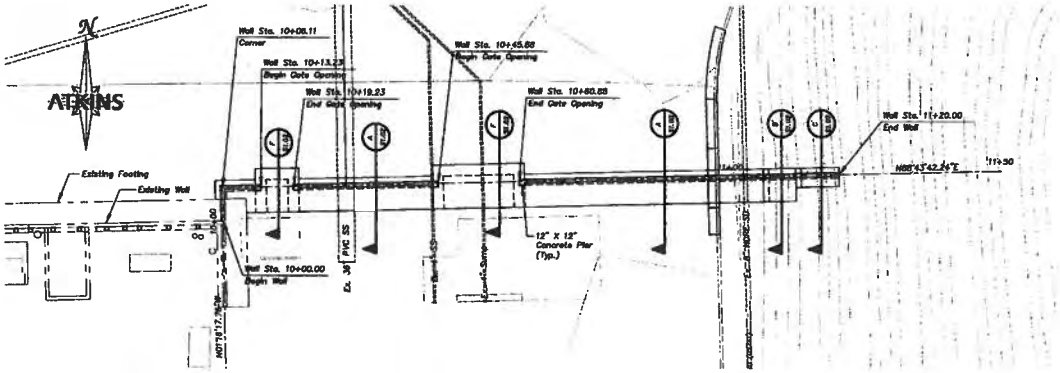
JOB NO. 100030858
FILE: S&C-S202.DWG
SCALE: HORIZ.:1"=10' VERT.: NONE

DESIGNED BY: A. LEE
DRAWN BY: M. FLORES
CHECKED BY: A. CHUNG
DATE: DECEMBER 17, 2012

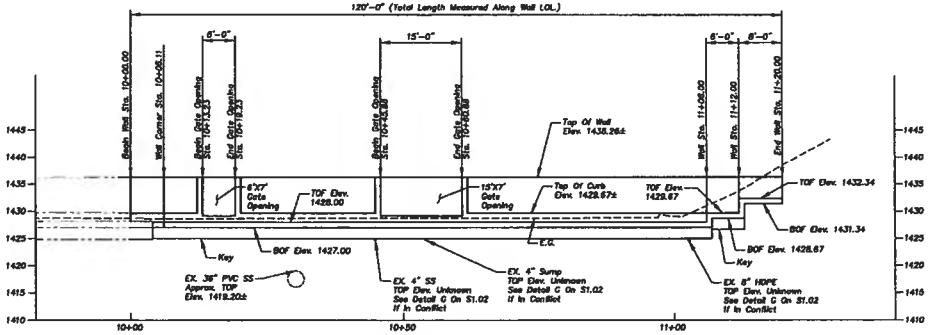
DRAWING NO. S202
SHEET NO. 15

JOB NO. 100030858

Z:\Projects\100030858-LLVLS\Sheets\Sheets\S202.dwg Layout: C201 Dec 13, 2012 - 2:48pm



PLAN
SCALE: 1"=10'



ELEVATION
SCALE: 1"=10'

GENERAL NOTES

1. REINFORCING STEEL SHALL CONFORM TO ASTM A-615, GRADE 60. ARC WELDING OF REINFORCING STEEL SHALL CONFORM TO AMERICAN WELDING SOCIETY STANDARDS FOR REINFORCING STEEL.
2. CONCRETE SHALL HAVE A MINIMUM STRENGTH OF 4000 psi AT 28 DAYS USING TYPE V CEMENT PER ASTM C-150. SPECIAL INSPECTION SHALL BE REQUIRED ON ALL WALLS AND FOOTINGS UNLESS OTHERWISE NOTED.
3. MASONRY UNITS SHALL BE ASTM C-90, GRADE N-1 HOLLOW CONCRETE UNITS. MASONRY DESIGN STRESSES ARE AS FOLLOWS: f'm=1500 psi. FULL STRESSES FOR MASONRY HAVE BEEN USED. SPECIAL INSPECTION SHALL BE REQUIRED PER THE IBC (2009) OR LATEST EDITION UNLESS OTHERWISE NOTED.
4. MORTAR SHALL BE ASTM C270, TYPE "M" or "S" WITH A MINIMUM STRENGTH OF 1900 psi AT 28 DAYS.
5. GROUT SHALL HAVE A MINIMUM STRENGTH OF 2000 psi AT 28 DAYS USING TYPE V CEMENT PER ASTM C-150.
6. FOOTINGS SHALL BE CAST AGAINST NATIVE MATERIAL FOR FULL DEPTH OF THE FOOTING OR FOOTING SHALL BE COMPLETELY BACKFILLED AND COMPACTED PER SPECIFICATIONS.
7. UNLESS OTHERWISE NOTED, ALL CONSTRUCTION SHALL CONFORM TO IBC 2009, AND PER STANDARD SPECIFICATIONS FOR CLARK COUNTY, NEVADA.
8. ALL WALLS ARE SUBJECT TO APPROVAL BY CITY OF HENDERSON, NEVADA, BUILDING DEPARTMENT.
9. SOLID GROUT ALL MASONRY UNIT CELLS TO THE TOP OF WALL .
10. ALL CORNERS OR ANGLES SHALL BE TIED TOGETHER WITH REINFORCING STEEL AND GROUTED SOLID.
11. WHERE VERTICAL GROUT POURS ARE NOT CONTINUOUS FOR THE ENTIRE HEIGHT OF THE WALL, THE LIFTS SHALL BE TERMINATED 1 1/2" BELOW THE TOP OF THE TOP BLOCK TO FORM A KEY FOR FUTURE LIFTS.
12. CONTROL JOINTS IN RETAINING WALL SHALL BE LOCATED AT A MAXIMUM SPACING OF 24'-0".
13. PREPARATION OF FOUNDATION MATERIAL LOCATED BELOW THE BOTTOM OF WALL SHALL BE PERFORMED IN ACCORDANCE WITH THE RECOMMENDATION CONTAINED IN THE SOILS REPORT DESCRIBED IN NOTE 14 OF THESE PLANS.
14. SOILS REPORT BY: "GEOTECHNICAL INVESTIGATION PROPOSED SEWAGE LIFT STATION AND APPURTENANT FACILITIES LAKE LAS VEGAS DEVELOPMENT, PROJECT NO. 96.184", DATED 12-11-1996
    (A) ALLOWABLE SOILS BEARING = 2000 PSF.
    (B) WATER PRESSURE (USED FOR DESIGN) = 63 PCF.
    (C) PASSIVE PRESSURE (USED FOR DESIGN) = 275 PCF
    (D) COEFFICIENT OF FRICTION = 0.55
15. TRENCH EXCAVATION SHORING SHALL CONFORM TO OSHA REGULATIONS 29 CFR PART 1926, SUBPART C.

NOTE: EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

Call Before You Dig 811 1-800-227-2600
1-702-227-2929
1-775-[illegible]

PCOH # 2012XXXXXX

XXXXX

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVAL

ATKINS
3275 Cornwall Drive, Suite 100
Las Vegas, Nevada 89120-3767
Telephone (702)795-7999
Fax (702)795-7970

City of Henderson, Nevada

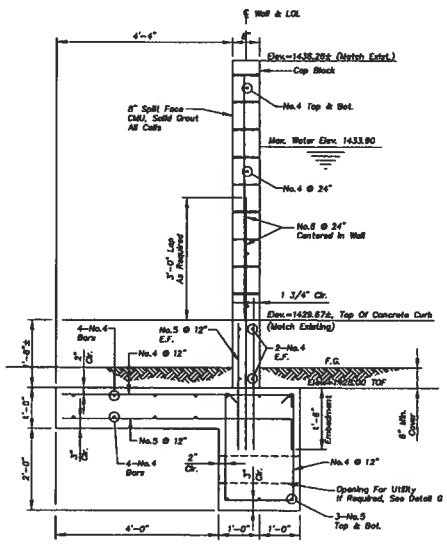
LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
FLOOD WALL PLAN AND ELEVATION

JOB NO. 100030658
PW NO. 100030658
DRAWING NO. S101
15 SHEETS

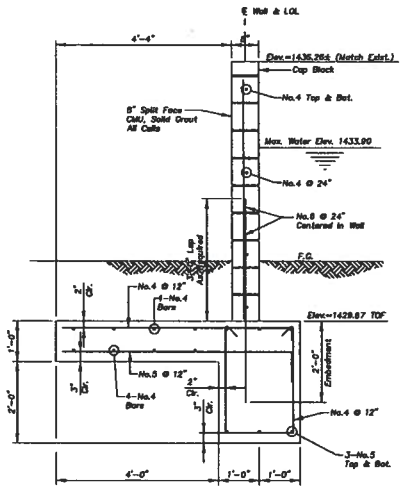
DESIGNED BY: J. LEE
DRAWN BY: J. CHANG
CHECKED BY: J. CHANG
DATE: DECEMBER 17, 2012

SCALE: 1"=10'
HORIZ.: 1"=10'
VERT.: NONE

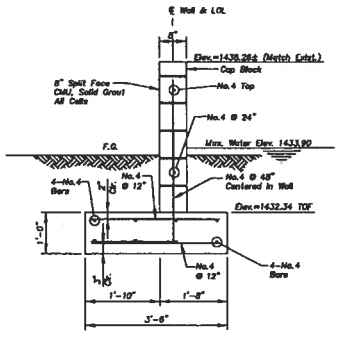
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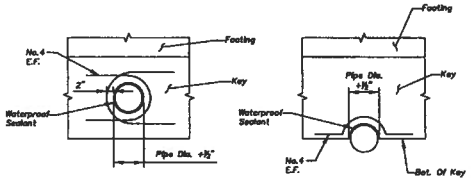
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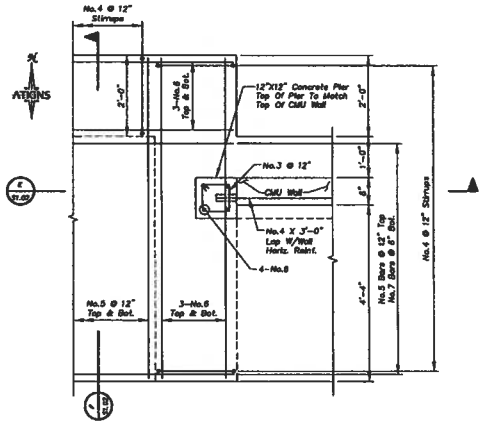
SECTION
SCALE: 1/2"=1'-0" (B, 21.02)



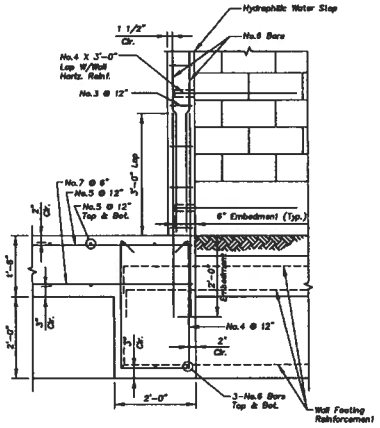
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SCALE: 1/2"=1'-0" (C, 21.02)



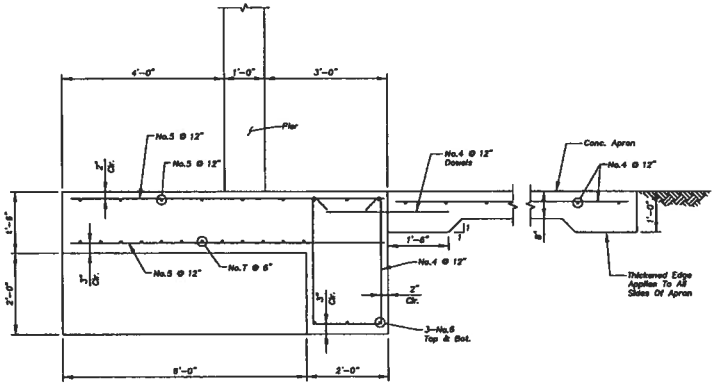
OPENING DETAIL
SCALE: 1/2"=1'-0" (G, 21.02)



PARTIAL PLAN AT GATE
SCALE: 1/2"=1'-0" (A, 21.02)



SECTION
SCALE: 1/2"=1'-0" (C, 21.02)



SECTION
SCALE: 1/2"=1'-0" (F, 21.02)

NOTE: EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO NOTIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

Call before you Dig
Call 811
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1-702-227-2929

PCOH # 2012XXXXXX

XXXXX

REVISIONS			
NO.	DESCRIPTION	BY	DATE APPROVAL

ATKINS

City of Henderson, Nevada

LAKE LAS VEGAS FLOOD PROTECTION PROJECT

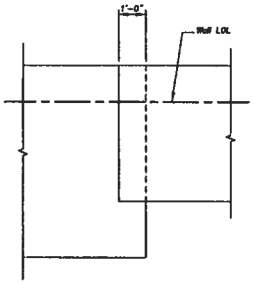
FLOOD WALL DETAILS NO. 1

JOB NO. 100030858
FILENAME 30858-S102.DWG
SCALE: MODEL:1"=1'0" PAPER: ANSI D
DESIGNED BY: J. LEE
DRAWN BY: S. EVANS
CHECKED BY: L. CHANG
DATE: DECEMBER 17, 2012
DRAWING NO. S102
REV. 0

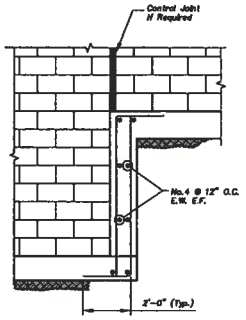
JOB NO. 100030858

L. CHANG
No. 13615
REGISTERED PROFESSIONAL ENGINEER
STATE OF NEVADA

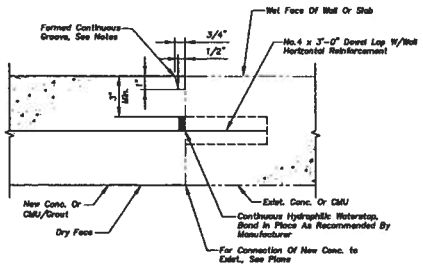
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PLAN

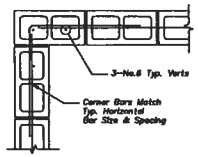


SECTION



NOTES:
1. Wait Until New Concrete Or CMU Grout Is Minimum 28 Days Old Prior To Grouting Groove.
2. Roughen And Clean Surfaces Of Groove With Power Wire Brush Or Sandblasting.
3. Saturate Area For 24 Hours Prior To Grouting.
4. Dry Pack With Type II Non-Shrink Grout.
5. Use Steel Hammer And Steel Tool To Densely Pack Grout Into Groove.
6. Water Cure Grout For 4 Days Minimum.
7. Reinforcing Not Shown For Clarity.

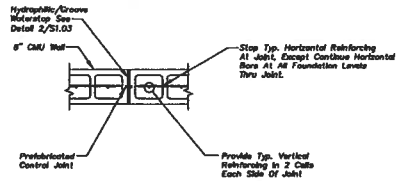
HYDROPHILIC/GROOVE WATERSTOP
SCALE: 3"=1'-0" (2/S1.03)



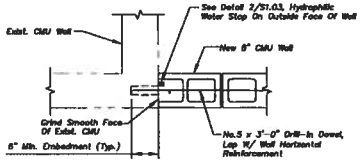
NOTES:
1. Lap = 48 Bar Diameters Or 2'-0" Min. Unless Otherwise Noted.
2. Provide A Standard 90° Hook Each End On Any Horizontal Bar Between Openings Or Corners Less Than 6'-0" In Length.

CMU WALL CORNERS
SCALE: 1"=1'-0" (3/S1.03)

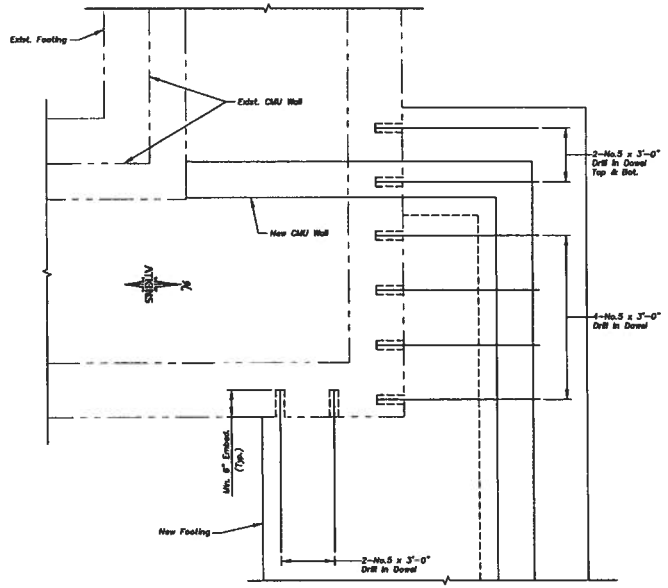
FOOTING STEP
SCALE: 1/2"=1'-0" (1/S1.03)



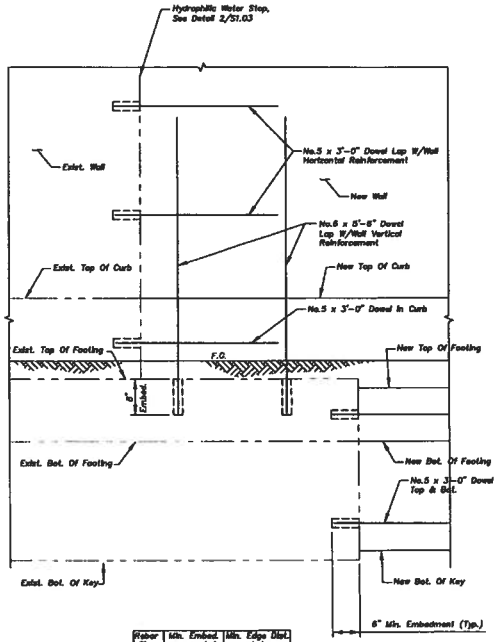
CMU CONTROL JOINT
SCALE: 1"=1'-0" (4/S1.03)



CMU WALL TO EXIST. CMU WALL CONNECTION
SCALE: 1"=1'-0" (5/S1.03)



WALL FOOTING TO EXIST. WALL FOOTING CONNECTION-PLAN
SCALE: 1"=1'-0" (6/S1.03)



Rebar Size	Min. Embed. Length (in)	Min. Edge Dist. (in)
No.5	6"	4"
No.6	8"	5"

NEW WALL TO EXIST. WALL-ELEVATION
SCALE: 1"=1'-0" (7/S1.03)

NOTE: EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

Call before you dig Call 811 1-800-227-2600

1-702-227-2929

1-702-455-6900

PCOH # 2012XXXXXX

XXXXX

REV.	DESCRIPTION	BY	DATE	APPROVAL
	REVISIONS			

ATKINS
3216 Clearview Circle, Suite 200
Las Vegas, Nevada 89120-3778
Phone: 702-233-2929

City of Henderson, Nevada
LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
FLOOD WALL DETAILS NO. 2

JOB NO. 100030858
FILE NAME: 30858-S103.dwg
DESIGNED BY: J. LEE
DRAWN BY: D. EVANS
CHECKED BY: C. CRAIG
DATE: DECEMBER 17, 2012
SCALE: 1"=1'-0" HORIZ. / VERT.

JOB NO. 100030858
DRAWING NO. 103
S103

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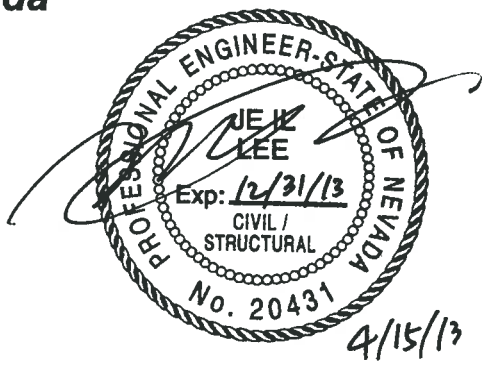
Lake Las Vegas Flood Protection

Design Check For

Exist. Flood Protection Wall

Prepared for:

City of Henderson, Nevada



Prepared by:

ATKINS
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074-6382

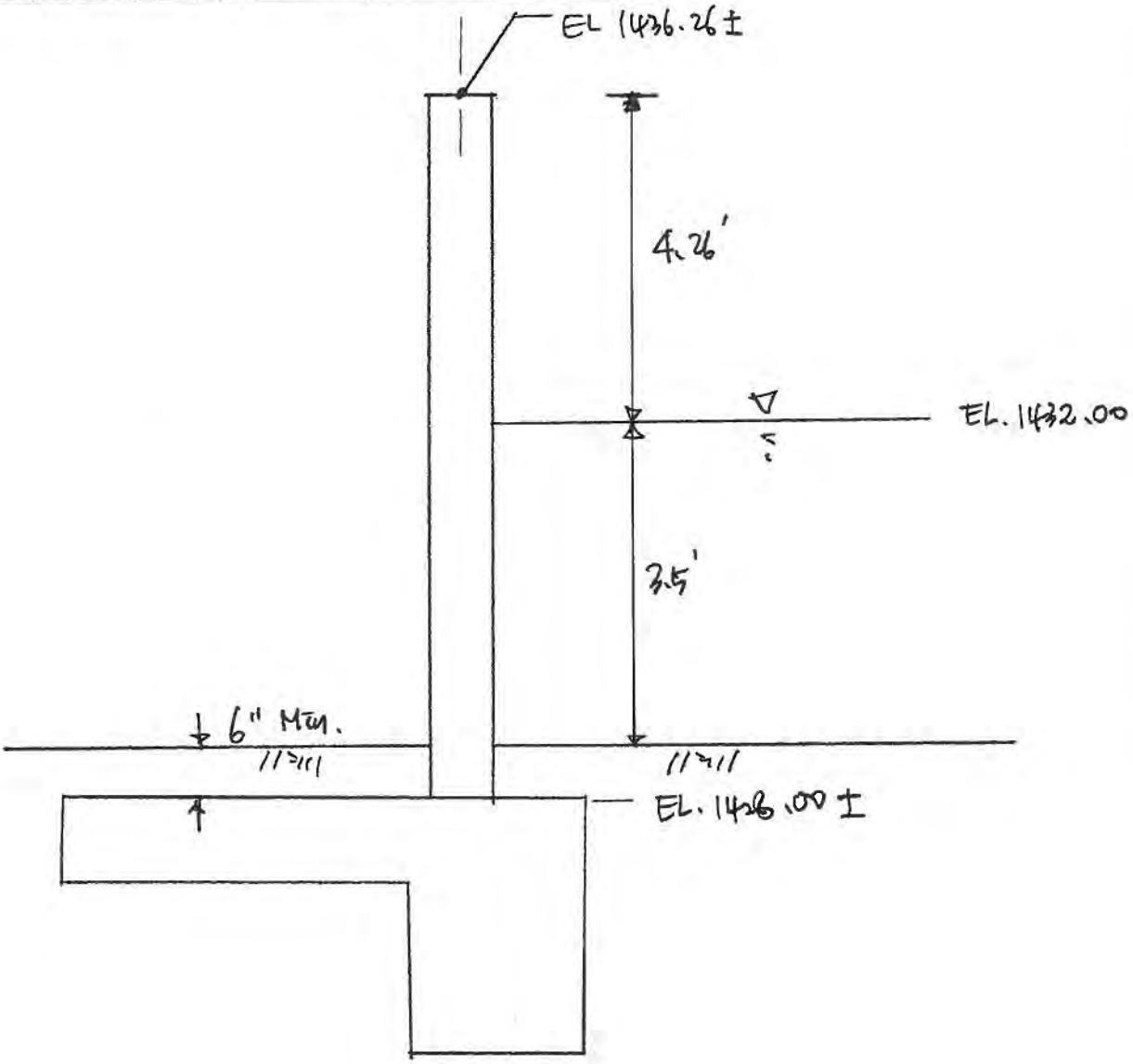
Project No. 100030858

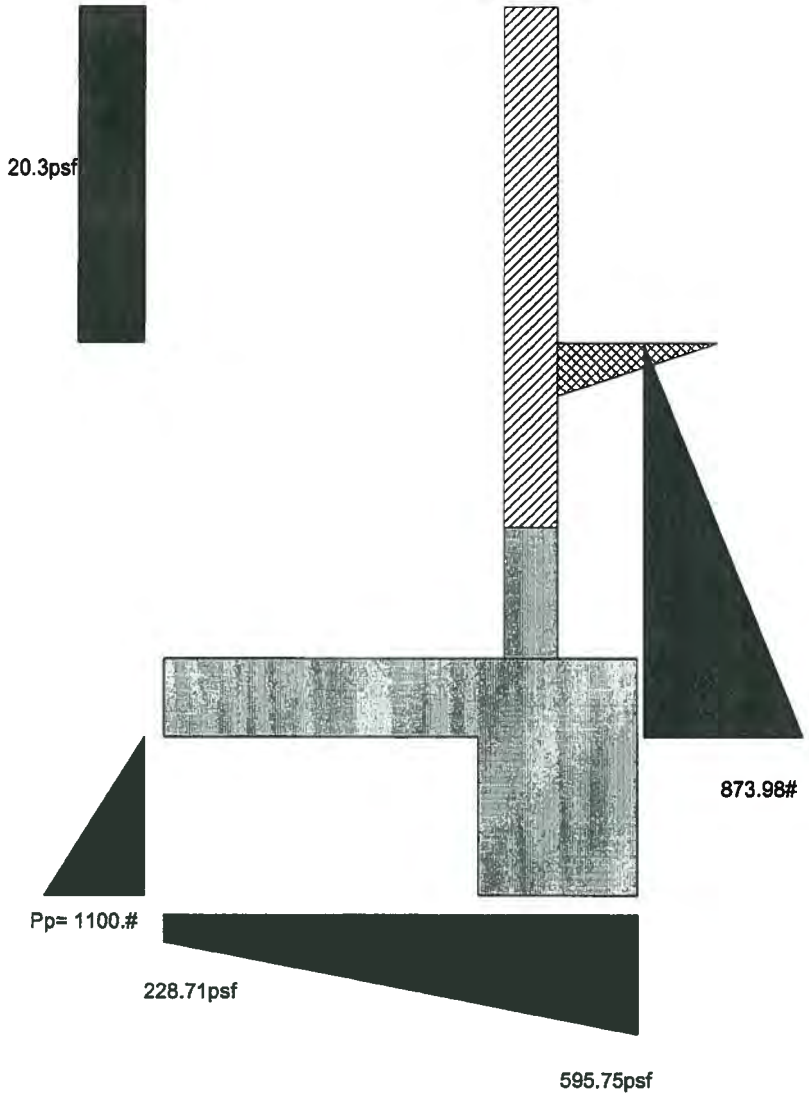
October, 2012

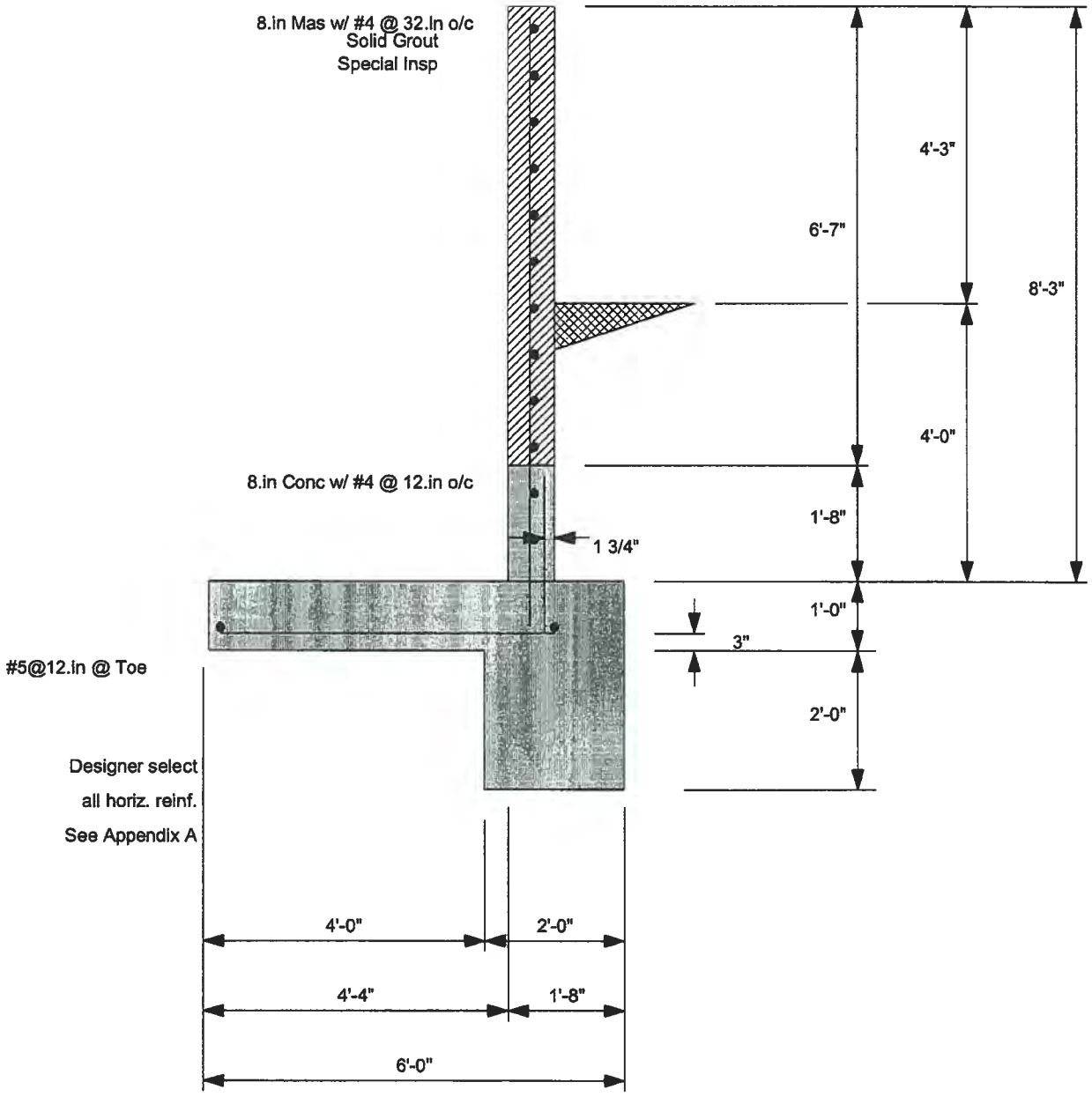
Subject: Lake Las Vegas – Floodwall Design		
Comp by: JL Check by:	Date: 10/8/12 Job Number: 100030858	Sheet Number:

ATKINS

Existing Wall : Maximum Water Elevation




20.3psf
873.98#
Pp= 1100.#
228.71psf
595.75psf


8.in Mas w/ #4 @ 32.in o/c
Solid Grout
Special Insp
4'-3"
6'-7"
8'-3"
4'-0"
8.in Conc w/ #4 @ 12.in o/c
1'-8"
1 3/4"
1'-0"
3"
#5@12.in @ Toe
2'-0"
Designer select
all horiz. reinf.
See Appendix A
4'-0"
2'-0"
4'-4"
1'-8"
6'-0"

RetainPro 10 (c) 1987-2011, Build 10.12.4.18
License : KW-06055864
License To : ATKINS

Cantilevered Retaining Wall Design

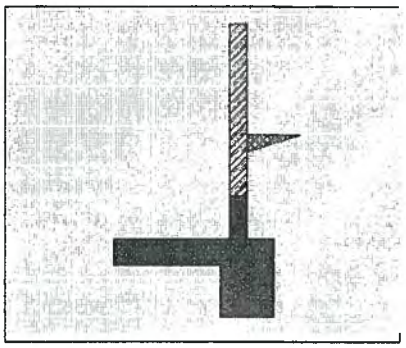
Code: IBC 2006,ACI 318-05,ACI 530-05

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	4.26 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	63.0 psf/ft
	=	
Passive Pressure	=	275.0 psf/ft
Soil Density, Heel	=	63.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.550
Soil height to Ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	20.3 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	5.42 OK
Sliding	=	2.82 OK
Total Bearing Load	=	2,473 lbs
...resultant ecc.	=	5.34 in
Soil Pressure @ Toe	=	229 psf OK
Soil Pressure @ Heel	=	596 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	274 psf
ACI Factored @ Heel	=	715 psf
Footing Shear @ Toe	=	8.1 psi OK
Footing Shear @ Heel	=	1.7 psi OK
Allowable	=	94.9 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	874.0 lbs
less 100% Passive Force	= -	1,100.0 lbs
less 100% Friction Force	= -	1,360.4 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

Building Code	IBC 2006,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	2.000
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Top Stem	2nd
		Stem OK	Stem OK
Design Height Above Ftg	ft =	1.67	0.00
Wall Material Above "Ht"	=	Masonry	Concrete
Thickness	=	8.00	8.00
Rebar Size	=	# 4	# 4
Rebar Spacing	=	32.00	12.00
Rebar Placed at	=	Center	Edge
Design Data			
fb/FB + fa/Fa	=	1.000	0.399
Total Force @ Section	lbs =	257.5	1,146.4
Moment....Actual	ft-# =	518.5	2,192.2
Moment.....Allowable	ft-# =	518.6	5,492.3
Shear.....Actual	psi =	5.7	15.3
Shear.....Allowable	psi =	38.7	94.9
Wall Weight	psf =	84.0	100.0
Rebar Depth 'd'	in =	3.75	6.25
LAP SPLICE IF ABOVE	in =	36.00	12.00
LAP SPLICE IF BELOW	in =	14.80	
HOOK EMBED INTO FTG	in =		6.00

Lap splice above base reduced by stress ratio
Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	1,500
Fs	psi =	24,000
Solid Grouting	=	Yes
Use Half Stresses	=	n/a
Modular Ratio 'n'	=	21.48
Short Term Factor	=	1.000
Equiv. Solid Thick.	in =	7.60
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	4,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall Design

Code: IBC 2006,ACI 318-05,ACI 530-05

Footing Dimensions & Strengths

Toe Width	=	4.33 ft
Heel Width	=	1.67
Total Footing Width	=	6.00
Footing Thickness	=	12.00 in
Key Width	=	24.00 in
Key Depth	=	24.00 in
Key Distance from Toe	=	4.00 ft

f'c = 4,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	274	715 psf
Mu' : Upward	=	3,566	429 ft-#
Mu' : Downward	=	1,687	243 ft-#
Mu: Design	=	1,879	-187 ft-#
Actual 1-Way Shear	=	8.07	1.72 psi
Allow 1-Way Shear	=	94.87	94.87 psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: Not req'd, Mu < S * Fr

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	787.5	1.67	1,312.5	Soil Over Heel	=	252.8	5.50	1,390.2
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=	86.5	7.13	616.6	* Axial Live Load on Stem	=			
	=				Soil Over Toe	=	252.8		
					Surcharge Over Toe	=			
Total		874.0	**O.T.M.**	1,929.1	Stem Weight(s)	=	720.6	4.66	3,360.2
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	900.0	3.00	2,700.0
					Key Weight	=	600.0	5.00	3,000.0
					Vert. Component	=			
						Total =	2,473.4 lbs	**R.M.**=	10,450.4

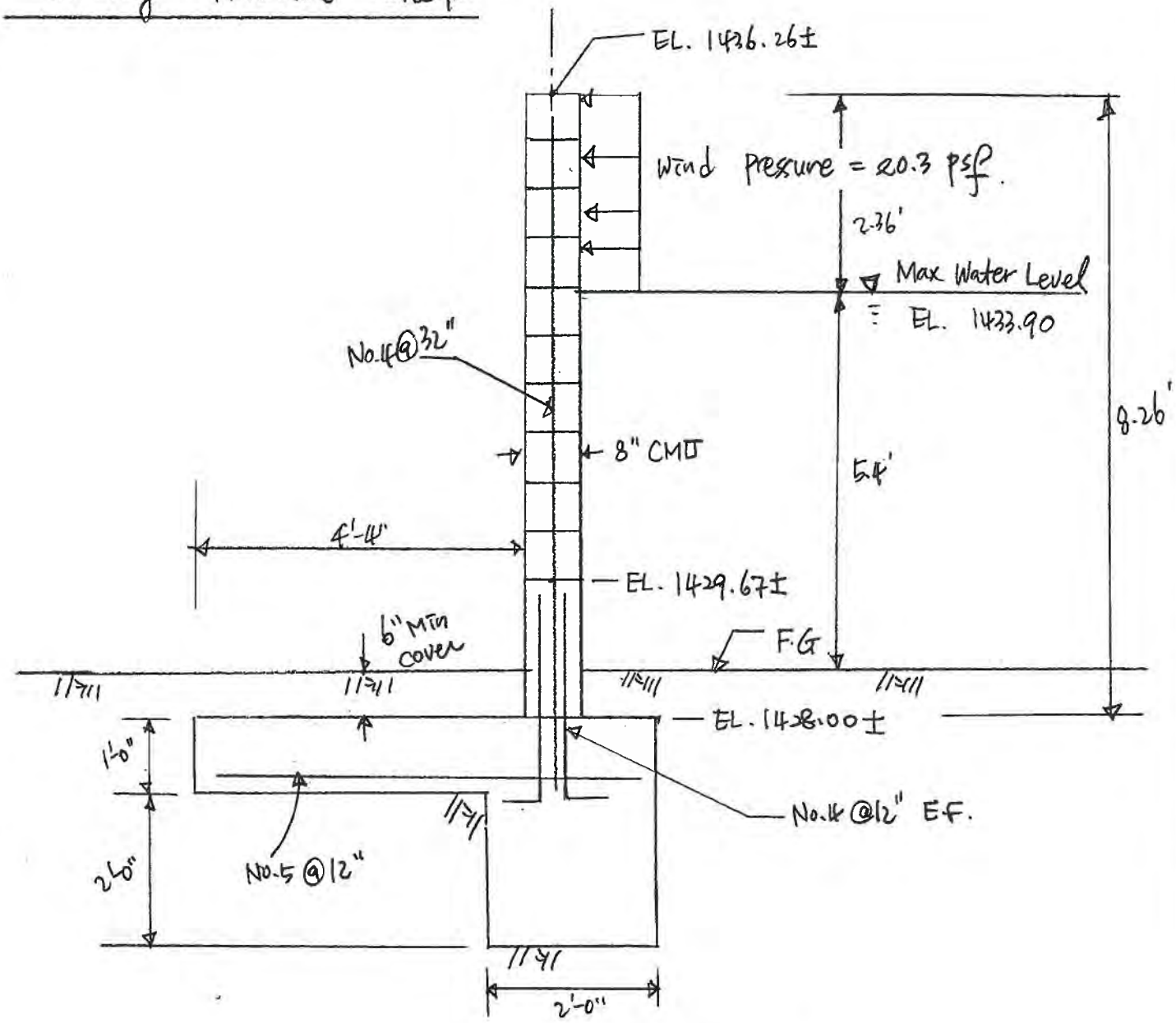
Resisting/Overturning Ratio = **5.42**
Vertical Loads used for Soil Pressure = 2,473.4 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

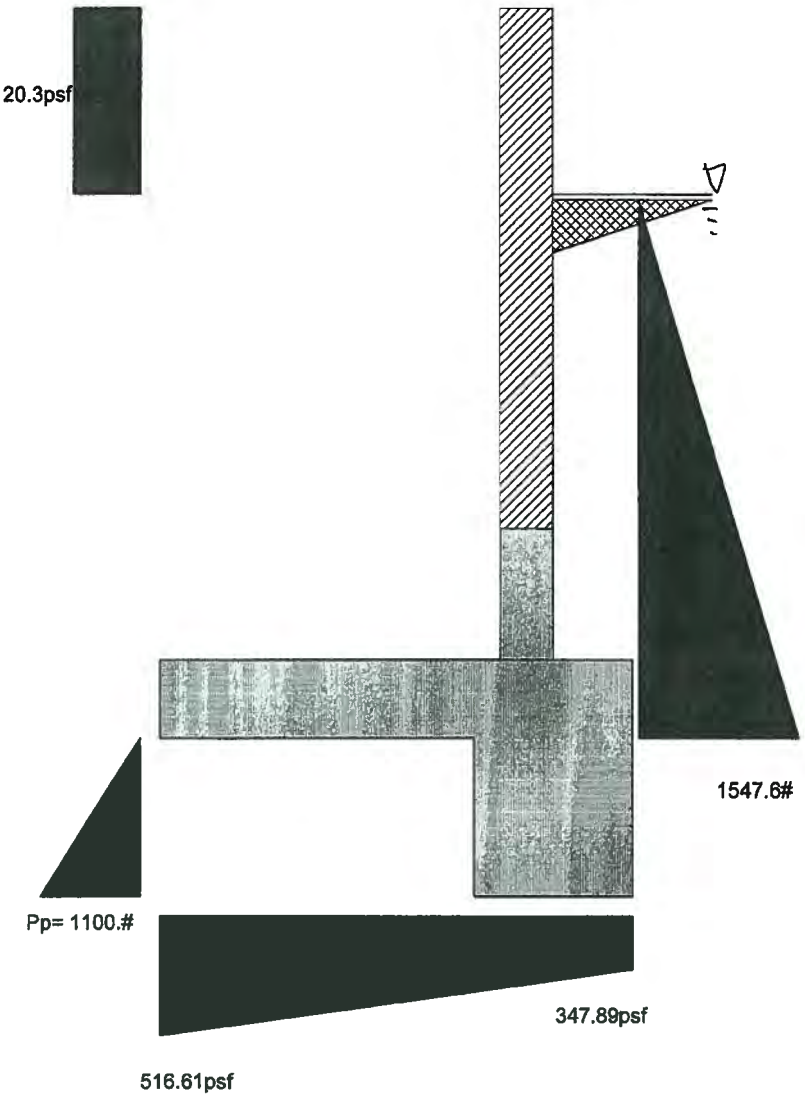
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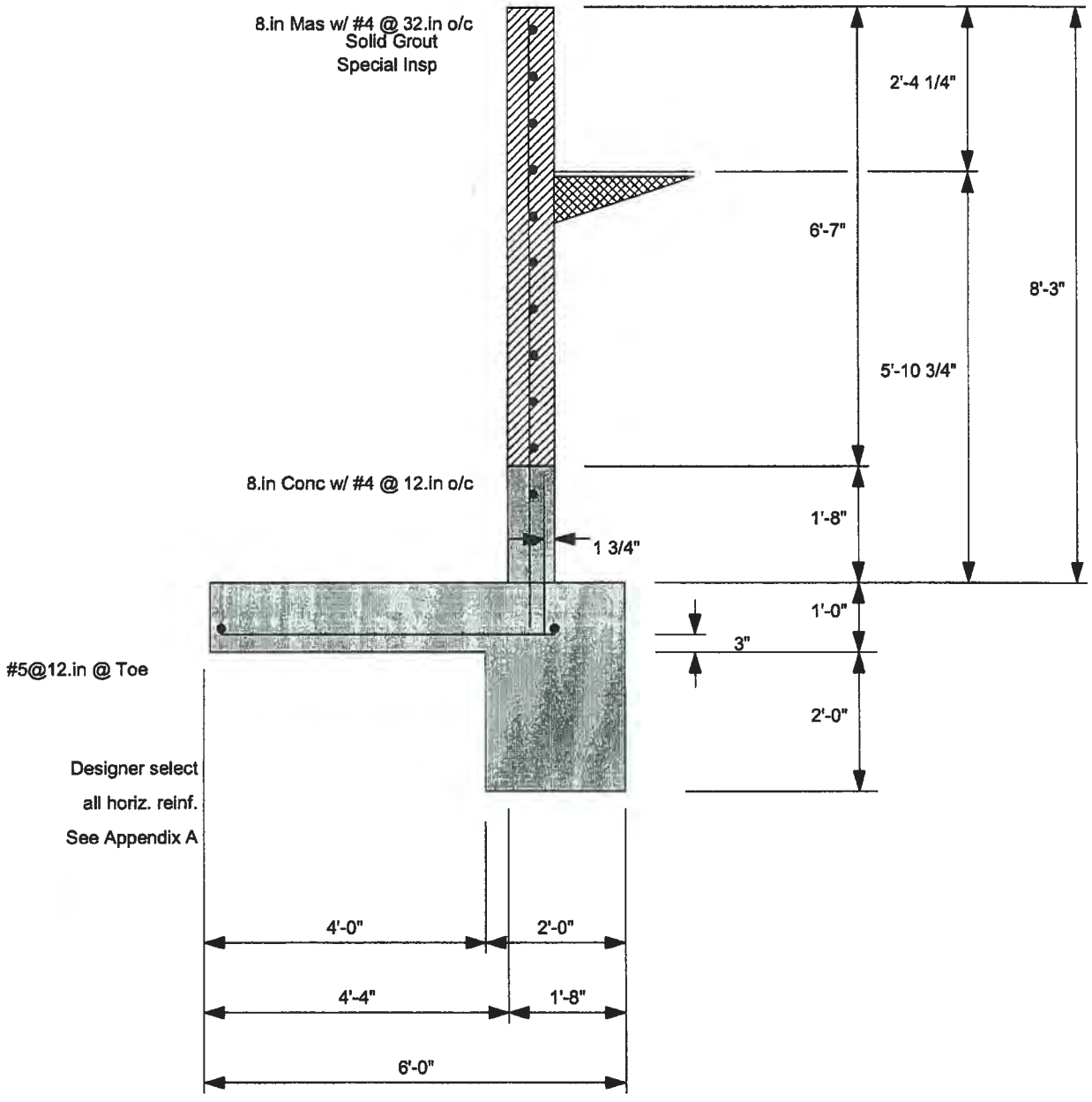
Subject: Lake Las Vegas – Floodwall Design		ATKINS
Comp by: JL Check by:	Date: 10/3/12 Job Number: 100030858	Sheet Number:

Existing Floodwall : check



Exist. Wall Typ. Section


20.3psf
1547.6#
Pp= 1100.#
347.89psf
516.61psf


8.in Mas w/ #4 @ 32.in o/c
Solid Grout
Special Insp
2'-4 1/4"
6'-7"
8'-3"
5'-10 3/4"
8.in Conc w/ #4 @ 12.in o/c
1'-8"
1 3/4"
1'-0"
3"
#5@12.in @ Toe
2'-0"
Designer select
all horiz. reinf.
See Appendix A
4'-0"
2'-0"
4'-4"
1'-8"
6'-0"

Cantilevered Retaining Wall Design

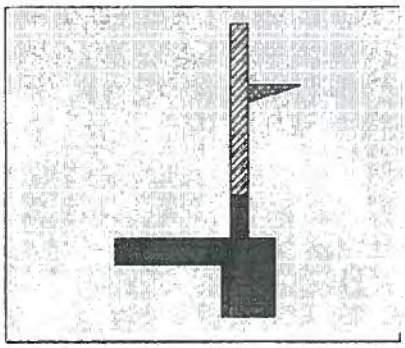
Code: IBC 2006,ACI 318-05,ACI 530-05

Criteria

Retained Height	=	5.90 ft
Wall height above soil	=	2.36 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	63.0 psf/ft
	=	
Passive Pressure	=	275.0 psf/ft
Soil Density, Heel	=	63.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.550
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	20.3 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.90 OK
Sliding	=	1.63 OK
Total Bearing Load	=	2,593 lbs
...resultant ecc.	=	2.34 in
Soil Pressure @ Toe	=	517 psf OK
Soil Pressure @ Heel	=	348 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	620 psf
ACI Factored @ Heel	=	417 psf
Footing Shear @ Toe	=	13.5 psi OK
Footing Shear @ Heel	=	1.7 psi OK
Allowable	=	94.9 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	1,547.6 lbs
less 100% Passive Force	= -	1,100.0 lbs
less 100% Friction Force	= -	1,426.4 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

Building Code	IBC 2006,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	2.000
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Top Stem	2nd
		Ratio > 1.0	As < Min %
Design Height Above Ftg	ft =	1.67	0.00
Wall Material Above "Ht"	=	Masonry	Concrete
Thickness	=	8.00	8.00
Rebar Size	=	# 4	# 4
Rebar Spacing	=	32.00	12.00
Rebar Placed at	=	Center	Edge
Design Data			
fb/FB + fa/Fa	=	2.032	No Good
Total Force @ Section	lbs =	611.5	2,269.7
Moment....Actual	ft-# =	1,053.9	4,855.7
Moment.....Allowable	ft-# =	518.6	5,492.3
Shear.....Actual	psi =	13.6	30.3
Shear.....Allowable	psi =	38.7	94.9
Wall Weight	psf =	84.0	100.0
Rebar Depth 'd'	in =	3.75	6.25
LAP SPLICE IF ABOVE	in =	36.00	12.00
LAP SPLICE IF BELOW	in =	30.08	
HOOK EMBED INTO FTG	in =		6.00

Lap splice above base reduced by stress ratio
Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	1,500
Fs	psi =	24,000
Solid Grouting	=	Yes
Use Half Stresses	=	n/a
Modular Ratio 'n'	=	21.48
Short Term Factor	=	1.000
Equiv. Solid Thick.	in =	7.60
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	4,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall Design

Code: IBC 2006,ACI 318-05,ACI 530-05

Footing Dimensions & Strengths

Toe Width	=	4.33 ft
Heel Width	=	1.67
Total Footing Width	=	6.00
Footing Thickness	=	12.00 in
Key Width	=	24.00 in
Key Depth	=	24.00 in
Key Distance from Toe	=	4.00 ft

f'c = 4,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	620	417 psf
Mu' : Upward	=	5,355	216 ft-#
Mu' : Downward	=	1,687	315 ft-#
Mu: Design	=	3,668	99 ft-#
Actual 1-Way Shear	=	13.45	1.69 psi
Allow 1-Way Shear	=	94.87	94.87 psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.50 in, #5@ 14.50 in, #6@ 20.50 in, #7@ 28.00 in, #8@ 36.75 in, #9@ 46
Heel: Not req'd, Mu < S * Fr
Key: Not req'd, Mu < S * Fr

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Item									
Heel Active Pressure	=	1,499.7	2.30	3,449.3	Soil Over Heel	=	372.9	5.50	2,050.5
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=	47.9	8.08	387.1	* Axial Live Load on Stem	=			
	=				Soil Over Toe	=	372.9		
					Surcharge Over Toe	=			
Total		1,547.6	O.T.M.	3,836.4	Stem Weight(s)	=	720.6	4.66	3,360.2
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	900.0	3.00	2,700.0
					Key Weight	=	600.0	5.00	3,000.0
					Vert. Component	=			
					Total	=	2,593.5 lbs	R.M.=	11,110.8

Resisting/Overturning Ratio = 2.90
Vertical Loads used for Soil Pressure = 2,593.5 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

DESIGNER NOTES:

Cantilevered Retaining Wall Design

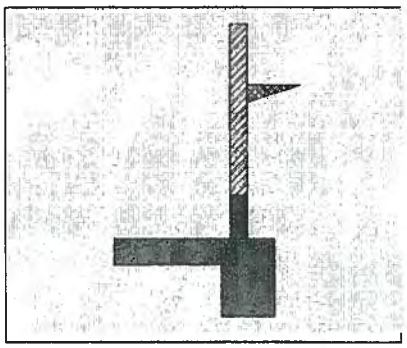
Code: IBC 2006,ACI 318-05,ACI 530-05

Criteria

Retained Height	=	5.90 ft
Wall height above soil	=	2.36 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	63.0 psf/ft
	=	
Passive Pressure	=	275.0 psf/ft
Soil Density, Heel	=	63.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.550
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	20.3 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.90 OK
Sliding	=	1.63 OK
Total Bearing Load	=	2,593 lbs
...resultant ecc.	=	2.34 in
Soil Pressure @ Toe	=	517 psf OK
Soil Pressure @ Heel	=	348 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	620 psf
ACI Factored @ Heel	=	417 psf
Footing Shear @ Toe	=	13.5 psi OK
Footing Shear @ Heel	=	1.7 psi OK
Allowable	=	94.9 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	1,547.6 lbs
less 100% Passive Force	= -	1,100.0 lbs
less 100% Friction Force	= -	1,426.4 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

Building Code	IBC 2006,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	2.000
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Top Stem	2nd
		Ratio > 1.0	As < Min %
Design Height Above Ftg	ft =	1.67	0.00
Wall Material Above "Ht"	=	Masonry	Concrete
Thickness	=	8.00	8.00
Rebar Size	=	# 4	# 4
Rebar Spacing	=	32.00	12.00
Rebar Placed at	=	Center	Edge
Design Data			
fb/FB + fa/Fa	=	**1.648**	**No Good**
Total Force @ Section	lbs =	1,203.9	2,269.7
Moment....Actual	ft-# =	2,004.1	4,855.7
Moment.....Allowable	ft-# =	1,216.0	5,492.3
Shear.....Actual	psi =	26.8	30.3
Shear.....Allowable	psi =	69.7	94.9
Wall Weight	psf =	84.0	100.0
Rebar Depth 'd'	in =	3.75	6.25
LAP SPLICE IF ABOVE	in =	36.00	12.00
LAP SPLICE IF BELOW	in =	24.39	
HOOK EMBED INTO FTG	in =		6.00

Lap splice above base reduced by stress ratio
Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	1,500
Fy	psi =	60,000
Solid Grouting	=	Yes
Use Half Stresses	=	n/a
Modular Ratio 'n'	=	21.48
Equiv. Solid Thick.	in =	7.60
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	LRFD

Concrete Data

f'c	psi =	4,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall Design

Code: IBC 2006,ACI 318-05,ACI 530-05

Footing Dimensions & Strengths

Toe Width	=	4.33 ft
Heel Width	=	1.67
Total Footing Width	=	6.00
Footing Thickness	=	12.00 in
Key Width	=	24.00 in
Key Depth	=	24.00 in
Key Distance from Toe	=	4.00 ft

f'c = 4,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	620	417 psf
Mu' : Upward	=	5,355	216 ft-#
Mu' : Downward	=	1,687	315 ft-#
Mu: Design	=	3,668	99 ft-#
Actual 1-Way Shear	=	13.45	1.69 psi
Allow 1-Way Shear	=	94.87	94.87 psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.50 in, #5@ 14.50 in, #6@ 20.50 in, #7@ 28.00 in, #8@ 36.75 in, #9@ 46
Heel: Not req'd, Mu < S * Fr
Key: Not req'd, Mu < S * Fr

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,499.7	2.30	3,449.3	Soil Over Heel	=	372.9	5.50	2,050.5
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=	47.9	8.08	387.1	* Axial Live Load on Stem	=			
	=				Soil Over Toe	=	372.9		
					Surcharge Over Toe	=			
Total		1,547.6	O.T.M.	3,836.4	Stem Weight(s)	=	720.6	4.66	3,360.2
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	900.0	3.00	2,700.0
					Key Weight	=	600.0	5.00	3,000.0
					Vert. Component	=			
					Total	=	2,593.5 lbs	R.M.=	11,110.8

Resisting/Overturning Ratio = 2.90
Vertical Loads used for Soil Pressure = 2,593.5 lbs

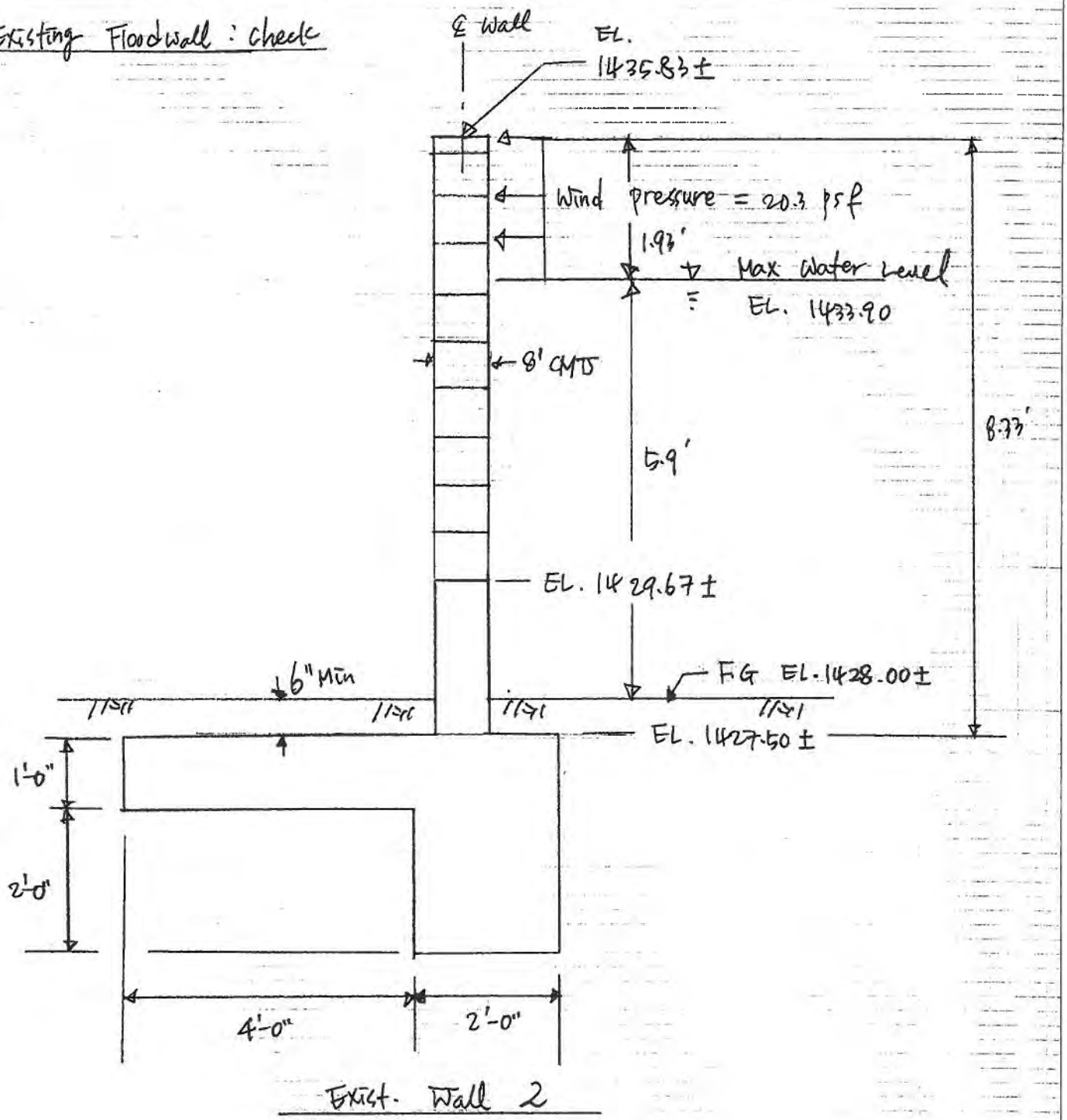
* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

DESIGNER NOTES:

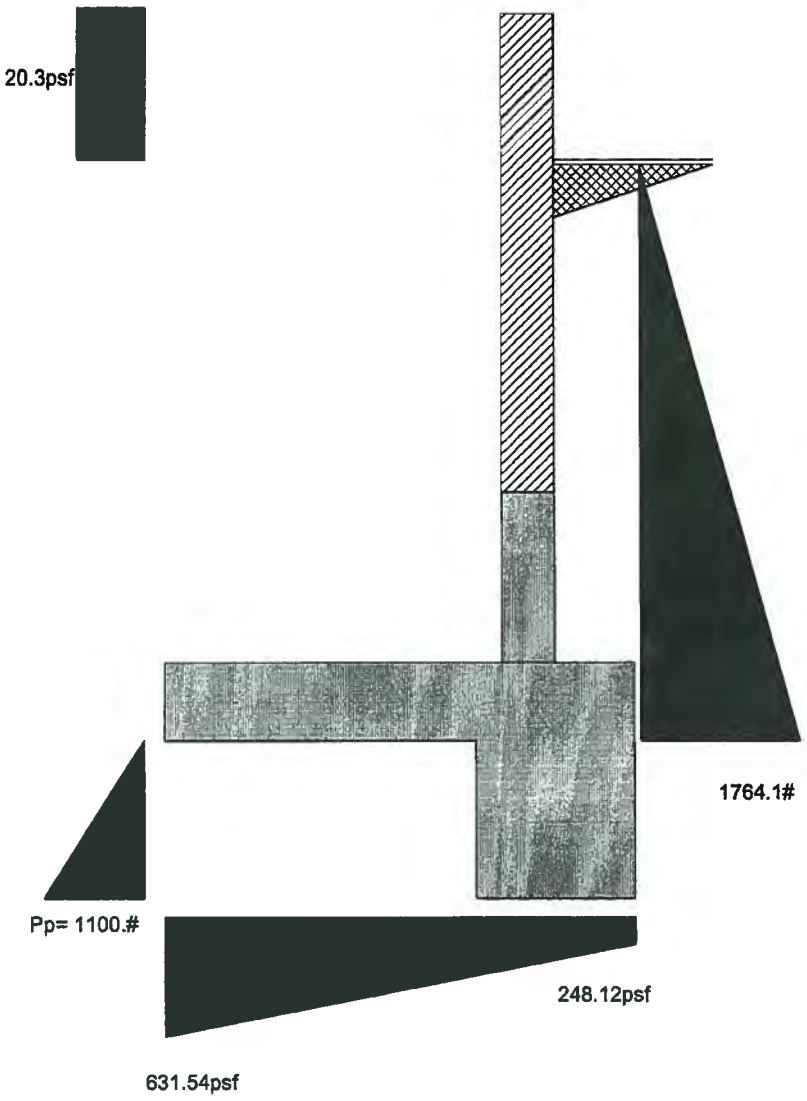
Subject: Lake Las Vegas - Floodwall Design		
Comp by: JL Check by:	Date: 10/16/12 Job Number: 100030858	Sheet Number:

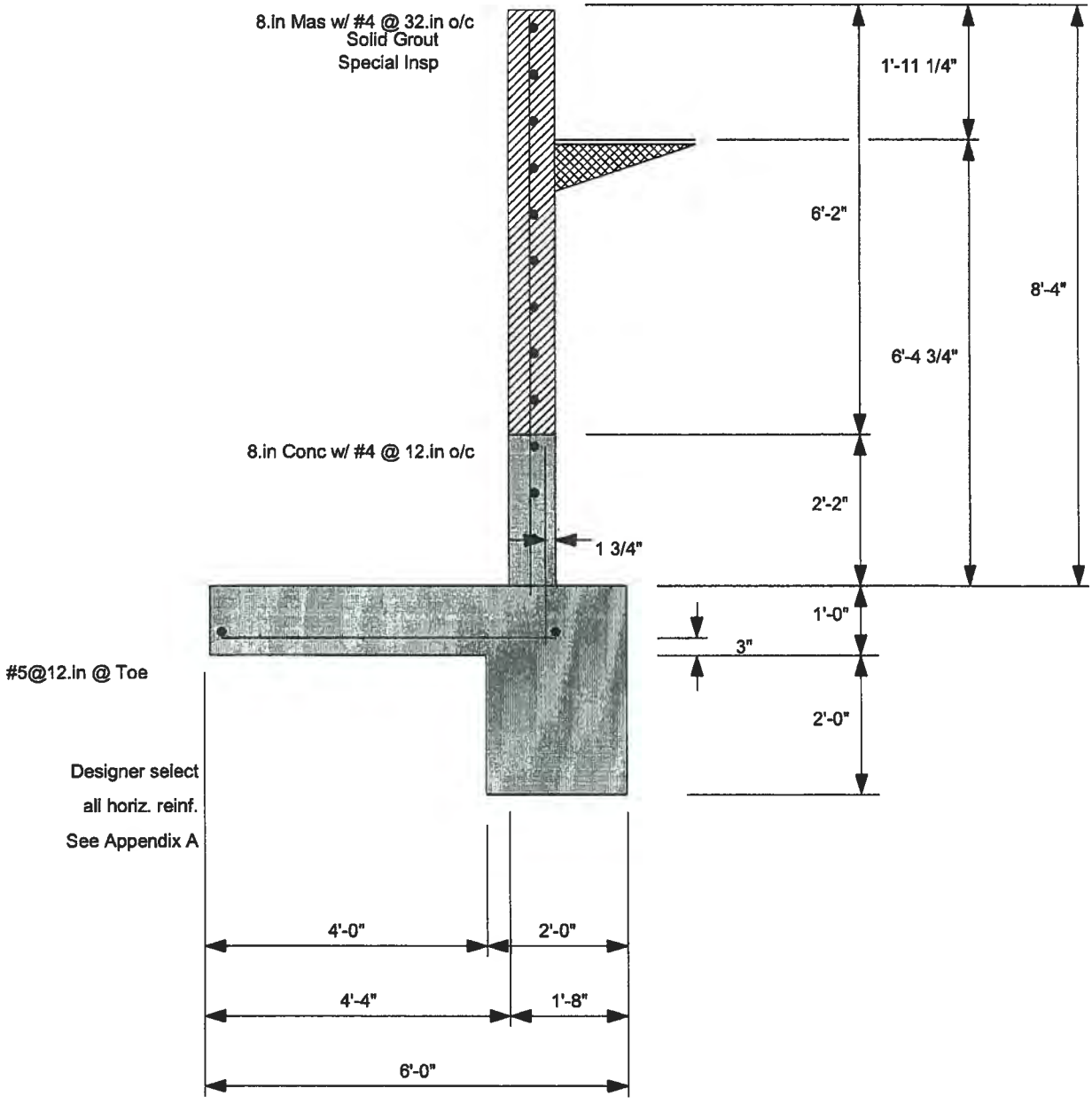
ATKINS

Existing Floodwall : check



Exist. Wall 2


20.3psf
1764.1#
Pp= 1100.#
248.12psf
631.54psf


8.In Mas w/ #4 @ 32.in o/c
Solid Grout
Special Insp
1'-11 1/4"
6'-2"
8'-4"
6'-4 3/4"
8.in Conc w/ #4 @ 12.in o/c
2'-2"
1 3/4"
1'-0"
3"
#5@12.In @ Toe
2'-0"
Designer select
all horiz. reinf.
See Appendix A
4'-0"
2'-0"
4'-4"
1'-8"
6'-0"

Cantilevered Retaining Wall Design

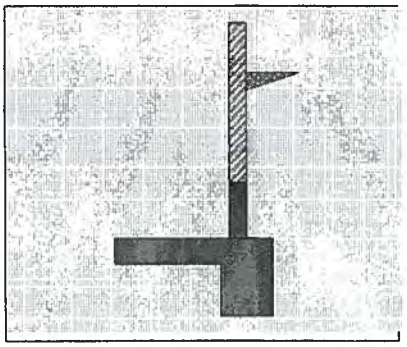
Code: IBC 2006,ACI 318-05,ACI 530-05

Criteria

Retained Height	=	6.40 ft
Wall height above soil	=	1.93 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	63.0 psf/ft
	=	
Passive Pressure	=	275.0 psf/ft
Soil Density, Heel	=	63.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.550
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	20.3 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.48 OK
Sliding	=	1.45 Ratio < 1.5!
Total Bearing Load	=	2,639 lbs
...resultant ecc.	=	5.23 in
Soil Pressure @ Toe	=	632 psf OK
Soil Pressure @ Heel	=	248 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	758 psf
ACI Factored @ Heel	=	298 psf
Footing Shear @ Toe	=	15.6 psi OK
Footing Shear @ Heel	=	2.9 psi OK
Allowable	=	94.9 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	1,764.1 lbs
less 100% Passive Force	= -	1,100.0 lbs
less 100% Friction Force	= -	1,451.4 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	94.7 lbs NG

Load Factors

Building Code	IBC 2006,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	2.000
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Top Stem	2nd
		Ratio > 1.0	As < Min %
Design Height Above Ftg	ft =	2.17	0.00
Wall Material Above "Ht"	=	Masonry	Concrete
Thickness	=	8.00	8.00
Rebar Size	=	# 4	# 4
Rebar Spacing	=	32.00	12.00
Rebar Placed at	=	Center	Edge
Design Data			
fb/FB + fa/Fa	=	1.925	No Good
Total Force @ Section	lbs =	602.8	2,643.2
Moment....Actual	ft-# =	998.2	5,966.7
Moment.....Allowable	ft-# =	518.6	5,492.3
Shear.....Actual	psi =	13.4	35.2
Shear.....Allowable	psi =	38.7	94.9
Wall Weight	psf =	84.0	100.0
Rebar Depth 'd'	in =	3.75	6.25
LAP SPLICE IF ABOVE	in =	36.00	12.00
LAP SPLICE IF BELOW	in =	28.49	
HOOK EMBED INTO FTG	in =		7.23

Lap splice above base reduced by stress ratio
Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	1,500
Fs	psi =	24,000
Solid Grouting	=	Yes
Use Half Stresses	=	n/a
Modular Ratio 'n'	=	21.48
Short Term Factor	=	1.000
Equiv. Solid Thick.	in =	7.60
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	4,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall Design

Code: IBC 2006,ACI 318-05,ACI 530-05

Footing Dimensions & Strengths

Toe Width	=	4.33 ft
Heel Width	=	1.67
Total Footing Width	=	6.00
Footing Thickness	=	12.00 in
Key Width	=	24.00 in
Key Depth	=	24.00 in
Key Distance from Toe	=	4.00 ft

f'c = 4,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	758	298 psf
Mu' : Upward	=	6,067	163 ft-#
Mu' : Downward	=	1,687	334 ft-#
Mu: Design	=	4,379	171 ft-#
Actual 1-Way Shear	=	15.59	2.88 psi
Allow 1-Way Shear	=	94.87	94.87 psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.50 in, #5@ 14.50 in, #6@ 20.50 in, #7@ 28.00 in, #8@ 36.75 in, #9@ 46
Heel: Not req'd, Mu < S * Fr
Key: Not req'd, Mu < S * Fr

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,724.9	2.47	4,254.9	Soil Over Heel	=	404.5	5.50	2,224.3
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=	39.2	8.37	327.7	* Axial Live Load on Stem	=			
	=				Soil Over Toe	=	404.5		
					Surcharge Over Toe	=			
Total		1,764.1	**O.T.M.**	4,582.6	Stem Weight(s)	=	734.4	4.66	3,424.9
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	900.0	3.00	2,700.0
Resisting/Overturning Ratio		= **2.48**			Key Weight	=	600.0	5.00	3,000.0
Vertical Loads used for Soil Pressure	=	2,639.0 lbs			Vert. Component	=			
					Total	=	2,639.0 lbs	**R.M.=**	11,349.3

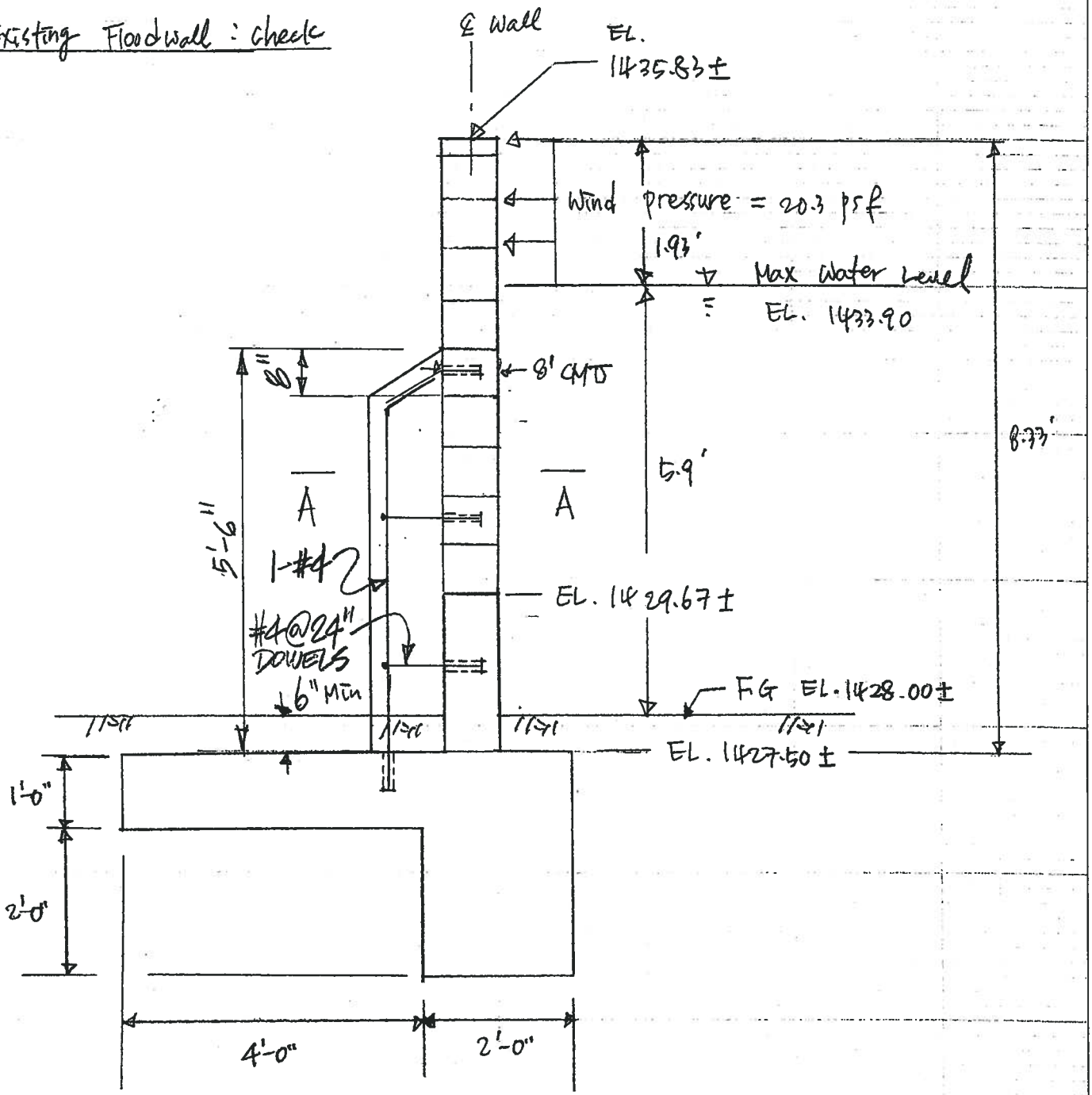
* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

DESIGNER NOTES:

Subject: Lake Las Vegas - Floodwall Design. Cofferdam Preliminary Design		
Comp by: JE JC	Date: 10/16/12	Sheet Number:
Check by:	Job Number: 100030858	

ATKINS

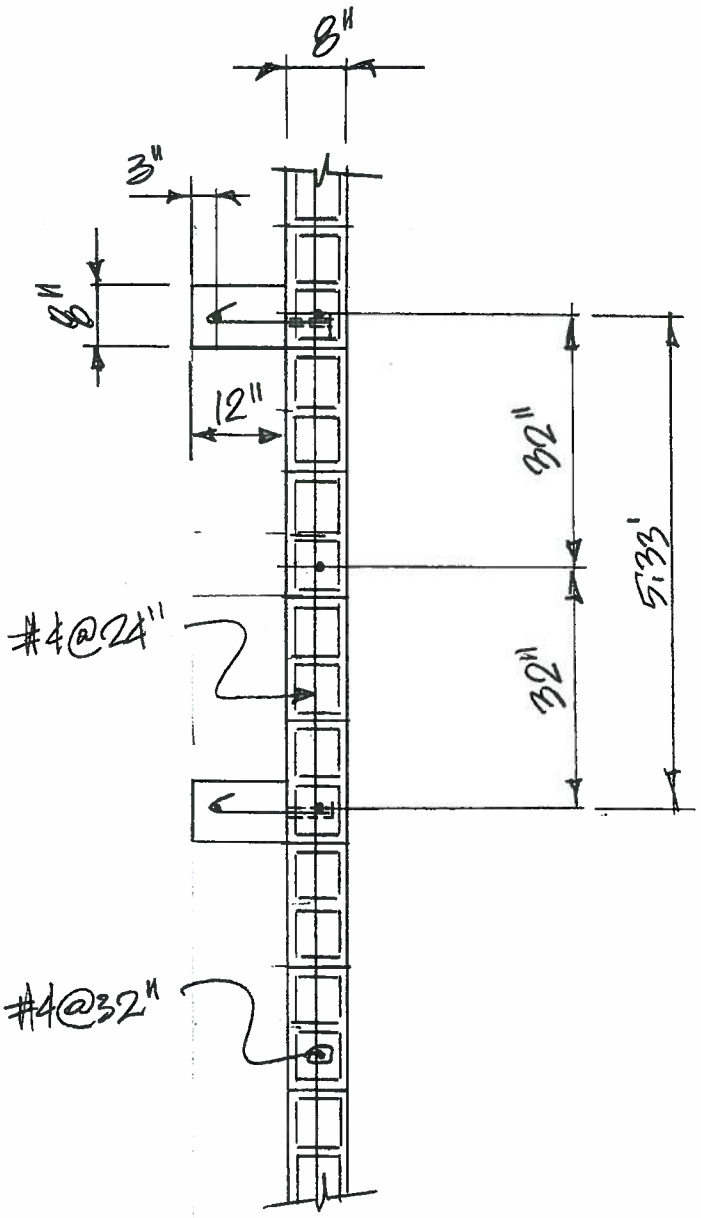
Existing Floodwall : check



Exist. Wall 2

Subject:	Lake Las Vegas - Floodwall Retrofit Preliminary Design		
Comp by: JC	Date: 10/23/12	Sheet Number:	
Check by:	Job Number: 1000 3858		

ATKINS

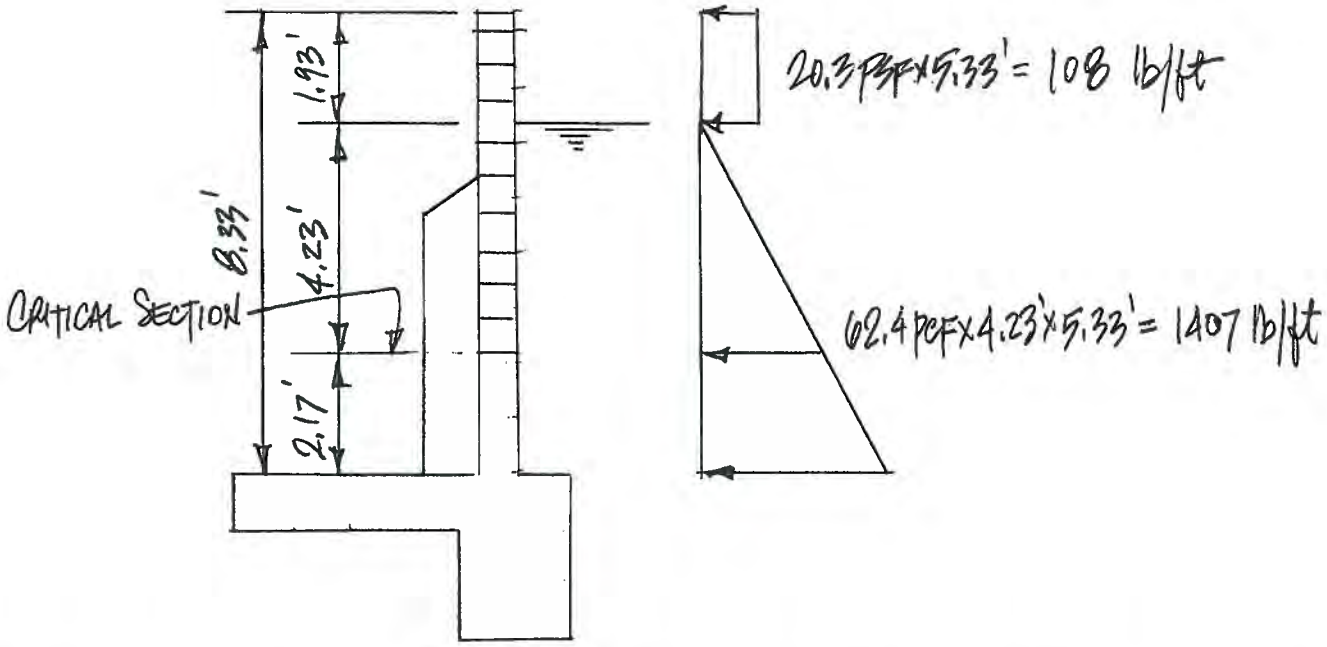


SECTION A-A

Subject:	Lake Las Vegas – Flood Wall Retrofit Preliminary Design		
Comp by: JC	Date: 10/23/12	Sheet Number:	
Check by:	Job Number: 10003085B		

ATKINS

Loads



Shear $V_u = 1.6 \times 108 \times 1.93 + 2.0 \times 1407 \times 4.23/2 = 334 + 5952 = 6286$ lbs

$\phi V_c = 0.85 \times 2 \times \sqrt{3000} \times 8 \times 16 = 11918$ lbs $> V_u$ OK!

Vertical Moment

$$M_u = 334 \times \left(4.23 + \frac{1.93}{2}\right) + 5952 \times \frac{4.23}{3} = 1735 + 8392 = 10127 \text{ lb.ft}$$

$$a = \frac{A_s f_y}{.85 f'_c b} = \frac{2 \times 0.20 \times 60}{.85 \times 3 \times 8} = 1.18 \text{ in}$$

$$\phi M_n = \phi A_s f_y \left(d - \frac{a}{2}\right) = 0.90 \times 0.40 \times 60 \left(12 - \frac{1.18}{2}\right) = 246.5 \text{ K.in}$$

$$= 20.5 \text{ K.ft} > M_u = 10.1 \text{ K.ft}$$

OK!

Subject: Lake Las Vegas – Flood Wall Retrofit Preliminary Design		
Comp by: JC	Date: 10/23/12	Sheet Number:
Check by:	Job Number: 10003858	

ATKINS

Horizontal Moment

$$W = 62.4 \times 4.23 = 264 \text{ psf}$$

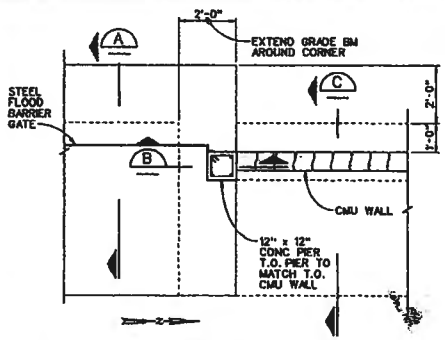
$$M_{ll} = \frac{1}{10} \times 264 \times 5.33^2 \times 2.0 = 1500 \text{ lb.ft/ft}$$

$$a = \frac{0.10 \times 60}{0.85 \times 1.5 \times 12} = 0.39 \text{ in}$$

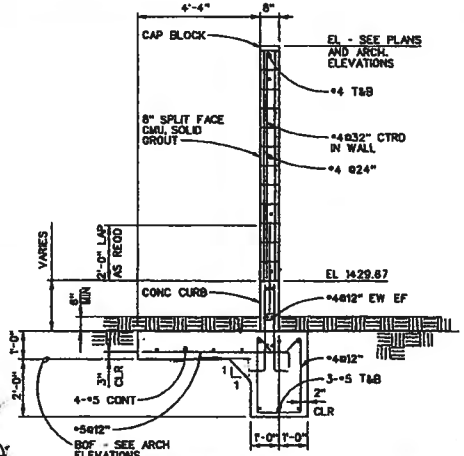
$$\phi M_n = 0.90 \times 0.10 \times 60 \times \left(4 - \frac{0.39}{2}\right) = 20.5 \text{ K.in/ft}$$

$$= 1.71 \text{ K.ft} > M_{ll} = 1.50 \text{ K.ft}$$

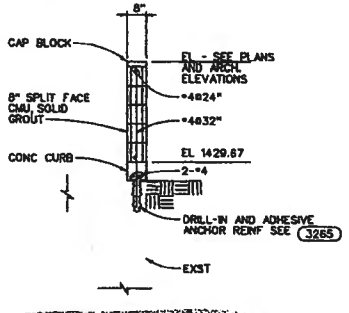
OK!



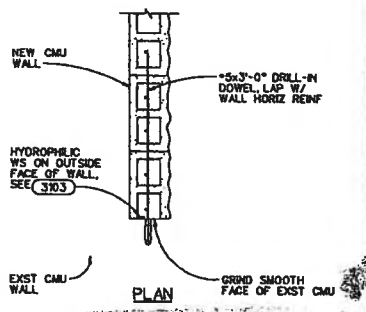
PARTIAL PLAN AT GATE G-1
1/2"-1'-0" M-1-FP



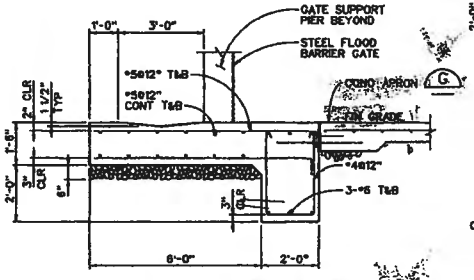
TYPICAL FLOOD PROTECTION WALL SECTION C
1/2"-1'-0" M-1-FP M-2-FP



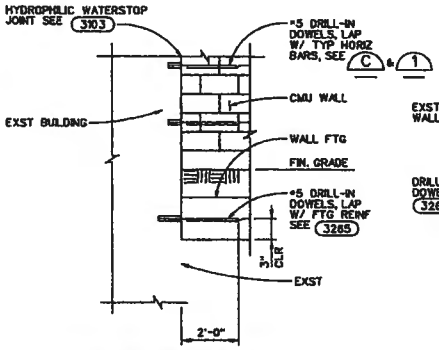
FLOOD PROTECTION WALL AT EXISTING E
1/2"-1'-0" M-1-FP M-2-FP



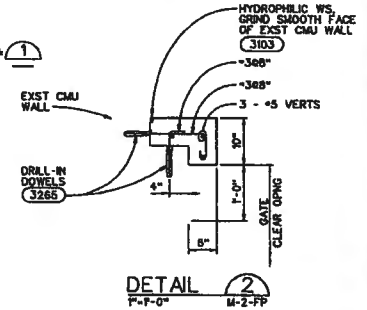
CMU WALL TO EXISTING CMU WALL CONNECTION 1
NTS M-1-FP M-2-FP



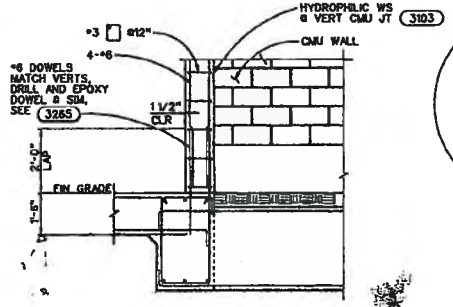
SECTION A
1/2"-1'-0" M-1-FP M-2-FP



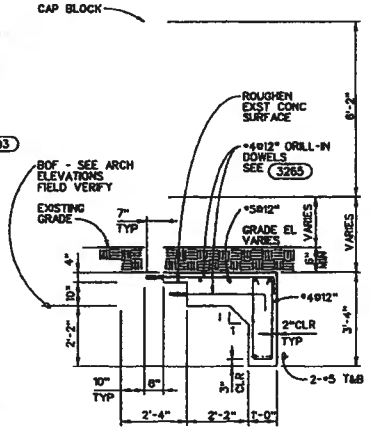
FLOOD PROTECTION WALL AT BUILDING F
1/2"-1'-0" M-1-FP



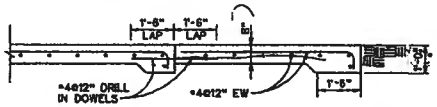
DETAIL 2
1"=1'-0" M-2-FP



GATE SUPPORT PIER B
1/2"-1'-0" M-1-FP



EXISTING SCREEN WALL D
1/2"-1'-0" M-1-FP M-2-FP



SECTION G
NTS M-2-FP

(05741) 2000000062

LAKE LAS VEGAS

STRUCTURAL
DETAILS

LAKE LAS VEGAS LIFT STATION AND FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2030 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.8113

NO.	DATE	REVISION	BY	APVD
1	7-10-00	FLOOD PROTECTION	TJA	JBF

DSGN D WAGNER
DR T ALI
CHK J CALL
APVD J FOSS

SHEET 6
CAD S-1-FP
DATE DEC 2000
PROJ NO. 145076.A6

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15-09-27 21-DEC-2000

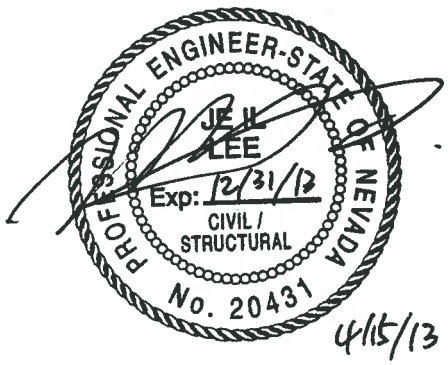
Lake Las Vegas Flood Protection

Design Calculations For

Flood Protection Wall

Prepared for:

City of Henderson, Nevada



Prepared by:

ATKINS
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074-6382

Project No. 100030858
October, 2012

DESIGN CRITERIA

Codes:

International Building Code 2009 (IBC 2009)
Building Code Requirements for Structural Concrete (ACI 318-08)
Minimum Design Loads for Buildings and Other Structures (ASCE 7-05)

Materials:

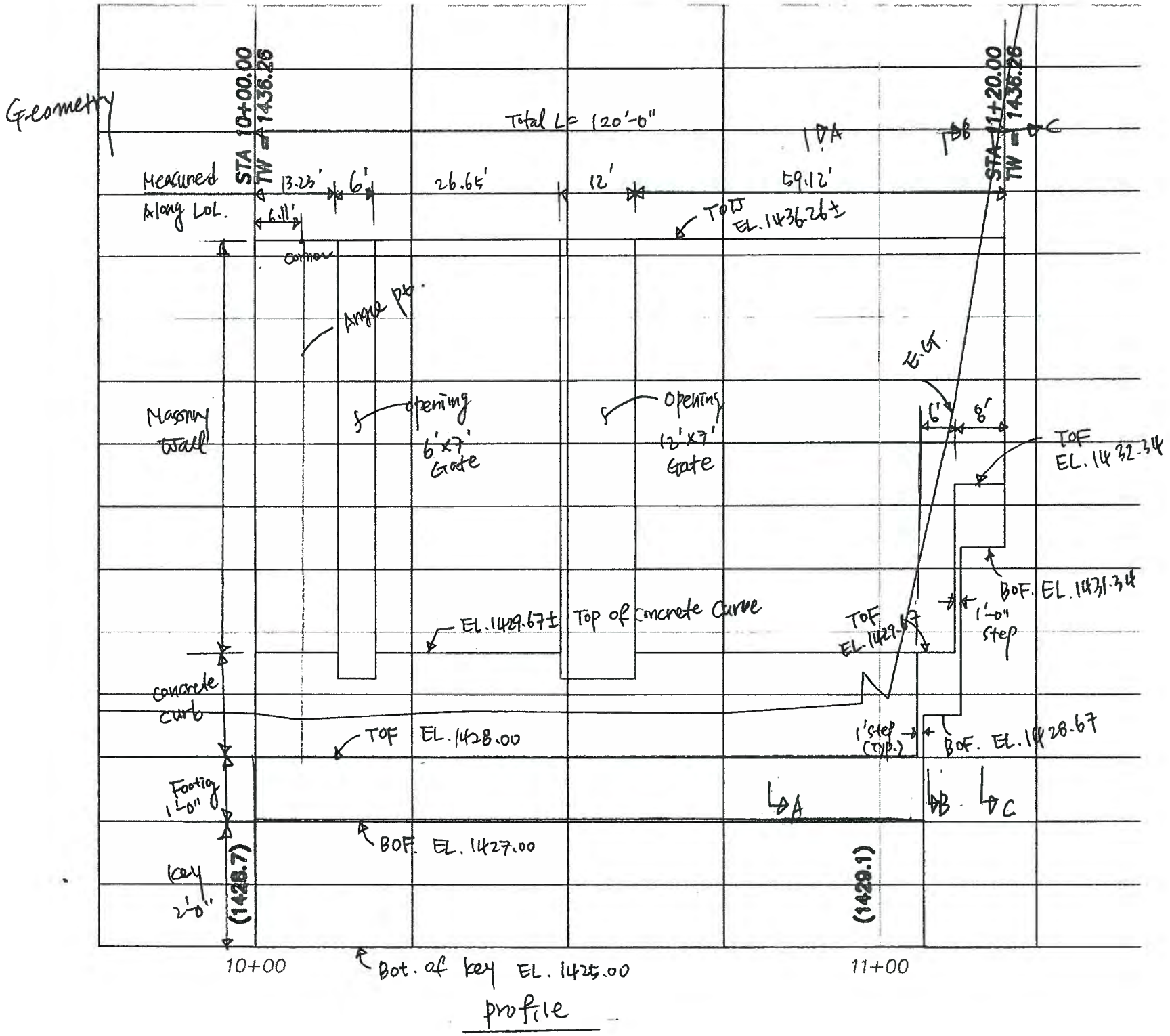
Concrete (Type V cement)	f'c = 4000 psi
Masonry (Split face)	f'm=1500 psi
Mortar (Type M or S)	Min. Strength=1900 psi
Grout (Type V cement)	Min. Strength=2000 psi
Reinforcing Steel ASTM A-615 Grade 60	fy = 60,000 psi

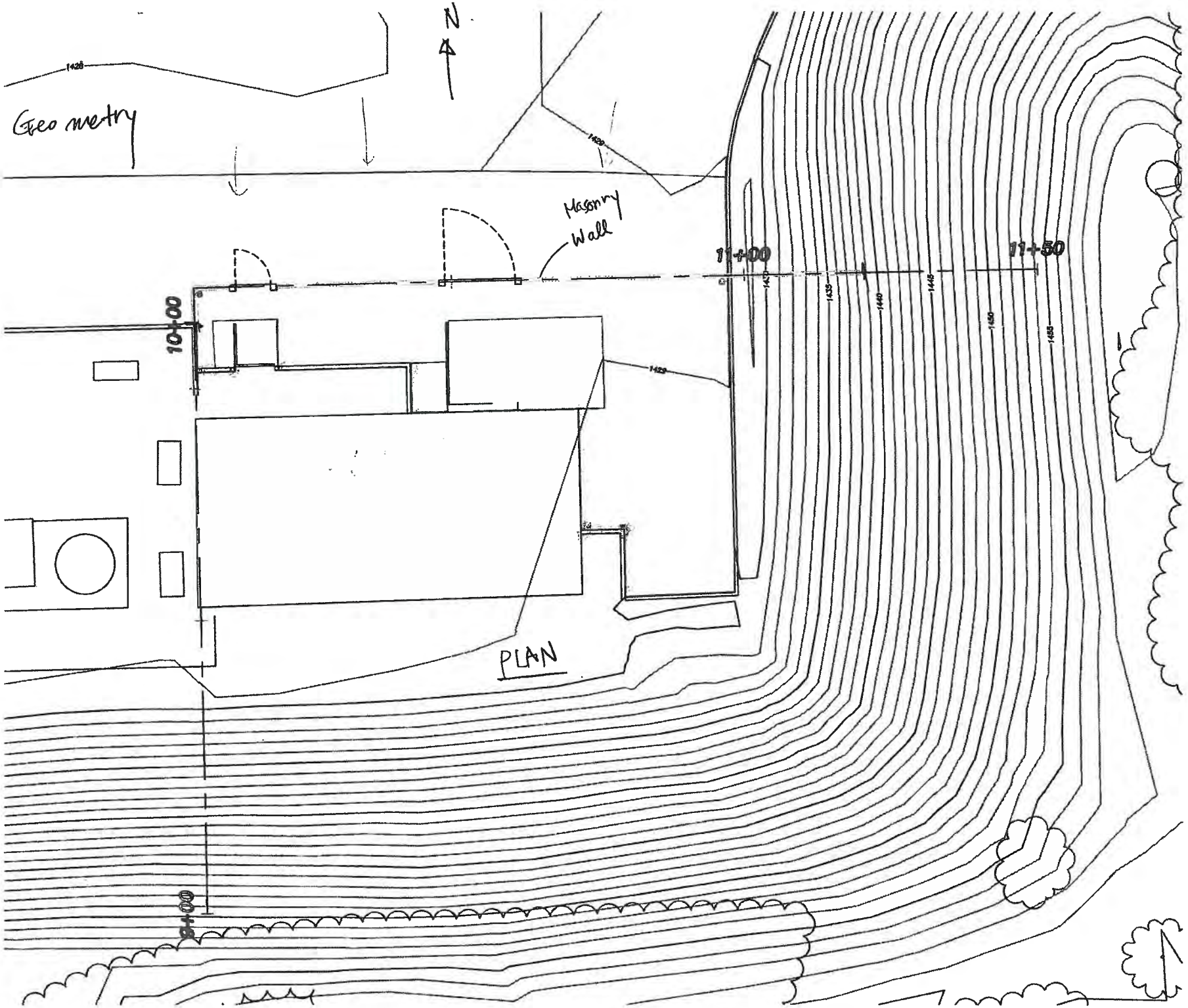
Loads:

Water Pressure	63 pcf
Wind Pressure	20.3 psf
Live Load	Vactor Truck

Soil Data:

Soil Density	125 pcf
Passive Pressure	275 pcf
Friction Coefficient (between Soil and Concrete)	0.55
Allowable Bearing Pressure	2000 psf

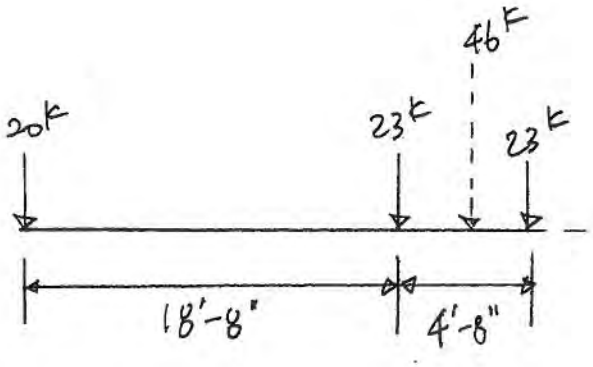

Geometry
STA 10+00.00
TW = 1436.26
Total L = 120'-0"
STA 11+20.00
TW = 1436.26
Measured Along LOL.
13.23'
6'
26.65'
12'
59.12'
6.11'
corner
Angle pt.
TOP EL. 1436.26±
Masonry Wall
opening 6'x7' Gate
opening 12'x7' Gate
6'
8'
TOF EL. 1432.34
BOF. EL. 1431.34
1'-0" step
EL. 1429.67± Top of concrete curve
TOF EL. 1429.67
concrete curb
TOF EL. 1428.00
1' step (typ.)
BOF. EL. 1428.67
Footing 1'-0"
BOF. EL. 1427.00
Key 2'-0"
(1428.7)
(1429.1)
10+00
Bot. of key EL. 1425.00
11+00
profile


N
Geometry
Masonry Wall
11+00
11+50
10+00
9+00
PLAN

Design Assumptions

1. The flood is flash, so that water does not affect soil under footing. Also, asphalt layer prevent water from being permeated.

Vactor Truck



Vactor Truck

6

02/17/2006 16:58 7022673506 DEPT UT SRVC TS DSC PAGE 01/01

Post-It® Fax Note 7671 Date 11/25/08 # of pages ▶ 1
To Matt Pelt Co. Dept. Co. Dept.
Phone # Phone # 247-2572
Fax # 463-7205 Fax #

MODEL # 2110-824-16
BASE 04-12V-8388

GVWR - 20,000 lb
GVWR - Rear 16,000 lb
GA WR - 23,000 lb
GVW - 66,000 lb
CAPACITY - DIESEL TANK - 15 Gallons
CAPACITY - FRESH WATER - 1500 Gals

VEHICLE WIDTH, MIRROR TO MIRROR 9'8"
VEHICLE WIDTH, REMOVE TO REMOVE 8'6"
TURNING RADIUS - OUTSIDE TO OUTSIDE - 85' Circle

Boom - 100 degree Rotation
Vertical Lift from Ground 16'6"
Reach - Side - 25' from Center
DEPTH From Ground Level - 25' Horizontal
Max - determined by Type of Outrigger Used - Maximum Reach Down 25' 73 High by 85' Radius

Vactor Truck

GVWR: Gross Vehicle Weight Rating
GAWR: Gross Axle Weight Rating
GVW: Gross Vehicle Weight

Wind pressure (ASCE 7 6.5.10)

$q_z = 0.00256\, K_z \cdot K_{zt} \cdot K_d \cdot V^2 I$ (ASCE 7 Eq 6-15)

$V = 90$ mph (Figure 6-1)

$K_d = 0.85$ (Table 6-4), MTWFR.

occupancy category = III (Table 1-1)

$I = 1.15$ (Table 6-1)

$K_{zt} = 1.0$ (Sec. 6.5.7.1)

Exposure category = C (Sec. 6.5.6.3)

$K_z = 0.85$ ($h \leq 15'$, Table 6-3)

$q_z = 0.00256\,(0.85)(1.0)(0.85)(90^2)(1.15) = 20.31$ psf

Load combination (ASCE 7 2.3.3)

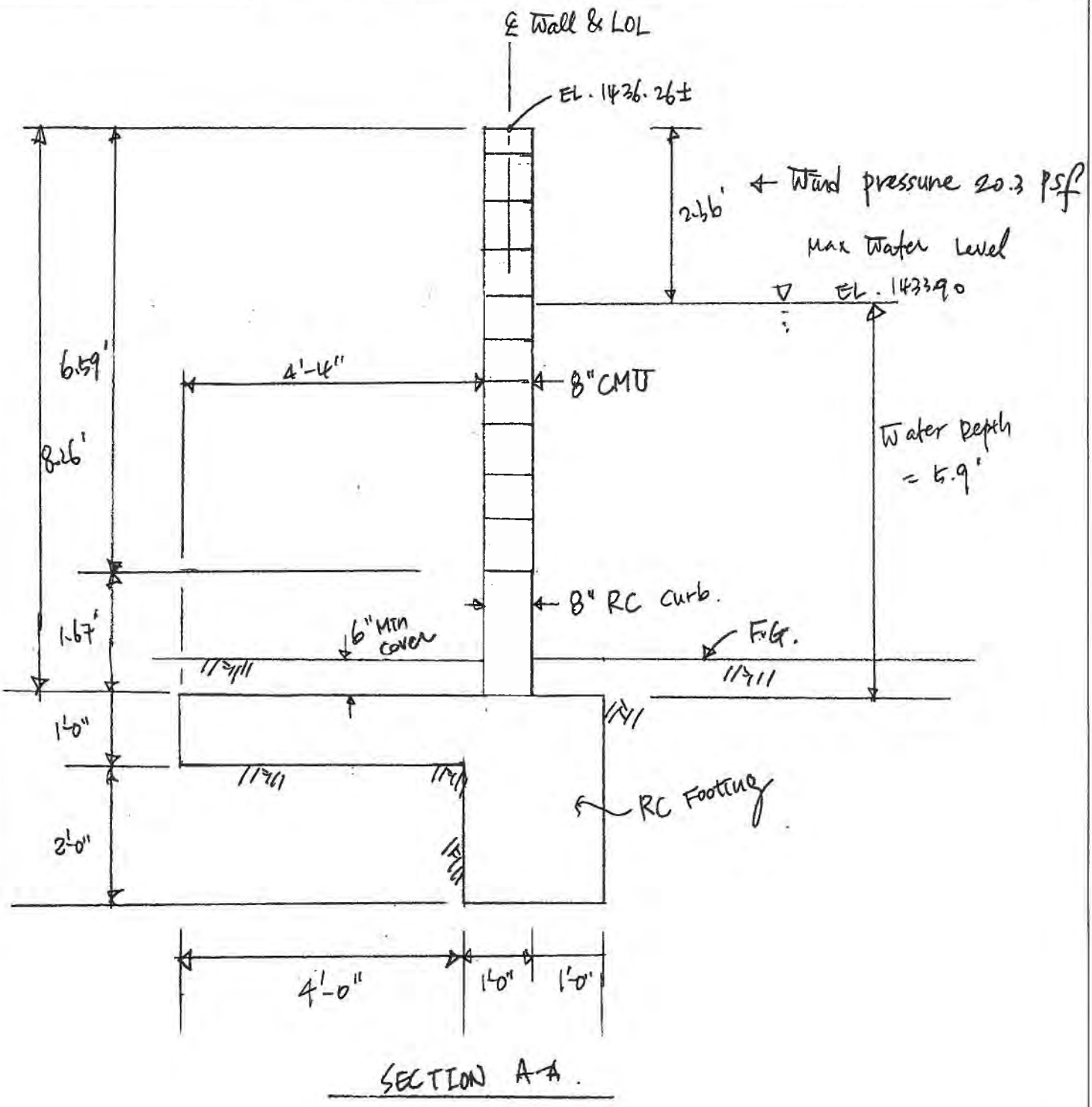
Load comb. $= 1.2D + 1.6W + 2.0F_a$

where, D = Dead Load

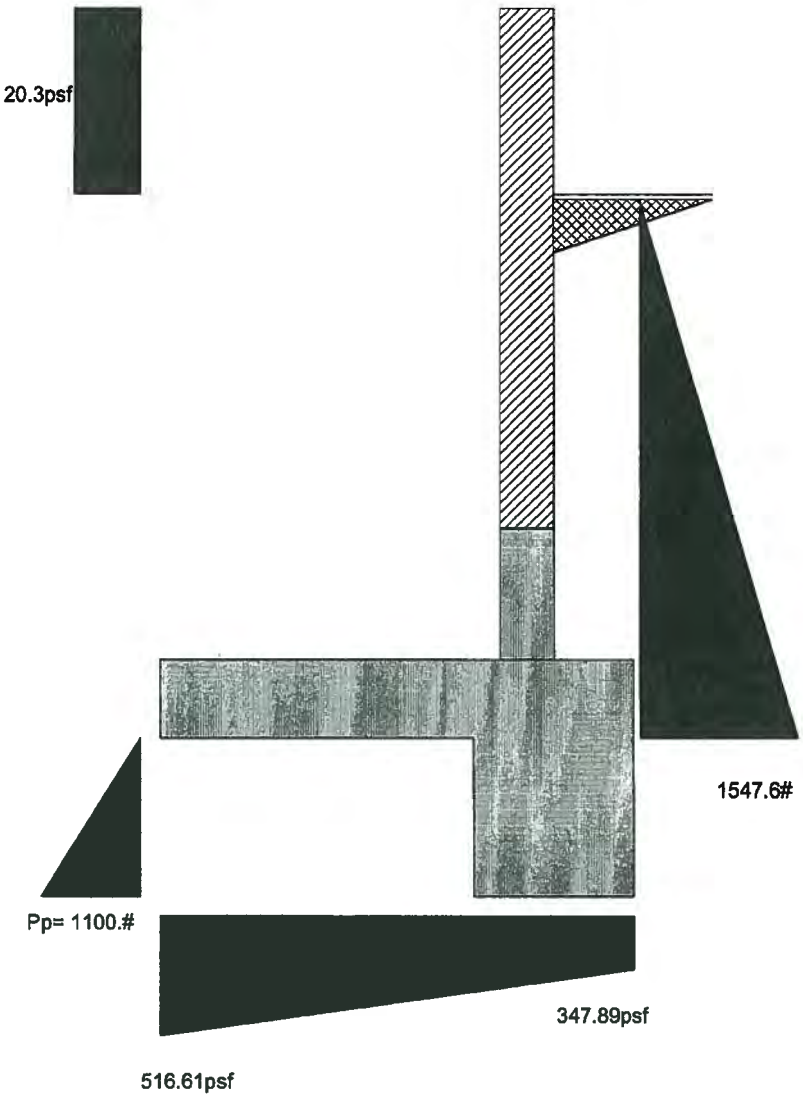
W = Wind Load

F_a = Flood Load.

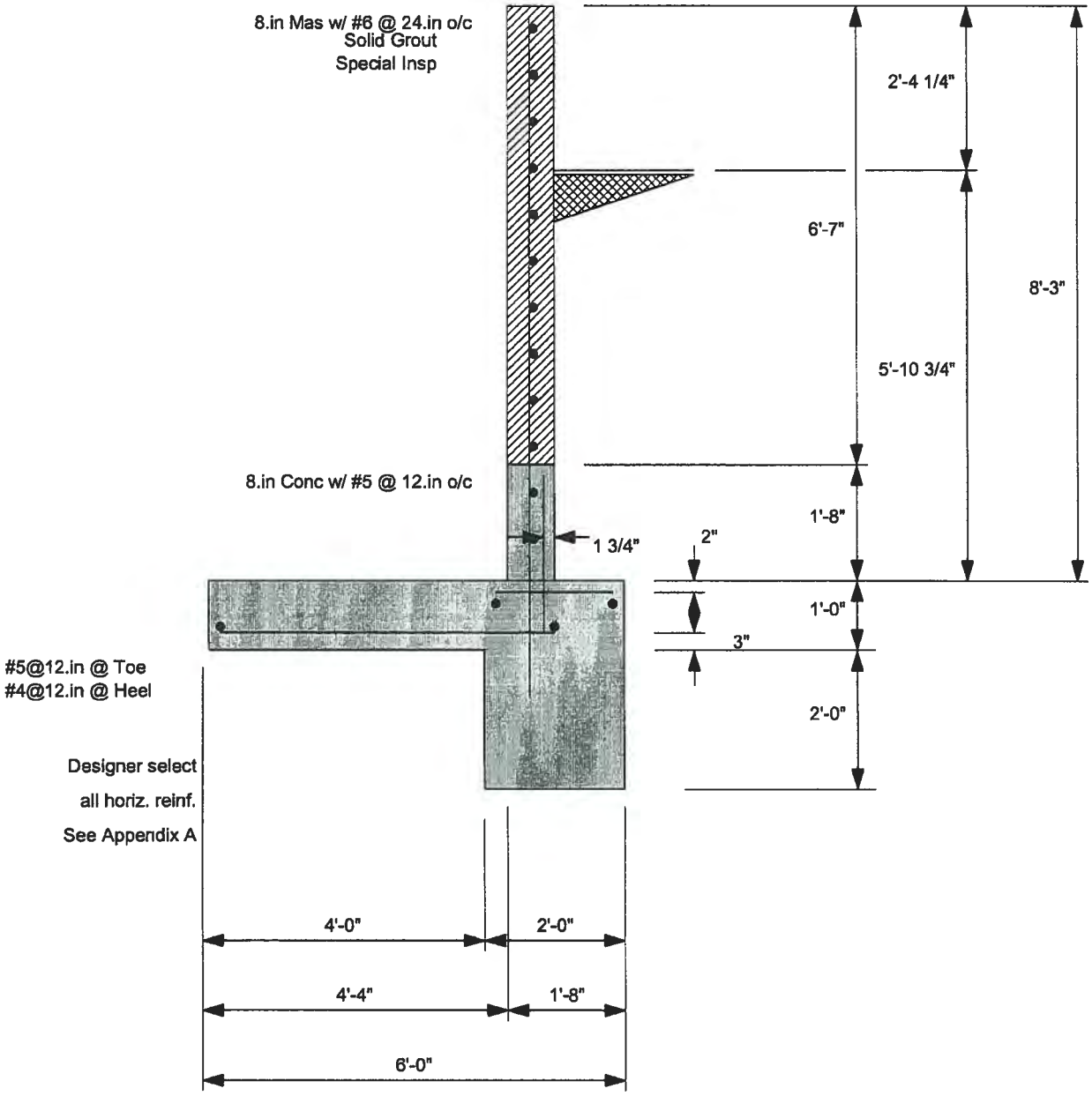
Subject: Lake Las Vegas - Flood Wall Design			ATKINS
Comp by: JL Check by: JC	Date: 09/27/12 Job Number: 10003085B	Sheet Number:	8



SECTION A-A.



SEC. A-A


8.in Mas w/ #6 @ 24.in o/c
Solid Grout
Special Insp
2'-4 1/4"
6'-7"
8'-3"
5'-10 3/4"
8.in Conc w/ #5 @ 12.in o/c
1'-8"
1 3/4"
2"
1'-0"
3"
2'-0"
#5@12.in @ Toe
#4@12.in @ Heel
Designer select
all horiz. reinf.
See Appendix A
4'-0"
2'-0"
4'-4"
1'-8"
6'-0"

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Cantilevered Retaining Wall Design

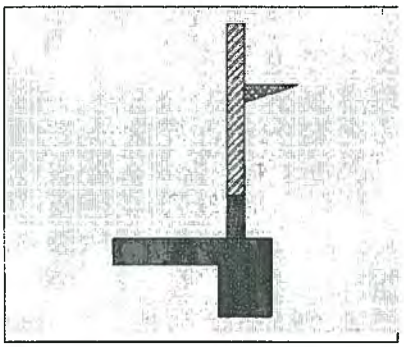
Code: IBC 2006,ACI 318-05,ACI 530-05

Criteria

Retained Height	=	5.90 ft
Wall height above soil	=	2.36 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	63.0 psf/ft
	=	
Passive Pressure	=	275.0 psf/ft
Soil Density, Heel	=	63.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.550
Soil height to Ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	20.3 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.90 OK
Sliding	=	1.63 OK
Total Bearing Load	=	2,593 lbs
...resultant ecc.	=	2.34 in
Soil Pressure @ Toe	=	517 psf OK
Soil Pressure @ Heel	=	348 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	620 psf
ACI Factored @ Heel	=	417 psf
Footing Shear @ Toe	=	13.5 psi OK
Footing Shear @ Heel	=	1.7 psi OK
Allowable	=	94.9 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	1,547.6 lbs
less 100% Passive Force	= -	1,100.0 lbs
less 100% Friction Force	= -	1,426.4 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

Building Code	IBC 2006,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	2.000
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Top Stem	2nd
		Stem OK	Stem OK
Design Height Above Ftg	ft =	1.67	0.00
Wall Material Above "Ht"	=	Masonry	Concrete
Thickness	=	8.00	8.00
Rebar Size	=	# 6	# 5
Rebar Spacing	=	24.00	12.00
Rebar Placed at	=	Center	Edge
Design Data			
fb/FB + fa/Fa	=	**0.944**	**0.584**
Total Force @ Section	lbs =	611.5	2,269.7
Moment....Actual	ft-# =	1,053.9	4,855.7
Moment.....Allowable	ft-# =	1,116.2	8,312.6
Shear.....Actual	psi =	13.6	30.6
Shear.....Allowable	psi =	38.7	94.9
Wall Weight	psf =	84.0	100.0
Rebar Depth 'd'	in =	3.75	6.19
LAP SPLICE IF ABOVE	in =	54.00	12.00
LAP SPLICE IF BELOW	in =	20.96	
HOOK EMBED INTO FTG	in =		6.00

Lap splice above base reduced by stress ratio
Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	1,500
Fs	psi =	24,000
Solid Grouting	=	Yes
Use Half Stresses	=	n/a
Modular Ratio 'n'	=	21.48
Short Term Factor	=	1.000
Equiv. Solid Thick.	in =	7.60
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	4,000.0
Fy	psi =	60,000.0

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Cantilevered Retaining Wall Design

Code: IBC 2006,ACI 318-05,ACI 530-05

Footing Dimensions & Strengths

Toe Width	=	4.33 ft
Heel Width	=	1.67
Total Footing Width	=	6.00
Footing Thickness	=	12.00 in
Key Width	=	24.00 in
Key Depth	=	24.00 in
Key Distance from Toe	=	4.00 ft

f'c = 4,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	620	417 psf
Mu' : Upward	=	5,355	216 ft-#
Mu' : Downward	=	1,687	315 ft-#
Mu: Design	=	3,668	99 ft-#
Actual 1-Way Shear	=	13.45	1.69 psi
Allow 1-Way Shear	=	94.87	94.87 psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = # 4 @ 12.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.50 in, #5@ 14.50 in, #6@ 20.50 in, #7@ 28.00 in, #8@ 36.75 in, #9@ 46
Heel: Not req'd, Mu < S * Fr
Key: Not req'd, Mu < S * Fr

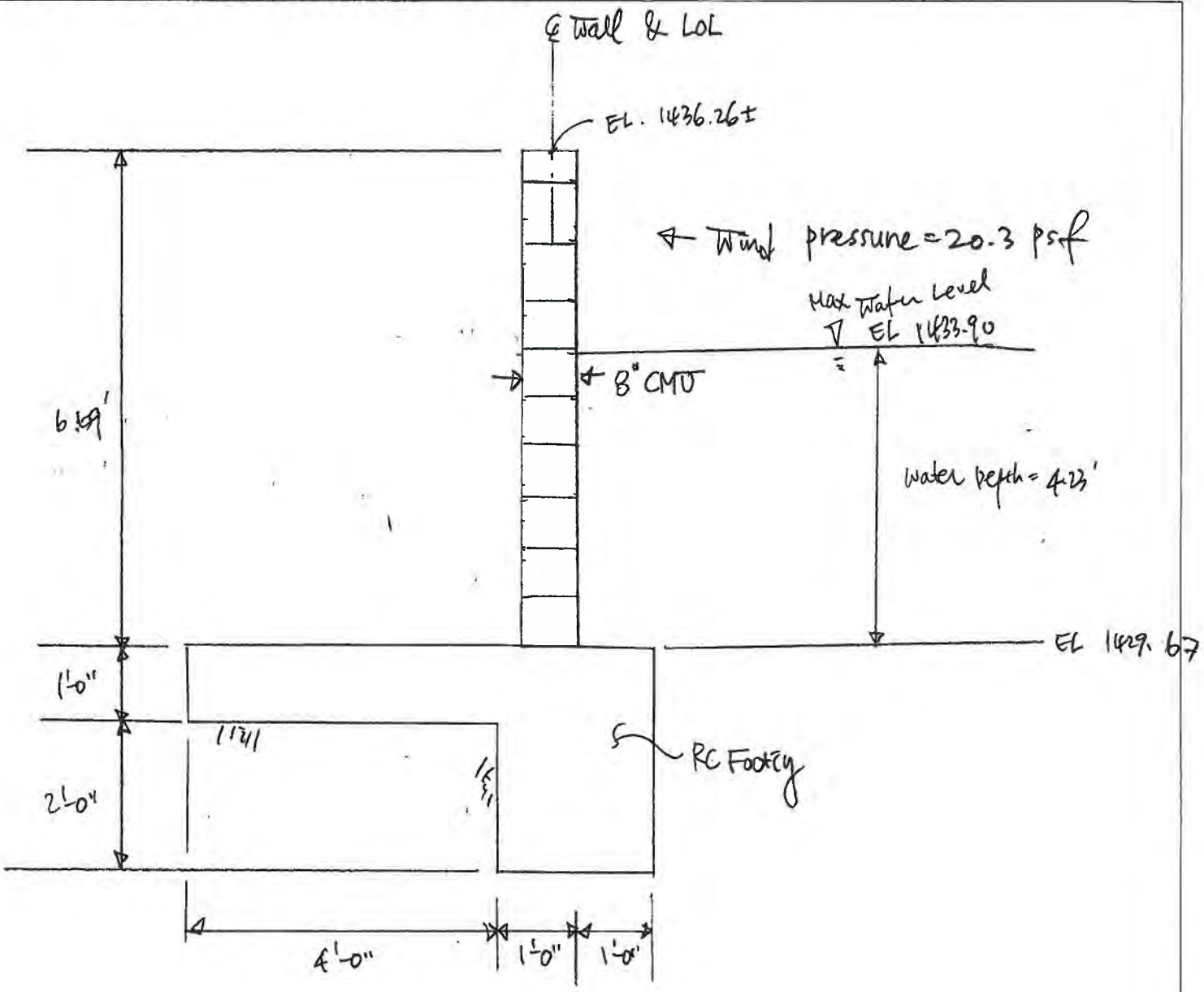
Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,499.7	2.30	3,449.3	Soil Over Heel	=	372.9	5.50	2,050.5
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=	47.9	8.08	387.1	* Axial Live Load on Stem	=			
	=				Soil Over Toe	=	372.9		
					Surcharge Over Toe	=			
Total		1,547.6	O.T.M.	3,836.4	Stem Weight(s)	=	720.6	4.66	3,360.2
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	900.0	3.00	2,700.0
					Key Weight	=	600.0	5.00	3,000.0
					Vert. Component	=			
					Total =		2,593.5 lbs	R.M.=	11,110.8

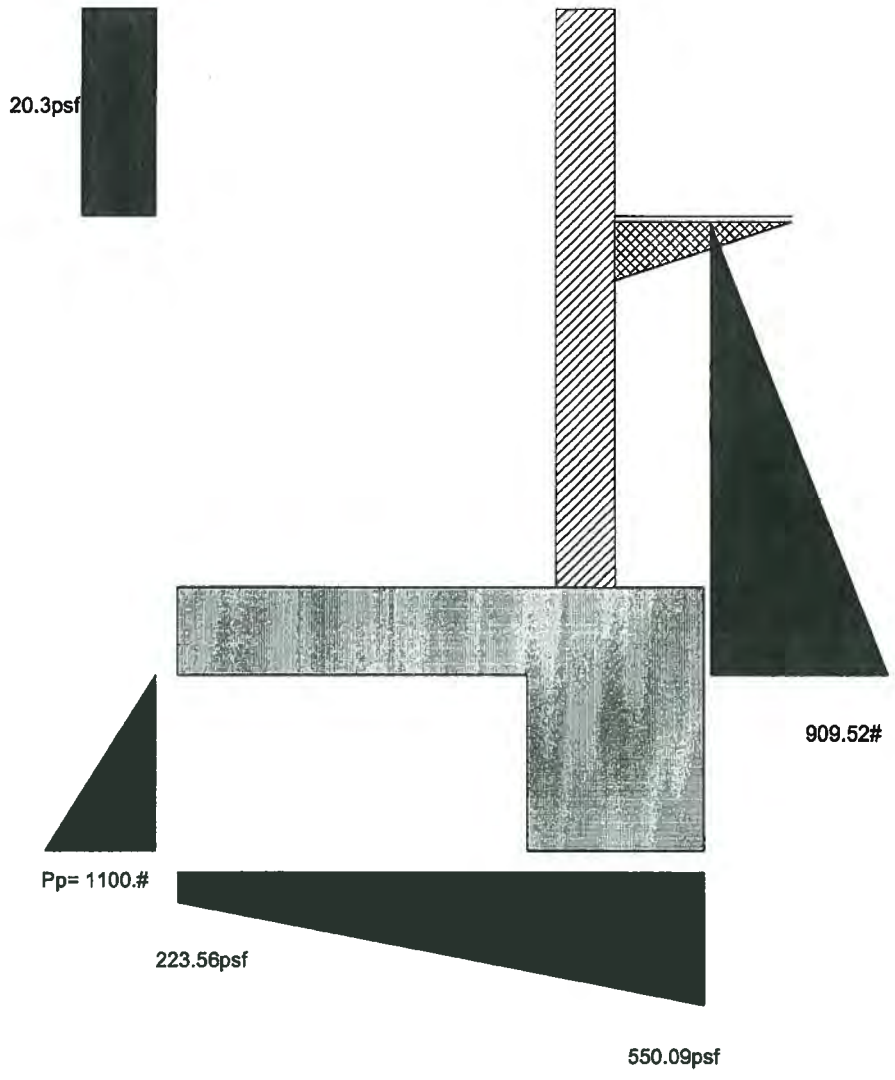
Resisting/Overturning Ratio = 2.90
Vertical Loads used for Soil Pressure = 2,593.5 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

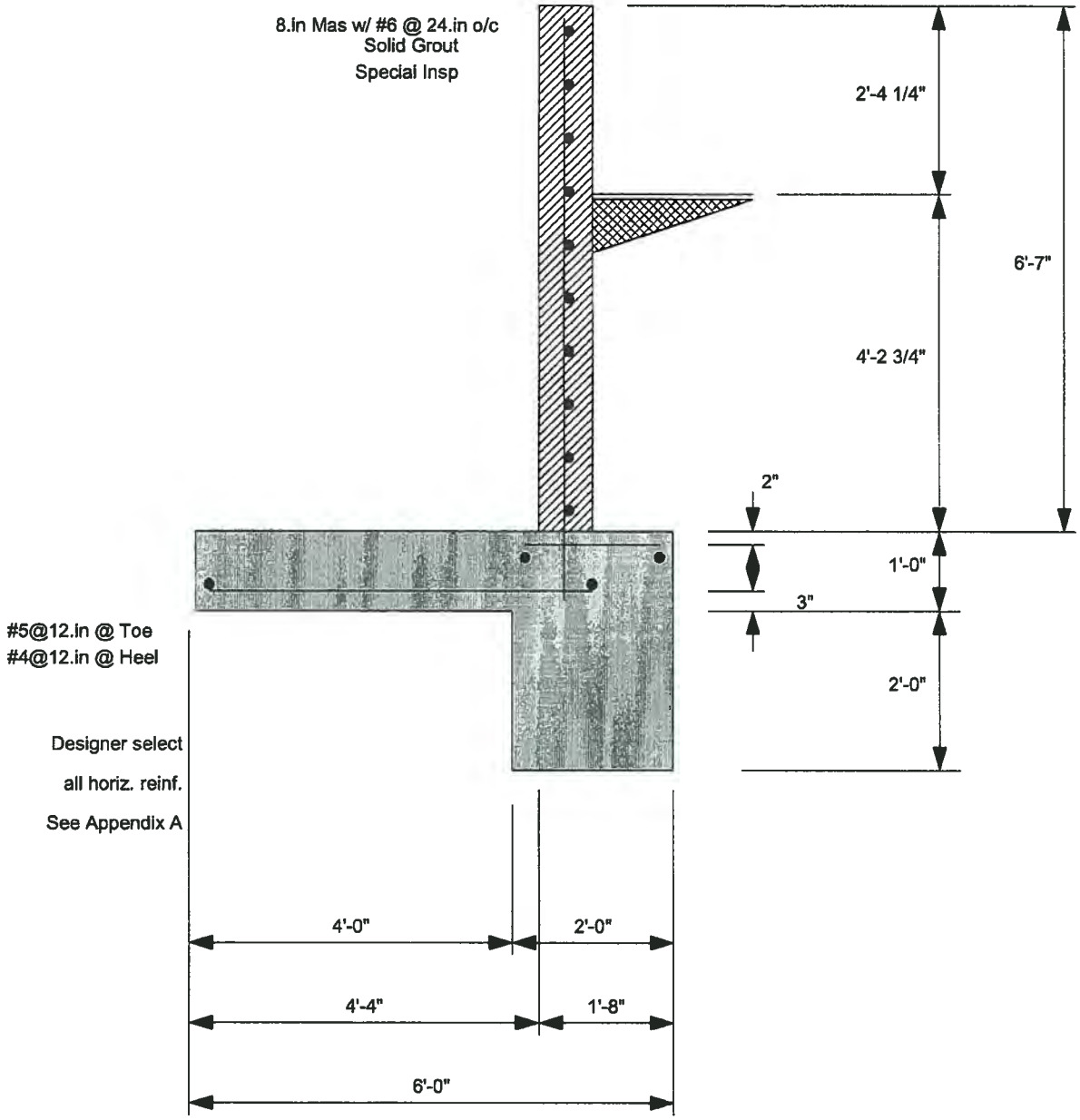
DESIGNER NOTES:


℄ Wall & LOL
EL. 1436.26±
← Wind pressure = 20.3 psf
Max Water Level
EL 1433.90
8" CMU
6'-9"
Water Depth = 4.23'
EL 1429.67
1'-0"
2'-0"
1'-4"
1'-4"
RC Footing
4'-0"
1'-0"
1'-0"

SECTION B-B



SEC. B-B


8.In Mas w/ #6 @ 24.in o/c
Solid Grout
Special Insp
2'-4 1/4"
6'-7"
4'-2 3/4"
2"
1'-0"
3"
2'-0"
#5@12.In @ Toe
#4@12.In @ Heel
Designer select
all horiz. reinf.
See Appendix A
4'-0"
2'-0"
4'-4"
1'-8"
6'-0"

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Cantilevered Retaining Wall Design

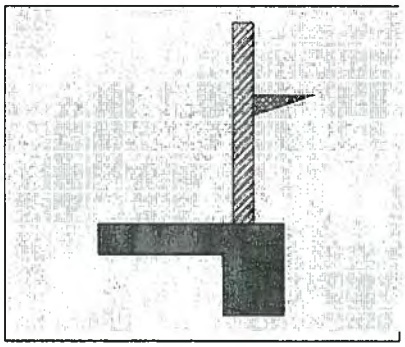
Code: IBC 2006,ACI 318-05,ACI 530-05

Criteria

Retained Height	=	4.23 ft
Wall height above soil	=	2.36 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	63.0 psf/ft
	=	
Passive Pressure	=	275.0 psf/ft
Soil Density, Heel	=	63.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.550
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	20.3 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	5.39	OK
Sliding	=	2.61	OK
Total Bearing Load	=	2,321 lbs	
...resultant ecc.	=	5.06 in	
Soil Pressure @ Toe	=	224 psf	OK
Soil Pressure @ Heel	=	550 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	268 psf	
ACI Factored @ Heel	=	660 psf	
Footing Shear @ Toe	=	9.7 psi	OK
Footing Shear @ Heel	=	1.1 psi	OK
Allowable	=	94.9 psi	

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	909.5 lbs	
less 100% Passive Force	= -	1,100.0 lbs	
less 100% Friction Force	= -	1,276.5 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 : 1 Stability	=	0.0 lbs	OK

Load Factors

Building Code	IBC 2006,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	2.000
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

Design Height Above Ftg	ft =	Stem OK	0.00
Wall Material Above "Ht"	=		Masonry
Thickness	=		8.00
Rebar Size	=		# 6
Rebar Spacing	=		24.00
Rebar Placed at	=		Center

Design Data

fb/FB + fa/Fa	=	**0.944**
Total Force @ Section	lbs =	611.5
Moment....Actual	ft-# =	1,053.9
Moment.....Allowable	=	1,116.2
Shear.....Actual	psi =	13.6
Shear.....Allowable	psi =	38.7
Wall Weight	=	84.0
Rebar Depth 'd'	in =	3.75
LAP SPLICE IF ABOVE	in =	54.00
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	7.24

Lap splice above base reduced by stress ratio
Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	1,500
Fs	psi =	24,000
Solid Grouting	=	Yes
Use Half Stresses	=	n/a
Modular Ratio 'n'	=	21.48
Short Term Factor	=	1.000
Equiv. Solid Thick.	in =	7.60
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	
Fy	psi =	

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Cantilevered Retaining Wall Design

Code: IBC 2006,ACI 318-05,ACI 530-05

Footing Dimensions & Strengths

Toe Width	=	4.33 ft
Heel Width	=	1.67
Total Footing Width	=	6.00
Footing Thickness	=	12.00 in
Key Width	=	24.00 in
Key Depth	=	24.00 In
Key Distance from Toe	=	4.00 ft

f'c = 4,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	268	660 psf
Mu' : Upward	=	4	9 ft-#
Mu' : Downward	=	3	7 ft-#
Mu: Design	=	1	-2 ft-#
Actual 1-Way Shear	=	9.75	1.12 psi
Allow 1-Way Shear	=	94.87	94.87 psi
Toe Reinforcing	=	# 5 @ 12.00 in	
Heel Reinforcing	=	# 4 @ 12.00 In	
Key Reinforcing	=	# 4 @ 0.00 in	

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: Not req'd, Mu < S * Fr

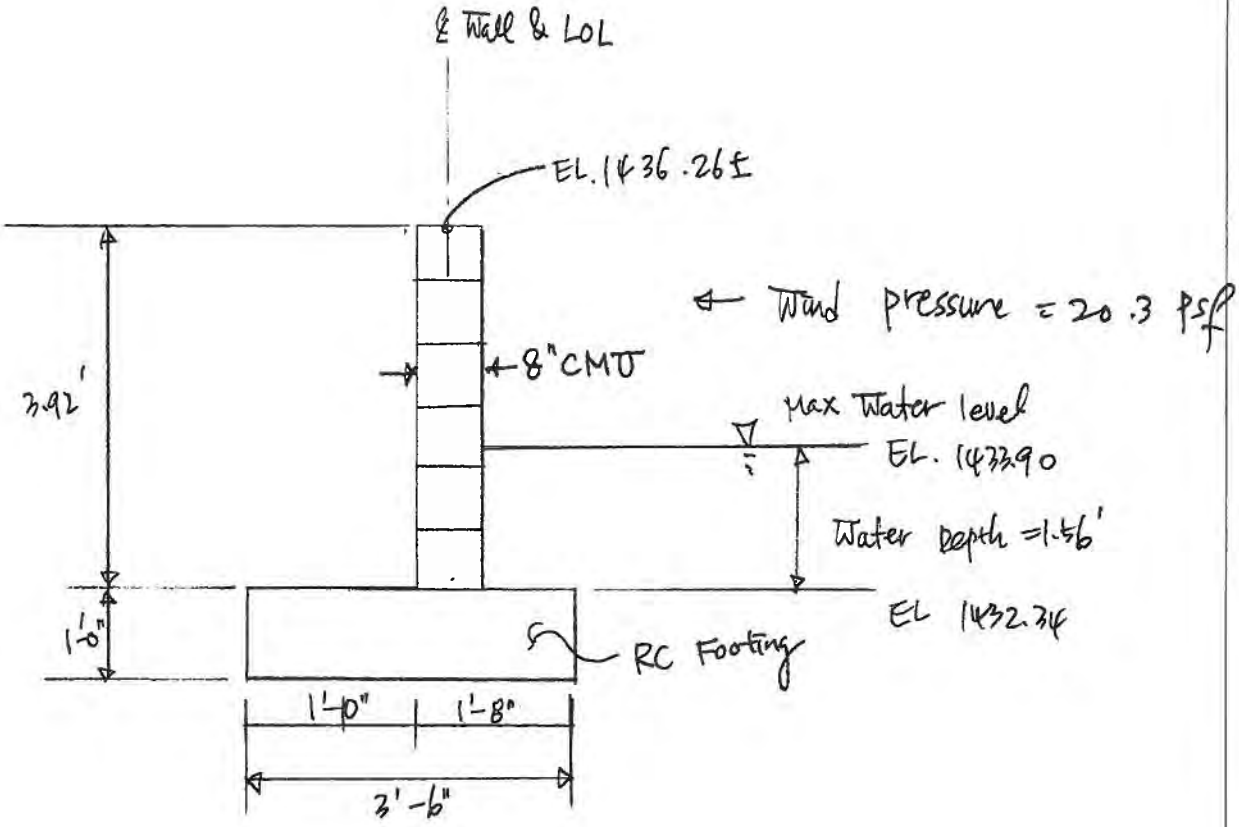
Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	861.6	1.74	1,502.1	Soil Over Heel	=	267.4	5.50	1,470.1
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=	47.9	6.41	307.1	* Axial Live Load on Stem	=			
	=				Soil Over Toe	=	267.4		
					Surcharge Over Toe	=			
Total		909.5	**O.T.M.**	1,809.2	Stem Weight(s)	=	553.6	4.66	2,581.4
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	900.0	3.00	2,700.0
					Key Weight	=	600.0	5.00	3,000.0
					Vert. Component	=			
					Total	=	2,320.9 lbs	**R.M.=**	9,751.6

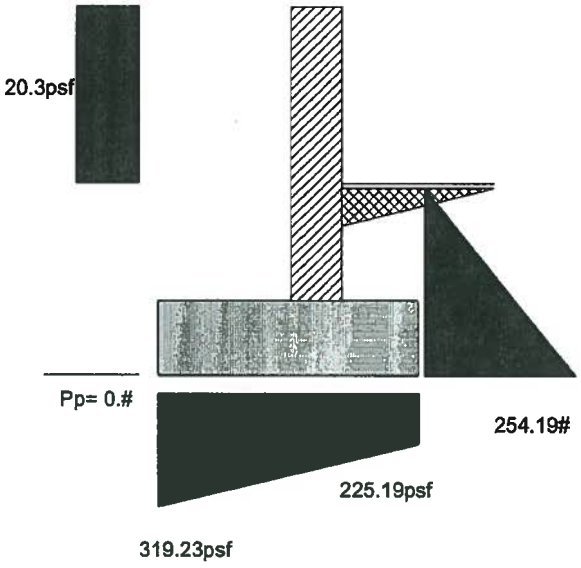
Resisting/Overturning Ratio = 5.39
Vertical Loads used for Soil Pressure = 2,320.9 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

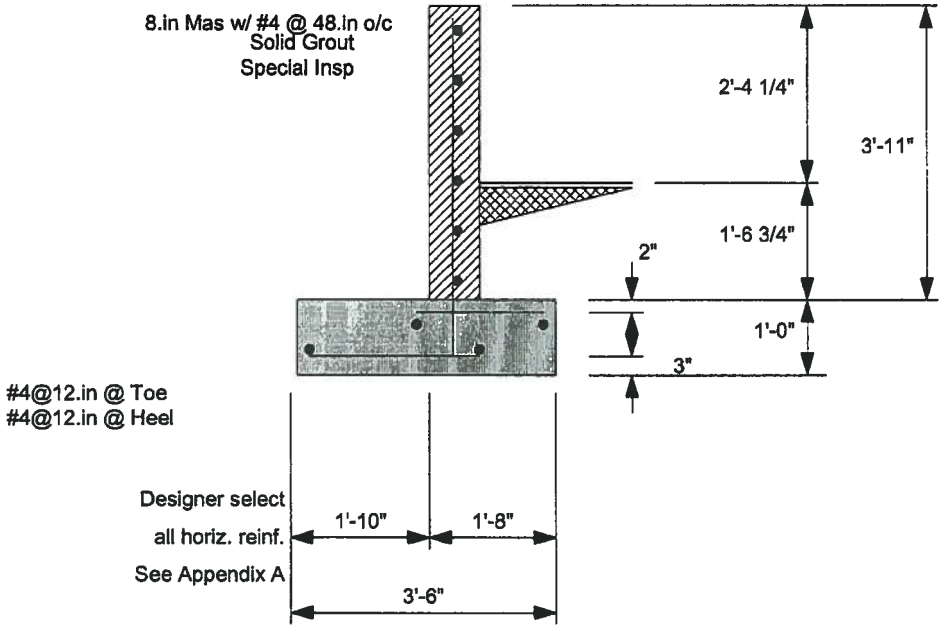
DESIGNER NOTES:


℄ Wall & LOL
EL. 1436.26±
← Wind pressure = 20.3 psf
8" CMU
3.92'
Max Water level
EL. 1433.90
Water depth = 1.56'
EL 1432.34
1'-0"
RC Footing
1'-0"
1'-8"
3'-6"

SECTION C-C



Sec. C - C


8.in Mas w/ #4 @ 48.in o/c
Solid Grout
Special Insp
2'-4 1/4"
3'-11"
1'-6 3/4"
2"
1'-0"
3"
#4@12.in @ Toe
#4@12.in @ Heel
Designer select
all horiz. reinf.
See Appendix A
1'-10"
1'-8"
3'-6"

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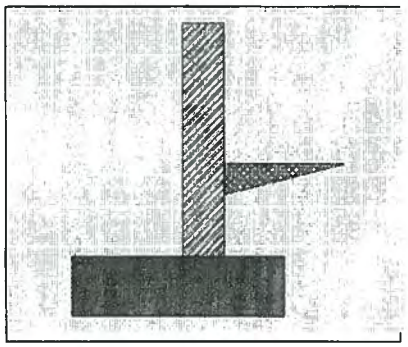
Code: IBC 2006,ACI 318-05,ACI 530-05

Criteria

Retained Height	=	1.56 ft
Wall height above soil	=	2.36 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	63.0 psf/ft
	=	
Passive Pressure	=	275.0 psf/ft
Soil Density, Heel	=	63.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.550
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	20.3 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	5.43 OK
Sliding	=	2.06 OK
Total Bearing Load	=	953 lbs
...resultant ecc.	=	1.21 in
Soil Pressure @ Toe	=	319 psf OK
Soil Pressure @ Heel	=	225 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	383 psf
ACI Factored @ Heel	=	270 psf
Footing Shear @ Toe	=	3.1 psi OK
Footing Shear @ Heel	=	0.1 psi OK
Allowable	=	94.9 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	254.2 lbs
less 100% Passive Force	= -	0.0 lbs
less 100% Friction Force	= -	524.0 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

Building Code	IBC 2006,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	2.000
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Masonry
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	48.00
Rebar Placed at	=	Center

Design Data

fb/FB + fa/Fa	=	0.488
Total Force @ Section	lbs =	124.5
Moment....Actual	ft-# =	171.0
Moment.....Allowable	=	350.5
Shear.....Actual	psi =	2.8
Shear.....Allowable	psi =	38.7
Wall Weight	=	84.0
Rebar Depth 'd'	in =	3.75
LAP SPLICE IF ABOVE	in =	24.00
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	6.00

Lap splice above base reduced by stress ratio
Hook embedment reduced by stress ratio

Masonry Data

f'm	psi =	1,500
Fs	psi =	24,000
Solid Grouting	=	Yes
Use Half Stresses	=	n/a
Modular Ratio 'n'	=	21.48
Short Term Factor	=	1.000
Equiv. Solid Thick.	in =	7.60
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	
Fy	psi =	

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Cantilevered Retaining Wall Design

Code: IBC 2006,ACI 318-05,ACI 530-05

Footing Dimensions & Strengths

Toe Width	=	1.83 ft
Heel Width	=	1.67
Total Footing Width	=	3.50
Footing Thickness	=	12.00 in
Key Width	=	24.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	1.00 ft

f'c = 4,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	383	270 psf
Mu' : Upward	=	5	4 ft-#
Mu' : Downward	=	3	4 ft-#
Mu: Design	=	3	0 ft-#
Actual 1-Way Shear	=	3.11	0.10 psi
Allow 1-Way Shear	=	94.87	94.87 psi

Toe Reinforcing = # 4 @ 12.00 in
Heel Reinforcing = # 4 @ 12.00 in
Key Reinforcing = # 4 @ 0.00 in

Other Acceptable Sizes & Spacings
Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: Not req'd, Mu < S * Fr

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	206.3	0.85	176.0	Soil Over Heel	=	98.5	3.00	295.5
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=	47.9	3.74	179.1	* Axial Live Load on Stem	=			
	=				Soil Over Toe	=	98.5		
					Surcharge Over Toe	=			
Total		254.2	O.T.M.	355.1	Stem Weight(s)	=	329.2	2.16	712.2
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	525.0	1.75	918.8
					Key Weight	=		2.00	
					Vert. Component	=			
					Total	=	952.7 lbs	R.M.=	1,926.4

Resisting/Overturning Ratio = 5.43
Vertical Loads used for Soil Pressure = 952.7 lbs

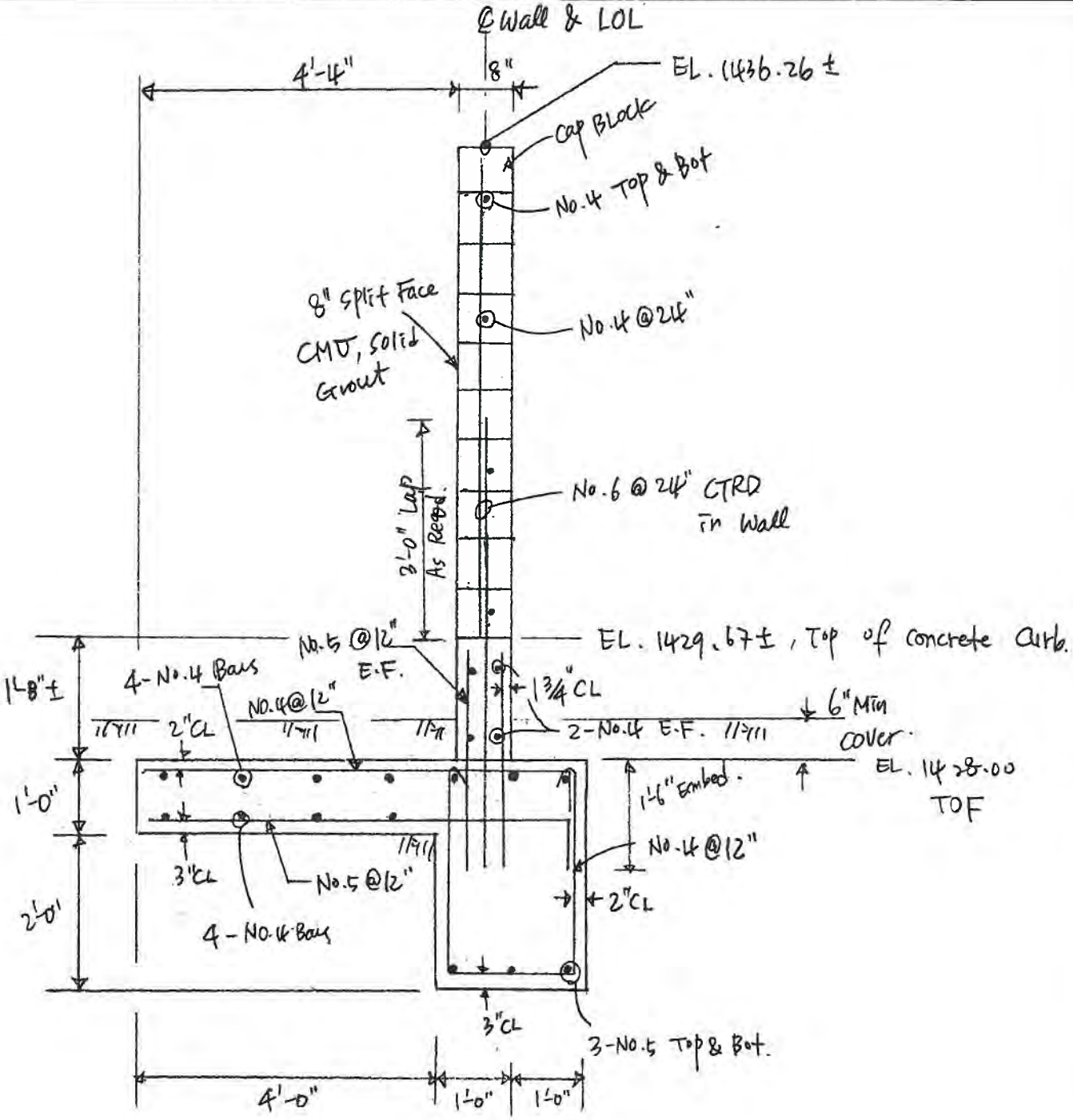
* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

DESIGNER NOTES:

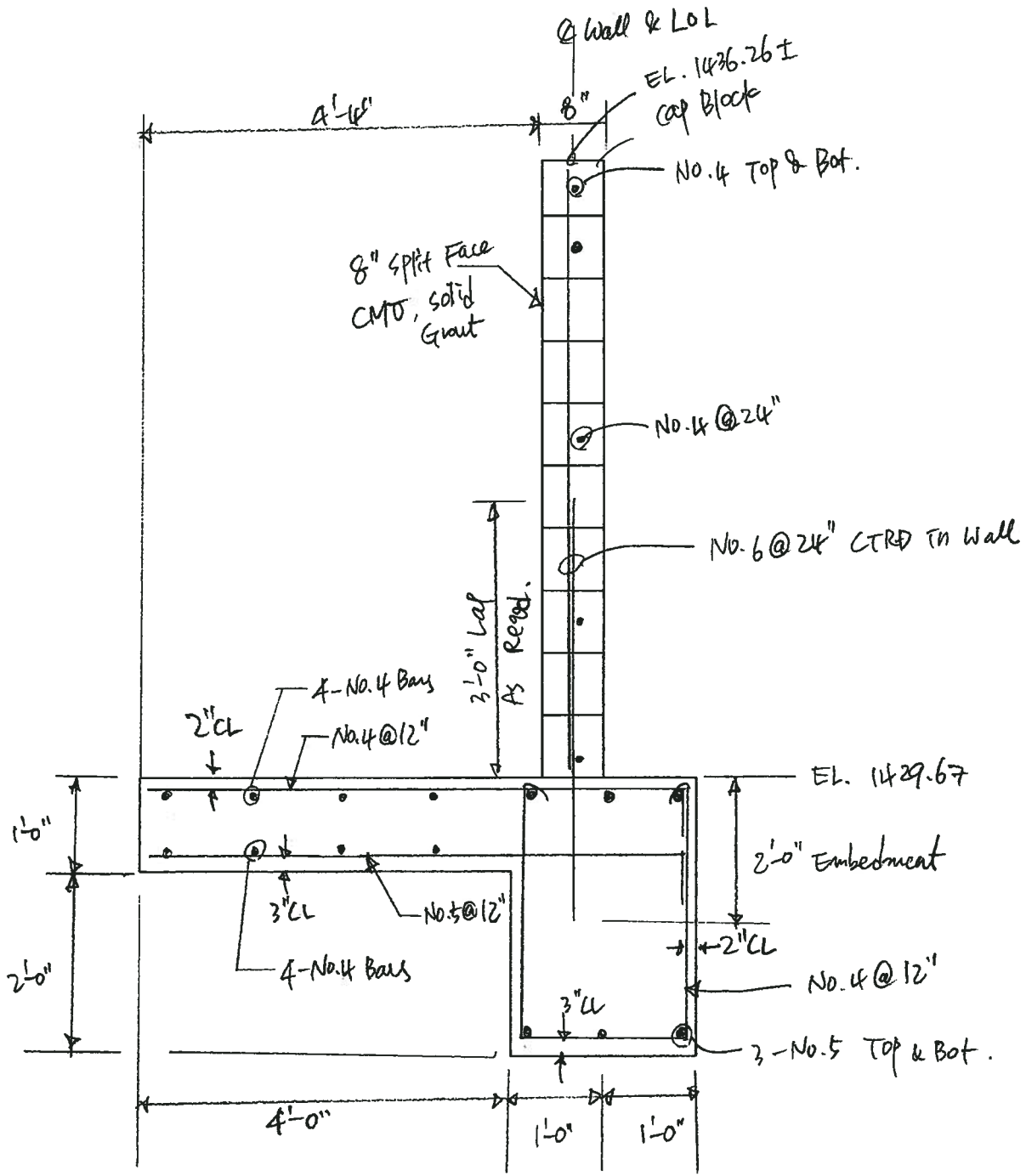
Subject: Lake Las Vegas - Flood Wall Design		
Comp by: JL Check by: JC	Date: 10/2/12 Job Number: 10002085B	Sheet Number:

ATKINS

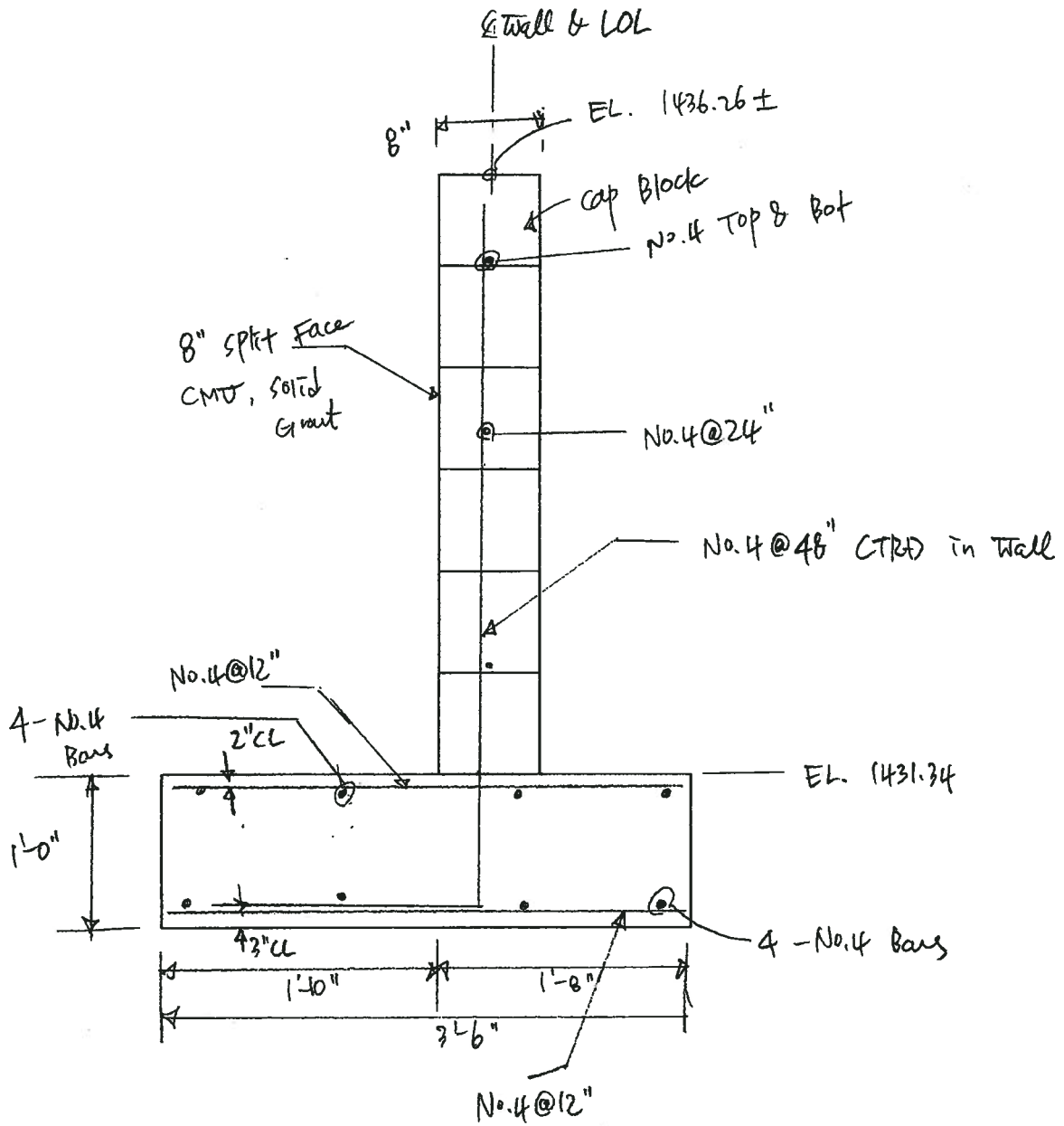
23



SECTION A-A


℄ Wall & LOL
EL. 1436.26 ±
Cap Block
4'-4"
8"
No.4 Top & Bot.
8" Split Face CMU, solid Grout
No.4 @24"
No.6 @24" CTRD In Wall
2'-0" Lap As Reqd.
4-No.4 Bars
2"CL
No.4@12"
EL. 1429.67
1'-0"
2'-0" Embedment
3"CL
No.5@12"
2"CL
2'-0"
4-No.4 Bars
No.4 @12"
3"CL
3-No.5 Top & Bot.
4'-0"
1'-0"
1'-0"

SECTION B-B


℄Wall & LOL
8"
EL. 1436.26 ±
Cap Block
No.4 Top & Bot
8" split Face CMU, solid Grout
No.4@24"
No.4@48" CTRD in Wall
No.4@12"
4-No.4 Bars
2"CL
EL. 1431.34
1'-0"
4-No.4 Bars
4"CL
1'-10"
1'-8"
3'-6"
No.4@12"

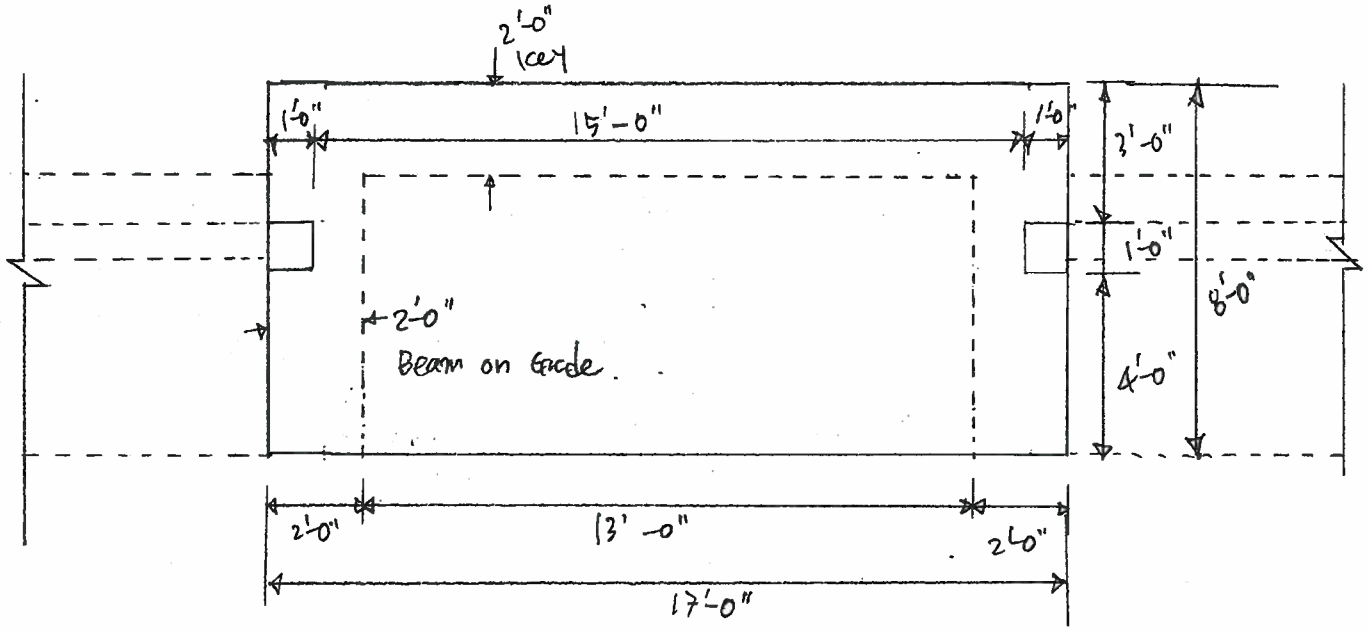
SECTION C-C

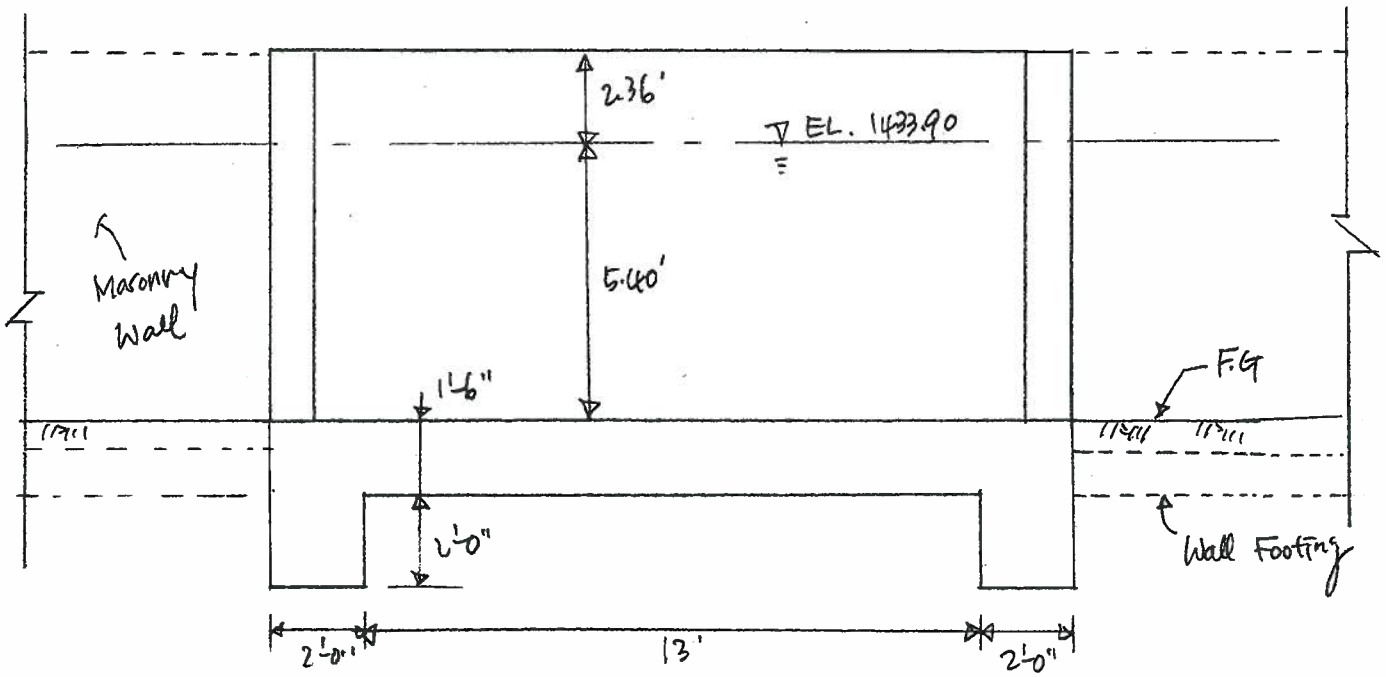
Subject: Lake Las Vegas - Flood Wall Design		
Comp by: JL Check by: JC	Date: 10/4/12 Job Number: 10003088	Sheet Number:

ATKINS

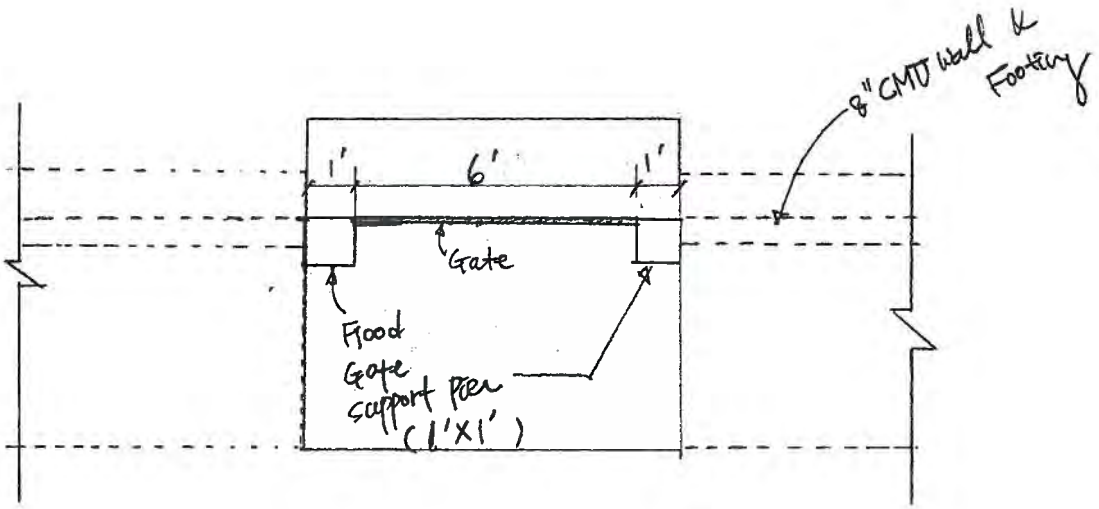
26

15'X7' Gate





6' x 7' Gate



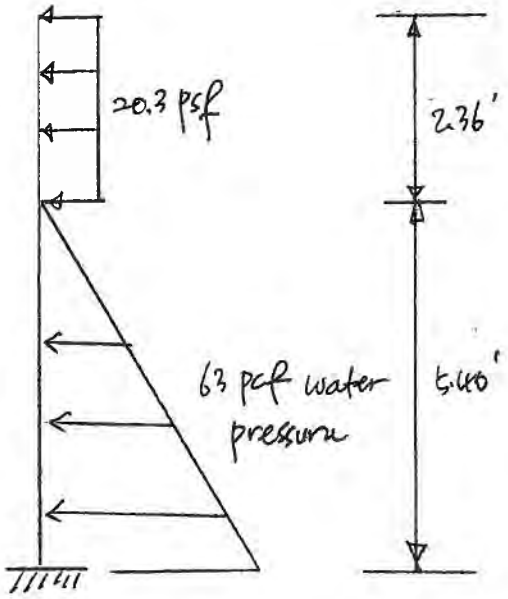
PLAN

Subject: Lake Las Vegas - Floodwall Design		
Comp by: JL Check by: JC	Date: 10/4/12 Job Number: 10003858	Sheet Number:

ATKINS

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Flood Gate support pier (15' x 7' Gate)



Wind pressure on piers is

$$P_W = (20.3\ psf)(2.36')(17')(10^{-3}) = 0.81^K$$

At each pier, shear is

$$P_{pier,W} = 0.81^K / 2\ piers = 0.41\ ^K/_{pier} \text{ @ } (5.46' + 2.36'/2) = 6.58' \text{ from TOF.}$$

Moment due to wind pressure is

$$M_{pier,W} = (0.41^K)(6.58') = 2.70\ K\text{-ft @ Bot.}$$

Flood Gate Support Pier (15' x 7' Gate)

Water pressure on pier is

$$P_H = \frac{1}{2}\gamma_w H^2 \cdot \text{Width} = \frac{1}{2}(63\ pcf)(5.4')^2(17')(10^{-3}) = 15.62^k$$

where, γ_w = Unit weight of water
H = Height
Width = Width of Gate plus pier width

At each pier, shear is

$$P_{pier,H} = 15.62^k/2\ piers = 7.81^k/pier \ @\ 5.4' \times 1/3 = 1.8'\ from\ TOF.$$

Moment due to water pressure is

$$M_{pier,H} = (7.81^k)(1.8') = 14.06\ k\text{-ft}$$

Load combination (per ASCE 7 2.3.3)

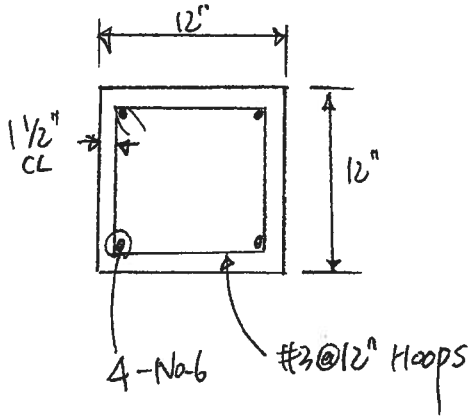
Assume special Flood Hazard Area per ASCE7 Sec. 5.2

Load comb. = $1.2D + 1.6W + 2.0F_a$

where, D = Dead Load
W = Wind Load
F_a = Flood Load

$$V_u = 1.6(0.81^k) + 2.0(7.81^k) = 16.92^k$$

$$M_u = 1.6(2.70^{k\text{-ft}}) + 2.0(14.06^{k\text{-ft}}) = 32.44\ k\text{-ft}$$



Try 2 - #6, $A_s = 2(0.44\ in^2) = 0.88\ in^2$

$$a = \frac{(0.88\ in^2)(60\ ksi)}{0.85(4\ ksi)(12")} = 1.29"$$

$$d = 12" - 1\tfrac{1}{2}"\ CL - 0.375" - 0.75"/2 = 9.75"$$

$$\phi M_n = (0.9)(0.88\ in^2)(60\ ksi)(9.75" - 1.29"/2)/12 = 36\ k\text{-}ft > M_u = 32.44\ k\text{-}ft \quad O.K$$

$$\phi V_c = \phi 2\sqrt{f_c'}\, b \cdot d = (0.85)\, 2\sqrt{4000}\,(12")(9.75")(10^{-3}) = 12.6\ k$$

$$\phi V_s = \phi \frac{A_v f_y \cdot d}{s} = (0.85)\frac{(0.22\ in^2)(60)(9.75")}{12"} = 9.11\ k \quad (\#3@12")$$

$$\phi V_n = \phi V_c + \phi V_s = 12.6 + 9.11 = 21.7^k > V_u = 16.92^k \quad O.K$$

Min. Flexural Reinforcement (ACI 10.5)

$$A_{s,min} = \frac{3\sqrt{f_c'}}{f_y} b_w \cdot d = \frac{3\sqrt{4000}}{60000}(12")(9.75") = 0.37\ in^2$$

or

$$200\, b_w \cdot d / f_y = 200(12")(9.75")/60000 = 0.39\ in^2 \quad \checkmark$$

<< provided $A_s = 0.88\ in^2$ O.K

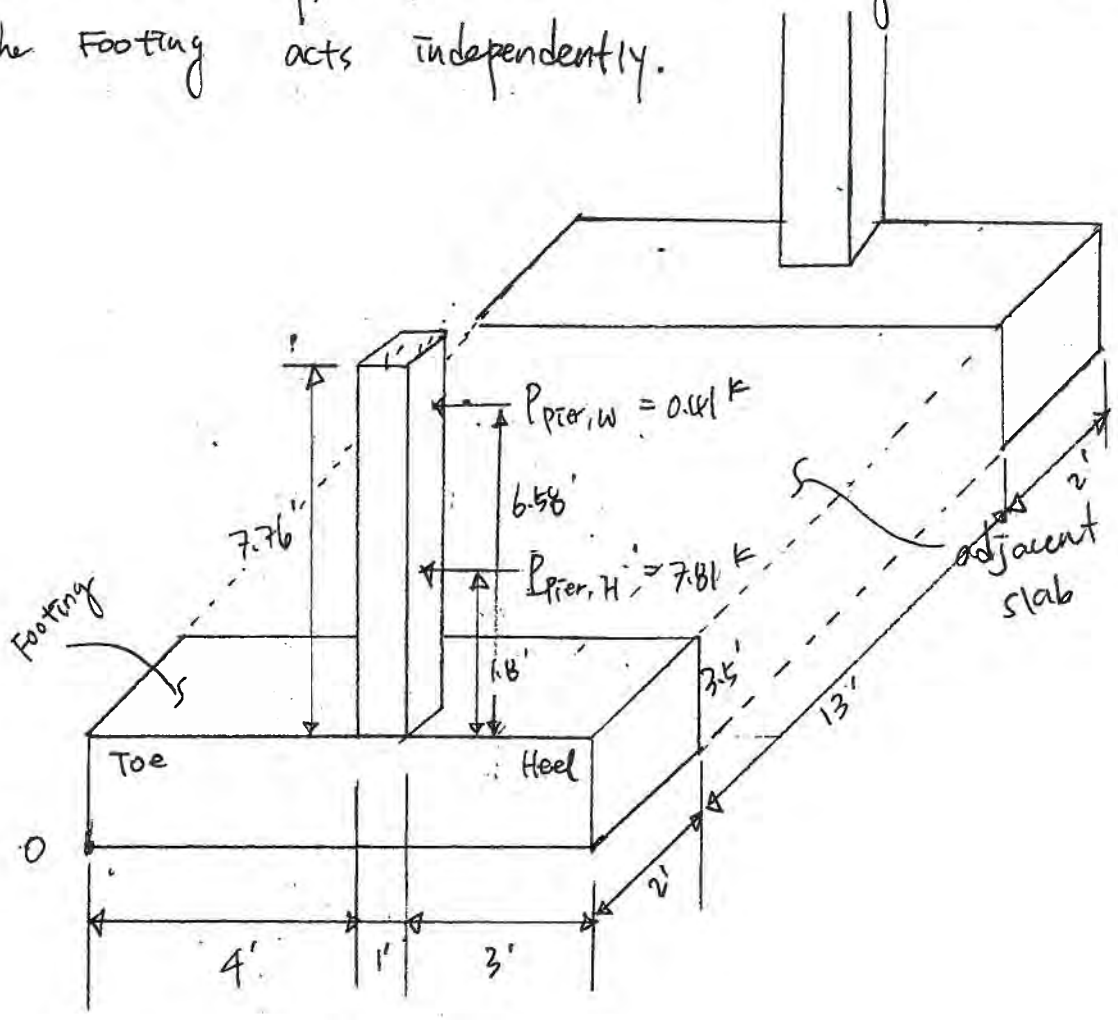
Min. Shear Reinforcement (ACI 11.4.6.3)

$$A_{v,min} = (50\, b_w \cdot s)/f_{yt} = 50(12")(12")/60000 = 0.12\ in^2$$

provided $A_v = (2 legs)(0.11\ in^2) = 0.22\ in^2$ O.K

Flood Gate pier Footing (15' x 7' Gate)

Assume Gate support pier is on the Footing on Grade, and the Footing acts independently.



Iso View

- Overturning Moment

	Force (k)	Arm (ft)	Moment (k-ft)
Water pressure	7.81	1.8' + 3.5' = 5.3	41.40
Wind pressure	0.41	6.58' + 3.5' = 10.08	4.13
Σ	8.22		45.53

- Resisting Moment (weight of steel Gate is ignored to be conservative)

	Force (k)	Arm (ft)	Moment (k-ft)
Pier	(0.15 kcf)(1')(1')(7.76') = 1.164	4.5	5.24
Footing	(0.15 kcf)(2')(2.5')(8') = 8.40	4	33.60
Adjacent slab	(0.15 kcf)(1.5')(13'/2)(8') = 11.70	4	46.8
Shear key in Front	(0.15 kcf)(2')(2')(13'/2) = 3.90	8'-1'=7	27.3
Water	(0.063 kcf)(3')(17'/2)(5.40') = 8.68	6.5	56.42
Σ	33.84		169.36

M_O = 45.53 k-ft

M_R = 169.36 k-ft

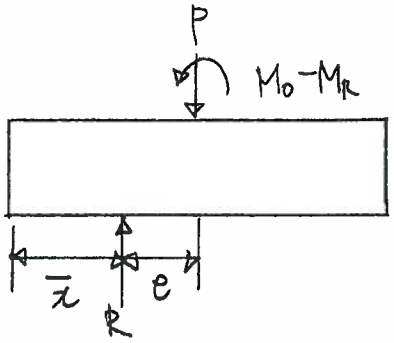
Overturning $F.S = M_R/M_O = 169.36/45.53 = 3.72 > F.S = 1.5$ O.K

Sliding Force, $F_S = 8.22^K$

Friction Force, $F_{fr} = 0.55\,(33.84^k) = 18.61^k$

Sliding $F.S = 18.61/8.22 = 2.26 > F.S. = 1.5$ O.K

Bearing pressure



$\bar{x} = (M_R - M_O)/R = (169.36 - 45.53)/33.84 = 3.66'$

$e = \frac{L}{2} - \bar{x} = 8'/2 - 3.66 = 0.34'$

$e < \frac{L}{6} = 8'/6 = 1.33'$ → Soil pressure distribution is trapezoidal

$$q_{max} = \frac{R}{BL}\left(1 + \frac{6e}{L}\right) = \frac{33.84}{(2')(8')}\left(1 + \frac{6(0.34)}{8}\right) = 2.65\ ksf$$

$< q_{all} = 1.33(2\,ksf) = 2.66\ ksf$ O.K

$$q_{min} = \frac{R}{BL}\left(1 - \frac{6e}{L}\right) = 1.58\ ksf$$

Factored soil pressure is shown in the spread sheet in next page

ATKINS

		Done By:	JL	**Date:**	10/5/2012
Subject:	Gate Support Pier Footing	**Check By:**	JC	**Date:**	10/6/12
	15'x7' Gate	**Sheet No.:**			
		Job No.	100030858		

Footing, B= 2 ft
Footing, L= 8 ft

Overturning Moment	Force (kips)	Arm(ft)	Moment(k-ft)	Load Factor	Factored Force(kips)	Factored Moment (k-ft)
Water Pressure	7.81	5.3	41.39	2.0	15.62	82.79
Wind Pressure	0.41	10.08	4.13	1.6	0.66	6.61
Sum=	8.22		45.53		16.28	89.40

Resisting Moment	Force (kips)	Arm(ft)	Moment(k-ft)	Load Factor	Factored Force(kips)	Factored Moment (k-ft)
Pier Weight	1.16	4.5	5.24	1.2	1.40	6.29
Footing	8.40	4	33.60	1.2	10.08	40.32
Adjacent Slab	11.70	4	46.80	1.2	14.04	56.16
Shear Key @ heel	3.90	7	27.30	1.2	4.68	32.76
Water	8.68	6.5	56.42	1.2	10.42	67.70
Sum	33.84		169.36		40.61	203.23

1. Allowable Strength Design

1.1 Check Overturning

M_o= 45.53 k-ft

M_R= 169.36 k-ft

$F.S=M_o/M_R$= 3.72 > 1.5 **OK**

1.2 Check Sliding

Sliding Force, F_s= 8.22 kips

Friction Force, F_μ= 18.61 kips

$F.S=F_S/F_\mu$= 2.26 > 1.5 **OK**

ATKINS

		Done By:	JL	**Date:**	10/5/2012
Subject:	Gate Support Pier Footing 15'x7' Gate	**Check By:**	JC	**Date:**	10/6/12
		Sheet No.:			
		Job No.	100030858		

1.3 Bearing Pressure

R=	33.84 kips	
$x= (M_R-M_o)/R=$	3.66 ft	
$e=L/2-x=$	0.34 ft	
L/6=	1.33 ft	e<= L/6, Trapezoidal Soil Pressure
$q_{max}=$	2.66 ksf	O.K. 1.33(2ksf)=2.66 ksf
$q_{min}=$	1.57 ksf	

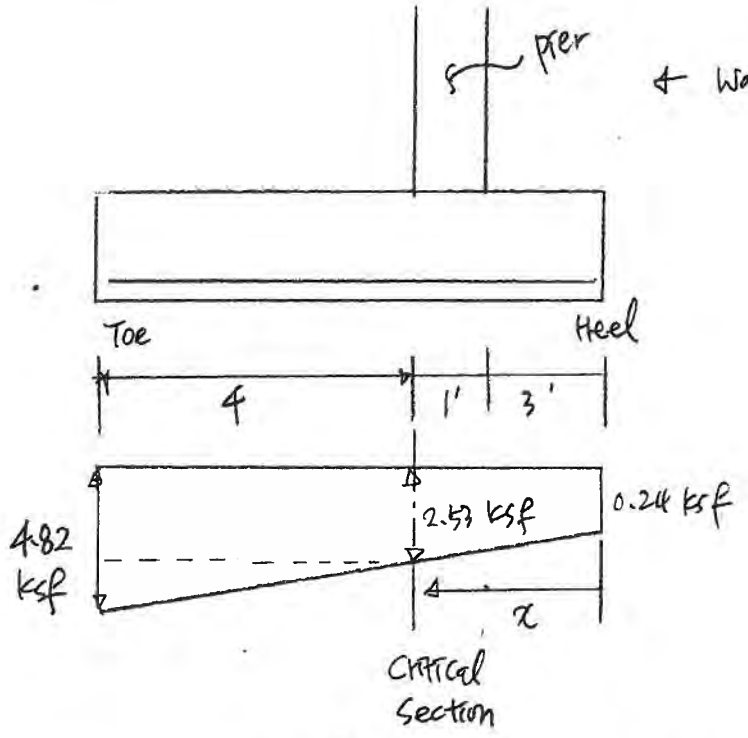
2. Strength Design

$M_o=$	89.40 k-ft	
$M_R=$	203.23 k-ft	
R=	40.61 kips	
$x= (M_R-M_o)/R=$	2.80 ft	
$e=L/2-x=$	1.20 ft	
L/6=	1.33 ft	e<= L/6, Trapezoidal Soil Pressure
$q_{max}=$	4.82 ksf	
$q_{min}=$	0.26 ksf	

Footing Reinforcement

From Factored soil pressure shown in spread sheet calcs,

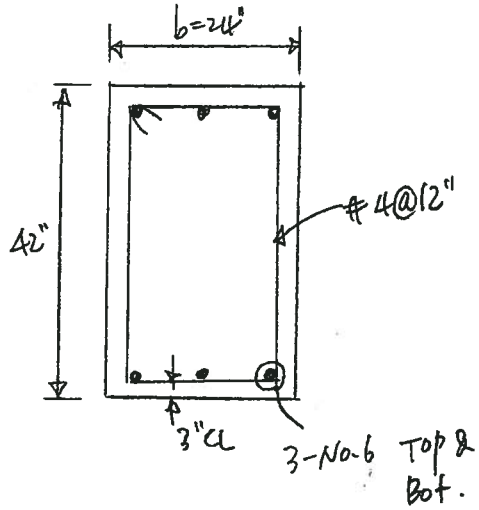
Toe Reinforcement



$$q_{x=4'} = 0.24\ ksf + \frac{(4.82 - 0.24)}{8} \times 4' = 2.53\ ksf$$

$$V_u = (2.53\ ksf)(4')(2') + \frac{1}{2}(4.82 - 2.53)(4)(2) = 20.24 + 9.16 = 29.40^k$$

$$M_u = (20.24^k)(2') + (9.16^k)(\tfrac{2}{3} \times 4') = 40.48 + 24.43 = 65\ k\text{-ft}$$



$b = 24"$

$d = 42" - 3"CL - 0.5" stirrup - 0.75"/2$

$= 38.125"$

$A_s = 3(0.44\ in^2) = 1.32\ in^2$

$$a = \frac{A_s \cdot f_y}{0.85 f_c' b} = \frac{(1.32)(60)}{0.85(4)(24)} = 0.97"$$

$$\phi M_n = \phi A_s f_y (d - a/2) = (0.9)(1.32)(60)(38.125 - 0.97/2)/12$$

$= 223.58$ k-ft $> M_u = 65$ k-ft O.K

Min. Flexural Reinforcement (ACI 10.5)

$$A_{s,min} = \frac{3\sqrt{f_c'}}{f_y} b_w \cdot d = \frac{3\sqrt{4000}}{60000} (24")(38.125") = 2.89\ in^2$$

$$200 b_w \cdot d / f_y = 200(24")(38.125")/60000 = 3.05\ in^2 \quad \checkmark$$

per ACI 10.5-3

$1.33 M_u < \phi M_n$, $A_{s,min}$ not required. use 3-#6 top & bot.

$$\phi V_c = \phi 2\sqrt{f_c'} b_w \cdot d = (0.85)(2\sqrt{4000})(24")(38.125")(10^{-3}) = 98.38^k$$

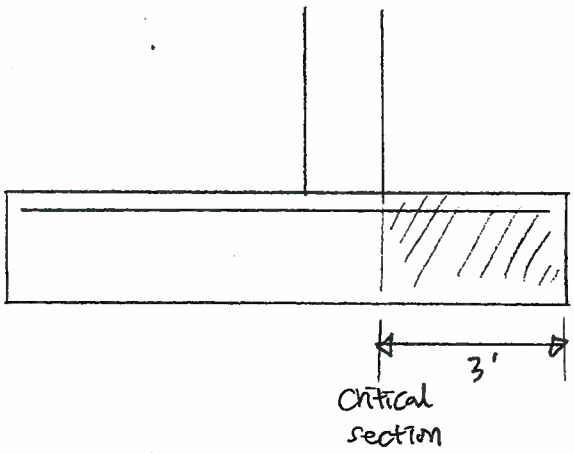
Min. Shear Reinforcement (ACI 11.4.6.3) $\gg V_u = 29.40^k$

$$A_{v,min} = 50 b_w \cdot s / f_{yt} = 50(24")(12")/60000 = 0.24\ in^2$$

Use #4 @ 12" stirrups ($A_v = (2\ legs)(0.2\ in^2) = 0.4\ in^2$)

→ Use same design for 6' x 7' Gate Footing

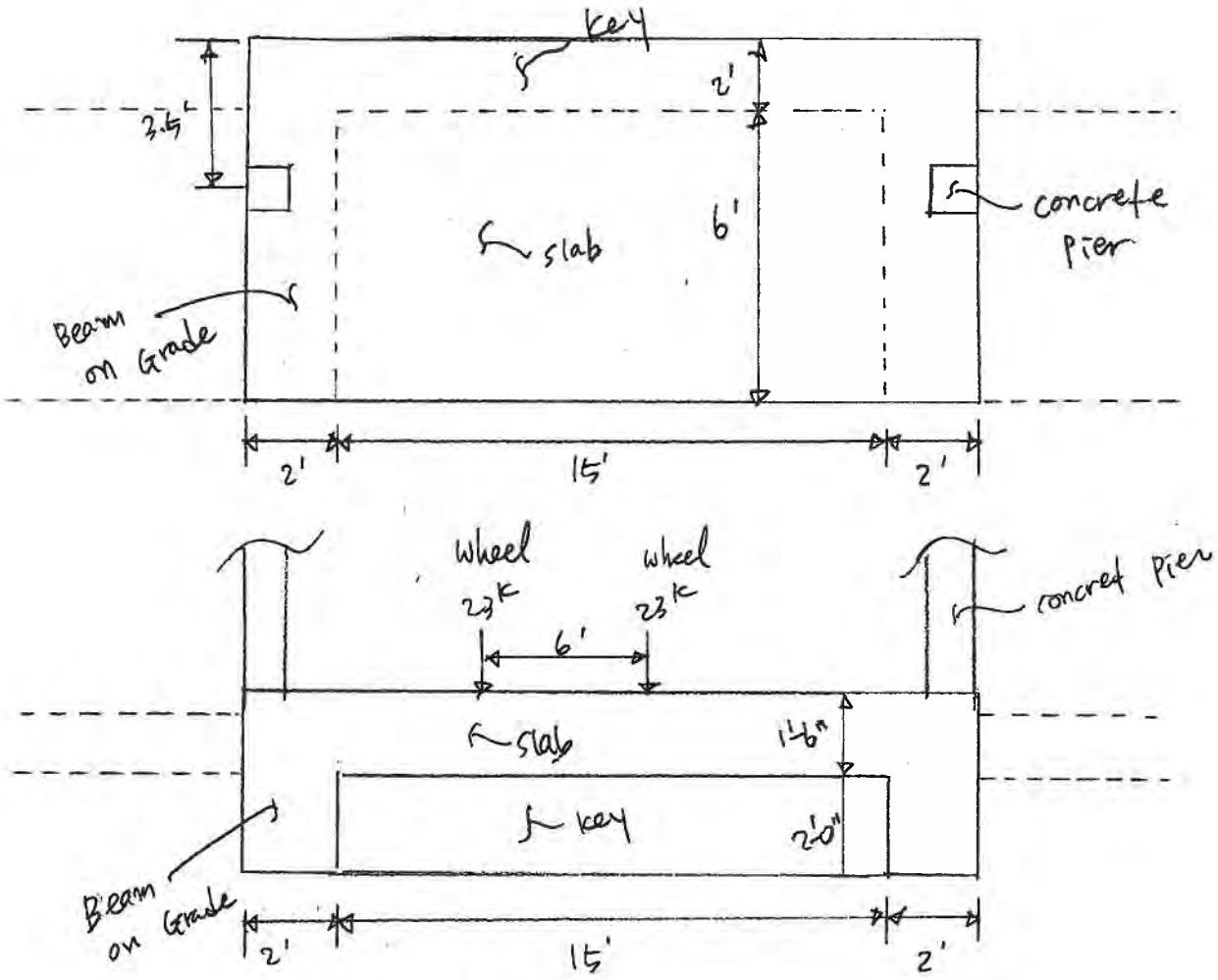
- Heel Reinforcement



	Weight (k)	Arm (ft)	Moment (k-ft)	Load Factor	Factored Shear (k)	Factored Moment (k-ft)
Footing	(0.15)(2)(3.5)(3) = 3.15	1.5	4.73	1.2	3.78	5.77
Adjacent Footing	(0.15)(1.5')(13'/2)(3) = 4.39	1.5	6.59	1.2	5.27	7.91
Shear key	(0.15)(2')(2')(13'/2) = 3.90	2	7.80	1.2	4.68	9.36
Water	(0.063)(3')(17'/2)(5.40') = 8.68	1.5	13.02	1.2	10.42	15.63
Σ					24.15	38.67

Use 3-#6 @ Top, By inspection, It is conservative.

Concrete Slab under Moving Tactor Truck



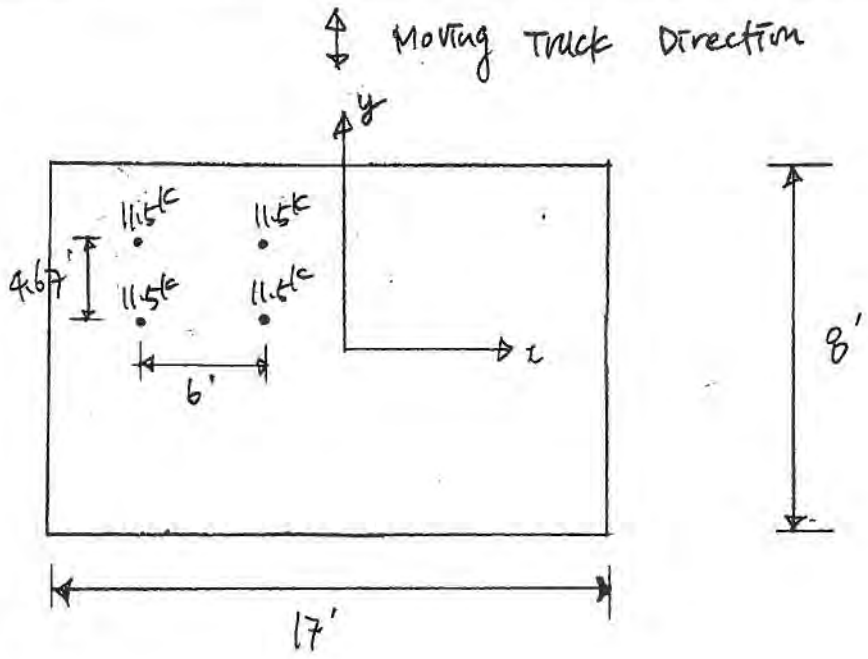
Assume the Footing is acting like Spread Footing & rigid therefore, soil Distribution is linear.

Also, assumed that Total 46K Axle Load is a point Load on top of Footing

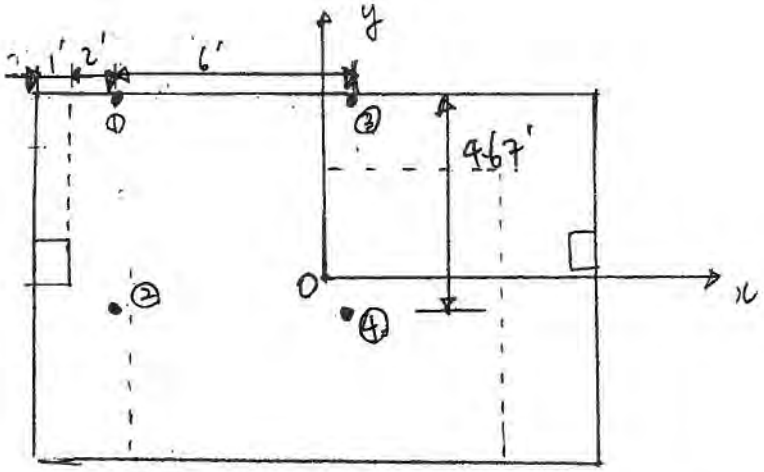
Subject: Lake Las Vegas - Floodwall Design		
Comp by: JL Check by: JC	Date: 10/8/12 Job Number: 100030858	Sheet Number:

ATKINS

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PLAN



At Location ①, Live Loads will be

	Weight, W(k)	x(ft)	Y(ft)	$M_{xLL} = W \times y$	$M_{yLL} = W \times x$
Wheel ①	11.5	-5.5	+4	46	-63.25
②	11.5	-5.5	-0.67	-7.71	-63.25
③	11.5	+0.5	+4	46	+5.75
④	11.5	+0.5	-0.67	-7.71	+5.75
Σ	46			76.58	-115

Dead Loads will be

	Weight, W (k)	x (ft)	y (ft)	$M_{x,DL} = W \times y$	$M_{y,DL} = W \times x$
Pier on Left	(0.15 kcf)(1')(1')(7.76') = 1.16	(-17/2) + 0.5' = -8	+0.5	+0.58	-9.28
Pier on Right	1.16	+8	+0.5	+0.58	+9.28
Beam on Left	(0.15 kcf)(2')(2')(8') = 4.8	-7.5	0	0	-36
Beam on Right	4.8	+7.5	0	0	+36
key	(0.15 kcf)(2')(2')(17') = 10.2	0	+3	+30.6	0
Slab	(0.15 kcf)(17')(8')(15') = 30.6	0	0	0	0
Σ	52.72			31.76	0

$P_{DL} = 52.72^{K}$

$M_{x,DL} = 31.76$ k-ft

$M_{y,DL} = 0$

$P_{LL} = 46^{K}$

$M_{x,LL} = 76.58$ k-ft

$M_{y,LL} = -115$ k-ft

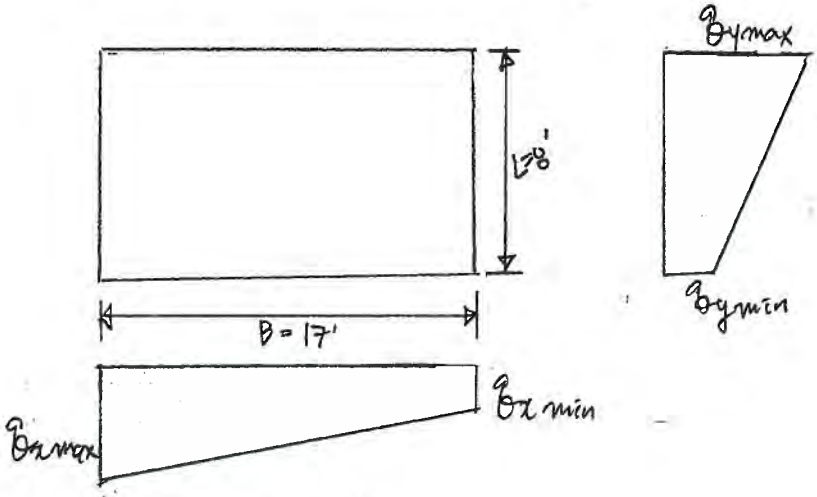
Load Combination

Comb. = 1.2DL + 1.6LL

$P_u = 1.2(52.72^{K}) + 1.6(46^{K}) = 137^{K}$

$M_{xu} = 1.2(31.76) + 1.6(76.58) = 161$ k-ft

$M_{yu} = 1.2(0) + 1.6(-115) = -184$ k-ft



$e_x = \frac{M_{yu}}{P_u} = \frac{-184}{137} = -1.34'$

$e_y = \frac{M_{xu}}{P_u} = \frac{161}{137} = +1.18'$

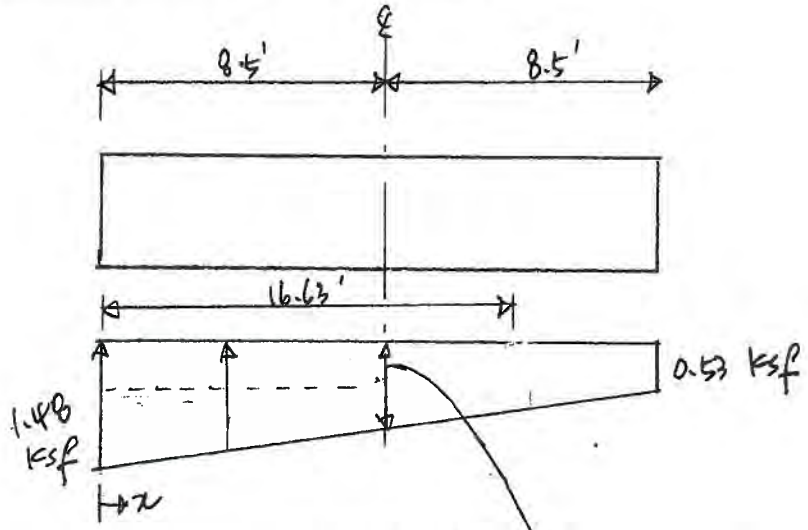
$|e_x| < \frac{B}{6} = 17/6 = 2.83'$ → Trapezoidal soil pressure

$|e_y| < \frac{L}{6} = 8'/6 = 1.33'$ → Trapezoidal soil pressure.

For x-direction.

$q_{x\,max} = \frac{P_u}{BL}\left(1 + \frac{6e_x}{B}\right) = \frac{137}{(17)(8)}\left(1 + \frac{6(1.34')}{17}\right) = 1.48$ ksf

$q_{x\,min} = \frac{P_u}{BL}\left(1 - \frac{6e_x}{B}\right) = 0.53$ ksf

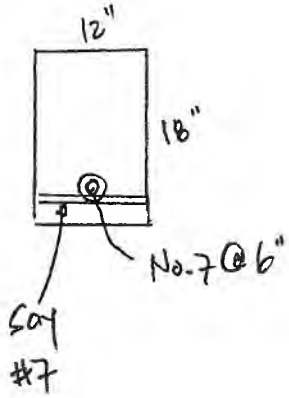


$q_{x=8.5'} = \frac{1.48 + 0.53}{2} = 1.00 \text{ ksf}$

$V_u @ ℄ = (1.00 \text{ ksf})(8.5') + \frac{1}{2}(1.48 - 1.00)(8.5) = 8.5^k + 2.04^k = 10.54^k/ft$

$M_u @ ℄ = (8.5^k)\left(\frac{8.5'}{2}\right) + (2.04^k)\left(\frac{2}{3} \times 8.5'\right)$

$\doteq 36.13 + 11.56 = 48 \text{ k-ft/ft}$



$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(1.2)(60)}{0.85(4)(12)} = 1.76"$

$d = 18" - 3"CL - 7/8" Bar - 7/8"/2 = 13.69"$

$\phi M_n = \phi A_s f_y (d - \frac{a}{2}) = (0.9)(1.20)(60)(13.69 - 1.76/2)/12$

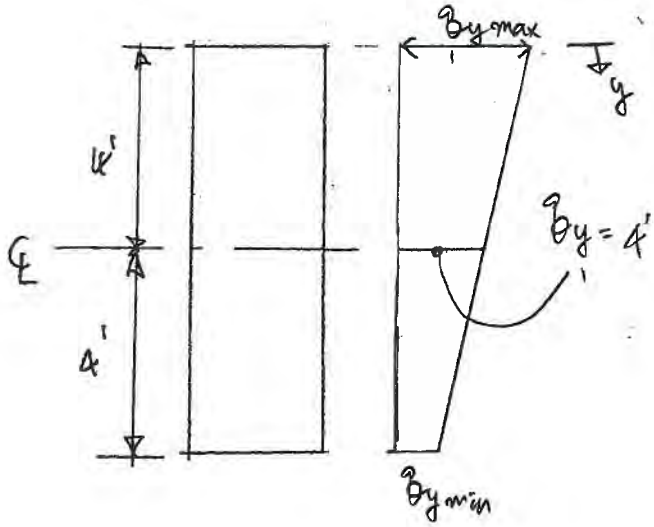
$= 69.3 \text{ k-ft/ft} > M_u = 48 \text{ k-ft/ft}$

O.K

For y-direction

$$q_{ymax} = \frac{P_u}{BL}\left(1 + \frac{6e_y}{L}\right) = \frac{137}{(17)(8)}\left(1 + \frac{6(1.18)}{8}\right) = 1.90 \text{ ksf}$$

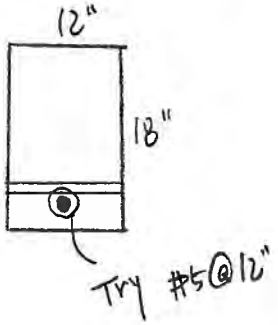
$$q_{ymin} = \frac{P_u}{BL}\left(1 - \frac{6e_y}{L}\right) = 0.12 \text{ ksf}$$



$$q_{y=4'} = \frac{1.90 + 0.12}{2} = 1.01$$

$$V_u @ ℄ = (1.01 \text{ ksf})(4') + \frac{1}{2}(1.90 - 1.01)(4')$$
$$= 4.04^k + 1.78^k = 5.82^k$$

$$M_u @ ℄ = (4.04^k)(4'/2) + (1.78^k)\left(\frac{2}{3} \times 4'\right) = 8.08 + 4.75$$
$$= 12.83 \text{ k-ft}$$



$$a = \frac{(0.31)(60)}{0.85(4)(12)} = 0.46"$$

$$d = 18" - 3"_{CL} - 5/8"/2 = 14.69"$$

$$\phi M_n = \phi A_s f_y \left(d - \frac{a}{2}\right)$$
$$= (0.9)(0.31)(60)(14.69 - 0.46/2)/12 = 20.17 \text{ k-ft/ft}$$

$> M_u = 12.83$ k-ft/ft O.K

Min. Flexural Reinforcement (ACI 10.5.4)

per ACI 7.12.2.1, For slab

$A_{s\min} = 0.0018\,bh = 0.0018(12")(18") = 0.39\ in^2/ft$

x direction (Top: #5@12" = 0.31 in^2/ft >> 0.39 in^2/ft o.k
Bot: #7@6" = 1.2 in^2/ft

y direction (Top: #5@12" = 0.31 in^2/ft >> 0.39 in^2/ft o.k
Bot: #5@12" = 0.31 in^2/ft

$\phi V_c = \phi\, 2\sqrt{f_c'}\, b_w d = (0.85)(2\sqrt{4000})(12)(13.69)(10^{-3}) = 17.67\ k/ft$

$> V_u = 13.05\ k/ft$ o.k

Min. shear Reinforcement (ACI 11.4.6)

Footing and solid slabs, Not required.

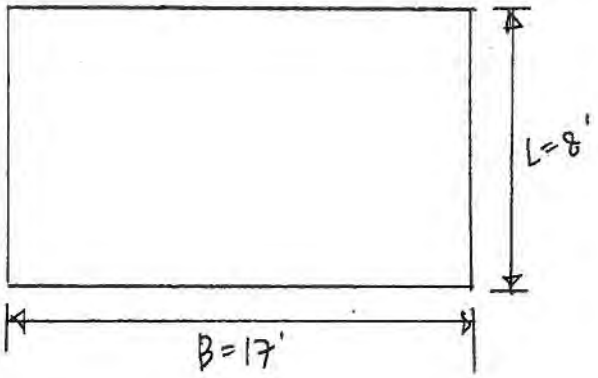
→ Use same detail for 6'x7' Gate slab.

Bearing pressure

$P = 52.72^k + 46^k = 98.72^k$

$M_x = 31.76 + 76.56 = 108$ k-ft

$M_y = 0 + -115 = -115$ k-ft



$e_x = \frac{M_y}{P} = \frac{-115}{98.72} = -1.16'$

$e_y = \frac{M_x}{P} = \frac{108}{98.72} = 1.09'$

$|e_x| < \frac{B}{6} = \frac{17'}{6} = 2.83'$ → Trapezoidal soil pressure

$|e_y| < \frac{L}{6} = 8'/6 = 1.33'$ → Trapezoidal soil pressure

Max. Bearing pressure

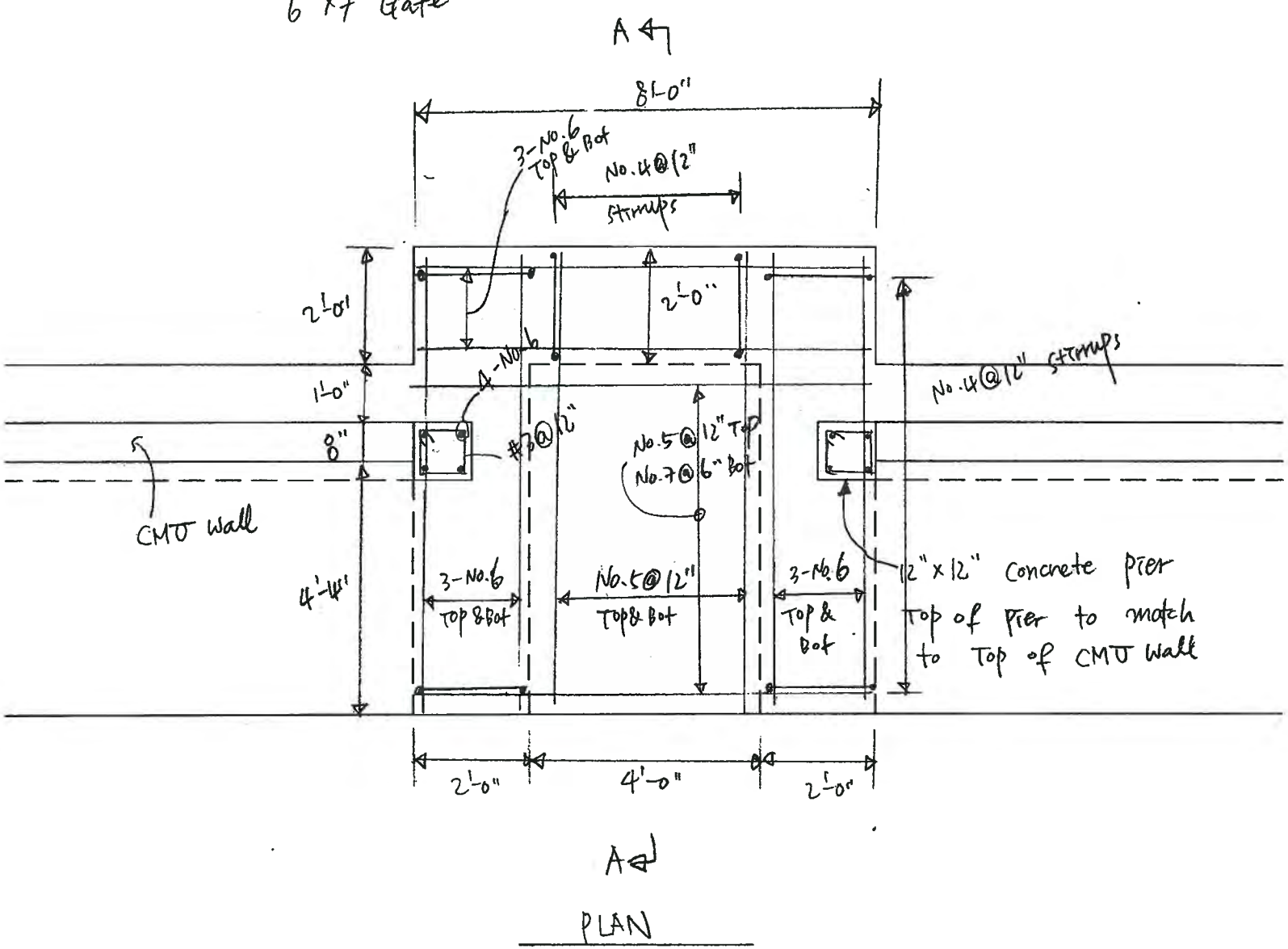
$$q_{max} = \frac{P}{BL}\left(1 + \frac{6e_x}{B} + \frac{6e_y}{L}\right)$$

$$= \frac{98.72}{(17)(8)}\left(1 + \frac{6(1.16)}{17} + \frac{6(1.09)}{8}\right) = 1.62 \text{ ksf} < 2.0 \text{ ksf}$$

q_{all}

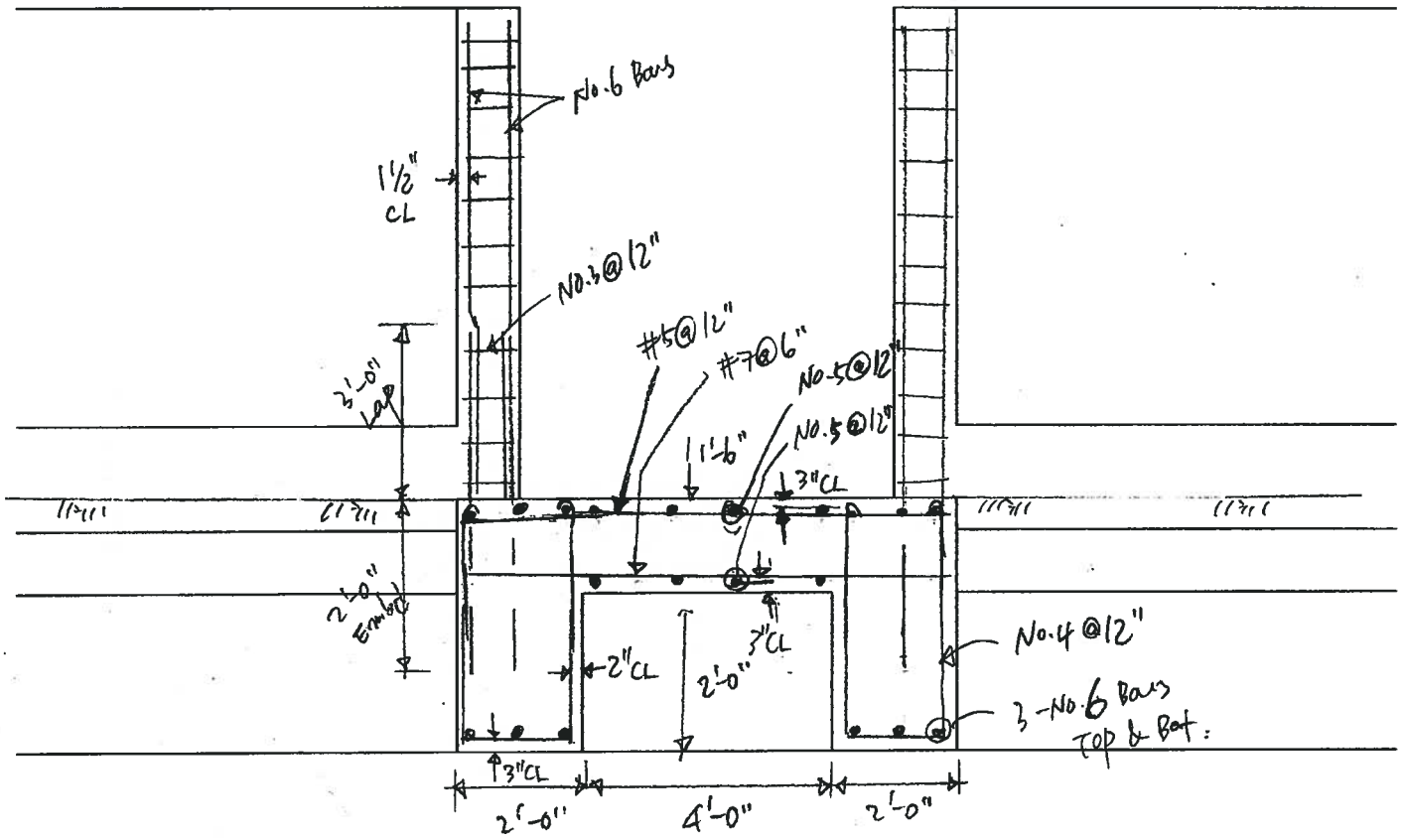
O.K

6' x 7' Gate

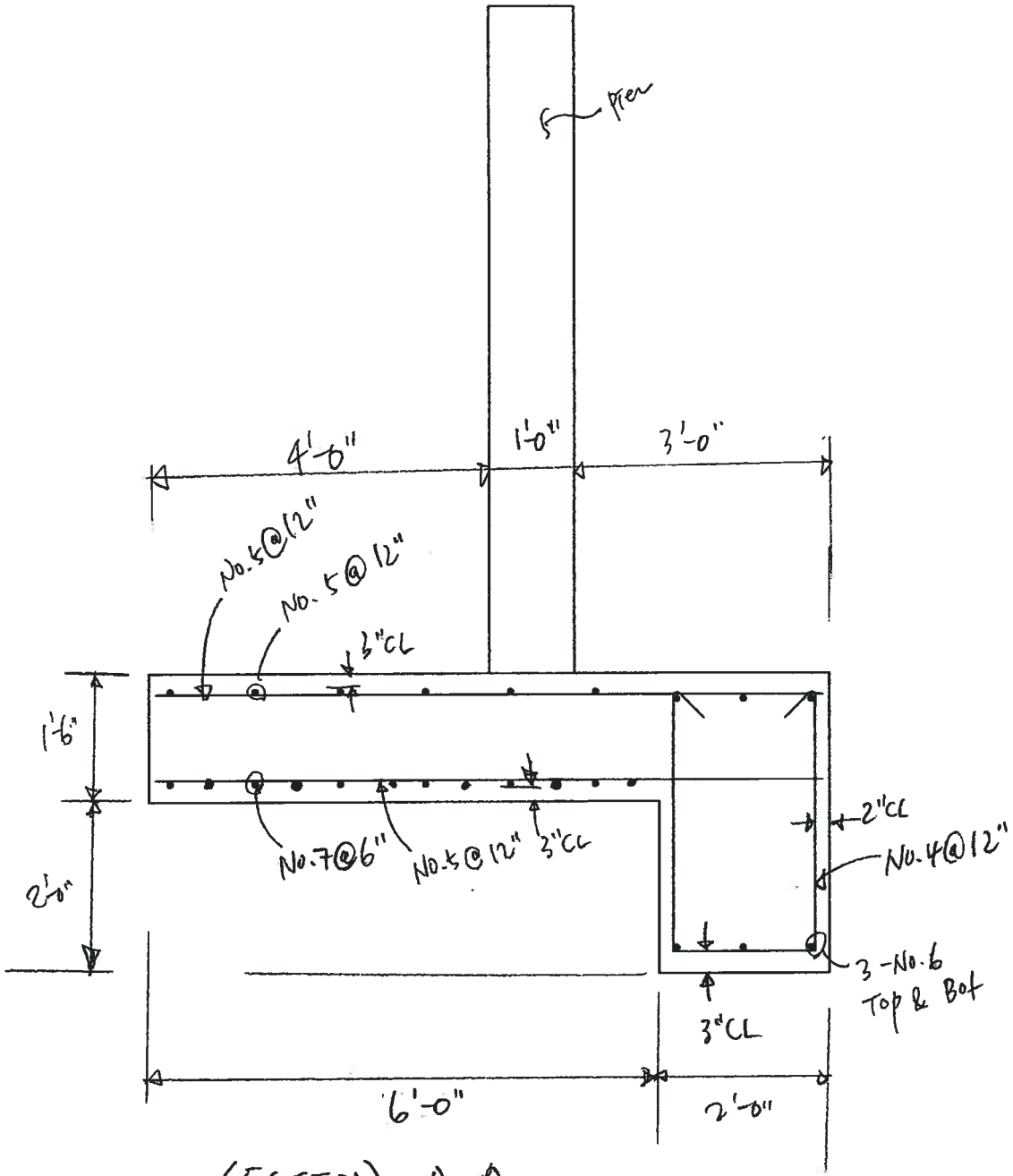


PLAN

6'x7' Gate



ELEV.


Pier
4'-0"
1'-0"
3'-0"
No.5@12"
No.5@12"
3"CL
1'-6"
2'-0"
No.7@6"
No.5@12"
3"CL
2"CL
No.4@12"
3-No.6
Top & Bot
3"CL
6'-0"
2'-0"

SECTION A-A

to

Walz & Krenzer, Inc.
91 Willenbrock Road, Unit B4
Oxford, CT 06478
(203) 267-5712 fax (203) 267-5716
sales@wkdoors.com www.wkdoors.com www.floodbarriers.com
An ISO 9001:2008 Certified Company

March 16, 2011

QUOTATION

Quoted to: PBS&J: Integrated Water Resources
Attn: Matt Wilkinson
Fax: Mwilkinson@pbsj.com
Phone: 702.551.0345
Ref: Lake Las Vegas
Summary: 6'W x 7'H and 12'W x 7'H Flood Gates

Quote #: **Q-11-051 Rev. A**
F.O.B. Shop (Rochester, NY or Pascagoula, MS)

Qty	Description	Unit Price	TOTAL
1	144"W x 84"H Hinged Lip Seal Flood Gate Similar to D-WK-875-83 Aluminum panels and A-36 steel bolt-on frame with epoxy paint.	$ 17,000.00	$ 17,000.00
1	72"W x 84"H Hinged Lip Seal Flood Gate Similar to D-WK-875-83 Aluminum panels and A-36 steel bolt-on frame with epoxy paint.	$ 6,500.00	$ 6,500.00
	Freight- to be invoiced to buyer at cost (Estimated total = $1200)	Invoice @ Cost	

Quotation Notes

1. Issuance of a purchase order implies acceptance of Walz & Krenzer Inc. Terms & Conditions of sale (attached).
2. Payment Terms - full payment due Net 30 from date of invoice (shipment) with approved credit. No retainage allov
3. Price does not include freight, unloading, anchor bolts & silicone sealant for installation, or installation.
4. Delivery - drawings submitted for approval approx. 5-7 weeks after receipt of order. Fabrication begins upon receipt of drawing approval and release for manufacture, with shipment approx. 8-10 weeks later.
5. Testing - shop operational test, shop leakage test, shop dimensional & flatness inspection.
6. **Rev. A: added freight estimate.**

WALZ & KRENZER, INC.

By: *Spencer Young* Spencer Young

Walz & Krenzer, Inc.
91 Willenbrock Road, Unit B4
Oxford, CT 06478
(203) 267-5712 fax (203) 267-5716
sales@wkdoors.com www.wkdoors.com www.floodbarriers.com
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TERMS & CONDITIONS OF SALE

1. TERMS OF SALE: These terms and conditions shall apply to and govern Buyer's Order. In the event of any inconsistency between these terms and conditions and Buyer's Order, said terms and conditions shall prevail. Modifications, changes, cancellations, or suspensions shall not be binding upon Walz & Krenzer (WK) unless approved by Walz & Krenzer. Quoted prices are exclusive of any city, county, state, provincial, or federal taxes. Prices include standard commercial packaging only. Bar coding, military packaging, labeling etc. is not included.

2. VALIDITY OF PRICES: Unless otherwise noted, prices quoted are valid for order placement within 30 days of the date of quotation, with delivery no later than 6 months from the date of the quotation. Later delivery, for whatever reason, may require a price adjustment due to increases in material costs. Such price adjustments are to be requested by WK in writing and approved by Buyer in writing prior to the release for manufacture.

3. DELIVERY SCHEDULES: Delivery schedules quoted are WK's best estimate, based on conditions prevailing at the time of quotation. However, deliveries cannot be guaranteed since conditions may change at the time of order entry. WK will use reasonable diligence to meet the quoted shipping date.

4. DELAY: WK shall not be liable for delays directly or indirectly resulting from or contributed to by any circumstances beyond WK's control.

5. TITLE AND RISK OF LOSS: Delivery to common carrier, F.O.B. shipping point (unless otherwise agreed to), shall constitute deliver and passage of title to Buyer. Risk of loss shall pass to Buyer concurrently with the transit of title.

6. TERMS OF PAYMENT: All prices quoted in US dollars. WK's standard terms of payment for domestic orders is Net 30 days from the date of the invoice, with credit approval. For international shipments, wire payments or credit card payments prior to shipment are required. Other terms can be negotiated. Unless expressly indicated, there is no provision in the quoted price for the retention of any portion of payment beyond the 30 day limit. Payment by credit card (Visa, MasterCard, and American Express) is accepted. Late payments may be charged interest at the rate of 1-1/2% per month.

7. CANCELLATION: In the event of a cancellation, the Buyer is obligated to reimburse WK for lost profits as well as for expenses incurred up until the time of cancellation, including material, labor, overhead, selling, general & administrative expenses based on WK rates. Included in expenses are all costs related to engineering/drafting/design effort whether or not any material has been supplied or is in progress.

8. PURCHASED ITEMS: It is the responsibility of the Buyer to confirm final sizes and quantities of items ordered. Custom or fabricated items are non-returnable. Other returns must be approved by WK prior to return, and are subject to applicable restocking charges. Freight charges to and from buyer on returns are to the buyer's account.

9. FABRICATION STANDARDS: All fabrication & finish processes are to "Best Commercial Practices" standards unless otherwise noted. Special processes or finishes are available at additional charge.

Walz & Krenzer, Inc.
91 Willenbrock Road, Unit B4
Oxford, CT 06478
(203) 267-5712 fax (203) 267-5716
sales@wkdoors.com www.wkdoors.com www.floodbarriers.com
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F.O.B. Shop (Rochester, NY or Pascagoula, MS)

TERMS & CONDITIONS OF SALE CONTINUED

10. DEFECTIVE MATERIAL: WK warrants to the Buyer each part to be free from defects in material and workmanship when properly installed, operated, and maintained. The obligations of WK is limited to the replacement or repair of any part or parts which are claimed by Buyer and determined by WK to have been defective and shall expire at the end of twelve (12) months from the date of shipment.

This warranty does not cover any charge incurred by Buyer for the replacement of parts, adjustment, repairs, or any work performed in connection therewith and shall not apply to any equipment or parts, which shall have been repaired or altered other than by WK in any way so as, in the judgment of WK, to affect their performance or reliability, or which have been subject to misuse, neglect or accident, whether in operation, in transit, or in storage, or shall have been operated beyond limits.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER REPRESENTATIONS, GUARANTEES OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING , BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR AS TO THE RESULTS TO BE OBTAINED FROM THE USE OF GOODS BY BUYER OR OTHERS.

11. LIMITATION OF DAMAGES: Under no circumstances shall WK have any liability for any loss of profits or special, incidental, indirect, or consequential damages of any kind. The goods and services sold under this order are sold on condition that the Buyer shall not, within or after the expiration of the terms of this warranty, make any claim against Walz & Krenzer, Inc. for such damages.

12. TIME IN WHICH TO MAKE CLAIM: Buyer expressly agrees that any claim brought by Buyer or by any of Buyer's employees, agents, or assigns which is based in any way upon their sales order, whether based upon warranty, contract, tort or otherwise, and whether based upon a claim of patent or latent defect, shall be brought within thirteen months after deliver of the goods and it is specifically agreed that any claim not brought within this period by delivering to WK a written notice of claim or by filing and serving lawsuit, shall be forever waived and barred.

13. DISCLAIMER: Walz & Krenzer, Inc. has a long & established reputation for providing dependable products and service. However, because our products are handled, installed, and used under varying conditions, and maintenance of such products is controlled exclusively by others, WK disclaims all responsibility for damage or injury resulting from the use of our products, and the purchaser & user assumes all responsibility for, and agrees to indemnify WK from, any and all claims arising directly from our products and/or their use.

14. For international shipments that cannot go by regular carrier (UPS or Fedex), the purchaser is responsible for providing a freight forwarder to coordinate shipments through customs. All freight forwarder and customs expenses are the responsibility of the purchaser. Any specialized crating for international shipments (i.e. treated wood) shall be billed at cost. It is the responsibility of the purchaser to notify WK of any shipping requirements.

LATERAL EARTH PRESSURES

Lateral earth pressures on walls depend upon the type of wall, hydrostatic pressure behind the wall, type of backfill material, and allowable wall movements. Since the structure will be rigid, we assume that wall movement will be constrained to less than 0.5 percent of the wall height. Lateral earth pressures, therefore, should be estimated for an "at rest" condition.

In areas where the structural walls of the proposed sewer lift station are above groundwater elevation, an equivalent lateral earth pressure for the "at rest" condition of 60 pounds per cubic foot (pcf) and an equivalent fluid weight for the "passive" condition of 275 pcf should be assumed. For areas of the structural walls below groundwater elevation, an equivalent lateral earth pressure for the "at rest" condition of 90 pcf and an equivalent fluid weight for the "passive" condition of 150 pcf should be assumed. We recommend a coefficient of sliding resistance between the concrete and soil is 0.55.

The additional effects of sloping backfill, adjacent slopes and roadways, and structure loads should be included in calculating lateral earth pressures. Backfill should be compacted within 2 percent of 90 percent relative compaction, as per ASTM D1557 test method, using light equipment. Over compaction of backfill material could cause loads exceeding the designed lateral pressures and result in wall distress.

CONCRETE FLOOR SLABS AND FLATWORK

Concrete floor slabs and flatwork placed on this material should not require special precautions if the grading recommendations are complied with. Concrete floor slabs and exterior flatwork should be supported by a minimum 4-inch layer of Structural Fill or Type II Aggregate Base material.

All concrete placements and curing operations should be performed in accordance with the American Concrete Institute (ACI) Manual of Concrete Practice. Excessive slump (due to high water-cement ratio) of the concrete and/or improper curing procedures could lead to excessive shrinkage, cracking, curling or slabs and other flatwork. To facilitate

Material obtained from excavation of caliche and cemented sand and gravel will likely be unsuitable for structural fill due to particle size. This gradation will be a function of excavation methods. Should excavation result in a well-graded material it may be acceptable as fill.

Type II Aggregate Base Backfill material should conform to the specifications stated in subsection 208.02.04 of the Uniform Standard Specifications for Public Works Construction, Off-Site Improvements, Clark County Area, Nevada.

Sand Backfill material should conform to the specifications stated in the Uniform Standard Specifications for Public Works' Construction, Off-Site Improvements, Clark County Area, Nevada in subsection 208.02.03.

Material Volume Changes Excavation and compaction of the on-site soil and caliche materials will result in shrinkage losses or material bulking. Actual in-place moisture density tests were not conducted during this investigation. Attempts to obtain undisturbed samples were not successful due to the granular nature of the soils.

Based upon previous site experience, we estimate that the on-site uncemented materials will shrink 8 to 10 percent when compacted. Cemented deposits can be anticipated to have an increased volume after excavation and recompaction. Excavation of caliche, and cemented sands and subsequent compaction are estimated to bulk approximately 15 percent to 20 percent.

FOUNDATIONS

SEWAGE LIFT STATION

Based upon the cross-section of the structure presented in Figure 4 and the current location shown on Figure 3, the foundation systems for the proposed structure exist at different elevations. Foundations at different elevations can bear on different materials. Placing the structure foundation systems on different materials can result in differential settlement. If the structures foundations remain at approximate elevations 1376 and 1390 as shown in Figure 4 then they will bear on caliche or very dense, possibly cemented

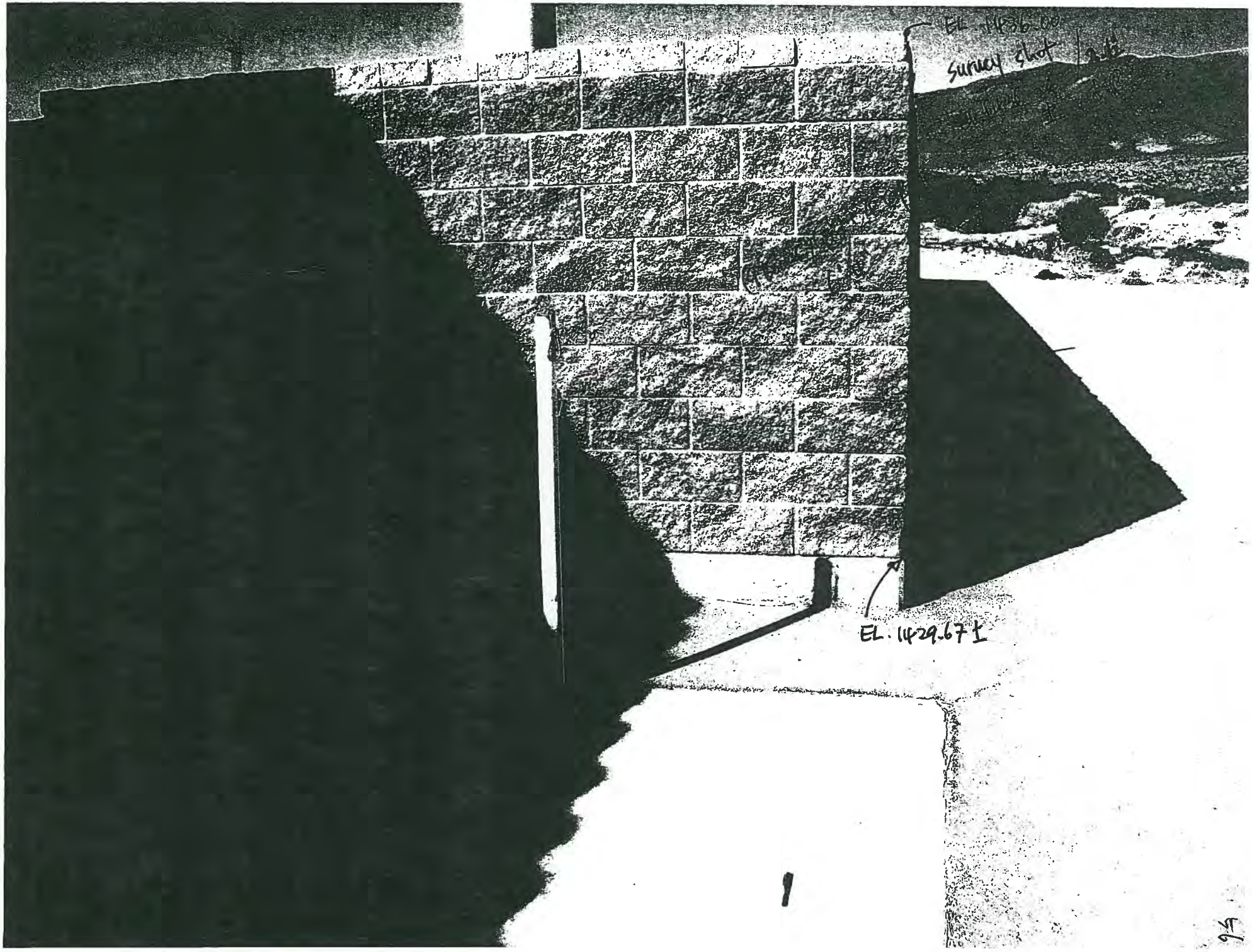
sands. These materials should be capable of adequately supporting the structure with a low probability of differential settlement. For this configuration we recommend that the structure be founded on conventional spread footings or mat foundations bearing on the underlying caliche or very dense, possibly cemented sands. These foundations can be designed for a maximum allowable bearing pressure of 4,000 pounds per square foot (psf).

If other levels exist in other sectional views that do not bear on the caliche or very dense sands then the risk of differential settlement becomes greater. For those areas, we recommend structural details to transfer these loads to the more competent bearing stratum. If design desires to found these portions of the structure above the caliche, then we recommend they be founded on controlled structural fill after removal of all existing fill material. These footings should be designed for a maximum allowable soil bearing pressure of 2,000 pounds per square foot (psf).

The maximum allowable bearing pressures are based upon dead load plus live load. A one-third increase in allowable bearing pressure may be used for short duration loads, such as wind or seismic loads. Footings should be at least 18 inches wide and should be established at least 12 inches below the lowest adjacent final grade. The following design criteria should also be observed:

a) Using the soil pressure recommended above, we estimate the maximum settlement for the structure if founded on the caliche and/or very dense sands should be less than one-half inch with differential settlement of approximately one-quarter inch. For footings founded on fill, total settlement should be less than one inch and differential settlement should be less than one-half inch. Footings should be proportioned as much as practicable to reduce differential settlement.

b) Steel reinforcement for continuous concrete foundation walls should be designed to span localized settlements over a distance of 10 feet.


EL. 1436.00
survey shot
EL. 1429.67±

Lee, Je Il

From: Wilkinson, Matthew
Sent: Thursday, September 27, 2012 10:31 AM
To: Lee, Je Il
Cc: Chang, Jaime; Lanum, Michael D
Subject: RE: Lake Las Vegas Flood Wall

The maximum water elevation for design is 1433.9.

Matt Wilkinson, P.E., CFM
Project Manager, Integrated Water Resources

ATKINS

2270 Corporate Circle, Suite #100, Henderson, NV 89074-7755 I Tel: +1 (702) 263-7275 Ext. 4513171 I Direct: +1 (702) 551-0345 I Cell: +1 (702) 427-5528
Fax: +1 (702) 263-7200 I Email: matthew.wilkinson@atkinsglobal.com I Web: www.atkinsglobal.com/northamerica www.atkinsglobal.com

---

From: Lee, Je Il
Sent: Thursday, September 27, 2012 10:27 AM
To: Wilkinson, Matthew
Cc: Chang, Jaime
Subject: Lake Las Vegas Flood Wall

Matt,

What is the maximum water elevation to design the flood wall? Is it the top of wall?
Would you let me know?

Thanks,

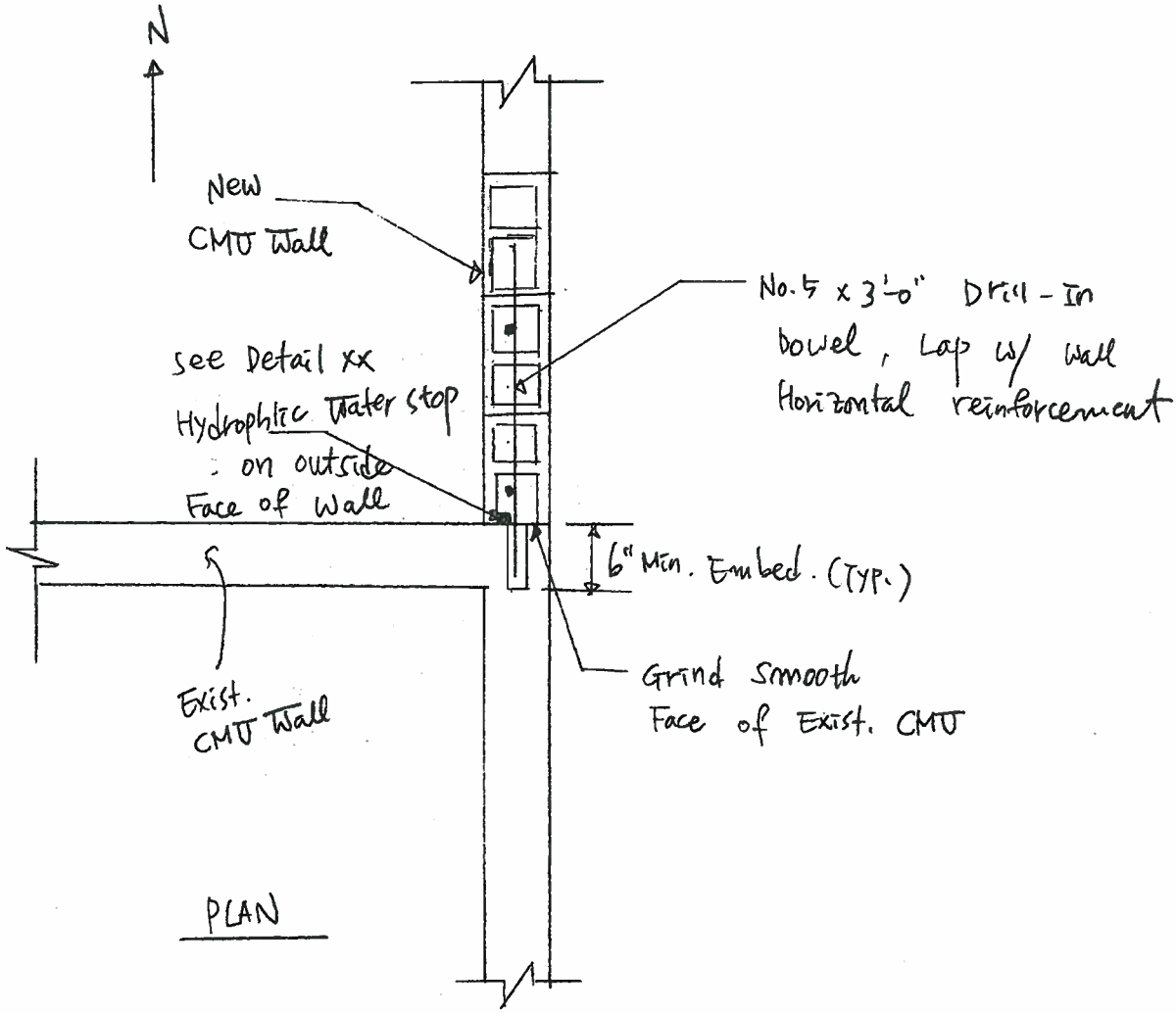
Je Il "Jay" Lee, Ph.D., PE, SE
Sr. Structural Engineer, Structures Design

ATKINS

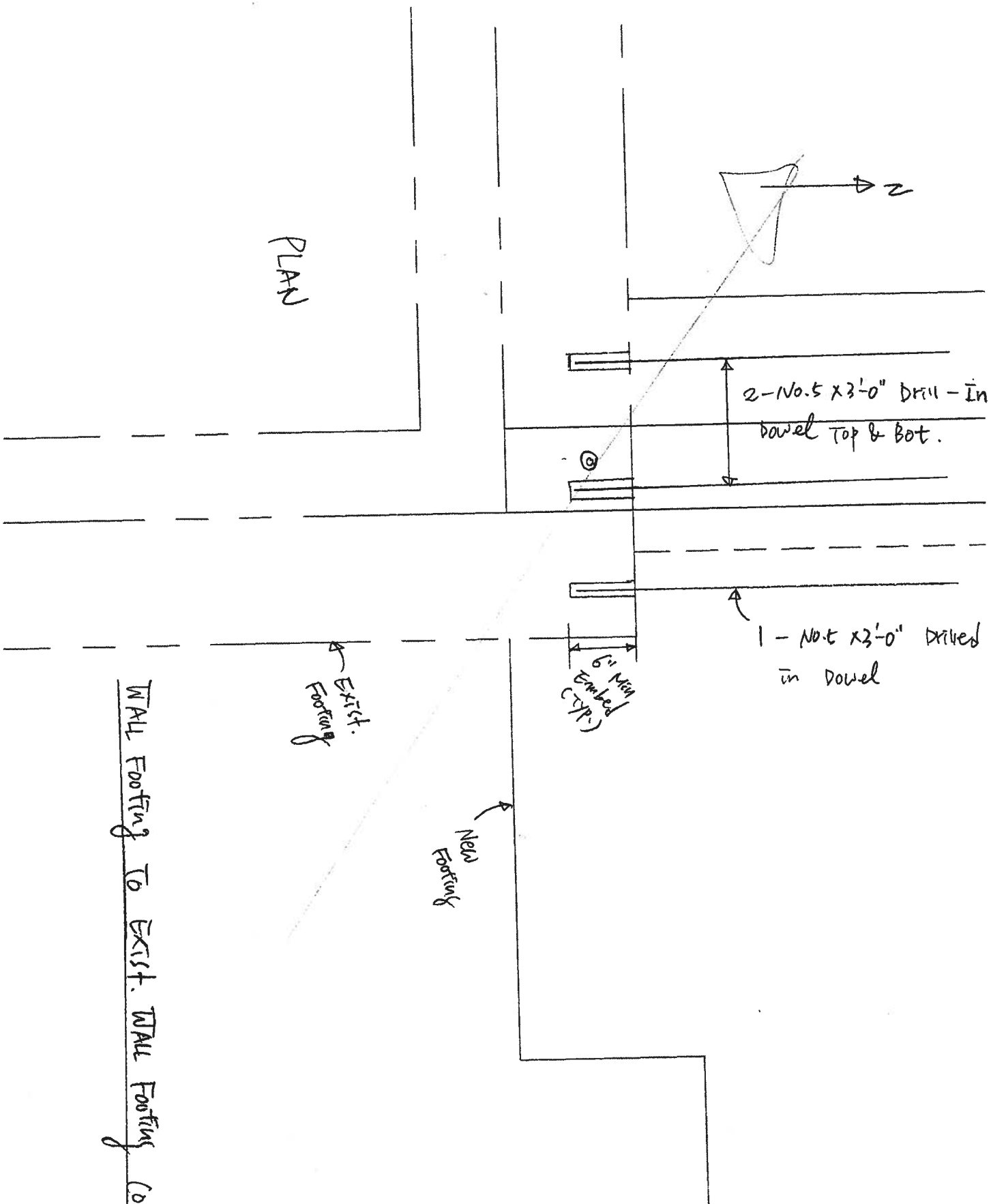
2270 Coporate Circle, Suite 100, Henderson, Nevada, 89074-7755 | Tel: +1 (702) 551 0339 | Fax: +1 (702) 263 7200 |
Email: jay.lee@atkinsglobal.com | Web: www.atkinsglobal.com/northamerica www.atkinsglobal.com

Subject: Lake Las Vegas - Floodwall Design		
Comp by: JL Check by:	Date: 10/3/12 Job Number: 10002058	Sheet Number:

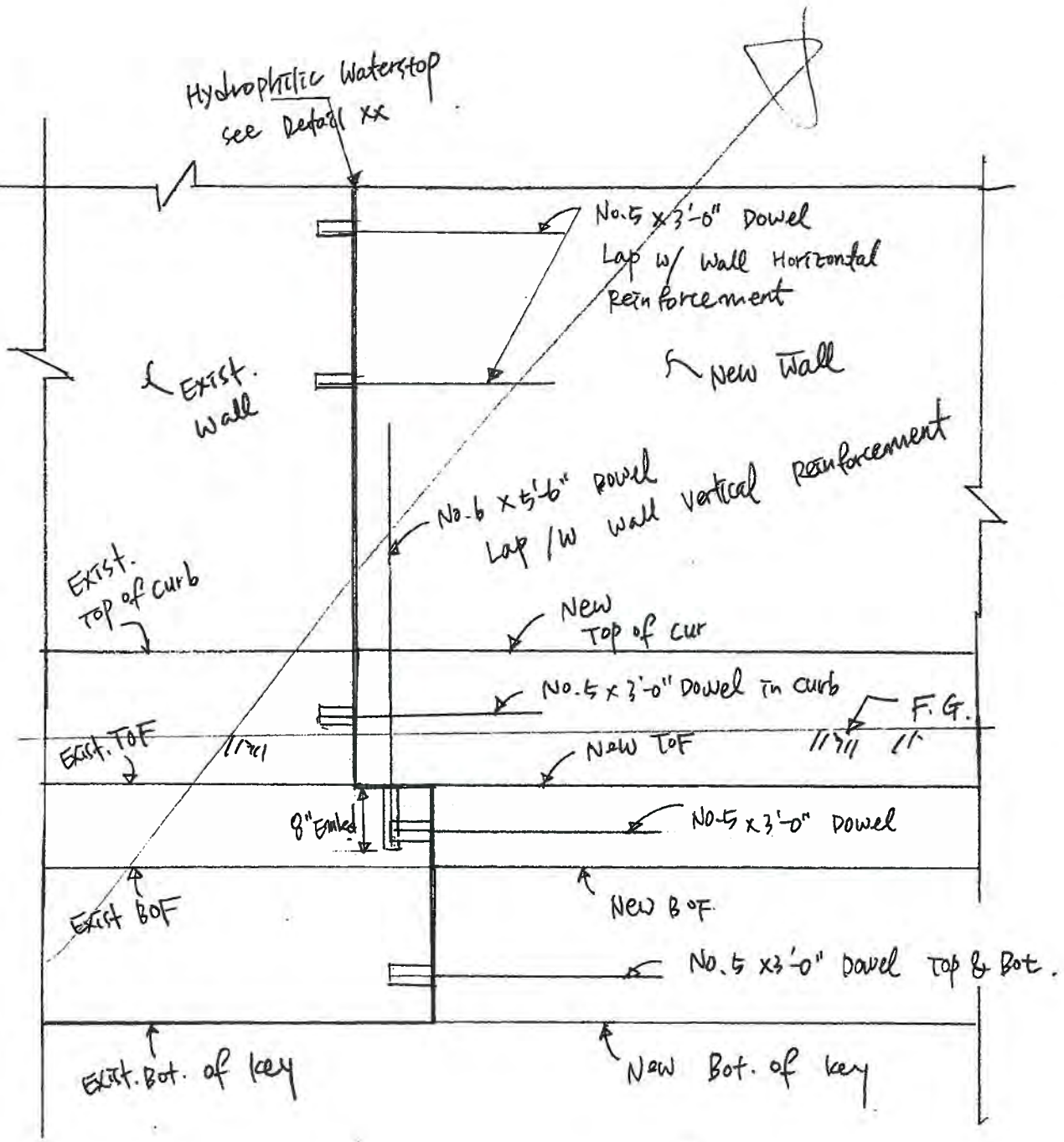
ATKINS



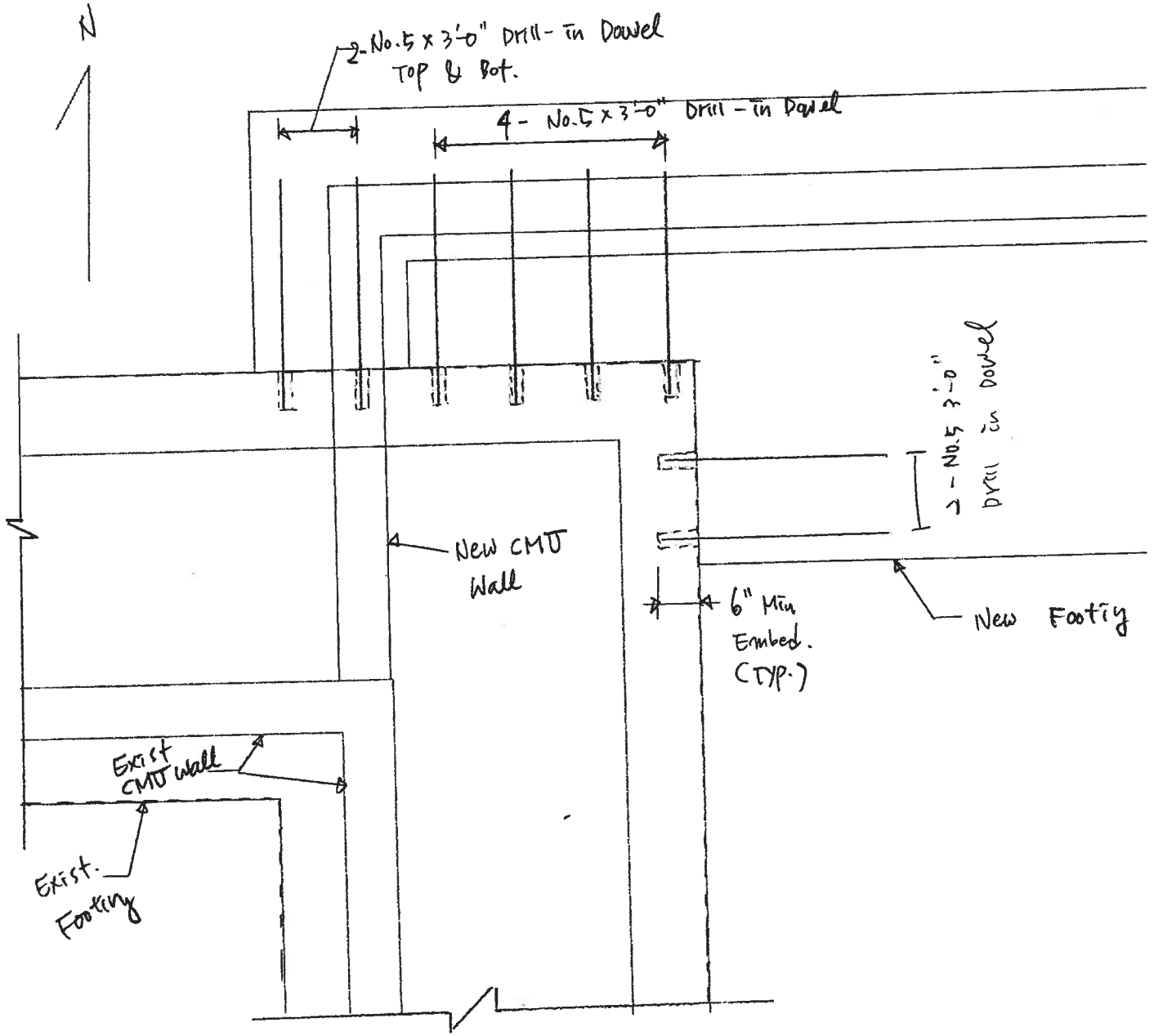
CMU WALL TO EXIST. CMU WALL CONNECTION



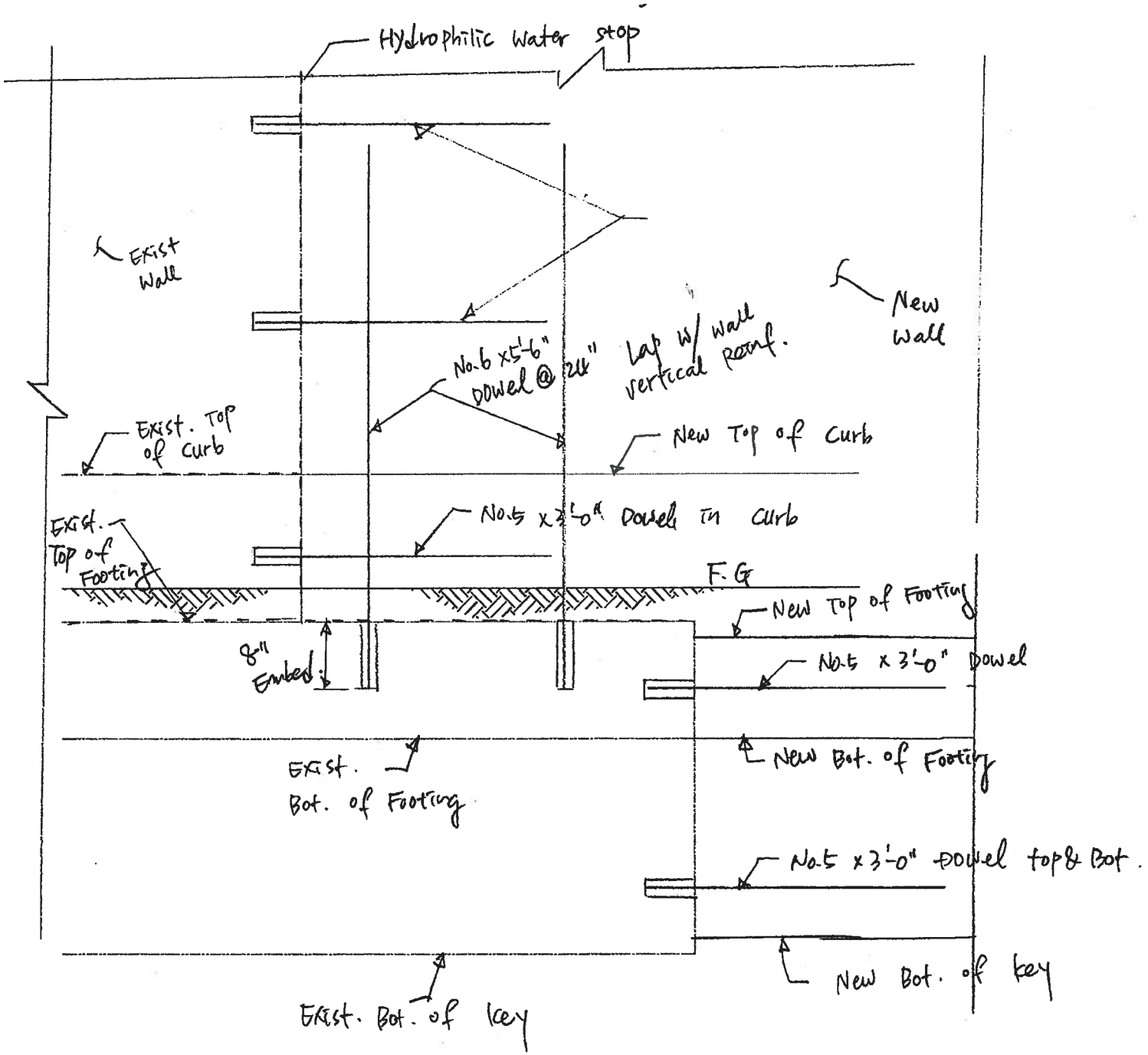
WALL Footing TO EXIST. WALL Footing Connection



New Wall To Exist. Wall Connection	Rebar Size	Min. Embed. Length (in)	Min. Edge Dist (in)
	No.5	6"	4"
	No.6	8"	5"



Wall Footing To Exist. Wall Footing Connection

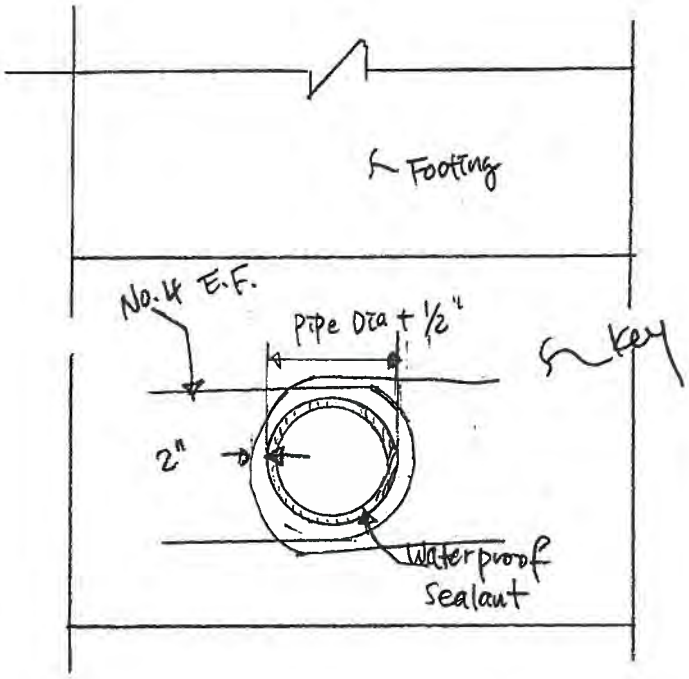


New Wall To Exist Wall - Elevation

Subject: Lake Las Vegas - Flood Wall Design		
Comp by: JL Check by:	Date: 10/4/12 Job Number: 10003085B	Sheet Number:

ATKINS

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Opening Detail

APPENDIX VI

Reference Material

Las Vegas Wash Flood Hazard Mapping Restudy

Las Vegas Wash
Flood Hazard Mapping Restudy

Volume 3 of 4

Prepared For:

Southern Nevada Water Authority
1900 E. Flamingo Road
Las Vegas, NV 89119

Prepared By:

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6.0 SNWA REACH

This report documents the hydraulic analysis for the SNWA Reach of the Las Vegas Wash Flood Hazard Mapping Restudy (Study) submittal to the Federal Emergency Management Agency (FEMA). Information related to the effective floodway and floodplain boundaries for the SNWA Reach of Las Vegas Wash is documented in *Flood Insurance Study for Clark County, Nevada and Incorporated Areas* (FEMA, 2002). These boundaries were developed from a hydraulic analysis completed by Nolte and Associates in 1999. Information about the analysis is documented in *Las Vegas Wash Flood Insurance Study* (Nolte and Associates, 1999).

There have been significant changes that have occurred to the SNWA Reach of the Las Vegas Wash since 1999. The channel characteristics (width, depth, and slope) have changed significantly due to incision, degradation, and lateral bank erosion processes associated with the base flows and significant flow events that have occurred since the effective FIS was completed. As a result of the significant changes, the Southern Nevada Water Authority (SNWA), under the authority of the Las Vegas Wash Coordination Committee, was selected as the lead agency to oversee and coordinate the management and restoration of the lower reach of the wash. SNWA maintains and administers the Las Vegas Wash Capital Improvement Plan (CIP). The CIP provides a summary of the planned capital expense activities necessary to manage and stabilize of the Wash. The CIP proposes a total of twenty-two grade control structures on the Las Vegas Wash between the City of Las Vegas Wastewater Treatment Plant and boundary of the Lake Mead National Recreational Area. Eleven of the structures presently exist and are included in the hydraulic analysis for this Study.

The hydrology of the wash has also recently been updated using an analytical method that considers storm centering. Information about the revised hydrology is documented in Volume 1 (Section 2) of this document.

Because of the various changes in the geometry and hydrology of the wash, a hydraulic analysis of the Las Vegas Wash was conducted to define the revised floodway and floodplain boundaries for this reach. This submittal has been prepared from the results of the analysis. It should be noted that the SNWA Reach will be included as part of a submittal that covers the entire detailed study reach presented in the effective Flood Insurance Study (FIS). As a result, duplicate and corrective effective models (DEM and CEM) were not prepared for the SNWA Reach.

The analysis was conducted for the reach of the wash from the intake structure for Lake Las Vegas at the downstream end to the northern property boundary of the Clark County Water Reclamation District (CCWRD) Central and Advanced Wastewater Treatment Plants (CCAWT) (near the Flamingo Road alignment), located about 7.0 miles upstream. The study reach is reflected by the magenta line in Figure 6.1.

The analysis was completed using Version 4.0 (Beta) of the Corps of Engineers River Analysis System (HEC-RAS) standard-step backwater computer program developed by the Corps of Engineers Hydrologic Engineering Center (USACE, 2006). The analysis was conducted only for the 1-percent annual chance of exceedance (return interval of 100-year) event. Information about the development of the HEC-RAS model and revised floodway and floodplain boundaries for the SNWA Reach of the Las Vegas Wash is presented in the following sections of this report.

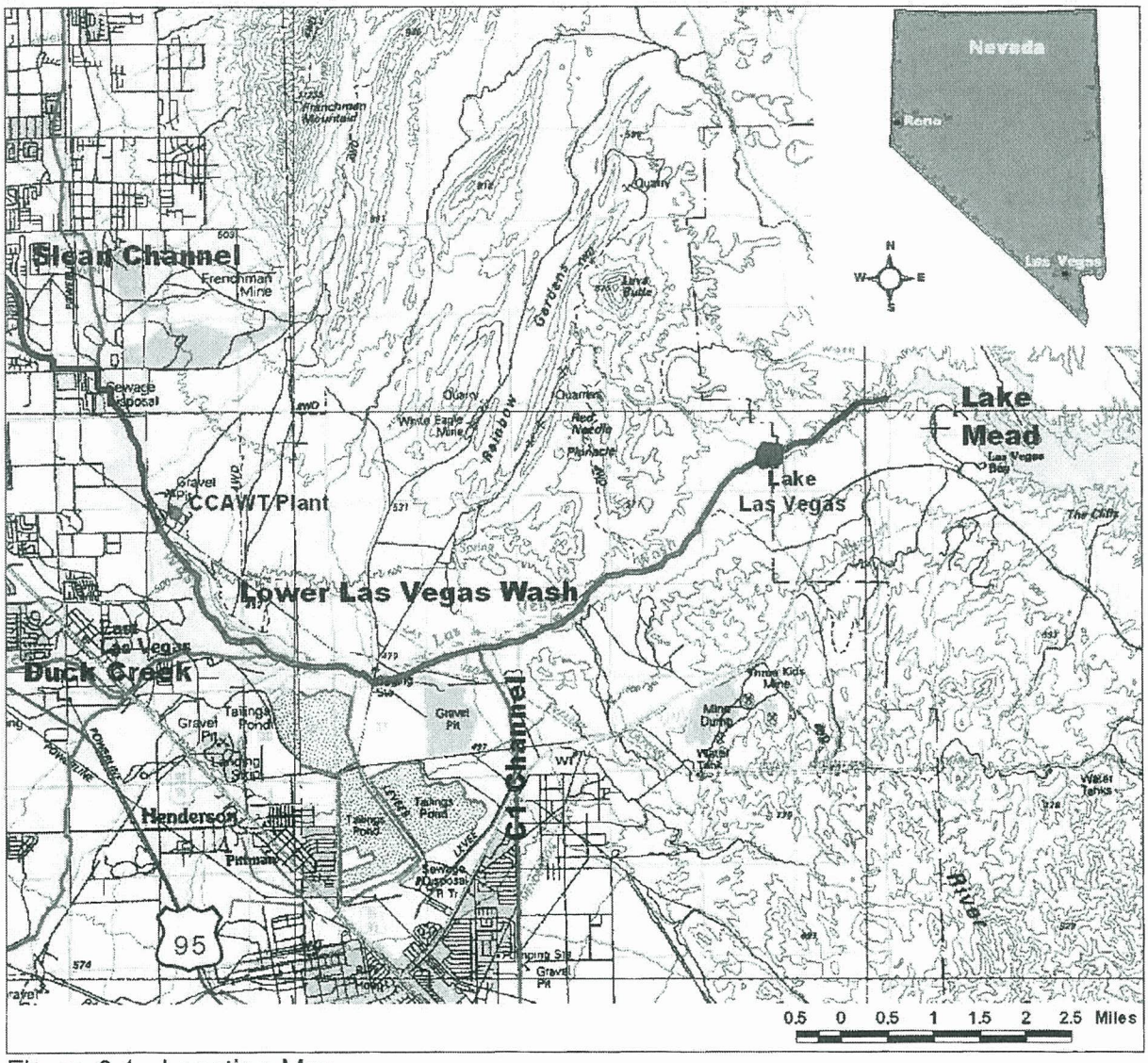


Figure 6.1. Location Map

6.1 Hydraulic Analysis

The hydraulic analysis for SNWA Reach of the Las Vegas Wash was completed using Version 4.0 Beta of the Corps of Engineers River Analysis System (HEC-RAS) standard-step backwater computer program developed by the Corps of Engineers Hydrologic Engineering Center (USACE, 2005). HEC-RAS models were developed for the existing conditions of the wash. Information related to the development of the HEC-RAS model is presented below.

6.1.1 Hydrology

The 100-year return period discharges utilized in the HEC-RAS model are based on the hydrologic analysis completed by G.C. Wallace Companies, which is documented in Volume 1 (Section 2) of this document, and summarized in Table 6-1.

Table 6-1. 100-year Discharges used in the SNWA Reach HEC-RAS Model

Return Frequency (years)	Reach	Flood Discharge (cfs)
100	Upstream of Monson Channel	18,718
	Upstream of Tropicana Ave	18,798
	Upstream of Duck Creek	20,690
	Upstream of Lake Las Vegas	22,530

6.1.2 Hydraulic Analysis for Base Flood Elevations

A HEC-RAS model was developed for the SNWA Reach of the wash from the intake structure for Lake Las Vegas at the downstream end to the Flamingo Road alignment (northern property boundary of the CCAWT plant) at the upstream end, which is located about 7.0 miles upstream. The model was developed using the HEC-GeoRAS extension developed by U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC) for ArcView 3.3 and shape files provided by SNWA. The shape files provided included the stream centerline, main channel banks, flow paths, cross section locations, and land use (Manning's roughness coefficients). Because of changes in the wash, the shape files for the main channel banks, flow paths, and cross section locations were revised to reflect the latest conditions of the wash. Topographic data based on 2005 aerial photography, as-constructed Computer-aided Design (CAD) files for the Powerline Weir and Upper Diversion Weir structures were also used in the development of the model.

The output file from HEC-GeoRAS (.RASimport.sdf) was imported into HEC-RAS and further revisions were made to the geometry file within the HEC-RAS program. These revisions included filtering of cross section points; incorporating the length across the various reach junctions, providing a single roughness coefficient for the main channel, incorporating in-line weir structures to model the existing weir structures, and adjustments to the bank stations, expansion and contraction coefficients, and ineffective flow boundaries.

6.1.2.1. Downstream Boundary

The downstream boundary for the SNWA Reach of the Las Vegas Wash is the inlet structure for Lake Las Vegas. This structure consists of two 84-inch-diameter culverts and seven 16.5-foot-wide by 8-foot-high reinforced concrete box (RCB) culverts. The inlet for the two 84-inch-diameter culverts is near the right hand side of the structure. These culverts outlet downstream of the lake and were designed to convey the more frequent flood flows downstream of the lake. For large flood events, the flood flows eventually flow through twelve upper level openings and then through the seven RCB culverts and into Lake Las Vegas. The upper level openings have bottom elevation of 1419.3 feet North American Vertical Datum of 1988 (NAVD88) and consist of ten 21-feet wide by 8-feet high openings and two 22-feet wide by 8-feet high openings.

The effective HEC-2 model is referenced to National Geodectic Vertical Datum of 1929 (NGVD29), and the difference between NAVD88 and NGVD29 at this location was determined to be about 2.25 feet using the Corpscon computer program, i.e., an elevation of 1417 feet NGVD29 corresponds to an elevation of 1419.25 feet NAVD88.

The starting water surface elevation at this location was determined to be 1431.40 feet NAVD88 using the discharge rating curve calculated for the inlet structure. This elevation is about 2.6 feet higher than the elevation obtained from the starting water surface elevations provided in the effective HEC-2 model for the FIS. The starting water surface elevations in the effective FIS model are based on the assumption that critical depth occurs at the upper level openings. This assumption was determined invalid for discharge greater than 17,000 cfs (EGL Elevation of 1427 feet NAVD88) where the control shifts to the inlet of the seven RCB culverts. Calculations of the discharge rating curve and the corresponding starting water surface elevation are included on the CD in Exhibit I.

6.1.2.2. Cross Sectional Data

Three different data sources were used to define the cross sectional geometry within the model. The first source was the 2005 topographic data developed from aerial photography using a horizontal datum of NAD83 Nevada East, a vertical datum of NAVD88, and English units. The cross section data for the entire reach is based on this source except for the reach in the immediate vicinity of the Powerline Weir and Upper Diversion Weir structures. This source was also used to define the geometric data for all of the weir structures existing at the time the data was developed: (1) Firestation

Weir, (2) Rainbow Gardens Weir, (3) Demonstration Weir, (4) Calico Ridge Weir, (5) Bostick Weir, (6) Historic Lateral Weir, (7) Pabco Weir, (8) Visitor Center, and (9) Monson Weir. One foot contours from this source are provided in Exhibit D. The second source was the as-constructed plans for Powerline Weir. This source was used to define the cross sectional data for the reach of the wash between about 500 feet downstream of the weir crest and about 350 feet upstream of the weir crest. The third source was the as-constructed plans for the Upper Diversion Weir structure and East Outfall Channel. Copies of the appropriate sheets from the as-constructed plans for the two weir structures are provided in Exhibit E.

The 2005 topographic data developed from aerial photography does not reflect the submerged portion of the wash as the result of effluent flows existing within the wash when the photographs were taken. This portion of the channel was assumed to be available to convey the base flows. Therefore, no revisions were made to the geometry based on this data and the hydrology considered in the model was not adjusted for base flows.

6.1.2.3. Roughness Coefficients

The Manning's roughness coefficients utilized within the model were defined using the shape file for Land Use provided by SNWA. The shape file was modified: (1) to reflected the present boundaries of the active low flow channel of the wash, (2) the area between the old and present boundaries of the active low flow channel was defined as a new classification (OWo), and (3) the limits of the rock toe protection constructed by SNWA was defined as a new classification (RR). The roughness coefficients defined in the database file were estimated using Cowan's Method, which is documented in *Open-Channel Hydraulics*, (Chow, 1959), except for the classification defined by the rock toe protection where the roughness coefficient was estimated using Equations 732 and 733 in *Hydrologic Criteria and Drainage Design Manual*, (CCRFCD, 1999). Roughness coefficients were defined for the more conservative condition associated with vegetation foliage (i.e., summer conditions). The coefficients defined for the classifications are summarized in Table 6-2.

Table 6-2. Roughness Coefficient for the Classifications in the Land Use Shape File.

Classification	General Description	Roughness Coefficient (Summer)
TA	Heavily vegetated terraced areas	0.130
UP	Upper terraced areas	0.043
OW	Active low flow channel boundaries	0.035
Owo	Old low flow channel boundaries	0.040
CR	Vegetated terraced area near Duck Creek	0.055
MX	Vegetated terraced area near Duck Creek	0.060
RR	Rock toe protection	0.065

The Land Use shape file and the corresponding database file define the roughness coefficients horizontally along each cross section. The HEC-RAS program does not subdivide the flow within the main channel for the hydraulic calculations, except when multiple roughness coefficients exist within the channel area and channel side slopes are less than 5H to 1V. If these conditions are not met, the program will compute a single composite roughness coefficient for the channel using the Equal Velocity Method. A review of the initial model results indicated that a composite roughness coefficient was not being computed for all of the cross sections. Therefore, a single roughness coefficient was defined for the cross sections.

The composite roughness coefficient was estimated using the same equation utilized in the HEC-RAS computer program or directly using the Cowan's Method. The equation was proposed independently by Horton and Einstein, and it is based on the assumption that the flow velocity in each area of the channel is equal to the mean velocity of the whole area. The equation is documented in *Open-Channel Hydraulics* (Chow, 1959), EM 1110-2-1601 (USACE, 1993), and in the HEC-RAS User's Manual (HEC, 2006). As documented in the HEC-RAS User's Manual (HEC, 2006), the composite roughness coefficients calculated using this equation should be checked for reasonableness because the equation can result in extremely high values. Unfortunately, this was the case for several of the cross sections where unreasonable values were determined due to a small amount of vegetation. Therefore, additional adjustments were considered. The first adjustment was that the upper value for the roughness coefficient was set at 0.065. Second, roughness characteristics were defined for reaches of similar characteristics, i.e., a selected roughness coefficient was applied to reach of the wash. Finally, adjustments were made to provide appropriate flow distribution within the channel and the left and right overbanks. Roughness coefficients for the riprap lined portion of the wash were estimated using Equations 732 and 733 in *Hydrologic Criteria and Drainage Design Manual*, (CCRFCD, 1999).

As discussed below, there are three flow split reaches. In general, the roughness coefficients for the flow split were determined using the same procedure. The roughness coefficients for the overbank areas were based on the Land Use shapefiles, and the coefficients for the channel were estimated using Cowan's Method or the composite technique mentioned above. Cowan's method was used to estimate the main channel roughness coefficient of 0.035 to 0.040 for the flow split through the Nature Center (upper split) and 0.045 to 0.055 for the split flow reach near the Duck Creek confluence (lower split). A composite value ranging from 0.049 to 0.058 was estimated for the channel of the East Diversion Channel (middle split). The East Diversion Channel includes vegetated benches. The benches were assigned a roughness coefficient of 0.08.

Information about the roughness coefficients used in the model is summarized in Exhibit F, and the roughness coefficients for each cross section are reflected on the cross plots (PDF files) provided on the CD included in Exhibit I.

6.1.2.4. Expansion and Contraction Coefficients

The default values of 0.1 and 0.3 for the contraction and expansion coefficients, respectively, were utilized for most of the cross sections. The coefficients were increased to 0.3 and 0.5, respectively, where the floodplain expands or contracts from a wide floodplain to a narrow floodplain, or where the invert of the main channel rapidly drops or rises.

6.1.2.5. Ineffective Flow Boundaries

Several of the cross sections contain areas that will not actively convey flow (i.e., areas where water will pond and the velocity in the downstream direction will be close to zero). Ineffective flow boundaries were incorporated into the model to accurately simulate the active flow areas. The ineffective flow boundaries were typically incorporated at areas where the flow rapidly contracts or expands. HEC performed a detailed study of flow contraction and expansion using field data and results from a two-dimensional analysis of idealized bridge sites to provide guidance to engineers for computing water surface profiles through a bridge. This study is documented in *Flow Transitions in Bridge Backwater Analysis, RD-42*, (USACE, 1995) and briefly discussed in the *HEC-RAS User's Manual.* The results of this study indicate that the contraction ratio was below 1 ft in the longitudinal direction to 1 ft in the lateral direction (1:1) for all of the field prototype cases and ranges from 0.7:1 to 2.3:1 for the idealized cases. The mean and median values for the complete data set were determined to be close to 1:1. The results of the study also indicate that the expansion ratio ranges between 1:1 and 2:1 for most cases, and most of the ratios were approximately 2:1. Therefore, the ineffective boundaries within the model were established using a contraction ratio of 1:1 and an expansion ratio of 2:1.

6.1.2.6. Existing Weir Structures

There are several existing weir structures located within the SNWA Reach of the Las Vegas Wash. The weir structures simulated in the model include: (1) Firestation Weir, (2) Powerline Weir, (3) Rainbow Gardens Weir, (4) Demonstration Weir, (5) Calico Ridge Weir, (6) Bostick Weir, (7) Historic Lateral Weir, (8) Pabco Weir, (9) Visitor Center Weir, (10) Monson Weir, and (11) Upper Diversion Weir. Six of the structures (Powerline, Rainbow Gardens, Calico Ridge, Bostick, Pabco, and Upper Diversion) were defined within the model using the In-line Weir option. A weir coefficient of 2.6 was assumed for all of the weir structures except for Rainbow Gardens where a value of 3.0 was assumed. The In-line Weir option was used at these structures because the top of the structures protrude above the thalweg of the wash. The three other structures (Firestation, Demonstration, and Historic Lateral) were defined within the model using the actual geometric data of the structure as defined by the survey data.

6.1.2.7. Flow Splits

There are three flow splits within the SNWA Reach of the Las Vegas Wash. All of these splits were included in the model, and they are shown in the work maps provided in Exhibit D.

The first split (Upper Split) is located near the upstream end of the Nature Center, and it is identified in the HEC-RAS model with a River Title of "LV_Wash ROB" and Reach Title of "NC". The Nature Center consists of a visitor center, interpretive sites, bird blinds, outdoor amphitheaters, various lakes and ponds, trails, access roads, and parking lots. It is located within the right floodplain of the wash approximately 6.4 miles upstream of Lake Las Vegas. The Nature Center is surrounded by berms that protect the site from frequent flood events. The berm along the northern edge of the Nature Center that terminates near the Upper Diversion Weir is the Monson Berm. The flood control effects of the berms were not considered in the model; however, the berm along the west side of the wash was used as the dividing point between the cross sections of the wash and the cross sections for the flow split.

At this flow split, flow in the right overbank upstream of the Monson Berm will overtop the berm and flow in a southeast direction until it flows back into the wash at the downstream end of the Nature Center, which is about 0.5 miles downstream from the upstream end. The flow split was required to provide appropriate flow distribution within this reach. Initially, the cross sections of the wash within this reach included the overbank area of the Nature Center. However, there were several cross sections that had significantly inconsistent flow distributions between the channel and overbank areas. These inconsistencies could not be eliminated even with adjustments to the Manning's roughness coefficients and ineffective flow areas in the right overbank area. Therefore, the overbank area was modeled as separate reach, and the "Split Flow Optimization" option in the HEC-RAS program was used to determine the flow between these reaches.

The second flow split (Middle Split) is located at the Upper Diversion Weir structure, which is located at about 6.3 miles upstream of Lake Las Vegas. This flow split reach is identified in the HEC-RAS model with a River Title of "East Diversion" and Reach Title of "EDC". The Upper Diversion Weir functions as a diversion structure. Water overtopping the weir either continues through the active channel of the wash or is conveyed through the East Outfall Channel. The total width of the weir is about 476 feet. About 200 feet of the weir conveys flow to the East Outfall Channel whereas the other 276 feet of the weir conveys flow to the wash. A pedestrian bridge is located on top of the weir crest. This bridge is supported by two vertical abutments and six 4-foot diameter piers. Three of the piers are located within the portion of the weir that conveys flow to the wash, two of the piers are located within the portion of the weir that conveys flow to the East Outfall Channel, and one of the piers is located at the dividing point between the wash and the East Outfall Channel. As in the first split flow location, the "Split Flow Optimization" option in the HEC-RAS program was used to determine the flow within the two reaches.

The third flow split (Lower Split) is located near the confluence of Duck Creek and the Las Vegas Wash. This flow split is located approximately 5.1 miles upstream of Lake Las Vegas, and it is located just downstream of the where the Duck Creek channel ends at Broadbent Boulevard. At this flow split location, most of the flow within the right overbank will continue to flow in a southeast direction through a channel located approximately 700 ft south of the main channel and eventually flow back into the wash about 0.6 miles downstream. Low flows from Duck Creek are conveyed through this flow split reach. This flow split reach is identified in the HEC-RAS model with a River and Reach Title of "split_duck", and the flow within the reach was determined using the "Split Flow Optimization" option.

6.1.2.8. Upstream Boundary

The upstream end of the model was tied into the HEC-RAS model developed for the CCRFCD Reach as documented in Volume 2 of this document by using several cross sections from the upstream model. A total of nine cross sections were utilized to ensure no difference in the water surface elevations at the upstream location.

6.1.2.9. Results

PDF files of the results in tabular and graphic format from the HEC-RAS model for the base flood event (1 percent annual chance of exceedance) are included on the CD provided in Exhibit I. The water surface profile for the base flood event is shown on Figures 6-2 through 6-5. Figures 6-2 shows the water surface profile for the SNWA Reach of the Las Vegas Wash, and the water surface profile for the flow split reaches near Duck Creek, East Outfall Channel, and the Nature Center are shown in Figures 6-3 through 6-5, respectively.

LAS VEGAS WASH (SNWA Reach)

FLOODWAY DATA

LOWER LAS VEGAS WASH

FLOODING SOURCE					FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION STATION	STATION IDENFIER	NUMBER	ALPHABETIC SECTION ID	DISTANCE[1] (ft)	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
14.48	14	1	A	14	446	7401	3.1	1431.4	1431.4	1432.4	1.0
182.42	182	2	B	182	455	6935	3.3	1431.4	1431.4	1432.4	1.0
405.15	405	3	C	405	202	3401	6.6	1431.2	1431.2	1432.1	1.0
659.78	660	4	D	660	169	2810	8.0	1431.5	1431.5	1432.4	0.9
997.53	998	5	E	998	207	2747	8.2	1434.4	1434.4	1434.7	0.3
1489.16	1489	6	F	1489	195	2369	9.5	1435.9	1435.9	1436.5	0.6
1579.28	1579	7	G	1579	233	3318	6.8	1437.2	1437.2	1437.6	0.4
1776.89	1777	8	H	1777	303	4976	4.5	1437.9	1437.9	1438.3	0.4
1985.39	1985	9	I	1985	299	3846	5.9	1438.1	1438.1	1438.5	0.4
2200.51	2201	10	J	2201	351	4748	4.8	1438.6	1438.6	1439.0	0.3
2308.22	2308	11	K	2308	254	3479	6.5	1438.6	1438.6	1438.9	0.3
2719.51	2720	12	L	2720	242	2459	9.2	1439.6	1439.6	1439.8	0.2
2831.75	2832	13	M	2832	364	2879	7.8	1446.0	1446.0	1446.0	0.0
2933.22	2933	14	N	2933	423	4280	5.3	1446.9	1446.9	1446.9	0.0
3303.9	3304	15	O	3304	469	4731	4.8	1447.8	1447.8	1447.8	0.0
3775.67	3776	16	P	3776	360	3385	6.7	1448.5	1448.5	1448.5	0.0
3934.49	3934	17	Q	3934	297	2843	7.9	1449.2	1449.2	1449.2	0.0
4092.23	4092	18	R	4092	324	3165	7.1	1450.2	1450.2	1450.2	0.0
4318.02	4318	19	S	4318	323	3547	6.4	1451.3	1451.3	1451.3	0.0
4669.4	4669	20	T	4669	257	2824	8.0	1452.4	1452.4	1452.4	0.0
4848.28	4848	21	U	4848	261	2623	8.6	1453.4	1453.4	1453.4	0.0
5023.61	5024	22	V	5024	397	3195	7.1	1462.1	1462.1	1462.1	0.0
5685.38	5685	23	W	5685	427	3054	7.4	1465.2	1465.2	1465.2	0.0
6039.66	6040	24	X	6040	478	3602	6.3	1468.0	1468.0	1468.0	0.0
6269.3	6269	25	Y	6269	390	3055	7.4	1469.2	1469.2	1469.2	0.0
6490.7	6491	26	Z	6491	317	2370	9.5	1470.8	1470.8	1470.8	0.0
6681.24	6681	27	AA	6681	317	3278	6.9	1472.8	1472.8	1472.8	0.0
6861.99	6862	28	AB	6862	496	4808	4.7	1473.7	1473.7	1473.7	0.0
7654.78	7655	29	AC	7655	158	1399	16.1	1475.7	1475.7	1475.7	0.0
7828.58	7829	30	AD	7829	178	2285	9.9	1481.2	1481.2	1481.2	0.0
8296.77	8297	31	AE	8297	335	4070	5.5	1485.0	1485.0	1485.0	0.0
8823.15	8823	32	AF	8823	536	5145	4.4	1486.6	1486.6	1486.6	0.0
9501.16	9501	33	AG	9501	505	3549	6.4	1488.0	1488.0	1488.0	0.0
9856.77	9857	34	AH	9857	432	3096	7.3	1489.2	1489.2	1489.2	0.0

[1] Feet above the inlet to Lake Las Vegas

LAS VEGAS WASH (SNWA Reach)

FLOODWAY DATA

LOWER LAS VEGAS WASH

FLOODING SOURCE					FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION STATION	STATION IDENFIER	NUMBER	ALPHABETIC SECTION ID	DISTANCE[1] (ft)	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
10200.66	10201	35	AI	10201	417	4271	5.3	1491.0	1491.0	1491.0	0.0
10598.94	10599	36	AJ	10599	389	2429	9.3	1492.1	1492.1	1492.1	0.0
10782.21	10782	37	AK	10782	431	2740	8.2	1498.4	1498.4	1498.4	0.0
11175.42	11175	38	AL	11175	440	3601	6.3	1500.8	1500.8	1500.8	0.0
11410.95	11411	39	AM	11411	445	3835	5.9	1501.3	1501.3	1501.3	0.0
11929.49	11929	40	AN	11929	685	5037	4.5	1502.3	1502.3	1502.3	0.0
12315.19	12315	41	AO	12315	784	3404	6.6	1513.7	1513.7	1513.7	0.0
12448.88	12449	42	AP	12449	780	3714	6.1	1514.5	1514.5	1514.5	0.0
12759.65	12760	43	AQ	12760	729	3845	5.9	1515.5	1515.5	1515.5	0.0
13351.49	13351	44	AR	13351	372	2283	9.9	1516.9	1516.9	1516.9	0.0
13668.66	13669	45	AS	13669	290	2179	10.3	1518.7	1518.7	1518.7	0.0
13924.58	13925	46	AT	13925	400	4013	5.6	1520.5	1520.5	1520.5	0.0
14078.75	14079	47	AU	14079	421	3985	5.7	1520.8	1520.8	1520.8	0.0
14333.93	14334	48	AV	14334	520	2857	7.9	1526.1	1526.1	1526.4	0.4
14547.73	14548	49	AW	14548	490	2879	7.8	1527.5	1527.5	1527.5	0.0
14913.53	14914	50	AX	14914	483	2916	7.8	1528.7	1528.7	1528.9	0.2
15339.77	15340	51	AY	15340	463	3302	6.8	1529.7	1529.7	1530.5	0.8
15566.37	15566	52	AZ	15566	438	2971	7.6	1530.4	1530.4	1531.2	0.8
15734.55	15735	53	BA	15735	489	3453	6.5	1531.2	1531.2	1532.0	0.8
16127.61	16128	54	BB	16128	572	4060	5.6	1532.8	1532.8	1533.3	0.5
16275.81	16276	55	BC	16276	546	4195	5.4	1533.2	1533.2	1533.5	0.4
16539.37	16539	56	BD	16539	558	3953	5.7	1533.6	1533.6	1533.9	0.4
16686.94	16687	57	BE	16687	394	2890	7.8	1533.6	1533.6	1533.9	0.3
16989.85	16990	58	BF	16990	315	2576	8.8	1535.6	1535.6	1535.7	0.0
17185.45	17185	59	BG	17185	339	2989	7.5	1536.6	1536.6	1536.7	0.1
17576.76	17577	60	BH	17577	456	3825	5.9	1537.8	1537.8	1537.9	0.1
17959.9	17960	61	BI	17960	800	5186	4.3	1538.5	1538.5	1538.6	0.1
18144.07	18144	62	BJ	18144	780	3122	7.4	1540.4	1540.4	1540.4	0.0
18277.82	18278	63	BK	18278	861	3510	6.4	1541.5	1541.5	1541.5	0.0
18948.38	18948	64	BL	18948	631	3577	6.3	1544.8	1544.8	1545.0	0.2
19144.12	19144	65	BM	19144	568	3112	7.2	1545.4	1545.4	1545.7	0.3
19547.49	19547	66	BN	19547	370	2495	9.0	1547.5	1547.5	1548.3	0.8
19945.85	19946	67	BO	19946	330	4000	5.6	1550.5	1550.5	1551.1	0.6
20142.43	20142	68	BP	20142	361	3532	6.4	1550.8	1550.8	1551.4	0.6

[1] Feet above the inlet to Lake Las Vegas

LAS VEGAS WASH (SNWA Reach)

FLOODWAY DATA

LOWER LAS VEGAS WASH

FLOODING SOURCE					FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION STATION	STATION IDENFIER	NUMBER	ALPHABETIC SECTION ID	DISTANCE[1] (ft)	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
20393.63	20394	69	BQ	20394	273	2925	7.7	1551.7	1551.7	1552.2	0.5
20539.76	20540	70	BR	20540	208	1945	11.6	1552.1	1552.1	1552.5	0.4
20740.67	20741	71	BS	20741	167	1765	12.8	1554.0	1554.0	1554.3	0.3
20941.54	20942	72	BT	20942	170	2586	8.7	1557.1	1557.1	1557.1	0.0
21140.82	21141	73	BU	21141	126	1720	13.1	1557.4	1557.4	1557.4	0.1
21339.83	21340	74	BV	21340	344	1644	13.7	1559.0	1559.0	1559.1	0.0
21450.46	21450	75	BW	21450	438	4427	5.1	1562.9	1562.9	1563.6	0.6
22126.97	22127	76	BX	22127	425	4900	4.6	1563.5	1563.5	1564.4	1.0
22528.57	22529	77	BY	22529	398	4690	4.8	1564.0	1564.0	1564.9	0.9
22730.9	22731	78	BZ	22731	232	2899	7.8	1563.9	1563.9	1564.8	0.9
22925.04	22925	79	CA	22925	269	2536	8.9	1564.7	1564.7	1565.4	0.7
23322.87	23323	80	CB	23323	160	1690	13.3	1567.1	1567.1	1567.3	0.2
23522.44	23522	81	CC	23522	276	3503	6.4	1569.8	1569.8	1570.4	0.5
23775.21	23775	82	CD	23775	347	3963	3.1	1570.5	1570.5	1571.3	0.8
24344.71	24345	83	CE	24345	304	2552	4.8	1570.9	1570.9	1571.6	0.8
24526.44	24526	84	CF	24526	231	1777	6.9	1571.1	1571.1	1571.9	0.7
24919.76	24920	85	CG	24920	150	1188	10.3	1573.1	1573.1	1573.5	0.4
25114.49	25114	86	CH	25114	152	1412	8.6	1575.1	1575.1	1575.4	0.3
25514.32	25514	87	CI	25514	212	1988	6.1	1577.5	1577.5	1577.8	0.3
25715.56	25716	88	CJ	25716	208	1677	7.3	1578.1	1578.1	1578.3	0.3
26118.49	26118	89	CK	26118	85	852	14.3	1579.8	1579.8	1580.0	0.2
26314.53	26315	90	CL	26315	125	1375	8.9	1584.0	1584.0	1584.3	0.3
26501.13	26501	91	CM	26501	133	1649	7.4	1585.3	1585.3	1585.7	0.4
26714.15	26714	92	CN	26714	131	1635	7.5	1586.2	1586.2	1586.5	0.3
26821.78	26822	93	CO	26822	157	1410	8.7	1586.2	1586.2	1586.9	0.7
26912.03	26912	94	CP	26912	1305	3402	6.1	1588.3	1588.3	1588.5	0.2
27111.62	27112	95	CQ	27112	1235	4632	4.5	1589.6	1589.6	1590.0	0.4
27446.45	27446	96	CR	27446	1176	3830	5.4	1590.8	1590.8	1591.3	0.5
27850.12	27850	97	CS	27850	992	3206	6.5	1593.4	1593.4	1594.1	0.8
27937.48	27937	98	CT	27937	955	3697	5.6	1594.7	1594.7	1595.4	0.7
28108.01	28108	99	CU	28108	900	3670	5.6	1595.6	1595.6	1596.2	0.6
28308.1	28308	100	CV	28308	897	4187	4.9	1597.3	1597.3	1597.7	0.5
28637.81	28638	101	CW	28638	933	3251	6.4	1599.7	1599.7	1599.9	0.2
28834.67	28835	102	CX	28835	840	3774	5.5	1601.9	1601.9	1602.2	0.3

[1] Feet above the inlet to Lake Las Vegas

LAS VEGAS WASH (SNWA Reach)

FLOODWAY DATA

LOWER LAS VEGAS WASH

FLOODING SOURCE					FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION STATION	STATION IDENFIER	NUMBER	ALPHABETIC SECTION ID	DISTANCE[1] (ft)	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
28982.39	28982	103	CY	28982	828	4198	4.9	1603.0	1603.0	1603.5	0.5
29234	29234	104	CZ	29234	792	3377	6.1	1604.2	1604.2	1605.1	0.9
29433.92	29434	105	DA	29434	810	2976	7.0	1605.7	1605.7	1606.7	1.0
29633.31	29633	106	DB	29633	760	3370	5.6	1608.6	1608.6	1609.6	1.0
29823.15	29823	107	DC	29823	576	2744	6.9	1610.3	1610.3	1610.8	0.5
30013.99	30014	108	DD	30014	456	2100	9.0	1612.9	1612.9	1612.9	0.0
30233.32	30233	109	DE	30233	393	2023	9.3	1614.5	1614.5	1615.0	0.6
30602.29	30602	110	DF	30602	435	2693	7.0	1618.4	1618.4	1619.1	0.6
30810.52	30811	111	DG	30811	311	1701	7.8	1619.5	1619.5	1620.1	0.6
30926.89	30927	112	DH	30927	266	1418	9.4	1621.5	1621.5	1621.8	0.2
31030.94	31031	113	DI	31031	282	1935	6.9	1622.6	1622.6	1623.5	0.9
31159.34	31159	114	DJ	31159	319	2119	6.3	1623.6	1623.6	1624.3	0.6
31228.3	31228	115	DK	31228	346	2294	5.8	1623.7	1623.7	1624.5	0.7
31477.87	31478	116	DL	31478	52	483	16.5	1627.0	1627.0	1627.8	0.8
31601.68	31602	117	DM	31602	122	1090	7.3	1633.1	1633.1	1633.8	0.8
31756.5	31757	118	DN	31757	143	2090	3.8	1633.9	1633.9	1634.8	0.9
31833.89	31834	119	DO	31834	171	2093	3.8	1633.9	1633.9	1634.9	0.9
31975.27	31975	120	DP	31975	229	2131	3.8	1634.1	1634.1	1635.1	1.0
32034.21	32034	121	DQ	32034	194	1637	4.9	1634.1	1634.1	1635.1	1.0
32185.7	32186	122	DR	32186	205	1674	4.8	1634.4	1634.4	1635.4	1.0
32248.15	32248	123	DS	32248	167	1258	6.4	1634.3	1634.3	1635.3	1.0
32304.15	32304	124	DT	32304	113	799	10.0	1634.0	1634.0	1634.9	0.9
32404.94	32405	125	DU	32405	92	705	11.3	1635.0	1635.0	1635.8	0.8
32525.66	32526	126	DV	32526	89	770	10.4	1636.7	1636.7	1637.4	0.7
32611.32	32611	127	DW	32611	85	806	9.9	1637.5	1637.5	1638.3	0.8
32672.38	32672	128	DX	32672	95	786	10.2	1637.9	1637.9	1638.7	0.8
32757.55	32758	129	DY	32758	149	1164	6.9	1639.6	1639.6	1640.6	0.9
32817.83	32818	130	DZ	32818	178	1401	5.7	1640.2	1640.2	1641.1	0.9
32855.09	32855	131	EA	32855	199	1456	5.5	1640.5	1640.5	1641.4	0.8
32875.06	32875	132	EB	32875	200	1432	5.6	1640.7	1640.7	1641.5	0.8
32919.46	32919	133	EC	32919	201	1513	5.3	1640.8	1640.8	1641.6	0.8
33009.88	33010	134	ED	33010	198	1363	5.9	1640.8	1640.8	1641.7	0.9
33195.64	33196	135	EE	33196	279	1192	6.7	1641.6	1641.6	1642.5	0.9
33275.67	33276	136	EF	33276	234	1170	6.8	1641.8	1641.8	1642.8	0.9

[1] Feet above the inlet to Lake Las Vegas

LAS VEGAS WASH (SNWA Reach)

FLOODWAY DATA

LOWER LAS VEGAS WASH

FLOODING SOURCE					FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION STATION	STATION IDENFIER	NUMBER	ALPHABETIC SECTION ID	DISTANCE[1] (ft)	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD)	WITHOUT FLOODWAY (FEET NAVD)	WITH FLOODWAY (FEET NAVD)	INCREASE (FEET)
33320.47	33320	137	EG	33320	318	2285	3.5	1645.7	1645.7	1646.1	0.4
33430.81	33431	138	EH	33431	485	3434	4.0	1645.9	1645.9	1646.3	0.4
33549.55	33550	139	EI	33550	371	2674	5.1	1645.9	1645.9	1646.4	0.4
33799.72	33800	140	EJ	33800	834	3059	6.2	1646.6	1646.6	1647.0	0.5
33876.1	33876	141	EK	33876	776	2798	6.7	1647.1	1647.1	1647.5	0.4
34192.21	34192	142	EL	34192	929	4350	4.3	1650.9	1650.9	1651.8	0.9
34289.28	34289	143	EM	34289	904	4291	4.4	1651.7	1651.7	1652.6	0.9
34343.43	34343	144	EN	34343	923	4434	4.2	1652.6	1652.6	1653.6	0.9
34419.98	34420	145	EO	34420	977	4405	4.3	1653.1	1653.1	1654.0	0.9
34622.3	34622	146	EP	34622	1033	4459	4.2	1654.8	1654.8	1655.5	0.8
34709.3	34709	147	EQ	34709	1003	4126	4.5	1655.3	1655.3	1656.1	0.7
34825.85	34826	148	ER	34826	1044	4169	4.5	1656.5	1656.5	1657.2	0.8
35157.56	35158	149	ES	35158	1044	5171	3.6	1659.4	1659.4	1660.2	0.8
35337.22	35337	150	ET	35337	988	5262	3.6	1660.7	1660.7	1661.4	0.8
35539.57	35540	151	EU	35540	927	5205	3.6	1661.9	1661.9	1662.7	0.8
35621.86	35622	152	EV	35622	930	5518	3.4	1662.3	1662.3	1663.1	0.8
35693.31	35693	153	EW	35693	911	5238	3.6	1662.8	1662.8	1663.5	0.8
35814.29	35814	154	EX	35814	882	5034	3.7	1663.4	1663.4	1664.2	0.8
35922.39	35922	155	EY	35922	857	5075	3.7	1664.2	1664.2	1665.0	0.8
36102.7	36103	156	EZ	36103	784	4676	4.0	1665.1	1665.1	1665.9	0.8
36220.66	36221	157	FA	36221	755	4177	4.5	1665.4	1665.4	1666.1	0.8
36333.25	36333	158	FB	36333	732	3972	4.7	1665.5	1665.5	1666.3	0.8
36401.45	36401	159	FC	36401	861	4947	3.8	1667.1	1667.1	1667.9	0.9
36517.68	36518	160	FD	36518	914	4986	3.8	1668.2	1668.2	1669.0	0.8
37123.55	37124	161	FE	37124	678	5907	3.2	1670.7	1670.7	1671.6	1.0
37705.89	37706	162	FF	37706	818	5963	3.1	1670.9	1670.9	1671.9	1.0
37905.89	37906	163	FG	37906	502	3651	5.1	1671.0	1671.0	1671.9	0.9
38101.89	38102	164	FH	38102	490	3520	5.3	1671.2	1671.2	1672.2	1.0
38304.89	38305	165	FI	38305	390	2462	7.6	1671.3	1671.3	1672.2	0.9
38887.89	38888	166	FJ	38888	212	1433	13.1	1674.0	1674.0	1674.0	0.0
39090.89	39091	167	FK	39091	231	2045	9.2	1676.9	1676.9	1677.1	0.1
39288.89	39289	168	FL	39289	237	2226	8.4	1677.5	1677.5	1677.7	0.2

[1] Feet above the inlet to Lake Las Vegas

DOWNSTREAM LIMIT OF THE SNWA REACH
(see Volume 4 for the Lake Las Vegas Reach)

LAKE LAS VEGAS

Southern Nevada Water Authority

WEST CONSULTANTS, INC

The Louis Berger Group, Inc.

NOTES:

1. *Topographic data is based on 1-foot contours developed from 2005 aerial photography.*
2. *Base Flood Elevations (BFEs) are based on the vertical datum of NAVD88.*
3. *BFEs were calculated using HEC-RAS Version 4.0 (Beta).*

0 200 400 800
Scale in Feet

LEGEND

- 1ft Contour
- 5ft Contour & Elevation
- HEC - RAS Centerline
- Limit of Study
- 100 - YR Flow Rate
- HEC - RAS Cross Section & Base Flood Elevation (NAVD88) (Las Vegas Wash)
- HEC - RAS Cross Section & Base Flood Elevation (NAVD88) (Duck Creek)
- Property Line and APN #
- Effective SFHA (Outside of Study Limit)
- Buildings
- Proposed Floodway Area (Zone AE)
- Proposed SFHA (Zone AE)

KEY MAP

LAS VEGAS WASH FLOOD HAZARD MAPPING RESTUDY

EXHIBIT D - WORK MAP
Sheet 1 of 5

Lake Las Vegas Wastewater Lift Station Flood Protection Improvements

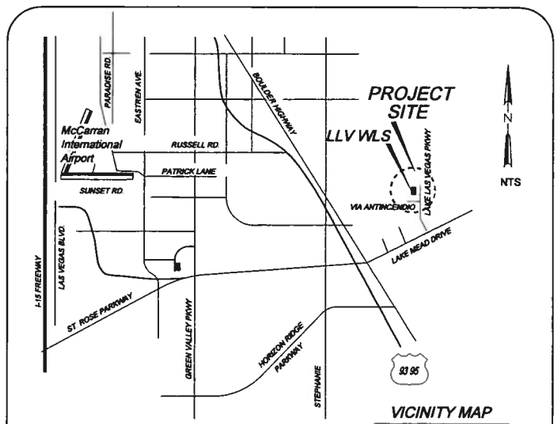
Design Plans for existing Floodwall

LAKE LAS VEGAS
WASTEWATER LIFT STATION
FLOOD PROTECTION IMPROVEMENTS

LAKE LAS VEGAS RESORT

1605 LAKE LAS VEGAS PARKWAY, HENDERSON, NV 89011

702-565-7400



VICINITY MAP





CONTRACTOR SHALL VISIT SITE PRIOR TO SUBMITTING PRICE AND REVIEW EXISTING SITE CONDITIONS AND ROUGH GRADE ELEVATIONS.

DRAWINGS SHALL BE READ, UNDERSTOOD AS, AND EXECUTED AS PART OF THE LAKE LAS VEGAS LIFT STATION, JUNE 1998 CONTRACT DOCUMENTS REVISED PER RECORD DRAWINGS, JANUARY 2000, BOTH PREPARED BY CH2M HILL.

LAKE LAS VEGAS

LIST OF DRAWINGS

SHEET	DRAWING NO.	TITLE
1	G-1-FP	COVER AND LIST OF DRAWINGS
2	C-1-FP	CIVIL SITE PLAN
3	C-2-FP	CIVIL SITE GRADING AND DRAINAGE PLAN
4	C-3-FP	CIVIL DETAILS
5	A-1-FP	ARCHITECTURAL LIFT STATION EXTERIOR ELEVATIONS
6	S-1-FP	STRUCTURAL DETAILS
7	S-2-FP	STRUCTURAL DETAILS
8	M-1-FP	MECHANICAL LIFT STATION PARTIAL PLAN
9	M-2-FP	MECHANICAL LIFT STATION PARTIAL PLAN
10	M-3-FP	MECHANICALFLOOD BARRIER GATE G-1 (REFERENCE ONLY)
11	M-4-FP	MECHANICAL FLOOD BARRIER GATES G-2 & G-3 (REFERENCE ONLY)
12	E-1-FP	SITE PLAN

CITY OF HENDERSON TRAFFIC NOTES

1. BEFORE ANY WORK IS STARTED IN THE RIGHT-OF-WAY, THE CONTRACTOR SHALL INSTALL ALL ADVANCE WARNING SIGNS FOR THE CONSTRUCTION ZONE. THE CONTRACTOR SHALL INSTALL TEMPORARY GROUND MOUNTED STOP SIGNS AT ALL NEW STREET ENCHROACHMENTS INTO EXISTING COUNTY STREETS IMMEDIATELY AFTER FIRST GRADING WORK IS ACCOMPLISHED, AND SHALL MAINTAIN SAID SIGNS.

2. ALL CONSTRUCTION SIGNING, BARRICADING AND PAVEMENT MARKINGS SHALL CONFORM TO THE "NEVADA WORK ZONE TRAFFIC CONTROL HANDBOOK" - 1986 AND TO THE "MANUAL ON UNIFORM TRAFFIC CONTORL DEVICES", CURRENT EDITION.

3. IF THE IMPROVEMENTS NECESSITATE THE OBLITERATION, TEMPORARY OBSTRUCTION, TEMPORARY REMOVAL, OR RELOCATION OF ANY EXISTING PAVEMENT MARKING, SUCH PAVEMENT MARKING SHALL BE RESTORED OR REPLACED WITH LIKE MATERIALS TO THE SATISFACTION OF THE CITY TRAFFIC ENGINEER.

THIS SET OF IMPROVEMENT PLANS IS CERTIFIED TO CONFORM TO THE REQUIREMENTS OF THE TRAFFIC STUDY ACCEPTANCE LETTER.

N/A
TONY T. ALI, P.E. 13682 — DATE 12/21/00

FOR MORE INFORMATION REGARDING THIS PROJECT, CONTACT:

TONY ALI, P.E.
CH2M HILL
2000 EAST FLAMINGO ROAD, SUITE A
LAS VEGAS, NV 89119
702.369.8175

PROFESSIONAL ENGINEER - STATE OF NEVADA — TONY T. ALI — No. 13682 — 12/21/00

APPROVALS

Curt Chandler, P.E. — FLOOD CONTROL COORDINATOR, CITY OF HENDERSON — 1-10-01 DATE

Kurt Siegler, P.E. — UTILITY SERVICES MANAGER, CITY OF HENDERSON — 1/11/01 DATE

Ken Koshiro, P.E. — NEW DEVELOPMENT ENGINEER — 1-17-01 DATE

John E. Bartels, P.E. — TRAFFIC ENGINEER, CITY OF HENDERSON — 1/9/01 DATE

Michael Bouse — DIRECTOR, BUILDING AND SAFETY, CITY OF HENDERSON — 1-10-01 DATE

James Madden — FIRE MARSHAL, CITY OF HENDERSON — 01-16-01 DATE

NEVADA POWER COMPANY — 12/21/00 DATE

CENTRAL TELEPHONE — 12-20-00 DATE

LLV COMMUNICATIONS, L.L.C. — 12/21/00 DATE

SOUTHWEST GAS - Craig S. Sisco — 12-1-00 DATE

CITY APPROVAL OF THESE PLANS IS GRANTED FOR ONE (1) YEAR ONLY. PLANS MUST BE RESUMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON, IF WORK IS NOT COMPLETED BY January, 2002.

APPROVAL OF THESE PLANS BY THE CITY OF HENDERSON IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHTS-OF-WAY AND/OR DIDICATED EASEMENTS.
THIS APPROVAL DOES NOT AUTHORIZE THE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS EXCEPT THOSE SPECIFICALLY IDENTIFIED AS "DEVIATIONS FROM STANDARDS".
THE ENGINEER SHALL RESOLVE ANY DEVIATIONS FROM THE STANDARDS IN FAVOR OF THE UNIFORM STANDARDS DRAWINGS AND SPECIFICATIONS CLARK COUNTY AREA NEVADA.

(05741) 2000000062

GENERAL
COVER AND LIST OF DRAWINGS

LAKE LAS VEGAS LIFT STATION AND FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.6175

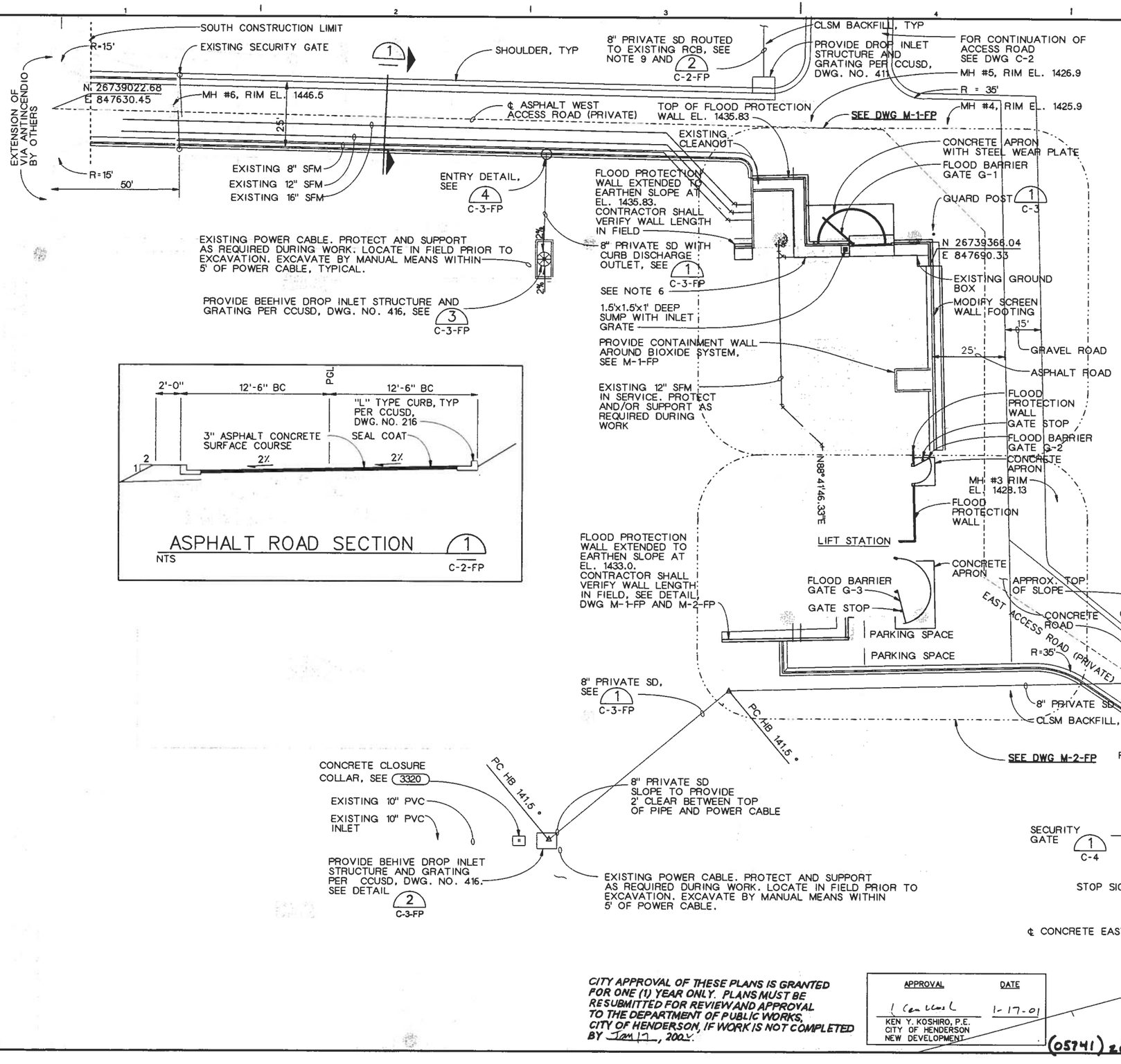
NO.	DATE	REVISION	BY	APVD
1	7-10-00	FLOOD PROTECTION	TTA	JGF

BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DSGN T ALI
DR T ALI
CHK D WAGNER
APVD J FOSS

SHEET 1
DWG NO. G-1-FP
DATE DEC 2000
PROJ NO. 145076.A6

08:34:20 20-APR-2000 5076gln.dw



NOTES:

1. DRAWINGS SHALL BE CONSIDERED AS PART OF THE LAKE LAS VEGAS LIFT STATION, JUNE 1998 CONTRACT DOCUMENTS REVISED PER RECORD DRAWINGS, JANUARY 2000. REFER TO RECORD DRAWINGS FOR LOCATION OF BURIED UTILITIES.
2. THE BEARING OF THE SOUTH WALL OF THE WASTEWATER LIFT STATION SHALL BE USED TO LOCATE ALL IMPROVEMENTS WITHIN THE CHEMICAL STORAGE AND FEED AREA, INCLUDING THE SCREEN WALL.
3. OWNER IS RESPONSIBLE TO PROVIDE SURVEY MONUMENTATION AS SHOWN. CONTRACTOR SHALL REPLACE ALL SURVEY MONUMENTATION DAMAGED, DISTURBED, DESTROYED OR OBSCURED DURING CONSTRUCTION.
4. CONTOURS ARE APPROXIMATELY SHOWN. CONFIRM ELEVATIONS IN FIELD AND ADJUST QUANTITIES ACCORDINGLY.
5. MANHOLES RIM ELEVATIONS SHALL BE INCREASED TO MATCH GRADING PLAN ELEVATIONS. MH #1 SHALL BE EXTENDED USING PRECAST SECTION AND LINED WITH PVC LINER TO MATCH EXISTING.
6. CONSTRUCTION WITHIN 5 FEET OF EXISTING SANITARY FORCE MAINS (SFM) SHALL COMMENCE ONLY AFTER APPROVAL TO DO SO BY THE CITY OF HENDERSON. CONTRACTOR SHALL EXCAVATE USING MANUAL MEANS.
7. 8" PRIVATE SD IS HDPE SUPPLIED BY OWNER, FITTINGS NOT INCLUDED. BUTT FUSE ALL JOINTS AND LEAK TEST PIPING SYSTEM TO 10 PSI.
8. ALL FLOOD PROTECTION ITEMS ARE DETAILED IN DRAWINGS M-1-FP AND M-2-FP.
9. PROVIDE 3' MINIMUM COVER OVER SD. VERIFY LENGTH IN FIELD AND AS-BUILT CONDITION PRIOR TO COMMENCING WORK, SEE 1 C-3-FP

BASIS OF BEARING

NORTH 89°55'19" EAST, BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF SECTION 22, TOWNSHIP 21 SOUTH, RANGE 63 EAST, M.D.M. AS SHOWN ON A MAP ON FILE IN THE CLARK COUNTY, NEVADA RECORDER'S OFFICE AS BOOK 74, PAGE 75 OF FINAL MAPS.

HORIZONTAL AND VERTICAL CONTROL

1. HORIZONTAL: NAVD 83 (GRID), NEVADA EAST ZONE, IN FEET (STATE PLANAR COORDINATES)
   VERTICAL: NAVD 88, LAKE LAS VEGAS BENCH MARK NO. 14
   BENCHMARK
2. LAKE LAS VEGAS BENCHMARK NO. 14: 2 INCH BRASS CAP LOCATED ON TOP OF INLET STRUCTURE CONCRETE HEADWALL IN THE SOUTHWEST CORNER OF LAKE LAS VEGAS ON THE WEST SIDE OF LAKE LAS VEGAS PARKWAY AT THE LAKE LAS VEGAS WASH. ELEVATION = 1423.91 NAVD 88 DATUM.

0 20 40 60
Scale In Feet

CITY APPROVAL OF THESE PLANS IS GRANTED FOR ONE (1) YEAR ONLY. PLANS MUST BE RESUBMITTED FOR REVIEW AND APPROVAL TO THE DEPARTMENT OF PUBLIC WORKS, CITY OF HENDERSON, IF WORK IS NOT COMPLETED BY Jan 17, 2002.

APPROVAL	DATE
KEN Y. KOSHIRO, P.E. CITY OF HENDERSON NEW DEVELOPMENT	1-17-01

(05741) 2000000042

LAKE LAS VEGAS

PROFESSIONAL ENGINEER · STATE OF NEVADA · TONY T. ALI · No. 13682

CIVIL

SITE PLAN

LAKE LAS VEGAS LIFT STATION AND FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.6175

BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

NO.	DATE	REVISION	BY	APVD
1	7-10-00	FLOOD PROTECTION	TTA	JGF

DSGN T ALI
DR T ALI
CHK M RANDALL
APVD J FOSS

SHEET 2
DWG NO. C-1-FP
DATE DEC 2000
PROJ NO. 145076.A6

14:43:07 21-DEC-2000 5076c1fp.div

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E:\WO5176\Dv...screen\mod\LV5076cfp06.mnt L1-3-5, 7, 9-30, 32-62 LU-V5076cfp06.mnt
D:\WO5176\Dv...screen\mod\LV5076DRAWING.MNT 6 LU-V5076DRAWING.MST
D:\WO5176\Dv...screen\mod\LV5076cfp05.MST 44-47, 49-53, 56-63 LU-V5076cfp05.MST
D:\WO5176\Dv...screen\mod\LV5076cfp04.MST 4-63 LU-V5076cfp04.MST
D:\WO5176\Dv...screen\mod\LV5076cfp03.MST Depth-30, 32-63 LU-V5076cfp03.MST
Architect.dfp L1, 3-30, 32-34, 23-43, 45-61 LU-V5076DOC2.MST 6

EXTENSION OF VIA ANTINCENDIO BY OTHERS

SOUTH LIMIT OF CONSTRUCTION MATCH EXIST ACP ELEVATION

R=15'

EXIST. SECURITY GATE

SIGN, TYP SEE 6 C-4

RED CURGS PAINTINGS FOR FIRE LANE RESTRICTION, BY OWNER

8" PRIVATE SD

SEE DWG. C-2 FOR CONTINUATION OF DRIVEWAY TO WEST

0+00 4% 0+50 GB ℄ 1+00 GB 2.0% 7.88% 2+00 GB ℄ WEST ACCESS ROAD (PRIVATE) 2+80 GB 3+00 3.0%

PI N 26739072.67
E 847631.49
EL. 1447.94 FG

PI N 26739122.66
E 847632.54
EL. 1444.00 FG

PI N 26739222.64
E 847634.63
EL. 1434.00 FG

PI N 26739302.62
E 847636.30
EL. 1428.00 FG

1425.61 FG

PI N 26739022.68
E 847631.49
EL. 1449.94 FG

MH #6, EXIST RIM EL. 1446.5
RAISE MH NECK AND RIM TO MATCH FG

RED CURBS PAINTED FOR FIRE LANE RESTRICTION, BY OWNER

1 C-1-FP

8" PRIVATE SD

1428.00 FG (×5)

SIGN, TYP SEE 7 C-4

Z

0 20 40 60
Scale In Feet

5 C-3-FP

EXISTING TOE OF SLOPE, TYP

SCREEN WALL

4" MIN TYPE II AGGREGATE BASE OVER 6" TYPE I AGGREGATE BASE 95% COMPACTION SEE CCUSD DWG. NO. 209

1.3%

1428.98 FG

1428.88 FG

APPROXIMATE TOP OF SLOPE ⊗1427.32 FG

ASPHALT CONCRETE PAVEMENT

ASPHALT-GRAVEL JOINT

CONCRETE-GRAVEL JOINT

ASPHALT-CONCRETE JOINT

1.0 %

SLOPE TO SUMP

RED CURBS PAINTED FOR FIRE LANE RESTRICTION, BY OWNER

POE 1+88

EAST ACCESS ROAD (PRIVATE)

1429.0 FG

1428.98 FG

1428.88 FG

1.0%

1+50

1%

1428.98 FG

1

8" PRIVATE SD

EXISTING TOE OF SLOPE, TYP

1+00 GB

PI N 26739486.57
E 847934.16
EL 1437.0

25'

6%

SECURITY GATE 1 C-4

PI N 26739481.4
E 847914.92
EL 1437.0

0+50 GB

6 C-3-FP

DEMOLISH EXISTING CURB PROVIDE VALLEY GUTTER TO MATCH

N 26739502.13
E 847945.99
EL 1436.58

N 26739510.72
E 847957.14
EL 1435.91

N 26739476.09
E 847952.37
EL 1437.08

N 26739476.09
E 847966.55
EL 1437.85

0.5%

0+00

6" CURB
0" CURB

6" CURB
0" CURB

CONCRETE DRIVEWAY

8" PRIVATE SD

WEST ACCESS ROAD PROFILE GRADE LINE (PGL)		EAST ACCESS ROAD PROFILE GRADE LINE (PGL)	
STA	PGL	STA	PGL
0.25	1448.94	0.25	1436.75
0.3	1448.73	0.3	01436.78
0.35	1448.50	0.35	1436.76
0.4	1448.25	0.4	01436.70
0.45	1447.98	0.459	1436.59
0.5	1447.70	0.5	1436.44
0.55	1447.39	0.554	1436.24
0.6	1447.06	0.6	1436.00
0.65	1446.72	0.65	1435.71
0.7	1446.35	0.7	1435.38
0.75	1445.97	0.75	1435.00
0.8	1445.57	0.8	1434.59
0.85	1445.16	0.85	1434.17
0.9	1444.74	0.9	1433.74
0.95	1444.31	0.95	1433.29
1	1443.87	1	1432.82
1.05	1443.42	1.05	1432.35
1.1	1442.95	1.1	1431.85
1.15	1442.48	1.15	1431.35
1.2	1441.99	1.2	1430.83
1.25	1441.50	1.25	1430.29
		1.35	1429.21
		1.4	1428.70
1.75	1436.50	1.45	11428.24
1.8	1436.01	1.5	1427.85
1.85	1435.53	1.55	1427.51
1.9	1435.06	1.6	1427.24
1.95	1434.60	1.65	1427.02
2	1434.16	1.7	1426.87
2.05	1433.73	1.75	1426.77
2.1	1433.31	1.8	1426.73
2.15	1432.90	1.85	1426.75
2.2	1432.51		
2.25	1432.13		
2.55	1429.88		
2.6	1429.51		
2.65	1429.18		
2.7	1428.87		
2.75	1428.60		
2.8	1428.34		
2.85	1428.12		
2.9	1427.92		
2.95	1427.76		
3	1427.61		
3.05	1427.50		

SEAL COAT
3" ASPHALT CONCRETE SURFACE COURSE
EDGE OF PAVEMENT ELEVATION VARIES
"L" TYPE CURB PER CCUSD DWG. NO. 216

EL. 1428.98
2%
2
1
24'-6"
2'-1"

CURB AND GUTTER 1
NTS

EXST 5'x11' RCB CULVERT
PACK ANNULAR SPACE WITH EMACCO
Ø 8" HDPE PRIVATE SD
EPOXY BOND HYDO-TITE WATERSTOP ALL AROUND CENTER OF WALL, TYP
CORE EXST CONCRETE WALL TO FIT 8" HDPE STORM DRAIN PENETRATION

STORM DRAIN PENETRATION DETAIL 2
NTS C-1-FP

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APPROVAL	DATE
KEN Y. KOSHIRO, P.E. CITY OF HENDERSON NEW DEVELOPMENT	1-17-01

NOTES:

1. PROVIDE WATER-TIGHT LIDS ON ALL MANHOLES

(05741) 2000000062

LAKE LAS VEGAS

PROFESSIONAL ENGINEER - STATE OF NEVADA - No 13682 - JOINT

CIVIL

SITE GRADING AND DRAINAGE PLAN

LAKE LAS VEGAS LIFT STATION AND FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.6175

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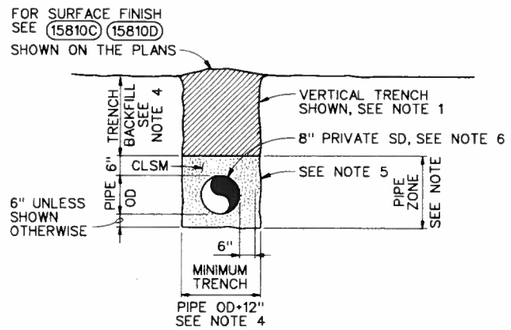
NO.	DATE	REVISION	BY	APVD
1	7-10-00	FLOOD PROTECTION	TTA	JGF

DSGN T ALI
DR T. ALI
CHK M. RANDALL
APVD J. FOSS

SHEET 3
DWG NO. C-2-FP
DATE DEC 2000
PROJ NO. 145076.A6

14:51:09 21-DEC-2000 5076c2fp.dlv

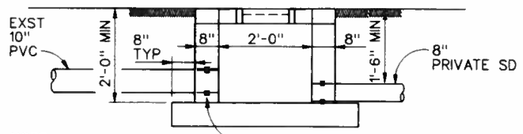
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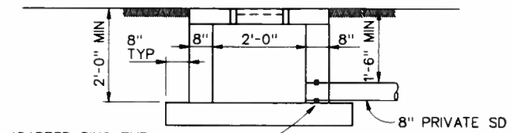
1. CONTRACTOR SHALL SLOPE TRENCH WALLS OR SHORE EXCAVATIONS FOR CONSTRUCTION AND SAFETY AND IN ACCORDANCE WITH CURRENT OSHA REQUIREMENTS.
2. FOR LOCATION OF MARKING TAPE SEE (4) C-3 ,SIMILAR
3. ANCHOR PIPING TO PREVENT FLOATATION DURING CLSM INSTALLATION. SUPPORT PIPING OFF TRENCH WALLS TO PROVIDE CLEARANCES SHOWN.
4. PIPE ZONE AND BACKFILL MATERIAL AS SHOWN OR SPECIFIED SHALL EXTEND TO EDGE OF EXCAVATED TRENCH.
5. CONTRACTOR SHALL PLACE CLSM AGAINST FIRM UNDISTURBED EARTH. ALL LOOSE MATERIAL SHALL BE REMOVED FROM TRENCH WALLS PRIOR TO PLACING CLSM.
6. 8" HDPE PIPING SUPPLIED BY OWNER, NOT INCLUDING FITTINGS. BUTT FUSE PIPING CONNECTIONS.

PRIVATE STORM DRAIN TRENCH (1)
NTS — C-1-FP



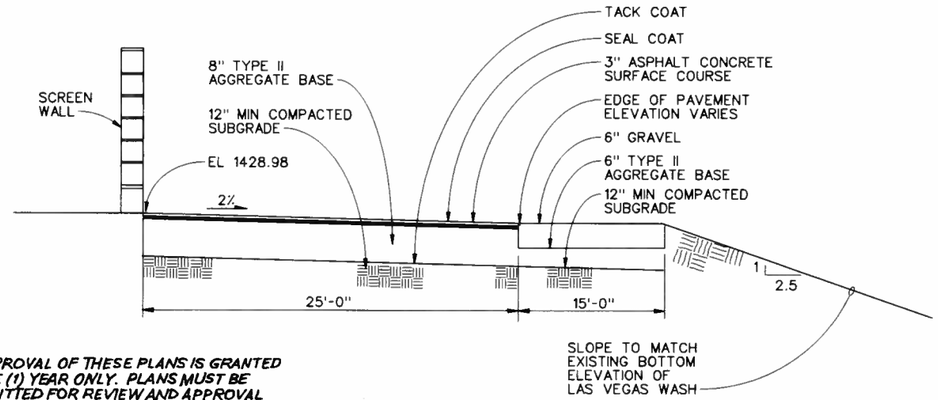
NOTE:
PROVIDE GRATE AND STRUCTURE PER CLARK COUNTY UNIFORM STANDARD DRAWINGS, DWG. NO. 416.

EXST 10" PVC TO 8" PVC CONNECTION MANHOLE (2)
NTS — C-1-FP



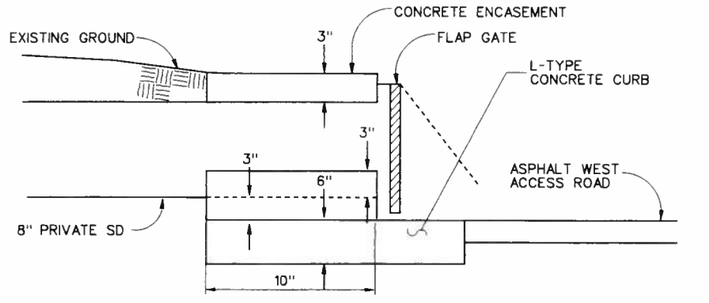
NOTE:
PROVIDE GRATE AND STRUCTURE PER CLARK COUNTY UNIFORM STANDARD DRAWINGS, DWG. NO. 416.

EAST PARKING LOT DROP INLET STRUCTURE (3)
NTS — C-1-FP

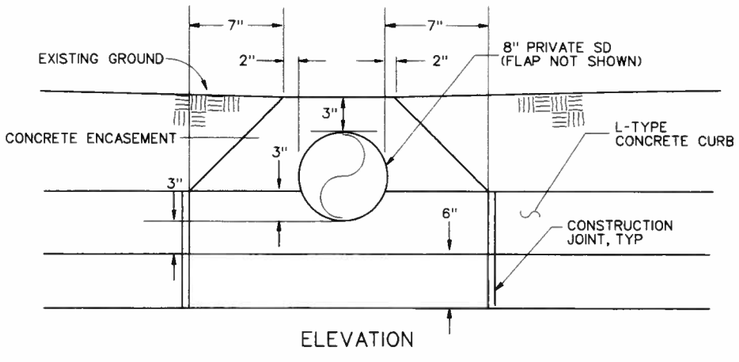


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DRIVEWAY SECTION NORTH OF SCREEN WALL (5)
NTS — C-2-FP

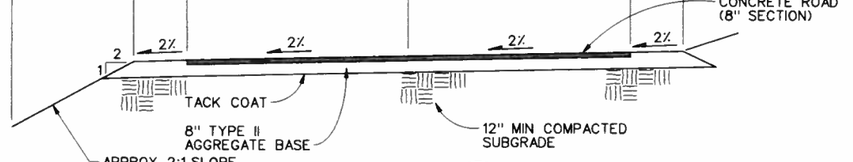


SECTION

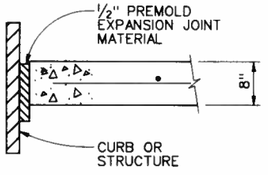


ELEVATION

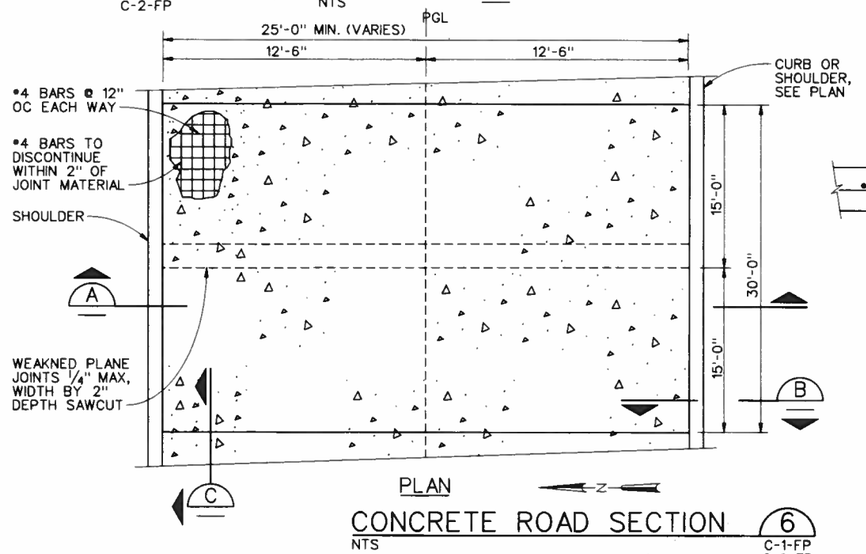
STORM DRAIN CURB ENTRY (4)
NTS — C-1-FP



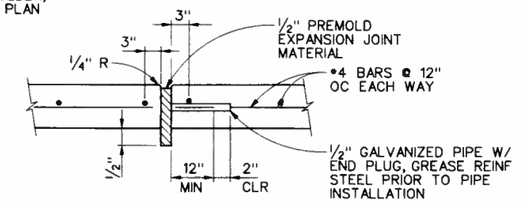
SECTION (A)
NTS



SECTION (B)
NTS



CONCRETE ROAD SECTION (6)
NTS — C-1-FP, C-2-FP



SECTION (C)
NTS

APPROVAL	DATE
Ken Koshiro	1-17-01
KEN Y. KOSHIRO, P.E. CITY OF HENDERSON NEW DEVELOPMENT	

LAKE LAS VEGAS

PROFESSIONAL ENGINEER · STATE OF NEVADA · No. 13681 · TONY T. ALI

(05741) 2000000062

CIVIL

DETAILS

LAKE LAS VEGAS LIFT STATION AND FORCE MAINS

HENDERSON, NEVADA

CH2MHILL

2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.6775

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NO.	DATE	REVISION	BY	APVD
1	7-10-00	FLOOD PROTECTION	TTA	JGF

DSGN T ALI
DR T ALI
CHK M RANDALL
APVD J FOSS

SHEET 4
DWG NO. C-3-FP
DATE DEC 2000
PROJ NO. 145076.A6

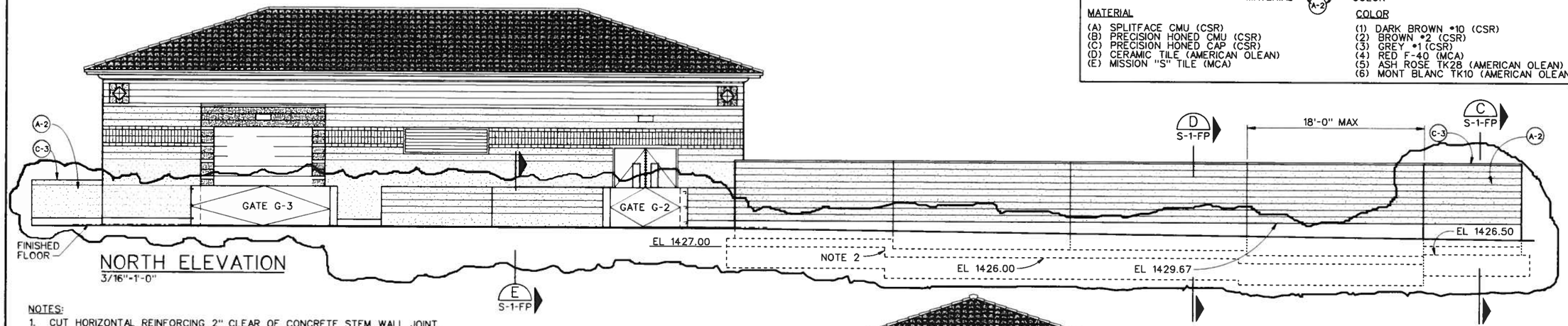
13:32:56 24-APR-2000 5076c3fp.dlv

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MATERIAL AND COLOR LEGEND

MATERIAL (A-2) COLOR

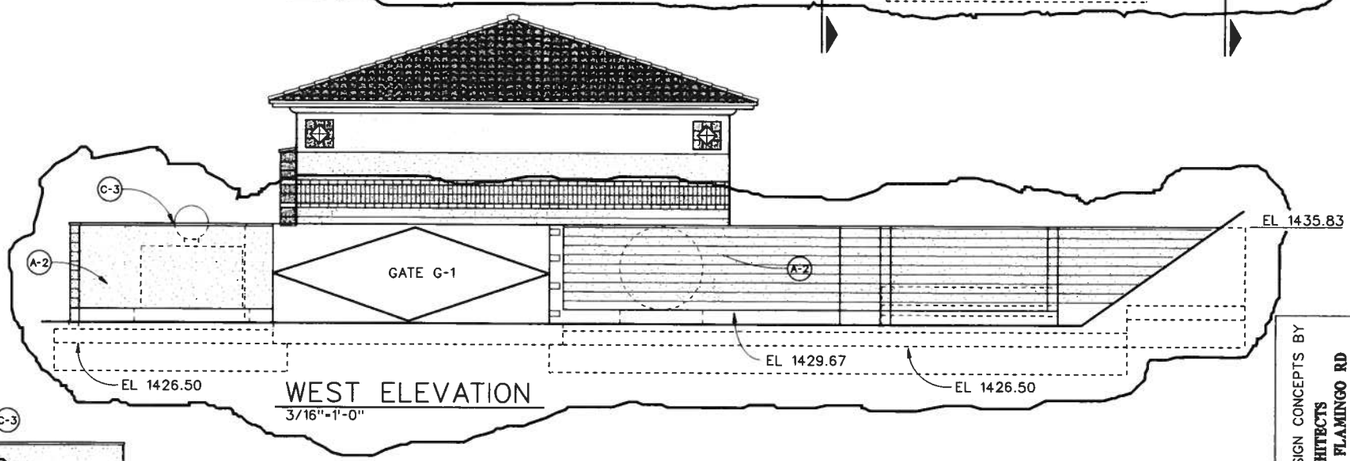
MATERIAL	COLOR
(A) SPLITFACE CMU (CSR)	(1) DARK BROWN #10 (CSR)
(B) PRECISION HONED CMU (CSR)	(2) BROWN #2 (CSR)
(C) PRECISION HONED CAP (CSR)	(3) GREY #1 (CSR)
(D) CERAMIC TILE (AMERICAN OLEAN)	(4) RED F-40 (MCA)
(E) MISSION "S" TILE (MCA)	(5) ASH ROSE TK28 (AMERICAN OLEAN)
	(6) MONT BLANC TK10 (AMERICAN OLEAN)



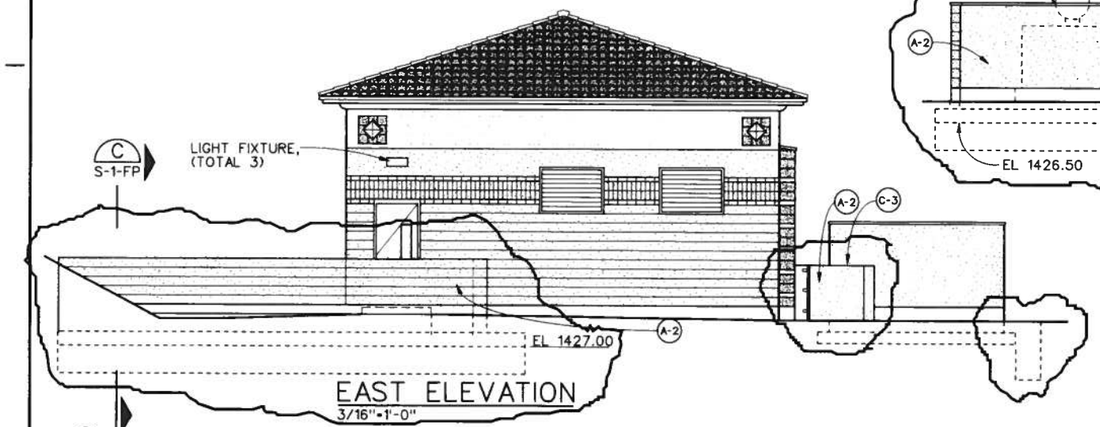
NORTH ELEVATION
3/16"=1'-0"

NOTES:

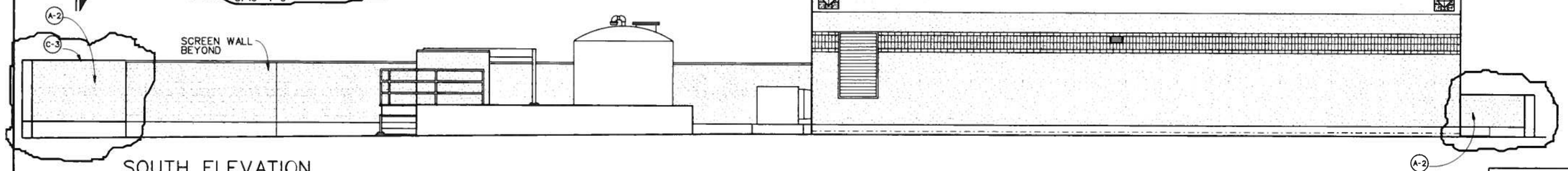
1. CUT HORIZONTAL REINFORCING 2" CLEAR OF CONCRETE STEM WALL JOINT AND APPLY BOND BREAKER TO JOINT SURFACE OF FIRST POUR. NO JOINT REQUIRED IN FOOTING.
2. STEP FOOTING AS REQUIRED AT CONTROL JOINTS TO MAINTAIN 6" COVER ON FOOTING.



WEST ELEVATION
3/16"=1'-0"



EAST ELEVATION
3/16"=1'-0"



SOUTH ELEVATION
3/16"=1'-0"

EXTERIOR DESIGN CONCEPTS BY
HCA ARCHITECTS
1850 EAST FLAMINGO RD
LAS VEGAS, NEVADA

ARCHITECTURAL

LIFT STATION
EXTERIOR ELEVATIONS

LAKE LAS VEGAS
LIFT STATION
AND
FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.5775

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1	7-10-00	FLOOD PROTECTION	TTA	JGF

DSGN C FELSKE
E McClelland
DR E McClelland
CHK T HOFFENSPRGER
APVD J FOSS

SHEET 5
DWG NO. A-1-FP
DATE DEC 2000
PROJ NO. 145076.A6

PROFESSIONAL ENGINEER - STATE OF NEVADA No. 13682

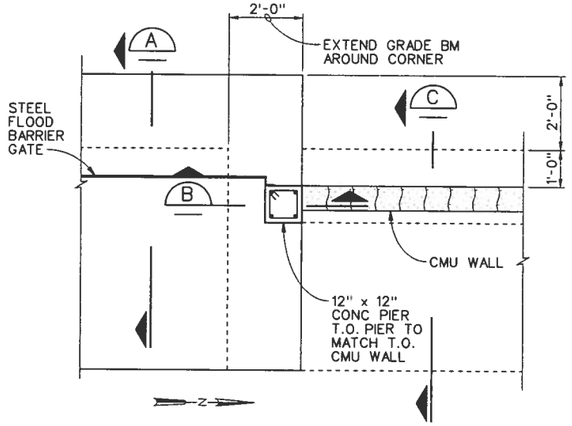
LAKE LAS VEGAS

(06741)2000000062

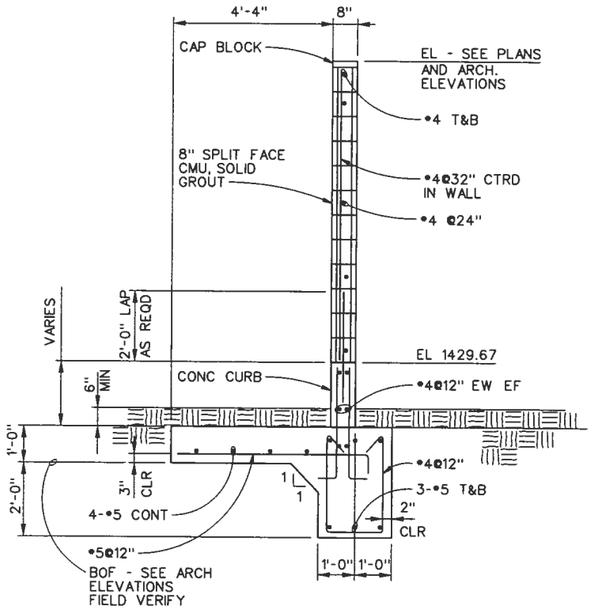
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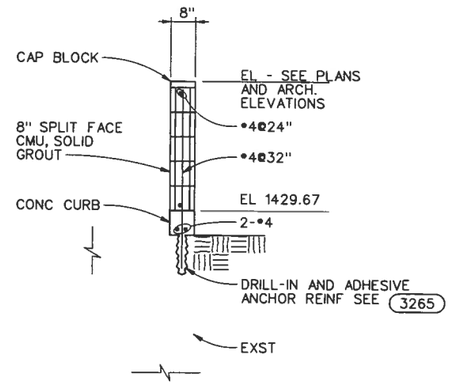
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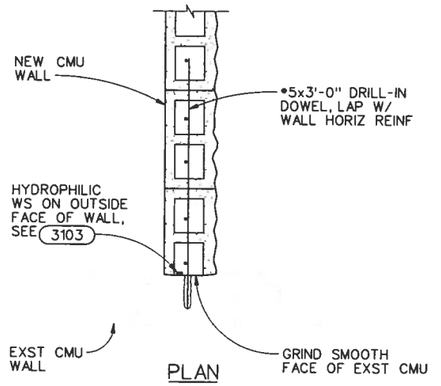
PARTIAL PLAN AT GATE G-1
1/2"=1'-0" M-1-FP



TYPICAL FLOOD PROTECTION WALL SECTION
1/2"=1'-0" C M-1-FP M-2-FP

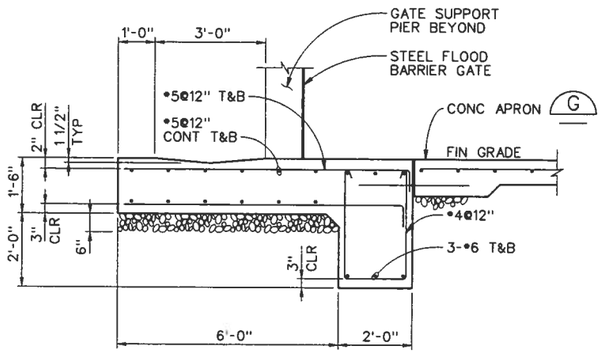


FLOOD PROTECTION WALL AT EXISTING
1/2"=1'-0" E M-1-FP M-2-FP

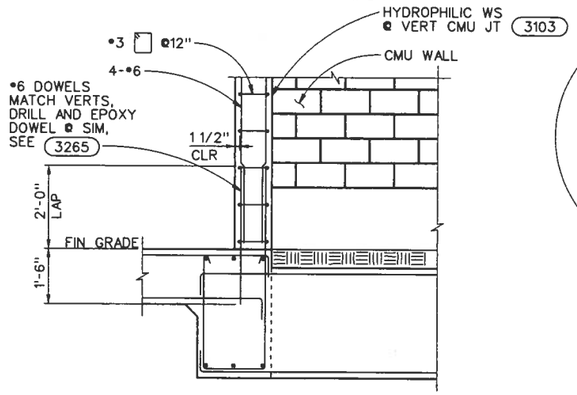


PLAN

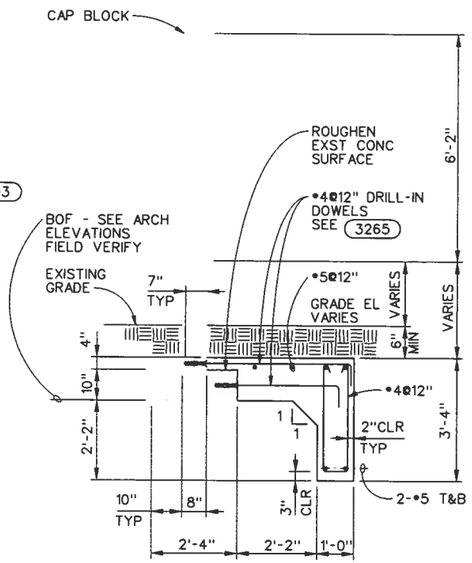
CMU WALL TO EXISTING CMU WALL CONNECTION
NTS 1 M-1-FP M-2-FP



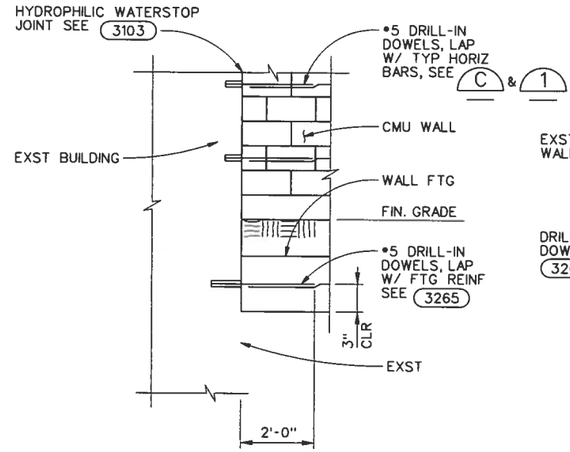
SECTION A
1/2"=1'-0" M-1-FP M-2-FP



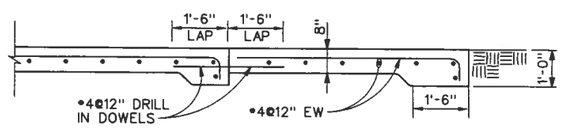
GATE SUPPORT PIER B
1/2"=1'-0" M-1-FP



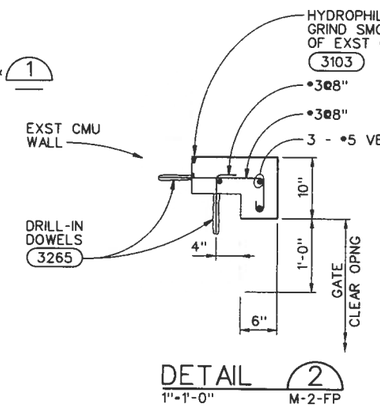
EXISTING SCREEN WALL D
1/2"=1'-0" M-1-FP M-2-FP



FLOOD PROTECTION WALL AT BUILDING
1/2"=1'-0" F M-1-FP



SECTION G
NTS M-1-FP M-2-FP



DETAIL 2
1"=1'-0" M-2-FP

(05741) 2000000062

LAKE LAS VEGAS

PROFESSIONAL ENGINEER - STATE OF NEVADA - No. 13682 - JOHN F. CALL

STRUCTURAL
DETAILS

LAKE LAS VEGAS LIFT STATION AND FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.8175

WILLIAMS SCOTSMAN

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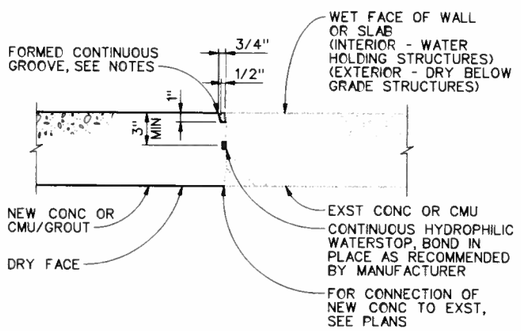
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1	7-10-00	FLOOD PROTECTION	TTA	JGF

DSGN D WAGNER
DR T ALI
CHK J CALL
APVD J FOSS

SHEET 6
DWG NO. S-1-FP
DATE DEC 2000
PROJ NO. 145076.A6

15:08:27 21-DEC-2000 5076s1fp.dlv

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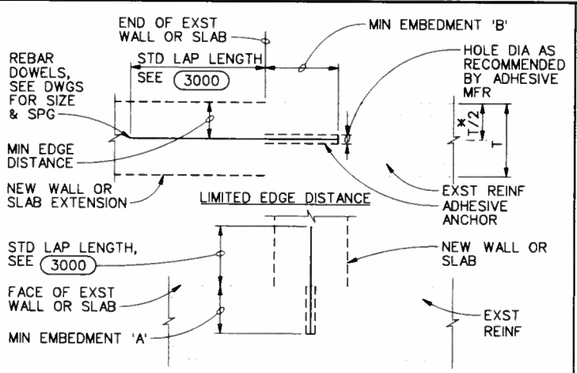


NOTES:

1. WAIT UNTIL NEW CONCRETE OR CMU GROUT IS MINIMUM 28 DAYS OLD PRIOR TO GROUTING GROOVE.
2. ROUGHEN AND CLEAN SURFACES OF GROOVE WITH POWER WIRE BRUSH OR SANDBLASTING.
3. SATURATE AREA FOR 24 HOURS PRIOR TO GROUTING.
4. DRY PACK WITH TYPE II NON-SHRINK GROUT.
5. USE STEEL HAMMER AND STEEL TOOL TO DENSELY PACK GROUT INTO GROOVE.
6. WATER CURE GROUT FOR 4 DAYS MINIMUM.
7. REINFORCING NOT SHOWN FOR CLARITY.

HYDROPHILIC/GROOVE WATERSTOP
NTS

3103



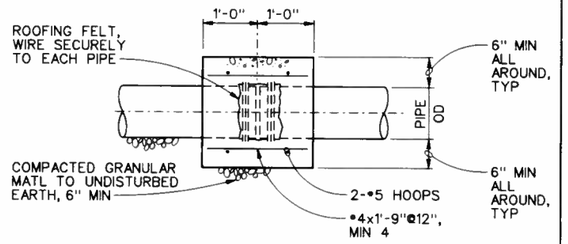
DOWEL SIZE	MIN EDGE DIST	MIN EMBEDMENT 'A'	MIN EMBEDMENT 'B'
#3	2 1/2"	5"	8"
#4	3 1/2"	7"	11"
#5	4"	8"	13"
#6	5"	10 1/2"	16"
#7	6"	12 1/2"	20"
#8	7"	14"	22"
#9	7 1/2"	15"	24"

NOTES:

1. CONFORM TO THE REQUIREMENTS OF SPECIFICATION SECTION 03215, DOWELING FOR CONCRETE.
2. FOLLOW ADHESIVE MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION.
3. USE MINIMUM EMBEDMENTS SHOWN, EXCEPT USE MANUFACTURER'S MINIMUM RECOMMENDED EMBEDMENT IF GREATER.
4. * LOCATE DOWELS CENTERED IN WALL OR SLAB UNLESS OTHERWISE NOTED ON DRAWINGS. WHERE 2 ROWS OF DOWELS INDICATED, STAGGER SPACING & LOCATE ALTERNATING DOWELS AT MINIMUM EDGE DISTANCE FROM OPPOSITE FACES.

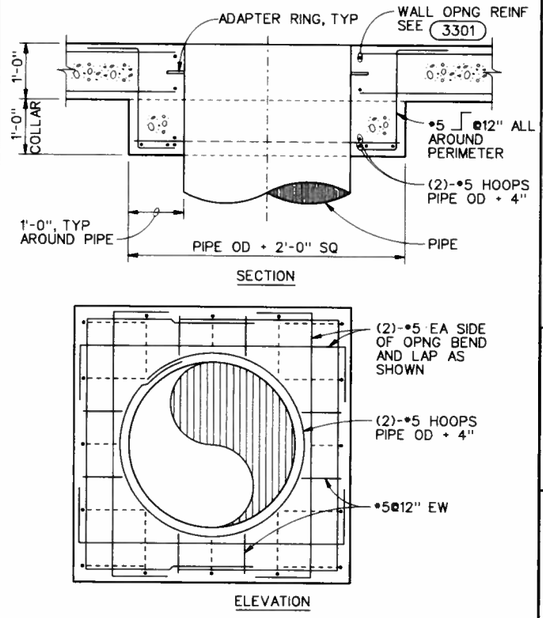
DRILL-IN DOWELS
NTS

3265



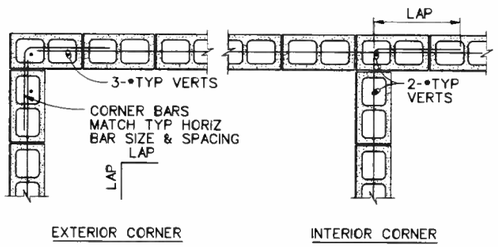
CONCRETE CLOSURE COLLAR
NTS

3320



PIPE COLLAR
NTS

3321



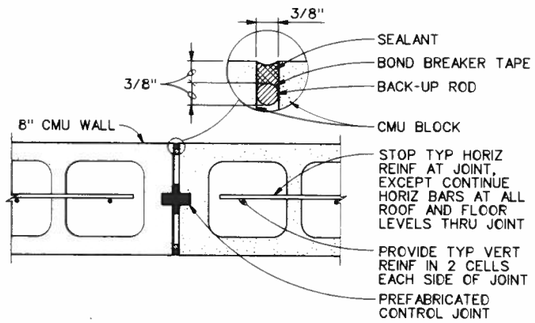
SINGLE MAT PLAN

NOTES:

1. LAP=48 BAR DIAMETERS OR 2'-0" MIN UNLESS OTHERWISE NOTED.
2. PROVIDE A STANDARD 90° HOOK EACH END ON ANY HORIZONTAL BAR BETWEEN OPENINGS OR CORNERS LESS THAN 6'-0" IN LENGTH.

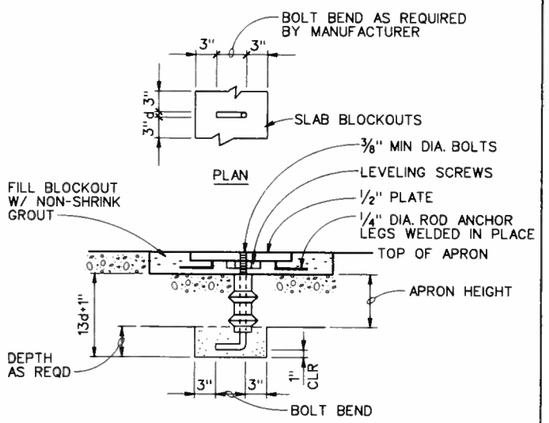
CMU WALL CORNERS
NTS

4001



CMU CONTROL JOINT
NTS

4031



NOTES:

SEE NOTES, DETAIL 3356 .

SLAB BLOCKOUT FOR ANCHOR BOLTS
NTS

3357

(05741)2000000068

LAKE LAS VEGAS

PROFESSIONAL ENGINEER · STATE OF NEVADA · No. 13682

STRUCTURAL

DETAILS

LAKE LAS VEGAS LIFT STATION AND FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.6175

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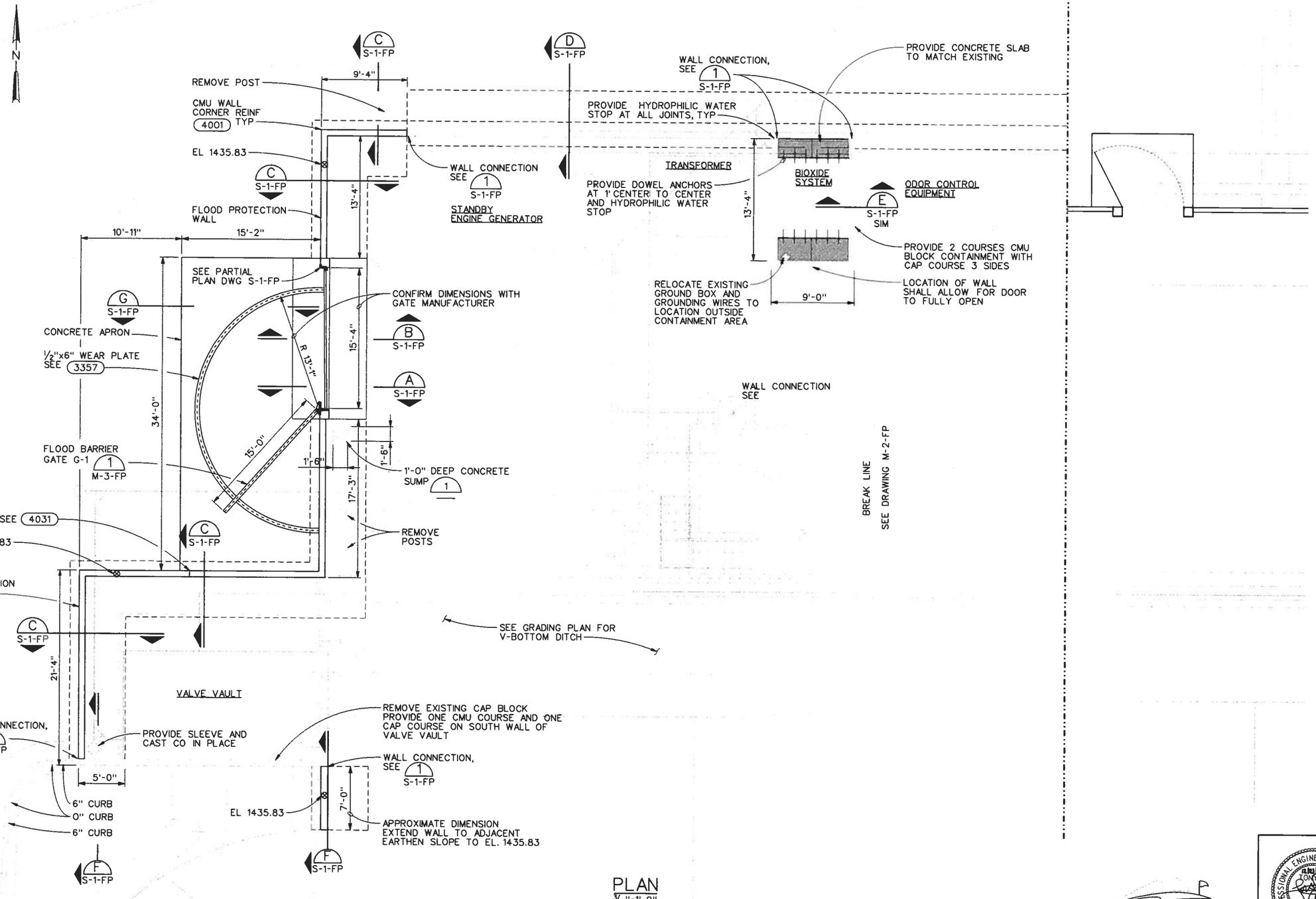
NO.	DATE	REVISION	BY	APVD
1	7-10-00	FLOOD PROTECTION	TTA	JGF

DSGN T ALI
DR T ALI
CHK M RANDALL
APVD J FOSS

SHEET 7
DWG NO. S-2-FP
DATE DEC 2000
PROJ NO. 145076.A6

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PLAN
3/16"=1'-0"

(05741)2000000062

LAKE LAS VEGAS

MECHANICAL
LIFT STATION PARTIAL PLAN

LAKE LAS VEGAS LIFT STATION AND FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.6175

PROFESSIONAL ENGINEER - STATE OF NEVADA - JAMES JOHN T. FOSS - No. 13682

			JGF	APVD
			TTA	BY
1	7-10-00	FLOOD PROTECTION REVISION		
NO.	DATE			

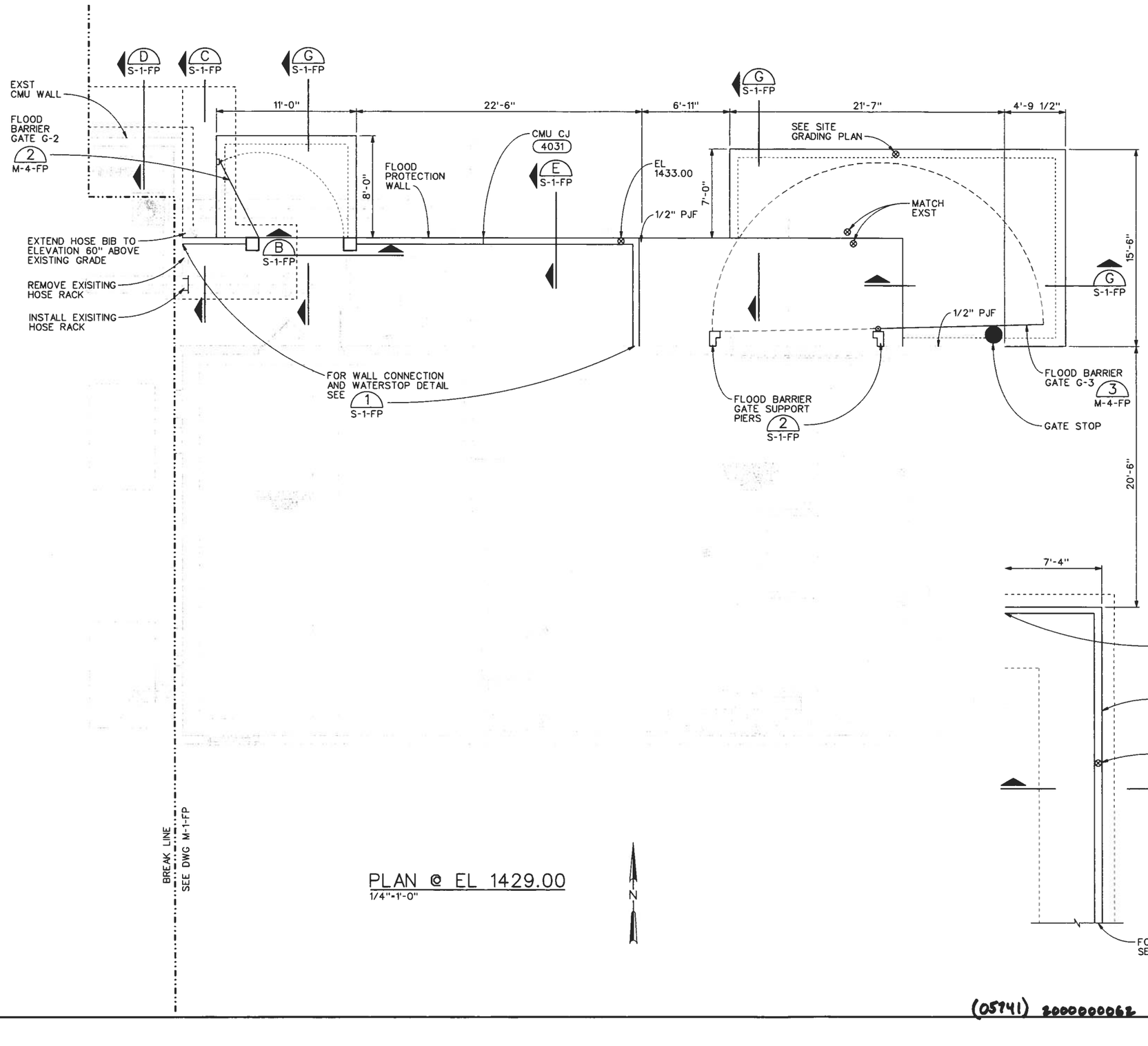
DSGN T ALI
DR T ALI
CHK D WAGNER
APVD J FOSS

SHEET 8
DWG NO. M-1-FP
DATE DEC 2000
PROJ NO. 145076.A6

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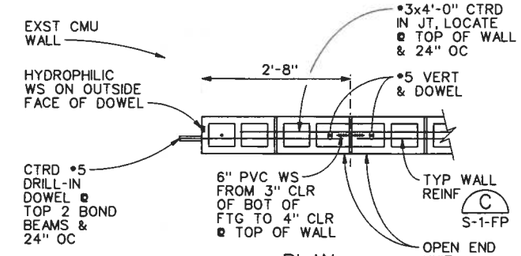
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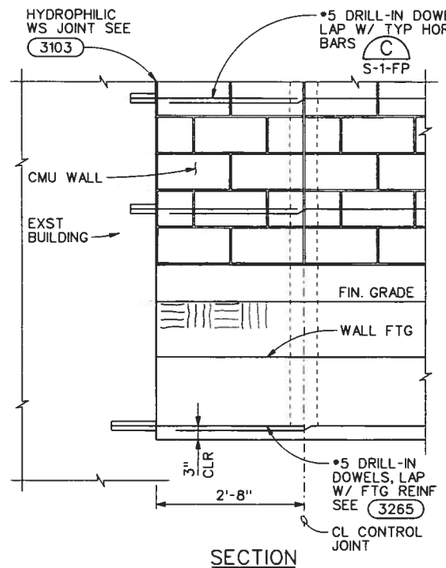


PLAN @ EL 1429.00
1/4"=1'-0"

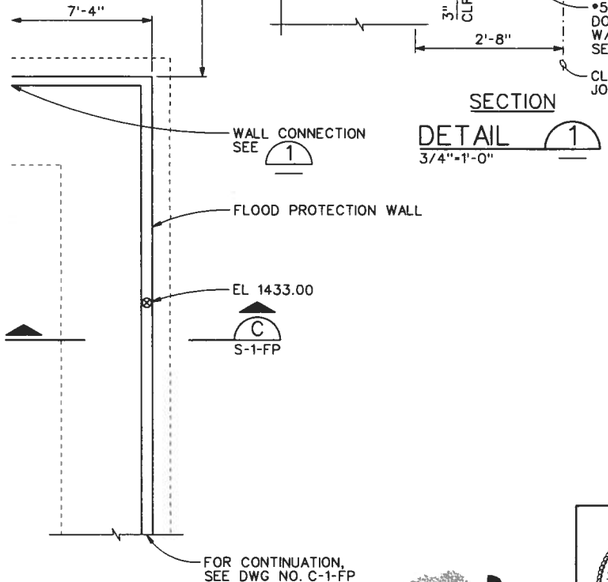
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PLAN



SECTION



DETAIL 1
3/4"=1'-0"

LAKE LAS VEGAS

(05741) 2000000062

MECHANICAL
LIFT STATION
PARTIAL PLAN

LAKE LAS VEGAS
LIFT STATION
AND
FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.6175

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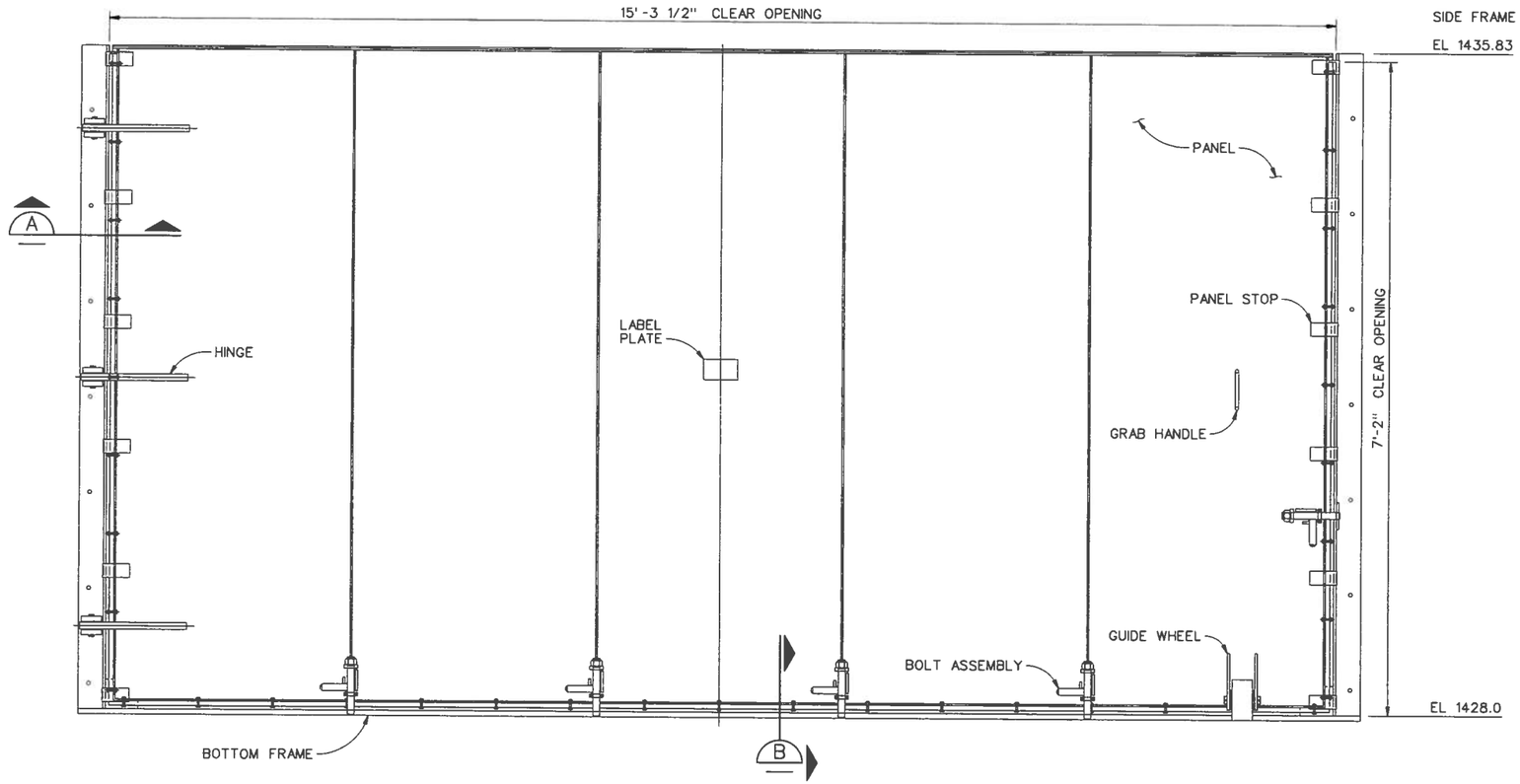
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1	7-10-00	FLOOD PROTECTION	TTA	JGF

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DR Y SAKALI
CHK T DAVIS
APVD J FOSS

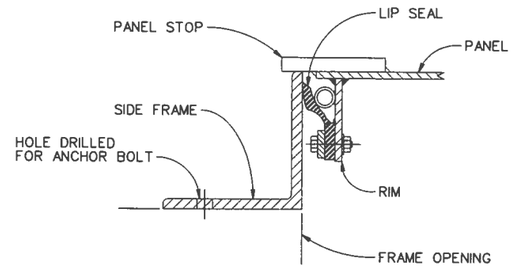
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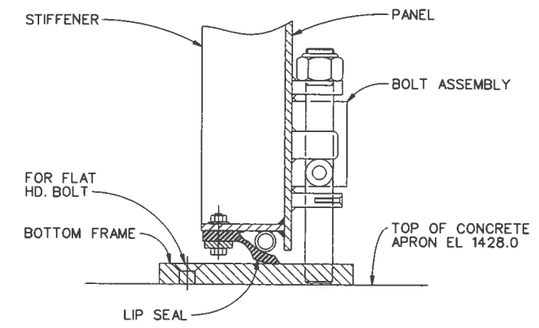
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FLOOD BARRIER GATE G-1 (1)
NTS M-1-FP



SECTION A
NTS M-4-FP



SECTION B
NTS M-4-FP

NOTES:
1. DRAWING SUPPLIED COURTESY OF WALZ AND KRENZER.
2. DRAWING NOT TO BE USED FOR CONSTRUCTION.
3. ORIENTATION OF GATE DIFFERS FROM THOSE SHOWN ON PLANS.
4. FIELD MEASURE AND CONFIRM ALL DIMENSIONS WITHIN TOLERANCE REQUIRED BY MANUFACTURER FOR SEALING AGAINST WATER HEAD.

(05741) 2000000062

LAKE LAS VEGAS

MECHANICAL
FLOOD BARRIER GATE G-1
(REFERENCE ONLY)

LAKE LAS VEGAS LIFT STATION AND FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.6175

VERIFY SCALE
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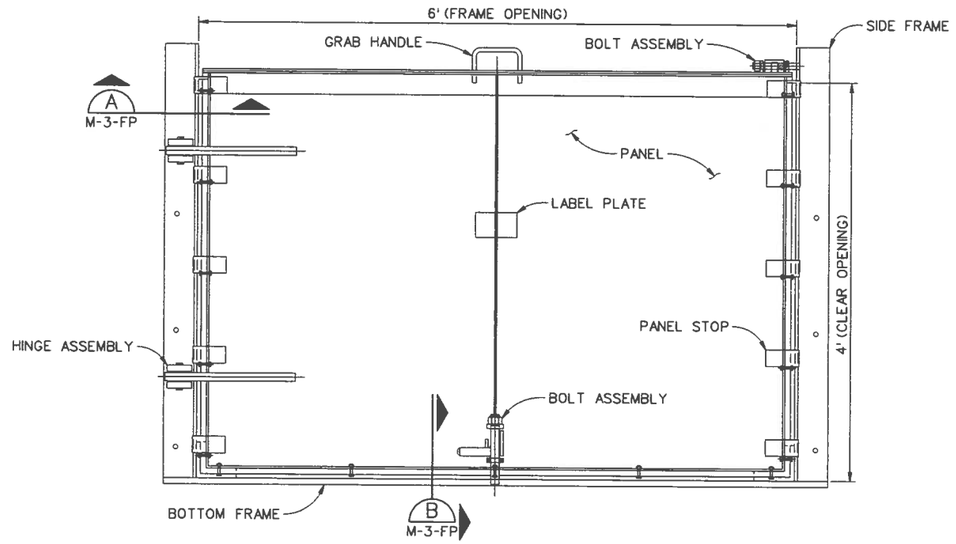
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1	7-10-00	FLOOD PROTECTION	TTA	JGF

DSGN
DR
CHK
APVD

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DATE DEC 2000
PROJ NO. 145076.A6

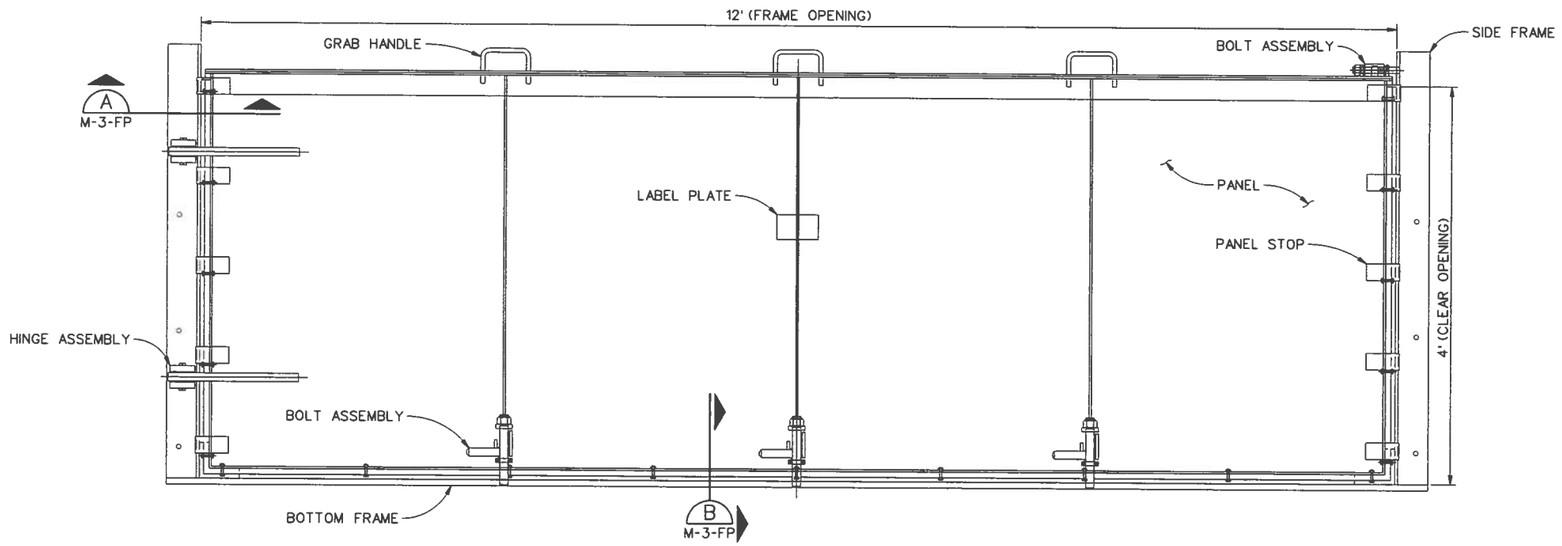
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FLOOD BARRIER GATE G-2 (2) M-2-FP

NTS



FLOOD BARRIER GATE G-3 (3) M-2-FP

NTS

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2. DRAWING NOT TO BE USED FOR CONSTRUCTION.
3. ORIENTATION OF GATE DIFFERS FROM THOSE SHOWN ON PLANS.
4. FIELD MEASURE AND CONFIRM ALL DIMENSIONS WITHIN TOLERANCE REQUIRED BY MANUFACTURER FOR SEALING AGAINST WATER HEAD.

(05741) 2000000062

LAKE LAS VEGAS

PROFESSIONAL ENGINEER · STATE OF NEVADA · TONY T. · No.13682 · CIVIL

MECHANICAL
FLOOD BARRIER GATES
G-2 & G-3
(REFERENCE ONLY)

LAKE LAS VEGAS
LIFT STATION
AND
FORCE MAINS
HENDERSON, NEVADA

CH2MHILL
2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.8175

NO.	DATE	REVISION	BY	APVD
1	7-10-00	FLOOD PROTECTION	TTA	JGF

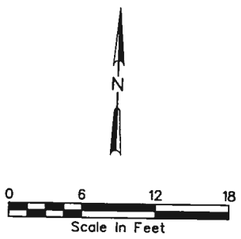
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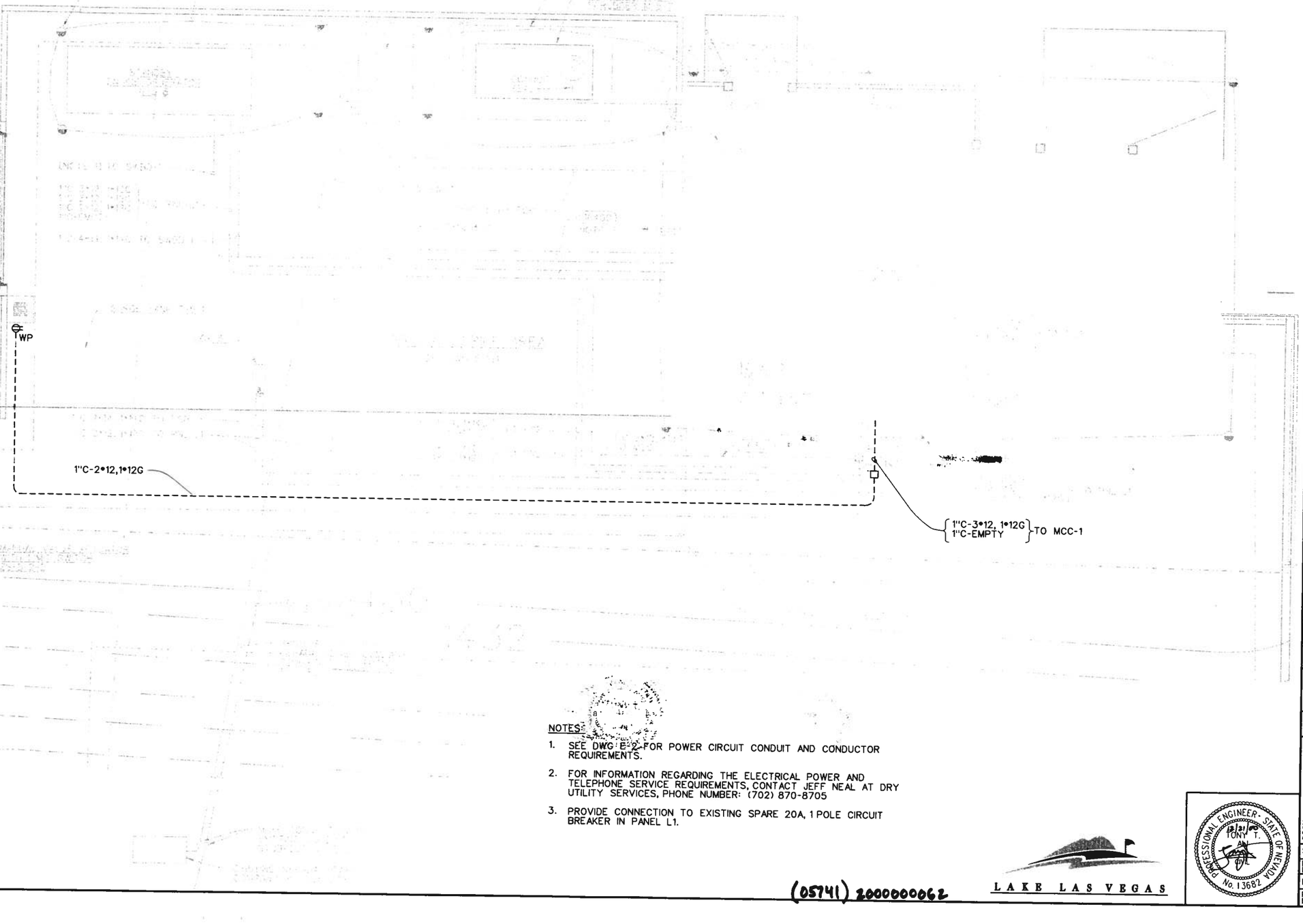
DSGN
DR
CHK
APVD

SHEET 11
DWG NO. M-4-FP
DATE DEC 2000
PROJ NO. 145076.A6

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NOTES:

1. SEE DWG E-2 FOR POWER CIRCUIT CONDUIT AND CONDUCTOR REQUIREMENTS.
2. FOR INFORMATION REGARDING THE ELECTRICAL POWER AND TELEPHONE SERVICE REQUIREMENTS, CONTACT JEFF NEAL AT DRY UTILITY SERVICES, PHONE NUMBER: (702) 870-8705
3. PROVIDE CONNECTION TO EXISTING SPARE 20A, 1 POLE CIRCUIT BREAKER IN PANEL L1.

(05741) 2000000062

LAKE LAS VEGAS

PROFESSIONAL ENGINEER · STATE OF NEVADA · No. 13682 · TONY T. · 12/21/00

ELECTRICAL

SITE PLAN

LAKE LAS VEGAS
LIFT STATION
AND
FORCE MAINS
HENDERSON, NEVADA

CH2MHILL

2000 EAST FLAMINGO, SUITE A
LAS VEGAS, NEVADA 89119
702.369.6775

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

NO.	DATE	REVISION	BY	APVD
1	7-10-00	FLOOD PROTECTION	TTA	JGF

DSGN	J. HOYLE
DR	Y. SAIKALI
CHK	T. ALI
APVD	J. FOSS
SHEET	12
DWG NO.	E-1-FP
DATE	DEC 2000
PROJ NO.	145076.A6

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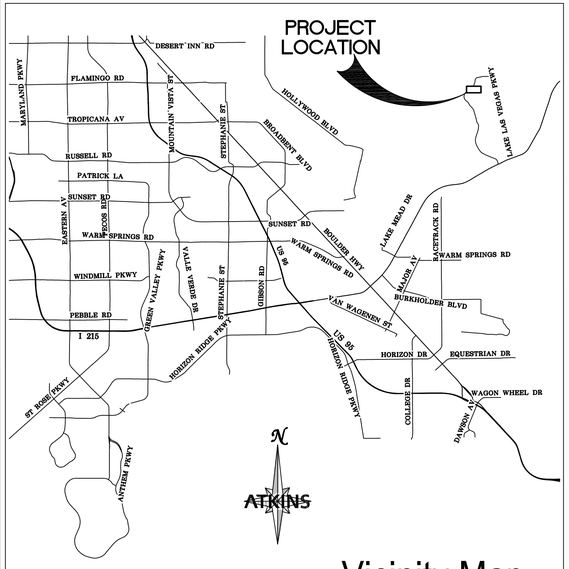
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APPENDIX VII

Proposed Floodwall Design Plans

LAKE LAS VEGAS LIFT STATION
FLOOD PROTECTION PROJECT

CONTRACT NO. 2013-78-0000
PWP NO. CL-2013-98



Vicinity Map

NOT TO SCALE

LEGAL DESCRIPTION

ALL OF LOT 2 AS SHOWN ON THE MAP THEREOF IN FILE 105 OF PARCEL MAPS, PAGE 54 OFFICIAL RECORDS, CLARK COUNTY, NEVADA. LOCATED IN A PORTION OF THE SOUTHEAST QUARTER (SE1/4) OF THE SOUTHWEST QUARTER (SW1/4) OF SECTION 22, TOWNSHIP 21 SOUTH, RANGE 63 EAST, M.D.M., CITY OF HENDERSON, CLARK COUNTY, NEVADA.

BASIS OF BEARING

SOUTH 01°35'42" EAST – BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF THE SOUTHWEST QUARTER (SW1/4) OF SECTION 22, TOWNSHIP 21 SOUTH, RANGE 63 EAST, M.D.M. AS SHOWN ON THE MAP THEREOF IN FILE 83 OF SURVEYS, PAGE 37, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

NOTE:

APPROVAL OF THESE PLANS BY THE CITY OF HENDERSON IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHTS-OF-WAY AND/OR DEDICATED EASEMENTS. THIS APPROVAL DOES NOT AUTHORIZE THE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS EXCEPT THOSE SPECIFICALLY IDENTIFIED AS "DEVIATIONS FROM STANDARDS". THE ENGINEER SHALL RESOLVE ANY DEVIATION OTHER THAN THOSE LISTED IN "DEVIATIONS FROM STANDARDS" IN FAVOR OF THE UNIFORM STANDARDS DRAWINGS AND SPECIFICATIONS CLARK COUNTY AREA NEVADA, (CURRENT EDITIONS.)

City Of Henderson
Clark County, Nevada
Department Of Utility Services

A Place To Call Home

Mayor
Andy Hafen

City Council
Sam Bateman
Debra March
John F. Marz
Gerri Schroder

City Manager
Jacob Snow

Director of Utility Services
Dennis B. Porter, P.E.

PROFESSIONAL ENGINEER-STATE OF NEVADA
MATTHEW K. WILKINSON
EXP. 06-30-14
CIVIL
No. 16420

Call before you Dig
AVOID DITCHING UNDERGROUND UTILITY LINES. IT'S COSTLY.
Call 811 OR 1-800-227-2600

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.
CALL BEFORE YOU DO OVERHEAD
1-702-227-2929

CALL BEFORE YOU DIG
Call before you UnderGround
1-702-432-5300
PRESENT AND FUTURE SYSTEM OF TRANSPORTATION

SHEET INDEX

1	C1.01	COVER
2	C1.02	GENERAL NOTES AND LOCATION MAP
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9	S1.01	FLOOD WALL PLAN AND ELEVATION
10	S1.02	FLOOD WALL DETAILS NO. 1
11	S1.03	FLOOD WALL DETAILS NO. 2
12	S2.01	EXISTING FLOOD WALL RETROFIT PLAN
13	S2.02	EXISTING FLOOD WALL RETROFIT DETAILS

Approval

TITLE	APPROVED	DATE
DIRECTOR OF PUBLIC WORKS		
DIRECTOR OF UTILITY SERVICES		
CITY ENGINEER		
SURVEY / RIGHT OF WAY		

Agency Approval

AGENCY	NO SERVICE	REVIEWED BY	DATE
SOUTHWEST GAS			
NV ENERGY DISTRIBUTION			
CENTURYLINK			
COX COMMUNICATIONS			

THE AFFIXED CENTURYLINK APPROVAL DOES NOT ASSUME OR GUARANTEE LIABILITY FOR KNOWN OR UNKNOWN CONFLICTS WITH EXISTING OR PROPOSED IMPROVEMENTS. RESOLUTION OF ANY CONFLICT WILL BE ACCOMPLISHED PURSUANT TO LOCAL ORDINANCES, NEVADA REVISED STATUTES AND/OR PUBLIC UTILITY COMMISSION RULES AND REGULATIONS.

CITY OF HENDERSON PCOH PERMIT NO. 2013-78-0000

REV.	DESCRIPTION	BY	DATE	APPROVAL

REVISIONS

ATKINS
2270 Corporate Circle, Suite 200
Henderson, Nevada 89074
Telephone: 702-263-3777
Fax: 702-263-7200

City of Henderson, Nevada

LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT

COVER

JOB NO.: 100030858
FILE NAME: 30858-C101.DWG
SCALE: HORIZ.:NONE VERT.: NONE

DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: M. WILKINSON
DATE: APRIL 23, 2013

JOB NO. 100030858
DRAWING NO. C101
SHEET 1 / 13

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CITY OF HENDERSON GENERAL NOTES

1. APPLICATION FOR INSPECTION BY THE CITY OF HENDERSON PUBLIC WORKS SHALL BE MADE BY THE CONTRACTOR AT LEAST 24 HOURS BEFORE THE INSPECTION SERVICES WILL BE REQUIRED. (702) 267–3144.
2. EXISTING UTILITIES ARE LOCATED ON PLANS FOR THE CONVENIENCE OF THE CONTRACTOR ONLY. THE CONTRACTOR SHALL BEAR FULL RESPONSIBILITY FOR THE PROTECTION OF UTILITIES AND THE ENGINEER BEARS NO RESPONSIBILITY FOR UTILITIES NOT SHOWN ON THE PLANS OR NOT IN THE LOCATION SHOWN ON THE PLANS. THIS INCLUDES ALL SERVICE LATERALS OF ANY KIND.
3. CURB AND GUTTER WITH A GRADE OF LESS THAN FIVE–TENTHS OF ONE PERCENT SHALL BE CONSTRUCTED BY FORMING. EACH JOINT SHALL BE CHECKED FOR GRADE PRIOR TO CONSTRUCTION AND WATER TESTED AS SOON AS POSSIBLE AFTER CONSTRUCTION.
4. THE EXACT LOCATION OF ALL SAWCUT LINES SHALL BE DETERMINED IN THE FIELD BY A CITY OF HENDERSON INSPECTOR.
5. PROTECTION AND REPLACEMENT OF SURVEY MONUMENTS OR PROPERTY STAKES NOT DELINEATED ON THE CONTRACT DRAWINGS SHALL BE THE CONTRACTOR'S RESPONSIBILITY. REPLACEMENT OF SURVEY MONUMENTS OR PROPERTY STAKES SHALL BE DONE TO THE CITY OF HENDERSON SURVEY DIVISION'S SATISFACTION.
6. THE CONTRACTOR SHALL TAKE REASONABLE MEASURE TO PROTECT EXISTING IMPROVEMENTS FROM DAMAGE AND ALL SUCH IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR RECONSTRUCTED TO THE ENGINEER'S SATISFACTION AT THE EXPENSE OF THE CONTRACTOR.
7. ANY EXISTING TRAFFIC CONTROL DEVICES AND/OR SIGNS SHALL BE MAINTAINED DURING THE CONSTRUCTION PHASE AND SHALL BE REPOSITIONED AS REQUIRED PER M.U.T.C.D. AND CITY STANDARDS UPON COMPLETION OF THE PROJECT.
8. ALL CONSTRUCTION SIGNING, BARRICADING, PAVEMENT MARKING, AND TRAFFIC DELINEATION SHALL CONFORM TO THE "NEVADA TRAFFIC CONTROL MANUAL" – CURRENT EDITION WITH ANY ADDENDAS AND REVISIONS AND BE APPROVED BY THE CITY OF HENDERSON BEFORE CONSTRUCTION BEGINS.
9. THE CONTRACTOR SHOULD CONTACT THE NEVADA DIVISION OF ENVIRONMENTAL PROTECTION (NDEP) TO OBTAIN A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT PRIOR TO CONSTRUCTION. ALL CONSTRUCTION PROJECTS ONE ACRE OR LARGER MUST APPLY FOR THE PERMIT THROUGH THE NDEP. ALL QUESTIONS REGARDING THE NPDES PERMIT REQUIREMENTS SHOULD BE DIRECTED TO THE NDEP (775) 687–9429.

STORM WATER POLLUTION NOTES

1. THE OWNER, SITE DEVELOPER, CONTRACTOR, AND/OR THEIR AUTHORIZED AGENTS SHALL EACH DAY REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO, OR ACCUMULATED IN, THE PUBLIC RIGHTS OF WAY OF THE CITY OF HENDERSON AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIALS SHALL BE PREVENTED FROM ENTERING THE STORM SEWER SYSTEM.
2. ADDITIONAL CONSTRUCTION SITE DISCHARGE BEST MANAGEMENT PRACTICES MAY BE REQUIRED OF THE OWNER AND HIS OR HER AGENTS DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT MEET THE PERFORMANCE STANDARDS SPECIFIED IN THE CITY OF HENDERSON AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BMP GUIDANCE MANUAL.
3. TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY; REFER TO THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.5.
4. AT A MINIMUM, THE CONTRACTOR OR HIS AGENT SHALL INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE MATERIALS AND EQUIPMENT THAT ARE EXPOSED TO PRECIPITATION, VEHICLE ENTRANCE AND EXIT LOCATIONS, AND ALL BMPS WEEKLY, AND WITHIN 24 HOURS AFTER ANY RAIN EVENT OF 0.5 INCHES OR MORE. THE CONTRACTOR OR HIS AGENT SHALL UPDATE OR MODIFY THE STORM WATER POLLUTION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS TO WEEKLY INSPECTIONS MAY APPLY, SUCH AS SUSPENSION OF LAND DISTURBANCE ACTIVITIES. REFER TO THE NEVADA STORM WATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.12.
5. ACCUMULATED SEDIMENT IN BMPS SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORM WATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

CONDUIT NOTE

ALL CONDUIT (BOX CULVERT, REINFORCED CONCRETE PIPE, CAST–IN–PLACE PIPE, AND/OR CORRUGATED METAL PIPE) SHOWN ON THESE PLANS ARE DESIGNED FOR STANDARD HIGHWAY LOADINGS. THE STANDARD SATISFACTORY MINIMUM COVERAGE REQUIREMENTS AS ESTABLISHED BY THE CONDUIT MANUFACTURER MAY NOT ALWAYS BE ADEQUATE DURING CONSTRUCTION. WHEN CONSTRUCTION EQUIPMENT, WHICH IS FREQUENTLY HEAVIER THAN TRAFFIC LOADS FOR WHICH THE CONDUIT HAS BEEN DESIGNED, IS TO BE DRIVEN OVER OR CLOSE TO THE BURIED CONDUIT IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE THE ADDITIONAL COVERAGE REQUIRED TO AVOID DAMAGE TO THE CONDUIT. THE ADEQUACY OF THE COVERAGE REQUIREMENTS FOR THE CONDUITS SHALL BE ANALYZED AND CHECKED BY THE CONTRACTOR TO ADDRESS LOADING CONDITIONS IMPOSED BY CONSTRUCTION ACTIVITY. ANY CONDUIT DAMAGED BY CONSTRUCTION ACTIVITY SHALL BE REPLACED AT THE CONTRACTORS EXPENSE.

BASIS OF BEARING

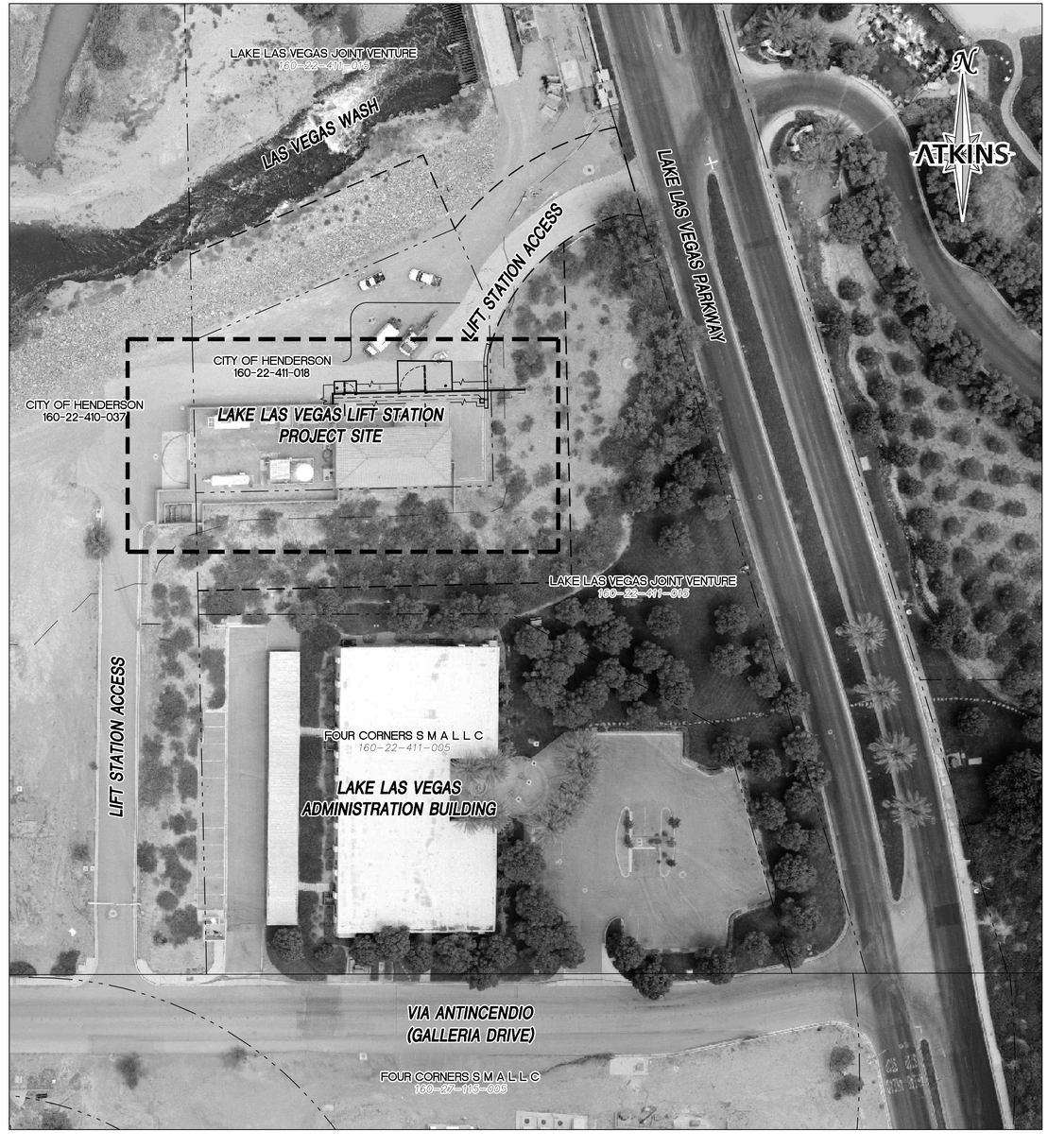
SOUTH 01°35'42" EAST – BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF THE SOUTHWEST QUARTER (SW1/4) OF SECTION 22, TOWNSHIP 21 SOUTH, RANGE 63 EAST, M.D.M. AS SHOWN ON THE MAP THEREOF IN FILE 83 OF SURVEYS, PAGE 37, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

BENCHMARK

COH BENCHMARK No. 635 – 2" ALUMINUM CAP IN THE TOP OF CURB ON THE EAST SIDE OF LAKE LAS VEGAS PARKWAY, 300'± NORTH OF THE CENTERLINE OF LAKE MEAD PARKWAY.

ELEVATION: 526.570 METERS
1727.59 FEET

CITY OF HENDERSON VERTICAL CONTROL (NAVD 88)
REVISED 2004



LOCATION MAP

GRAPHIC SCALE
40 0 20 40 80
HORIZONTAL: 1"=40'

PCOH-2013-78-0000

XXXXX

REVISIONS			
REV.	DESCRIPTION	BY	DATE	APPROVAL

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2270 Corporate Circle, Suite 200
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Telephone: 702.263.3273
Fax: 702.263.7200

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MATTHEW K. WILKINSON
EXP. 06–30–14
CIVIL
No. 15420

City of Henderson, Nevada

LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
GENERAL NOTES AND LOCATION MAP

JOB NO.: 100030858
FILE NAME: 30858–C102.DWG
SCALE: HORIZ.:NONE VERT.: NONE

DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: M. WILKINSON
DATE: APRIL 23, 2013

JOB NO. 100030858
DRAWING NO. C102
SHEET 2 OF 13

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@	AT
#	NUMBER
A	ANODE
A	AMPERES
AB	ABANDONED
AC	ASPHALTIC CONCRETE
ACP	ASBESTOS CEMENT PIPE
AD	ALGEBRAIC DIFFERENCE
AGG	AGGREGATE
AIP	ABANDON IN PLACE
ALT	ALTERNATE
AP	ANGLE POINT
APP	APPROACH
APPROX	APPROXIMATE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AV/AR	AIR VACUUM AIR RELIEF VALVE
AWG	AMERICAN WIRE GAUGE
BC	BACK OF CURB
BCR	BACK OF CURB RADIUS
BLK	BLOCK
BLVD	BOULEVARD
BM	BENCHMARK
BO	BLOW OFF
BOT	BOTTOM
BRG	BRIDGE
BS	BACK SLOPE
BSW	BACK OF SIDEWALK
BVC	BEGIN VERTICAL CURVE
BVCE	BEGINNING OF VERTICAL CURVE ELEVATION
BVCS	BEGINNING OF VERTICAL CURVE STATION
BW	BOTTOM WIDTH
BWC	BASIC WATER COMPANY
C&G	CURB AND GUTTER
C–C	CENTER TO CENTER
CATV	CABLE TELEVISION
CBC	CITY OF BOULDER CITY
CC	CLARK COUNTY
CCAUSD	CLARK COUNTY AREA UNIFORM STANDARD DRAWING
CCRFCD	CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
CCWRD	CLARK COUNTY WATER RECLAMATION DISTRICT
CCW	COUNTER CLOCKWISE
CF	CUBIC FOOT
CIP	CAST IRON PIPE OR CAST IN PLACE
CL	CENTERLINE
CLR	CLEAR
CLV	CITY OF LAS VEGAS
CM	CONSTRUCTION MANAGER OR CITY OF MESQUITE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CNDT	CONDUIT
CNLV	CITY OF NORTH LAS VEGAS
CO	CLEANOUT
COH	CITY OF HENDERSON
COL	COLUMN
COMM	COMMERCIAL
CONT	CONTINUATION
CONC	CONCRETE
CONST	CONSTRUCT OR CONSTRUCTION
COR	CORNER
CP	CONTROL POINT
CPP	CORRUGATED PLASTIC PIPE
CSAP	CORRUGATED STEEL ARCH PIPE
CSP	CORRUGATED STEEL PIPE
CU	CUBIC
CULV	CULVERT
CW	CLOCKWISE
CY	CUBIC YARD
D	DEPTH
D	DISTANCE
DCSWCS	DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS
DET	DETAIL
DEPT	DEPARTMENT
DG	DESIGN GRADE
DI	DROP INLET
DIA	DIAMETER
DIAG	DIAGONAL
DMS	DYNAMIC MESSAGE SIGN
DW	DRIVEWAY
DWG	DRAWING
E	EAST
E/o	EAST OF
EA	EACH
EB	EASTBOUND
EC	END OF CURVE
ECR	END CURB RETURN
EF	EACH FACE
EG	EXISTING GROUND
ELEC	ELECTRICAL
ELEV	ELEVATION
EMBK	EMBANKMENT
EOC	EDGE OF CONCRETE
EOP	EDGE OF PAVEMENT
EP	EDGE OF PAVEMENT
EQ	EQUAL
ESMT	EASEMENT
EVC	END VERTICAL CURVE
EVCE	END VERTICAL CURVE ELEVATION
EVCS	END VERTICAL CURVE STATION
EW	EACH WAY
EX	EXISTING
EXP JT	EXPANSION JOINT
FA	FIRE ALARM
FC	FACE OF CURB
FF	FINISHED FLOOR ELEVATION
F	FAR FACE
FG	FINISHED GRADE
FH	FIRE HYDRANT
FL	FLOW LINE
FO	FIBER OPTIC
FT	FOOT OR FEET
G	GAS LINE
G	GRAMS
GALV	GALVANIZED
GB	GRADE BREAK
GL	GRATE LENGTH
GM	GAS METER
GR	GAS PRESSURE REGULATOR
GUT	GUTTER
GV	GATE VALVE
H	HEIGHT
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HDWL	HEADWALL
HE	HORIZONTAL ELLIPTICAL
HGL	HYDRAULIC GRADE LINE
HOR	HORIZONTAL
HP	HIGH POINT
	HIGH PRESSURE
ID	INSIDE DIAMETER
IN	INCH(ES)
INT	INTERSECTION
INV	INVERT
IQAC	INTERAGENCY QUALITY ASSURANCE COMMITTEE
IRR	IRRIGATION
ISL	ISLAND
JB	JUNCTION BOX
JCT	JUNCTION
JT	JOINT
K	VERTICAL CURVE K VALUE
KIPS	THOUSANDS OF POUNDS PER SQUARE INCH
KRG	KERN RIVER GAS COMPANY
KSI	THOUSANDS OF POUNDS PER SQUARE INCH
KV	KILOVOLT
L	LENGTH
LB	POUND(S)
LF	LINEAR FEET
LIE	LOWER INVER ELEVATION
LIN	LINEAR
LOC	LENGTH OF CURVE
LOL	LAYOUT LINE
LP	LOW POINT
LT	LEFT
LVVWD	LAS VEGAS VALLEY WATER DISTRICT
MAS	MASONRY
MAX	MAXIMUM
MH	MANHOLE
MIN	MINIMUM
MON	MONOLITHIC
MTL	MATERIAL
N	NORTH OR
	MANNINGS ROUGHNESS COEFFICIENT
N/o	NORTH OF
NAP	NOT A PART
NDOT	NEVADA DEPARTMENT OF TRANSPORTATION
NF	NEAR FACE
NG	NUMBER OF GRATES OR NATURAL GRADE
NIC	NOT IN CONTRACT
No.	NUMBER
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OG	OPEN GRADE
OH	OVERHEAD
OHP	OVERHEAD POWER
OS	OFFSET
P	POWER
PB	PULL BOX
PBS	PLANTMIX BITUMINOUS SURFACE
PC	POINT OF CURVATURE
PCC	PORTLAND CEMENT CONCRETE OR POINT OF COMPOUND CURVATURE
PE	POLYETHYLENE
PG	PROPOSED GRADE
PGL	PROFILE GRADE LINE
PH	POT HOLE
PI	POINT OF INTERSECTION
PIP	PROTECT IN PLACE
PL	PROPERTY LINE
PLCS	PLACES
PMF	PAVEMENT MARKING FILM
PP	POWER POLE
PRC	POINT OF REVERSE CURVATURE
PROP	PROPOSED
PSI	POUNDS PER SQUARE INCH
PT	POINT
	POINT OF TANGENCY
PUE	PUBLIC UTILTIY EASEMENT
PVC	POLYVINYL CHLORIDE
PVI	POINT OF VERTICAL INTERSECTION
PVMT	PAVEMENT
QTY	QUANTITY
(R)	RADIAL
R/W	RIGHT OF WAY
R	RADIUS
RC	REINFORCED CONCRETE
RCA	REINFORCED CONCRETE ARCH
RCB	REINFORCED CONCRETE BOX
RCC	ROLLER COMPACTED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
REINF	REINFORCED
	REINFORCEMENT
RELOC	RELOCATE
REV	REVISION
ROW	RIGHT OF WAY
RP	RADIUS POINT
RPM	RAISED PAVEMENT MARKER
RR	RAILROAD
RT	RIGHT
RW	RECLAIMED WATER
S	SOUTH/SLOPE
S/o	SOUTH OF
SCHED	SCHEDULE
SD	STORM DRAIN
SDMH	STORM DRAIN MANHOLE
SF	SQUARE FOOT/SQUARE FEET
SHLD	SHOULDER
SHT	SHEET
SHP	STEEL HIGH PRESSURE PIPE
SL	STREET LIGHT
SMFO	SINGLE MODE FIBER OPTIC
SNWA	SOUTHERN NEVADA WATER AUTHORITY
SPA	SPACING
SQ	SQUARE
SS	SANITARY SEWER/SIDE SLOPE
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STL	STEEL
STLT	STREETLIGHT
STRUCT	STRUCTURAL OR STRUCTURE
SURV	SURVEY
SW	SIDEWALK
SY	SQUARE YARD
T	TELEPHONE LINE
TAN	TANGENT
TB	TOP OF BOX
TBA	TO BE ADJUSTED
TBC	TOP OF BACK OF CURB
TBR	TO BE REMOVED
TC	TOP OF CURB
TCE	TEMPORARY CONSTRUCTION EASEMENT
TEL	TELEPHONE
TEMP	TEMPORARY
THK	THICK
THR	THRUST
THW	TOP OF HEADWALL
TOF	TOP OF FACE
TOW	TOP OF WALL
TP	TOP OF PIPE
TRANS	TRANSITION
TS	TRAFFIC SIGNAL
TSI	TRAFFIC SIGNAL INTERCONNECT
TW	TOP OF WALL
TYP	TYPICAL
UDACS	UNIFORM DESIGN AND CONSTRUCTION STANDARDS FOR WATER DISTRIBUTION SYSTEMS
UG	UNDERGROUND
UGP	UNDERGROUND POWER
UIE	UPPER INVERT ELEVAATION
UNO	UNLESS NOTED OTHERWISE
UPRR	UNION PACIFIC RAILROAD
USD	UNIFORM STANDARD DRAWING
UTACS	ULTRA THIN ASPHALT CONCRETE SURFACE
V	VOLT
VAR	VARIABLE
VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
VG	VALLEY GUTTER
VOTR	VIDEO OPTICAL TRANSCEIVER
W	WEST/WATER/WIDTH
W/	WITH
W/o	WEST OF
WB	WEST BOUND
WL	WATER LINE
WM	WATER METER
WN	WEAKENED PLANE JOINT
WO/	WITHOUT
WPJ	WEAKENED PLANE JOINT
WV	WATER VALVE
WW	WING WALL
YD	YARD(S)

RPPA

BLOWOFF

CAP

CELL TOWER

LOOP DETECTOR

DROP INLET

AREA INLET

DRUM

BENCHMARK

MONUMENT CALCULATED

MONUMENT FOUND

MONUMENT TYPE 1

MONUMENT TYPE 2

MONUMENT TYPE 3

MONUMENT TYPE Z

FDC

FH EXISTING

FH PROPOSED

POST INDICATING VALVE

GATE VALVE

HC DOMES

MH

REDUCER

UTILTY VAULT

GUY WIRE

TRANSMISSION POLE

UTILITY POLE

TEST STATION

AIR–VACUUM VALVE

WATER METER

NDOT BARRIER A

NDOT BARRIER B

NDOT BARRIER FA

NDOT BARRIER FB

NDOT BARRIER PORTABLE

NDOT CURB 2

NDOT CURB 3

NDOT CURB A

NDOT CURB B

NDOT CURB GUTTER 1

NDOT CURB GUTTER 4

NDOT CURB GUTTER 5

NDOT CURB GUTTER 6

NDOT CURB GUTTER 7

NDOT CURB GUTTER 8

NDOT GUARDRAIL 3

NDOT GUARDRAIL 4

NDOT PED RAIL R

FLAGGER

IMPACT

PPCBR

PULLBOX No. 3 1/2

PULLBOX No. 5

PULLBOX TRAFFIC SIGNAL

PULLBOX No. 7

PULLBOX No. 9

PULLBOX P–30

PULLBOX T–300

ANGLE POINT

COORDINATE

PVI

HYDRAULIC GRADE LINE

EXISTING ELEVATION

NEW ELEVATION

ELEVATION [PROPOSED BY OTHERS]

CONDUIT RUN NUMBER

SIGNAL POLE LABEL

EXISTING STREETLIGHT

STREETLIGHT 100w

STREETLIGHT 150w

STREETLIGHT 200w

STREETLIGHT 250w

STREETLIGHT 400w

STREETLIGHT 450w

STREETLIGHT 750w

SERVICE PEDESTAL

EXISTING SERVICE POINT

SIGNPOST AND D3

SIGNPOST EXISTING

SIGNPOST NEW

OPTICOM

RED LIGHT INDICATOR

VIDEO CAMERA

CONTROLLER

SCHOOL FLASHER

PEDESTRIAN INDICATOR

SIGNAL HEAD

SIGNAL HEAD PERMISSIVE

SIGNAL HEAD PROTECTED

ILLUMINATED STREET NAME SIGN

SIGN ON ARM

EXISTING SIGNAL ARM

PROPOSED SIGNAL ARM

DETECTION ZONE, MINIMUM AREA

PROPOSED SIGN

EXISTING SIGN

CENTERLINE

PROPERTY LINE

RIGHT OF WAY

EXISTING EASEMENTS

PROPOSED EASEMENTS

MATCHLINE

PROPOSED STREETLIGHT CONDUIT

EXISTING STREETLIGHT CONDUIT

PROPOSED 4" INTERCONNECT CONDUIT

PROPOSED 3" INTERCONNECT CONDUIT

EXISTING CHAIN LINK FENCE

EXISTING BLOCK WALL

RETAINING WALL

EXISTING OVERHEAD POWER

EXISTING UNDERGROUND POWER

EXISTING SANITARY SEWER

EXISTING WATER

EXISTING GAS

EXISTING CABLE T.V.

EXISTING STORM DRAIN

EXISTING TELEPHONE

NEW STREETLIGHT CONDUIT

EXISTING STREETLIGHT CONDUIT

TRAFFIC SIGNAL CONDUITS

PROPOSED INTERCONNECT

STUB AND CAP

SAWCUT PAVEMENT

LIMITS OF OPEN GRADE

EDGE OF PAVEMENT

GUARD RAIL

LANE LINE 8"

LANE LINE CAT TRACKS

LANE LINE DROP

LANE LINE STORAGE 8"

LANE LINE TYPE 1

LANE LINE TYPE 2

LANE LINE TYPE 3

LANE LINE TYPE 4

NEW STORM DRAIN

EXISTING SCARP

PROPOSED SCARP

CURB AND GUTTER

EXISTING

PROPOSED

PROPOSED BY OTHERS

DISH ANTENNA

EXISTING GATE

LIGHT POLE

PALM TREE

PEDESTRIAN SIGNAL

BOLLARD

DOUBLE POST SIGN

OVERHEAD SIGN

TREE

STREETSIGN

CULVERT

FLAG

MISC SYMBOL

AERIAL PANEL

CACTUS

CATCH BASIN

OFF ROAD CATCH BASIN

BILLBOARD

TRAFFIC SIGNAL

SIGN BRIDGE

TRANSMISSION POLE

UTILITY POLE

VALVE

PCOH-2013-78-0000

XXXXX

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVAL

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Fax: 702.263.7200

City of Henderson, Nevada

LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT

LEGEND AND ABBREVIATIONS

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PROFESSIONAL ENGINEER–STATE OF NEVADA
MATTHEW K. WILKINSON
EXP. 06–30–14
CIVIL
No. 16420

JOB NO. 100030858
DRAWING NO. C103
SHEET 3 OF 13

X:\Projects\100030858–LLVLSFloodWall\Sheets\30858–C103.dwg Layout: C103 Apr 23, 2013 – 5:50am

COUNTY RECORDER'S NOTE

ANY SUBSEQUENT CHANGES TO THIS MAP SHOULD BE EXAMINED AND MAY BE DETERMINED BY REFERENCE TO THE COUNTY RECORDER'S CUMULATIVE MAP INDEX NRS 278.5695

SURVEYOR'S CERTIFICATE

I, ERIC CHRISTIANSON, A PROFESSIONAL LAND SURVEYOR LICENSED IN THE STATE OF NEVADA, CERTIFY THAT:

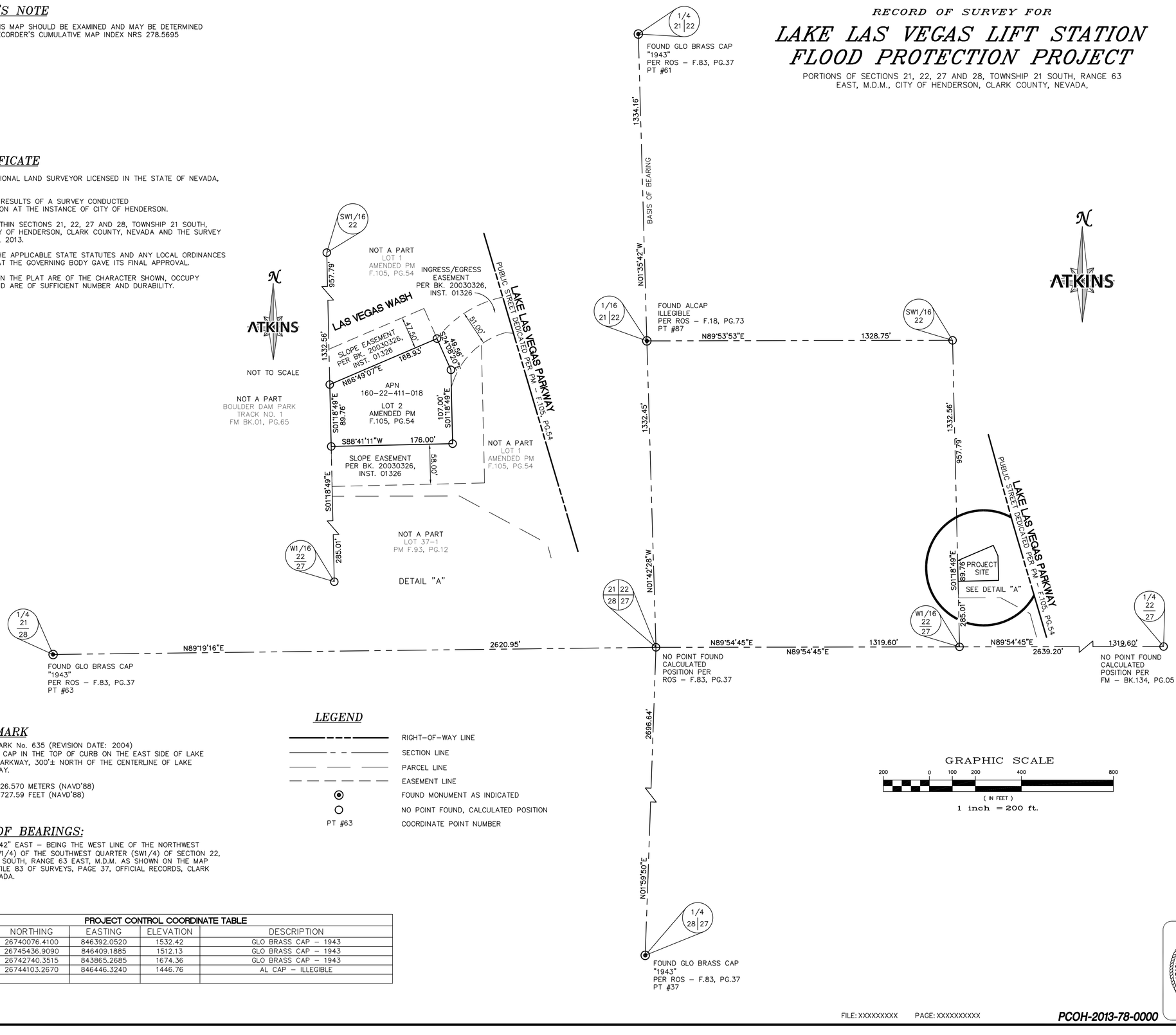
1. THIS PLAT REPRESENTS THE RESULTS OF A SURVEY CONDUCTED UNDER MY DIRECT SUPERVISION AT THE INSTANCE OF CITY OF HENDERSON.
2. THE LANDS SURVEYED LIE WITHIN SECTIONS 21, 22, 27 AND 28, TOWNSHIP 21 SOUTH, RANGE 63 EAST, M.D.M., CITY OF HENDERSON, CLARK COUNTY, NEVADA AND THE SURVEY WAS COMPLETED ON APRIL 1, 2013.
3. THIS PLAT COMPLIES WITH THE APPLICABLE STATE STATUTES AND ANY LOCAL ORDINANCES IN EFFECT ON THE DATE THAT THE GOVERNING BODY GAVE ITS FINAL APPROVAL.
4. THE MONUMENTS DEPICTED ON THE PLAT ARE OF THE CHARACTER SHOWN, OCCUPY THE POSITIONS INDICATED AND ARE OF SUFFICIENT NUMBER AND DURABILITY.

ERIC CHRISTIANSON
PROFESSIONAL LAND SURVEYOR
STATE OF NEVADA
NEVADA LICENSE No. 8895

RECORD OF SURVEY FOR

LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT

PORTIONS OF SECTIONS 21, 22, 27 AND 28, TOWNSHIP 21 SOUTH, RANGE 63 EAST, M.D.M., CITY OF HENDERSON, CLARK COUNTY, NEVADA,



BENCHMARK

COH BENCHMARK No. 635 (REVISION DATE: 2004)
2" ALUMINUM CAP IN THE TOP OF CURB ON THE EAST SIDE OF LAKE LAS VEGAS PARKWAY, 300'± NORTH OF THE CENTERLINE OF LAKE MEAD PARKWAY.

ELEVATION: 526.570 METERS (NAVD'88)
1727.59 FEET (NAVD'88)

BASIS OF BEARINGS:

SOUTH 01°35'42" EAST – BEING THE WEST LINE OF THE NORTHWEST QUARTER (NW1/4) OF THE SOUTHWEST QUARTER (SW1/4) OF SECTION 22, TOWNSHIP 21 SOUTH, RANGE 63 EAST, M.D.M. AS SHOWN ON THE MAP THEREOF IN FILE 83 OF SURVEYS, PAGE 37, OFFICIAL RECORDS, CLARK COUNTY, NEVADA.

LEGEND

- RIGHT–OF–WAY LINE
- SECTION LINE
- PARCEL LINE
- EASEMENT LINE
- FOUND MONUMENT AS INDICATED
- NO POINT FOUND, CALCULATED POSITION
- PT #63 — COORDINATE POINT NUMBER

GRAPHIC SCALE

200 0 100 200 400 800
(IN FEET)
1 inch = 200 ft.

PROJECT CONTROL COORDINATE TABLE

POINT No.	NORTHING	EASTING	ELEVATION	DESCRIPTION
37	26740076.4100	846392.0520	1532.42	GLO BRASS CAP – 1943
61	26745436.9090	846409.1885	1512.13	GLO BRASS CAP – 1943
63	26742740.3515	843865.2685	1674.36	GLO BRASS CAP – 1943
87	26744103.2670	846446.3240	1446.76	AL CAP – ILLEGIBLE

PROFESSIONAL LAND SURVEYOR – STATE OF NEVADA – ERIC P. CHRISTIANSON Exp 12-31-12 No. 8895

FILE: XXXXXXXXX PAGE: XXXXXXXXXX

PCOH-2013-78-0000

XXXXX

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVAL

ATKINS
2270 Corporate Circle, Suite 200
Henderson, Nevada 89074
Telephone: 702.263-2777
Fax: 702/263-7200

City of Henderson, Nevada

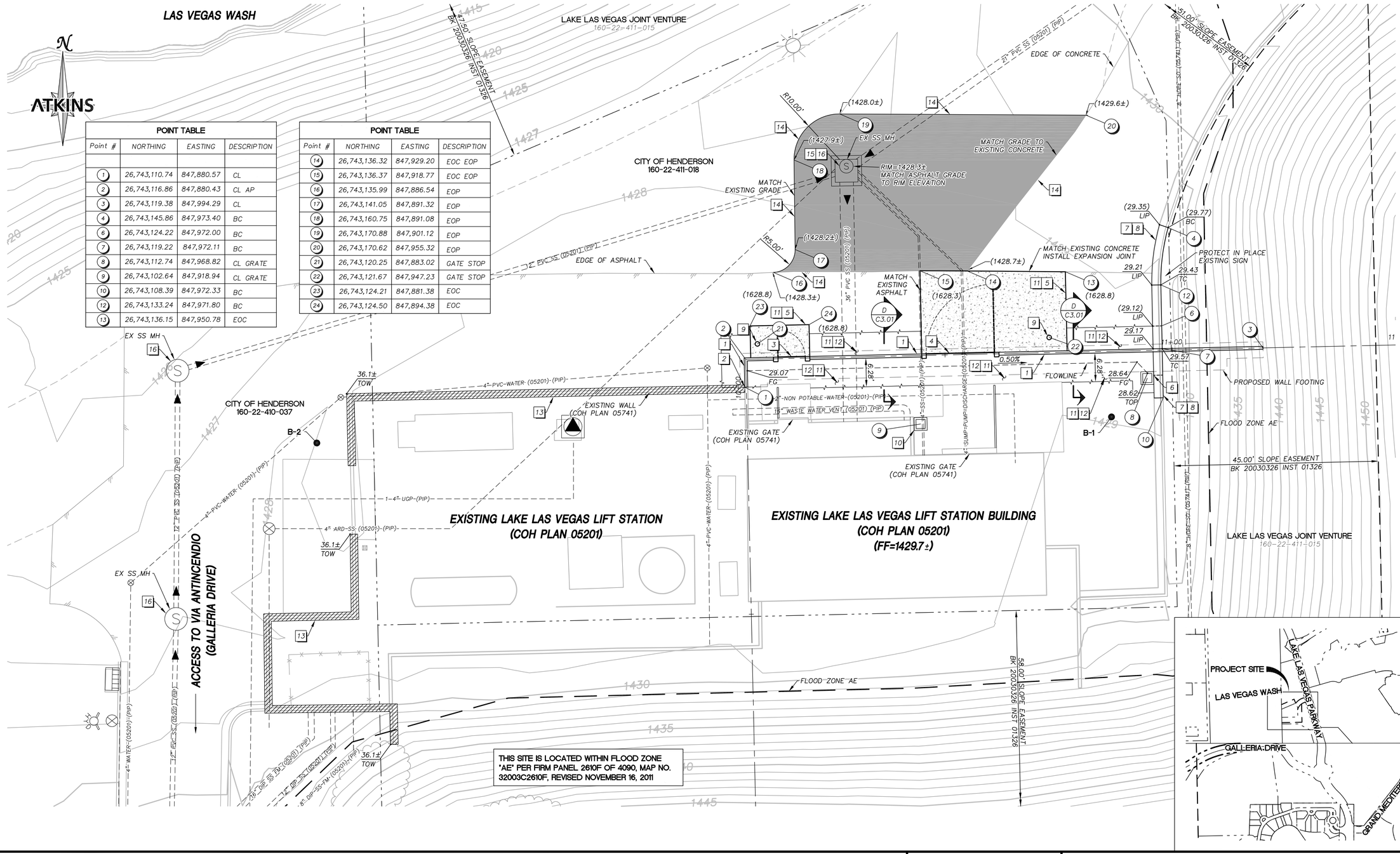
LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
HORIZONTAL CONTROL

JOB NO.: 100030858
FILE NAME: 30858-C104.DWG
SCALE: HORIZ.:NONE VERT.: NONE

DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: E. CHRISTIANSON
DATE: APRIL 23, 2013

JOB NO. 100030858
DRAWING NO. C104
SHEET 4 OF 13

X:\Projects\100030858-LLVLSFloodWall\Sheets\30858-C104.dwg Layout: C104 Apr 23, 2013 – 5:51am



POINT TABLE			
Point #	NORTHING	EASTING	DESCRIPTION
1	26,743,110.74	847,880.57	CL
2	26,743,116.86	847,880.43	CL AP
3	26,743,119.38	847,994.29	CL
4	26,743,145.86	847,973.40	BC
6	26,743,124.22	847,972.00	BC
7	26,743,119.22	847,972.11	BC
8	26,743,112.74	847,968.82	CL GRATE
9	26,743,102.64	847,918.94	CL GRATE
10	26,743,108.39	847,972.33	BC
12	26,743,133.24	847,971.80	BC
13	26,743,136.15	847,950.78	EOC

POINT TABLE			
Point #	NORTHING	EASTING	DESCRIPTION
14	26,743,136.32	847,929.20	EOC EOP
15	26,743,136.37	847,918.77	EOC EOP
16	26,743,135.99	847,886.54	EOP
17	26,743,141.05	847,891.32	EOP
18	26,743,160.75	847,891.08	EOP
19	26,743,170.88	847,901.12	EOP
20	26,743,170.62	847,955.32	EOP
21	26,743,120.25	847,883.02	GATE STOP
22	26,743,121.67	847,947.23	GATE STOP
23	26,743,124.21	847,881.38	EOC
24	26,743,124.50	847,894.38	EOC

THIS SITE IS LOCATED WITHIN FLOOD ZONE "AE" PER FIRM PANEL 2610F OF 4090, MAP NO. 32003C2610F, REVISED NOVEMBER 16, 2011

KEY NOTES

1. CONSTRUCT FLOOD WALL PER STRUCTURAL SHEETS
2. CONNECT FLOOD WALL TO EXISTING WALL PER STRUCTURAL SHEETS
3. INSTALL 72"W x 84"H HINGED LIP SEAL FLOOD GATE PER SHEET C3.02
4. INSTALL 180"W x 84"H HINGED LIP SEAL FLOOD GATE PER SHEET C3.02
5. CONSTRUCT CONCRETE PAVEMENT PER DETAIL F SHEET S1.02
6. INSTALL SUMP INLET PER DETAIL B SHEET C3.01
7. SAWCUT REMOVE EXISTING CURB AND GUTTER
8. CONSTRUCT MODIFIED "L" TYPE CURB AND GUTTER PER PER DETAIL A SHEET C3.01
9. INSTALL GATE STOP PER DETAIL B SHEET C3.03
10. INSTALL SUMP INLET PER DETAIL C SHEET C3.01
11. SAWCUT AND REMOVE EXISTING ASPHALT PAVEMENT
12. PLACE 3" PLANTMIX BITUMINOUS SURFACE PER DETAIL D ON C3.01
13. RETROFIT EXISTING FLOOD WALL PER STRUCTURAL SHEETS
14. CONSTRUCT 3" ASPHALT OVER 8" TYPE II AGGREGATE BASE
15. INSTALL CONCRETE COLLAR TO EXISTING SEWER MANHOLE PER DCSWCS SD-4
16. REMOVE AND REPLACE SEWER MANHOLE LID AND COVER PER DETAIL A SHEET C3.03

GRAPHIC SCALE
10 0 5 10 20
HORIZONTAL: 1"=10'

NOTE: EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

Call before you Dig AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY. Call 811 OR 1-800-227-2600

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY. CALL BEFORE YOU DO OVERHEAD 1-702-227-2929

CALL BEFORE YOU DIG UNDERGROUND Call before you UnderGround 1-702-432-5300 NEVADA AND HAWAII, STATE OF TRANSPORTATION

PROFESSIONAL ENGINEER-STATE OF NEVADA MATTHEW K. WILKINSON EXP. 06-30-14 CIVIL No. 16420

PCOH-2013-78-0000

XXXXX

REVISIONS

REV.	DESCRIPTION	BY	DATE	APPROVAL

ATKINS
2270 Corporate Circle, Suite 200
Henderson, Nevada 89074
Telephone: 702-263-2777
Fax: 702/263-7200

City of Henderson, Nevada

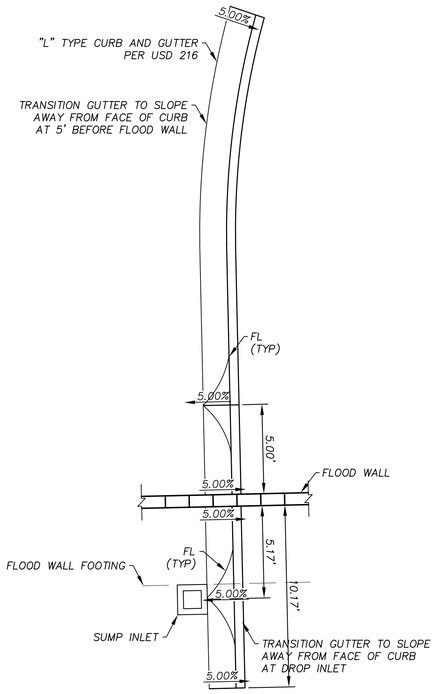
LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
CONSTRUCTION PLAN

JOB NO.: 100030858
FILE NAME: 30858-C201.DWG
SCALE: HORIZ.:1"=10' VERT.: NONE

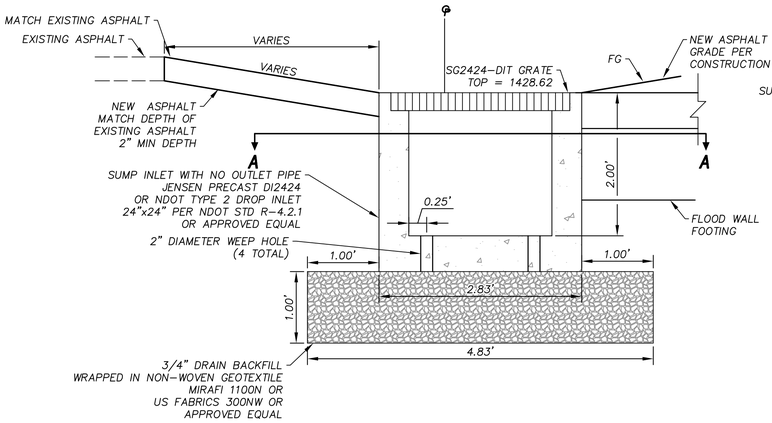
DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: K. WILKINSON
DATE: APRIL 23, 2013

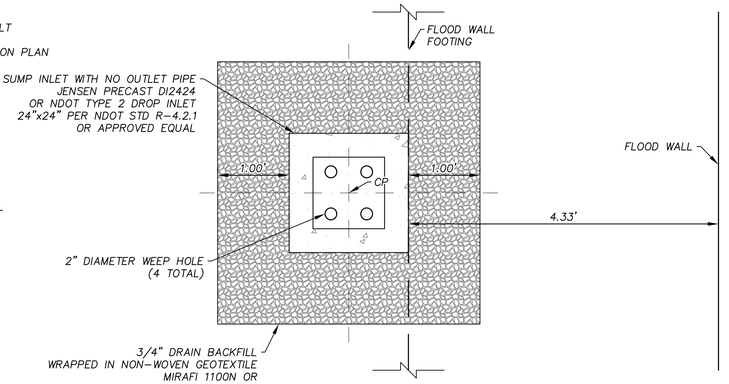
JOB NO. 100030858
DRAWING NO. C201
5 / 13

X:\Projects\100030858-LLWLSFloodWall\Sheets\30858-C201.dwg Layout: C201 Apr 23, 2013 - 5:51am



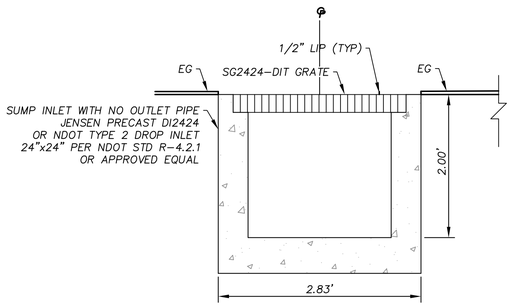
"L" CURB TRANSITION (A, C3.01)
NTS



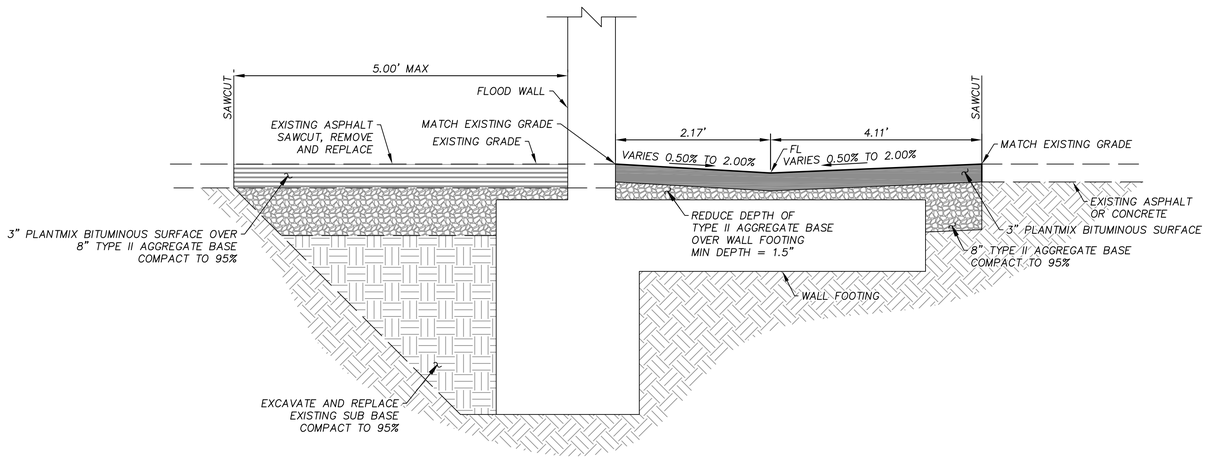


SECTION A-A
NTS

SUMP INLET (B, C3.01)
NTS



SUMP INLET (C, C3.01)
NTS



TYPICAL WALL SECTION (D, C3.01)
NTS

NOTE: EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

Call before you Dig — AVOID CUTTING UNDERGROUND UTILITY LINES. ITS DOWNTO. Call 811 or 1-800-227-2600

AVOID HITTING OVERHEAD POWER LINES. ITS DOWNTO. CALL BEFORE YOU DO OVERHEAD. 1-702-227-2929

AVOID HITTING UNDERGROUND PIPES AND UTILITIES. ITS DOWNTO. CALL BEFORE YOU DIG UNDERGROUND. Call before you UnderGround 1-702-432-5300 REGENT AND INTERNAL SYSTEM OF TRANSPORTATION

PCOH-2013-78-0000

PROFESSIONAL ENGINEER-STATE OF NEVADA — MATTHEW K. WILKINSON — EXP. 06-30-14 — CIVIL — No. 16420

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REVISIONS				
REV.	DESCRIPTION	BY	DATE	APPROVAL

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2270 Corporate Circle, Suite 200
Henderson, Nevada 89074
Telephone: 702-263-3777
Fax: 702/263-7200

City of Henderson, Nevada

LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
CONSTRUCTION DETAILS NO. 1

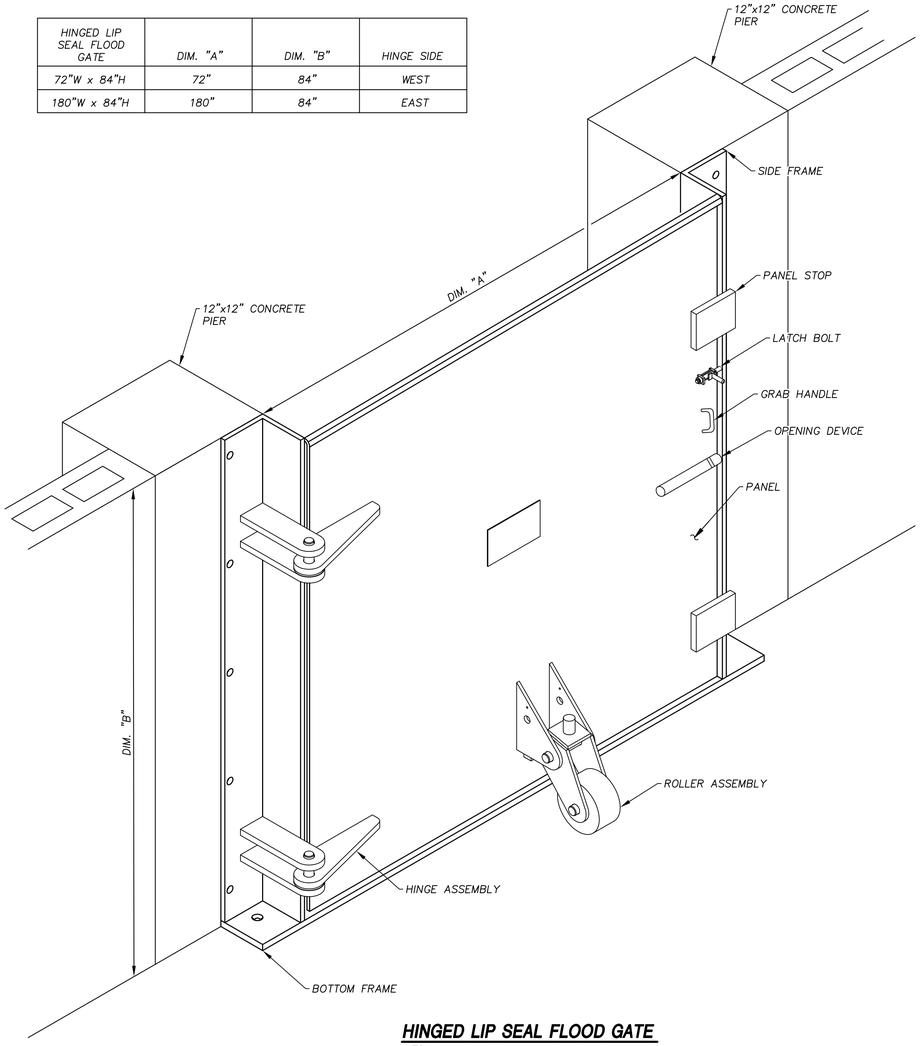
JOB NO.: 100030858
FILE NAME: 30858-C301.DWG
SCALE: HORIZ.:NONE VERT.: NONE

DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: M. WILKINSON
DATE: APRIL 23, 2013

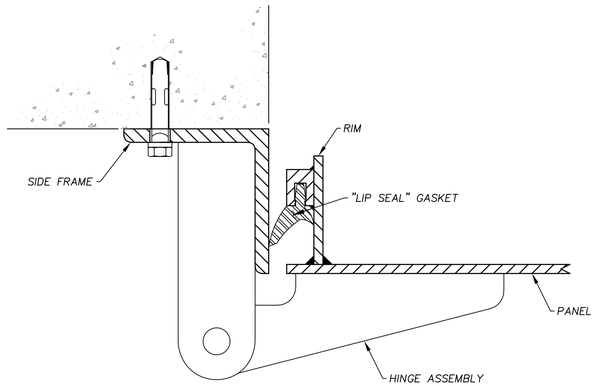
JOB NO. 100030858
DRAWING NO. C3.01
SHEET NO. 6
OF 13

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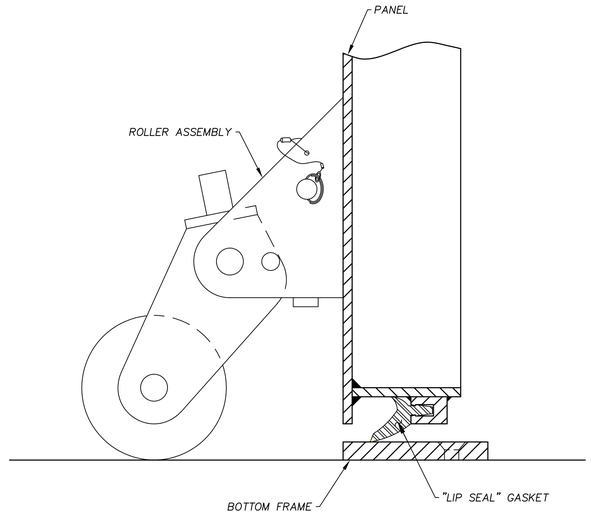
HINGED LIP SEAL FLOOD GATE	DIM. "A"	DIM. "B"	HINGE SIDE
72"W x 84"H	72"	84"	WEST
180"W x 84"H	180"	84"	EAST



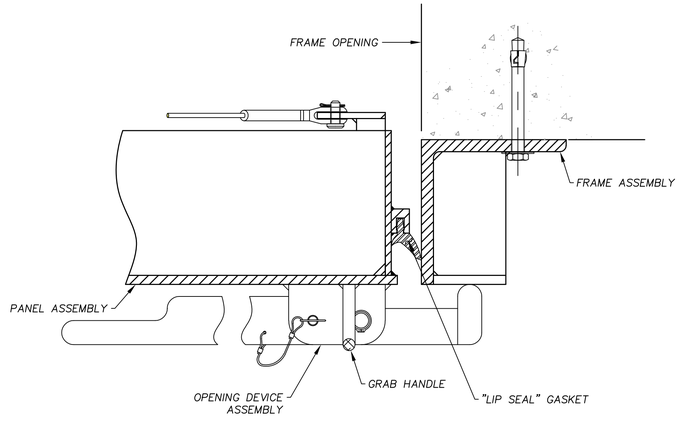
HINGED LIP SEAL FLOOD GATE
NTS



HINGE ASSEMBLY DETAIL
NTS



ROLLER ASSEMBLY DETAIL
NTS



OPENING DEVICE DETAIL
NTS

NOTES:

1. FIELD MEASURE AND CONFIRM ALL DIMENSIONS WITHIN TOLERANCE REQUIRED BY MANUFACTURER FOR SEALING AGAINST WATER HEAD INDICATED IN SPECIFICATIONS.
2. LIP SEALED SIDE HINGE FLOOD GATES SHALL BE MODEL FG-LS AS MANUFACTURED BY WALZ & KRENZER, INC., OR APPROVED EQUAL.
3. MOUNTING HOLES FOR EXPANSION ANCHORS SHALL BE LOCATED SO AS TO NOT BE IN CONFLICT WITH REINFORCING BARS FOR THE CONCRETE PIERS.
4. FRAME AND PANEL SHALL HAVE CORRESPONDING HOLES FOR A PADLOCK. HOLES FOR PADLOCK SHALL BE LOCATED NO LOWER THAN 1 FOOT FROM TOP OF FLOOD GATE.

NOTE: EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

Call before you Dig — AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY. Call 811 OR 1-800-227-2600

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY. CALL BEFORE YOU DO OVERHEAD 1-702-227-2929

CALL BEFORE YOU DIG UNDERGROUND Call before you UnderGround 1-702-432-5300 RECENT AND INTERNAL SYSTEM OF TRANSPORTATION

PCOH-2013-78-0000

PROFESSIONAL ENGINEER-STATE OF NEVADA — MATTHEW K. WILKINSON — EXP. 06-30-14 — CIVIL — No. 16420

REVISIONS			
REV.	DESCRIPTION	BY	DATE APPROVAL

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2270 Corporate Circle, Suite 200
Henderson, Nevada 89074
Telephone: 702.263-3777
Fax: 702/263-7200

City of Henderson, Nevada

LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
CONSTRUCTION DETAILS NO. 2

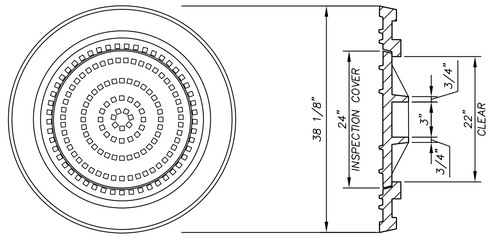
JOB NO.: 100030858
FILE NAME: 30858-C302.DWG
SCALE: HORIZ.:NONE VERT.: NONE

DESIGNED BY: J. CORDOVA
DRAWN BY: J. CORDOVA
CHECKED BY: M. WILKINSON
DATE: APRIL 23, 2013

JOB NO. 100030858
DRAWING NO. C3.02
7 / 13

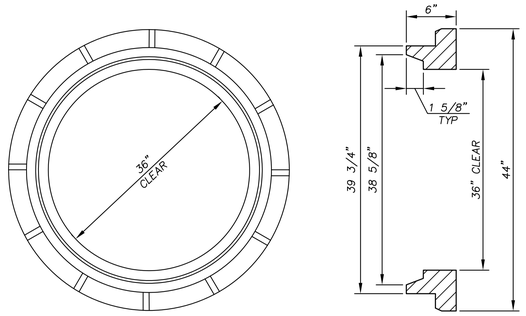
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XXXXX



PLAN SECTION

COVER DETAIL



PLAN SECTION

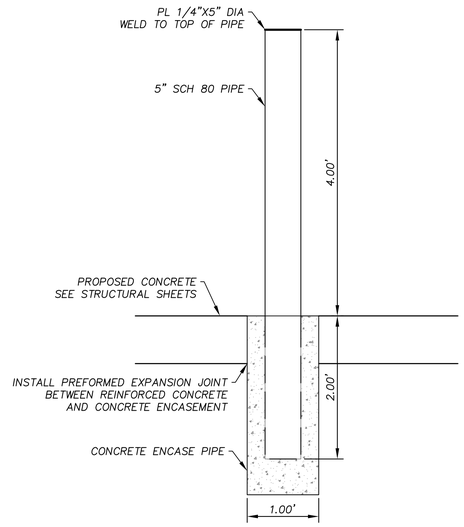
FRAME DETAIL

NOTES

1. FRAME AND COVER TO BE SOUTH BAY FOUNDRY CO TYPE A-2 OR NEENAH FOUNDRY COMPANY TYPE R-1740 OR APPROVED EQUAL
2. CAST IRON SHALL HAVE MINIMUM TENSILE STRENGTH OF 30,000 PSI
3. FRAME AND COVER MACHINED TO FIT
4. WEIGHT OF FRAME AND COVER 805 LBS (APPROX)
5. INSTALL RUBBER GASKET TO MAKE WATER TIGHT, COVER SHALL NOT HAVE ANY VENT HOLES

DUAL MANHOLE COVER AND FRAME

NTS — A C3.03



NOTES

ALL EXPOSED STEEL SURFACES SHALL BE PAINTED WHITE

GATE STOP

NTS — B C3.03

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AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY. CALL BEFORE YOU DIG OVERHEAD 1-702-227-2929

Call before you UnderGround 1-702-432-5300

PROFESSIONAL ENGINEER-STATE OF NEVADA — MATTHEW K. WILKINSON — EXP. 06-30-14 — CIVIL — No. 16420

PCOH-2013-78-0000

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REVISIONS				
REV.	DESCRIPTION	BY	DATE	APPROVAL

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2270 Corporate Circle, Suite 200
Henderson, Nevada 89074
Telephone: 702.263.3273
Fax: 702.263-7200

A Member of the SNC-Lavalin Group

City of Henderson, Nevada

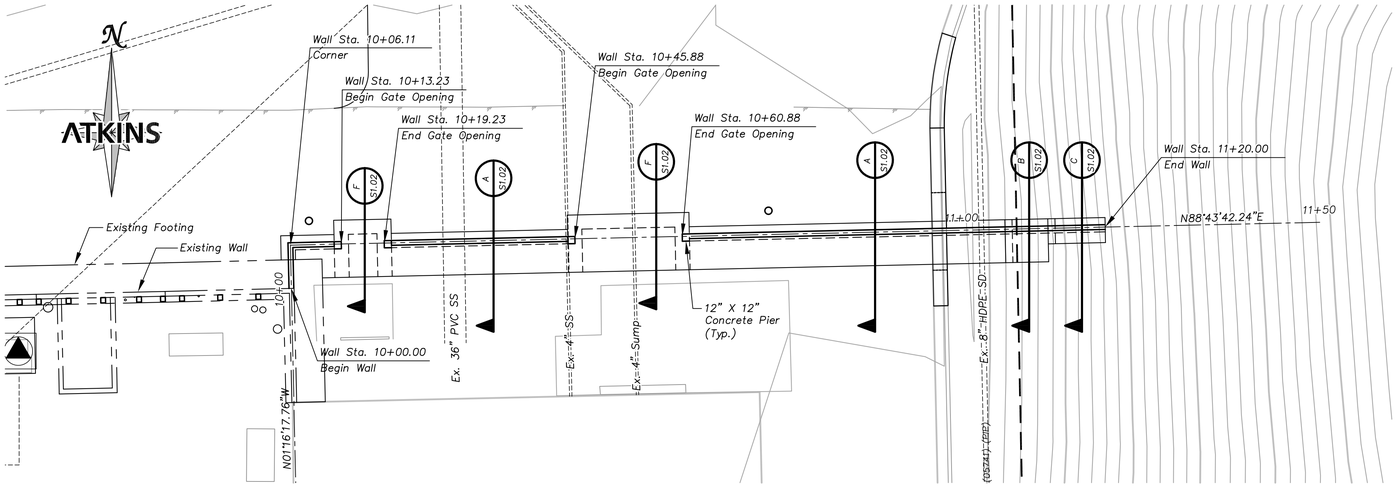
LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
CONSTRUCTION DETAILS NO. 3

JOB NO.: 100030858
FILE NAME: 30858-C303.DWG
SCALE: HORIZ.:NONE VERT.: NONE

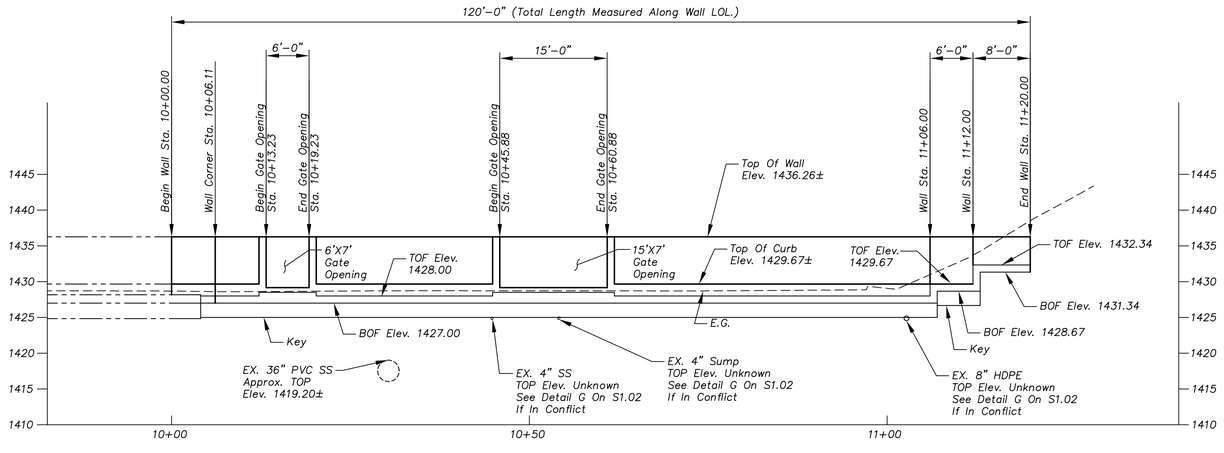
DESIGNED BY: M. LANUM
DRAWN BY: M. LANUM
CHECKED BY: M. WILKINSON
DATE: APRIL 23, 2013

JOB NO. 100030858
DRAWING NO. C3.02
8 / 13

X:\Projects\100030858-LVLSFloodWall\Sheets\30858-C303.dwg Layout: C303 Apr 23, 2013 - 5:51am



PLAN
SCALE: 1"=10' (1 / S1.01)



ELEVATION
SCALE: 1"=10' (2 / S1.01)

GENERAL NOTES

1. REINFORCING STEEL SHALL CONFORM TO ASTM A-615, GRADE 60. ARC WELDING OF REINFORCING STEEL SHALL CONFORM TO AMERICAN WELDING SOCIETY STANDARDS FOR REINFORCING STEEL.
2. CONCRETE SHALL HAVE A MINIMUM STRENGTH OF 4500 psi AT 28 DAYS USING TYPE V CEMENT PER ASTM C-150. SPECIAL INSPECTION SHALL BE REQUIRED ON ALL WALLS AND FOOTINGS UNLESS OTHERWISE NOTED.
3. MASONRY UNITS SHALL BE ASTM C-90, GRADE N-1 HOLLOW CONCRETE UNITS. MASONRY DESIGN STRESSES ARE AS FOLLOWS: f'm=1500 psi. FULL STRESSES FOR MASONRY HAVE BEEN USED. SPECIAL INSPECTION SHALL BE REQUIRED PER THE IBC (2009) OR LATEST EDITION UNLESS OTHERWISE NOTED.
4. MORTAR SHALL BE ASTM C270, TYPE "M" or "S" WITH A MINIMUM STRENGTH OF 1900 psi AT 28 DAYS.
5. GROUT SHALL HAVE A MINIMUM STRENGTH OF 2000 psi AT 28 DAYS USING TYPE V CEMENT PER ASTM C-150.
6. FOOTINGS SHALL BE CAST AGAINST NATIVE MATERIAL FOR FULL DEPTH OF THE FOOTING OR FOOTING SHALL BE COMPLETELY BACKFILLED AND COMPACTED PER SPECIFICATIONS.
7. UNLESS OTHERWISE NOTED, ALL CONSTRUCTION SHALL CONFORM TO IBC 2009, AND PER UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA.
8. ALL WALLS ARE SUBJECT TO APPROVAL BY CITY OF HENDERSON, NEVADA, BUILDING DEPARTMENT.
9. SOLID GROUT ALL MASONRY UNIT CELLS TO THE TOP OF WALL .
10. ALL CORNERS OR ANGLES SHALL BE TIED TOGETHER WITH REINFORCING STEEL AND GROUTED SOLID.
11. WHERE VERTICAL GROUT POURS ARE NOT CONTINUOUS FOR THE ENTIRE HEIGHT OF THE WALL, THE LIFTS SHALL BE TERMINATED 1 1/2" BELOW THE TOP OF THE TOP BLOCK TO FORM A KEY FOR FUTURE LIFTS.
12. CONTROL JOINTS IN RETAINING WALL SHALL BE LOCATED AT A MAXIMUM SPACING OF 24'-0".
13. PREPARATION OF FOUNDATION MATERIAL LOCATED BELOW THE BOTTOM OF WALL SHALL BE PERFORMED IN ACCORDANCE WITH THE RECOMMENDATION CONTAINED IN THE SOILS REPORT DESCRIBED IN NOTE 14 OF THESE PLANS.
14. SOILS REPORT BY: GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC. "GEOTECHNICAL EVALUATION LAKE LAS VEGAS LIFT STATION FLOOD WALL IMPROVEMENTS, PROJECT NO. 20133164E1". DATED 04-15-2013.
    (A) ALLOWABLE SOILS BEARING = 2000 PSF.
    (B) WATER PRESSURE (USED FOR DESIGN) = 63 PCF.
    (C) PASSIVE PRESSURE (USED FOR DESIGN) = 275 PCF
    (D) COEFFICIENT OF FRICTION = 0.55
15. TRENCH EXCAVATION SHORING SHALL CONFORM TO OSHA REGULATIONS 29 CFR PART 1926, SUBPART C.

NOTE: EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

Call before you Dig AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY. Call 811 or 1-800-227-2600

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY. CALL BEFORE YOU DIG OVERHEAD 1-702-227-2929

AVOID THE HAZARDS AND COSTLY REPAIRS OF DAMAGED UNDERGROUND UTILITIES. CALL TODAY BEFORE YOU UNDERGROUND. Call before you UnderGround 1-702-432-5300

PCOH-2013-78-0000

PROFESSIONAL ENGINEER-STATE OF NEVADA
JAIME A. CHANG
EXP. 12-31-12
CIVIL
No. 14023

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REVISIONS			
REV.	DESCRIPTION	BY	DATE APPROVAL

ATKINS
2270 Corporate Circle, Suite 200
Henderson, Nevada 89074
Telephone: 702.263.3777
Fax: 702.263-7200

City of Henderson, Nevada

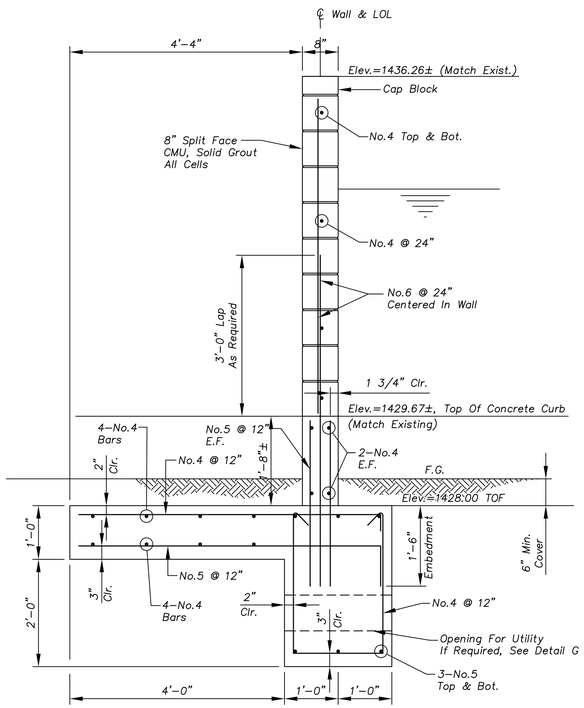
LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
FLOOD WALL PLAN AND ELEVATION

JOB NO.: 100030858
FILE NAME: 30858-S101.DWG
SCALE: HORIZ.:1"=10' VERT.: NONE

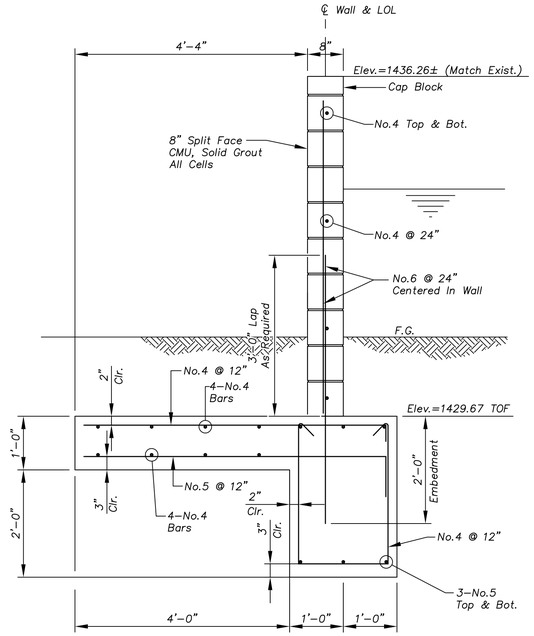
DESIGNED BY: J. LEE
DRAWN BY: D. EVANS
CHECKED BY: J. CHANG
DATE: APRIL 23, 2013

JOB NO. 100030858
DRAWING NO. S101 9/13

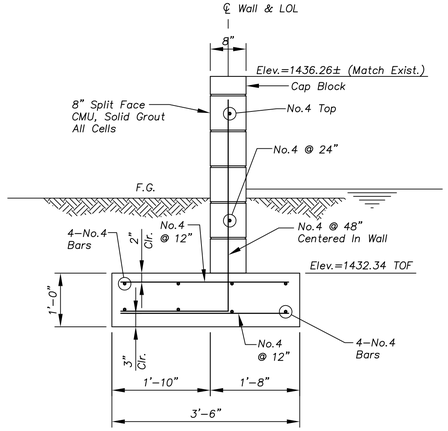
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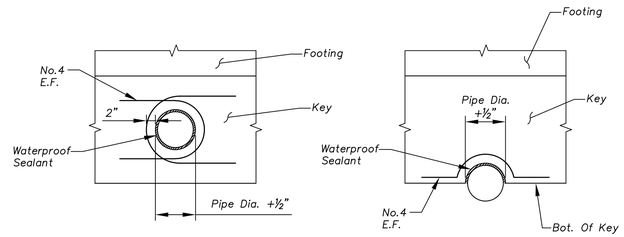
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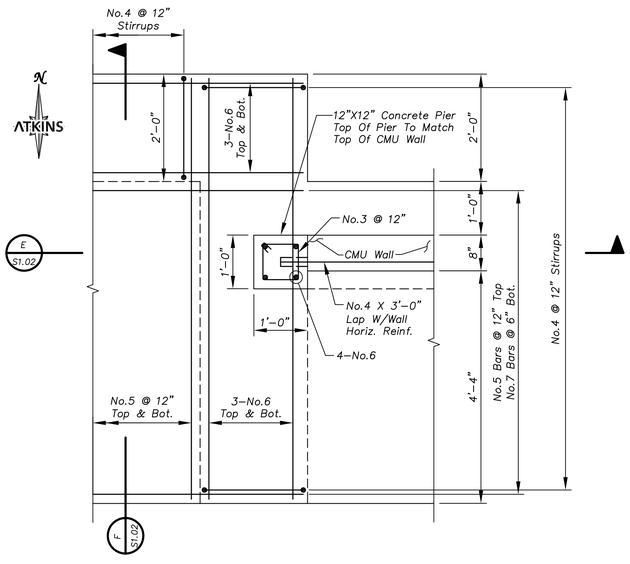
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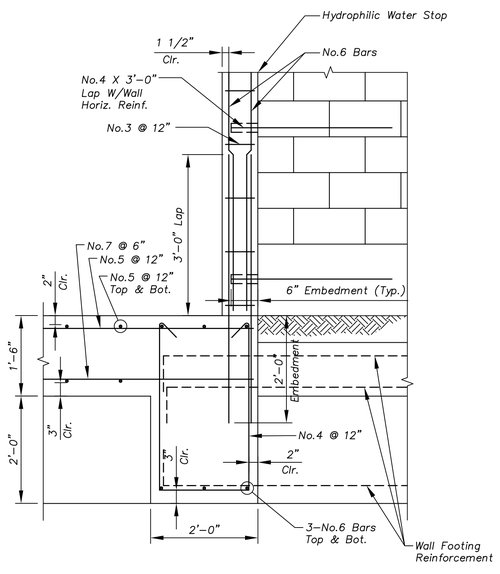
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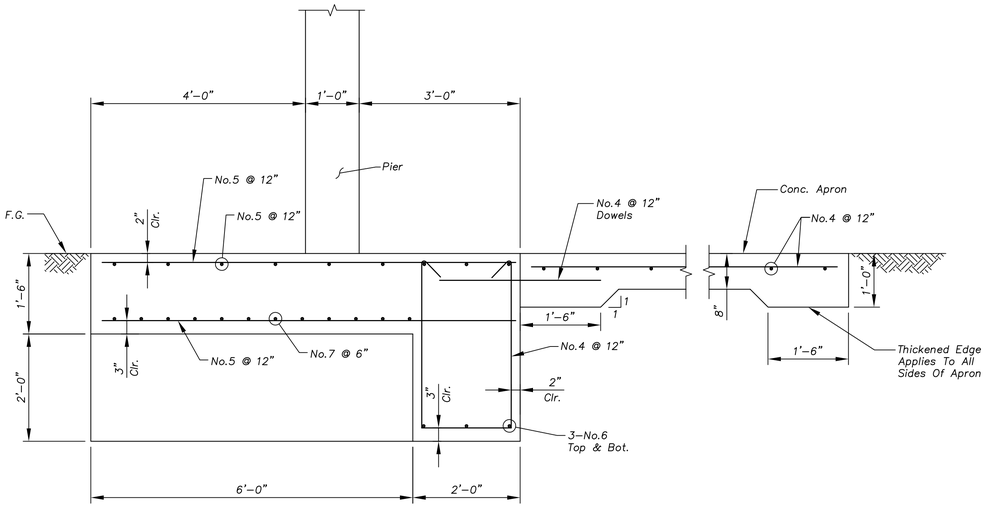
OPENING DETAIL (G S1.02)
SCALE: 1/2"=1'-0"



PARTIAL PLAN AT GATE (D S1.02)
SCALE: 1/2"=1'-0"



SECTION (E S1.02)
SCALE: 1/2"=1'-0"



SECTION (F S1.02)
SCALE: 1/2"=1'-0"

NOTE: EXISTING UTILITIES ARE LOCATED ON THE PLANS FROM A SEARCH OF AVAILABLE RECORDS. CONTRACTOR TO VERIFY LOCATIONS AND DEPTHS PRIOR TO CONSTRUCTION.

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AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY. CALL BEFORE YOU DO OVERHEAD 1-702-227-2929

AVOID HITTING UNDERGROUND UTILITY LINES. IT'S COSTLY. CALL BEFORE YOU DO UNDERGROUND. Call before you UnderGround 1-702-432-5300 REGENT AND NATIONAL SYSTEM OF TRANSPORTATION

PROFESSIONAL ENGINEER-STATE OF NEVADA — JAIME A. CHANG — EXP. 12-31-12 — CIVIL — No. 14023

PCOH-2013-78-0000

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REVISIONS

ATKINS
2270 Corporate Circle, Suite 200
Henderson, Nevada 89074
Telephone: 702-263-2777
Fax: 702/263-7200

A Place To Call Home

City of Henderson, Nevada

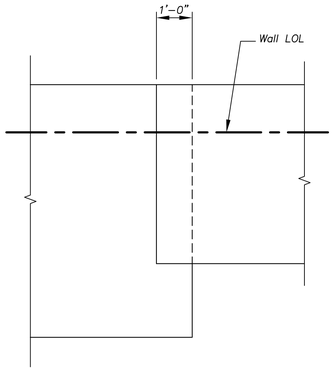
LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
FLOOD WALL DETAILS NO. 1

JOB NO.: 100030858
FILE NAME: 30858-S102.DWG
SCALE: HORIZ.:1"=10' VERT.: NONE

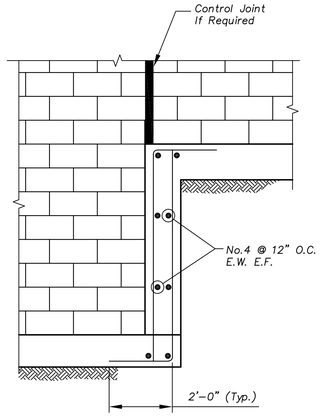
DESIGNED BY: J. LEE
DRAWN BY: D. EVANS
CHECKED BY: J. CHANG
DATE: APRIL 23, 2013

JOB NO. 100030858
DRAWING NO. S102
10 / 13

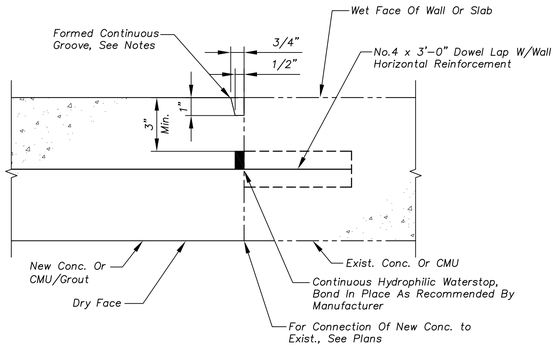
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PLAN



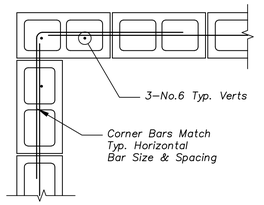
SECTION



NOTES:

1. Wait Until New Concrete Or CMU Grout Is Minimum 28 Days Old Prior To Grouting Groove.
2. Roughen And Clean Surfaces Of Groove With Power Wire Brush Or Sandblasting.
3. Saturate Area For 24 Hours Prior To Grouting.
4. Dry Pack With Type II Non-Shrink Grout.
5. Use Steel Hammer And Steel Tool To Densely Pack Grout Into Groove.
6. Water Cure Grout For 4 Days Minimum.
7. Reinforcing Not Shown For Clarity.

HYDROPHILIC/GROOVE WATERSTOP (2 / S1.03)
SCALE: 3"=1'-0"

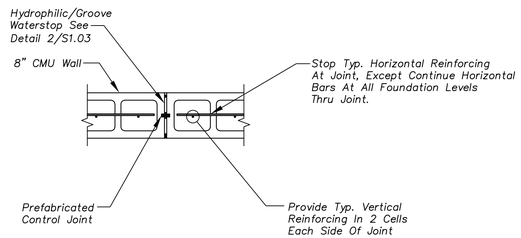


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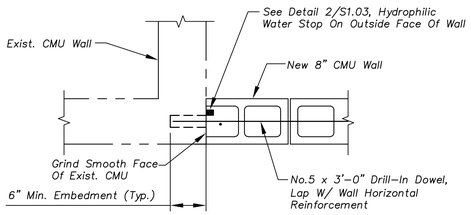
1. Lap = 48 Bar Diameters Or 2'-0" Min. Unless Otherwise Noted.
2. Provide A Standard 90° Hook Each End On Any Horizontal Bar Between Openings Or Corners Less Than 6'-0" In Length.

CMU WALL CORNERS (3 / S1.03)
SCALE: 1"=1'-0"

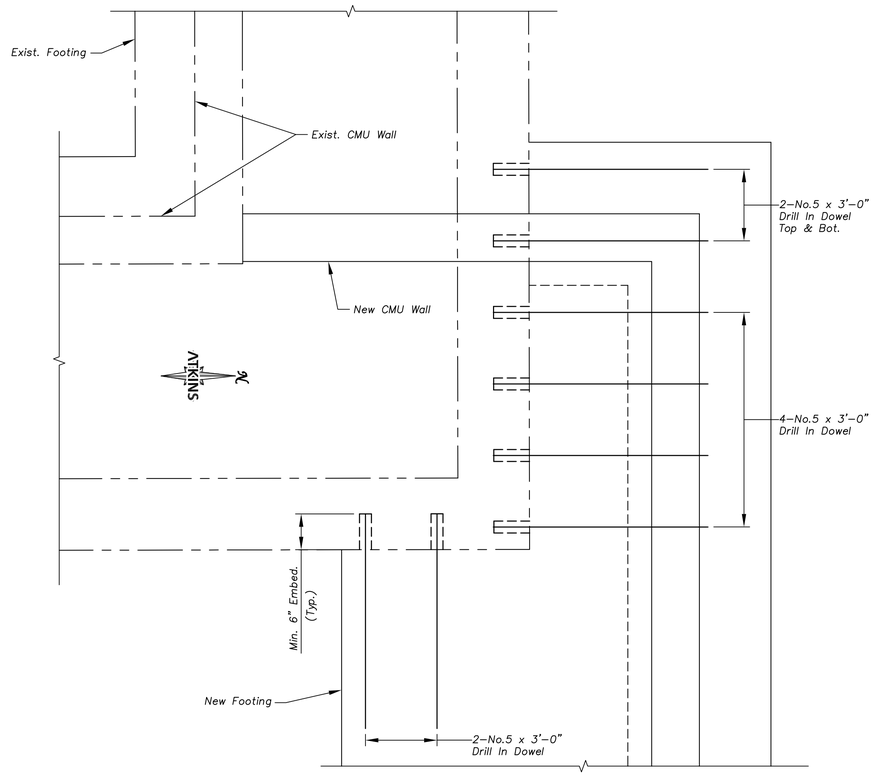
FOOTING STEP (1 / S1.03)
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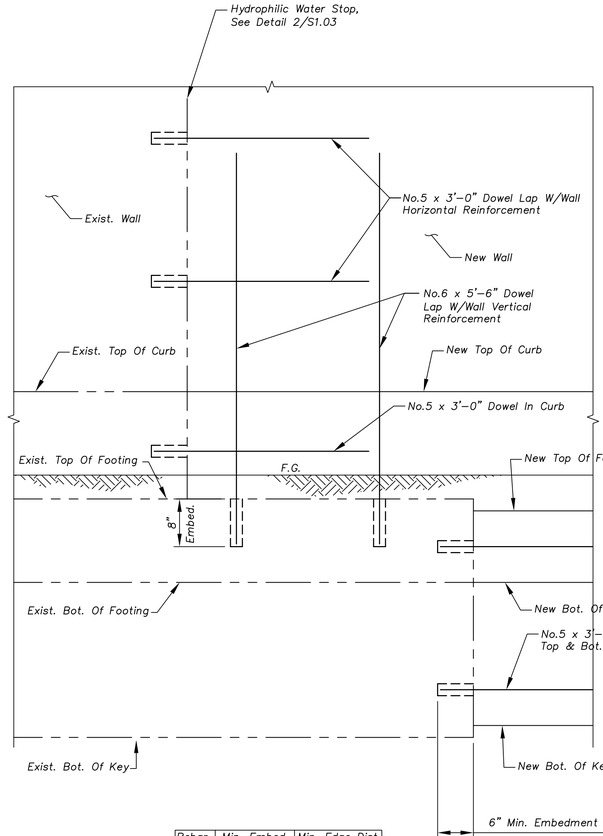
CMU CONTROL JOINT (4 / S1.03)
SCALE: 1"=1'-0"



CMU WALL TO EXIST. CMU WALL CONNECTION (5 / S1.03)
SCALE: 1"=1'-0"



WALL FOOTING TO EXIST. WALL FOOTING CONNECTION-PLAN (6 / S1.03)
SCALE: 1"=1'-0"



Rebar Size	Min. Embed. Length (in)	Min. Edge Dist. (in)
No.5	6"	4"
No.6	8"	5"

NEW WALL TO EXIST. WALL-ELEVATION (7 / S1.03)
SCALE: 1"=1'-0"

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PROFESSIONAL ENGINEER-STATE OF NEVADA — JAIME A. CHANG — EXP. 12-31-12 — CIVIL — No. 14023

PCOH-2013-78-0000

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REV.	DESCRIPTION	BY	DATE	APPROVAL
	REVISIONS			

ATKINS
2270 Corporate Circle, Suite 200
Henderson, Nevada 89074
Telephone: 702-263-3777
Fax: 702-263-7200

City of Henderson, Nevada

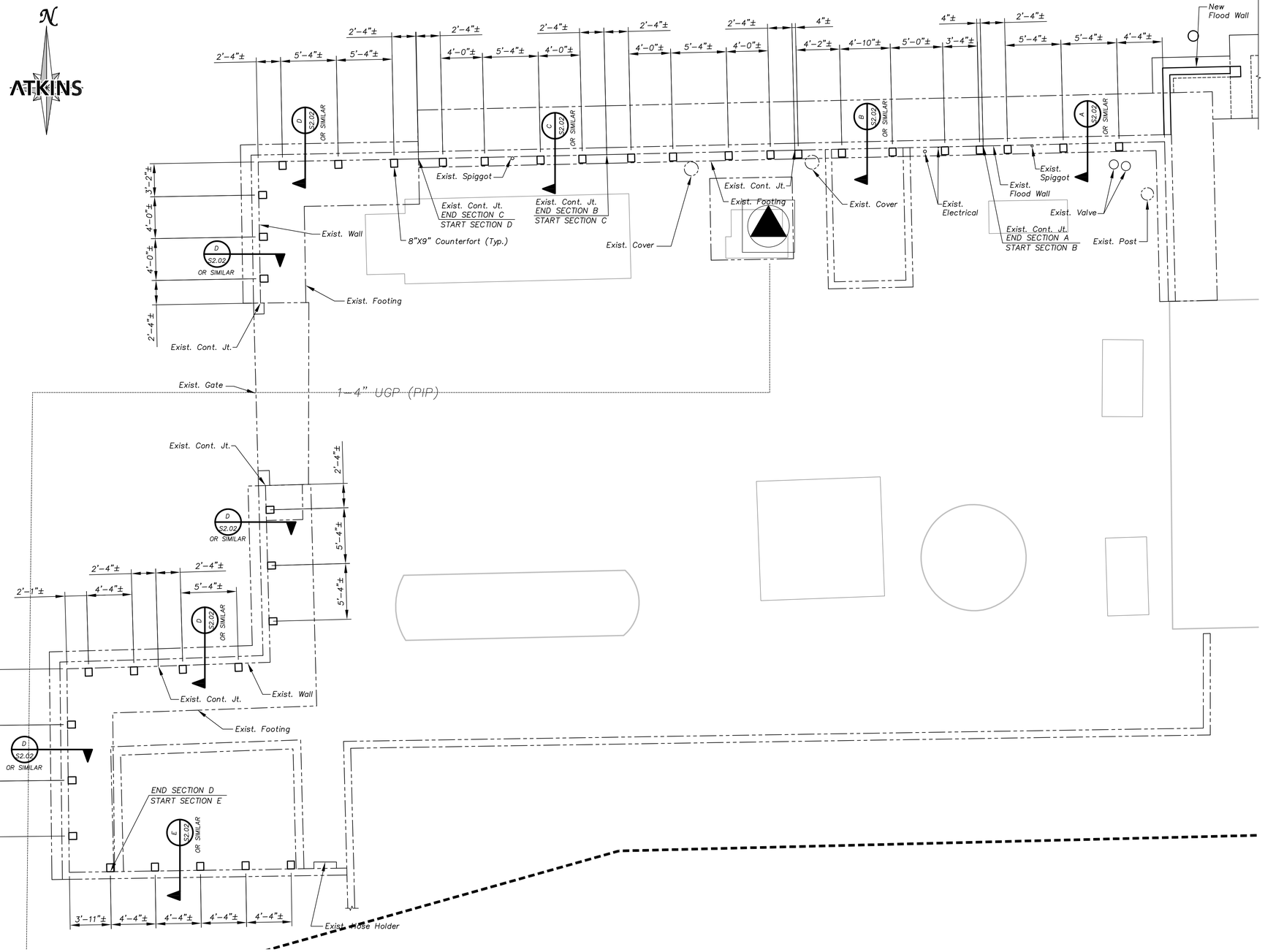
LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
FLOOD WALL DETAILS NO. 2

JOB NO.: 100030858
FILE NAME: 30858-S103.DWG
SCALE: HORIZ.:1"=10' VERT.: NONE

DESIGNED BY: J. LEE
DRAWN BY: D. EVANS
CHECKED BY: J. CHANG
DATE: APRIL 23, 2013

JOB NO. 100030858
DRAWING NO. S103
11 / 13

X:\Projects\100030858-LLVLSFloodWall\Sheets\30858-S103.dwg Layout: C201 Apr 23, 2013 - 5:52am



PLAN VIEW (1 / S2.01)
SCALE: 1"=5'

GENERAL NOTES

1. REINFORCING STEEL SHALL CONFORM TO ASTM A-615, GRADE 60. FURNISH AND ERECT IN ACCORDANCE WITH ACI MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES, ACI 315. ARC WELDING OF REINFORCING STEEL SHALL CONFORM TO AMERICAN WELDING SOCIETY STANDARDS FOR REINFORCING STEEL.
2. ALL CAST IN PLACE CONCRETE SHALL HAVE A MINIMUM STRENGTH OF 4000 PSI AT 28 DAYS USING TYPE V CEMENT PER ASTM C-150.
3. CONTRACTOR SHALL VERIFY ALL MASONRY CELLS ARE SOLID GROUT BEFORE DRILLING. IN CASE HOLLOW CELLS EXIST, CONTRACTOR SHALL GROUT THE CELLS WITH A MINIMUM STRENGTH OF 2000 PSI AT 28 DAYS USING TYPE V CEMENT PER ASTM C-150. SOLID GROUT ALL MASONRY UNIT CELLS TO THE TOP OF WALL. SPECIAL INSPECTION IS REQUIRED FOR DRILLED AND EPOXY DOWELS PER SECTION 1704 OF THE 2009 IBC.
4. ALL DIMENSIONS AND ELEVATIONS SHALL BE VERIFIED BEFORE BEGINNING CONSTRUCTION.
5. THE DISTANCE BETWEEN 8" X 9" COUNTERFORTS MAY BE ADJUSTED TO AVOID OBSTACLES NOT GREATER THAN 5'-4" MAXIMUM DISTANCE. THE DISTANCE FROM THE COUNTERFORT TO AN ADJACENT CMU WALL CONTROL JOINT SHALL NOT EXCEED 2'-4". CONTRACTOR SHALL VERIFY THE LOCATION OF ALL CONTROL JOINTS ALONG THE WALL AND AT THE CORNERS, IF ANY. REFER TO SECTION F ON SHEET S2.02.
6. UNLESS OTHERWISE NOTED, ALL CONSTRUCTION SHALL CONFORM TO IBC 2009, AND PER UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA.
7. ALL WALLS ARE SUBJECT TO APPROVAL BY CITY OF HENDERSON, NEVADA, BUILDING DEPARTMENT.

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CALL BEFORE YOU DO UNDERGROUND Call before you UnderGround 1-702-432-5300

PROFESSIONAL ENGINEER - STATE OF NEVADA — JAIME A. CHANG — EXP. 12-31-12 — CIVIL — No. 14023

PCOH-2013-78-0000

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	REVISIONS			

ATKINS
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Henderson, Nevada 89074
Telephone: 702-263-2777
Fax: 702/263-7200

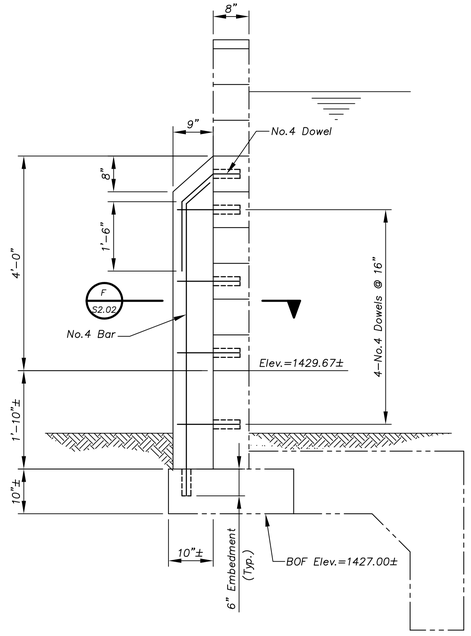
City of Henderson, Nevada

LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
EXISTING FLOOD WALL RETROFIT PLAN

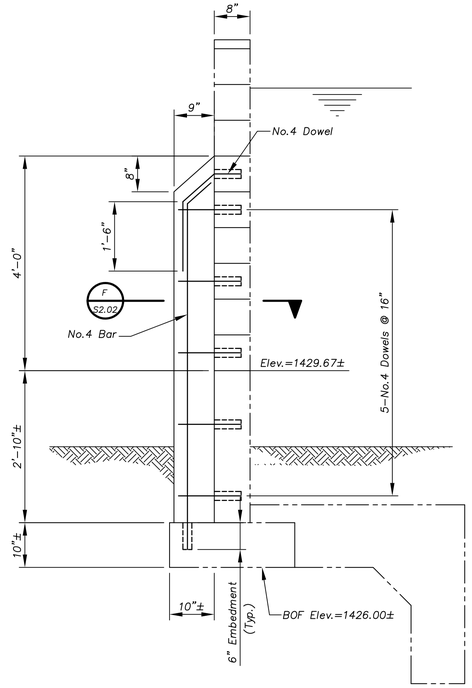
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FILE NAME: 30858-S201.DWG
SCALE: HORIZ.:1"=5' VERT.: NONE
DESIGNED BY: J. LEE
DRAWN BY: D. EVANS
CHECKED BY: J. CHANG
DATE: APRIL 23, 2013

JOB NO. 100030858
DRAWING NO. S2.01 | 12 / 13

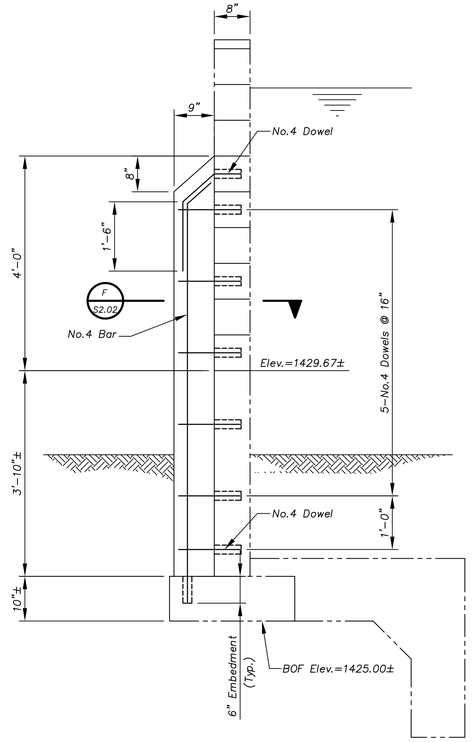
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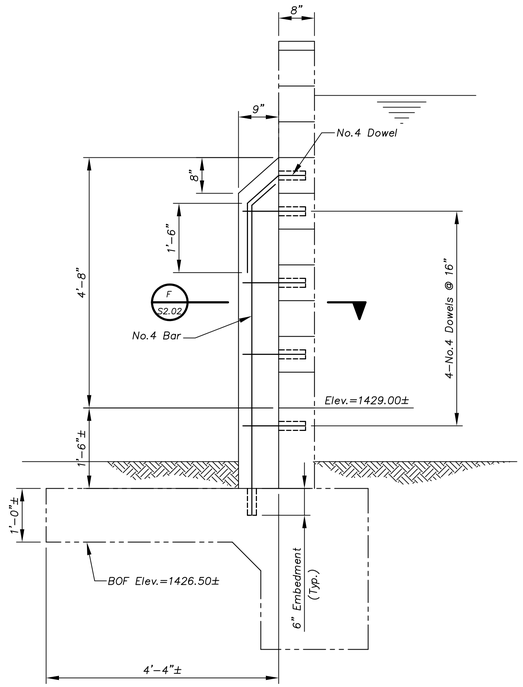
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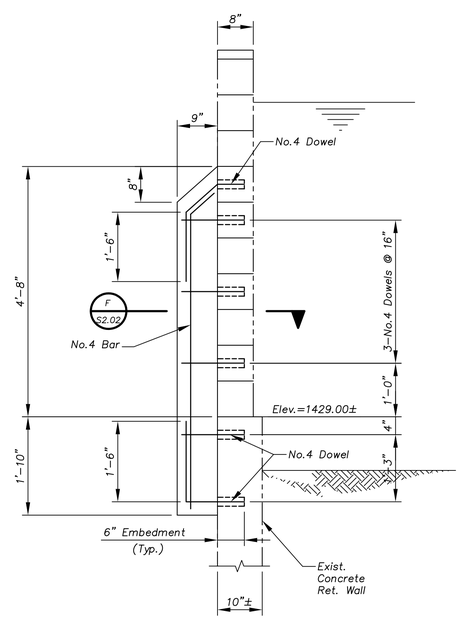
SECTION B
SCALE: 1/2"=1'-0" S2.02



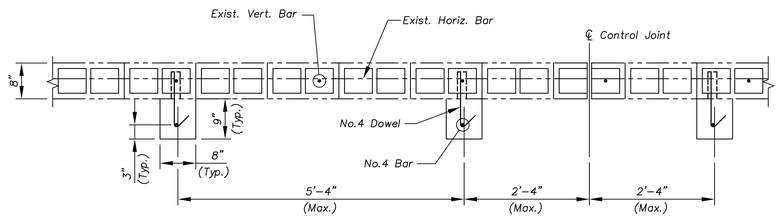
SECTION C
SCALE: 1/2"=1'-0" S2.02



SECTION D
SCALE: 1/2"=1'-0" S2.02



SECTION E
SCALE: 1/2"=1'-0" S2.02



SECTION F
SCALE: 1/2"=1'-0" S2.02

NOTE:

1. GRIND SMOOTH FACE OF EXISTING CMU WALL AND FOOTING TO PROVIDE A ROUGH CONTACT SURFACE.

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PROFESSIONAL ENGINEER-STATE OF NEVADA — JAIME A. CHANG — EXP. 12-31-12 — CIVIL — No. 14023

PCOH-2013-78-0000

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2270 Corporate Circle, Suite 200
Henderson, Nevada 89074
Telephone: 702-263-2777
Fax: 702/263-7200

City of Henderson, Nevada

LAKE LAS VEGAS LIFT STATION FLOOD PROTECTION PROJECT
EXISTING FLOOD WALL RETROFIT DETAILS

JOB NO.: 100030858
FILE NAME: 30858-S202.DWG
SCALE: HORIZ.:1"=1'0" VERT.: NONE
DESIGNED BY: J. LEE
DRAWN BY: D. EVANS
CHECKED BY: J. CHANG
DATE: APRIL 23, 2013
JOB NO. 100030858
DRAWING NO. S202 13 13

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APPENDIX VIII

Data CD