APPENDIX D-3 – P/S LANDFILL AREA 5 DEWATERING TIME FRAME MODELING

FINAL FEASIBILITY STUDY
CASMALIA RESOURCES SUPERFUND SITE
CASMALIA, CALIFORNIA

Prepared by: ERM

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LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
HSU	Hydrostratigraphic Unit
P/S	Pesticide/Solvent
RCRA	Resource Conservation and Recovery Act

1.0 Introduction

Groundwater flow model simulations were performed to estimate the dewatering time frames for the southern portion of the Pesticide/Solvent (P/S) Landfill under the different alternative sitewide remedies for the Feasibility Study of the Casmalia Resources Superfund Site (site) in Santa Barbara County, California. This appendix describes the groundwater models that were used for these evaluations, outlines the methods that were used to perform these evaluations and summarizes the results of the model simulations.

The sitewide groundwater flow models developed by the Casmalia Resources Superfund Site Steering Committee (CSC) for the site Remedial Investigation were used for this evaluation. The design, construction and calibration of these models are briefly described in Section 2.0 of Appendix D-1 and documented in more detail in Attachment F-3 to Appendix F of the Final Remedial Investigation Report, Casmalia Resources Superfund Site (CSC, 2011). Minor modifications were made to the sitewide groundwater flow models to simulate the remedial alternatives. These modifications are described in Section 3.0 of Appendix D-1.

The groundwater model simulations for this evaluation were performed in accordance with the American Society for Testing and Materials (ASTM) guidelines for groundwater modeling (ASTM, 1996) and generally accepted industry practice (Anderson and Woessner, 1992). The ASTM guidelines were developed as part of a cooperative agreement between the U.S. Environmental Protection Agency, the U.S. Geological Survey, and the U.S. Navy.

The groundwater model simulations were constructed with Groundwater Vistas™, a computer-aided design program for groundwater modeling (Environmental Simulations, Inc., 2007). Groundwater Vistas™ fully supports the model code MODFLOW-2000 (McDonald and Harbaugh, 1988; Harbaugh et al., 2000) that was used to perform the simulations for this evaluation.

2.0 Model Simulations

For this remedial time frame analysis, uncalibrated transient simulations were performed with the modified 2004 (Dry Season) model for alternative Site Wide Remedies 2 through 6. A specific storage of 2×10^{-4} 1/foot was used for model layers 1-3, which represent the Upper Hydrostratigraphic Unit (HSU), and a specific storage of 2×10^{-6} 1/foot was used for model layers 4-7, which represent the Lower HSU. These values of specific storage are based on typical values for medium-hard clays presented in Anderson and Woessner (1992). The transient simulations were performed for a total simulation time of 100 years using the steady-state head solution from the modified 200 4 model as the initial head conditions.

Water level declines in the transient model simulations were monitored at two sites at the base of the Upper HSU (model layer 3) within the P/S Landfill area (Figure D3-1). The first site was at the location of monitoring well RIPZ-13, which is just north of the clay barrier. The second site was approximately 500 feet north of the RIPZ-13 location. Dewatering of the landfill at these two sites was considered to be complete when the water levels declined below the Upper HSU/Lower HSU contact (base of model layer 3).

3.0 Summary

The results of the model simulations are shown in Figures D3-2 through D3-6 and are summarized as follows:

Site Wide Alternative	Simulated Time to Achieve Dewatering	
	RIPZ-13 Location	500 Feet North of RIPZ-13
2	> 100 years	1.5 years
3	10 years	1.3 years
4	11 years	1.3 years
5	9 years	1.2 years
6	4 years	1.0 years

The model simulations for the two sites within the P/S Landfill indicate the time frames for achieving dewatering of the southern portion of the landfill would range from 4 years to more than 100 years at the location of RIPZ-13, and from 1.0 to 1.5 years at a location north of RIPZ-13 under alternative Site Wide remedies 2 through 6. The dewatering time frames are longest for Alternative 2, which includes continued operation of the Gallery Well with only minimal additional capping of the 8.4-acre Resource Conservation and Recovery Act (RCRA) Canyon area. The model simulations indicate that dewatering times would be shorter for Alternatives 3 and 4, which include continued operation of the Gallery Well and more extensive capping in the RCRA Canyon and West Canyon Spray Area. The shortest dewatering times are for Alternatives 5 and 6, which include more aggressive groundwater removal in the P/S Landfill by horizontal light non-aqueous phase liquid /dense non-aqueous phase liquid extraction wells. These simulated time frames to achieve dewatering are considered to rough approximations because of the uncertainty in the accuracy of the transient model input parameters. However, they probably provide conservative estimates for the dewatering of the P/S Landfill since the actual time frames for the decline in measured water levels after installation of the existing caps on the P/S Landfill in 1999 (Well A1M, Appendix F, Figure F1-U3; CSC, 2011) and the Engineering Evaluation/Cost Analysis area in 2001 and 2002 (Wells SW-48, WP-8S, TP-4 and RG-9B, Appendix F, Figures F1-U4 to F1-U6; Well SW-31, Appendix F, Figure F1-U14, and Wells LCW-3 and RG-8B, Appendix F, Figure F1-U20; CSC, 2011) were somewhat shorter, ranging between 1.5 and 4 years.

4.0 References

American Society for Testing and Materials, 1996, *ASTM Standards on Analysis of Hydrologic Parameters and Ground Water Modeling*, ASTM Publication Number 03-418096-38, 148 pp.

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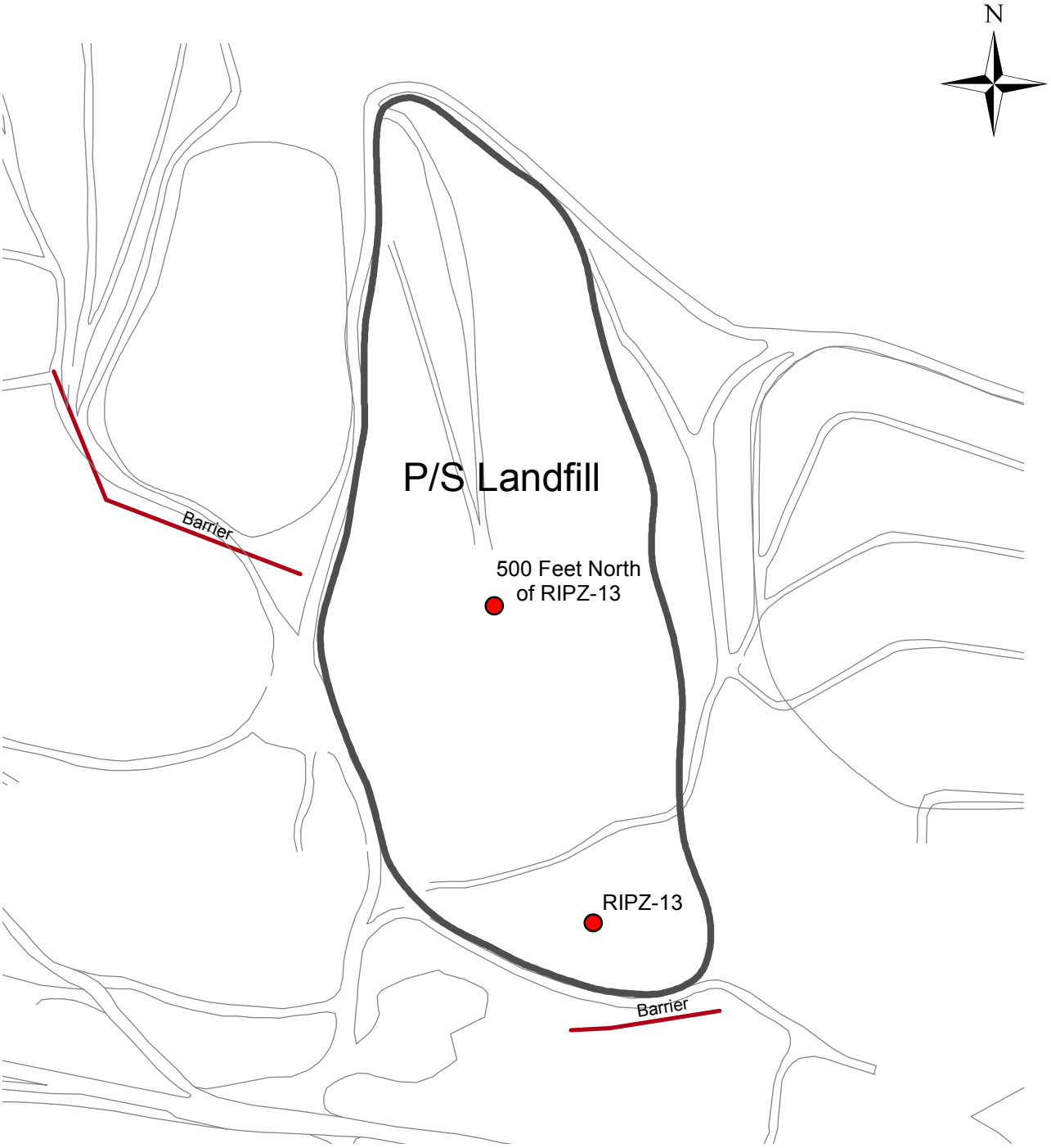
Harbaugh, A.W., E.R. Banta, M.C. Hill, and M.G. McDonald, 2000, "MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Model – User Guide to Modularization Concepts and the Ground-Water Flow Process," U.S. Geological Survey Open File Report 00-92.

McDonald, M.G., and A.W. Harbaugh, 1988, "A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model," *Techniques of Water Resources Investigations of the United States Geological Survey*, Book 6, Chapter A-1.

Figures



Explanation

- Water Level Monitoring Site
- Clay Barrier
- Approximate P/S Landfill Boundary

0 125 250 500 Feet

FigureD3-1.mxd

Location of Water Level Monitoring Sites
Transient Model Simulations of P/S Landfill Dewatering
Final Feasibility Study
Casmalia Resources Superfund Site
Casmalia, California

FIGURE
D3-1

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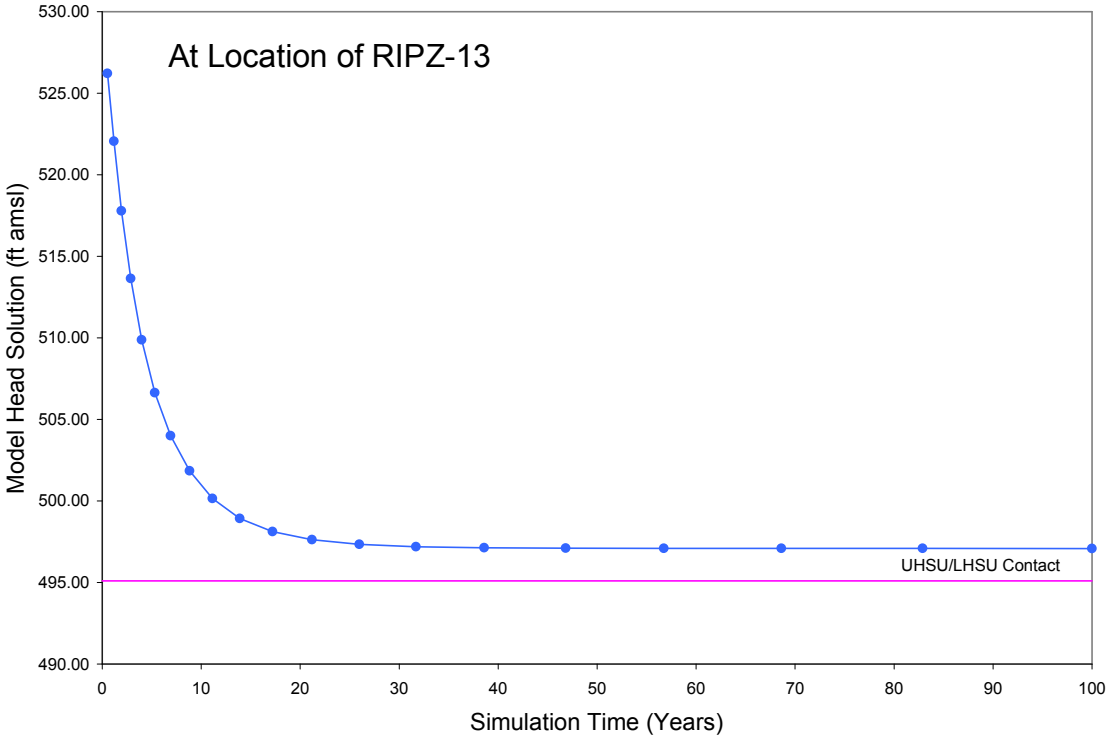

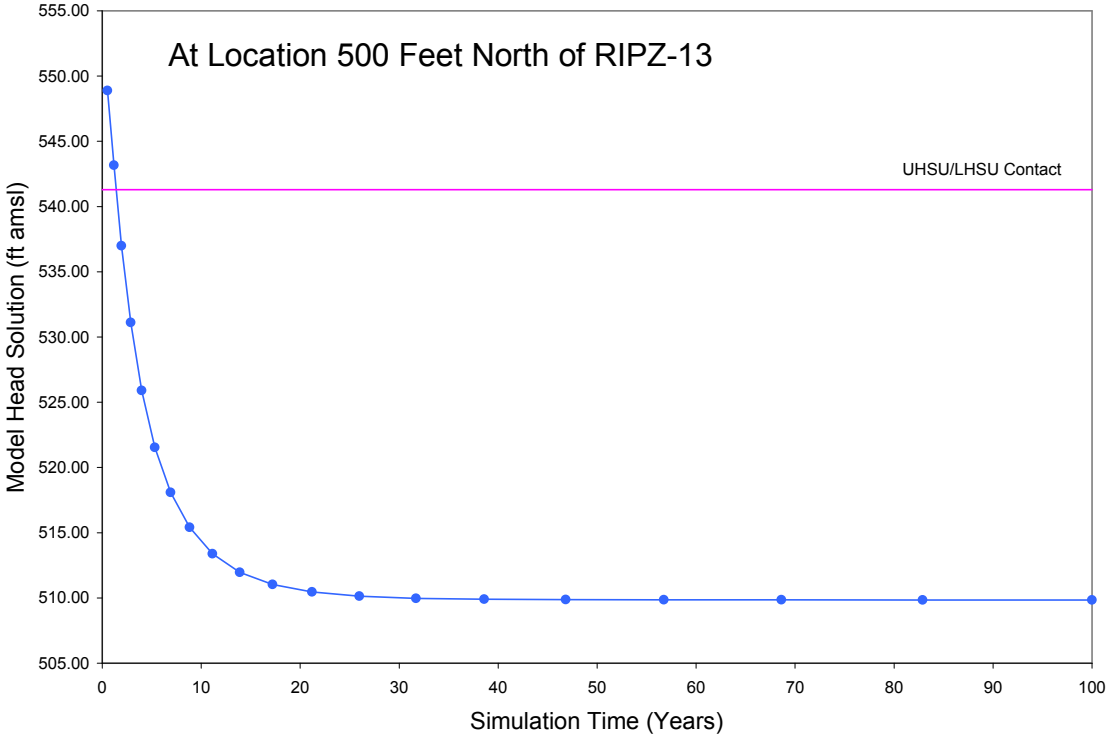

FigureD3-2.mxd

Alternative 2
Dewatering of P/S Landfill
Modified 2004 (Dry Season) Model
Final Feasibility Study
Casmalia Resources Superfund Site
Casmalia, California

FIGURE
D3-2

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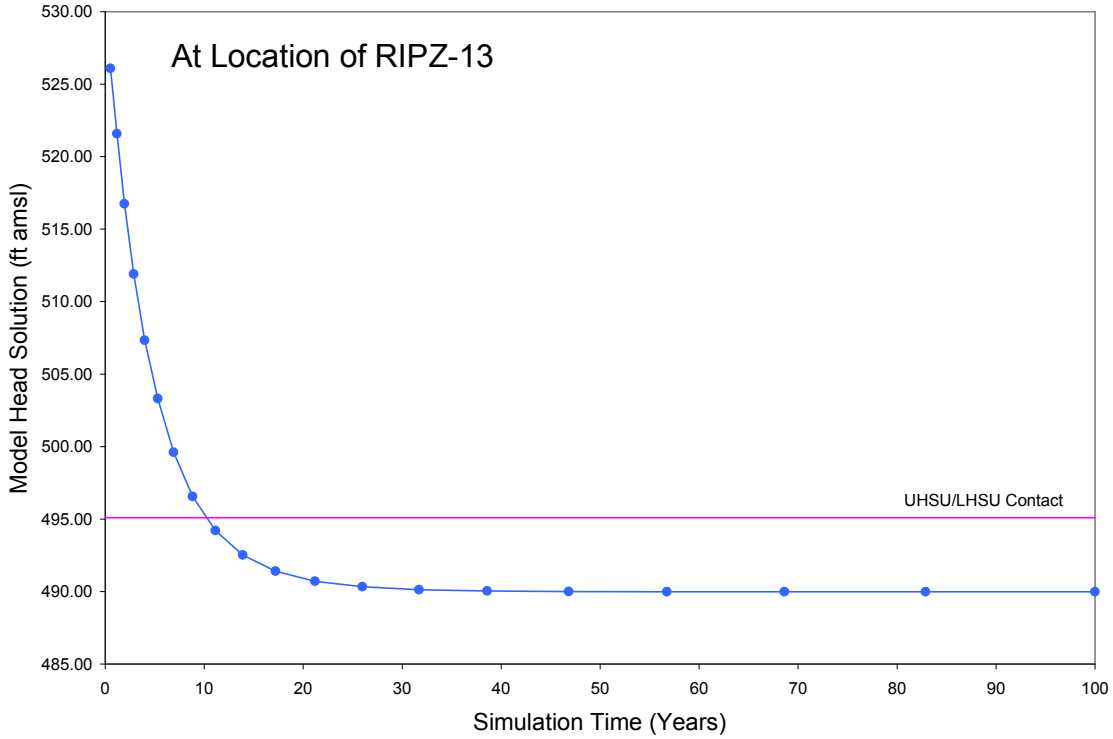

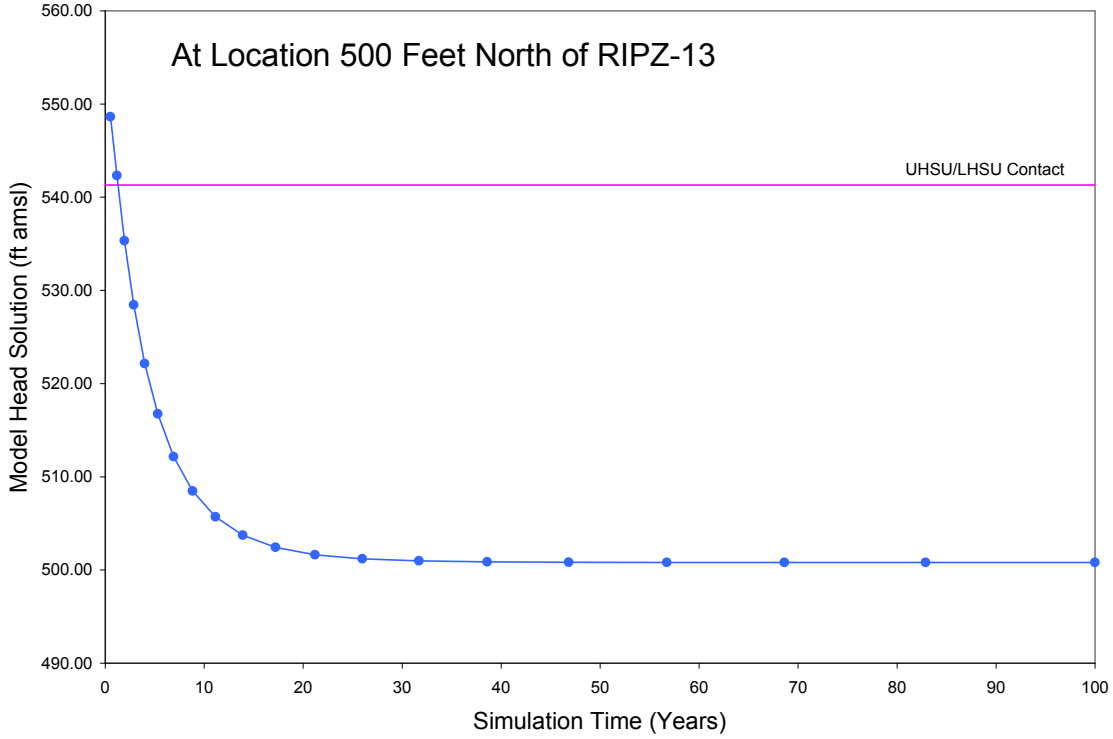

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Alternative 3
Dewatering of P/S Landfill
Modified 2004 (Dry Season) Model
Final Feasibility Study
Casmalia Resources Superfund Site
Casmalia, California

FIGURE
D3-3

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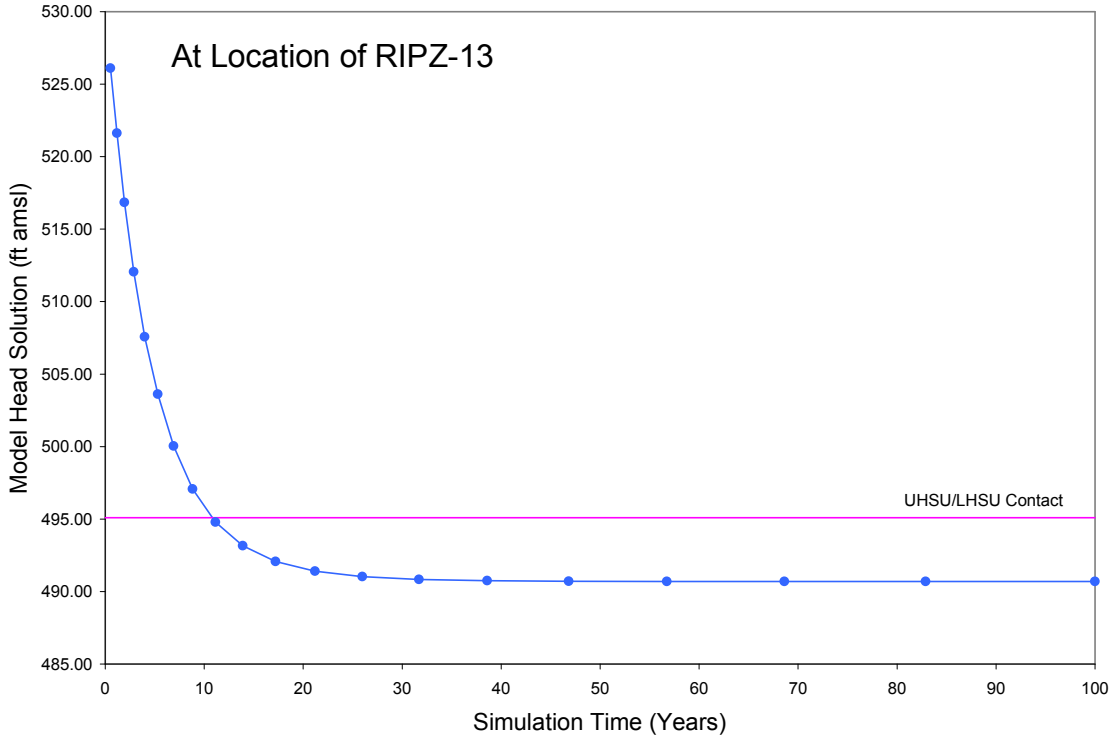

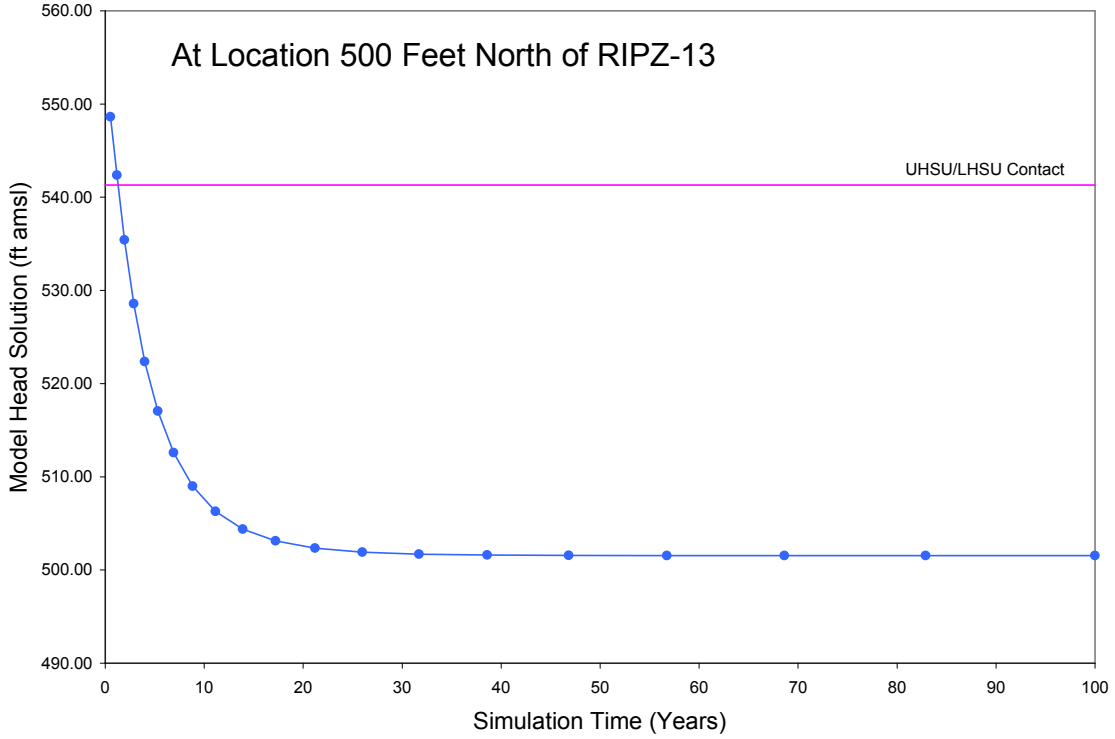

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Alternative 4
Dewatering of P/S Landfill
Modified 2004 (Dry Season) Model
Final Feasibility Study
Casmalia Resources Superfund Site
Casmalia, California

FIGURE
D3-4

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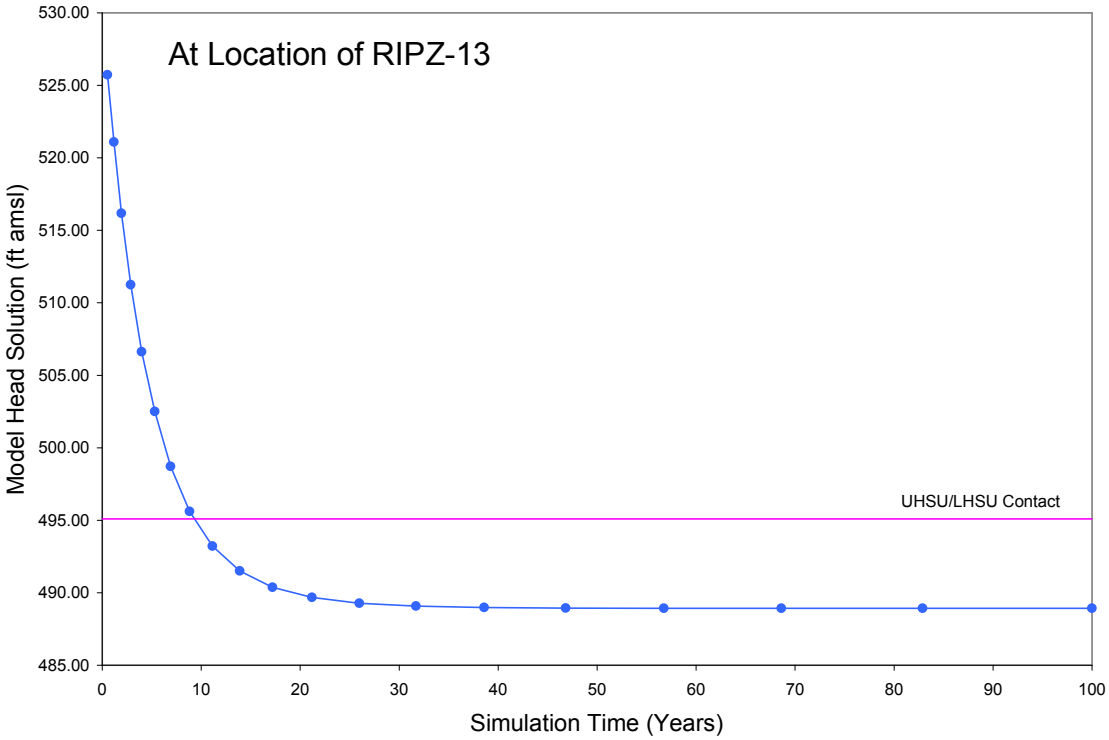

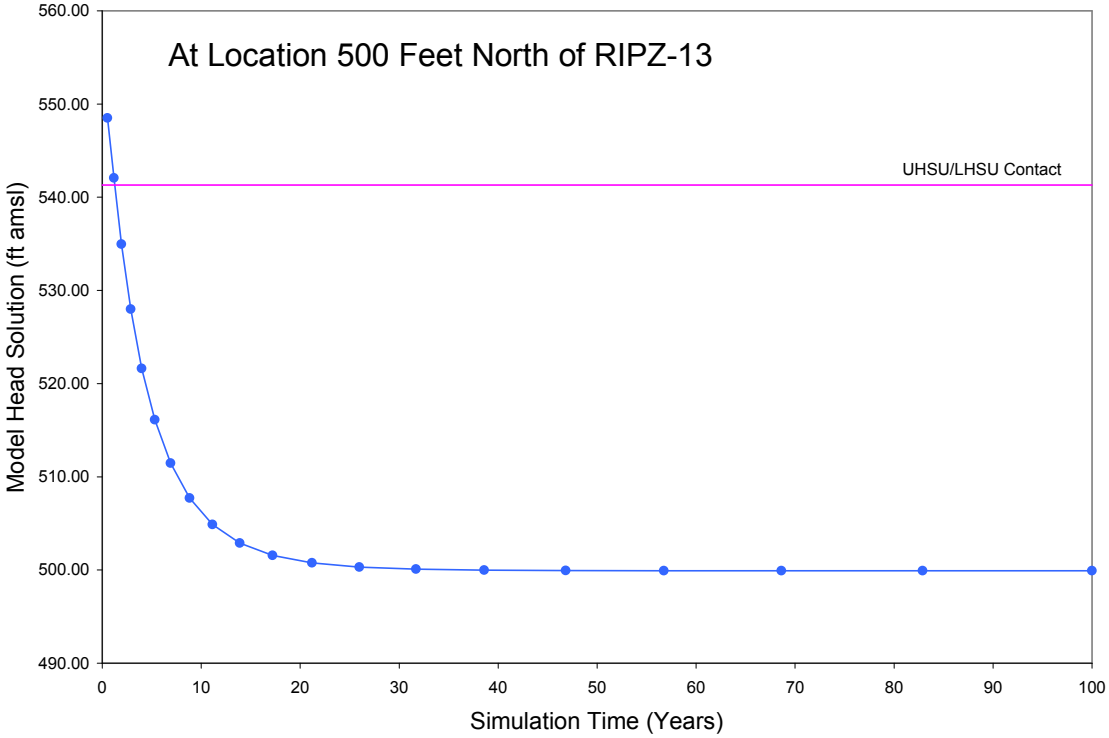

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Alternative 5
Dewatering of P/S Landfill
Modified 2004 (Dry Season) Model
Final Feasibility Study
Casmalia Resources Superfund Site
Casmalia, California

FIGURE
D3-5

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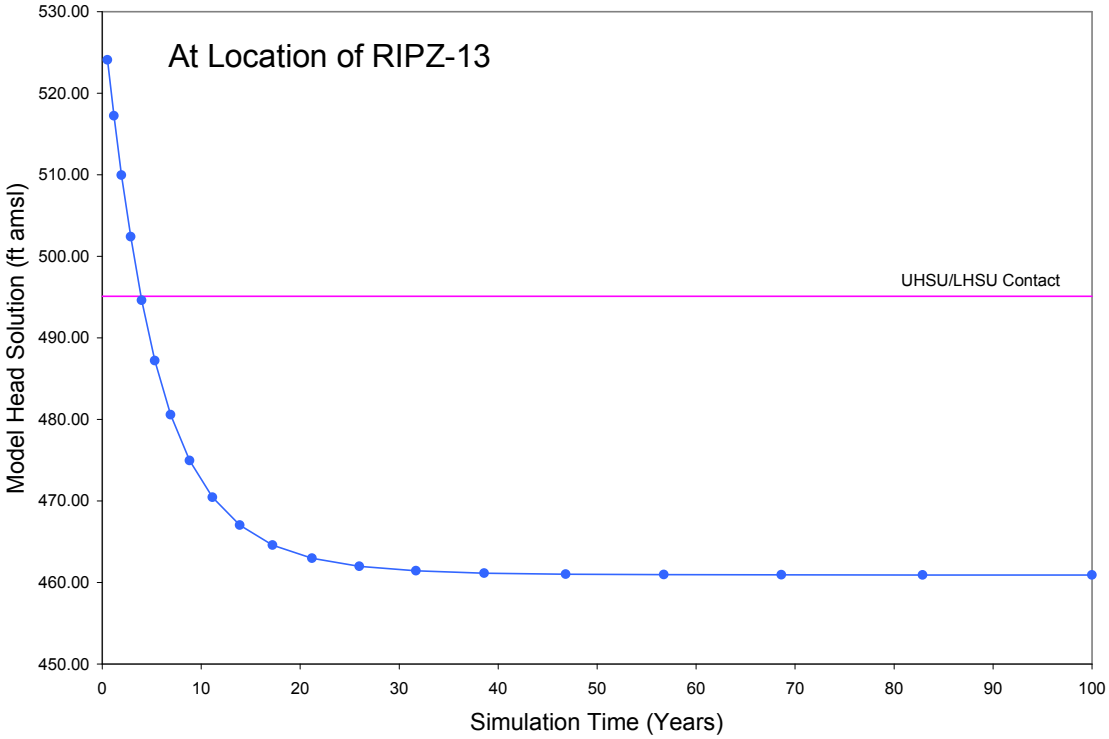

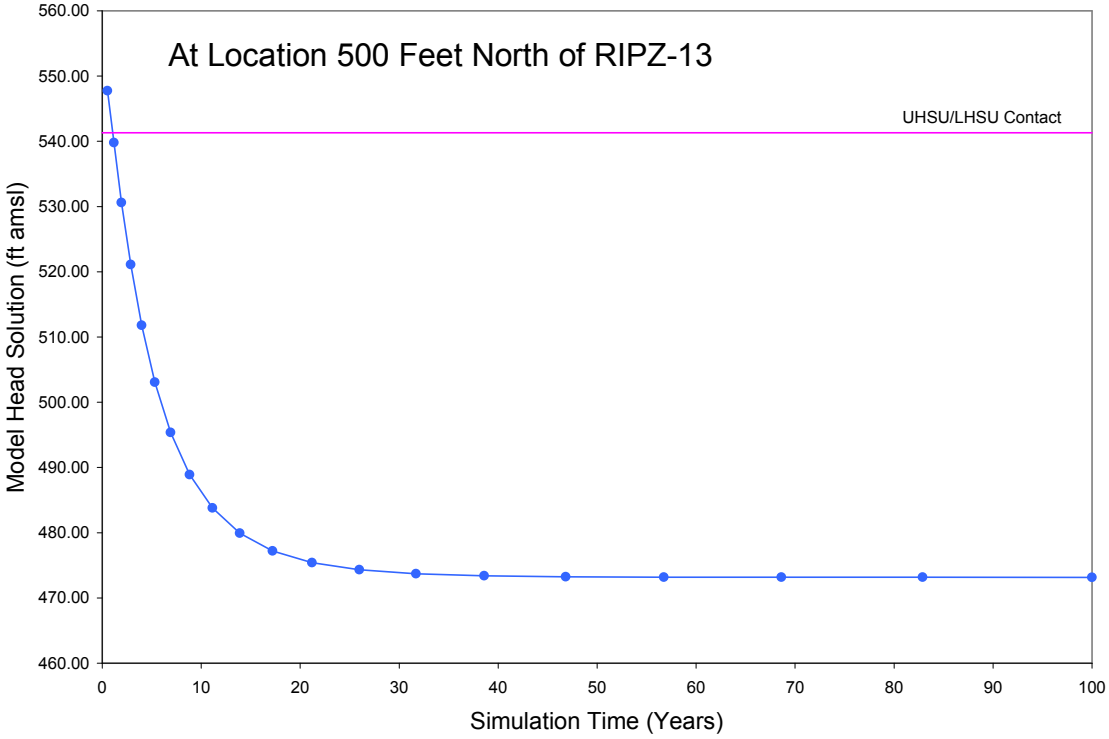

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Alternative 6
Dewatering of P/S Landfill
Modified 2004 (Dry Season) Model
Final Feasibility Study
Casmalia Resources Superfund Site
Casmalia, California

FIGURE

D3-6

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