Gray & Osborne, Inc.
CONSULTING ENGINEERS

July 17, 2013

Mr. M. Dean Parsons, P.E.
RWCC Administrative Manager
City of Raymond
Public Works Department
300 First Street
Raymond, Washington 98577-2427

SUBJECT: ASSESMENT AND MITIGATION PLAN, GROUND SUBSIDENCE
AT WILLAPA REGIONAL WASTEWATER FACILITY
CITY OF RAYMOND, PACIFIC COUNTY, WASHINGTON
G&O #11419.00

Dear Mr. Parsons:

We have requested our geotechnical subconsultant, Ralph Boirum, P.E., of HWA GeoSciences, Inc., to prepare an evaluation of the long-term anticipated settlement at the Willapa Regional Wastewater Facility. Mr. Boirum's analysis is attached for your use. The basis of the analysis is a plot of a log scale of time versus elevation for various locations across the site. A straight-line extrapolation of the time-elevation plots yields a "worst case" prediction of future settlement. The prediction can be characterized as "worst case" because the time-elevation curve can typically approach a zero slope over time as the underlying soils approach full consolidation. The straight-line extrapolation does not take this possibility into account.

Survey data collected since February indicates that the worst settlement is occurring in the areas where construction excavation was the deepest, i.e., in the vicinity of the clarifiers and the aeration basin, with the worst location being the fire hydrant at the east end of the site, just north of the clarifiers. Mr. Boirum indicates that this location could be expected to settle as much as 2 inches in the next year, and an additional 2 inches in the 10 years after that. Consequently, the mitigation measures described below are designed to accommodate future settlement in excess of 4 and as much as 6 inches.

MITIGATION MEASURES ALREADY COMPLETED

The first phase of mitigation included excavating and resetting the Plant Drain Pump Station Valve Vault, the Energy Recovery Ventilator ductwork, and process piping along the north and east sides of the Equipment Building. This work also included assessment

and survey by Rognlin's and was paid for in Change Order No. 10. Video inspection of several pipes at that time indicated that the pipes were in sound condition, even though the deflection just outside of the pile-supported structure was clearly visible. The resetting of these pipes and the ductwork relieved this deflection and will allow an additional 4 to 6 inches of future settlement without compromising pipe integrity.

MITIGATION MEASURES CURRENTLY UNDERWAY

There has been a problem with small-diameter non-potable water piping separating on the vertical runs. The piping is primarily Schedule 80 PVC socket-welded pipe and has very little, if any, ability to flex or expand in the vertical direction. A stainless steel braided hose will be installed at any locations where there is a potential for this type of failure. The braided hose will be installed with enough slack to allow an additional 4 to 6 inches of ground subsidence without damage to the pipe.

Recent excavations of electrical conduit have exposed shear failures in the PVC conduit where it connects to the rigid, long sweep, steel elbow coming from the adjacent structure. The contrast between the strength and the stiffness of the two materials results in a failure at that point. There are approximately 60 of these locations. Our proposed remedy is to pull the wire and insert both an expansion/deflection coupling and a PVC expansion joint with a section of PVC-coated rigid conduit between these two fittings in the conduit run just beyond the long sweep elbows. It is anticipated that the existing wires will then be able to be repulled and reconnected. In combination, these two fittings should allow an additional 4 to 6 inches of ground subsidence.

There are a number of stair landings and building entry slabs where the gravel material, which originally supported the slab, has dropped away and the slab is now supported by doweling into the adjacent structure. We are investigating the appropriate grouting methods for filling in these gaps with a light-weight pumpable cellular concrete product and will be directing the contractor to proceed with a remedy.

LONG-TERM MONITORING

Attached is a drawing of the site showing the total settlement at 21 long-term monitoring points across the site. Five of these locations are pile supported and will serve as a baseline for settlement in the other 16 locations. All 21 locations can be surveyed from two different instrument setup locations, also shown on the drawing. After the Rognlin's contract is closed out, Gray & Osborne's surveyors will continue to monitor these points, two to three times per year until the rate of subsidence slows to the point where the frequency can be reduced. Monitoring results will be reported to the RWCC as they are available. In areas where ground subsidence eventually exceeds 2 inches or more, we

will conduct further investigations to check the integrity of process piping and electrical conduits. Ongoing monitoring and reporting will be provided at no cost to the RWCC.

It is our opinion that this Mitigation Plan will maintain the functionality of the Willapa Regional Wastewater Facility and we remain committed to a long-term monitoring program to ensure that long-term process reliability is not compromised by the geological conditions at the site.

NEXT STEPS

The cost impacts of the mitigation measures currently underway will be the subject of a meeting with Rognlin's next week. It is anticipated that additional contract time of 4 to 6 weeks will be required to complete the work. Due to the nature of the time and materials work, we are unable to negotiate a firm, final cost at this time. However, to keep the contractor proceeding with the remedies outlined above, we are asking the RWCC to approve $100,000 at this time, subject to approval of grant funds by Rural Development. Gray & Osborne will provide any additional inspection and engineering for mitigation within the existing Construction Management budget.

Very truly yours,

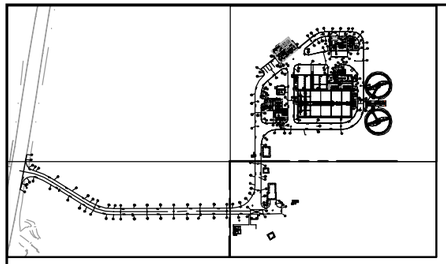
GRAY & OSBORNE, INC.

Thomas M. Zerkel, P.E.

TMZ/hhj
Encl.

cc: Mr. Eric DeMontigny, P.E., Chairman, Regional Wastewater Coordinating Committee
Regional Wastewater Coordinating Committee Members

SURVEYED SITE SETTLEMENT MONITORING



0.72" S.H.B. MANHOLE

0.96" S.H.B. HYDRANT

1.08" S.E. BLDG. CORNER

PROPOSED INSTRUMENT SETUP

0.96" S.W. BLDG. CORNER

1.92" DIGESTER C.O.-2

DIGESTER BENCHMARK (PILE SUPPORTED) 0.0"

SILO SLAB (PILE SUPPORTED) 0.0"

RAS C.O. (SEE NOTE 3) 0.36"

EAST CRNR. PUD VAULT 1.44"

DIGESTER STAIR PAD 1.92"

EAST HYDRANT 2.04"

1.32" S.W. CRNR. VALVE VAULT

0.96" N.W. CRNR. HEADWORKS BUILDING

1.20" S.E. CRNR. HEADWORKS BUILDING

0.60" N.E. HEADWORKS WATER VALVE BOX

0.0" HEADWORKS DUMPSTER PAD-3 (PILE SUPPORTED)

0.48" INFLUENT VALVE-1

S.E. CORNER SCUM VAULT 0.96"

WEST END UV STRUCTURE (PILE SUPPORTED) 0.0"

PROPOSED INSTRUMENT SETUP

S. A.B. C.O.-1 0.96"

S.W. A.B. WATER VALVE BOX 0.72"

HEADWORKS STEPS (PILE SUPPORTED) 0.0"

TBM-136 0.0"

RAYMOND WWTP SITE - NORTH ROAD GRADING PLAN

SCALE: 1"=20'-0"

Notes:

1. Total measured site settlement through June 14, 2013 based on construction site surveys beginning February 8, 2013.

2. Survey sensitivity is approximately +/- 1/8" (or 0.01').

3. RAS Clean-out has only been monitored since May 29, 2013.

FOR CONTINUATION SEE UPPER PLAN SHEET G-22

0 1" 2"
TWO INCHES AT FULL SCALE. IF NOT, SCALE ACCORDINGLY

Gray & Osborne, Inc.
CONSULTING ENGINEERS
701 DEXTER AVENUE NORTH, SUITE 200
SEATTLE, WASHINGTON 98109 • (206) 284-0860

DATE: OCT 2010
SCALE: NOTED
DRAWN: R.L.M.
CHECKED: D.A.W.
APPROVED: D.A.W.

No.	REVISION	DATE	APPD

DOUGLAS A. WELCH STATE OF WASHINGTON 21682 REGISTERED PROFESSIONAL ENGINEER

CITIES OF RAYMOND & SOUTH BEND
WASHINGTON
PACIFIC COUNTY
WILLAPA REGIONAL WASTEWATER FACILITIES
SCHEDULE A - WILLAPA REGIONAL WASTEWATER TREATMENT FACILITIES
WWTP SITE NORTH ROAD GRADING PLAN

SHEET: G-23
OF: 27
JOB NO.: 08593
DWG: PRO_ROAD

HWA GEOSCIENCES INC.
Geotechnical & Pavement Engineering • Hydrogeology • Geoenvironmental • Inspection & Testing

July 17, 2013
HWA Project Number 2008-097-21

Gray & Osborne, Inc.
701 Dexter Avenue North, Suite 200
Seattle, Washington 98109

Attn: Mr. Tom Zerkel

RE: **SETTLEMENT EVALUATION**
Willapa Regional Wastewater Treatment Plant
Raymond, Washington

Dear Tom,

At your request, we have reviewed the settlement data from readings taken over the past months at the new treatment plant. Our review included plotting elevation data from 88 locations around the plant site recorded since February 8, 2013. That data is presented in Table 1. Plots of this data are provided in the attached figures.

The treatment plant site is underlain by about 50 feet of soft, compressible clay. In order to minimize post construction settlements, the site was preloaded by the placement of fill. At least 2 feet, and in some locations, more than 4 feet of settlement occurred under the weight of the fill. Some of the preload fill was removed, and most of the structures were then founded on pile foundations. Despite the preloading, some settlement of non-pile supported areas has continued to occur since construction of the plant. This letter presents our evaluation of the post construction settlements to date.

The elevation for each surveyed location was plotted versus the log of time in days. This was done because the long-term rate of settlement of clay most closely resembles a log function. Theoretically, the rate of settlement of normally loaded clay will decline logarithmically; therefore, plotting it on log scale will allow long-term settlements to be predicted with reasonable accuracy over a period of years.

Figure 1 presents a plan showing the locations of the 88 points at which elevation measurements have been made since February 2013. Figure 2 presents elevation plots of 8 selected locations. These eight include points that appear to have the highest rates of settlement (East Hydrant and AD Pad). Lines have been drawn on several of the plots on Figure 2 to indicate what future settlements might occur. Straight line extension of the AD Pad plot indicates that the pad could settle as much as 2 inches over the next year. Another ¾ inch could occur a second year from now with perhaps 2 more inches over the following 10 years. Extensions of most data plots indicate settlements on the order of an inch over the next year. With more measurements, better predictions should be possible in about 3 months.

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Suite 110
Bothell, WA 98021.7010
Tel: 425.774.0106
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www.hwageo.com

July 17, 2013
HWA Project Number 2008-097-21

The straight-line extensions of the current settlement plots over-estimate future settlements at many locations. There has not been sufficient time since the last loads were placed for the time-settlement curves to fully develop. Fill and roadway pavement has been placed since February 2013, and many of the time-settlement curves now plot steeper than they will in a few months. We expect the settlement magnitudes discussed in the previous paragraph to be maximum values, and plots using future elevation measurements should predict less settlement.

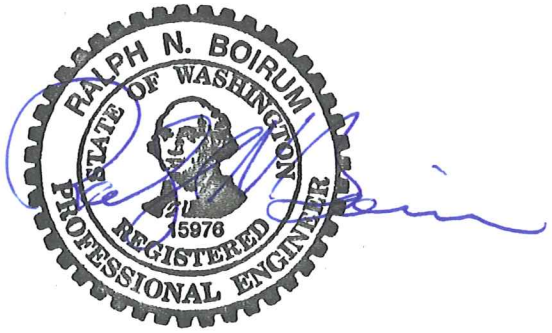
We recommend that additional elevation measurements be made at approximately three month intervals for the next six months and at 6-month intervals for another year. These additional data points would be added to the current plots to create better estimates of future settlement. We will provide updates to anticipated settlement as future measurements become available.

The damage resulting from future settlements will depend heavily on the location and type of the structure and how it is connected to other structures. Settlement of the East Hydrant and AD Pad may be inconsequential; however, settlement of piping that is connected to pile-supported structures could require repair, and structures which settle differentially may require re-leveling. We recommend that future settlement measurements concentrate on structures that are most likely to incur damage as a result of settlement, with measurements on a few non-critical structures (such as the East Hydrant) as a baseline.

We appreciate the opportunity to be of service.

Sincerely,

HWA GEOSCIENCES INC.



Ralph N. Boirum, P.E.
Geotechnical Engineer, Principal

Attachments:

Table 1	Elevation Measurements
Figure 1	Sheet G-23, Locations of Settlement Points
Figure 2	Elevation Plots of Selected Points
Figures 3 - 12	Time - Elevation Plots

TABLE 1
WILLAPA REGIONAL WWTF
SITE SETTLEMENT SURVEY DATA

	Survey Date										
Location Name	**2/8/2013**	**2/15/2013**	**2/21/2013**	**3/5/2013**	**3/14/2013**	**3/28/2013**	**4/11/2013**	**4/24/2013**	**5/9/2013**	**5/29/2013**	**6/14/2013**
	60	**67**	**73**	**85**	**94**	**108**	**122**	**135**	**150**	**170**	**186**
TBM-136	14.65	14.65	14.66	14.64	14.65	14.65	14.64	14.64	14.64	14.65	14.65
EV P-2	18.74	18.75	18.72	18.72	18.71	18.69	19.73	19.71	19.69	19.68	19.67
EV P-3	19.24	19.23	19.22	19.21	19.20	19.18	19.69	19.68	19.66	19.64	19.62
EV S-3	19.33	19.31	19.31	19.30	19.28	19.28	19.80	19.79	19.77	19.75	19.73
EV P-1	19.35	19.37	19.34	19.32	19.33	19.32	19.84	19.83	19.82	19.79	19.79
CTRL BLDG-W SIDE	20.46	20.45	20.46	20.43	20.45	20.44	20.40	20.40	20.40	20.38	20.38
CTRL BDLG-E SIDE	20.48	20.48	20.48	20.47	20.47	20.47	20.46	20.44	20.42	20.42	20.35
CTRL BDLG-SE CRNR	20.62	20.61	20.62	20.61	20.59	20.57	20.56	20.55	20.54	20.53	20.53
CTRL BLDG-NE CRNR	20.63	20.62	20.62	20.61	20.60	20.60	20.59	20.58	20.57	20.56	20.56
CTRL BLDG-SW CRNR	20.64	20.64	20.64	20.62	20.62	20.61	20.60	20.59	20.59	20.57	20.56
	60	**67**	**73**	**85**	**94**	**108**	**122**	**135**	**150**	**170**	**186**
FUEL PAD	20.72	20.70	20.70	20.70	20.69	20.67	20.67	20.66	20.64	20.63	20.63
CTRL BLDG-NW CRNR	20.73	20.73	20.73	20.71	20.72	20.71	20.71	20.70	20.69	20.69	20.68
SHB-MANHOLE	20.73	20.73	20.73	20.72	20.73	20.71	20.70	20.70	20.69	20.68	20.67
AD PAD	21.10	21.09	21.08	21.07	21.04	21.03	21.01	21.02	20.98	20.97	20.94
HWBB-NE	21.44	21.43	21.42	21.42	21.40	21.39	21.38	21.37	21.36	21.34	21.32
HWBB-SE	21.50	21.49	21.48	21.47	21.47	21.45	21.45	21.44	21.43	21.41	21.40
SV-1	21.60	21.59	21.58	21.57	21.58	21.57	21.56	21.56	21.55	21.54	21.54
HWBB-NW	21.61	21.60	21.60	21.59	21.57	21.58	21.57	21.56	21.55	21.54	21.53
HWBB-SW	21.64	21.63	21.63	21.62	21.62	21.61	21.59	21.61	21.60	21.59	21.58
UV-EFFLUENT VAULT	21.73	21.70	21.69	21.68	21.70	21.70	21.69	21.69	21.68	21.68	21.68
	60	**67**	**73**	**85**	**94**	**108**	**122**	**135**	**150**	**170**	**186**
AB W-3 (N. STAIR POST)	21.89	21.88	21.86	21.85	21.85	21.84	21.84	21.83	21.83	21.82	21.81
AB W-1 (S. STAIR POST)	22.05	22.05	22.03	22.03	22.02	22.01	22.00	22.00	22.00	21.97	21.97
UV-W	22.15	22.13	22.13	22.12	22.13	22.14	22.13	22.13	22.13	22.13	22.13
CLARIFIER 2-1	22.43	22.42	22.42	22.41	22.41	22.41	22.42	22.42	22.42	22.42	22.42
CLARIFIER 2-2	22.45	22.44	22.44	22.43	22.43	22.43	22.43	22.43	22.43	22.43	22.43
CLARIFIER 1-1	22.49	22.48	22.47	22.47	22.47	22.48	22.48	22.48	22.47	22.47	22.47
CLARIFIER 1-2	22.49	22.47	22.45	22.46	22.46	22.46	22.46	22.47	22.46	22.46	22.46
AB CO 1-S	22.50	22.49	22.475	22.47	22.46	22.47	22.45	20.60	20.59	20.57	20.57
SHB-HYD	23.01	23.00	22.99	22.99	22.99	22.98	22.97	22.96	22.96	22.94	22.93
EAST HYD	23.17	23.13	23.12	23.11	23.11	23.10	23.08	23.07	23.05	23.02	23.00
	60	**67**	**73**	**85**	**94**	**108**	**122**	**135**	**150**	**170**	**186**
LT BASE AD-N	23.41	23.39	23.38	23.37	23.35	23.34	23.32	23.30	23.28	23.26	23.24
LT BASE AB-S	23.88	23.89	23.87	23.87	23.86	23.85	23.84	23.82	23.81	23.79	23.78
LT BASE AB-W	23.92	23.90	23.90	23.89	23.88	23.87	23.86	23.86	23.85	23.84	23.83
LT BASE SPLITTER BOX	24.01	24.00	23.99	23.98	23.98	21.40	23.97	23.97	23.96	23.95	23.94
LT BASE CLARIFIER 1	24.13	24.11	24.09	24.08	24.09	24.08	24.07	23.97	24.05	24.04	24.03
	60	**67**	**85**	**94**	**108**	**122**	**135**	**150**	**170**	**186**	
EV P-5	18.82	18.80	18.81	18.82	18.82	19.36	19.34	19.33	19.33	19.32	
EV S-5	18.92	18.91	18.92	18.92	18.91	19.46	19.45	19.44	19.45	19.43	
SHB-SILO	21.02	20.98	20.97	20.97	20.97	20.98	20.99	20.97	20.98	20.98	
	60	**67**	**73**	**85**	**94**	**108**	**135**	**150**	**170**	**186**	
PUD-W	21.19	21.17	21.19	21.15	21.16	21.15	21.11	21.10	21.09	21.08	
	60	**67**	**73**	**85**	**108**	**122**	**135**	**150**	**170**	**186**	
LT BASE-EAST	23.37	23.34	23.31	23.30	23.29	23.27	23.27	23.24	23.23	23.21	
	60	**67**	**73**	**94**	**108**	**122**	**135**	**150**	**170**	**186**	
LT BASE CLARIFIER 2	24.05	24.04	24.03	24.02	24.02	24.00	24.01	24.00	23.98	23.97	
	67	**73**	**85**	**94**	**108**	**122**	**135**	**150**	**170**	**186**	
EV P-7	19.98	19.98	19.97	19.98	19.97	20.61	20.50	20.49	20.49	20.47	
EV S-7	20.08	20.08	20.07	20.08	20.08	20.51	20.60	20.60	20.60	20.57	
	60	**67**	**73**	**85**	**94**	**108**	**122**	**135**	**150**	**186**	
EV S-2	18.83	18.82	18.81	18.81	18.80	18.80	19.85	19.89	19.82	19.80	
EV S-6	18.84	18.83	18.83	18.82	18.82	18.81	19.34	19.33	19.83	19.82	
EV P-6	19.33	19.33	19.32	19.32	19.32	19.32	19.83	19.83	19.31	19.31	
EV P-4	20.31	20.31	20.30	20.29	20.28	20.27	20.69	20.79	20.77	20.25	
EV S-4	20.44	20.43	20.43	20.43	20.41	20.42	20.95	20.94	20.93	20.92	
GEN RM-1	20.80	20.79	20.79	20.80	20.79	20.79	20.79	20.80	20.80	20.79	
HW-1	21.14	21.13	21.14	21.13	21.13	21.13	21.14	21.13	21.13	21.13	
SV-2	21.44	21.43	24.41	21.40	21.40	21.40	21.39	21.39	21.38	21.36	
	60	**67**	**94**	**108**	**122**	**135**	**150**	**170**	**186**		
VV-SW	20.04	20.02	20.51	20.49	20.46	20.45	20.43	20.42	20.40		
VV-NE	20.29	20.28	20.51	20.49	20.48	20.47	20.46	20.44	20.43		
	60	**67**	**73**	**85**	**94**	**108**	**122**	**135**	**150**		
PDPS PAD	21.41	21.41	21.41	21.41	21.41	21.41	21.41	21.41	21.42		
AB W-4 (N. STAIR LNDING)	21.48	21.48	21.48	21.48	21.48	21.48	21.48	21.48	21.48		
AB W-2 (S. STAIR LNDING)	21.70	21.70	21.70	21.70	21.70	21.70	21.70	21.71	21.71		
	60	**85**	**94**	**108**	**122**	**135**	**150**	**170**	**186**		

WILLAPA REGIONAL WWTF
SITE SETTLEMENT SURVEY DATA

	Survey Date										
Location Name	2/8/2013	2/15/2013	2/21/2013	3/5/2013	3/14/2013	3/28/2013	4/11/2013	4/24/2013	5/9/2013	5/29/2013	6/14/2013
WEST HYD	23.20	23.17	23.16	23.15	23.13	23.11	23.10	23.08	23.07		
	67	85	94	108	122	135	150	170	186		
HW-3	19.98	19.97	19.98	19.99	19.99	19.98	19.98	19.98	19.98		
LT BASE HEADWORKS	22.87	22.87	22.87	22.87	22.87	22.87	22.87	22.86	22.86		
PUD-E	21.27	21.24	21.25	21.24	21.21	21.20	21.18	21.16	21.15		
	60	67	73	85	94	108	122	135			
AB HUB-1 SE	19.97	19.94	19.94	19.94	19.94	19.94	19.93	19.92			
AB HUB-5 SW	20.16	20.15	20.14	20.11	20.12	20.10	20.10	20.11			
	60	67	108	122	135	150	170	186			
ERV-2	21.06	21.04	21.11	21.10	21.09	21.08	21.07	21.05			
	67	85	94	108	122	135	150	170			
EX. BLR BLDG	18.98	18.99	19.00	18.98	19.00	19.00	18.99	18.99			
	67	85	108	122	135	150	170	186			
PUD-S	21.20	21.17	21.17	21.15	21.13	21.10	21.09	21.08			
	60	67	73	85	94	108	122				
AD HUB-1	19.71	19.69	19.68	19.67	19.66	19.64	19.62				
AB HUB-2	19.78	19.76	19.75	19.73	19.73	19.72	19.72				
AB HUB-3	19.86	19.85	19.85	19.83	19.83	19.81	19.81				
	94	108	122	135	150	170	186				
SHB-W SLAB	20.49	20.48	20.48	20.49	20.49	20.49	20.49				
	60	67	73	85	94	108					
CB-13	18.32	18.31	18.30	18.31	18.29	19.48					
GEN HUB-1	18.71	18.69	18.67	18.65	18.65	18.64					
	60	67	85	94	108	122					
PUD V-1	19.07	19.07	19.07	19.06	19.06	19.07					
TEL V-1	19.17	19.17	19.17	19.16	19.16	19.17					
	60	85	94	108	122	135					
EX. EFF	19.48	19.49	19.50	19.50	19.50	19.49					
	108	122	135	150	170	186					
ERV-1	21.11	21.10	21.10	21.08	21.06	21.05					
	60	135	150	170	186						
AD-CO 2 NW	19.36	19.26	19.24	19.21	19.20						
	60	67	85	94	186						
EV S-1	19.36	19.33	19.30	19.30	19.76						
	67	73	85	94	108						
AB HUB-4	20.21	20.21	20.20	20.20	20.18						
	122	135	150	170	186						
AD-WV N	16.76	16.75	16.73	16.72	16.69						
	122	135	150	170	186						
HW-WV NE	18.53	18.52	18.51	18.49	18.48						
LT BASE CTRL BLDG-E	23.31	23.30	23.29	23.29	23.79						
SSV-1	16.97	16.96	16.95	16.94	16.93						
	122	135	150	186							
LT BASE CTRL BLDG-W	23.46	23.46	23.46	23.44							
	135	150	170	186							
WV AB-SW	18.49	18.46	18.43	18.43							
	60	67	85								
EX. GEN B	19.21	19.21	19.20								
	122	135	186								
CLARIFIER 1-WV S	16.51	16.51	16.45								
	60	67									
EX. CONTR B	19.70	19.69									
	170	186									
FUEL RAS CO	19.46	19.43									

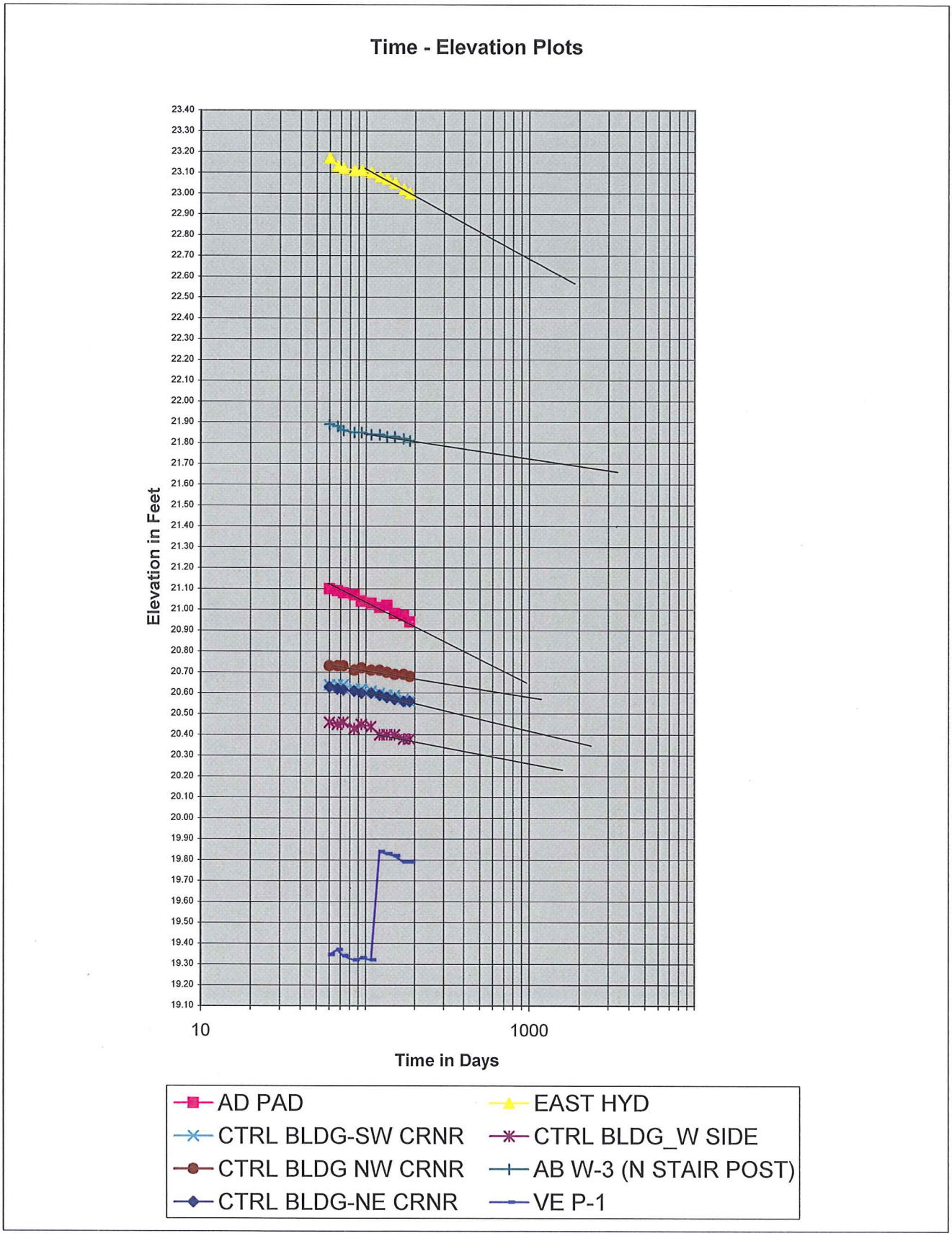

Time - Elevation Plots
Elevation in Feet
23.40
23.30
23.20
23.10
23.00
22.90
22.80
22.70
22.60
22.50
22.40
22.30
22.20
22.10
22.00
21.90
21.80
21.70
21.60
21.50
21.40
21.30
21.20
21.10
21.00
20.90
20.80
20.70
20.60
20.50
20.40
20.30
20.20
20.10
20.00
19.90
19.80
19.70
19.60
19.50
19.40
19.30
19.20
19.10
10
1000
Time in Days
AD PAD
EAST HYD
CTRL BLDG-SW CRNR
CTRL BLDG_W SIDE
CTRL BLDG NW CRNR
AB W-3 (N STAIR POST)
CTRL BLDG-NE CRNR
VE P-1

Figure 2